Edge-corE®

ECS4660-28F
28-Port Gigabit Ethernet
Layer 3 Switch

Installation Guide

INSTALLATION GUIDE

ECS4660-28F GIGABIT ETHERNET LAYER 3 SWITCH

Layer 3 FTTH Switch with
24 Gigabit Ethernet SFP Slots,
2 10-Gigabit Ethernet XFP Slots,
2 10-Gigabit Ethernet Expansion Module Slots,
and 1 Fast Ethernet Management Port (RJ-45)

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.

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 according to EN 55022:2007, Class A/B
	◆ Limit for harmonic current emission according to EN 61000-3-2:2006, Class A
	◆ Limitation of voltage fluctuation and flicker in low-voltage supply system according to EN 61000-3-3:2005
Immunity:	◆ Product family standard according to EN 55024:2001 + A2:2003
	◆ Electrostatic Discharge according to IEC 61000-4-2:2008
	◆ Radio-frequency electromagnetic field according to IEC 61000-4-3:2007
	◆ Electrical fast transient/burst according to IEC 61000-4-4:2004
	◆ 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 61000-4-8:2001
	◆ Voltage dips, short interruptions and voltage variations immunity test according to IEC 61000-4-11:2004
LVD:	◆ EN 60950-1:2006+A11:2009

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.

Avertissment: 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[†] 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	The cord set must be UL-approved and CSA certified.
	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
	The cord set must have a rated current capacity of at least 10 A
	The attachment plug must be an earth-grounding type with NEMA 5-15P (15 A, 125 V) or NEMA 6-15P (15 A, 250 V) configuration.
Denmark	The supply plug must comply with Section 107-2-D1, Standard DK2-1a or DK2-5a.
Switzerland	The supply plug must comply with SEV/ASE 1011.
U.K.	The supply plug must comply with BS1363 (3-pin 13 A) and be fitted with a 5 A fuse which complies with BS1362.
	The mains cord must be <HAR> or <BASEC> marked and be of type HO3VVF3GO.75 (minimum).
Europe	The supply plug must comply with CEE7/7 ("SCHUKO").
	The mains cord must be <HAR> or <BASEC> marked and be of type HO3VVF3GO.75 (minimum).
	IEC-320 receptacle.

Veuillez 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.

◆ 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	
Etats-Unis et Canada:	Le cordon doit avoir reçu l'homologation des UL et un certificat de la CSA.
	Les spécifications minimales pour un cable flexible sont AWG No. 18, ouAWG No. 16 pour un cable 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) ou NEMA 6-15P (15 A, 250 V).
Danemark:	La prise mâle d'alimentation doit respecter la section 107-2 D1 de la norme DK2 1a ou DK2 5a.
Suisse:	La prise mâle d'alimentation doit respecter la norme SEV/ASE 1011.
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 1011Bestimmungen einhalten.
Europe	Das Netzkabel muß vom Typ HO3VVF3GO.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 though 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.

COMPLIANCES AND SAFETY STATEMENTS

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:

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

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

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

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.

SEPTEMBER 2011 REVISION

This is the first revision of this guide.

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1 INTRODUCTION

OVERVIEW

This device is an intelligent Layer 3 switch designed for delivering Fiber-To-The-Home (FTTH) high-speed Internet access. It can provide first or second level aggregation of fiber optic nodes. When functioning as a lower level aggregation device, it supports up to 24 subscribers through SFP fiber optic downlink connections to the customer's premises equipment (CPE).

The switch provides two 10 Gigabit XFP slots for uplink connections to the Central Office (CO), or for downlinks to other network aggregation devices.

The switch has one 10/100BASE-TX port for dedicated management access, which can be operated outside the data channel. It has an SNMP-based management agent embedded on the main board, which supports both in-band and out-of-band access using a Web browser, SNMP/RMON, or Telnet/SSH.

Figure 1: Front Panel
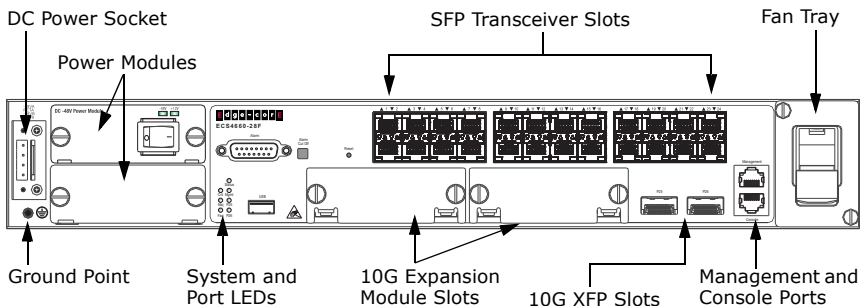
SWITCH ARCHITECTURE

This 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.

For communications between different VLANs, this switch uses IP routing. For communications within the same VLAN, the 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.

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 it through a network connection (in-band) using Telnet, the on-board web agent, or SNMP-based network management software.

The Managementt port (RJ-45) provides a dedicated management channel that operates outside of the data transport network. This makes it possible to re-configure or troubleshoot the switch over either a local or remote connection to the Management port when access through the data channel is not possible or deemed insecure.

For a detailed description of the switch's software features, refer to the *Management Guide*.

DESCRIPTION OF HARDWARE

SFP SLOTS

The switch provides 24 slots for SFP-compliant fiber-optic transceivers. Each fiber port can be used for a direct connection to a subscriber's CPE, or as a downlink to another aggregation node.

The supported transceiver types are listed below:

◆ 1000 Mbps Ethernet SFP transceivers

   ▪ 1000BASE-SX

- ■ 1000BASE-LX

- ■ 1000BASE-LH

◆ 100 Mbps Ethernet SFP transceivers

- ■ 100BASE-FX

For information on the recommended standards for fiber optic cabling, see "1000 Mbps Gigabit Ethernet Collision Domain" on page 56.

Each port supports auto-negotiation of flow control, so the switch can automatically prevent port buffers from becoming saturated. Also, when a port is connected to a subscriber, the bandwidth can be restricted by rate-limiting to support differentiated service fees.

