Installation Guide for the Model FS518 Fast Ethernet Switch with Gigabit Uplinks

NETGEAR

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It is hereby certified that the Model FS518 Fast Ethernet Switch has been suppressed in accordance with the conditions set out in the BMPT-AmtsblVfg 243/1991 and Vfg 46/1992. The operation of some equipment (for example, test transmitters) in accordance with the regulations may, however, be subject to certain restrictions. Please refer to the notes in the operating instructions.

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Note: 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. If it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to take whatever measures may be necessary to correct the interference at their own expense.

EN 55 022 Statement

This is to certify that the Model FS518 Fast Ethernet Switch is shielded against the generation of radio interference in accordance with the application of Council Directive 89/336/EEC, Article 4a. Conformity is declared by the application of EN 55 022 Class A (CISPR 22).

Warning: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take appropriate measures.

Bestätigung des Herstellers/Importeurs

Es wird hiermit bestätigt, daß das Model FS518 Fast Ethernet Switch gemäß der im BMPT-AmtsblVfg 243/1991 und Vfg 46/1992 aufgeführten Bestimmungen entstört ist. Das vorschriftsmäßige Betreiben einiger Geräte (z.B. Testsender) kann jedoch gewissen Beschränkungen unterliegen. Lesen Sie dazu bitte die Anmerkungen in der Betriebsanleitung.

Das Bundesamt für Zulassungen in der Telekommunikation wurde davon unterrichtet, daß dieses Gerät auf den Markt gebracht wurde und es ist berechtigt, die Serie auf die Erfüllung der Vorschriften hin zu überprüfen.

Voluntary Control Council for Interference (VCCI) Statement

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Voluntary Control Council for Interference (VCCI) Statement

This is a Class A product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio disturbance may arise. When such trouble occurs, the user may be required to take corrective actions.

Canadian Department of Communications Radio Interference Regulations

This digital apparatus (Model FS518 Fast Ethernet Switch) does not exceed the Class A limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Règlement sur le brouillage radioélectrique du ministère des Communications

Cet appareil numérique (Model FS518 Fast Ethernet Switch) respecte les limites de bruits radioélectriques visant les appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique du ministère des Communications du Canada.

Customer Support

For assistance with installing and configuring your NETGEAR system or with questions or problems following installation:

- Check the NETGEAR Web page at *http://www.NETGEAR.com.*
- Call Technical Support at the phone number listed on the Support Information Card that shipped with your switch.

Defective or damaged merchandise can be returned to your point-of-purchase representative.

Internet/World Wide Web

NETGEAR maintains a World Wide Web home page that you can access at the universal resource locator (URL) *http://www.NETGEAR.com*. A direct connection to the Internet and a Web browser such as Internet Explorer or Netscape are required.

Contents

Figures

Tables

Chapter 1
Introduction

Congratulations on your purchase of the NETGEAR Model FS518 Fast Ethernet Switch. This switch provides you with a low-cost, high-performance network solution and is designed to support power workgroups operating at either 10 megabits per second (Mbps) or 100 Mbps. To relieve server and backbone bottlenecks, the Model FS518 switch also has two Gigabit Ethernet fiber uplink ports.

Benefits of Using Switching Technology

A majority of installed networks today are based on shared network technology. With this technology, a number of users or groups of users share a total available network bandwidth (or network capacity) of 10 Mbps, 100 Mbps, or other amounts of network bandwidth. For example, with a total of 10 users, the average bandwidth available to each user on a 10 Mbps network is calculated as 10/10 Mbps, which equals 1 Mbps of bandwidth per user. On a 100 Mbps (Fast Ethernet) network, the average bandwidth available to each of the 10 users is 100/10 Mbps, which equals 10 Mbps of bandwidth per user.

Ethernet switches significantly increase network throughput by segmenting network traffic. They check traffic coming in to each port to learn which network device is located on which segment. Based on this information, switches forward cross-segment traffic only to the appropriate segment. The traffic will not show up in the other segments because it is filtered out. In this way, network capacity is fully reserved for traffic destined for that segment only, and other segments will not be saturated with unnecessary traffic.

Ethernet switches provide private, dedicated, 10 Mbps (or 100 Mbps) capacity to each connected PC/server or hub/workgroup segment, which is significantly higher than in a shared environment. The higher bandwidth enables the use of applications such as multimedia, imaging, video, or high-performance client-server functions among users who are spread out over the network.

This improvement is accomplished very easily, with no change to the desktop (the network interface cards or software and the network wiring). As a result, the performance upgrade and the applications it enables are obtained very quickly and at a low cost.

When all network ports are operating at 100 Mbps and sending traffic to the server, the server needs a faster transmission speed to avoid bottlenecks. The 1000 Mbps (Gigabit) ports add the necessary increase in throughput.

Types of Ethernet Switches

Ethernet switches can be classified in different ways—as desktop switches or as segment switches. A *desktop switch* is designed to support one or a few PCs per port. It is generally used when the individuals need the full 10 Mbps network throughput to support the applications. Often, these switches support only a single MAC (media access control) address per port, have high-speed 100 Mbps ports to connect to fast servers, and are relatively inexpensive compared to a segment switch. A *segment switch*, in contrast, is designed to support an entire workgroup on each port, with each port having significant memory buffering and supporting thousands of MAC addresses.

Switches can also be classified by speed. As the name suggests, 10 Mbps switches support only 10 Mbps connections. Similarly, 100 Mbps switches support only 100 Mbps connections. Usually, 10/100 Mbps switches have primarily 10 Mbps ports with only one or a few 100 Mbps ports. Autosensing 10/100 Mbps switches support 10 Mbps or 100 Mbps connections on each port and are the most versatile and adaptive type of switches. Gigabit (1000 Mbps) switch ports are used to connect to shared network resources and network backbones at higher speed.

