Catalyst 2900 Series XL Modules Hardware Installation Guide

Corporate 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: 408 526-4100

Customer Order Number: DOC-CAT2900IG=
Text Part Number: 78-5912-03

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The following information is for FCC compliance of Class A devices: 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 can radiate 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 will be required to correct the interference at their own expense.

The following information is for FCC compliance of Class B devices: The equipment described in this manual generates and may radiate radio-frequency energy. If it is not installed in accordance with Cisco's installation instructions, it may cause interference with radio and television reception. This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in part 15 of the FCC rules. These specifications are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

Modifying the equipment without Cisco's written authorization may result in the equipment no longer complying with FCC requirements for Class A or Class B digital devices. In that event, your right to use the equipment may be limited by FCC regulations, and you may be required to correct any interference to radio or television communications at your 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 or the other 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.)

Modifications to this product not authorized by Cisco Systems, Inc. could void the FCC approval and negate your authority to operate the product.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

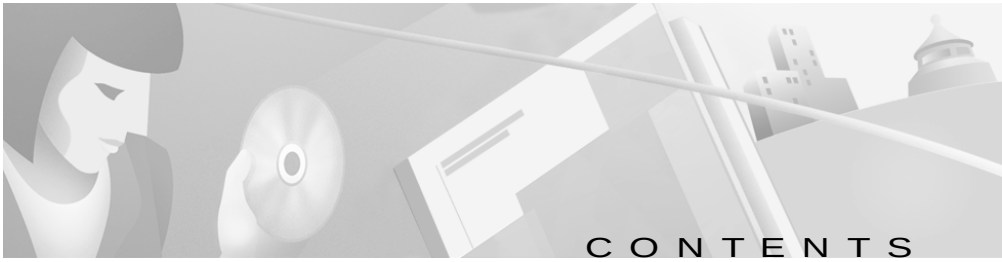
NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Access Registrar, AccessPath, Any to Any, AtmDirector, Browse with Me, CCDA, CCDE, CCDP, CCIE, CCNA, CCNP, CCSI, CD-PAC, the Cisco logo, the Cisco Certified Internetwork Expert logo, CiscoLink, the Cisco Management Connection logo, the Cisco NetWorks logo, the Cisco Powered Network logo, Cisco Systems Capital, the Cisco Systems Capital logo, Cisco Systems Networking Academy, the Cisco Systems Networking Academy logo, the Cisco Technologies logo, ConnectWay, Fast Step, FireRunner, Follow Me Browsing, FormShare, GigaStack, IGX, Intelligence in the Optical Core, Internet Quotient, IP/VC, Kernel Proxy, MGX, MultiPath Data, MultiPath Voice, Natural Network Viewer, NetSonar, Network Registrar, the Networkers logo, Packet, PIX, Point and Click Internetworking, Policy Builder, Precept, ScriptShare, Secure Script, ServiceWay, Shop with Me, SlideCast, SMARTnet, SVX, The Cell, TrafficDirector, TransPath, ViewRunner, Virtual Loop Carrier System, Virtual Service Node, Virtual Voice Line, VisionWay, VlanDirector, Voice LAN, WaRP, Wavelength Router, Wavelength Router Protocol, WebViewer, Workgroup Director, and Workgroup Stack are trademarks™; Changing the Way We Work, Live, Play, and Learn, Empowering the Internet Generation, The Internet Economy,

and The New Internet Economy are service marks(SM); and ASIST, BPX, Catalyst, Cisco, Cisco IOS, the Cisco IOS logo, Cisco Systems, the Cisco Systems logo, the Cisco Systems Cisco Press logo, Enterprise/Solver, EtherChannel, EtherSwitch, FastHub, FastLink, FastPAD, FastSwitch, GeoTel, IOS, IP/TV, IPX, LightStream, LightSwitch, MICA, NetRanger, Post-Routing, Pre-Routing, Registrar, StrataView Plus, Stratm, TeleRouter, and VCO are registered trademarks® of Cisco Systems, Inc. or its affiliates in the U.S. and certain other countries. All other trademarks mentioned in this document are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any of its resellers. (9912R)

Catalyst 2900 Series XL Modules Hardware Installation Guide
Copyright © 2000, Cisco Systems, Inc.
All rights reserved.



CONTENTS

About This Guide ix

Audience and Scope **ix**

Document Organization **x**

Notes, Cautions, and Warnings **x**

Cisco Connection Online **xiii**

Documentation CD-ROM **xiv**

CHAPTER 1

Overview 1-1

Key Features **1-2**

10BaseT/100BaseTX Module **1-3**

100BaseFX Modules **1-4**

1000BaseX Module **1-5**

1000BaseT Module **1-7**

LEDs **1-8**

Cabling Guidelines **1-8**

10/100 Module **1-8**

100BaseFX Modules **1-9**

1000BaseX Modules **1-9**

1000BaseT Module **1-10**

Deployment Examples **1-10**

Gigabit Uplink **1-11**

Wiring Closet Aggregator **1-12**

Fast or Gigabit EtherChannel Backbone **1-13**

Backbone for Small- to Medium-Sized LAN **1-13**
High-Performance Workgroup **1-15**

CHAPTER 2 **Installation 2-1**
Inspecting the Packing List **2-1**
EMC Regulatory Statements **2-2**
U.S.A. **2-2**
Taiwan **2-2**
Avoiding Electrostatic Discharge **2-2**
Installing a Module **2-2**
Handling a GBIC **2-4**
Installing a GBIC **2-5**
Connecting to Module Ports **2-6**
Using a Patch Cord with the GBICs **2-8**
Default Settings for the 1000BaseX and 1000BaseT modules **2-10**
Removing a GBIC **2-10**
Removing a Module **2-11**
Power-On Self-Test **2-11**

CHAPTER 3 **Troubleshooting 3-1**

APPENDIX A **Technical Specifications A-1**

APPENDIX B **Connectors and Cables B-1**
10/100 Module Cabling **B-1**
10/100 Module Connectors **B-2**
1000BaseT Module Connectors **B-3**

100BaseFX and 1000BaseX Modules Cabling **B-3**

APPENDIX C

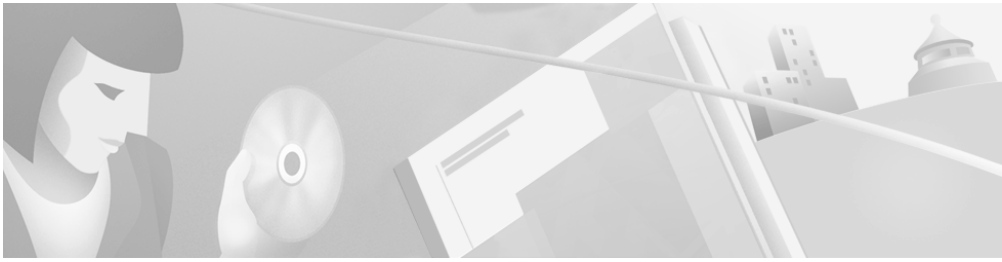
Translated Safety Warnings C-1

Class 1 Laser Product Warning **C-1**

Laser Beam Exposure Warning **C-2**

Product Disposal **C-3**

INDEX



About This Guide

This section defines the audience and scope of this guide and briefly describes the contents of each chapter. There are also descriptions of the icons and conventions used to convey instructions and information.

Audience and Scope

This guide is for the technician installing the Catalyst 2900 series XL modules, hereafter referred to as the 2900 series modules. We assume that you are familiar with the concepts and terminology of Ethernet and local-area networking. This guide provides the information you need to install the 2900 series modules and to troubleshoot problems associated with their installation.

Note The 2900 series modules and their ports are managed through one of the management interfaces of a Catalyst 2900 series switch. For more information, see the *Catalyst 2900 Series XL Installation and Configuration Guide*.

Document Organization

This guide is organized into the following chapters:

Chapter 1, “Overview,” describes the modules and their key features. It contains a physical description of the modules, a description of the networking standards they support, and several examples of how they can be deployed in real networks.

Chapter 2, “Installation,” explains how to install the modules.

Chapter 3, “Troubleshooting,” describes how to identify and resolve common module installation and cabling problems.

Appendix A, “Technical Specifications,” lists the physical and environmental specifications of the modules and the regulatory agency approvals.

Appendix B, “Connectors and Cables,” describes the cables and connectors that can connect to the 2900 series module ports.

Appendix C, “Translated Safety Warnings,” contains translations of the warnings in this guide.

Notes, Cautions, and Warnings

Notes, cautions, and warnings use the following conventions and symbols:

Note Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Caution Means reader be careful. In this situation, you might do something that could result in equipment damage or loss of data.

