



Cabling the MGX RPM Back Cards

This chapter provides an overview of the RJ45-4E and FE back card functionality, cabling, and connectors as well as procedures for making back card connections. It contains the following sections:

- [MGX-RJ45-4E and MGX-RJ45-4E/B Back Cards](#)
- [Attaching MGX-RJ45-4E and MGX-RJ45-4E/B Back Card Interface Cables](#)
- [Fast Ethernet Back Card](#)
- [FE-TX and FE-FX Back Cards](#)
- [Attaching FE Back Card Interface Cables](#)
- [FDDI Back Cards for the RPM/B](#)
- [Attaching FDDI Back Card Interface Cables](#)



Note

The RPM card within the MGX 8850 chassis supports online insertion and removal of MGX-RJ45-4E, MGX-RJ45-4E/B, and FE back cards. The ATM port adapter is internal to the RPM.



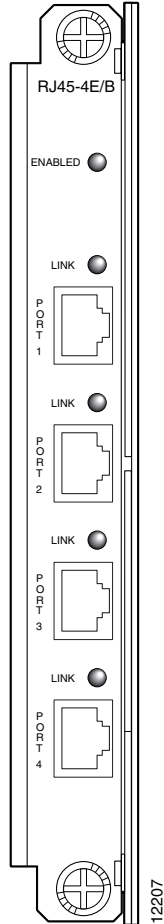
Note

RPM/B supports the MGX-RJ45-4E back card and the RPM-PR supports the MGX-RJ45-4E/B back card, a new version of the RJ45-4E. Other than a new label on the card, changes to the card are transparent to the user. Thus, the cabling and features described for the RJ45-4E back card apply for the RJ45-4E/B and vice versa, unless otherwise noted.

MGX-RJ45-4E and MGX-RJ45-4E/B Back Cards

The MGX-RJ45-4E (PA-4E) and MGX-RJ45-4E/B back cards provide up to four IEEE 802.3 Ethernet 10BaseT interfaces (see [Figure 4-1](#)).

Figure 4-1 MGX-RJ45-4E/B Ethernet Back Card



Ethernet 10BaseT Overview

Ethernet is commonly used for all carrier sense multiple access/collision detection (CSMA/CD) local-area networks (LANs), which generally conform to Ethernet specifications, including IEEE 802.3 Ethernet Version 1 and IEEE 802.3 Ethernet Version 2. The slight differences between Ethernet and IEEE 802.3 are implemented in the hardware, and both are supported automatically by the Ethernet 10BaseT back card without any hardware configuration changes. Together, Ethernet and IEEE 802.3 are the most widely used LAN protocols. They are well suited to applications where a local communication medium must carry sporadic and occasionally heavy traffic.

Nodes on a CSMA/CD LAN can access the network at any time. Before sending data, the station *listens* to the network to determine if it is in use. If it is, the station waits until the network is not in use, then transmits. A collision occurs when two stations listen for network traffic, hear none, and transmit simultaneously. When this happens, both transmissions are damaged, and the stations must retransmit. The stations detect the collision and use backoff algorithms to determine when they should retransmit.

Both Ethernet and IEEE 802.3 are broadcast networks, which means that all stations hear all transmissions. Each station must examine received frames to determine whether it is the intended destination and, if it is, pass the frame to a higher protocol layer for processing.

Each IEEE 802.3 physical layer protocol has a name that summarizes its characteristics in the format *speed/signaling method/segment length*, where *speed* is the LAN speed in Mbps, *signaling method* is either *baseband* or *broadband*, and *segment length* is the maximum length between stations in hundreds of meters.

IEEE 802.3 10BaseT Specifications

Table 4-1 summarizes the characteristics of IEEE 802.3 Ethernet and Ethernet Version 2 for 10BaseT.

Table 4-1 IEEE 802.3 and 10BaseT Ethernet Version 2 Physical Characteristics

Parameter	IEEE 802.3 Ethernet	10BaseT Ethernet
Data rate (Mbps)	10	10
Signaling method	Baseband	Baseband
Max. segment length (m)	500	100 (UTP)
Media	50-ohm coax (thick)	Unshielded twisted-pair (UTP)
Topology	Bus	Star

Table 4-2 lists the cabling specifications for 10-Mbps transmission over UTP and STP cables.

Table 4-2 Cabling Specifications for 10-Mbps Over UTP and STP Cables

Parameter	RJ-45
Cable specification	Category 3 or Category 5 UTP ¹ , 22 to 24 AWG ²
Maximum segment length	328 ft (100 m) for 10BaseT
Maximum network length	9,186 ft (2,800 m) (with 4 repeaters)

1. Cisco Systems does not supply Category 3 and Category 5 UTP RJ-45 cables; these cables are available commercially.
2. AWG = American Wire Gauge. This gauge is specified by the EIA/TIA-568 standard.



Note

The IEEE 802.3 Ethernet specifications call the RJ45-4E or RJ45-4E/B device an “end station.” The RJ45-4E and RJ45-4E/B have a built-in transceiver and connect directly to a hub or repeater.

MGX-RJ45-4E and MGX-RJ45-4E/B Back Card LEDs

The RJ45-4E and RJ45-4E/B back card contain the enabled LED, standard on all back cards, and one status LED for each port, called the “link” LED. After system initialization, the enabled LED goes on to indicate that the RJ45-4E back card has been enabled for operation. When a 10BaseT port is active, its link LED is on when a port on the RJ45-4E back card is receiving a carrier signal from the network. (See Figure 4-1.) The following conditions must be met before the enabled LED goes on:

- RJ45-4E back card is correctly connected and receiving power

- RJ45-4E-equipped card or chassis contains a valid microcode version that has been downloaded successfully
- Bus recognizes the RJ45-4E back card

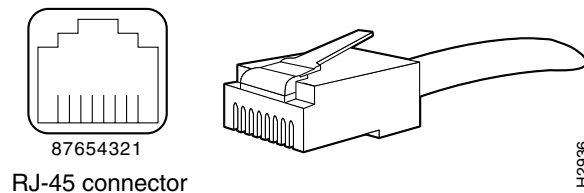
If any of these conditions is not met, or if the initialization fails for other reasons, the enabled LED does not go on.

MGX-RJ45-4E and MGX-RJ45-4E/B Back Card Receptacles and Cables

The interface connectors on the RJ45-4E back card are four individual RJ-45 receptacles. You can use all four simultaneously. Each connection supports IEEE 802.3 and Ethernet 10BaseT interfaces compliant with appropriate standards. The RJ-45 connections require external transceivers. Cisco Systems does not supply Category 5 UTP RJ-45 cables; these cables are available commercially.

Figure 4-2 shows the RJ-45 connectors. See Appendix B, “Cable and Connector Specifications” for pinouts and signals for the RJ-45 connectors.

Figure 4-2 4E RJ-45 Connections, Plug and Receptacle



Warning

The ports labeled “Ethernet,” “10BaseT,” “Console,” and “AUX” are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.

Attaching MGX-RJ45-4E and MGX-RJ45-4E/B Back Card Interface Cables

On a single MGX-RJ45-4E or e MGX-RJ45-4E/B back card, you can attach up to four RJ-45 connections.



Note

RJ-45 cables are not available from Cisco Systems; they are available from outside commercial cable vendors.

To connect RJ-45 cables to the MGX-RJ45-4E or MGX-RJ45-4E/B back card, you can

- Attach the Category 5 UTP cable (also called straight-through 10BaseT cable) directly to the RJ-45 port on the MGX-RJ45-4E or MGX-RJ45-4E/B back card to a hub or repeater.
- Attach the network end of your RJ-45 cable to your 10BaseT hub or repeater, DTE, or other external 10BaseT equipment by using one of the following cables:

- Straight-through 10BaseT cable to connect the 10BaseT port to a 10BaseT hub (see Figure 4-3).
- Crossover 10BaseT cable to connect the 10BaseT port to a PC network interface card (see Figure 4-4).

