Intelligent Workgroup Switch

Installation Guide

Intelligent Workgroup Switch

*with 24 10BASE-T / 100BASE-TX (RJ-45) Ports,
and 2 Slots for 100BASE-FX or Gigabit Uplink Modules*

Compliances and Safety Warnings

FCC - Class A

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart B of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference. 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.

Warnings: 1. Wear an anti-static wrist strap or take other suitable measures to prevent electrostatic discharge when handling this equipment.
2. When connecting this hub 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.

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

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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 55022:1998

• Limit class A for harmonic current emission according to EN 61000-3-2/1995

• Limitation of voltage fluctuation and flicker in low-voltage supply system according to EN 61000-3-3/1995

Immunity: • Product family standard according to EN 55024:1998

• Electrostatic Discharge according to EN 61000-4-2:1995 (Contact Discharge: ±4 kV, Air Discharge: ±8 kV)

• Radio-frequency electromagnetic field according to EN 61000-4-3:1996 (80 - 1000 MHz with 1 kHz AM 80% Modulation: 3 V/m)

• Electrical fast transient/burst according to EN 61000-4-4:1995 (AC/DC power supply: ±1 kV, Data/Signal lines: ±0.5 kV)

• Surge immunity test according to EN 61000-4-5:1995 (AC/DC Line to Line: ±1 kV, AC/DC Line to Earth: ±2 kV)

• Immunity to conducted disturbances, Induced by radio-frequency fields: EN 61000-4-6:1996 (0.15 - 80 MHz with 1 kHz AM 80% Modulation: 3 V/m)

• Power frequency magnetic field immunity test according to EN 61000-4-8:1993 (1 A/m at frequency 50 Hz)

• Voltage dips, short interruptions and voltage variations immunity test according to EN 61000-4-11:1994 (>95% Reduction @10 ms, 30% Reduction @500 ms, >95% Reduction @5000 ms)

LVD: • EN 60950 (A1/1992; A2/1993; A3/1993; A4/1995; A11/1997)

Warning! Do not plug a phone jack connector in the RJ-45 port. This may damage this device. Les raccordeurs ne sont pas utilisé pour le système téléphonique!

Australia AS/NZS 3548 (1995) - Class A

 ACN 066 352 010

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. |

Underwriters Laboratories Compliance Statement

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

Operating Voltage Electrical Cord Requirements	
Operating Voltage	**Cord Set Specifications**
120 Volts	UL Listed/CSA Certified Cord Set
	Minimum 18 AWG
	Type SVT or SJT three conductor cord
	Maximum length of 15 feet
	Parallel blade, grounding type attachment plug rated 15A, 125V
240 Volts (Europe only)	Cord Set with H05VV-F cord having three conductors with minimum diameter of 0.75 mm^2
	IEC-320 receptacle
	Male plug rated 10A, 250V

The unit automatically matches the connected input voltage. Therefore, no additional adjustments are necessary when connecting it to any input voltage within the range marked on the rear panel.

Wichtige Sicherheitshinweise (Germany)

1. Bitte lesen Sie diese Hinweise sorgfältig durch.
2. Heben Sie diese Anleitung für den späteren Gebrauch auf.
3. Vor jedem Reinigen ist das Gerät vom Stromnetz zu trennen. Verwenden Sie keine Flüssigoder Aerosolreiniger. Am besten eignet sich ein angefeuchtetes Tuch zur Reinigung.
4. Die Netzanschlu ßsteckdose soll nahe dem Gerät angebracht und leicht zugänglich sein.
5. Das Gerät ist vor Feuchtigkeit zu schützen.
6. Bei der Aufstellung des Gerätes ist auf sicheren Stand zu achten. Ein Kippen oder Fallen könnte Beschädigungen hervorrufen.
7. Die Belüftungsöffnungen dienen der Luftzirkulation, die das Gerät vor Überhitzung schützt. Sorgen Sie dafür, daß diese Öffnungen nicht abgedeckt werden.
8. Beachten Sie beim Anschluß an das Stromnetz die Anschlußwerte.
9. Verlegen Sie die Netzanschlußleitung so, daß niemand darüber fallen kann. Es sollte auch nichts auf der Leitung abgestellt werden.
10. Alle Hinweise und Warnungen, die sich am Gerät befinden, sind zu beachten.
11. Wird das Gerät über einen längeren Zeitraum nicht benutzt, sollten Sie es vom Stromnetz trennen. Somit wird im Falle einer Überspannung eine Beschädigung vermieden.
12. Durch die Lüftungsöffnungen dürfen niemals Gegenstände oder Flüssigkeiten in das Gerät gelangen. Dies könnte einen Brand bzw. elektrischen Schlag auslösen.
13. Öffnen sie niemals das Gerät. Das Gerät darf aus Gründen der elektrischen Sicherheit nur von authorisiertem Servicepersonal geöffnet werden.
14. Wenn folgende Situationen auftreten ist das Gerät vom Stromnetz zu trennen und von einer qualifizierten Servicestelle zu überprüfen:
    a. Netzkabel oder Netzstecker sind beschädigt.
    b. Flüssigkeit ist in das Gerät eingedrungen.
    c. Das Gerät war Feuchtigkeit ausgesetzt.
    d. Wenn das Gerät nicht der Bedienungsanleitung entsprechend funktioniert oder Sie mit Hilfe dieser Anleitung keine Verbesserung erzielen.
    e. Das Gerät ist gefallen und/oder das Gehäuse ist beschädigt.
    f. Wenn das Gerät deutliche Anzeichen eines Defektes aufweist.
15. Zum Netzanschluß dieses Gerätes ist eine geprüfte Leitung zu verwenden. Für einen Nennstrom bis 6A und einem Gerätegewicht größer 3kg ist eine Leitung nicht leichter als H05VV-F, 3G, 0.75mm^2 einzusetzen.

Der arbeitsplatzbezogene Schalldruckpegel nach DIN 45 635 Teil 1000 beträgt 70dB(A) oder weniger.

Warnings and Cautionary Messages

Warning: This product does not contain any servicable user parts.

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. Les raccordeurs ne sont pas utilisé pour le système téléphonique!