Model FS518 Switch Overview

The NETGEAR Model FS518 Fast Ethernet Switch with Gigabit uplinks is an autosensing 10/100 Mbps switch with two Gigabit uplink interfaces. This high-performance switch is developed primarily to be used as a segment switch, even though it is priced as a desktop switch.

All of the UTP ports on the Model FS518 switch can adapt automatically to the speed of the connected network or the PC, and the ports can operate at either 10 Mbps or 100 Mbps. In addition, each port can automatically negotiate with the connected device to operate in full-duplex mode. If the connected device is operating in half-duplex mode only or does not have the capability to participate in the negotiation process, the port will default to half-duplex mode.

The Model FS518 switch can be used to partition a 10 Mbps or 100 Mbps network to enhance the capacity of the network to support advanced applications. In addition, the switch provides a link between traditional 10 Mbps networks and faster 100 Mbps networks. By installing a Model FS518 switch, a user can connect any 10 Mbps or 100 Mbps device to the switch without worrying about the running speed of the device. The Model FS518 switch provides a built-in upgrade path; you can remove a 10 Mbps connection and replace the connection with a 100 Mbps connection with little or no change to the rest of the network.

The Model FS518 switch can be effectively used to join multiple 100 Mbps Fast Ethernet segments and to extend the reach of the network. Copper-based Fast Ethernet networks have a network diameter of up to 200 meters. The Model FS518 switch can be used to join these 200-meter segments to enable them to function as a single logical network. With one Model FS518 switch, the reach extends to 400 meters.

The Gigabit Ethernet uplink ports on the Model FS518 switch can be used to connect to the network backbone and shared network resources such as servers at 1000 Mbps. The full-duplex 1000BASE-SX ports allow users to connect at high speed to a wiring closet or server located from 2 to 525 meters away.

All 10/100 ports can autonegotiate the duplex mode with the connected device. If negotiation fails, the ports default to half-duplex mode. Gigabit fiber ports will advertise their full-duplex operation and negotiate flow control with the connected device. If negotiation fails, the ports will default to full-duplex mode and no flow control.

Because the Model FS518 switch is an ISO media access control (MAC) layer device, the switch is network protocol independent and compatible with all popular networks such as the Internet or TCP/IP, NetWare, DECnet, Microsoft NETBEUI, and LANTASTIC.

Features

The Model FS518 switch has the following key features:

- 16 autonegotiating (speed and duplex mode) 10/100 Mbps UTP ports to provide fast information exchange, resource sharing, and client or peer-to-peer communication using simple Category 5 unshielded twisted pair (UTP) cable
- 16 vista RJ-45 network ports with built-in LEDs to monitor individual port status
- Two autonegotiating (duplex mode and flow control) Gigabit fiber ports with standard SC connectors

  The ports support multimode optical fiber (SX) up to 525 meters (m) with 50 µm fiber cable. With 62.5 µm fiber cable, the maximum distance is 260 m.
- Two 62.5/125 µm fiber cables included for connecting the Gigabit ports to servers or the network backbone
- Autonegotiation supported by all 10/100 Mbps and Gigabit ports
- Automatic address-learning function to build the packet-forwarding information table

  The table contains up to 8,000 MAC addresses (that is, the switch can support networks with as many as 8,000 devices).
- Wire-speed filtering and forwarding to direct traffic to the appropriate route without slowing down the traffic
- Store-and-forward forwarding mode to minimize erroneous packets on the network
- Aging function to automatically track changes in network configuration
- Minimum latency of packet transmission (leading edge to leading edge) less than 80 µs
- Easy plug-and-play installation with no software to configure, which saves time and minimizes the potential for configuration errors
- Protocol independence and compatibility with all common protocols such as TCP/IP, NetWare, DECnet, and Microsoft Networks
- Normal/Uplink push button to simplify network extension to 10/100 segments
- Connection to a hub using a simple, straight-through cable

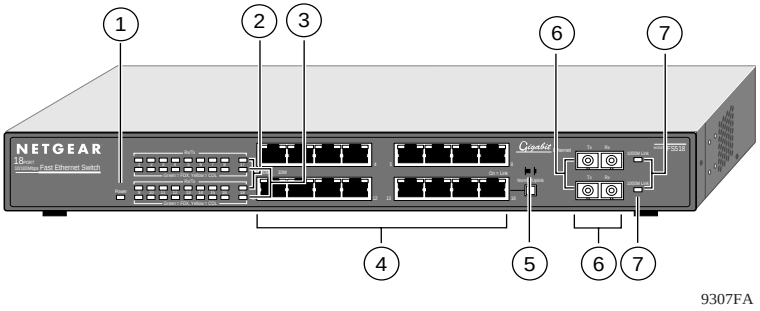
- Conformity to standards:
  - — IEEE 802.3u 100BASE-TX standard
  - — ISO/IEC 8802-3 and ANSI/IEEE 802.3 10BASE-T standards
  - — IEEE 802.3z 1000BASE-SX standard
- Rack Mount Kit provided for installing the switch in a standard 19-inch equipment rack or for mounting on the wall

Chapter 2
Physical Description

This chapter describes the hardware features of the NETGEAR Model FS518 Fast Ethernet Switch.

Front Panel

For easier management and control of the Model FS518 switch, familiarize yourself with the ports, LEDs, and Normal/Uplink push button on the front panel of the switch, as illustrated in Figure 2-1.