This completes the RJ45-4E back card cable installation.

Figure 4-3 Ethernet Connection to a 10BaseT Hub

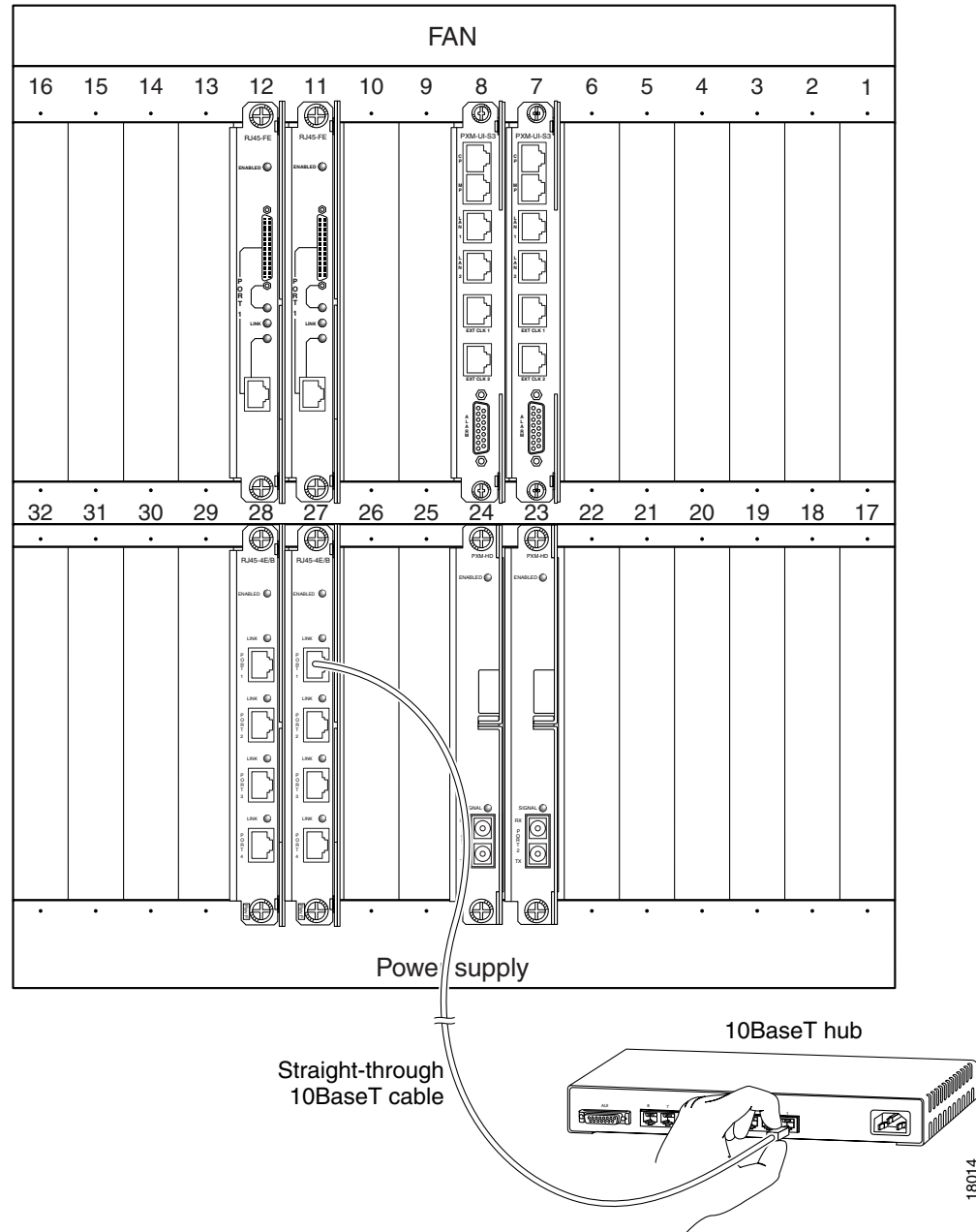
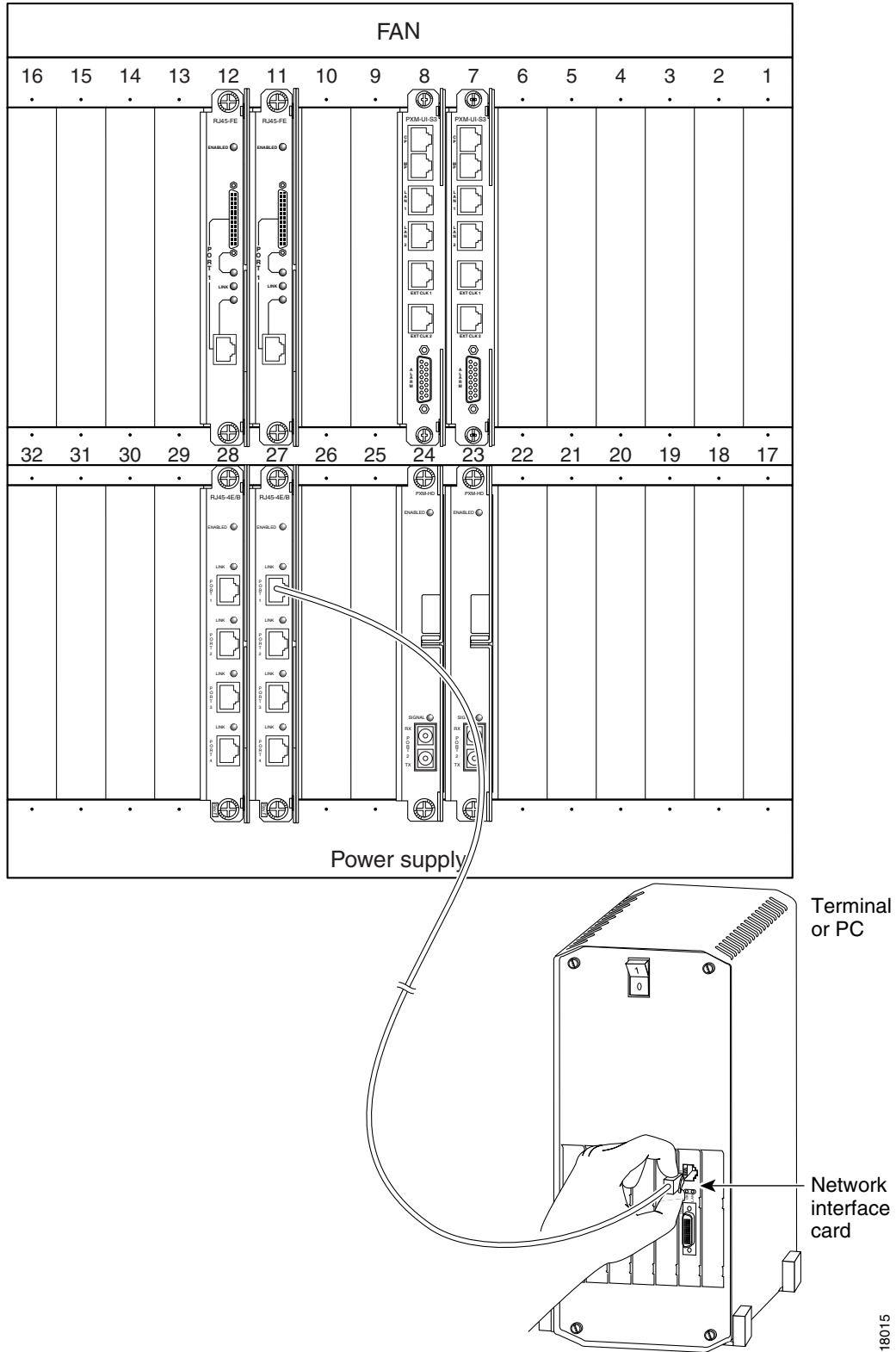


Figure 4-4 Ethernet Connection to a PC Network Interface Card



18015

Fast Ethernet Back Card

Fast Ethernet is commonly used for all carrier sense multiple access/collision detection (CSMA/CD), local-area networks (LANs) that generally conform to Ethernet specifications, including Fast Ethernet under IEEE 802.3u.