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

Caution: DO NOT install slide-in modules with the switch powered on. Be sure you power off the switch before installing any module.

Environmental Statement

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.

Purpose

This guide details the hardware features of the SF-2024F switch, including Its physical and performance-related characteristics, and how to install the switch.

Related Publications

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

The *Intelligent Workgroup Switch Management Guide*

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

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Figures

Chapter 1: Introduction

Overview

The Intelligent Workgroup Switch contains 24 10BASE-T / 100BASE-TX (RJ-45) ports plus two slots on the front panel for slide-in modules (100BASE-FX, 1000BASE-SX/LX/T, or GBIC transceivers). There is also an SNMP-based management agent embedded on the main board. This agent supports both in-band and out-of-band access for managing the switch.

This switch provides a broad range of powerful features for Layer 2 switching, delivering reliability and consistent performance for your network traffic. It brings order to poorly performing networks by segregating them into separate broadcast domains with IEEE 802.3Q compliant VLANs, and empowers multimedia applications with multicast switching and CoS services.
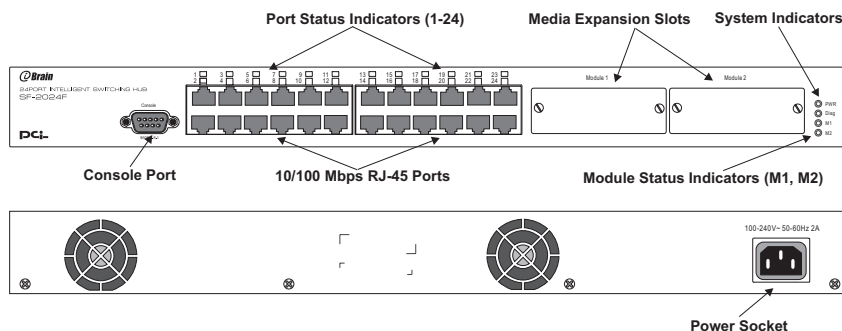
Figure 1-1. Front and Rear Panels

Switch Architecture

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

Auto-negotiation is used to select the optimal transmission speed and communication mode for each connection. With store-and-forward switching and flow control, maximum data integrity is always maintained, even under heavy loading.

This switch includes two slots on the front panel for slide-in 1000BASE-LX, 1000BASE-SX, 1000BASE-T, 1000BASE-X (GBIC), or 100BASE-FX modules. Cascade connections between switches can be made using these modules.

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 RS-232 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 Windows-based network management software.

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

Description of Hardware

RJ-45 Ports

The switch base unit contains 24 10BASE-T/100BASE-TX RJ-45 ports. All of these 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. (See "10BASE-T/100BASE-TX Pin Assignments" on page B-1.)

Each of these ports support 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. If a device connected to one of these ports does not support auto-negotiation, the correct speed will be sensed by the port, but the transmission mode will default to half duplex.

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

Status LEDs

The LEDs, which are located on the front panel for easy viewing, are shown below and described in the following table.
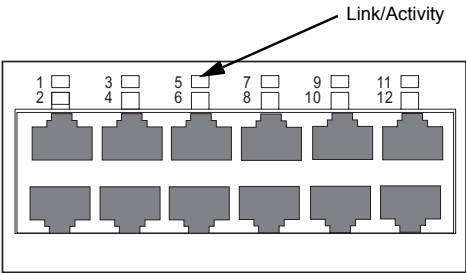
Figure 1-2. Port LEDs

Table 1-1. Port Status LEDs

LED	Condition	Status
Base Unit Ports		
1~24 (Link/Activity)	On/Flashing Amber	Port has established a valid 10 Mbps network connection. Flashing indicates activity.
	On/Flashing Green	Port has established a valid 100 Mbps network connection. Flashing indicates activity.
	Off	There is no valid link on the port.
Module Ports		
M1, M2	On/Flashing Amber	Port has established a valid 10/100 Mbps network connection. Flashing indicates activity.
	On/Flashing Green	Port has established a valid 1000 Mbps network connection. Flashing indicates activity.
	Off	There is no valid link on the port.
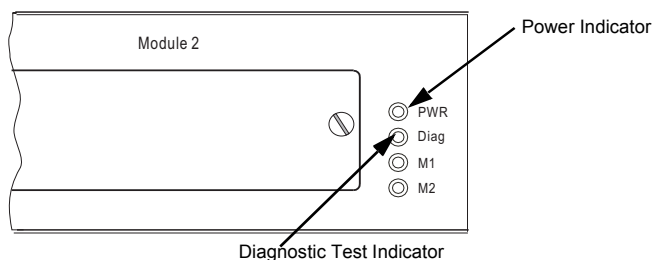
Figure 1-3. System LEDs

Table 1-2. System Status LEDs

LED	Condition	Status
PWR	On Green	The unit's internal power supply is operating normally.
	Off	The unit has no power connected.
Diag	On Green	The system diagnostic test has completed successfully.
	Flashing Green	The system diagnostic test is in progress.
	On Amber	The system diagnostic test has detected a fault.

Power Supply Receptacle

There is one power receptacle on the rear panel of the switch. The standard power receptacle is for the AC power cord.

100-240V~ 50-60Hz 2A
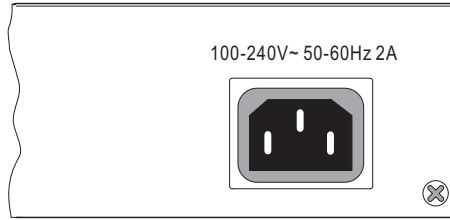
Figure 1-4. Power Supply Receptacle

Optional Media Expansion Modules

Optional 1000BASE-T Module

1000BASE-T RJ45 Module
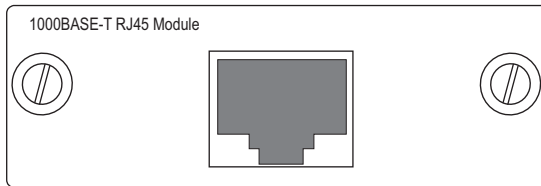
Figure 1-5. Single-Port 1000BASE-T Module

Using Category 5, 5e, or 6 twisted-pair cable you can connect to another device up to 100 m (328 ft) away. The 1000BASE-T module operates at 10/100/1000 Mbps. At 1000 Mbps it operates at full duplex and supports auto-negotiation of speed and flow control. At 10/100 Mbps it supports auto-negotiation of speed, duplex mode (i.e., half or full duplex), and flow control. Note that you should first test the cable installation for IEEE 802.3ab compliance. See "Cable Testing for Existing Category 5 Cable" on page B-4.