Warning **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 the standard practices for preventing accidents. The warning symbol also means that you can see the warning in multiple languages in "Translated Safety Warnings."**

Waarschuwing **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 standaard maatregelen om ongelukken te voorkomen. Het waarschuwingssymbool betekent ook dat u de waarschuwing in meerdere talen in "Translated Safety Warnings" kunt vinden.**

Varoitus **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. Varoitusmerkki tarkoittaa myös sitä, että varoitus esiintyy useilla kielillä osassa "Translated Safety Warnings".**

Attention **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. Le symbole d'avertissement signifie également que cet avis se trouve traduit dans plusieurs langues dans la section «Translated Safety Warnings».**

Warnung **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. Das Warnsymbol bedeutet auch, daß Sie die Warnung in verschiedenen Sprachen unter “Translated Safety Warnings” lesen können.**

Avvertenza **Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. Il simbolo di avvertenza indica inoltre che l’avvertenza viene presentata in diverse lingue in “Translated Safety Warnings”.**

Advarsel **Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. Dette varselsymbolet betyr også at du kan lese advarselen på flere språk i «Translated Safety Warnings».**

Aviso **Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes. Este símbolo serve também para indicar que poderá ler este tipo de aviso em várias línguas na secção: “Translated Safety Warnings.”**

¡Atención! **Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes. Este símbolo de aviso también significa que la misma advertencia aparece en varios idiomas bajo el título "Translated Safety Warnings."**

Varning! **Denna varningssymbol 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 vanligt förfarande för att förebygga skador. Denna varningssymbol innebär också att du kan se varningsmeddelandet på flera språk i "Translated Safety Warnings."**

Cisco Connection Online

Cisco Connection Online (CCO) is Cisco Systems' primary, real-time support channel. Maintenance customers and partners can self-register on CCO to obtain additional information and services.

Available 24 hours a day, 7 days a week, CCO provides a wealth of standard and value-added services to Cisco's customers and business partners. CCO services include product information, product documentation, software updates, release notes, technical tips, the Bug Navigator, configuration notes, brochures, descriptions of service offerings, and download access to public and authorized files.

CCO serves a wide variety of users through two interfaces that are updated and enhanced simultaneously: a character-based version and a multimedia version that resides on the World Wide Web (WWW). The character-based CCO supports Zmodem, Kermit, Xmodem, FTP, and Internet e-mail, and it is excellent for quick access to information over lower bandwidths. The WWW version of CCO provides richly formatted documents with photographs, figures, graphics, and video, as well as hyperlinks to related information.

You can access CCO in the following ways:

- WWW: http://www.cisco.com

- WWW: http://www-europe.cisco.com
- WWW: http://www-china.cisco.com
- Telnet: cco.cisco.com
- Modem: From North America, 408 526-8070; from Europe, 33 1 64 46 40 82. Use the following terminal settings: VT100 emulation; databits: 8; parity: none; stop bits: 1; and connection rates up to 28.8 kbps.

For a copy of CCO's Frequently Asked Questions (FAQ), contact cco-help@cisco.com. For additional information, contact cco-team@cisco.com.

Note If you are a network administrator and need personal technical assistance with a Cisco product that is under warranty or covered by a maintenance contract, contact Cisco's Technical Assistance Center (TAC) at 800 553-2447, 408 526-7209, or tac@cisco.com. To obtain general information about Cisco Systems, Cisco products, or upgrades, contact 800 553-6387, 408 526-7208, or cs-rep@cisco.com.

Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM, a member of the Cisco Connection Family, is updated monthly. Therefore, it might be more current than printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service. The CD-ROM package is available as a single package or as an annual subscription. You can also access Cisco documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

If you are reading Cisco product documentation on the World Wide Web, you can submit comments electronically. Click **Feedback** in the toolbar and select **Documentation**. After you complete the form, click **Submit** to send it to Cisco. We appreciate your comments.

CHAPTER 1

Overview

The Catalyst 2900 series XL modules add port density and high-performance connectivity to a Catalyst 2900 series network. When installed in the appropriate Catalyst 2900 series switch, these modules support a full range of cabling types, port connectors, and 10, 100, and 1000 megabit-per-second (Mbps) transmission speeds. All the Catalyst 2900 series modules autonegotiate the duplex mode of each port to match that of the attached device. The Ethernet and Fast Ethernet modules also autonegotiate the speed settings of each port.

This chapter contains the following topics:

- Key features of the modules
- Descriptions of the module LEDs
- Module cabling guidelines
- Examples of how the modules can be deployed

The Catalyst 2900 series modules support Inter-Switch Link (ISL) and IEEE 802.1Q trunking or multi-virtual LAN (VLAN) ports. The following table describes the modules by model number.

Model Number[1]	Description
WS-X2914-XL-V	4 autosensing 10/100 UTP ports
WS-X2922-XL-V	2 100BaseFX ports
WS-X2932-XL	1 1000BaseT port
WS-X2924-XL-V	4 100BaseFX ports
WS-X2931-XL	1 1000BaseX port

1. If you insert these modules into a Catalyst 2912MF XL (WS-C2912MF-XL) or Catalyst 2924M XL switch (WS-C2924M-XL-A or WS-C2924M-XL-EN), they support up to 8192 MAC addresses on each switch. If you insert any of these modules into a Catalyst 2916M XL switch (WS-C2916M-XL), they support up to 2048 MAC addresses on each switch.

Note To use the ISL and IEEE 802.1Q trunking features, you must enable them by using the Enterprise Edition Software. These features cannot be used with the standard edition software.

Key Features

Table 1-1 describes the module features in detail.

Table 1-1 Catalyst 2900 Series XL Modules Features

Module	Feature
WS-X2931-XL (1 1000BaseX port) WS-X2932-XL (1 1000BaseT port)	• Hot-swappable • Management through an SNMP management station, the Cisco IOS command-line interface (CLI), or the web-based Visual Switch Manager (VSM) • Autonegotiation of duplex mode and flow control • IEEE 802.1Q VLAN trunk support • ISL trunk support • Up to 8192 MAC addresses on each modular switch

Table 1-1 Catalyst 2900 Series XL Modules Features (continued)

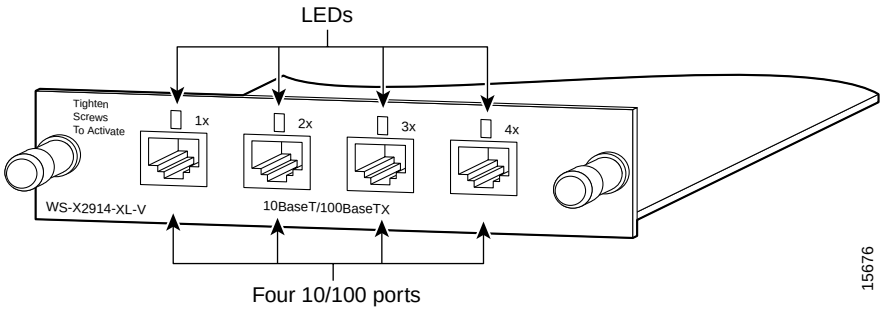
Module	Feature
	• Support for Catalyst 2900 XL series Cisco IOS Release 12.0(5)XU or later • Gigabit EtherChannel support • Gigabit Interface Converter (GBIC) field-replaceable interface for Catalyst 2931XL 1000BaseSX and 1000BaseLX/LH modules • IEEE 802.3x, 802.3z, and 802.3ab compliant[1]
WS-X2914-XL-V (4 10/100 UTP ports) WS-X2922-XL-V (2 100BaseFX ports) WS-X2924-XL-V (4 100BaseFX ports)	• All switched ports • Autonegotiation of speed and duplex on the 10BaseT/100BaseTX module • Per-port data rates of up to 200 Mbps in full-duplex mode • Hot-swappable • Management through an SNMP management station, the Cisco IOS command-line interface (CLI), or the web-based Visual Switch Manager (VSM) • Fast EtherChannel support on all ports • IEEE 802.1Q virtual LAN (VLAN) trunk support • ISL trunk support • Up to 8192 MAC addresses on each modular switch • Support for Catalyst 2900 XL series Cisco IOS Release 11.2(8)SA4 or later

1. Catalyst 2900 Series XL modules support the relevant IEEE 802.3x, IEEE 802.3z, or IEEE 802.3ab protocols appropriate for that module.

10BaseT/100BaseTX Module

The10BaseT/100BaseTX module, hereafter referred to as the 10/100 module, has four switched 10/100 autosensing ports. The ports can autonegotiate the transmission speed, or they can be set to 10 Mbps or 100 Mbps. Ports can also be set to half duplex, full duplex, or autonegotiate. Figure 1-1 shows the 10/100 module.

Figure 1-1 10/100 Module



The 10/100 module is compatible with the IEEE 802.3 10BaseT standard and the IEEE 802.3u 100BaseT standard. The ports use RJ-45 connectors and Category 5 unshielded twisted-pair (UTP) copper cabling. For connector and schematic information, see Appendix B, "Connectors and Cables."

100BaseFX Modules

The 100BaseFX modules have either two or four switched 100BaseFX ports for 100-Mbps fiber-optic connectivity. The ports can run in half-duplex or full-duplex modes. The module support the IEEE 802.3u 100BaseT standard and use standard, duplex, SC connectors. Figure 1-2 and Figure 1-3 show the 100BaseFX modules.

