SA33-0358-01

IBM 8260 Nways Multiprotocol Switching Hub

ATM 155 Mbps Flexible Concentration Module Installation and User's Guide

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Note!

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Second Edition (February 1996)

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Industry Standards Reflected in This Product

The 8260 Nways ATM 155 Mbps Flexible Concentration (ATMflex) module complies with the the ATM User-Network Interface (UNI) Specification V3.0 and V3.1, ATM Forum.

The ATMflex module is designed according to the specifications of the following industry standards as understood and interpreted by IBM as of September 1994:

- RFC854 - TELNET protocol
- RFC1350 - Trivial File Transfer Protocol (TFTP)
- RFC1577 - Classical IP and ARP (Address Resolution Protocol) over ATM
- SNMP:
  - RFC1155 - Structure and Identification of Management Information (SMI) for TCP/IP based Internet.
  - RFC1156 - Management Information Base (MIB) for network management of TCP/IP based Internets (MIB-I)
  - RFC1157 - Simple Network Management Protocol (SNMP)
  - RFC1212 - Concise MIB definitions
  - RFC1213 - Management Information Base (MIB) for network management of TCP/IP based Internets (MIB-II)
  - RFC1215 - Convention for defining traps for use with SNMP
- ANSI SONET STS-3C (SONET lite)

The ATMflex single mode and multimode fiber daughter cards operate at a nominal wavelength of 1300nm, and the interface conforms to the ATM Forum for OC-3 Single Mode LANs.

The laser is a Class 1 Laser Product and complies with the following safety standards:

IEC 825-1: 1993 EN 60825-1: 1993
IEC 825-2: 1993 EN 60825-2: 1993

IEC 950: 1991 + Amdt 1: 1992 + Amdt 2: 1993
EN 60950: 1992 + Amdt 1: 1992 + Amdt 2: 1993

The compliance label on the ATMflex singlemode and multimode daughter cards is shown in Figure 1.

Figure 1. Class 1 Laser Label

This product complies with US regulations on lasers (CFR 21-J).

For more information, see the *IBM Telecommunication Products Safety Handbook*, GA33-0126.

The ATMflex UTP/FTP/STP daughter card runs on cabling according to rules established in EIA/TIA-568A Category 5 Commercial Building Telecommunications Cabling Standard and ISO/IEC 11801, for horizontal cabling class D.

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Read the instructions for correct handling.

Korean Communications Statement

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Safety

This product complies with IBM* safety standards.

A combination of novel optical subassembly design and careful control of the characteristics of the laser chip creates a laser emission that complies with Class 1 specifications. As a result, the laser transmitter provided on the ATMflex singlemode and multimode daughter cards are eye-safe.

For more information, see the *IBM Telecommunication Products Safety Handbook*, GA33-0126.

How to Use This Guide

This guide presents information on how to install and configure the Nways* 8260 ATM 155 Mbps Flexible (ATMflex) module in the IBM 8260 Nways Multiprotocol Switching Hub. It describes how to:

- Plan and set up valid links in an 8260 based ATM subnetwork using the ATMflex module.
- Diagnose and solve problems associated with the operation of the ATMflex module.

Who Should Use This Guide

This guide is intended for the following people at your site:

- ATM network administrator
- ATM network operator
- Hardware installer

Contents of This Guide

This guide contains five chapters and two appendixes:

Chapter 1, "Overview" on page 1 gives an overview of the main functions of the ATMflex module, the daughter cards used with the module, and the ATM interfaces used by ATMflex ports to interconnect user devices in an ATM campus network.

Chapter 2, "Setting Up an ATM Network Using Fiber" on page 11 describes how to set up an ATM campus network by laying out valid ATMflex port-to-port and port-to-device fiber cable connections. It also describes how to maintain the ATM connections you create.

Chapter 3, "UTP/FTP/STP Cabling Information" on page 27 describes the cabling configuration and types of cables and connections used by the FTP/STP/UTP ATMflex daughter card.

Chapter 4, "Installation and Configuration" on page 33 describes how to install and configure the ATMflex module in an 8260 hub.

Chapter 5, "Troubleshooting" on page 53 describes how to diagnose and solve problems associated with the operation of the ATMflex module.

Appendix A, "Technical Specifications" on page 63 describes the specifications for the ATMflex module, including the optical specifications for ATMflex SC transmitters and receivers.

Appendix B, "ATM Components" on page 69 lists the part numbers for the ATM components that you can order for use with the ATMflex module.

"Glossary" on page 71 describes the terms and abbreviations used in this manual.

"Index" on page 83 lists the concepts, terms, and tasks described in this manual and the page numbers on which you can find the information.

Related Information

To understand the information presented in this guide, refer to:

- *IBM 8260 Multiprotocol Intelligent Switching Hub Product Description* (GA33-0315) for more information features and characteristics of the IBM 8260 Nways Multiprotocol Switching hub
- *IBM 8250 Multiprotocol Hub, IBM 8260 Multiprotocol Intelligent Switching Hub, IBM 8285 Nways ATM Workgroup Switch, Planning and Site Preparation Guide* (GA33-0285) for more information regarding calbing and connectors.
- *IBM 8260 Nways Multiprotocol Switching Hub, IBM 8285 Nways ATM Workgroup Switch, ATM Command Reference Guide* (SA33-0385) for more information regarding ATM commands.
- Publications listed in the “Bibliography” on page 81 for information on the principles of asynchronous transfer mode (ATM) technology
- ATM Forum UNI Specification V3.0 and V3.1.

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Conventions Used in This Guide

The following text conventions are used in this guide:

Text Convention	Meaning	Example
Bold	Text emphasis	**Selective backpressure** temporarily stops one virtual connection. **Global backpressure** temporarily stops an ATM link.
Italics	Special term	This is known as a *hot swap*.
	Document titles	Refer to the *ATM User-Network Interface Specification - Version 3.0* for more information.
`Monospace`	Command syntax (parameters and variables)	`SET PORT slot.port ENABLE`
	User input (including carriage return)	To display detailed information, enter the following command: `show port 4.2 verbose [ENTER]`

	System messages and screen displays	`Port display for 8260 ATM 155 Mbps Module:`
		`Port Type Mode Status`
		`---`
		`4.02 NNI enabled UP-OKAY`

Chapter 1. Overview

This chapter presents an overview of the 8260 Nways ATM 155 Mbps Flexible Concentration (ATMflex) module. It describes the main functions of the ATMflex module, the daughter cards used with the module, and how the module operates as part of the ATM subsystem in the IBM 8260 Nways Multiprotocol Switching hub.

ATMflex Module in the 8260 Hub

The ATMflex module is a single-slot, 2-port 155 Mbps concentrator module that functions as part of the IBM 8260 Nways Multiprotocol Switching hub with ATM backplane. It allows you to "mix and match" different types of daughter cards according to your ATM networking needs.

ATMflex modules can be used in any of the following ways:

- To send and receive data from an ATM subsystem in another ATM 8260 hub
- To attach high capacity workstations and servers that function in ATM mode and support the SONET lite (LAN) and SDH standards

ATMflex modules interface to the 8260 hub by means of the ATM Control Point and Switch (A-CPSW) module. ATMflex modules process ATM cells of data by:

- Checking their validity
- Accessing the switching tables to locate the destination module
- Preparing the internal ATM format required by the A-CPSW module
- Sending the cells to the A-CPSW module

ATMflex modules can be used in any slot in the 8260 hub, except for slots 9, 10, and (for A17 models) 11. These slots are reserved for A-CPSW modules. In A17 models, although slot 12 is also reserved, you can insert an ATMflex module in slot 12 if no A-CPSW module is installed in slot 11. Like other ATM media modules, such as the A4-FB100 module, the ATMflex module can be inserted in the hub while the hub is operating without disturbing data traffic on other modules. Before removing the module from the hub, however, you must first isolate it by using the SET MODULE command.

For more information on how to install and change modules in the 8260 hub, see the *IBM 8260 Multiprotocol Intelligent Switching Hub Installation Guide*, SA33-0251.

ATMflex Functions

The ATMflex module has the following characteristics:

- Two ports operating with up to 155 Mbps to connect to stations, servers, and other hubs. Each port may connect to:
  - An ATM or multimedia workstation that requires a high bit rate
  - A UNI, NNI, or SSI device using a supported interface.
- Motherboard and up to two daughter cards for ATMflex port-to-port and ATMflex port-to-device connections.
- Physical interface: optical fiber or copper cable, depending on the type of daughter card used.
- ATMflex connections: port-to-port, hub-to-server, and hub-to-workstation having the maximum distances shown in Table 1.
- Up to fourteen ATMflex modules can be used in the 17-slot 8260 hub at the same time (8 in the 10-slot 8260 hub).

Table 1. Maximum Distances for Valid ATMflex Connections

Cable Type	**ATMflex Connection**		
	Port-to-Port	**Hub-to-Server**	**Hub-to-Workstation**
Multimode Fiber	2.2 km (1.36 miles)	2 km (1.24 miles)	2 km (1.24 miles)
Singlemode Fiber	20 km (12.4 miles)	20 km (12.4 miles)	20 km (12.4 miles)
Copper UTP-5 Category 5, Class D 100 ohm	100 m (328 ft)	100 m (328 ft)	100 m (328 ft)
Copper FTP/SFTP Category 5, Class D 100/120 ohm	100 m (328 ft)	100 m (328 ft)	100 m (328 ft)
Copper STP IBM cabling 150 ohm	150 m (493 ft)	150 m (493 ft)	150 m (493 ft)

ATMflex Daughter Cards

The ATMflex module allows you to use different daughter cards to mix and match different media types in an 8260 based ATM subnetwork. By taking advantage of this flexibility, you can create customized mixed-media solutions for your individual network needs.

