

# 7 OmniSwitch Switching Modules

Switching modules are available for Ethernet, ATM, FDDI, CDDI, Token Ring and WAN interfaces. A variety of connector, speed, and signalling options is available for each network interface type.

Each switching module port is assigned a dedicated amount of bandwidth. For example, a 10 Mbps Ethernet module contains ports that each provide the full 10 Mbps of bandwidth. Likewise, an ATM OC-3 module contains ports that each provide the full 155 Mbps of bandwidth. Translations are provided for all interfaces contained in an OmniSwitch chassis. For example, if your OmniSwitch contained Ethernet, Token Ring, and ATM switching modules then all devices from all three network interfaces would be able to communicate through the OmniSwitch.

Since the OmniSwitch employs a distributed architecture, each switching module you add increases the processing and memory power of the entire switch. The Management Processor Module (MPM) handles central functions such as software storage, VLAN MAC learning, routing, and SNMP/User Interface management. But the MPM passes off much of the processing and memory functions to individual switching modules. Switching modules perform software filtering, translations between dissimilar network interfaces (e.g., Token Ring and Ethernet, Ethernet and ATM, ATM and Frame Relay), and hardware-based switching.

Each switching module contains at least one RISC processor, RAM for software storage, ASICs for performing hardware-based switching, and content addressable memory (CAM) for storing the MAC addresses of source devices. A MAC address for a single source device only needs to be stored once in the CAM of the switching module that received the original frame. The memory on each switching module can be leveraged over an entire switch since all switching modules can communicate with each other. Each module's CAM is capable of storing up to 1,024 MAC addresses, and you can optionally add CAM to boost the total addresses stored by the module to 4,096.

All switching modules provide front panel LEDs that give a quick view of the status of the board, ports, connections and traffic. All switching modules may be hot swapped as long as you re-insert a module of the same type. The following lists the available switching modules:

## ***Ethernet (10 Mbps) Modules***

- |            |   |
|------------|---|
| • ESM-C-12 | Twelve 10BASE-T connections using RJ-45 ports.  |
| • ESM-C-8  | Eight 10BASE-T connections using RJ-45 ports. ( <b>Discontinued</b> )   |
| • ESM-F-8  | Eight 10BASE-FL connections using fiber (ST) ports.   |
| • ESM-T-12 | One Telco connector supporting 12 UTP or STP ports.   |
| • ESM-U    | Universal Ethernet module supporting six connections that may be a combination of AUI (full- or half-duplex), RJ-45, fiber, or BNC ports. |

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### ***High-Density and 10/100 Ethernet Modules***

- ESM-100C-12 Twelve auto-sensing 10/100 Mbps connections using RJ-45 ports.
- ESM-100FM-8 Eight 100BASE-FX connections using multimode fiber (SC) ports.
- ESM-C-16 Sixteen 10BASE-T connections using RJ-45 ports.
- ESM-C-32 Thirty-two 10BASE-T connections using RJ-45 ports.
- ESM-FM-16W Sixteen 10BASEFL connections using multimode fiber (ST) ports.
- ESM-100C-32W 32-port auto-sensing 10/100 Ethernet switching module
- ESM-T-24W Two Telco connectors supporting 24 UTP or STP ports.

### ***Fast Ethernet (100 Mbps) Modules***

- ESM-100C Four or eight 100BASE-Tx connections using RJ-45 ports.
- ESM-100C-FD One or two full-duplex 100BASE-Tx connections using RJ-45 ports.
- ESM-100Fx-FD One or two full-duplex 100BASE-Fx fiber connections (single mode or multimode) using SC connectors.
- ESM-100C-5 Five 100BASE-Tx connections using RJ-45 ports. One of the five ports supports full-duplex operation.
- ESM-100CFx-5 One fiber 100BASE-Fx connection and four 100Base-Tx connections. The fiber port supports full-duplex operation and can be configured with single mode or multimode connectors.

### ***Gigabit Ethernet Modules***

- GSM-FM/FS/FSH-2W 2-port Gigabit Ethernet switching module

### ***ATM Access Modules***

- ASM-155Fx One or two port fiber single mode or multimode OC-3 module.
- ASM2-155Fx One or two port fiber single mode or multimode OC-3 switching module. This is a higher performance version of the ASM-155Fx.
- ASM-155C One or two port UTP OC-3 module.
- ASM2-622F One or two port fiber single mode or multimode OC-12 switching module.
- ASM2-622FR Two or four port redundant fiber single mode or multimode OC-12 switching module. Each port pair includes a primary and backup port.
- ASM-DS3 One or two port DS-3 module.
- ASM-E3 One or two port E3 module.
- ASM-CE One ATM uplink port (OC-3, DS-3 or E3), two T1/E1 ports, and two serial ports supporting ATM circuit emulation.
- ASM2-DS3 1- or 2-port ATM DS3 uplink module
- ASM2-E3 1- or 2-port ATM E3 uplink module

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### ***FDDI/CDDI Modules***

- FSM-M One or two DAS connections over multimode fiber.
- FSM-S One or two DAS connections over single mode fiber.
- FSM-SH One or two DAS connections over single mode fiber using Category 2 high-powered laser optics.
- FSM-C Four or eight RJ-45 ports for CDDI.
- FSM-M-C One FDDI DAS connection and four CDDI ports.

### ***Token Ring Modules***

- TSM-C-6 Six-port UTP or STP Station connections. (**Discontinued**)
- TSM-F-6 Six-port fiber that supports Station, Lobe, Ring Out, Ring In/Ring Out connections.
- TSM-CD-6 Six-port UTP or STP that supports Station or Lobe connections. (**Discontinued**)
- TSM-CD-16W 16-port Token Ring (Lobe and Station) switching module.

### ***WAN Modules (Except for the WSM-M013, these modules are described in detail in Chapter 48, "Managing WAN Switching Modules.")***

- WSM-S Two, four, or eight serial ports that support the frame relay or PPP protocol.
- WSM-FT1/E1 One or two T1/E1 ports and one or two serial ports that support the frame relay or PPP protocol.
- WSM-BRI One UPS (Universal Serial Port) and one ISDN-BRI port that support Frame Relay or PPP.
- WSM-M013 Two or four channelized DS3 ports (described in Chapter 56, "Managing Channelized DS3 Modules.")

### ***Cell Switching Modules (These modules are described in detail in Chapter 41, "Cell Switching Modules (CSMs)")***

- FCSM I Frame-to-Cell Switching Module.
- FCSM II The OC-12c/STM-4c version of the original FCSM.
- CSM-155F Eight-port 155 Mbps cell switching module.
- CSM-622 Two-port 622 Mbps cell switching module.
- CSM-155C Eight-port 155 Mbps cell switching module.
- CSM-A25-12 Twelve-port ATM 25 Mbps cell switching module.
- CSM-A25-24 Twenty-four port ATM 25 Mbps cell switching module.
- CSM-U Universal cell switching module with three adapter board positions. Adapter boards include support for OC-3 fiber and copper ports, T1/E1 ports, DS3/E3 ports, T1/E1 circuit emulation ports, Stratum-3 hardware clocking, and Inverse Multiplexing over ATM (IMA).

# Installing a Switching Module

All switching modules can be inserted and removed from the switch chassis while power is on or off without disrupting the other modules. *A standard screwdriver is required for installing and removing switching modules.* You can also hot swap modules of the same type while the switch is active.

Switching modules may be installed in any slot. If the MPM is installed in Slot 2, you can install a Switching Module in Slot 1 or any other slot but 2. If it is installed in Slot 1, a Switching Module can be installed in Slot 2 or any other slot but 1. In a setup with redundant MPM modules, Slots 1 and 2 are reserved for the MPMs. Additional modules can be installed in any available slot. (Omni-5 slots are numbered 1 to 5 starting from the topmost slot. Omni-9 slots are numbered 1 to 9 starting from the left.)

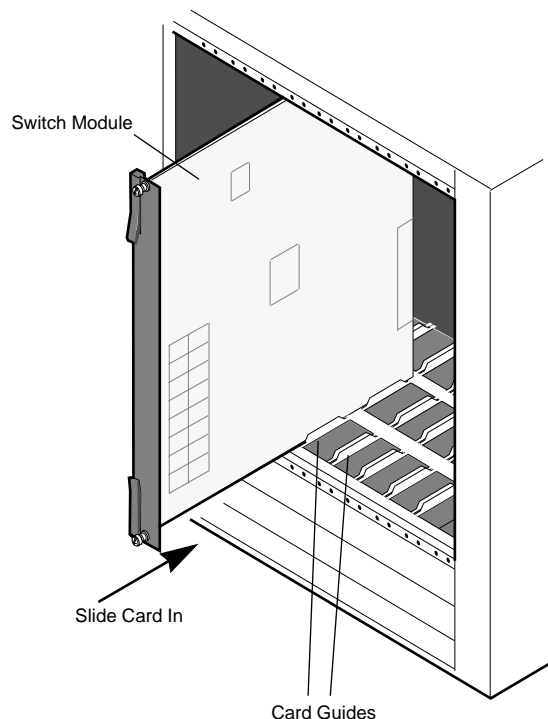
### ◆ Anti-Static Warning ◆

Before handling a switching module, free your hands of static by wearing a grounding strip, or by grounding yourself properly. Static discharge can damage the components on the switching module.

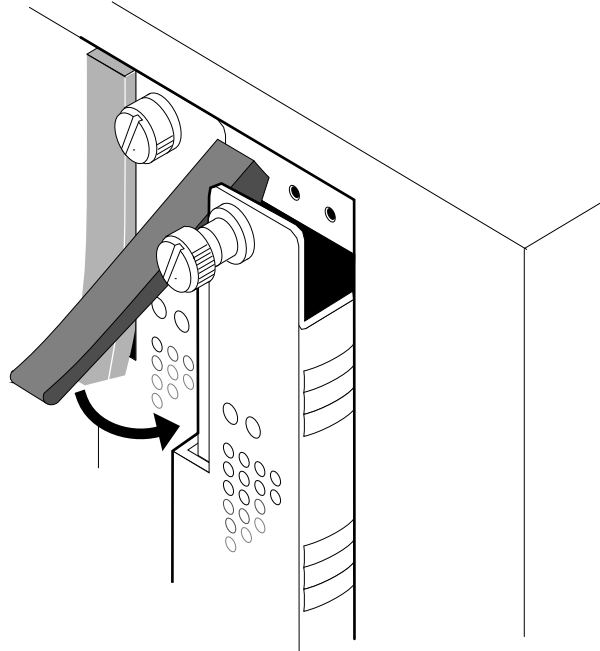
To insert a switching module follow these instructions:

1. Holding the module firmly in both hands, carefully slide it into the card guide. The front panel connectors and LEDs should face outward. In a 9-slot OmniSwitch, the component side of the board should face right (toward the power supply). In a 5-slot OmniSwitch, the component side should face up.

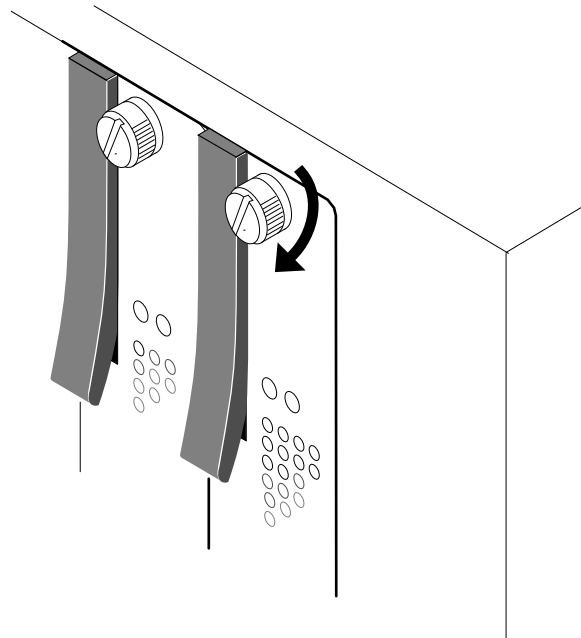
The module should slide in easily. A large amount of force is not necessary and should not be used. If any resistance is encountered, check to be sure that the module is aligned properly in the card guide.



2. Once the module is in the slot, close the two card ejectors (one on each end of the module) by pressing them in toward the module until they snap into place.



3. Use a standard screwdriver to tighten the two screw fasteners to secure the module inside the chassis. The screws should be tight enough such that a screwdriver would be necessary to loosen the screws.



### Removing a Switching Module

To remove a switching module, follow the instructions below. If you are “hot swapping” the modules (i.e., removing and inserting while power is on), see *Hot Swapping a Switching Module* on page 7-7.

#### ◆ Anti-Static Warning ◆

Before handling a switching module, free your hands of static by wearing a grounding strip, or by grounding yourself properly. Static discharge can damage the components on your switching module.

1. Loosen the screw fasteners at the top and bottom of the switching module using a standard screwdriver.
2. Gently unlock the two card ejectors by pulling them out away from the module.
3. With both hands, carefully pull the module free of the chassis enclosure.

## Hot Swapping a Switching Module

You may remove and insert switching modules while the switch is running. This technique is referred to as “hot swapping.” When you hot swap, you must replace the module with the same module type as the one you removed. For example, if you remove an ASM switching module you must replace it with another ASM switching module.

### ◆ Note ◆

You *cannot* hot swap a module into a previously empty slot. To use an empty slot, you *must* power down your chassis.

Perform the following steps to safely hot swap a switching module. (You cannot hot swap a primary MPM module.) Since this procedure could possibly disrupt the network, it is best to hot swap during network down times.

1. At the system prompt, enter

**swap on <minutes>**

where **minutes** is the number of minutes you want the switch to be in swap mode (the default is 5 minutes). A message similar to the following will be displayed.

**Swap is ON for 5 minutes**

The swap mode *must* be enabled (**ON**) to insert a switching module. If not, the system may halt or restart. (See Chapter 10, “Configuring Management Processor Modules,” for more information on the **swap** command.)

If you have an ATM access module (e.g., ASM, ASM2, or ASX) or a CSM module, proceed to step 3. Otherwise, proceed to step 2.

### ◆ Caution ◆

Modules can only be reset and hot-swapped when the MPM's **OK2** light is in its normal flashing green state.

2. Enter **reset**, followed by the slot number of the switching module you want to hot swap, then followed by the word **disable**. (See Chapter 58, “Running Hardware Diagnostics,” for more information on the **reset** command.) For example, if you want to hot swap the switching module in slot 4, you would enter

**reset 4 disable**

at the system prompt. Next, the switch will prompt you to confirm the reset. The following is an example of the display for an ESM Mammoth module. The display for other types of switching modules will be similar.

**Resetting slot of type F-Ether/M may crash system  
Attempt reset anyway {Y/N}? (N) :**

Press **y** and then press **<Enter>**. If the switching module is in slot 4, a message similar to the following will be displayed.

**resetting slot 4 to disable**

3. The MPM's **OK2** LED will flash amber 1 or 2 times, then return to normal flashing green. The switching module's **OK1** LED will turn amber and the **OK2** LED will *not* be illuminated. Remove all cables attached to ports on the switching module that you are going to swap out.

4. Carefully remove the switching module from the chassis and put it in a safe place. (See *Removing a Switching Module* on page 7-6 for instructions on removing a switching module.) The MPM's **OK2** LED will flash amber 1 or 2 times, then return to normal flashing green. In addition, the swap time will reset to its original value. (For example, if you set the swap time to 15 minutes in step 1, you will have 15 minutes again, regardless of how much time has elapsed.)

◆ **Warning** ◆

Removing or inserting the switching module while the MPM's **OK2** LED is flashing amber can cause the system to reset.

5. Carefully insert the new switching module into the chassis. (See *Installing a Switching Module* on page 7-4 for instructions on inserting a switching module.)

◆ **Caution** ◆

When re-installing a module during a hot swap, it must make a proper connection to the switch backplane. The connection is made when you close the card ejectors. Always close the card ejectors firmly and briskly, without hesitation. Closing them too slowly can cause the switch to halt or restart.

The MPM's **OK2** LED will flash amber 1 or 2 times, then return to normal flashing green. If, after hot-swapping modules, the MPM's **OK2** LED continues to flash amber for more than about 8 seconds, it means that the switch needs to be reset.

The swap time will again reset to its original value.

6. Re-insert the cables that were removed in step 3 into the new switching module. If you have an ATM access module (e.g., ASM, ASM2, or ASX) or a CSM module, proceed to step 8. Otherwise, proceed to step 7.
7. Enter **reset** followed by the slot number for the new switching module. For example, if the new switching module is in slot 4, you would enter

**reset 4**

at the system prompt. Next, the switch will prompt you to confirm the reset. The following is an example of the display for an ESM Mammoth module. The display for other types of switching modules will be similar.

**Resetting slot of type F-Ether/M may crash system  
Attempt reset anyway {Y/N}? (N) :**

Press **y** and then press **<Enter>**. If the switching module is in slot 4, a message similar to the following will be displayed.

**resetting slot 4 to enable**

8. The MPM's **OK2** LED will flash amber 1 or 2 times, then return to normal flashing green. The switching module's **OK1** LED will turn from amber to solid green and the **OK2** LED will be blinking green. If the **OK1** LED on the switching module is amber, then the hardware has failed diagnostics or the corresponding image file for the module is not in flash memory. If the **OK2** LED on the switching module is solid amber, then the module failed to download software from the MPM.

9. If the hot swapping mode has not timed out, enter

**swap off**

at the system prompt. Something like the following will then be displayed.

**Swap is OFF, timeout is 5 minutes**  
**usage swap { ON [ minutes ] | OFF [ minutes ] }**

## Diagnostic Tests

All switching modules are subjected to extensive power-on diagnostics during the Power-On Self-Test cycle (POST). These diagnostics are designed to be as extensive as possible without causing disruption to external networks or requiring special test connections. While the diagnostics are running, the MPM **OK2** LED will be flashing green. LEDs on the switching module can provide information on the success or failure of these tests. See *Module LEDs* on page 7-13 for information on these LEDs. Also refer to Chapter 57, “Troubleshooting,” for information on error conditions reflected in the LED displays.

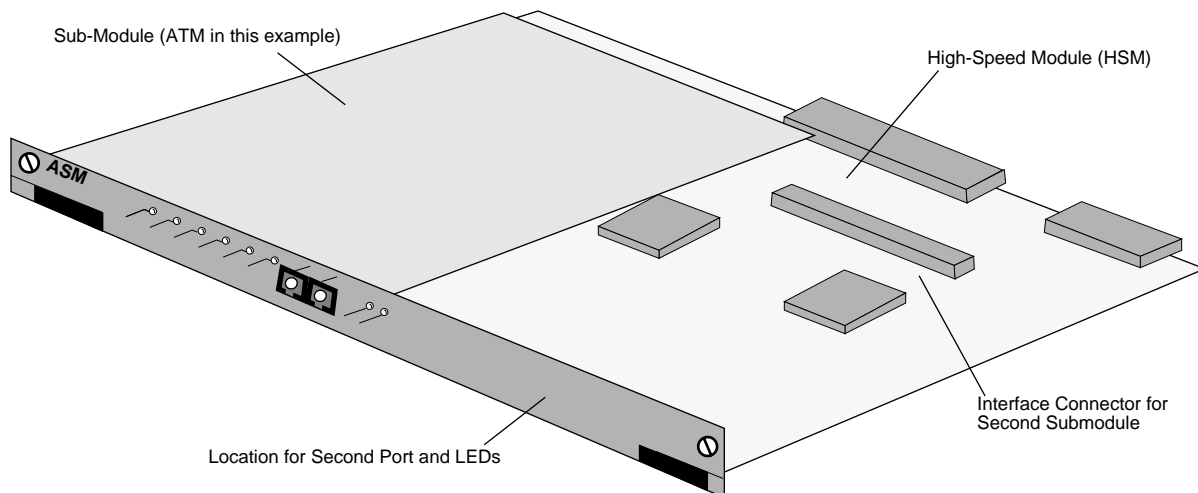
More extensive diagnostic tests are available for off-line testing of switching modules. See Chapter 58, “Running Hardware Diagnostics,” for further information.

# High-Speed Module (HSM)

Many switching modules that operate at speeds in excess of 10 Mbps are actually submodules that attach to a High-Speed Module (HSM). These switching modules include ATM, FDDI, Frame Relay modules, some 100 Mbps Ethernet and most Token Ring modules. The HSM provides the base memory and processing power for these high throughput switching modules.

The HSM contains RISC processors, RAM for holding software image files, ASICs for performing switching, and Content Addressable Memory (CAM) for storing MAC addresses. The HSM comes in three versions—HSM, HSM2, and HSM3.

You have the option of factory installing either one or two submodules on an HSM. Two submodules double the port count for a particular module. For example, a one-port ATM module contains one submodule attached to an HSM, and a two-port ATM module has two submodules attached to an HSM. The illustration below shows an HSM with an attached submodule.



**The HSM and Attached Submodule**

You plug cable directly into a submodule, but it is the HSM module that connects to the switch backplane.

## Content Addressable Memory (CAM)

Each switching module is shipped with 1K, 2K, or 4K of Content Addressable Memory (CAM). CAM is used to claim frames from the VBUS for forwarding to the ports on that switching module. Modules with 1K of CAM can store 1,024 addresses, modules with 2K of CAM can store 2,048 addresses, and modules with 4K of CAM can store 4,096 addresses.

CAM is located directly on some Ethernet module boards; it is located on the HSM boards for ATM, FDDI, CDDI, Token Ring, and Frame Relay modules. Two CAM sockets are available for all 10 Mbps Ethernet modules and all HSM modules.

In a configuration where all switching modules use the standard 1K of CAM, the OmniSwitch can actively manage up to 8,192 MAC addresses in a 9-slot chassis, and up to 4,096 addresses in a 5-slot chassis.

Because the CAM is actually a cache of most recently observed addresses and not all of the addresses in the network, even a 1K CAM can often support networks with many more than 1,024 stations. However, a module with only 1K of CAM can cause problems in networks with large shared media backbones in which more than 1,024 addresses are simultaneously active.

The 2K and 4K CAM options address this limitation by allowing up to 2,048 or 4,096 addresses per switching module. This option provides a larger CAM for address recognition logic, which makes the OmniSwitch more robust in networks with large shared media backbones. This option is supported on most switching modules.

### Note

ESM-U-6 modules must be at least Rev. F1 to support the 2K CAM option. Older versions of the board do not contain an extra CAM socket.

The switch software recognizes if more than 1K of CAM is installed on a switching module. The switch can support up to 16K of CAM among all switching modules. If you have more than 16K of CAM installed on all switching modules in your chassis, then you can view each module's CAM usage through the **camstat** command. In such configurations, you may also need to configure each slot's CAM usage through the **camcfg** command (see the section on **camcfg** in Chapter 13, "Configuring Switch-Wide Parameters," for further information). If you have 16K CAM or less, then no special configuration is required.

The 2K or 4K CAM option is not normally required unless a port on that module is plugged into a backbone, such as an ATM backbone, in which a large number of addresses are simultaneously active. Each network is different and the traffic patterns should be observed to best decide when this is used. Another alternative to greatly improve both CAM utilization and network performance is to split the backbone into multiple networks and switch between them.

### Source Learning and CAM Capacity

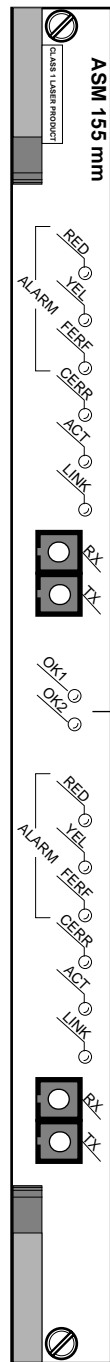
Learning of source addresses is affected by the amount of space available in CAM. When CAM capacity is less than 85 percent (870 or fewer entries in a 1K CAM), normal source learning occurs. When CAM capacity is 85 percent or more (870 or more entries in 1K CAM), the source addresses for broadcast frames are not learned; non-broadcast frames are still learned. At the 95 percent level (972 or more entries in 1K CAM), the CAM will not learn source addresses for frames sent to unknown destinations; frames destined to a known address are still learned.

#### Note

Learning returns to normal once the CAM returns to below the 85 percent capacity.

## Module LEDs

LEDs on switching modules vary by the network interface type and by a module's application. However, two LEDs are common to all switching modules. These LEDs, **OK1** and **OK2**, provide information on the hardware and software status, respectively, of the module. These two LEDs are normally located in the middle of the module, as shown below. However, on 10 Mbps Ethernet modules they are located at the top or the bottom of the module.



### Module LEDs

**OK1** (Hardware Status). On Green when the module has passed diagnostic tests successfully. On Amber when the hardware has failed diagnostics or if the corresponding image file for the module is not in flash memory.

**OK2** (Software Status). Blinking Green when the module software was downloaded successfully and the module is communicating with the MPM. Blinking Amber when the module is in a transitional state. On solid Amber if the module failed to download software from the MPM.

# Ethernet (10 Mbps) Modules

The 10 Mbps Ethernet switching modules provide a variety of connection options. Each switch port supports one Ethernet segment. You can choose from modules with copper, fiber, or Telco connectors. Port densities range from six (6) to 12 ports per module. The six-port option allows you to mix and match Ethernet connector types (AUI, RJ-45, fiber ST, and BNC).

### ◆ Note ◆

High-density, 10/100, and Gigabit Ethernet modules are described in the section, *High-Density, 10/100, and Gigabit Ethernet Modules* on page 7-102.

You can connect a hub or a single device to an Ethernet switching module port. If you connect a hub, you can gradually decrease the number of devices connecting to that switch port as bandwidth requirements increase. High-traffic network devices, such as network servers, can connect directly into a single dedicated switch port using the full 10 Mbps of bandwidth available. The switch will automatically sense if only one device is attached to a port and optimize it to receive only traffic destined for the address of that device.

