41 Cell Switching Modules (CSMs)

The OmniSwitch provides the flexibility to start as a pure LAN switch, gradually migrate to a hybrid LAN/ATM switch, and finally transform into a pure ATM switch capable of supporting multiple Classes of Service and robust traffic management. Making the transition from a LAN switch to an ATM switch requires only a change of interface modules; no backplane upgrade is necessary.

The OmniSwitch with ATM switching functionality comes in 3-slot, 5-slot, and 9-slot versions. Each version supports the same management, frame switching, and cell switching modules. Each version also supports the same bus architecture. OmniSwitch chassis types are described in Chapter 4, "The OmniSwitch Chassis."

Using a distributed architecture, the OmniSwitch enables you to increase the switching capacity as you add Cell Switching Modules (CSMs). Each CSM provides enough capacity to handle the non-blocking load of its own ports. In this way, the OmniSwitch scales cost-effectively with the growth requirements of your ATM network.

This chapter provides a reference to the OmniSwitch ATM cell matrix, the frame-to-cell switching module, and cell switching modules. In addition, it provides application examples to show typical implementations of the OmniSwitch's ATM switching technology. More detailed information on Quality of Service (QoS) support, traffic management, and virtual circuit configuration is in Chapter 42, "Managing Cell Switching Modules (CSMs)." Information on using the PNNI protocol with the OmniSwitch can be found in Chapter 45, "Configuring and Monitoring PNNI."

♦ Special Note ♦

The chapter assumes familiarity with ATM concepts. The focus of the chapter to is not to explain ATM concepts, but to describe the OmniSwitch implementation of various ATM switch features.

Virtual Circuits

Console and Network Management Software allow you to configure and monitor Permanent Virtual Circuits (PVCs) and "soft PVCs." Switched Virtual Circuits (SVCs) are only monitored. Statistics are provided for all types of virtual circuits. Virtual circuits may be either Virtual Path Connections (VPCs) or Virtual Channel Connections (VCCs).

A variety of statistics are available at the port and virtual connection level. These statistics provide information on Cell Loss Priority (CLP) cell flows, cell discards, and actions taken as a result of leaky bucket algorithms.

Dynamic Input Buffering With Output Control

The OmniSwitch uses a unique buffer management system that combines the scalability of input buffers and the control of output buffers. Cell buffers are located on input ports, but these buffers are actually controlled by output ports. Each output port sees the traffic destined for it and uses this knowledge to schedule traffic flow across the fabric.

To effectively interconnect ATM networks with the bursty nature of LANs, the OmniSwitch uses very large cell buffers that can withstand massive inflows of LAN traffic.

Quality of Service (QoS)

The OmniSwitch's buffer management supports six (6) different Class of Service levels that are compatible and expand upon ATM Forum QoS specifications. Each QoS level supports a different ATM traffic type (CBR, rt-VBR, nrt-VBR, ABR, or UBR) and supports different Generic Cell Rate Algorithms (GCRAs). The levels are organized by priority with additional granularity provided by sixteen (16) different user priority levels assignable at the virtual circuit level.

Partial Packet Discard (PPD) and Early Packet Discard (EPD)

When either Partial Packet Discard (PPD) or Early Packet Discard (EPD) is enabled, the switch can intelligently discard cells associated with AAL5 PDU during congestion conditions. This feature reduces the bandwidth used along the remaining downstream path. PPD or EPD can be enabled for a specific virtual circuit through the **cvc** command. See Chapter 42, "Managing Cell Switching Modules (CSMs)," for more information on enabling PPD or EPD.

Dual Leaky Buckets

Dual leaky buckets are set up on each virtual circuit and policing algorithms can check for Peak Cell Rate (PCR), Sustained Cell Rate (SCR), and Maximum Burst Size (MBS). Options for enforcement of the traffic contract can be static—dropping all cells in excess of the contract regardless of congestion conditions—or congestion-based. Congestion-based enforcement will tag or discard cells depending on the level of congestion on the connection and a cell's Cell Loss Priority (CLP). The enforcement method is defaulted based on traffic descriptors and is not user-selectable in this release.

Available Bit Rate Traffic

The OmniSwitch supports Explicit Rate flow control for ABR traffic. Resource Management (RM) cells are forwarded along virtual connections. In addition, the Explicit Forward Congestion Indicator (EFCI) is supported for all traffic types. Currently SARs do not support ABR resource management. Therefore, ATM End Systems supporting resource management are not available to test at this time, and this feature is not fully operational in this release.

MPM-C and MPM-III Signaling Performance

Large numbers of calls to other switches (e.g., 250 per second) can cause excessive CPU utilization on an MPM-C or an MPM-III, which degrades signaling performance. Therefore, to improve signalling performance, add the following line to the switch's command file (**mpc860.cmd** on the MPM-C and **mpm3.cmd** on the MPM-III):

```
atm_use_mbus=0
```

This line *must* be placed before the **cmInit** line. See Chapter 11, "Managing Files," for more information on editing the command file.

♦ Note ♦

The default MPM-C command file (**mpc860.cmd**) includes the **atm_use_mbus=0** line.

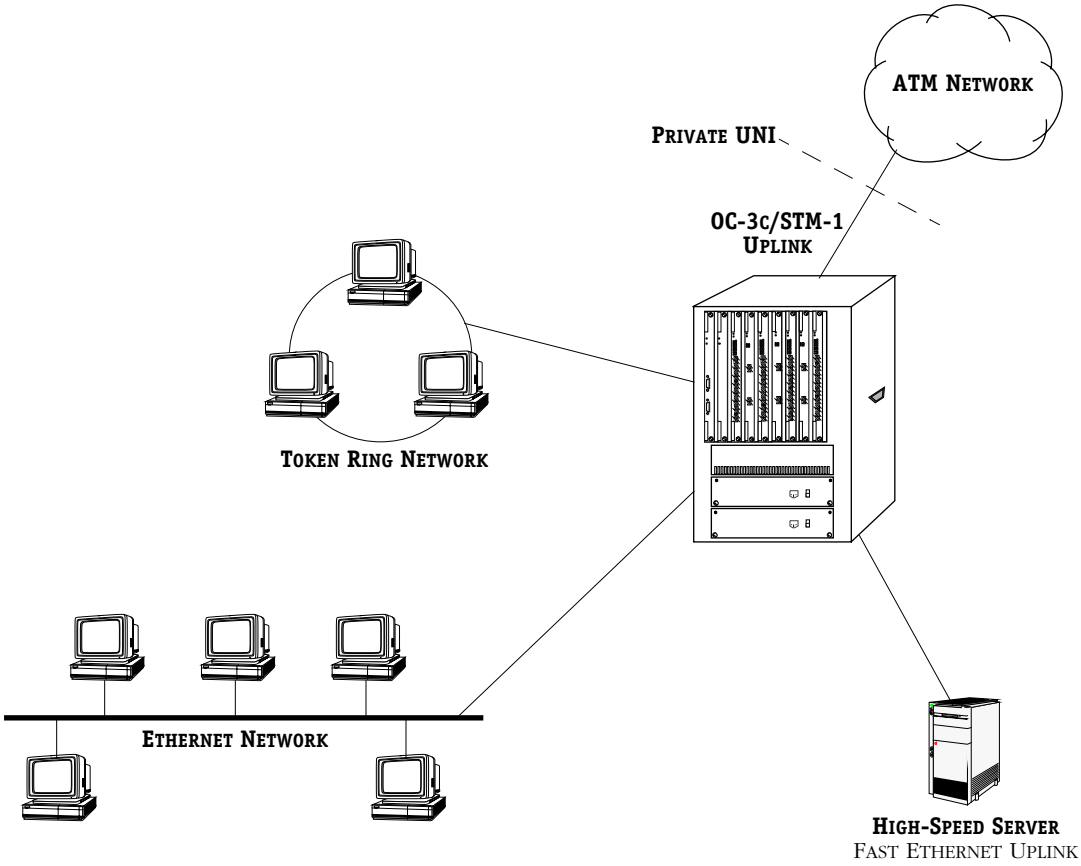
ATM Switching Applications and Configurations

With its embedded frame bus and cell matrix, the OmniSwitch is an ideal system for migrating from frame-based LAN interfaces, such as Ethernet and Token Ring, to cell-based ATM networks. It provides all the advanced LAN switching of an OmniSwitch and can be transformed into a pure ATM switch capable of supporting OC-3c/STM-1 and OC-12c/STM-4c connections that are compliant with current ATM standards. The following sections provide examples of OmniSwitch ATM switching applications.

Frame-Based LAN Switch With ATM Uplinks

The OmniSwitch can start as a pure LAN switch, switching frames from LAN interfaces such as Ethernet and Token Ring. It can also support ATM uplink connections that are compatible with User-to-Network (UNI) versions 4.0, 3.1, and 3.0 to provide comprehensive LAN-to-ATM internetworking. These ATM uplink connections provide connectivity to the native ATM network. When you want to add cell switching modules that provide OC-3c/STM-1 and OC-12c/STM-4c connections, you can add them at any time—the cell switching backplane is already in place.

The network in the illustration below shows an OmniSwitch switching traffic for Ethernet, Token Ring, Fast Ethernet, and ATM uplink interfaces. It serves as a LAN switch while having an uplink to the ATM network. At any time, it could be turned into an ATM switch. For a close-up view and the module mix of the OmniSwitch as a LAN switch, see *Pure LAN Switch* on page 41-9.



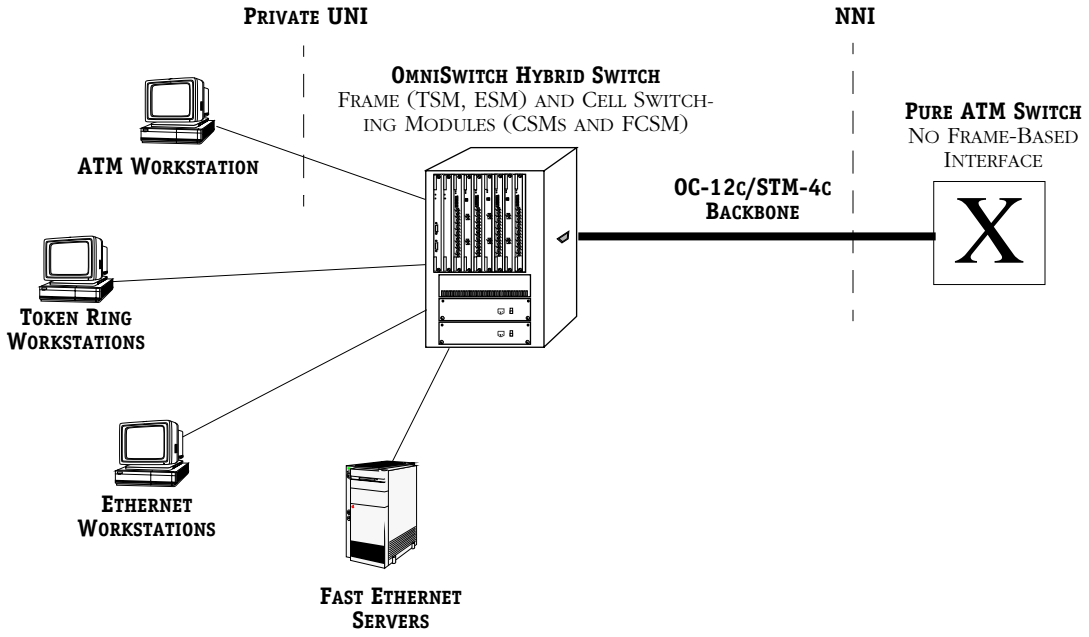
OmniSwitch as a Frame-Based LAN Switch

Hybrid LAN/ATM Switch

An intermediate step in the migration to an ATM network might require the OmniSwitch to support LAN and ATM switching in one chassis. This dual-functionality is possible since cell switching modules and frame switching modules can be installed in the same OmniSwitch chassis. LAN devices and networks can be connected to Ethernet, Token Ring, Fast Ethernet, and FDDI modules and enjoy the benefits of high-speed, VLAN-capable any-to-any switching. At the same time, these LAN devices have access to the ATM network via the CSM modules installed in the same chassis.

In the network illustration below, the OmniSwitch chassis contains both cell and frame switching modules. (For a close-up view of this configuration and its module mix, see *Hybrid LAN/ATM Switch* on page 41-10.) It can switch LAN traffic among the Token Ring workstations, Ethernet workstations, and the Fast Ethernet server. All of these LAN devices are connected to frame switching modules, such as TSMs and ESMs.

In addition, the OmniSwitch provides ATM switching to the desktop for the ATM End Station (ES), which is connected directly to a CSM port. Another CSM port connects to an OC-12c/STM-4c backbone that links to a pure ATM switch.



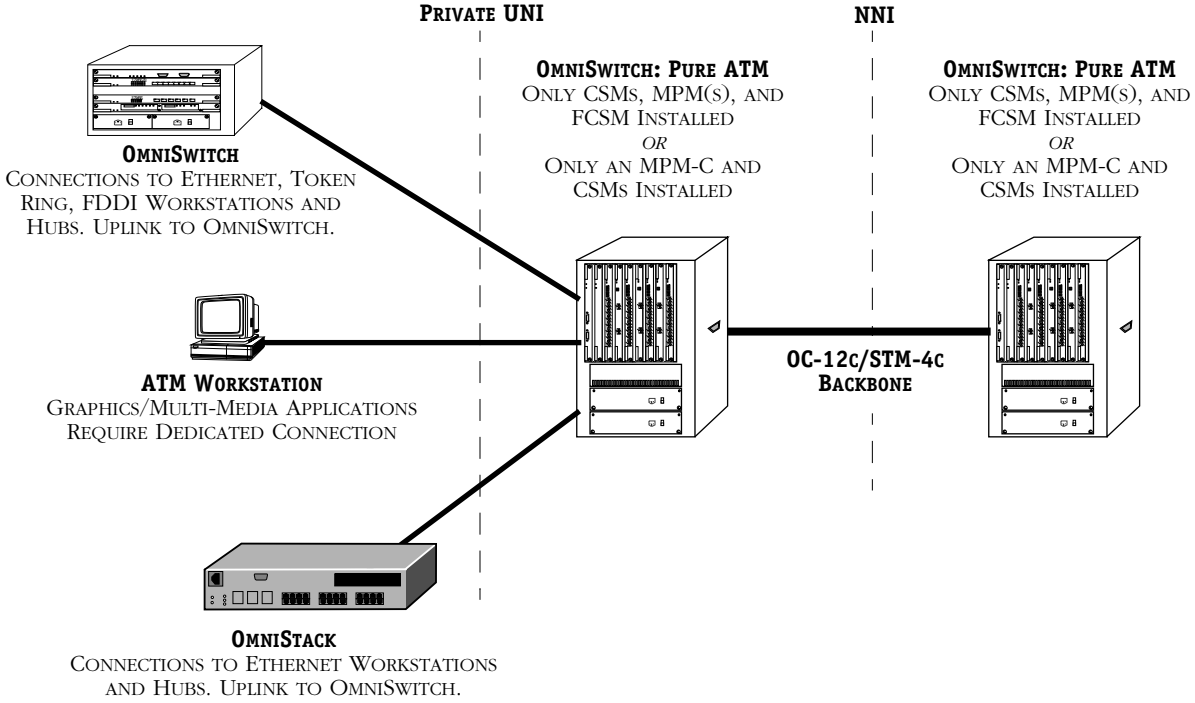
OmniSwitch as a Hybrid Frame and Cell Switch

Pure ATM Campus Switch

Although the OmniSwitch can support LAN-based interfaces, you could equip it with only cell switching modules and use it as a pure ATM switch. In a campus environment such a switch can be very useful in connecting high-speed backbones, such as OC-3c/STM-1 and OC-12c/STM-4c. CSM modules are available that support OC-3c/STM-1 at 155 Mbps and OC-12c/STM-4c at 622 Mbps. The choice between an OC-3c/STM-1 or OC-12c/STM-4c connection depends on the network design.