Figure 1-2 2-Port 100BaseFX Modules

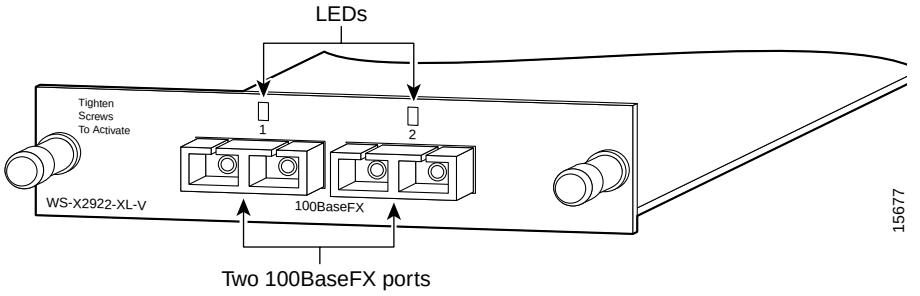
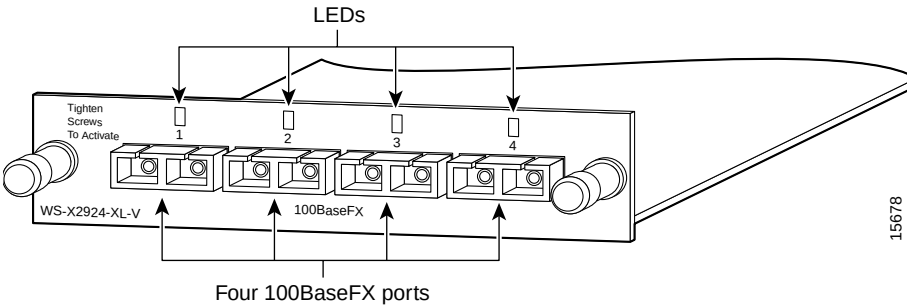


Figure 1-3 4-Port100BaseFX Modules

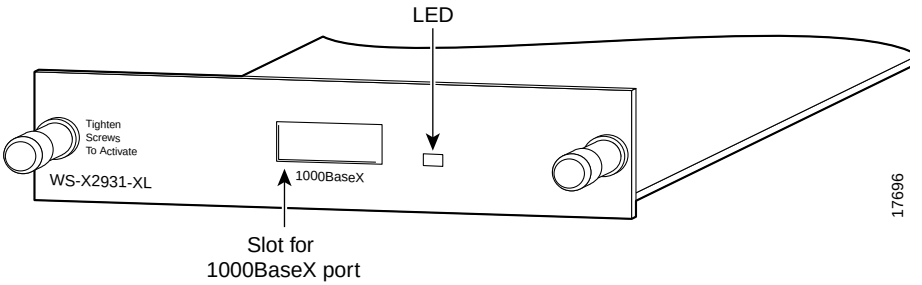


For connector and schematic information, see "100BaseFX and 1000BaseX Modules Cabling" in Appendix B, "Connectors and Cables."

1000BaseX Module

The 1000BaseX module, shown in Figure 1-4, provides one switched 1000-Mbps, full-duplex port that uses an SC fiber-optic connector. The port supports the IEEE 802.3z 1000BaseX standard. For connector and schematic information, see "100BaseFX and 1000BaseX Modules Cabling" in Appendix B, "Connectors and Cables."

Figure 1-4 1000BaseX Module



GBICs for the 1000BaseX Module

You can install either a short-wavelength (SX) or a long-wavelength/long-haul (LX/LH) GBIC into the 1000BaseX module. Figure 1-5 shows a GBIC, and the GBIC types are listed in Table 1-2.

Figure 1-5 GBIC

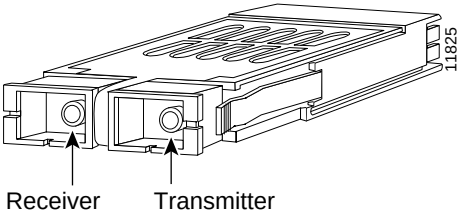


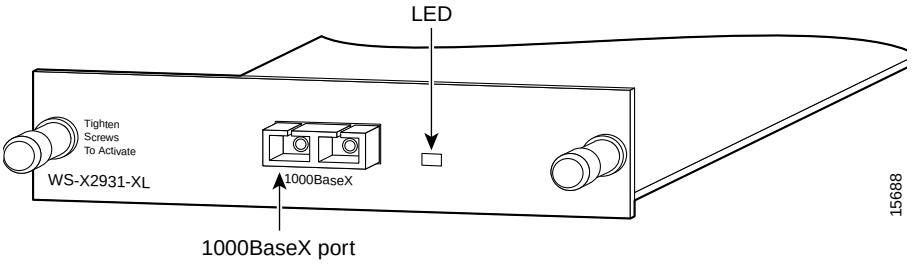
Table 1-2 GBIC Types

GBIC	Part Number
Short wavelength (SX)	WS-G5484=
Long wavelength/long-haul (LX/LH)	WS-G5486=

Note GBICs are sold separately from the 1000BaseX modules. Cisco supports some approved third-party GBICs. For more information, refer to the *Catalyst GigaStack Gigabit Interface Converter Hardware Installation Guide*.

The GBICs fit through cutouts in the front of the module and plug into connectors on the module.

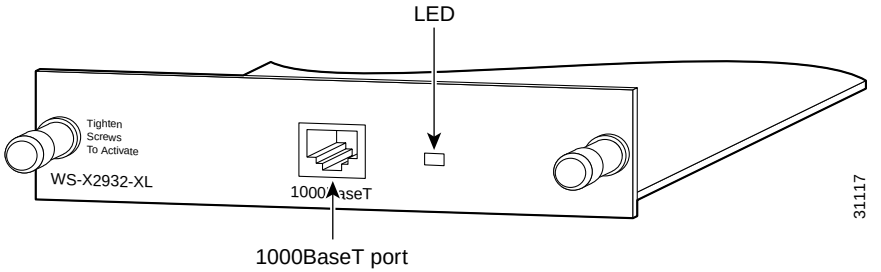
Figure 1-6 1000BaseX Module with GBIC Installed



1000BaseT Module

The 1000BaseT module, shown in Figure 1-7, provides one switched 1000-Mbps, full-duplex port over UTP copper cabling. The 1000BaseT module port supports the IEEE 802.3ab standard.

Figure 1-7 1000BaseT Module



The “10/100 Module Cabling” section in the “Connectors and Cables” appendix describes the RJ-45 connector.

LEDs

An LED above or next to each port reflects the port status, as described in Table 1-3.

Table 1-3 Port LEDs

Color	Meaning
Off	No link.
Green	Link present.
Flashing green	Activity; port is transmitting or receiving data.
Alternating green-amber	The port is experiencing error frames that can affect connectivity. The port monitors errors such as excessive collisions, cyclic redundancy check (CRC) errors, and alignment errors.
Amber	Port is not forwarding because • It is initializing • It was disabled by management or by an address violation • It was blocked by Spanning Tree Protocol

Cabling Guidelines

This section describes the cabling guidelines you need to consider when planning your network.

10/100 Module

The 10/100 ports require Category 5 UTP cabling. Attached devices must be within 100 meters of the port and be either 10BaseT or 100BaseTX compatible.

The 10/100 ports are numbered 1X through 4X. The X indicates that the pins on the port connector are internally crossed. If you are connecting to a device with ports marked with an X, such as another switch or hub, use a crossover cable. If you are connecting to devices with ports not marked with an X, such as a PC, workstation, or server, use a straight-through cable.

For the connector pinouts and schematics, see the section "10/100 Module Cabling" in Appendix B, "Connectors and Cables."

Note Always observe the following general rules when connecting devices: Use a straight-through cable to connect two ports when one is designated with an **X**; use a crossover cable to connect two ports when both are designated with an **X**.

100BaseFX Modules

The 100BaseFX ports use 50/125- or 62.5/125-micron multimode fiber-optic cabling with duplex SC connectors. When set to run in full-duplex mode, 100BaseFX module ports can connect to compatible devices over distances of up to 2 kilometers. For connector and schematic information, see Appendix B, "Connectors and Cables."

1000BaseX Modules

GBICs require the following fiber-optic cables with duplex SC connectors.

Table 1-4 GBIC Cable Specifications

GBIC	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz.km)	Cable Distance Maximum
Shortwave (SX)	850	MMF	62.5	160	722 ft (220 m)
			62.5	200	902 ft (275 m)
			50.0	400	1640 ft (500 m)
			50.0	500	1804 ft (550 m)

Table 1-4 GBIC Cable Specifications (continued)

GBIC	Wavelength (nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz.km)	Cable Distance Maximum
Longwave/Long-haul (LX/LH) (Patch cord installation is required for distances exceeding 300 m.)	1300	MMF	62.5	500	1804 ft (550 m)
			50.0	400	1804 ft (550 m)
			50.0	500	1804 ft (550 m)
Longwave/Long-haul (LX/LH)	1300	SMF (LX/LH)	9/10		32,810 ft (10 km)

1000BaseT Module

The 1000BaseT port requires Category 5 UTP cabling. Attached devices must be within 100 meters of the port and be 1000BaseT compatible.

For the connector pinouts and schematics, see the section "1000BaseT Module Connectors" in Appendix B, "Connectors and Cables."