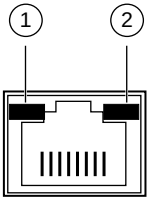
Key:
1 = Power LED
2 = RX/TX LEDs
3 = FDX/COL LEDs
4 = 10/100 Mbps UTP ports with 10M or 100M Link LEDs on each port
5 = Normal/Uplink push button for port 16
6 = Gigabit Ethernet (1000BASE-SX) SC fiber ports
7 = Link LEDs for the Gigabit Ethernet ports

Figure 2-1. Front Panel of the Model FS518 Switch

As Figure 2-1 shows, the Model FS518 switch is equipped with 16 autosensing 10/100 Mbps Fast Ethernet UTP ports. The network access speed for the 10/100 Mbps ports is automatically sensed and displayed on the front panel by the 10 Mbps or 100 Mbps Link LEDs.

The 10/100 Mbps ports support only unshielded twisted pair (UTP) cable using an 8-pin RJ-45 plug. Each of the 10/100 Mbps ports uses vista RJ-45 connectors that have built-in LEDs, as illustrated in Figure 2-2. The LEDs, as described in Table 2-1 on page 2-5, indicate that the connection to the port is valid and that the port is operating at either 10 or 100 Mbps.

For further information about the vista RJ-45 connector and the RJ-45 plug, refer to Appendix B, "Connector Pin Assignments," and Appendix C, "Cabling Guidelines."



Key:
1 = 100M link LED
2 = 10M link LED

Figure 2-2. Vista RJ-45 Connector with Built-In LEDs

1000BASE-SX Fiber Ports

The Model FS518 switch has two1000BASE-SX fiber ports. These ports operate at 1000 Mbps full-duplex mode exclusively and provide a standard duplex SC connector for 62.5/125 µm or 50/125 µm multimode fiber optic cable. Figure 2-3 shows a fiber optic cable connection to a duplex SC connector. The Link LED to the right of the 1000BASE-SX fiber port indicates whether or not proper signaling is established with the remote port. For further information about fiber optic cables and connectors, refer to Appendix B, "Connector Pin Assignments," and Appendix C, "Cabling Guidelines."

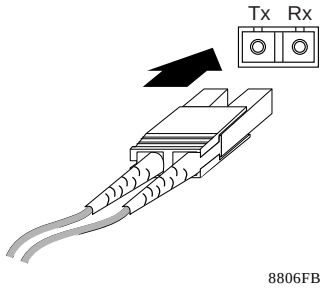


Figure 2-3. 1000BASE-SX Fiber Connection

⚠	**Warning:** Fiber optic equipment can emit laser or infrared light that might injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a light source.

Normal/Uplink Push Button

The Normal/Uplink push button on the front panel of the switch, as illustrated in Figure 2-1, allows you to select uplink (MDI) or normal (MDI-X) wiring for port 16 on the Model FS518 switch. This port is configured for normal wiring to connect to a PC when the push button is in the out position. When the push button is pressed in, this port is configured for uplink wiring to connect to another switch or to a hub, using a straight-through twisted pair cable.

LEDs

The LEDs on the front panel of the switch and two vista LEDs on each RJ-45 connector allow you to identify the following information:

- Status of the power supply
- For each 10/100 Ethernet port:
  - Network link at 10 Mbps or 100 Mbps
  - Data transmission or receive activity
  - Collision occurrence when in half-duplex mode or full-duplex mode
- For the fiber port:
  - Link status (fiber port 17 or 18 operates only at 1000 Mbps)
  - Data transmission or receive activity
  - Full-duplex operation

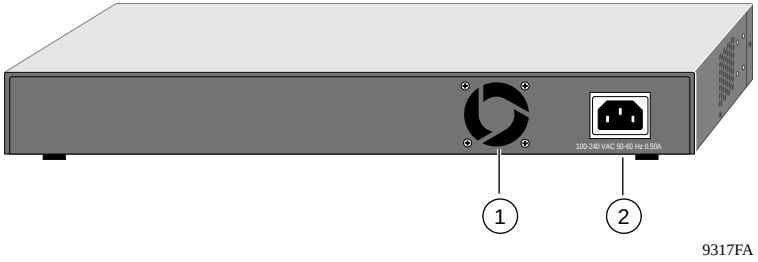
Table 2-1 describes each LED on the front panel of the Model FS518 switch.

Table 2-1. LED Descriptions

Label	Color	Activity	Description
Power	Green	On	Power is supplied to the switch.
		Off	Power is disconnected.
RX/TX	Green	Blinking	Packet transmission or reception is occurring on the port. The blinking action corresponds to the number of packets that are transmitted or received.
		Off	No packet transmission or reception is occurring on the port.
FDX/COL	Green	On	A full-duplex link is established on the port.
	Yellow	On	A half-duplex link is established on the port, and the port is experiencing collisions. (Note that occasional collisions are normal.)
		Off	No full-duplex link is established, or no collisions are occurring on the port when operating in half-duplex mode.
100M Link (located at the top left corner of each 10/100 Mbps UTP port)	Green	On	A valid 100 Mbps link is established on the port.
		Off	No 100 Mbps link is established on the port.
10M Link (located at the top right corner of each 10/100 Mbps UTP port)	Green	On	A valid 10 Mbps link is established on the port.
		Off	No 10 Mbps link is established on the port.
1000 Mbps Link (located to the right of the fiber connector)	Green	On	A valid 1000 Mbps link is established on the port.
		Off	No 1000 Mbps link is established on the port.

Rear Panel

As illustrated in Figure 2-4, the rear panel of the Model FS518 switch has a cooling fan and a standard AC power receptacle.



