3 Omni Switch/Router Switching Modules

Omni Switch/Router switching modules perform software filtering, translations between dissimilar network interfaces, and hardware-based switching. Omni Switch/Router switching modules have an additional on-board interface connector for the HRE-X.

Currently, Omni Switch/Router switching modules consist of Gigabit Ethernet modules, auto-sensing 10/100 Ethernet modules, Fast (100 Mbps) Ethernet modules, 10 Mbps Ethernet modules, Token Ring modules, ATM uplink modules, FDDI modules, and WAN modules.

♦ Important Note ♦

Omni Switch/Router modules require the use of an Omni Switch/Router chassis (see Chapter 1, "Omni Switch/Router Chassis and Power Supplies"). Do *not* install an Omni Switch/Router module in an OmniSwitch chassis and do *not* install an OmniSwitch module in an Omni Switch/Router chassis.

Gigabit Ethernet Modules

- GSX-FM/FS/FSH-2W — 2-port Gigabit Ethernet switching module
- GSX-FM/FS-4W — 4-port Gigabit Ethernet switching module

10/100 Ethernet Modules

- ESX-100C-12W — 12-port auto-sensing 10/100 Ethernet switching module
- ESX-100C-32W — 32-port auto-sensing 10/100 Ethernet switching module

Fast (100 Mbps) Ethernet Modules

- ESX-100FM/FS-12W — 12-port Fast Ethernet (100 Mbps) switching module

10 Mbps Ethernet Modules

- ESX-FM-24W — 24-port 10 Mbps Ethernet switching module with fiber ports

Token Ring Modules

- TSX-C-32W — 32-port Token Ring (Lobe only) switching module
- TSX-CD-16W — 16-port Token Ring (Lobe and Station) switching module

ATM Uplink Modules

- ASX-155FM/FS/FSH-1W/2W — 1- or 2-port ATM uplink (155 Mbps) switching modules
- ASX-155RFM/RFS-1W — 1-port (redundant) ATM uplink (155 Mbps) switching module
- ASX-622RFM/RFS-1W — 1-port (redundant) ATM uplink (622 Mbps) switching module
- ASX-DS3-1W/2W — 1- or 2-port ATM DS3 uplink modules
- ASX-E3-1W/2W — 1- or 2-port ATM E3 uplink modules

FDDI Modules

- FSX-FS-1W/2W — 1- and 2-port DAS connections over single mode fiber
- FSX-FM-1W/2W — 1- and 2-port DAS connections over multimode fiber
- FSX-FSH-1W/2W — 1- and 2-port DAS connections over single mode fiber using Category 2 high-powered laser optics

WAN Modules

- WSX-S-2W — 2 serial ports that support the frame relay or PPP protocol.
- WSX-SC-4W/8W — 4 or 8 serial ports that support the frame relay or PPP protocol.
- WSX-FT1/E1-SC-1W/2W — 1 or 2 T1/E1 ports and one or two serial ports that support the frame relay or PPP protocol
- WSX-BRI-SC-1W/2W — 1 or 2 UPS (Universal Serial Port) and 1 or 2 ISDN-BRI ports that support Frame Relay or PPP
- WSX-M013-2W/4W — 2 or 4 channelized DS3 ports (described in Chapter 56, "Managing Channelized DS3 Modules")

Omni Switch/Router Hardware Routing Engine

The HRE-X offers high-speed Layer 3 switching from 1.5 to 12.0 million packets per second (Mpps) in a fully loaded chassis. See Chapter 1, "Omni Switch/Router Chassis and Power Supplies," for more information on the HRE-X.

♦ Important Note ♦

Omni Switch/Router switching modules require an MPX. You cannot install any version of the MPM (i.e, MPM 1G, MPM II, or original MPM) in a chassis with an MPX. See Chapter 2, "The Omni Switch/Router MPX," for more information on the MPX.

Handling Fiber and Fiber Optic Connectors

Using fiber is extremely simple, but a few important rules should always be followed:

Step 1. Use Premium Grade Jumper Cables with Duplex SC Connectors

There are many brands of fiber optic jumper cables, with a wide range of quality between each manufacturer. Premium cables do three things well:

- They provide a good polish on the fiber optic connector endface (where the light exits the cable). Endface geometries must be exceptionally precise and aligned to extremely tight tolerances. The better the endface geometry, the lower the loss and more consistent the connection. Poor connector interfaces will reflect light back into the laser, causing an increase in laser noise.
- They mate well with other connector interfaces. Chances are the manufacturer of the jumper cable will not be the same as the manufacturer of the transceiver connector interface. Premium jumper cables mechanically align themselves well into most transceiver interfaces. This provides both better performance as well as better repeatability. You will always see a variance in transceiver power due to connector alignment, often as much as 0.3 to 0.7 dB. Good jumper cables help reduce this variance.
- They continue to mate well after many insertions and removals. Premium grade jumper use premium connectors that maintain their mechanical integrity up to and beyond 2000 insertion cycles.

For better repeatability, always use duplex (two connectors fused together and terminated to two cables) SC connectors on your jumper cables when connecting to a fiber-optic transceiver. Two simplex connectors inserted into a transceiver interface will often have up to 3 dB greater variation in repeatability compared to duplex connectors.

Never bend the fiber optic cable beyond its recommended minimum bend radius (1.2 inches minimum). This introduces bend losses and reflections that will degrade the performance of your system. It can also damage the fiber, although fiber is much tougher than most would assume. Still, it is highly recommended to buy only jumper cables with 3mm Kevlar jacketing, which offer superior protection and longer life.

Step 2. Keep Your Fiber Optic Connectors Clean

Unlike electrical connectors, fiber-optic connectors need to be extremely clean to ensure good system performance. Microscopic particles on the connector endface (where the light exits the connector) can degrade the performance of your system, often to the point of failure. If you have low-power output from a fiber-optic transceiver or a fault signal from your equipment, cleaning your fiber-optic connectors should always be done before trouble shooting.

Follow the steps below to clean your fiber optic connector:

1. Hold the connector cleaner tool in the palm of your left hand and, with the silver shutter upwards, rotate the cloth-forwarding lever (located on the right side of the tool) with your thumb away from your body. As the lever winds the cleaning cloth inside the case, it simultaneously opens the silver shutter located at the top of the unit.

2. Keeping your thumb pressed on the cloth-forwarding lever, press the optical plug ferrule endface against the cleaning cloth and drag the plug down toward your body (there should be arrows on the top of the tool that indicate the proper wiping direction). The connector is now clean.

3. Release the cloth-forwarding lever, allowing it to return to its initial position.

A cleaning cloth reel can enable over 400 cleanings and is replaceable. When cables are not being used, always put the plastic or rubber endcaps back on the connector to ensure cleanliness.

Step 3. Keep the Transceiver Interface Clean

If you have cleaned your connectors, but still experience low-power output from a fiber-optic transceiver or a fault signal from your equipment, you should clean the transceiver interface by blowing inert dusting gas inside the transceiver interface. This removes dust and other small particles that may block the optical path between the optics of the transceiver and the connector's endface.

Step 4. Attenuate Properly

Often equipment using laser-based transceivers need to have the optical path attenuated when performing loop-back testing or testing between two pieces of equipment. Too much optical power launched into the receiver will cause saturation and result in system failure. If you are using single mode fiber and you do not know the power output of the laser, it is always best to use a 10 dB attenuator when testing. Using the wrong type of attenuator will introduce problems, most notably reflection of light back into the laser, often resulting in excess noise and causing system failure.

Inline attenuators eliminate the need for additional jumper cables and thus reduce the number of connection interfaces. This increases the integrity of the optical path resulting in a more accurate test.

Gigabit Ethernet Modules

Gigabit Ethernet connections can be used as network backbones or in a wiring closet. The following Omni Switch/Router Gigabit Ethernet modules are available:

- GSX-FM/FS/FSH-2W Two (2) Gigabit Ethernet backbone connections using fiber (SC) connectors.
- GSX-FM/FS-4W Four (4) Gigabit Ethernet server connections using fiber (SC) connectors.

These modules are described and illustrated in the following sections.

GSX-FM/FS/FSH-2W

The GSX-FM/FS/FSH-2W Gigabit Ethernet backbone switching module contains two fiber SC connectors that support two fully switched 1000Base-LX (long-distance fiber transmissions) or 1000Base-SX (short-distance fiber transmission ports). The GSX-FM/FS/FSH-2W can be factory configured with long-reach single mode, intermediate-reach single mode, or multimode fiber ports (see *GSX-FM/FS/FSH-2W Technical Specifications* on page 3-6 for more information). The long-reach single mode version is referred to as the GSX-FSH-2W; the intermediate-reach single mode version is referred to as the GSX-FS-2W; and the multimode version is referred to as the GSX-FM-2W. The ports are color coded to differentiate the mode: multimode connectors are black, long-haul single mode connectors are yellow, and intermediate-reach single mode connectors are blue. (See *Handling Fiber and Fiber Optic Connectors* on page 3-3 for proper handling of SC connectors and fiber-optic cable.)

The GSX-FM/FS/FSH-2W can be used as a backbone connection in networks where Gigabit Ethernet is used as the backbone media.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

GSX-FM/FS/FSH-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 (Long-reach single mode)
Input Optical Power	-17 to 0 dBm (Multimode) -20 to -3 dBm (Intermediate-reach single mode) -24 to -3 dBm (Long-reach single mode)
Cable Distance	Multimode fiber: ≈ 220 m Intermediate-reach single mode fiber: ≈ 10 km Long-reach single mode fiber: ≈ 70 km
Current Draw	6.75 amps without an HRE-X 8.25 amps with an HRE-X

♦ Special Note ♦

The single mode version of this module has been deemed:

CLASS 1 LASER PRODUCT
LASER KLASSE 1
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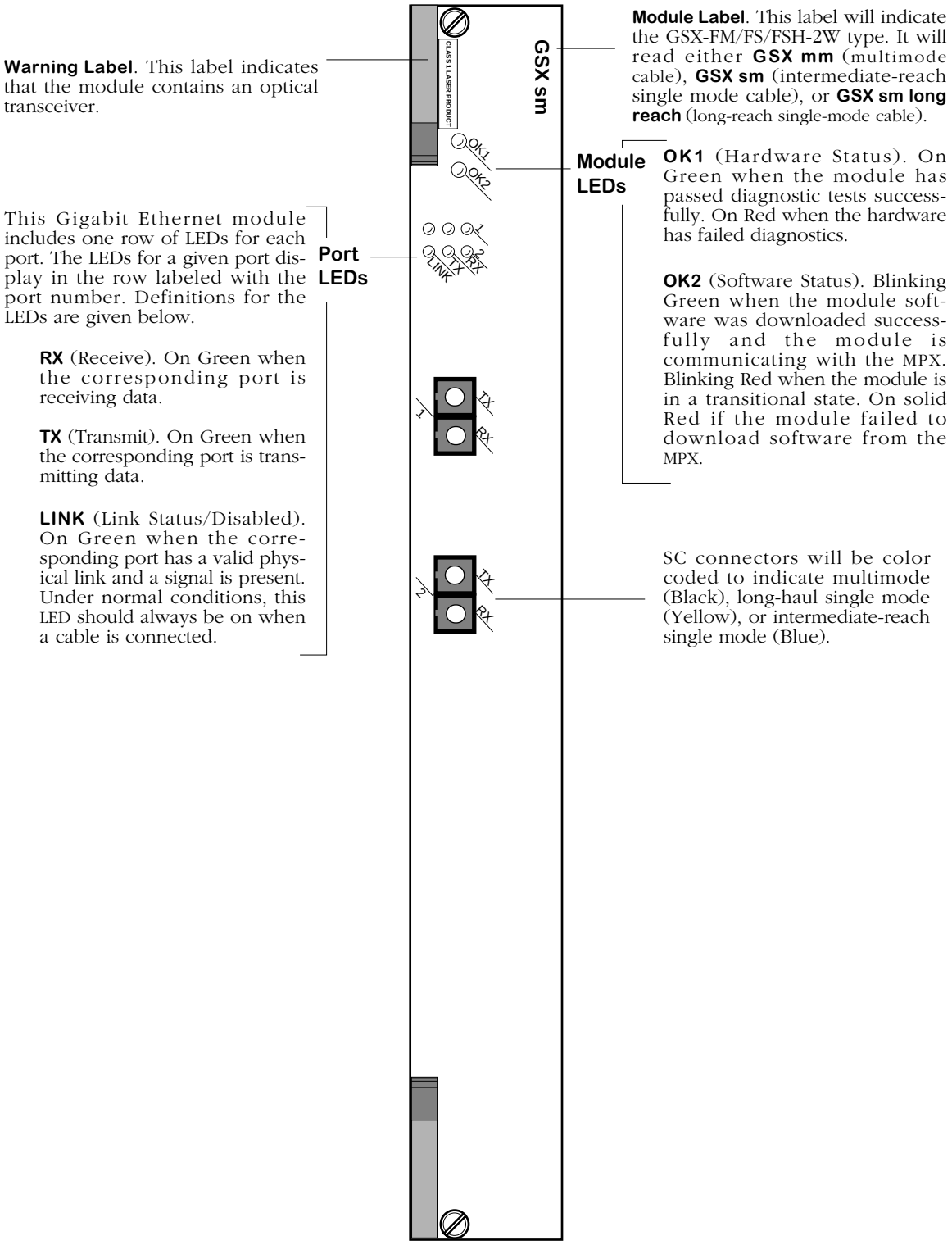
to IEC 825:1984/CENELEC HD 482 S1.



2-Port Gigabit Ethernet Switching Module

GSX-FM/FS-4W

The GSX-FM/FS-4W Gigabit Ethernet server switching module contains four fiber SC connectors that support four 1000Base-LX (long-distance fiber transmissions) or 1000Base-SX (short-distance fiber transmission ports). The GSX-FM/FS-4W can be factory configured with single (1000Base-LX) mode or multimode (1000Base-SX) fiber ports (see *GSX-FM/FS-4W Technical Specifications* on page 3-9 for more information). The single mode (1000Base-LX) version is referred to as the GSX-FS-4W; the multimode version (1000Base-SX) is referred to as the GSX-FM-4W. The ports are color coded to differentiate the mode: single mode connectors are blue and multimode connectors are black. (See *Handling Fiber and Fiber Optic Connectors* on page 3-3 for proper handling of SC connectors and fiber-optic cable.)

