Module Overview and Specifications

This chapter provides an overview of the features of the Catalyst 4500 series supervisor engines and switching modules. The information is presented in the following major sections:

- Catalyst 4000 Series Switches, page 1-1
- Catalyst 4500 Series Switches, page 1-2
- Supervisor Engines, page 1-2
- Ethernet and Fast Ethernet Switching Modules, page 1-12
- Gigabit Ethernet Switching Modules, page 1-29
- Other Switching Modules, page 1-44
- Switching Module LEDs, page 1-45
- Hot-Swapping Feature, page 1-46

Catalyst 4000 Series Switches

The Catalyst 4000 series switches consist of the Catalyst 4003 switch and the Catalyst 4006 switch. The switches are designed for high-performance, high-density wiring closet applications. A detailed overview of these switches is in the *Catalyst 4000 Series Installation Guide*.

Catalyst 4500 Series Switches

The Catalyst 4500 series switches consist of the Catalyst 4503 switch, the Catalyst 4506 switch, the Catalyst 4507R switch, and the Catalyst 4510R switch. The switches are designed for high-performance, high-density wiring closet applications. A detailed overview of these switches is in the *Catalyst 4500 Series Installation Guide*.

Supervisor Engines

These sections describe the supervisor engines available for the Catalyst 4500 series switches:

- Supervisor Engine I (WS-X4012), which is used in the Catalyst 4003 switch (Figure 1-1)
- Supervisor Engine II (WS-X4013, which is used in the Catalyst 4006, 4503, and 4506 switches (Figure 1-2)
- Supervisor Engine II-Plus (WS-X4013+), which is used in the Catalyst 4006, 4503, 4506, and 4507R switches (Figure 1-3)
- Supervisor Engine II-Plus TS (WS-X4013+TS), which is used in Catalyst 4503 switches only (Figure 1-4)
- Supervisor Engine II-Plus 10GE (WS-X4013+10GE), which is used in Catalyst 4503, 4506, and 4507R switches (Figure 1-5)
- Supervisor Engine III (WS-X4014), which is used in the Catalyst 4006, 4503, and 4506 switches (Figure 1-6)
- Supervisor Engine IV (WS-X4515), which is used in the Catalyst 4006, 4503, 4506, and 4507R switches (Figure 1-7)
- Supervisor Engine V (WS-X4516), which is used in the Catalyst 4006, 4503, 4506, 4507R, and 4510R switches (Figure 1-8)
- Supervisor Engine V-10GE (WS-X4516-10GE), which is used in the Catalyst 4503, 4506, 4507R, and 4510R switches (Figure 1-9)

On the Catalyst 4006, 4503, and 4506 switches, you can install the Supervisor Engine in slot 1 only. On the Catalyst 4507R or 4510R switch, you install the primary supervisor engine in slot 1, and you can install an optional redundant supervisor engine in slot 2.

The supervisor engines have the following features:

- Data path and control for all network interfaces
- Management functions:
  - Interface monitoring
  - Environmental status
  - SNMP and console/Telnet interface
- Hot-swapping

Note Packets are not forwarded while the module is removed. A system reboot occurs when a supervisor engine is reinserted.

- The Supervisor Engine II-Plus TS provides 12 nonblocking 10/100/1000BASE-T (RJ-45) ports and 8 1000BASE-X (SFP) ports.
- The Supervisor Engine II-Plus 10GE and Supervisor Engine V-10GE provide 2 nonblocking 10GBASE uplink ports.
- The Supervisor Engine II-Plus 10GE and Supervisor Engine V-10GE provide 4 1000BASE-X (SFP) ports.
- The Supervisor Engine IV and V support the Catalyst 4500 series NetFlow Services Card (WS-F4531). NetFlow is integral to the Supervisor Engine V-10 GE.

To install a supervisor engine, follow the procedure in the "Installing the Modules" section on page 3-2.

The supervisor engines used in Catalyst 4000 and Catalyst 4500 switches are shown in Figure 1-1 to Figure 1-8.

Figure 1-1 Supervisor Engine I (WS-X4012)

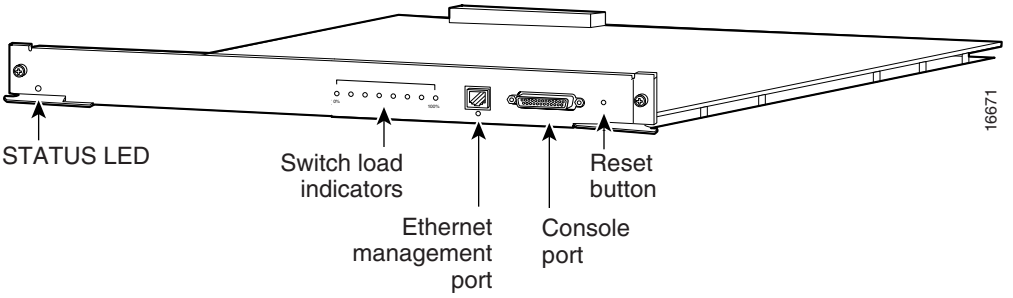


Figure 1-2 Supervisor Engine II (WS-X4013)

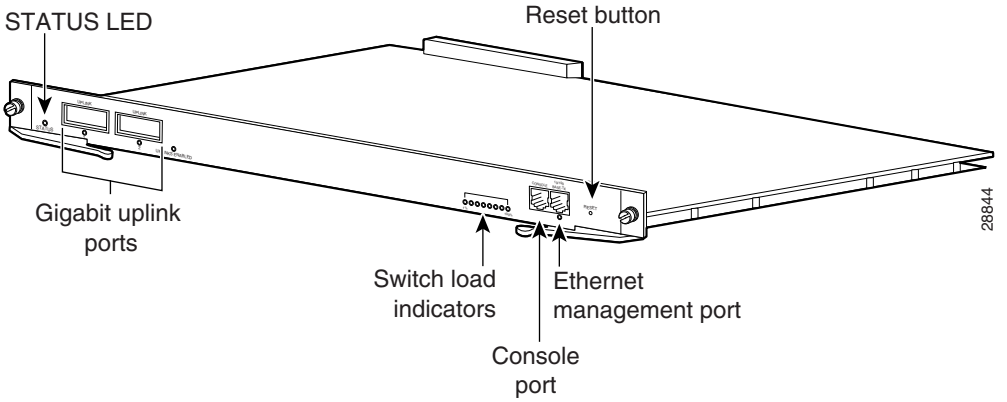


Figure 1-3 Supervisor Engine II-Plus (WS-X4013+)

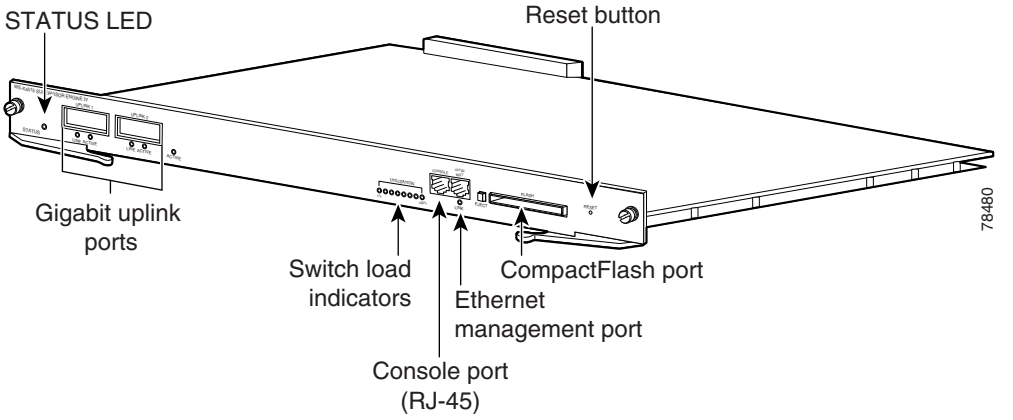


Figure 1-4 Supervisor Engine II-Plus TS (WS-X4013+TS)

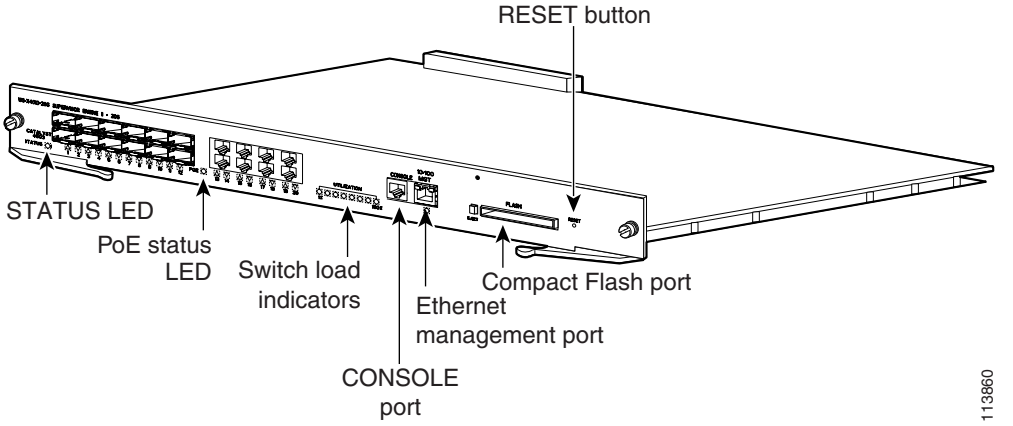


Figure 1-5 Supervisor Engine II-Plus 10GE (WS-X4013+10GE)

