



ECS4510-28T  
28-Port Layer 2  
Gigabit Ethernet Switch

Installation Guide



# INSTALLATION GUIDE

## **ECS4510-28T GIGABIT ETHERNET SWITCH**

*Layer 2 Gigabit Ethernet Switch  
with 24 10/100/1000BASE-T (RJ-45) Ports,  
2 10 Gigabit SFP+ Ports,  
and 1 10-Gigabit SFP+ Extender Module Slot*

ECS4510-28T  
E072012-CS-R01  
150200000433A



# COMPLIANCES AND SAFETY STATEMENTS

## FCC - CLASS A

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 the user will be required to correct the interference at his own expense.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

You may use unshielded twisted-pair (UTP) for RJ-45 connections - Category 3 or better for 10 Mbps connections, Category 5 or better for 100 Mbps connections, Category 5, 5e, or 6 for 1000 Mbps connections. For fiber optic connections, you may use 50/125 or 62.5/125 micron multimode fiber or 9/125 micron single-mode fiber.

## INDUSTRY CANADA - CLASS A

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of the Department of Communications.

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: "Appareils Numériques," NMB-003 édictée par le ministère des Communications.

## JAPAN VCCI CLASS A

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

**CE MARK DECLARATION OF CONFORMANCE FOR EMI AND SAFETY (EEC)**

This information technology equipment complies with the requirements of the Council Directive 89/336/EEC on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility and 73/23/EEC for electrical equipment used within certain voltage limits and the Amendment Directive 93/68/EEC. For the evaluation of the compliance with these Directives, the following standards were applied:

- RFI Emission:
- ◆ Limit class A according to EN 55022: 2010, Class A/B
  - ◆ Limit class A for harmonic current emission according to EN 61000-3-2: 2009, Class A
  - ◆ Limitation of voltage fluctuation and flicker in low-voltage supply system according to EN 61000-3-3: 2008
- Immunity:
- ◆ Product family standard according to EN 55024: 2010
  - ◆ Electrostatic Discharge according to IEC 61000-4-2: 2008
  - ◆ Radio-frequency electromagnetic field according to IEC 61000-4-3: 2010
  - ◆ Electrical fast transient/burst according to IEC 61000-4-4: 2011
  - ◆ Surge immunity test according to IEC 61000-4-5: 2005
  - ◆ Immunity to conducted disturbances, Induced by radio-frequency fields: IEC 61000-4-6: 2008
  - ◆ Power frequency magnetic field immunity test according to IEC 61000-4-8: 2009
  - ◆ Voltage dips, short interruptions and voltage variations immunity test according to IEC 61000-4-11: 2004
- LVD:
- ◆ EN 60950-1: 2011

## SAFETY COMPLIANCE

### Warning: Fiber Optic Port Safety

CLASS I  
LASER DEVICE

When using a fiber optic port, never look at the transmit laser while it is powered on. Also, never look directly at the fiber TX port and fiber cable ends when they are powered on.

### Avertissement: Ports pour fibres optiques - sécurité sur le plan optique

DISPOSITIF LASER  
DE CLASSE I

Ne regardez jamais le laser tant qu'il est sous tension. Ne regardez jamais directement le port TX (Transmission) à fibres optiques et les embouts de câbles à fibres optiques tant qu'ils sont sous tension.

### Warnhinweis: Faseroptikanschlüsse - Optische Sicherheit

LASERGERÄT  
DER KLASSE I

Niemals ein Übertragungslaser betrachten, während dieses eingeschaltet ist. Niemals direkt auf den Faser-TX-Anschluß und auf die Faserkabelenden schauen, während diese eingeschaltet sind.

## PSE ALARM

本製品に同梱いたしております電源コードセットは、本製品専用です。本電源コードセットは、本製品以外の製品並びに他の用途でご使用いただくことは出来ません。製品本体に同梱された電源コードセットを利用し、他製品の電源コードセットを使用しないで下さい。

## POWER CORD SAFETY

**Please read the following safety information carefully before installing the switch:**

**WARNING:** Installation and removal of the unit must be carried out by qualified personnel only.

- ◆ The unit must be connected to an earthed (grounded) outlet to comply with international safety standards.
- ◆ Do not connect the unit to an A.C. outlet (power supply) without an earth (ground) connection.
- ◆ The appliance coupler (the connector to the unit and not the wall plug) must have a configuration for mating with an EN 60320/IEC 320 appliance inlet.
- ◆ The socket outlet must be near to the unit and easily accessible. You can only remove power from the unit by disconnecting the power cord from the outlet.
- ◆ This unit operates under SELV (Safety Extra Low Voltage) conditions according to IEC 60950. The conditions are only maintained if the equipment to which it is connected also operates under SELV conditions.

### *France and Peru only*

This unit cannot be powered from IT<sup>†</sup> supplies. If your supplies are of IT type, this unit must be powered by 230 V (2P+T) via an isolation transformer ratio 1:1, with the secondary connection point labelled Neutral, connected directly to earth (ground).

† Impédance à la terre

**IMPORTANT!** Before making connections, make sure you have the correct cord set. Check it (read the label on the cable) against the following:



**Power Cord Set**

U.S.A. and Canada	<p>The cord set must be UL-approved and CSA certified.</p> <p>The minimum specifications for the flexible cord are:          - No. 18 AWG - not longer than 2 meters, or 16 AWG.          - Type SV or SJ          - 3-conductor</p> <p>The cord set must have a rated current capacity of at least 10 A</p> <p>The attachment plug must be an earth-grounding type with NEMA 5-15P (15 A, 125 V) configuration.</p>
Denmark	<p>The supply plug must comply with Section 107-2-D1, Standard DK2-1a or DK2-5a.</p>
Switzerland	<p>The supply plug must comply with SEV/ASE 1011.</p>
U.K.	<p>The supply plug must comply with BS1363 (3-pin 13 A) and be fitted with a 5 A fuse which complies with BS1362.</p> <p>The mains cord must be &lt;HAR&gt; or &lt;BASEC&gt; marked and be of type HO3VVF3GO.75 (minimum).</p>
Europe	<p>The supply plug must comply with CEE7/7 ("SCHUKO").</p> <p>The mains cord must be &lt;HAR&gt; or &lt;BASEC&gt; marked and be of type HO3VVF3GO.75 (minimum).</p> <p>IEC-320 receptacle.</p>

**Veillez lire à fond l'information de la sécurité suivante avant d'installer le Switch:**

**AVERTISSEMENT:** L'installation et la dépose de ce groupe doivent être confiés à un personnel qualifié.

- ◆ Ne branchez pas votre appareil sur une prise secteur (alimentation électrique) lorsqu'il n'y a pas de connexion de mise à la terre (mise à la masse).
- ◆ Vous devez raccorder ce groupe à une sortie mise à la terre (mise à la masse) afin de respecter les normes internationales de sécurité.
- ◆ Le coupleur d'appareil (le connecteur du groupe et non pas la prise murale) doit respecter une configuration qui permet un branchement sur une entrée d'appareil EN 60320/IEC 320.

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## COMPLIANCES AND SAFETY STATEMENTS

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- ◆ La prise secteur doit se trouver à proximité de l'appareil et son accès doit être facile. Vous ne pouvez mettre l'appareil hors circuit qu'en débranchant son cordon électrique au niveau de cette prise.
- ◆ L'appareil fonctionne à une tension extrêmement basse de sécurité qui est conforme à la norme IEC 60950. Ces conditions ne sont maintenues que si l'équipement auquel il est raccordé fonctionne dans les mêmes conditions.

### *France et Pérou uniquement:*

Ce groupe ne peut pas être alimenté par un dispositif à impédance à la terre. Si vos alimentations sont du type impédance à la terre, ce groupe doit être alimenté par une tension de 230 V (2 P+T) par le biais d'un transformateur d'isolement à rapport 1:1, avec un point secondaire de connexion portant l'appellation Neutre et avec raccordement direct à la terre (masse).

---

### **Cordon électrique** - Il doit être agréé dans le pays d'utilisation

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Etats-Unis et Canada: Le cordon doit avoir reçu l'homologation des UL et un certificat de la CSA.

Les spécifications minimales pour un câble flexible sont AWG No. 18, ou AWG No. 16 pour un câble de longueur inférieure à 2 mètres.  
- type SV ou SJ  
- 3 conducteurs

Le cordon doit être en mesure d'acheminer un courant nominal d'au moins 10 A.

La prise femelle de branchement doit être du type à mise à la terre (mise à la masse) et respecter la configuration NEMA 5-15P (15 A, 125 V).

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Danemark: La prise mâle d'alimentation doit respecter la section 107-2 D1 de la norme DK2 1a ou DK2 5a.

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Suisse: La prise mâle d'alimentation doit respecter la norme SEV/ASE 1011.

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Europe La prise secteur doit être conforme aux normes CEE 7/7 ("SCHUKO")  
Le cordon secteur doit porter la mention <HAR> ou <BASEC> et doit être de type HO3VVF3GO.75 (minimum).

---

**Bitte unbedingt vor dem Einbauen des Switches die folgenden Sicherheitsanweisungen durchlesen:**

**WARNUNG:** Die Installation und der Ausbau des Geräts darf nur durch Fachpersonal erfolgen.

- ◆ Das Gerät sollte nicht an eine ungeerdete Wechselstromsteckdose angeschlossen werden.
- ◆ Das Gerät muß an eine geerdete Steckdose angeschlossen werden, welche die internationalen Sicherheitsnormen erfüllt.
- ◆ Der Gerätestecker (der Anschluß an das Gerät, nicht der Wandsteckdosenstecker) muß einen gemäß EN 60320/IEC 320 konfigurierten Geräteeingang haben.
- ◆ Die Netzsteckdose muß in der Nähe des Geräts und leicht zugänglich sein. Die Stromversorgung des Geräts kann nur durch Herausziehen des Gerätenetzkabels aus der Netzsteckdose unterbrochen werden.
- ◆ Der Betrieb dieses Geräts erfolgt unter den SELV-Bedingungen (Sicherheitskleinstspannung) gemäß IEC 60950. Diese Bedingungen sind nur gegeben, wenn auch die an das Gerät angeschlossenen Geräte unter SELV-Bedingungen betrieben werden.