The GSX-FM/FS-4W can be used to connect to Gigabit Ethernet edge devices and servers.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

GSX-FM/FS-4W Technical Specifications	
Number of ports	4
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 edge device or server
Cable Supported	1000Base-SX Multimode 1000Base-LX Single mode
Output Optical Power	-9.5 to -4 dBm (Multimode) -9.5 to -3 dBm (Single mode)
Input Optical Power	-17 to 0 dBm (Multimode) -20 to -3 dBm (Single mode)
Cable Distance	1000Base-SX Multimode fiber: approximately 200 m 1000Base-LX Single mode fiber: approximately 10 km
Current Draw	10.0 amps without an HRE-X 11.5 amps with an HRE-X

♦ Special Note ♦

The single mode version of this module has been deemed:

CLASS 1 LASER PRODUCT
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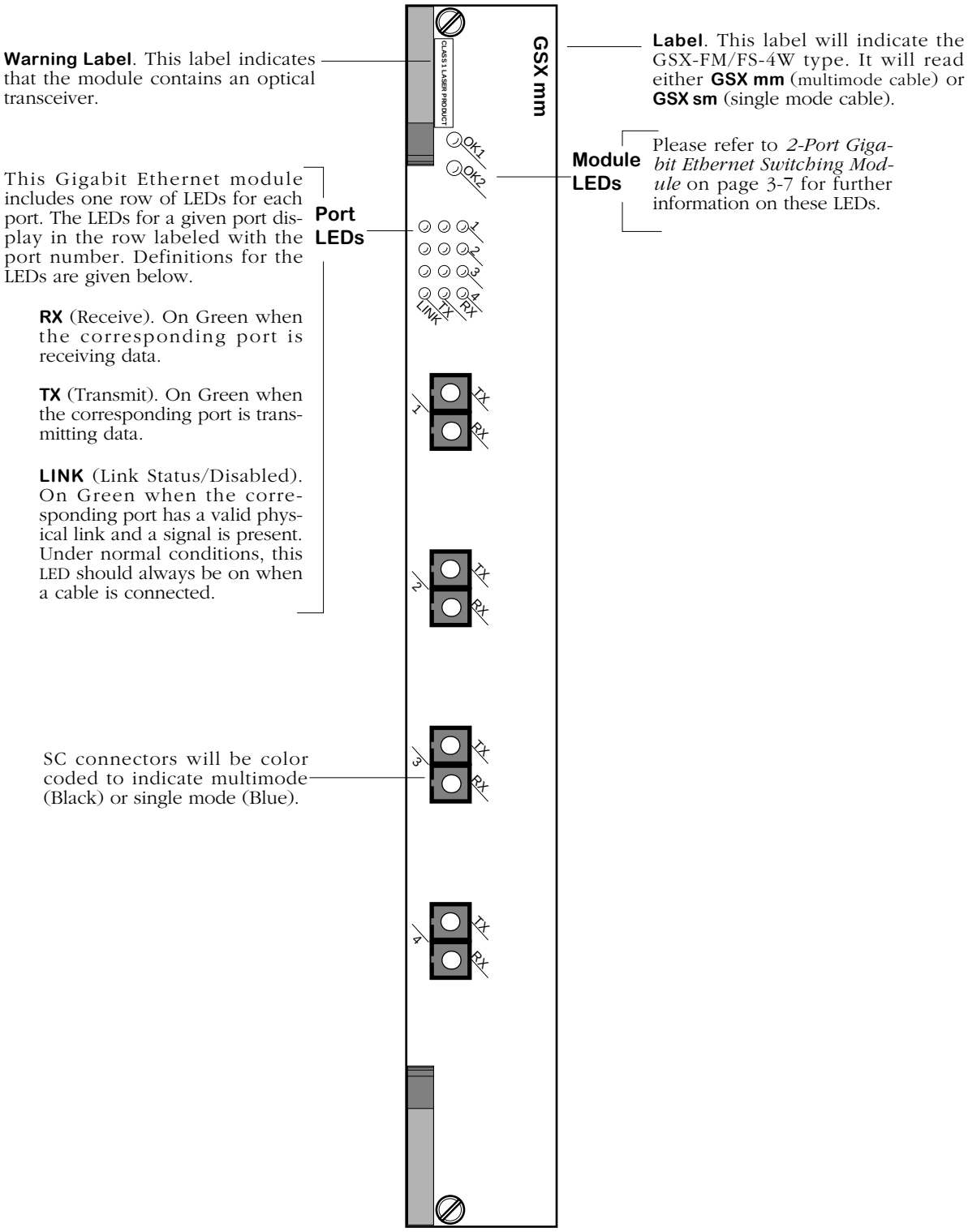
APPAREIL A LASER DE CLASSE 1

to IEC 825:1984/CENELEC HD 482 S1.



4-Port Gigabit Ethernet Switching Module

Auto-Sensing 10/100 Ethernet Modules

Alcatel's Omni Switch/Router 10/100 Ethernet modules can be used to connect networks with a mix of 10 Mbps and 100 Mbps workstations or as a network backbone.

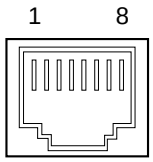
The following Omni Switch/Router 10/100 and Fast Ethernet modules are available:

- ESX-100C-12W — Twelve (12) auto-sensing 10/100 Mbps backbone connections using RJ-45 ports.
- ESX-100C-32W — Thirty-two (32) auto-sensing 10/100 Mbps desktop connections using RJ-45 ports.

These modules are described and illustrated in the following sections.

Ethernet RJ-45 Pinouts

The figure and table below illustrate the pinouts used on RJ-45 ports in Omni Switch/Router 10/100 Ethernet modules.



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

ESX-100C-12W

The ESX-100C-12W Omni Switch/Router 10/100 Ethernet backbone switching module contains 12 ports that each support a fully switched 10 or 100 Mbps connection in full- or half-duplex mode. This module provides high-speed backbone connectivity. It also supports backbone features such as 802.1q and OmniChannel. 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 or unshielded twisted pair (UTP) cable (see *ESX-100C-12W Technical Specifications* on page 3-12 for more information). Each port may connect to a single high-speed device or a hub serving multiple devices. The ESX-100C-12W can be used as a network backbone or in the wiring closet with a mix of 10 Mbps and 100 Mbps workstations.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

ESX-100C-12W 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 (full or half duplex)
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	4,096
Connections Supported	10BaseT hub or device 100BaseTx hub or device
Cable Supported	10BaseT Unshielded twisted-pair (UTP) 100BaseTx Unshielded twisted-pair: Category 5, EIA/TIA 568 Shielded twisted-pair Category 5, 100 ohm
Maximum Cable Distance	100 m
Current Draw	5.75 amps without an HRE-X 7.25 amps with an HRE-X

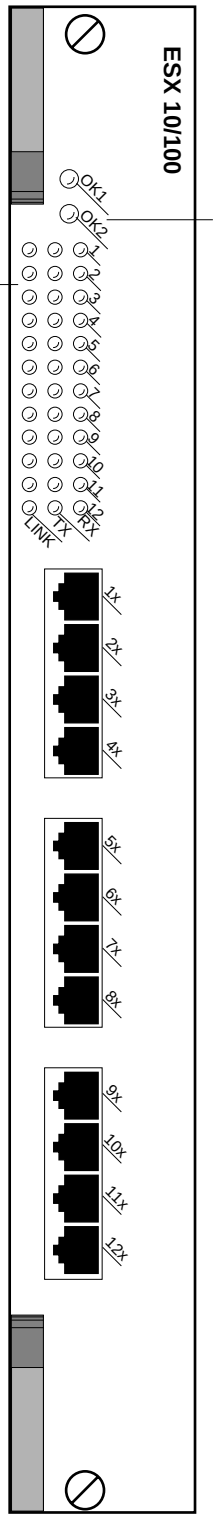
This 10/100 Ethernet module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number. Definitions for the LEDs are given below.

RX (Receive). On Green when the corresponding port is receiving data.

TX (Transmit). On Green when the corresponding port is transmitting data.

LINK (Link Status/Disabled). On Green when the corresponding port has a valid physical link and a signal is present. Under normal conditions, this LED should always be on when a cable is connected.

Port LEDs



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 MPX. Blinking Amber when the module is in a transitional state. On solid Amber if the module failed to download software from the MPX.

12-Port Auto-Sensing 10/100 Ethernet Switching Module

ESX-100C-32W

The ESX-100C-32W Omni Switch/Router 10/100 Ethernet switching module contains 32 ports that each support a fully switched 10 or 100 Mbps connection in full- or half-duplex mode. This module offers high density 10/100 connectivity for desktop connections. 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 32 RJ-45 ports may connect to unshielded or shielded twisted pair (UTP) cable (see *ESX-100C-32W Technical Specifications* on page 3-15 for more information). Each port may connect to a single high-speed device or a hub serving multiple devices. The ESX-100C-32W can be used in the wiring closet with a mix of 100 Mbps Ethernet devices and 10 Mbps Ethernet devices that are transitioning to higher speed 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 (see *32-Port Auto-Sensing 10/100 Ethernet Switching Module* on page 3-16). Software commands will number these ports 1 through 32, with Port **A1** as 1, Port **B1** as 9, **C1** as 17, **D1** as 25, etc.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

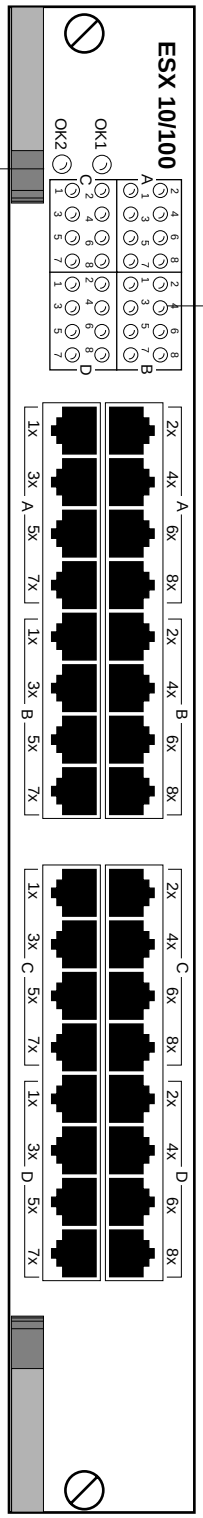
♦ Note ♦

OmniChannel is not supported on the ESX-100C-32W. It is, however, supported on the ESX-100C-12W (see *ESX-100C-12W* on page 3-11) and on the ESX-100FM/FS-12W (see *ESX-100FM/FS-12W* on page 3-17).

ESX-100C-32W Technical Specifications	
Number of ports	32
Connector Type	RJ-45
Standards Supported	IEEE 802.3; IAB RFCs 826, 894
Data Rate	10 or 100 Mbps (full or half duplex)
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024
Connections Supported	10BaseT hub or device 100BaseTx hub or device
Cable Supported	10BaseT Unshielded twisted-pair (UTP) 100BaseTx Unshielded twisted-pair: Category 5, EIA/TIA 568 Shielded twisted-pair Category 5, 100 ohm
Maximum Cable Distance	100 m
Current Draw	11.25 amps without an HRE-X 12.75 amps with an HRE-X

Please refer to *12-Port Auto-Sensing 10/100 Ethernet Switching Module* on page 3-13 for further information on these LEDs.

Module LEDs



Port LEDs

Each LED corresponds to a port on the module. When an LED is on Green continuously, a good cable connection exists. The LED will blink Green when traffic is transmitted or received on the port.

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

Fast (100 Mbps) Ethernet Modules

Alcatel's Omni Switch/Router Fast Ethernet modules can be used to connect networks with 100 Mbps workstations or as a network backbone.

The following Omni Switch/Router Fast Ethernet modules is available:

- ESX-100FM/FS-12W Twelve (12) Fast Ethernet (100 Mbps) backbone connections using MT-RJ ports.

This module is described and illustrated in the following sections.

ESX-100FM/FS-12W

The ESX-100FM/FS-12W Omni Switch/Router Fast Ethernet switching module has twelve (12) fiber MT-RJ ports that each support a fully-switched 100 Mbps connection in full-duplex mode. This module provides high-speed backbone connectivity. It also supports backbone features such as 802.1q and OmniChannel. Each port uses the full 100 Mbps of bandwidth in each direction (see *ESX-100FM/FS-12W Technical Specifications* on page 3-18). The single mode version is referred to as the ESX-100FS-12W; the multimode version is referred to as the ESX-100FM-12W. Multimode and single mode connectors are differentiated by color: multimode connectors are black and single mode connectors are blue.

♦ Note ♦

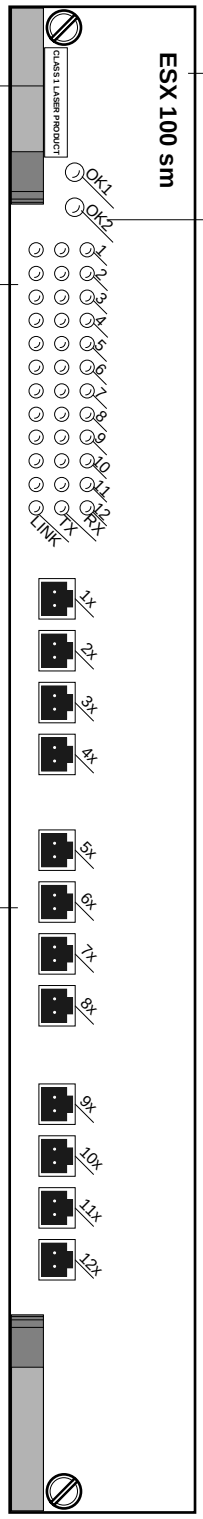
If your network currently uses SC connectors, you can order MT-RJ-to-SC cables from Alcatel.

The MT-RJ fiber port supports full-duplex operation. You can configure half-duplex mode on each port through **10/100cfg**. 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 ESX-100FM/FS-12W is best used as a backbone connection in networks where Fast Ethernet is used as the backbone media. Each 100Base-Fx port may also connect to a single high-traffic device, such as a mail or file server.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

ESX-100FM/FS-12W Technical Specifications	
Number of ports	12
Connector Type	MT-RJ
Standards Supported	IEEE 802.3; IAB RFCs 826, 894
Data Rate	100 Mbps (full duplex)
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	4,096
Connections Supported	100Base-Fx connection to backbone or server
Cable Supported	Multimode: 62.5/125 micron multimode fiber Single mode: single mode fiber
Optical output power	Multimode: -19 to -14 dBm Single-mode: -20 to -14 dBm
Optical receiver sensitivity	Multimode: -31 dBm Max. Single-mode: -31 dBm Max.
Cable Distance	Multimode: approximately 2 km Single-mode: approximately 15 km
Current Draw	10.0 amps without an HRE-X 11.5 amps with an HRE-X



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

Module Label. This label will indicate the ESX-100FM/FS-12W type. It will read either **ESX 100 mm** (multimode cable) or **ESX 100 sm** (single mode cable).

Module LEDs

Please refer to *12-Port Auto-Sensing 10/100 Ethernet Switching Module* on page 3-13 for further information on these LEDs.