10G XFP SLOTS

The switch includes two slots for 10 Gigabit Ethernet XFP-compliant fiber-optic transceivers. These fiber ports are designed for use as an uplink connection to the central office, or as a downlink to another aggregation node.

The supported XFP transceiver types are listed below:

◆ 10GBASE-SR

◆ 10GBASE-LR

◆ 10GBASE-ER

For information on the recommended standards for fiber optic cabling, see "1000 Mbps Gigabit Ethernet Collision Domain" on page 56.

Each port supports auto-negotiation of flow control, so the switch can automatically prevent port buffers from becoming saturated.

EXPANSION MODULE SLOTS

The two expansion module slots on the switch are reserved for future use.

100BASE-TX MANAGEMENT PORT

The 10/100BASE-TX port labeled "Management" provides a dedicated management interface which is segregated from the data traffic crossing the other ports.

This port supports auto-negotiation, so the optimum transmission mode (half or full duplex) and data rate (10 or 100 Mbps) can be selected automatically, if this feature is also supported by the attached device. However, note that the interface connection parameters of this port cannot be configured.

CONSOLE PORT

The console port on the switch's front panel uses an RJ-45 jack with with serial pinouts (see Table 2 on page 45) which enable a connection to a terminal for performing switch monitoring and configuration functions. The terminal may be a PC or workstation running terminal emulation software, or a terminal configured as a Data Terminal Equipment (DTE) connection. A null-modem wired serial cable is supplied with the switch for connecting to this interface.

ALARM INTERFACE PORT

The DB-15 alarm port on the switch's front panel can be used to provide alarm, service port, and BITS clock reference interfaces. The switch supports two sets of alarm relay contacts (major and minor), and 4 external customer site alarm inputs. It also provides an alarm cutoff button (labeled ACO). Refer to "Connecting to the Alarm Port" on page 46 for a description of the pin assignments used to connect to the alarm port.

USB PORT

The USB 2.0 port (operates at 1.5 Mbps or 12 Mbps) can be used to connect external memory device to the switch.

PORT AND SYSTEM STATUS LEDS

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

Figure 2: Port and System LEDs
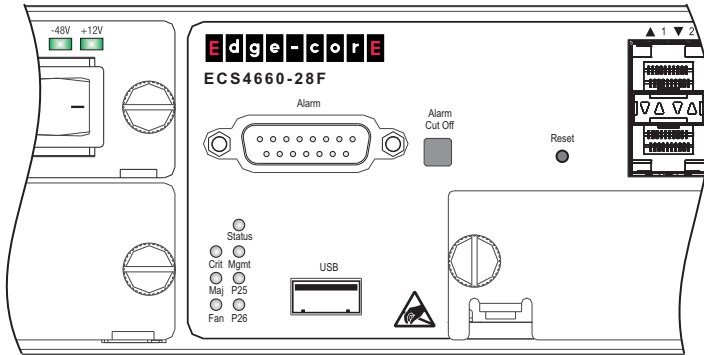
Table 1: Port and System Status LEDs

LED	Condition	Status
Crit	Red	Indicates the presence within the system of one or more critical traffic-affecting system alarms that are not masked by the alarm filter.
Maj	Amber	Indicates the presence within the system of one or more major traffic-affecting system alarms that are not masked by the alarm filter.
Fan	Red	Indicates failure of one or more fans.
Status	Flashing Green	System self-diagnostic test in progress.
	Green	System self-diagnostic test successfully completed.
	Off	System self-diagnostic test has detected a fault.
Mgmt	Green	Port has a valid link.
	Flashing Green	Flashing indicates activity on the port.
	Off	The link is down.

Table 1: Port and System Status LEDs

LED	Condition	Status
Link/Activity (Ports 1-24, P25, P26)	Green	Port has a valid link.
	Flashing Green	Flashing indicates activity on the port.
	Off	The link is down.
Power Module* 48V/+12V, or AC/+12V	Green	DC or AC power is functioning normally.
	Off	External power not connected or has failed.

*   The -48V/AC LEDs on the left indicate the status of external power. The +12V LED
       on the right indicates the status of the internal power conversion process.

FAN TRAY

A removable fan tray on the right side of the front panel contains three fans that provide cooling for the chassis. The following figure shows the fan tray removed from the switch

Figure 3: Port and System LEDs
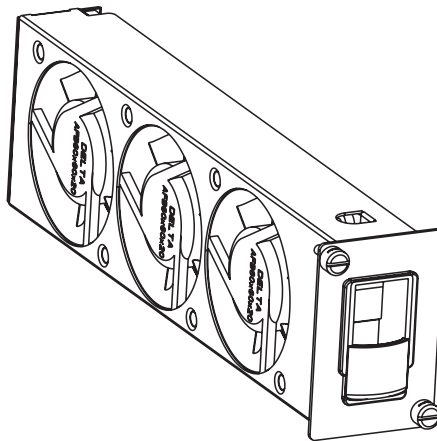
POWER MODULES

This switch provides two power module options: -48 VDC and universal AC. For specifications on the power conversion modules and external input power requirements, see "Power Supply" on page 74.

Figure 4: Optional Power Modules
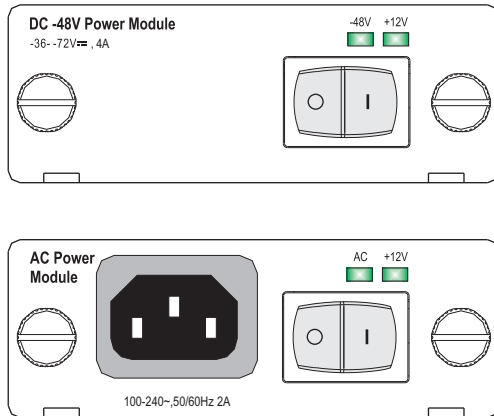
CONNECTION EXAMPLE

This switch is designed to offer a cost-effective solution for FTTH, providing downlink connections to subscribers over fiber cable, and high-bandwidth uplink connections to core switches and routers at the CO using 10GBASE-SR fiber cable for short runs or 10GBASE-LR/ER cable for longer runs. A dedicated management port provides secure management access to the switch over a dedicated management channel outside of the data network.

