# Installation Guide for the Model SW108 Ethernet Switch

NETGEAR

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M-SW108NA-0
June 1997

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This is to certify that the NETGEAR Model SW108 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).

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**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.

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- Phone:

  U.S./Canada: 1-800-211-2069
  Japan: 0031-1-26133
  Europe: (44) 171-571-5120
  Australia: 1- 800-14-20-46

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  U.S./Canada: 510-498-2609

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

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# Chapter 1
# Introduction

Congratulations on your purchase of the NETGEAR™ Model SW108 8-port Ethernet Switch. The Model SW108 switch segments Ethernet networks to relieve bandwidth congestion instantly, without having to replace network wiring, interface cards, or software.

This guide describes how to install and use the switch. It includes physical configuration guidelines for connecting multiple 10 megabit per second (Mbps) hubs and for connecting 10 Mbps Ethernet stations, PCs, and servers.

## Benefits of Using Switching Technology

Most of installed networks today are based on shared network technology. With this technology, a number of users or groups of users share 10 Mbps, 100 Mbps, or other amounts of available network bandwidth (network capacity). 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, or 1 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 since it is filtered out. In this way, network capacity is fully reserved for traffic destined for that segment only, and other segments are not saturated with unnecessary traffic.

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

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

## Types of Ethernet Switches

Ethernet switches can be classified in different ways—as desktop switches or segment switches. A *desktop switch* is designed to support one or a few PCs per port. It is generally used when users 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, 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 one or 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 adaptable switch type.

## Model SW108 Switch Overview

The Model SW108 switch is a 10 Mbps switch that can be used as either a segment or a desktop switch. Its design enables it to function as a segment switching, yet its pricing makes the switch very affordable for use in desktop applications.

Up to 4 switching paths (8 paths in full-duplex mode) can be established at the same time, with each path crossing two ports, performing switching that sends packets to the appropriate port according to the destination address scanned from the packet header. This technique reduces the latency of packet transmission to 75 microseconds (µs) or less. Compared to approximately 800 µs for a bridge or 1800 µs for a router, the Model SW108 switch delivers a major improvement in the network performance.

Because the Model SW108 switch is a device functioning on the MAC layer, the switch is protocol independent and is compatible with IEEE802.3, IEEE802.3u, TCP/IP, NetWare, DECnet, and XNS protocols.

# Features

The Model SW108 switch has the following key features:

- Eight switched, 10 Mbps, Ethernet 10BASE-T ports
- Full-duplex or half-duplex mode of operation

  Full-duplex mode doubles throughput of point-to-point connections by letting individual ports transmit and receive concurrently when the connecting device also supports full-duplex mode.
- Easy plug-and-play installation with no software to configure, saving time and minimizing the potential for configuration errors
- Eight vista RJ-45 connector ports

  Each port has built-in LEDs to monitor individual port status.
- LEDs provide network traffic status and information about data transmission speed
- Normal/Uplink push button to simplify network extension

  The switch can be connected to a hub using a simple, straight-through cable.
- Compact, sturdy metal case design, which enables easy desktop, wall-mount, or under-desk installation
- Wire-speed filtering and forwarding to provide a “traffic cop” function by directing traffic to the appropriate port or network segment without slowing down the traffic
- Low latency store-and-forward transmission mode with leading edge to leading edge of less than 75 µs
- Automatic address learning function to build the packet forwarding information table.

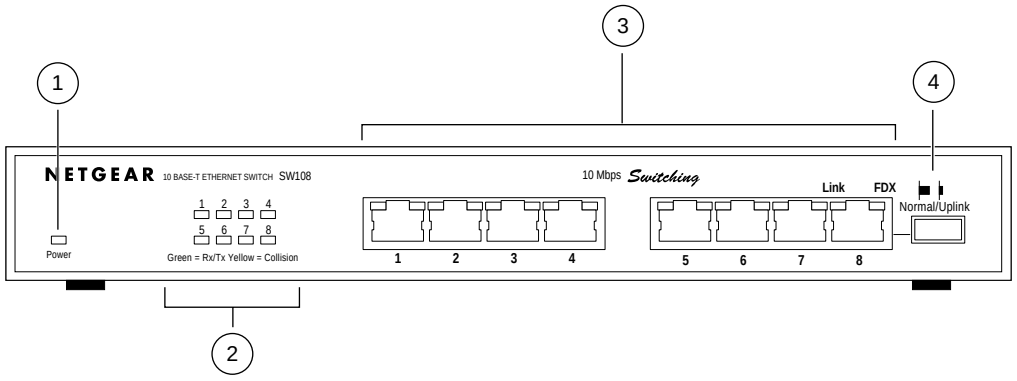
  The table contains up to 8,000 MAC addresses (that is, the switch can support networks with as many as 8,000 devices).
- One megabyte (MB) buffer provided for the 10 Mbps ports
- IEEE 802.3 10BASE-T standard compliance

