



CHAPTER 5

WAVE Inline Network Adapter

This chapter describes the Cisco WAVE inline network adapter and contains the following sections:

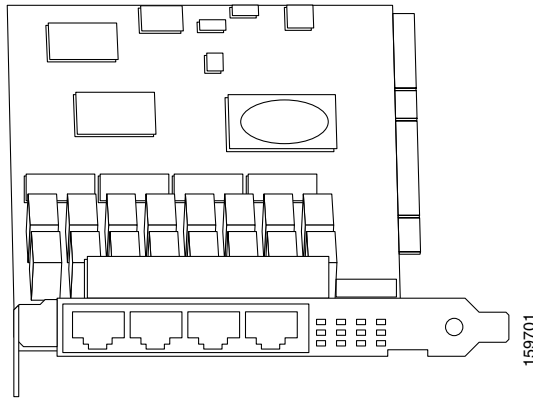
- [Inline Network Adapter Description, page 5-1](#)
- [Ports and LED Indicators, page 5-3](#)
- [Inline Network Adapter Cabling Requirements, page 5-4](#)
- [Installation Scenarios and Cabling Examples for Fast Ethernet Connections, page 5-8](#)

For information on installing an inline adapter in your WAVE-574, see the [“Installing a Cisco WAVE Inline Adapter”](#) section on page 4-3.

For adapter specifications, see [Table A-2](#) in Appendix A.

Inline Network Adapter Description

The WAVE appliance supports one optional 2-port Gigabit Ethernet inline network adapter or one optional 4-port Gigabit Ethernet inline network adapter. The inline network adapter is a full-height, three-quarter-length PCI Express network interface card that contains two or four independent Gigabit Ethernet ports. (See [Figure 5-1](#).)

Figure 5-1 4-Port Inline Network Adapter

The Cisco WAVE inline network adapter provides an inline traffic interception capability for your appliance. When you configure the WAVE appliance for inline interception mode, you can set attributes to control which interfaces are to be used over which VLANs. By default, the adapter operates on all inline-capable interfaces and VLANs. You can configure the inline redirection feature using the WAAS CLI or the WAAS Central Manager GUI.

**Note**

Throughout this section, we refer to a WAVE appliance configured for inline interception mode as a *WAVE inline appliance*.

The WAAS software defines two new interface types: A group interface that represents an inline pair grouping and a port interface that represents the individual port. These interfaces are referred to as inlineGroup and inlinePort.

InlineGroup interfaces are numbered using the format slot/group. The slot number is the slot in which the adapter is inserted. The group number is either 0 or 1 (each adapter has 2 group pairs). The group number is displayed on the adapter label.

InlinePort interfaces are numbered slot/group/lan or slot/group/wan. The last attribute is the LAN or WAN designator.

The inline network adapter also includes an onboard programmable watch dog timer (WDT) controller that allows you to set the time to wait after a failure event, such as a power outage or a kernel crash, before the unit begins to operate in mechanical bypass mode. In mechanical bypass mode, the traffic is bridged between the LAN and WAN ports of each group. Mechanical bypass mode

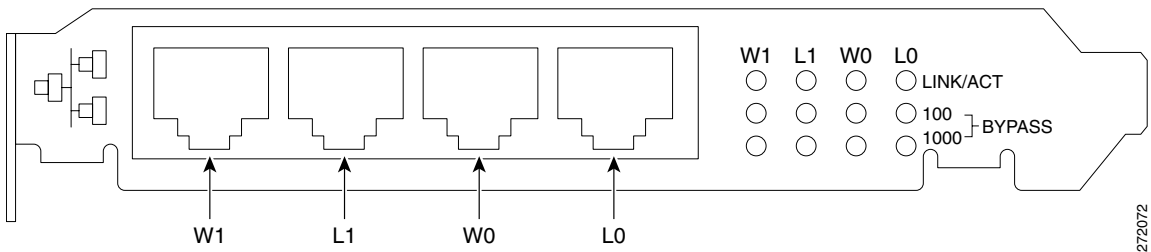
prevents the WAVE appliance from becoming a single point of failure and allows traffic to continue to flow between the router and the client while it passes through an unresponsive WAVE appliance without being processed.

For more information about configuring the inline network adapter, see the *Cisco Wide Area Application Services Configuration Guide*.

Ports and LED Indicators

Figure 5-2 shows the 4-port inline network adapter port numbers, interface designations, and LEDs. The 2-port adapter is similar, but has only two ports and two sets of LEDs.