Deployment Examples

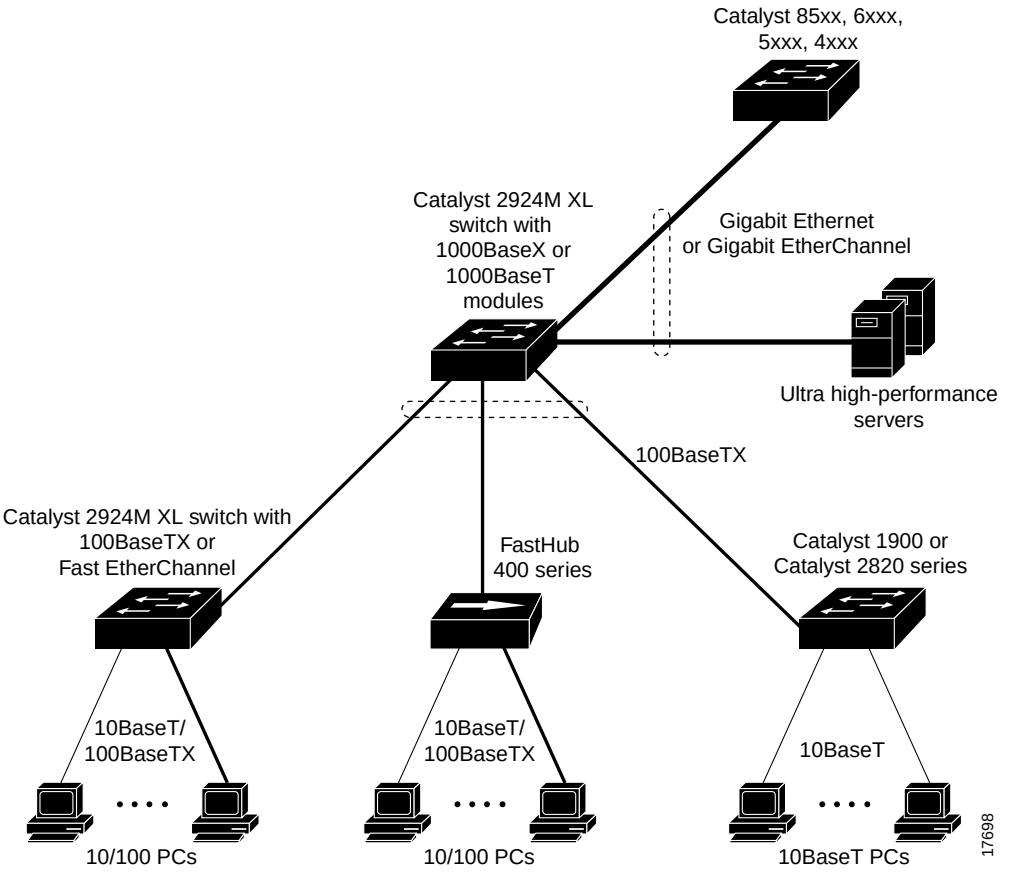
This section describes five examples that use Catalyst 2900 series modules:

- Network with gigabit uplink
- Aggregating traffic from switched and shared networks
- Fast EtherChannel backbone
- Small to medium-sized LAN backbone
- High-performance client-server workgroups

Gigabit Uplink

Figure 1-8 shows a ultra-high-performance client-server workgroup. Catalyst 2900 series switches with 10/100, 1000BaseX, and 1000BaseT modules installed connect the PCs and create a gigabit Ethernet or gigabit EtherChannel link to an ultra-high-performance server supporting the Fast EtherChannel feature.

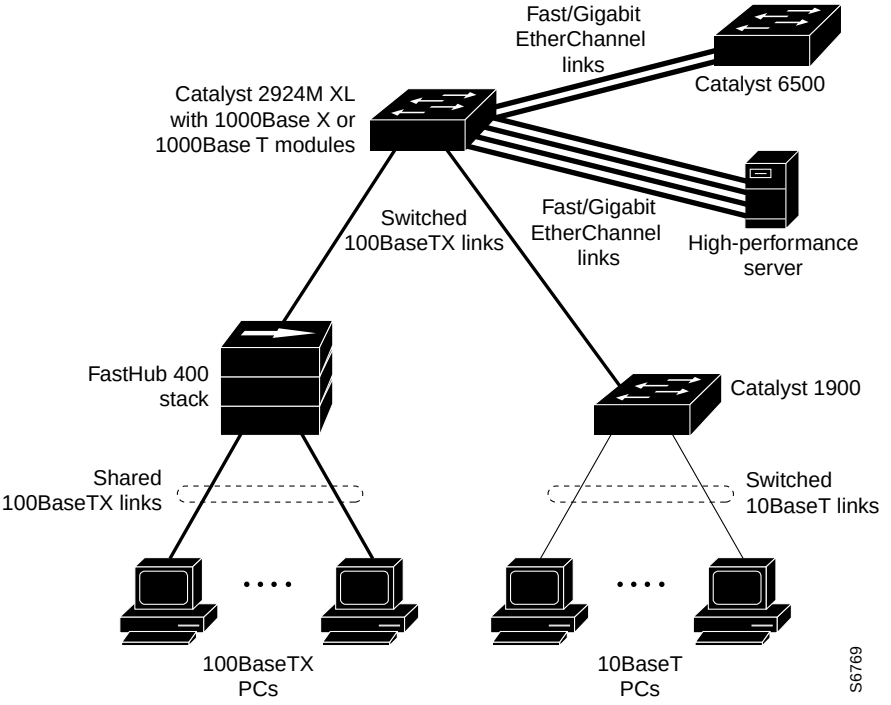
Figure 1-8 Gigabit Uplink Client-Server Workgroup



Wiring Closet Aggregator

Figure 1-9 shows a Catalyst 2924M XL switch aggregating traffic from shared 10BaseT, switched 100BaseTX, and switched 10BaseT networks. A 100BaseFX module passes the traffic to a backbone switch or router, and a 10/100 module links the switch through a Fast EtherChannel link to a high-performance server.

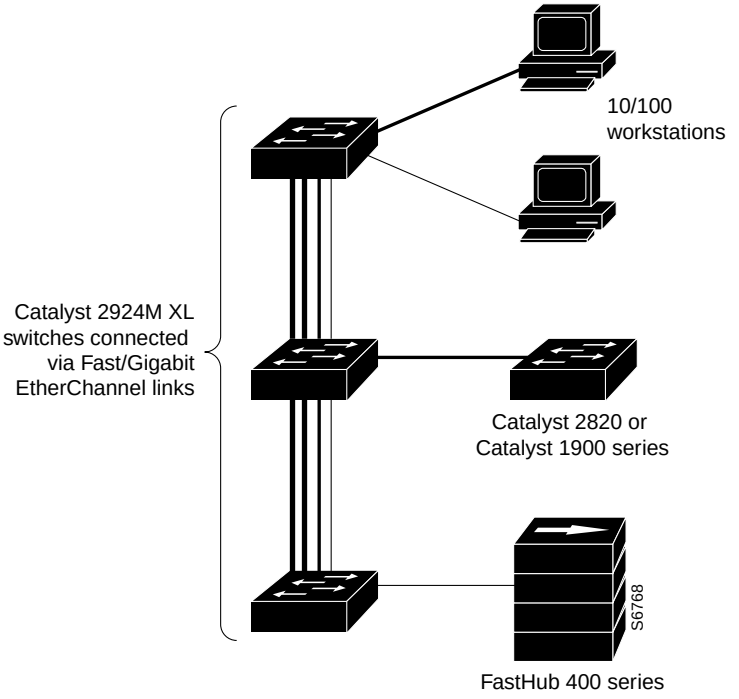
Figure 1-9 Wiring Closet Aggregator



Fast or Gigabit EtherChannel Backbone

Figure 1-10 shows three Catalyst 2924M XL switches creating a high-speed backbone for 10/100 PCs, Catalyst 2820 or Catalyst 1900 series switches, and stacked FastHub 100BaseTX repeaters.

Figure 1-10 Fast EtherChannel Backbone

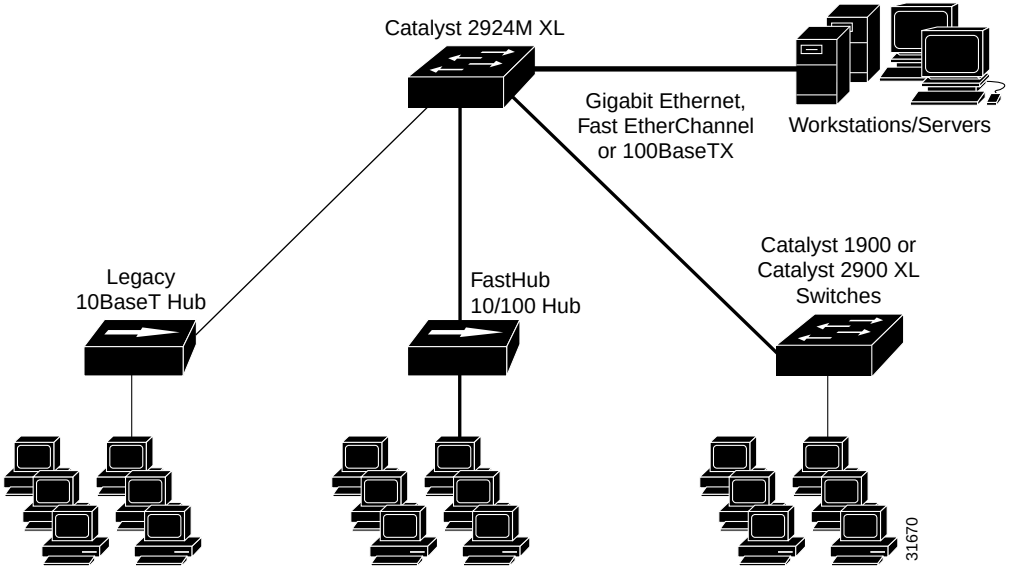


Backbone for Small- to Medium-Sized LAN

Figure 1-11 shows a Catalyst 2924M XL switch used as a corporate network backbone of a small to medium-sized LAN, providing high-speed access to the corporate servers using the Fast EtherChannel link.

This configuration provides a cost-effective migration path from legacy shared 10-Mbps networks to switched Fast Ethernet and gigabit Ethernet networks.