For example, if your network contained a number of low-speed connections (10 Mbps), then an OC-3c/STM-1 backbone would probably provide enough bandwidth to trunk data traffic over the backbone. However, if it contained a number of high-speed desktop connections (100 and 155 Mbps), then an OC-12c/STM-4c backbone might be necessary to carry the traffic. In addition, an OC-12c/STM-4c backbone would be appropriate where several OC-3c/STM-1 backbones needed to be trunked over a larger backbone.

In the network illustration below, the OmniSwitch contains only cell switching modules. (For a close-up view of this configuration and its module mix, see *Pure ATM Switch* on page 41-11.) LAN switches with ATM uplinks and an ATM workstation connect to the OmniSwitch via CSM modules with OC-3c/STM-1 ports. This OmniSwitch, which is a pure ATM switch, links to the rest of the ATM network through an OC-12c/STM-4c port connection with another OmniSwitch.

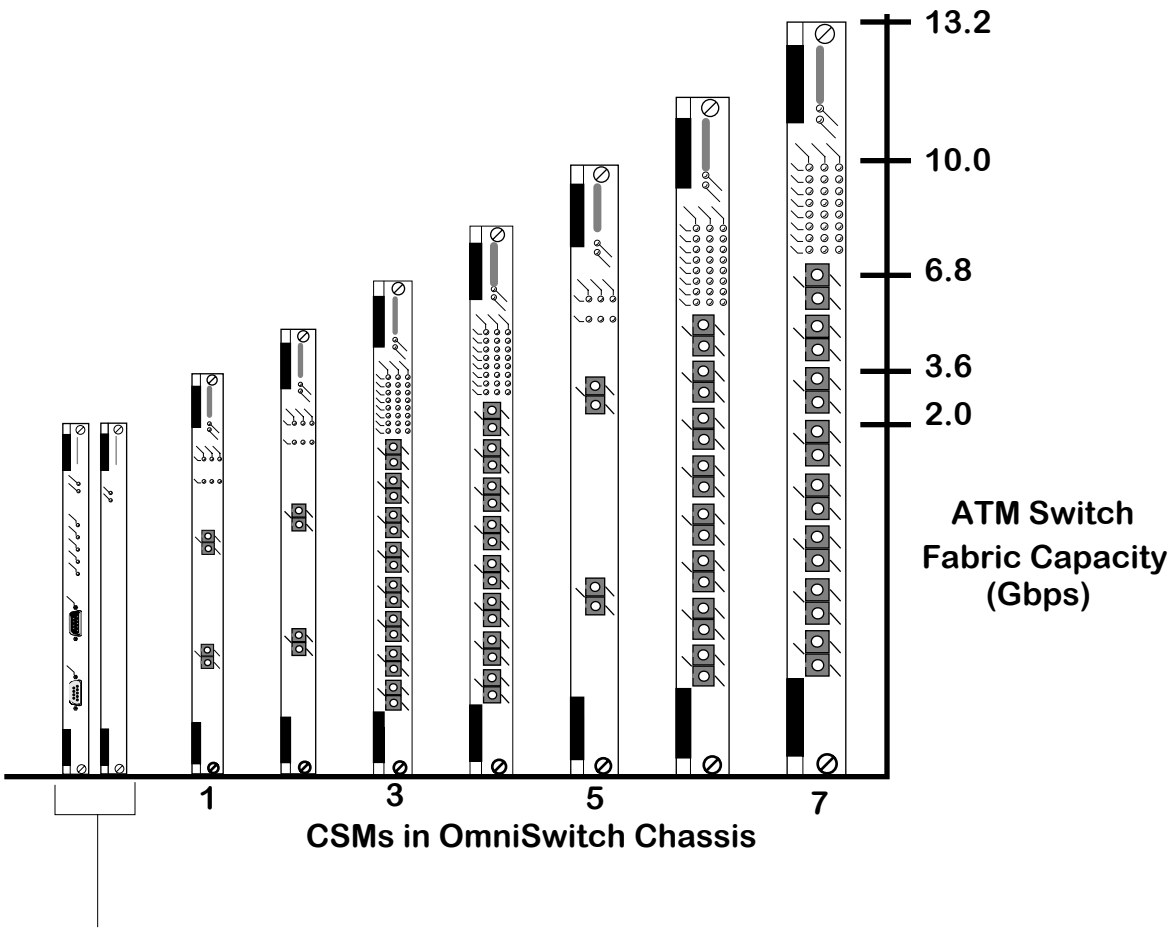


OmniSwitch as a Pure ATM Switch

Distributed Cell Switching Fabric

The OmniSwitch ATM cell matrix is fully distributed with no central switch component and no single point of failure. One advantage of this distributed fabric is that it can grow cost-effectively as your ATM network requirements grow; the aggregate 13.2 Gbps of switch fabric is distributed across all Cell Switching Modules (CSMs). As an ATM switch, the OmniSwitch can be scaled from 2.0 Gbps to 13.2 Gbps, in 1.6 Gbps increments.

Each CSM added to the switch provides an additional 1.6 Gbps of backplane capacity. Each CSM adds exactly as much capacity and buffers to the overall fabric as is required by its ports. A CSM module may contain eight (8) OC-3c/STM-1 ports or two (2) OC-12c/STM-4c ports. The chart below provides an idea of how the fabric capacity of the OmniSwitch scales with each new CSM module installed.



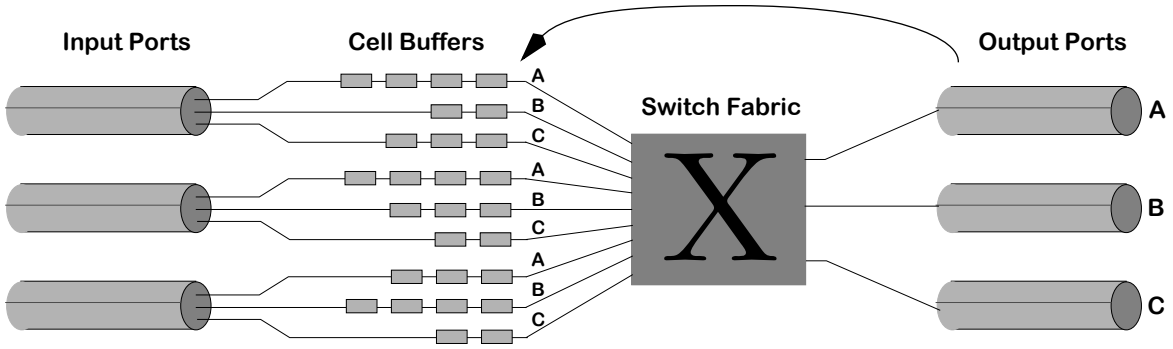
The MPM and FCSM modules are the base requirement in most cell switching configurations (PVC-only configurations do not require an FCSM). The MPM module is on the left and the FCSM is on the right.

Buffer Management

Cells enter the cell switching fabric on input ports and are switched to output ports. Sometimes collisions take place between cells when cells come in on two or more input ports that are destined for the same output port. This competition for output bandwidth may cause momentary input buffering or it could lead to sustained congestion.

Collisions on the cell fabric create the need for queueing, or buffering, where one or more cells must wait in line before being delivered to the output port. The queueing or buffer management scheme determines the throughput seen by the user. The OmniSwitch uses a dynamic input buffering with output control scheme. The buffers are physically located on the input ports but they are controlled by the destination output port.

Buffers are dynamically allocated based on a connection's Class of Service and the output port. Essentially, *the output port controls the input port buffers*. Each output port can see all traffic destined for it, and can determine how to schedule the release of this traffic based on Class of Service and fairness algorithms. The illustration below shows how cell buffers lie on input ports, but are actually managed by output ports.



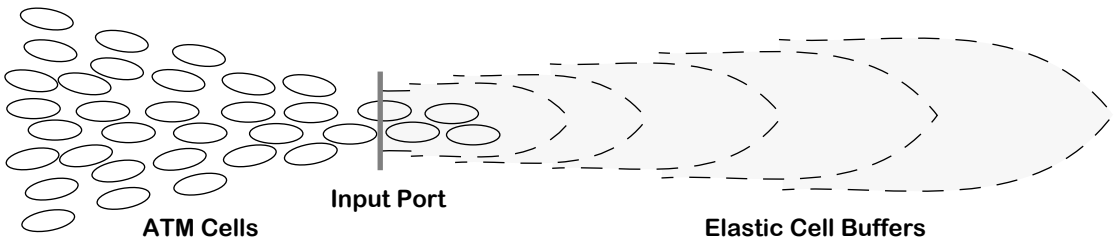
Input Buffers Controlled by Output Ports

This method of buffer management provides completely non-blocking performance while cost effectively scaling buffer requirements as the system grows.

Cell Buffers

In campus and enterprise networks, about 95% of the traffic is bursty LAN-based data traffic. Buffer management must be designed knowing that networks will be characterized by massive, but momentary, traffic bursts. At other times, traffic activity may be quiet or may be mixed with isochronous voice and video traffic.

LAN-based traffic has been shown to respond poorly to cell loss due to congestion. In order to operate effectively in such a network environment, the OmniSwitch was designed with very large, efficiently managed cell buffers. Cell buffers need to be elastic enough to withstand massive bursts of data from large numbers of sources without resorting to congestion control or discarding cells. On CSMs, each OC-3c/STM-1 port has 8192 cell buffers and each OC-12c/STM-4c port has 131,072 cell buffers.



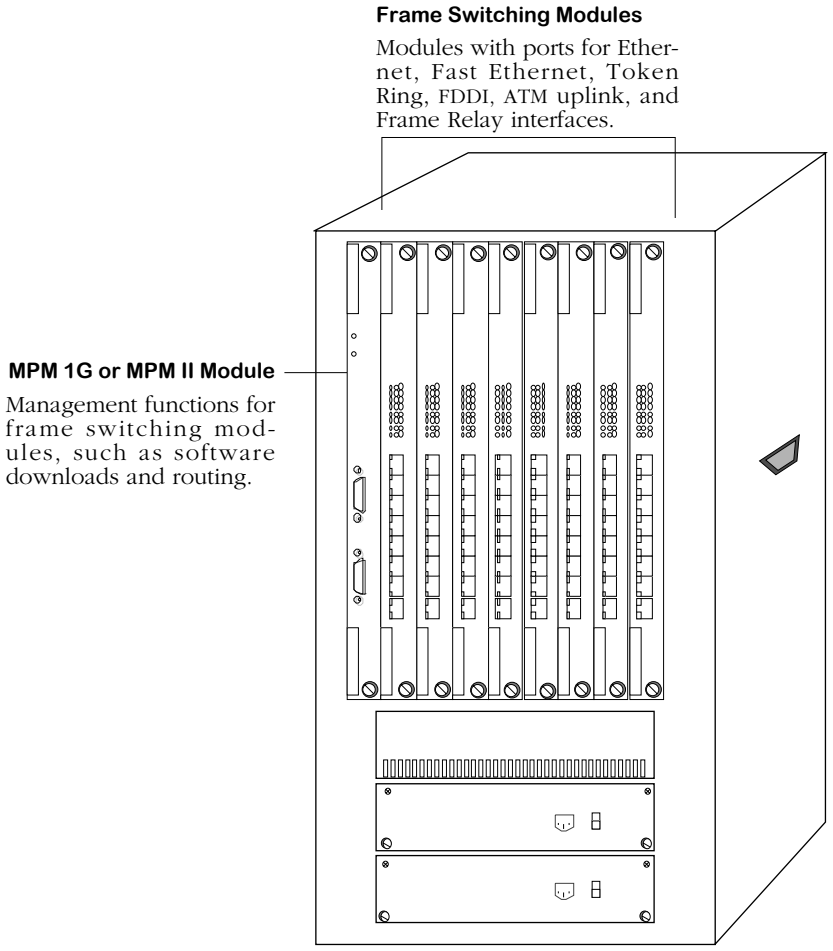
OmniSwitch's Very Large Cell Buffers

Module Mix for OmniSwitch Configurations

The mix of modules in your OmniSwitch chassis will vary depending upon whether you configure it as a pure LAN switch, a hybrid LAN/ATM switch, or a pure ATM switch. All configurations require an MPM 1G, MPM II, or MPM-C module, but not all require an FCSM module. The following sections and illustrations below describe the differences between the three main OmniSwitch configurations.

Pure LAN Switch

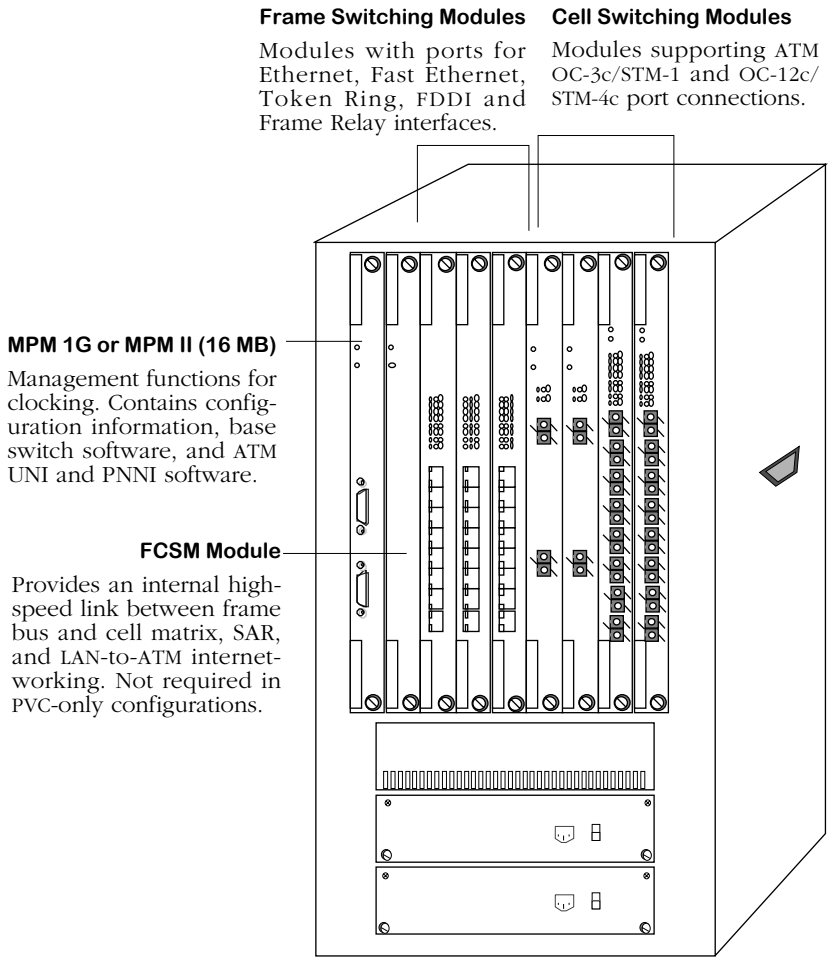
When the OmniSwitch is configured as a LAN switch it requires an MPM 1G or MPM II module and frame switching modules, such as Ethernet (ESM), Token Ring (TSM), and FDDI (FSM) modules. (An MPM-C *cannot* be used in a pure LAN switch configuration.) In addition, you could also install ATM uplink (ASM) modules into this pure LAN switch. The illustration below points out the parts of a pure LAN switch configuration:



OmniSwitch as a Pure LAN Switch

Hybrid LAN/ATM Switch

When the OmniSwitch is configured as a hybrid LAN/ATM switch, it requires an MPM 1G or MPM II module, an FCSM module, frame switching modules, and Cell Switching Modules (CSMs). (An MPM-C *cannot* be used in a hybrid LAN/ATM switch configuration.) The MPM module must contain at least 16 MB of system memory. Both the frame switching modules and cell switching modules are supported by the OmniSwitch backplane. The FCSM module serves as an internal link between the cell and frame backplanes and provides complete LAN-to-ATM internetworking functions. In addition, the FCSM provides the SAR functionality on behalf of the MPM for call processing. The illustration below points out the major parts of a hybrid switch.