Figure 5: Uplink and Downlink Fiber Connections
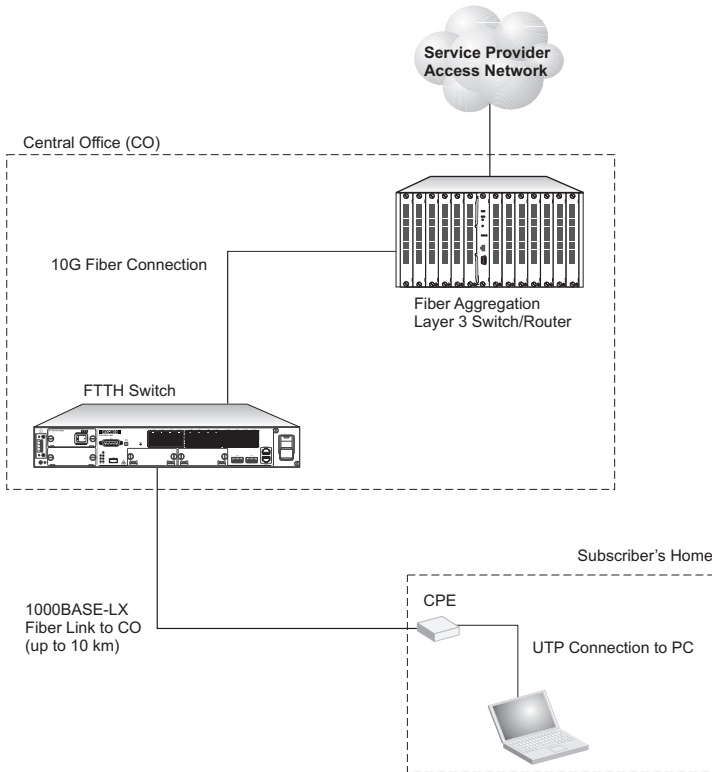
2 INSTALLING THE SWITCH

SELECTING A SITE

Switches 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:

   ▪ restrict access to authorized service personnel in accordance with IEC 60950-1. A restricted access location is one where access is secure and limited to service personnel who have a special key, or other means of security.

   ▪ be at the center of all the devices you want to link and near a power outlet.

   ▪ be able to maintain its temperature within -40 to 65 °C (-40 to 149 °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 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. This switch provides two power module options: -48 VDC and universal AC. Verify that the external power requirements for the selected option can be met as listed under "Power Supply" on page 74.

ETHERNET CABLING

To ensure proper operation when installing 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 6: RJ-45 Connections
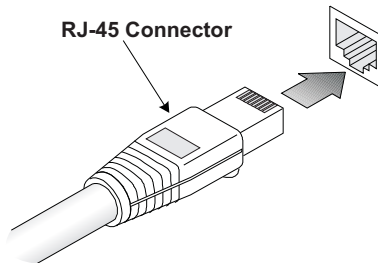
EQUIPMENT CHECKLIST

After unpacking the 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

◆ ECS4660-28F Gigabit Ethernet Access Switch

◆ 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

> (i) **NOTE:** Power supplies are not included in the package.

OPTIONAL RACK-MOUNTING EQUIPMENT

If you plan to rack-mount the switches, 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

A switch unit 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 74.)

◆   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.

To rack-mount devices:

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

Figure 7: Attaching the Brackets
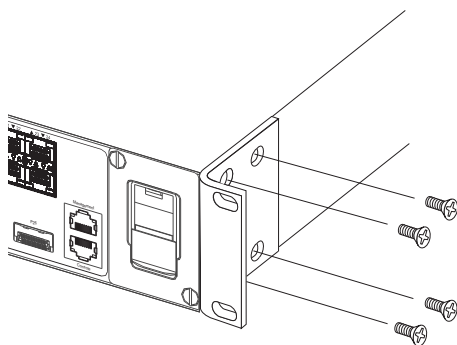
2. Mount the device in the rack, using four rack-mounting screws (not provided).

Figure 8: Installing the Switch in a Rack
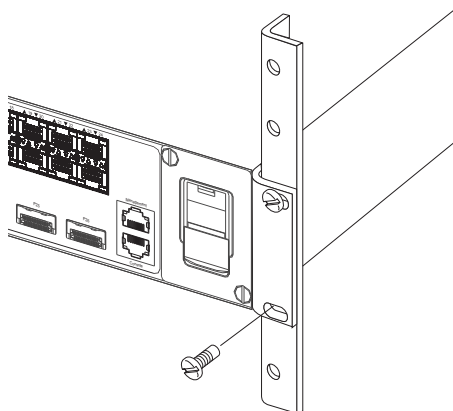
3. If installing a single switch only, turn to "Connecting to a Power Source" on page 41.

4. If installing multiple switches, mount them in the rack, one below the other, in any order.

DESKTOP OR SHELF MOUNTING

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

Figure 9: Attaching the Adhesive Feet
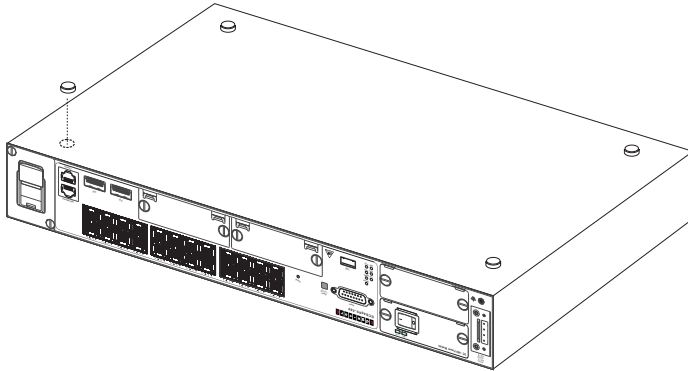
2. Set the device on a flat surface near an external power source, making sure there are at least two inches of space on all sides for proper air flow.

3. If installing a single switch only, go to "Connecting to a Power Source" on page 41.

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.