The ATMflex module supports the following daughter cards:

- FTP/STP/UTP (TP)
- Multimode fiber (MF)
- Single mode fiber (SF)

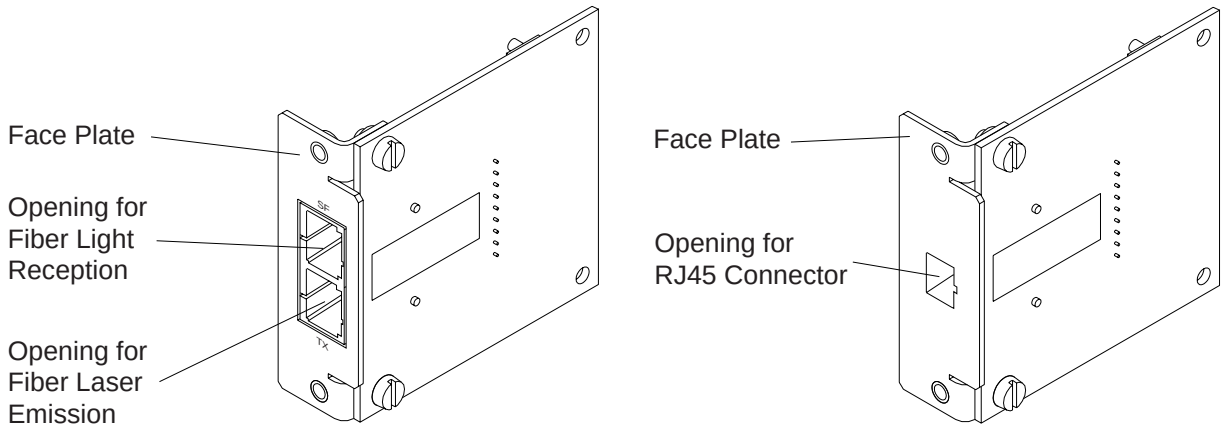


Figure 2. Face Plates of the ATMflex Daughter Cards

Interfaces Supported

The ATMflex module supports the following interfaces:

- User-to-network (UNI)
- Network-to-network (NNI)
- Switch-to-switch (SSI)

The UNI and NNI interfaces supported by the ATMflex module are defined in the following documents:

- ATM Forum UNI Specification V3.0 and V3.1
- ITU (ex-CCITT) SG13 as defined in the following standards:
  - I.413 (B_ISDN User-Network Interface)
  - I.432 (Physical Layer)
  - Q.2931 (Signaling)

The SSI is a form of the NNI interface developed for use in IBM 8260-based ATM subnetworks.

ATM Traffic Management Using Reserved Bandwidth

The ATMflex module provides Reserved Bandwidth (RB) service (specified QOS class 1 in the ATM Forum UNI Specification V3.0).

The traffic of the RB service is controlled at call setup by the Connection Admission Control (CAC) mechanism. Resource allocation is performed according to the Peak Cell Rate (PCR) negotiated in the traffic contract between the user and the network. PCR allocation provides a class A circuit emulation service.

For RB traffic, resource allocation is performed according to the PCR. The maximum bandwidth that can be reserved is eighty-five per cent of the total throughput capacity.

RB cells are immediately transmitted as long as the total aggregate throughput from the A-CPSW module to a given ATMflex port does not exceed 155 Mbps (approximate value).

Based on these total aggregate throughput capacities, bandwidth for ATMflex ports set with SSI interfaces (on the same module) is reserved as follows:

- If a single port is configured for SSI, up to 131 Mbps (85% of 155 Mbps) is reserved for ATM traffic.
- If the second port is also configured as SSI, up to 90 Mbps is reserved for each port; the amount of reserved bandwidth for the first SSI port is automatically scaled down to 90 Mbps. If the PCR on the first SSI port exceeds 90 Mbps, the command setting for the second SSI port is rejected.

Note: If both ports of the ATMflex are used for SSI, the bandwidth **must** be specified.

Using ATMflex for ATM Campus Networking

The ATMflex module can be used as a link to build an ATM campus network by:

- Interconnecting 8260 based ATM hubs in the same or different ATM subnetworks
- Allowing workstations, servers, and other ATM devices to communicate across the network

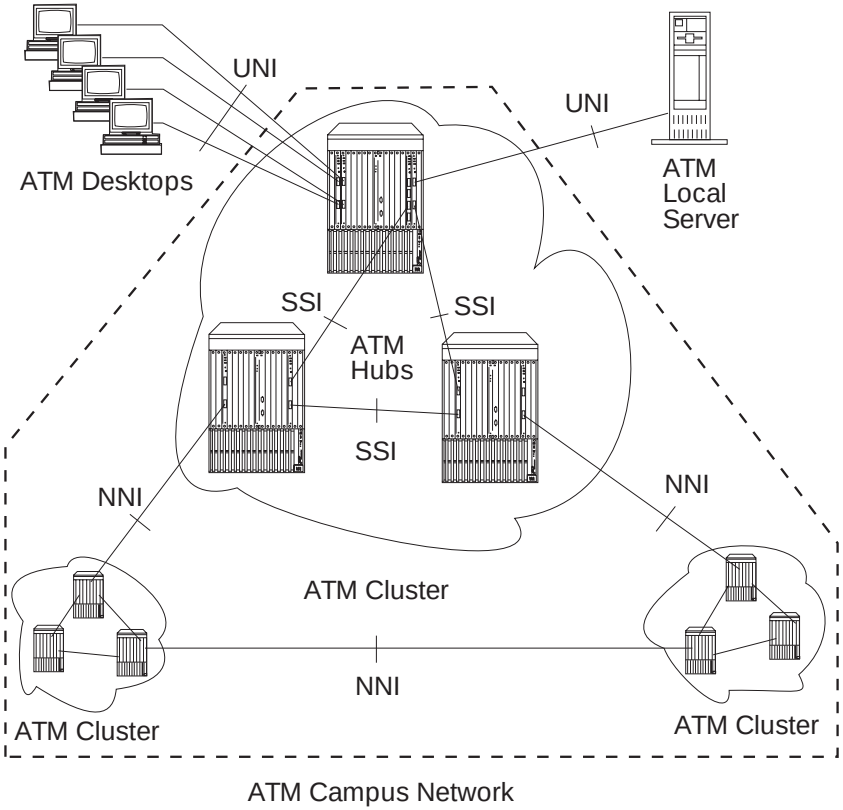


Figure 3. Using the ATMflex Module in ATM Campus Networking

ATMflex Front Panel

ATM connections are made through the ATMflex module by means of the ports on its front panel and its backplane interfaces. The ATMflex front panel is shown in Figure 4 on page 9. The meaning of each ATMflex LED is shown in Table 2 on page 10.

By pressing the Module Reset button, you interrupt and reset the operation of the ATMflex module. All ATM data traffic and connections that are being transmitted are stopped. The change in status of the ATMflex module (from normal operation to reset status) is reported to the A-CPSW module.

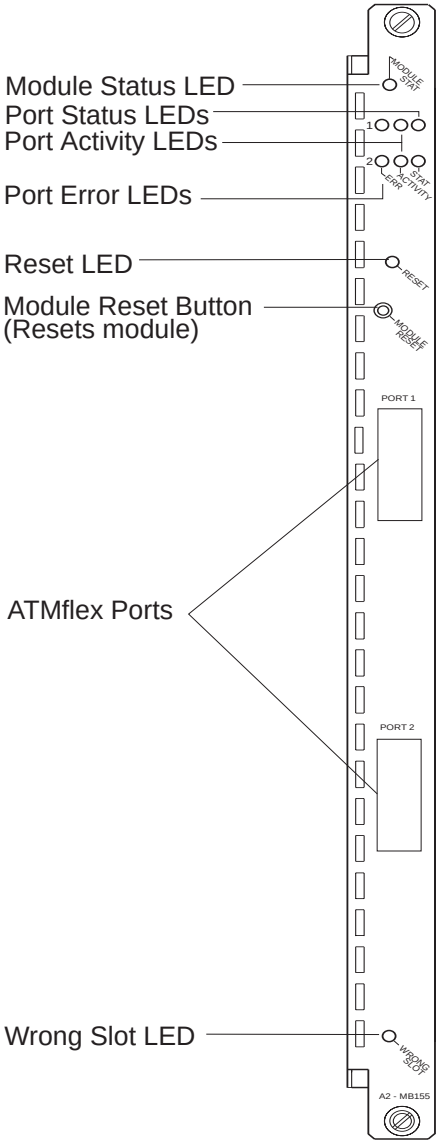


Figure 4. ATMflex Module Front Panel

Table 2. Meaning of the ATMflex LEDs

LED Name	Color	State	Meaning
Module Status (MODULE STAT)	Green	OFF	Either no power is reaching the ATMflex module or the module is inoperational (isolated).
		ON	Normal operation (connected).
Port Error (ERR)	Yellow	OFF	Normal operation.
		ON	Either no signal is detected or an error condition is detected on the port.
Port Activity (ACTIVITY)	Yellow	OFF	No ATM data traffic is being transmitted.
		ON	ATM cells are being transmitted.
Port Status (STAT)	Green	OFF	Port is disabled.
		ON	Port is enabled.
		Blinking	Port is enabled, but either no cable is connected or the cable is damaged.
Reset	Yellow	OFF	Normal operation. Module is not being reset.
		ON	Module is being reset; data traffic is interrupted.
		Blinking	ATMflex module is not receiving its clock because no A-CPSW module has been installed.
Wrong Slot	Yellow	OFF	Normal operation. ATMflex module is installed in the correct slot (1-8 on A10 8260 models, 1-8 and 12-17 on A17 models).
		ON	ATMflex module is installed in an incorrect slot and no power is reaching the module.

Chapter 2. Setting Up an ATM Network Using Fiber

This chapter describes the steps necessary for planning and setting up an ATM switch based ATM network:

- Choosing the type of fiber cable to be used and understanding basic principles of optical power transmission (see “Before You Start: General Guidelines” on page 12)
- Laying out valid ATMflex links (ATMflex port-to-port and ATMflex port-to-device connections) by calculating the optical power budget and computing the optical power losses for each link (see “Planning Cabling Distances in a Fiber Network” on page 13)
- Maintaining the valid ATM connections that you create (see “Maintaining ATM Fiber Connections” on page 25)

In an ATM network, the ATMflex module is used to connect ATM devices (workstations, servers, concentrators, bridges, and so on) and other 8260-based ATM hubs. For information on the cabling and connectors required, see Appendix A, “Technical Specifications” on page 63.