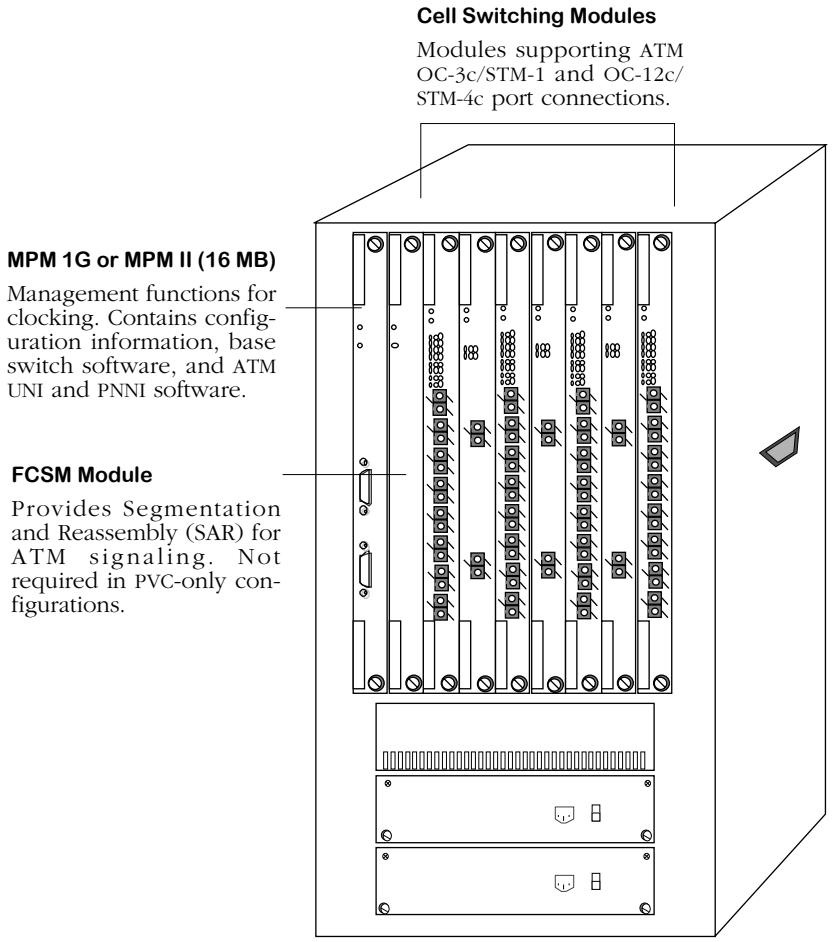
OmniSwitch as a Hybrid LAN/ATM Switch

Pure ATM Switch

When the OmniSwitch is configured as a pure ATM switch, it must have one of the following configurations:

- An MPM 1G or MPM II module, an FCSM module, and Cell Switching Modules (CSMs)
- An MPM-C and CSMs.

The MPM module must contain at least 16 MB of system memory. The FCSM and MPM-C provide call processing Segmentation and Reassembly (SAR) for the cell switching backplane. The illustration below points out the major parts of a pure ATM switch using an MPM and an FCSM. See *Omni-3wx with an MPM-C and Two CSMs* on page 41-20 for an illustration of a pure ATM switch with an MPM-C.



OmniSwitch as a Pure ATM Switch

Cell Switching Modules

The OmniSwitch Cell Switching Modules support ATM UNI 4.0, 3.1, and 3.0 and NNI (PNNI 1.0 or IISP) interfaces via OC-3c/STM-1 or OC-12c/STM-4c ports. Most CSMs are equipped with four (4) Input Output Processor (IOP) ASICs and one ATM fabric ASIC. (The FCSM I has one IOP, the FCSM II has two IOPs, and the CSM-U has three IOPs.) All port types support point-to-point and point-to-multipoint connections. Both Virtual Path Connections (VPCs) and Virtual Channel Connections (VCCs) are supported. VPI and VPI/VCI label assignment and management is supported for VPCs and VCCs, respectively.

The OmniSwitch supports Permanent Virtual Circuits (PVCs), Switched Virtual Circuits (SVCs), and soft PVCs. PVCs and soft PVCs are configurable through ATM menu software commands. SVCs are automatically set up by the network via PNNI. The configuration of PVCs and soft PVCs is described in Chapter 42, "Managing Cell Switching Modules (CSMs)."

Each OC-3c/STM-1 port, in hardware, supports up to 4096 connections and each OC-12c/STM-4c port supports 65,536 connections. All ports support very large cell buffers. Each OC-3c/STM-1 port has enough capacity for 8192 cell buffers, and each OC-12c/STM-4c port has enough capacity for 131,072 cell buffers.

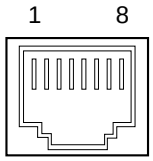
You may remove and insert CSM modules while the switch is running. This technique is referred to as "hot swapping." When you hot swap, you must replace the CSM module with the same module type as the one you removed. See Chapter 7, "OmniSwitch Switching Modules," for more information on hot swapping CSM modules.

CSMs cannot be installed in Slot 1 of an OmniSwitch chassis; they can only be installed in slots 2 and above. The Cell Switching Modules are as follows:

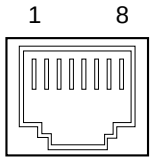
- FCSM I — Frame-to-Cell Switching Module. Required in all OmniSwitch ATM switch configurations that use an MPM and works in conjunction with the MPM to provide call processing Segmentation and Reassembly (SAR) and LAN-to-ATM internetworking.
- FCSM II — The OC-12c/STM-4c version of the original FCSM.
- MPM-C — Management Processing Module with cell switching matrix. In a wide-format chassis, the MPM-C can be used in place of an MPM and FCSM.
- CSM-155F — Eight-port 155 Mbps cell switching module. Each port supports an OC-3c/STM-1 connection and can be factory-configured to support single mode or multimode fiber.
- CSM-622 — Two-port 622 Mbps cell switching module. Each port supports an OC-12c/STM-4c connection and can be factory-configured to support single mode or multimode fiber.
- CSM-155C — Eight-port 155 Mbps cell switching module. Each port supports an OC-3c/STM-1 connection on UTP cable.
- CSM-A25-12 — Twelve-port ATM 25 Mbps cell switching module.
- CSM-A25-24 — Twenty-four port ATM 25 Mbps cell switching module.
- CSM-U — Universal cell switching module with three adapter board positions. Adapter boards include support for OC-3 fiber and copper ports, T1/E1 ports, DS3/E3 ports, T1/E1 circuit emulation ports, Stratum-3 hardware clocking, and Inverse Multiplexing over ATM (IMA).

CSM Pinouts

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



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



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

Frame-to-Cell Switching Module (FCSM)

The Frame-to-Cell Switching Module (FCSM) provides an internal link between the OmniSwitch backplane's frame bus and cell matrix. Since the MPM is not directly attached to the OmniSwitch cell switching fabric, the FCSM provides the Segmentation and Reassembly (SAR) functionality required for the cell backplane as well as LAN-to-ATM internetworking. There are two versions of the FCSM. The FCSM I (also known as the FCSM-155) supports OC-3c/STM-1 connections and the FCSM II supports OC-12c/STM-4c connections.

The FCSM is required when the OmniSwitch is configured as a hybrid ATM-to-LAN interface switch. (It is not required for a pure frame switch configuration). In a hybrid configuration, the FCSM provides frame switching modules with a "link" to the cell matrix. In a pure ATM switch configuration, the FCSM provides call processing SAR functionality for the MPM module. The FCSM can be installed in any chassis slot except Slot 1.

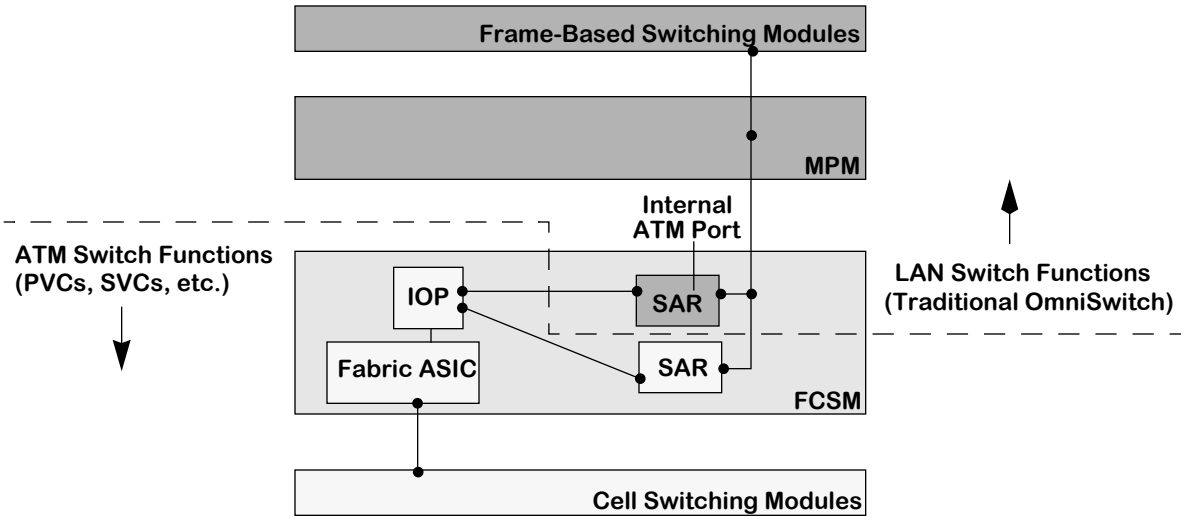
♦ Important Note ♦

The FCSM module *must* be installed before any Cell Switching Module (CSM); i.e., the FCSM must have a lower slot number than any CSM in the same chassis.

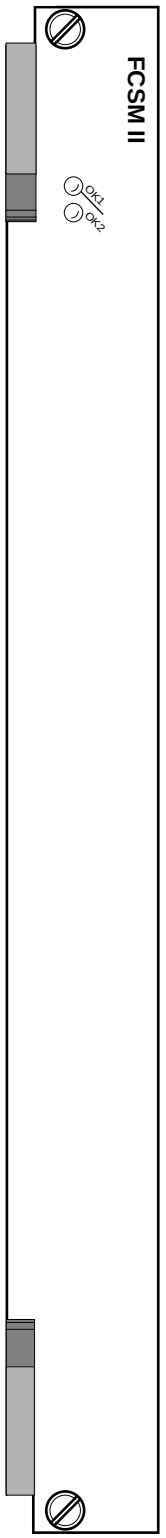
Although the FCSM does not contain any physical ports, it does contain an internal ATM port that can be viewed and configured through switch software. This port is functionally the same as an ASM module port. However, instead of connecting to an ATM switch through fiber cable, this logical port is hardwired into the ATM cell matrix. You can view statistics and configure ATM services, such as LAN Emulation and Classical IP and Trunking, on this internal port. By creating ATM services on this port, you provide a bridge between devices on LAN interfaces (Ethernet, Token Ring, FDDI, etc.) and those connected to the native ATM network.

This internal ATM access port is directly connected to an OC-3c/STM-1 or OC-12c/STM-4c port that is functionally the same as a CSM port. Logically, these two ports are two halves of the same port; User Interface software displays them as part of the same port. The FCSM I also contains a second internal port that also contains an ATM access half and a CSM half. This second port is used to pass management cells for signaling, ILMI, and PNNI.

The illustration below shows the parts of an FCSM and how the FCSM interacts with other modules in an OmniSwitch chassis:



FCSM Provides the Link Between Frame Bus and Cell Matrix



Module Label. This label will indicate the FCSM type. It will read either **FCSM I** or **FCSM II**.

Module LEDs

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

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

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

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

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

The Frame-to-Cell Switching Module

FCSM I (FCSM-155)

The FCSM I contains two RISC processors used for LAN-to-ATM internetworking (i.e., MAC layer translations). These processors provide the same function as the OmniSwitch ASM uplink modules. The FCSM also contains two OC-3c/STM-1 SARs. One SAR has 0.5 MB for signalling functions and one has 2 MB for data. Finally, the FCSM I contains an Input Output Processor (IOP) ASIC and an ATM fabric ASIC.

♦ Note ♦

You *cannot* use an FCSM I with an MPM-C.

FCSM I Redundancy

Release 3.3 and later software supports redundant FCSM I (also referred to as the FCSM-155) module configurations. This feature will automatically switch control to a secondary FCSM I if the primary FCSM I fails. Redundant FCSM II configurations are not currently supported.

By default, the FCSM I inserted into the lowest slot number will be the primary FCSM I. An FCSM I should *not* be installed in Slot 1. Both FCSMs should be inserted before any CSMs (i.e., the FCSMs must have a lower slot number than any CSM in the same chassis).

For example, you could install the primary FCSM I in Slot 2 and the secondary FCSM I in Slot 4 as long as you did not install a CSM module in Slot 3. In this setup, you could install an Ethernet or other non-CSM module in Slot 3.

There are two methods for setting up redundant FCSMs. Both methods require you to set up identical ATM services (if applicable) on each FCSM.

The first method is recommended, but requires two power cycles. The second method requires only one power cycle, uses hot swapping, and exercises the redundant FCSM configuration. Alcatel recommends the first method as long as your network environment can tolerate two power cycles. If you want to avoid the second power cycle, then use the second method.

Redundancy Configuration Method 1: Two Power Cycles

This procedure requires you to power up and power down the switch twice. Make sure you perform this procedure during a time when these power cycles will not disrupt network use.

Begin this procedure with the primary FCSM installed in the chassis. By default, the FCSM inserted into the slot with the lowest number will be the primary FCSM. An FCSM should not be installed in Slot 1 and FCSMs must be inserted before any CSMs (i.e., the FCSMs must have a lower slot number than any CSM in the same chassis).

If your switch is powered down, begin by installing the primary FCSM in the appropriate slot. If your switch is already operational, issue the following command before inserting the FCSM:

```
swap on
```

This command allows you to hot swap modules in the chassis; it is explained in more detail in Chapter 10, “Configuring Management Processor Modules.”

1. Configure all required ATM services, such as LAN Emulation (LANE), on the primary FCSM. (If this is an existing FCSM I, you may have already configured these services.) Keep good records of all configuration parameters because you will need to re-enter them on the secondary FCSM I.
2. Power down the switch.

3. Pull the primary FCSM away from the backplane of the switch chassis. You do not need to remove the module from the chassis, but it should not be connected to the backplane.

4. Insert the secondary FCSM into the slot where it will reside. This slot number should be higher than the slot number used for the primary FCSM. However, the secondary FCSM should be inserted before any CSM modules in the same switch chassis.