IEEE 802.3u is well suited to applications where a local communication medium must carry sporadic, occasionally heavy traffic at high peak data rates. Stations on a CSMA/CD LAN can access the network at any time. Before sending data, the station *listens* to the network to see if it is already in use. If it is, the station waits until the network is not in use, then transmits; this is a half-duplex operation. A collision occurs when two stations listen for network traffic, hear none, and transmit very close to simultaneously. When this happens, both transmissions are damaged, and the stations must retransmit. The stations detect the collision and use backoff algorithms to determine when they should retransmit.

Both Ethernet and IEEE 802.3u are broadcast networks, which means that all stations see all transmissions. Each station must examine received frames to determine whether it is the intended destination and, if it is, pass the frame to a higher protocol layer for processing.

IEEE 802.3u specifies the following physical layers for 100BaseT:

- 100BaseTX—100BaseT, half and full duplex over Category 5 unshielded twisted-pair (UTP), Electronics Industry Association/Telecommunications Industry Association [EIA/TIA]-568-compliant cable.
- 100BaseFX—100BaseT, half and full duplex over optical fiber.

Each physical layer protocol has a name that summarizes its characteristics in the format speed/signaling method/segment length, where speed is the LAN speed in megabits per second (Mbps), signaling method is the signaling method used (either baseband or broadband), and segment length is typically the maximum length between stations in hundreds of meters. Therefore, 100BaseT specifies a 100-Mbps, baseband LAN with maximum network segments.

IEEE 802.3u 100BaseT Specifications

Table 4-3 lists the cabling specifications for 100-Mbps Fast Ethernet transmission over UTP, STP, and fiber-optic cables. Table 4-4 summarizes IEEE 802.3u 100BaseT physical characteristics.

Table 4-3 Specifications and Connection Limits for 100-Mbps Transmission

Parameter	RJ-45	MII	Parameter
Cable specification	Category 5 ¹ UTP ² , 22 to 24 AWG	Category 3, 4, or 5, 150-ohm UTP or STP, or multimode optical fiber	Cable specification
Maximum cable length	—	1.64 ft (0.5 m) (MII-to-MII cable ³)	Maximum cable length
Maximum segment length	328 ft (100 m) for 100BaseTX	3.28 ft (1 m) ⁴ or 1,312 ft (400 m) for 100BaseFX	Maximum segment length
Maximum network length	656 ft (200 m) ⁴ (with 1 repeater)	—	Maximum network length

1. EIA/TIA-568 or EIA-TIA-568 TSB-36 compliant.
2. Cisco Systems does not supply Category 5 UTP RJ-45 or 150-ohm STP MII cables. Both are available commercially.
3. This cable is between the MII port on the FE back card and the appropriate transceiver.
4. This length is specifically between any two stations on a repeated segment.

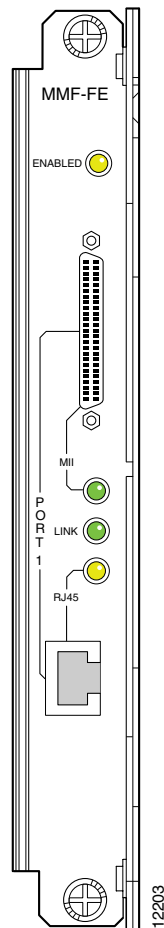
Table 4-4 IEEE 802.3u Physical Characteristics

Parameter	100BaseFX	100BaseTX
Data rate (Mbps)	100	100
Signaling method	Baseband	Baseband
Maximum segment length (meters)	100 m between repeaters	100 m between DTE ¹ and repeaters
Media	SC-type—dual simplex or single duplex for Rx and Tx	RJ-45MII
Topology	Star/Hub	Star/Hub

1. DTE = data terminal equipment.

FE-TX and FE-FX Back Cards

Figure 4-5 shows the FE back card.

Figure 4-5 Fast Ethernet Back Card

FE-TX Back Card

Each Fast Ethernet port on the FE-TX back card has an RJ-45 connector to attach to Category 5 unshielded twisted-pair (UTP) for 100BaseTX, and a MII connector that permits connection through external transceivers to multimode fiber for 100BaseFX physical media.

FE-FX Back Card

Each Fast Ethernet port on the FE-FX back card has an SC-type fiber-optic connector for 100BaseFX, and an MII connector that permits connection through external transceivers to multimode fiber for 100BaseFX physical media.

Fast Ethernet Back Card LEDs

The FE-TX and FE-FX back cards contain the enabled LED, which is standard on all back cards, and a bank of three status LEDs for the ports. After system initialization, the enabled LED goes on to indicate that the FE back card has been enabled for operation. The LEDs are shown in [Figure 4-1](#).

The following conditions must be met before the enabled LED goes on:

- FE back card is correctly connected and receiving power.
- FE-equipped card or chassis contains a valid microcode version that has been downloaded successfully.
- Bus recognizes the FE back card.

If any of these conditions is not met, or if the initialization fails for other reasons, the enabled LED does not go on.

The three status LEDs indicate which port is active.

- MII—On when the MII port is selected as the active port by the controller.
- Link—When the RJ-45 or SC port is active, this LED is on when the back card is receiving a carrier signal from the network. When the MII port is active, this LED is an indication of network activity, and it flickers on and off proportionally to this activity.
- RJ-45 (or FIBER on FE-FX)—On when the RJ-45 (or FIBER) port is selected as the active port by the controller.

**Note**

Either the MII LED *or* the RJ-45 (or FIBER) LED should be on, but never both.

Fast Ethernet Back Card Receptacles and Cables

The two interface receptacles on the FE back card are:

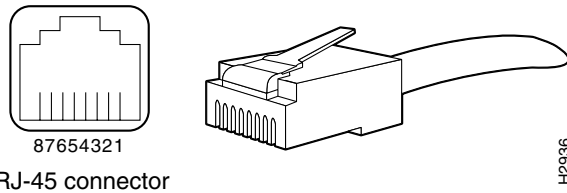
- Single MII, 40-pin, D-shell type
- Single RJ-45 (or SC-type for FE-FX optical-fiber connections)

You can use either one or the other. Only one receptacle can be used at one time. Each connection supports IEEE 802.3u interfaces compliant with the 100BaseX and 100BaseT standards. The RJ-45 connection does not require an external transceiver. The MII connection requires an external physical sublayer (PHY) and an external transceiver.

Cisco Systems does not supply Category 5 UTP RJ-45 cables; these cables are available commercially. See [Appendix B, “Cable and Connector Specifications”](#) for pinouts and signals for the FE-TX RJ-45 connectors.

[Figure 4-6](#) shows the RJ-45 connector used for FE-TX connections.

Figure 4-6 FE-TX RJ-45 Connections (Plug and Receptacle Shown)



Warning

The ports labeled “Ethernet,” “10BaseT,” “Console,” and “AUX” are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.

[Figure 4-7](#) shows the duplex SC connector (one required for both transmit and receive). [Figure 4-8](#) shows the simplex SC connector (two required, one for each transmit and receive) used for the FE-FX optical-fiber connections. These multimode optical-fiber cables are commercially available, but are not available from Cisco Systems.