Port LEDs

This Fast Ethernet module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number. Definitions for the LEDs are given below.

RX (Receive). On Green when the corresponding port is receiving data.

TX (Transmit). On Green when the corresponding port is transmitting data.

LINK (Link Status/Disabled). On Green when the corresponding port has a valid physical link and a signal is present. Under normal conditions, this LED should always be on when a cable is connected.

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

12-Port Fast Ethernet Switching Module

10 Mbps Ethernet Modules

Alcatel's Omni Switch/Router 10 Mbps Ethernet modules can be used to connect networks with 10 Mbps workstations. The following Omni Switch/Router Fast Ethernet modules is available:

- ESX-FM-24W — Twelve (12) Fast Ethernet (100 Mbps) backbone connections using MT-RJ ports.

This modules is described and illustrated in the following sections.

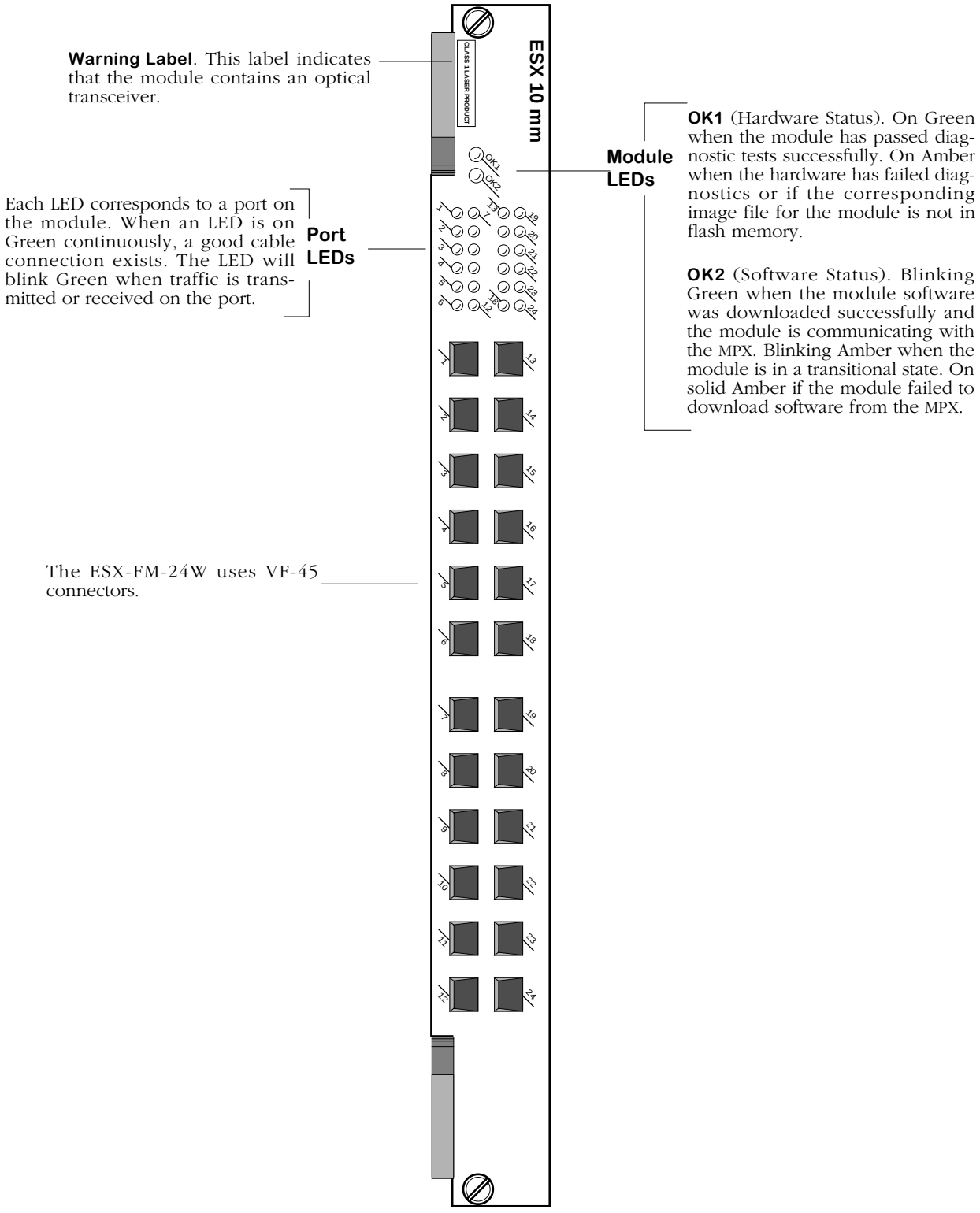
ESX-FM-24W

The ESX-FM-24W switching module contains twenty-four (24) 10BaseFl ports. Each port connection supports one switched Ethernet segment at the full 10 Mbps of bandwidth. The ESX-FM-24W uses VF-45 connectors. Each port supports multimode fiber connections to desktop devices. See *ESX-FM-24W Technical Specifications* on page 3-21 for more information.

By default, each port is configured to operate in full-duplex mode. You can configure half-duplex mode on each port through **10/100cfg**. An additional software command, **10/100vc**, allows you to view the current link mode of each port connection. The **10/100cfg** and **10/100vc** commands are described in Chapter 19, "Managing Ethernet Modules."

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

ESX-FM-24W Technical Specifications	
Number of ports	24
Connector Type	Fiber VF-45
Standards Supported	IEEE 802.3; IAB RFCs 826, 894
Data Rate	10 Mbps (full duplex)
Maximum Frame Size	1,518 bytes
MAC Addresses Supported	1,024
Connections Supported	10BaseFl connection to desktop
Cable Supported	multimode fiber
Optical output power	-20 to -14 dBm
Optical receiver sensitivity	-33 to -31 dBm
Cable Distance	approximately 2 km
Current Draw	13.0 amps without an HRE-X 14.5 amps with an HRE-X



24-Port 10 Mbps Ethernet Switching Module with VF-45 Connectors

Token Ring Modules

Omni Switch/Router Token Ring modules support Lobe (TSX-C-32W and TSX-CD-16W) and Station (TSX-CD-16W only) configurations. Module ports can connect existing Token Ring Multistation Access Units (MAUs), hubs, and devices. These modules support Transparent Bridging (TB), Source Route Transparent Bridging (SRT), and Source Route Bridging (SRB), IEEE 802.1d, IBM Spanning Tree, port mirroring, RMON, and standard MIBs.

Token Ring ports support a fully switched connection at either 4 or 16 Mbps. In addition, these 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.

Omni Switch/Router Token Ring modules also support virtual rings. This feature allows you to group Token Ring ports on an Omni Switch/Router as one logical ring with a common ring number. With virtual rings, you can micro-segment physical Token Rings into smaller, more manageable virtual rings without changing end-station configurations or making any topology changes. Broadcast traffic is also decreased by eliminating source route hops.

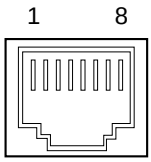
The following Omni Switch/Router Token Ring modules are available:

- TSX-C-32W Thirty-two (32) UTP or STP RJ-45 ports that support desktop connections.
- TSX-CD-16W Sixteen (16) UTP or STP RJ-45 ports that support desktop or MAU connections.

These modules are described and illustrated in the following sections.

Token Ring RJ-45 Pinouts

The figure and table below illustrate the pinouts used on RJ-45 ports in Omni Switch/Router token ring modules.



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

TSX-C-32W

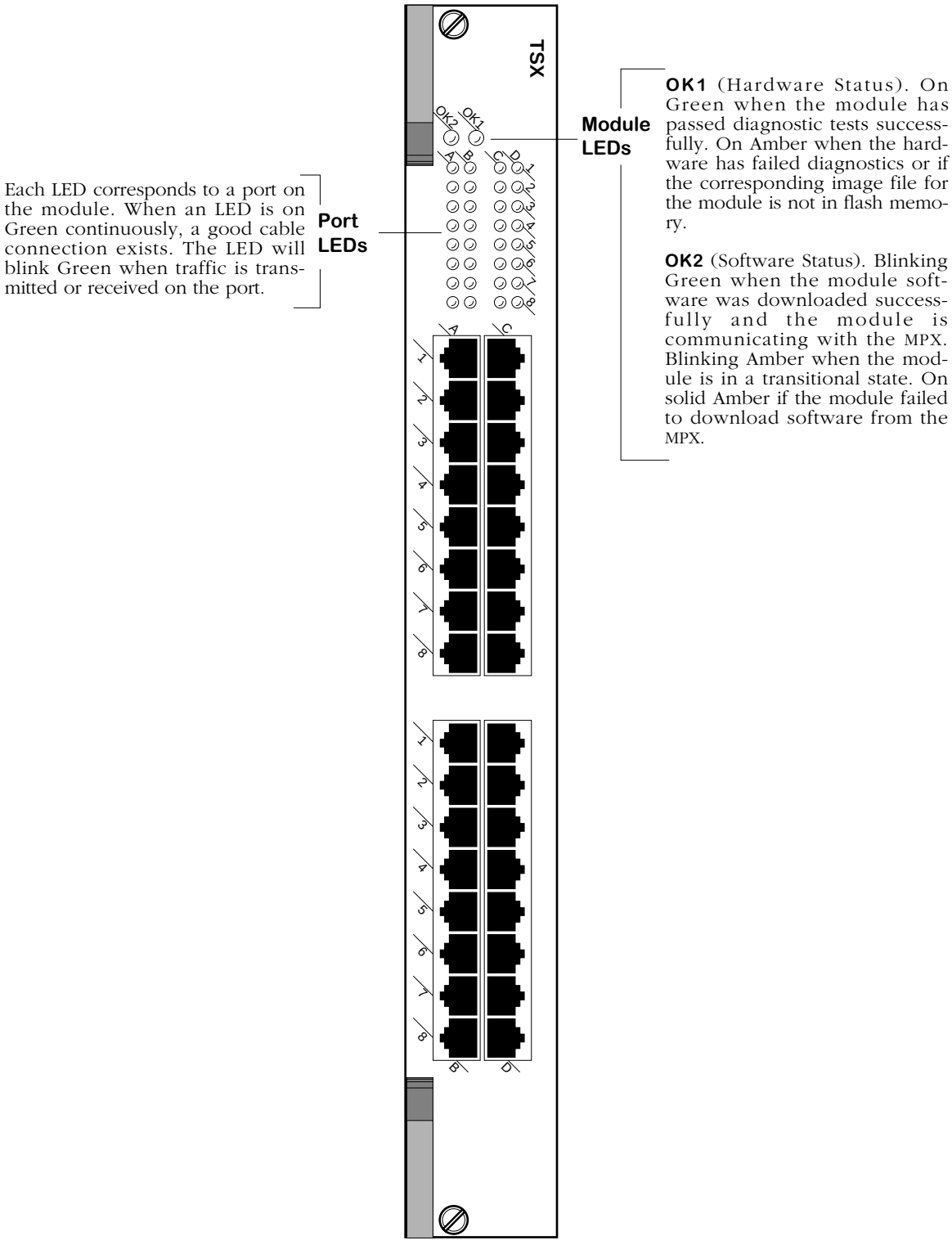
The TSX-C-32W allows you to connect to Token Ring workstations. This module contains thirty-two (32) active ports that may support either unshielded twisted pair (UTP) or shielded twisted pair (STP) connections (see *TSX-C-32W Technical Specifications* on page 3-24 for more information). The ports each support a fully switched connection at either 4 or 16 Mbps in full- or half-duplex mode. The Ring Speed is configurable through the **tpcfg** command. Ports are Lobe only, supporting connections to desktop devices. By default, ports are auto-sensing 4/16 Mbps and full/half duplex mode. If you disable auto sensing with the **tpcfg** command, you can configure an individual port's ring speed (4 or 16 Mbps) and duplex mode (full or half).

If the TSX-C-32W is set to auto-configuration mode (the default), switch software will automatically modify the Ring Speed if there is a discrepancy with the ring to which the port is connected. (The new Ring Speed, however, is not saved in the system configuration file, **mpm.cfg**.)

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 (see *32-Port Token Ring Switching Module* on page 3-25). Software commands will number these ports 1 through 32, with Port **A1** as 1, Port **B1** as 9, **C1** as 17, **D1** as 25, etc.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

TSX-C-32W Technical Specifications	
Number of ports	32
Connector Type	Shielded RJ-45 (UTP or STP)
Standards Supported	IEEE 8-2.5r
Data Rate	4 or 16 Mbps (full or half-duplex)
Maximum Frame Size	8,144 bytes
MAC Addresses Supported	1,024
Connections Supported	Desktop devices
Cable Supported	Shielded twisted pair (STP) —100 or 150 ohm • IBM Type 1 Unshielded twisted pair (UTP) —100 ohm • IBM Type 3 • ANSI Category 3, 4, or 5
Maximum Cable Distance	100 m
Current Draw	9.25 amps without an HRE-X 10.75 amps with an HRE-X



32-Port Token Ring Switching Module

TSX-CD-16W

The TSX-CD-16W allows 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 Omni Switch/Router network. As a Lobe connection, you can connect Omni Switch/Routers to high-traffic Token Ring workstations or servers.

This module contains sixteen (16) active ports that may support either unshielded twisted pair (UTP) or shielded twisted pair (STP) connections (see *TSX-CD-16W Technical Specifications* on page 3-27 for more information). The ports each support a fully switched connection at either 4 or 16 Mbps in full- or half-duplex mode. The Ring Speed is configurable through the **tpcfg** command. By default, ports are auto-sensing 4/16 Mbps, Station/Lobe, and full/half duplex mode. If you disable auto sensing with the **tpcfg** command, you can configure an individual port's ring speed (4 or 16 Mbps), port mode (Station or Lobe) and duplex mode (full or half).

If the TSX-CD-16W is set to auto-configuration mode (the default), switch software will automatically modify the Ring Speed if there is a discrepancy with the ring to which the port is connected. A TSX-CD-16W 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 connections handle automatic speed detection this way.