Optional 1000BASE-SX Module

Figure 1-6. Single-Port 1000BASE-SX Gigabit Module

Using multimode fiber optic cable, the 1000BASE-SX port can be connected to a remote site up to 550 m (1805 ft) away. The 1000BASE-SX Gigabit module operates at 1 Gbps, with support for full-duplex mode and flow control.

Optional 1000BASE-LX Module
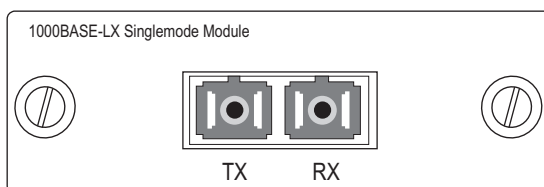
Figure 1-7. Single-Port 1000BASE-LX Gigabit Module

Using single-mode fiber optic cable, the 1000BASE-LX port can be connected to a remote site up to 5 km (16404 ft) away. The 1000BASE-LX Gigabit module operates at 1 Gbps, with support for full-duplex mode and flow control.

Optional 100BASE-FX Multimode Module
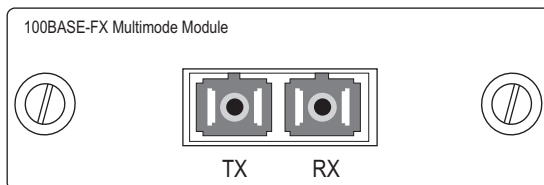
Figure 1-8. Single-Port 100BASE-FX Multimode Module

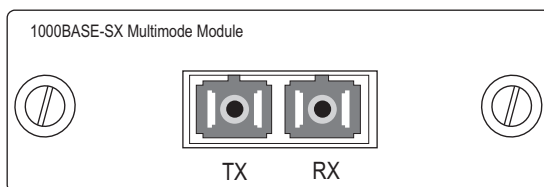Using multimode fiber optic cable, the 100BASE-FX port can be connected to a remote site up to 2 km (1.24 miles) away. The 100BASE-FX module is fixed to operate at 100 Mbps full duplex, and supports auto-negotiation for flow control. The module is fitted with an SC connector.

Optional 100BASE-FX Single-mode Module

1000BASE-SX Singlemode Module

TX   RX
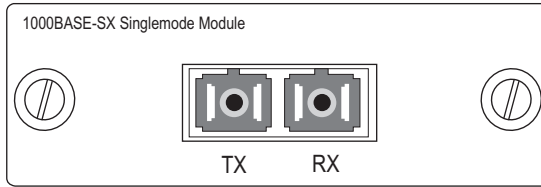
Figure 1-9. Single-Port 100BASE-FX Single-mode Module

Using fiber optic cable, the 100BASE-FX port can be connected to a remote site up to 20 km (12.43 miles) away. The 100BASE-FX module is fixed to operate at 100 Mbps full duplex, and supports auto-negotiation for flow control. The module is fitted with an SC connector.

Optional 1000BASE-X GBIC Module

1000BASE-X GBIC Module
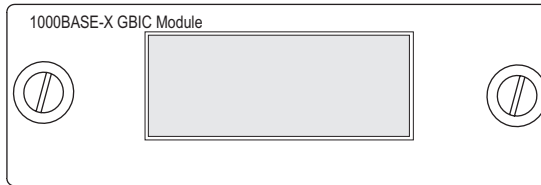
Figure 1-10. Single-Port 1000BASE-X GBIC Module

The slot on the front panel can be used for a single-port GBIC transceiver. This module supports 5 V 1000BASE-SX, 1000BASE-LX and 1000BASE-LH GBIC transceivers (purchased separately).

Features and Benefits

Connectivity
- 24 dual-speed ports for 10 or 100 Mbps Ethernet connections
- Auto-negotiation enables each RJ-45 port to automatically select the optimum communication mode (half or full duplex) if this feature is supported by the attached device; otherwise the port can be configured manually
- Independent RJ-45 ports with support for automatic MDI/MDI-X
- Unshielded (UTP) cable supported on all RJ-45 ports: Category 3 or better for 10 Mbps connections and Category 5 or better for 100 Mbps connections
- IEEE 802.3 Ethernet and 802.3u Fast Ethernet compliance ensures compatibility with standards-based hubs, network cards and switches from any vendor

Expandability
- Optional single-port 1000BASE-SX Gigabit module
- Optional single-port 1000BASE-LX Gigabit module
- Optional single-port 1000BASE-T Gigabit module
- Optional single-port 100BASE-FX multimode and single-mode modules
- Optional single-port 1000BASE-X GBIC module that supports a single-port 1000BASE-SX, 1000BASE-LX, or 1000BASE-LH GBIC transceiver.

Performance
- Transparent bridging
- Aggregate bandwidth up to 8.8 Gbps
- Switching Table with 8K MAC address entries
- Filtering and forwarding at line speed
- Desktop or rack-mountable

Management
- "At-a-glance" LEDs for easy troubleshooting
- Management agent:
    - Supports Telnet, SNMP and Web-based interface
    - Manages switch in-band or out-of-band

Chapter 2: Network Planning

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. The switch has, 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 maximum distance between end stations is limited. For Ethernet, there may be up to four hubs between any pair of stations; for Fast Ethernet, the maximum is two. This is known as the 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 or Fast Ethernet network to significantly boost bandwidth while using conventional cabling and network cards.

Application Examples

This switch is not only designed to segment your network, but also to provide a wide range of options in setting up network connections. Some typical applications are described below.

Collapsed Backbone

This switch is an excellent choice for mixed Ethernet and Fast Ethernet installations where significant growth is expected in the near future. 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 cascade the switch to an Ethernet or Fast Ethernet hub or switch.

In the figure below, this 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 servers.