Ethernet modules include the following:

- ESM-C-12 Twelve 10BASE-T connections using RJ-45 ports.
- ESM-C-8 Eight 10BASE-T connections using RJ-45 ports. (**Discontinued**)
- ESM-F-8 Eight 10BASE-FL connections using fiber (ST) ports.
- ESM-T-12 One Telco connector supporting 12 ports.
- ESM-U-6 Universal Ethernet module supporting six connections that may be a combination of AUI (full- or half-duplex), RJ-45, fiber, or BNC ports.

Each of these modules is illustrated and described in this section.

### ◆ Note ◆

See *Ethernet Pinouts* on page 7-102 for information on Ethernet RJ-45 pinouts.

## ESM-C-12

The ESM-C-12 Ethernet switching module contains 12 10BASE-T ports. Each port connection supports one switched Ethernet segment at the full 10 Mbps of bandwidth. The 12 RJ-45 ports may connect to unshielded twisted pair (UTP) or shielded twisted pair (STP) cable. Each port may connect to a single high-traffic device, such as a mail or file server, or a hub serving multiple devices. In a fully populated 5-slot switch, you could have up to 48 switched Ethernet connections, and in a fully populated 9-slot switch you could have up to 96 switched connections.

ESM-C-12 Technical Specifications	
Number of ports	12
Connector Type	RJ-45 (MDI)
Standards Supported	IEEE 802.3, 802.3i; IAB RFCs 826, 894, 1398
Data Rate	10 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	10BASE-T hub or device
Cable Supported	Unshielded twisted-pair (UTP) Shielded twisted-pair (STP)—100 ohm
Cable Distance	100 m

This ESM module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number.

**STA** (Status). On Green continuously when a good cable connection exists, per the 10BASE-T specification, to a 10BASE-T device. Off when a good connection does not exist. Flashes Green slowly when the port has been disabled.

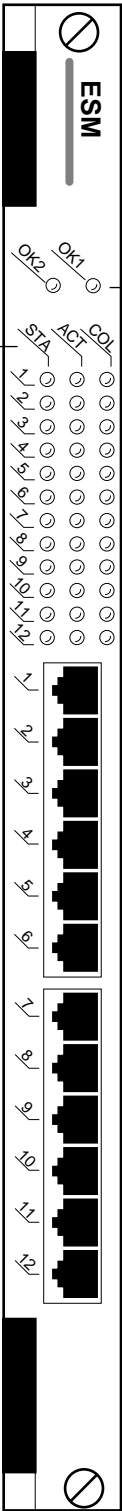
**ACT** (Activity). On Green when data is transmitted or received on the corresponding port.

**COL** (Collision). Flashes amber when a collision has been detected on the port.

Port LEDs

Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



Ethernet 12-Port UTP/STP Module

## ESM-C-8 (Discontinued)

The ESM-C-8 Ethernet switching module contains eight 10BASE-T ports. Each port connection supports one switched Ethernet segment at the full 10 Mbps of bandwidth. The eight RJ-45 ports may connect to unshielded twisted pair (UTP) or shielded twisted pair (STP) cable. Each port may connect to a single high-traffic device, such as a mail or file server, or a hub serving multiple devices. In a fully populated 5-slot switch, you could have up to 32 switched Ethernet connections, and in a fully populated 9-slot switch you could have up to 64 switched connections.

### Note

The ESM-C-8 is supported, but it has been discontinued. For 10BASE-T switching, the ESM-C-16 or ESM-C-32 modules are recommended.

ESM-C-8 Technical Specifications	
Number of ports	8
Connector Type	RJ-45 (MDI)
Standards Supported	IEEE 802.3, 802.3i; IAB RFCs 826, 894, 1398
Data Rate	10 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	10BASET hub or device; half-duplex Ethernet-to-Ethernet
Cable Supported	Unshielded twisted-pair (UTP) Shielded twisted-pair (STP)—100 ohm
Cable Distance	100 m

This ESM module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number.

**STA** (Status). On Green continuously when a good cable connection exists, per the 10BASE-T specification, to a 10BASE-T device. Off when a good connection does not exist. Flashes Green slowly when the port has been disabled.

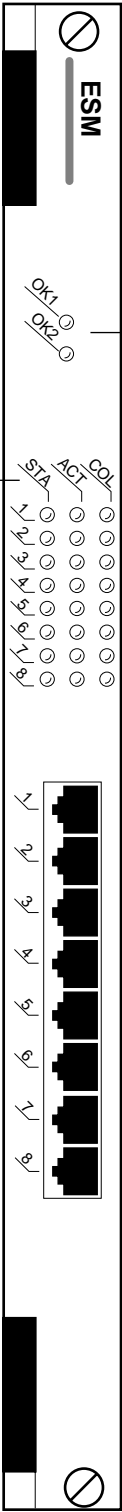
**ACT** (Activity). On Green when data is transmitted or received on the corresponding port.

**COL** (Collision). Flashes amber when a collision has been detected on the port.

Port LEDs

Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



Ethernet 8-Port Module (Discontinued)

## ESM-F-8

The ESM-F-8 Ethernet switching module contains eight 10BASE-FL ports. Each port connection supports one switched Ethernet segment at the full 10 Mbps of bandwidth. The eight dual ST connector ports connect to multimode fiber optic cable. Each port may connect to a single high-traffic device, such as a mail or file server, or a hub serving multiple devices. In a fully populated 5-slot switch, you could have up to 32 switched Ethernet connections, and in a fully populated 9-slot switch you could have up to 64 switched connections.

ESM-F-8 Technical Specifications	
Number of ports	8
Connector Type	ST
Standards Supported	IEEE 802.3, 802.3i; IAB RFCs 826, 894, 1398
Data Rate	10 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	10BASE-FL hub or device; half-duplex Ethernet-to-Ethernet
Optical output power	-20 to -12 dBm
Optical receiver sensitivity	-32.5 to -12 dBm
Power Budget	12.5 dB
Cable Supported	62.5 micron multimode fiber (13 dBm)
Cable Distance	2 km

**Warning Label.** This label indicates that the module contains an optical transceiver.

This ESM module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number.

**STA** (Status). On Green continuously when a good cable connection exists, per the 10BASE-FL specification, to a 10BASE-FL device. Off when a good connection does not exist. Flashes Green slowly when the port has been disabled.

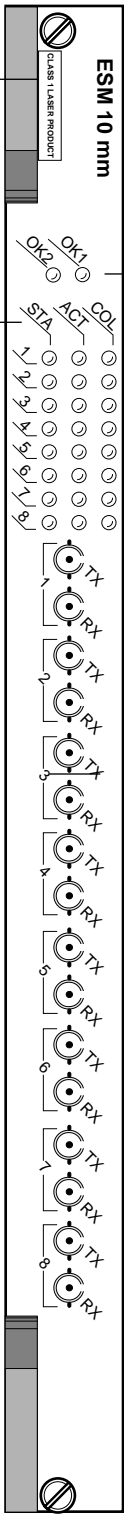
**ACT** (Activity). On Green when data is transmitted or received on the corresponding port.

**COL** (Collision). Flashes amber when a collision has been detected on the port.

**Module Label.** This label will indicate the ESM-F-8 type. It will read either **ESM 10 mm** (multimode cable), or **ESM 10 sm** (single mode cable).

**Module LEDs** Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

**Port LEDs**



Ethernet 8-Port Fiber Module

## ESM-T-12

The ESM-T-12 Ethernet switching module contains one 50-pin connector that supports 12 switched Ethernet ports. Each of the 12 ports uses the full 10 Mbps of dedicated bandwidth. The 50-pin RJ-21 connector provides a convenient cabling solution for networks with existing punch down blocks and patch panels. Each port may connect to a single high-traffic device, such as a mail or file server, or a hub serving multiple devices. In a fully populated 5-slot switch, you could have up to 48 switched Ethernet connections, and in a fully populated 9-slot switch you could have up to 96 switched connections.

ESM-T-12 Technical Specifications	
Number of ports	One Telco supporting 12 end devices
Connector Type	Telco 50-pin (RJ-21)
Standards Supported	IEEE 802.3, 802.3i; IAB RFCs 826, 894, 1398
Data Rate	10 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	Telco patch panel or punch down block
Cable Supported	Unshielded twisted pair (UTP) Shielded twisted pair (STP)—100 ohm
Cable Distance	100 m

This ESM module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number.

**STA** (Status). On Green continuously when a good cable connection exists, per the 10BASE-T specification, to a 10BASE-T device. Off when a good connection does not exist. Flashes Green slowly when the port has been disabled.

**ACT** (Activity). On Green when data is transmitted or received on the corresponding port.

**COL** (Collision). Flashes amber when a collision has been detected on the port.

Port LEDs

Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



Ethernet 12-Port Telco Module

## **ESM-U-6**

The Ethernet Universal switching module has six positions in which you can mix and match different Ethernet media. The media options are as follows:

- 10BaseFL fiber optic ST (single mode or multimode)
- 10Base2 thin coax BNC
- 10BaseT UTP RJ-45
- Combined 10Base5 thick coax AUI and 10BaseT UTP RJ-45 (occupies two positions)
- 10Base5 thick coax AUI (full-duplex)

Each port connection supports one switched Ethernet segment at the full 10 Mbps of bandwidth. Depending on the connector types with which the ESM-U is configured, each port connector may connect to the following cable types: multimode fiber optic, single mode fiber optic, thin coaxial, unshielded twisted pair (UTP), or thick coaxial. Each port may connect to a single high-traffic device, such as a mail or file server, or a hub serving multiple devices.

ESM-U Technical Specifications	
Number of ports	6
Connector Type	Combinations of dual-fiber (ST), BNC, RJ-45 and AUI
Standards Supported	IEEE 802.3, 802.3i; IAB RFCs 826, 894, 1398
Data Rate	10 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	10BASE-FL, 10BASE-2, AUI-based transceiver, or 10BASE-T hubs or device; Half-duplex Ethernet-to-Ethernet with full-duplex support for AUI connections.
Cable Supported	62.5 micron multimode fiber optic 9 micron single mode fiber optic Thin coaxial Thick coaxial Unshielded twisted pair (UTP)
Cable Distance	Multimode Fiber: 2 kilometers Single Mode Fiber: 5.7 kilometers Long-Reach Single Mode Fiber: 28.0 kilometers ThinNet: 185 meters over RG58 cable ThickNet: 50 meters UTP: 100 meters over 100 ohm Category 3

### ◆ Special Note ◆

The single mode fiber adapter used with the ESM-U-6 has been deemed:

CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLAITE  
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.

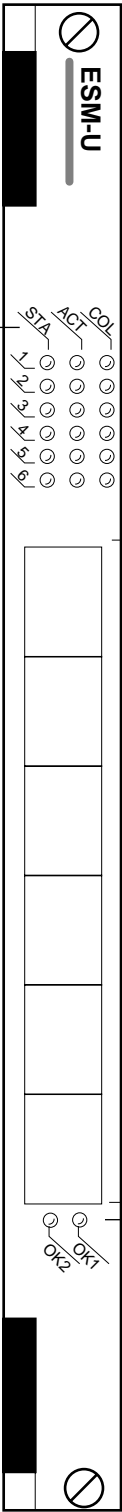
This ESM module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number.

**STA** (Status). On Green continuously when a good cable connection exists to a network device. Off when a good connection does not exist. Flashes Green slowly when the port has been disabled.

**ACT** (Activity). On Green when data is transmitted or received on the corresponding port.

**COL** (Collision). Flashes amber when a collision has been detected on the port.

Port LEDs



Connector Slots

Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

Ethernet 6-Port Universal Switching Module

### Installing Ethernet Universal Adapter Boards

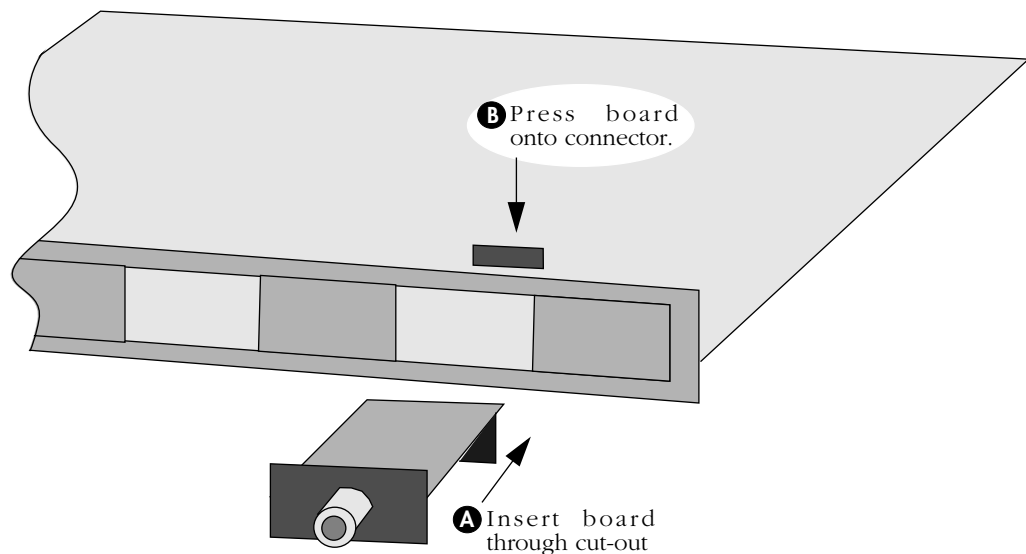
This section provides instructions for installing Ethernet Universal Switching Module adapter boards. The Ethernet Universal Switching Module has six adapter board positions located on the front panel of the module. All adapter boards, except for the AUI/10BASE-T version, occupy one of the six slot positions. The AUI/10BASE-T adapter board occupies two positions.

#### Note

The 10BASE-2 (BNC) adapter board requires that you set up grounding and termination jumpers before installing the board. This is the only adapter board that may require the setting of jumpers. See *Grounding and Termination on the 10BASE-2 Adapter Board* on page 7-27 for further information.

Follow these instructions to install an ESM-U adapter board:

1. Remove the Ethernet Universal Switching Module from the chassis. Make sure the **OK2** LED is in its normal flashing green state before removing the ESM-U. When you remove the module, the MPM's **OK2** LED will flash amber one or two times, then return to normal flashing green.
2. Place the ESM-U in a safe, flat working area that is free of static.
3. Position the adapter board in front of the ESM-U cut-out where it will be installed.
4. Insert the board through the appropriate cut-out position with its board connector facing down. Align its connector with the corresponding connector on the ESM-U.



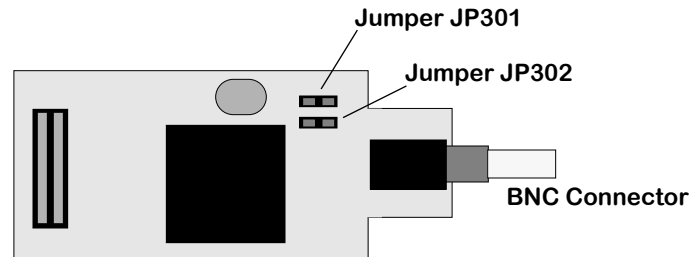
#### Inserting an ESM-U Adapter Board

5. Gently press the adapter board connector into place.
6. Secure the adapter board with the screws supplied.
7. Insert the Ethernet Universal Switching Module back into the chassis. When you insert a module, the MPM's **OK2** light will flash amber for several seconds then return to normal.

## Grounding and Termination on the 10BASE-2 Adapter Board

Depending upon your installation, you may need to install or remove grounding and termination jumpers on the 10BASE-2 Adapter Board before installing it in the Ethernet Universal Switching Module.

**Grounding.** Jumper JP301 is used for grounding and is installed at the factory. The figure below shows the location of this jumper.



### Location of 10Base2 Adapter Board Jumpers for Grounding and Termination

When jumper JP301 is installed, the ThinNet BNC connector's shell is connected to the chassis ground. Only one grounding is required on an entire ThinNet segment. If this is the grounding point, then leave the jumper in its place. If the ThinNet segment is already grounded then remove the jumper. Multiple grounding points in a single segment will create ground loop problems.

**Termination.** Jumper JP302 is used for termination and is installed at the factory. See the above figure for the location of this jumper.

When jumper JP302 is installed, the ThinNet BNC connector is internally terminated with 50-ohms. Termination is only required at both ends of the BNC cable. If this module is at one of the end nodes, install the jumper. If this module is in the middle of the cable, remove the jumper.

### Removing and Installing Jumpers

To remove one of these jumpers, gently grasp the jumper and pull straight up. Store the jumper by placing it over only one of the pins so that a connection is not made.

To install a jumper, place the jumper on the two pin headers and gently press down into place.

## Fast Ethernet (100 Mbps) Modules

Fast Ethernet switching modules provide a variety of connection options. You can choose from copper or fiber (SC) connectors running at full or half-duplex. Ethernet 100 Mbps modules can each support two fully switched ports. The copper UTP option allows you to divide a switched port into a single collision domain of four ports that share the 100 Mbps of bandwidth.

You can connect a hub, single device, or backbone to an Ethernet switching module port. If you connect a hub, you can gradually decrease the number of devices connecting to that switch port as bandwidth requirements increase. High-traffic network devices, such as network servers, can connect directly into a single dedicated switch port using the full 100 Mbps of bandwidth available. The switch will automatically sense if only one device is attached to a port and optimize it to receive only traffic destined for the address of that device. Fiber-port modules are suited for backbone connections in networks where Fast Ethernet is used as the backbone media.

Fast Ethernet modules include the following:

- ESM-100C Four or eight 100BASE-Tx connections using RJ-45 ports.
- ESM-100C-FD One or two full-duplex 100BASE-Tx connections using RJ-45 ports.
- ESM-100Fx-FD One or two full-duplex 100BASE-Fx fiber connections (single mode or multimode) using SC connectors.
- ESM-100C-5 Five 100BASE-Tx connections using RJ-45 ports. One of the five ports supports full-duplex operation; the other four ports share a 100Base-Tx connection.
- ESM-100CFx-5 One fiber 100BASE-Fx connection and four shared 100Base-Tx connections. The fiber port supports full-duplex operation and can be configured with single mode or multimode connectors.

Each of these modules is illustrated and described in this section.

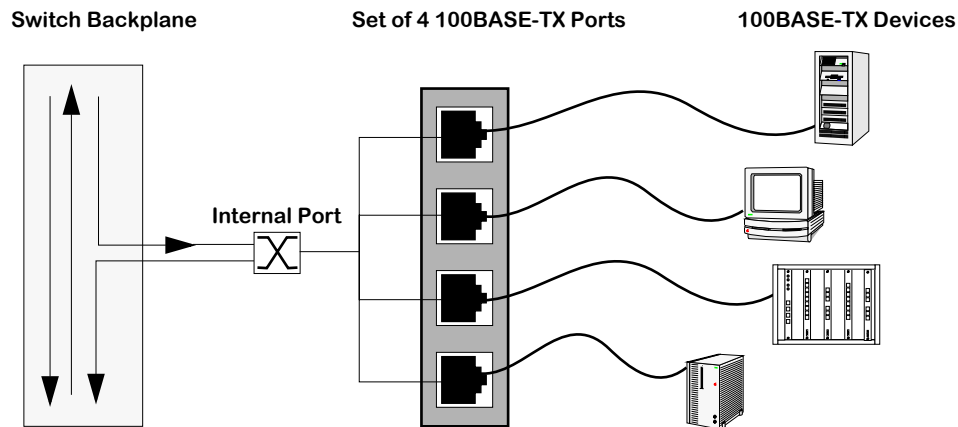
◆ **Note** ◆

See *Ethernet Pinouts* on page 7-102 for information on Ethernet RJ-45 pinouts.

## ESM-100C

The ESM-100C can be configured with four or eight ports that connect to 100Base-Tx devices. Each set of four ports is one collision domain that connects to a fifth internal port. This internal port connects directly to the switch backplane and has a unique MAC address.

Each front panel port on the ESM-100C is capable of using the full 100 Mbps of dedicated bandwidth. However, when more than one connection is made to each set of four ports, those connections must share the 100 Mbps of bandwidth. Front panel ports receive data from attached 100BaseTx devices and from the fifth internal port (which connects to the switch backplane). In addition, data received on any front panel port is automatically passed on to the other three ports that share its collision domain and to the internal port.



The internal switch port receives data from the switch backplane and the 100Base-Tx front panel ports. This port passes data destined for the front panel ports (from other switch ports) in one direction, and passes data destined for other switch ports (from the front panel ports) in the other direction. This internal port has its own set of LEDs, separate from the front panel port LEDs.

ESM-100C Technical Specifications	
Number of ports	4 or 8
Connector Type	RJ-45
Standards Supported	IEEE 802.3u (100Base-Tx)
Data Rate	100 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	100Base-Tx hub or device
Cable Supported	Unshielded twisted-pair (UTP), Category 5 EIA/TIA 568
Cable Distance	100 m

There are two versions of the ESM-100C front panel design. The difference between the two is in how LEDs are organized. Internal port LEDs are separated from front panel port LEDs. Both versions of the front panel are shown on the following pages.

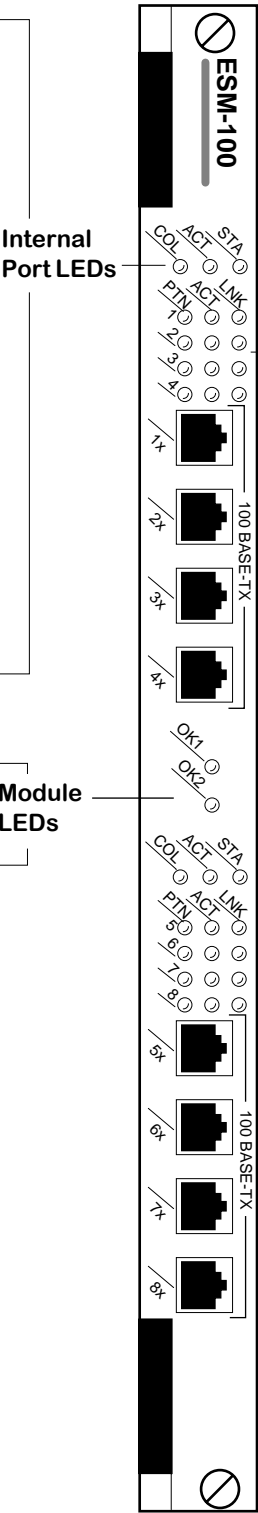
The module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number. If the ESM module includes a total of eight ports, then the module contains two sets of five rows of LEDs. The second set of LEDs displays above the second set of ports.

**COL.** Flashes amber when a collision has been detected on the internal port. A collision here is defined as two or more ports receiving data at the same time. The ports included in this collision domain include the four front panel ports plus the internal port connected to the switch backplane. A collision may occur when data is received simultaneously on two front panel ports or when data is received on a front panel port and the internal port attached to the switch backplane simultaneously.

**ACT.** On Green when data is received from the switch backplane that is destined for one of the front panel ports.

**STA.** On Green when the internal port has a valid connection to the switch backplane and has been initialized. This connection can be disabled via software.

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



**PTN.** On amber when excessive collisions have forced the port to be partitioned. A port will partition after 64 collisions have occurred. Partitioning the port allows the other three ports to receive data again. Only one of the four front panel ports can receive data at one time. Therefore, partitioning a port that is creating a bottleneck with excessive collisions clears the data path so that the other three ports can receive data.

**ACT.** On Green when data is received on the corresponding port. After receiving data, the receiving port automatically transmits the data to the other three front panel ports.

**LNK.** On Green continuously when a good cable connection to a 100Base-Tx device exists. Off when a good connection does not exist. Flashes Green when the port has been disabled.

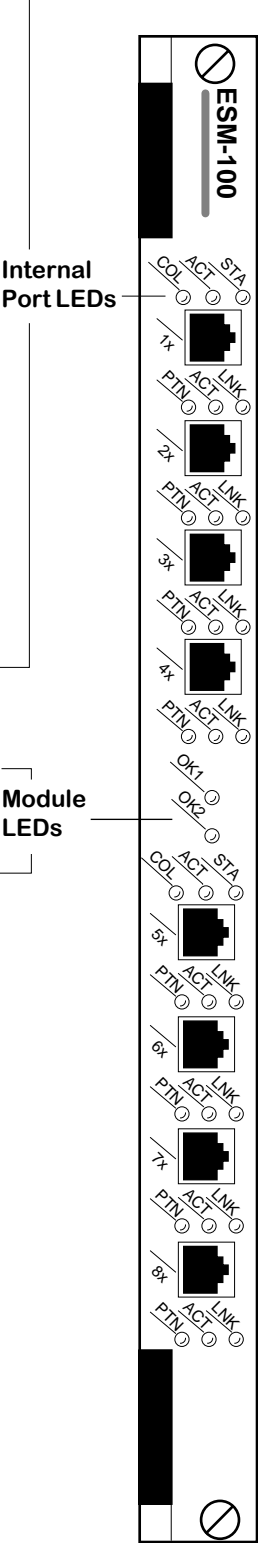
ESM-100C 8-Port Module

**COL.** Flashes amber when a collision has been detected on the internal port. A collision here is defined as two or more ports receiving data at the same time. The ports included in this collision domain include the four front panel ports plus the internal port connected to the switch backplane. A collision may occur when data is received simultaneously on two front panel ports or when data is received on a front panel port and the internal port attached to the switch backplane simultaneously.

**ACT.** On Green when data is received from the switch backplane that is destined for one of the front panel ports.

**STA.** On Green when the internal port has a valid connection to the switch backplane and has been initialized. This connection can be disabled via software.