# Chapter 2
# Physical Description

This chapter explains the hardware features of the NETGEAR Model SW108 Ethernet switch. It is divided into sections explaining the front and rear panels of the switch. Use the key at the bottom of each illustration to identify the panel components.

## Front Panel

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




Key:
1 = Power LED
2 = Rx/Tx and Collision LEDs for ports 1 through 8
3 =10 Mbps Ethernet ports1 through 8 with Link and FDX LEDs on each port
4 = Normal/Uplink push button to configure port 8

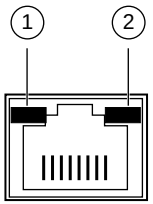
**Figure 2-1. Front panel of the Model SW108 switch**

## Ethernet Ports

The Model SW108 switch is equipped with eight 10 Mbps Ethernet ports that support one cable connection, unshielded twisted pair (UTP) cable. An eight-pin RJ-45 plug is used for connection to these ports.

Each port uses vista RJ-45 connectors that have built-in LEDs, as illustrated in Figure 2-2. The LEDs, as described in Table 2-1, indicate that the connection to the port is valid and that the port is operating in full-duplex mode.

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




Key:
1 = Link LED
2 = FDX LED

**Figure 2-2. The vista RJ-45 connector with built-in LEDs**

## Normal/Uplink Push Button

As illustrated in Figure 2-1, port 8 on the switch is equipped with a Normal/Uplink push button that allows you to select normal (MDI-X) wiring or uplink (MDI) wiring. The port is configured for normal wiring when the push button is in the out position for connection to a PC. When the push button is pressed in, the port is configured for uplink wiring for connection to another switch or a hub using simple, straight-through wiring.

## LEDs

You use LEDs on the Model SW108 switch to monitor and diagnose the devices. LEDs on the front panel of the switch and two LEDs on each port allow you to identify the following information:

- Status of the switch power supply
- Data transmission or receive activity
- Collision occurrence
- Full- or half-duplex transmission

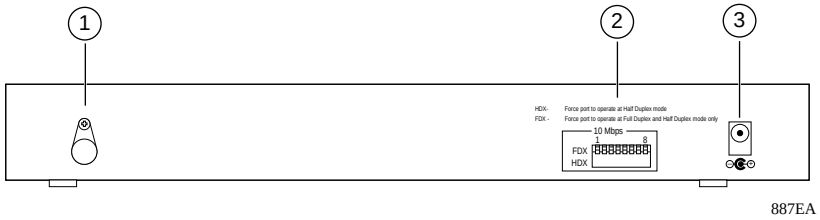
Table 2-1 describes each LED on the front panel of the switch. See Figure 2-1 for the locations of the LEDs.

**Table 2-1. LED descriptions**

| Label | Color | Activity | Description |
|---|---|---|---|
| Power | Green | On | Power is supplied to the switch. |
| | | Off | Power is disconnected. |
| Rx/Tx/Collision | Green | On or blinking | Packet transmission or reception is occurring on the port. |
| | | Off | There is no packet transmission or reception occurring on the port. |
| | Yellow | Blinking | Data collision is occurring on the port. The blinking action corresponds to the amount of collisions.<br>When a collision occurs, the connected device pauses and transmits again after waiting a specified time.<br>A moderate amount of collision is normal. |
| Link | Green | On | A valid link is established on the port. |
| | | Off | A link is not established on the port. |
| FDX | Green | On | The port is operating in full-duplex mode. |
| | | Off | The port is operating in half-duplex mode. |

# Rear Panel

As illustrated in Figure 2-3, the rear panel has full-duplex (FDX), and half-duplex (HDX) toggle switches, a ground clip, and a standard AC power receptacle.