Figure 4-7 FE-FX Duplex SC Connector

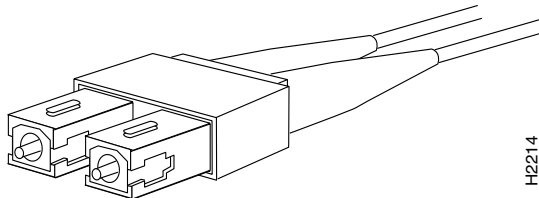
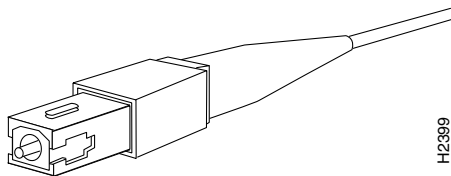


Figure 4-8 FE-FX Simplex SC Connector



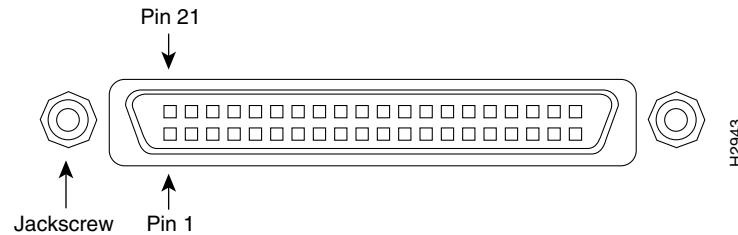
Depending on the type of media you use between the MII connection on the back card and your switch or hub, the network side of your 100BaseT transceiver should be appropriately equipped with ST-type connectors (for optical fiber), BNC connectors, and so forth. [Figure 4-9](#) shows the pin orientation of the female MII connector on the back card. The back cards are field-replaceable units (FRUs).

The MII receptacle uses 2-56 screw-type locks, called *jackscrews* (see [Figure 4-9](#)), to secure the cable or transceiver to the MII port. MII cables and transceivers have knurled thumbscrews that you fasten to the jackscrews on the FE-TX back card’s MII connector. Use the jackscrews to provide strain relief for the MII cable. [Figure 4-9](#) also shows the MII female connector (receptacle).

**Caution**

Before you attach your MII transceiver to the MII receptacle on your FE back card, ensure that your MII transceiver responds to physical sublayer (PHY) address 0 per section 22.2.4.4. “PHY Address” of the IEEE 802.3u specification; otherwise, interface problems might result. Confirm that this capability is available on the MII transceiver with the transceiver’s vendor or in the transceiver’s documentation. If a selection for Isolation Mode is available, we recommend you use this setting (if no mention is made of PHY addressing).

Figure 4-9 FE-TX or FE-FX MII Connection (Receptacle Shown)



See [Appendix B, “Cable and Connector Specifications”](#) for the MII connector pinout and signals. MII cables are available commercially and are not available from Cisco Systems. The appendix refers to MII cables used between the MII connector on the FE-TX back card and an appropriate transceiver. The connection between this transceiver and your network can be Category 3, 4, or 5, 150-ohm UTP or STP, or multimode optical fiber.

Attaching FE Back Card Interface Cables

On a single FE back card, you can use *either* the RJ-45 (or SC for FE-FX) connection *or* the MII connection. (RJ-45, SC, and MII cables are not available from Cisco Systems; they are available from outside commercial cable vendors.) If you have two FE back cards, you can use the RJ-45 (or SC for FE-FX) connection on one back card and the MII connection on the other back card.

**Caution**

Before you attach your MII transceiver to the MII receptacle on your FE back card, ensure that your MII transceiver responds to physical sublayer (PHY) address 0 per section 22.2.4.4. “PHY Address” of the IEEE 802.3u specification; otherwise, interface problems might result. Confirm that this capability is available on your MII transceiver with the transceiver’s vendor or in the transceiver’s documentation. If a selection for Isolation Mode is available, we recommend you use this setting (if no mention is made of PHY addressing).

Use the following procedure to connect RJ-45, SC (FE-FX), or MII cables.

Step 1

Depending on the connection, do one of the following:

- If you have MII connections, attach an MII cable directly to the MII receptacle on the FE back card or attach a 100BaseT transceiver, with the media appropriate to your application, to the MII receptacle on the FE back card.
- If you have RJ-45 connections, attach the Category 5 UTP cable directly to the RJ-45 port on the FE back card. The FE back card is an end station device and not a repeater. You *must* connect the FE back card to a repeater or hub.

- If you have an SC connection (FE-FX back card), attach the cable directly to the SC port on the FE-FX back card. Use either one duplex SC connector or two simplex SC connectors, and observe the correct relationship between the receive (RX) and transmit (TX) ports on the FE-FX back card and your repeater.



Note Each FE (FX or TX) back card can have *either* an MII attachment or an RJ-45 (or SC) attachment, but not both simultaneously. The MII and RJ-45 (or SC) receptacles represent two physical connection options for one Fast Ethernet interface.



Warning

Invisible laser radiation may be emitted from the aperture of the port when no cable is connected. To avoid exposure to laser radiation, do not stare into open apertures.

Step 2

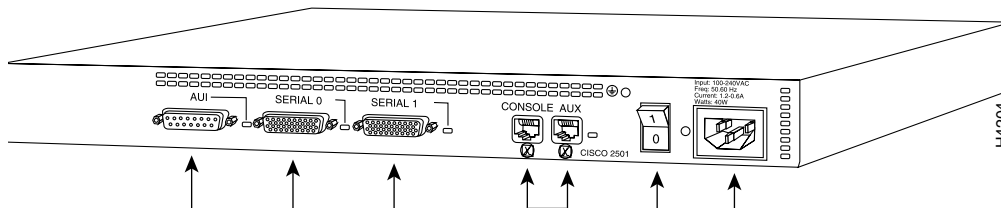
For the FE-TX, attach the ferrite bead to the RJ-45 cable (at either end), as shown in [Figure 4-10](#).



Caution

The ferrite bead prevents electromagnetic interference (EMI) from affecting the FE-TX-equipped system. It is a required component for proper system operation.

Figure 4-10 Attaching the Ferrite Bead around the RJ-45 Cable



Caution

To prevent problems on your FE back card and network, do not simultaneously connect RJ-45 (or SC) and MII cables to one FE back card. On a single FE back card, only one network connection can be used at one time. Only connect cables that comply with EIA/TIA-568 standards.

Step 3

Attach the network end of your RJ-45 (SC) or MII cable to your 100BaseT transceiver, switch, hub, repeater, DTE, or other external 100BaseT equipment.



Note After your MII transceiver is connected and the FE interface is configured as up, you can verify that your MII transceiver responds to physical sublayer (PHY) address 0 by disconnecting the transceiver from the MII receptacle; if the FE interface goes down, then your MII transceiver responds to PHY address 0.

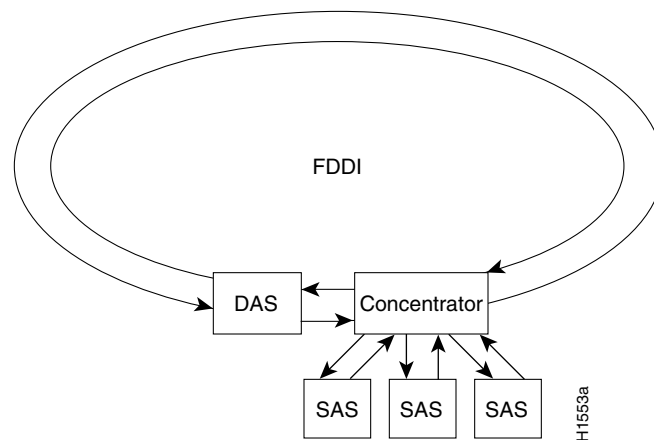
FDDI Back Cards for the RPM/B

FDDI, which specifies a 100-Mbps, wire-speed, token-passing dual-ring network using fiber-optic transmission media, is defined by the ANSI X3.1 standard and by ISO 9314, the international version of the ANSI standard. An FDDI network comprises two token-passing fiber-optic rings: a primary ring and a secondary ring.