Key:
1= Cooling fan
2= AC power outlet

Figure 2-4. Rear Panel of the Model FS518 Switch

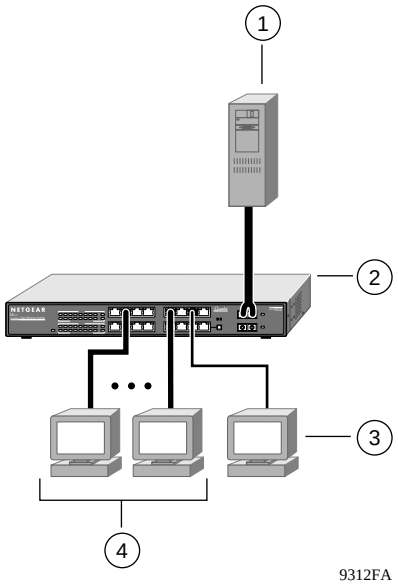
Chapter 3
Applications

This chapter presents an overview of the levels of service provided by incorporating the technology of the Model FS518 Fast Ethernet Switch into your network.

The Model FS518 switch is designed to provide flexibility in configuring your network connections. Each switch can be used as a standalone device or can be used with 10 Mbps, 100 Mbps, or 1000 Mbps hubs or other interconnection devices in various configurations. The configuration examples in this chapter illustrate the integration of the NETGEAR Model FS518 Fast Ethernet Switch with Gigabit uplinks in network environments of all sizes and types. These examples include a network of a few workstations connected to a printer or a segmented network with multiple users or workgroups and other networking devices.

Desktop Switching

Figure 3-1 illustrates the Model FS518 switch used as a desktop switch to build a small network that enables users to have Gigabit (1000 Mbps) access to a file server.



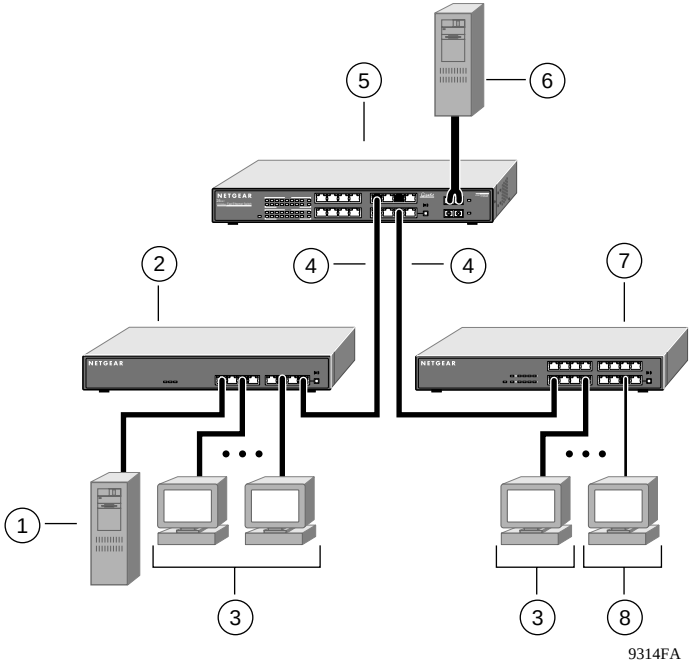
Key:
1 = Server with 2000 Mbps connection (1000 Mbps full-duplex)
2 = Model FS518 Fast Ethernet Switch (Normal/Uplink push button set to Normal position)
3 = PC with 10 Mbps connection
4 = PCs with 100 Mbps Fast Ethernet adapter cards installed

Figure 3-1. Model FS518 Switch Used as a Desktop Switch

Note: If a full-duplex adapter card is installed in the server or PC, a 2000 Mbps connection is possible on the port where the server is connected.

Segment Switching

The Model FS518 switch can segment a network into multiple connected pieces, increasing overall bandwidth and throughput. Figure 3-2 illustrates the Model FS518 switch segmenting networks that are built with a NETGEAR Model FE508 Fast Ethernet Hub and a NETGEAR Model DS516 Dual Speed Hub.



Key:
1 = Server with 100 Mbps connection
2 = Model FE508 Fast Ethernet Hub (Normal/Uplink push button set to Uplink position)
3 = PCs with network adapter installed, enabling 100 Mbps connection
4 = 100 Mbps connection
5 = Model FS518 Fast Ethernet Switch (Normal/Uplink push button set to Uplink position)
6 = Server with 2000 Mbps connection (1000 Mbps full-duplex)
7 = Model DS516 Dual Speed Hub (Normal/Uplink push button set to Uplink position)
8 = PC connected at 10 Mbps

Figure 3-2. Model FS518 Switch Used as a Segment Switch

Chapter 4
Installation

This chapter describes the installation procedures for the Model FS518 Fast Ethernet Switch.

Preparing the Site

Before you begin installing the switch, prepare the installation site. Make sure the operating environment meets the physical requirements of the switch, as described in Appendix A, "Technical Specifications."

Checking Package Contents

Unpack the contents of the package and verify them against the following list:

- NETGEAR Model FS518 Fast Ethernet Switch
- Two 25 foot (7.6 m) fiber cables
- Self-adhesive rubber footpads for desktop installation
- Rack Mount Kit for rack installation
- AC power cord
- Warranty & Owner Registration Card
- This installation guide
- Support Information Card

	**Caution:** Use the appropriate power cord as required by your national electrical codes and ordinances.

Call your reseller or customer support in your area if there are any wrong, missing, or damaged parts. Refer to the enclosed Customer Support Information Card for more information.