**Stromkabel.** Dies muss von dem Land, in dem es benutzt wird geprüft werden:

Schweiz	Dieser Stromstecker muß die SEV/ASE 1011 Bestimmungen einhalten.
Europe	Das Netzkabel muß vom Typ HO3VVF3G0.75 (Mindestanforderung) sein und die Aufschrift <HAR> oder <BASEC> tragen. Der Netzstecker muß die Norm CEE 7/7 erfüllen ("SCHUKO").

## WARNINGS AND CAUTIONARY MESSAGES



**WARNING:** This product does not contain any serviceable user parts.

**WARNING:** Installation and removal of the unit must be carried out by qualified personnel only.

**WARNING:** When connecting this device to a power outlet, connect the field ground lead on the tri-pole power plug to a valid earth ground line to prevent electrical hazards.

**WARNING:** This switch uses lasers to transmit signals over fiber optic cable. The lasers are compliant with the requirements of a Class 1 Laser Product and are inherently eye safe in normal operation. However, you should never look directly at a transmit port when it is powered on.



**CAUTION:** Wear an anti-static wrist strap or take other suitable measures to prevent electrostatic discharge when handling this equipment.

**CAUTION:** Do not plug a phone jack connector in the RJ-45 port. This may damage this device.

**CAUTION:** Use only twisted-pair cables with RJ-45 connectors that conform to FCC standards.

## ENVIRONMENTAL STATEMENTS

The manufacturer of this product endeavours to sustain an environmentally-friendly policy throughout the entire production process. This is achieved through the following means:

- ◆ Adherence to national legislation and regulations on environmental production standards.
- ◆ Conservation of operational resources.
- ◆ Waste reduction and safe disposal of all harmful un-recyclable by-products.
- ◆ Recycling of all reusable waste content.
- ◆ Design of products to maximize recyclables at the end of the product's life span.
- ◆ Continual monitoring of safety standards.

### **END OF PRODUCT LIFE SPAN**

This product is manufactured in such a way as to allow for the recovery and disposal of all included electrical components once the product has reached the end of its life.

### **MANUFACTURING MATERIALS**

There are no hazardous nor ozone-depleting materials in this product.

### **DOCUMENTATION**

All printed documentation for this product uses biodegradable paper that originates from sustained and managed forests. The inks used in the printing process are non-toxic.



# ABOUT THIS GUIDE

## PURPOSE

This guide details the hardware features of the switch, including the physical and performance-related characteristics, and how to install the switch.

## AUDIENCE

The guide is intended for use by network administrators who are responsible for installing and setting up network equipment; consequently, it assumes a basic working knowledge of LANs (Local Area Networks).

## CONVENTIONS

The following conventions are used throughout this guide to show information:



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**NOTE:** Emphasizes important information or calls your attention to related features or instructions.

---



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**CAUTION:** Alerts you to a potential hazard that could cause loss of data, or damage the system or equipment.

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**WARNING:** Alerts you to a potential hazard that could cause personal injury.

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## RELATED PUBLICATIONS

The following publication gives specific information on how to operate and use the management functions of the switch:

The *Management Guide*

Also, as part of the switch's software, there is an online web-based help that describes all management related features.

**REVISION HISTORY**

This section summarizes the changes in each revision of this guide.

**JULY 2012 REVISION**

This was the first revision of this guide.



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# 1

## INTRODUCTION

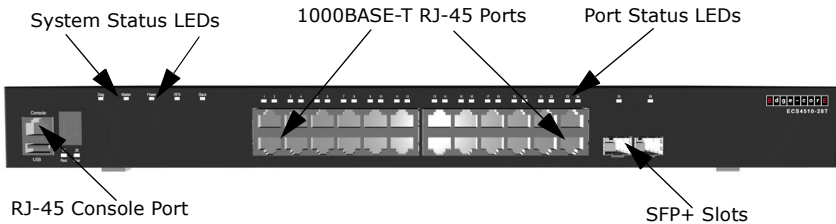
### OVERVIEW

The ECS4510-28T Switch is an intelligent Layer 2 switch with 24 10/100/1000BASE-T ports, and 2 10G SFP+ slots. The rear panel provides one slot for a dual-port 10 Gigabit Ethernet hot-swappable expansion module.

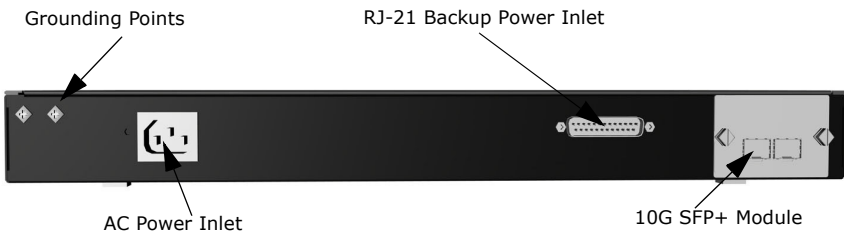
The switch includes an SNMP-based management agent embedded on the main board, which supports both in-band and out-of-band access for managing the switch.

The switch can easily tame your network with full support for Spanning Tree Protocol, Multicast Switching, and Virtual LANs. It brings order to poorly performing networks by segregating them into separate broadcast domains with IEEE 802.1Q compliant VLANs, and empowers multimedia applications with multicast switching and CoS services.

**Figure 1: Front Panel**



**Figure 2: Rear Panel**



## SWITCH ARCHITECTURE

This Gigabit Ethernet switch employs a wire-speed, non-blocking switching fabric. This permits simultaneous wire-speed transport of multiple packets at low latency on all ports. The switch also features full-duplex capability on all ports, which effectively doubles the bandwidth of each connection.

This switch uses store-and-forward switching to ensure maximum data integrity. With store-and-forward switching, the entire packet must be received into a buffer and checked for validity before being forwarded. This prevents errors from being propagated throughout the network.

This switch also includes one slot on the rear panel for a slide-in dual-port SFP+ 10GBASE module.

## NETWORK MANAGEMENT OPTIONS

This switch contains a comprehensive array of LEDs for “at-a-glance” monitoring of network and port status. It also includes a management agent that allows you to configure or monitor the switch using its embedded management software, or via SNMP applications. To manage the switch, you can make a direct connection to the console port (out-of-band), or you can manage the switch through a network connection (in-band) using Telnet, the on-board web agent, or SNMP-based network management software.

For a detailed description of the management features, refer to the *Management Guide*.

---

## DESCRIPTION OF HARDWARE

### 10/100/1000BASE-T PORTS

The switch contains 28 RJ-45 ports that operate at 10 Mbps or 100 Mbps, half or full duplex, or at 1000 Mbps, full duplex. Because all ports on this switch support automatic MDI/MDI-X operation, you can use straight-through cables for all network connections to PCs or servers, or to other switches or hubs. (See “1000BASE-T Pin Assignments” on page 64.)

Each of these ports support auto-negotiation, so the optimum transmission mode (half or full duplex), and data rate (10, 100, or 1000 Mbps) can be selected automatically. If a device connected to one of these ports does not



support auto-negotiation, the communication mode of that port can be configured manually.

## SFP+ TRANSCEIVER SLOTS

The Small Form Factor Pluggable+ (SFP+) transceiver slots are 10G capable slots that support both SFP and SFP+ modules (purchased separately.)

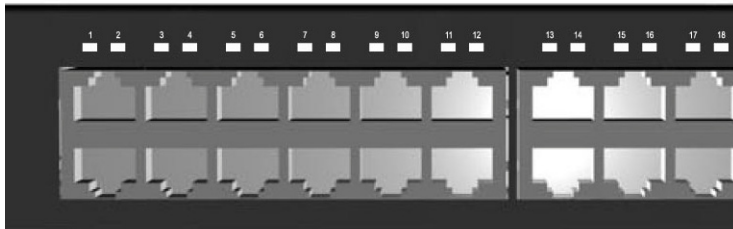
## 10 GIGABIT ETHERNET EXPANSION MODULE

This switch includes one slot on the rear panel for a hot-swappable dual-port 10GBASE module. Refer to ["Optional Media Extender Modules" on page 27](#) for more information on the supported modules.

## PORT AND SYSTEM STATUS LEDs

This switch includes a display panel for key system and port indications that simplify installation and network troubleshooting. The LEDs, which are located on the front panel for easy viewing, are shown below and described in the following tables.

**Figure 3: Port LEDs**



**Table 1: Port Status LEDs**

LED	Condition	Status
Link/Activity	On/Flashing Green	Port has a valid link. Flashing indicates activity.
	Off	The link is down.

**Figure 4: System LEDs**



**Table 2: System Status LEDs**

LED	Condition	Status
Power	Green	Internal power is operating normally.
	Amber	Internal power supply failure.
	Off	Power off.
Diag	Flashing Green	System self-diagnostic test in progress.
	Green	System self-diagnostic test successfully completed.
	Amber	System self-diagnostic test has detected a fault.
RPS	Green	Redundant power supply is receiving power.
	Amber	Fault in redundant power supply, including thermal or fan failure.
	Off	Redundant power supply is not plugged in.

## OPTIONAL REDUNDANT POWER SUPPLY

The switch supports an optional Redundant Power Supply (RPS), that can supply power to the switch in the event the internal power supply fails.

## POWER SUPPLY SOCKET

There are two power sockets on the rear panel of each switch. The standard power socket is for the AC power cord. The socket labeled "RPS" is for the optional Redundant Power Supply (RPS).