A *ring* consists of two or more point-to-point connections between adjacent stations. On most networks, the primary ring is used for data communication, and the secondary ring is used as a backup. Single attachment stations attach to one ring and are typically attached through a concentrator; Class A, or dual attachment stations (DASs), attach to both rings.

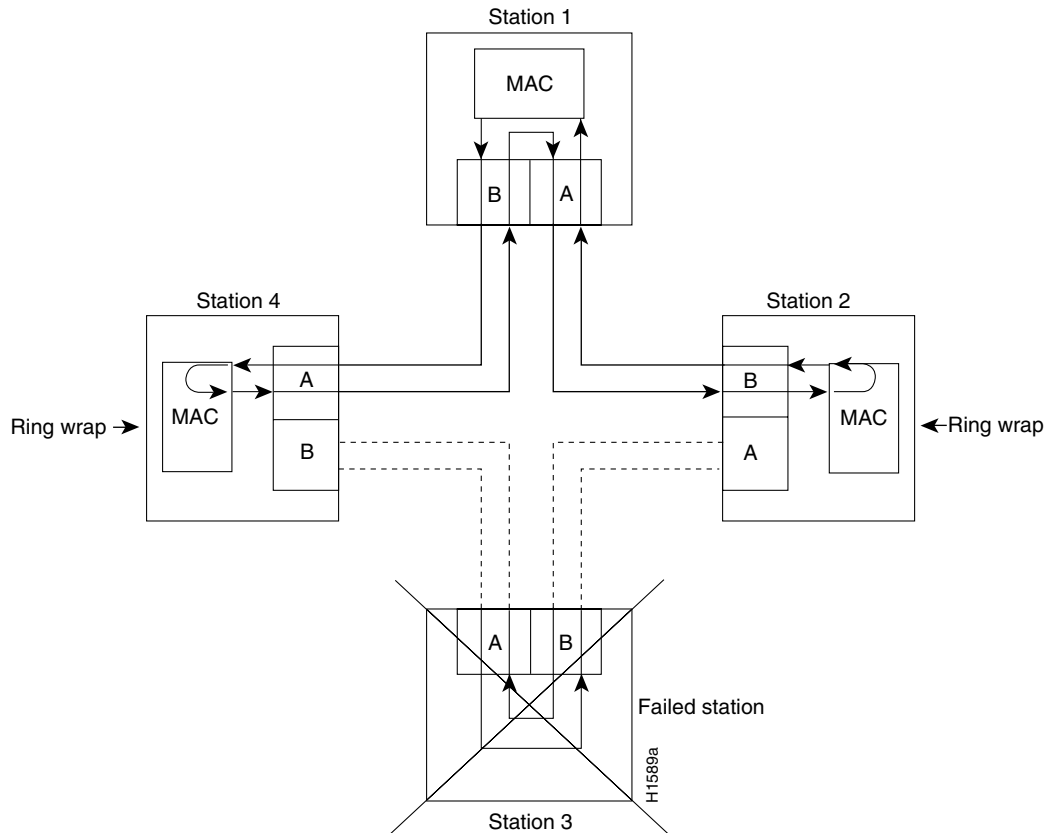
Figure 4-11 shows a typical FDDI configuration with both dual-attached and single-attached connections. Single attachment stations (SASs) typically attach to the primary ring through a concentrator, which provides connections for multiple single-attached devices. The concentrator ensures that a failure or power down of any single attachment station does not interrupt the ring. SASs use one transmit port and one receive port to attach to the single ring. DASs (Class A) have two physical ports, designated PHY A and PHY B, each of which connects the station to both the primary and secondary rings. Each port is a receiver for one ring and a transmitter for the other. For example, PHY A receives traffic from the primary ring and PHY B transmits to it.

Figure 4-11 Typical Configuration with DAS, Concentrator, and Single Attachment



The dual rings in an FDDI network provide fault tolerance. If a station on a dual ring shuts down or fails, such as Station 3 in Figure 4-12, the ring automatically wraps (doubles back on itself) to form a single contiguous ring. This removes the failed station from the ring, but allows the other stations to continue operation. In Figure 4-12, the ring wraps to eliminate Station 3 and forms a smaller ring that includes only Stations 1, 2, and 4. A second failure could cause the ring to wrap in both directions from the point of failure, which would segment the ring into two separate rings that could not communicate with each other.

Figure 4-12 DAS Station Failure and Ring Recovery Example



For example, if Station 1 in Figure 4-12 fails after Station 3 fails, Stations 2 and 4 will each be isolated because no path for communication exists between them. Subsequent failures cause additional segmentation.

Optical Bypass Overview

This section includes information on optical bypass switching with FDDI.

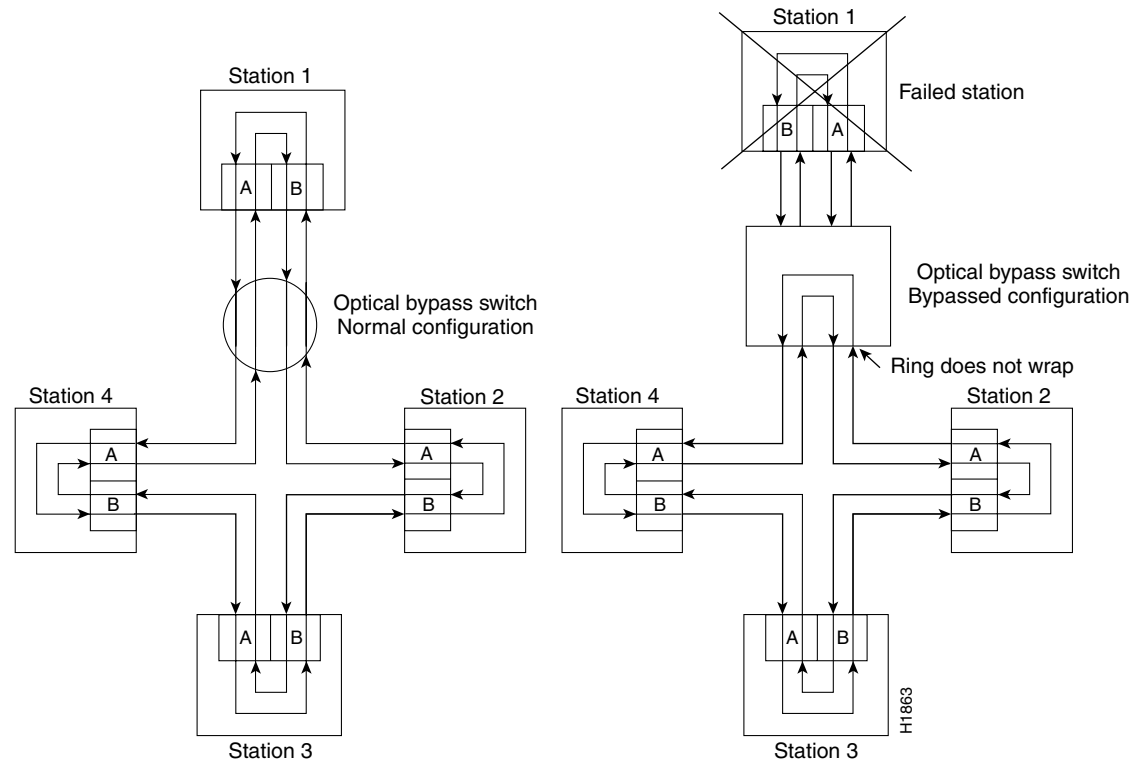
Optical bypass switching avoids segmentation by eliminating failed stations from a ring. An optical bypass switch allows the light signal to pass directly through it, completely bypassing the failed or shut down station.