Figure 5-2 4-Port Inline Network Adapter Port Numbering and LEDs



W1	Port WAN1; Group 1 WAN interface	L1	Port LAN1; Group 1 LAN interface
W0	Port WAN0; Group 0 WAN interface	L0	Port LAN0; Group 0 LAN interface

The inline network adapter has three LEDs that correspond to each port (the W1 LEDs correspond to Port W1, and so forth). Table 5-1 describes the LEDs.

Table 5-1 *Inline Network Adapter LEDs*

LEDs	State	Description
Link / Activity	On	The 10/100/1000BASE-T interface is receiving power.
	Blinking	The Ethernet link is transmitting data.
100	On	The speed of the Ethernet connection is 100BASE-TX.
1000	On	The speed of the Ethernet connection is 1000BASE-TX.
Bypass	Both the 100 and 1000 LEDs are on	The corresponding ports are in mechanical bypass mode.

Inline Network Adapter Cabling Requirements

The inline network adapter ships with two types of cables: crossover and straight-through. When you connect the WAVE inline network adapter, the cable that you use depends on the link speed (Gigabit Ethernet or Fast Ethernet) and the types of devices (DCE or DTE) being connected.



Note

You must retain the same link speed from one end of the connection to the other end. Inline adapter interfaces are able to autonegotiate link speeds. If you configure any of your connecting interfaces for Fast Ethernet (whether on a switch or a router), your WAVE inline adapter uses Fast Ethernet. If you configure any of your connecting interfaces for Gigabit Ethernet, your WAVE inline adapter uses Gigabit Ethernet. Speed and duplex settings are port specific so that two inline ports can negotiate different speeds independently.

If you are connecting a WAVE inline appliance between two devices using Gigabit Ethernet, you can use either straight-through cables, crossover cables, or any combination of the two cable types, regardless of the type of device. However, for consistency, we recommend that you use straight-through cables for all Gigabit Ethernet connections.

[Table 5-2](#) shows the cable requirements for WAVE appliance and non-WAVE appliance connections when you are using Gigabit Ethernet end to end.

Table 5-2 *Cable Requirements for WAVE Connections Using Gigabit Ethernet*

Connection	Required Cable
Switch to switch (no WAVE)	Crossover or straight-through
Switch to router (no WAVE)	Crossover or straight-through
Router to router (no WAVE)	Crossover or straight-through
Switch to WAVE and	Crossover or straight-through
WAVE to Router	Crossover or straight-through
Switch to WAVE and	Crossover or straight-through
WAVE to Switch	Crossover or straight-through
Router to WAVE and	Crossover or straight-through
WAVE to Router	Crossover or straight-through
WAVE to WAVE	Crossover or straight-through

Some switches support automatic medium-dependent interface crossover (MDIX). You can configure MDIX by using the **mdix auto** global configuration switch command. If your switch supports MDIX, you do not need to follow these cabling rules because MDIX automatically adjusts transmit and receive pairs when an incorrect cable type (crossover or straight-through) is installed on a 10/100 Fast Ethernet port. However, when you configure MDIX, you must also configure the port to use autosense (not manual selection of speed/duplex).

**Caution**

If you are connecting to Fast Ethernet ports on both the LAN and the WAN sides of the WAVE inline appliance, you must consider the types of devices that are being connected, and you must use the correct cables. You must follow these cabling instructions for the inline network adapter to work properly. (See [Table 5-3](#). For illustrations and examples, see the “[Installation Scenarios and Cabling Examples for Fast Ethernet Connections](#)” section on page 5-8.)

To connect the inline network adapter using the correct cables for Fast Ethernet connections, follow these steps:

- Step 1** Determine the type of cable that you would use for a direct connection between your two end devices (without a WAVE inline network appliance connected between them) by using the following standard cabling rules:
- When you are directly connecting two network devices that are similar, such as two switches, use a crossover cable.
 - When you are directly connecting two network devices that are different, such as a switch and router, use a straight-through cable.



Note Because the inline network adapter has an internal crossover connection that becomes active when the InlineGroup interface is placed in mechanical bypass mode, you must decide which cable you would use to connect the two network devices directly, and then you must install the other cable type (on one side, usually the WAN side of the inline appliance) instead.

Table 5-3 shows the cable requirements for WAVE and non-WAVE connections when you are using Fast Ethernet end to end.