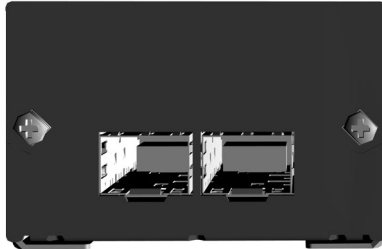
**Figure 5: Power Supply Sockets**



## OPTIONAL MEDIA EXTENDER MODULES

### 10GBASE SFP+ MODULE

**Figure 6: Dual-Port 10GBASE Module (SFP+)**



The module's SFP+ slots support standard 10 Gigabit Ethernet (10G) SFP+ transceivers. The 10GBASE transceivers operate at 10 Gbps full duplex with support for flow control.



# 2

## NETWORK PLANNING

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### INTRODUCTION TO SWITCHING

A network switch allows simultaneous transmission of multiple packets via non-crossbar switching. This means that it can partition a network more efficiently than bridges or routers. These switches have, therefore, been recognized as one of the most important building blocks for today's networking technology.

When performance bottlenecks are caused by congestion at the network access point (such as the network card for a high-volume file server), the device experiencing congestion (server, power user or hub) can be attached directly to a switched port. And, by using full-duplex mode, the bandwidth of the dedicated segment can be doubled to maximize throughput.

When networks are based on repeater (hub) technology, the distance between end stations is limited by a maximum hop count. However, a switch turns the hop count back to zero. So subdividing the network into smaller and more manageable segments, and linking them to the larger network by means of a switch, removes this limitation.

A switch can be easily configured in any Ethernet, Fast Ethernet, Gigabit Ethernet, or 10G Ethernet network to significantly boost bandwidth while using conventional cabling and network cards.

## APPLICATION EXAMPLES

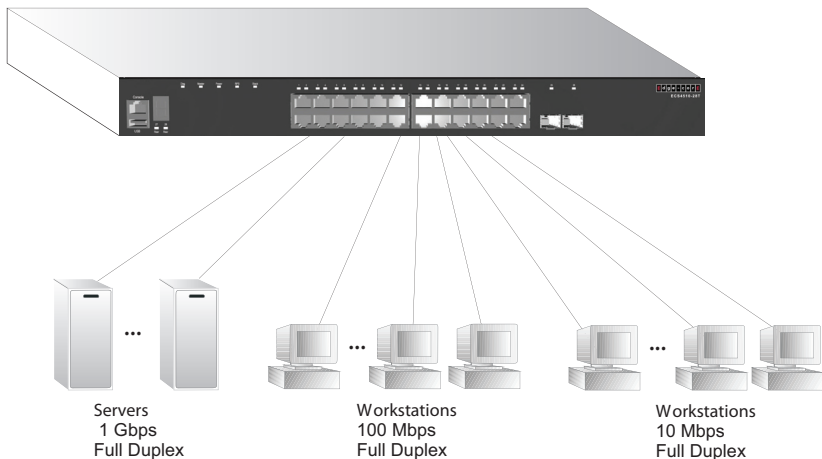
The Gigabit Ethernet Switch is not only designed to segment your network, but also to provide a wide range of options in setting up network connections and linking VLANs or IP subnets. Some typical applications are described below.

### COLLAPSED BACKBONE

The Gigabit Ethernet Switch is an excellent choice for mixed Ethernet, Fast Ethernet, and Gigabit Ethernet installations where significant growth is expected in the near future. In a basic stand-alone configuration, it can provide direct full-duplex connections for up to 28 workstations or servers. You can easily build on this basic configuration, adding direct full-duplex connections to workstations or servers. When the time comes for further expansion, just connect to another switch using one of the Gigabit Ethernet ports built into the front panel, a Gigabit Ethernet port on a plug-in SFP transceiver, or a 10G transceiver on an optional module.

In the figure below, the 28-port Gigabit Ethernet Switch is operating as a collapsed backbone for a small LAN. It is providing dedicated 10 Mbps full-duplex connections to workstations and 100 Mbps full-duplex connections to power users, and 1 Gbps full-duplex connections to servers.

**Figure 7: Collapsed Backbone**

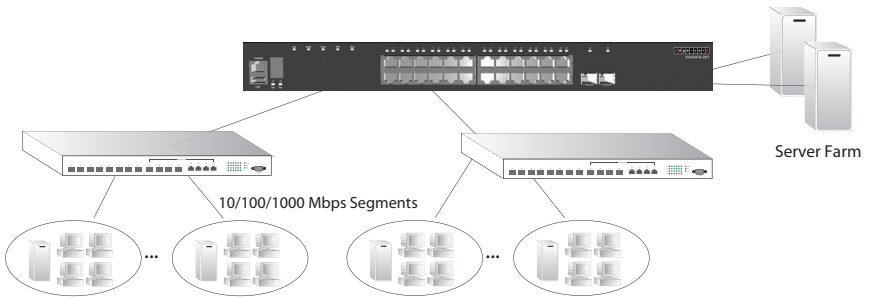


## NETWORK AGGREGATION PLAN

With 28 parallel bridging ports (i.e., 28 distinct collision domains), a Gigabit switch can collapse a complex network down into a single efficient bridged node, increasing overall bandwidth and throughput.

In the figure below, the 10/100/1000BASE-T ports of a 28-port Gigabit Ethernet switch are providing 1000 Mbps connectivity through other switches. In addition, the switch is also connecting servers at 10 Gbps.

**Figure 8: Network Aggregation Plan**



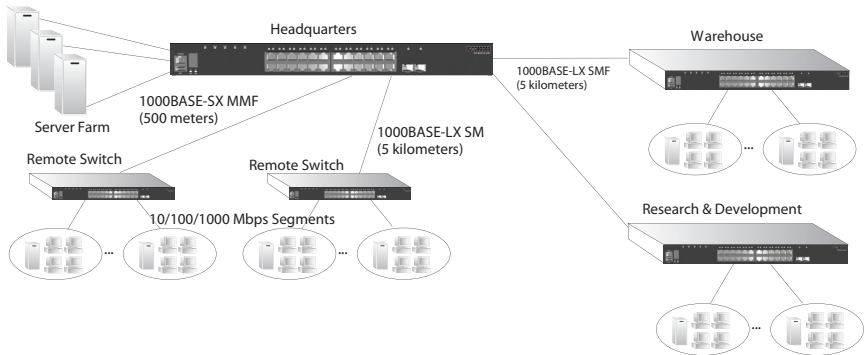
## REMOTE CONNECTIONS WITH FIBER CABLE

Fiber optic technology allows for longer cabling than any other media type. A 1000BASE-SX (MMF) link can connect to a site up to 550 meters away, a 1000BASE-LX (SMF) link up to 5 km, and a 1000BASE-LH link up to 70 km. This allows a switch to serve as a collapsed backbone, providing direct connectivity for a widespread LAN.

A 1000BASE-SX SFP transceiver can be used for a high-speed connection between floors in the same building and a 10GBASE-LR module can be used for high-bandwidth core connections between buildings in a campus setting. For long-haul connections, a 1000BASE-LH SFP transceiver can be used to reach another site up to 70 kilometers away.

The figure below illustrates three Gigabit Ethernet switches interconnecting multiple segments with fiber cable.

**Figure 9: Remote Connections with Fiber Cable**





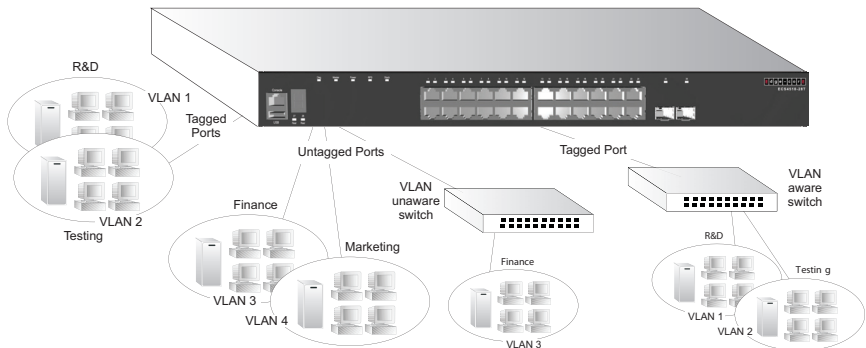
## MAKING VLAN CONNECTIONS

This switch supports VLANs which can be used to organize any group of network nodes into separate broadcast domains. VLANs confine broadcast traffic to the originating group, and can eliminate broadcast storms in large networks. This provides a more secure and cleaner network environment.

VLANs can be based on untagged port groups, or traffic can be explicitly tagged to identify the VLAN group to which it belongs. Untagged VLANs can be used for small networks attached to a single switch. However, tagged VLANs should be used for larger networks, and all the VLANs assigned to the inter-switch links.

This switch also supports multiple spanning trees which allow VLAN groups to maintain a more stable path between all VLAN members. This can reduce the overall amount of protocol traffic crossing the network, and provide a shorter reconfiguration time if any link in the spanning tree fails.

**Figure 10: Making VLAN Connections**



**NOTE:** When connecting to a switch that does not support IEEE 802.1Q VLAN tags, use untagged ports.

---

## APPLICATION NOTES

1. Full-duplex operation only applies to point-to-point access (such as when a switch is attached to a workstation, server or another switch). When the switch is connected to a hub, both devices must operate in half-duplex mode.
2. For network applications that require routing between dissimilar network types, you can attach this switch directly to a multi-protocol router.
3. As a general rule, the length of fiber optic cable for a single switched link should not exceed:
  - 1000BASE-SX: 550 m (1805 ft) for multimode fiber
  - 1000BASE-LX: 5 km (3.1 miles) for single-mode fiber
  - 1000BASE-LH: 70 km (43.5 miles) for single-mode fiber
  - 10GBASE-SR: 300 m (984 ft) for multimode fiber
  - 10GBASE-LR: 10 km (6.2 miles) for single-mode fiber
  - 10GBASE-ER: 40 km (24.8 miles) for single-mode fiber

However, power budget constraints must also be considered when calculating the maximum cable length for your specific environment.