Keep the carton, including the original packing materials. Use them to repack the switch if you need to return it for repair.

To qualify for product updates and product warranty registration, fill in the Warranty & Owner Registration Card within 30 days of purchase and return it to NETGEAR, Inc.

Installing a Switch

To install a switch on a desktop, on another flat surface, or in a rack:

1. **Unpack the switch.**
2. **Choose a location near the devices to be connected and close to an electrical outlet.**
3. **Proceed to "Installing the Switch on a Flat Surface" or "Installing the Switch in a Rack."**

Installing the Switch on a Flat Surface

To install the switch on a desktop or any other flat surface:

1. **Install self-adhesive rubber footpads on the bottom of the switch.**

   Peel off the protective backing from the rubber pads and apply one at each marked location on the bottom of the switch.

2. **Set the switch on a desktop or any other flat surface.**

   For proper ventilation, make sure that the switch has at least 2 inches of space on each side and 5 inches of space at the back. It is very important that the fans located in the rear panel are not blocked.

Caution: Restricted airflow could cause overheating of the components.

Installing the Switch in a Rack

To mount the switch in a standard 19-inch equipment rack, you need these tools and materials:

- Two mounting brackets supplied from the Rack Mount Kit
- Eight screws supplied from the Rack Mount Kit to attach the mounting brackets to the switch
- Four screws and nylon washers supplied from the Rack Mount Kit to attach the mounting brackets to the rack
- #1 Phillips screwdriver
- #2 Phillips screwdriver

To install the switch in a rack:

1. **Attach the mounting brackets to the sides of the switch as illustrated in Figure 4-1.**

   Hold a mounting bracket against each side of the switch and align the countersunk screw holes in the bracket with the bracket mounting holes in the switch.

2. **Insert the screws provided in the Rack Mount Kit through each bracket and into the bracket mounting holes in the switch.**

3. **Using a #1 Phillips screwdriver, tighten the screws to secure each bracket.**

4. **Hold the switch with the mounting holes in the brackets aligned with the holes in the rack.**

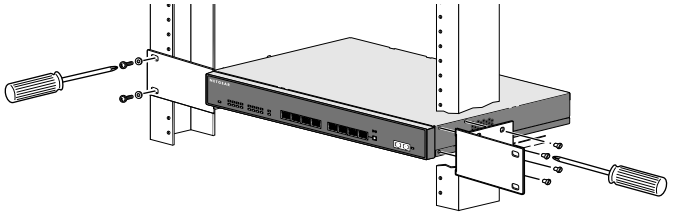


Figure 4-1. Attaching Mounting Brackets to the Model FS518 Switch

5. **Insert two pan-head screws with nylon washers through each bracket and into the rack.**
6. **Using a #2 Phillips screwdriver, tighten the screws to secure the switch to the rack.**

   For proper ventilation, make sure that the switch has at least 2 inches of space on each side and 5 inches of space at the back. It is very important that the fans located in the rear panel are not blocked.

	Caution: Restricted airflow could cause overheating of the components.

To connect additional switches or other devices, refer to "Connecting Devices to the Switch."

Connecting Devices to the Switch

To connect devices to the switch:

1. **Connect the devices to the 10/100 Mbps ports on the switch, using Category 5 UTP cable.**

	**Note:** Ethernet specifications limit the cable length between your PC or server and the switch to 328 feet (100 meters) in length.

2. **Connect one end of the fiber cable to the Gigabit uplink port and the other end to the linking server or network device.**

	**Note:** Gigabit Ethernet fiber cable lengths are 260 m with 62.5 µm multimode fiber and 525 m with 50 µm multimode fiber.

   Ensure that the Tx (transmit data) Gigabit fiber connector of the Model FS518 switch is attached to the Rx (receive data) Gigabit fiber connector of the remote partner using one of the pairs of the fiber cable, as illustrated in Figure 4-2. Be sure that the Rx Gigabit fiber connector of the switch is attached to the Tx Gigabit fiber connector of the remote partner using the other pair from the same fiber cable.

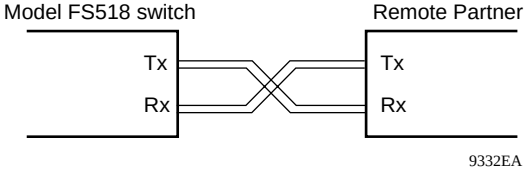


Figure 4-2. Tx/Rx Connection Between Switches

3. **Connect one end of the AC power cord to the power outlet on the rear panel of the switch and the other end of the AC power cord to the wall outlet.**

   Refer to Figure 4-3 on page 4-6 when connecting the Model FS518 switch.