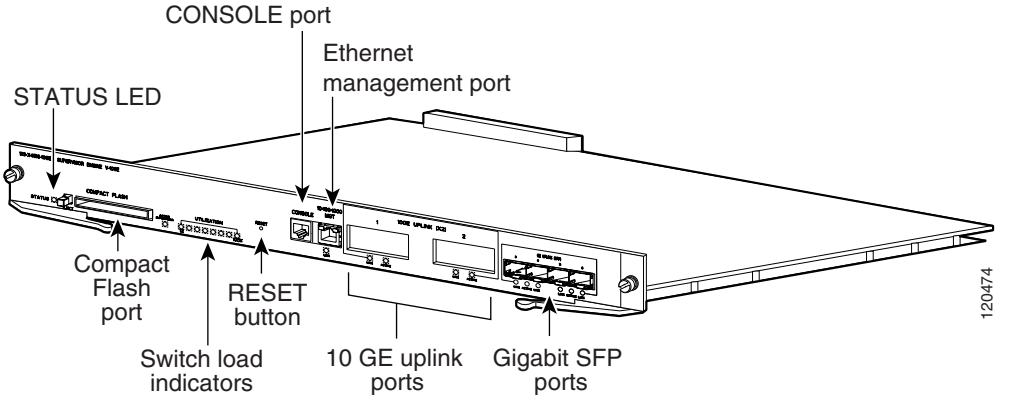


Figure 1-6 Supervisor Engine III (WS-X4014)

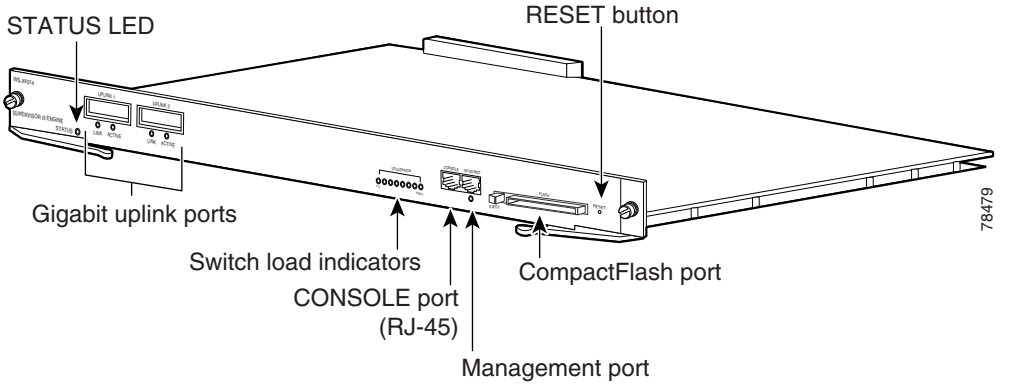


Figure 1-7 Supervisor Engine IV (WS-X4515)

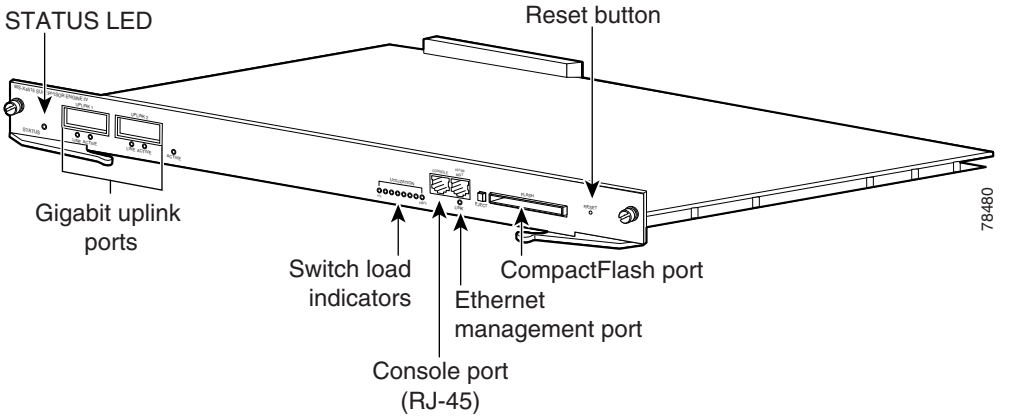


Figure 1-8 Supervisor Engine V (WS-X4516)

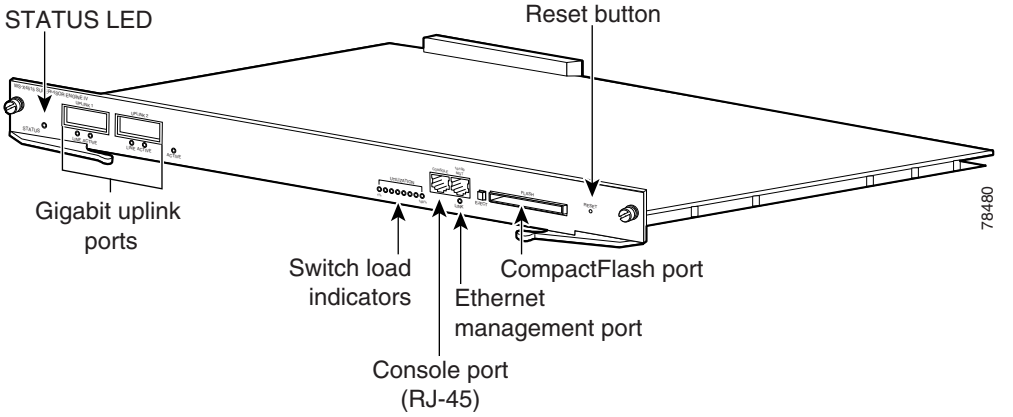
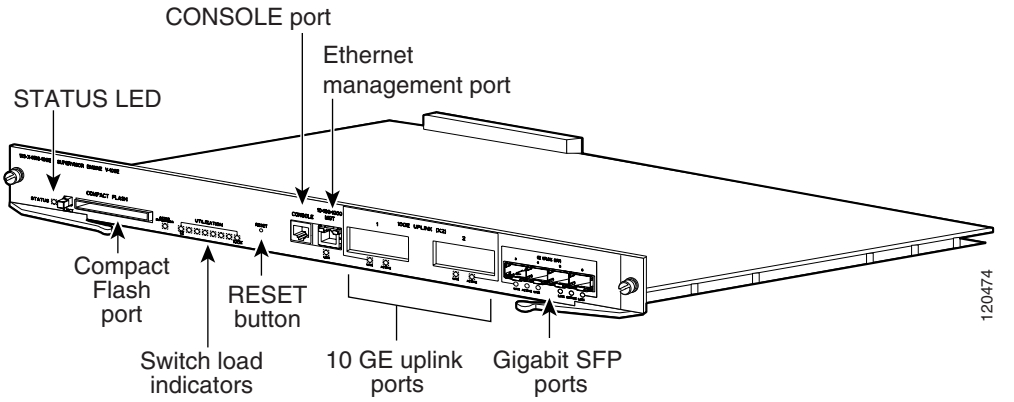


Figure 1-9 Supervisor Engine V-10GE (WS-X4516-10GE)



Front-Panel Components

The following connectors, LEDs, and buttons are located on the front panel of the supervisor engine:

- The STATUS LED, which indicates the operating state of the module
- Two Gigabit uplink ports (WS-X4013, WS-X4013+, WS-X4014, and WS-X4515 supervisor engines only)
- Four SFP Gigabit uplinks ports and 2 10-Gigabit uplink ports on WS-X4013+10GE and WS-X4016-10GE.
- Eight unmarked switch load indicator LEDs, which provide an approximation of the current traffic across the backplane
- A console port (DB-25 for the WS-X4012; RJ-45 for the WS-X4013, WS-X4013+, WS-X4013+ TS, WS-X4013+10GE, WS-X4014, WS-X4515, WS-X4516, and WS-X4516-10GE supervisor engines)
- An Ethernet management port (RJ-45)
- A link status LED, which provides status for the management port (10BASE-T on the WS-X4012 and 10/100BASE-T on the WS-X4013, WS-X4013+, WS-X4013+ TS, WS-X4013+10GE, WS-X4014, WS-X4515, WS-X4516, and WS-X4516-10GE supervisor engines)

- The Reset button (recessed), which allows you to reset the system
- The CompactFlash port and eject button (WS-X4013+, WS-X4013+ TS, WS-X4013+10GE, WS-4014, WS-X4515, WS-X4516, and WS-X4516-10GE supervisor engines only) (refer to *Using the Compact Flash on the Catalyst 4000 Family Supervisor Engine III and IV*.)

Table 1-1 describes the supervisor engine LEDs.

Table 1-1 Supervisor Engine LEDs

LED	Color/State	Description
STATUS		Indicates the results of a series of self-tests.
	Green	All diagnostic tests passed.
	Red	A test failed.
	Orange	System boot or diagnostic test is in progress.
	Off	Module is disabled.
UTILIZATION	Green 1–100%	If the switch is operational, this display indicates the current traffic load over the backplane (as an approximate percentage).
LINK		Indicates the status of the 10/100BASE-T Ethernet management port or uplink ports.
	Green	The link is operational.
	Orange	The link is disabled by user.
	Flashing orange	The power-on self-test indicates a faulty port.
	Off	No signal is detected or there is a link configuration failure.
ACTIVE		Indicates whether the uplink port is active or not.
	Green	The port is active.
	Off	The port is not active.