# 3

## INSTALLING THE SWITCH

---

### SELECTING A SITE

Switch units can be mounted in a standard 19-inch equipment rack or on a flat surface. Be sure to follow the guidelines below when choosing a location.

- ◆ The site should:
  - be at the center of all the devices you want to link and near a power outlet.
  - be able to maintain its temperature within 0 to 50 °C (32 to 122 °F) and its humidity within 5% to 95%, non-condensing
  - provide adequate space (approximately five centimeters or two inches) on all sides for proper air flow
  - be accessible for installing, cabling and maintaining the devices
  - allow the status LEDs to be clearly visible
- ◆ Make sure twisted-pair cable is always routed away from power lines, fluorescent lighting fixtures and other sources of electrical interference, such as radios and transmitters.
- ◆ Make sure that the unit is connected to a separate grounded power outlet that provides 100 to 240 VAC, 50 to 60 Hz, is within 2 m (6.6 feet) of each device and is powered from an independent circuit breaker. As with any equipment, using a filter or surge suppressor is recommended.

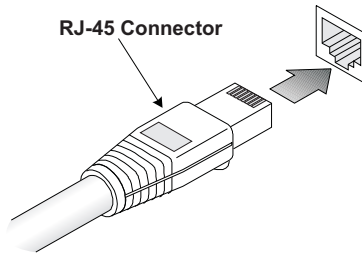
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## ETHERNET CABLING

To ensure proper operation when installing the switches into a network, make sure that the current cables are suitable for 10BASE-T, 100BASE-TX or 1000BASE-T operation. Check the following criteria against the current installation of your network:

- ◆ Cable type: Unshielded twisted pair (UTP) or shielded twisted pair (STP) cables with RJ-45 connectors; Category 3 or better for 10BASE-T, Category 5 or better for 100BASE-TX, and Category 5, 5e or 6 for 1000BASE-T.
- ◆ Protection from radio frequency interference emissions
- ◆ Electrical surge suppression
- ◆ Separation of electrical wires (switch related or other) and electromagnetic fields from data based network wiring
- ◆ Safe connections with no damaged cables, connectors or shields

**Figure 11: RJ-45 Connections**



---

## EQUIPMENT CHECKLIST

After unpacking this switch, check the contents to be sure you have received all the components. Then, before beginning the installation, be sure you have all other necessary installation equipment.

### PACKAGE CONTENTS

- ◆ 28-port Gigabit Ethernet Switch (ECS4510-28T)
- ◆ Four adhesive foot pads
- ◆ Bracket Mounting Kit containing two brackets and eight screws for attaching the brackets to the switch
- ◆ Power cord—either US, Continental Europe or UK
- ◆ Console cable (RJ-45 to RS-232)
- ◆ This Installation Guide
- ◆ Management Guide CD

### OPTIONAL RACK-MOUNTING EQUIPMENT

If you plan to rack-mount the switch, be sure to have the following equipment available:

- ◆ Four mounting screws for each device you plan to install in a rack—these are not included
- ◆ A screwdriver (Phillips or flathead, depending on the type of screws used)

---

## MOUNTING

The switch can be mounted in a standard 19-inch equipment rack or on a desktop or shelf. Mounting instructions for each type of site follow.

### RACK MOUNTING

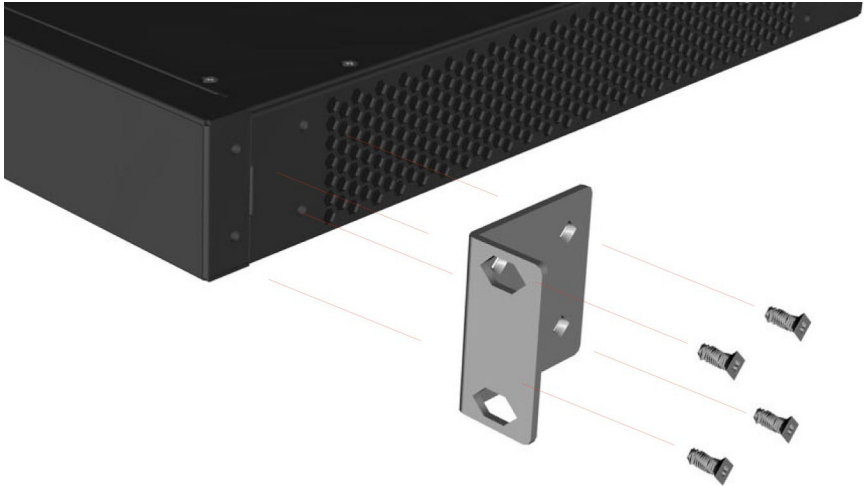
Before rack mounting the switch, pay particular attention to the following factors:

- ◆ **Temperature:** Since the temperature within a rack assembly may be higher than the ambient room temperature, check that the rack-environment temperature is within the specified operating temperature range. (See [page 68](#).)
- ◆ **Mechanical Loading:** Do not place any equipment on top of a rack-mounted unit.
- ◆ **Circuit Overloading:** Be sure that the supply circuit to the rack assembly is not overloaded.
- ◆ **Grounding:** Rack-mounted equipment should be properly grounded. Particular attention should be given to supply connections other than direct connections to the mains.

To rack-mount devices:

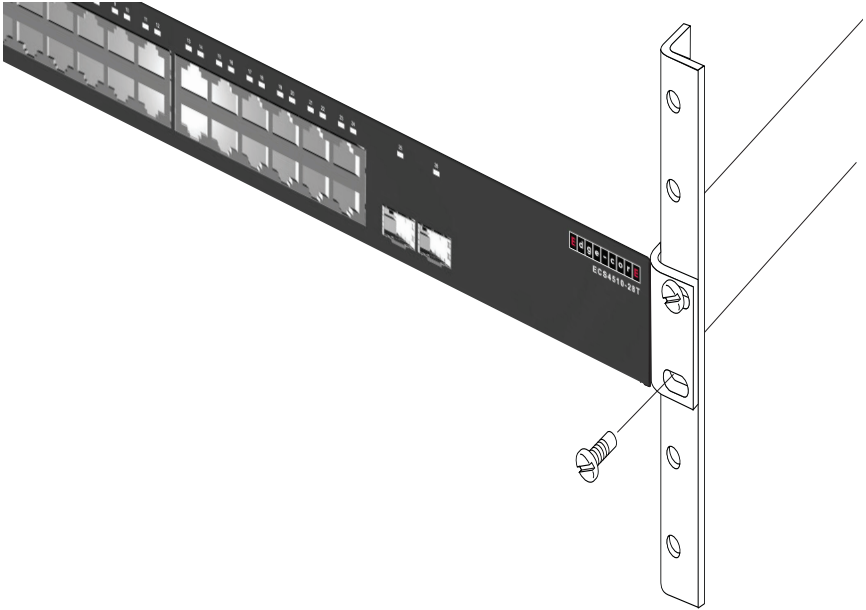
1. Attach the brackets to the device using the screws provided in the Bracket Mounting Kit.

Figure 12: Attaching the Brackets



2. Mount the device in the rack, using four rack-mounting screws (not provided).

**Figure 13: Installing the Switch in a Rack**



3. If installing a single switch only, turn to ["Connecting to a Power Source"](#) on page 44.
4. If installing multiple switches, mount them in the rack, one below the other, in any order.
5. If also installing an RPS, mount it in the rack below the other devices.

## DESKTOP OR SHELF MOUNTING

1. Attach the four adhesive feet to the bottom of the first switch.



**Figure 14: Attaching the Adhesive Feet**



2. Set the device on a flat surface near an AC power source, making sure there are at least two inches of space on all sides for proper air flow.
3. If installing a single switch only, go to ["Connecting to a Power Source" on page 44.](#)
4. If installing multiple switches, attach four adhesive feet to each one. Place each device squarely on top of the one below, in any order.
5. If also installing an RPS, place it close to the stack.

## INSTALLING AN OPTIONAL MODULE INTO THE SWITCH

**Figure 15: Installing an Optional Module**



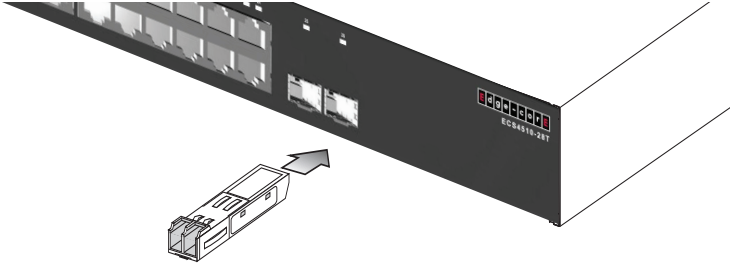
**NOTE:** The slide-in modules are hot-swappable, you do not need to power off the switch before installing or removing a module.

To install an optional module into the switch, do the following:

1. Remove the blank metal plate (or a previously installed module) from the appropriate slot by removing the two screws with a flat-head screwdriver.
2. Before opening the package that contains the module, touch the bag to the switch casing to discharge any potential static electricity. Also, it is recommended to use an ESD wrist strap during installation.
3. Remove the module from the anti-static shielded bag.
4. Holding the module level, guide it into the carrier rails on each side and gently push it all the way into the slot, ensuring that it firmly engages with the connector.
5. If you are sure the module is properly mated with the connector, tighten the retainer screws to secure the module in the slot.
6. The Module LED on the switch's front panel should turn green to confirm that the module is correctly installed and ready to use.