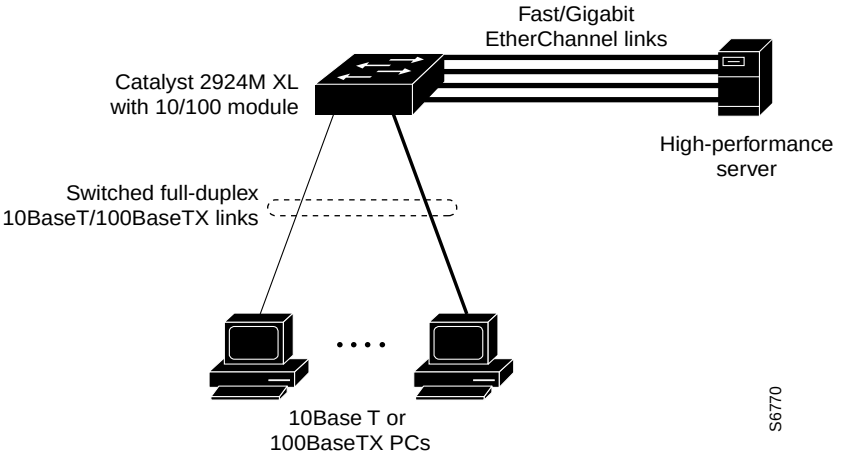
Figure 1-11 Small- to Medium-Sized LAN Backbone



High-Performance Workgroup

Figure 1-12 shows a high-performance client-server workgroup. A Catalyst 2924M XL switch with a 10/100 module installed connects the PCs and creates a four-port Fast EtherChannel link to a high-performance server supporting Fast EtherChannel.

Figure 1-12 High-Performance Client-Server Workgroup



Installation

This chapter describes how to install, connect, and remove the Catalyst 2900 series 10/100, 100BaseFX, 1000BaseX, and 1000BaseT modules.

These modules can be installed while the switch is running and require no configuration. A power-on self-test (POST) verifies that the module is running properly before any packets are forwarded.

You can manage module ports the same way you manage fixed ports on the switch. The web-based Switch Manager is a graphical user interface for monitoring and controlling port features, and you can use the console port or Telnet to access the Cisco IOS command-line interface.

Inspecting the Packing List

Before you install a 10/100, 100BaseFX, 1000BaseX, or 1000BaseT module, ensure that the following items are included in the package:

- Catalyst 2900 series XL module
- Cisco Information Packet
- One CD-ROM containing the Flash image to upgrade the software for the Catalyst 2900 series switch and the corresponding documentation.

If anything is missing, contact your Cisco Systems customer service representative.

EMC Regulatory Statements

U.S.A.

U.S. regulatory information for this product is in the front matter of this manual. For translated warnings, see Appendix C, “Translated Safety Warnings.”

Taiwan

警告使用者：
這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

5456

Avoiding Electrostatic Discharge

Before you install the module, ground yourself by touching a piece of metal to avoid electrostatic discharge (ESD). You should also take the following precautions to prevent damage to the board:

- Keep the module in its antistatic shielded bag until you are ready to install it.
- Handle the modules by the edges.
- Do not touch the components, pins, leads, or solder connections.

Installing a Module

The switch expansion slots are numbered 1 (left) and 2 (right). You can install either of the modules into either slot. Blank faceplates on the Catalyst 2924M XL switch cover the slots, as shown in Figure 2-1

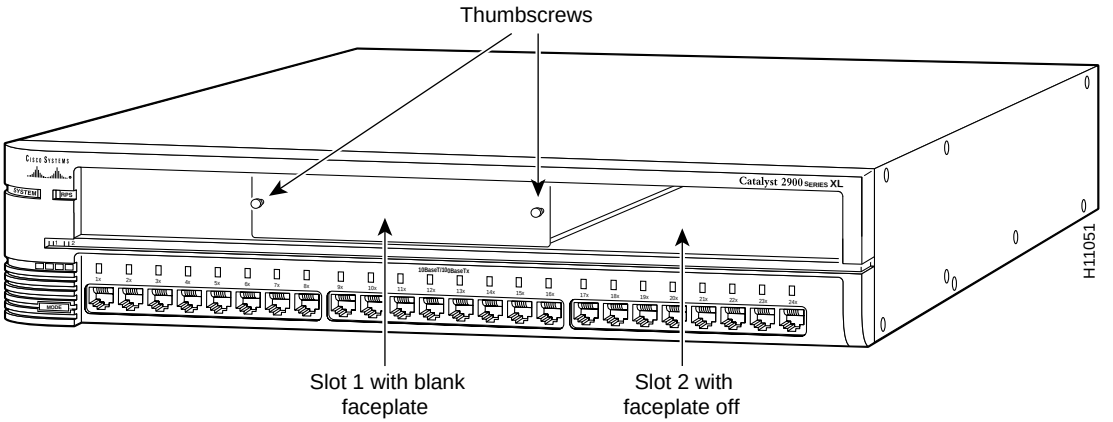
Caution When installing a 100BaseFX or 1000BaseX module, do not remove the rubber plugs from the fiber-optic port or the rubber caps from the fiber-optic cable until you are ready to connect the cable. The plugs and caps protect the fiber-optic port and cable from contamination and ambient light.

To remove a faceplate, follow these steps:

Step 1 Loosen the thumbscrews attaching the faceplate to the switch.

Step 2 Remove the faceplate from the switch, and store it for future use. Figure 2-1 shows a Catalyst 2924M XL switch with an empty expansion slot.

Figure 2-1 Catalyst 2924M XL Switch with an Empty Expansion Slot



After you have removed the faceplate, follow these steps to install a module in the empty expansion slot.

Warning **Class 1 laser product.**

Warning **Avoid exposure to the laser beam.**

Step 3 Slide the module into the slot card-guides until you feel it touch the back of the unit.

Step 4 Push the module firmly until it snaps into place.

Step 5 Tighten the thumbscrews on the module faceplate. The module begins running POST when the thumbscrews are tightened.

Note The installation is not complete until the thumbscrews are tightened.

Step 6 Ensure that the STATUS LED is green (module operational).

Step 7 If the module is not operational, reseat it. If the module still is not operational, contact Cisco Systems for a replacement.

Handling a GBIC

Following are the Gigabit Interface Converter (GBIC) handling guidelines:

- GBICs are static sensitive. To prevent ESD damage, follow appropriate board and component handling procedures.
- GBICs are dust sensitive. When storing a GBIC or when a fiber-optic cable is not plugged in, always keep plugs in the GBIC optical bores.
- The most common source of contaminants in the optical bores is debris picked up on the ferrules of the optical connectors. Use an alcohol swab or Kim-Wipe to clean the ferrules of the optical connector.

Installing a GBIC

1000BaseX modules are shipped without GBICs installed.

Note GBICs are hot-swappable in 1000BaseX modules.

Caution Before you install the GBIC, ground yourself by touching a piece of metal to avoid electrostatic discharge.

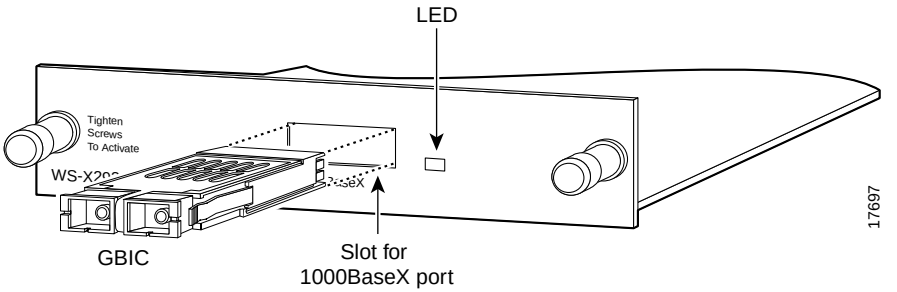
To install a GBIC, do the following:

Step 1 Remove the GBIC from its protective packaging.

Step 2 Verify that the GBIC is the correct type for your network by checking the part number. The number indicates whether it is a 1000BaseSX, 1000BaseLX/LH, or ZX.

Step 3 Grip the sides of the GBIC with your thumb and forefinger, and insert it into the slot on the front panel of the 1000BaseX module, as shown in Figure 2-2.

Figure 2-2 GBIC Insertion



Note GBICs are keyed to prevent incorrect insertion.

Warning **Class 1 laser product.**

Warning **Avoid exposure to the laser beam.**

Step 4 When you are ready to attach the network interface fiber-optic cable, remove the plug from the GBIC, and save it for future use.

Connecting to Module Ports

Insert a connector according to the type of module (100BaseFX, 10/100/1000BaseT, or 1000BaseX), as follows:

- RJ-45 connector (10/100 and 1000BaseT modules)

  Insert the RJ-45 connector until it snaps into place, as shown in Figure 2-3.

- Fiber-optic port (100BaseFX and 1000BaseX SC modules)

  Remove the rubber plugs from the fiber-optic port on the module and store them for future use. Insert the connector in the fiber-optic receptacle, as shown in Figure 2-5.

Note The port status LED is amber while Spanning Tree Protocol discovers the topology and searches for loops. This takes about 30 seconds. The port status LED then turns green.