Ethernet Management Port

The WS-X4012 supervisor engine has a 10BASE-T Ethernet management port. The WS-X4516-10GE and WS-X4013+10GE supervisor engine modules have a 10/100/1000BASE-T Ethernet management port.The other supervisor engine modules have a 10/100BASE-T Ethernet management port. Supervisor engines use an RJ-45 connector on the front panel with a link status LED. For the location of the port, see Figure 1-1 (WS-X4012), Figure 1-2 (WS-X4013), Figure 1-3 (WS-X4013+), Figure 1-4 (WS-X4013+TS), Figure 1-5 (WS-X4013+10GE), Figure 1-6 (WS-X4014), Figure 1-7 (WS-X4515), Figure 1-8 (WS-X4516), or Figure 1-9 (WS-X4516-10GE).

TCP/IP-based management services available through inband access also are provided through this port (Telnet and SNMP). This management port also supports image download.

Note The 10BASE-T and 10/100BASE-T Ethernet management ports are for network management only. These ports do not support network switching.

Console Port

The console port allows you to perform the following functions:

- Configure the switch from the CLI
- Monitor network statistics and errors
- Configure SNMP agent parameters
- Download software updates to the switch or distribute software images residing in Flash memory to attached devices

The Catalyst 4003 console port is a DCE DB-25 receptacle, which supports a DCE EIA/TIA-232 interface. The console port is an RJ-45 receptacle on the Catalyst 4006, 4503, 4506, and 4507.

Note EIA/TIA-232 was known as recommended standard RS-232 before its acceptance as a standard by the Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA).

Supervisor Memory

Table 1-2 lists the memory and processor specifications for the Supervisor engines.

Table 1-2 Supervisor Memory

Supervisor Engine	
Supervisor Engine II+	256 MB SODIMM SDRAM 32 MB Flash memory
Supervisor Engine II+TS	256 MB SODIMM SDRAM 32 MB Flash memory
Supervisor Engine II+10GE	256 MB SODIMM SDRAM (upgradeable to 512 MB) 64 MB Flash memory
Supervisor Engine III	256 MB DIMM SDRAM 64 MB Flash memory 512 KB NVRAM
Supervisor Engine IV	512 MB SODIMM SDRAM 64 MB Flash memory 512 KB NVRAM
Supervisor Engine V	512 MB SODIMM SDRAM 64 MB Flash memory 512 KB NVRAM
Supervisor Engine V-10GE	512 MB SODIMM SDRAM 64 MB Flash memory 512 KB NVRAM

Ethernet and Fast Ethernet Switching Modules

This section describes the Catalyst 4500 series Ethernet and Fast Ethernet switching modules and includes the following sections:

- WS-X4124-RJ45, page 1-12
- WS-X4124-FX-MT, page 1-14
- WS-X4148-FX-MT, page 1-15
- WS-X4148-RJ, page 1-15
- WS-X4148-FE-BD-LC, page 1-16
- WS-X4148-FE-LX-MT, page 1-17
- WS-X4148-RJ21, page 1-18
- WS-X4148-RJ45V, page 1-18
- WS-X4248-FE-SFP, page 1-20
- WS-X4224-RJ45V, page 1-20
- WS-X4248-RJ21V, page 1-22
- WS-X4248-RJ45V, page 1-23
- WS-X4232-GB-RJ, page 1-24
- WS-X4232-L3, page 1-25
- WS-X4232-RJ-XX, page 1-27
  - WS-U4504-FX-MT Uplink Module, page 1-28

WS-X4124-RJ45

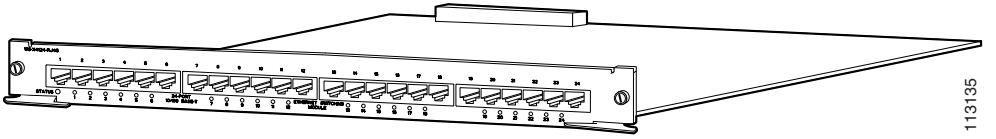
The WS-X4124-RJ45 24-port Fast Ethernet switching module (see Figure 1-10) has the following specifications:

Specification	Description
Module type	10/100BASE-TX Fast Ethernet switching module
Port duplex mode	Half or full duplex mode
Port speed	10 or 100 Mbps

Specification	Description
Number of ports	24
Connector type	RJ-45 (See Figure 2-1 on page 2-2.)
Cable type	UTP[1] or FTP

1. UTP = unshielded twisted-pair

Figure 1-10 WS-X4124-RJ45 24-Port 10/100BASE-TX Fast Ethernet Switching Module

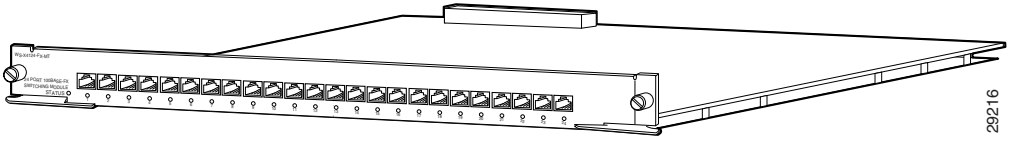


WS-X4124-FX-MT

The WS-X4124-FX-MT 24-port Fast Ethernet switching module (see Figure 1-11) has the following specifications:

Specification	Description
Module type	100BASE-FX Fast Ethernet switching module
Port duplex mode	Half or full duplex mode
Port speed	100 Mbps
Number of ports	24
Connector type	MT-RJ fiber-optic (See Figure 2-4 on page 2-4.)
Cable type	MMF

Figure 1-11 WS-X4124-FX-MT 24-Port 100BASE-FX Fast Ethernet Switching Module



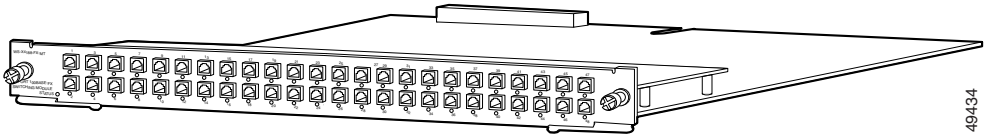
Note Catalyst 4000 WS-X4124-FX-MT modules with hardware revisions 1.5 and earlier are supported with the Supervisor Engines I (WS-X4012) and II (WS-X4013) only. Contact your technical support representative for a replacement if you need to use this module with another supervisor.

WS-X4148-FX-MT

The WS-X4148-FX-MT 48-port 100BASE-FX Fast Ethernet switching module (see Figure 1-12) has the following specifications:

Specification	Description
Module type	100BASE-FX Fast Ethernet switching module
Port duplex mode	Half or full duplex mode
Port speed	100 Mbps
Number of ports	48
Connector type	MT-RJ fiber-optic (See Figure 2-4 on page 2-4.)
Cable type	MMF

Figure 1-12 WS-X4148-FX-MT 48-Port 100BASE-FX Fast Ethernet Switching Module



WS-X4148-RJ

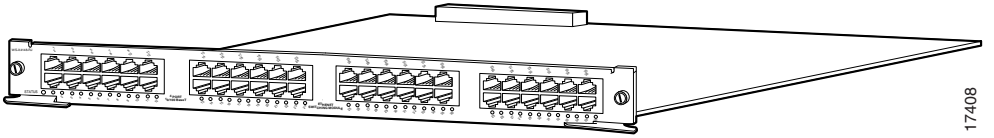
The WS-X4148-RJ 48-port Fast Ethernet switching module (see Figure 1-13) has the following specifications:

Specification	Description
Module type	10/100BASE-TX Fast Ethernet switching module
Port duplex mode	Half or full duplex mode
Port speed	10 or 100 Mbps
Number of ports	48

Specification	Description
Connector type	RJ-45 (See Figure 2-1 on page 2-2.)
Cable type	UTP[1] or FTP

1. UTP = unshielded twisted-pair

Figure 1-13 WS-X4148-RJ 48-Port 10/100BASE-TX Fast Ethernet Switching Module



WS-X4148-FE-BD-LC

The WS-X4148-FE-BD-LC 48-port 100BASE-BX10-D Fast Ethernet switching module (see Figure 1-14) has the following specifications:

Specification	Description
Module type	100BASE-BX10-D Fast Ethernet switching module
Port duplex mode	Full duplex mode
Port speed	100 Mbps
Number of ports	48
Connector type	Single LC (See Figure 1-15.)
Cable type	SMF

Figure 1-14 WS-X4148-FE-BD-LC 48-Port Fast Ethernet Switching Module

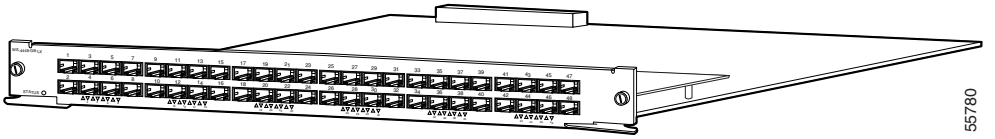
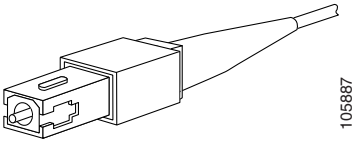