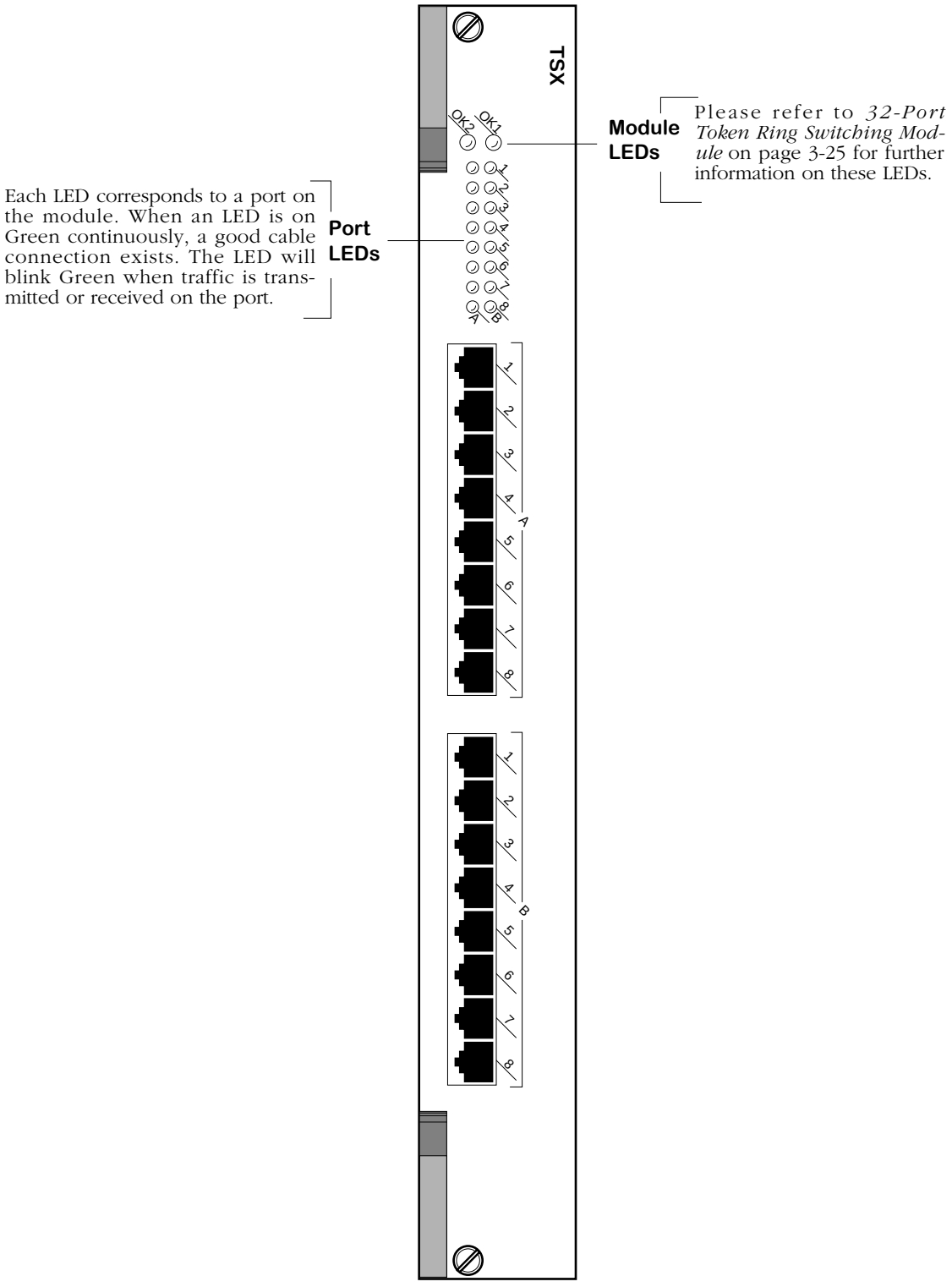
If a TSX-CD-16W port is set to auto-configuration mode and it is the first device on the ring, the TSX-CD-16W will attempt to auto sense the ring speed every 18 seconds until there is an insertion of another device on the ring. The port does not reset to match the Ring Speed—its speed becomes the Ring 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 TSX-CD-16W module can auto-detect Station/Lobe mode. In addition, you can change an individual port from Lobe to Station or Station to Lobe with the **tpcfg** command. See Chapter 21, "Managing Token Ring Modules," for more information on the **tpcfg** command.

Module ports are divided into two (2) banks of eight (8) ports. Ports are numbered from 1 to 8 within each of the two banks. The two banks are labelled **A** and **B**. This grouping simplifies the display of LEDs, which are organized as a matrix (see *16-Port Token Ring Switching Module* on page 3-28). Software commands will number these ports 1 through 16, with Port **A1** as 1, Port **A2** as 2, **B1** as 9, **B2** as 10, etc.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

TSX-CD-16W Technical Specifications	
Number of ports	16
Connector Type	Shielded RJ-45 (UTP or STP)
Standards Supported	IEEE 8-2.5r
Data Rate	4 or 16 Mbps (full- or half duplex)
Maximum Frame Size	8,144 bytes
MAC Addresses Supported	4,096
Connections Supported	Desktop devices and MAUs
Cable Supported	Shielded twisted pair (STP) —100 or 150 ohm • IBM Type 1 Unshielded twisted pair (UTP) —100 ohm • IBM Type 3 • ANSI Category 3, 4, or 5
Maximum Cable Distance	100 m
Current Draw	7.0 amps without an HRE-X 8.5 amps with an HRE-X



16-Port Token Ring Switching Module

ATM Uplink Modules

ATM uplink (ASX) switching modules allow you to connect the Omni Switch/Router to ATM servers, backbones, and switches. Omni Switch/Router ATM uplink modules currently support OC-3 (155 Mbps), OC-12 (622 Mbps), DS3, and E3 interfaces and include the following:

- ASX-155FM/FS/FSH-1W/2W One or two single mode or multimode fiber OC-3 ports.
- ASX-155RFM/RFS-1W One single mode or multimode fiber OC-3 port pairs(redundant). The port pair contains a primary and backup port.
- ASX-622RFM/RFS-1W One-port redundant fiber single mode or multimode OC-12 switching module. The port pair includes a primary and backup port.
- ASX-DS3-1W/2W One or two port DS3 switching module.
- ASX-E3-1W/2W One or two port E3 switching module.

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 Omni Switch/Routers could be connected over one or more backbones. In such a configuration, you combine the flexibility of the Omni Switch/Router'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 Omni Switch/Router directly to an ATM server, then all non-ATM devices in the LAN can communicate with the high-speed ATM server through the Omni Switch/Router.

If your network uses ATM backbone switches, then the Omni Switch/Router 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 Omni Switch/Routers and OmniStack switches 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.

ASX ports allow you to configure several traffic parameters, including Peak Cell Rate (PCR), Sustaining Cell Rate (SCR), and Maximum Burst Size (MBS). You can divide ASX ports into discrete "bandwidth groups." Unique PCR, SCR, and MBS values can be assigned to bandwidth groups. This feature, called "traffic shaping," takes place on data that is exiting (i.e., transmitted out) a switch port.

Software controls on the switch allow you to control and monitor activity on ASX 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.

ASX-155FM/FS/FSH

The ASX-155FM/FS/FSH switching module contains one (1) or two (2) fiber (SC) ports that support OC-3 connections. The port connections provide 155 Mbps of bandwidth and connect to either multimode, intermediate-reach single mode, or long-reach single mode cable. The ASX-155FM/FS/FSH can be factory configured with single mode or multimode fiber ports (see *ASX-155FM/FS/FSH Technical Specifications* on page 3-31 for more information). The intermediate-reach single mode version is referred to as the ASX-155FS; the long-haul (Category 2 laser) single mode version is referred to as the ASX-155FSH; and the multimode version is referred to as the ASX-155FM. Connector types are differentiated by color: multimode connectors are black, long-haul single mode connectors are yellow, and intermediate-reach single mode connectors are blue.

The ASX-155FM/FS/FSH is 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 Omni Switch/Router over the ATM fiber backbone without the use of a high-end ATM switch.

The ASX-155FM/FS/FSH switching module is actually a daughtercard that attaches to an Omni Switch/Router High-Speed Module (HSX). The HSX provides the base memory and processing power for these high throughput switching modules.

The HSX contains RISC processors, RAM for holding software image files, ASICs for performing switching, and Content Addressable Memory (CAM) for storing MAC addresses. You plug cable directly into a submodule, but it is the HSX module that connects to the switch backplane.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

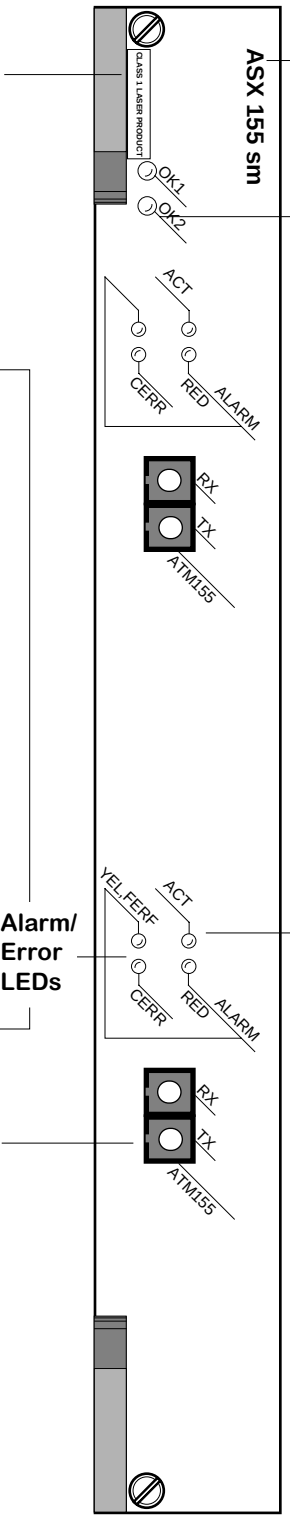
ASX-155FM/FS/FSH Technical Specifications	
Number of ports	1 or 2
Connector Type	SC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/V2.0 MPOA Client
Data Rate	155 Mbps
ATM Adaption Layers	AAL5
MAC Addresses Supported	4,096
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 haul): -5 to 0 dBm
Optical receiver sensitivity	Multimode: -30 to -14 dBm Single mode (intermediate reach): -31 to -8 dBm Single mode (long haul): -34 (max.), -37 (typical)
Power Budget	Multimode: 11 dB Single mode (intermediate reach): 16 dB Single mode (long haul): 29 dBm
Cable Supported	Multimode: 62.5 micron multimode fiber Single mode (intermediate reach and long haul): 9 micron single mode fiber
Cable Distance	Multimode: 4.2 km Single mode (intermediate reach): 24 km Single mode (long haul): 40 km
Current Draw	**1-port**: 5.25 amps without an HRE-X **1-port**: 6.75 amps with an HRE-X **2-port**: 6.25 amps without an HRE-X **2-port**: 7.75 amps with an HRE-X

♦ 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.



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

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

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 MPX. Blinking Amber when the module is in a transitional state. On solid Amber if the module failed to download software from the MPX.

YEL, FERF (Yellow/Far End Status Alarm). On Amber when a far end receive failure occurs. The recipient of cells from this ASX is not receiving those cells. This error may be due to a transmission error by the ASX 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 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 ASX module is plugged in, but no cable has been connected.

Alarm/ Error LEDs

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

OffThere is no link and no data transmitting. Possibly 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.

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

2-Port 155 Mbps ATM Uplink Switching Module

ASX-155RFM/RFS-1W

The ASX-155RFM/RFS-1W switching module contains one (1) redundant fiber (SC) port pair that supports OC-3 connections. (Only one port in the port pair can be active at one time.) The port connections provide 155 Mbps of bandwidth and connect to either multimode or single mode cable (see *ASX-155RFM/RFS-1W Technical Specifications* on page 3-34 for more information). The ASX-155RFM/RFS-1W can be factory configured with a single mode or multimode fiber port. The single mode version is referred to as the ASX-155RFS-1W; the multimode version is referred to as the ASX-155RFM-1W. Multimode and single mode connectors are differentiated by color: multimode connectors are black and single mode connectors are blue.

The ASX-155RFM/RFS-1W is ideally suited for mission-critical ATM access connections. The redundant port pair ensures that critical backbone and server connections are protected against failures on the primary link.

The ASX-155RFM/RFS-1W switching module is actually a daughtercard that attaches to an Omni Switch/Router High-Speed Module (HSX). The HSX provides the base memory and processing power for these high throughput switching modules.

The HSX contains RISC processors, RAM for holding software image files, ASICs for performing switching, and Content Addressable Memory (CAM) for storing MAC addresses. You plug cable directly into a submodule, but it is the HSX module that connects to the switch backplane.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

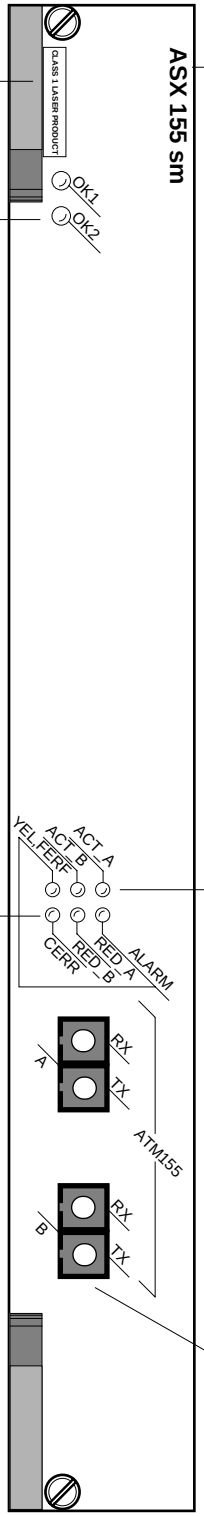
ASX-155RFM/RFS-1W Technical Specifications	
Number of ports	1 port pair (the pair consists of 1 primary, 1 backup port)
Connector Type	SC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/V2.0 MPOA Client
Data Rate	155 Mbps
ATM Adaption Layers	AAL5
MAC Addresses Supported	4,096
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
Optical receiver sensitivity	Multimode: -30 to -14 dBm Single mode (intermediate reach): -31 to -8 dBm
Power Budget	Multimode: 11 dB Single mode: 16 dB
Cable Supported	Multimode: 62.5 micron multimode fiber Single mode: 9 micron single mode fiber
Cable Distance	Multimode: 4.2 km Single mode: 24 km
Current Draw	5.75 amps without an HRE-X 7.25 amps with an HRE-X

♦ 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.



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

Please refer to *2-Port 155 Mbps ATM Uplink Switching Module* on page 3-32 for further information on these **Module LEDs**.

Module Label. This label will indicate the ASX-155RFM/RFS type. It will read either **ASX 155 mm** (multimode cable) or **ASX 155 sm** (single mode cable).

YEL, FERF (Yellow/Far End Status Alarm). On Amber when a far end receive failure occurs. The recipient of cells from this ASX is not receiving those cells. This error may be due to a transmission error by the ASX 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**). 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 ASX module is plugged in, but no cable has been connected.

Alarm/ Error LEDs

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 three states. The following describes each state:

Off	There is no link and no data transmitting. Possibly 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.