For example, if an optical bypass switch was installed at Station 3 in the example ring, it would allow the light signal to pass through the switch and maintain its existing path and direction without wrapping back on itself.

The FDDI back cards have an optical bypass switch feature by way of a DIN connection. Optical bypass switches avoid segmentation by eliminating failed stations from the ring. During normal operation, an optical bypass switch allows the light signal to pass uninterrupted directly through itself. When a station with a bypass switch fails, the bypass switch reroutes the signal back onto the ring before it reaches the failed station, so the ring does not have to wrap back on itself.

Figure 4-13 shows an optical bypass switch installed at Station 1. In the normal configuration shown, Station 1 is functioning normally, so the optical bypass switch appears transparent. The switch essentially allows the signals to pass through it without interruption. However, if Station 1 fails, the optical bypass switch enables the bypassed configuration shown on the right.

Figure 4-13 Optical Bypass Operation on a DAS



The optical bypass switch reroutes the light signal by intercepting it before it reaches the failed Station 1 and sends it back out to the ring, allowing the signal to maintain its existing path and direction without wrapping back on itself. However, stations that are operating normally repeat the signal when sending it back out to the ring. Optical bypass switches do not repeat or drive the signal (they just allow the signal to pass through them), so significant signal loss can occur when the downstream neighbor (the next station on the ring) is far away.

Another technique for fault tolerance is *dual homing*, whereby critical devices are attached to two concentrators. Only the designated primary concentrator is active unless it (or its link) fails. If the primary fails, the backup (passive) concentrator is automatically activated and sustains the ring.

FDDI Specifications

Typically, FDDI uses two types of fiber-optic cable:

- Single-mode (also called monomode) optical fiber with SC-type, duplex and simplex connectors
- Multimode optical fiber with MICs

Mode refers to the angle at which light rays (signals) are reflected and propagated through the optical fiber core, which acts as a waveguide for the light signals. Multimode fiber has a relatively thick core (62.5/125-micron) that reflects light rays at many angles. Single-mode fiber has a narrow core (8.7 to 10/125-micron) that allows the light to enter only at a single angle.

Although multimode fiber allows more light signals to enter at a greater variety of angles (modes), the different angles create multiple propagation paths that cause the signals to spread out in time and limits the rate at which data can be accurately received. This distortion does not occur on the single path of the single-mode signal; therefore, single-mode fiber is capable of higher bandwidth and greater cable run distances than multimode fiber. In addition, multimode transmitters usually use LEDs as a light source, and single-mode transmitters use a laser diode, which is capable of sustaining faster data rates. Both types use a photodiode detector at the receiver to translate the light signal into electrical signals.

The FDDI standard sets total fiber lengths of 2 kilometers (1.2 miles) for multimode fiber and 15 kilometers (9.3 miles) for single-mode fiber. (The maximum circumference of the FDDI network is only half the specified distance because of signal wrapping or loopback that occurs during fault correction.) The FDDI standard allows a maximum of 500 stations with a maximum distance between active stations of 2 kilometers.

See [Appendix B, “Cable and Connector Specifications,”](#) for a description of the mini-DIN optical bypass switch available on the FDDI back cards. The mini-DIN-to-DIN adapter cable (CAB-FMDD=) allows a connection to an optical bypass switch with a DIN connector (which is larger than the mini-DIN connector on the FDDI back cards).

**Note**

Up to 160 milliamperes (mA) of current can be supplied to the optical bypass switch.

The FDDI back card implementation complies with Version 6.1 of the X3T9.5 FDDI specification, offering a Class A dual attachment interface that supports the fault-recovery methods of DAS. The FDDI back card supports dual homing and optical bypass and complies with ANSI X3.1 and ISO 9314 FDDI standards.

Maximum Transmission Distances for FDDI Connections

The maximum transmission distances for single-mode and multimode FDDI stations are shown in [Table 4-5](#). If the distance between two connected stations is greater than the maximum distance shown, significant signal loss can result.

Table 4-5 FDDI Maximum Transmission Distances

Transceiver Type	Maximum Distance Between Stations
Single-mode	Up to 9.3 miles (15 km)
Multimode	Up to 1.2 miles (2 km)

FDDI Back Card Optical Power Parameters

The multimode and single-mode optical-fiber connections conform to the following optical power parameters:

- Output power: -19 to -14 dBm
- Input power: -31 to -14 dBm
- Input sensitivity: -31 dBm @ 2.5×10^{-10} BER @ 125 Mbps

FDDI Back Card

The FDDI back cards provide a half-duplex FDDI for both single-mode and multimode fiber-optic cable. The two physical ports (PHY A and PHY B) are available with either single-mode (SC) or multimode MIC receptacles. Each back card's FDDI connection allows a maximum bandwidth of 100 Mbps per the FDDI standard.

The following FDDI back card combinations are available:

- PA-F-MM—FDDI PHY-A multimode, PHY-B multimode back card with optical bypass switch capability
- PA-F-SM—FDDI PHY-A single-mode, PHY-B single-mode back card with optical bypass switch capability



Warning

Invisible laser radiation may be emitted from the aperture ports of the single-mode FDDI products when no fiber cable is connected. *Avoid exposure and do not stare into open apertures.*

FDDI Back Card LEDs

This section describes the functions of the LEDs on the half-duplex FDDI back cards.

The FDDI back card contains the enabled LED, standard on all back cards, and status LEDs for each port. After system initialization, the enabled LED goes on to indicate that the FDDI back card has been enabled for operation. The LEDs on both half-duplex FDDI back cards are identical.

The following conditions must be met before the enabled LED goes on:

- FDDI back card is correctly connected and receiving power.
- FDDI-equipped card or chassis contains a valid microcode version that is downloaded successfully.
- Bus recognizes the FDDI-equipped card or chassis.

If any of these conditions is not met, or if the initialization fails for other reasons, the enabled LED does not go on. In addition to the enabled LED, the FDDI back card has the following three LEDs:

- PHY-A—This green LED is on when the PHY A connection is active on the FDDI ring.
- PHY-B—This green LED is on when the PHY B connection is active on the FDDI ring.
- DUAL HOME—This green LED is on when the FDDI station is dual homed.

The states of the back card's LEDs and the meanings of each are described in [Table 4-6](#).

Table 4-6 FDDI Back Card LED States

PA-F-MM and PA-F-SM LEDs ¹			Indication
PHY A	PHY B	Dual-Homed	
—	—	—	Not connected
—	—	O	Not possible
—	O	—	Wrap B
—	O	O	Dual homed (B connected to M port)
O	—	—	Wrap A

Table 4-6 FDDI Back Card LED States (continued)

PA-F-MM and PA-F-SM LEDs ¹			Indication
PHY A	PHY B	Dual-Homed	
O	—	O	Dual homing back-up (A connected to M port; B port is not connected)
O	O	—	Through A
O	O	O	Not possible

1. For the LED patterns “—” means off, “O” means on.

FDDI SMF Back Card Fiber-Optic Cables

This section describes the half-duplex FDDI back card receptacles and cables.

The interface receptacles on the FDDI back card use SC-type connectors for simplex and duplex, single-mode applications. For FDDI single-mode connections, use one duplex SC connector (see [Figure 4-14](#)) or two single SC connectors, at both the back card end and the network end (see [Figure 4-15](#)). Single-mode optical fiber cable has a narrow core (8.7 to 10/125-micron) that allows light to enter only at a single angle.