## INSTALLING AN SFP OR SFP+ TRANSCEIVER

**Figure 16: Inserting an SFP Transceiver into a Slot**



These switches support the following optional transceivers:

**Table 3: Optional Transceivers**

SFP	SFP+
1000BASE-SX (ET4201-SX)	10GBASE-SR (ET5402-SR)
1000BASE-LX (ET4201-LX)	10GBASE-LR (ET5402-LR)
1000BASE-ZX (ET4201-ZX)	10GBASE-ER (ET5402-ER)

To install an SFP or SFP+ transceiver, do the following:

1. Consider network and cabling requirements to select an appropriate transceiver type. See ["Connectivity Rules" on page 53](#).
2. Insert the transceiver with the optical connector facing outward and the slot connector facing down. Note that SFP and SFP+ transceivers are keyed so they can only be installed in one orientation.
3. Slide the transceiver into the slot until it clicks into place.



**NOTE:** SFP/SFP+ transceivers are hot-swappable. The switch does not need to be powered off before installing or removing a transceiver. However, always first disconnect the network cable before removing a transceiver.

**NOTE:** SFP/SFP+ transceivers are not provided in the switch package.

---

## CONNECTING TO A POWER SOURCE

To connect a switch to a power source:

1. Insert the power cable plug directly into the AC socket located at the back of the switch.

**Figure 17: Power Socket**



2. Plug the other end of the cable into a grounded, 3-pin, AC power source.



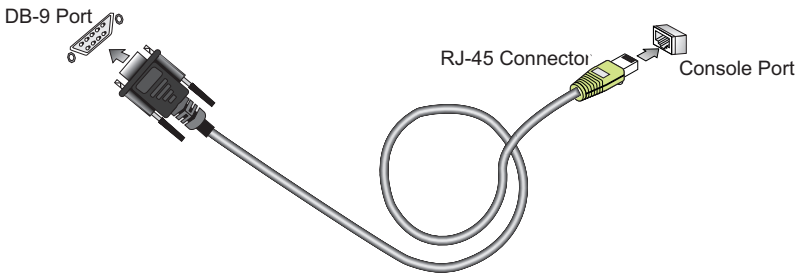
**NOTE:** For International use, you may need to change the AC line cord. You must use a line cord set that has been approved for the socket type in your country.

3. Check the front-panel LEDs as the device is powered on to be sure the PWR LED is lit. If not, check that the power cable is correctly plugged in.
4. If you have purchased a Redundant Power Supply, connect it to the switch and to an AC power source now, following the instructions included with the package.

## CONNECTING TO THE CONSOLE PORT

The RJ-45 serial port on the switch's front panel is used to connect to the switch for out-of-band console configuration. The on-board configuration program can be accessed from a terminal or a PC running a terminal emulation program. The pin assignments used to connect to the serial port are provided in the following table.

**Figure 18: Serial Port (RJ-45) Pin-Out**



## WIRING MAP FOR SERIAL CABLE

**Table 4: Serial Cable Wiring**

Switch's 8-Pin Serial Port	Null Modem	PC's 9-Pin DTE Port
6 RXD (receive data)	<-----	3 TXD (transmit data)
3 TXD (transmit data)	----->	2 RXD (receive data)
5 SGND (signal ground)	-----	5 SGND (signal ground)

No other pins are used.

The serial port's configuration requirements are as follows:

- ◆ Default Baud rate—115,200 bps
- ◆ Character Size—8 Characters
- ◆ Parity—None

- ◆ Stop bit—One
- ◆ Data bits—8
- ◆ Flow control—none

# 4

## MAKING NETWORK CONNECTIONS

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### CONNECTING NETWORK DEVICES

This switch is designed to interconnect multiple segments (or collision domains). It can be connected to network cards in PCs and servers, as well as to hubs, switches or routers. It may also be connected to devices using optional 1G SFP or 10 SFP+ transceivers.

---

### TWISTED-PAIR DEVICES

Each device requires an unshielded twisted-pair (UTP) cable with RJ-45 connectors at both ends. Use Category 5e or better for 1000BASE-T connections, Category 5 or better for 100BASE-TX connections, and Category 3 or better for 10BASE-T connections.

### CABLING GUIDELINES

The RJ-45 ports on the switch support automatic MDI/MDI-X pinout configuration, so you can use standard straight-through twisted-pair cables to connect to any other network device (PCs, servers, switches, routers, or hubs).

See Appendix B for further information on cabling.



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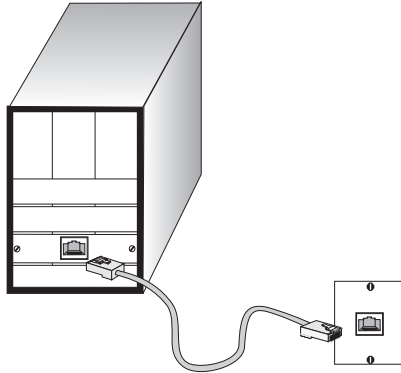
**CAUTION:** Do not plug a phone jack connector into an RJ-45 port. This will damage the switch. Use only twisted-pair cables with RJ-45 connectors that conform to FCC standards.

---

## CONNECTING TO PCs, SERVERS, HUBS AND SWITCHES

1. Attach one end of a twisted-pair cable segment to the device's RJ-45 connector.

**Figure 19: Making Twisted-Pair Connections**



2. If the device is a network card and the switch is in the wiring closet, attach the other end of the cable segment to a modular wall outlet that is connected to the wiring closet. (See the section "[Network Wiring Connections](#)" on page 48.) Otherwise, attach the other end to an available port on the switch.

Make sure each twisted pair cable does not exceed 100 meters (328 ft) in length.

3. As each connection is made, the Link LED (on the switch) corresponding to each port will light green (1000 Mbps) or yellow (10/100 Mbps) to indicate that the connection is valid.

## NETWORK WIRING CONNECTIONS

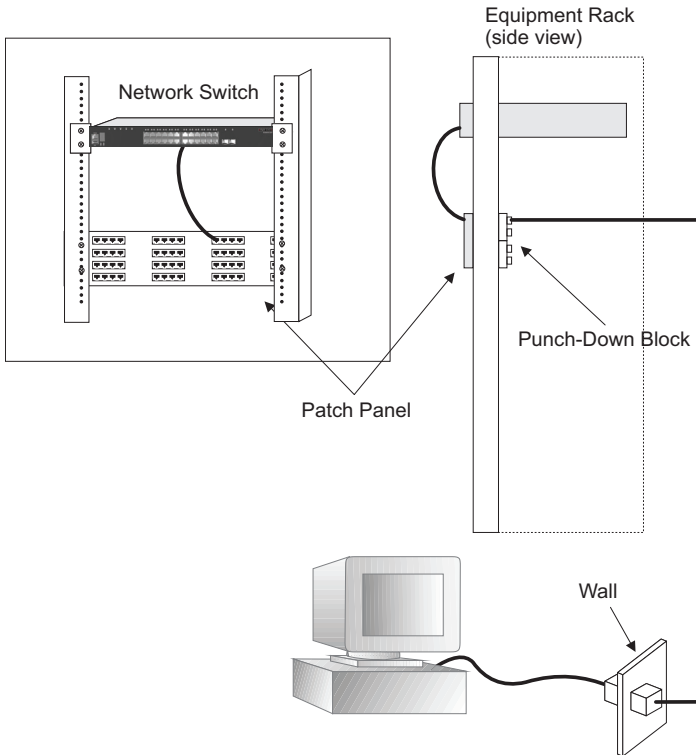
Today, the punch-down block is an integral part of many of the newer equipment racks. It is actually part of the patch panel. Instructions for making connections in the wiring closet with this type of equipment follows.

1. Attach one end of a patch cable to an available port on the switch, and the other end to the patch panel.



2. If not already in place, attach one end of a cable segment to the back of the patch panel where the punch-down block is located, and the other end to a modular wall outlet.
3. Label the cables to simplify future troubleshooting. See “Cable Labeling and Connection Records” on page 55.

**Figure 20: Network Wiring Connections**



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## FIBER OPTIC SFP DEVICES

An optional Gigabit SFP transceiver (1000BASE-SX, 1000BASE-LX, or 1000BASE-LH) can be used for a backbone connection between switches, or for connecting to a high-speed server.

Each single-mode fiber port requires 9/125 micron single-mode fiber optic cable with an LC connector at both ends. Each multimode fiber optic port requires 50/125 or 62.5/125 micron multimode fiber optic cabling with an LC connector at both ends.



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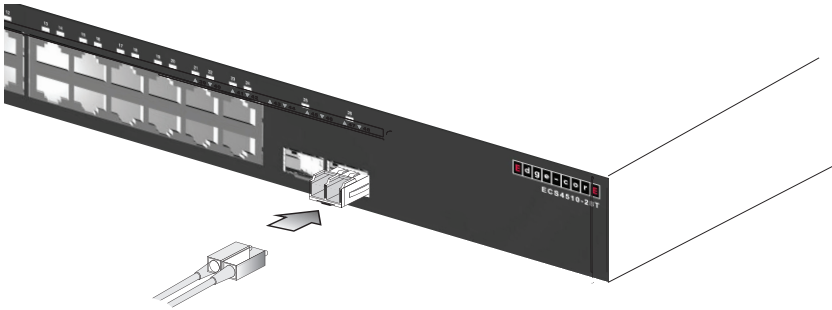
**WARNING:** This switch uses lasers to transmit signals over fiber optic cable. The lasers are compliant with the requirements of a Class 1 Laser Product and are inherently eye safe in normal operation. However, you should never look directly at a transmit port when it is powered on.

**WARNING:** When selecting a fiber SFP device, considering safety, please make sure that it can function at a temperature that is not less than the recommended maximum operational temperature of the product. You must also use an approved Laser Class 1 SFP transceiver.