Before You Start: General Guidelines

Some general guidelines to follow when planning and setting up an ATM network **using fiber as the backbone medium** are as follows:

- When you use multimode fiber, IBM recommends that you use 62.5 micron fiber that conforms with IEEE 10BASE-F standards.
- When you use singlemode fiber, IBM recommends that you use 9 micron fiber that conforms with IEEE 10BASE-F standards.
- Carefully note all sources of optical power loss, such as connectors, splices, patch panels, and type of cable used.
- Calculate the total power loss in each ATM fiber link and verify that the distance between the two ATMflex ports or between the ATMflex port and an ATM user device does not exceed the optical power budget.
- The power loss you calculate is valid for an ATM connection between two ATMflex ports or an ATMflex port and an ATM user device. **Each ATMflex port regenerates the optical signal at full strength as it was originally transmitted from the source end system in the connection**. Therefore, the difference between the total power loss and the optical power budget should be re-calculated at each ATMflex port in the end-to-end connection.

Planning Cabling Distances in a Fiber Network

This section describes how to plan the cabling distance between two ATMflex ports (or between an ATMflex port and a user device) in a fiber network. To ensure that an ATMflex link will be valid for data transmission, collect the following information:

- Type and length of fiber cable
- Type and number of connectors used
- Type and number of splices used
- Type and number of patch panels used
- Number of jumper cables used

Once you have the necessary information, you can plan the cabling distance between ATM ports by following these steps:

1. Determine the optical power budget for the ATMflex port and cable size using Table 3 and Table 4 on page 15.
2. Verify that the overall power loss in the ATMflex link due to connectors, splices, fiber cable type, patch panels, and jumper cables is less than the optical power budget.

Each step is described in the following sections.

Note: As shown in Table 1 on page 3, when you use fiber cable, the (conservative) recommended distances between ATMflex ports and transceivers are:

Multimode fiber 2 kilometers (1.24 miles)
Singlemode fiber 20 kilometers (12.4 miles)

If the distance is greater than two kilometers (for multimode) or twenty kilometers (for singlemode), you must carefully calculate the total power loss across the link to make sure that it does not exceed the total power budget.

Optical Power Budget

When validating cabling distances in ATMflex links, network planners and installers should calculate for maximum optical power losses in each end-to-end connection. Table 3 and Table 4 on page 15 do this for you by taking the minimum amount of power that can be transmitted and the maximum amount of power that can be received for different types of fiber cable.

The optical power budget for the ATMflex port-to-port or port-to-device connection is shown in the column on the far right-hand side of each table. By not exceeding this value, you can ensure the integrity of the ATM connections you create.

The Optical Power Budget value shows the amount of optical power left to compensate for power losses from connectors, splices, patch panels, and so on (see the following sections) in each ATMflex link of an ATM connection. **In order for an ATMflex link to transmit ATM data effectively, the optical power budget must be greater than the total power loss**. See "Calculating Power Loss in an ATM Connection" on page 21 for an example.

When taking the optical power budget for an ATM link between an ATMflex port and an end user device, be sure to use the values specified in the *ATM User-Network Interface (UNI) Specification V3.0*, ATM Forum. These values are shown in Table 3 on page 15.

Table 3. Optical Power Budget for ATMflex Port-to-Device Connections (ATM Forum V3.0)

Fiber Cable: Type and Size	**Minimum Transmitted Power**	**Maximum Received Power**	**Optical Power Budget**	**Maximum Link Distance**
Multimode 50/125 micron NA 0.20	-21 dB	-30 dB	9 dB	2 km (1.24 miles)
Multimode 62.5/125 micron NA 0.275	-20 dB	-29 dB	9 dB	2 km (1.24 miles)
Singlemode 9/125 micron	—	—	—	20 km (12.4 miles)

Table 4. Optical Power Budget for ATMflex Port-to-Port Connections

Fiber Cable: Type and Size	**Minimum Transmitted Power**	**Maximum Received Power**	**Optical Power Budget**	**Maximum Link Distance**
Multimode 50/125 micron NA 0.20	-22.5 dB	-30 dB	7.5 dB	2 km (1.24 miles)
Multimode 62.5/125 micron NA 0.275	-19 dB	-30 dB	11 dB	2.2 km (1.36 miles)
Singlemode 9/125 micron	-15 dB	-32.5 dB	17.5 dB	20 km (12.4 miles)

Optical Power Loss Through Connectors

When calculating optical power loss in ATM connections, you must take into account the number and types of connectors used. In your calculation, use the average power loss for connectors with physical and non-physical contacts as shown in Table 5.

IBM recommends that high-quality, low-loss connectors be used in your ATM connections.

Table 5. Optical Power Loss per Connector

Connector Type	Cable Size (microns)	Average Loss (dB)
Physical contact	62.5 to 62.5	0.4
	50 to 50	0.4
	100 to 100	0.4
	62.5 to 50	4.8
	50 to 62.5	0.0
	62.5 to 100	0.0
	100 to 62.5	4.72
	9 to 9	0.35
Non-physical contact	62.5 to 62.5	0.7
	50 to 50	0.7
	100 to 100	0.7
	62.5 to 50	5.0
	50 to 62.5	0.3
	62.5 to 100	0.3
	100 to 62.5	4.9

Optical Power Loss Through Splicing

If a fiber cable breaks, it is usually repaired by splicing the broken ends together. Two types of splice are normally used: mechanical and fusion. A fusion splice results in lower power loss, but requires expensive equipment. A mechanical splice is simple to perform on site when fusion splicing is not available.

If you repair a broken cable using either type of splice, make sure that the power loss in the cable does not exceed the value for "Maximum Received Power" in Table 3 and Table 4 on page 15. Table 6 shows the average power loss for each splice type according to cable size.

When calculating the total power loss for ATM connections in your network, you should use the Maximum Loss values whenever possible as a "worst case" scenario. If a Maximum Loss value is not given for a certain splice type and cable size, use the Average Loss value.

Table 6. Optical Power Loss per Splice

Splice Type	Cable Size (microns)	Maximum Loss (dB)	Average Loss (dB)
Mechanical	62.5 to 62.5	—	0.15
	50 to 50	—	0.15
	100 to 100	—	0.15
	9 to 9	—	0.15
Fusion	62.5 to 62.5	1.0	0.4
	50 to 50	1.0	0.4
	100 to 100	1.0	0.4
	9 to 9	1.0	0.4

Optical Power Loss by Fiber Cable Type

Although fiber optic cable can carry light signals over long distances, optical power loss can reduce this capability. Table 7 shows the ranges and typical amounts of power loss for different types of fiber cables. To determine the power loss in your fiber cable, refer to the loss characteristic established by the cable manufacturer.

When calculating the total power loss for an ATM connection, be sure to use the highest value in the range given in the Power Loss column. In this way, your calculation covers a "worst case" scenario.

Table 7. Optical Power Loss by Cable Type

Type of Fiber Cable	Power Loss (dB/km)	Typical Loss (dB/km)
50/125 micron @ 1300 nM	0.5 to 2.5	1.5
62.5/125 micron @ 1300 nM	0.5 to 2	1.5
85/125 micron @ 1300 nM	3 to 6	4.0
100/140 micron @ 1300 nM	3 to 6	5.0
9/125 micron @ 1300 nM	—	0.5

Optical Power Loss Through Patch Panels

In fiber optic networks, patch panels are often used to allow for network expansion and topological changes. In an ATM network, a patch panel consists of a pair of female-to-female bulkhead barrel connectors which connect to the male fiber connectors from ATMflex ports.

The optical power loss through a patch panel includes the loss resulting from the two connectors and the bulkhead. Table 8 shows the ranges and typical amounts of power loss for different types of patch panels.

When calculating the total power loss for an ATM connection, be sure to use the highest value in the range given in the Power Loss column. In this way, your calculation covers a "worst case" scenario.

Table 8. Optical Power Loss per Patch Panel

Type of Patch Panel	Power Loss	Typical Loss
SC to MIC	0.1 to 1.0 dB	0.6 dB
ST to SC	0.1 to 1.0 dB	0.6 dB
SC to SC	0.1 to 1.0 dB	0.6 dB

Optical Power Loss Through Jumper Cables

When 8260 hubs are installed in patch panel racks, IBM jumper cables are often used to connect an ATMflex port in the hub to the patch panel. The use of jumper cables in this type of configuration is recommended in your ATM network because **each ATMflex port regenerates the optical signal at full strength as it was originally transmitted from the source end system in the connection**. For more information on IBM ATM jumper cables, see Appendix B, “ATM Components” on page 69.

The total power loss at each IBM jumper cables is shown in Table 9. Note that this value includes the combined power loss from the two connectors (ATMflex and patch panel) and the length of the jumper cable itself.