Figure 4-14 Duplex SC Connector

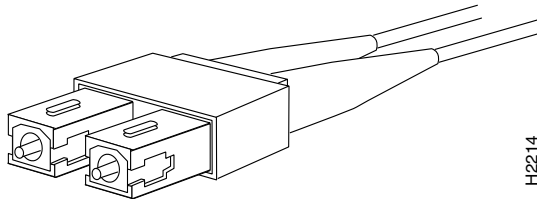
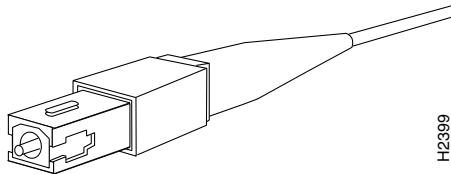


Figure 4-15 Simplex SC Connector

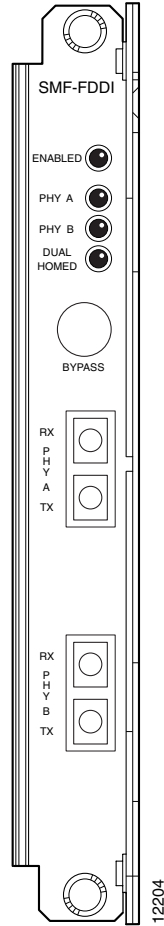


Warning

Invisible laser radiation may be emitted from the aperture ports of the single-mode FDDI products when no fiber cable is connected. *Avoid exposure and do not stare into open apertures.*

[Figure 4-16](#) shows a view of the FDDI SMF back card.

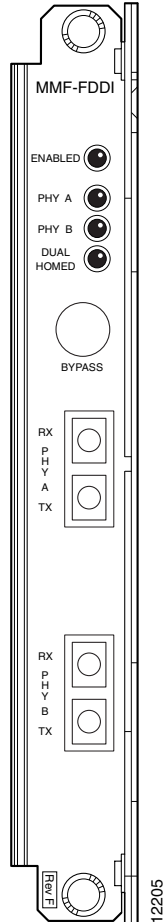
Figure 4-16 FDDI SMF Back Card



FDDI MMF Back Card

Figure 4-17 shows a view of the FDDI MMF back card.

Figure 4-17 FDDI MMF Back Card



FDDI Back Card LEDs

This section describes the functions of the LEDs on the half-duplex FDDI back cards.

The FDDI back card contains the enabled LED, standard on all back cards, and status LEDs for each port. After system initialization, the enabled LED goes on to indicate that the FDDI back card has been enabled for operation. The LEDs are shown in [Figure 4-16](#) and [Figure 4-17](#). The LEDs on both half-duplex FDDI back cards are identical.

The following conditions must be met before the enabled LED goes on:

- FDDI back card is correctly connected and receiving power.
- FDDI-equipped card or chassis contains a valid microcode version that has been downloaded successfully.
- Bus recognizes the FDDI-equipped card or chassis.

If any of these conditions is not met, or if the initialization fails for other reasons, the enabled LED does not go on. In addition to the enabled LED, the FDDI back card has the following three LEDs:

- PHY-A—This green LED is on when the PHY A connection is active on the FDDI ring.
- PHY-B—This green LED is on when the PHY B connection is active on the FDDI ring.

- DUAL HOME—This green LED is on when the FDDI station is dual homed.

The states of the back card's LEDs and the meanings of each are described in [Table 4-7](#).

Table 4-7 FDDI Back Card LED States

PA-F-MM and PA-F-SM LEDs ¹			Indication
PHY A	PHY B	Dual-Homed	
—	—	—	Not connected
—	—	O	Not possible
—	O	—	Wrap B
—	O	O	Dual homed (B connected to M port)
O	—	—	Wrap A
O	—	O	Dual homing back-up (A connected to M port; B port is not connected)
O	O	—	Through A
O	O	O	Not possible

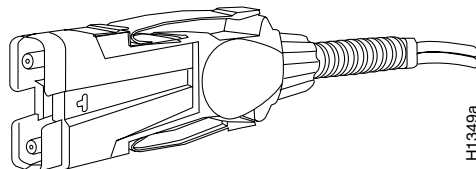
1. For the LED patterns “—” means off, “O” means on.

FDDI MMF Back Card Fiber-Optic Cables

This section describes the half-duplex FDDI back card receptacles and cables.

The interface receptacles on the FDDI back card are MICs for multimode applications. The multimode receptacle is an FDDI-standard physical sublayer (PHY) connector that encodes and decodes the data into a format acceptable for fiber transmission. The multimode receptacle accepts standard 62.5/125-micron, multimode fiber-optic cable using the MIC and, with proper cable terminators, can accept 50/125 micron fiber-optic cable. Fiber-optic cables are commercially available and are not available from Cisco Systems. Multimode uses the integrated MIC shown in [Figure 4-18](#), at both the back card end and the network end.

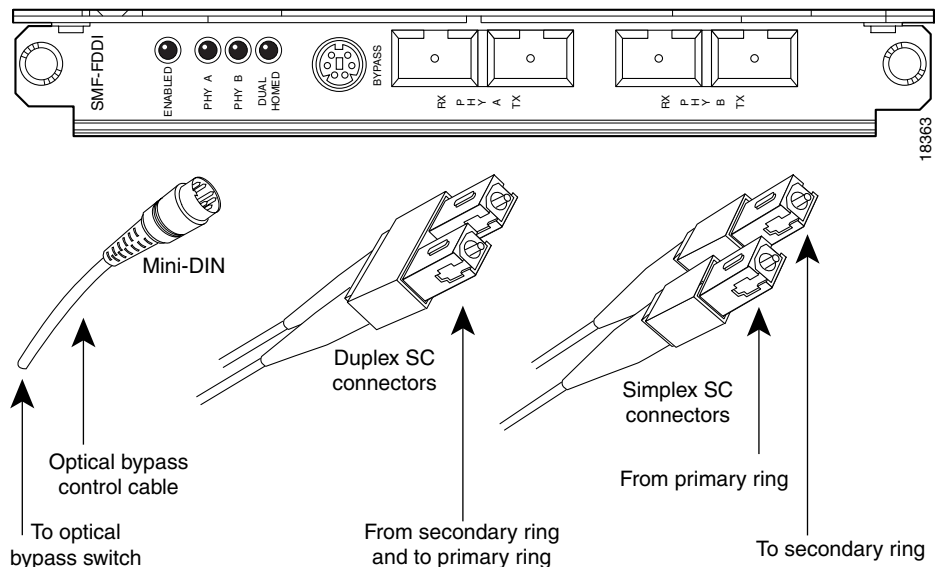
Figure 4-18 Multimode FDDI Network Interface MIC



Attaching FDDI Back Card Interface Cables

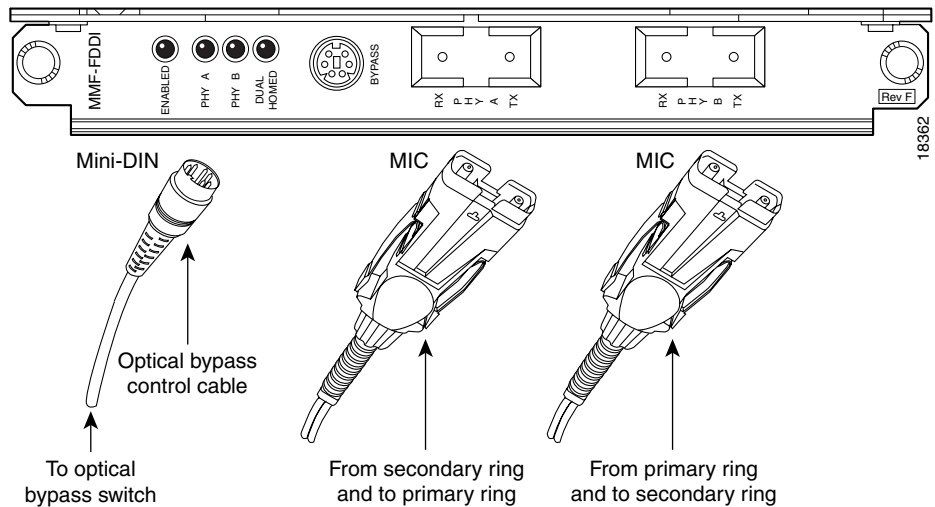
Both single-mode and multimode, dual attachment cable connections are available. Fiber-optic cable connects directly to the FDDI ports. Single-mode uses simplex or duplex SC-type transmit and receive cables. Connect single-mode, dual attachment as shown in [Figure 4-19](#).