Figure 2-3 Inserting an RJ-45 Connector into a 10/100 Module

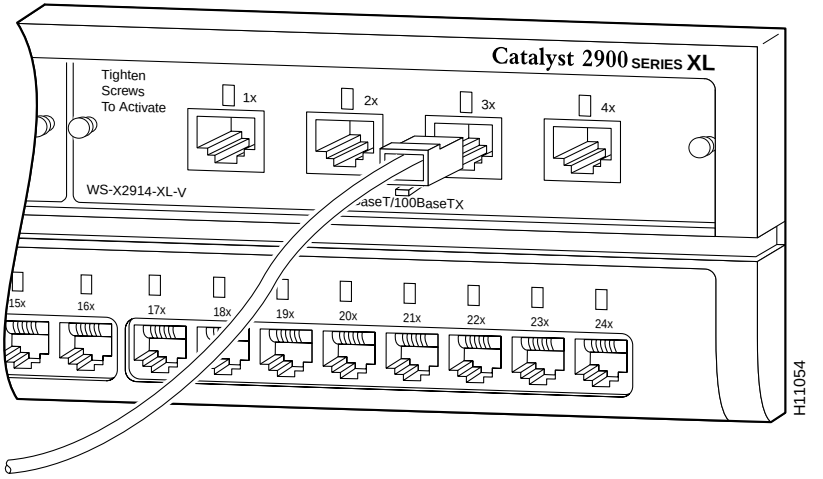
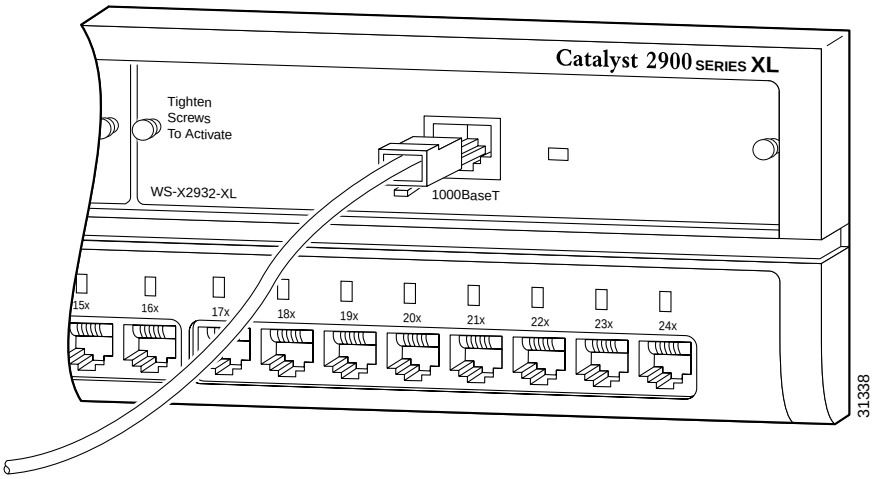
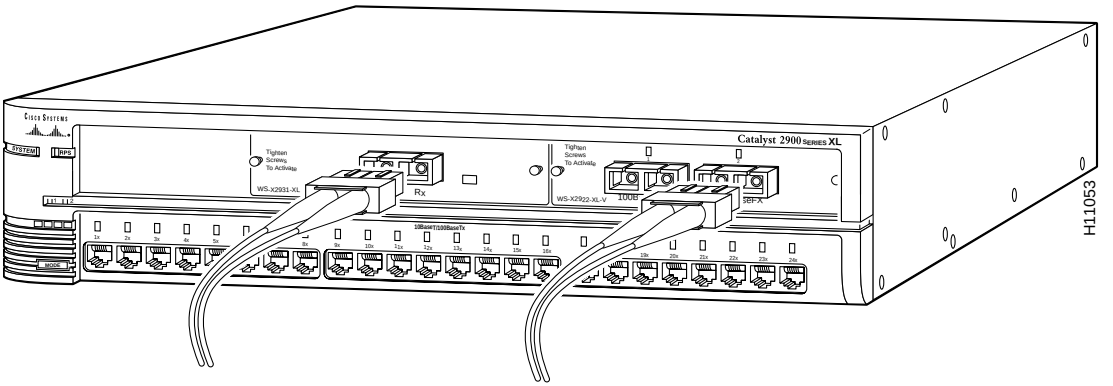


Figure 2-4 Inserting an RJ-45 Connector into a 1000BaseT Module



Note Always use a straight-through cable when connecting to a PC, server, or workstation. Use a crossover cable to connect to another switch or hub. See the section "10/100 Module Cabling" in Appendix B, "Connectors and Cables."

Figure 2-5 Inserting an SC Connector into a 100BaseFX or 1000BaseX SC Module



Using a Patch Cord with the GBICs

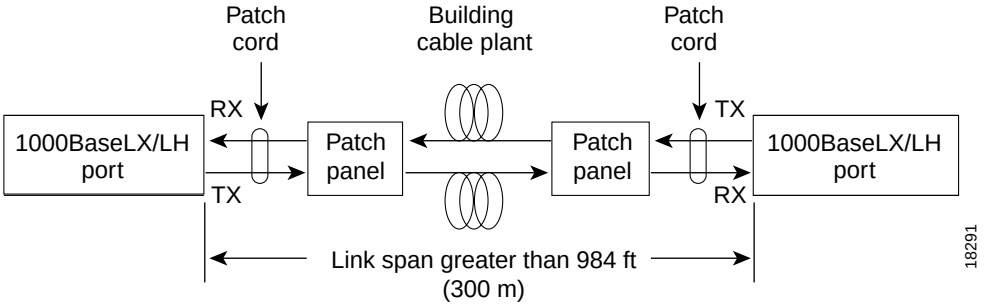
When using the LX/LH GBIC with 62.5-micron diameter multimode fiber (MMF), you must install a mode-conditioning patch cord (Cisco product number CAB-GELX-625 or equivalent) between the GBIC and the MMF cable on both the transmit and receive ends of the link for link distances greater than 984 feet (300 meters).

Note You must use the patch cord to comply with the IEEE 802.3z standards. Using the LX/LH GBIC with MMF and no patch cord for very short link distances (tens of meters) is not recommended. The result could be an elevated bit error rate (BER).

Patch Cord Configuration Example

Following is a typical configuration example:

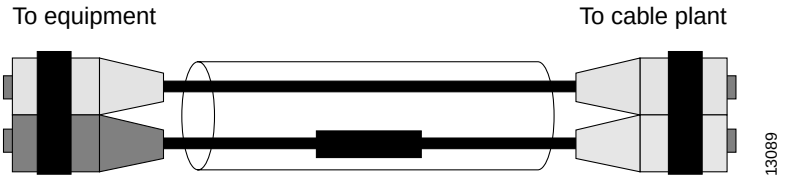
Figure 2-6 Patch Cord Example



Installing the Patch Cord

Figure 2-7 shows the connectors on the patch cord. Connect the end of the patch cord labeled “To Equipment” into the GBIC. Connect the end labeled “To Cable Plant” into the patch panel. The patch cord is 9.84 feet (3 meters) long and has duplex SC male connectors at each end.

Figure 2-7 Patch Cord Cabling



Default Settings for the 1000BaseX and 1000BaseT modules

The 1000BaseX and 1000BaseT modules have the same default settings as the 10/100 and 100BaseFX modules, with the following exception:

- port cost value

  The Spanning Tree Protocol (STP) uses port path costs to determine which port to select as a forwarding port. Ports attached to faster media (such as 1000BaseX) have lower numbers assigned to them by default, and ports attached to slower media have higher numbers assigned. The default port cost value for 1000BaseX and 1000BaseT ports is 4.

Removing a GBIC

To remove a GBIC, do the following:

Step 1 Disconnect the network fiber cable from the GBIC SC connector.

Step 2 Release the GBIC from the slot by simultaneously squeezing the two plastic tabs (one on each side of the GBIC).

Step 3 Slide the GBIC out of the Gigabit Ethernet module slot. A flap drops down to protect the Gigabit Ethernet module connector.

Step 4 If the GBIC is defective, dispose of the product.

Warning **Ultimate disposal of this product should be handled according to all national laws and regulations.**

Removing a Module

To remove a module, follow these steps:

Step 1 Disconnect the cable from the module port.

Caution Catalyst 2900 series modules are "hot swappable," provided that you disconnect the cable from the module port before removing the module from the switch. Removing the module before disconnecting the module port cable(s) can result in a reboot or crash of the switch.

Step 2 Loosen the thumbscrews attaching the module faceplate to the switch.

Step 3 Remove the module by grasping the thumbscrews and pulling the module out of the slot.

Caution Replace the rubber plugs in the fiber-optic connector on the module and the rubber caps on the fiber-optic connector on the cable. The plugs and caps protect the fiber-optic connectors from contamination and ambient light.

Step 4 Replace the blank faceplate to cover the empty expansion slot.

Step 5 Tighten the thumbscrews on the faceplate.

Power-On Self-Test

When a module is inserted into the expansion slot, the port LEDs on the module turn amber. After the module thumbscrews are tightened, the LEDs turn off and then turn green. Starting from the left-most LED, the LEDs turn off in turn as POST completes successfully. When all the LEDs are off, the LEDs blink green and begin normal operations.

If a module fails POST, the expansion slot LED (1 or 2) on the switch turns amber. All POST failures are fatal. Call Cisco Systems if a module fails POST.

Note If you power up a Catalyst 2912MF XL, Catalyst 2916M XL, or Catalyst 2924M XL switch with modules installed, the module ports are the last to run POST.

Troubleshooting

Use Table 3-1 to identify problems with the modules and take the appropriate corrective action.