Figure 1-15 Single LC Connector

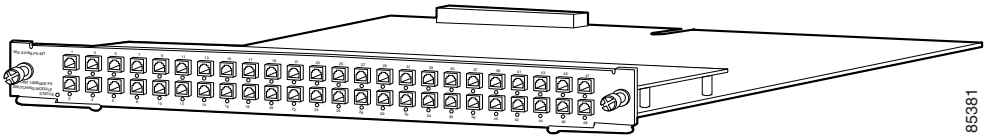


WS-X4148-FE-LX-MT

The WS-X4148-FE-LX-MT 48-port 100BASE-LX10 Fast Ethernet switching module (see Figure 1-16) has the following specifications:

Specification	Description
Module type	100BASE-LX10 Fast Ethernet switching module
Port duplex mode	Half or full duplex mode
Port speed	100 Mbps
Number of ports	48
Connector type	MT-RJ fiber-optic (See Figure 2-4 on page 2-4.)
Cable type	SMF

Figure 1-16 WS-X4148-FE-LX-MT 48-Port 100BASE-LX-MT Fast Ethernet Switching Module

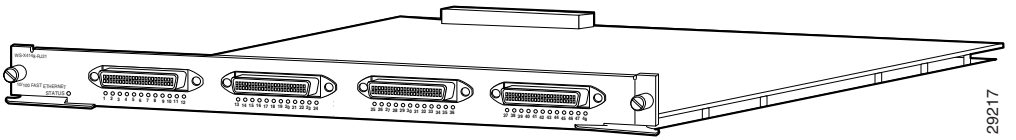


WS-X4148-RJ21

The WS-X4148-RJ21 48-port Fast Ethernet switching module (see Figure 1-17) has the following specifications:

Specification	Description
Module type	10/100BASE-TX Fast Ethernet switching module
Port duplex mode	Half or full duplex mode
Port speed	10 or 100 Mbps
Number of ports	48
Connector type	RJ-21 (See Figure 2-5 on page 2-5 or Figure 2-6 on page 2-5.)
Cable type	Category 5 UTP

Figure 1-17 WS-X4148-RJ21 48-Port 10/100-Mbps Fast Ethernet Switching Module



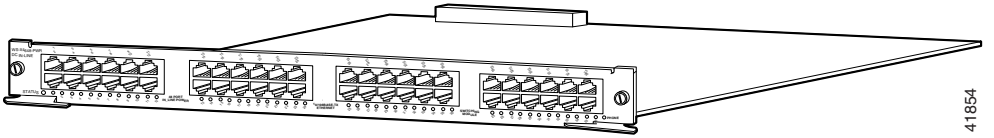
WS-X4148-RJ45V

The WS-X4148-RJ45V 48-port Cisco pre-standard Power over Ethernet (PoE) 10/100BASE-TX switching module (see Figure 1-18) has the following specifications:

Specification	Description
Module type	10/100BASE-TX Fast Ethernet switching module with Cisco pre-standard PoE
Port duplex mode	Half or full duplex mode
Port speed	10 or 100 Mbps

Specification	Description
Number of ports	48
Connector type	RJ-45 (See Figure 2-1 on page 2-2.)
Cable type	UTP
Power over Ethernet	6.3 W per-powered device on a port, on all 48 ports

Figure 1-18 WS-X4148-RJ45V 48-Port PoE 10/100BASE-TX Switching Module



To provide PoE with the 48-port PoE 10/100BASE-TX switching module in a Catalyst 4006 switch, you must have a power entry module (PEM) and a power shelf installed. For more information about installing the PEM or the external power shelf, refer to the *Catalyst 4000 Series Installation Guide*, *Catalyst 4500 Series Installation Guide, Installation and Configuration Note for the Catalyst 4500 Series AC Power Shelf,* or the *Catalyst 4500 Series Power Entry Module and External Power Shelf Installation Note*.

To provide PoE with the 48-port PoE 10/100BASE-TX switching module in a Catalyst 4500 series switch, you must have a PoE-enabled power supply. All power supplies support PoE except the 1000 W and 1400 W AC power supplies.

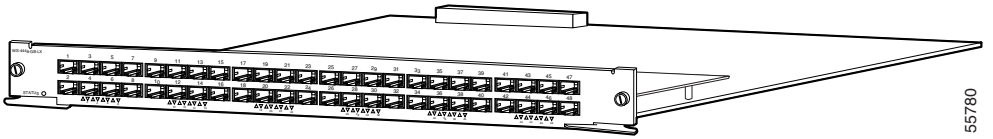
Note Auto MDIX is not supported on PoE enabled switching modules.

WS-X4248-FE-SFP

The WS-X4248-FE-SFP 48-port 100BASE-X Fast Ethernet switching module (see Figure 1-19) has the following specifications:

Specification	Description
Module type	100BASE-X Fast Ethernet switching module
Port duplex mode	Half or full duplex mode
Port speed	100 Mbps
Number of ports	48
Connector type	LC type (See Figure 2-9 on page 2-6.)
Cable type	MMF or SMF
SFP type	FX, LX10, BX-D and BX-U

Figure 1-19 WS-X4248-FE-SFP 48-Port 100BASE-X Fast Ethernet Switching Module



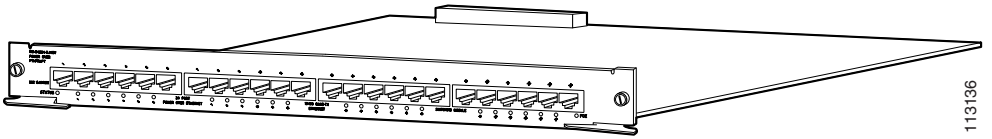
WS-X4224-RJ45V

The WS-X4224-RJ45V 24-port IEEE 802.3af-compliant PoE 10/100BASE-TX switching module (see Figure 1-20) has the following specifications:

Specification	Description
Module type	10/100BASE-TX Fast Ethernet switching module with IEEE 802.3af PoE
Port duplex mode	Half or full duplex mode
Port speed	10 or 100 Mbps
Number of ports	24

Specification	Description
Connector type	RJ-45 (See Figure 2-1 on page 2-2.)
Cable type	UTP
Power over Ethernet	Up to 15.4 W per powered device on all 24 ports (to a 312 W total on the Catalyst 4006)
Power regulation	Internal on the switching module

Figure 1-20 WS-X4224-RJ45V 24-Port IEEE 802.3af-Compliant PoE 10/100BASE-TX Switching Module



To provide PoE with the 24-port PoE 10/100BASE-TX switching module in a Catalyst 4006 switch, you must have a power entry module (PEM) and a power shelf installed. The Catalyst 4006 switch can provide 312 W per PoE module to powered devices. If the powered devices are using the maximum 15.4 W per port, there is only enough power for 18 powered devices. If the powered devices are using less than 15.4 W per port, more powered devices can be powered, up to the 312 W maximum. For more information about installing the PEM or the external power shelf, refer to the *Catalyst 4000 Series Installation Guide*, *Catalyst 4500 Series Installation Guide, Installation and Configuration Note for the Catalyst 4500 Series AC Power Shelf,* or the *Catalyst 4500 Series Power Entry Module and External Power Shelf Installation Note*.

To provide PoE with the 24-port PoE 10/100BASE-TX switching module in a Catalyst 4500 series switch, you must have a PoE-enabled power supply. All power supplies support PoE except the 1000 W and 1400 W AC power supplies.

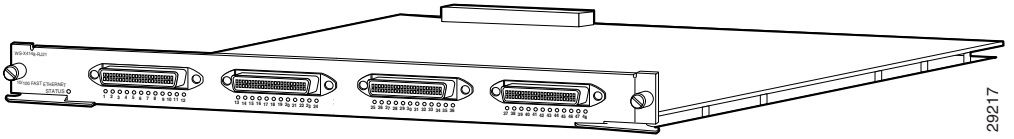
Note Auto MDIX is not supported on PoE enabled switching modules.

WS-X4248-RJ21V

The WS-X4248-RJ21V 48-port IEEE 802.3af-compliant PoE 10/100BASE-TX RJ-21 switching module (see Figure 1-21) has the following specifications:

Specification	Description
Module type	10/100BASE-TX Fast Ethernet switching module with IEEE 802.3af PoE
Port duplex mode	Half or full duplex mode
Port speed	10 or 100 Mbps
Number of ports	48
Connector type	RJ-21 (See Figure 2-5 on page 2-5 or Figure 2-6 on page 2-5.)
Cable type	Category 5 UTP
Power over Ethernet	Up to 15.4 W per powered device on all 48 ports (to a 312 W total on the Catalyst 4006)
Power regulation	Internal on the switching module

Figure 1-21 WS-X4248-RJ21V IEEE 802.3af-Compliant PoE 48-Port 10/100-Mbps Switching Module



To provide PoE with the 48-port PoE 10/100BASE-TX switching module in a Catalyst 4006 switch, you must have a power entry module (PEM) and power shelf installed. The Catalyst 4006 switch can provide 312 W per PoE module to powered devices. If the powered devices are using the maximum 15.4 W per port, there is only enough power for 18 powered devices. If the powered devices are using less than 15.4 W per port, more powered devices can be powered, up to the 312 W maximum. For more information about installing the PEM or the external power shelf, refer to the *Catalyst 4000 Series Installation Guide*, *Catalyst 4500*

Series Installation Guide, Installation and Configuration Note for the Catalyst 4500 Series AC Power Shelf, or the *Catalyst 4500 Series Power Entry Module and External Power Shelf Installation Note*.

To provide PoE with the 48-port PoE 10/100BASE-TX switching module in a Catalyst 4500 series switch, you must have a PoE-enabled power supply. All power supplies support PoE except the 1000 W and 1400 W AC power supplies.