Table 9. Optical Power Loss per IBM Jumper Cable

Cable Type	Total Loss	By Component
Singlemode	0.75 dB	0.7 (0.35 × 2 connectors) + 0.05 (cable loss for 100 meters)
Multimode	1.5 dB	1.4 (0.7 × 2 connectors) + 0.1 (cable loss for 100 meters)

Calculating Power Loss in an ATM Connection

This section contains an example of how to calculate power loss in an ATM ATMflex connection; that is, between two ATMflex ports and between the ATMflex port and ATM device on each end of the connection. The data used to calculate the distances is taken from the tables in the preceding sections:

- "Optical Power Budget" on page 14
- "Optical Power Loss Through Connectors" on page 16
- "Optical Power Loss Through Splicing" on page 17
- "Optical Power Loss by Fiber Cable Type" on page 18
- "Optical Power Loss Through Patch Panels" on page 19

In the example shown in Figure 5, two ATM desktops communicate across an ATM connection using the following optical fiber components:

- ATMflex modules for multimode fiber
- 62.5/125 fiber cable
- 50-meter and 150-meter cables to connect the desktops to the wall sockets
- Physical and non-physical contacts in the wall sockets
- 100-meter and 250-meter cables to connect the wall sockets to the patch panels
- Two jumper cables to connect each patch panel to an ATMflex port in the 8260 ATM hubs
- Two other jumper cables to connect another ATMflex port in each hub to the patch panels
- A 1.8-kilometer (1.12-mile) cable with a mechanical splice to connect the two patch panels

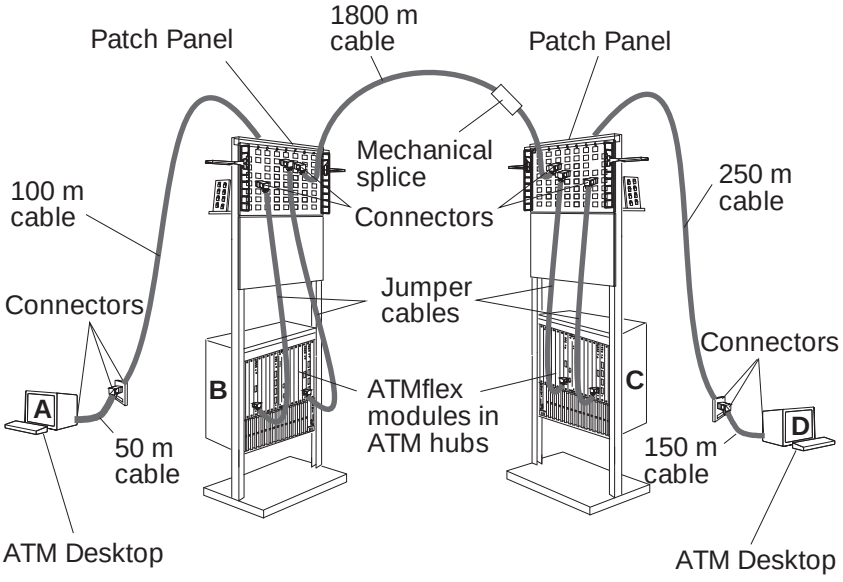


Figure 5. ATMflex Links in an ATM Connection Between Two Desktops

In Figure 5, the ATM multimode fiber connection between Desktop A and Desktop D consists of three separate ATMflex links:

- Desktop A to the ATMflex port in Hub B
- ATMflex port in Hub B to ATMflex port in Hub C
- ATMflex port in Hub C to Desktop D

To ensure the validity of the complete ATM connection (Desktop A to Desktop D), it is necessary to perform three separate calculations to verify the validity of each link. The power losses for the individual components in each link are shown in Table 10 on page 23. The number of the table from which each power loss value comes is shown in the Reference column.

Table 10. Power Loss for ATMflex Links (by Component)

ATMflex Link	Component	Power Loss (dB)	Reference
Desktop A to Hub B	Cable connector (to ATM desktop)	0.7	Table 5
	50-meter cable	0.1 ("worst case")	Table 7
	Cable connector (to wall socket)	0.7	Table 5
	Wall socket (physical contact)	0.4	Table 5
	Wall socket (non-physical contact in wall)	0.7	Table 5
	100-meter cable (in wall)	0.2 ("worst case")	Table 7
	Cable connector (to patch panel)	0.7	Table 5
	Patch panel	1.0	Table 8
	Jumper cable (from patch panel to hub B)	1.5	Table 9
Hub B to Hub C	Jumper cable (from hub B to patch panel)	1.5	Table 9
	Patch panel	1.0	Table 8
	Cable connector (to one patch panel)	0.7	Table 5
	1.8-kilometer cable (between buildings)	3.5 ("worst case")	Table 7
	Mechanical splice	0.15	Table 6
	Cable connector (to other patch panel)	0.7	Table 5
	Patch panel	1.0	Table 8
	Jumper cable (from patch panel to hub C)	1.5	Table 9
Hub C to Desktop D	Jumper cable (from hub C to patch panel)	1.5	Table 9
	Patch panel	1.0	Table 8
	Cable connector (to patch panel)	0.7	Table 5
	250-meter cable (in wall)	0.5 ("worst case")	Table 7
	Wall socket (non-physical contact in wall)	0.7	Table 5
	Wall socket (physical contact)	0.4	Table 5
	Cable connector (to wall socket)	0.7	Table 5
	150-meter cable	0.3 ("worst case")	Table 7
	Cable connector (to ATM desktop)	0.7	Table 5

Verifying ATM Fiber Connections

To verify that a fiber connection is valid for ATM data transmission, you add up the power losses for the components in each ATMflex link and compare the sums with the optical power budget for each link. The results for the links in Figure 5 on page 21 are shown in Table 11.

Table 11. Power Loss Compared to Power Budget for Each ATMflex Link

ATMflex Link	Total Power Loss	Optical Power Budget	Reference
Desktop A to ATMflex port in Hub B	6.0 dB	9.0 dB	Table 3
ATMflex port in Hub B to ATMflex port in Hub C	10.15 dB	11.0 dB	Table 4
ATMflex port in Hub C to Desktop D	6.5 dB	9.0 dB	Table 3

Since the total power losses are less than the optical power budget allotted for each ATMflex link, the links are valid and the ATM desktop-to-desktop fiber connection can be successfully made.

Maintaining ATM Fiber Connections

After calculating the optical power loss for ATMflex links and allowing for "worst case" scenarios, the data transmission in the ATM connections in your network should be reliable. To ensure that the optical power transmission does not exceed the optical power budget and disrupt the quality of data transmission for your current fiber configuration, IBM recommends that you:

- Do not install additional links (for example, patch panels or jumper cables) in each connection.
- Maintain the homogeneity of ATM links by using the same category of fiber cable (for example, 62.5/125) in each link of an ATM connection.
- When the margin between the total power loss on a connection and the optical power budget is less than or equal to 1dB (≥ **1dB**), check with your vendor to make sure you are using the power loss value set by the manufacturer for your cable type and recalculate the total power loss including the variance value for each component.

  The variance value of each optical fiber component (splices, connectors, cables, and so on) is shown in the tables in Appendix A of the *IBM 8250 Multiprotocol Switching Hub, IBM 8260 Multiprotocol Intelligent Switching Hub, IBM 8285 Nways ATM Workgroup Switch, Planning and Site Preparation Guide*, GA33-0285.

Chapter 3. UTP/FTP/STP Cabling Information

This chapter describes the cables and connectors for use with the ATMflex UTP/FTP/STP daughter card

This section details the supported cables and maximum allowable distances for attaching the ATMflex UTP/FTP/STP daughter card. This daughter card runs on cabling following rules established in EIA/TIA-568A Category 5 Commercial Building Telecommunications Cabling Standard and ISO/IEC 11801, for horizontal cabling Class D.

Table 12. UTP/FTP/STP Cabling Specifications

Cable Type	**Maximum Allowable Distance (m)**
100 ohm UTP Category 5 / Class D	100 (330 ft)
100 ohm FTP/SFTP Category 5 / Class D	100 (330 ft)
120 ohm FTP/SFTP Category 5 / Class D	100 (330 ft)
150 ohm STP IBM cabling	150 (493 ft)

UTP/FTP/STP Cables

The following table details the accepted UTP/FTP/STP cables for the ATMflex daughter card.

Table 13. UTP/FTP/STP Cabling Details

Cable Type	Impedance	Category	Trunk Attenuation @ 100 MHz	Patch Attenuation @ 100 MHz	RFI Class
UTP-5	100 ohm	5 / Class D	22db MAX / 100m	33db MAX / 100m	A
FTP/SFTP	100 ohm	5 / Class D	22db MAX / 100m	33db MAX / 100m	B
FTP/SFTP	120 ohm	5 / Class D	17db MAX / 100m	25db MAX / 100m	B
STP	150 ohm		IBM type 1/1A 12.3db MAX / 100m	IBM type 6/6A 18.4db MAX / 100m	B

Legend:

UTP-5 Unshielded Twisted Pair (Category 5)

FTP Foiled Twisted Pair

SFTP Screened and Foiled Twisted Pair

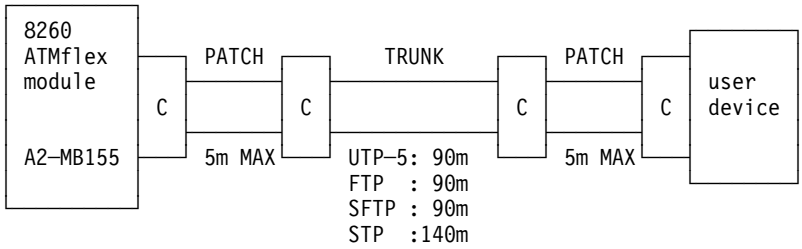
STP Shielded Twisted Pair

TRUNK rigid cable

PATCH flexible cable

For more information, refer to the *IBM 8250 Multiprotocol Intelligent Hub, IBM 8260 Multiprotocol Intelligent Switching Hub, IBM 8285 Nways ATM Workgroup Switch, Planning and Site Preparation Guide*, GA33-0285.

Cabling Configuration



C = Connection Points

Note.The total attentuation for cabling links (including cables and connectors) is 23.6dB maximum.

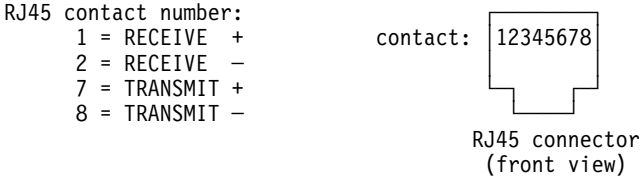
Connectors

Connection to the ATMflex FTP/STP/UTP daughter card is achieved is two ways:

- via a shielded RJ45 connector for FTP/SFTP/UTP
- via an IBM cable that has an RJ45 connector at one end and an IBM data connector at the other (part number: 42H0544) for STP.