5. Power up the switch.

6. Configure all ATM services on the secondary FCSM that you configured during Step 2 for the primary FCSM. It is important that the configurations match so that, in case of a switch-over, the same services will be supported once the secondary FCSM takes over.

7. Power down the switch.

8. Re-insert the primary FCSM into the same slot where it resided when you configured services in Step 1. The secondary FCSM should still be installed in the switch.

9. Power up the switch. Your redundant FCSM configuration is now operational.

Redundancy Configuration Method 2: One Power Cycle

The procedure requires you to power down and power up the switch once. Use this procedure if your network cannot tolerate the two power cycles required by Method 1.

Begin this procedure with both the primary and secondary FCSMs installed in the chassis. By default, the FCSM inserted into the slot with the lowest number will be the primary FCSM. Neither FCSM should be installed in Slot 1 and both FCSMs should be inserted before any CSMs (i.e., the FCSMs must have a lower slot number than any CSM in the same chassis).

If your switch is powered down, begin by installing the two FCSMs in the appropriate slots. If your switch is already operational, issue the following command before inserting an FCSM:

```
swap on
```

This command allows you to hot swap modules in the chassis; it is explained in more detail in Chapter 10, "Configuring Management Processor Modules."

1. Configure all needed ATM services, such as LAN Emulation (LANE), on the primary FCSM. Keep good records of all configuration parameters because you will need to re-enter them on the secondary FCSM.

2. Enter the following command:

   ```
   swap on
   ```

   The following message will display:

   ```
   Swap is ON for 5 minutes
   ```

3. Pull the primary FCSM away from the backplane of the switch chassis. You do not need to remove the module from the chassis. Messages similar to the following will display:

   ```
   Module removed from slot 3
   Bringing down primary FCSM on slot 3.....
   Bringing up secondary FCSM on slot 4.
   Initializing slot 4, iop 0, Initializing Fabric.
   complete
   ```

   These messages indicate that the secondary FCSM took over once the primary FCSM was removed from the switch backplane.

4. Configure all ATM services on the secondary FCSM that you configured during Step 2 for the primary FCSM. It is important that the configurations match so that, in case of a switch-over, the same services will be supported once the secondary FCSM takes over.

5. Power down the switch.

6. Re-install the primary FCSM into the same slot from which you removed it in Step 3.

7. Power up the switch. Once the switch comes back up, your redundant FCSM configuration will be operational.

What Happens When an FCSM Fails

Before a primary FCSM I fails the switch will attempt to ping it before bringing it down. Messages similar to the following display during the failure of a primary FCSM and the switch-over to the secondary FCSM:

```
Pinging module 3
Pinging module 3
Pinging module 3
Pinging module 3
Bringing down primary FCSM on slot 3.....
Bringing up secondary FCSM on slot 4.
Initializing slot 4, iop 0, Initializing Fabric.
complete
```

After a primary FCSM I fails, its LEDs will be off and its status will read **Disabled** in the **slot** command. The following screen shows a **slot** command display with a primary FCSM, which has just failed, in slot 3 and a secondary FCSM, which just took over, in slot 4:

Slot	Module-Type Part-Number	Adm-Status Oper-Status	HW Rev	Board Serial #	Mfg Date	Firmware-Version Base-MAC-Address
1*	MPM-II 5012013	Enabled Operational	A	70201177	01/08/97	3.3 00:20:da:04:21:f0
2	Empty					
3	FCSM 5012906	Disabled Problem	A2	71750011	04/25/97	3.3 00:20:da:7e:fe:50
4	FCSM 5012906	Enabled Operational	A2	71337442	03/29/97	3.3 00:20:da:7b:1e:30
5	Empty					
6	Empty					
7	Ether/8 50000014	Enabled Operational	B	192	01/25/95	3.3 00:20:da:03:06:30
8	CSM-OC12-S 5013306	Enabled Operational	A1	1	06/24/97	3.3 None
9	Empty					

After a primary FCSM goes down and the secondary FCSM takes over, you must first power down the switch before replacing the failed primary FCSM with a new primary FCSM.

FCSM II

The FCSM II contains a custom ASIC for LAN-to-ATM internetworking (i.e., MAC layer translations). This processor provides the same function as an OmniSwitch ASM uplink module. The FCSM also contains one OC-12c/STM-4c SAR. Finally, the FCSM contains two Input Output Processor (IOP) ASICs and an ATM fabric ASIC. It is recommended that the FCSM II be installed in a chassis slot, except Slot 1, with a lower number than any installed CSM modules.

The FCSM II differs from the FCSM I in that it contains only one internal port that is visible to the user through software. The FCSM I contains two internal ports, one of which handles management signaling while the other handles data transmission. On the FCSM II, all management signaling and data transmission occur over the same internal port.

FCSM II Technical Specifications	
Standards Supported	ATM Forum User-to-Network Interface 4.0, 3.1, and 3.0 ISO Q.2931 ATM LAN Emulation Client V1.0 ITU-T I.432 and G.957 Bellcore TR-NWT-000253 Private Network-to-Network Interface (PNNI) 1.0 Interim Interswitch Protocol (IISP)
Data Rate	Up to 500 Mbps
Maximum Frame Size	8,000 bytes (ASM half)

♦ Note ♦

The FCSM II requires an MPM III or an MPM 1G, Revision B16 or later. You *cannot* use an FCSM II with an MPM II or and MPM-C.

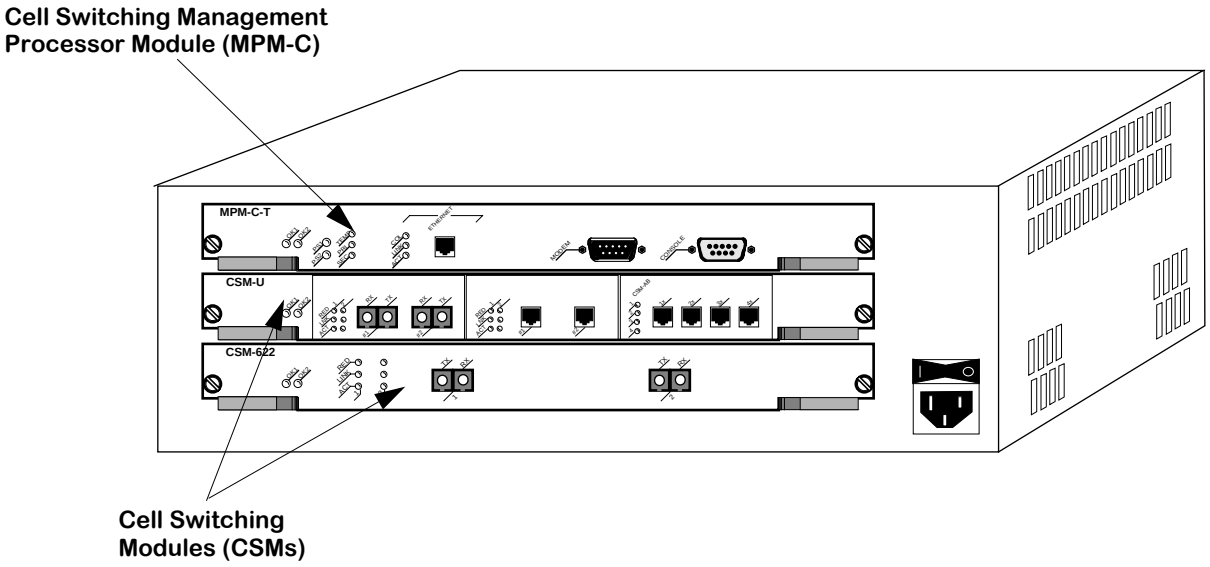
The Cell Switching Management Processor Module (MPM-C)

The MPM-C combines the management functions of an MPM 1G and the connection to the cell matrix provided by an FCSM. As a management module, the MPM-C provides such system services as maintenance of user configuration information, downloading of switching module software, basic bridge management functions, the SNMP management agent, and access to the User Interface software.

The MPM-C can only be used with Cell Switching Modules (CSMs). You cannot install an MPM-C with frame-based switching modules (e.g., ESMs, TSMs, FSMs).

♦ Note ♦

The MPM-C can be installed in a wide-format chassis (Omni-3wx, Omni-5wx, or Omni-9wx) only.



Omni-3wx with an MPM-C and Two CSMs

The MPM-C contains one OC-3c/STM-1 Segmentation and Reassembly (SAR), which provides call processing SAR functions (i.e., "FCSM" functionality). In addition, the MPM-C has one Input Output Processor (IOP) ASIC, which communicates with the cell switching fabric. In a fully loaded Omni-9wx, the MPM-C has a 13.2 Gbps cell fabric matrix. It supports OC-3c/STM-1 and OC-12c/STM-4c connections, integrated call setup, and PNNI processing.

Although the MPM-C does not have any physical ATM ports, it does have a single *logical* port that can be used for management purposes. See *ATM Services on the MPM-C* on page 41-26 for more information.

MPM-C Technical Specifications	
Flash Memory	8 MB (expandable to 32 MB)
SIMM (DRAM) Memory	32 MB (expandable to 128 MB)
SDRAM Memory	64 MB
Cell Switching Fabric	Up to 13.2 Gbps (aggregate)
Serial Ports	2 (1 male DB9 modem connector and 1 female DB9 console connector)
Ethernet (10 Mbps) Switch Management Ports	1 copper RJ-45 or fiber (ST) port for switch management functions.
Standards Supported	ATM Forum User-to-Network Interface 4.0, 3.1, and 3.0 ISO Q.2931 ATM LAN Emulation Client V1.0 ITU-T I.432 and G.957 Bellcore TR-NWT-000253 Private Network-to-Network Interface (PNNI) 1.0 Interim Interswitch Protocol (IISP)
Maximum Frame Size	8,000 bytes (“FCSM” half)
Power Consumption	3.5 amps

In an Omni-3wx, you can install up to two (2) Cell Switching Modules (CSMs). In an Omni-5wx, you can install up to four (4) CSMs. And in an Omni-9wx, you can install up to eight (8) CSMs.

♦ Note ♦

The MPM-C *must* be installed in Slot 1 or Slot 2. In addition, you *cannot* install a CSM in Slot 1.

OK1 (Hardware Status). This dual-state LED is on Green when the MPM-C has passed power-on hardware diagnostics successfully. On Amber when the hardware has failed diagnostic tests. If the **OK1** LED is alternating Green and Amber, then file system compaction is in progress.

Caution

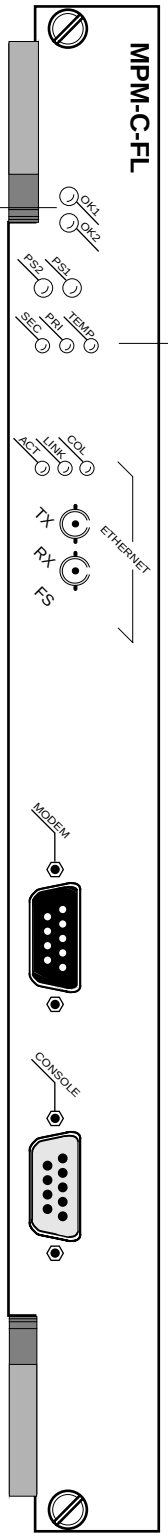
Do not power down the OmniSwitch or insert any modules while the **OK1** LED is alternating Green and Amber. If you do, file corruption may result and you will not be able to restart the switch.

OK2 (Software Status). Blinking Green when the MPM-C has successfully loaded software to the switching modules. Blinking Amber when the MPM-C is in a transitional state, such as when it first boots up. If the **OK2** LED blinks Amber for an extended period of time (i.e., more than a minute), then you should reboot the switch.

Caution

Do not insert or remove any modules while the MPM-C **OK2** LED is blinking Amber. If you do, file corruption may result and you will not be able to restart the switch.

Module Status LEDs



Module Status LEDs

PS1 (Power Supply 1 Status). This dual-state LED is on Green when the switch is receiving the proper voltage from Power Supply 1. It is on Amber when Power Supply 1 is on, but not supplying the correct amount of voltage to power the switch, or is installed and turned off. The **PS1** LED is Off when the Power Supply 1 is not present.

PS2 (Power Supply 2 Status). This dual-state LED is on Green when the OmniSwitch is receiving the proper voltage from Power Supply 2. It is on Amber when Power Supply 2 is on, but not supplying the correct amount of voltage to power the switch, or is installed and turned off. The **PS2** LED is Off when Power Supply 2 is not present.

TEMP (Temperature). On Yellow to warn that the internal switch temperature is approaching maximum operating limits. Note that this LED comes on *before* the temperature limit is reached.

PRI (Primary MPM-C). On Green when this MPM-C is the active, or controlling, MPM-C. It is also on Green when this is the only MPM-C installed in the switch.

SEC (Secondary MPM-C). On Green when this MPM-C is the secondary MPM-C in a redundant MPM-C configuration. As the secondary MPM-C, this module is in hot standby mode.

Cell-Switching Management Processor Module (MPM-C) Status LEDs

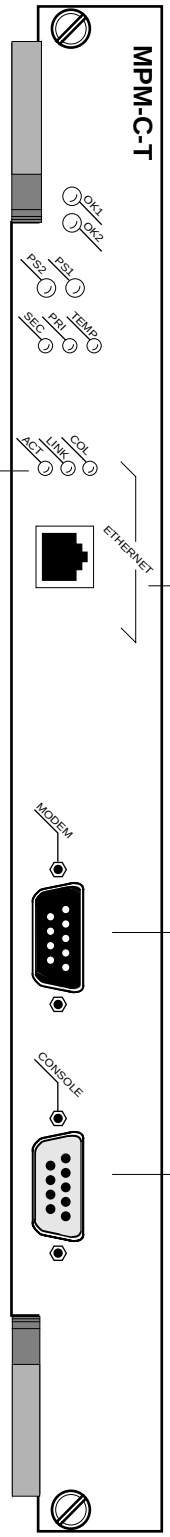
The MPM-C module includes one row of LEDs for the Ethernet management port.

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

LINK (Link Status/Disabled). On Green continuously when a good cable connection exists. Off when a good connection does not exist.

COL (Collision). On Yellow when a collision has been detected on the port.

Port LEDs



Ethernet Management Port. Copper RJ-45 (shown here) and fiber ST ports are available for rapid switch file transfers and network management functions.

Modem Connector. A male serial DB-9 DTE connector for switch file transfers and network management functions.

Console Connector. A female serial DB-9 DCE connector for switch file transfers and network management functions.

MPM-C Management Connectors

MPM-C Serial and Ethernet Management Ports

You can gain access to switch management software through one of the two serial (RS-232) ports on the MPM-C or the Ethernet management port. The two serial ports are configured with 9-pin "D" connectors (DB-9) per the IBM AT serial port specification. One port, called the "modem" port, is male and the other, called the "console" port, is female. See (*MPM-C Management Connectors* on page 41-23) for illustrations of these ports.

The modem port is a Data Terminal Equipment (DTE) connector, which is typically connected to a modem. You can also connect directly from this port to a PC or terminal with a standard null-modem cable available in most computer equipment stores.

♦ Note ♦

The modem port is hard-wired for DTE communication; you do not need to set any jumpers.

The console port is a Data Communication Equipment (DCE) connector, which can be directly connected to a PC, terminal, or printer.

Ethernet Management Port

The MPM-C also supports an out-of-band Ethernet port for high-speed uploads and switch management functions. With this port, you can access the OmniSwitch over a network via Telnet or FTP. See the table below for available Ethernet management port types.