Table 5-3 *Cable Requirements for WAVE Connections Using Fast Ethernet*

Connection	Required Cable
Switch to switch (no WAVE)	Crossover
Switch to router (no WAVE)	Straight-through
Router to router (no WAVE)	Crossover
Switch to WAVE and	Straight-through
WAVE to Router	Crossover
Switch to WAVE and	Straight-through
WAVE to Switch	Straight-through

Table 5-3 *Cable Requirements for WAVE Connections Using Fast Ethernet (continued)*

Connection	Required Cable
Router to WAVE and	Straight-through
WAVE to Router	Straight-through
WAVE to WAVE	Crossover

Step 2 Connect Fast Ethernet ports on both the LAN and the WAN sides of the WAVE inline appliance by using the following cable types:

- On the LAN side of the connection, use a straight-through cable between the WAVE inline appliance and the network device.
- On the WAN side of the connection, use the cable that is different from the cable that you would use to connect the two network devices directly (as determined in [Step 1](#)).

For example, if you are connecting a router and a switch (two different devices) through the WAVE inline appliance, use a straight-through cable on the LAN side of the connection and use a crossover cable on the WAN side of the connection. (If you were connecting the two different devices directly, you would use a straight-through cable, so use the crossover cable instead.)

If you are connecting two switches (or two similar devices), use straight-through cables on both the LAN and the WAN sides of the WAVE inline appliance.

[Figure 5-3](#) through [Figure 5-5](#) show which cables to use for the WAVE LAN and WAN connections between Fast Ethernet ports.

Installation Scenarios and Cabling Examples for Fast Ethernet Connections

WAVE appliances can be installed physically between two network devices (such as the branch office router and branch office LAN switch) by connecting the WAVE inline network adapter ports to the network devices using the proper cables.

If you are connecting a WAVE inline appliance between two devices using Gigabit Ethernet, you can use either straight-through cables, crossover cables, or any combination of the two cable types, regardless of the type of device. This section shows cabling examples for Fast Ethernet connections only, because Fast Ethernet has specific cabling requirements.

The inline network adapter has four ports that are divided into two inline groups (see the “[Ports and LED Indicators](#)” section on page 5-3). The WAVE appliance can be physically placed inline between two distinct network paths, creating redundant WAN links. (See [Figure 5-3](#).)

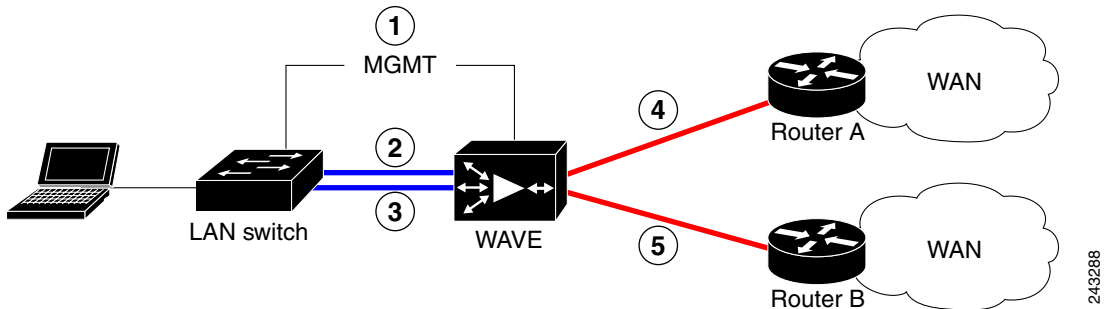
Two WAVE appliances with inline network adapters can also be installed back-to-back in a serial fashion between two network devices for failover purposes. In this serial cluster configuration, if one WAVE appliance fails, the other WAVE appliance can provide optimization. (See [Figure 5-4](#).)



Note

When you connect two WAVE inline appliances to each other serially, always use a crossover cable between the two WAVE appliances. (See [Figure 5-5](#).)

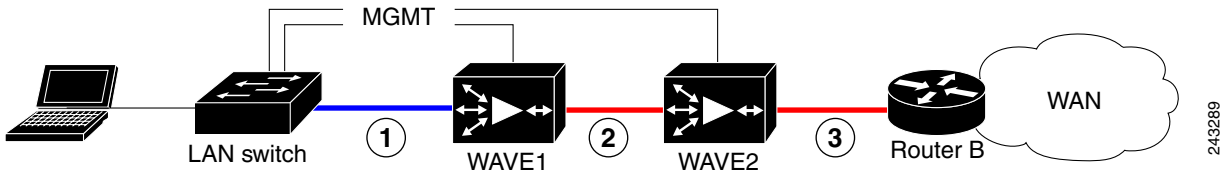
Figure 5-3 Cabling for a Single Inline WAVE Appliance with Redundant WAN Connections