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



The ESM module includes one row of LEDs for each port. The LEDs for a given port display below that port.

**PTN.** On amber when excessive collisions have forced the port to be partitioned. A port will partition after 64 consecutive collisions have occurred. Partitioning the port allows the other three ports to receive data again. Only one of the four front panel ports can receive data at one time. Therefore, partitioning a port that is creating a bottleneck with excessive collisions clears the data path so that the other three ports can receive data.

**ACT.** On Green when data is received on the corresponding port. After receiving data, the receiving port automatically transmits the data to the other three front panel ports and to the internal port.

**LNK.** On Green continuously when a good cable connection to a 100Base-Tx device exists. Off when a good connection does not exist. Flashes Green when the port has been disabled.

ESM-100C (Older Front Panel Design)

## ESM-100C-FD

The ESM-100C-FD Ethernet switching module contains one or two RJ-45 connectors that support one or two fully switched, full-duplex, 100Base-Tx ports. Each port uses the full 100 Mbps of bandwidth in each direction. Each port supports either half- or full-duplex operation. You configure whether you want a half- or full-duplex connection through the **eth100cfg** command. By default, ESM-100C-FD ports support full-duplex connections.

The ESM-100C-FD is best used as a high-speed connection to a server. If the server supports full-duplex communication, then throughput is doubled from a standard half-duplex connection. If connection to a Fast Ethernet backbone is desired, then the fiber variation of this module, the ESM-100F-FD, is a more suitable choice. See *ESM-100Fx-FD* on page 7-35 for information on the ESM-100F-FD.

The ESM-100C-FD is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your Ethernet cable directly into the ESM-100C-FD sub-module, but it is the HSM module that connects to the switch backplane.

ESM-100C-FD Technical Specifications	
Number of ports	One or two
Connector Type	RJ-45
Standards Supported	IEEE 100Base-Tx
Data Rate	100 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	Full duplex: 100Base-Tx device or bridge port Half-duplex: 100Base-Tx device, hub or bridge port
Cable Supported	Unshielded twisted-pair (UTP)—100 ohm Shielded twisted-pair (STP)—100 ohm
Cable Distance	100 m

The ESM-100C-FD module includes one set of LEDs for each 100Base-Tx port. The LEDs for a given port display above the port. If the ESM module includes two ports, then the module contains two sets of LEDs. The second set of LEDs displays above the second 100Base-Tx port.

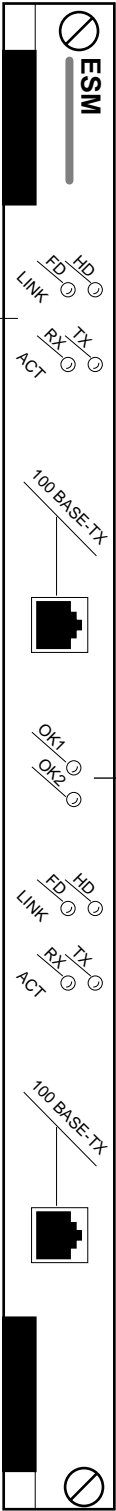
**FD** and **HD**. These two LEDs indicate the current operational mode and the link status of the connection for this ESM-100 port. When the **HD** LED is On, then the port has a good connection and is operating in half-duplex mode; the port and the device to which it is connected do not transmit at the same time. When the **FD** LED is On, the port has a good connection and is operating in full-duplex mode; the port and the device to which it is connected can transmit simultaneously. You can configure whether the port operates in half- or full-duplex mode with the **eth100cfg** command. By default, the port operates in full-duplex mode.

**RX** and **TX**. These two LEDs indicate transmit and receive activity on this port. The RX LED is On when data is received on the port. The TX LED is On when data is transmitted from the port.

Port LEDs

Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



Ethernet 100Base-Tx Full-Duplex Switching Module

## ESM-100Fx-FD

The ESM-100Fx-FD Ethernet switching module contains one or two fiber SC connectors that support one or two fully switched 100Base-Fx ports. Each port uses the full 100 Mbps of bandwidth in each direction. The ESM-100Fx-FD can be factory configured with single mode or multimode fiber ports. The single mode version is referred to as the ESM-100FS-FD; the multimode version is referred to as the ESM-100FM-FD. The ports are color coded to differentiate the mode: single mode connectors are blue and multimode connectors are black.

The fiber port supports either half- or full-duplex operation. You configure whether you want a half- or full-duplex connection through the **eth100cfg** command. By default, ESM-100Fx-FD ports support full-duplex connections.

The ESM-100Fx-FD is best used as a backbone connection in networks where Fast Ethernet is used as the backbone media. Its support for full-duplex operation allows you to exceed the distance available through half-duplex connections. Each 100BaseFx port may also connect to a single high-traffic device, such as a mail or file server.

The ESM-100Fx-FD is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your Ethernet cable directly into the ESM-100F-FD sub-module, but it is the HSM module that connects to the switch backplane.

ESM-100Fx-FD Technical Specifications	
Number of ports	One or two
Connector Type	SC
Standards Supported	IEEE 100Base-Fx
Data Rate	100 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	Full duplex: 100Base-Fx device or bridge port Half-duplex: 100Base-Fx device, hub or bridge port
Cable Supported	Single mode or multimode fiber
Optical output power	Multimode: -19 to -14 dBm Single mode (category 1): -20 to -14 dBm
Optical receiver sensitivity	Multimode: -31 to -14 dBm Single mode (category 1): -31 to -8 dBm
Cable Distance	Multimode (12dB) fiber: approximately 4.5 km Single mode (11 dB) fiber: approximately 16.5 km

### ◆ Special Note ◆

The single mode version of this module has been deemed:

CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLAITE  
APPAREIL A LASER DE CLASSE 1

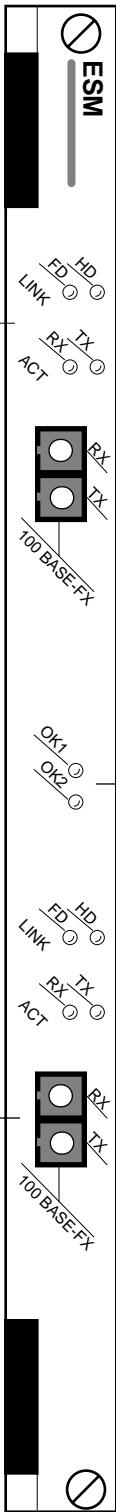
to IEC 825:1984/CENELEC HD 482 S1.

The ESM-100Fx-FD module includes one set of LEDs for each 100Base-Fx port. The LEDs for a given port display above the port. If the ESM module includes two ports, then the module contains two sets of LEDs. The second set of LEDs displays above the second 100Base-Fx port.

**FD** and **HD**. These two LEDs indicate the current operational mode and the link status of the connection for this ESM-100 port. When the **HD** LED is On, then the port has a good connection and is operating in half-duplex mode; the port and the device to which it is connected do not transmit at the same time. When the **FD** LED is On, the port has a good connection and is operating in full-duplex mode; the port and the device to which it is connected can transmit simultaneously. You can configure whether the port operates in half- or full-duplex mode with the **eth100cfg** command. By default, the port operates in full-duplex mode.

**RX** and **TX**. These two LEDs indicate transmit and receive activity on this port. The RX LED is On when data is received on the port. The TX LED is On when data is transmitted from the port.

SC connectors are color coded to indicate multimode (Black) or single mode (Blue).



**Module LEDs** Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

Ethernet 100Base-Fx Full-Duplex Switching Module (Single or Multimode)

## ESM-100C-5

The ESM-100C-5 Ethernet switching module contains five 100Base-Tx ports using RJ-45 connectors. The single top port is a full-duplex port that supports 100 Mbps of bandwidth in each direction over one dedicated Ethernet segment. The bottom set of four ports are one shared collision domain that switches between the top port or any other network segment.

### Full-Duplex Port

The single top port is a fully switched, full-duplex 100Base-Tx port that uses the full 100 Mbps of bandwidth in each direction. It supports either half- or full-duplex operation. You configure whether you want a half- or full-duplex connection through the **eth100cfg** command, but by default the ports support full-duplex connections. This port is best used as a high-speed connection to a server. If the server supports full-duplex communication, then throughput is doubled from a standard half-duplex connection.

### Four-Port Shared Collision Domain

The bottom four ports connect to 100Base-Tx devices. The set of ports connects to a fifth, internal port. This internal port connects directly to the switch backplane and has a unique MAC address. Each of the bottom four front panel ports are capable of using the full 100 Mbps of dedicated bandwidth. However, when more than one connection is made to each set of four ports, those connections share the 100 Mbps of bandwidth.

Front panel ports receive data from attached 100BaseTx devices and from the fifth internal port (which connects to the switch backplane). In addition, data received on any front panel port is automatically passed on to the other three ports that share its collision domain and to the internal port.

The internal switch port receives data from the switch backplane and the 100Base-Tx front panel ports. This port passes data destined for the front panel ports (from other switch ports) in one direction, and passes data destined for other switch ports (from the front panel ports) in the other direction. This internal port has its own set of LEDs, which is located above the front panel port LEDs.

The ESM-100C-5 is actually two sub-modules, or daughtercards, that attach to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your Ethernet cable directly into the ESM-100C-5 sub-module, but it is the HSM module that connects to the switch backplane.

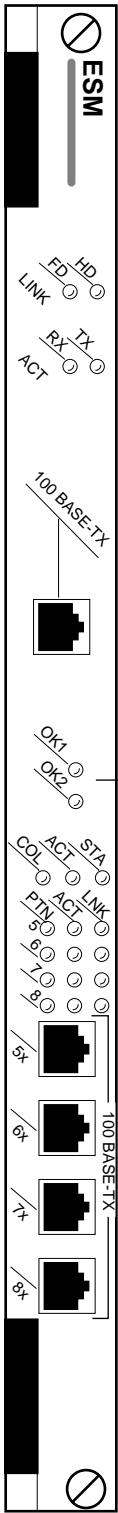
ESM-100C-5 Technical Specifications	
Number of ports	5
Connector Type	RJ-45
Standards Supported	IEEE 100Base-Tx
Data Rate	100 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	Full duplex: 100Base-Tx device or bridge port Half-duplex: 100Base-Tx device, hub or bridge port
Cable Supported	Unshielded twisted-pair (UTP)—100 ohm Shielded twisted-pair (STP)—100 ohm
Cable Distance	100 m

This module includes one set of LEDs for the full-duplex connection and one set of LEDs for the four shared-domain ports. The LEDs for the full-duplex connection display above the top switch port. The LEDs for the four shared domain ports display above the set of ports.

**Full-Duplex Port LEDs.** These LEDs are described for the ESM-100C-FD module. See *ESM-100C-FD* on page 7-33 for a description of these LEDs.

**Shared Domain LEDs.** These LEDs are described for the ESM-100C module. See *ESM-100C* on page 7-29 for a description of these LEDs.

**Module LEDs** Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



Ethernet 100Base-Tx 5-Port Switching Module

### ESM-100CFx-5

The ESM-100CFx-5 Ethernet switching module contains one fiber SC connector and four RJ-45 connectors that support one fully switched 100Base-Fx port and four shared 100Base-Tx ports, respectively. The fiber port is a full-duplex port that supports 100 Mbps of bandwidth in each direction. The set of four ports is one shared collision domain that switches between the 100Base-Fx port or any other segment in the network.

#### Full-Duplex Fiber Port

The fiber port is a fully switched, full-duplex 100Base-Fx port that uses the full 100 Mbps of bandwidth in each direction. The ESM-100CFx-5 can be factory configured with single mode or multimode fiber ports. The single mode version is referred to as the ESM-100CFS-5; the multimode version is referred to as the ESM-100CFM-5. The port is color coded to differentiate the mode: a single mode connector is blue and a multimode connector is black.

The fiber port supports either half- or full-duplex operation. You configure whether you want a half- or full-duplex connection through the **eth100cfg** command. By default, the port supports full-duplex connections.

This port is best used as a backbone connection in networks where Fast Ethernet is used as the backbone media. Its support for full-duplex operation allows you to exceed the distance available through half-duplex connections. In addition to its use as a backbone connection, this port may connect to a single high-traffic device, such as a mail or file server.

#### Four-Port Shared Collision Domain

The bottom four ports connect to 100Base-Tx devices. The set of ports connects to a fifth, internal port. This internal port connects directly to the switch backplane and has a unique MAC address. Each of the four front panel ports are capable of using the full 100 Mbps of dedicated bandwidth. However, when more than one connection is made to each set of four ports, those connections must share the 100 Mbps of bandwidth.

Front panel ports receive data from attached 100BaseTx devices and from the fifth internal port (which connects to the switch backplane). In addition, data received on any front panel port is automatically passed on to the other three ports that share its collision domain and to the internal port.

The internal switch port receives data from the switch backplane and the 100Base-Tx front panel ports. This port passes data destined for the front panel ports (from other switch ports) in one direction, and passes data destined for other switch ports (from the front panel ports) in the other direction. This internal port has its own set of LEDs, which is located above the front panel port LEDs.

The ESM-100CFx-5 is actually two sub-modules, or daughtercards, that attach to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your Ethernet cable directly into the ESM-100CF-5 sub-module, but it is the HSM module that connects to the switch backplane.

<b>ESM-100CFx-5 Technical Specifications</b>	
Number of ports	5
Connector Type	SC and RJ-45
Standards Supported	IEEE 100Base-Fx and 100Base-Tx
Data Rate	100 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	Full duplex: 100Base-Fx device or bridge port Half-duplex: 100Base-Fx/Tx device, hub or bridge port
Cable Supported	<b>Fiber Port</b> Single mode or multimode fiber <b>Shared Port</b> Unshielded twisted-pair (UTP)—100 ohm Shielded twisted-pair (STP)—100 ohm
Optical output power	Multimode fiber: -19 to -14 dBm Single mode (category 1) fiber: -20 to -14 dBm
Optical receiver sensitivity	Multimode fiber: -31 to -14 dBm Single mode (category 1) fiber: -31 to -8 dBm
Cable Distance	<b>RJ-45 Port:</b> 100 m <b>Fiber Full-Duplex Port:</b> Multimode (12dB) fiber: approximately 4.5 km Single mode (11 dB) fiber: approximately 16.5 km

#### ◆ Special Note ◆

The single mode fiber version of this module has been deemed:

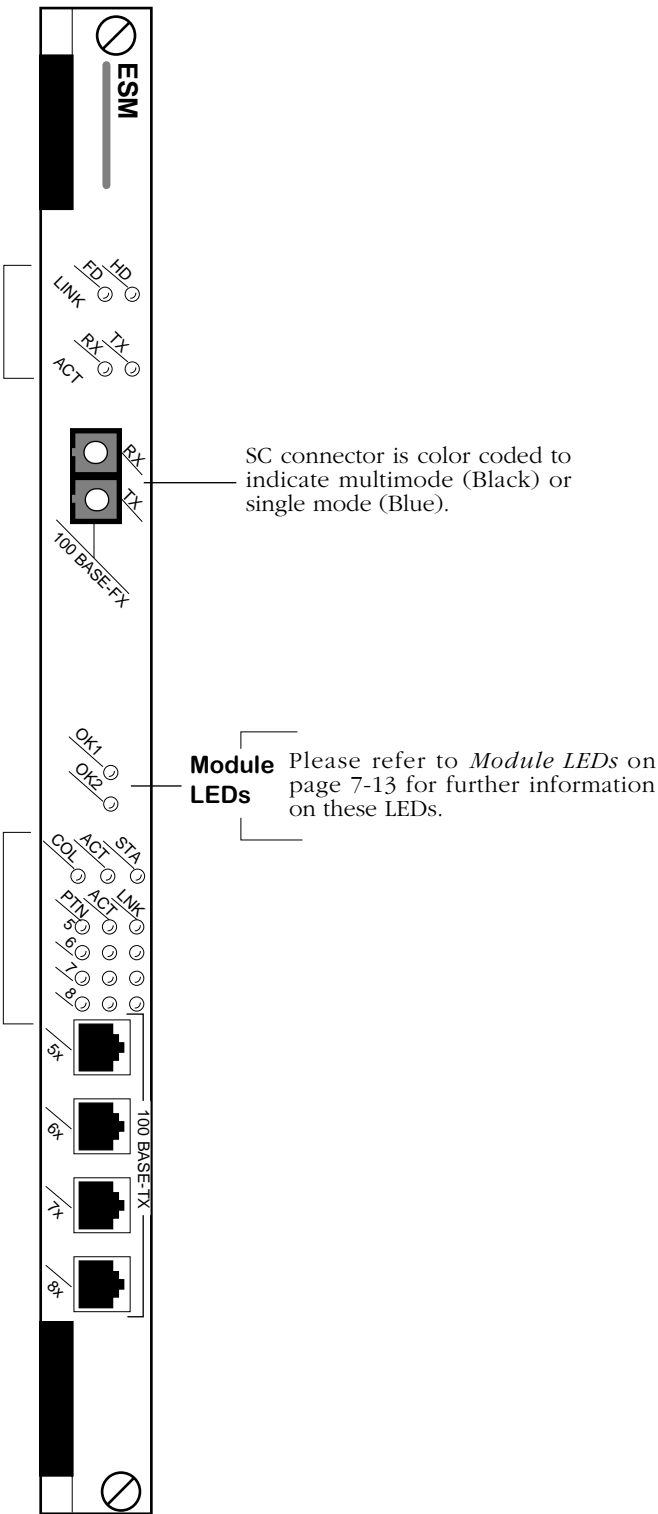
CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLAITE  
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.

This module includes one set of LEDs for the fiber connection and one set of LEDs for the four shared-domain ports. The LEDs for the fiber connection display above the top switch port. The LEDs for the four shared domain ports display above the set of ports.

**Full-Duplex Port LEDs.** These LEDs are described for the ESM-100F-FD module. See *ESM-100Fx-FD* on page 7-35 for a description of these LEDs.

**Shared Domain LEDs.** These LEDs are described for the ESM-100C module. See *ESM-100C* on page 7-29 for a description of these LEDs.



Ethernet 100Base-Fx/100Base-Tx 5-Port Switching Module

## ATM Access Modules

ATM access switching modules allow you to connect the OmniSwitch to ATM servers, backbones and switches. ATM modules support OC-3, DS-3, and E3 interfaces (155, 44.736, and 34.368 Mbps respectively) and include the following:

- **ASM-155F $x$**  One or two port fiber single mode or multimode OC-3 switching module.
- **ASM2-155F $x$**  One or two port fiber single mode or multimode OC-3 switching module. This is a higher performance version of the ASM-155F $x$ .
- **ASM-155C** One or two port UTP OC-3 switching module.
- **ASM2-622F** One or two port fiber single mode or multimode OC-12 switching module.
- **ASM2-622FR** Two or four port redundant fiber single mode or multimode OC-12 switching module. Each port pair includes a primary and backup port.
- **ASM-DS3** One or two port DS-3 switching module.
- **ASM-E3** One or two port E3 switching module.
- **ASM-CE** One ATM uplink port (OC-3, DS-3 or E3), two T1/E1 ports, and two serial ports supporting ATM circuit emulation.
- **ASM2-DS3** One or two port DS-3 switching module. This is a higher performance version of the ASM-DS3.
- **ASM2-E3** One or two port E3 switching module. This is a higher performance version of the ASM-E3.

The OC-3 modules are suited for connecting the switch to an ATM campus backbone or directly to an ATM server.

Through the use of Point-to-Point Bridging (RFC 1483), you can extend all LAN traffic over the ATM backbone. Several OmniSwitches could be connected over one or more backbones. In such a configuration, you combine the flexibility of the OmniSwitch's any-to-any switching with the power and speed of the ATM backbone without the use of an ATM backbone switch.

If you are connecting the OmniSwitch directly to an ATM server, then all non-ATM devices in the LAN can communicate with the high-speed ATM server through the OmniSwitch.

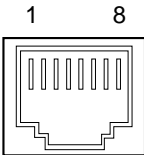
If your network uses ATM backbone switches, then the OmniSwitch ATM modules allow all non-ATM devices in the network to have access to the ATM network through the use of LAN Emulation (LANE) or an Alcatel version of LANE called XLANE, or "VLAN Clusters." XLANE connects OmniSwitches and OmniStacks together across ATM and legacy LAN networks to gain the benefits of LANE while eliminating interoperability issues. Classical IP (RFC 1577) may also be used to extend LAN traffic over ATM.

The DS-3 and E3 modules are well suited for connecting the switch to ATM carrier services offered by Telco service providers.

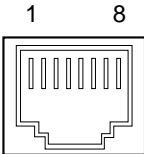
Software controls on the switch allow you to control and monitor activity on ATM modules. On each ATM port, you can configure the connection type (SVC or PVC), Virtual Channel Connections (VCC), segment sizes, and loopback controls. On each VCC, you can configure Quality of Service (QoS), Best Effort, Traffic Descriptor, and Peak Cell Rate variables. In addition, you can configure all ATM bridging and trunking services (Point-to-Point Bridging, LANE, XLANE, Classical IP). See Chapter 35, "Managing ATM Access Modules," and Chapter 38, "Configuring ATM Services," for further information on ATM software controls.

ATM Pinouts

The following figures and table illustrate the pinouts for copper-based connector ports.



ATM RJ-45 Specifications	
Pin Number	Standard Signal Name
1	Xmit Data +
2	Xmit Data -
3	
4,	
5	
6	
7	Receive Data +
8	Receive Data -



ATM RJ-48C Specifications	
Pin Number	Standard Signal Name
1	Rx_Ring
2	Rx_Tip
3	Chassis GND
4,	Tx_Ring
5	Tx_Tip
6	Chassis GND
7	Chassis GND  (A jumper is provided for connecting Pins 7 and 8 to the chassis ground, if required.)
8	Chassis GND  (A jumper is provided for connecting Pins 7 and 8 to the chassis ground, if required.)

## ASM-155F $x$

The ASM-155F $x$  switching module can contain one or two fiber (SC) ports that support OC-3 connections. Each port connection provides 155 Mbps of bandwidth and connects to either multimode or single mode cable. The ASM-155F $x$  can be factory configured with single mode (intermediate- or long-reach) or multimode fiber ports. The single mode intermediate-reach version is referred to as the ASM-155FS; the single mode long-reach version is referred to as the ASM-155FSH; the multimode version is referred to as the ASM-155FM. Connector types are differentiated by color: multimode connectors are black, single mode intermediate-reach connectors are blue, and single mode long-reach connectors are yellow.

ASM-155F $x$  ports are ideally suited for connections to an ATM campus fiber backbone. Using point-to-point bridging (RFC 1483), you can extend all devices (ATM and non-ATM) connected to an OmniSwitch over the ATM fiber backbone without the use of a high-end ATM switch. This module comes in a high-performance version referred to as the ASM2-155-F $x$ , which is recommended for LANE and point-to-point bridging configurations.

<b>ASM-155Fx Technical Specifications</b>	
Number of ports	1 or 2
Connector Type	SC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/2.0 MPOA Client
Data Rate	155 Mbps
ATM Adaption Layers	AAL5
MAC Addresses Supported	1,024; 2,048 or 4,096 with CAM upgrade option
Max. No. of VCs Supported	1,024
Connections Supported	OC-3 connections to ATM server, backbone, or switch.
Optical output power	Multimode: -19 to -14 dBm Single mode (intermediate reach): -14 to -8 dBm Single mode (long reach): -20 to -14 dBm
Optical receiver sensitivity	Multimode: -30 to -14 dBm Single mode (intermediate reach): -31 to -8 dBm Single mode (long reach): -34 to -10 dBm
Power Budget	Multimode: 11 dB Single mode (intermediate reach): 16 dB Single mode (long reach): 29 dB
Cable Supported	Multimode: 62.5 micron multimode fiber Single mode (intermediate and long reach): single mode fiber
Cable Distance	Multimode: 4.2 km Single mode (intermediate reach): 24 km Single mode (long reach): 40 km

**◆ Special Note ◆**

The single mode version of this module is:

CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLAITE  
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.

This module includes one set of LEDs for each port. The LEDs for a given port display above the port. If the ASM module includes two ports, then the module contains two sets of LEDs. The second set of LEDs displays above the second port.

**Warning Label.** This label indicates that the module contains an optical transceiver.

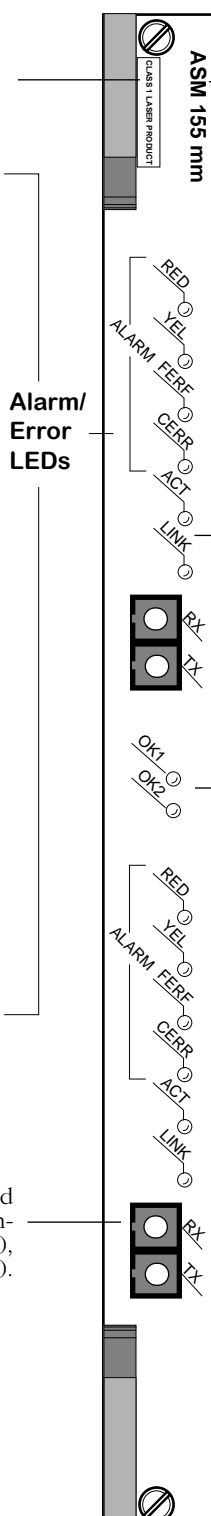
**RED (Red Alarm).** On Amber when a receive failure occurs. A receive failure results when the port is persistently losing frames or when a cable is not inserted. This LED will be on when the ASM module is plugged in, but no cable has been connected.

**YEL (Yellow Alarm).** On Amber when a far end receive failure occurs. The recipient of cells from this ASM is not receiving those cells. This error may be due to a transmission error by the ASM or a receive error on the other end of the link.