Key:
1 = Ground clip
2 = FDX and HDX toggle switches to set the duplex mode of each 10 Mbps port
3 = AC power outlet

**Figure 2-3. Rear panel of the Model SW108 switch**

## FDX and HDX Duplex Toggle Switches

Full-duplex mode is supported for all 10 Mbps ports and allows a port to transmit and receive data at the same time. Full-duplex operation applies only to point-to-point access where the remote device also supports full-duplex. In half-duplex mode, the port can either transmit or receive data at any time, but not transmit or receive data concurrently.

As illustrated in Figure 2-3, one full-duplex (FDX) and half-duplex (HDX) toggle switch is assigned to each 10 Mbps port on the switch to set the communication mode to either full-duplex or half-duplex mode.

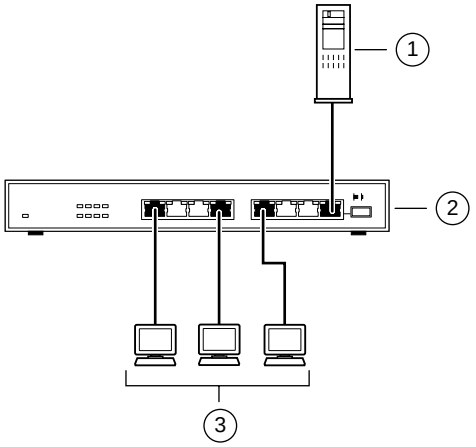
# Chapter 3
# Applications

This chapter presents an overview of the levels of service provided by incorporating the technology of the NETGEAR Model SW108 Ethernet switch into your network.

The Model SW108 Ethernet 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 hubs or other interconnection devices in various configurations. The configuration examples in this chapter illustrate the integration of the switches in network environments of all sizes and types. These examples include a network of a few workstations connected to a printer or in a segmented network with multiple users or workgroups and other networking devices.

# Desktop Switching

Figure 3-1 illustrates the Model SW108 switch used as a desktop switch to build a small network that enables users to have 10 Mbps access to a file server.



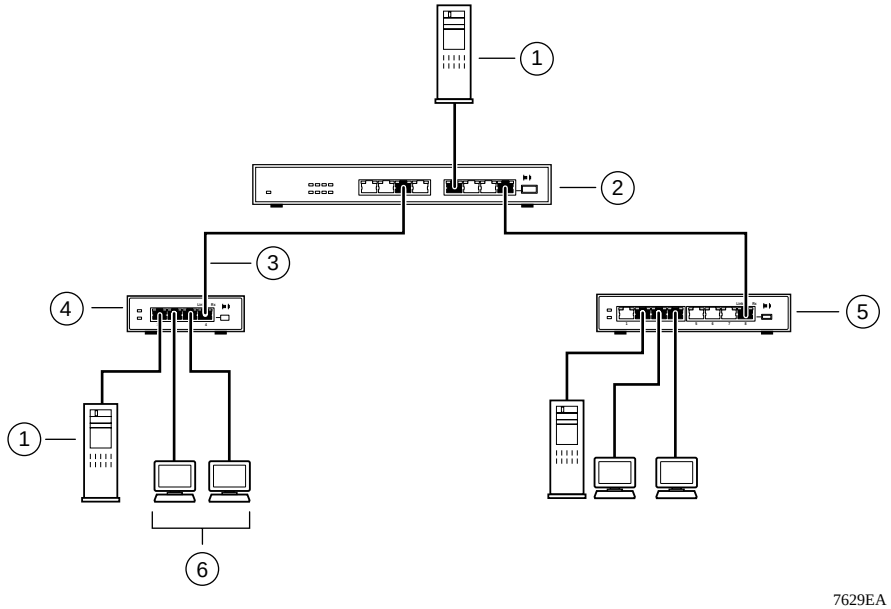

Key:
1 = Server with 10 Mbps connection
2 = Model SW108 Ethernet switch (Normal/Uplink push button set to Normal position)
3 = PCs with 10 Mbps connection

**Figure 3-1. Using the Model SW108 switch for desktop switching**

**Note:** If a full-duplex adapter card is installed in the server or PC, a 20 Mbps connection is possible on the port where the server or PC is connected.

# Segment Switching

The Model SW108 switch can segment a network into multiple connected pieces, increasing overall bandwidth and throughput. Figure 3-2 illustrates the Model SW108 Ethernet switch segmenting networks that are built with the NETGEAR Model EN104 and Model EN108 Ethernet hubs.