---

1. Remove and keep the LC port's rubber plug. When not connected to a fiber cable, the rubber plug should be replaced to protect the optics.
2. Check that the fiber terminators are clean. You can clean the cable plugs by wiping them gently with a clean tissue or cotton ball moistened with a little ethanol. Dirty fiber terminators on fiber optic cables will impair the quality of the light transmitted through the cable and lead to degraded performance on the port.
3. Connect one end of the cable to the LC port on the switch and the other end to the LC port on the other device. Since LC connectors are keyed, the cable can be attached in only one orientation.

Figure 21: Making Fiber Port Connections



4. As a connection is made, check the Link LED on the switch corresponding to the port to be sure that the connection is valid.

The 1000BASE-SX, 1000BASE-LX, 1000BASE-LH fiber optic ports operate at 1 Gbps, full duplex, with auto-negotiation of flow control. The maximum length for fiber optic cable operating at Gigabit speed will depend on the fiber type as listed under ["1000 Mbps Gigabit Ethernet Collision Domain"](#) on page 54.

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## 10 GBPS FIBER OPTIC CONNECTIONS

An optional 10 Gigabit transceiver (SFP+) can be used for a backbone connection between switches.

Single-mode fiber ports require 9/125 micron single-mode fiber optic cable. Multimode fiber optic ports require 50/125 or 62.5/125 micron multimode fiber optic cable. Each fiber optic cable must have an LC connector attached at both ends.



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**WARNING:** This switch uses lasers to transmit signals over fiber optic cable. The lasers are compliant with the requirements of a Class 1 Laser Product and are inherently eye safe in normal operation. However, you should never look directly at a transmit port when it is powered on.

**WARNING:** When selecting a fiber device, considering safety, please make sure that it can function at a temperature that is not less than the recommended maximum operational temperature of the product. You must also use an approved Laser Class 1 SFP transceiver.

---

1. Remove and keep the port's protective cover. When not connected to a fiber cable, the cover should be replaced to protect the optics.
2. Check that the fiber terminators are clean. You can clean the cable plugs by wiping them gently with a clean tissue or cotton ball moistened with a little ethanol. Dirty fiber terminators on fiber cables will impair the quality of the light transmitted through the cable and lead to degraded performance on the port.
3. Connect one end of the cable to the LC port on the switch and the other end to the LC port on the other device. Since LC connectors are keyed, the cable can be attached in only one orientation.
4. As a connection is made, check the Link LED on the module to be sure that the connection is valid.

The 10G fiber optic ports operate at 10 Gbps full duplex. The maximum length for fiber optic cable operating at 10 Gbps will depend on the fiber type as listed under "[10 Gbps Ethernet Collision Domain](#)" on [page 53](#).

## CONNECTIVITY RULES

When adding hubs (repeaters) to your network, please follow the connectivity rules listed in the manuals for these products. However, note that because switches break up the path for connected devices into separate collision domains, you should not include the switch or connected cabling in your calculations for cascade length involving other devices.

### 1000BASE-T CABLE REQUIREMENTS

All Category 5 UTP cables that are used for 100BASE-TX connections should also work for 1000BASE-T, providing that all four wire pairs are connected. However, it is recommended that for all critical connections, or any new cable installations, Category 5e (enhanced Category 5) or Category 6 cable should be used. The Category 5e specification includes test parameters that are only recommendations for Category 5. Therefore, the first step in preparing existing Category 5 cabling for running 1000BASE-T is a simple test of the cable installation to be sure that it complies with the IEEE 802.3-2008 standards.

### 10 GBPS ETHERNET COLLISION DOMAIN

**Table 5: Maximum 1000BASE-SR Gigabit Ethernet Cable Lengths**

Fiber Size	Fiber Bandwidth	Maximum Cable Length	Connector
62.5/125 micron multimode fiber	160 MHz/km	2-26 m (7-85 ft.)	LC
	200 MHz/km	2-33 m (7-108 ft.)	LC
50/125 micron multimode fiber	400 MHz/km	2-66 m (7-216 ft.)	LC
	500 MHz/km	2-82 m (7-269 ft.)	LC
	2000 MHz/km	2-300 m (7-984 ft.)	LC

**Table 6: Maximum 10GBASE-LR 10 Gigabit Ethernet Cable Length**

Fiber Size	Fiber Bandwidth	Maximum Cable Length	Connector
9/125 micron single-mode fiber	N/A	10 km (6.2 miles)	LC

**Table 7: Maximum 10GBASE-ER 10 Gigabit Ethernet Cable Length**

Fiber Size	Fiber Bandwidth	Maximum Cable Length	Connector
9/125 micron single-mode fiber	N/A	40 km (24.85 miles)	LC

## 1000 MBPS GIGABIT ETHERNET COLLISION DOMAIN

**Table 8: Maximum 1000BASE-T Gigabit Ethernet Cable Length**

Cable Type	Maximum Cable Length	Connector
Category 5, 5e, or 6 100-ohm UTP or STP	100 m (328 ft)	RJ-45

**Table 9: Maximum 1000BASE-SX Gigabit Ethernet Cable Lengths**

Fiber Size	Fiber Bandwidth	Maximum Cable Length	Connector
62.5/125 micron multimode fiber	160 MHz/km	2-220 m (7-722 ft)	LC
	200 MHz/km	2-275 m (7-902 ft)	LC
50/125 micron multimode fiber	400 MHz/km	2-500 m (7-1641 ft)	LC
	500 MHz/km	2-550 m (7-1805 ft)	LC

**Table 10: Maximum 1000BASE-LX Gigabit Ethernet Cable Length**

Fiber Size	Fiber Bandwidth	Maximum Cable Length	Connector
9/125 micron single-mode fiber	N/A	2 m - 5 km (7 ft - 3.2 miles)	LC

**Table 11: Maximum 1000BASE-LH Gigabit Ethernet Cable Length**

Fiber Size	Fiber Bandwidth	Maximum Cable Length	Connector
9/125 micron single-mode fiber	N/A	2 m - 70 km (7 ft - 43.5 miles)	LC

## 100 MBPS FAST ETHERNET COLLISION DOMAIN

**Table 12: Maximum Fast Ethernet Cable Lengths**

Type	Cable Type	Max. Cable Length	Connector
100BASE-TX	Category 5 or better 100-ohm UTP or STP	100 m (328 ft)	RJ-45

## 10 MBPS ETHERNET COLLISION DOMAIN

**Table 13: Maximum Ethernet Cable Length**

Type	Cable Type	Max. Cable Length	Connector
10BASE-T	Category 3 or better 100-ohm UTP	100 m (328 ft)	RJ-45

## CABLE LABELING AND CONNECTION RECORDS

When planning a network installation, it is essential to label the opposing ends of cables and to record where each cable is connected. Doing so will enable you to easily locate inter-connected devices, isolate faults and change your topology without need for unnecessary time consumption.

To best manage the physical implementations of your network, follow these guidelines:

- ◆ Clearly label the opposing ends of each cable.
- ◆ Using your building's floor plans, draw a map of the location of all network-connected equipment. For each piece of equipment, identify the devices to which it is connected.
- ◆ Note the length of each cable and the maximum cable length supported by the switch ports.
- ◆ For ease of understanding, use a location-based key when assigning prefixes to your cable labeling.
- ◆ Use sequential numbers for cables that originate from the same equipment.

- ◆ Differentiate between racks by naming accordingly.
- ◆ Label each separate piece of equipment.
- ◆ Display a copy of your equipment map, including keys to all abbreviations at each equipment rack.



# A

## TROUBLESHOOTING

### DIAGNOSING SWITCH INDICATORS

**Table 14: Troubleshooting Chart**

Symptom	Action
Power LED is Off	<ul style="list-style-type: none"><li>◆ Check connections between the switch, the power cord and the wall outlet.</li><li>◆ Contact your dealer for assistance.</li></ul>
Power LED is Amber	<ul style="list-style-type: none"><li>◆ Internal power supply has failed. Contact your local dealer for assistance.</li></ul>
DIAG LED Flashing Yellow	<ul style="list-style-type: none"><li>◆ Power cycle the switch to try and clear the condition.</li><li>◆ If the condition does not clear, contact your dealer for assistance.</li></ul>
Link LED is Off	<ul style="list-style-type: none"><li>◆ Verify that the switch and attached device are powered on.</li><li>◆ Be sure the cable is plugged into both the switch and corresponding device.</li><li>◆ If the switch is installed in a rack, check the connections to the punch-down block and patch panel.</li><li>◆ Verify that the proper cable type is used and its length does not exceed specified limits.</li><li>◆ Check the adapter on the attached device and cable connections for possible defects. Replace the defective adapter or cable if necessary.</li></ul>

### DIAGNOSING POWER PROBLEMS WITH THE LEDs

The Power and RPU LEDs work in combination to indicate power status as follows.

**Table 15: Power/RPS LEDs**

Power LED	RPU LED	Status
Green	Green	Internal power functioning normally; RPU is present.
Green	Amber	Internal power functioning normally; RPU plugged in but faulty.
Green	Off	Internal power functioning normally; RPU not plugged in.
Amber	Green	Internal power faulty; RPU delivering power.
Off	Off	Both internal power and RPU unplugged or not functioning.

---

## POWER AND COOLING PROBLEMS

If the power indicator does not turn on when the power cord is plugged in, you may have a problem with the power outlet, power cord, or internal power supply. However, if the unit powers off after running for a while, check for loose power connections, power losses or surges at the power outlet. If you still cannot isolate the problem, the internal power supply may be defective.

---

## INSTALLATION

Verify that all system components have been properly installed. If one or more components appear to be malfunctioning (such as the power cord or network cabling), test them in an alternate environment where you are sure that all the other components are functioning properly.