**FERF (Far End Status Alarm).** On Amber when a far end receive failure occurs. The recipient of cells from this ASM is not receiving those cells. This error may be due to a transmission error by the ASM or a receive error on the other end of the link. This LED functions the same as the YEL LED.

**CERR (Cell Error).** On Amber when a cell error occurs. A cell error may result from bad data within a cell or when cells are not being received (receive error). If the RED Alarm LED is On, the CERR LED will also be On since receive errors are also considered cell errors. This LED will be on when the module is plugged in but no cable has been connected.

SC connectors will be color coded to indicate multimode (Black), single mode intermediate-reach (Blue), or single mode long-reach (Yellow).



**Module Label.** This label will indicate the ASM-155Fx type. It will read either **ASM 155 mm** (multimode cable), **ASM 155 sm** (intermediate-reach single mode cable), or **ASM 155 sm long reach** (long-reach single-mode cable).

**ACT (Activity).** On Green when the port is transmitting or receiving cells.

**LINK (Link Status/Disabled).** On Green when the module has a valid physical link and a signal is present. Under normal conditions, this LED should always be on when a cable is connected. It will be off if no cable is connected. It should not be on at the same time as the RED Alarm LED.

**Status LEDs**

**Module LEDs**

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

**ATM 2-Port Switching Module (Single or Multimode)**

## ASM-155C

The ASM-155C switching module can contain one or two RJ-45 ports that support OC-3 connections. Each port connection provides 155 Mbps of bandwidth and connects to unshielded twisted pair (UTP) cable.

ASM-155C ports are suited for connections to ATM servers. By connecting an ASM-155C port to an ATM server, you enable all devices (ATM and non-ATM) connected to an OmniSwitch to communicate with the high-speed ATM server.

The ASM-155C is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your cable directly into the ASM-155C sub-module, but it is the HSM module that connects to the switch backplane

ASM-155C Technical Specifications	
Number of ports	1 or 2
Connector Type	RJ-45
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/2.0 MPOA Client
Data Rate	155 Mbps
ATM Adaption Layers	AAL5
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Max. No. of VCs Supported	1,024
Connections Supported	OC-3 connections to ATM server, backbone, or switch.
Cable Supported	Unshielded twisted pair (UTP)

This module includes one set of LEDs for each port. The LEDs for a given port display above the port. If the ASM module includes two ports, then the module contains two sets of LEDs. The second set of LEDs displays above the second port.

**RED** (Red Alarm). On Amber when a receive failure occurs. A receive failure results when the port is persistently losing frames or when a cable is not inserted. This LED will be on when the ASM module is plugged in, but no cable has been connected.

**YEL** (Yellow Alarm). On Amber when a far end receive failure occurs. The recipient of cells from this ASM is not receiving those cells. This error may be due to a transmission error by the ASM or a receive error on the other end of the link.

**FERF** (Far End Status Alarm). On Amber when a far end receive failure occurs. The recipient of cells from this ASM is not receiving those cells. This error may be due to a transmission error by the ASM or a receive error on the other end of the link. This LED functions the same as the YEL LED.

**CERR** (Cell Error). On Amber when a cell error occurs. A cell error may result from bad data within a cell or when cells are not being received (receive error). If the RED Alarm LED is On, the CERR LED will also be On since receive errors are also considered cell errors. This LED will be on when the module is plugged in but no cable has been connected.

#### Alarm/ Error LEDs

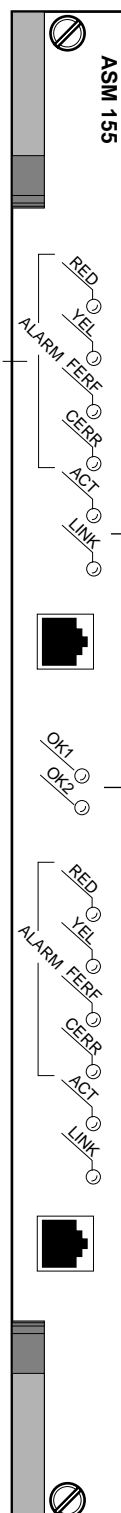
**ACT** (Activity). On Green when the port is transmitting or receiving cells.

**LINK** (Link Status/Disabled). On Green when the module has a valid physical link and a signal is present. Under normal conditions, this LED should always be on when a cable is connected. It will be off if no cable is connected. It should not be on at the same time as the RED Alarm LED.

#### Status LEDs

#### Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



**ATM 2-Port UTP Module**

### ASM2-155F

The ASM2-155F switching module is an enhanced version of the ASM-155F. It contains one or two fiber (SC) ports that support OC-3 connections. Each port connection provides 155 Mbps of bandwidth and connects to either multimode or single mode cable. The ASM2-155F can be factory configured with single mode or multimode fiber ports. The intermediate-reach single mode version is referred to as the ASM2-155FS; long-reach single mode version is referred to as the ASM2-155FSH; the multimode version is referred to as the ASM2-155FM. Multimode and single mode connectors are differentiated by color: multimode connectors are black and single mode connectors are blue.

ASM2-155F ports are suited for connections to an ATM campus fiber backbone. Using an ATM service (LANE, point-to-point bridging, etc.), you can extend all devices (ATM and non-ATM) connected to an OmniSwitch over the ATM fiber backbone.

<b>ASM2-155FM/S Technical Specifications</b>	
Number of ports	1 or 2
Connector Type	SC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/2.0 MPOA Client
Data Rate	155 Mbps
Maximum Frame Size	8,000 bytes
MAC Addresses Supported	4,096
Max. No. of VCs Supported	1,024
Connections Supported	OC-3 connections to ATM server or backbone.
Optical output power	Multimode: -19 to -14 dBm Single mode (intermediate reach): -14 to -8 dBm Single mode (long reach): -20 to -14 dBm
Optical receiver sensitivity	Multimode: -30 to -14 dBm Single mode (intermediate reach): -31 to -8 dBm Single mode (long reach): -34 to -10 dBm
Power Budget	Multimode: 11 dB Single mode (intermediate reach): 16 dB Single mode (long reach): 29 dB
Cable Supported	Multimode: 62.5 micron multimode fiber Single mode (intermediate and long reach): single mode fiber
Cable Distance	Multimode: 4.2 km Single mode (intermediate reach): 24 km Single mode (long reach): 40 km

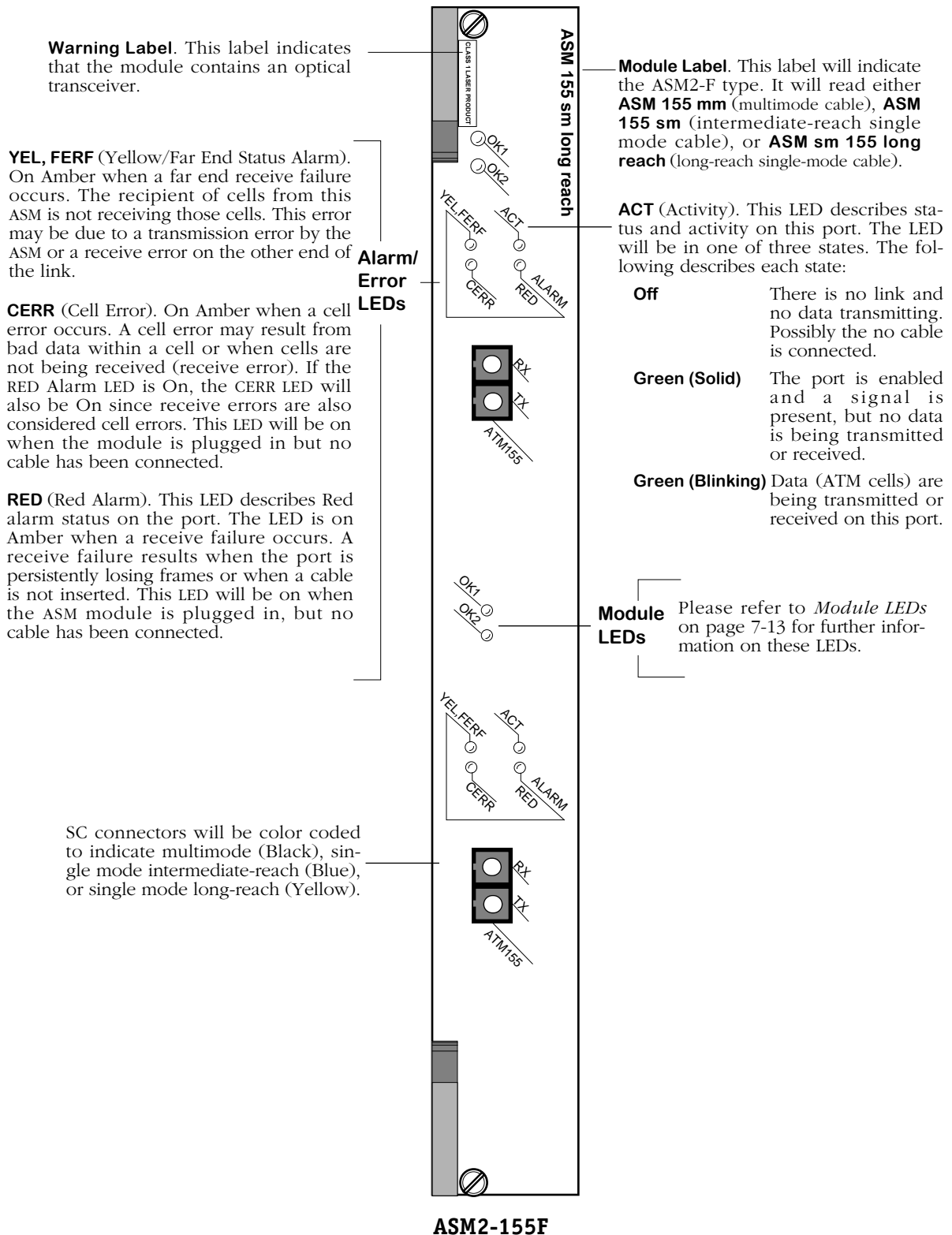
◆ **Special Note** ◆

The single mode version of this module is:

CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLÄITE  
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.

This module includes one set of LEDs for each port. The LEDs for a given port display above the port. If the ASM module includes two ports, then the module contains two sets of LEDs. The second set of LEDs displays above the second port.



## ASM2-155RF

The ASM2-155RF switching module can contain one or two sets of dual-redundant fiber (SC) port pairs that support OC-3 connections. Each port connection provides 155 Mbps of bandwidth and connects to either multimode or single mode cable. The ASM2-155RF can be factory configured with single mode or multimode fiber ports. The single mode version is referred to as the ASM2-155RFS; the multimode version is referred to as the ASM2-155RFM. Multimode and single mode connectors are differentiated by color: multimode connectors are black and single mode connectors are blue.

ASM2-155RF ports are ideally suited for mission-critical ATM access connections. The redundant port pairs ensure that critical backbone and server connections are protected against failures on the primary link.

**◆ Note ◆**

The two-port version of the ASM2-155RF has been discontinued.

<b>ASM2-155RFM/S Technical Specifications</b>	
Number of ports	1 or 2 port pairs (each port pair includes a primary and backup)
Connector Type	SC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/2.0 MPOA Client
Data Rate	155 Mbps
Maximum Frame Size	8,000 bytes
MAC Addresses Supported	4,096
Connections Supported	OC-3 connections to ATM servers or backbone.
Max. No. of VCs Supported	1,024
Optical output power	Multimode: -19 to -14 dBm Single mode (intermediate reach): -14 to -8 dBm
Optical receiver sensitivity	Multimode: -30 to -14 dBm Single mode (intermediate reach): -31 to -8 dBm
Power Budget	Multimode: 11 dB Single mode (intermediate reach): 16 dB
Cable Supported	Multimode: 62.5 micron multimode fiber Single mode (intermediate reach): single mode fiber
Cable Distance	Multimode: 4.2 km Single mode (intermediate reach): 24 km

**◆ Special Note ◆**

The single mode version of this module is:

CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLAITE  
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.

This module includes one set of LEDs for each redundant port pair. The LEDs for a given pair display above the port. If the ASM2 module includes two sets of ports, then the module contains two sets of LEDs. The second set of LEDs displays above the second port pair.

**Warning Label.** This label indicates that the module contains an optical transceiver.

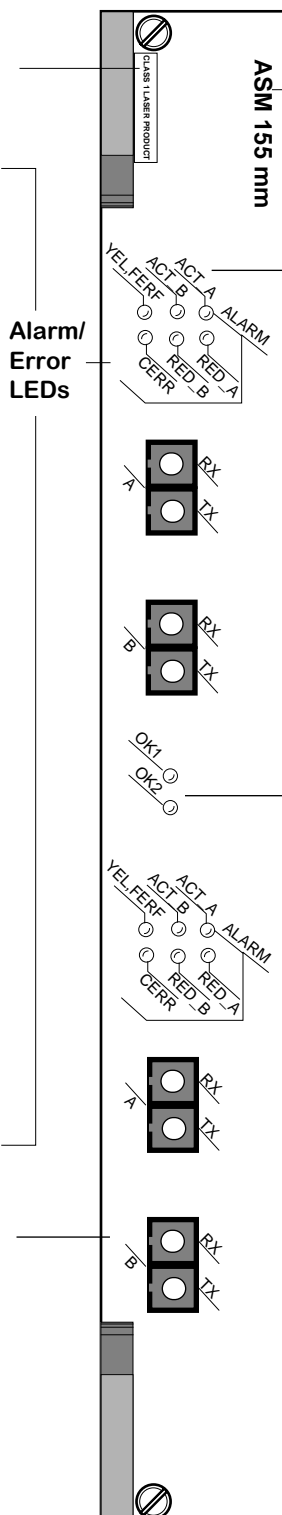
**YEL, FERF** (Yellow/Far End Status Alarm). On Amber when a far end receive failure occurs. The recipient of cells from this ASM is not receiving those cells. This error may be due to a transmission error by the ASM or a receive error on the other end of the link.

**CERR** (Cell Error). On Amber when a cell error occurs. A cell error may result from bad data within a cell or when cells are not being received (receive error). If the RED Alarm LED is On, the CERR LED will also be On since receive errors are also considered cell errors. This LED will be on when the module is plugged in but no cable has been connected.

**RED\_A** and **RED\_B** (Red Alarm). These two LEDs describe Red alarm status on Port A (**RED\_A**) and Port B (**RED\_B**). On the active (primary) port, the LED is on Amber when a receive failure occurs. A receive failure results when the port is persistently losing frames or when a cable is not inserted. This LED will be on when the ASM module is plugged in, but no cable has been connected.

On the redundant (non-active) port, this LED is not relevant.

SC connectors will be color coded to indicate multimode (Black) or single mode (Blue).



**Module Label.** This label will indicate the ASM2-RF type. It will read either **ASM 155 mm** (multimode cable) or **ASM 155 sm** (intermediate-reach single mode cable).

**ACT\_A** and **ACT\_B** (Activity). These two LEDs describe status and activity on Port A (**ACT\_A**) and Port B (**ACT\_B**). Each LED will be in one of the following states:

**Primary (Active) Port:**

If the port is enabled and a signal is present, but no data is being transmitted or received, this LED will be solid Green. If data (ATM cells) are being transmitted or received on this port. If there is no link and no data transmitting, this LED will be Off. Possibly no cable is connected.

**Redundant (Non-Active) Port:**

If there is a good connection, this LED will be solid Green. If there is no connection, this LED will be Off.

**Module LEDs** Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

**ASM2-155RF**

## **ASM2-622F (Discontinued)**

The ASM2-622F switching module can contain one or two fiber (SC) ports that support OC-12 connections. Each port connection provides 622 Mbps of bandwidth and connects to either multimode or single mode cable. The ASM2-622F can be factory configured with single mode or multimode fiber ports. The single mode version is referred to as the ASM2-622FS; the multimode version is referred to as the ASM2-622FM. Multimode and single mode connectors are differentiated by color: multimode connectors are black and single mode connectors are blue.

ASM2-622F ports are ideally suited for ATM access connections in an ATM campus fiber backbone. The ASM2-622FM/FS switching module can connect to ATM servers and backbones. Its on-board Content Addressable Memory (CAM) supports up to 8,192 MAC addresses, making the module a powerful backbone connection.

### **◆ Note ◆**

The ASM2-622F is supported, but it has been discontinued. For 622 Mbps ATM access, the ASM2-622RF (see *ASM2-622RF* on page 7-59) is recommended.

<b>ASM2-622FM/S Technical Specifications</b>	
Number of ports	1 or 2
Connector Type	SC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/2.0 MPOA Client
Data Rate	622 Mbps
Maximum Frame Size	8,000 bytes
MAC Addresses Supported	4,096 or 8,192
Max. No. of VCs Supported	1,024
Connections Supported	OC-12 connections to ATM server or backbone.
Optical output power	Multimode: -20 to -14 dBm Single mode: -15 to -8 dBm
Optical receiver sensitivity	Multimode: -26 to -14 dBm Single mode: -28 to -8 dBm
Cable Supported	Multi-Mode: 62.5 micron multimode fiber Single mode: intermediate-reach single-mode fiber
Cable Distance	Multimode: 500 meters Single mode: 15 km (intermediate reach)

**◆ Special Note ◆**

The single mode version of this module is:

CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLAITE  
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.

This module includes one set of LEDs for each port. The LEDs for a given port display above the port. If the ASM2 module includes two ports, then the module contains two sets of LEDs. The second set of LEDs displays above the second port.

**YEL, FERF** (Yellow/Far End Status Alarm). On Amber when a far end receive failure occurs. The recipient of cells from this ASM2 is not receiving those cells. This error may be due to a transmission error by the ASM2 or a receive error on the other end of the link.

**CERR** (Cell Error). On Amber when a cell error occurs. A cell error may result from bad data within a cell or when cells are not being received (receive error). If the RED Alarm LED is On, the CERR LED will also be On since receive errors are also considered cell errors. This LED will be on when the module is plugged in but no cable has been connected.

**RED** (Red Alarm). This LED describes Red alarm status on the ASM2-622 port. The LED is on Amber when a receive failure occurs. A receive failure results when the port is persistently losing frames or when a cable is not inserted. This LED will be on when the ASM module is plugged in, but no cable has been connected.

### Alarm/ Error LEDs

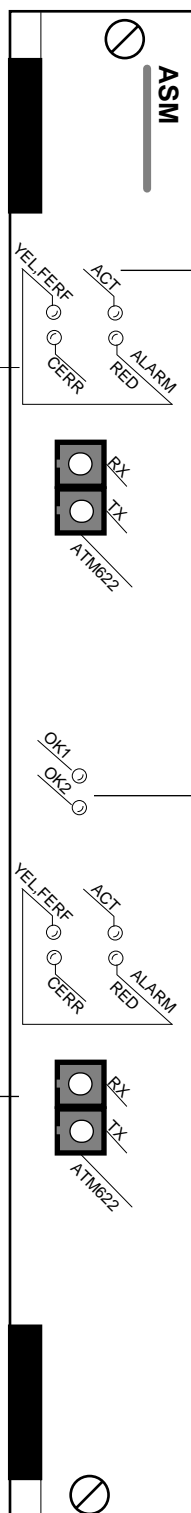
**ACT**(Activity). This LED describes status and activity on the ASM2-622 port. The LED will be in one of three states. The following describes each state:

- Off** There is no link and no data transmitting. Possibly the no cable is connected.
- Green (Solid)** The port is enabled and a signal is present, but no data is being transmitted or received.
- Green (Blinking)** Data (ATM cells) are being transmitted or received on this port.

### Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

SC connectors will be color coded to indicate multimode (Black) or single mode (Blue).



**ASM2-622F**

## ASM2-622RF

The ASM2-622RF switching module can contain one or two sets of dual-redundant fiber (SC) port pairs that support OC-12 connections. Each port connection provides 622 Mbps of bandwidth and connects to either multimode or single mode cable. The ASM2-622RF can be factory configured with single mode or multimode fiber ports. The single mode version is referred to as the ASM2-622RFS; the multi- mode version is referred to as the ASM2-622RFM. Multimode and single mode connectors are differentiated by color: multimode connectors are black and single mode connectors are blue.

ASM2-622RF ports are ideally suited for mission-critical ATM access connections. The redundant port pairs ensure that critical backbone and server connections are protected against failures on the primary link. In addition, the module's on-board Content Addressable Memory (CAM) supports up to 8,192 MAC addresses, making the module a powerful backbone connection.

**◆ Note ◆**

The two-port version of the ASM2-622RF has been discontinued.

<b>ASM2-622RFM/S Technical Specifications</b>	
Number of ports	1 or 2 port pairs (each port pair includes a primary and backup)
Connector Type	SC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/2.0 MPOA Client
Data Rate	622 Mbps
Maximum Frame Size	8,000 bytes
MAC Addresses Supported	4,096 or 8,192
Max. No. of VCs Supported	1,024
Connections Supported	OC-12 connections to ATM servers or backbone.
Optical output power	Multimode: -20 to -14 dBm Single mode: -15 to -8 dBm
Optical receiver sensitivity	Multimode: -26 to -14 dBm Single mode: -28 to -8 dBm
Cable Supported	Multi-Mode: 62.5 micron multimode fiber Single mode: intermediate-reach single-mode fiber
Cable Distance	Multimode: 500 meters Single mode: 15 km (intermediate reach)

**◆ Special Note ◆**

The single mode version of this module is:

CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLAITE  
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.

This module includes one set of LEDs for each redundant port pair. The LEDs for a given pair display above the port. If the ASM2 module includes two sets of ports, then the module contains two sets of LEDs. The second set of LEDs displays above the second port pair.

**Warning Label.** This label indicates that the module contains an optical transceiver.

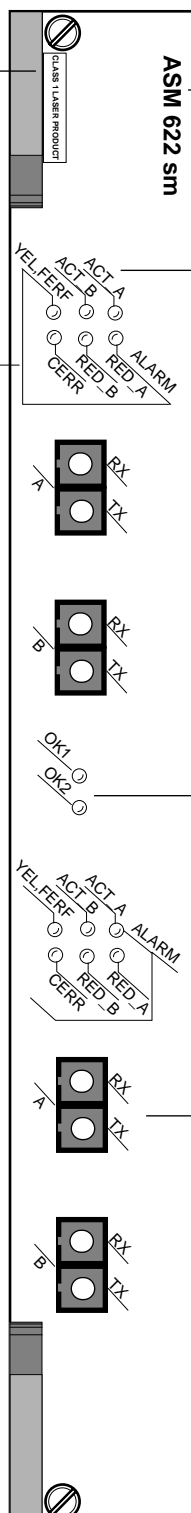
**YEL, FERF** (Yellow/Far End Status Alarm). On Amber when a far end receive failure occurs. The recipient of cells from this ASM is not receiving those cells. This error may be due to a transmission error by the ASM or a receive error on the other end of the link.

**CERR** (Cell Error). On Amber when a cell error occurs. A cell error may result from bad data within a cell or when cells are not being received (receive error). If the RED Alarm LED is On, the CERR LED will also be On since receive errors are also considered cell errors. This LED will be on when the module is plugged in but no cable has been connected.

**RED\_A** and **RED\_B** (Red Alarm). These two LEDs describe Red alarm status on Port A (**RED\_A**) and Port B (**RED\_B**). On the active (primary) port, the LED is on Amber when a receive failure occurs. A receive failure results when the port is persistently losing frames or when a cable is not inserted. This LED will be on when the ASM module is plugged in, but no cable has been connected.

On the redundant (non-active) port, this LED is not relevant.

#### Alarm/ Error LEDs



**Module Label.** This label will indicate the ASM2-622RF type. It will read either **ASM 622 mm** (multimode cable) or **ASM 622 sm** (intermediate-reach single mode cable).

**ACT\_A** and **ACT\_B** (Activity). These two LEDs describe status and activity on Port A (**ACT\_A**) and Port B (**ACT\_B**). Each LED will be in one of the following states:

#### Primary (Active) Port:

If the port is enabled and a signal is present, but no data is being transmitted or received, this LED will be solid Green. If data (ATM cells) are being transmitted or received on this port. If there is no link and no data transmitting, this LED will be Off. Possibly no cable is connected.

#### Redundant (Non-Active) Port:

If there is a good connection, this LED will be solid Green. If there is no connection, this LED will be Off.

#### Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

SC connectors will be color coded to indicate multimode (Black) or single mode (Blue).

**ASM2-622RF**

### ASM-DS3

The ASM-DS3 switching module can contain one or two BNC ports that support DS-3 connections. Each port connection provides 44.736 Mbps of bandwidth and connects to coaxial (RG-59) cable. ASM-DS3 ports are suited for connections to ATM carrier services offered by North American Telcos. The ASM-DS3 port is a physical DTE (Data Termination Equipment) device that connects to a physical DCE (Data Communication Equipment) device, such as a DSU (Data Service Unit).

DS-3 is a Digital Signal (DS) interface used to implement wide area, public connectivity for ATM networks. There is a hierarchy of DS services based on channel capacity. DS-0, the lowest bandwidth DS channel, provides 64 Kbps of throughput. Twenty-four (24) DS-0 channels combine to form a DS-1 (1.544 Mbps of throughput). Four DS-1 channels combine to form a DS-2 (6.312 Mbps of throughput). And seven DS-2 channels combine to form a DS-3 (44.736 Mbps of throughput).

By default the ASM-DS3 uses B3ZS line encoding. Using the **map** command, you can configure the module to use C-bit parity or M23 parity and configure it for loopback controls. You should configure the ASM-DS3 module to use the same parity as the ATM service provider.

Two different mapping protocols are used to transmit ATM cells over DS-3: PLCP (Physical Layer Convergence Protocol) and ATM Direct Mapped (ADM) System. The two protocols are not compatible. Many existing DS-3 implementations use PLCP as defined in ANSI T1.624-1993, but many new implementations of DS-3 use ADM. The ASM-DS3 module supports both physical layer protocols.