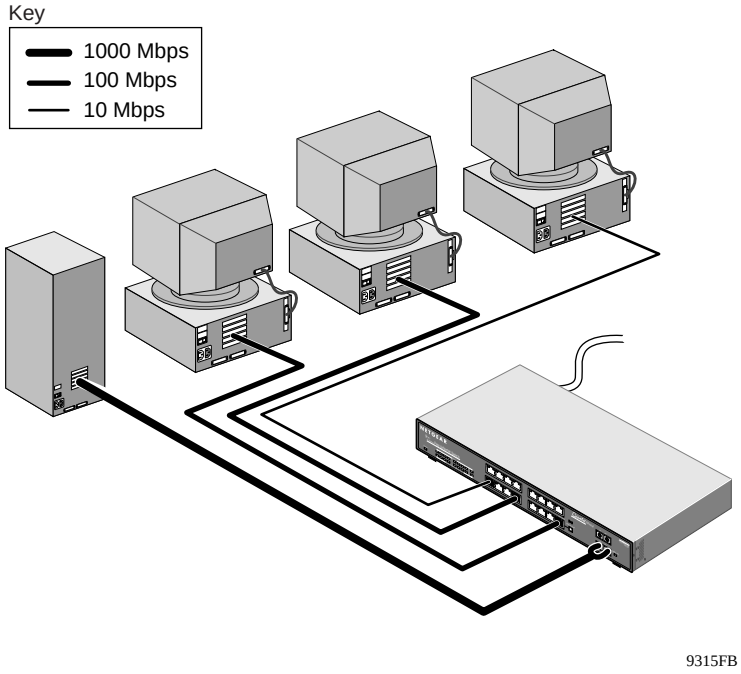


Figure 4-3. Connecting to the Model FS518 Fast Ethernet Switch

Note: The 1000 Mbps Gigabit Ethernet port always operates at full-duplex mode.

Verifying Installation

Verify network communications by ensuring that all the necessary connections have been made, that all connected resources can be accessed, and that the LED indicators on the switch are functioning properly. For additional information, refer to Chapter 5, “Troubleshooting.”

Chapter 5
Troubleshooting

This chapter provides information about troubleshooting the Model FS518 Fast Ethernet Switch. Table 5-1 lists symptoms, causes, and solutions of possible problems.

Table 5-1. Troubleshooting Information

Symptom	Cause	Solution
Power LED is off.	No power is received at the hub.	Check the power cord connections for the switch and the connected device. Check for a defective adapter card, cable, or port by testing them in an alternate environment where all products are functioning. Make sure all cables used are correct and comply with Ethernet specifications.
Either 10M, 100M, or 1000M Link LED is off or intermittent.	Port connection is not functioning.	Check the crimp on the RJ-45 connectors or fiber connectors and make sure that the plug is properly inserted and locked into the port at both the switch and the connecting device. Make sure all cables used are correct and comply with Ethernet specifications. All fiber cables must be crossover cables for proper communication between the transmit and receive signals to take place.
One or more components are malfunctioning.	Not all system components are properly installed.	Test the components in an alternate environment where all other components are functioning properly.
A segment or device is not recognized as part of the network.	One or more devices are not properly connected or cabling does not meet Ethernet guidelines.	Verify that the cabling is correct (refer to Appendix C, “Cabling Guidelines”). Be sure all cable connectors are securely positioned in the required ports. Straight-through cables should be used for all standard twisted pair connections. Make sure all devices are connected to the network. Equipment may have been accidentally disconnected.

Network Adapter Cards

Make sure the network adapter cards installed in the PCs are in working condition and the software driver has been installed.

Configuration

If problems occur after altering the network configuration, restore the original connections and determine the problem by implementing the new changes, one procedure at a time. Make sure that cable distances, repeater limits, and other physical aspects of the installation do not exceed the Ethernet limitations.

Switch Integrity

If required, verify the integrity of the switch by resetting the switch. Turn power to the switch off and then back on. If the problem continues and you have completed all the preceding diagnoses, contact your NETGEAR point-of-sale representative.

Autonegotiation

The 10/100 Mbps ports will negotiate the correct duplex mode and speed, provided the link partner supports autonegotiation. If the link partner does not support autonegotiation, only the speed will be determined correctly and the duplex mode will default to half.

The Gigabit fiber ports will negotiate duplex mode and flow control, provided that the link partner supports the autonegotiation mechanism. If not, a full-duplex, no flow controlled link will be formed by default.

Appendix A
Technical Specifications

This appendix provides technical specifications for the Model FS518 Fast Ethernet Switch.

General Specifications

Network Protocol and Standards Compatibility

ISO/IEC 802-3i 10BASE-T

IEEE 802.3u 100BASE-TX

IEEE 802.3z 1000BASE-SX

Data Rate

10 Mbps differential Manchester encoded, IEEE 802.3

100 Mbps with 4B/5B encoding and MLT-3 physical interface for 100BASE-TX

1000 Mbps with 8B/10B encoding and short wavelength optical laser interface for 1000BASE-SX

Interface

RJ-45 connector for 10BASE-T and 100BASE-TX Fast Ethernet

Duplex SC connector for 1000BASE-SX Gigabit Ethernet

Electrical Specifications

Power consumption: 45 W maximum

Physical Specifications

Dimensions:	(W) 13 by (H) 1.7 by (D) 8 in. (W) 33.0 by (H) 4.3 by (D) 20.3 cm
Weight:	5.0 lb 2.3 kg

Environmental Specifications

Operating temperature:	0° to 40° C
Storage temperature:	-32° to 104° C
Operating humidity:	90% maximum relative humidity, noncondensing
Storage humidity:	95% maximum relative humidity, noncondensing
Operating altitude:	10,000 ft (3,000 m) maximum
Storage altitude:	10,000 ft (3,000 m) maximum

Electromagnetic Emissions

Meets requirements of:

CE mark, commercial

FCC Part 15, Subpart B, Class A

EN 55 022 (CISPR 22), Class A

VCCI Class 1A

Electromagnetic Susceptibility

CE mark, commercial

Electrostatic discharge (ESD):	IEC 801-2, Level 2/3
Radiated electromagnetic field:	IEC 801-3, Level 2
Electrical fast transient/burst:	IEC 801-4, Level 2
Electrical surge:	IEC 801-5, Level 1/2

Safety Agency Approvals

CE mark, commercial

UL listed (UL 1950)

CSA certified (CSA 22.2 #950)

TUV licensed (EN 60 950)