Servers
100 Mbps
Full Duplex

Workstations
100 Mbps
Full Duplex

Workstations
10 Mbps
Full Duplex
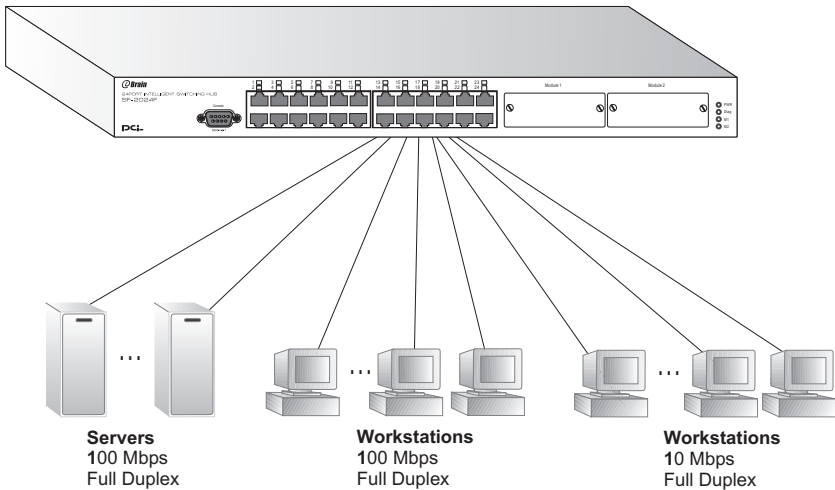
Figure 2-1. Collapsed Backbone

Network Aggregation Plan

With 26 parallel bridging ports (i.e., 26 distinct collision domains), this switch can collapse a complex network down into a single efficient bridged node, increasing overall bandwidth and throughput.

In the figure below, the 10BASE-T/100BASE-TX ports on the switch are providing 100 Mbps connectivity for up to 24 segments. In addition, the switch is also connecting servers at 100 Mbps.
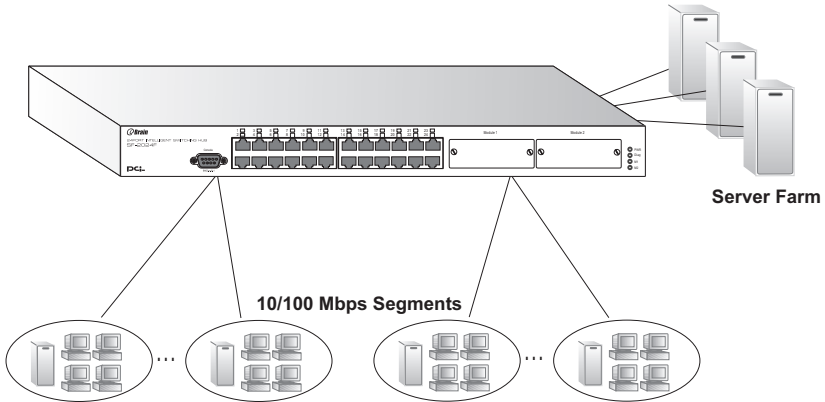
Figure 2-2. Network Aggregation Plan

Remote Connection with Fiber Cable

Fiber optic technology allows for longer cabling than any other media type. A 100 Mbps multimode fiber (MMF) link can run up to 2 km, and a 100 Mbps single-mode fiber (SMF) link can run as far as 20 km. A 1000BASE-SX (MMF) link can connect to a site up to 550 meters away, and a 1000BASE-LX (SMF) link can run up to 5 km. This allows the switch to serve as a collapsed backbone, providing direct connectivity for a widespread LAN.

The 100BASE-FX (SMF) plug-in module or 1000BASE-LH GBIC transceiver can be used to interconnect remote network segments. While a 1000BASE-SX module can be used for a high-speed connection between floors in the same building, and a 1000BASE-LX module can be used to connect to other buildings in a campus setting.

The figure below illustrates this switch connecting to a remote segment with fiber cable.
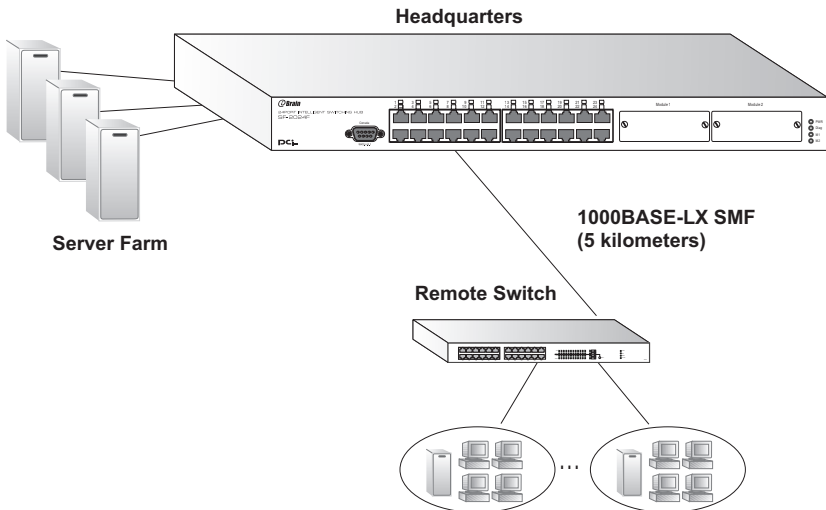
Figure 2-3. Remote Connection with Fiber Cable

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. Unttagged 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.

The switch also supports multiple spanning trees which allow VLANs 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 when any link in the spanning tree fails.
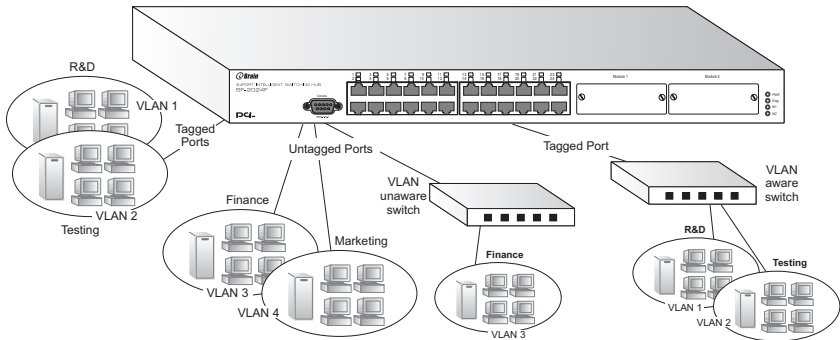
Figure 2-4. Making VLAN Connections

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. As a general rule the length of fiber optic cable for a single switched link should not exceed:

   • 1000BASE-SX/LX: 550 m (1805 ft) for multimode fiber or 5 km (16404 ft) for single-mode fiber.