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

1-Port (Redundant) 155 Mbps ATM Uplink Switching Module

ASX-622RFS/RFM-1W

The ASX-622RFS/RFM-1W switching module contains one redundant fiber (SC) port pair that supports an OC-12 connection. (Only one port in this pair can be active at one time.) The port connection provides 622 Mbps of bandwidth and connects to either multimode or single mode cable. The ASX-622RFS/RFM-1W can be factory configured with single mode or multi-mode fiber ports. The single mode version is referred to as the ASX-622RFS-1W; the multimode version is referred to as the ASX-622RFM-1W. Multimode and single mode connectors are differentiated by color: multimode connectors are black and single mode connectors are blue. See *ASX-622RFM/RFS-1W Technical Specifications* on page 3-37 for more information.

An ASX-622RFS/RFM-1W is ideally suited for mission-critical ATM access connections. The redundant port pair ensures that critical backbone and server connections are protected against failures on the primary link.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

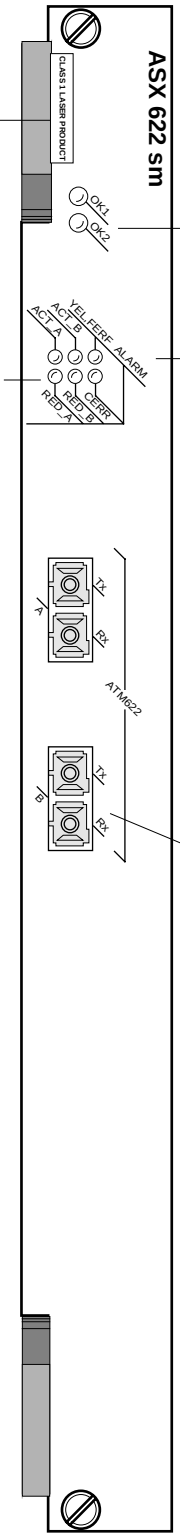
ASX-622RFM/RFS-1W Technical Specifications	
Number of ports	1 primary, 1 backup (functions as 1 port)
Connector Type	SC
Standards Supported	ANSI T1.105-1988 Digital Hierarchy — Optical Interface Rates and Formats Specification T1.624-1993 Broadband ISDN — User Network Interfaces, Rates and Formats T1E1.2/92-020 Broadband ISDN — Customer Installation Interfaces, Physical Media Dependent Specification ATM Forum User-to-Network Interface (UNI) 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 MPOA Client
Data Rate	622 Mbps
Maximum Frame Size	8000 bytes
MAC Addresses Supported	4096
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
Power Budget	Multimode: 6 dB Single mode: 12 dB
Cable Supported	Multimode: 62.5/125 micron multimode fiber Single mode: single mode fiber
Cable Distance	Multimode: 500 m Single mode: 15 km
Current Draw	11.0 without an HRE-X 12.5 with an HRE-X

♦ 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.



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

Module Label. This label will indicate the ASX-622RFM/RFS-1W type. It will read either **ASX mm** (multimode cable) or **ASX sm** (single mode cable).

Module LEDs

Please refer to *2-Port 155 Mbps ATM Uplink Switching Module* on page 3-32 for further information on these LEDs.

Alarm/ Error LEDs

YEL, FERF (Yellow/Far End Status Alarm). On Amber when a far end receive failure occurs. The recipient of cells from this ASX is not receiving those cells. This error may be due to a transmission error by the ASX 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 ASX module is plugged in, but no cable has been connected.

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

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, will be flashing Green. 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.

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

1-Port (Redundant) 622 Mbps ATM Uplink Switching Module

ASX-DS3

The ASX-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. ASX-DS3 ports are suited for connections to ATM carrier services offered by North American Telcos. The ASX-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 ASX-DS3-1W; the two-port version is called the ASX-DS3-2W. See *ASX-DS3 Technical Specifications* on page 3-40 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).

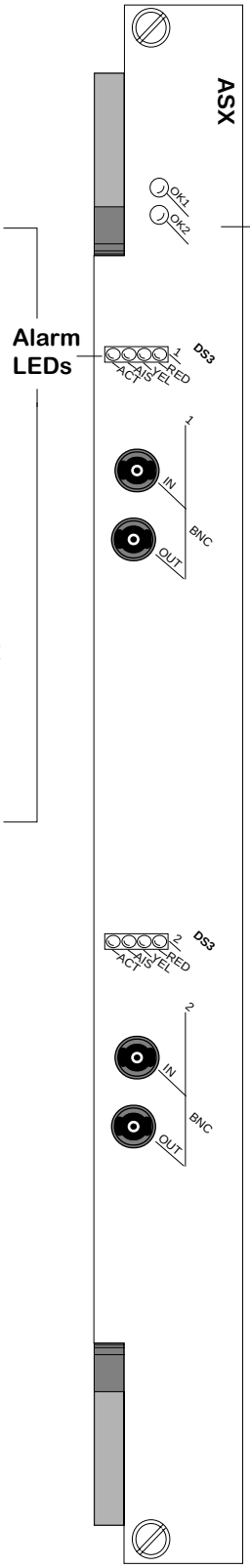
By default the ASX-DS3 uses B3ZS line encoding. Using the **dsmod** command, you can configure the module to use C-bit parity or M23 parity and configure it for loopback controls. You should configure the ASX-DS3 module to use the same parity as the ATM service provider.

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 ASX-DS3 module supports both physical layer protocols.

The ASX-DS3 is actually a submodule, or daughtercard, that attaches to an Omni Switch/Router High-Speed Module (HSX). You plug your cable directly into the ASX-DS3 submodule, but it is the HSX module that connects to the switch backplane.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second.

ASX-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	ASX-DS3-1W: 5.75 amps without an HRE-X ASX-DS3-1W: 7.25 amps with an HRE-X ASX-DS3-2W: 7.25 without HRE-X ASX-DS3-2W: 8.25 with an HRE-X



Module LEDs

Please refer to *2-Port 155 Mbps ATM Uplink Switching Module* on page 3-32 for further information on these LEDs.

Alarm LEDs

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 ASX 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 ASX is not receiving those cells. This error may be due to a transmission error by the ASX or a receive error on the other end of the link.

AIS (Alarm Indication Signal). On when a maintenance signal is sent to the ASX 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.

ATM DS-3 Uplink Module

ASX-E3

The ASX-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. ASX-E3 ports are suited for connections to ATM carrier services offered by International Telcos. The ASX-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 ASX-DS3-1W; the two-port version is called the ASX-DS3-2W. See *ASX-E3 Technical Specifications* on page 3-43 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 ASX-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 ASX-E3 module supports all three physical layer protocols. To configure E3 parameters, use the **dsmod** command.

The ASX-E3 is actually a sub-module, or daughtercard, that attaches to an Omni Switch/Router High-Speed Module (HSX). You plug your cable directly into the ASX-E3 sub-module, but it is the HSX module that connects to the switch backplane

With the optional HRE-X you can increase routing performance to 1.5 million packets per second.

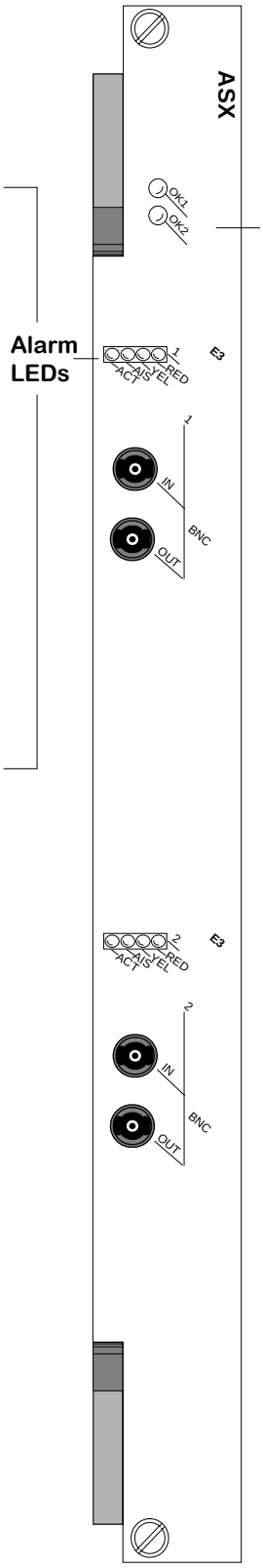
ASX-E3 Technical Specifications	
Number of ports	1 or 2
Connector Type	BNC
Standards Supported	ATM Forum User-to-Network Interface 3.1 and 3.0 ISO Q.2931 IAB RFC 1483 (Multiprotocol Point-to-Point Encapsulation over ATM) IAB RFC 1577 (Classical IP over ATM) IAB RFC 1755 (Signaling guidelines for Classical IP) ATM LAN Emulation Client V1.0/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	ASX-E3-1W: 5.75 amps without an HRE-X ASX-E3-1W: 7.25 amps with an HRE-X ASX-E3-2W: 7.25 amps without an HRE-x ASX-E3-2W: 8.75 amps with an HRE-X

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 ASX 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 ASX is not receiving those cells. This error may be due to a transmission error by the ASX or a receive error on the other end of the link.

AIS (Alarm Indication Signal). On when a maintenance signal is sent to the ASX 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.



Please refer to *2-Port 155 Mbps ATM Uplink Switching Module* on page 3-32 for further information on these LEDs.

ATM E3 Uplink Module

FDDI Modules

Omni Switch/Router FDDI modules support backbone, server, concentrator, and single device connections at 100 Mbps. The following FDDI modules are available:

- FSX-FM — One or two DAS connections over multimode fiber.
- FSX-FS — One or two DAS connections over single-mode fiber.
- FSX-SFH — One or two DAS connections over single-mode fiber using Category 2 high-powered laser optics.

These modules are described and illustrated in the following sections.

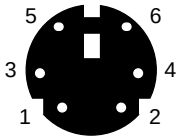
The multimode and single mode fiber modules are well suited for connections over an FDDI dual-ring backbone. Omni Switch/Router software allows you to configure Alcatel FDDI Trunking, Domain Bridging, or 802.10 Trunking over FDDI backbones so that you can maintain Group and VLAN configurations on both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

Software controls allow you to configure Station Management (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 modules.

Omni Switch/Router FDDI modules are actually submodules, or daughtercards, that attach to Omni Switch/Router High-Speed Modules (HSXs). The HSX contains RISC processors, RAM for holding software image files, ASICs for performing switching, and Content Addressable Memory (CAM) for storing MAC addresses. You plug cable directly into a submodule, but it is the HSX module that connects to the switch backplane.

FDDI MiniDIN 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

FSX-FM

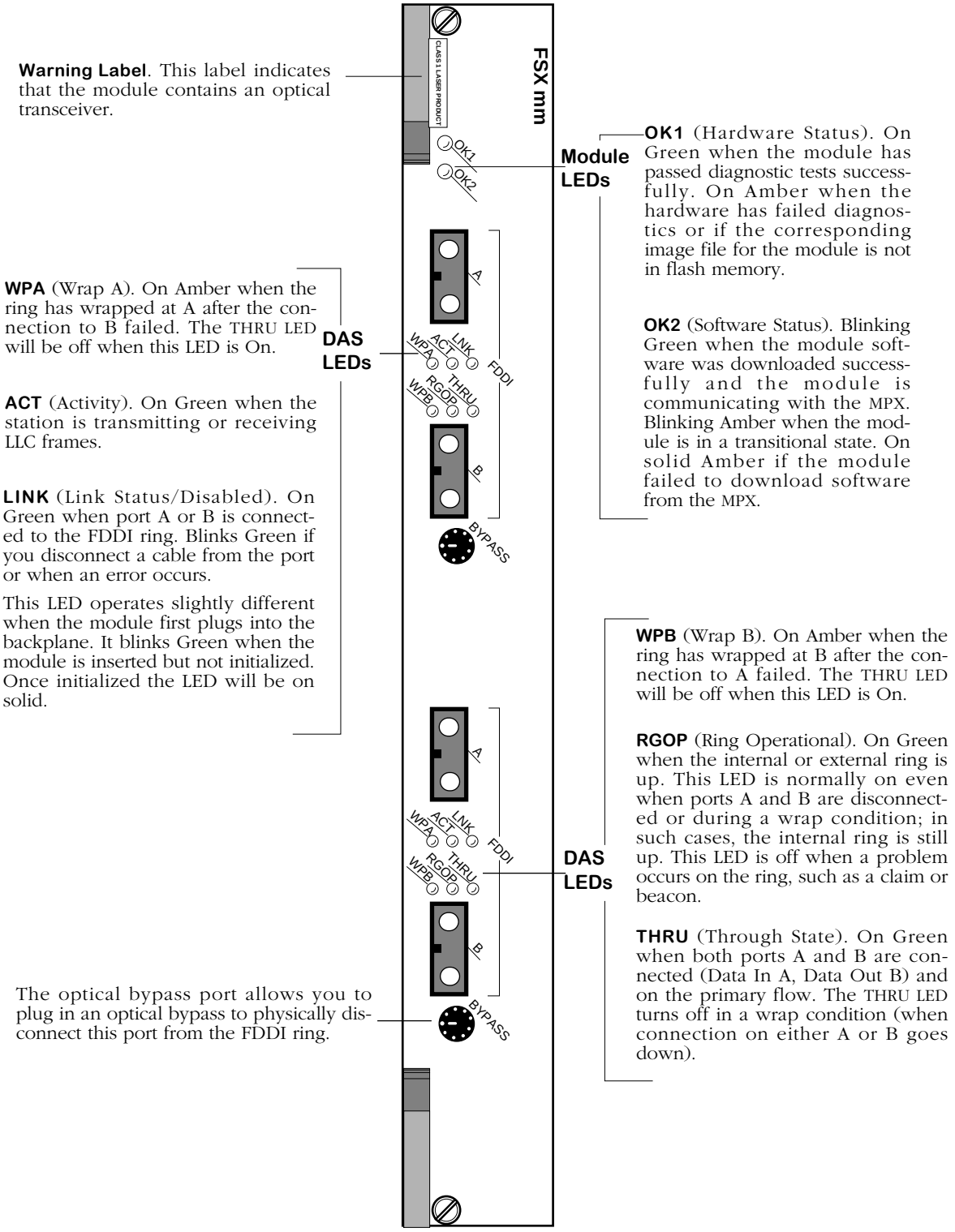
The FSX-FM FDDI switching module may contain one or two dual-attachment station (DAS) connections for support of dual FDDI rings. Each DAS connection is a set of A/B media interface connectors (MIC). The FSX-FM supports multimode connections. The 1-port version is referred to as the FSX-FM-1W; the 2-port version is referred to as the FSX-FM-2W.