---

## IN-BAND ACCESS

You can access the management agent in the switch from anywhere within the attached network using Telnet, a web browser, or other network management software tools. However, you must first configure the switch with a valid IP address, subnet mask, and default gateway. If you have trouble establishing a link to the management agent, check to see if you have a valid network connection. Then verify that you entered the correct IP address. Also, be sure the port through which you are connecting to the switch has not been disabled. If it has not been disabled, then check the network cabling that runs between your remote location and the switch.



---

**NOTE:** The management agent accepts up to four simultaneous Telnet sessions. If the maximum number of sessions already exists, an additional Telnet connection will not be able to log into the system.

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# B

## CABLES

### TWISTED-PAIR CABLE AND PIN ASSIGNMENTS

For 10/100BASE-TX connections, the twisted-pair cable must have two pairs of wires. For 1000BASE-T connections the twisted-pair cable must have four pairs of wires. Each wire pair is identified by two different colors. For example, one wire might be green and the other, green with white stripes. Also, an RJ-45 connector must be attached to both ends of the cable.

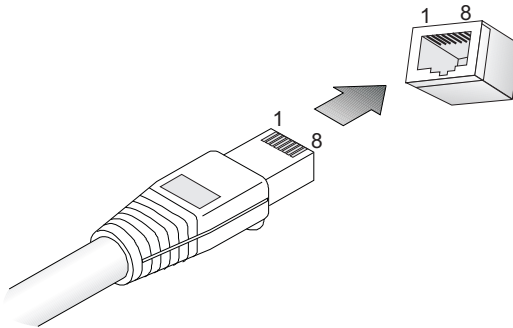


**CAUTION:** DO NOT plug a phone jack connector into any RJ-45 port. Use only twisted-pair cables with RJ-45 connectors that conform with FCC standards.

**CAUTION:** Each wire pair must be attached to the RJ-45 connectors in a specific orientation.

The figure below illustrates how the pins on the RJ-45 connector are numbered. Be sure to hold the connectors in the same orientation when attaching the wires to the pins.

**Figure 22: RJ-45 Connector Pin Numbers**



## 10BASE-T/100BASE-TX PIN ASSIGNMENTS

Use unshielded twisted-pair (UTP) or shielded twisted-pair (STP) cable for RJ-45 connections: 100-ohm Category 3 or better cable for 10 Mbps connections, or 100-ohm Category 5 or better cable for 100 Mbps connections. Also be sure that the length of any twisted-pair connection does not exceed 100 meters (328 feet).

The RJ-45 ports on the switch base unit support automatic MDI/MDI-X operation, so you can use straight-through cables for all network connections to PCs or servers, or to other switches or hubs. In straight-through cable, pins 1, 2, 3, and 6, at one end of the cable, are connected straight through to pins 1, 2, 3, and 6 at the other end of the cable. When using any RJ-45 port on this switch, you can use either straight-through or crossover cable.

**Table 16: 10/100BASE-TX MDI and MDI-X Port Pinouts**

Pin	MDI Signal Name	MDI-X Signal Name
1	Transmit Data plus (TD+)	Receive Data plus (RD+)
2	Transmit Data minus (TD-)	Receive Data minus (RD-)
3	Receive Data plus (RD+)	Transmit Data plus (TD+)
6	Receive Data minus (RD-)	Transmit Data minus (TD-)
4,5,7,8	Not used	Not used

**Note:**The "+" and "-" signs represent the polarity of the wires that make up each wire pair.

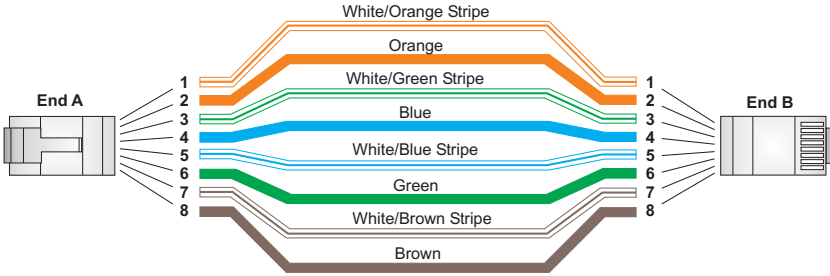
## STRAIGHT-THROUGH WIRING

If the twisted-pair cable is to join two ports and only one of the ports has an internal crossover (MDI-X), the two pairs of wires must be straight-through. (When auto-negotiation is enabled for any RJ-45 port on this switch, you can use either straight-through or crossover cable to connect to any device type.)

You must connect all four wire pairs as shown in the following diagram to support Gigabit Ethernet.

Figure 23: Straight-through Wiring

EIA/TIA 568B RJ-45 Wiring Standard  
10/100BASE-TX Straight-through Cable



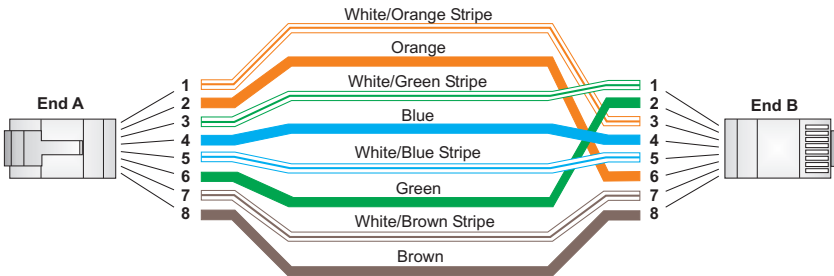
## CROSSOVER WIRING

If the twisted-pair cable is to join two ports and either both ports are labeled with an "X" (MDI-X) or neither port is labeled with an "X" (MDI), a crossover must be implemented in the wiring. (When auto-negotiation is enabled for any RJ-45 port on this switch, you can use either straight-through or crossover cable to connect to any device type.)

You must connect all four wire pairs as shown in the following diagram to support Gigabit Ethernet.

Figure 24: Crossover Wiring

EIA/TIA 568B RJ-45 Wiring Standard  
10/100BASE-TX Crossover Cable



## 1000BASE-T PIN ASSIGNMENTS

All 1000BASE-T ports support automatic MDI/MDI-X operation, so you can use straight-through cables for all network connections to PCs or servers, or to other switches or hubs.

The table below shows the 1000BASE-T MDI and MDI-X port pinouts. These ports require that all four pairs of wires be connected. Note that for 1000BASE-T operation, all four pairs of wires are used for both transmit and receive.

Use 100-ohm Category 5, 5e or 6 unshielded twisted-pair (UTP) or shielded twisted-pair (STP) cable for 1000BASE-T connections. Also be sure that the length of any twisted-pair connection does not exceed 100 meters (328 feet).

**Table 17: 1000BASE-T MDI/MDI-X Port Pinouts**

Pin	MDI Signal Name	MDI-X Signal Name
1	Bi-directional Pair A Plus (BI_DA+)	Bi-directional Pair B Plus (BI_DB+)
2	Bi-directional Pair A Minus (BI_DA-)	Bi-directional Pair B Minus (BI_DB-)
3	Bi-directional Pair B Plus (BI_DB+)	Bi-directional Pair A Plus (BI_DA+)
4	Bi-directional Pair C Plus (BI_DC+)	Bi-directional Pair D Plus (BI_DD+)
5	Bi-directional Pair C Minus (BI_DC-)	Bi-directional Pair D Minus (BI_DD-)
6	Bi-directional Pair B Minus (BI_DB-)	Bi-directional Pair A Minus (BI_DA-)
7	Bi-directional Pair D Plus (BI_DD+)	Bi-directional Pair C Plus (BI_DC+)
8	Bi-directional Pair D Minus (BI_DD-)	Bi-directional Pair C Minus (BI_DC-)

## CABLE TESTING FOR EXISTING CATEGORY 5 CABLE

Installed Category 5 cabling must pass tests for Attenuation, Near-End Crosstalk (NEXT), and Far-End Crosstalk (FEXT). This cable testing information is specified in the ANSI/TIA/EIA-TSB-67 standard. Additionally, cables must also pass test parameters for Return Loss and Equal-Level Far-End Crosstalk (ELFEXT). These tests are specified in the ANSI/TIA/EIA-TSB-95 Bulletin, "The Additional Transmission Performance Guidelines for 100 Ohm 4-Pair Category 5 Cabling."

Note that when testing your cable installation, be sure to include all patch cables between switches and end devices.



## ADJUSTING EXISTING CABLING FOR 1000BASE-T

If your existing cable installation does not meet one of the test parameters for 1000BASE-T, there are basically three measures that can be applied to try and correct the problem:

1. Replace any Category 5 patch cables with high-performance Category 5e or Category 6 cables.
2. Reduce the number of connectors used in the link.
3. Reconnect some of the connectors in the link.

## FIBER STANDARDS

The International Telecommunication Union (ITU-T) has standardized various fiber types for data networks. These are summarized in the following table.

**Table 18: Fiber Standards**

ITU-T Standard	Description	Application
G.651	<b>Multimode Fiber</b> 50/125-micron core	Short-reach connections in the 1300-nm or 850-nm band
G.652	<b>Non-Dispersion-Shifted Fiber</b> Single-mode, 9/125-micron core	Longer spans and extended reach. Optimized for operation in the 1310-nm band, but can also be used in the 1550-nm band
G.652.C	<b>Low Water Peak Non-Dispersion-Shifted Fiber</b> Single-mode, 9/125-micron core	Longer spans and extended reach. Optimized for wavelength-division multiplexing (WDM) transmission across wavelengths from 1285 to 1625 nm. The zero dispersion wavelength is in the 1310-nm region.
G.653	<b>Dispersion-Shifted Fiber</b> Single-mode, 9/125-micron core	Longer spans and extended reach. Optimized for operation in the region from 1500 to 1600-nm.