   • 100BASE-FX: 2 km (1.24 miles) for multimode fiber or 20 km (2.43 miles) for single-mode fiber.

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

Chapter 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 10% to 90%, non-condensing
  - provide adequate space (approximately 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, transmitters, etc.
- 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 2.44 m (8 feet) of each device and is powered from an independent circuit breaker. As with any equipment, using a filter or surge suppressor is recommended.

Ethernet Cabling

To ensure proper operation when installing the switch into a network, make sure that the current cables are suitable for 10BASE-T or 100BASE-TX 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 and Category 5 or better for 100BASE-TX.
- 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
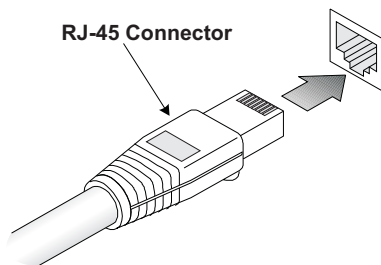
RJ-45 Connector

Figure 3-1. 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

- 24-Port Intelligent Workgroup 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
- RS-232 console cable
- This Installation Guide
- Management Guide

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

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.

Installing Optional Modules: Before mounting the switch, be sure you install any optional modules. If you have purchased optional slide-in 1000BASE-T, 1000BASE-SX, 1000BASE-LX, 100BASE-FX or GBIC media expansion module, install these modules now, following the instructions "Installing an Optional Module into the Switch" on page 3-5.

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 C-1.)
• **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.
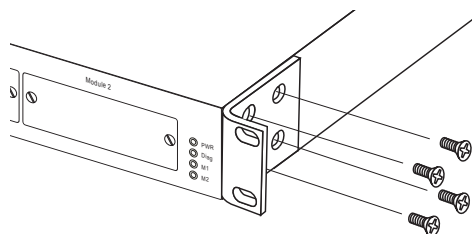
Figure 3-2. Attaching the Brackets

2. Mount the device in the rack, using four rack-mounting screws (not provided).
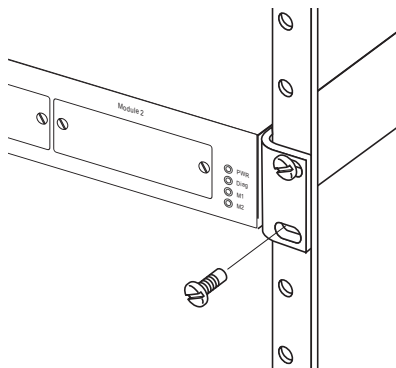
Figure 3-3. Installing the Switch in a Rack

3. If installing a single switch only, turn to "Connecting to a Power Source" at the end of this chapter.

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 3-4. 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" at the end of this chapter.

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.
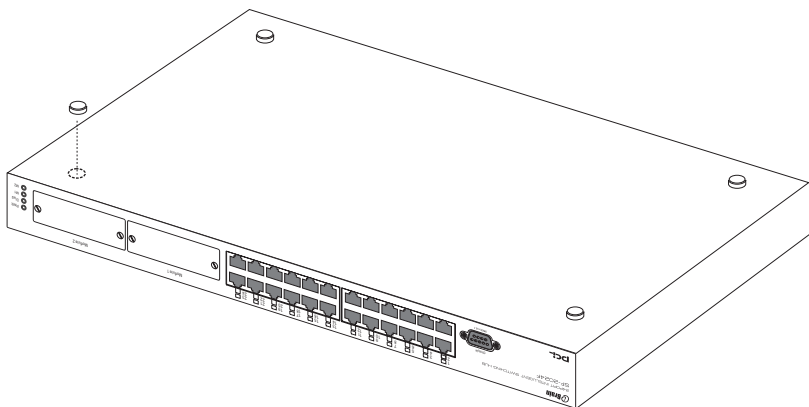
Installing an Optional Module into the Switch
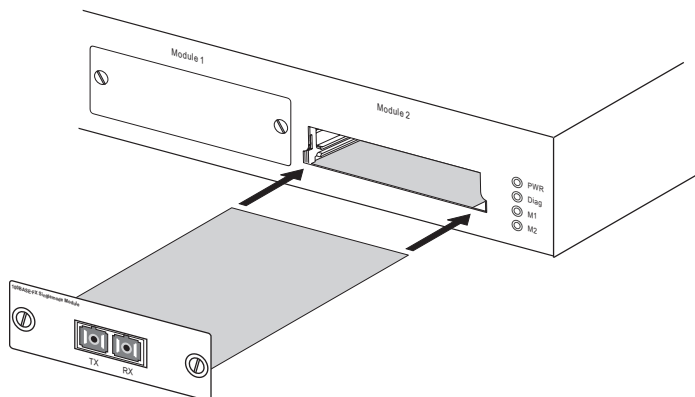
Figure 3-5. Installing an Optional Module

Caution: DO NOT install slide-in modules with the switch powered on. Be sure you power off the switch before installing any module.

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

1. Disconnect power to the switch.

2. Remove the blank metal plate (or a previously installed module) from the appropriate slot by removing the two screws with a flat-head screwdriver.

3. With the module still in the anti-static bag, touch the metal frame of the switch to prevent damage caused by static electricity discharge. Also, it is recommended to use an ESD wrist strap during installation.

4. Remove the module from the anti-static shielded bag.

5. 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.