MPM-C Module	Ethernet Management Port Type (Cable Type)	Max. Cable Distance
MPM-C-T	RJ-45 (UTP)	100 meters
MPM-C-FL	ST (Multimode fiber)	2 kilometers

The Ethernet management port has a default IP address of 192.168.11.1, which can be used for initial connectivity. You can use the Boot prompt or the **ethernetc** command to change this address. See Chapter 10, "Configuring Management Processor Modules," for more information on the **ethernetc** command and see Appendix A, "The Boot Line Prompt," for documentation on configuring the Ethernet management port with the boot prompt.

Configuring MPM-C Serial Ports

The serial communications parameters for the two MPM-C serial ports are set by default to the following:

- 9600 bits per second (bps)
- 8 data bits
- 1 stop bit
- no parity
- no hardware flow control (Windows)

Each serial port supports serial data rates of 1200, 9600, 19200, and 38400 bps. However, you must remove the default baud rate shunt (E1), which fixes the baud rate at 9600 bps, before you can change the baud rate. This shunt is located near the front end of the MPM-C's circuit board, just to the right of the Ethernet management port.

To change the serial port configuration parameters, use the **ser** command, which is described in detail in Chapter 10, "Configuring Management Processor Modules."

Flash Memory and OmniSwitch Software

Flash memory on the MPM-C holds the OmniSwitch's executable images and configuration data. When a switching module comes online, the MPM-C downloads the appropriate image file for that module to that module's memory. Image files (those with the **img** extension) contain executable code for different switching modules and software features. See Chapter 6, "The Management Processor Module (MPM)," for more information on image files.

MPM-C Redundancy

You can configure an OmniSwitch with redundant MPM-Cs. For MPM functions (e.g., switch management), the MPM-C operates in the same manner as a standard MPM. For "FCSM" functionality (e.g., ATM services), the MPM-C functions in ways very similar to the FCSM I. See the subsections below for descriptions of these two types of redundancy.

Redundancy for MPM Functions

Each MPM-C in a redundant configuration stores information for the switch. If one MPM-C fails, the other MPM-C automatically assumes all management responsibilities. After initialization, the new MPM-C will read the configuration information from the existing MPM-C as long as you set automatic configuration synchronization to active. Any virtual paths and/or virtual circuits you created will be saved in the configuration files if automatic configuration synchronization is active. See Chapter 6, "The Management Processor Module (MPM)," for more information on redundancy for MPM functionality.

Redundancy for FCSM Functions

Follow the steps below to configure "FCSM" redundancy (i.e., configuring redundant ATM services) on the MPM-C.

1. Configure all required ATM services, such as LAN Emulation (LANE), on the primary MPM-C. Keep good records of all configuration parameters because you will need to re-enter them on the secondary MPM-C.

2. Configure all ATM services on the secondary MPM-C. It is important that the configurations match so that, in case of a switch-over, the same services will be supported once the secondary MPM-C takes over.

ATM Services on the MPM-C

Currently, you can configure a single LANE (Ethernet or Token Ring) client, Classical IP (CIP), or Point-to-Point (PTOP) services on an MPM-C; however, VLAN cluster, Alcatel-proprietary ATM trunking, and 1483 scaling services are *not* supported.

A single LANE Client (LEC) or PTOP service can be used for switch management purposes. The service's IP address can be used to telnet, FTP, ping, SNMP, etc., to and from the switch. UI commands to create, view, modify, and delete ATM services (**cas**, **vas**, **mas**, and **das**, respectively) operate on an MPM-C. If you wanted to create a PTOP service on an MPM-C in slot 1, for example, you would enter

```
cas 1/1
```

at the system prompt. See Chapter 38, "ATM Services," for more information on ATM services command.

CSM-155F

The CSM-155 Cell Switching Module (CSM) contains eight full-duplex SONET/SDH STS-3c ports that use fiber SC connectors. The ports support the OC-3c/STM-1 standard data rate of 155 Mbps. The CSM-155 can be factory configured with single mode single mode or multimode fiber connectors. The single mode version is referred to as the CSM-155-8S; the multimode version is referred to as the CSM-155-8. There is also a version with six multimode and two single mode connectors referred to as the CSM-155-6M2SW. Multimode and single mode connectors are differentiated by color: multimode connectors are black, single mode connectors are blue.

Each of the eight OC-3c/STM-1 ports supports up to 4096 virtual circuits (either Virtual Paths or Virtual Channels). In addition, each CSM-155 supports a total of 8192 point-to-multipoint virtual circuits. The cell buffer size for each physical port is 8192 cells.

The CSM-155 is suited for either direct connections to ATM workstations, backbone connections, or as an NNI link to a larger backbone. High-performance ATM workstations, servers, LAN switches, and routers can connect directly to CSM-155 ports; the CSM-155 can then connect into an ATM network that might support a larger backbone.

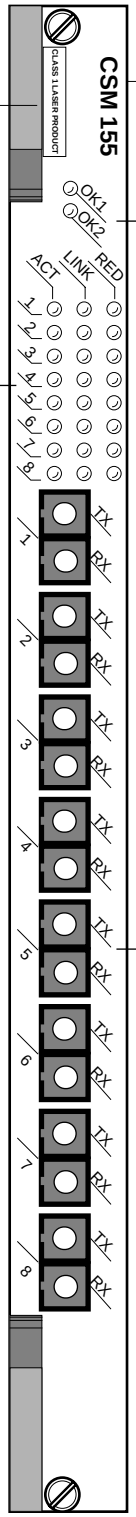
CSM-155 Technical Specifications	
Number of ports	8 SONET/SDH
Connector Type	SC
Standards Supported	ATM Forum User-to-Network Interface 4.0, 3.1, and 3.0 ITU-T I.432 and G.957 ANSI T1.105 Bellcore TR-NWT-000253 ATM Forum Traffic Management 4.0 Private Network-to-Network Interface (PNNI) 1.0 Interim Interswitch Protocol (IISP)
Data Rate	155 Mbps
Virtual Circuits Supported	4096 point-to-point per port; 8192 point-to-multipoint per CSM-155
Cell Buffer Size	8192 per port
Connections Supported	OC-3c/STM-1 connections to ATM stations, backbones.
Optical output power	Multimode: -20 to -14 dBm Single mode: -15 to -8 dBm
Optical receiver sensitivity	Multimode: -29 to -14 dBm Single mode: -31 to -8 dBm
Cable Supported	Multimode: 62.5 micron multimode fiber Single mode: intermediate-reach single-mode fiber
Cable Distance	Multimode: 2 km Single mode: 24 km

♦ Special Note ♦

The single mode version of this module has been deemed:

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

to IEC 825:1984/CENELEC HD 482 S1.



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

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

Module LEDs

Please refer to *Frame-to-Cell Switching Module (FCSM)* on page 41-14 for further information on these LEDs.

Port LEDs

The CSM-155 modules include one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number.

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 CSM module is plugged in, but no cable has been connected.

LINK (Link Status/Disabled). On Green when the corresponding port is enabled and a signal is present. Flashing Green when the corresponding port is disabled and a signal is present. This LED will be off when the port is disabled and no signal is present.

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

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

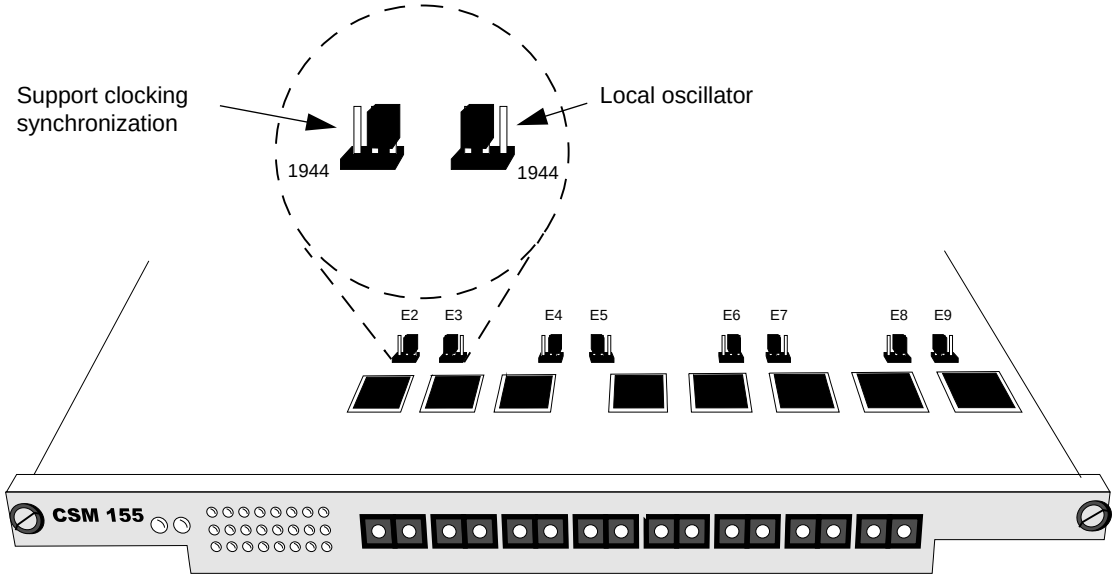
Cell Switching Module With Eight OC-3c/STM-1 Ports

Jumper Settings

Each of the eight ports on the CSM-155 board has a jumper (E2-E9) associated with it. Each jumper is labeled **1944** either to the left or to the right of the jumper pins. These jumpers enable you to configure whether the clock source is software controlled. If the middle pin is jumpered to the pin closest to the **1944** label, then software selection of the clocking mode is enabled. If the middle pin is jumpered to the "unlabeled" (i.e., furthest from the **1944** label), then the clocking mode is set to local oscillator only regardless of the software setting. (For more information on setting the clocking source through software, refer to Chapter 47, "Clocking ATM Networks.")

Note

Some older versions of this module may not support clock synchronization. If you have any questions, contact Technical Support.



CSM-155 Clock Source Jumper Settings

Note

If your board includes Jumper E1, note that this jumper is set at the factory, and should not be changed.

CSM-622

The CSM-622 Cell Switching Module (CSM) contains two full-duplex SONET/SDH STS-12c ports that use fiber SC connectors. The ports support the OC-12c/STM-4c standard data rate of 622 Mbps. The CSM-622 can be factory configured with single mode or multimode fiber connectors. The intermediate-reach single mode version is referred to as the CSM-622-2SE; the long-reach single mode version is referred to as the CSM-622FSH-2SE; the multimode version is referred to as the CSM-622-2E. Multimode and single mode connectors are differentiated by a color code: multimode connectors are black, long-reach single mode connectors are yellow, and intermediate-reach single mode connectors are blue.

Each of the two OC-12c/STM-4c ports can support up 65,536 virtual circuits (either Virtual Paths or Virtual Channels). In addition, each CSM-155 supports a total of 16,000 point-to-multipoint virtual circuits. The cell buffer size for each physical port is 131,072 cells.

The CSM-622 is suited for high-performance backbone connections within an ATM network. The OmniSwitch where this module is installed may also contain OC-3c/STM-1 links that connect high-performance workstations or backbones into the OmniSwitch; the CSM-622 might serve as a backbone trunk for these OC-3c/STM-1 connections.

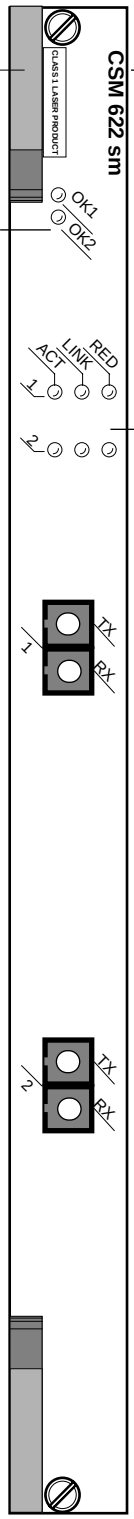
CSM-622 Technical Specifications	
Number of ports	2 SONET/SDH
Connector Type	SC
Standards Supported	ATM Forum User-to-Network Interface 4.0, 3.1, and 3.0 ITU-T I.432 and G.957 Bellcore TR-NWT-000253 ATM Forum Traffic Management 4.0 Private Network-to-Network Interface (PNNI) 1.0 Interim Interswitch Protocol (IISP)
Data Rate	622 Mbps
Virtual Circuits Supported	65,536 point-to-point/port; 16,000 point-to-multipoint/CSM-622
Cell Buffer Size	131,072 per port
Connections Supported	OC-12c/STM-4c connections to ATM stations, backbones.
Optical output power	Multimode: -20 to -14 dBm Single mode (intermediate reach): -15 to -8 dBm Single mode (long reach): -3 to 2 dBm
Optical receiver sensitivity	Multimode: -26 to -14 dBm Single mode (intermediate reach): -28 to -8 dBm Single mode (long reach): -28 dBm (minimum), -30 dBm (typical)
Cable Supported	Multi-Mode: 62.5 micron multimode fiber Single mode (intermediate reach): intermediate-reach single-mode fiber Single mode (long reach): long-reach single-mode fiber
Cable Distance	Multimode: 500 meters Single mode (intermediate reach): 15 km Single mode (long reach): 40 km

♦ Special Note ♦

The single mode version of this module has been deemed:

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

to IEC 825:1984/CENELEC HD 482 S1.



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

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

Please refer to *Frame-to-Cell Switching Module (FCSM)* on page 41-14 for further information on these LEDs.

Module LEDs

The CSM-622 module includes one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number.

Port 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 CSM module is plugged in, but no cable has been connected.

LINK (Link Status/Disabled). On Green when the corresponding port is enabled and a signal is present. Flashing Green when the corresponding port is disabled and a signal is present. This LED will be off when the port is disabled and no signal is present.

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

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

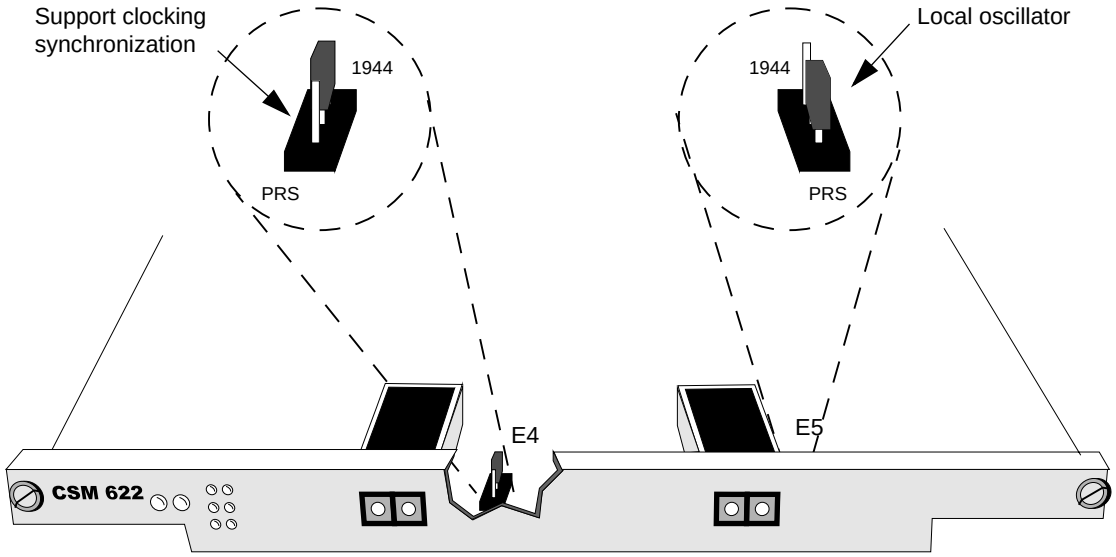
Cell Switching Module With Two OC-12c/STM-4c Ports

Jumper Settings

Each of the two ports on the CSM-622 board has a jumper (E4, E5) associated with it. These jumpers enable you to configure whether the clock source is software controlled. If the middle and top (i.e., the closest to the label **1944**) pins are jumpered, the clocking source for that port will be determined by the software, meaning that you can software select either clocking synchronization or the local oscillator (for more information on setting the clocking source through software, refer to Chapter 47, "Clocking ATM Networks.") If the bottom (i.e., the closest to the label **PRS**) and middle pins are jumpered, the clocking source for that port will always be the local oscillator, regardless of the software setting, meaning you will not be able to use clocking synchronization.