Table 3-1 Common Problems and Their Solutions

Symptom	Possible Causes	Corrective Action
Port LED is amber.	Thumbscrews have not been tightened.	Tighten thumbscrews.
	Spanning Tree Protocol is checking for loops.	Wait for Spanning Tree Protocol to complete its search. The LED turns green when Spanning Tree Protocol completes its check.
	Port is initializing, it was disabled by management or an address violation, or it was blocked by Spanning Tree Protocol.	Use Visual Switch Manager or the IOS command-line interface to check the status of the port and to enable it.
Port LED is alternating between green and amber.	Port is experiencing error frames. This could be due to a duplex mismatch caused by autonegotiation, collisions, CRC errors, or alignment errors.	Check the duplex settings on both devices. Check the speed settings on both devices except when using a gigabit Ethernet module. You cannot change the speed on the gigabit Ethernet modules. If one parameter is manually set, manually set all of them, or set both devices to autonegotiate speed and duplex. See the *Catalyst 2900 Series XL Installation and Configuration Guide* for more information.

Table 3-1 Common Problems and Their Solutions (continued)

Symptom	Possible Causes	Corrective Action
Port LED is off.	Device has no power.	Ensure that the switch and the target device have power.
	Wrong cable type.	Verify that the cable is correct: crossover or straight-through.
	Bad cable.	Replace with a known good cable.
	No cable.	Insert and connect cable.
Expansion slot LED is amber.	Module failed POST.	Ensure that the switch is running an IOS software release that supports the module. (See "Key Features" in Chapter 1, "Overview.") If the IOS software release is correct, call Cisco Systems to replace the module.
Switch crashes or reboots	Removed the module before disconnecting the module port cables.	Reset switch (if the switch doesn't reset itself). When hot swapping the module, disconnect the cable from the module port before removing the module from the switch.

Technical Specifications

This appendix lists the technical specifications and regulatory agency approvals for the Catalyst 2900 series modules.

Environmental Ranges	
Operating temperature	
10BaseT, 100BaseTX, 100BaseFX, 1000BaseX modules	32 to 122°F (0 to 50°C)
1000BaseT module	–23 to 113°F (–5 to 45°C)
Storage temperature	
10BaseT, 100BaseTX, 100BaseFX, 1000BaseX modules	–4 to 149°F (–20 to 65°C)
1000BaseT module	–13 to 158°F (–25 to 70°C)
Operating humidity	
10BaseT, 100BaseTX, 100BaseFX, 1000BaseX modules	10 to 85% (noncondensing)
1000BaseT module	10 to 90% (noncondensing)
Storage humidity	
10BaseT, 100BaseTX, 100BaseFX, 1000BaseX modules	5 to 95% (noncondensing)
1000BaseT module	5 to 95% (noncondensing)

Operating altitude	
10BaseT, 100BaseTX, 100BaseFX, 1000BaseX modules	Up to 10,000 ft (3048 m)
1000BaseT module	Up to 10,000 ft (3048 m)
Storage altitude	
10BaseT, 100BaseTX, 100BaseFX, 1000BaseX modules	Up to 15,000 ft (4570 m)
1000BaseT module	Up to 30,000 ft (9114 m)

Power Consumption

Module Type	Current
10/100	6.60W
100BaseFX	8.40W (two ports) 11.85W (four ports)
1000BaseX	11.2W
1000BaseT	15.5W

Physical Dimensions

Height x Width x Depth	1.25 x 5.75 x 10.3 in. (3.18 x 14.61 x 26.16 cm)
Weight	10.1 oz (0.29 kg)

Agency Approvals

Safety	EMI
AS/NZS 3260, TS001	FCC Part 15 Class A
UL 1950/CSA 22.2 No. 950	EN 55022A Class A (CISPR 22 Class A)
IEC 950/EN 60950	VCCI Class A
CE	AS/NRZ 3548 Class A
	BCIQ
	CE Class A

Connectors and Cables

This appendix describes the cables and connectors for the Catalyst 2900 series modules.

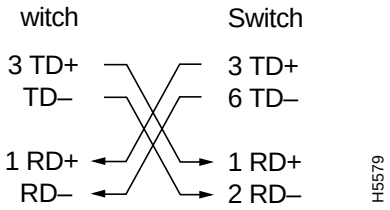
10/100 Module Cabling

The 10/100 module ports are marked with an **X**, indicating that they have their transmit (TD) and receive (RD) signals internally crossed for attachment of an Ethernet adapter using a straight-through cable.

When connecting the 10/100 ports to 10BaseT or 100BaseTX servers and workstations, ensure that you use a Category 5 *straight-through* cable. When connecting to other switches or repeaters, ensure that you use a *crossover* cable.

The schematics of crossover and straight-through cables are shown in Figure B-1.

Figure B-1 Crossover and Straight-Through Cable Schematics



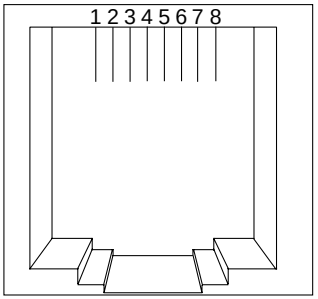
Note Always observe the following general rules when connecting devices: use a straight-through cable to connect two ports when one is designated with an **X**; use a crossover cable to connect two ports when both are designated with an **X**.

10/100 Module Connectors

The 1000BaseT module has one or more RJ-45 connectors on the front panel. Figure B-2 shows the pinout.

Figure B-2 10/100BaseT RJ-45 Connector

Pin	Label
1	RD+
2	RD-
3	TD+
4	NC
5	NC
6	TD-
7	NC
8	NC



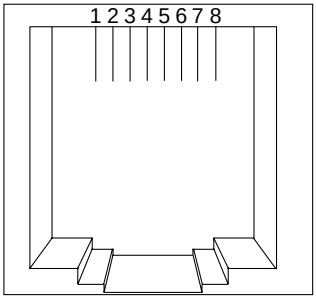
H5318

1000BaseT Module Connectors

The 1000BaseT module has one RJ-45 connector on the front panel. Figure B-3 shows the pinout.

Figure B-3 1000BaseT RJ-45 Connector

Pin	Label
1	TP0+
2	TP0-
3	TP1+
4	TP2+
5	TP2-
6	TP1-
7	TP3+
8	TP3-

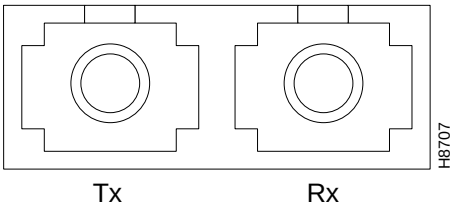


34751

100BaseFX and 1000BaseX Modules Cabling

The 100BaseFX and the 1000BaseX modules use duplex SC connectors. This type of connector is shown in Figure B-4.

Figure B-4 100BaseFX and 1000BaseX SC Connector



H8707

Translated Safety Warnings

This appendix repeats in multiple languages the warnings in this guide.

Class 1 Laser Product Warning

Warning	**Class 1 laser product.**
Waarschuwing	**Klasse-1 laser produkt.**
Varoitus	**Luokan 1 lasertuote.**
Attention	**Produit laser de classe 1.**
Warnung	**Laserprodukt der Klasse 1.**
Avvertenza	**Prodotto laser di Classe 1.**
Advarsel	**Laserprodukt av klasse 1.**
Aviso	**Produto laser de classe 1.**

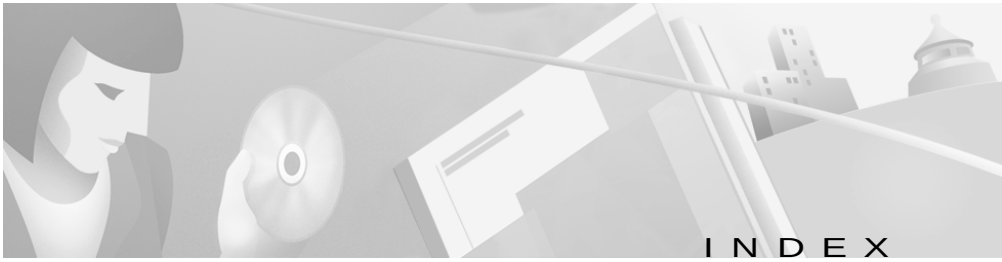
¡Advertencia!	Producto láser Clase I.
Varning!	Laserprodukt av klass 1.

Laser Beam Exposure Warning

Warning	Avoid exposure to the laser beam.
Waarschuwing	Vermijd blootstelling aan de straal.
Varoitus	Vältä säteelle altistumista.
Attention	Eviter toute exposition au faisceau.
Warnung	Schützen Sie sich vor Strahlung.
Avvertenza	Evitare l'esposizione al raggio.
Advarsel	Unngå å bli utsatt for strålen.
Aviso	Evite exposição ao raio.
¡Advertencia!	Evitar la exposición al haz.
Varning!	Utsätt dig inte för laserstrålningen.