INSTALLING AN OPTIONAL SFP/XFP TRANSCEIVER

Figure 10: Inserting an SFP/XFP Transceiver into a Slot
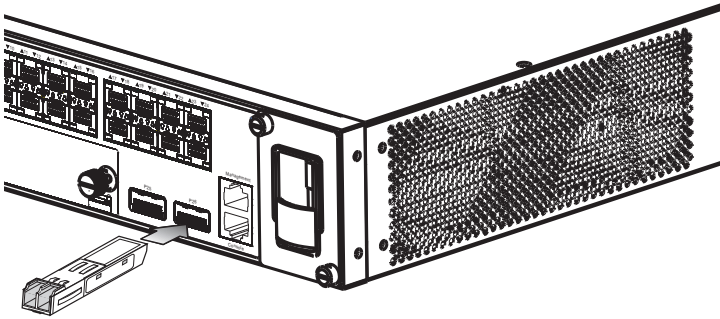
This switch supports 1000BASE-SX/LX/LH and 100BASE-FX SFP-compatible transceivers on ports 1-24, and 10GBASE-SR/LR/ER XFP-compatible transceivers on port 25-26. To install an SFP/XFP transceiver, do the following:

1. Consider network and cabling requirements to select an appropriate transceiver type.

2. Insert the transceiver with the optical connector facing outward and the slot connector facing down. Note that SFP/XFP transceivers are keyed so they can only be installed in the correct orientation.

3. Slide the transceiver into the slot until it clicks into place.

> (i) **NOTE:** SFP/XFP 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/XFP transceivers are not provided in the switch package.

GROUNDING THE CHASSIS

Before powering on the switch, ground the switch to earth as described below.

1. Ensure that the rack on which the switch is to be mounted is properly grounded and in compliance with ETSI ETS 300 253.

2. Ensure that there is a good electrical connection to the grounding point on the rack (no paint or isolating surface treatment).

3. Disconnect all power cables to the switch.

4. The switch chassis is connected internally to 0 V. This circuit is connected to the single-hole grounding terminal on the front of the switch (lower left corner). The surface area around this terminal is not painted in order to provide for a good connection. Attach a 6 AWG stranded copper wire to the grounding terminal on the switch.

5. Then attach the grounding wire to the ground point on the rack.

CAUTION: The earth connection must not be removed unless all supply connections have been disconnected.

CONNECTING TO A POWER SOURCE

This switch supports both AC and DC power conversion modules.

CONNECTING DC POWER

When a -48 VDC power conversion module is installed in the switch, an external DC power supply must be connected to the DC power connection on the left side of the front panel.

⚠️ **CAUTION:** Before wiring the DC plug or connecting power to the switch, ensure that power to the feed lines is turned off at the supply circuit breaker or disconnected from the power bus.

ⓘ **NOTE:** To provide adequate circuit protection between the DC power supply and the switch, all intermediate wiring and circuitry should be rated to carry a load at least two times the maximum rating for this switch.

NOTE: The wiring between the DC power supply and the switch must be stranded copper wire within the range of 10 to 24 AWG.

NOTE: Wiring for the power input terminals on the switch are described below. Wiring of the DC power supply terminals depends on the equipment in use on the local site, but should be wired in such a way as to meet the input requirements shown in . The wiring should also be color coded according to local standards to ensure that the input power and ground lines can be easily distinguished.

NOTE: When using two power conversion modules with the switch, either AC or DC modules can be used – both AC, both DC, or one AC and one DC.

To connect the switch to a power source:

1. First verify that the external DC power supply can provide -36 to -72 VDC, 4 A minimum for the -48 VDC power conversion module.

2. Prepare two wires for each power source to be used (A or B). Use 10 to 24 AWG stranded copper wire. Make sure these wires are not plugged into the power source.

3. Use a wire stripper to carefully strip about a half an inch of the outer insulation off the end of each wire, exposing the copper core.

4. Twist the copper wire strands together to form a tight braid. If possible, solder the exposed braid of wire together for better conductivity.

5. Connect the external power feed and power ground/return lines to the DC plug (provided with the switch) as shown below. The power leads are labeled on the front of the chassis, above the DC power connection block. The -48 VDC power feed uses the "-48VDC" input and RETA/B (Return) lines for power source A and B respectively. Use a small flat-tip screwdriver to loosen the screws on the power plug and open the wire clamps.

6. Insert the wire leads into the openings shown in the figure below. Each lead inserted in the power plug must match the lead attached to the power source. Use the label above the DC power connection block to identify the appropriate power input and return or ground lines.

⚠️ **CAUTION:** If the power leads are plugged into the wrong holes, the power supply will not work properly and may damage the switch.

Figure 11: DC Plug Connections

-48VDC/Ground (Source A)

-48VDC/Ground (Source B)
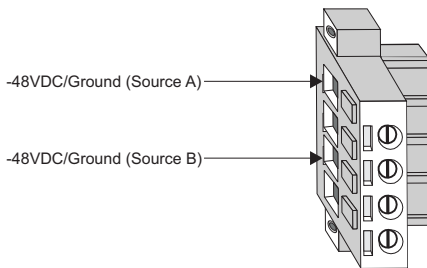
7. Push each wire about half an inch into the opening on the plug, and tighten down the clamp screw securely. You should not be able to pull on the wire and dislodge it.

8. Insert the power plug in the power receptacle on the left side of the front panel.

9. At the power source, turn on the power for the feed lines or power bus.

10. After the power source is tuned on, set the power button on the front of the power conversion module to the ON position (marked "−").

11. Check the indicators on the power conversion module as the switch is powered on to verify that the -48V LED indicating external power status is on, and that the +12V LED indicating internal power conversion is on. If not, recheck the power supply and power cable connections at the supply source and at power conversion module.

12. If you have installed both a primary and redundant power conversion module, verify that the LEDs on both modules are lit as indicated in the preceding step.

CONNECTING AC POWER

When a universal AC power module is installed in the switch, external AC power must be supplied to the module.

To connect the switch to a power source:

1. First verify that the external AC power supply can provide 100 to 240 VAC, 50-60 Hz, 2 A minimum.

2. Plug the power 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 receptacle type in your country.

3. Insert the plug on the other end of the power cable directly into the receptacle on the AC power module.

Figure 12: AC Power Receptacle
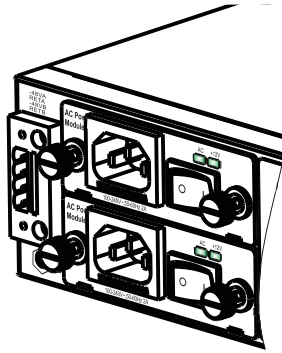
4. Check the indicators on the power module as the switch is powered on to verify that the AC LED indicating external power status is on, and that the +12V LED indicating internal power conversion is on. If not, recheck the power supply and power cable connections at the supply source and at power module.