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. See *FSX-FM Technical Specifications* on page 3-47 for more information.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

FSX-FM 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	4,096
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
Power Consumption	1-port: 5.25 amps (without an HRE-X) 1-port: 6.75 amps (with an HRE-X) 2-port: 6.25 amps (without an HRE-X) 2-port: 7.75 amps (with an HRE-X)

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



2-Port FDDI Multimode Switching Module

FSX-FS

The FSX-FS 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 FSX-S from the FSX-FSH, which has yellow connectors. The FSX-FS supports single mode connections. The 1-port version is referred to as the FSX-FS-1W; the 2-port version is referred to as the FSX-FS-2W.

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. See *FSX-FS Technical Specifications* on page 3-50 for more information.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

FSX-FS 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	4,096
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
Power Consumption	1-port: 5.25 amps (without an HRE-X) 1-port: 6.75 amps (with an HRE-X) 2-port: 6.25 amps (without an HRE-X) 2-port: 7.75 amps (with an HRE-X)

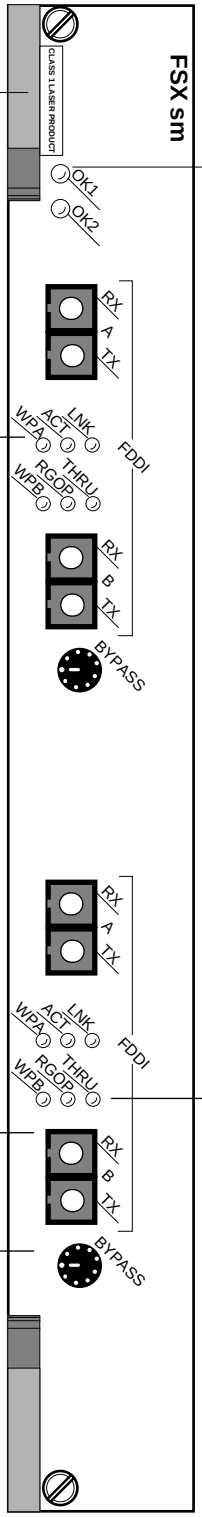
♦ Special Note ♦

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 are located between the A and B ports. If the FSX module includes two DAS connections, then the module contains two sets of LEDs. The second set of LEDs are located between 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.

Module LEDs

Please refer to *2-Port FDDI Multimode Switching Module* on page 3-48 for further information on these LEDs.

DAS LEDs

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.

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

SC connectors will be color coded Gray to differentiate this module from the FSX-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.

2-Port FDDI Single Mode Switching Module

FSX-FSH

The FSX-FSH 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. The 1-port version is referred to as the FSX-FSH-1W; the 2-port version is referred to as the FSX-FSH-2W.

Each DAS connection is a set of A/B fiber connectors (SC style). Each connector is yellow to differentiate the FSX-FSH module from the FSX-FS module, which has gray connectors. The FSX-FSH 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 See *FSX-FSH Technical Specifications* on page 3-53 for more information.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

FSX-FSH 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	4,096
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
Cable Distance	40 km
Power Consumption	1-port: 5.25 amps (without an HRE-X) 1-port: 6.75 amps (with an HRE-X) 2-port: 6.25 amps (without an HRE-X) 2-port: 7.75 amps (with an HRE-X)

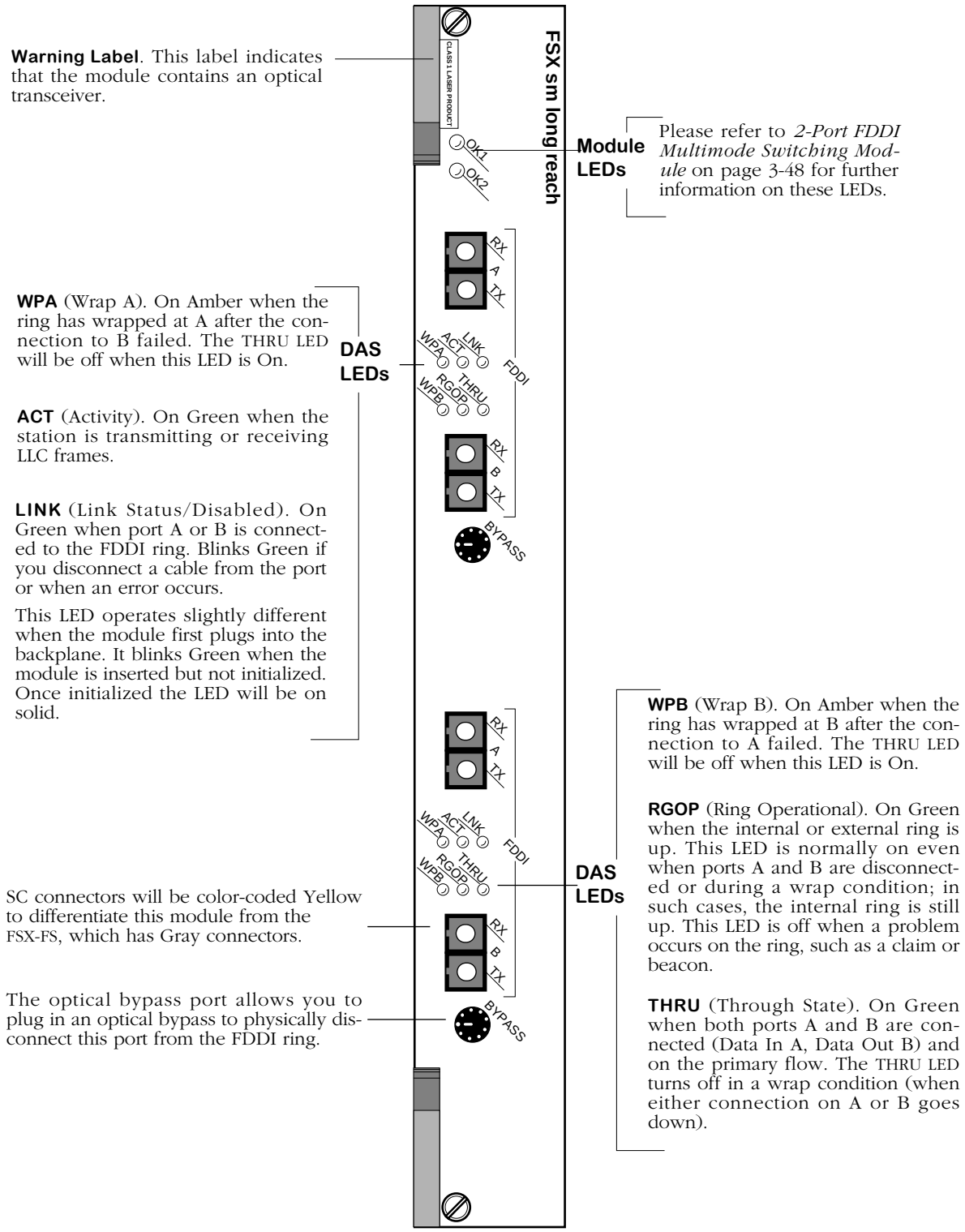
♦ Special Note ♦

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 are located between the A and B ports. If the FSX module includes two DAS connections, then the module contains two sets of LEDs. The second set of LEDs are located between the second DAS connector. In addition, each DAS connection has an optical bypass port located below the B port.



2-Port FDDI High-Powered Laser Switching Module

WAN Modules

The Omni Switch/Router currently supports the following Wide Area Network (WAN) modules:

- WSX-S-2W — Provides two serial ports that support Frame Relay or PPP.
- WSX-SC — Provides four or eight serial ports that support Frame Relay or PPP with data compression.
- WSX-FT1/E1-SC — Provides one or two T1/E1 ports and one or two serial ports that support Frame Relay or PPP with data compression.
- WSX-BRI-SC — Provides one or two Universal Serial Ports (USPs) ports and one or two ISDN-BRI ports that support Frame Relay or PPP with data compression.
- WSX-M013 — Provides 2 or 4 channelized DS3 ports (described in Chapter 56, "Managing Channelized DS3 Modules.")

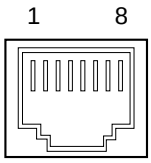
Except for the WSX-M013, all of these modules are described and illustrated in the sections beginning on page 3-60.

A WSX switching module is actually a submodule, or daughtercard, that attaches to an Omni Switch/Router High-Speed Module (HSX). The HSX contains RISC processors, RAM for holding software image files, ASICs for performing switching, and Content Addressable Memory (CAM) for storing MAC addresses. You plug your cable into the WSX submodule, but it is the HSX module that connects to the switch's backplane.

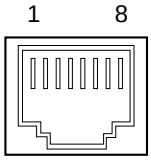
WAN Pinouts

The figures and tables on the following pages illustrate the pinouts used on Omni Switch/Router WAN modules. Please note that the signal commonly knows as "remote loop-back" (LL) is not supported on the WAN serial port (see *WAN Serial Port Specifications* on page 3-58). In addition, CTP2, CTP1, and CTP0 are assigned to CS(B), DR(B), and CD(B), respectively, on the serial port. The later are not used in the cable configurations that require the former.

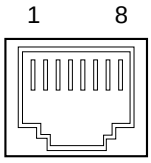
See Appendix B, "Custom Cables," for information on cables used to connect the serial connector to different interface types.



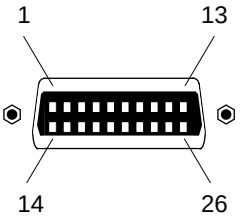
WAN BRI Port Specifications (S/T Interface)	
Pin Number	**Standard Signal Name**
1	Not Used
2	Not Used
3	Rcv + from TE
4,	Rcv - from TE
5	Xmt + from TE
6	Xmt - from TE
7	Not Used
8	Not Used



WAN BRI Port Specifications (U Interface)	
Pin Number	**Standard Signal Name**
1	Not Used
2	Not Used
3	Xmt to /Rcv from Network
4,	Xmt to /Rcv from Network
5	Not Used
6	Not Used
7	Not Used
8	Not Used



WAN T1/E1 Port 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.)



WAN Serial Port Numbering

WAN Serial Port Specifications							
		Alcatel SPI		EIA-530		RS-449	
Generic Signal Name	Source	Mnemonic	Pin	Mnemonic	Pin	Mnemonic	Pin
Shield	--	Shield	1	--	1	--	1
Signal Ground	--	AB	7	AB	7	SG	19
Transmitted Data	DTE	TD(A)	2	BA(A)	2	SD(A)	4
		TD(B)	14	BA(B)	14	SD(B)	22
Received Data	DCE	RD(A)	3	BB(A)	3	RD(A)	6
		RD(B)	16	BB(B)	16	RD(B)	24
Transmit Clock	DCE	TC(A)	15	DB(A)	15	ST(A)	5
		TC(B)	12	DB(B)	12	ST(B)	23
Receive Clock	DCE	TC(A)	17	DD(A)	17	RT(A)	8
		TC(B)	9	DD(B)	9	RT(B)	26
Ext. Transmit Clock	DTE	XC(A)	24	DA(A)	24	TT(A)	17
		XC(B)	11	DA(B)	11	TT(B)	35
Request To Send	DTE	RS(A)	4	CA(A)	4	RS(A)	7
		RS(B)	19	CA(B)	19	RS(B)	25
Clear To Send	DCE	CS(A)	5	CB(A)	5	CS(A)	9
		CS(B)	13	CB(B)	13	CS(B)	27
Data Set Ready	DCE	DR(A)	6	CC(A)	6	DM(A)	11
		DR(B)	22	CC(B)	22	DM(B)	29
Data Terminal Ready	DTE	TR(A)	20	CD(A)	20	TR(A)	12
		TR(B)	23	CD(B)	23	TR(B)	30
Data Carrier Detect	DCE	CD(A)	8	CF(A)	8	RR(A)	13
		CD(B)	10	CF(B)	10	RR(B)	31
Local Loopback	DTE	LL	18	LL	18	LL	10
Remote Loopback	DTE	RL	21	RL	21	RL	14
Ring Indicator	DCE	RI/TM	25	--	--	--	--
Test Mode	DCE	RI/TM	25	TM	25	TM	18
Cable Type 4	--	CTP4	18		n/c		n/c
Cable Type 3	--	CTP3	26		n/c		n/c
Cable Type 2	--	CTP2	13				
Cable Type 1	--	CTP1	22				
Cable Type 0	--	CTP0	10				

continued on next page...

WAN Serial Port Specifications (cont.)							
		X.21/X.26		V.35		RS232	
Generic Signal Name	Source	Mnemonic	Pin	Mnemonic	Pin	Mnemonic	Pin
Shield	--	--	1	--	A	--	1
Signal Ground	--	G	8	102	B	AB	7
Transmitted Data	DTE	T(A) T(B)	2 9	103(A) 103(B)	P S	BA	2
Received Data	DCE	R(A) R(B)	4 11	104(A) 104(B)	R T	BB	3
Transmit Clock	DCE	--	--	114(A) 114(B)	Y AA	DB	15
Receive Clock	DCE	S(A) S(B)	6 13	115(A) 115(B)	V X	DD	17
Ext. Transmit Clock	DTE	B(A) B(B)	7 14	113(A) 113	U W	DA	24
Request To Send	DTE	C(A) C(B)	3 10	105	C	CA	4
Clear To Send	DCE	--	--	106	D	CB	5
Data Set Ready	DCE	--	--	107	E	CC	6
Data Terminal Ready	DTE	--	--	108	H	CD	20
Data Carrier Detect	DCE	I(A) I(B)	5 12	109	F	CF	8
Local Loopback	DTE	--	--	141	L	LL	18
Remote Loopback	DTE	--	--	140	N	RL	21
Ring Indicator	DCE	--	--	125	J	CE	22
Test Mode	DCE	--	--	142	NN	TM	25
Cable Type 4	--		n/c		n/c		
Cable Type 3	--		n/c		n/c		
Cable Type 2	--						
Cable Type 1	--						
Cable Type 0	--						

WSX-S-2W

The WSX-S-2W supports two (2) serial ports, which can provide access rates from 9.6 Kbps to 2 Mbps. The WSX-S-2W also supports three types of clocking (internal, external, and split). See *WSX-S-2W Technical Specifications* on page 3-60 for more information.