243288

1	Connection: Management Gigabit Ethernet: 1/0 Cable type: Straight-through (recommended)	2	Connection: WAVE to LAN switch (using InlineGroup 1/0) Fast Ethernet: LAN0 (InlinePort 1/0/lan) Cable type: Straight-through
3	Connection: WAVE to LAN switch (using InlineGroup 1/1) Fast Ethernet: LAN1 (InlinePort 1/1/lan) Cable type: Straight-through	4	Connection: WAVE to WAN router A (using InlineGroup 1/0) Fast Ethernet: WAN0 (InlinePort 1/0/wan) Cable type: Crossover
5	Connection: WAVE to WAN router B (using InlineGroup 1/1) Fast Ethernet: WAN1 (InlinePort 1/1/wan) Cable type: Crossover		

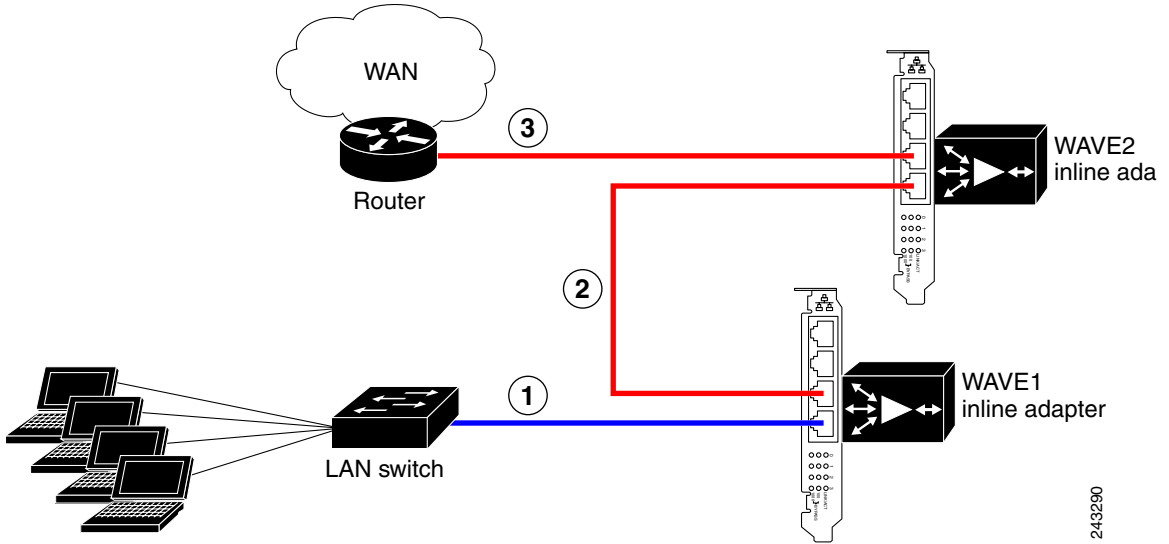
Figure 5-4 Cabling for Serial Cluster Inline WAVEs with a Single WAN Connection



243289

1	Connection: WAVE 1 to LAN switch Fast Ethernet: LAN0 (InlinePort 1/0/lan) Cable type: Straight-through	2	Connection: WAVE 1 to WAVE 2 Fast Ethernet: WAVE1 WAN0 (InlinePort 1/0/wan) to WAVE 2 LAN0 (InlinePort 1/0/lan) Cable type: Crossover
3	Connection: WAVE 2 to WAN router Fast Ethernet: WAVE 2 WAN0 (InlinePort 1/0/wan) Cable type: Crossover		

Figure 5-5 Cabling Between Two Inline WAVEs



243290

1	<p>Connection: WAVE 1 to LAN switch</p> <p>Fast Ethernet: WAVE 1 LAN0 (InlinePort 1/0/lan)</p> <p>Cable type: Straight-through</p>	2	<p>Connection: WAVE 1 to WAVE 2</p> <p>Fast Ethernet: WAVE 1 WAN0 (InlinePort 1/0/wan) to WAVE 2 LAN0 (InlinePort 1/0/lan)</p> <p>Cable type: Crossover</p>
3	<p>Connection: WAVE 2 to WAN router</p> <p>Fast Ethernet: WAVE 2 WAN0 (InlinePort 1/0/wan)</p> <p>Cable type: Crossover</p>		