5. If you have installed both a primary and redundant power conversion modules, verify that the LEDs on both modules are lit as indicated in the preceding step.

CONNECTING TO THE CONSOLE PORT

The RJ-45 Console port on the switch's front panel is used to connect to the switch for out-of-band console configuration. The console device can be a PC or workstation running a VT-100 terminal emulator, or a VT-100 terminal. An RJ-45-to-DB-9 cable is supplied with the switch for connecting to a PC's RS-232 serial DB-9 DTE port. The pin assignments used in the RJ-45-to-DB-9 cable are described below.

Figure 13: Console Port Connection
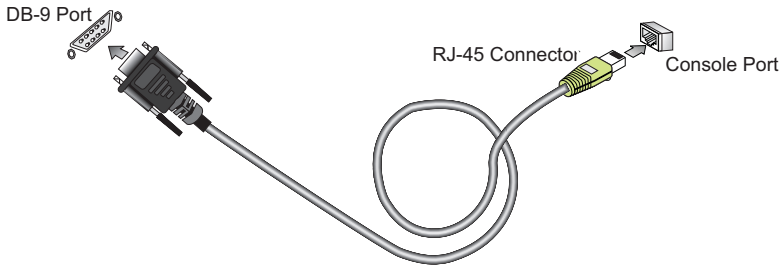
WIRING MAP FOR CONSOLE CABLE

The following table describes the pin connections for the RJ-45-to-DB-9 serial cable.

Table 2: Console Cable Wiring

Switch's 8-Pin Console 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

CONNECTING TO THE ALARM PORT

The DB-15 alarm port on the switch's front panel is used to provide alarm, service port, and BITS clock reference interfaces. The switch supports two sets of alarm relay contacts (major and minor), and 4 external customer site alarm inputs. It also provides an alarm cutoff button (labeled ACO). The pin assignments used to connect to the alarm port are provided in the following table.

Figure 14: Alarm Port (DB-15) Pin-Out
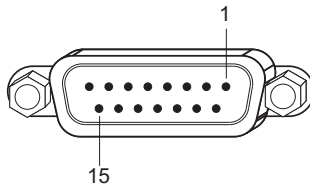
WIRING MAP FOR ALARM CABLE

The signals include relay contacts for major and minor system alarms, and external alarm inputs.

Table 3: Alarm Cable Wiring

| Switch's Alarm Port	Function
1 (MJR_ALARM_CNTR)	Common contact for major alarm relay.
2 (MNR_ALARM_CNTR)	Common contact for minor alarm relay.
3 (ALARM_IN3_EXT_P[a])	External alarm input 3 (external relay dry contact closure to pin 13).
4 (ALARM_IN4_EXT_P)	External alarm input 4 (external relay dry contact closure to pin 8).
5 (No Contact)	
6 (MJR_ALARM_NO)	Normally open during major alarm state.
7 (MNR_ALARM_NO)	Normally open during minor alarm state.
8 (ALARM_IN4_EXT_RTN[b])	External alarm input 4 (external relay dry contact closure from pin 3).
9 (ALARM_IN1_EXT_P)	External alarm input 1 (external relay dry contact closure to pin14).
10 (ALARM_IN2_EXT_P)	External alarm input 2 (external relay dry contact closure to pin 15).
11 (MJR_ALARM_NC)	Normally closed during major alarm state.
12 (MNR_ALARM_NC)	Normally closed during minor alarm state.
13 (ALARM_IN3_EXT_RTN)	External alarm input 3 (external relay dry contact closure from pin 3).
14 (ALARM_IN1_EXT_RTN)	External alarm input 1 (external relay dry contact closure from pin 9).
15 (ALARM_IN2_EXT_RTN)	External alarm input 2 (external relay dry contact closure from pin 10).

a.   P indicates positive input.
b.   RTN indicates return to Ground.

The following figure shows the pinout information for the DB-15 ALARM connector on the front panel.

Figure 15: External Alarm I/O Connections

Alarm Connector

Alarm input is isolated by photo-coupler.
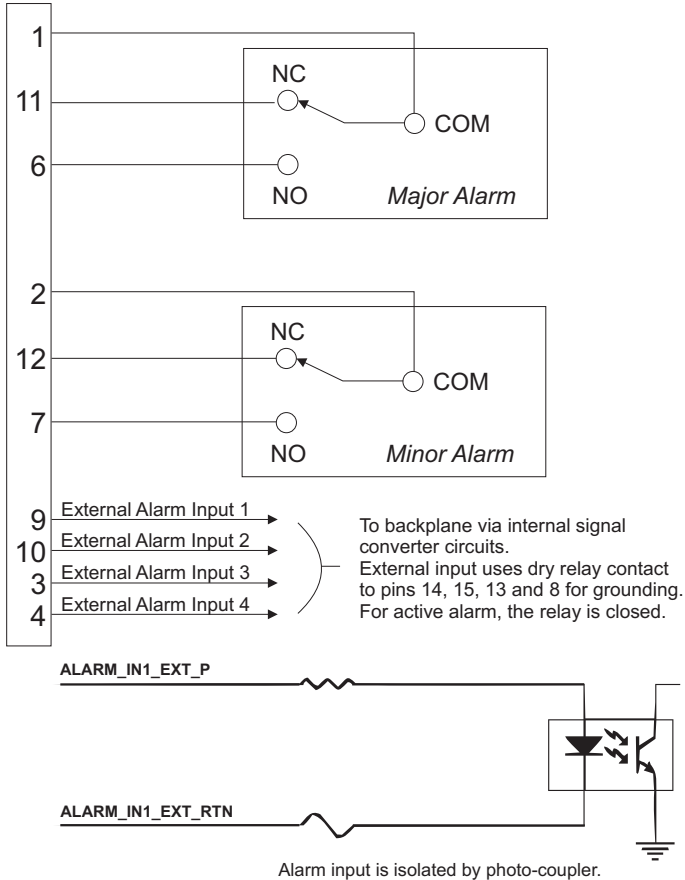
3 MAKING NETWORK CONNECTIONS

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 be connected to devices using optional SFP or XFP transceivers.