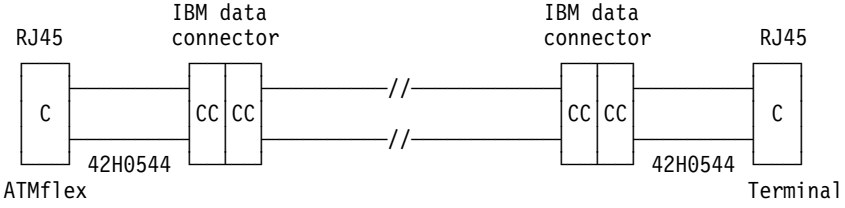
UTP/FTP/SFTP: The wiring must be such that at the user device level (terminal), the TRANSMIT contacts correspond with the RECEIVE pins of the ATMflex connector:

Terminal end	ATMflex end
TRANSMIT +	RECEIVE +
TRANSMIT -	RECEIVE -
RECEIVE +	TRANSMIT +
RECEIVE -	TRANSMIT -

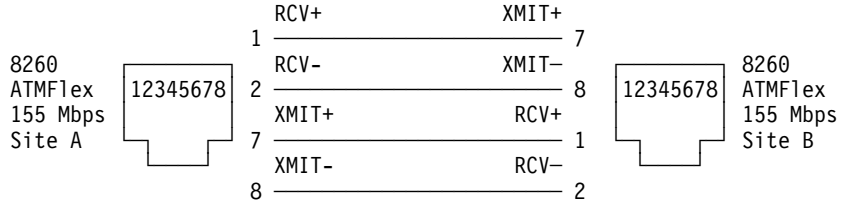


This is achieved by using a cable that has corresponding connections at either end (that is, pin1 to pin1, pin2 to pin2 etc.).

STP: For a connection via Token-Ring cabling using IBM data connectors, it is recommended to use the IBM cable (part number 42H0544) at both sites. This cable has an RJ45 connector at one end, and an IBM data connector at the other. This cable provides the required pin connections; 1 to 1, 2 to 2, 7 to 7, and 8 to 8 at RJ45 levels.



Cable and Connections for SSI Link: The SSI connection between two 8260 ATMflex modules needs to carefully respect the following cable wiring:



For UTP, use wire swapping cable Part Number 51H3971.

Chapter 4. Installation and Configuration

This chapter describes how to unpack, install, and connect ATM devices to the ATMflex module in an IBM 8260 Nways Multiprotocol Switching hub. It also describes the commands necessary to:

- Configure the ATMflex module for use in an ATM subnetwork.
- Configure ATM clusters and subnetworks to allow them to communicate.

Please read the precautions in “Before You Unpack the Module” before you unpack the module.

Before You Unpack the Module

Take the following precautions before unpacking the ATMflex motherboard (A2-MB155) and daughter cards:

- Do not remove the ATMflex motherboard and daughter cards from their anti-static shielding bags until you are ready to assemble them. This avoids the possibility of having electrostatic discharge damage static-sensitive devices on the board and the cards.
- Always handle the motherboard and daughter cards by the faceplate.
- Always use a foot strap and grounded mat or wear a grounded static discharge wrist strap whenever you inspect or assemble the motherboard and daughter cards. Or else, be sure to touch a grounded rack or another source of ground **before** handling them.

Unpacking the Module

When you receive the ATMflex module, the shipping group consists of a motherboard and possibly one or two daughter cards, each with four screws for attachment to the motherboard.

To unpack the ATMflex motherboard and daughter cards, follow these steps:

1. Verify that the ATMflex motherboard and daughter cards are the correct models by matching the model number listed on the side of their shipping cartons to the model numbers you ordered.
2. Remove the motherboard and daughter cards from their shipping cartons.
3. Remove the motherboard and daughter cards from their anti-static bags and inspect them for damage. Always handle them by the faceplate being careful not to touch the internal components.

   If either the motherboard or a daughter card appears to be damaged, put it back in the anti-static bag, and put the bag back into the shipping carton. Then contact your local IBM dealer.

IBM suggests that you keep the shipping carton and the anti-static shielding bags in which the ATMflex motherboard and daughter cards were delivered in case you later want to repackage them for storage or shipment.

IBM also suggests that you record the serial numbers of the ATMflex motherboard and daughter cards, and other information about the modules in your 8260 hub in the Slot Usage chart in the binder of the *IBM 8260 Multiprotocol Intelligent Switching Hub Reference Library* (Part Number 59G0022) that is shipped with the 8260 hub.

Be sure to keep the four screws that come with each daughter card as you will need them to install the cards on the motherboard.

Assembling the Motherboard and Daughter Cards

Before installing the ATMflex module, you must first assemble it by installing the daughter cards on the motherboard. To assemble the ATMflex module, follow these steps:

1. If necessary, remove the two screws and faceplate that cover the ATMflex port on the front panel of the motherboard (see Figure 6 on page 36). Put the screws and faceplate in a safe place.
2. Hold the daughter card so that its connector and screw holes are aligned over the connector and small metal posts on the motherboard. Then gently push the card forward (so that its port fits into the opening on the motherboard front panel) and down until you hear it click into the motherboard connector.
3. Place two of the screws that come with the daughter card into the metal posts and tighten them with a screwdriver.
4. Place the remaining two screws into their holes on the front panel and tighten them with a screwdriver. This secures the daughter card on the motherboard.

Note: If you replace a daughter card after configuring the ATMflex module (see "Configuration" on page 43) and re-insert the module in the hub, the new card is automatically configured with the settings of the previous card.

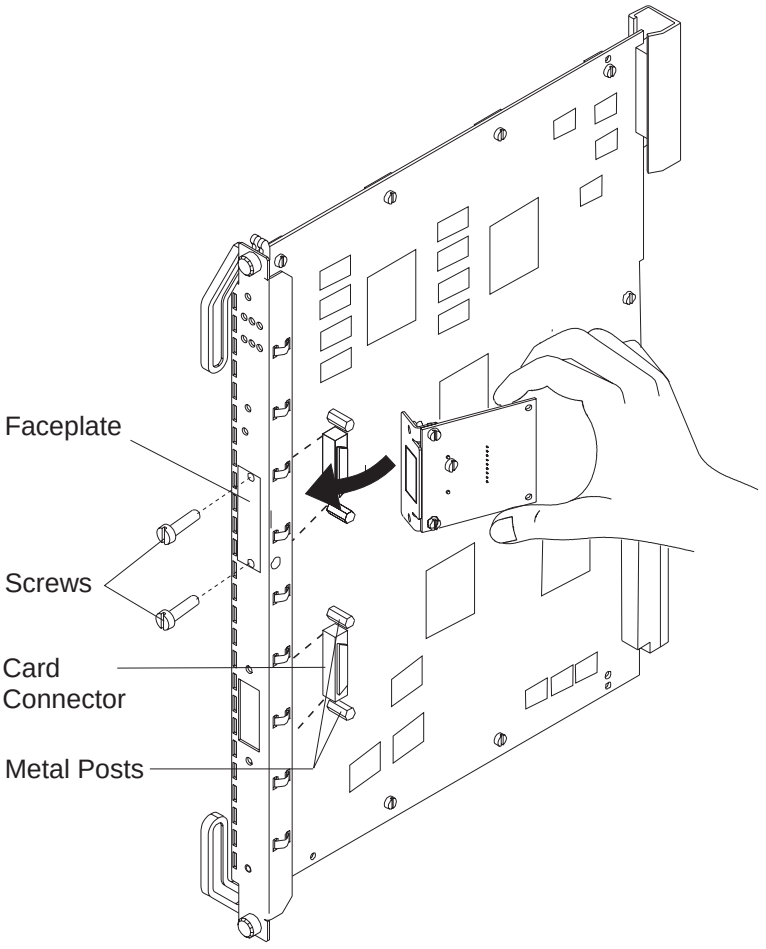


Figure 6. Installing a Daughter Card on the ATMflex Motherboard

Warning: When installing a daughter card on the motherboard, be careful not to touch its components. Always hold the card by the faceplate or by its edges as shown in Figure 6.

Installation and Configuration Summary

Table 14 lists the steps to follow to install and configure the ATMflex module after you have already unpacked and assembled the motherboard and daughter cards. Each step is described in detail in this chapter.

To record configuration information on your complete ATM network, use the ATM cabling charts in Appendix A of the *IBM 8250 Multiprotocol Intelligent Hub, IBM 8260 Multiprotocol Intelligent Switching Hub, IBM 8285 Nways ATM Workgroup Switch, Planning and Site Preparation Guide* (GA33-0285).

Before installing an ATMflex module in an 8260, make sure that an A-CPSW module is installed in slots 9-10 (or 11 in A17 models), and that an A-CPSW console has already been configured. If no A-CPSW module is installed in the hub, the Reset LED on the ATMflex module will start blinking when you insert the module.

Table 14. ATMflex Installation and Configuration Overview

Step	Refer to
1. Insert the ATMflex module into slots 1-8 on A10 8260 models (or 1-8 or 12-17 on A17 models) in the 8260, and tighten the faceplate screws. The Reset LED lights (ON) briefly and then turns OFF.	"Installing the ATMflex Module in the Hub" on page 38
2. Set up connections between the ATMflex ports and ATMflex ports in other hubs or ATM devices using the appropriate fiber cables or Twisted Pair (TP) cables and connectors.	"Connecting ATM Devices" on page 41
3. Configure the ATMflex module by entering the ATM configuration commands at at the console.	"Configuration" on page 43
4. Verify that the LEDs indicate normal operation. If not, refer to Chapter 5, "Troubleshooting" on page 53.	"Verifying ATMflex Operation" on page 51

Installation

You can install the ATMflex module in an 8260 hub either when the hub is running or turned OFF.