Performance Specifications

Frame filter rate:	14,800 frames/second, maximum on 10 Mbps port 148,000 frames/second maximum on 100 Mbps port 1,480,000 frames/second maximum on 1000 Mbps port
Frame forward rate:	14,800 frames/second, maximum on 10 Mbps port 148,000 frames/second maximum on 100 Mbps port 1,480,000 frames/second maximum on 1000 Mbps port
10/100 buffer memory:	8 MB for 16 ports 4 MB for 2 ports
Gigabit buffer memory:	2 MB
Forwarding modes:	Store-and-forward
Network latency:	Less than 80 microseconds for 64-byte frames in store-and-forward mode for 10 Mbps to 100 Mbps transmission
Address database size:	8,000 media access control (MAC) addresses per system
Addressing:	48-bit MAC address
10/100 queue buffer:	256 KB queue buffer per port

Cable Specification

62.5/125 µm multimode fiber optic cable

Appendix B
Connector Pin Assignments

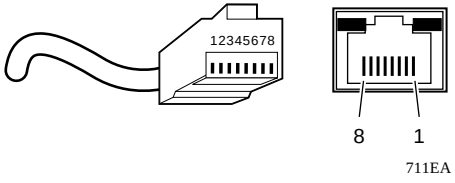
This appendix provides information about the RJ-45 plug, the RJ-45 connector, and the fiber connector used for the NETGEAR Model FS518 Fast Ethernet Switch with Gigabit uplinks.

RJ-45 Plug and Vista RJ-45 Connector

In a Fast Ethernet network, it is important that all 100BASE-T certified Category 5 cabling use RJ-45 plugs. The RJ-45 plug accepts 4-pair unshielded twisted pair (UTP) or shielded twisted pair (STP) 100 ohm cable and connects into the vista RJ-45 connector.

The vista RJ-45 connector (also referred to as a 10/100 Mbps port) is used to connect stations, hubs, and switches through UTP cable; it supports 10 Mbps or 100 Mbps data transmission.

The RJ-45 plug and vista RJ-45 connector are both illustrated in Figure B-1.



Key:
1 to 8 = pin numbers

Figure B-1. RJ-45 Plug and Vista RJ-45 Connector with Built-In LEDs

Table B-1 lists the pin assignments for the RJ-45 plug and the vista RJ-45 connector.

Table B-1. RJ-45 Plug and Vista RJ-45 Connector Pin Assignments

Pin	Normal Assignment on Ports 1 to 8	Uplink Assignment on Port 8
1	Input Receive Data +	Output Transmit Data +
2	Input Receive Data –	Output Transmit Data –
3	Output Transmit Data +	Input Receive Data +
6	Output Transmit Data –	Input Receive Data –
4, 5, 7, 8	Internal termination, not used for data transmission	

Duplex SC Plug and Duplex SC Connector

The duplex SC connector connects stations, hubs, and switches that support the 1000BASE-SX fiber interface. Each fiber link needs a clearly defined, external crossover. In other words, the transmit port of one interface must be wired to the receive port of the opposite interface and vice versa. Fiber cables must be connected in this manner to transmit and receive data.

The duplex SC connector and duplex SC plug are illustrated in Figure B-2.

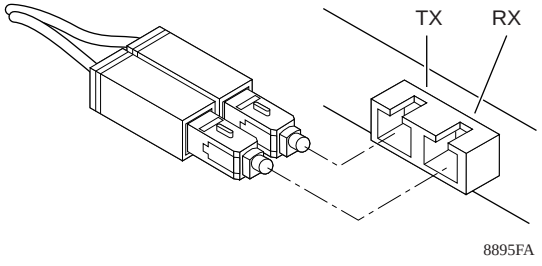


Figure B-2. Duplex SC Connector and Duplex SC Plug Connection

Warning: Fiber optic equipment can emit laser or infrared light that might injure your eyes. Never look into an optical fiber or connector port. Always assume that fiber optic cables are connected to a light source.

Appendix C
Cabling Guidelines

This appendix provides specifications for cables used with the Model FS518 Fast Ethernet Switch.

Fast Ethernet Cable Guidelines

Fast Ethernet uses UTP cable, as specified in the IEEE 802.3u standard for 100BASE-TX. The specification requires Category 5 UTP cable consisting of either two-pair or four-pair twisted insulated copper conductors bound in a single plastic sheath. Category 5 cable is certified up to 100 MHz bandwidth. 100BASE-TX operation uses one pair of wires for transmission and the other pair for receiving and for collision detection.

When installing Category 5 UTP cabling, use the following guidelines to ensure that your cables perform to the following specifications:

- Certification

  Make sure that your Category 5 UTP cable has completed the Underwriters Laboratories (UL) or Electronic Testing Laboratories (ETL) certification process.

- Termination method

  To minimize crosstalk noise, maintain the twist ratio of the cable up to the point of termination; untwist at any RJ-45 plug or patch panel should not exceed 0.5 inch (1.5 cm).

Category 5 Cable

Category 5 distributed cable that meets ANSI/EIA/TIA-568-A building wiring standards can be a maximum of 328 feet (ft) or 100 meters (m) in length, divided as follows:

- 20 ft (6 m) between the hub and the patch panel (if used)
- 295 ft (90 m) from the wiring closet to the wall outlet
- 10 ft (3 m) from the wall outlet to the desktop device

The patch panel and other connecting hardware must meet the requirements for 100 Mbps operation (Category 5). Only 0.5 inch (1.5 cm) of untwist in the wire pair is allowed at any termination point.

Category 5 Cable Specifications

Ensure that the fiber cable is crossed over to guarantee link.