Key:
1 = Server with 10 Mbps connection
2 = Model SW108 Ethernet switch (Normal/Uplink push button set to Normal position)
3 =10 Mbps connection
4 = Model EN104 Ethernet hub (Normal/Uplink push button set to Uplink position)
5 = Model EN108 Ethernet hub (Normal/Uplink push button set to Uplink position)
6 = PCs with 10 Mbps connection

**Figure 3-2. Model SW108 switch used as a segment switch**

# Chapter 4
# Installation

This chapter provides information about installing the Model SW108 Ethernet switch and information about verifying installation.

## Preparing the Site

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

## Package Contents

This package should contain the following items:

- Model SW108 Ethernet switch
- DC power adapter
- Warranty and Owner Registration Card
- This installation guide

Call your reseller or customer support in your area if there are any wrong, missing, or damaged parts. Refer to page iii for the location of customer support in your area.

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 registrations, fill in the Warranty and Owner Registration Card within 30 days of purchase and return it to NETGEAR, Inc.

## Installing the Switch on a Desktop

Choose a location near the devices to be connected and close to an electrical outlet. Set the switch on a desktop or tabletop, allowing at least two inches (5 cm) of space on all sides to prevent restriction of airflow.

## Connecting Devices to the Switch

Before connecting the switch, refer to Chapter 3, "Applications," for information to help you determine the appropriate configuration for your networking needs.

To connect the switch, follow these steps:

1. **Connect the devices to the ports on the switch, using Category 5 UTP cable and an RJ-45 plug.**
2. **Set the Normal/Uplink push button.**

   The Normal/Uplink push button eliminates the need to use a crossover twisted pair cable for daisy-chaining or cascading. Use the following guidelines to configure port 1 on the Model SW108 switch:

   - Configure the port for normal wiring if the port is to be connected to an uplink-wired device, such as a network station or a PC.
   - Configure the port for uplink wiring if the port is to be connected to a normal-wired device, such as a hub or another switch.

   The remaining (normal) ports on the Model SW108 switch cannot be configured for uplink wiring. If you are using one of these ports to connect to another normal port, you must use a crossover twisted pair cable to connect the two ports. Refer to Appendix C, "Cabling Guidelines," for information about crossover twisted pair cable and straight-through twisted pair cable.

3. **Set the FDX or HDX toggle switches on the rear panel for the selected duplex mode.**

   A hub and repeater use a common collision domain for all communications and cannot support full-duplex mode. When connecting any of the 10 Mbps ports on the switch to a hub, set the port to HDX. When connecting to a PC, a server, or another switch, the duplex setting for the port must be the same as the duplex setting on the PC, server, or other switch.

**Note:** Whenever a port changes between FDX and HDX mode, the Model SW108 switch resets and traffic in all ports temporarily stops. When the switch resets, the list of learned addresses is not affected.

4. **Connect one end of the DC power adapter cable to the power outlet on the rear panel of the switch and the other end of the power adapter cable to the wall outlet.**

## Verifying Installation

When the installation is complete and power has been applied to the switch, the following conditions should exist:

- The Power LED on the front panel is on.
- The Link LED on each connected port is on.
- The Rx/Tx/Collision LED on the connected port blinks green when data is being received by the port and blinks yellow when data collision is occurring on the port.

If you encounter any problems, refer to Chapter 5, “Troubleshooting.”

# Chapter 5
# Troubleshooting

This chapter provides information about troubleshooting the NETGEAR Model SW108 Ethernet switch.

## Troubleshooting the Switch and the Network

To troubleshoot the switch and the network, refer to Table 5-1.