Connecting to a Power Source

To connect a device to a power source:

1. Insert the power cable plug directly into the receptacle located at the back of the device.
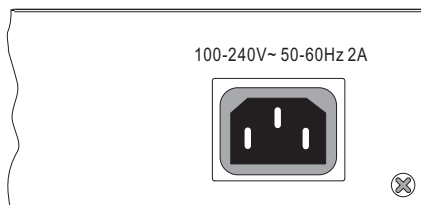
Figure 3-6. Power Receptacle

2. Plug the other end of the cable into a grounded, 3-pin socket.

Caution: 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. Check the front-panel LEDs as the device is powered on to be sure the Power LED is lit. If not, check that the power cable is correctly plugged in.

Connecting to the Console Port

The DB-9 serial port on the switch's front panel is used to connect to the switch for out-of-band console configuration. The command-line 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 tables.
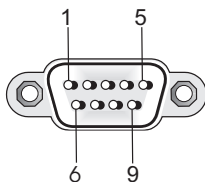
Figure 3-7. Serial Port (DB-9 DTE) Pin-Out

Wiring Map for Serial Cable

Table 3-1. Serial Cable Wiring

Switch's 9-Pin Serial Port	Null Modem	PC's 9-Pin DTE Port
2 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—9,600 bps
• Character Size—8 Characters
• Parity—None
• Stop bit—One
• Data bits—8

Chapter 4: Making Network Connections

Connecting Network Devices

The switch may be connected to 10 or 100 Mbps network cards in PCs and servers, as well as to other switches and hubs. It may also be connected to remote devices using the optional fiber optic modules.

Twisted-Pair Devices

Each device requires a shielded or unshielded twisted-pair (STP or UTP) cable with RJ-45 connectors at both ends. For 1000BASE-T Category 5, 5e, or 6 cable is required, for 100BASE-TX connections, Category 5 or better cable is required; for 10BASE-T, Category 3 or better cable can be used.

Cabling Guidelines

A twisted-pair connection between two ports must have a crossover of the transmit and receive wires to be able to function. This crossover can be implemented in either of the ports, or in the cable connecting them.

Network card ports in PCs and servers do not contain an internal wiring crossover, these are known as straight-through (MDI) ports. Therefore, most switch and hub ports implement a built-in crossover — known as fixed crossover (MDI-X) ports — so that they can be connected to PCs and servers using standard straight-through cable. Some switches and hubs also have an MDI port, so that they can connect to another switch's/hub's MDI-X port using straight-through cable. To connect between two switches/hubs that only have fixed MDI-X ports, the wiring crossover must be implemented in the cable — known as a crossover cable.

The RJ-45 ports on the switch base unit support automatic MDI/MDI-X operation, which means that they automatically detect the wiring in the link and configure as MDI or MDI-X accordingly. So for these ports, you can use standard straight-through twisted-pair cables to connect to any other network device (PCs, servers, switches, hubs, or routers). However, note that auto-negotiation must be enabled on these ports for automatic wiring configuration to function properly.

Connecting to PCs, Servers, Hubs and Switches

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.

1. Attach one end of a twisted-pair cable segment to the device's RJ-45 connector.
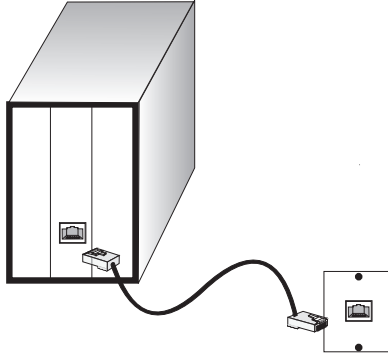
Figure 4-1. Making Twisted-Pair Connections

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. (See "Wiring Closet Connections" on the next page.) Otherwise, attach the other end to an available port on the switch.

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

Note: 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.

4. As each connection is made, the green Link LED (on the switch) corresponding to each port will light 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.

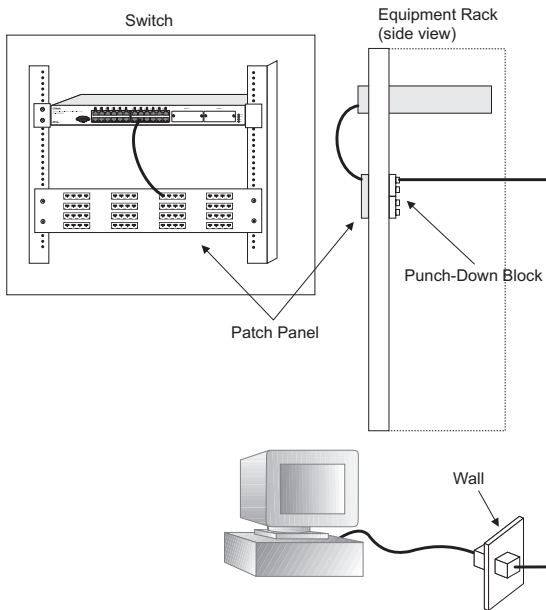3. Label the cables to simplify future troubleshooting.

Figure 4-2. Network Wiring Connections

Fiber Optic Devices

An optional slide-in 1000BASE-SX, 1000BASE-LX, or 100BASE-FX module may be used for backbone and long distance connections. A 1000BASE-SX, or 1000BASE-LX module may also be used for connecting to a high-speed server.

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

Caution: 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.

1. Remove and keep the SC 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 SC port on the switch and the other end to the SC port on the other device. Since SC connectors are keyed, the cable can be attached in only one orientation.
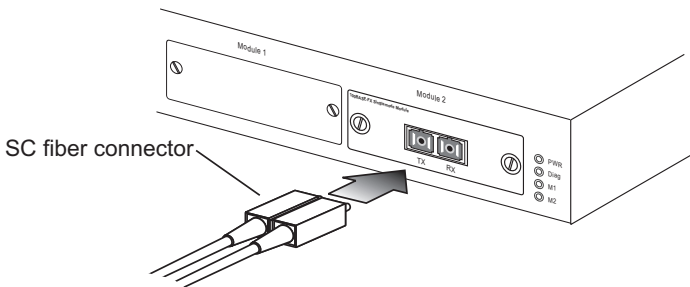

Figure 4-3. Making SC Port Connections

4. As a connection is made, check the LED on the switch's front panel for the corresponding module to be sure that the connection is valid.