Note

Some older versions of this module may not support clock synchronization. If you have any questions, contact Technical Support.



CSM-622 Clock Source Jumper Settings

Note

If your board has a Jumper E1, note that this jumper is set at the factory, and should not be changed.

CSM-155C-8

The CSM-155C-8 Cell Switching Module (CSM) contains eight RJ-45 ports. The ports support the STS-3c/STM-1 standard data rate of 155 Mbps. Each of the eight STS-3c/STM-1 ports supports up to 4096 virtual circuits (either Virtual Paths or Virtual Channels). In addition, each CSM-155 supports a total of 8192 point-to-multipoint virtual circuits. The cell buffer size for each physical port is 8192 cells.

The CSM-155C is available in wide format. Wide versions must be used in a wide chassis, such as the Omni-5wx and the Omni-9wx.

The CSM-155 is suited for either direct connections to ATM workstations, servers, or as an NNI link to a larger backbone. High-performance ATM workstations, servers, LAN switches, and routers can connect directly to CSM-155 ports.

CSM-155C-8 Technical Specifications	
Number of ports	8
Connector Type	RJ-45
Standards Supported	ATM Forum User-to-Network Interface 4.0, 3.1, and 3.0 ITU-T I.432 and G.957 ANSI T1.105 Bellcore TR-NWT-000253 ATM Forum Traffic Management 4.0 Private Network-to-Network Interface (PNNI) 1.0 Interim Interswitch Protocol (IISP)
Data Rate	155 Mbps
Virtual Circuits Supported	4096 point-to-point per port; 8192 point-to-multipoint per CSM-155
Cell Buffer Size	8192 per port
Connections Supported	STS-3c/STM-1 connections to ATM stations, backbones.
Cable Distance	90 meters

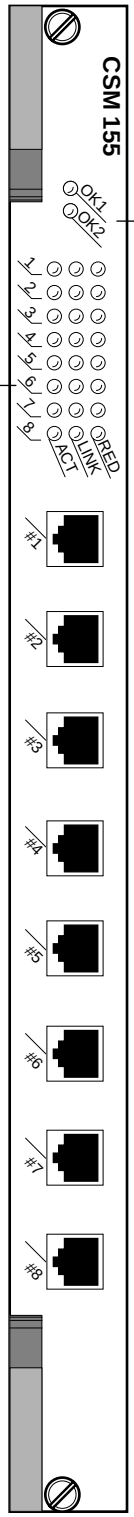
The CSM-155 modules include one row of LEDs for each port. The LEDs for a given port display in the row labeled with the port number.

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 CSM module is plugged in, but no cable has been connected.

LINK (Link Status/Disabled). On Green when the corresponding port is enabled and a signal is present. Flashing Green when the corresponding port is disabled and a signal is present. This LED will be off when the port is disabled and no signal is present.

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

Port LEDs



Module LEDs

Please refer to *Frame-to-Cell Switching Module (FCSM)* on page 41-14 for further information on these LEDs.

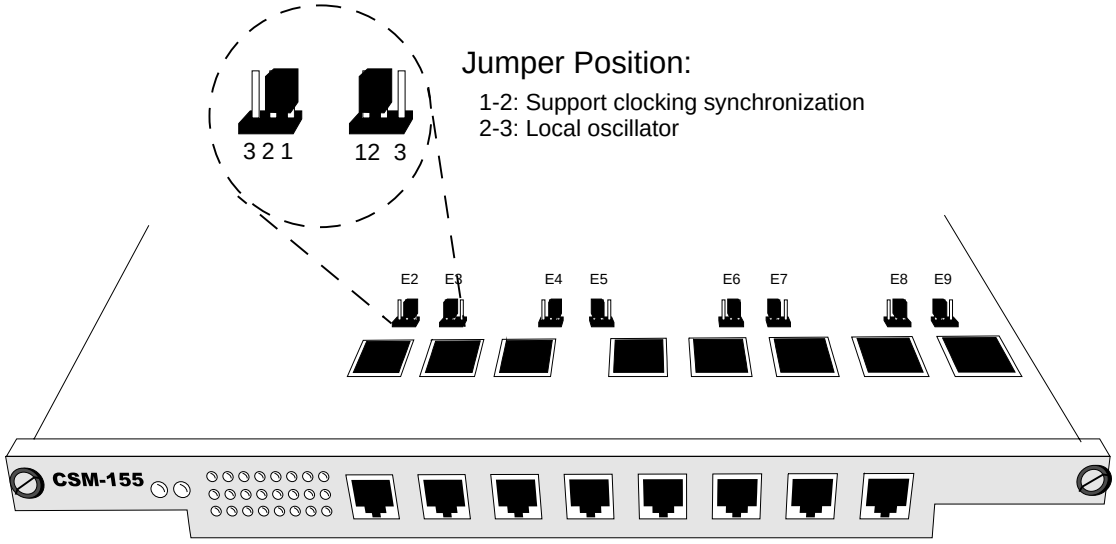
Cell Switching Module With Eight OC-3c/STM-1 Ports

Jumper Settings

Each of the eight ports on the CSM-155C-8 board has a jumper (E2-E9) associated with it. These jumpers enable you to configure whether the clock source is software controlled. If pins 1 and 2 are jumpered, the clocking source for that port will be determined by the software, meaning that you can software select either clocking synchronization or the local oscillator (for more information on setting the clocking source through software, refer to Chapter 47, "Clocking ATM Networks.") If pins 2 and 3 are jumpered, the clocking source for that port will always be the local oscillator, regardless of the software setting, meaning you will not be able to use clocking synchronization.

Note

Some older versions of this module may not support clock synchronization. If you have any questions, contact Technical Support.



CSM-155C-8 Clock Source Jumper Settings

Note

If your board has a jumper E1, note that it is set at the factory, and should not be changed.

CSM-A25-12

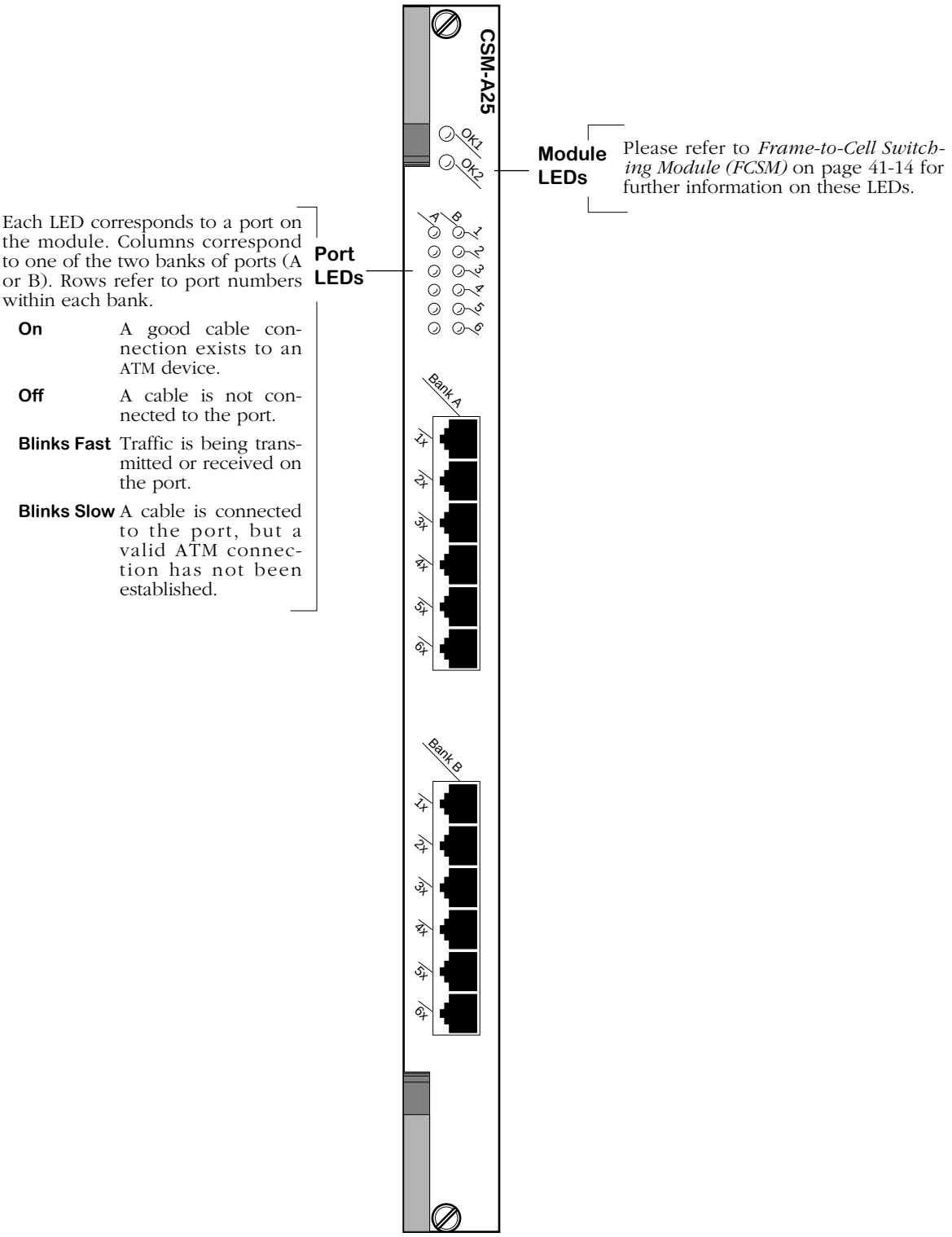
The CSM-A25-12 cell switching module contains 12 ATM 25 Mbps ports. The 12 RJ-45 ports may connect to unshielded twisted pair (UTP) or shielded twisted pair (STP) cable. Typically, each port will connect to a single device, such as an ATM workstation or server.

Each of the twelve (12) 25 Mbps ports supports up to 512 virtual circuits (either Virtual Paths or Virtual Channels). In addition, each CSM-A25-12 module supports a total of 2000 point-to-multipoint virtual circuits. The cell buffer size for each physical port is 2048 cells.

Module ports are divided into two (2) banks of six (6) ports. Ports are numbered from 1 to 6 within each of the banks. The banks are labelled **A** and **B**. This grouping simplifies the display of LEDs, which are organized as a matrix. You can find the LED for a particular port by matching the port number with the bank letter within the LED matrix display (see illustration on the next page).

The CSM-A25-12 is available in wide or narrow format. Wide versions must be used in a wide chassis, such as the Omni-5wx and the Omni-9wx.

CSM-A25-12 Technical Specifications	
Number of ports	12
Connector Type	RJ-45
Standards Supported	ATM Forum User-to-Network Interface 4.0, 3.1, and 3.0
Data Rate	25 Mbps
Virtual Circuits Supported	512 point-to-point per port; 2000 point-to-multipoint per CSM-A25
Cell Buffer Size	2048 per port
Connections Supported	ATM 25 Mbps connections to ATM workstations or servers
Cable Distance	100 meters
Cable Supported	Unshielded twisted-pair (UTP)—100 ohm Shielded twisted-pair (STP)—100 ohm



ATM 25 Mbps Cell Switching 12-Port Module

CSM-A25-24W

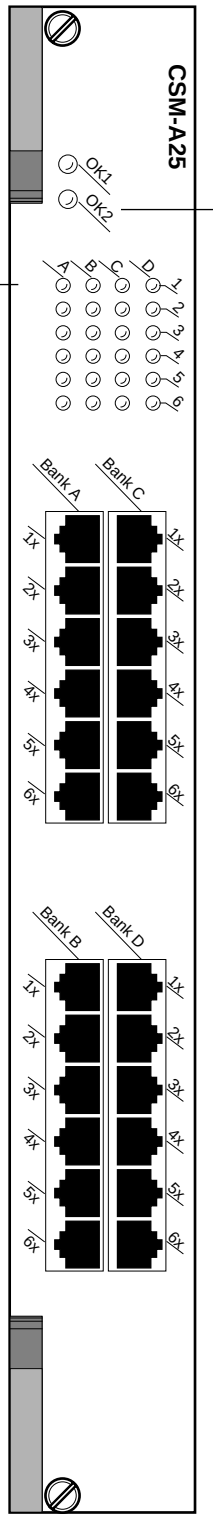
The CSM-A25-24W cell switching module contains 24 ATM 25 Mbps ports. The 24 RJ-45 ports may connect to unshielded twisted pair (UTP) or shielded twisted pair (STP) cable. Typically, each port will connect to a single device, such as an ATM workstation or server.

Each of the twenty-four (24) 25 Mbps ports supports up to 512 virtual circuits (either Virtual Paths or Virtual Channels). In addition, each CSM-A25-12 module supports a total of 4000 point-to-multipoint virtual circuits. The cell buffer size for each physical port is 2048 cells.

Module ports are divided into four (4) banks of six (6) ports. Ports are numbered from 1 to 6 within each of the four banks. The four banks are labelled **A**, **B**, **C**, and **D**. This grouping simplifies the display of LEDs, which are organized as a matrix. You can find the LED for a particular port by matching the port number with the bank letter within the LED matrix display (see illustration on the next page).

The CSM-A25-24 is available only in wide format. It must be used in a wide chassis, such as the Omni-3wx, Omni-5wx, and the Omni-9wx.

CSM-A25-24 Technical Specifications	
Number of ports	24
Connector Type	RJ-45
Standards Supported	ATM Forum User-to-Network Interface 4.0, 3.1, and 3.0
Data Rate	25 Mbps
Virtual Circuits Supported	512 point-to-point per port; 4000 point-to-multipoint per CSM-A25
Cell Buffer Size	2048 per port
Connections Supported	ATM 25 Mbps connections to ATM workstations or servers
Cable Distance	100 meters
Cable Supported	Unshielded twisted-pair (UTP)—100 ohm Shielded twisted-pair (STP)—100 ohm



Module LEDs

Please refer to *Frame-to-Cell Switching Module (FCSM)* on page 41-14 for further information on these LEDs.

Port LEDs

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

On	A good cable connection exists to an ATM device.
Off	A cable is not connected to the port.
Blinks Fast	Traffic is being transmitted or received on the port.
Blinks Slow	A cable is connected to the port, but a valid ATM connection has not been established.