**Table 5-1. Troubleshooting**

| Symptom | Activity | Check |
|---|---|---|
| No power at switch | Power LED off | Check the power cord connections and make sure the ends are properly plugged into the switch and the wall outlet. |
| Rx/Tx Collision LED blinking | Blinking yellow | Data collisions are normal on Ethernet networks and occur when two or more computers transmit data on the network simultaneously. Computers that caused the collision retry transmission at different intervals until the transmission succeeds. Excessive collisions can result when multiple switches are connected and when many computers are connected on the network. Incorrect cabling, connectors, wiring techniques, and mismatched duplex operating mode settings are other causes for excessive collisions. |
| When configured to operate in full-duplex mode, the port is operating in half-duplex mode | FDX LED off | The connected device may not be able to operate at half-duplex or may not have the ability to signal the operating mode. Verify that the connected device is operational. |

**Table 5-1. Troubleshooting (continued)**

| Symptom | Activity | Check |
|---|---|---|
| Port connection not functioning | Link LED off or intermittent | After the cabling has been installed, if the Link LED is not lit on an active port, check the attached device and make sure that it is powered on and there is a proper UTP connection at that end. Also make sure that the proper cable is installed, and check for miswired cable pairs or loose connectors.<br>If the Link LED is on intermittently, check the port termination at both the switch and device ends. Check the crimp on the RJ-45 connectors.<br>Check that the length of the UTP cable from the switch to the device does not exceed 328 feet (100 meters). Using cable test equipment, check that the cable meets the specifications as required by the 10BASE-T standard. Refer to Chapter C, “Cabling Guidelines,” for information on cable specifications.<br>Make sure the network adapter card installed in the PC is in working condition.<br>Make sure that there is power to both the switch and the connected PC. |
| Problems with port 8 on the Model SW108 switch | Link LED off | Check the Normal/Uplink push button on the front panel.<br>If you are using a straight-through cable connected to a PC or other MDI-wired device, make sure the Normal/Uplink push button is set in the Normal position.<br>If you are using a straight-through cable connected to a router or another switch, make sure the Normal/Uplink push button is set in the Uplink position.<br>Try the alternate position of the Normal/Uplink push button to turn the Link LED on.<br>Refer to Chapter C, “Cabling Guidelines,” for cable information. |

# Appendix A
# Technical Specifications

This appendix provides technical specifications for the NETGEAR Model SW108 switch.

## General Specifications

### Network Protocol and Standard

ISO/IEC 802-3 (ANSI/IEEE 802.3i 10BASE-T, Ethernet

### Data Rate

10 Mbps Manchester encoded

### Interface

RJ-45 connector for 10BASE-T Ethernet interface

### Electrical Specifications

| | |
|---|---|
| Power Consumption: | 12.7 W |
| Input Voltage: | 12 V dc |

### Physical Specifications

| | |
|---|---|
| Dimensions: | (W) 9.3 by (H) 1.1 by (D) 4.1 in.<br>(W) 23.5 by (H) 2.7 by (D) 10.3 cm |
| Weight: | 1.61 lb.<br>.73 kg |

### Environmental Specifications

| | |
|---|---|
| Operating temperature: | 0° to 40° C (32° to 104° F) |
| Storage temperature: | -25° to 70° C (-13° to 158° F) |
| Operating humidity: | 80% 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, Class A

EN 55 022 (CISPR 22), Class A

VCCI Class 1 ITE

### Electromagnetic Susceptibility

CE mark, commercial

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

### Safety Agency Approvals for Power Adapter

CE mark, commercial

UL listed (UL 1950**)**

CSA certified (CSA 22.2 #950)

TUV licensed (EN 60 950)

T-Mark

### Performance Specifications

| | |
|---|---|
| Frame filter rate: | 14,800 frames/second, maximum |
| Frame forward rate: | 14,800 frames/second, maximum |
| Network latency: | Less than 75 microseconds for 64-byte frames in store-and-forward mode |
| Address database size: | 8,000 media access control (MAC) addresses per port |
| Addressing: | 48-bit MAC address |
| Queque buffer: | 1 MB of buffer space for all 8 ports |

# Appendix B
# Connector Pin Assignments

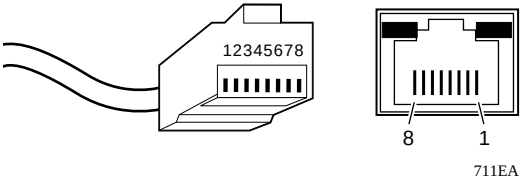
This appendix provides information about the RJ-45 connector used for the NETGEAR Model SW108 Ethernet switch.

## RJ-45 Plug and vista RJ-45 Connector

The RJ-45 plug accepts 4-pair unshielded twisted pair (UTP) or shielded twisted pair (STP) 100 Ω cable and connects into the vista RJ-45 connector.