♦ Note ♦

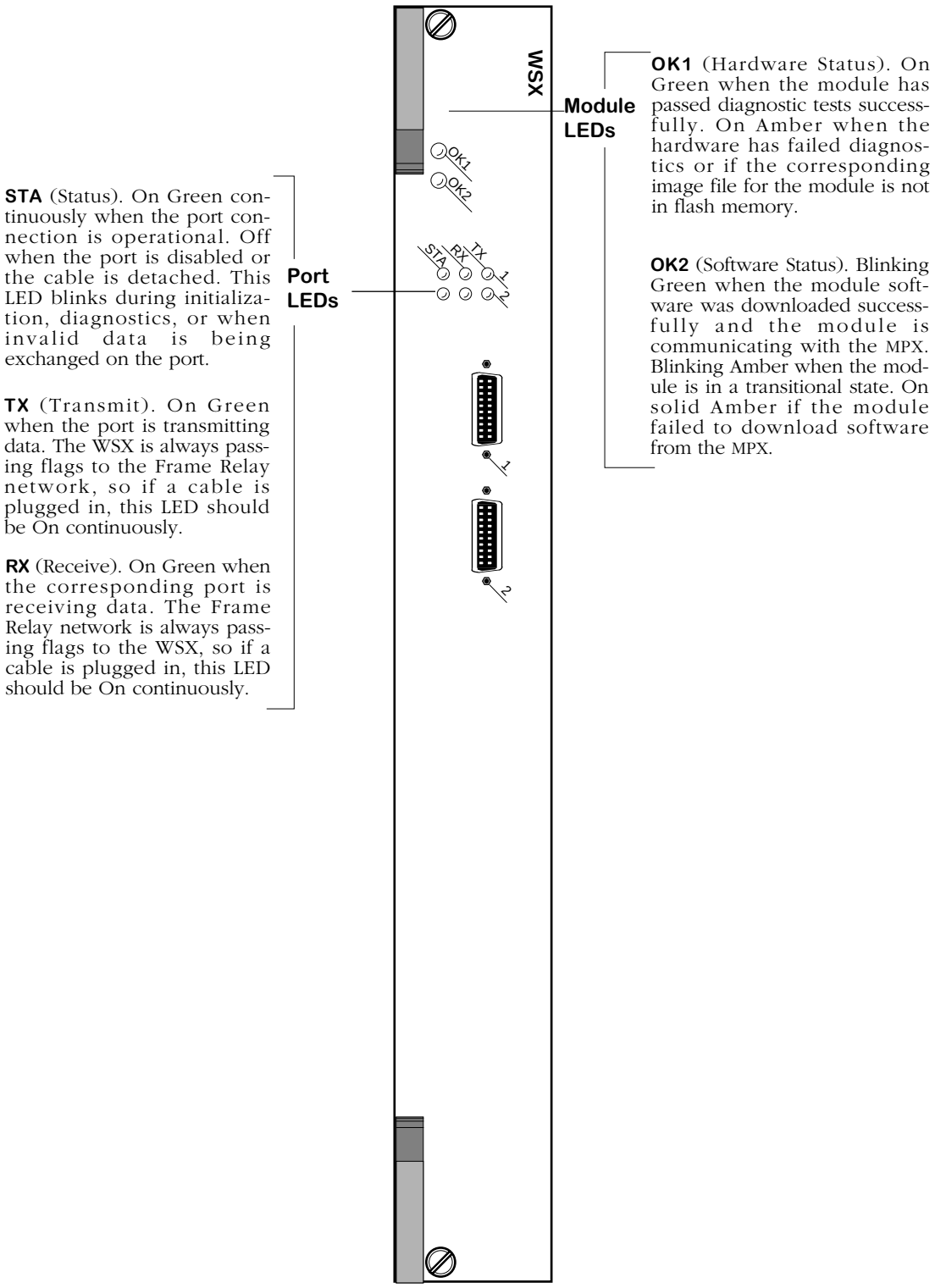
The WSX-S-2W does not support hardware compression.

The WSX-S-2W can sense and auto-configure for any of five serial cable types (RS-232, V.35, X.21, RS-530, and RS-449). A WSX-S-2W port is normally considered a physical DTE device. It can be turned into a physical DCE device—for speed or clocking purposes— by plugging in a DCE cable. The WSX-S-2W senses whether a DCE or DTE cable is connected.

Software in the switch allows you to configure parameters for the Frame Relay or Point-to-Point Protocol (PPP). Software commands allow you to view the status of the WAN connection at the WSX-S-2W board, port, or virtual circuit level. Extensive statistics are provided at each level. Software commands for Frame Relay are described in Chapter 49, "Managing Frame Relay"; commands for PPP are described in Chapter 50, "Point to Point Protocol."

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

WSX-S-2W Technical Specifications	
Number of ports	2
Connector Type	High-density 26-pin shielded serial
Protocols Supported	Frame Relay and Point-to-Point (PPP)
Data Rates Supported	9.6, 19.2, 56, 64, 128, 256, 512, 768, 1024, 1536, 2048 Kbps
Clocking	Internal, External, or Split
Virtual Circuits Supported	Permanent Virtual Circuits (PVCs)
MAC Addresses Supported	4,096
Connections Supported	Physical Data Terminal Equipment (DTE) or Data Communication Equipment (DCE)
Cable Supported	DTE or DCE in the following types: R2-232, V.35, X.21, RS-530, RS-449
Power Consumption	5.25 amps (without an HRE-X) 6.75 amps (with an HRE-X)



2-Port WAN Frame Relay Switching Module

WSX-SC

The WSX-SC supports 4 or 8 serial ports, each of which can provide access rates from 9.6 Kbps to 2 Mbps. The 4-port version is referred to as the WSX-SC-4W, and the 8-port version is referred to as the WSX-SC-8W. The WSX-SC supports STAC hardware compression and three types of clocking (internal, external, and split). See *WSX-SC Technical Specifications* on page 3-63 for more information.

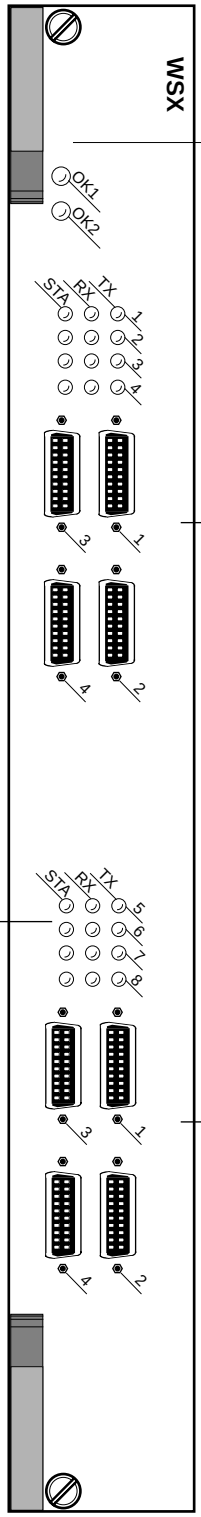
The WSX-SC can sense and auto-configure for any of five serial cable types (RS-232, V.35, X.21, RS-530, and RS-449). A WSX-SC port is normally considered a physical DTE device. It can be turned into a physical DCE device—for speed or clocking purposes— by plugging in a DCE cable. The WSX-SC board senses whether a DCE or DTE cable is connected.

Software in the switch allows you to configure parameters for the Frame Relay or Point-to-Point Protocol (PPP). Software commands allow you to view the status of the WAN connection at the WSX-SC board, port, or virtual circuit level. Extensive statistics are provided at each level. Software commands for Frame Relay are described in Chapter 49, “Managing Frame Relay”; commands for PPP are described in Chapter 50, “Point to Point Protocol.”

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

WSX-SC Technical Specifications	
Number of ports	4 or 8
Connector Type	High-density 26-pin shielded serial
Protocols Supported	Frame Relay and Point-to-Point (PPP)
Data Rates Supported	9.6, 19.2, 56, 64, 128, 256, 512, 768, 1024, 1536, 2048 Kbps
Compression	Hardware-based using STAC 9705
Clocking	Internal, External, or Split
Virtual Circuits Supported	Permanent Virtual Circuits (PVCs)
MAC Addresses Supported	4,096
Connections Supported	Physical Data Terminal Equipment (DTE) or Data Communication Equipment (DCE)
Cable Supported	DTE or DCE in the following types: R2-232, V.35, X.21, RS-530, RS-449
Power Consumption	WSX-SC-4W without an HRE-X: 6.25 amps WSX-SC-4W with an HRE-X: 7.75 amps WSX-SC-8W without an HRE-X: 8.25 amps WSX-SC-8W with an HRE-X: 9.75 amps

The module includes one row of LEDs for each port. The LEDs for a given port are located in the row labeled with the port number. If the WSX module includes a total of eight ports, then the module contains two sets of four rows of LEDs. The second set of LEDs are located above the second set of ports.



Module LEDs — Please refer to *2-Port WAN Frame Relay Switching Module* on page 3-61 for further information on these LEDs.

Ports 1 through 4

Port LEDs

STA (Status). On Green continuously when the port connection is operational. Off when the port is disabled or the cable is detached. This LED blinks during initialization, diagnostics, or when invalid data is being exchanged on the port.

TX (Transmit). On Green when the port is transmitting data. The WSX is always passing flags to the Frame Relay network, so if a cable is plugged in, this LED should be On continuously.

RX (Receive). On Green when the corresponding port is receiving data. The Frame Relay network is always passing flags to the WSX, so if a cable is plugged in, this LED should be On continuously.

Ports 5 through 8

8-Port WAN Frame Relay Switching Module

WSX-FT1/E1-SC

The WSX-FT1/E1-SC module contains one or two T1 or E1 ports and one or two serial ports. T1 and E1 ports use RJ-48C connectors. The T1 version of this module is referred to as the WSX-FT1-SC; the E1 version is referred to as the WSX-FE1-SC. You can configure these ports to run either Frame Relay or the Point-to-Point Protocol (PPP). See *WSX-FT1/E1-SC Technical Specifications* on page 3-66 for more information.

This module includes an integrated CSU/DSU to enable direct connection to a T1/E1 device, such as a PBX, or a T1/E1 line to a service provider.

You can configure physical port parameters through software commands. Configuration options include frame format, facility datalink, and line coding. In addition, the switch can store up to 24 hours of local and remote statistics. See Chapter 53, "Managing T1 and E1 Ports," for more information on software-configurable parameters.

The WSX-FT1/E1-SC also supports STAC hardware compression.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

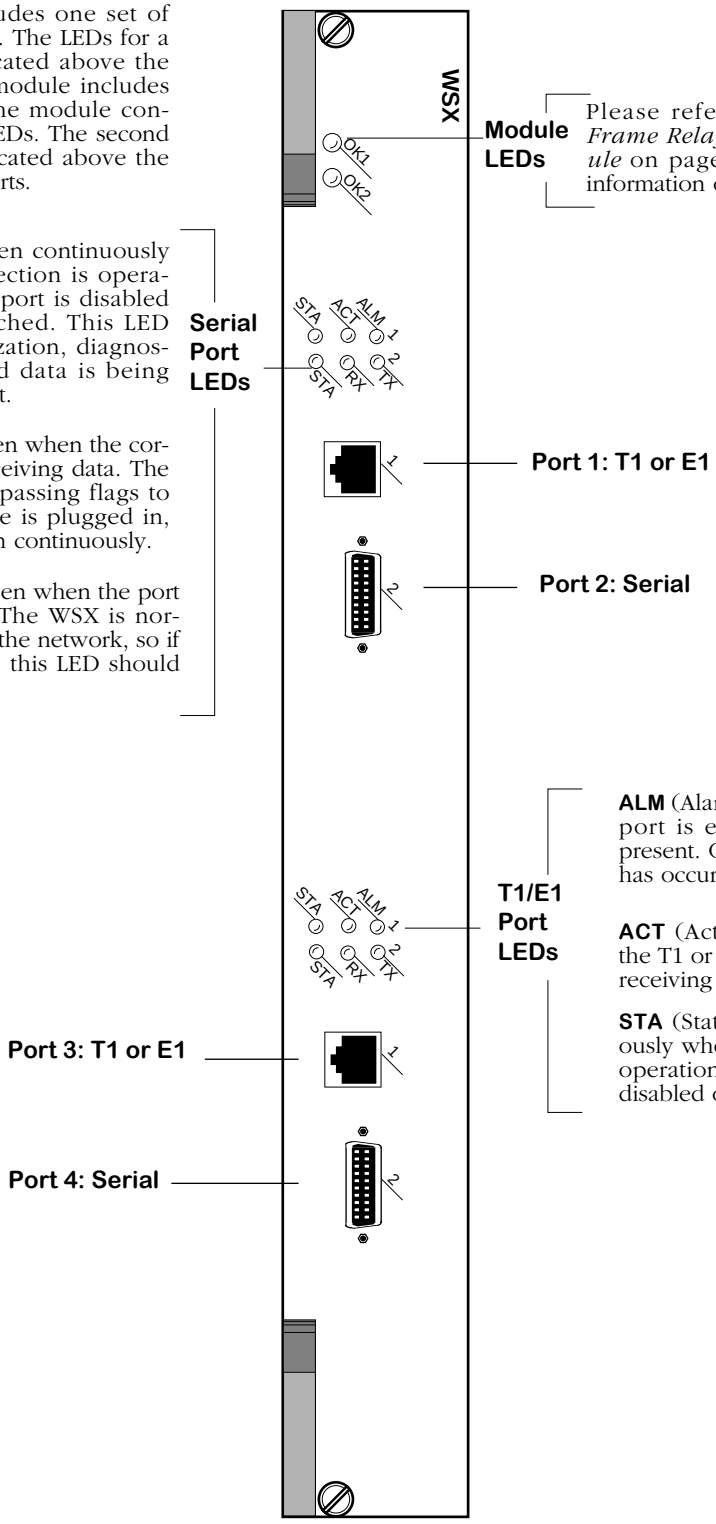
WSX-FT1/E1-SC Technical Specifications	
Number of ports	1 or 2 T1 or E1 ports 1 or 2 Universal Serial ports
Connector Types	T1/E1: RJ-48C Serial: High-density, 26-pin shielded
Standards Supported	RFCs 1406, 1213, 1659
Frame Formats	T1: Superframe, Extended Superframe, Unframed E1: E1, E1-CRC, E1-MF, E1-CRC-MF, Unframed
Line Coding	T1: B8ZS or AMI E1: HDB3 or AMI
Data Rates Supported	T1: 1.544 Mbps E1: 2.048 Mbps Serial: 56, 64, 128, 256, 384, 512, 768, 1024, 1536, 1544, 2048 Kbps
Compression	Hardware-based using STAC 9705
Facility Datalink Protocol	ANSI T1.403 and AT&T 54016
MAC Addresses Supported	4,096
Connections Supported	Physical Data Terminal Equipment (DTE) or Data Communication Equipment (DCE)
Cable Supported	Serial Ports DTE or DCE of the following types: R2-232, V.35, X.21, RS-530, RS-449
Cable Distance	T1/E1 (short haul): 200 meters T1/E1 (long haul): 1829 meters
Power Consumption	WSX-FT1/E1-SC-1W without an HRE-X: 5.75 amps WSX-FT1/E1-SC-1W with an HRE-X: 7.25 amps WSX-FT1/E1-SC-2W without an HRE-X: 7.25 amps WSX-FT1/E1-SC-2W with an HRE-X: 8.75 amps

This module includes one set of LEDs for each port. The LEDs for a given port are located above the port. If the WSX module includes four ports, then the module contains two sets of LEDs. The second set of LEDs are located above the third and fourth ports.