Product Disposal

Warning	**Ultimate disposal of this product should be handled according to all national laws and regulations.**
Waarschuwing	**Het uiteindelijke wegruimen van dit product dient te geschieden in overeenstemming met alle nationale wetten en reglementen.**
Varoitus	**Tämä tuote on hävitettävä kansallisten lakien ja määräysten mukaisesti.**
Attention	**La mise au rebut ou le recyclage de ce produit sont généralement soumis à des lois et/ou directives de respect de l'environnement. Renseignez-vous auprès de l'organisme compétent.**
Warnung	**Die Entsorgung dieses Produkts sollte gemäß allen Bestimmungen und Gesetzen des Landes erfolgen.**
Avvertenza	**Lo smaltimento di questo prodotto deve essere eseguito secondo le leggi e regolazioni locali.**
Advarsel	**Endelig kassering av dette produktet skal være i henhold til alle relevante nasjonale lover og bestemmelser.**
Aviso	**Deitar fora este produto em conformidade com todas as leis e regulamentos nacionais.**
¡Advertencia!	**Al deshacerse por completo de este producto debe seguir todas las leyes y reglamentos nacionales.**
Varning!	**Vid deponering hanteras produkten enligt gällande lagar och bestämmelser.**



Numerics

10/100 module
  cabling guidelines **1-4, 1-8**
  crossover cabling **1-9**
  half/full duplex **1-3**
  IEEE 802.3 standards **1-4**
  model number **1-2**
  overview **1-3**
  UTP distance limitations **1-8**
1000BaseT module
  cabling guidelines **1-10**
  IEEE 802.3 standards **1-7**
  model number **1-2**
  overview **1-7**
  UTP distance limitations **1-10**
  VLAN support **1-2**
1000BaseX module
  cabling guidelines **1-9**
  IEEE 802.3 standards **1-5**
  long-wavelength/long-haul (LX/LH) GBIC **1-6**
  model number **1-2**
  overview **1-5**
  SC fiber-optic connector **1-5**
  short-wavelength (SX) GBIC **1-6**
  VLAN support **1-2**
100Base FX module
  model number **1-2**
100BaseFX module
  cable guidelines **1-9**
  distance limitations **1-9**
  IEEE 802.3 standards **1-4**
  overview **1-4**
  port connection information **1-4**
802.1Q trunking support **1-1, 1-2, 1-3**
802.3 standards
  10/100 module **1-4**
  1000BaseT module **1-2, 1-7**
  1000BaseX module **1-2, 1-5**
  100BaseFX module **1-4**

A

agency approvals **A-2**
altitude
  operating range **A-2**
  storage range **A-2**
autonegotiation **1-3**

B

backbone topology **1-13**
bad cable, troubleshooting **3-2**

C

cabling
  Category 5 UTP **1-4**
  crossover **1-9, B-1**
  guidelines
    10/100 ports **1-8, B-2**
    1000BaseT ports **1-10, B-3**
    1000BaseX ports **1-9, B-3**
    100BaseFX ports **1-9, B-3**
  multimode fiber, *see* MMF
  patch cord requirements **2-8**
  straight-through **B-1**
  straight-through vs. crossover **2-8**
  troubleshooting **3-2**
cabling guidelines **1-8 to 1-10**
Category 5 UTP cables **1-4**
caution definition **x**
CLI **1-2, 1-3**
client-server topology **1-15**
command-line interface, *see* CLI
connectors
  10/100 RJ-45 pinout **B-2**
  1000BaseT RJ-45 pinout **B-3**
  inserting **2-6**
  SC fiber-optic **1-5**
crossover cabling **1-9, B-1**

D

data rates **1-3**
deployment examples **1-10 to 1-15**
disabled port **1-8**
distance limitations
  fiber **1-9**
  UTP **1-8**
duplex mode
  autonegotiation **1-1, 1-2**
  SC connector **B-3**

E

electrostatic discharge, *see* ESD
EMC regulatory statements **2-2**
EMI agency approvals **A-2**
environmental ranges **A-1**
error frames
  LED indication **1-8**
  Spanning-Tree Protocol **3-1**
ESD, avoiding **2-2**

F

faceplates, removing **2-2**
Fast EtherChannel
backbone example **1-13**
links **1-12**
module support for **1-3**
FastHubs in a network **1-13**
fiber-optic
100-Mbps connectivity **1-4**
connector caution **2-11**
contamination caution **2-3**
figures
10/100BaseT RJ-45 Connector **B-2**
10/100 module **1-3**
1000BaseT Module **1-7**
1000BaseT RJ-45 Connector **B-3**
1000BaseX Module **1-5**
1000BaseX Module with GBIC **1-7**
100BaseFX module (four port) **1-5**
100BaseFX module (two port) **1-4**
Catalyst 2924M XL Switch with an Empty Expansion Slot **2-3**
Crossover and Straight-Through Cable Schematics **B-1**
Fast EtherChannel Backbone **1-13**
GBIC Insertion **2-5**
Gigabit Uplink Client-Server Workgroup **1-11**
High Performance Workgroup **1-15**
Inserting an RJ-45 Connector into a 10/100 Module **2-7**
Inserting an RJ-45 Connector into a 1000BaseT Module **2-7**
Inserting an SC Connector into a 100BaseFX or 1000BaseX SC Module **2-8**
Patch Cord Cabling **2-9**
Patch Cord Example **2-9**
Small- to Medium-Sized Lan Backbone **1-14**
Wiring Closet Aggregator **1-12**

G

GBIC
cable specifications **1-9**
elevated bit error rate (BER) **2-8**
handling **2-4**
hot-swapping **2-5**
installing **2-5**
link distances **2-8**
long-wavelength/long-haul (LX/LH) **1-6**
mode-conditioning patch cable **2-8**
part numbers **1-6**
patch cord
62.5-micron diameter MMF **2-8**
installation **2-9**
requirements **2-8**
removing **2-10**
short-wavelength (SX) **1-6**
third-party GBICs supported **1-6**

verify part number **2-5**
gigabit EtherChannel support **1-3**
Gigabit Interface Converters, *see* GBIC
gigabit uplink example **1-11**

H

high-performance client-server workgroup example **1-15**
hot swapping
caveat **2-11**
modules supporting **1-2, 1-3**
humidity
operating range **A-1**
storage range **A-1**

I

IEEE standards
802.1Q **1-1, 1-2, 1-3**
802.3ab **1-5, 1-7**
802.3 protocols supported **1-3**
802.3u **1-4**
installation
connecting to module ports **2-6**
inserting a module **2-3**
patch cord **2-9**
warnings **2-3**
Inter-Switch Link (ISL) trunking
module support **1-1 to 1-3**
software requirements **1-2**
IOS Release support **1-3**
IOS release support **1-3**

L

LEDs
description **1-8**
error indicators **1-8**
failing POST **2-11**
port status
alternating green/amber **3-1**
amber **3-1**
during STP search **2-6**
status **3-2**
troubleshooting with **3-1**
Longwave/long-haul (LX/LH) **1-10**

M

MAC addresses, supported **1-2, 1-3**
model numbers **1-2**
modules
cabling **B-1 to B-3**
connecting to ports **2-6**
deployment examples
Fast EtherChannel backbone **1-13**

gigabit uplink client-server workgroup **1-11**
high-performance workgroup **1-15**
small to medium LAN **1-13**
wiring closet aggregator **1-12**
features **1-3**
hot swapping caution **2-11**
installing **2-2 to 2-4**
IOS software release troubleshooting **3-2**
model numbers **1-2**
removing **2-11**
running POST **2-12**
multi-VLAN ports, supported **1-1**

N

network examples **1-10**
note definition **x**

O

optical bores, troubleshooting **2-4**

P

packing list **2-1**
patch cord
62.5-micron diameter MMF **2-8**
configuration example **2-9**
installing **2-9**
physical dimensions **A-2**
pinouts
10/100 RJ-45 **B-2**
1000BaseT RJ-45 **B-3**
ports, connecting to
10/100 module **1-3**
1000BaseT module **1-7**
1000BaseX module **1-5**
100BaseFX module **1-4**
port status LED **1-8**
POST
failing **2-11**
LED display **2-11**
running **2-12**
troubleshooting **3-2**
power, troubleshooting **3-2**
power consumption **A-2**
power-on self-test, *see* POST

R

regulatory statements **2-2**
removing a module **2-11**
RJ-45 connector
10/100 pinout **B-2**
1000BaseT pinout **B-3**
inserting **2-6**

S

safety
agency approvals **A-2**
warnings, translated **C-1**
SC fiber-optic connector **1-5**
SNMP **1-2, 1-3**
Spanning Tree Protocol
discovery **2-6**
troubleshooting check **3-1**
specifications **A-1**
storage temperature range **A-1**
straight-through cabling **B-1**
Switch Manager **2-1**

T

tables
Common Problems and Their Solutions **3-1**
GBIC cable specifications **1-9**
GBIC Types **1-6**
model numbers and descriptions **1-2**
module features **1-2**
Port LEDs **1-8**
technical specifications **A-1**
temperature specifications **A-1**
topology
client-server **1-11, 1-15**
Fast EtherChannel **1-13**
troubleshooting
duplex settings **3-1**
optical bores **2-4**
POST **3-2**
trunking, ISL
module support **1-1, 1-3**
software requirements **1-2**

U

unshielded twisted-pair, *see* UTP
UTP
10/100 module requirements **1-4**
distance limitations for 10/100 module **1-8**
distance limitations for 1000BaseT module **1-10**

V

virtual LAN, *see* VLAN
Visual Switch Manager, *see* VSM
VLAN
802.1Q trunk support **1-2, 1-3**
multiple supported **1-1**
VSM
troubleshooting using **3-1**
web-based management **1-2, 1-3**

W

warning definition **xi**
warnings
  Class 1 Laser Product **C-1**
  Laser Beam Exposure **C-2**
  Product Disposal **C-3**
  translated **C-1**
weight **A-2**