Installing the ATMflex Module in the Hub

To install an ATMflex module in a 8260 hub, follow these steps:

1. Install the 8260 hub in its rack or on a desktop by following the instructions in the *IBM 8260 Multiprotocol Intelligent Switching Hub Installation Guide*, SA33-0251.
2. Install an A-CPSW module in slots 9-10 (or 11-12 in A17 models) by following the instructions in the *IBM 8260 Nways Multiprotocol Switching Hub, ATM Control Point and Switch Module Installation and User's Guide*, SA33-0326.
3. Install the daughter card(s) on the motherboard by following the steps described in “Assembling the Motherboard and Daughter Cards” on page 35.
4. Locate a blank slot in positions 1 to 8 (or 12 to 17 in A17 models). (Slots 9 and 10 are reserved for the A-CPSW module. You cannot install the ATMflex module in slot 11.) If necessary, remove a panel on the hub to expose a blank slot.
5. Make sure that the slot to be used is in Isolated mode by entering the following command from the A-CPSW console:

   ```
   SET MODULE slot ISOLATED
   ```

   where `slot` specifies the number of the slot to be used. For more information, see the *IBM ATM Control Point and Switch Module Installation and User's Guide*.
6. Insert the ATMflex module into one of the free slots in the hub as shown in Figure 7 on page 39, matching the top and bottom board guides as you slide the module cleanly into place (by pressing evenly on the top and bottom of the faceplate). Do not attempt to push the module all the way into the hub until you have verified that the top and bottom module ejectors are OPEN (see Figure 8 on page 40.)

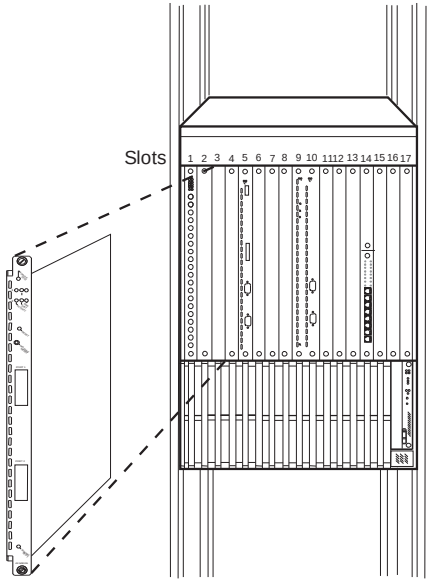


Figure 7. Installing the ATMflex Module in an 8260 Hub

7. Close the top and bottom ejectors simultaneously.

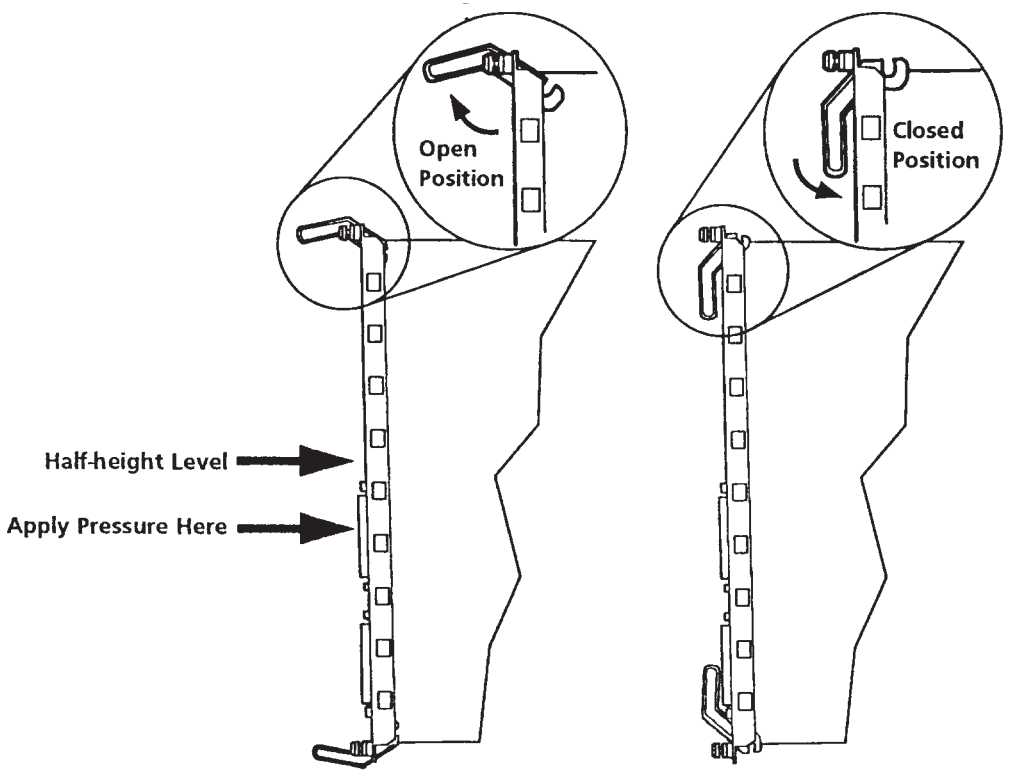


Figure 8. 8260 Module Ejectors

8. The Reset LED should light (ON) briefly, and then turn OFF. Other LEDs may also light (ON) if the slot was previously configured for an ATMflex module.
9. Fasten the spring-loaded screws on the front panel of the module to the hub using your fingers. Do not overtighten.

Connecting ATM Devices

After inserting the ATMflex module, attach the fiber or TP cables to the ATMflex ports that will connect to ATM devices. If the correct daughter card connectors are not installed in the module, contact your local IBM dealer.

Do not connect an ATMflex port to an Ethernet, Token-Ring, FDDI, or A4-FB100 module in the 8260 hub or to any other product that is not compatible with the ATMflex module.

Using Fiber: Make sure that transmit and receive cables are clearly marked or color coded before attaching them to the appropriate ATMflex ports. Also, make sure that each cable has been properly cleaned with the appropriate fiber optic cleaning solution before you attach it. Then proceed as follows:

1. Remove the plastic fiber optic covers from the ATMflex ports you will use. Leave the covers on unused ports to keep them clean.
2. Attach a fiber cable to each ATMflex port.

   Make sure that you attach an ATM fiber cable that uses the same type of connectors as the ATMflex port. For a singlemode port, you must use 9/125 micron fiber cable. For a multimode port, you must use 50/125 or 62.5/125 micron fiber cable.

   If you loop a fiber cable under the hub (as shown in Figure 9 on page 42), be sure not to exceed the bend radius of the cable. To find out the bend radius, refer to the cable's specifications.
3. Attach the other end of each cable to an ATM device, such as a server, workstation, or an ATMflex module in another 8260 hub. Make sure that each transmit cable end connects to a receiver ATM port.

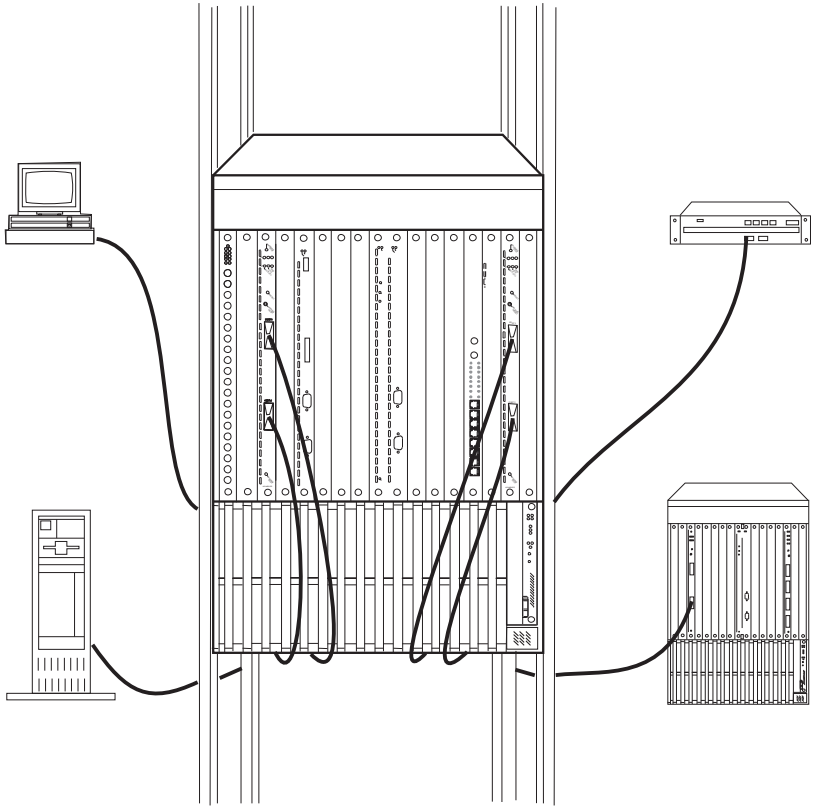


Figure 9. Attaching ATM Devices to the ATMflex Module

Configuration

After installing the ATMflex module and attaching media cables to ATM devices, you must enter configuration commands from the A-CPSW console to:

- Connect the ATMflex module to the network.
- Enable ATMflex ports and configure their port parameters.
- Configure the logical link for ATMflex port-to-port connections between two ATM subnetworks (optional).

This section describes the ATM commands you need to enter to configure each ATMflex module in the ways described above. For a complete description of all ATM commands, see the *IBM 8260 Nways Multiprotocol Switching Hub, IBM 8285 Nways ATM Workgroup Switch, ATM Command Reference Guide*, SA33-0385.

Connecting the ATMflex Module to the Network

When you install an ATMflex module, it is by default set to Isolated mode and all of its ports are disabled. When an ATMflex module is isolated, no network activity takes place on it and it cannot be accessed by the network. This is a security measure that protects your ATM network from unauthorized access and module disfunction.

To establish the ATMflex module's connection to the network, enter the following command at the A-CPSW console prompt:

```
SET MODULE slot CONNECTED
```

where `slot` specifies the slot number of the ATMflex module. The Module Status LED should light (ON).

Enabling ATMflex Ports and Configuring Port Parameters

There are three types of interface used in the IBM ATM network: user-to-network, network-to-network, and switch-to-switch.