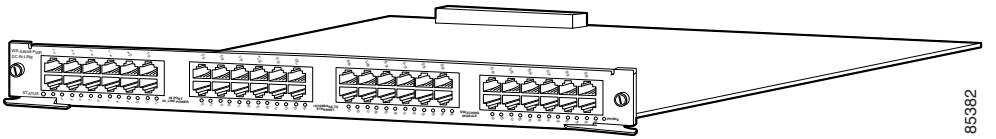
Note Auto MDIX is not supported on PoE enabled switching modules.

WS-X4248-RJ45V

The WS-X4248-RJ45V 48-port IEEE 802.3af-compliant PoE 10/100BASE-TX switching module (see Figure 1-22) has the following specifications:

Specification	Description
Module type	10/100BASE-TX Fast Ethernet switching module with IEEE 802.3af PoE
Port duplex mode	Half or full duplex mode
Port speed	10 or 100 Mbps
Number of ports	48
Connector type	RJ-45 (See Figure 2-1 on page 2-2.)
Cable type	UTP
Power over Ethernet	Up to 15.4 W per powered device on all 48 ports (to a 312 W total on the Catalyst 4006)
Power regulation	Internal on the switching module

Figure 1-22 WS-X4248-RJ45V 48-Port IEEE 802.3af-Compliant PoE 10/100BASE-TX Switching Module



To provide PoE with the 48-port PoE 10/100BASE-TX switching module in a Catalyst 4006 switch, you must have a power entry module (PEM) and a power shelf installed. The Catalyst 4006 switch can provide 312 W per PoE module to powered devices. If the powered devices are using the maximum 15.4 W per port, there is only enough power for 18 powered devices. If the powered devices are using less than 15.4 W per port, more powered devices can be powered, up to the 312 Watt maximum. For more information about installing the PEM or the external power shelf, refer to the *Catalyst 4000 Series Installation Guide*, *Catalyst 4500 Series Installation Guide, Installation and Configuration Note for the Catalyst 4500 Series AC Power Shelf,* or the *Catalyst 4500 Series Power Entry Module and External Power Shelf Installation Note*.

To provide PoE with the 48-port PoE 10/100BASE-TX switching module in a Catalyst 4500 series switch, you must have a PoE-enabled power supply. All power supplies support PoE except the 1000 W and 1400 W AC power supplies.

Note Auto MDIX is not supported on PoE enabled switching modules.

WS-X4232-GB-RJ

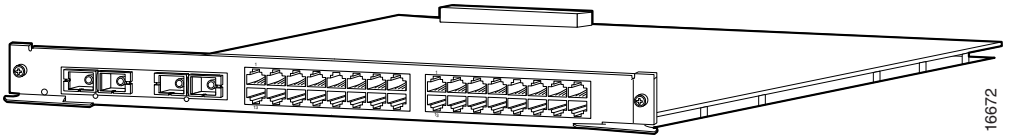
The WS-X4232-GB-RJ 34-port Ethernet switching module (see Figure 1-23) has the following specifications:

Specification	Description
Module type	10/100BASE-TX Ethernet plus 1000BASE-X Gigabit Ethernet switching module
Port duplex mode	Half or full duplex mode on the 10/100BASE-TX ports Full duplex mode on the 1000BASE-X ports
Port speed	10, 100, and 1000 Mbps
Number of ports	32 10/100BASE-TX ports 2 1000BASE-X[1] ports

Specification	Description
Connector type	RJ-45 10/100BASE-TX ports (See Figure 2-1 on page 2-2.) SC-type 1000BASE-X ports[1] (See Figure 2-16 on page 2-18.)
Cable type	Category 5 UTP (10/100BASE-TX) MMF or SMF (1000BASE-X)

1. See the "Installing, Removing, and Maintaining GBICs" section on page 2-8 for GBIC support information.

Figure 1-23 WS-X4232-GB-RJ 2-Port Gigabit and 32-Port 10/100BASE-T Ethernet Switching Module



WS-X4232-L3

The WS-X4232-L3 Layer 3 services module (see Figure 1-24) has the following specifications:

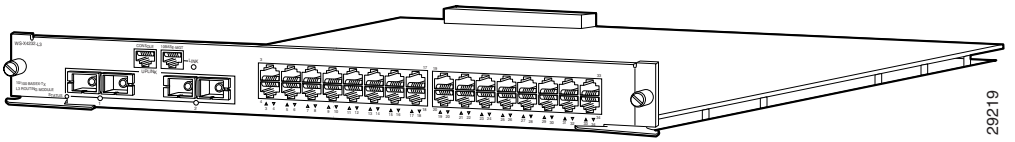
Specification	Description
Module type	Layer 3 services module
Port duplex mode	Half or full duplex mode on the 10/100BASE-TX ports Full duplex mode on the 1000BASE-X Layer 3 ports
Port speed	10, 100, and 1000 Mbps
Number of ports	32 10/100BASE-TX ports 2 1000BASE-X ports 1 console port 1 10BASE-T uplink port

Specification	Description
Connector type	RJ-45 10/100BASE-TX ports (See Figure 2-1 on page 2-2.) SC-type 1000BASE-X ports[1] (See Figure 2-16 on page 2-18.) RJ-45 (console and 10BASE-T ports) (See Figure 2-1 on page 2-2.)
Cable type	Category 5 UTP (10/100BASE-TX) MMF or SMF (1000BASE-X) Category 3 or Category 5 UTP (console and 10BASE-T ports)

1. See the "Installing, Removing, and Maintaining GBICs" section on page 2-8 for GBIC support information.

For more information, refer to the *Installation and Configuration Note for the Catalyst 4000 Layer 3 Services Module*.

Figure 1-24 WS-X4232-L3 Layer 3 Services Module

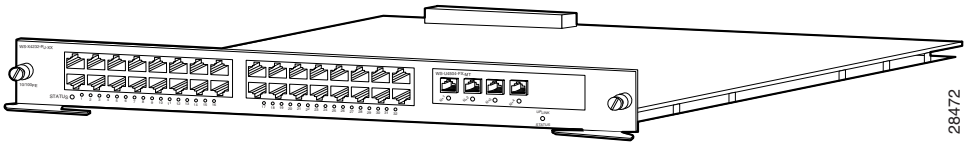


WS-X4232-RJ-XX

The WS-X4232-RJ-XX 32-port Ethernet switching module (see Figure 1-25) has the following specifications:

Specification	Description
Module type	10/100BASE-TX plus 100BASE-FX Ethernet switching module
Port duplex mode	Half or full duplex mode on both the 10/100BASE-TX and the 100BASE-FX ports
Port speed	10 and 100 Mbps
Number of ports	32 10/100BASE-TX ports 4 optional 100BASE-FX ports on an optional uplink module (WS-U4504-FX-MT)
Connector type	RJ-45 32 10/100BASE-TX ports (See Figure 2-1 on page 2-2.) MT-RJ for the 4 optional ports 100BASE-FX (See Figure 2-4 on page 2-4.)
Cable type	Category 5 UTP (10/100BASE-TX) MMF or SMF (100BASE-FX)

Figure 1-25 WS-X4232-RJ-XX 32-port Ethernet Switching Module



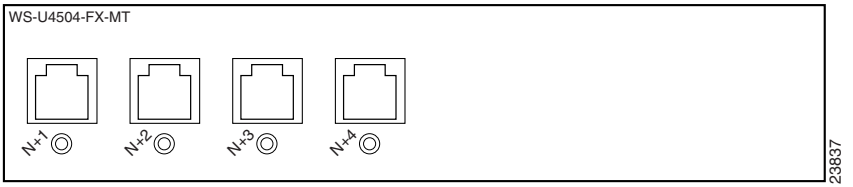
Note The WS-X4232-RJ-XX Ethernet switching module can operate with or without the WS-U4504-FX-MT uplink module installed.

WS-U4504-FX-MT Uplink Module

The WS-U4504-FX-MT uplink module (see Figure 1-26) has the following specifications:

Specification	Description
Module type	100BASE-FX uplink module
Port duplex mode	Half or full duplex mode
Port speed	100 Mbps
Number of ports	4
Connector type	MT-RJ (See Figure 2-4 on page 2-4.)
Cable type	MMF cable

Figure 1-26 WS-U4504-FX-MT Uplink Module



The WS-U4504-FX-MT uplink module is installed onto a switching module to provide optional port configurations.

Each port has a port link status LED below it, which is labeled N+*x*. The N indicates the last number of the port that is used on the Ethernet switching module (WS-X4232-RJ-XX).

For the far left port on the WS-U4504-FX-MT uplink module, add 1 to that number; for the second port, add 2; for the third port, add 3; for the last port, add 4.