ATM 25 Mbps Cell Switching 24-Port Module

CSM-U

The Cell Switching Universal Module (CSM-U) contains three (3) adapter board slots in which you can install different cell switching interfaces. All adapter boards support the cell switching matrix. The available adapter board types are as follows:

- 2-port OC-3 fiber (multimode, single mode, and long-reach single mode)
- 2-port OC-3 copper
- 2-port DS3 or E3
- 4-port T1 or E1
- 4-port T1 or E1 supporting circuit emulation
- 8-port T1 or E1 supporting Inverse Multiplexing over ATM (IMA)

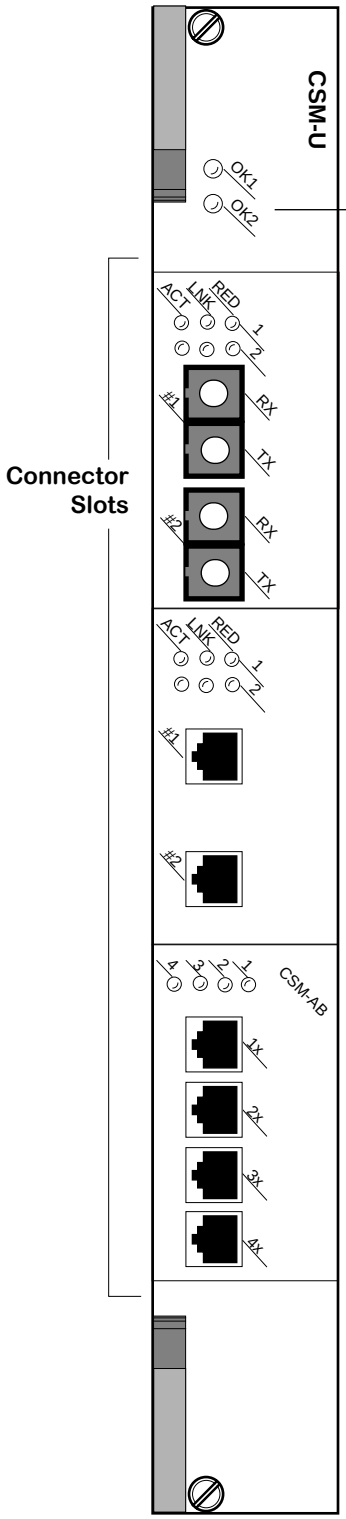
The CSM-U and all of its associated adapter boards use the wide module format. Wide modules must be used in a wide chassis, such as the Omni-3wx, Omni-5wx, or the Omni-9wx.

Switch software reads the ports on the CSM-U consecutively. For example, if the CSM-U contained three adapter boards, each board with two ports, then the top 2 ports would be reported in software as Ports 1 and 2 and the remaining ports would be reported as 3, 4, 5, and 6. However, labels on the front panel of the adapter boards will not match this internal numbering. The first port on each physical adapter board will always be labelled "1." In a CSM-U configuration of three, two-port adapter boards, the first port on the second module would have a front panel label of 1, but software would see this port as Port 3.

The following sections provide Technical Specifications and LED descriptions for each of the adapter boards.

CSM-U Technical Specifications	
Number of adapter boards	3
Maximum number of ports	24
Connector Types	SC fiber (OC-3 single mode and multimode) RJ-45 UTP (OC-3) RJ-48C (T1, E1, T1 or E1 circuit emulation) BNC (DS-3 and E3)

The CSM-U provides room for three (3) universal cell switching adapter boards. The illustration below shows a CSM-U with three different adapter board types: a fiber OC-3 board, a copper OC-3 board, and a T1/E1 board. Each adapter board type is described in the pages that follow.



Cell Switching Universal Switching Module

CSM-AB-155F

The CSM-AB-155F cell switching adapter board contains two full-duplex SONET/SDH STS-3c ports that use fiber SC connectors. The ports support the OC-3c/STM-1 standard data rate of 155 Mbps. The CSM-AB-155 can be factory configured with single mode intermediate reach, single mode long reach, or multimode fiber connectors.

The single mode intermediate reach version of this adapter board is referred to as the CSM-AB-155-FS; the single mode long reach version is referred to as the CSM-AB-155-FSH; the multimode version is referred to as the CSM-AB-155-FM. Each connector type is differentiated by color: single mode intermediate reach connectors are blue; single mode long reach connectors are yellow; and multimode connectors are black.

Each of the OC-3c/STM-1 ports supports up to 4096 virtual circuits (either Virtual Paths or Virtual Channels). In addition, each CSM-AB-155F supports a total of 2048 point-to-multipoint virtual circuits. The cell buffer size for each physical port is 8192 cells.

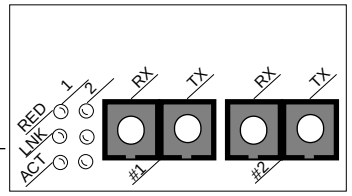
The CSM-AB-155F is suited for either direct connections to ATM workstations, backbone connections, or as an NNI link to a larger backbone. High-performance ATM workstations, servers, LAN switches, and routers can connect directly to CSM-AB-155F ports; the CSM-AB-155F can then connect into an ATM network that might support a larger backbone.

The CSM-AB-155 adapter board includes one column of LEDs for each port. The LEDs for a given port display in the column labeled with the port number.

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 CSM board is plugged in, but no cable has been connected.

LINK (Link Status/Disabled). On Green when the corresponding port is enabled and a signal is present. Flashing Green when the corresponding port is disabled and a signal is present. This LED will be off when the port is disabled and no signal is present.

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



The CSM-AB-155F LEDs

CSM-AB-155F Technical Specifications	
Number of ports	2 SONET/SDH
Connector Type	SC
Standards Supported	ATM Forum User-to-Network Interface 4.0, 3.1, and 3.0 ITU-T I.432 and G.957 ANSI T1.105 Bellcore TR-NWT-000253 ATM Forum Traffic Management 4.0 Private Network-to-Network Interface (PNNI) 1.0 Interim Interswitch Protocol (IISP)
Data Rate	155 Mbps
Virtual Circuits Supported	4096 point-to-point per port; 2048 point-to-multipoint per CSM-155
Cell Buffer Size	8192 per port
Connections Supported	OC-3c/STM-1 connections to ATM stations, backbones.
Optical output power	Multimode: -19 to -14 dBm Single mode intermediate reach: -15 to -8 dBm Single mode long reach: -5 to 0 dBm
Optical receiver sensitivity	Multimode: -30 to -14 dBm Single mode intermediate reach: -31 to -8 dBm Single mode long reach: -34 to -10 dBm
Cable Supported	Multimode: 62.5 micron multimode fiber Single mode intermediate reach: intermediate-reach single-mode fiber Single mode long reach: long-reach single-mode fiber
Cable Distance	Multimode: 4 km Single mode intermediate reach: 24 km Single mode long reach: 40 km

♦ Special Note ♦

The single mode version of this module has been deemed:

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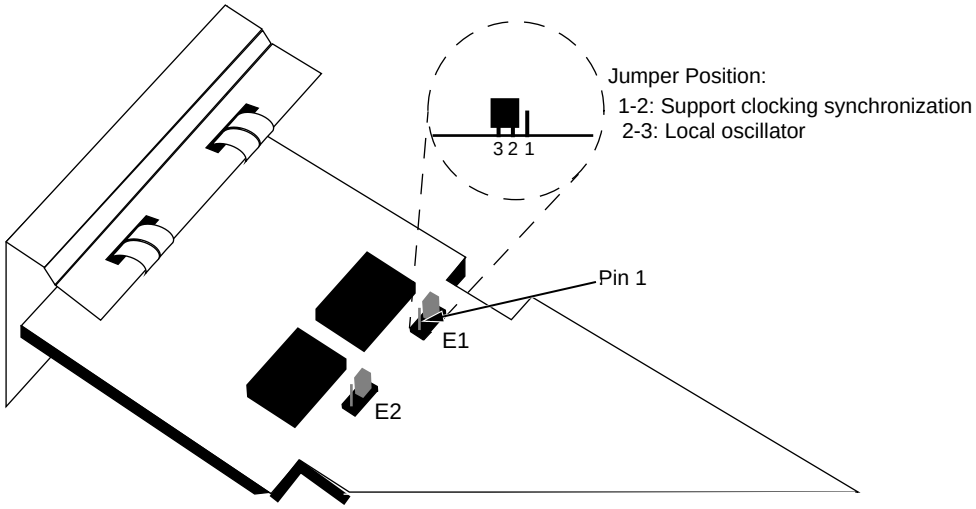
to IEC 825:1984/CENELEC HD 482 S1.

Jumper Settings

Each of the two ports on the CSM-AB-155F board has a jumper (E1-E2) associated with it. These jumpers enable you to configure whether the clock source is software controlled. If pins 1 and 2 are jumpered, the clocking source for that port will be determined by the software, meaning that you can software select either clocking synchronization or the local oscillator (for more information on setting the clocking source through software, refer to Chapter 47, "Clocking ATM Networks"). If pins 2 and 3 are jumpered, the clocking source for that port will always be the local oscillator, regardless of the software setting, meaning you will not be able to use clocking synchronization.

Note

Some older versions of this module may not support clock synchronization. If you have any questions, contact Technical Support.



CSM-AB-155F Clock Source Jumper Settings

CSM-AB-155C

The CSM-AB-155C cell switching adapter board contains two RJ-45 ports. The ports support the STS-3c/STM-1 standard data rate of 155 Mbps. Each of the STS-3c/STM-1 ports supports up to 4096 virtual circuits (either Virtual Paths or Virtual Channels). In addition, each CSM-AB-155C adapter board supports a total of 2048 point-to-multipoint virtual circuits. The cell buffer size for each physical port is 8192 cells.

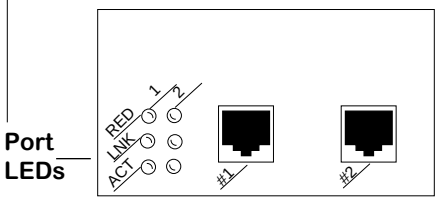
The CSM-AB-155C is suited for either direct connections to ATM workstations, servers, or as an NNI link to a larger backbone. High-performance ATM workstations, servers, LAN switches, and routers can connect directly to CSM-AB-155C ports.

The CSM-AB-155C adapter board includes one column of LEDs for each port. The LEDs for a given port display in the column labeled with the port number.

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 CSM board is plugged in, but no cable has been connected.

LINK (Link Status/Disabled). On Green when the corresponding port is enabled and a signal is present. Flashing Green when the corresponding port is disabled and a signal is present. This LED will be off when the port is disabled and no signal is present.

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



The CSM-AB-155C LEDs

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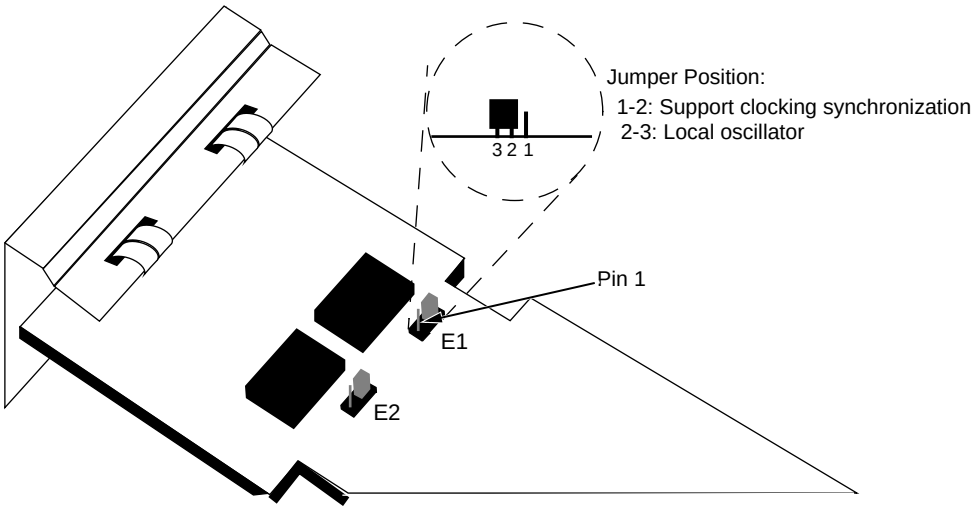
CSM-AB-155C Technical Specifications	
Number of ports	2
Connector Type	RJ-45
Standards Supported	ATM Forum User-to-Network Interface 4.0, 3.1, and 3.0 ITU-T I.432 and G.957 ANSI T1.105 Bellcore TR-NWT-000253 ATM Forum Traffic Management 4.0 Private Network-to-Network Interface (PNNI) 1.0 Interim Interswitch Protocol (IISP)
Data Rate	155 Mbps
Virtual Circuits Supported	4096 point-to-point per port; 2048 point-to-multipoint per CSM-155
Cell Buffer Size	8192 per port
Connections Supported	STS-3c/STM-1 connections to ATM stations, backbones.
Cable Distance	90 meters

Jumper Settings

Each of the two ports on the CSM-AB-155C board has a jumper (E1-E2) associated with it. These jumpers enable you to configure whether the clock source is software controlled. If pins 1 and 2 are jumpered, the clocking source for that port will be determined by the software, meaning that you can software select either clocking synchronization or the local oscillator (for more information on setting the clocking source through software, refer to Chapter 47, "Clocking ATM Networks.") If pins 2 and 3 are jumpered, the clocking source for that port will always be the local oscillator, regardless of the software setting, meaning you will not be able to use clocking synchronization.

Note

Some older versions of this module may not support clock synchronization. If you have any questions, contact Technical Support.



CSM-AB-155C Clock Source Jumper Settings

CSM-AB-T1/E1-4W

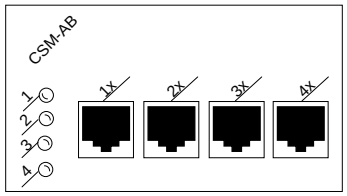
The CSM-AB-T1/E1 adapter board contains four T1 or E1 ports using RJ-48C connectors. The T1 version of this adapter board is referred to as the CSM-AB-T1-4W; the E1 version is referred to as the CSM-AB-E1-4W.

You must adjust jumpers on the E1 version of this adapter board to set the cable resistance (75 or 120 ohm) of the connection correctly. These adapter boards include an integrated CSU/DSU to enable direct connection to a T1/E1 device, such as a PBX.

You can configure several physical port parameters through switch 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.

Port LEDs. Each port on this adapter board is assigned a labelled status LED. Each LED will be in one of four 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.
Yellow (Solid)	An error has occurred on the port.



The CSM-AB-T1/E1 LEDs

CSM-AB-T1/E1 Technical Specifications	
Number of ports	4 T1 or E1
Connector Type	RJ-48C
Standards Supported	RFC 1406
Frame Formats	T1: Superframe, Extended Superframe, Unframed E1: E1, E1-CRC, E1-MF, E1-CRC-MF, Unframed
Line Type	T1: B8ZS or AMI E1: HDB3 or AMI
Data Rates Supported	T1: 1.544 Mbps E1: 2.048 Mbps
Facility Datalink Protocol	ANSI T1.403 and AT&T 54016
Connections Supported	Physical Data Terminal Equipment (DTE) or Data Communication Equipment (DCE)
Cable Distance	T1/E1 (short haul): 200 meters T1/E1 (long haul): 1829 meters

CSM-AB-DS3/E3-2W

The CSM-AB-DS3/E3 adapter board contains two BNC ports that support DS-3 or E3 connections. Each port connection provides 44.736 Mbps (DS-3) or 34.368 Mbps (E3) of bandwidth and connects to coaxial (RG-59) cable. The DS-3 version of this adapter board is referred to as the CSM-AB-DS3-2W; the E3 version of this adapter board is referred to as the CSM-AB-E3-2W.

CSM-AB-DS3/E3 ports are suited for connections to ATM carrier services. The CSM-AB-DS3/E3 ports are physical DTE (Data Termination Equipment) devices that connect to physical DCE (Data Communication Equipment) devices, such as DSUs (Data Service Unit).

By default DS3 ports use Cbitparity line encoding, but you can configure these ports to use M23. By default E3 ports uses G.751 line encoding, but you can configure them to use G.832. You should configure all ports to use the same line encoding as the ATM service provider. You can configure loopback controls for all port types.