The ASM-DS3 is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your cable directly into the ASM-DS3 sub-module, but it is the HSM module that connects to the switch backplane.

<b>ASM-DS3 Technical Specifications</b>	
Number of ports	1 or 2
Connector Type	BNC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/2.0 MPOA Client ANSI T1.624-1993 (PLCP Mapping)
Data Rate	44.736 Mbps
ATM Adaption Layers	AAL5
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Max. No. of VCs Supported	1,024
Connections Supported	DS-3 connections to ATM carrier service.
Cable Distance	185 m
Cable Supported	Coaxial RG-59 (75 ohm)

This module includes one set of LEDs for each port. The LEDs for a given port display above the port. If the ASM module includes two ports, then the module contains two sets of LEDs. The second set of LEDs displays above the second port.

**RED** (Red Alarm). On Amber when a receive failure occurs. A receive failure results when the port is persistently losing frames or when a cable is not inserted. This LED will be on when the ASM module is plugged in, but no cable has been connected.

**YEL** (Yellow Alarm). On Amber when a far end receive failure occurs. The recipient of cells from this ASM is not receiving those cells. This error may be due to a transmission error by the ASM or a receive error on the other end of the link.

**AIS** (Alarm Indication Signal). On when a maintenance signal is sent to the ASM by the network. If this LED is on, then there has been a change in the Alarm Indication Signal (AIS).

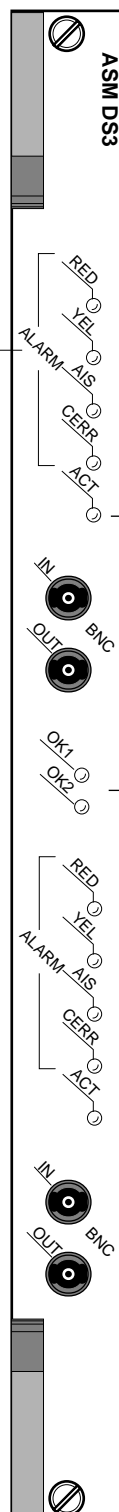
**CERR** (Cell Loss Error). Interpretation of the CERR LED depends on the mapping protocol used on this ATM port. The mapping may be ATM Direct Mapped (ADM) or Physical Layer Convergence Protocol (PLCP) and is configured through the **map** command.

If ADM is used, then the CERR LED goes on after seven consecutive cells with errors are received. It turns back off again when six consecutive cells are received without errors.

If PLCP is used, then this LED goes on when PLCP frames are out of frame for 1 ms. It turns back off again when no out-of-frame errors have occurred for 12 ms. In PLCP framing, ATM cells are prepended with three framing octets and a path overhead octet. A PLCP frame is considered out-of-frame when errors are detected in the first two framing octets, or in the third frame octet and the path overhead octet.

In addition, the CERR LED will be on when the receive cable is not inserted.

### Alarm LEDs



**ACT** (Activity). On Green when the port is transmitting or receiving cells.

### Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

**ATM 2-Port DS-3 Module**

## ASM-E3

The ASM-E3 switching module can contain one or two BNC ports that support E3 connections. Each port connection provides 34.368 Mbps of bandwidth and connects to coaxial (RG-59) cable. ASM-E3 ports are suited for connections to ATM carrier services offered by International Telcos. The ASM-E3 port is a physical DTE (Data Termination Equipment) device that connects to a physical DCE (Data Communication Equipment) device, such as a DSU (Data Service Unit).

E3 is a designation used by Telcos to indicate the capacity of a digital service. E3 actually multiplexes two smaller types of digital service lines (E1 and E2) to reach its channel capacity. E1 is a carrier designation for a digital service with a data rate of 2.048 Mbps. E2 is a carrier designation for a digital services with a data rate of 8.448 Mbps. E3, which interleaves four E2 channels, has a data rate of 34.368.

By default the ASM-E3 uses HDB3 line encoding. Three different mapping protocols are used to transmit ATM cells over an E3 line: Physical Layer Convergence Protocol (PLCP) and two ATM Direct Mapped (ADM) Systems. The PLCP is G.751, and the ADM protocols are G.751 and G.832. The three protocols are not compatible. Many existing E3 implementations use PLCP as defined in ANSI T1.624-1993, but many new implementations of Digital Signaling use ADM. The ASM-E3 module supports all three physical layer protocols.

The ASM-E3 is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your cable directly into the ASM-E3 sub-module, but it is the HSM module that connects to the switch backplane

ASM-E3 Technical Specifications	
Number of ports	1 or 2
Connector Type	BNC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/2.0 MPOA Client ANSI T1.624-1993 (PLCP Mapping)
Data Rate	34.368 Mbps
ATM Adaption Layers	AAL5
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Max. No. of VCs Supported	1,024
Connections Supported	E3 connections to ATM carrier service.
Cable Distance	185 m
Cable Supported	Coaxial RG-59 (75 ohm)

This module includes one set of LEDs for each port. The LEDs for a given port display above the port. If the ASM module includes two ports, then the module contains two sets of LEDs. The second set of LEDs displays above the second port.

**RED** (Red Alarm). On Amber when a receive failure occurs. A receive failure results when the port is persistently losing frames or when the receive cable is not inserted. This LED will be on when the ASM module is plugged in, but no cable has been connected.

**YEL** (Yellow Alarm). On Amber when a far end receive failure occurs. The Far End Receive Failure (FERF) is defined as FERF for ADM G.832 mapping protocols, and defined as Remote Alarm Indication (RAI) for PLCP and ADM G.751 mapping protocols. The recipient of cells from this ASM is not receiving those cells. This error may be due to a transmission error by the ASM or a receive error on the other end of the link.

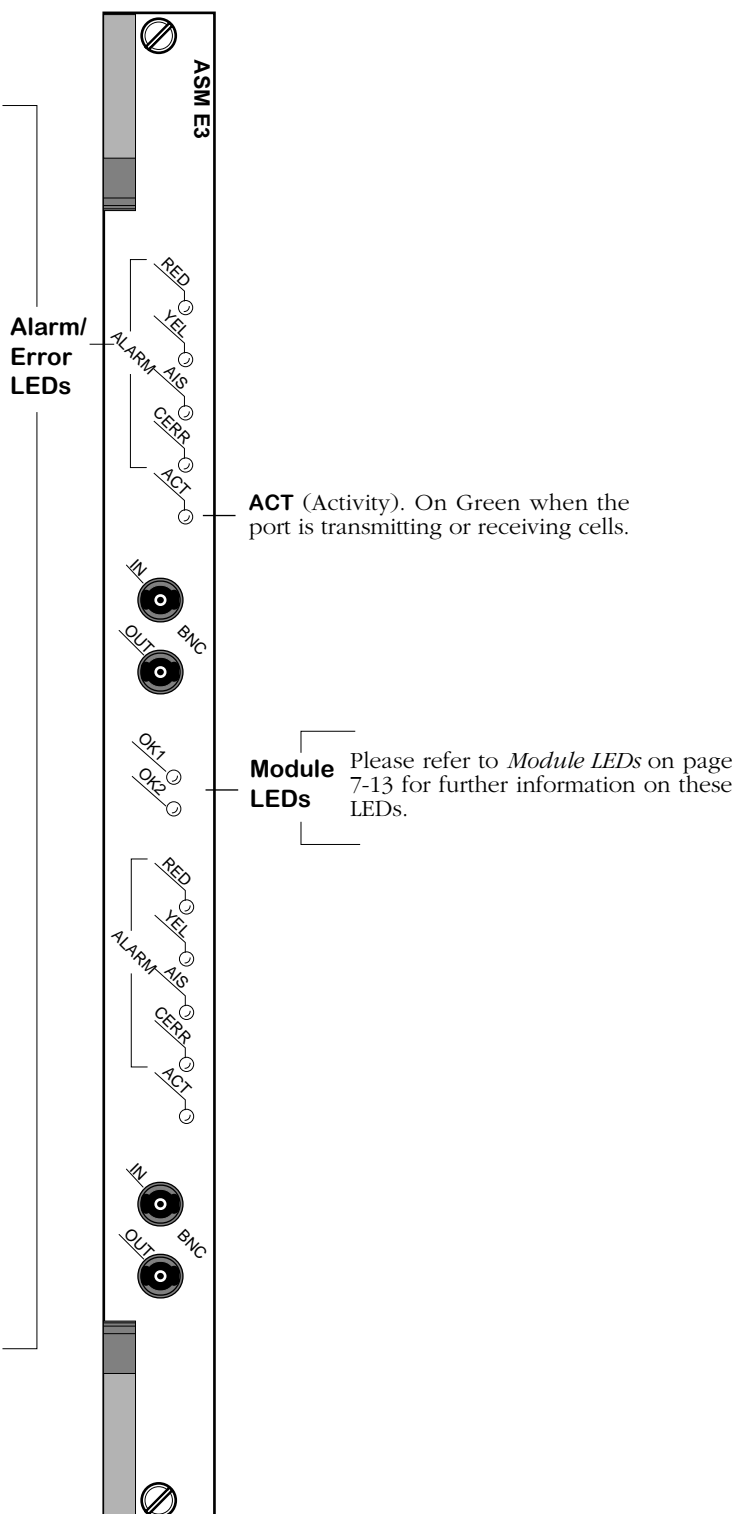
**AIS** (Alarm Indication Signal). On while the Alarm Indication Signal (AIS) maintenance signal is received in the frame payload of the ASM.

**CERR** (Cell Loss Error). Interpretation of the CERR LED depends on the mapping protocol used on this ATM port. The mapping may be ATM Direct Mapped (ADM) or Physical Layer Convergence Protocol (PLCP) and is configured through the **map** command.

If ADM is used, then the CERR LED goes on after seven consecutive cells with errors are received. It turns back off again when six consecutive cells are received without errors.

If PLCP is used, then this LED goes on when PLCP frames are out of frame for 1.2 ms. It turns back off again when no out-of-frame errors have occurred for 10 ms. In PLCP framing, ATM cells are prepended with three framing octets and a path overhead octet. A PLCP frame is considered out-of-frame when errors are detected in the first two framing octets, or in the third frame octet and the path overhead octet.

In addition, the CERR LED will be on when the receive cable is not inserted.



**ATM 2-Port E3 Module**

## ASM-CE

The ASM-CE converts traditional circuit emulation traffic from T1, E1, or serial ports to ATM cells for transport over an ATM network. This module is best employed as a means of connecting legacy Time Division Multiplexing (TDM) and synchronous serial traffic to an enterprise ATM network. It contains one ATM uplink port, two T1 or E1 ports, and two serial ports. The ATM uplink port may be factory-configured as OC-3, DS-3, or E3.

You can configure several circuit emulation parameters through switch software commands. Configurable options include service mode (structured or unstructured), clocking mode, cell delay variation, and ATM reassembly buffer size. Configuration options specifically for T1 and E1 ports include frame format, facility datalink, and line coding. In addition, the switch can store up to 24 hours of local and remote statistics for T1 and E1 ports.

ASM-CE Technical Specifications	
Number of ports	5 total 1 ATM Uplink port (OC-3, DS-3, or E3) 2 T1 or E1 ports 2 Universal Serial ports
Connector Types	ATM Uplink OC-3: SC fiber (single or multimode) DS-3 and E3: BNC T1/E1 RJ-48C
Standards Supported	RFCs 1406, 1213, 1659 ATM Forum CES-IS, version 2 ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/2.0 MPOA Client ANSI T1.624-1993 (PLCP Mapping)
Frame Formats	T1: Superframe, Extended Superframe, Unframed E1: E1, E1-CRC, E1-MF, E1-CRC-MF, Unframed
Line Coding	T1: B8ZS or AMI E1: HDB3 or AMI
Data Rates Supported	ATM Uplink OC-3: 155 Mbps DS-3: 44.736 Mbps E3: 34.368 Mbps T1: 1.544 Mbps E1: 2.048 Mbps Serial: 56, 64, 128, 256, 384, 512, 768, 1024, 1536, 1544, 2048 Kbps

*continued on next page...*

<b>ASM-CE Technical Specifications (Cont.)</b>	
Facility Datalink Protocol	ANSI T1.403 and AT&T 54016
Data Transfer Services	Structured or Unstructured
Clocking	Synchronous, SRTS, Adaptive
Virtual Circuits Supported	Permanent Virtual Circuits (PVCs) for CE traffic PVCs or (SVCs) for LAN traffic.
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Max. No. of VCs Supported	1,024
Connections Supported	Physical Data Terminal Equipment (DTE) or Data Communication Equipment (DCE)
Optical output power (fiber ports)	Multimode: -19 to -14 dBm Single mode (intermediate reach): -14 to -8 dBm
Optical receiver sensitivity (fiber ports)	Multimode: -30 to -14 dBm Single mode (intermediate reach): -31 to -8 dBm
Power Budget (fiber ports)	Multimode: 11 dB Single mode (intermediate reach): 16 dB
Cable Distance	T1/E1 (short haul): 200 meters T1/E1 (long haul): 1829 meters  Multimode: 4.2 km Single mode (intermediate reach): 24 km
Cable Supported	Serial Ports: DTE or DCE in the following types: R2-232, V.35, X.21, RS-530, RS-449  Fiber ports: Multimode: 62.5 micron multimode fiber Single mode (intermediate reach): single mode fiber

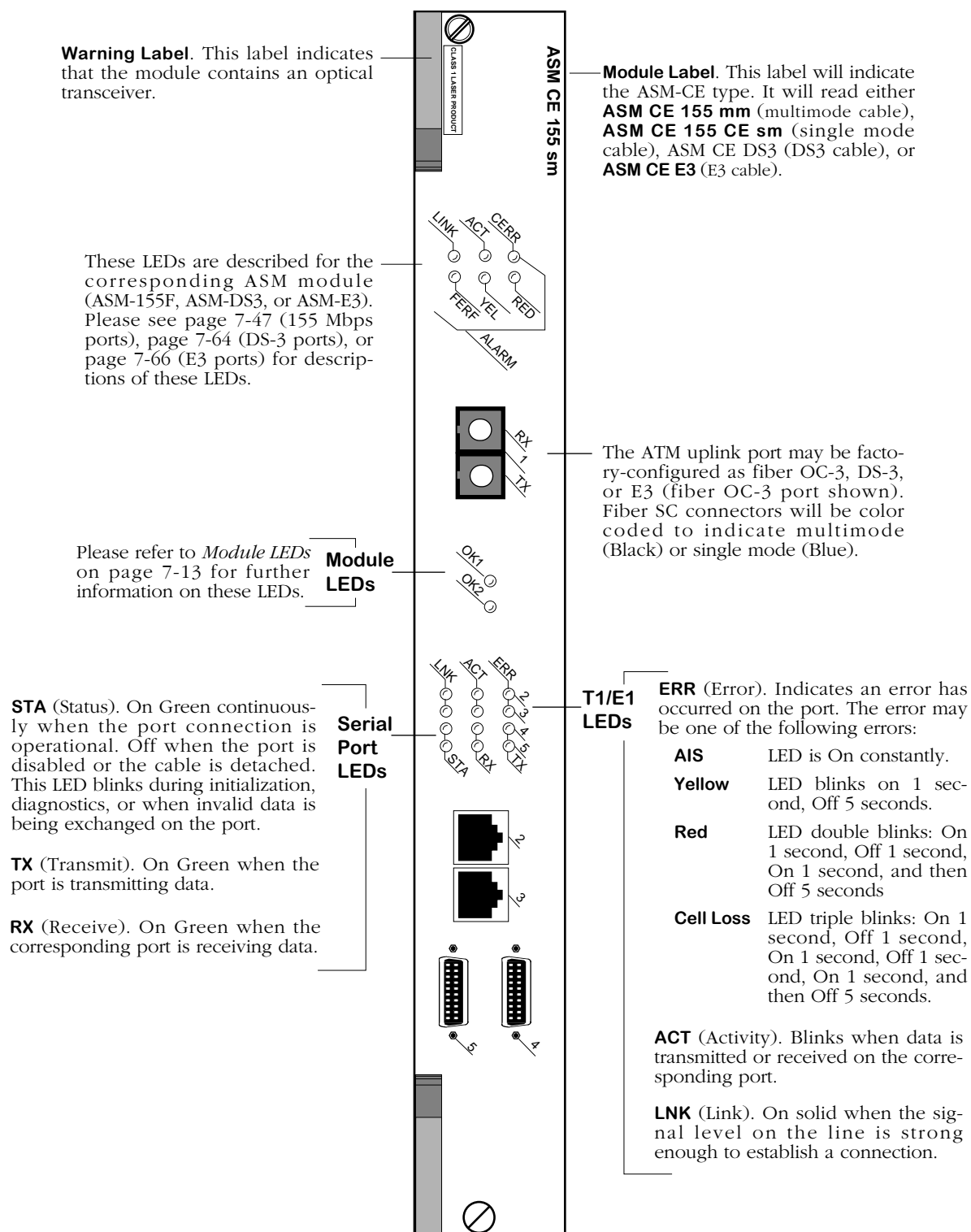
**◆ Special Note ◆**

The single mode version of this module is:

CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLAITE  
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.

This module includes three sets of LEDs. The cluster of six LEDs for the ATM uplink port are located above that port. LEDs for the T1/E1 ports and the serial ports are clustered together above those ports; the first two rows of LEDs in this cluster describe activity on the T1/E1 ports, and the second two rows describe activity on the serial ports. Each port and its corresponding LEDs are labelled.



**ATM Circuit Emulation Module With OC-3 Uplink**

### ASM2-DS3

The ASM2-DS3 switching module contains one or two BNC ports that support DS-3 connections. The port connection provides 44.736 Mbps of bandwidth and connects to coaxial (RG-59) cable. ASM2-DS3 ports are suited for connections to ATM carrier services offered by North American Telcos. The ASM2-DS3 port is a physical DTE (Data Termination Equipment) device that connects to a physical DCE (Data Communication Equipment) device, such as a DSU (Data Service Unit). The one-port version is called the ASM2-DS3-1W; the two-port version is called the ASM2-DS3-2W. See *ASM2-DS3 Technical Specifications* on page 7-71 for more information.

DS-3 is a Digital Signal (DS) interface used to implement wide area, public connectivity for ATM networks. There is a hierarchy of DS services based on channel capacity. DS-0, the lowest bandwidth DS channel, provides 64 Kbps of throughput. Twenty-four (24) DS-0 channels combine to form a DS-1 (1.544 Mbps of throughput). Four DS-1 channels combine to form a DS-2 (6.312 Mbps of throughput). And seven DS-2 channels combine to form a DS-3 (44.736 Mbps of throughput).

By default the ASM2-DS3 uses B3ZS line encoding. Using the **dsmod** command, you can configure the module to use C-bit parity or M23 parity and configure it for loopback controls. You should configure the ASM2-DS3 module to use the same parity as the ATM service provider.

Two different mapping protocols are used to transmit ATM cells over DS-3: PLCP (Physical Layer Convergence Protocol) and ATM Direct Mapped (ADM) System. The two protocols are not compatible. Many existing DS-3 implementations use PLCP as defined in ANSI T1.624-1993, but many new implementations of DS-3 use ADM. The ASM2-DS3 module supports both physical layer protocols.

The ASM2-DS3 is actually a submodule, or daughtercard, that attaches to a High-Speed Module (HSM). You plug your cable directly into the ASM2-DS3 submodule, but it is the HSM module that connects to the switch backplane.

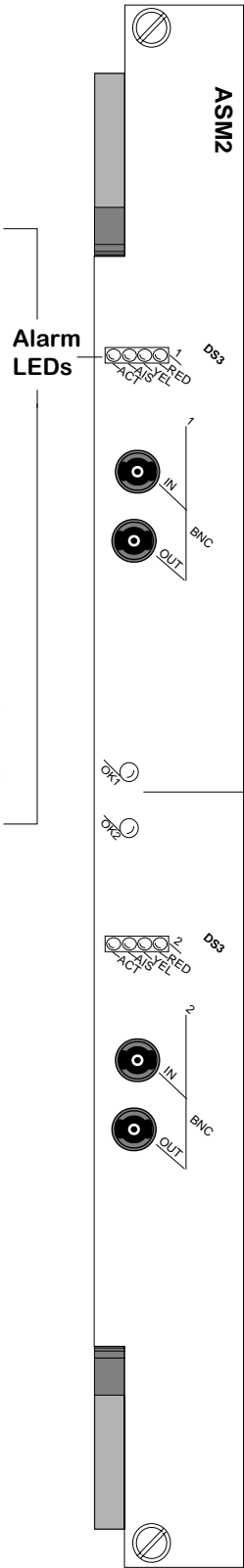
ASM2-DS3 Technical Specifications	
Number of ports	1 or 2
Connector Type	BNC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/V2.0 ANSI T1.624-1993 (PLCP Mapping) MPOA Client
Data Rate	44.736 Mbps
ATM Adaption Layers	AAL5
MAC Addresses Supported	4096
Max. No. of VCs Supported	1,024
Connections Supported	DS-3 connections to ATM carrier service.
Cable Supported	Coaxial RG-59 (75 ohm)
Cable Distance	185 m
Current Draw	<b>1-port:</b> 4.0 amps <b>2-port:</b> 5.5 amps

**RED** (Red Alarm). On Amber when a receive failure occurs. A receive failure results when the port is persistently losing frames or when a cable is not inserted. This LED will be on when the ASM module is plugged in, but no cable has been connected.

**YEL** (Yellow Alarm). On Amber when a far end receive failure occurs. The recipient of cells from this ASM is not receiving those cells. This error may be due to a transmission error by the ASM or a receive error on the other end of the link.

**AIS** (Alarm Indication Signal). On when a maintenance signal is sent to the ASM by the network. If this LED is on, then there has been a change in the Alarm Indication Signal (AIS).

**ACT** (Activity). On Green when the port is transmitting or receiving cells.



**Module LEDs** Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

ATM DS-3 Uplink Module

## ASM2-E3

The ASM2-E3 switching module contains one or two BNC ports that support E3 connections. Each port connection provides 34.368 Mbps of bandwidth and connects to coaxial (RG-59) cable. ASM2-E3 ports are suited for connections to ATM carrier services offered by International Telcos. The ASM2-E3 port is a physical DTE (Data Termination Equipment) device that connects to a physical DCE (Data Communication Equipment) device, such as a DSU (Data Service Unit). The one-port version is called the ASM2-DS3-1W; the two-port version is called the ASM2-DS3-2W. See *ASM2-E3 Technical Specifications* on page 7-74 for more information.

E3 is a designation used by Telcos to indicate the capacity of a digital service. E3 actually multiplexes two smaller types of digital service lines (E1 and E2) to reach its channel capacity. E1 is a carrier designation for a digital service with a data rate of 2.048 Mbps. E2 is a carrier designation for a digital services with a data rate of 8.448 Mbps. E3, which interleaves four E2 channels, has a data rate of 34.368.

By default the ASM2-E3 uses HDB3 line encoding. Three different mapping protocols are used to transmit ATM cells over an E3 line: Physical Layer Convergence Protocol (PLCP) and two ATM Direct Mapped (ADM) Systems. The PLCP is G.751, and the ADM protocols are G.751 and G.832. The three protocols are not compatible. Many existing E3 implementations use PLCP as defined in ANSI T1.624-1993, but many new implementations of Digital Signaling use ADM. The ASM2-E3 module supports all three physical layer protocols. To configure E3 parameters, use the **dsmod** command.

The ASM2-E3 is actually a submodule, or daughtercard, that attaches to an High-Speed Module (HSM). You plug your cable directly into the ASM2-E3 submodule, but it is the HSM module that connects to the switch backplane

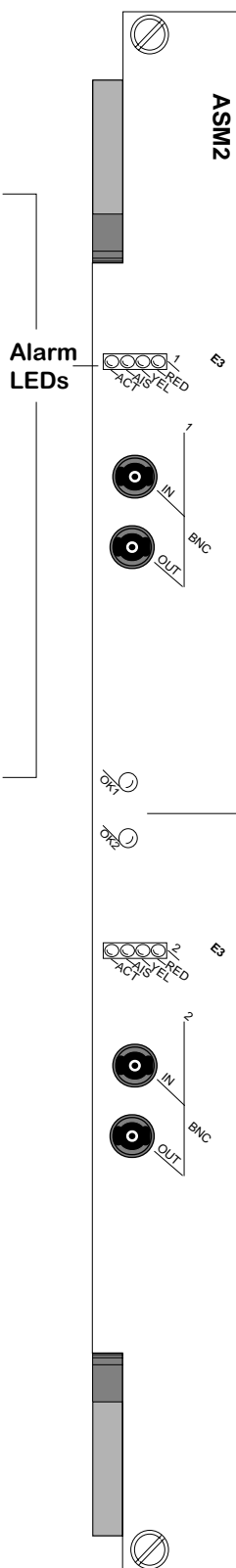
<b>ASM2-E3 Technical Specifications</b>	
Number of ports	1 or 2
Connector Type	BNC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/V2.0 ANSI T1.624-1993 (PLCP Mapping) MPOA Client)
Data Rate	34.368 Mbps
ATM Adaption Layers	AAL5
MAC Addresses Supported	4096
Max. No. of VCs Supported	1,024
Connections Supported	E3 connections to ATM carrier service.
Cable Supported	Coaxial RG-59 (75 ohm)
Cable Distance	185 m
Current Draw	<b>1-port:</b> 4.0 amps <b>2-port:</b> 5.5 amps

**RED** (Red Alarm). On Amber when a receive failure occurs. A receive failure results when the port is persistently losing frames or when a cable is not inserted. This LED will be on when the ASM module is plugged in, but no cable has been connected.

**YEL** (Yellow Alarm). On Amber when a far end receive failure occurs. The recipient of cells from this ASM is not receiving those cells. This error may be due to a transmission error by the ASM or a receive error on the other end of the link.