Gigabit Ethernet Switching Modules

This section describes the Catalyst 4500 series Gigabit Ethernet switching modules and includes the following sections:

- WS-X4302-GB, page 1-29
- WS-X4306-GB, page 1-30
- WS-X4506-GB-T, page 1-31
- WS-X4412-2GB-T, page 1-33
- WS-X4418-GB, page 1-34
- WS-X4424-GB-RJ45, page 1-35
- WS-X4448-GB-LX, page 1-36
- WS-X4448-GB-RJ45, page 1-37
- WS-X4524-GB-RJ45V, page 1-38
- WS-X4548-GB-RJ45, page 1-39
- WS-X4448-GB-SFP, page 1-40
- WS-X4548-GB-RJ45V, page 1-41
- WS-X4548-RJ45V+, page 1-42
- WS-X4019, page 1-44
- Access Gateway Module (WS-X4604-GWY), page 1-45

WS-X4302-GB

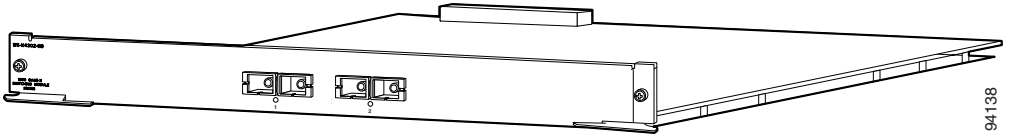
The WS-X4302-GB 2-port Gigabit Ethernet switching module (see Figure 1-27) has the following specifications:

Specification	Description
Module type	1000BASE-X Gigabit Ethernet switching module
Port duplex mode	Full duplex mode
Port speed	1000 Mbps
Number of ports	2

Specification	Description
Connector type	SC type[1] (See Figure 2-16 on page 2-18.)
Cable type	MMF or SMF

1. See the "Installing, Removing, and Maintaining GBICs" section on page 2-8 for GBIC support information.

Figure 1-27 WS-X4302-GB 2-Port Gigabit Ethernet Switching Module



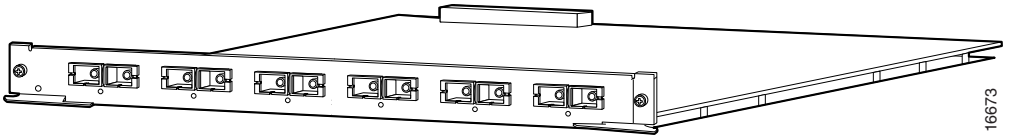
WS-X4306-GB

The WS-X4306-GB 6-port Gigabit Ethernet switching module (see Figure 1-28) has the following specifications:

Specification	Description
Module type	1000BASE-X Gigabit Ethernet switching module
Port duplex mode	Full duplex mode
Port speed	1000 Mbps
Number of ports	6
Connector type	SC type[1] (See Figure 2-16 on page 2-18.)
Cable type	MMF or SMF

1. See the "Installing, Removing, and Maintaining GBICs" section on page 2-8 for GBIC support information.

Figure 1-28 WS-X4306-GB 6-Port Gigabit Ethernet Switching Module



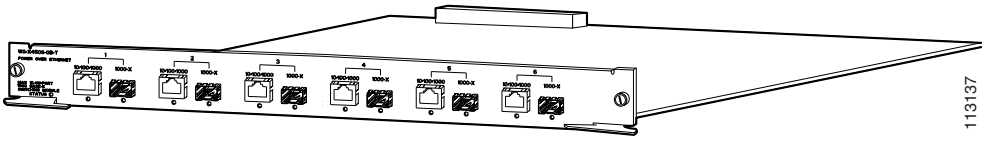
WS-X4506-GB-T

The WS-X4506-GB-T 6-port Gigabit Ethernet switching module (see Figure 1-28) has the following specifications:

Specification	Description
Module type	10/100/1000BASE-T Fast Ethernet with IEEE802.3af PoE or 1000BASE-X SFP Gigabit Ethernet switching module
Port duplex mode	Half or full duplex mode
Port speed	10, 100, or 1000 Mbps
Number of ports	6 total
Connector type	RJ-45 (See Figure 2-1 on page 2-2.) LC type (See Figure 2-9 on page 2-6.)
Cable type	Category 5 UTP (1000BASE-T) MMF or SMF (1000BASE-X, LX fiber-optic cable only)
Power over Ethernet	Up to 15.4 W per powered device on all 6 ports

Note There are six10/100/1000BASE-T and six 1000BASE-X SFP Gigabit Ethernet connectors present. Use the **select media** sfp | rj45 command to set whether a specific port number uses the SFP or RJ-45 connector. SFP is the default.

Figure 1-29 WS-X4506-GB-T 6-Port Gigabit Ethernet Switching Module



To provide PoE with the 6-port Gigabit Ethernet switching module in a Catalyst 4006 switch, you must have a power entry module (PEM) and power shelf installed. For more information about installing the PEM or the external power shelf, refer to the *Catalyst 4000 Series Installation Guide*, *Catalyst 4500 Series Installation Guide, Installation and Configuration Note for the Catalyst 4500 Series AC Power Shelf,* or the *Catalyst 4500 Series Power Entry Module and External Power Shelf Installation Note*.

To provide PoE with the 6-port Gigabit Ethernet switching module in a Catalyst 4500 series switch, you must have a PoE-enabled power supply.

Note Auto MDIX is not supported on PoE enabled switching modules.

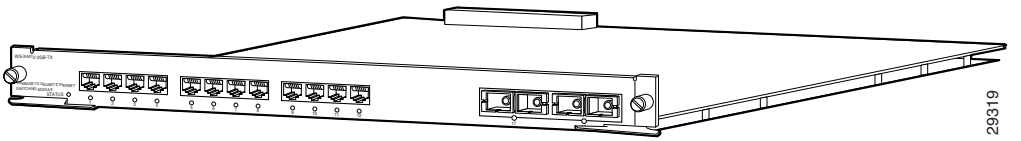
WS-X4412-2GB-T

The WS-X4412-2GB-T 14-port Gigabit Ethernet switching module (see Figure 1-30) has the following specifications:

Specification	Description
Module type	1000BASE-T plus 1000BASE-X Gigabit Ethernet switching module
Port duplex mode	Full duplex mode
Port speed	1000 Mbps
Number of ports	12 1000BASE-T ports 2 optional 1000BASE-X[1] uplink ports
Connector type	RJ-45 for the 12 1000BASE-T ports (See Figure 2-1 on page 2-2.) SC-type for the 2 1000BASE-X ports[1] (See Figure 2-16 on page 2-18.)
Cable type	Category 5 UTP (1000BASE-T) MMF or SMF (1000BASE-X)

1. See the "Installing, Removing, and Maintaining GBICs" section on page 2-8 for GBIC support information.

Figure 1-30 WS-X4412-2GB-T 14-Port Gigabit Ethernet Switching Module



Some Gigabit Ethernet ports on the WS-X4412-2GB-T switching module are oversubscribed. For additional information on these ports, see the "Configuring Gigabit Ethernet Ports" section on page 3-9.

Note You must use Category 5 cables when connecting to the 1000BASE-T ports on this switching module.

The two Gigabit Ethernet ports can be configured with any combination of shortwave (SX), longwave/long-haul (LX/LH), and long-range (ZX) GBICs. For a description of GBICs, see the "Installing, Removing, and Maintaining GBICs" section on page 2-8.

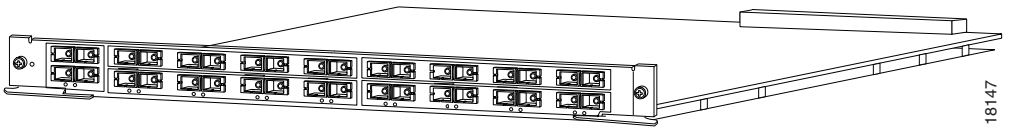
WS-X4418-GB

The WS-X4418-GB 18-port Gigabit Ethernet switching module (see Figure 1-31) has the following specifications:

Specification	Description
Module type	1000BASE-X Gigabit Ethernet switching module
Port duplex mode	Full duplex mode
Port speed	1000 Mbps
Number of ports	18
Connector type	SC type[1] (See Figure 2-16 on page 2-18.)
Cable type	MMF or SMF

1. See the "Installing, Removing, and Maintaining GBICs" section on page 2-8 for GBIC support information.

Figure 1-31 WS-X4418-GB 18-Port Gigabit Ethernet Switching Module



Some ports on this switching module are oversubscribed. For further information on these ports, see the "Configuring Gigabit Ethernet Ports" section on page 3-9.

Note WS-X4418-GB does not support WS-G5483, which is the 1000BASE-T GBIC.

The ports on this switching module can be configured with any combination of shortwave (SX), longwave/long-haul (LX/LH), and long-range (ZX) GBICs. For a description of GBICs, see the "Installing, Removing, and Maintaining GBICs" section on page 2-8.

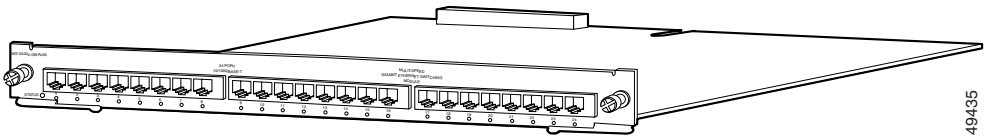
WS-X4424-GB-RJ45

The WS-X4424-GB-RJ45 24-port 10/100/1000BASE-T Gigabit Ethernet switching module (see Figure 1-32) has the following specifications:

Specification	Description
Module type	10/100/1000 Fast or Gigabit Ethernet switching module
Port duplex mode	Half or full duplex mode at 10 and 100 Mbps; full duplex mode only at 1000 Mbps
Port speed	10, 100, or 1000 Mbps
Number of ports	24
Connector type	RJ-45 (See Figure 2-1 on page 2-2.)
Cable type	UTP

Note You must use Category 5 cables when connecting to the 1000BASE-T ports on this switching module.