TWISTED-PAIR DEVICES

Each device requires an unshielded twisted-pair (UTP) cable with RJ-45 connectors at both ends. Use Category 5, 5e or 6 cable 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.

⚠ **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 16: Making Twisted-Pair Connections
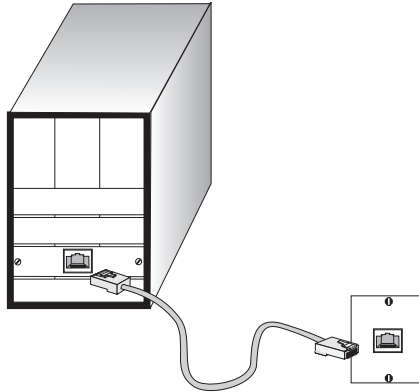
2. If the device is a PC card and the switch is in the wiring closet, attach the other end of the cable segment to a modular wall outlet that is connected to the wiring closet. Otherwise, attach the other end to an available port on the switch.

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 to indicate that the connection is valid.

FIBER OPTIC SFP CONNECTIONS

Each of the optional SFP transceivers on the switch's front panel can connect directly to a CPE at the subscriber's premises. The transceiver ports require multimode duplex fiber optic cable with an LC connector at the switch end. The connector used at the other end of the cable depends on the target device. When connecting to a CPE, the fiber cable is normally hard-wired directly to the unit. When connecting to another switch or networking device, an LC connector is required.

Each 1000BASE-LX/LH single-mode fiber port requires 9/125 micron single-mode fiber optic cable. Each 1000BASE-SX multimode fiber optic port requires 50/125 or 62.5/125 micron multimode fiber optic cabling. 1000BASE-SX/LX/LH uses duplex fiber, operating at the same wavelength for both transmit and receive signals (SX: 850 nm, LX: 1310 nm, LH: 1550 nm). Each 100BASE-FX single-mode fiber port requires 9/125 micron single-mode fiber optic cable.

> **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 fiber port's rubber cover. When not connected to a fiber cable, the rubber 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. When running cable to a subscriber, connect one end of the cable to the LC connector on one of the switch's SFP transceivers and the other end to the CPE at the subscriber's premises. Most CPEs require the fiber cable to be hard-wired to the device with an internal splice, which should only be done by trained service personnel. When connecting to another switch or

networking device, connect one end of the cable to the LC connector on one of the switch's SFP transceivers and the other end to the LC port on the other device. Since both LC connectors are keyed, the cable can only be attached in the correct orientation.

Figure 17: Making Connections to SFP Transceivers
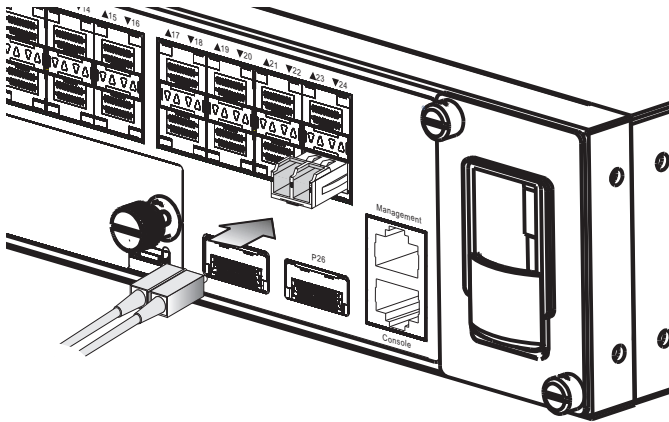
4. As a connection is made, check the Link LED on the switch corresponding to the port to be sure that the connection is valid.

The 1000BASE-SX/LX/LH fiber optic ports operate at 1 Gbps full duplex. The maximum length for fiber optic cable operating at Gigabit speeds will depend on the fiber type as listed under "1000 Mbps Gigabit Ethernet Collision Domain" on page 56. Also, remember to consider power budget constraints when calculating the maximum cable length for each specific connection.

The 100BASE-FX fiber optic ports operate at 100 Mbps full duplex. The maximum length for fiber optic cable operating at 100 Mbps is listed under "100 Mbps Fast Ethernet Collision Domain" on page 57.

10 GBPS FIBER OPTIC CONNECTIONS

An optional 10 Gigabit transceiver (XFP) can be used for a backbone connection between switches, normally uplinked to the service provider through a single transceiver or with two transceivers trunked together.

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

Each 1000BASE-LR/ER single-mode fiber port requires 9/125 micron single-mode fiber optic cable. Each 1000BASE-SR multimode fiber optic port requires 50/125 or 62.5/125 micron multimode fiber optic cabling. 1000BASE-SR/LR/ER uses duplex fiber, operating at the same wavelength for both transmit and receive signals (SR: 850 nm, LR: 1310 nm, ER: 1550 nm).

> **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 XFP 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 XFP 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 only be attached in the correct orientation.

Figure 18: Connecting to an XFP Transceiver
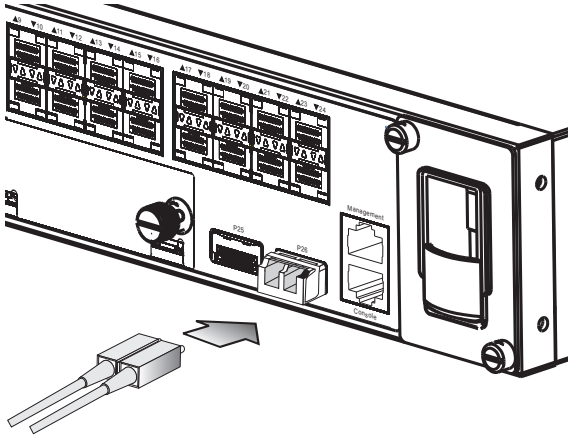
4. As a connection is made, check the Link LED on the module to be sure that the connection is valid.

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 55.