**AIS** (Alarm Indication Signal). On when a maintenance signal is sent to the ASM by the network. If this LED is on, then there has been a change in the Alarm Indication Signal (AIS).

**ACT** (Activity). On Green when the port is transmitting or receiving cells.



#### Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

**ATM E3 Uplink Module**

## **FDDI and CDDI Modules**

FDDI and CDDI modules support backbone, server, concentrator and single device connections at 100 Mbps. The following FDDI/CDDI modules are supported:

- **FSM-M**                One or two DAS connections over multimode fiber
- **FSM-S**                One or two DAS connections over single mode fiber
- **FSM-SH**              One or two DAS connections over single mode fiber using Category 2 high-powered laser optics.
- **FSM-C**                Four or eight RJ-45 ports for CDDI
- **FSM-M-C**            One FDDI DAS connection and four CDDI ports

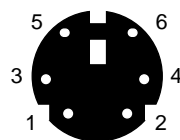
The multimode and single mode fiber modules are well suited for connections over an FDDI dual-ring backbone. OmniSwitch software allows you to configure FDDI Trunking or 802.10 Trunking over FDDI backbones so that you can maintain Group and VLAN configurations on both sides of the backbone. In addition, non-FDDI devices connected to the OmniSwitch will be able to communicate with devices on the FDDI ring.

The CDDI modules can connect high-speed CDDI servers, concentrators, or single devices. A combination module includes four CDDI ports and one FDDI DAS connection that provides the flexibility for high-speed backbone and single device connectivity.

Software controls allow you to configure SMT stations and station timers, view information categorized by MAC address, and view information on specific ports. In addition, you set up Trunking services through software commands. See Chapter 22, "Managing FDDI Modules," for further information on software controls for FDDI and CDDI modules.

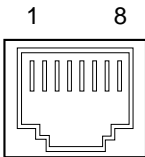
FDDI and CDDI Pinouts

The figure and table below describe and show the locations for the pinouts. Please note that the primary and secondary FDDI rings must be switched at the same time.



FDDI MiniDIN Specifications	
Pin Number	Standard Signal Name
1	Secondary bypass voltage (5V = operational, <4V = bypass)
2	Primary bypass voltage (5V = operational, <4V = bypass)
3	Secondary ground
4,	Primary ground
5	Connected to ground on FSM, looped to Pin 6 inside bypass switch
6	Looped signal from Pin 5, low = bypass switch present

The following figure and table illustrate the pinouts for a CDDI RJ-45 port.



CDDI RJ-45 Specifications	
Pin Number	Standard Signal Name
1	Receive Data +
2	Receive Data -
3	
4,	
5	
6	
7	Xmit Data +
8	Xmit Data -

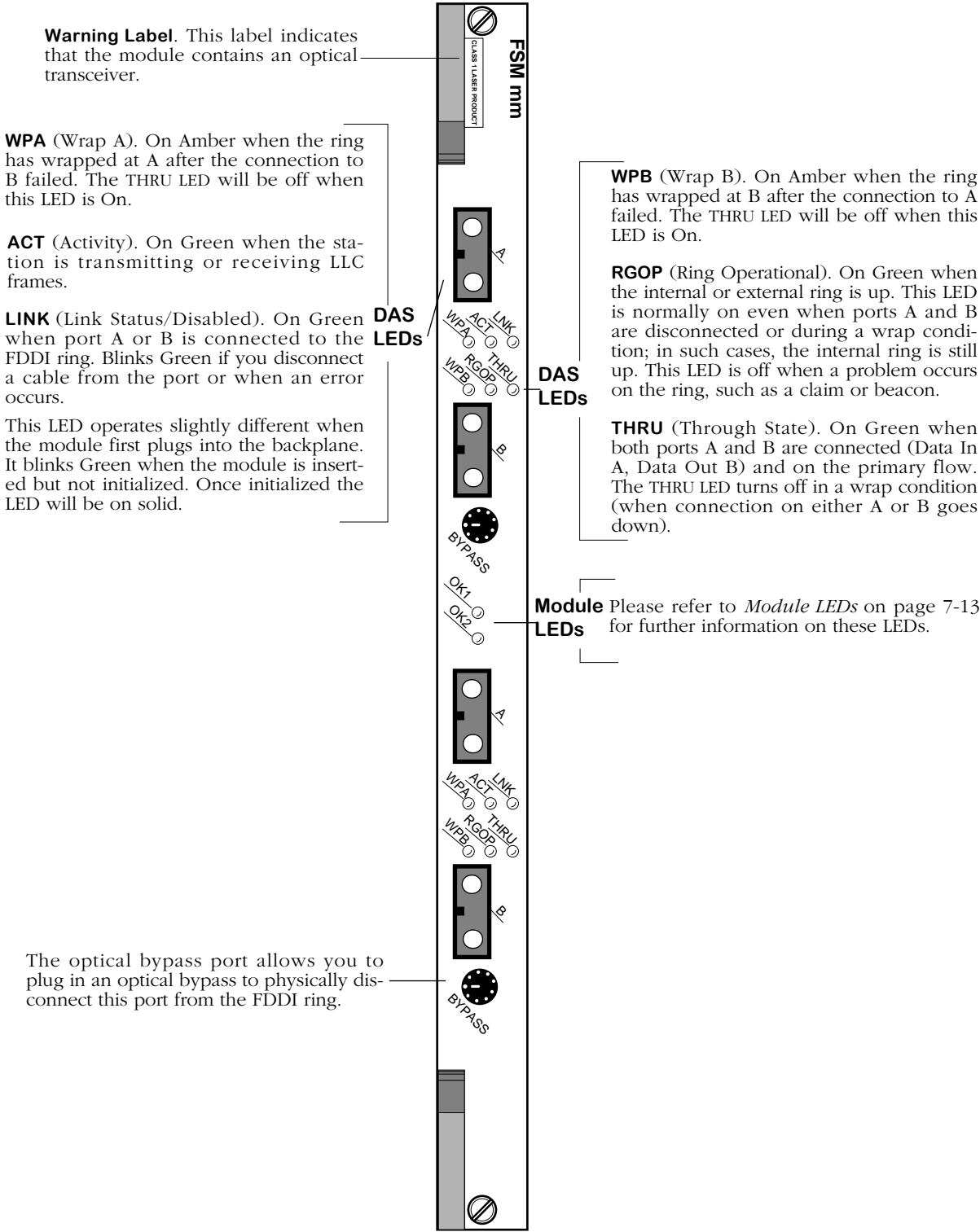
## FSM-M

The FSM-M FDDI switching module may contain one or two dual-attachment station (DAS) connections for support of dual FDDI rings. Each DAS connection is a set of A/B media interface connectors (MIC). The FSM-M supports multimode connections. (The FSM-S module supports single mode DAS connections.) In addition, each DAS connection has an optical bypass port that may be used to disconnect a port from the FDDI ring, or bypass this DAS connection.

The FSM-M is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your fiber optic cable directly into the FSM-M sub-module, but it is the HSM module that connects to the switch backplane.

FSM-M Technical Specifications	
Number of ports	1 or 2 Dual-Attachment Station (DAS). Each DAS contains an A port and a B port.
Connector Type	MIC
Standards Supported	ANSI X3T9.5 ANSI X3.166 RFC 1390 RFC 1512
Data Rate	100 Mbps
Maximum Frame Size	4,500 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	FDDI Dual Ring
Optical output power	-19 to -14 dBm
Optical receiver sensitivity	-31 to -14 dBm
Power Budget	12 dB
Cable Supported	62.5 micron multimode fiber optic
Cable Distance	4.5 km

This module includes one set of LEDs for each DAS (A/B port pair) connection. The LEDs for a given DAS connection display between the A and B ports. If the FSM module includes two DAS connections, then the module contains two sets of LEDs. The second set of LEDs displays with the second DAS connector. In addition, each DAS connection has an optical bypass port located below the B port.



FDDI 2-Port Multimode Module

## FSM-S

The FSM-S FDDI switching module may contain one or two dual-attachment station (DAS) connections for support of dual FDDI rings. Each DAS connection is a set of A/B fiber connectors (SC style). Each connector is color-coded gray to differentiate the FSM-S from the FSM-SH, which has yellow connectors. The FSM-S supports single mode connections. (The FSM-M module supports multimode DAS connections.) In addition, each DAS connection has an optical bypass port that may be used to disconnect a port from the FDDI ring, or bypass this DAS connection.

The FSM-S is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your fiber optic cable directly into the FSM-S sub-module, but it is the HSM module that connects to the switch backplane.

FSM-S Technical Specifications	
Number of ports	1 or 2 Dual-Attachment Station (DAS). Each DAS is an A port and a B port.
Connector Type	SC
Standards Supported	ANSI X3T9.5 ANSI X3.166 RFC 1390 RFC 1512
Data Rate	100 Mbps
Maximum Frame Size	4,500 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	FDDI Dual Ring
Optical output power	-20 to -14 dBm (category 1)
Optical receiver sensitivity	-31 to -8 dBm (category 1)
Power Budget	11 dB
Cable Supported	9 micron single mode fiber optic
Cable Distance	16.5 km

### ◆ Special Note ◆

This single mode fiber module has been deemed:

CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLAITE  
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.

This module includes one set of LEDs for each DAS (A/B port pair) connection. The LEDs for a given DAS connection display between the A and B ports. If the FSM module includes two DAS connections, then the module contains two sets of LEDs. The second set of LEDs displays with the second DAS connector. In addition, each DAS connection has an optical bypass port located below the B port.

**Warning Label.** This label indicates that the module contains an optical transceiver.

**WPA (Wrap A).** On Amber when the ring has wrapped at A after the connection to B failed. The THRU LED will be off when this LED is On.

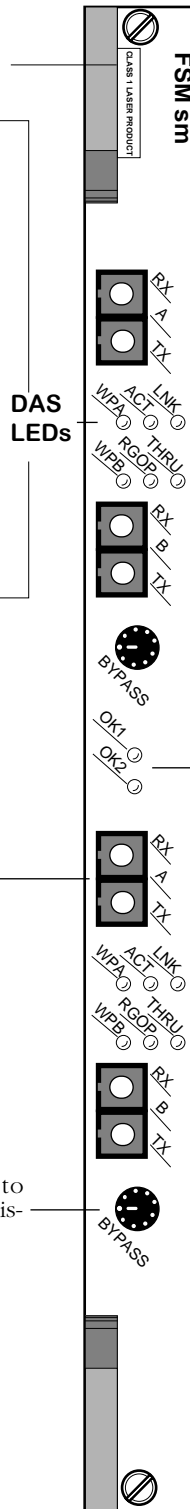
**ACT (Activity).** On Green when the station is transmitting or receiving LLC frames.

**LINK (Link Status/Disabled).** On Green when port A or B is connected to the FDDI ring. Blinks Green if you disconnect a cable from the port or when an error occurs.

This LED operates slightly different when the module first plugs into the backplane. It blinks Green when the module is inserted but not initialized. Once initialized the LED will be on solid.

SC connectors will be color coded Gray to differentiate this module from the FSM-SH, which has yellow connectors.

The optical bypass port allows you to plug in an optical bypass to physically disconnect this port from the FDDI ring.



**WPB (Wrap B).** On Amber when the ring has wrapped at B after the connection to A failed. The THRU LED will be off when this LED is On.

**RGOP (Ring Operational).** On Green when the internal or external ring is up. This LED is normally on even when ports A and B are disconnected or during a wrap condition; in such cases, the internal ring is still up. This LED is off when a problem occurs on the ring, such as a claim or beacon.

**THRU (Through State).** On Green when both ports A and B are connected (Data In A, Data Out B) and on the primary flow. The THRU LED turns off in a wrap condition (when either connection on A or B goes down).

**Module LEDs** Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

**FDDI 2-Port Single Mode Module**

## FSM-SH

The FSM-SH FDDI switching module may contain one or two dual-attachment station (DAS) connections for support of high-speed FDDI backbones over very long distances. Typically these FDDI backbones are used in large metropolitan applications for private or service access networks.

Each DAS connection is a set of A/B fiber connectors (SC style). Each connector is yellow to differentiate the FSM-SH module from the FSM-S module, which has blue connectors. The FSM-SH supports single mode connections using Category 2 high-powered laser optics. Each DAS connection has an optical bypass port that may be used to disconnect a port from the FDDI ring, or bypass this DAS connection.

The FSM-SH is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your fiber optic cable directly into the FSM-SH sub-module, but it is the HSM module that connects to the switch backplane.

FSM-SH Technical Specifications	
Number of ports	1 or 2 Dual-Attachment Station (DAS). Each DAS is an A port and a B port.
Connector Type	SC
Standards Supported	ANSI X3T9.5 ANSI X3.166 RFC 1390 RFC 1512
Data Rate	100 Mbps
Maximum Frame Size	4,500 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	FDDI Dual Ring
Optical output power	-4 to -0 dBm (category 2)
Optical receiver sensitivity	-37 to -15 dBm (category 2)
Power Budget	26 dB
Cable Supported	9 micron single mode fiber optic

### ◆ Special Note ◆

This single mode fiber module has been deemed:

CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLAITE  
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.

This module includes one set of LEDs for each DAS (A/B port pair) connection. The LEDs for a given DAS connection display between the A and B ports. If the FSM module includes two DAS connections, then the module contains two sets of LEDs. The second set of LEDs displays with the second DAS connector. In addition, each DAS connection has an optical bypass port located below the B port.

**WPA** (Wrap A). On Amber when the ring has wrapped at A after the connection to B failed. The THRU LED will be off when this LED is On.

**ACT** (Activity). On Green when the station is transmitting or receiving LLC frames.

**LINK** (Link Status/Disabled). On Green when port A or B is connected to the FDDI ring. Blinks Green if you disconnect a cable from the port or when an error occurs.

This LED operates slightly different when the module first plugs into the backplane. It blinks Green when the module is inserted but not initialized. Once initialized the LED will be on solid.

#### DAS LEDs

**WPB** (Wrap B). On Amber when the ring has wrapped at B after the connection to A failed. The THRU LED will be off when this LED is On.

**RGOP** (Ring Operational). On Green when the internal or external ring is up. This LED is normally on even when ports A and B are disconnected or during a wrap condition; in such cases, the internal ring is still up. This LED is off when a problem occurs on the ring, such as a claim or beacon.

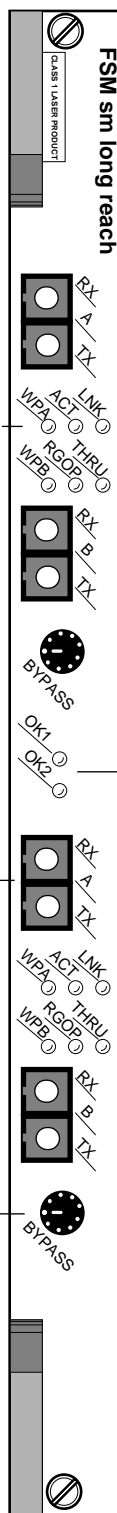
**THRU** (Through State). On Green when both ports A and B are connected (Data In A, Data Out B) and on the primary flow. The THRU LED turns off in a wrap condition (when either connection on A or B goes down).

#### DAS LEDs

**Module LEDs** Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

SC connectors will be color-coded Yellow to differentiate this module from the FSM-S, which has Gray connectors.

The optical bypass port allows you to plug in an optical bypass to physically disconnect this port from the FDDI ring.



**FDDI High-Powered Laser Module**

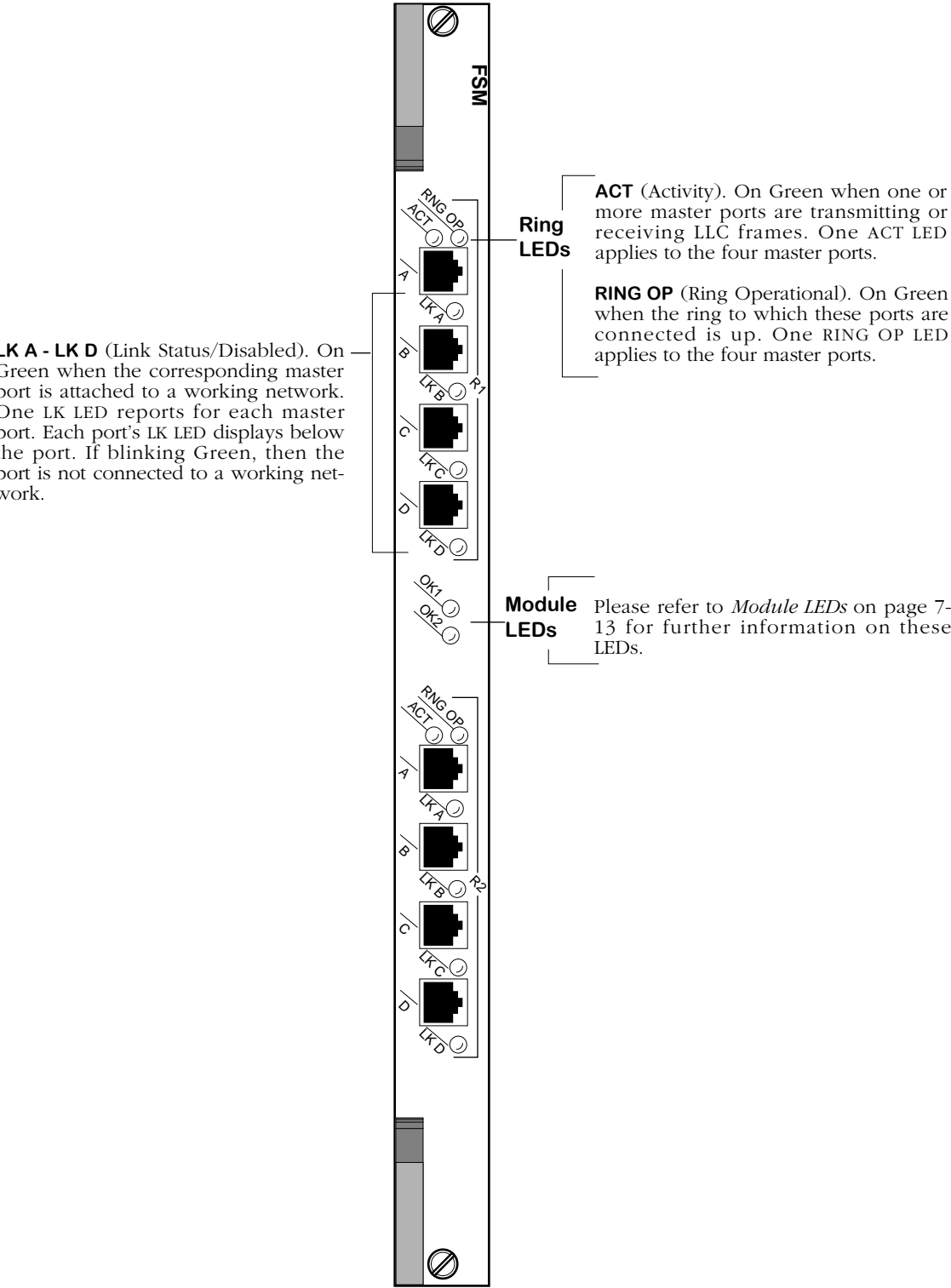
## **FSM-C**

The FSM-C switching module may contain four or eight copper FDDI (CDDI) ports. Each port supports unshielded twisted pair (UTP) cable rather than fiber cable. Each port may connect to an FDDI concentrator or an FDDI device. The FSM-C is well suited for high-speed connections to CDDI-based servers. In addition, you can attach an FDDI concentrator (A, B, or S port) to an FSM-C port to enable FDDI devices attached to the concentrator to communicate with non-FDDI devices attached to the switch.

The FSM-C is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your cable directly into the FSM-C sub-module, but it is the HSM module that connects to the switch backplane.

<b>FSM-C Technical Specifications</b>	
Number of ports	4 or 8 CDDI M-ports
Connector Type	RJ-45
Standards Supported	ANSI X3T9.5 ANSI TP-PMD RFC 1390 RFC 1512
Data Rate	100 Mbps
Maximum Frame Size	4,500 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	FDDI concentrator or device
Cable Supported	Unshielded twisted pair (UTP)

This module includes one pair of LEDs for each set of four ports. The LEDs for a given set of four ports display above the ports. If the FSM-C includes a total of eight ports, then the module contains two sets of LEDs. The second set of LEDs displays with the second set of four ports.



CDDI 8-Port Module

## FSM-M-C

The FSM-M-C FDDI/CDDI switching module contains one dual-attachment station (DAS) connection for support of dual FDDI rings and four copper FDDI (CDDI) ports. The DAS connection is a set of A/B media interface connectors (MIC). The MIC connectors support multimode cable. In addition, the DAS connection has an optical bypass port that may be used to disconnect the switch from the FDDI ring, or bypass this DAS connection. Each CDDI master port may connect to an FDDI concentrator (A, B, or S port) or an FDDI device.

The FSM-M-C is well suited for both FDDI backbone connections and high-speed connections to CDDI-based servers. The multimode fiber connectors can connect to a dual FDDI ring, and the CDDI ports can connect to servers. In addition, you can attach FDDI concentrators to CDDI ports to enable devices attached to the concentrator to communicate with non-FDDI devices attached to the switch.

The FSM-M-C is actually two sub-modules, or daughtercards, that attach to a High-Speed Module (HSM). One submodule contains the DAS port and the other sub-module contains the four CDDI ports. The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your cable directly into the FSM-M-C sub-modules, but it is the HSM module that connects to the switch backplane.

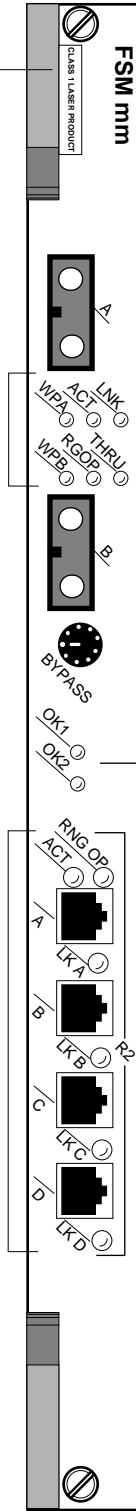
FSM-M-C Technical Specifications	
Number of ports	1 Dual-Attachment Station (DAS) 4 CDDI M-ports
Connector Type	MIC and RJ-45
Standards Supported	ANSI X3T9.5 ANSI X3.166 ANSI TP-PMD RFC 1390 RFC 1512
Data Rate	100 Mbps
Maximum Frame Size	4,500 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	FDDI dual ring, concentrator, device or single ring
Optical output power	-19 to -14 dBm
Optical receiver sensitivity	-31 to -14 dBm
Power Budget	12 dB
Cable Supported	62.5 micron multimode fiber optic Unshielded twisted pair (UTP)

This module includes one set of LEDs for the DAS (A/B port pair) connection and one set of LEDs for the four CDDI ports. The LEDs for the DAS connection display between the A and B ports. In addition, each DAS connection has an optical bypass port located below the B port. The LEDs for the four CDDI ports display above the set of ports and below each individual port.

**Warning Label.** This label indicates that the module contains an optical transceiver.

**DAS LEDs.** These LEDs are described for the FSM-M module. See *FSM-M* on page 7-78 for a description of these LEDs.

**CDDI LEDs.** These LEDs are described for the FSM-C module. See *FSM-C* on page 7-84 for a description of these LEDs.



## Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

### FDDI 1-Port/CDDI 4-Port Combination Module

# Token Ring Modules

The Token Ring modules support Station, Lobe, Ring Out Only, and Ring In/Ring Out configurations. Module ports can connect existing Token Ring MAUs, hubs, and devices. In addition, the Token Ring fiber module supports specialized hub connections—Ring Out Only and Ring In/Ring Out—to Synoptics (Bay), IBM, ODS, and Bytex hubs. The Token Ring modules are as follows:

- TSM-C-6            Six port UTP or STP Station connections. (**Discontinued**)
- TSM-F-6            Six-port fiber that supports Station, Lobe, Ring Out, Ring In/Ring Out connections.
- TSM-CD-6          Six-port UTP or STP that supports Station or Lobe connections. (**Discontinued**)
- TSM-CD-16W      Sixteen-port UTP or STP that supports Station or Lobe connections.

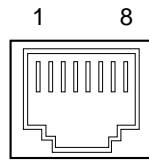
The TSM-C-6 allows you to connect existing Token Ring MAUs and hubs to your OmniSwitch network and extend Token Ring devices over Fast Ethernet, FDDI or ATM backbones.

The TSM-F-6 allows you to configure all ports in the module s Station or Lobe connections. The TSM-CD-6 and TSM-CD-16W allow you to configure individual ports as Station or Lobe connections. As a Station port, you can connect existing Token Ring MAUs and hubs to your OmniSwitch network and extend Token Ring devices over Fast Ethernet, FDDI or ATM backbones. As a Lobe port, you can connect high-traffic Token Ring workstations or servers directly to an OmniSwitch and provide the full 4 or 16 Mbps of bandwidth to that single device. In addition, the TSM-F-6 allows you to connect in Ring Out Only mode or Ring In/Ring Out mode to Synoptics, IBM, ODS, and Bytex hubs.

Token Ring ports are configurable through software. You can set the ring speed (4 or 16 Mbps), active monitor participation, and frame copied bit variables for all ports. In addition, a variety of error and configuration statistics are available through software commands. See Chapter 21, “Managing Token Ring Modules,” for further information on software configuration and monitoring commands.

## Token Ring Pinouts

The figure and table below illustrate the pinouts for a Token Ring RJ-45 port.