Figure 1-32 WS-X4424-GB-RJ45 24-Port 10/100/1000BASE-T Gigabit Ethernet Switching Module



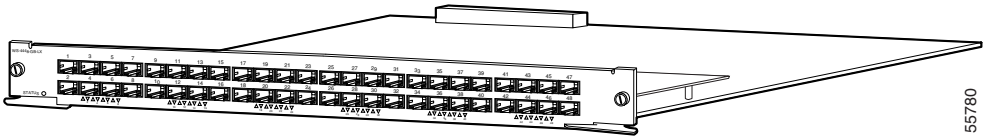
Ports on this switching module may be oversubscribed, depending on utilization. For further information on these ports, see the "Configuring Gigabit Ethernet Ports" section on page 3-9.

WS-X4448-GB-LX

The WS-X4448-GB-LX 48-port Gigabit Ethernet switching module (see Figure 1-33) has the following specifications:

Specification	Description
Module type	1000BASE-X Gigabit Ethernet switching module
Port duplex mode	Full duplex mode
Port speed	1000 Mbps
Number of ports	48
Connector type	LC type (See Figure 2-9 on page 2-6.)
Cable type	MMF or SMF (LX fiber-optic cable only)

Figure 1-33 WS-X4448-GB-LX 48-Port Gigabit Ethernet Switching Module



Ports on this switching module may be oversubscribed, depending on utilization. For further information on these ports, see the "Configuring Gigabit Ethernet Ports" section on page 3-9.

The 48 ports can be configured with any combination of small, form-factor pluggable (SFP) modules. For a description of SFP modules, see the "Installing SFP Modules" section on page 2-22.

Problem Insertion of unsupported SFPs (small form-factor pluggable optics) into a WS-X4448-GB-LX module can cause undetected communication failures between the supervisor engine and the corresponding module. Subsequent insertion or removal of SFPs from the module is not recognized by the system. This activity can be observed on a Catalyst 4500 series switch using Release 12.1(12c)EW1 or later releases.

Solution Reset the module with the **hw-module module reset** command. (CSCee05078)

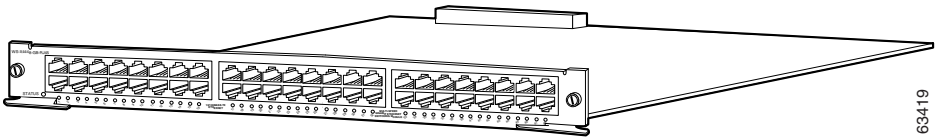
WS-X4448-GB-RJ45

The WS-X4448-GB-RJ45 48-port 10/100/1000BASE-T Gigabit Ethernet switching module (see Figure 1-34) has the following specifications:

Specification	Description
Module type	10/100/1000 Fast or Gigabit Ethernet switching module
Port duplex mode	Half or full duplex mode at 10 and 100 Mbps; full duplex mode only at 1000 Mbps
Port speed	10, 100, or 1000 Mbps
Number of ports	48
Connector type	RJ-45 (See Figure 2-1 on page 2-2.)
Cable type	UTP

Note You must use Category 5 cables when connecting to the 1000BASE-T ports on this switching module.

Figure 1-34 WS-X4448-GB-RJ45 48-Port 10/100/1000BASE-T Gigabit Ethernet Switching Module



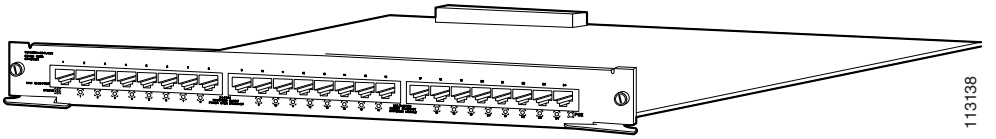
Ports on this switching module may be oversubscribed, depending on utilization. For further information on these ports, see the "Configuring Gigabit Ethernet Ports" section on page 3-9.

WS-X4524-GB-RJ45V

The WS-X4524-GB-RJ45V 24-port IEEE 802.3af-compliant PoE 10/100/1000BASE-T RJ-45 switching module (see Figure 1-35) has the following specifications:

Specification	Description
Module type	10/100/1000BASE-T Fast Ethernet switching module with IEEE802.3af PoE
Port duplex mode	Half or full duplex mode
Port speed	10, 100, or 1000 Mbps
Number of ports	24
Connector type	RJ-45 (See Figure 2-1 on page 2-2.)
Cable type	UTP
Power over Ethernet	Up to 15.4 W per powered device on all 24 ports (to a 312 W total on the Catalyst 4006)

Figure 1-35 WS-X4524-GB-RJ45V 24-Port IEEE-Compliant PoE 10/100/1000BASE-T Switching Module



To provide PoE with the 24-port PoE 10/100BASE-TX switching module in a Catalyst 4006 switch, you must have a power entry module (PEM) and a power shelf installed. The Catalyst 4006 switch can provide 312 W per PoE module to powered devices. If the powered devices are using the maximum 15.4 W per port, there is only enough power for 18 powered devices. If the powered devices are using less than 15.4 W per port, more powered devices can be powered, up to the 312 Watt maximum. For more information about installing the PEM or the external power shelf, refer to the *Catalyst 4000 Series Installation Guide*, *Catalyst 4500 Series Installation Guide, Installation and Configuration Note for the Catalyst 4500 Series AC Power Shelf,* or the *Catalyst 4500 Series Power Entry Module and External Power Shelf Installation Note*.

To provide PoE with the 24-port PoE 10/100/1000BASE-T switching module in a Catalyst 4500 series switch, you must have an PoE-enabled power supply. All power supplies support PoE except the 1000 W and 1400 W AC power supplies.

Note Auto MDIX is not supported on PoE enabled switching modules.

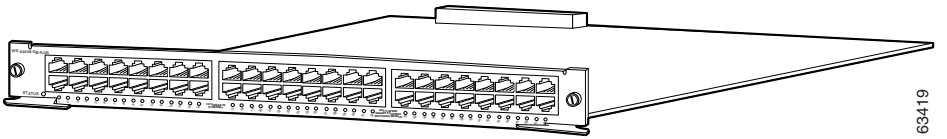
WS-X4548-GB-RJ45

The WS-X4548-GB-RJ45 48-port 10/100/1000BASE-T Gigabit Ethernet switching module (see Figure 1-36) has the following specifications:

Specification	Description
Module type	10/100/1000 Fast or Gigabit Ethernet switching module
Port duplex mode	Half or full duplex mode at 10 and 100 Mbps; full duplex mode only at 1000 Mbps
Port speed	10, 100, or 1000 Mbps
Number of ports	48
Connector type	RJ-45 (See Figure 2-1 on page 2-2.)
Cable type	UTP

Note You must use Category 5 cables when connecting to the 1000BASE-T ports on this switching module.

Figure 1-36 WS-X4548-GB-RJ45 48-Port 10/100/1000BASE-T Gigabit Ethernet Switching Module



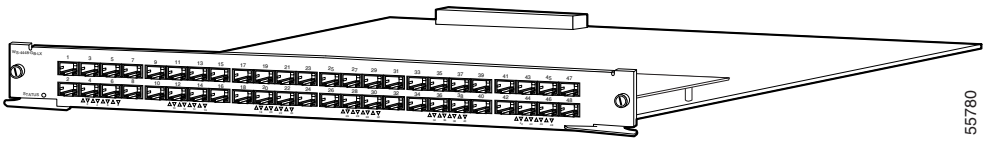
Ports on this switching module may be oversubscribed, depending on utilization. For further information on these ports, see the "Configuring Gigabit Ethernet Ports" section on page 3-9.

WS-X4448-GB-SFP

The WS-X4448-GB-SFP 48-port Gigabit Ethernet switching module (see Figure 1-37) has the following specifications:

Specification	Description
Module type	1000BASE-X Gigabit Ethernet switching module
Port duplex mode	Full duplex mode
Port speed	1000 Mbps
Number of ports	48
Connector type	LC type (See Figure 2-9 on page 2-6.)
Cable type	MMF or SMF
SFP type	SX, LX, Copper 1000BASE-T, BX10-D and BX10-U

Figure 1-37 WS-X4448-GB-SFP 48-Port Gigabit Ethernet Switching Module



Ports on this switching module may be oversubscribed, depending on utilization. For further information on these ports, see the "Configuring Gigabit Ethernet Ports" section on page 3-9.

For a description of SFP modules, see the "Installing SFP Modules" section on page 2-22.

Problem Insertion of unsupported SFPs (small form-factor pluggable optics) into a WS-X4448-GB-SFP module can cause undetected communication failures between the supervisor engine and the corresponding module. Subsequent

insertion or removal of SFPs from the module is not recognized by the system. This activity can be observed on a Catalyst 4500 series switch using Release 12.1(12c)EW1 or later releases.