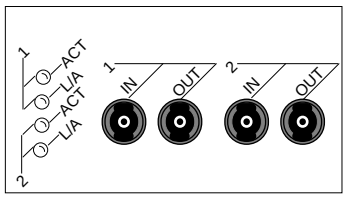
Two different mapping protocols are used to transmit ATM cells over DS-3 and E3: PLCP (Physical Layer Convergence Protocol) and ATM Direct Mapped (ADM) System. The two protocols are not compatible. Many existing implementations use PLCP as defined in ANSI T1.624-1993, but many new implementations use ADM. The CSM-AB-DS3/E3 ports support both physical layer protocols.

The CSM-AB-DS3/E3 adapter board includes one column of LEDs for each port. The LEDs for a given port display in the column labeled with the port number.

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

L/A (Link/Alarm). Both ports on this adapter board use a dual-color Link/Alarm LED which convey two different states. The following describes each state:

Green	The port is enabled and a signal is present.
Yellow	An error has occurred on the port.



The CSM-AB-DS3/E3 LEDs

CSM-AB-DS3/E3 Technical Specifications	
Number of ports	2
Connector Type	BNC
Standards Supported	ANSI T1.624-1993 (PLCP Mapping) IEEE P802.6
Data Rate	DS-3: 44.736 Mbps E3: 34.368 Mbps
Line Types Supported	DS-3: CbitParity or M23 E3: G.751 or G.832
Sublayers Supported	PLCP or ADM
Connections Supported	DS-3 and E3 connections to ATM carrier service.
Cable Supported	Coaxial RG-59 (75 ohm)
Cable Distance	185 m

CSM-AB-CE-T1/E1-4W

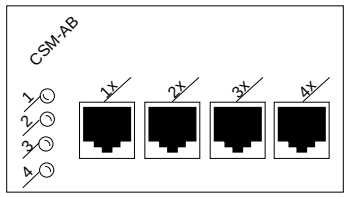
The CSM-AB-CE circuit emulation adapter board converts traditional circuit emulation traffic from T1 or E1 ports to ATM cells for transport over an ATM network. This module is best employed as a means of connecting legacy Time Division Multiplexing (TDM) traffic to an enterprise ATM network. It contains four T1 or E1 ports. The T1 version of this adapter board is referred to as the CSM-AB-CE-T1-4W; the E1 version is referred to as the CSM-AB-CE-E1-4W.

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

The CSM-AB-CE modules use four RJ-48C connectors. You must adjust jumpers on the E1 version of this adapter board to set the cable resistance (75 or 120 ohm) of the connections correctly.

Port LEDs. Each port on this adapter board is assigned a labelled status LED. Each LED will be in one of four 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.
Yellow (Solid)	An error has occurred on the port.



The CSM-AB-CE Adapter Board LEDs

CSM-AB-CE Technical Specifications	
Number of ports	4 T1 or E1
Connector Type	RJ-48C
Standards Supported	RFC 1406 ATM Forum CES-IS, version 2
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
Facility Datalink Protocol	ANSI T1.403 and AT&T 54016
Data Transfer Services	Structured or Unstructured
Clocking	Synchronous, SRTS, Adaptive
Virtual Circuits Supported	Permanent Virtual Circuits (PVCs)
Connections Supported	Physical Data Terminal Equipment (DTE) or Data Communication Equipment (DCE)
Cable Distance	T1/E1 (short haul): 200 meters T1/E1 (long haul): 1829 meters

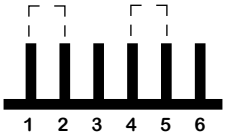
CSM-AB-CE-E1-4W Impedance Jumpers

The CSM-AB-CE-E1-4W submodule has four (4) jumpers (one for each port) to set the impedance level (see the table below). The jumpers are located on the top of the submodule near the ports. The CSM-AB-CE-E1-4W submodule supports 75 Ohm and 120 Ohm (the default) impedance levels.

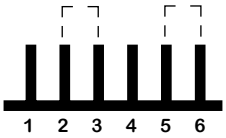
CSM-AB-CE-E1-4W Impedance Jumper Numbers

Port Number	Jumper Number	Port Number	Jumper Number
1	J5	3	J7
2	J6	4	J8

As shown in the figure on the following page, you must connect two pairs of pins on each jumper. To set the port for coaxial cable (75 Ohm impedance), you must connect pins 1 and 2 to each other and pins 4 and 5 to each other. To set the port for twisted pair cable (120 Ohm impedance), you must connect pins 2 and 3 to each other and pins 5 and 6 to each other.



75 Ohm (Coaxial)



120 Ohm (Twisted Pair)
(Factory Default)

CSM-AB-CE-E1-4W Jumper Settings

CSM-AB-CE-E1-4W RJ-48 Grounding Jumpers

The CSM-AB-CE-E1-4W submodule has four (4) jumpers (one for each port) that allow you to ground Pins 7 and 8 of each RJ-48C port. The jumpers are located on the top of the submodule and are identified in the table below. To ground a port, use a shunt to connect the two pins of the jumper.

CSM-AB-CE-E1-4W Grounding Jumper Numbers

Port Number	Jumper Number	Port Number	Jumper Number
1	J9	3	J11
2	J10	4	J12

CSM-AB-CM

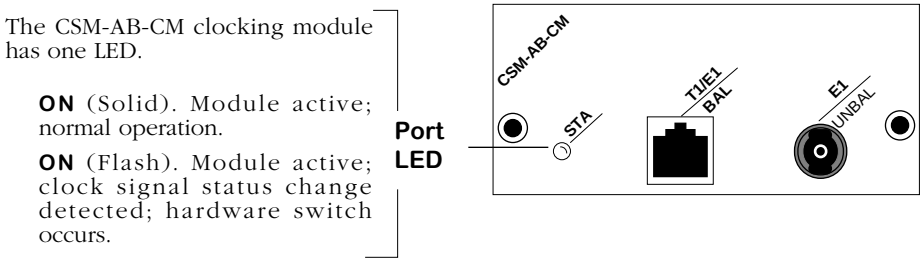
The CSM-AB-CM Clocking Module is a daughtercard that plugs into one of the three submodule slots in the CSM-U motherboard. It adds the following abilities to the OmniSwitch:

- To internally generate Stratum 3, 8 KHz and 19.44 MHz clocks for distribution to the OmniSwitch backplane.
- To derive an input reference timing source from the T1 or E1 line.
- To monitor the clocking signal for inaccurate or missing signal, and switch to a backup clock source, if necessary.
- To generate a 19.44 MHz clock for distribution to the OmniSwitch backplane by multiplying the backplane's 8 kHz clock.

♦ Important Note ♦

Only one (1) CSM-AB-CM Clocking Module is supported on a switch. Therefore, you *cannot* use one CSM-AB-CM module to back up another.

The Clocking Module contains one RJ-48 port for balanced T1 or E1, and one BNC port for unbalanced E1. Only one of these ports can be used at a time. The board contains configuration jumpers that must be set before you use the board. For details on setting these jumpers, refer to the installation instructions that accompany the board.



The CSM-AB-CM LED

CSM-AB-CM Technical Specifications	
Number of ports	2 (1 usable at any one time)
Connector Type	RJ-48C (T1, 100 ohm or E1, 120 Ohm) BNC (E1, 75 Ohm)
Standards Supported	American National Standard for Telecommunications: ANSI T1.101-1994 American National Standard for Telecommunications: ANSI T1.403-1995 Network-to-Customer Installation-- DS1 Metallic Interface Bellcore "System Interface" TR-TSY-000510, Issue 2, July, 1987 Bellcore "Transport Systems Generic Requirements (TSGR): Common Requirements" TR-TSY-000499, Issue, December, 1989 ITU Recommendation G.703: Physical/Electrical Characteristics of Hierarchical Digital Interfaces, 1991 ITU Recommendation G.823: The Control of Jitter and Wander within Digital Networks Which Are Based on the 2048 Kbit/s Hierarchy.
Data Rates Supported	T1: 1.544 Mbps E1: 2.048 Mbps
Clocking Stratum Support	Stratum 3 accuracy (4.6×10^{-6} or better)
Line Coding	T1: B8ZS or AMI E1: HDB3 or AMI
Cable Distance	T1/E1 (short haul): 200 meters T1/E1 (long haul): 1829 meters BNC: 185 meters

CSM-AB-CM Jumper Settings

See the tables below for the appropriate jumper settings or your CSM-AB-CM submodule. If you are using a balanced E1 port, for example, pins 2 and 3 must be jumpered on Jumper E2 and pins 1 and 2 must be jumpered on Jumpers JP1, JP2, and JP3. (Note: The acronym "N/C" in the tables below means "no connection.")

CSM-AB-CM Port Type Jumper Settings

	Jumper Settings						
Jumper Number:	E1	E2	E3	E4	JP1	JP2	JP3
Port Type							
T1	1&2	1&2	1&2	1&2	N/C	N/C	N/C
Balanced E1	N/C	2&3	N/C	N/C	1&2	1&2	1&2
Unbalanced E1	2&3	2&3	2&3	2&3	N/C	N/C	N/C

CSM-AB-CM Port Shield Jumper Settings

	Jumper Settings	
Jumper Number:	E5	E6
Shield Type		
T1	1&2	N/C
E1 Unbalanced	N/C	1&2

CSM-AB-IMA-T1/E1-8W

The CSM-AB-IMA-T1/E1-8W adapter board contains eight (8) T1 (DS1) or E1 ports using RJ-48C connectors. The T1 version of this adapter board is referred to as the CSM-AB-IMA-T1-8W; the E1 version is referred to as the CSM-AB-IMA-E1-8W. The CSM-AB-IMA-T1/E1-8W adapter board can transmit and receive up to four (4) IMA groups. You can display and configure IMA groups through commands contained in the IMA submenu. See Chapter 44, "Inverse Multiplexing over ATM (IMA)," for descriptions of these commands.

♦ Note ♦

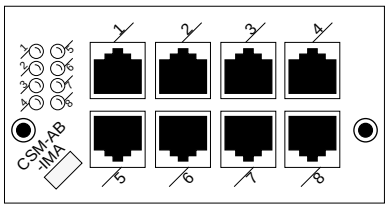
Groups cannot span multiple CSM-AB-IMA-T1/E1-8W adapter boards.

The CSM-AB-IMA-T1/E1-8W adapter board plugs into a Cell Switching Universal Module (CSM-U). The CSM-U contains three (3) adapter board slots in which you can install CSM-AB-IMA-T1/E1-8W and many other cell switching adapter boards including OC-3, DS3, E3, T1/E1, or T1/E1 with circuit emulation interfaces. All adapter boards support the cell switching matrix. The CSM-U and all of its associated adapter boards use the wide module format. Wide modules must be used in a wide chassis, such as the Omni-3wx, Omni-5wx, or Omni-9wx.

You must adjust jumpers on the E1 version of this adapter board to set the cable impedance (75 or 120 Ohm) of the connection correctly. These adapter boards include an integrated CSU/DSU to enable direct connection to a T1/E1 device, such as a PBX. See *CSM-AB-IMA-E1-8W Jumpers* on page 41-63 for more information on setting these jumper ports. See Appendix B, "Custom Cables," for more information on 75 Ohm cables for the CSM-AB-IMA-E1-8W submodule.

Port LEDs. Each port on this adapter board is assigned a labelled status LED. Each LED will be in one of four 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.
Yellow (Solid)	An error has occurred on the port (e.g., loss of signal, loss Link Out of Delay Synchronization, Red Alarm).



The CSM-AB-IMA-TI-8W/CSM-AB-IMA-EI-8W Adapter Board LEDs

CSM-AB-IMA-T1-8W/CSM-AB-IMA-E1-8W Technical Specifications	
Number of ports	8 T1 or E1
Connector Type	RJ-48C
Standards Supported	ANSI T1.102, T1.107, T1.231, and T1.646 ATM Forum af-phy-0086.000, *ATM Forum Inverse Multiplexing for ATM (IMA) Specification*, Version 1.0, July 1997; and af-phy-0086.001, *ATM Forum Inverse Multiplexing for ATM (IMA) Specification*, Version 1.1, March 1999 ATM Forum User-to-Network Interface 4.0, 3.1, and 3.0 ISO 2593 ITU-T G.703; G.704; G.804; G.826; I.321; I.432; and I.610, Section 7.1 RFC 1213 and 1406
Frame Formats	T1: Superframe, Extended Superframe E1: E1, E1-CRC
Line Type	T1: B8ZS E1: HDB3
Data Rates Supported	T1: 1.544 Mbps E1: 2.048 Mbps
Facility Datalink Protocol	ANSI T1.403 and AT&T 54016
Connections Supported	Physical Data Terminal Equipment (DTE) or Data Communication Equipment (DCE)
Cable Distance	T1/E1 (short haul): 200 meters T1/E1 (long haul): 1829 meters
Maximum Number of IMA Groups	4
Power Consumption	2.5 amps

The CSM-AB-IMA-T1/E1-8W submodule uses the same physical connections as standard E1 and T1 switching modules and adapter boards (e.g., the CSM-AB-T1-4W/CSM-AB-E1-4W).

♦ Note ♦

See Chapter 53, "Managing T1 and E1 Ports," for more information on T1 and E1 ports.

CSM-AB-IMA-E1-8W Jumpers

The E1 version of this submodule supports both twisted pair (120 Ohm) and coaxial (75 Ohm) cable types. In addition, some applications of the E1 submodule require that the Pins 7 and 8 of the ports be grounded. Therefore, the CSM-AB-IMA-E1-8W submodule provides jumpers to set the correct impedance and jumpers to ground the ports.

♦ Note ♦

For more detailed information on the types of cables to use with this submodule, see Appendix B, "Custom Cables."

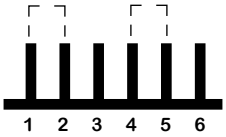
CSM-AB-IMA-E1-8W Impedance Jumpers

The CSM-AB-IMA-E1-8W submodule has eight jumpers (one for each port) to set the impedance level (see the table below). The jumpers are located on the side of the submodule opposite the ports. The CSM-AB-IMA-E1-8W submodule supports 75 Ohm and 120 Ohm (the default) impedance levels.

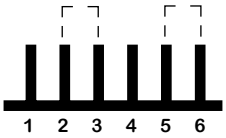
CSM-AB-IMA-E1-8W Impedance Jumper Numbers

Port Number	Jumper Number	Port Number	Jumper Number
1	J1	5	J11
2	J2	6	J12
3	J7	7	J13
4	J8	8	J14

As shown in the figure on the following page, you must connect two pairs of pins on each jumper. To set the port for coaxial cable (75 Ohm impedance), you must connect pins 1 and 2 to each other and pins 4 and 5 to each other. To set the port for twisted pair cable (120 Ohm impedance), you must connect pins 2 and 3 to each other and pins 5 and 6 to each other.



75 Ohm (Coaxial)



120 Ohm (Twisted Pair)
(Factory Default)

CSM-AB-IMA-E1-8W Jumper Settings

CSM-AB-IMA-E1-8W RJ-48 Grounding Jumpers

The CSM-AB-IMA-E1-8W submodule has eight jumpers (one for each port) that allow you to ground Pins 7 and 8 of each RJ-48C port. The jumpers are located on the top of the submodule and are identified in the table below. To ground a port, use a shunt to connect the two pins of the jumper.

CSM-AB-IMA-E1-8W Grounding Jumper Numbers

Port Number	Jumper Number	Port Number	Jumper Number
1	J5	5	J3
2	J4	6	J6
3	J18	7	J16
4	J15	8	J17