STA (Status). On Green continuously when the port connection is operational. Off when the port is disabled or the cable is detached. This LED blinks during initialization, diagnostics, or when invalid data is being exchanged on the port.

RX (Receive). On Green when the corresponding port is receiving data. The network is normally passing flags to the WSX, so if a cable is plugged in, this LED should be On continuously.

TX (Transmit). On Green when the port is transmitting data. The WSX is normally passing flags to the network, so if a cable is plugged in, this LED should be On continuously.



Please refer to *2-Port WAN Frame Relay Switching Module* on page 3-61 for further information on these LEDs.

ALM (Alarm). On Green when the port is enabled and a signal is present. On Yellow when an error has occurred on the port.

ACT (Activity). On Green when the T1 or E1 port is transmitting or receiving data.

STA (Status). On Green continuously when the port connection is operational. Off when the port is disabled or the cable is detached.

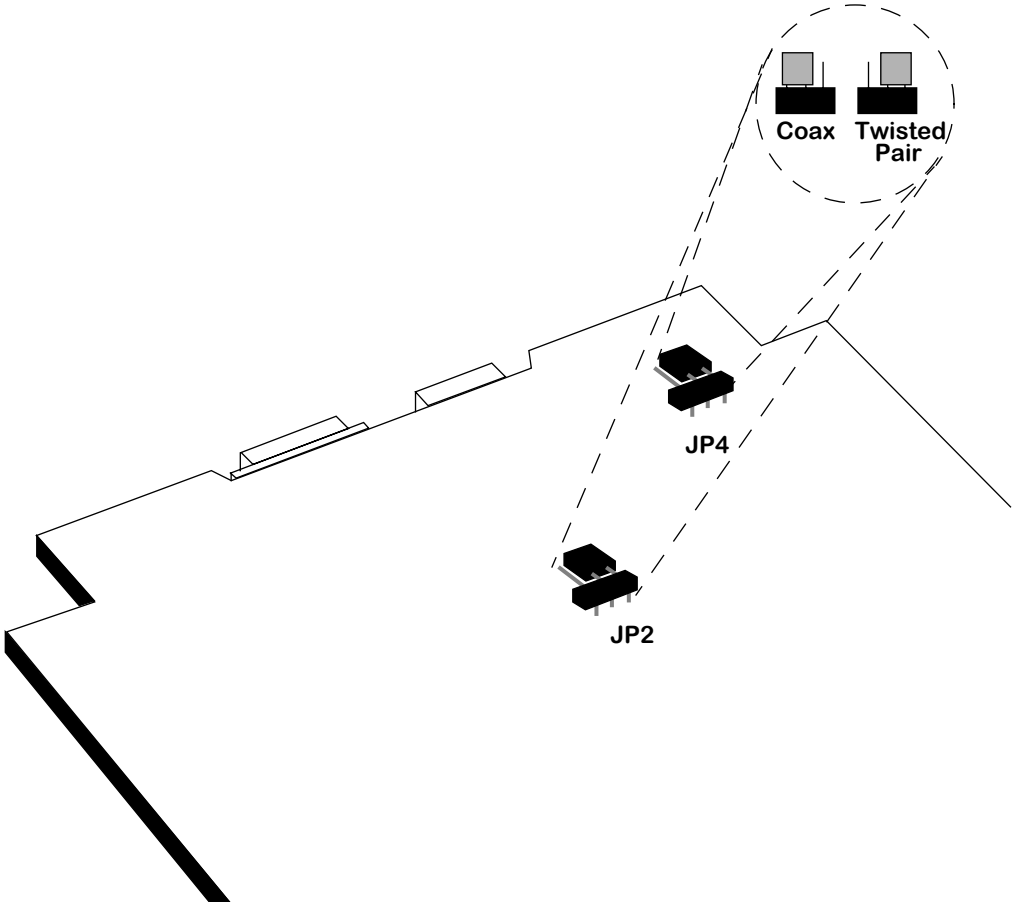
WAN 2-Port Serial and 2-Port Fractional T1/E1 Switching Module

WSX-FE1-SC Cabling/Jumper Settings

The WSX-FE1-SC supports both twisted pair (120 Ohm) and coaxial (75 Ohm) cable types. The default is 120 Ohm. You must set a pair of jumpers (JP2 and JP4) on the back of the board to correspond to the type of cable you are using. For more detailed information on the types of cables to use with this module, see Appendix B, "Custom Cables." The illustration below shows the correct jumper positions.

♦ Note ♦

JP3 is reserved. Do not set a jumper across JP3.



Cable Termination Jumpers for WSX-FE1-SC

WSX-BRI-SC

The ISDN Basic Rate Interface WAN Switching Module (WSX-BRI-SC) supports either one (1) serial port and one (1) BRI port or two (2) serial ports and two (2) BRI ports. The version with 1 serial port and 1 BRI port is referred to as the WSX-BRI-SC-1W; the version with 2 serial ports and 2 BRI ports is referred to as the WSX-BRI-SC-2W. See *WSX-BRI-SC Technical Specifications* on page 3-70 for more information.

The serial port on a WSX-BRI-SC module is essentially the same as the serial ports found on the WSX-SC module. A WSX-BRI-SC serial port can detect, and configure itself, for any of five serial cable types (RS-232, V.35, X.21, RS-530, and RS-449). A WSX-BRI-SC serial port is normally considered a physical DTE device, but it can be turned into a physical DCE device—for speed or clocking purposes—by simply plugging in a DCE cable. The WSX-BRI-SC internally senses whether a DCE or DTE cable is connected and configures itself appropriately.

The BRI port on the WSX-BRI-SC board can be configured as either a "U" or an "S/T" type of interface (the board is shipped set to "U"). Either type of interface supports two "B" channels operating at 56/64 Kbps and one "D" channel operating at 16 Kbps.

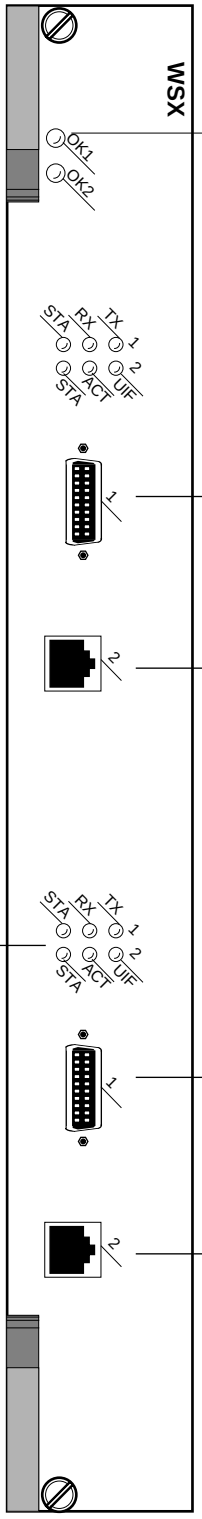
Software running in the switch allows you to configure the operation of the Point-to-Point Protocol (PPP) over the serial port or the BRI port. The serial port can also support the Frame Relay protocol. The software commands used to configure PPP are described in Chapter 50, "Point-to-Point Protocol." The software commands used to configure Frame Relay are described in Chapter 49, "Managing Frame Relay." The software commands used to configure the WAN "links" that support PPP connections are described in Chapter 51, "WAN Links." Finally, the software commands used to manage the ISDN ports are described in Chapter 52, "Managing ISDN Ports."

The WSX-FT1/FE1-SC also supports STAC hardware compression.

With the optional HRE-X you can increase routing performance to 1.5 million packets per second per module and up to 12 Mpps in a fully-loaded 9-slot chassis.

WSX-BRI-SC Technical Specifications	
Number of ports	1 or 2 pairs of a serial port and an ISDN Basic Rate Interface (BRI) port
Serial Connector Type	High-density 26-pin shielded serial
BRI Connector Type	RJ-45
Protocols Supported	Point-to-Point Protocol (PPP); Frame Relay (supported on the serial port only)
Data Rates Supported	2 “B” Channels at 56/64 Kbps 1 “D” Channel at 16 Kbps
Compression	Hardware-based using STAC 9705
MAC Addresses Supported	4,096
Serial Port Connections Supported	Physical Data Terminal Equipment (DTE) or Data Communication Equipment (DCE)
Serial Cables Supported	DTE or DCE in the following types: R2-232, V.35, X.21, RS-530, RS-449
BRI Port Connections Supported	“U” interface or “S/T” interface (jumper-selectable; “U” is shipping default)
Maximum Cable Distance	BRI: 100 m
Switch Types Supported	National ISDN-1, AT&T 5ESS, Northern Telecom DMS100, ETSI Euro-ISDN Net3
ISDN Standards Supported	Q.921, Q.931, I.430, T1.601
Power Consumption	WSX-BRI-SC-1W without an HRE-X: 4.75 amps WSX-BRI-SC-1W with an HRE-X: 6.25 amps WSX-BRI-SC-2W without an HRE-X: 5.25 amps WSX-BRI-SC-2W with an HRE-X: 6.75 amps

The WSX-BRI module includes one set of LEDs for each port. The LEDs for a given port are located in the set labeled with the port number. If the HSX module contains two WSX-BRI daughter cards, the second set of ports (one Serial and one BRI) are numbered as Ports 3 and 4 respectively, and include their own separate set of LEDs that function exactly like those related to Ports 1 and 2.



Module LEDs — Please refer to *2-Port WAN Frame Relay Switching Module* on page 3-61 for further information on these LEDs.

Port 1: Serial Port

Port 2: BRI Port ("U" or "S/T")

Port LEDs

STA. On Green continuously when the port connection is operational. Off when the port is disabled or the cable is detached. This LED blinks during initialization.

RX (Receive). On Green when the corresponding port is receiving data.

TX (Transmit). On Green when the port is transmitting data.

ACT (Activity). On Green when the ISDN-BRI port is sending or receiving data.

UIF ("U" Interface). On Green when the ISDN-BRI port is configured as a "U" type of interface. Off when the port is configured as an "S/T" type of interface.

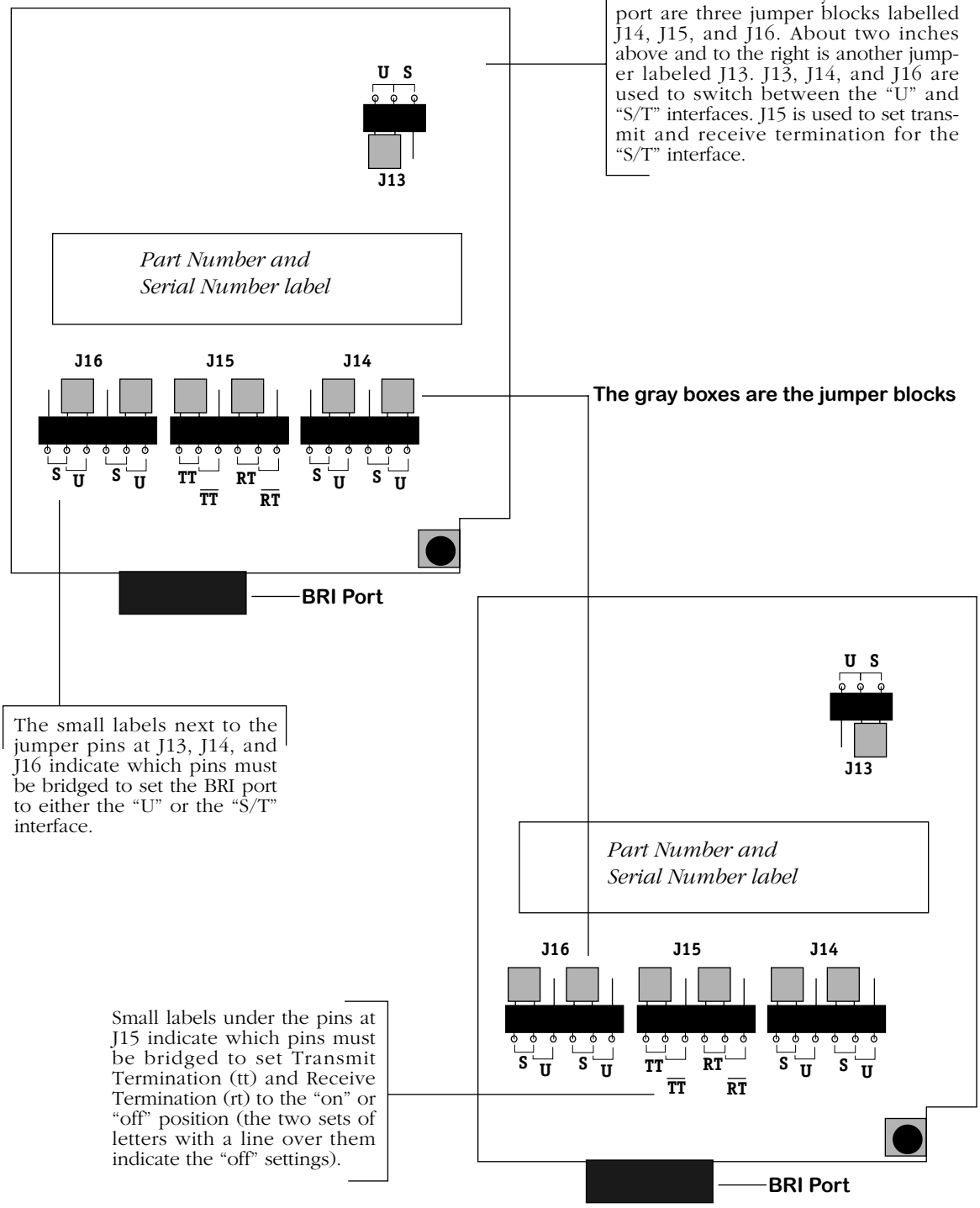
Port 3: Serial Port

Port 4: BRI Port ("U" or "S/T")

WAN 2-Port Serial and 2-Port BRI-ISDN Switching Module

Jumper Configuration for the "U" Interface (this is how the board is shipped)

This is a simplified view of the bottom lower-right quadrant of the WSX-BRI submodule. Immediately above the BRI port are three jumper blocks labelled J14, J15, and J16. About two inches above and to the right is another jumper labeled J13. J13, J14, and J16 are used to switch between the "U" and "S/T" interfaces. J15 is used to set transmit and receive termination for the "S/T" interface.



The small labels next to the jumper pins at J13, J14, and J16 indicate which pins must be bridged to set the BRI port to either the "U" or the "S/T" interface.

Small labels under the pins at J15 indicate which pins must be bridged to set Transmit Termination (tt) and Receive Termination (rt) to the "on" or "off" position (the two sets of letters with a line over them indicate the "off" settings).

Jumper Configuration for the "S/T" Interface (transmit/receive termination are set to "on")