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 and 6 specifications include 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 802.3-2005 standards.

10 GBPS ETHERNET COLLISION DOMAIN

Table 4: Maximum 10GBASE-SR 10 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
62.5/125 micron multimode fiber	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
50/125 micron multimode fiber	500 MHz/km	2-82 m (7-269 ft.)	LC
50/125 micron multimode fiber	2000 MHz/km	2-300 m (7-984 ft.)	LC

Table 5: 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 6: 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 7: 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 8: 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 9: 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 - 10 km (7 ft - 6.2 miles)	LC

Table 10: 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 11: 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
100BASE-FX	9/125 micron single-mode simplex fiber	2 m - 20 km (7 ft - 12.4 miles)	SC

10 MBPS ETHERNET COLLISION DOMAIN

Table 12: 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

ETHERNET CABLING

To ensure proper operation when installing the switch 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

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.

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. Avoid using flow control on a port connected to a hub unless it is actually required to solve a problem. Otherwise back pressure jamming signals may degrade overall performance for the segment attached to the hub.

3. Based on recommended standards, the length of fiber optic cable for a single switched link should not exceed:

   - 10GBASE-SR: 300 m (984 ft) for multimode fiber.

   - 10GBASE-LR: 10 km (6.2 miles) for single-mode fiber.

   - 10GBASE-ER: 40 km (25 miles) for single-mode fiber.

   - 1000BASE-SX: 550 m (1805 ft) for multimode fiber.

   - 1000BASE-LX: 10 km (6.2 miles) for single-mode fiber.

   - 1000BASE-LH: 70 km (43.5 miles) for single-mode fiber.

   - 100BASE-FX: 20 km (12.4 miles) for single-mode fiber.

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

A TROUBLESHOOTING

DIAGNOSING SWITCH INDICATORS

This switch can be easily monitored through panel indicators to identify problems. The table below describes common problems you may encounter and possible solutions.

Table 13: Troubleshooting Chart

Symptom	Possible Cause	Action
Power Module LED is off -48 VDC or AC	Power outlet, power cord, or power module may be defective.	◆ If using a DC power conversion module, check the connections between the switch and the external DC power supply. If using an AC power module, check connections between the switch, the power cord, and the wall outlet. ◆ Contact your dealer for assistance.
Power Module LED is off +12 VDC	Power module may be defective.	◆ Internal power supply has failed. Contact your local dealer for assistance.
Status LED is off	Boot-up diagnostic program has detected a problem.	◆ Power cycle the switch to try and clear the condition. ◆ If the condition does not clear, contact your local dealer for assistance.
Link LED is Off	Network cable or Ethernet device attached to this port may be defective.	◆ Verify that the switch and attached device are powered on. ◆ Be sure the cable is plugged into both the switch and corresponding device. ◆ Verify that the proper cable type is used and its length does not exceed specified limits. ◆ Check the adapter on the attached device and cable connections for possible defects. Replace the defective adapter or cable if necessary.

Table 13: Troubleshooting Chart (Continued)

Symptom	Possible Cause	Action
Crit LED is Red	Critical alarm detected.	◆ One or more critical system alarms affecting traffic have occurred. Check the alarm filter mask to determine the potential cause.
Maj LED is Amber	Major alarm detected.	◆ One or more major system alarms affecting traffic have occurred. Check the alarm filter mask to determine the potential cause.
Fan LED is Red	Fan failure	◆ One or more fans in the fan tray have failed. Replace the fan tray.

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 power supply unit. 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 power supply unit 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.

MANAGEMENT ACCESS

You can access the management agent in the switch through a connection to the Management port 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 Management port 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.

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 19: RJ-45 Connector Pin Numbers
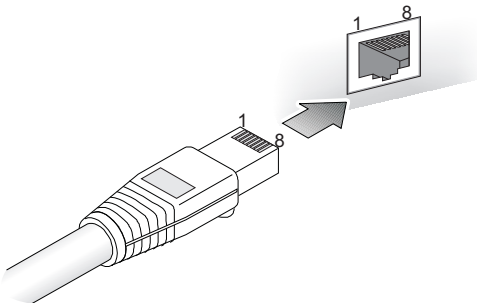
10BASE-T/100BASE-TX PIN ASSIGNMENTS

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 14: 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 20: Straight-through Wiring

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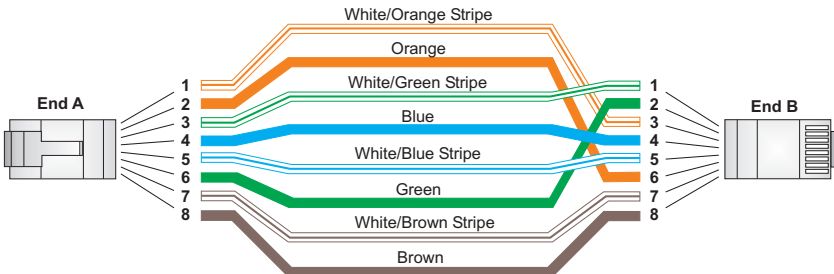10/100BASE-TX Straight-through Cable
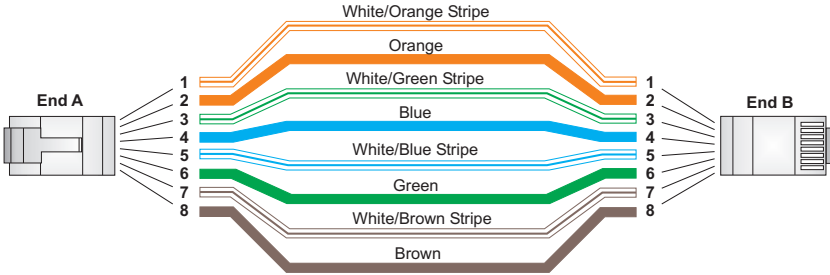
CROSSOVER WIRING

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 21: 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 15: 1000BASE-T MDI and 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 CATEGORY 5 CABLING TO RUN 1000BASE-T

If your existing Category 5 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 16: Fiber Standards

ITU-T Standard	Description	Application
G.651	**Multimode Fiber** 50/125-micron core	Short-reach connections in the 1300-nm or 850-nm band
G.652	**Non-Dispersion-Shifted Fiber** 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	**Low Water Peak Non-Dispersion-Shifted Fiber** 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	**Dispersion-Shifted Fiber** Single-mode, 9/125-micron core	Longer spans and extended reach. Optimized for operation in the region from 1500 to 1600-nm.