- A user-to-network interface (UNI) defines the interface between an ATM user device (such as a router, bridge, server, workstation, or concentrator equipped with an ATM adapter) and the ATM network.
- A network-to-network interface (NNI) defines the interface between a pair of ATM clusters. (An ATM cluster is a group of interconnected ATM hubs.)
- A switch-to-switch interface (SSI) defines the interface between a pair of ATM hubs in the same ATM cluster. (The SSI has been developed from the NNI for use in IBM 8260 ATM subnetworks.)

After you connect an ATMflex module to the ATM network (as described in “Connecting the ATMflex Module to the Network” on page 43), you must:

- Enable the ports you want to use.
- Set the type of ATM interface used on each port.
- Set the bandwidth allocation (SSI ports only)
- Set the mode for the clock (UNI and NNI networks only)
- Specify the type of network the port is connected to (UNI and NNI ports only).

In addition, for UNI ports only, you can activate or deactivate ILMI flow control, and specify the ILMI characteristics.

When an ATMflex port is enabled, it can transmit and receive cells in the ATM network. To enable individual ATMflex ports and set the other port parameters, enter the following command at the A-CPSW console prompt:

```
SET PORT slot.port mode type bandwidth flow_control ilmi clocking network
```

slot Slot number of the A2-MB155 module.

port ATM port number.

mode `enable` or `disable`

type Type of interface used:

- `NNI` (network-to-network interface)
- `SSI` (switch-to-switch interface)
- `UNI` (user-to-network interface).

Default: Last value entered.

bandwidth Specifies the bandwidth allocation for a SSI port in Kbps. The specified value must be greater than 51 and will be rounded by the system to the next upper multiple of 10 Kbps.

This parameter must be entered when configuring an SSI port if two SSI ports are defined.

Default: Last value entered.

flow_control Used to activate or deactivate the ILMI flow control for this UNI port:

- `FLOW_CONTROL_ENABLED`: activate ILMI flow control (GFC field of the cell header)
- `FLOW_CONTROL_DISABLED`: deactivate ILMI flow control.

Default: Last value entered.

ilmi Specifies the ILMI characteristics for this UNI port:

- `NORMAL_ILMI`: ILMI active with automatic detection of the signalling protocol version (UNI 3.0 or UNI 3.1). ILMI address registration is normally performed.
- `ILMI_FORCED_SIGN_3.0`: UNI 3.0 signalling is forced, and ILMI address registration is active.
- `ILMI_FORCED_SIGN_3.1`: UNI 3.1 signalling is forced, and ILMI address registration is active.
- `NO_ILMI_SIGN_3.0`: UNI 3.0 signalling is forced, and ILMI address registration is inactive.
- `NO_ILMI_SIGN_3.1`: UNI 3.1 signalling is forced, and ILMI address registration is inactive.

Default: Last value entered.

clocking Specifies the mode used by the SONET lite clock for this UNI or NNI port:

- `INTERNAL_CLOCK`: The transmit clock is provided by the ATMflex module.
- `EXTERNAL_CLOCK`: The transmit clock is provided by the network or the attached device.

  Default: If no previous value specified, `INTERNAL_CLOCK`

network Specifies the type of network this UNI or NNI port is connected to :

- `SDH_STM_1` Synchronous digital hierarchy (SDH), synchronous transfer module 1 (STM-1) at 155.520 Mbps line rate.
- `SONET_STS_3C` Synchronous optical network (SONET), synchronous transport signal 3 (STS-3C) at 155.520 Mbps line rate.

  Scrambling of data on the port is performed on a frame and cell basis.

Default: Last value entered.

Example: The following configures a UNI port on an A2-MB155 module without ILMI address registration.

```
8260ATM> set port 14.1 enable uni no_ilmi_sig_3.0       [ENTER]

8260ATM> Port set.
8260ATM> show port 14.1 verbose       [ENTER]

      Type  Mode      Status
-------------------------------------------------------------------------------
14.01:UNI   enabled   UP-OKAY

Signalling Version   : 3.0 without ILMI
Frame format         : SONET-STS-3C
Flow control         : On
Connector            : SC duplex
Media                : multimode fiber
Port speed           : 155000 kbps
IX status            : IX OK
Scrambling mode      : frame and cell
Clock mode           : external clock

8260ATM>
```

Configuring Logical Links for ATMflex Connections

If you are configuring an ATMflex connection between two ATM subnetworks over a virtual path service provider or between two ATM clusters in the same subnetwork, you must configure the ATM trunk that connects the two subnetworks or clusters.

To configure an ATM trunk between two clusters, you use the SET LOGICAL_LINK command. If you are configuring a connection between clusters in different ATM subnetworks, you must also map each static route to an ATM cluster number using the SET STATIC_ROUTE command at each 8260 hub in the subnetwork.

Logical links can be defined only for ATMflex ports configured with a network-to-network (NNI) interface. You enter the SET LOGICAL_LINK command **only** for the ATMflex port on the boundary hub of each ATM subnetwork or cluster.

For the full syntax of the SET LOGICAL_LINK and SET STATIC_ROUTE commands, see the *IBM 8260/8285 ATM Command Reference Guide*.

```
SET LOGICAL_LINK slot.port vpi acn role uni_version traffic_type bandwidth
```

slot Slot number of the ATMflex.

port Port number of the ATMflex port.

vpi Virtual path identifier used to identify the logical link (0-15).

You must assign the same VPI to the ports at each end of a logical link. If you configure more than one logical link for a port, you must assign a different VPI for each link.

If you change the VPI assigned to a port, reset the module or the ATM subsystem.

acn When interconnecting two ATM subnetworks, this value is the ATM cluster number (ACN) of the logical hub associated with the remote subnetwork and configured with the SET STATIC_ROUTE command (01-FF).

When interconnecting two ATM clusters in the same subnetwork, this is the ATM cluster number of the remote boundary hub.

role `network_side` or `user_side`.

This parameter defines the Q.2931 role. `network_side` means that the 8260 hub assigns ATM labels for this logical link. `user_side` means that the hub does not assign labels.

You can assign `network_side` to only one port in a logical link. The other port must be configured as `user_side`.

uni_version `3.0` or `3.1`.

This parameter defines the version of UNI signalling protocol for this logical link.

traffic_type Specifies the type of traffic to be dedicated to this logical link:

- `NON_RESERVED_BANDWIDTH`
- `RESERVED_BANDWIDTH`
- `ANY` (both types are allowed)

bandwidth Required if you specify `RESERVED_BANDWIDTH` or `ANY` as the dedicated traffic type, this parameter specifies the maximum bandwidth allocation in kilobits per second to be reserved for this logical link in the ATM network. The total bandwidth reserved for NNI links cannot exceed 131 Mbps per port, and 180 Mbps per ATM media module.

Valid values: a number representing from 1 to 85% of the maximum bandwidth used by the ATM port. You can assign different bandwidth values for the two ports in a logical link.

Example: The following example creates a logical link for port 1 on the ATM media module in slot 13 having VPI 9 to ACN 2, a network_side role, and a 500 Kbps bandwidth:

```
8260ATM> set logical_link 13.1 9 2 network_side 3.1 reserved_bandwidth 500 [ENTER]

8260ATM> Logical link set.
8260ATM>
```

Saving Configuration Changes

After configuring ATMflex module and port settings, save your configuration changes by entering the SAVE MODULE_PORT command.

Displaying Configuration Changes

To display status information about an ATMflex module, enter one of the following commands:

- SHOW MODULE
- SHOW MODULE VERBOSE
- SHOW PORT
- SHOW PORT VERBOSE

For example, to display configuration information about the ATMflex module in slot 2, you would enter the following command:

```
8260ATM> show module 2 verbose     [ENTER]

Slot Install Connect Operation General Information
------------------------------------------------------------------------
 2      Y       Y        Y     8260 ATM 2 Ports 155 Mbps Module

status: connected / hardware okay
        enable  / Normal
P/N:51H3635 EC level:E28056 Manufacturer:VIME
Operational FPGA version : 7
     Backup FPGA version : 7

     Type   Mode      Status
------------------------------------------------------------------------
 2.01:SSI   enabled  UP-OKAY
 2.02:NNI   enabled  UP-NO ACTIVITY

8260ATM>
```

If the value for `port status` indicates that an ATMflex port is inoperational or not functioning properly (for example, `NOT IN SERVICE` or `NO ACTIVITY`), refer to "Troubleshooting", in the *IBM 8260 Nways Multiprotocol Switching Hub, ATM Control Point and Switch Module Installation and User's Guide*, SA33-0326

The following example shows how to display detailed information about the ports of the ATMflex module in slot 1:

```
8260ATM> show port 1.all verbose     [ENTER]
Port display for module 8260 ATM 155 Mbps Module

8260ATM> show port 1.all verbose

Type  Mode     Status
--------------------------------------------------------------------------------
 1.01:UNI enabled  UP-NO ACTIVITY

Signalling Version   : with ILMI
Flow Control         : Off
Frame format         : SONET STS-3c
Connector            : RJ45
Media                : Twisted Pair (UTP/STP)
Port speed           : 155000 Kbps
Remote device is inactive
IX status            : IX KO
Scrambling mode      : frame and cell
Clock mode           : internal

 1.02:SSI enabled  UP-NO ACTIVITY

SSI Bandwidth        : 150000 Kbps
Connector            : SC DUPLEX
Media                : Multimode fiber
Port speed           : 155000 Kbps
Remote device is inactive
IX status            : IX KO
Scrambling mode      : frame and cell
Clock mode           : internal

8260ATM>
```

For more information on the SHOW MODULE and SHOW PORT commands, see the *IBM 8260/8285 ATM Command Reference Guide*, SA33-0385.

Verifying ATMflex Operation

After configuring and saving ATMflex port and module settings, refer to Table 2 on page 10 to make sure that the module is functioning properly. If you find any of the following operating conditions, see Chapter 5, “Troubleshooting” on page 53:

- The Module Status LED does not light.
- A Port Status LED does not light or is blinking.
- A Port Activity LED does not light.
- A Port Error LED is ON.
- The Reset LED is ON or is blinking.
- The Wrong Slot LED is ON.