Note: If you use an SC-ST converter, be sure to connect the converter's Tx (Rx) port to the Rx (Tx) port on the other device.

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 802.3ab standards.

1000 Mbps Gigabit Ethernet Collision Domain

Table 4-1. Maximum 1000BASE-T Gigabit Ethernet Cable Length

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

Table 4-2. Maximum 1000BASE-SX Gigabit Ethernet Cable Length

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

Table 4-3. 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)	SC or ST

Table 4-4. Maximum 1000BASE-LH Gigabit Ethernet Cable Length

Fiber Size	Fiber Bandwidth	Cable Length Range
9/125 micron single-mode fiber	N/A	70 km (43 miles)

100 Mbps Fast Ethernet Collision Domain

Table 4-5. Maximum Fast Ethernet Cable Distance

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 Multimode	50/125 or 62.5/125 micron core multimode fiber (MMF)	2 km (1.24 miles)	SC or ST
100BASE-FX Single-Mode	9/125 micron core single-mode fiber (SMF)	20 km (12.43 miles)	SC or ST

10 Mbps Ethernet Collision Domain

Table 4-6. Maximum Ethernet Cable Distance

Cable Type	Maximum Length	Connector
Twisted Pair, Categories 3, 4, 5 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.

Appendix A: Troubleshooting

Diagnosing Switch Indicators

Table A-1. Troubleshooting Chart

Troubleshooting Chart	
Symptom	**Action**
Power LED is Off	• Check connections between the switch, the power cord, and the wall outlet. • Contact your dealer for assistance.
Diag LED is On Amber	• The switch has deteced a fault. Try power cycling the switch to clear the condition. • If the condition persists, contact your dealer for assistance.
Link LED is Off	• 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.

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, and verify that the fans on the unit are unobstructed and running prior to shutdown. If you still cannot isolate the problem, then 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.

Caution: The management agent can accept 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.

Appendix B: Cables

Twisted-Pair Cable and Pin Assignments

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.

For 10BASE-T/100BASE-TX connections, a twisted-pair cable must have two 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: Each wire pair must be attached to the RJ-45 connectors in a specific orientation. (See "Cabling Guidelines" on page 4-1 for an explanation.)

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.
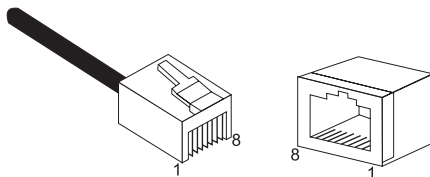

Figure B-1. RJ-45 Connector Pin Numbers

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, 4 or 5 cable for 10 Mbps connections or 100-ohm Category 5 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, 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 B-1. 10/100BASE-TX MDI and MDI-X Port Pinouts

Pin	MDI-X Signal Name	MDI Signal Name
1	Receive Data plus (RD+)	Transmit Data plus (TD+)
2	Receive Data minus (RD-)	Transmit Data minus (TD-)
3	Transmit Data plus (TD+)	Receive Data plus (RD+)
6	Transmit Data minus (TD-)	Receive Data minus (RD-)
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.)
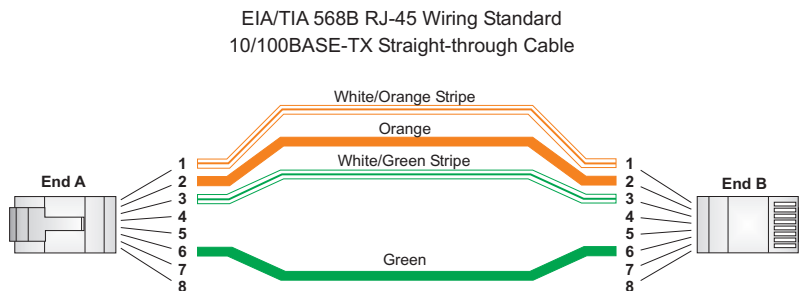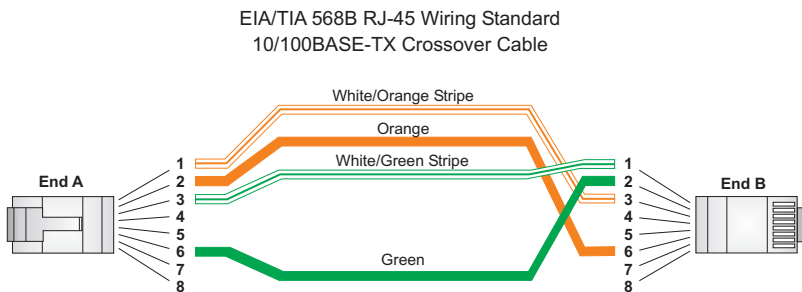
EIA/TIA 568B RJ-45 Wiring Standard
10/100BASE-TX Straight-through Cable

Figure B-2. Straight-through Wiring

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.)

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

White/Orange Stripe

Orange

White/Green Stripe

Green

End A

End B

Figure B-3. Crossover Wiring

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 B-2. 1000BASE-T MDI-X and MDI Port Pinouts

1000BASE-T MDI-X and MDI Port Pinouts		
Pin	MDI-X Signal Name	MDI Signal Name
1	Bi-directional Data Two Plus (BI_D2+)	Bi-directional Data One Plus (BI_D1+)
2	Bi-directional Data Two Minus (BI_D2-)	Bi-directional Data One Minus (BI_D1-)
3	Bi-directional Data One Plus (BI_D1+)	Bi-directional Data Two Plus (BI_D2+)
4	Bi-directional Data Four Plus (BI_D4+)	Bi-directional Data Three Plus (BI_D3+)
5	Bi-directional Data Four Minus (BI_D4-)	Bi-directional Data Three Minus (BI_D3-)
6	Bi-directional Data One Minus (BI_D1-)	Bi-directional Data Two Minus (BI_D2-)
7	Bi-directional Data One Plus (BI_D3+)	Bi-directional Data One Plus (BI_D4+)
8	Bi-directional Data Three Minus (BI_D3-)	Bi-directional Data Four Minus (BI_D4-)

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 current TIA (Telecommunications Industry Association) 568-A specification on optical fiber cabling consists of one recognized cable type for horizontal subsytems and two cable types for backbone subsystems.