Table 16: Fiber Standards (Continued)

ITU-T Standard	Description	Application
G.654	**1550-nm Loss-Minimized Fiber** 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	**Non-Zero Dispersion-Shifted Fiber** 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.

USB CABLING

The access device provides one USB 2.0 downstream port for connecting memory devices (e.g., memory stick or disk). The port can operate at either 1.5 or 12 Mbps, and deliver 5V power to the connected device at a maximum current of up to 500mA. USB 2.0 cable should not exceed 5 meters for 12 Mbps connections or 3 meters for 1.5 Mbps connections.

Standard USB cable has an A-series connector, and consists of one 20-28 AWG wire pair for power and one 28 AWG twisted pair for data. The cable has a connector shield and an overall jacket.

Figure 22: USB Port Pinouts

Male

Female

Table 17: USB Port Pinouts

Pin	Signal Name	Wire Color
1	VCC	Red
2	-Data	White
3	+Data	Green
4	GND	Black

The "+" and "-" signs represent the polarity of the wires.

C SPECIFICATIONS

PHYSICAL CHARACTERISTICS

PORTS
24 Gigabit Ethernet SFP slots
2 10-Gigabit Ethernet XFP Slots
2 10-Gigabit Ethernet expansion module slots (reserved)
1 Fast Ethernet management port (RJ-45)
1 RS-232 console interface (RJ-45)
1 USB 2.0 port for memory stick (operates at 1.5 Mbps or 12 Mbps)

NETWORK INTERFACE
Ports 1-24: SFP transceiver slot, 10/100/1000 Mbps, full-duplex
Ports 25-26: XFP transceiver slot, 10/100/1000/10000 Mbps, full-duplex
Management Port: 10/100BASE-TX RJ-45 connector, auto MDI/X

ALARM PORT
DB-15 connector
4 inputs: local choice
2 outputs: Major and minor mechanical/environmental alarms

BUFFER ARCHITECTURE
3 Mbytes

AGGREGATE BANDWIDTH
88 Gbps

SWITCHING DATABASE
32K MAC address entries, 1K static MAC addresses;
255 multicast groups

LEDs

System: Power Module (-48/+12 VDC, AC/+12VDC), Alarm (Crit, Maj, Fan),
Status
Port: Link/Activity

WEIGHT

4.65 kg (10.25 lbs)

SIZE

6.7 x 44.0 x 25.4 cm (2.64 x 17.32 x 10 in.)

TEMPERATURE

Operating: -40 to 65 °C (-40 to 149 °F)
Storage: -40 to 70 °C (-40 to 158 °F)

HUMIDITY

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

POWER SUPPLY

These power modules are offered:
-48 VDC: -36 to -72 VDC input range, 4 A @ -48 VDC
100-240 VAC: 100 to 240 VAC, 50-60 Hz input range, 2 A

POWER CONSUMPTION

60 Watts

MAXIMUM CURRENT

2.0 A @ -38 VDC
1.0 A @ -72 VDC
0.8 A @ 110 VAC
0.4 A @ 240 VAC

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
Web, Telnet, SSH, or SNMP manager

OUT-OF-BAND MANAGEMENT
Console port (RJ-45 interface, RS-232 signals)
Isolated management port, Fast Ethernet (RJ-45)

SOFTWARE LOADING
TFTP or HTTP in-band

STANDARDS

IEEE 802.3-2005
    Ethernet, Fast Ethernet, Gigabit Ethernet
    Link Aggregation Control Protocol (LACP)
    Full-duplex flow control (ISO/IEC 8802-3)
IEEE 802.3ae 10 Gigabit Ethernet
IEEE 802.1p Priority Tags
IEEE 802.3ac VLAN tagging
IEEE 802.1D -2004
    Spanning Tree Protocol
    Rapid Spanning Tree Protocol
    Multiple Spanning Tree Protocol
ISO/IEC 8802-3 CSMA/CD

COMPLIANCES

CE MARK

EMISSIONS
FCC Class A
VCCI Class A
CFR 47 Part 15 Subpart B
EN55022 (CISPR 22) Class A
EN 61000-3-2/3

IMMUNITY
EN 55024
EN 61000-4-2/3/4/5/6/8/11

SAFETY
TUV c us (CSA 22.2. NO 60950-1 & UL60950-1)
CB (IEC60950-1/EN60950-1)

GLOSSARY

10BASE-T

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

100BASE-FX

IEEE 802.3u specification for 100 Mbps Ethernet over two strands of 50/125, 62.5/125 or 9/125 micron core fiber cable.

100BASE-TX

IEEE 802.3u specification for 100 Mbps Ethernet over two pairs of Category 5 UTP 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-LH

A specification for Gigabit Ethernet over two strands of 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-CR

Specification for 10 Gigabit Ethernet over twinax copper cable terminated by SFP+ connectors.

10GBASE-LR

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

10GBASE-LRM

Specification for 10 Gigabit Ethernet over two strands of 62.5/125 micron core multimode fiber cable.

10GBASE-SR

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

10GBASE-SRL

Specification for 10 Gigabit Ethernet over two strands of 62.5/125 micron core multimode fiber cable.

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 802.3-2005.)

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 802.3-2005.)

IEEE 802.3X

Defines Ethernet frame start/stop requests and timers used for flow control on full-duplex links. (Now incorporated in IEEE 802.3-2005.)

IEEE 802.3Z

Defines CSMA/CD access method and physical layer specifications for 1000BASE Gigabit Ethernet. (Now incorporated in IEEE 802.3-2005.)

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.

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.

USER DATAGRAM PROTOCOL (UDP)

UDP provides a datagram mode for packet-switched communications. It uses IP as the underlying transport mechanism to provide access to IP-like services. UDP packets are delivered just like IP packets – connection-less datagrams that may be discarded before reaching their targets. UDP is useful when TCP would be too complex, too slow, or just unnecessary.

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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