Figure 4-19 Single-Mode Dual Attachment with Duplex and Simplex SC-Type Cables and Optical Bypass Control Cable



Multimode uses MIC cables. Connect multimode with Fixed Shrouded Duplex connector as shown in Figure 4-20.

Figure 4-20 Multimode Dual Attachment with MIC Cables and Optical Bypass Control Cable



Attaching an Optical Bypass Switch

An optical bypass switch is a device installed between the ring and the station that provides additional fault tolerance to the network. If an FDDI back card that is connected to a bypass switch fails or shuts down, the bypass switch activates automatically and allows the light signal to pass directly through it, bypassing the back card completely.

Following are general instructions for connecting an optical bypass switch to the FDDI back card; however, your particular bypass switch may require a different connection scheme. Use these illustrations and general guidelines. For specific connection requirements, refer to the instructions provided by the manufacturer of the optical bypass switch.

- Connect the bypass switch to the ring. Unless the documentation that accompanies the bypass switch instructs otherwise, observe the same guidelines for connecting the A/B ports on the bypass switch that you would to connect the ring directly to the FDDI ports. Use the receive label on the cable connectors as a key and connect the multimode or single-mode cables to the network (ring) side of the bypass switch as follows:
 - Connect the cable coming in from the primary ring (*from PHY B at the preceding station*) to the PHY A receive port on the network (ring) side of the bypass switch. This also connects the signal going out to the secondary ring to the PHY A transmit port.
 - Connect the cable coming in from the secondary ring (*from PHY A at the preceding station*) to the PHY B receive port on the network (ring) side of the bypass switch. This also connects the signal going out to the primary ring to the PHY B transmit port.
- Connect the bypass switch to the back card. Unless the documentation that accompanies the bypass switch instructs otherwise, consider the bypass an extension of the FDDI ports and connect A to A and B to B. The network cables are already connected to the bypass switch following the standard B-to-A/A-to-B scheme.
 - Connect an interface cable between the PHY A port on the station (back card) side of the bypass switch and the FIP PHY A port.
 - Connect an interface cable between the PHY B port on the station (back card) side of the bypass switch and the FIP PHY B port.
- Connect the bypass switch control cable. If the control cable on your optical bypass switch uses a mini-DIN connector, connect the cable directly to the female mini-DIN optical bypass port on the FDDI back card. If the switch uses a standard DIN connector, use the optical bypass adapter cable (CAB-FMDD=) supplied with each FDDI back card. Connect the DIN end of the adapter cable to the DIN on the control cable, and connect the mini-DIN end of adapter cable to the mini-DIN optical bypass port on the FDDI back card.

A port for connecting an optical bypass switch is provided on the multimode back card (PA-F/FD-MM, shown in [Figure 4-21](#)), and the single-mode back card (PA-F/FD-SM, shown in [Figure 4-22](#)).

Figure 4-21 Optical Bypass Switch Connection (PA-F/FD-MM)

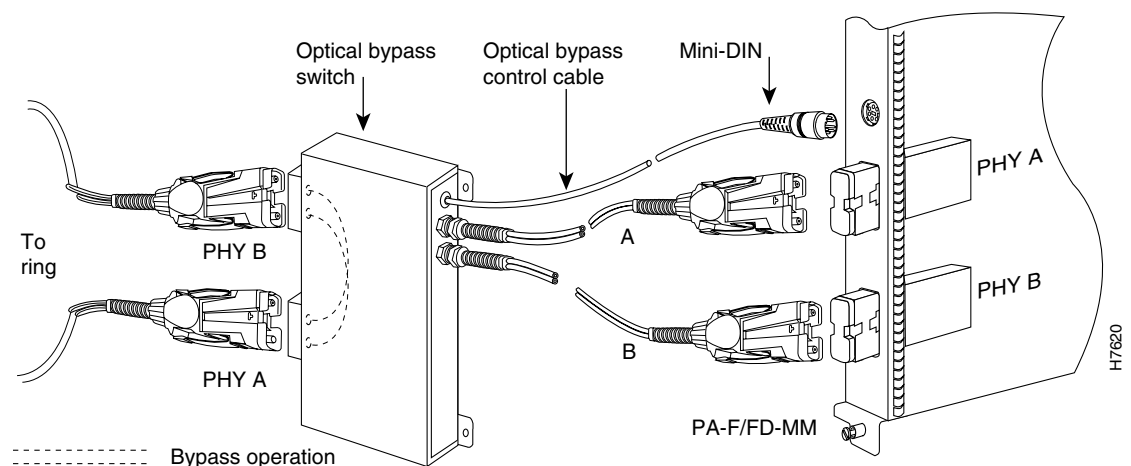
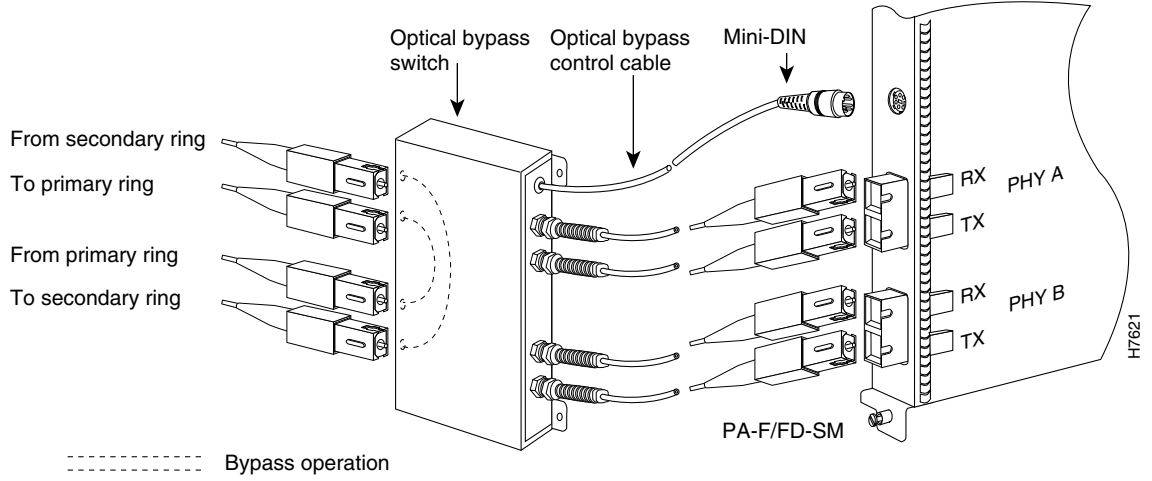


Figure 4-22 Optical Bypass Switch Connection (PA-F/FD-SM)



Note

Up to 160 milliamperes of current can be supplied to the optical bypass switch.