Horizontal 62.5/125 micron multimode (two fibers per outlet).
Backbone 62.5/125 micron multimode or singlemode.

TIA 568-B will allow the use of 50/125 micron multimode optical fiber in both the horizontal and backbone in addition to the types listed above. All optical fiber components and installation practices must meet applicable building and safety codes.

Appendix C: Specifications

Physical Characteristics

Ports

24 10BASE-T/100BASE-TX, with auto-negotiation

Media Slots

2 slots for optional 100BASE-FX, 1000BASE-T, 1000BASE-SX, 1000BASE-LX, or GBIC modules

Network Interface

10BASE-T: RJ-45 (100-ohm, UTP cable; Categories 3 or better)
100BASE-TX:RJ-45 (100-ohm, UTP cable; Category 5 or better)
Ports 1-24: RJ-45 connectors, auto MDI/MDI-X

Communication Speed

10 and 100 Mbps

Communication Mode

Full and half duplex

Buffer Architecture

4 Mbit per system

Aggregate Bandwidth

8.8 Gbps

Switching Database

8K MAC address entries

LEDs

System: PWR (Power), Diag (Diagnostics)
Ports: Link/Activity

Weight

3.08 kg (6 lb. 13 oz.)

Size

44 x 32.4 x 4.3 cm (17.32 x 12.8 x 1.69 in.)

Temperature

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

Humidity

Operating: 10% to 90%, non-condensing

Power Supply
  Internal, auto-ranging transformer: 100 to 240 VAC, 47 to 63 Hz

Power Consumption
  60 Watts maximum

Heat Dissipation
  205 BTU/hr. maximum

Maximum Current
  3.0 A @ 110 V
  2.0 A @ 240 V

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, or SNMP manager

Out-of-Band Management
  RS-232 DB-9 console port

Software Loading
  TFTP in-band, or XModem out-of-band

MIB Support
  MIB II (RFC1213), Bridge MIB (RFC 1493, without Static Table)

Standards

IEEE 802.3 Ethernet, IEEE 802.3u Fast Ethernet
IEEE 802.1D (Bridging)
IEEE 802.3x full-duplex flow control
ISO/IEC 8802-3
UDP (RFC 768), IP (RFC 791), TCP (RFC793), TFTP (RFC 783), TELNET
(RFC 783), SNMP (RFC 1157), MIB II (RFC 1213), Traps (RFC 1215), Bridge
MIB (RFC 1493), RMON (RFC 1757), HTML (RFC 1866), HTTP (RFC 2068)

Compliances

CE Mark

Emissions
FCC Class A
Industry Canada Class A
EN55022 (CISPR 22) Class A
EN 61000-3-2/3
VCCI Class A
C-Tick - AS/NZS 3548 (1995) Class A

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

Safety
CSA/NRTL (CSA 22.2.950 & UL 1950)
TUV/GS (EN60950)

Slide-in Modules

100BASE-FX Extender Modules

Ports
1 100BASE-FX, SC connectors

Communication Speed
100 Mbps

Communication Mode
Full duplex

Network Interface
Single-mode transceiver: 9/125 micron single-mode fiber cable
Multimode transceiver: 50/125 or 62.5/125 micron multimode fiber cable

Standards
IEEE 802.3u Fast Ethernet
ISO/IEC 8802-3

1000BASE-T Extender Module

Ports
1 1000BASE-T, RJ-45 connector

Communication Speed
10/100/1000 Mbps

Communication Mode
Full duplex only at 1000 Mbps
Full and half duplex at 10/100 Mbps

Network Interface
RJ-45 (100-ohm, UTP cable; Category 5, 5e, or 6)

Standards
IEEE 802.3ab Gigabit Ethernet
IEEE 802.3u Fast Ethernet
IEEE 802.3 Ethernet

1000BASE-SX Extender Module

Ports
1 1000BASE-SX SC-type port

Communication Speed
1000 Mbps

Communication Mode
Full duplex

Network Interface

SC connector: 50/125 or 62.5/125 micron multimode fiber cable

Standards

IEEE 802.3z Gigabit Ethernet

1000BASE-LX Extender Module

Ports

1 1000BASE-LX SC-type port

Communication Speed

1000 Mbps

Communication Mode

Full duplex

Network Interface

SC connector, 9/125 micron single-mode fiber

Standards

IEEE 802.3z Gigabit Ethernet

1000BASE-X GBIC Module

Ports

1 slot for GBIC transceivers

Communication Mode

Full duplex

Communication Speed

1000 Mbps

Standards

IEEE 802.3z

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 Fast Ethernet over two strands of 50/125 or 62.5/125 micron core fiber cable.

100BASE-TX

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

1000BASE-LX

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

1000BASE-LH

Long-haul 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 four pairs of Category 5, 5e, or 6 100-ohm UTP cable.

Auto-Negotiation

Signalling method allowing each node to select its optimum operational mode (e.g., 10, 100, or 1000 Mbps and half or full duplex) 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

A condition in which packets transmitted over the cable interfere with each other. Their interference makes both signals unintelligible.

Collision Domain

Single CSMA/CD LAN segment.

CSMA/CD

Carrier Sense Multiple Access/Collision Detect is the communication method employed by Ethernet and Fast Ethernet.

End Station

A workstation, server, or other device that does not act as a network interconnection.

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.

Fast Ethernet Switch

Device that provides a full 100 Mbps bandwidth (or either 10 or 100 Mbps bandwidth with Auto-Negotiation) to each port (LAN segment).

Full Duplex

Transmission method that allows switch and network card 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 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.

IEEE 802.3u

Defines CSMA/CD access method and physical layer specifications for 100BASE-TX and 100BASE-FX Fast Ethernet.

IEEE 802.3x

Defines Ethernet frame start/stop requests and timers used for flow control on full-duplex links.

IEEE 802.3z

Defines CSMA/CD access method and physical layer specifications for 1000BASE Gigabit Ethernet over fiber cable.

LAN Segment

Separate LAN or collision domain.

LED

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

Link Segment

Length of twisted-pair or fiber cable joining a pair of repeaters or a repeater and a PC.

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.

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.

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.

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