The vista RJ-45 connector (also referred to as a 10 Mbps port) is used to connect stations, hubs, and switches through UTP cable and supports 10 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 | Uplink assignment* |
|---|---|---|
| 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 | |

* Applicable to port1 on the Model SW108 switch, when the Normal/Uplink push button is in the Uplink position.

# Appendix C
# Cabling Guidelines

This appendix provides information on the cable specifications and guidelines for Category 5 UTP cabling used with the NETGEAR Model SW108 Ethernet switch.

## Ethernet Technology

When 10BASE-T technology was originally introduced, multiple repeaters were frequently used to build large networks. To increase the number of connections, repeaters were connected together because individual repeater port densities were often limited to 8 to 24 ports. As structured wiring systems were implemented, horizontal wiring from the wiring closet to the desktop was designed for a maximum distance of 100 meters. Stackable repeaters eliminated the need for collision domains to extend over multiple repeater hubs.

## Cable Specifications

For 10 Mbps connections, Category 3, 4, or 5 cable can be used; however, NETGEAR highly recommends Category 5 cable. Category 5 cable will prevent unnecessary expense or confusion if you upgrade to Fast Ethernet.

Table C-1 lists the electrical requirements of the Category 3, 4, and 5 cables.

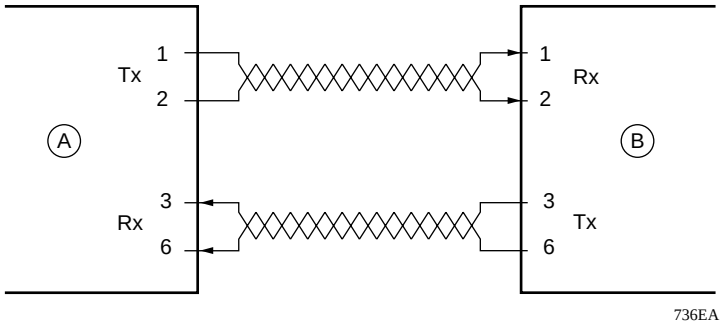
**Table C-1. Electrical requirements of Category 3, 4, and 5 cables**

| Specification | Category 3 | Category 4 | Category 5 |
|---|---|---|---|
| Number of pairs | Four | Four | Two or Four |
| Impedance | 100 Ω ± 15% | 100 Ω ± 15% | 100 Ω ± 15% |
| Mutual capacitance at 1 KHz | ≤6.6 nF per 100 m | ≤5.6 nF per 100 m | ≤5.6 nF per 100 m |
| Maximum attenuation (dB per 100 m, at 20° C) | at 4 MHz: 5.6<br>at 10 MHz: 9.8<br>at 16 MHz: 13.1 | at 4 MHz: 4.3<br>at 10 MHz: 7.2<br>at 16 MHz: 8.9 | at 16 MHz: 8.2<br>at 31 MHz: 11.7<br>at 100 MHz: 22 |
| NEXT loss (dB minimum) | at 4 MHz: 32<br>at 10 MHz: 26<br>at 16 MHz: 23 | at 4 MHz: 47<br>at 10 MHz: 41<br>at 16 MHz: 38 | at 16 MHz: 44<br>at 31 MHz: 39<br>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.

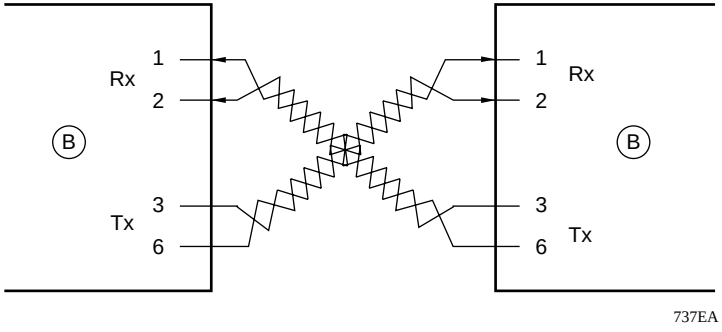
Figure C-1 illustrates straight-through twisted pair cable connections.




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 = Connector pins

**Figure C-1. Straight-through twisted pair cable**

Figure C-2 illustrates crossover twisted pair cable connections.




Key:
B = Normal or MDI-X port (As on a hub or switch)
1, 2, 3, 6 = Connector pins

**Figure C-2. Crossover twisted pair cable**

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