Token Ring RJ-45 Specifications	
Pin Number	Standard Signal Name
1	Not used
2	Not used
3	TX -
4	RX +
5	RX -
6	TX +
7	Not used
8	Not used

### TSM-C-6 (Discontinued)

The TSM-C-6 contains six active ports that may support either unshielded twisted pair (UTP) or shielded twisted pair (STP) connections. Each active port connects to a Lobe port on an MAU, so the TSM port acts as a Token Ring station. The ports each support a fully switched connection at either 4 or 16 Mbps. The Ring Speed is configurable through software.

The TSM-C-6 is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your cable directly into the TSM-C-6 sub-module, but it is the HSM module that connects to the switch backplane.

#### Note

The TSM-C-6 is supported, but it has been discontinued. For copper-based Token Ring switching, the TSM-CD-16W module (see *TSM-CD-16W* on page 7-99) is recommended.

TSM-C-6 Technical Specifications	
Number of ports	6 Station Ports
Connector Type	Shielded RJ-45 (UTP or STP)
Standards Supported	IEEE 802.5 IAB RFC 1231
Data Rate	4 or 16 Mbps
Maximum Frame Size	4,472 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	Lobe port on MAU or hub acting as device
Cable Supported	Shielded twisted pair (STP) <ul style="list-style-type: none"><li>• IBM Type 1</li></ul> Unshielded twisted pair (UTP) <ul style="list-style-type: none"><li>• IBM Type 3</li><li>• ANSI category 3, 4, or 5</li></ul>
Cable Distance	100 m

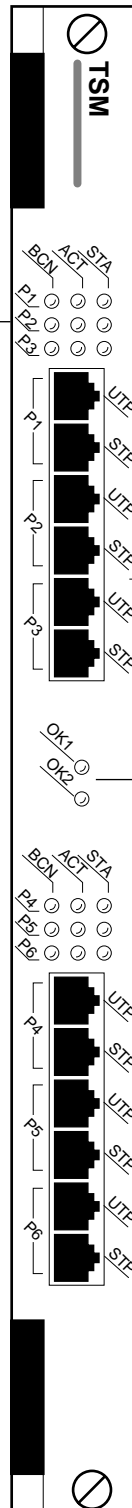
This module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number. The TSM module includes a total of six ports with one set of LEDs for the top three ports and a second set of LEDs for the bottom set of ports.

**BCN** (Beacon Detect). On Yellow when this port is inoperable because of a hard error and the beacon recovery process is in effect.

**ACT** (Activity). On Green when the port is transmitting or receiving frames on the ring.

**STA** (Link Status/Disabled). On Green when attached to a working network. Off when not attached to a network. Flashing Green when the port is initializing.

**Port LEDs**



Each port contains an unshielded twisted pair (UTP) and a shielded twisted pair (STP) connector. You can use the UTP or STP connector on each port, but not both.

**Module LEDs**

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

**Token Ring Single Mode 6-Port Module**

### TSM-F-6

The TSM-F-6 contains six multimode fiber ports that may be configured to operate as Station, Lobe, Ring Out Only, or Ring In/Ring Out ports. Ports are configured through software, but all ports on a module are set to the same interface type. The ports each support a fully switched connection at either 4 or 16 Mbps. The Ring Speed is individually configurable through software. See Chapter 21, “Managing Token Ring Modules,” for information on software commands.

The TSM-F-6 is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your cable directly into the TSM-F-6 sub-module, but it is the HSM module that connects to the switch backplane.

TSM-F-6 Technical Specifications	
Number of ports	6 Lobe or Station Ports
Connector Type	ST
Standards Supported	IEEE 802.5j IAB RFC 1231
Data Rate	4 or 16 Mbps
Maximum Frame Size	4,472 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	Lobe port, station port, Ring Out Only, or Ring In/Ring Out (RI/RO) port
Optical output power	-19 to -12 dBm
Optical receiver sensitivity	-31 to -11 dBm
Power Budget	13 dB
Cable Supported	62.5/125 micron multimode fiber cable 50/100 micron multimode fiber cable
Cable Distance	2 km

This module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number. The TSM module includes a total of six ports with one set of LEDs for the top three ports and a second set of LEDs for the bottom set of ports. (Ring In/Ring Out configurations use only the top three rows of LEDs because only three logical ports exist.)

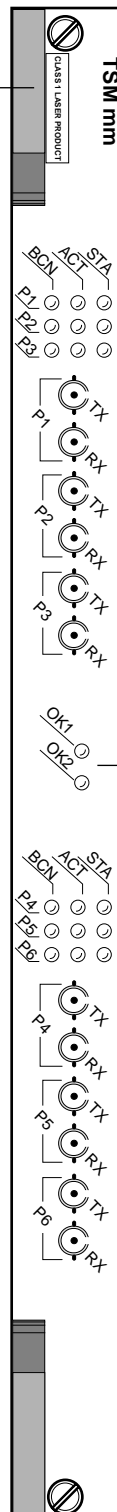
**Warning Label.** This label indicates that the module contains an optical transceiver.

**BCN** (Beacon Detect). On Yellow when this port is inoperable because of a hard error and the beacon recovery process is in effect.

**ACT** (Activity). On Green when the port is transmitting or receiving frames on the ring.

**STA** (Link Status/Disabled). On Green when attached to a working network. Off when not attached to a network. Flashing Green when the port is initializing.

**Port LEDs**



**Module LEDs**

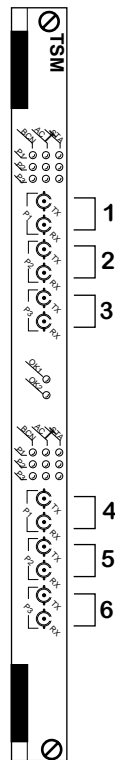
Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

**Token Ring 6-Port Fiber Module**

### TSM-F-6 Port Configurations

The TSM-F-6 ports may be configured as a Station, Lobe, Ring Out Only, or Ring In/Ring Out ports. The Ring Out Only and Ring In/Ring Out configurations each contain options for IBM, Synoptics (Bay Networks) and Bytex hubs. You configure these ports through the Token Ring Interface menu, which is described in Chapter 21, "Managing Token Ring Modules." The following sections show how ports are handled in each configuration option.

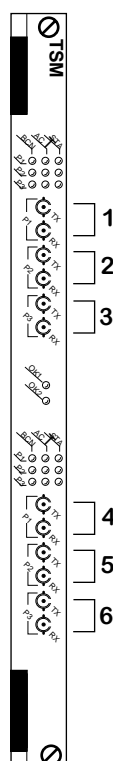
#### Station or Lobe Ports



When ports are used in a Station or Lobe interface, each port operates independently. In total, there are 6 ports with the assignments shown in the figure to the left. There are two configuration options that can be chosen through software:

- Station 802.5j Interface
- Lobe 802.5j Interface

## Ring Out Only



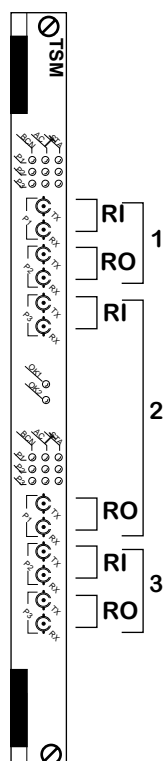
When ports are used in a Ring Out Only interface, each port operates as a Ring Out Port. In total, there are 6 Ring Out ports with the assignments shown in the figure to the left.

There are three configuration options that can be chosen through software for the Ring Out (RO) interface:

- IBM RO Ports Interface
- Synoptics RO Ports Interface
- Bytex RO Ports Interface

In the Ring Out Only configuration, the TX port on the TSM-F-6 should connect directly to the Ring In (RI) port on a Bytex or Synoptics (Bay) hub. The Ring Out (RO) ports on the hub should not be connected.

## Ring In/Ring Out



When ports are used in a Ring In/Ring Out (RI/RO) interface, two fiber ports act as a RI/RO port pair. In total, the module provides three RI/RO port pairs and each pair operates as a single switch port. Only the top three rows of LEDs are used in this configuration.

There are three configuration options that can be chosen through software for the RI/RO interface:

- IBM RI/RO Ports Interface
- Synoptics RI/RO Ports Interface
- Bytex RI/RO Ports Interface

The following list describes the RI/RO function and port number for each port labelled on the TSM-F-6:

<u>Port Number</u>	<u>Function</u>	<u>Logical Port</u>	<u>To Hub</u>
P1	RI	1	RO
P2	RO	1	RI
P3	RI	2	RO
P4	RO	2	RI
P5	RI	3	RO
P6	RO	3	RI

### TSM-CD-6 (Discontinued)

The TSM-CD-6 contains six shielded ports that each may be separately configured as a Station or Lobe port. As a Station port, the TSM-CD-6 port plugs directly into a MAU; as a Lobe port, the port acts as an MAU port and a Token Ring station plugs directly into the module. You configure the ports as Station or Lobe through the **tsc** command. By default, ports are configured as Lobe ports. See Chapter 21, “Managing Token Ring Modules,” for more information.

Each port can support either unshielded twisted pair (UTP) or shielded twisted pair (STP) connections. No configuration is necessary to set up a port for UTP or STP.

Each port supports a fully switched connection at either 4 or 16 Mbps. Ring Speed is configurable through the **tpcfg** command. By default, ports are configured at 16 Mbps.

**Automatic Speed Detection.** Switch software will automatically modify the Ring Speed if there is a discrepancy with the ring to which the port is connected. A TSM-CD-6 port detects this difference in Ring Speed as it is inserted into the ring, then it resets itself and comes up in the new Ring Speed. (The new Ring Speed, however, is not saved in the system configuration file, **mpm.cfg**.) Once the port inserts into the ring, automatic Ring Speed detection is disabled (i.e., thereafter the port will not change speed automatically). Both Station and Lobe ports handle automatic speed detection this way.

If a TSM-CD-6 port is the first device on the ring, then the Ring Speed is automatically set to the port's configured speed. The port does not reset to match the Ring Speed—its speed becomes the Ring Speed. If the port is not the first device, then it will auto-detect the ring speed and match that speed as described in the preceding paragraph.

The TSM-CD-6 is actually a sub-module, or daughtercard, that attaches to a High-Speed Module (HSM). The HSM contains memory and processing power for switching modules that operate at speeds greater than 10 Mbps. You plug your cable directly into the TSM-CD-6 sub-module, but it is the HSM module that connects to the switch backplane.

#### Note

The TSM-CD-6 is supported, but it has been discontinued. For copper-based Token Ring switching, the TSM-CD-16W module (see *TSM-CD-16W* on page 7-99) is recommended.

TSM-CD-6 Technical Specifications	
Number of ports	6 Station or Lobe Ports
Connector Type	Shielded RJ-45 (UTP or STP)
Standards Supported	IEEE 802.5 IAB RFC 1231
Data Rate	4 or 16 Mbps
Maximum Frame Size	4,472 bytes
MAC Addresses Supported	1,024; 2,048 with CAM upgrade option
Connections Supported	Station or Lobe port
Cable Supported	Shielded twisted pair (STP)—100 or 150 ohm. Unshielded twisted pair (UTP)—100 ohm.
Cable Distance	100 m

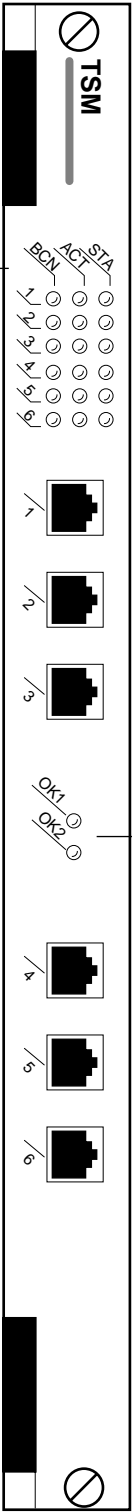
The module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number.

**BCN** (Beacon Detect). On Yellow when this port is inoperable because of a hard error and the beacon recovery process is in effect.

**ACT** (Activity). On Green when the port is transmitting or receiving frames on the ring.

**STA** (Link Status/Disabled). On Green when attached to a working network. Off when not attached to a network. Flashing Green when the port is initializing.

Port LEDs



Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.

Token Ring Dual Mode 6-Port Module

## TSM-CD-16W

The TSM-CD-16W contains sixteen (16) auto-sensing ports, each supporting a fully-switched 4 or 16 Mbps connection in either full- or half-duplex mode.

The TSM-CD-16W also allows you to configure individual ports as either Station or Lobe connections. As a Station connection, a port can be used to connect existing Token Ring MAUs and hubs to your OmniSwitch network. As a Lobe connection, a port can be used to connect OmniSwitches to high-traffic Token Ring workstations or servers.

### ◆ Important Note ◆

Although the TSM-CD-16W offers similar functionality to the Omni Switch/Router TSX-CD-16W module, the TSM-CD-16W is compatible *only* with the OmniSwitch chassis. (Note that OmniSwitch modules are distinguished by the letter **M** in the module name on the front panel, whereas Omni Switch/Router modules are distinguished by the letter **X**.)

In addition, the TSM-CD-16W is intended for use *only* with MPM 1G management processor modules.

Each port in the TSM-CD-16W is auto-sensing [i.e., each port can automatically detect Ring Speed (4 or 16 Mbps), Port Mode (Station or Lobe), and Duplex Mode (half or full) and then reconfigure itself to match the ring's parameters]. You can enable or disable auto-sensing via the **tpcfg** command.

If a TSM-CD-16W port is the first device inserted into the ring and auto-sensing has been enabled, it will auto-sense the ring speed every 18 seconds, or until another device is inserted into the ring. However, if the port is *not* the first device in the ring (and auto-sensing has been enabled), it will auto-detect the existing ring speed and reconfigure itself to conform to that speed. (Note that the new ring speed is *not* saved in the system configuration file, **mpm.cfg**.)

Once a port has been inserted into the ring, automatic ring speed detection will become disabled (i.e., the port will no longer reset its speed automatically).

### ◆ Note ◆

The automatic speed detection information described above applies to both Station and Lobe connections.

If auto-sensing has been disabled, you can manually configure an individual port's parameters via the **tpcfg** command [These parameters include Ring Speed (4 or 16 Mbps), Port Mode (Station or Lobe), and Duplex Mode (half or full)].

For more information on the **tpcfg** command, see Chapter 21, "Managing Token Ring Modules."

TSM-CD-16W Technical Specifications	
Ports	16
Connector Type	RJ-45
Standards Supported	IEEE 802.5r, IAB RFC 1231
Data Rate	4 or 16 Mbps (full- or half duplex)
Maximum Frame Size	8,144 bytes
MAC Addresses Supported	4,096
Connections Supported	Station or Lobe connections
Cables Supported	Unshielded twisted pair (UTP)—100 ohm Shielded twisted pair (STP)—100 or 150 ohm
Current Draw	8.0 amps
Cable Distance	100 m

**OK1 LED (Hardware Status).** This dual-state LED displays Green when the switch has passed hardware diagnostic tests that are initiated at boot-up.

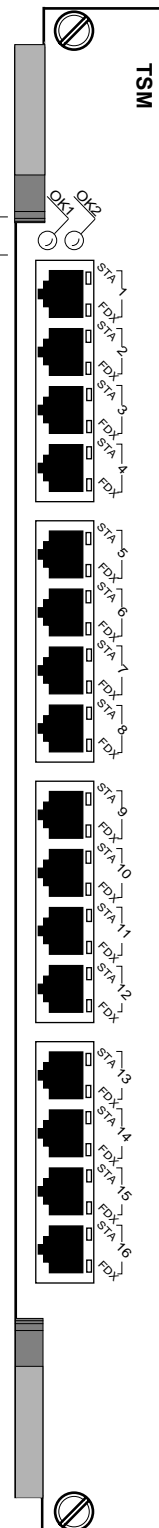
The **OK1** LED displays Amber when the hardware has failed diagnostic tests.

**OK2 LED (Software Status).** This dual-state LED displays Green when software has loaded successfully and the module is ready to execute commands.

The **OK2** LED blinks Amber when the switch is in a transitional state, such as when it first boots up. [If the **OK2** LED blinks Amber for an extended period of time (i.e., more than a minute), you should reboot the switch.]

The **OK2** LED displays solid Amber when software was not loaded successfully.

**Module LEDs**



**Port LEDs (Port Connection Status).** There are two (2) port LEDs located directly above each port. Definitions for these LEDs are given below.

**STA (Link Status).** Displays Green when the corresponding port has a valid physical link and a signal is present. Under normal conditions, this LED should always display Green whenever a cable is connected.

**FDX (Full-Duplex Status).** Displays Green when the corresponding port is operating in full-duplex mode.

**Port LEDs**

**16-Port Token Ring Switching Module**

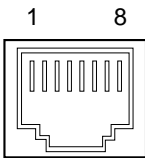
## High-Density, 10/100, and Gigabit Ethernet Modules

The following Ethernet modules take advantage of new Ethernet/Fast Ethernet ASIC technology. Software commands are available to view and configure Ethernet ports on all modules. The modules are as follows:

- ESM-100C-12                      Twelve auto-sensing 10/100 Mbps connections using RJ-45 ports.
- ESM-100FM-8                    Eight 100BASE-FX connections using multimode fiber (SC) ports.
- ESM-C-16                         Sixteen 10BASE-T connections using RJ-45 ports.
- ESM-C-32                         Thirty-two 10BASE-T connections using RJ-45 ports.
- ESM-FM-16W                    Sixteen 10BASE-FL connections using fiber (ST) ports.
- ESM-100C-32W                  Thirty-two auto-sensing 10/100 Mbps connections using RJ-45 ports.
- ESM-T-24W                      Two Telco connectors supporting twenty-four (24) 10 Mbps ports.
- GSM-FM/FS/FSH-2W          Two (2) Gigabit Ethernet connections using fiber (SC) connectors.

### Ethernet Pinouts

The figure and table below illustrate the pinouts for an Ethernet RJ-45 port.



Ethernet RJ-45 Specifications	
Pin Number	Standard Signal Name
1	RD +
2	RD –
3	TD +
4,	Not Used
5	Not Used
6	TD –
7	Not Used
8	Not Used

## ESM-100C-12

The ESM-100C-12 Ethernet switching module contains 12 ports that each support a fully switched 10 or 100 Mbps connection in full- or half-duplex mode. Each port can auto-sense the connection speed and automatically switch at that speed. You configure whether you want to use the auto-sensing functionality through the **10/100cfg** command. By default, each port is configured to operate in half-duplex, auto-sensing mode. You can configure full-duplex mode on each port through **10/100cfg**. Auto-sensing may be disabled to allow you to manually configure ports through the **10/100cfg** command. An additional software command, **10/100vc**, allows you to view the current line speed and link mode of each port connection. The **10/100cfg** and **10/100vc** commands are described in Chapter 19, “Managing Ethernet Modules.”

The 12 RJ-45 ports may connect to unshielded twisted pair (UTP) cable. Each port may connect to a single high-speed device or a hub serving multiple devices. In a fully populated 5-slot switch, you could have up to 48 switched Ethernet connections, and in a fully populated 9-slot switch you could have up to 96 switched connections

The ESM-100C-12 is best used in networks with a mix of 10 Mbps and 100 Mbps Ethernet devices that are transitioning to higher speed connections. As more 100 Mbps connections are added, the ESM-100C-12 automatically senses the higher speed and switches at that speed.

ESM-100C-12 Technical Specifications	
Number of ports	12
Connector Type	RJ-45
Standards Supported	IEEE 802.3; IAB RFCs 826, 894
Data Rate	10 or 100 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024 or 2,048 with ESM-100C-12-2C
Connections Supported	10/100BASE-T hub or device
Cable Supported	10BASE-T Unshielded twisted-pair (UTP) 100BASE-T Unshielded twisted-pair: Category 5, EIA/TIA 568 Shielded twisted-pair Category 5, 100 ohm
Cable Distance	100 m

This ESM module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number.

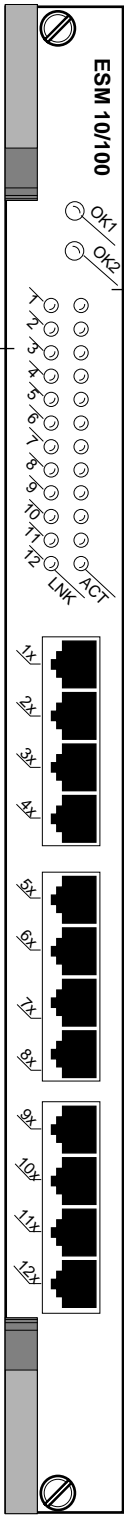
**LNK** (Link). On Green continuously when a good cable connection exists to an attached device. Off when a good connection does not exist. Blinks Green slowly when the port has been disabled.

**ACT** (Activity). On Green when data is transmitted or received on the corresponding port.

Port LEDs

Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



Ethernet 12-Port 10/100 Module

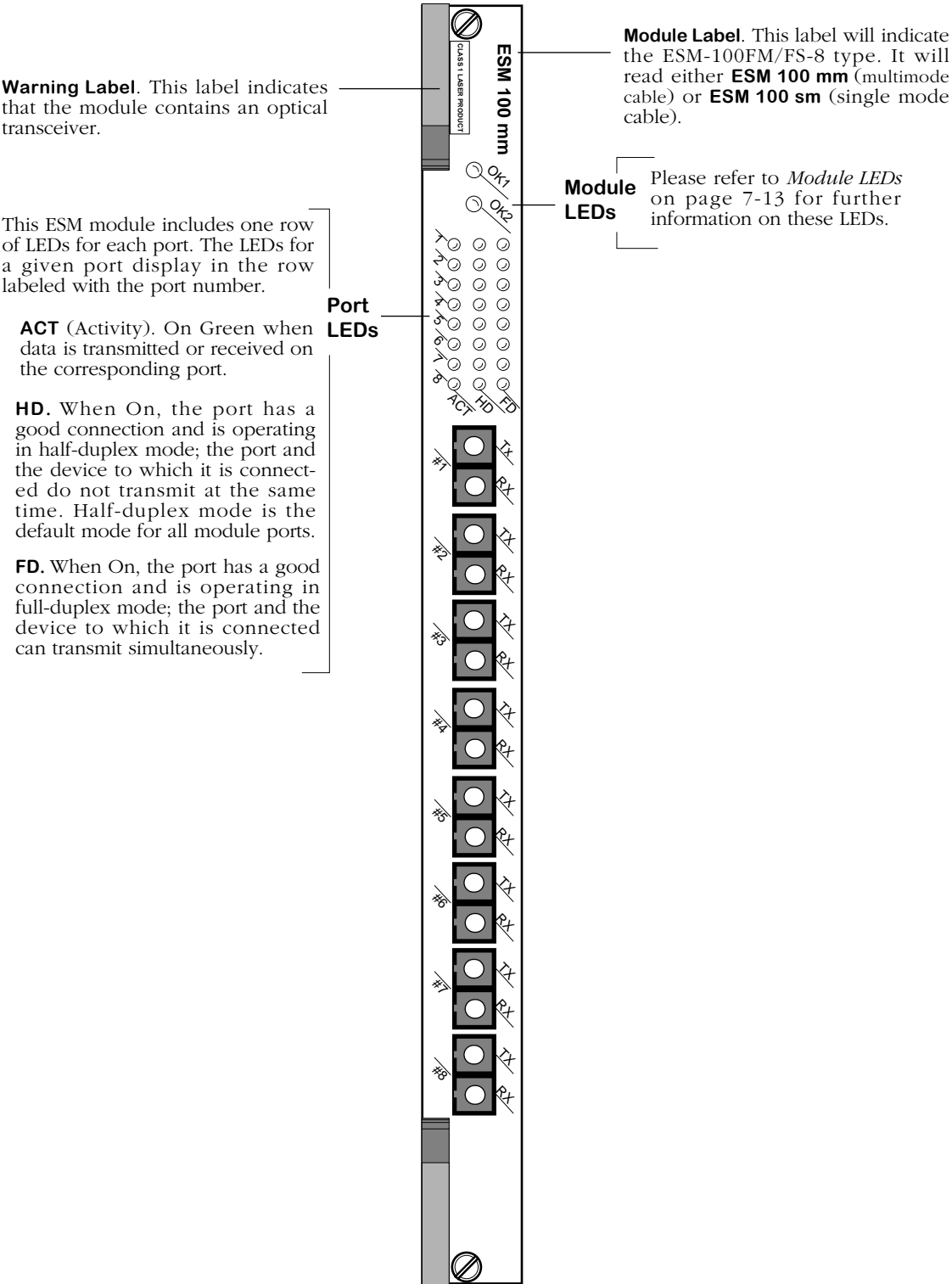
## ESM-100FM/FS-8

The ESM-100FM/FS-8 Ethernet switching module contains eight fiber SC connectors that support eight fully switched 100Base-Fx ports. The ESM-100FM-8 uses multimode fiber ports that are color coded black.

All ports support either half- or full-duplex operation. You configure whether you want a half- or full-duplex connection through the **10/100cfg** command. By default, ESM-100FM-8 ports are configured for half-duplex connections.

The ESM-100FM-8 is best used as a backbone connection in networks where Fast Ethernet is used as the backbone media. In addition to its use as a backbone connection, each 100BaseFx port may connect to a single high-traffic device, such as a mail or file server.