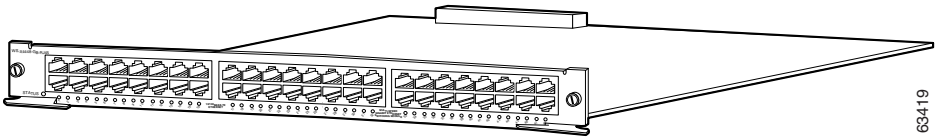
Solution Reset the module with the **hw-module module reset** command. (CSCee05078)

WS-X4548-GB-RJ45V

The WS-X4548-GB-RJ45V 48-port IEEE 802.3af-compliant PoE 10/100/1000BASE-T RJ-45 switching module (see Figure 1-38) has the following specifications:

Specification	Description
Module type	10/100/1000BASE-T Fast Ethernet switching module with IEEE802.3af PoE
Port duplex mode	Half or full duplex mode
Port speed	10, 100, or 1000 Mbps
Number of ports	48
Connector type	RJ-45 (See Figure 2-1 on page 2-2.)
Cable type	UTP
Power over Ethernet	Up to 15.4 W per powered device on all 48 ports (to a 312 W total on the Catalyst 4006)

Figure 1-38 WS-X4548-GB-RJ45V 48-Port IEEE-Compliant PoE 10/100/1000BASE-T Switching Module



To provide PoE with the 48-port PoE 10/100BASE-TX switching module in a Catalyst 4006 switch, you must have a power entry module (PEM) and a power shelf installed. The Catalyst 4006 switch can provide 312 W per PoE module to powered devices. If the powered devices are using the maximum 15.4 W per port,

there is only enough power for 18 powered devices. If the powered devices are using less than 15.4 W per port, more powered devices can be powered, up to the 312 W maximum. For more information about installing the PEM or the external power shelf, refer to the *Catalyst 4000 Series Installation Guide*, *Catalyst 4500 Series Installation Guide, Installation and Configuration Note for the Catalyst 4500 Series AC Power Shelf,* or the *Catalyst 4500 Series Power Entry Module and External Power Shelf Installation Note*.

To provide PoE with the 48-port PoE 10/100/1000BASE-T switching module in a Catalyst 4500 series switch, you must have an PoE-enabled power supply. All power supplies support PoE except the 1000 W and 1400 W AC power supplies.

Note Auto MDIX is not supported on PoE enabled switching modules.

WS-X4548-RJ45V+

General information about Enhanced PoE features are available at:

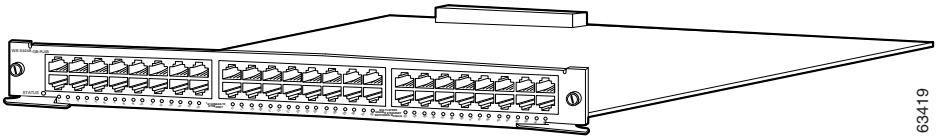
http://www.cisco.com/en/US/prod/switches/epoe.html

The WS-X4548-RJ45V+ 48-port 10/100/1000BASE-T enhanced PoE switching module (see Figure 1-39) has the following specifications:

Specification	Description
Module type	10/100/1000BASE-T Fast Ethernet switching module with IEEE802.3af PoE and Cisco Enhanced PoE
Port duplex mode	Half- or full-duplex mode
Port speed	10, 100, or 1000 Mbps
Number of ports	48
Connector type	RJ-45 (See Figure 2-1 on page 2-2.)

Specification	Description
Cable type	UTP
Power over Ethernet	1050 W of maximum total power to the front panel, for up to 35 ports providing 30 W per port. If some ports provide less thanthe maximum wattage, more PoE ports are possible up to the supported wattage. **Note** On a 4510R-E 10 slot chassis, the 1050 W per slot maximum only applies to slots 1 and 2; slots 3, 4 ,7, 8, 9, and 10 can supply up to 750 W, providing up to 25 ports of 30 W PoE.

Figure 1-39 WS-X4548-RJ45V+ 48-port 10/100/1000BASE-T Enhanced Power over Ethernet Switching Module



Ports on this switching module may be oversubscribed, depending on utilization. For further information on these ports, see the "Configuring Gigabit Ethernet Ports" section on page 3-9.

This module is not supported on Catalyst 4000 Series Switches or the Supervisor Engine I, II or III. It is compatible with all Supervisor Engines that use Cisco IOS software. Refer to the release notes for supported Cisco IOS releases.

To provide PoE with the 48-port PoE 10/100/1000BASE-T switching module in a Catalyst 4500 series switch, you must have an PoE-enabled power supply. All power supplies support PoE except the 1000 W and 1400 W AC power supplies. Choose a power supply with adequate capacity for your PoE requirements. If you have several of these PoE modules in a switch, all available PoE in the smaller power supplies will be quickly utilized.

Note Auto MDIX is not supported on PoE-enabled switching modules.

Other Switching Modules

This section describes other Catalyst 4500 series switching modules and includes the following sections:

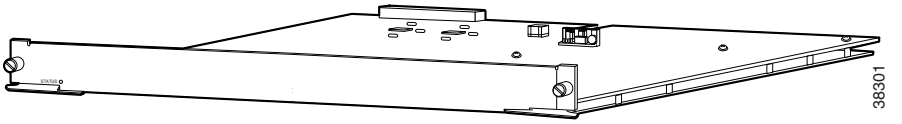
- WS-X4019, page 1-44
- Access Gateway Module (WS-X4604-GWY), page 1-45

WS-X4019

The WS-X4019 backplane channel module (see Figure 1-40) has the following specifications:

Specification	Description
Module type	Backplane channel module
Port duplex mode	–
Port speed	–
Number of ports	0
Connector type	–
Cable type	–

Figure 1-40 WS-X4019 Backplane Channel Module



Note The backplane channel module is supported by only the WS-X4013 supervisor engine in the Catalyst 4006, 4503, or 4506 switches using the Catalyst Operating System.

Access Gateway Module (WS-X4604-GWY)

The Access Gateway Module is described in the *Catalyst 4000 Access Gateway Module Installation and Configuration Note* (DOC-7810818).

Switching Module LEDs

Each switching module has one LED labeled STATUS that provides information about the module and one numbered LED labeled LINK for each port on the module. Figure 1-41 shows the Gigabit Ethernet port and status LEDs. Figure 1-42 shows the 10/100BASE-T port LEDs. Table 1-3 describes the switching module LEDs.

Figure 1-41 Gigabit Ethernet Port and Status LEDs

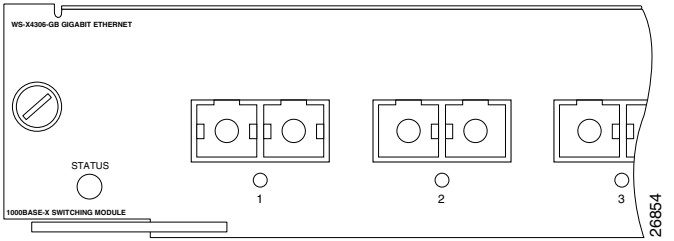


Figure 1-42 10/100BASE-T Port LEDs

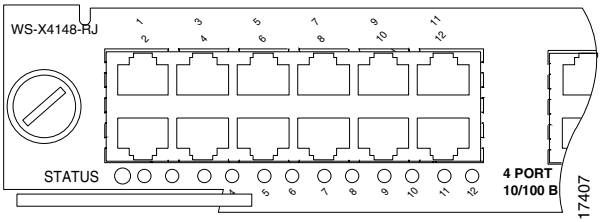


Table 1-3 Switching Module LEDs

LED	Color/State	Description
STATUS		Indicates the results of a series of self-tests and diagnostic tests performed by the switch.
	Green	All the tests pass.
	Red	A test other than an individual port test failed.
	Orange	System boot, self-test diagnostics running, or the module is disabled.
LINK[1]		Indicates the status of the 10BASE-T port.
	Green	The port is operational (a signal is detected).
	Orange	The link has been disabled by software.
	Flashing orange	The link has been disabled due to a hardware failure.
	Off	No signal is detected.
Port Status[2]		Indicates individual port status.
	Green	The port is operational (a signal is detected).
	Orange	The link has been disabled by software.
	Flashing orange	The link has been disabled due to a hardware failure.
	Off	No signal is detected.

1. Used on the WS-X4232-L3 Ethernet routing module.
2. LEDs labeled 1 through the number of ports on the switching module are the individual port link LEDs.

Hot-Swapping Feature

Catalyst 4500 series switches allow you to remove and replace switching modules without powering down the switch. This feature is known as *hot swapping*.

When you remove or insert a switching module while the switch is operating, the system does the following:

1. Scans the backplane for configuration changes.
2. Initializes all newly inserted switching modules, notes any removed modules, and places them in the administratively shutdown state.
3. Places any previously configured interfaces on the switching module back to the state they were in when they were removed. Any newly inserted interfaces are put in the administratively shutdown state, as if they were present (but unconfigured) at boot time. If you insert a similar switching-module type into a slot, its ports are configured and brought online up to the port count of the original switching module.

The system runs diagnostic tests on any new interfaces. If the test passes, the system is operating normally. If the new switching module is faulty, the system resumes normal operation but places the new module in the "faulty" state.

If the diagnostic test fails, the system crashes, which usually indicates that the new switching module has a problem and should be removed.

Caution To avoid erroneous failure messages, allow at least 15 seconds for the system to reinitialize, and note the current configuration of all interfaces before you remove or insert another switching module.

When you hot swap switching modules, the system displays status messages on the console screen. The following sample display shows the messages logged by the system when a switching module is removed from slot 2:

```
Console> (enable)
2001 Sep 09 12:23:26 %SYS-5-MOD_REMOVE:Module 3 has been removed
Console> (enable)
2001 Sep 09 12:23:44 %SYS-5-MOD_INSERT:Module 3 has been inserted
Console> (enable)
2001 Sep 09 12:23:47 %SYS-5-MOD_OK:Module 3 is online
Console> (enable)
```

If you use the **show port** command to query the module before reinstalling a module to replace the removed one, the system responds, "Module 3 is not installed." When the module is reinserted, the system recognizes the module as ready again.