Table C-1 lists the electrical requirements of Category 5 UTP cable.

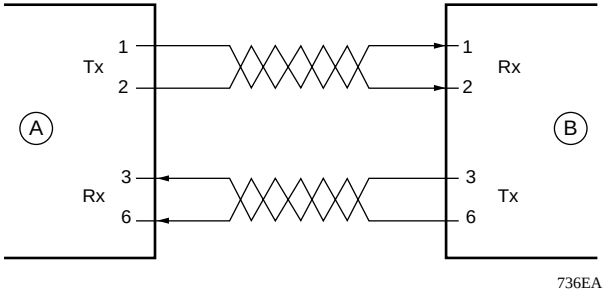
Table C-1. Electrical Requirements of Category 5 Cable

Specification	Category 5 Cable Requirements
Number of pairs	Four
Impedance	100 Ω ± 15%
Mutual capacitance at 1 KHz	≤ 5.6 nF per 100 m
Maximum attenuation (dB per 100 m, at 20° C)	at 4 MHz: 8.2
	at 31 MHz: 11.7
	at 100 MHz: 22.0
NEXT loss (dB minimum)	at 16 MHz: 44
	at 31 MHz: 39
	at 100 MHz: 32

Twisted Pair Cables

For two devices to communicate, the transmitter of each device must be connected to the receiver of the other device. The crossover function is usually implemented internally as part of the circuitry in the device. Computers and workstation adapter cards are usually media-dependent interface ports, called MDI or uplink ports. Most repeaters and switch ports are configured as media-dependent interfaces with built-in crossover ports, called MDI-X or normal ports.

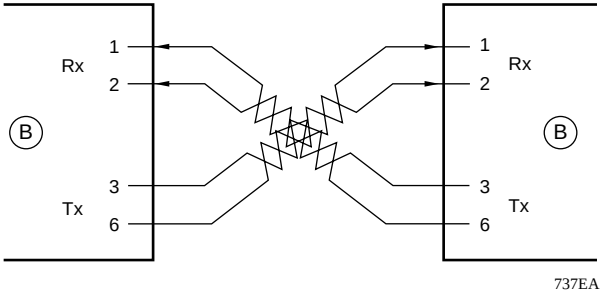
Figure C-1 illustrates straight-through twisted pair cable.



Key:
A = Uplink or MDI port (as on a PC)
B = Normal or MDI-X port (as on a hub or switch)
1, 2, 3, 6 = Pin numbers

Figure C-1. Straight-Through Twisted Pair Cable

Figure C-2 illustrates crossover twisted pair cable.



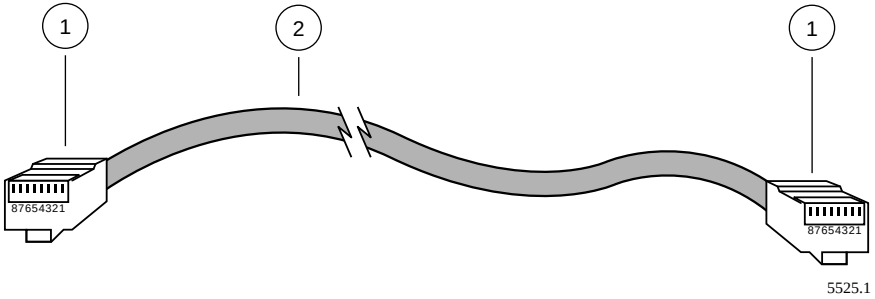
Key:
B = Normal or MDI-X port (as on a hub or switch)
1, 2, 3, 6 = Pin numbers

Figure C-2. Crossover Twisted Pair Cable

Patch Panels and Cables

If you are using patch panels, make sure that they meet the 100BASE-TX requirements. NETGEAR recommends Category 5 UTP cable for all patch cables and work area cables to ensure that your UTP patch cable rating meets or exceeds the distribution cable rating.

To wire patch panels, you need two Category 5 UTP cables with an RJ-45 plug at each end, as shown in Figure C-3.



Key:
1 = RJ-45 plug
2 = Category 5 UTP patch cable

Figure C-3. Category 5 UTP Patch Cable with Male RJ-45 Plug at Each End

Note: Flat “silver satin” telephone cable may have the same RJ-45 plug. However, using telephone cable will result in excessive collisions and cause the attached port to be partitioned or disconnected from the network.

Fiber Optic Cables

In North America, use EIA-569-A horizontal 62.5/125 µm multimode optical fiber cable (ANSI/EIA/TIA-492AAAA).

Internationally, use ISO/IEC 11801 62.5/125 µm multimode optical fiber cable (IEC 793-2 type A1b, with 1.0 db/km attenuation and 500 MHz/km bandwidth). Refer to Table C-2 for the minimum requirements of fiber optic cable.

Fiber Cable Specifications

Table C-2 lists the electrical requirements of fiber cable.

Table C-2. Electrical Requirements of Fiber Optic Cable

Specification	Fiber Optic Cable
Number of strands	Two
Cable type	62.5/125 µm multimode fiber optic cable
Numerical aperture	0.275
Total link budget	11 db
Modal band	500 MHz/km
Zero dispersion wavelength	1295 to 1365 nm
Dispersion slope	< 0.093 ps/nm^2-km

Gigabit Cable Guidelines

Table C-3 lists the distance limitations for Gigabit fiber connections.

Table C-3. Gigabit Cable Guidelines

Multimode Fiber	62.5/125 Micron	50/125 Micron
Operating Range	2 to 260 meters	2 to 525 meters

Index

Numbers

A

C

D

F

I

L

M

N

P

R

S

T

U

V

W