ESM-100FM/FS-8 Technical Specifications	
Number of ports	Eight
Connector Type	SC
Standards Supported	IEEE 100Base-Fx
Data Rate	100 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	4,096
Connections Supported	100Base-Fx device, hub (half-duplex mode only) or bridge port
Cable Supported	Multimode: 62.5 micron multimode fiber Single mode (intermediate reach): single mode fiber
Optical output power	Multimode: -19 to -14 dBm Single mode: -20 to -14 dBm
Optical receiver sensitivity	Multimode: -31 to -14 dBm Single mode: -31 to -14 dBm
Cable Distance	Multimode (12dB) fiber: approximately 4.5 km Single mode: 16.5 km



Ethernet 8-Port 100BASE-FX Module

## ESM-C-16

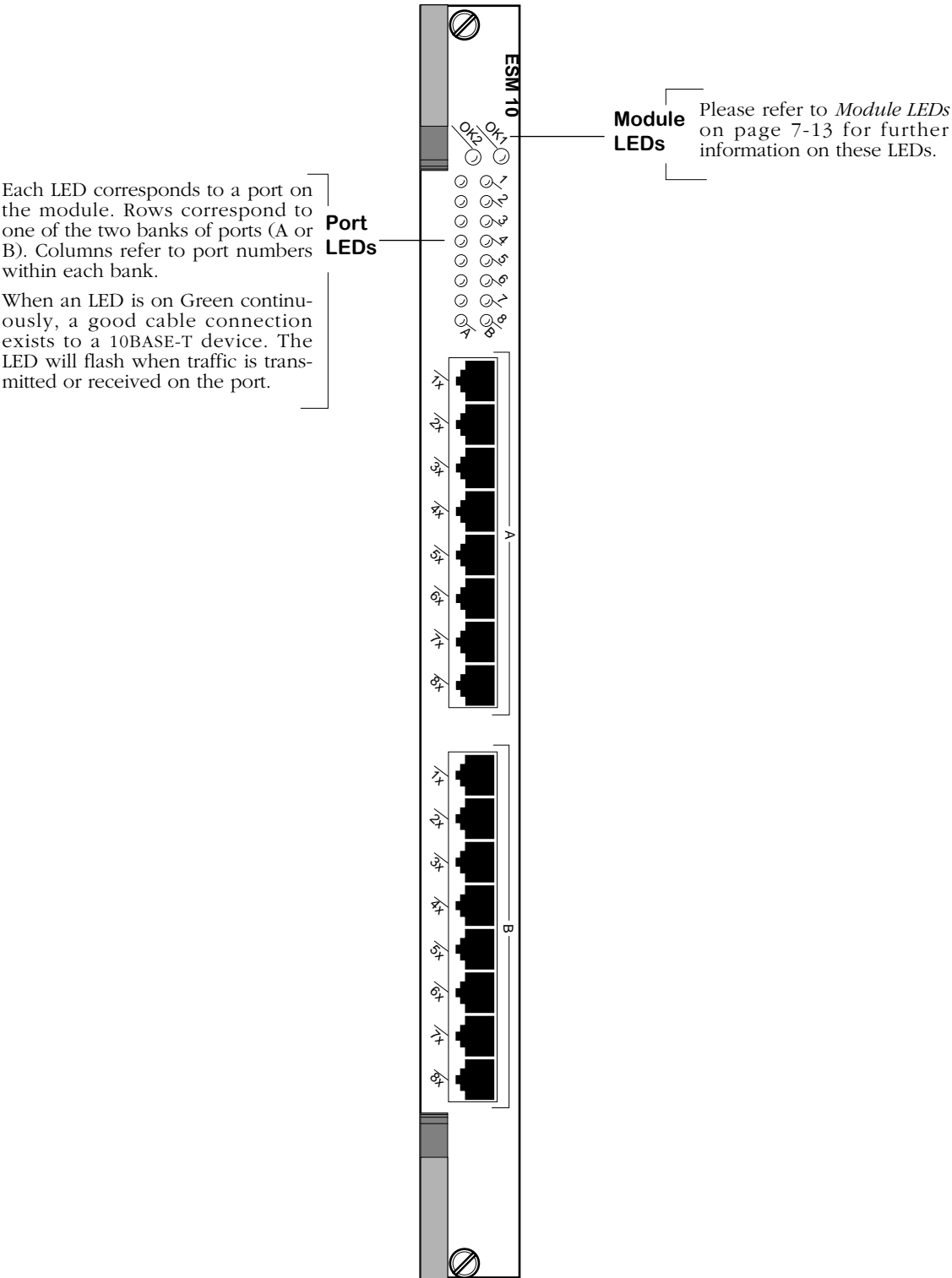
The ESM-C-16 Ethernet switching module contains 16 10BASE-T ports. Each port connection supports one switched Ethernet segment at the full 10 Mbps of bandwidth. The 16 RJ-45 ports may connect to unshielded twisted pair (UTP) or shielded twisted pair (STP) cable. Each port may connect to a single device, such as a workstation or server, or a hub serving multiple devices.

All ports support either half- or full-duplex operation. You configure whether you want a half- or full-duplex connection through the **10/100cfg** command. By default, ESM-C-16 ports are configured for half-duplex connections.

Module ports are divided into two banks of eight (8) ports. Ports are numbered from 1 to 8 within each bank. The banks are labelled **A** and **B**. This grouping simplifies the display of LEDs, which are organized as a matrix. You can find the LED for a particular port by matching the port number with the bank letter within the LED matrix display (see illustration on the next page).

Using ESM-C-16 modules in a fully populated Omni-5wx, you could have up to 64 switched Ethernet connections, and in a fully populated Omni-9wx you could have up to 128 switched connections.

ESM-C-16 Technical Specifications	
Number of ports	16
Connector Type	RJ-45
Standards Supported	IEEE 802.3
Data Rate	10 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024
Connections Supported	10BASE-T hub (half-duplex only) or device
Cable Supported	Unshielded twisted-pair (UTP)—100 ohm Shielded twisted-pair (STP)—100 ohm
Cable Distance	100 m



Ethernet 16-Port 10BASE-T Module

## ESM-C-32W

The ESM-C-32W Ethernet switching module contains 32 10BASE-T ports. Each port connection supports one switched Ethernet segment at the full 10 Mbps of bandwidth. The 32 RJ-45 ports may connect to unshielded twisted pair (UTP) or shielded twisted pair (STP) cable. Each port may connect to a single device, such as a workstation or server, or a hub serving multiple devices.

All ports support either half- or full-duplex operation. You configure whether you want a half- or full-duplex connection through the **10/100cfg** command. By default, ESM-C-32W ports are configured for half-duplex connections.

Module ports are divided into four (4) banks of eight (8) ports. Ports are numbered from 1 to 8 within each of the four banks. The four banks are labelled **A**, **B**, **C**, and **D**. This grouping simplifies the display of LEDs, which are organized as a matrix. You can find the LED for a particular port by matching the port number with the bank letter within the LED matrix display (see illustration on the next page).

Because the ESM-C-32W is a wide-style module, it is only supported in a wide chassis (i.e., Omni-3wx, Omni-5wx or Omni-9wx). Using ESM-C-32 modules in a fully populated Omni-3wx, you could have up to 64 switched connections; in an Omni-5wx, you could have up to 128 switched Ethernet connections; and in a fully populated Omni-9wx, you could have up to 254 switched connections.

ESM-C-32W Technical Specifications	
Number of ports	32
Connector Type	RJ-45
Standards Supported	IEEE 802.3
Data Rate	10 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024
Connections Supported	10BASE-T hub or device
Cable Supported	Unshielded twisted-pair (UTP)—100 ohm Shielded twisted-pair (STP)—100 ohm
Cable Distance	100 m

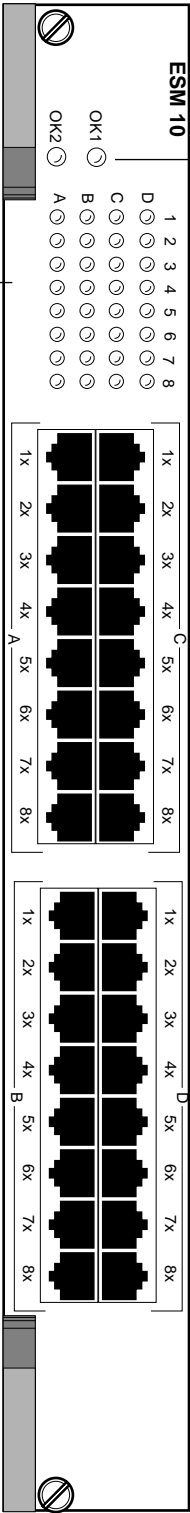
Each LED corresponds to a port on the module. Rows correspond to one of the four banks of ports (A, B, C, or D). Columns refer to port numbers within each bank.

When an LED is on Green continuously, a good cable connection exists to a 10BASE-T device. The LED will flash when traffic is transmitted or received on the port.

Port LEDs

Module LEDs

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



Ethernet 32-Port 10BASE-T Wide Module

## ESM-FM-16W

The ESM-FM-16W Ethernet switching module contains 16 10BASE-FL ports. Each port connection supports one switched Ethernet segment at the full 10 Mbps of bandwidth. The 16 dual ST connector ports connect to multimode fiber optic cable. Each port may connect to a single high-traffic device, such as a mail or file server, or a hub serving multiple devices.

Because the ESM-FM-16W is a wide-style module, it is only supported in a wide chassis (i.e., Omni-3wx, Omni-5wx or Omni-9wx). In a fully populated 3-slot switch, you could have up to 32 switched connections, in a fully populated 5-slot switch, you could have up to 64 switched Ethernet connections, and in a fully populated 9-slot switch you could have up to 128 switched connections.

ESM-FM-16W Technical Specifications	
Number of ports	16
Connector Type	ST
Standards Supported	IEEE 802.3, 802.3i; IAB RFCs 826, 894, 1398
Data Rate	10 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	2,048
Connections Supported	10BASE-FL hub or device; full or half duplex Ethernet-to-Ethernet
Optical output power	-20 to -12 dBm
Optical receiver sensitivity	-32.5 to -12 dBm
Power Budget	12.5 dB
Cable Supported	62.5 micron multimode fiber (12.5 dBm)
Cable Distance	2 km

**Warning Label.** This label indicates that the module contains an optical transceiver.

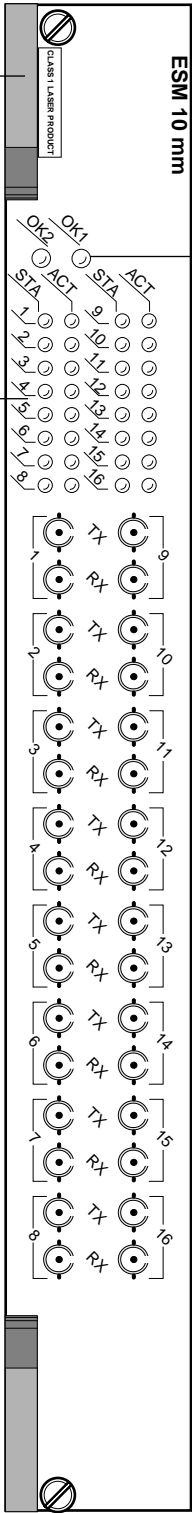
This ESM module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number.

**STA** (Status). On Green continuously when a good cable connection exists, per the 10BASE-FL specification, to a 10BASE-FL device. Off when a good connection does not exist. Flashes Green slowly when the port has been disabled.

**ACT** (Activity). On Green when data is transmitted or received on the corresponding port.

**Port LEDs**

**Module LEDs** Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



Ethernet 16-Port Fiber Wide Module

## ESM-100C-32W Ethernet Module

The ESM-100C-32W Ethernet module contains 32 ports. Each port supports a fully-switched, high-density 10 or 100 Mbps desktop connection in either half- or full-duplex mode.

The flexibility of 10/100 Mbps ports allows users to support their current 10BaseT devices and gradually upgrade to 100BaseTx without having to replace their switch ports. Also, users who want high-density 10/100 with an ATM PNNI backbone can use the ESM-100C-32W in conjunction with a CSM switching module installed in the OmniSwitch chassis.

### ◆ Important Note ◆

While the ESM-100C-32W offers similar functionality to the Omni Switch/Router ESX-100C-32W module, the ESM-100C-32W is compatible *only* with the OmniSwitch chassis. (Note that OmniSwitch modules are distinguished by the letter **M** in the module name on the front panel, whereas Omni Switch/Router modules are distinguished by the letter **X**.)

In addition, the ESM-100C-32W is intended for use *only* with MPM II and MPM 1G management processor modules.

Each of the thirty-two (32) Ethernet ports on the ESM-100C-32W can auto-sense the connection speed and automatically switch at that speed. By default, each port is configured to operate in auto-sensing, half-duplex mode. However, each port may be manually configured via the **10/100cfg** command. (The **10/100cfg** command allows you to disable or enable auto-sensing, set the line speed, and set the link mode to half- or full-duplex.)

An additional software command, **10/100vc**, allows you to view the current line speed and link mode of each port connection. For more information on the **10/100cfg** and **10/100vc** commands, refer to Chapter 19, “Managing Ethernet Modules.”

The 32 RJ-45 ports on the ESM-100C-32W support either unshielded twisted pair (UTP) or shielded twisted pair (STP) cable (see *ESM-100C-32W Technical Specifications* on page 7-114 for more information). Each port may be connected to a single high-speed device or to a hub that is serving multiple devices. In addition, the ESM-100C-32W can be used in the wiring closet with a mix of 10 Mbps Ethernet devices and 100 Mbps Fast Ethernet devices.

Module ports are divided into four (4) banks, with eight (8) ports per bank. Ports are numbered from 1 to 8 within each of the four banks. Banks are labelled **A**, **B**, **C**, and **D**. The ESM-100C-32W software automatically numbers the port/bank locations—1 through 32—with Port **A1** labeled as 1, Port **B1** as 9, **C1** as 17, **D1** as 25, etc. This grouping simplifies the module’s LED display, which is organized as a matrix (for more details, refer to the illustration on page 7-115).

### ◆ Note ◆

Because it is intended to support high-density desktop connections, rather than backbone connections, the ESM-100C-32W does not support OmniChannel.

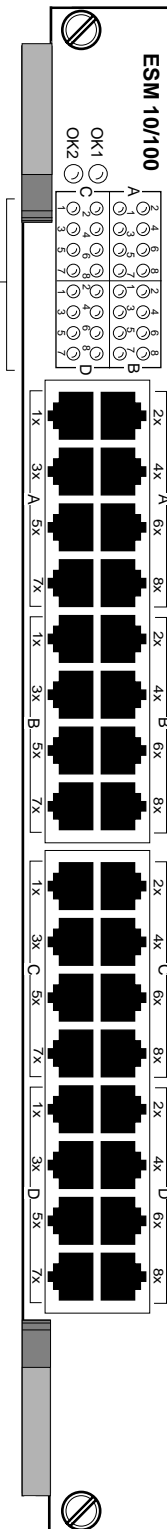
<b>ESM-100C-32W Technical Specifications</b>	
Ports	(32) 10BaseT/100BaseTx Ethernet ports
Connector Type	RJ-45
Standards Supported	IEEE 802.3; IAB RFCs 826, 894, IEEE 10BaseT, 100BaseTx
Data Rate	10 or 100 Mbps (auto-sensing)
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024 (2,048 with CAM upgrade option)
Connections Supported	10BaseT hub or device; 100BaseTx hub or device
Cables Supported	Unshielded twisted-pair (UTP)—100 ohms (Category 5, EIA/TIA 568); Shielded twisted-pair (STP)—100 ohms (Category 5)
Current Draw	5.75 amps
Cable Distance	100 m

**Port LEDs** (Port Connection Status). Each port LED corresponds numerically to a port on the module.

When an LED displays green continuously, a good cable connection exists.

A port LED will blink green when traffic is transmitted or received on the port.

**Port LEDs**



**Module LEDs**

**OK1 LED** (Hardware Status). This dual-state LED displays Green when the switch has passed hardware diagnostic tests that are initiated at boot-up.

The **OK1** LED displays Amber when the hardware has failed diagnostic tests.

**OK2 LED** (Software Status). This dual-state LED displays Green when software has loaded successfully and the module is ready to execute commands.

The **OK2** LED blinks Amber when the switch is in a transitional state, such as when it first boots up. [If the **OK2** LED blinks Amber for an extended period of time (i.e., more than a minute), you should reboot the switch.]

The **OK2** LED displays solid Amber when software was not loaded successfully.

**32-Port Auto-Sensing 10/100 Ethernet Switching Module**

### ESM-T-24W

The ESM-T-24W Ethernet switching module contains two 50-pin connectors that support 24 switched 10BaseT Ethernet ports. Each of the 12 ports uses the full 10 Mbps of dedicated bandwidth. The 50-pin RJ-21 connectors provide a convenient cabling solution for networks with existing punch down blocks and patch panels.

All ports support either half- or full-duplex operation. You configure whether you want a half- or full-duplex connection through the **10/100cfg** command, which is explained in Chapter 19, “Managing Ethernet Modules.” By default, ESM-T-24W ports are configured for half-duplex connections.

Port LEDs are divided into two (2) banks of twelve (12). LEDs are numbered from 1 to 12 within each of the two banks and each LED corresponds to a port. The two sets are labelled **A** and **B** (see illustration on the next page).

Because the ESM-T-24W is a wide-style module, it is only supported in a wide chassis (i.e., Omni-3wx, Omni-5wx, or Omni-9wx). Using ESM-T-24W modules in a fully populated Omni-5wx, you could have up to 96 switched Ethernet connections, and in a fully populated Omni-9wx you could have up to 192 switched connections.

ESM-T-24W Technical Specifications	
Number of ports	(2) Telco supporting 24 end devices
Connector Type	Telco 50-pin (RJ-21)
Standards Supported	IEEE 802.3, 802.3i; IAB RFCs 826, 894, 1398
Data Rate	10 Mbps
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024
Connections Supported	Telco patch panel or punch down block
Cable Supported	Unshielded twisted pair (UTP) Shielded twisted pair (STP)—100 ohm
Cable Distance	100 m

Each LED corresponds to a port on the module.

Letters correspond to the Telco connector through which a port connects. **A** corresponds to the top RJ-21 connector and **B** corresponds to the bottom RJ-21 connector.

The numbers correspond to port numbers attached to either the **A** or **B** connector.

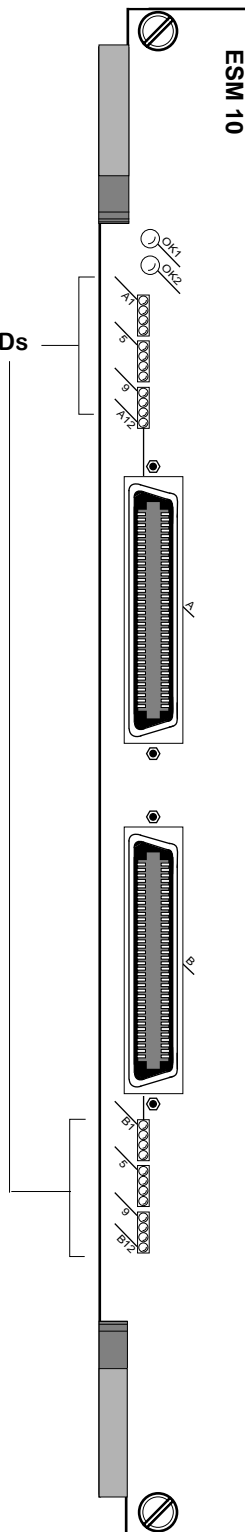
When an LED displays Green continuously, a good cable connection exists to a 10BASE-T device.

An LED will flash when traffic is transmitted or received on the port.

**Port LEDs**

**Module LEDs**

Please refer to *Module LEDs* on page 7-13 for further information on these LEDs.



**Ethernet 24-Port Telco Module**

### GSM-F-2W Gigabit Ethernet Module

The GSM-F-2W is a 2-port Gigabit Ethernet module designed to support fully-switched Gigabit backbone connections into the OmniSwitch.

This module allows users to maintain their current OmniSwitch(es) in the wiring closet while upgrading their core switch(es) to the Omni Switch/Router.

#### ◆ Important Note ◆

While the GSM-F-2W offers similar functionality to the Omni Switch/Router GSX-F-2W module, the GSM-F-2W is compatible *only* with the OmniSwitch chassis. (Note that OmniSwitch modules are distinguished by the letter **M** in the module name on the front panel, whereas Omni Switch/Router modules are distinguished by the letter **X**.)

In addition, the GSM-F-2W is intended for use *only* with MPM II and MPM 1G management processor modules.

GSM-F-2W modules are factory configured with either two (2) multimode, two (2) long-reach single mode, or two (2) 1000BASE-LX single mode fiber ports. The model number for each configuration is as follows:

GSM-FM-2W: Factory configured with two (2) 1000BASE-SX multimode fiber ports.

GSM-FSH-2W: Factory configured with two (2) long-reach single mode fiber ports.

GSM-FS-2W: Factory configured with two (2) intermediate-reach single mode fiber ports.

Each port configuration is color-coded in order to differentiate between modes: Black for multimode fiber connections; blue for intermediate-reach single mode fiber connections; yellow for long-reach single mode fiber connections. (See the “Handling Fiber and Fiber Optic Connectors” section in Chapter 3, “Omni Switch/Router Switching Modules,” for information on proper handling of SC connectors and fiber-optic cable.)

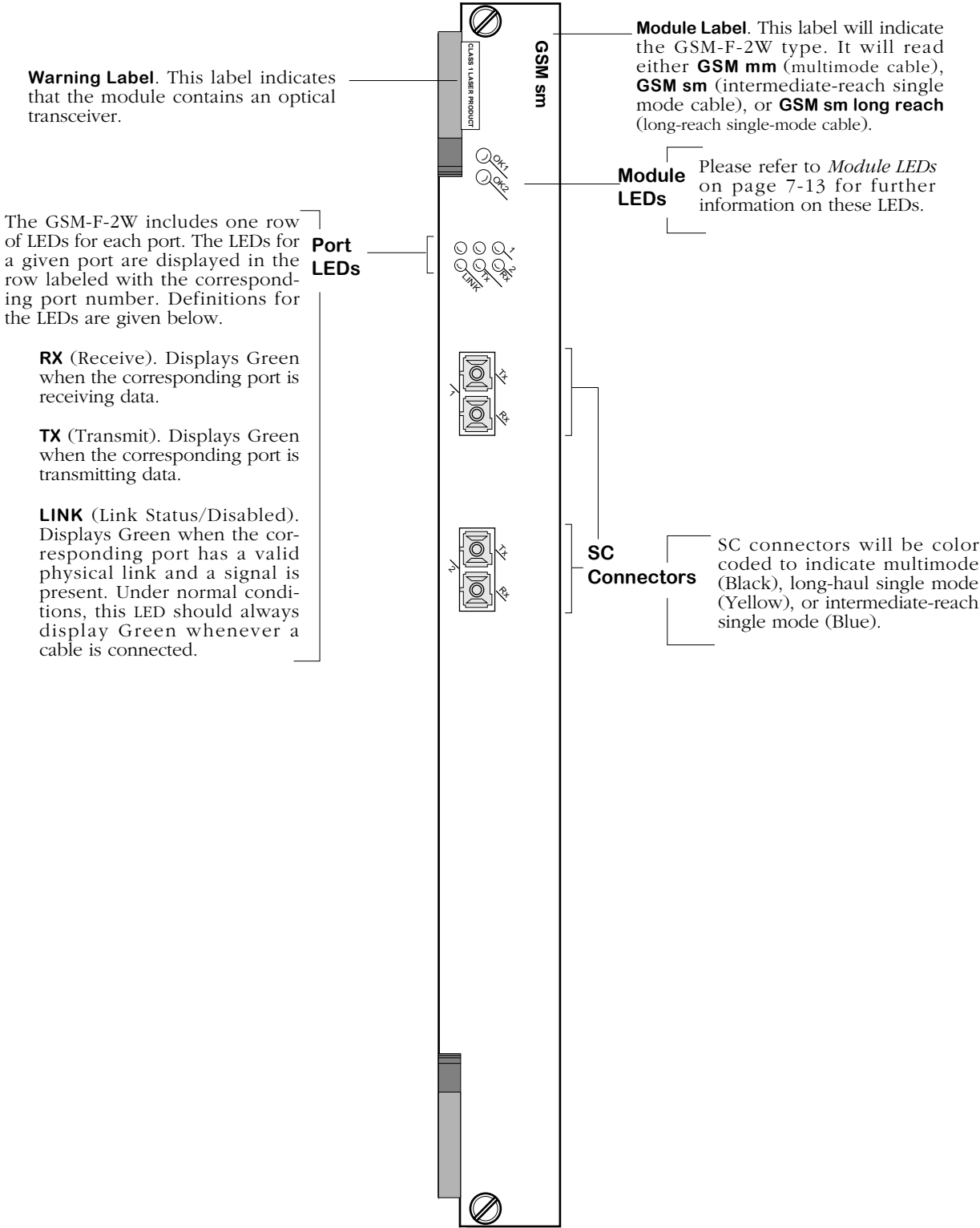
GSM-F-2W Technical Specifications	
Number of ports	2
Connector Type	SC
Standards Supported	802-3z, 1000Base-LX, and 1000Base-SX
Data Rate	1 Gigabit per second (full duplex)
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	4,096
Connections Supported	1000Base-LX or 1000Base-SX connection to backbone or server
Cable Supported	Multimode and single mode
Output Optical Power	-9.5 to -4 dBm (Multimode) -9.5 to -3 dBm (Intermediate-reach single mode) 0 to +5 dBm (Intermediate-reach single mode)
Input Optical Power	-17 to 0 dBm (Multimode) -20 to -3 dBm (Intermediate-reach single mode) -24 to -3 dBm (Intermediate-reach single mode)
Cable Distance	Multimode fiber: $\approx$ 220 m Intermediate-reach single mode fiber: $\approx$ 10 km Long-reach single mode fiber: $\approx$ 70 km

◆ **Special Note** ◆

The single mode version of this module has been deemed:

CLASS 1 LASER PRODUCT  
LASER KLASSE 1  
LUOKAN 1 LASERLAITE  
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.



2-Port Gigabit Ethernet Switching Module