**Table 18: Fiber Standards (Continued)**

<b>ITU-T Standard</b>	<b>Description</b>	<b>Application</b>
G.654	<b>1550-nm Loss-Minimized Fiber</b> Single-mode, 9/125-micron core	Extended long-haul applications. Optimized for high-power transmission in the 1500 to 1600-nm region, with low loss in the 1550-nm band.
G.655	<b>Non-Zero Dispersion-Shifted Fiber</b> Single-mode, 9/125-micron core	Extended long-haul applications. Optimized for high-power dense wavelength-division multiplexing (DWDM) operation in the region from 1500 to 1600-nm.

---

## PHYSICAL CHARACTERISTICS

### PORTS

24 10/100/1000BASE-T (RJ-45) ports,  
2 10 Gigabit SFP+ ports,  
and 1 expansion module slot (supporting dual-port 10G SFP+ module).

### NETWORK INTERFACE

Ports 1-24: RJ-45 connector, auto MDI/MDI-X

10BASE-T: RJ-45 (100-ohm, UTP cable; Category 3 or better)

100BASE-TX: RJ-45 (100-ohm, UTP cable; Category 5 or better)

1000BASE-T: RJ-45 (100-ohm, UTP or STP cable; Category 5, 5e or 6)

*\*Maximum Cable Length - 100 m (328 ft)*

Ports 25-28: SFP+ ports

10 Gigabit fiber transmission: SFP+ transceiver slots

\*The maximum length for fiber optic cable operating at 10 Gigabit speed will depend on the fiber type as listed under "[10 Gbps Ethernet Collision Domain](#)" on page 53.

### BUFFER ARCHITECTURE

1.5 Mbytes

### AGGREGATE BANDWIDTH

128 Gbps

### SWITCHING DATABASE

16K MAC address entries, 1024 static MAC addresses, 32 IP interfaces,  
1023 multicast groups

## **LEDs**

System: Power, Diag, RPS, Master, Stack  
Port: Status (link, activity)

## **WEIGHT**

3.7 kg (8.1 lbs)

## **SIZE**

44.0 x 31.5 x 4.4 cm (17.3 x 12.4 x 1.7 in.)

## **TEMPERATURE**

Operating: 0 to 50 °C (32 to 122 °F)  
Storage: -40 to 70 °C (-40 to 158 °F)

## **HUMIDITY**

Operating: 5% to 95% (non-condensing)

## **AC INPUT**

100 to 240 V, 50-60 Hz, 1.5A

## **POWER SUPPLY**

Internal, auto-ranging transformer: 100 to 240 VAC, 50/60 Hz  
External, supports connection for redundant power supply

## **POWER CONSUMPTION**

35 Watts (without expansion module)  
40 Watts (with one expansion module)

## **MAXIMUM CURRENT**

0.65 A @ 110 VAC (without expansion module)  
1.1 A @ 110 VAC (with one expansion module)

---

## **SWITCH FEATURES**

### **FORWARDING MODE**

Store-and-forward

### **THROUGHPUT**

Wire speed

### **FLOW CONTROL**

Full-duplex: IEEE 802.3x

Half-duplex: Back pressure

---

## **MANAGEMENT FEATURES**

### **IN-BAND MANAGEMENT**

Telnet, SSH, SNMP, or HTTP

### **OUT-OF-BAND MANAGEMENT**

RS-232 RJ-45 console port

### **SOFTWARE LOADING**

FTP/TFTP or HTTP in-band, or XModem out-of-band

---

## **STANDARDS**

IEEE 802.3-2008

Ethernet, Fast Ethernet, Gigabit Ethernet, and  
10 Gigabit Ethernet (10GBASE-SR, 10GBASE-LR, 10GBASE-ER)

IEEE 802.1D Spanning Tree Protocol

IEEE 802.1w Rapid Spanning Tree Protocol

IEEE 802.1s Multiple Spanning Tree Protocol

IEEE 802.1Q Virtual LAN

ISO/IEC 8802-3 CSMA/CD

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## **COMPLIANCES**

### **CE MARK**

#### **EMISSIONS**

FCC Class A

EN55022 (CISPR 22) Class A

EN 61000-3-2/3

VCCI Class A

#### **IMMUNITY**

EN 61000-4-2/3/4/5/6/8/11

#### **SAFETY**

UL 60950-1 & CSA 60950-1

IEC 60950-1 & EN 60950-1

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## 10GBASE-SFP+ EXTENDER MODULE

### PORTS

2 slots for 10GBASE SFP+ transceivers

### COMMUNICATION SPEED

10 Gbps

### COMMUNICATION MODE

Full duplex

### NETWORK INTERFACE

SFP+ slot

### STANDARDS

IEEE 802.3ae 10 Gigabit Ethernet





# GLOSSARY

## **10BASE-T**

IEEE 802.3 specification for 10 Mbps Ethernet over two pairs of Category 3, 4, or 5 UTP cable.

## **100BASE-TX**

IEEE 802.3u specification for 100 Mbps Ethernet over two pairs of Category 5 UTP cable.

## **1000BASE-LH**

Specification for long-haul Gigabit Ethernet over two strands of 9/125 micron core fiber cable.

## **1000BASE-LX**

IEEE 802.3z specification for Gigabit Ethernet over two strands of 50/125, 62.5/125 or 9/125 micron core fiber cable.

## **1000BASE-SX**

IEEE 802.3z specification for Gigabit Ethernet over two strands of 50/125 or 62.5/125 micron core fiber cable.

## **1000BASE-T**

IEEE 802.3ab specification for Gigabit Ethernet over 100-ohm Category 5, 5e or 6 twisted-pair cable (using all four wire pairs).

## **10GBASE-ER**

IEEE 802.3ae specification for 10 Gigabit Ethernet over two strands of 9/125 micron core single-mode fiber cable.

**10GBASE-LR**

IEEE 802.3ae specification for 10 Gigabit Ethernet over two strands of 9/125 micron core single-mode fiber cable.

**10GBASE-SR**

IEEE 802.3ae specification for 10 Gigabit Ethernet over two strands of 62.5/125 micron core multimode fiber cable.

**10 GIGABIT ETHERNET**

A 10 Gbps network communication system based on Ethernet.

**AUTO-NEGOTIATION**

Signalling method allowing each node to select its optimum operational mode (e.g., speed and duplex mode) based on the capabilities of the node to which it is connected.

**BANDWIDTH**

The difference between the highest and lowest frequencies available for network signals. Also synonymous with wire speed, the actual speed of the data transmission along the cable.

**COLLISION DOMAIN**

Single CSMA/CD LAN segment.

**CSMA/CD**

CSMA/CD (Carrier Sense Multiple Access/Collision Detect) is the communication method employed by Ethernet, Fast Ethernet, and Gigabit Ethernet.

**END STATION**

A workstation, server, or other device that does not forward traffic.

**ETHERNET**

A network communication system developed and standardized by DEC, Intel, and Xerox, using baseband transmission, CSMA/CD access, logical bus topology, and coaxial cable. The successor IEEE 802.3 standard provides for integration into the OSI model and extends the physical layer and media with repeaters and implementations that operate on fiber, thin coax and twisted-pair cable.

**FAST ETHERNET**

A 100 Mbps network communication system based on Ethernet and the CSMA/CD access method.

**FULL-DUPLEX**

Transmission method that allows two network devices to transmit and receive concurrently, effectively doubling the bandwidth of that link.

**GIGABIT ETHERNET**

A 1000 Mbps network communication system based on Ethernet and the CSMA/CD access method.

**IEEE**

Institute of Electrical and Electronic Engineers.

**IEEE 802.3**

Defines carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

**IEEE 802.3AB**

Defines CSMA/CD access method and physical layer specifications for 1000BASE-T Gigabit Ethernet. (Now incorporated in IEEE 802.3-2008.)

**IEEE 802.3AE**

Defines the physical layer specifications for 10 Gigabit Ethernet.

**IEEE 802.3u**

Defines CSMA/CD access method and physical layer specifications for 100BASE-TX Fast Ethernet. (Now incorporated in IEEE 802.3-2008.)

**IEEE 802.3x**

Defines Ethernet frame start and stop requests and timers used for flow control on full-duplex links. (Now incorporated in IEEE 802.3-2008.)

**IEEE 802.3z**

Defines CSMA/CD access method and physical layer specifications for 1000BASE Gigabit Ethernet. (Now incorporated in IEEE 802.3-2008.)

**LAN SEGMENT**

Separate LAN or collision domain.

**LED**

Light emitting diode used for monitoring a device or network condition.

**LOCAL AREA NETWORK (LAN)**

A group of interconnected computer and support devices.

**MEDIA ACCESS CONTROL (MAC)**

A portion of the networking protocol that governs access to the transmission medium, facilitating the exchange of data between network nodes.

**MIB**

An acronym for Management Information Base. It is a set of database objects that contains information about the device.

**MODAL BANDWIDTH**

Bandwidth for multimode fiber is referred to as modal bandwidth because it varies with the modal field (or core diameter) of the fiber. Modal bandwidth is

specified in units of MHz per km, which indicates the amount of bandwidth supported by the fiber for a one km distance.

### **NETWORK DIAMETER**

Wire distance between two end stations in the same collision domain.

### **REDUNDANT POWER SUPPLY (RPS)**

A backup power supply unit that automatically takes over in case the primary power supply should fail.

### **RJ-45 CONNECTOR**

A connector for twisted-pair wiring.

### **SWITCHED PORTS**

Ports that are on separate collision domains or LAN segments.

### **TIA**

Telecommunications Industry Association

### **TRANSMISSION CONTROL PROTOCOL/INTERNET PROTOCOL (TCP/IP)**

Protocol suite that includes TCP as the primary transport protocol, and IP as the network layer protocol.

### **UTP**

Unshielded twisted-pair cable.

### **VIRTUAL LAN (VLAN)**

A Virtual LAN is a collection of network nodes that share the same collision domain regardless of their physical location or connection point in the network. A VLAN serves as a logical workgroup with no physical barriers, allowing users to share information and resources as though located on the same LAN.



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