Chapter 5. Troubleshooting

This chapter describes how to diagnose and solve problems that may arise with the operation of an ATMflex module. These problems are signaled by the following conditions:

- The Module Status LED does not light.
- The Status LED of an ATMflex port does not light or is blinking.
- The Activity LED of an ATMflex port does not light during data transmission.
- A Port Error LED is ON.
- The Reset LED is either ON or blinking.
- The Wrong Slot LED is ON.

Before you start troubleshooting, be sure to carry out the procedure described in "Verifying LED Operation."

When instructed to replace an ATMflex module, proceed as described in "Replacing ATMflex Modules" on page 57.

USA and Canada: If the problem is not resolved after following the troubleshooting procedures outlined in this chapter, call toll-free 800-IBM-SERV for IBM support.

Verifying LED Operation

Before troubleshooting an ATMflex module, verify that all LEDs on the module are functioning properly. To do so, press the LED Test button on the Fault-Tolerant Controller module in the 8260 hub.

All LEDs should light ON. If one or more ATMflex LEDs do not light ON, replace the module.

Determining the Failing Component Using a Wrap Test

In the troubleshooting procedures in this chapter, you are sometimes instructed to perform a wrap test in order to determine the failing component (for example, daughter card or motherboard) that caused the problem in an ATMflex connection.

To run a wrap test for an ATMflex connection, follow these steps:

1. Enter `SET PORT slot.port DISABLE` where `slot` is the slot number of the ATMflex module (1 to 8 or 12 to 17) and `port` is the number of the port (1 or 2). Then press Enter.
2. Enter `WRAP slot.port INTERNAL` where `slot` is the slot number of the ATMflex module and `port` is the number of the port. Then press Enter.

   If you receive a return code of `KO Test Failed`, the motherboard is faulty and should be replaced. If you receive a return code of `OK Test Successful`, continue with the next step.
3. Insert a wrap plug in the port.
4. Enter `WRAP slot.port EXTERNAL` where `slot` is the slot number of the module and `port` is the number of the port. Then press Enter.

   If you receive a return code of `KO Test Failed`, the daughter card is faulty and should be replaced.

   If you receive a return code of `OK Test Successful` and if another 8260 hub is attached to the port, continue with the next step.

   If you receive a return code of `OK Test Successful` and if another device besides an 8260 hub, (for example, a workstation adapter over a UNI connection) is attached to the port, return to the troubleshooting procedure and follow the next step in it or contact your IBM service representative.
5. If the port in which you inserted the wrap plug is attached to an 8260 hub, disable the port on the remote hub by entering `SET PORT slot.port DISABLE` from the console attached to the remote hub. Then press Enter.
6. Enable the wrap procedure on the remote ATMflex port by entering `WRAP slot.port REPLY_MODE ENABLE`. Then press Enter.

7. From the console attached to the local hub, enter `WRAP slot.port EXTERNAL`. This command sends a signal across the connection to the remote (wrapped) port on the attached 8260 hub. The test result appears on the console of the local hub.

   If you receive a return code of `KO Test Failed`, the cable is faulty and should be replaced. If you receive a return code of `OK Test Successful`, the cause of the problem is on the remote 8260 hub.

8. Disable the wrap procedure on the remote ATMflex port by entering `WRAP slot.port REPLY_MODE DISABLE` from the console attached to the remote hub. Then press Enter.

9. Repeat step 1 through step 4 on page 54 for the ATMflex port on the remote 8260 hub in order to determine the failing component.

Replacing ATMflex Daughter Cards

After running a wrap test, you may find that a daughter card is faulty and you need to replace it. Or, while troubleshooting a problem from the condition of the ATMflex LEDs, you may be instructed to replace a daughter card.

To replace a daughter card, follow these steps:

1. Enter `SET MODULE slot ISOLATED` where `slot` is the slot number of the ATMflex module containing the daughter card. Then press Enter.
2. Remove the module from the hub.
3. Unscrew the daughter card from the motherboard.
4. Install a new daughter card on the motherboard as described in “Assembling the Motherboard and Daughter Cards” on page 35.
5. Re-insert the module into the hub.
6. Enter `SET MODULE slot CONNECTED` where `slot` is the slot number of the module. Then press Enter.

Replacing ATMflex Modules

The troubleshooting procedures in this chapter sometimes instruct you to replace a failing ATMflex module. To do so, follow these steps:

1. Enter `SET MODULE slot ISOLATED` where `slot` is the slot number of the failed module. Then press Enter.
2. Remove the failed module and insert another ATMflex module in its slot.
3. Enter `SET MODULE slot CONNECTED` where `slot` is the slot number of the failed module. Then press Enter.

The new ATMflex module is automatically configured with the last settings configured for the slot number you entered.

When the Module Status LED Does Not Light

During normal 8260 hub operation, the Module Status LED of an ATMflex module should light (ON). If the Module Status LED does not light (ON), the module is inoperational. Refer to Table 15 to diagnose and solve the problem.

Table 15. ATMflex Problem Determination Using Module Status LED

Module Status LED	Module Status	Possible Cause	Corrective Action
OFF	Disabled or Isolated	Module is not receiving power.	1) At the A-CPSW console, enter `SET MODULE slot CONNECTED`. 2) Check the power supply LEDs on the 8260 Fault-Tolerant Controller module. 3) Check the power budget by entering `SHOW POWER` from the Distributed Management Module (DMM) (or A-CPSW console if a DMM module not installed). For more information, refer to the *IBM 8260 Multiprotocol Intelligent Switching Hub Distributed Management Module User's Guide*, SA33-0259. 4) Re-insert the ATMflex module in the hub.
		Power budget has been exceeded.	Check the power budget by entering `SHOW POWER` from the Distributed Management Module. (or A-CPSW console if DMM module not installed).
		Module is faulty.	Replace the module.
		Status LED is burned out.	1) Press the LED Test button on the 8260 Fault-Tolerant Controller module. 2) If necessary, replace the module.

When a Port Status LED Does Not Light or Is Blinking

When the Status LED of an ATMflex port does not light (ON) or is blinking, the port detects a possible problem. Refer to Table 16 to diagnose and solve the problem.

Table 16. ATMflex Problem Determination Using Status LEDs

Status LED	Port Status	Possible Cause	Corrective Action
OFF	Disabled	Port is disabled.	Enable port.
		ATMflex module is not powered ON.	1) Check the Module Status LED and the power supply LEDs on the 8260 Fault-Tolerant Controller module. 2) Re-insert the ATMflex module in the hub.
		Status LED is burned out.	1) Press the LED Test button on the 8260 Fault-Tolerant Controller module. 2) If necessary, replace the module.
		ATMflex module is faulty.	Perform the wrap tests described in "Determining the Failing Component Using a Wrap Test" on page 54.
Blinking	Enabled	Cable attached to the ATMflex port is faulty.	1) Change the cable. 2) Perform the wrap tests to determine the failing component. 3) Check the cable type.
		For fiber cables, the transmit and receive connectors on the cable are not plugged into the correct port connectors.	Unplug the cable connectors and plug them into the correct port connectors.
		Remote station attached to the ATMflex port is either turned OFF or inoperational.	Check the remote station. If the station is turned OFF, turn ON the station. If the station is inoperational, restart the application that is running on it.
		Maximum link distance exceeded.	See Table 1 on page 3 for the maximum distances for valid ATMflex connections.

When a Port Activity LED Does Not Light

If during continous traffic the Activity LED of an ATMflex port does not light ON, refer to Table 17 to diagnose and solve the problem.

Table 17. ATMflex Problem Determination Using Activity LEDs

Activity LED	Possible Cause	Corrective Action
OFF	Port is disabled.	Enter `SHOW PORT` command at the A-CPSW console to see if port is enabled.
	ATMflex module is not powered ON.	1) Check the Module Status LED and the power supply LEDs on the 8260 Fault-Tolerant Controller module. 2) Re-insert the ATMflex module in the hub.
	Activity LED is burned out.	1) Press the LED Test button on the 8260 Fault-Tolerant Controller module to verify that all LEDs are functioning. 2) If necessary, replace the module.
	ATMflex port is faulty.	Perform the wrap tests described in “Determining the Failing Component Using a Wrap Test” on page 54.
	There is a bad connection on the ATM backplane.	1) Remove the ATMflex module and re-insert it in the same slot. 2) If the problem persists, insert the module in another slot.
	UNI port is enabled but not in service.	From the ATM host, make sure that the station attached to the port has been assigned an ATM address and that the address is unique within the network.

When a Port Error LED Is ON

When an Error LED of an ATMflex port is ON, the port has entered into an error condition. Table 18 describes the possible problems that may occur and the corrective action to take for each problem.

Table 18. ATMflex Problem Determination Using the Error LED

Error LED	Meaning	Possible Cause	Corrective Action
ON	Error condition on ATMflex port	ATMflex module is faulty.	Perform the wrap tests described in "Determining the Failing Component Using a Wrap Test" on page 54.
		Cable attached to the ATMflex port is faulty.	1) Change the cable. 2) Perform the wrap tests to determine the failing component. 3) Check the cable type.
		Remote station attached to the ATMflex port is either turned OFF or inoperational.	Check the remote station. If the station is turned OFF, turn ON the station. If the station is inoperational, restart the application running on it.
Blinking	Error condition due to bad transmission quality as a result of frame errors or HEC cell errors	Cable attached to the ATMflex port is faulty.	1) Change the cable. 2) Perform the wrap tests to determine the failing component. 3) Check the cable type.
		Remote station attached to the ATMflex port is either turned OFF or inoperational.	Check the remote station. If the station is turned OFF, turn ON the station. If the station is inoperational, restart the application running on it.

When the Reset LED Is ON or Starts Blinking

When the Reset LED of an ATMflex module is ON or starts blinking, the module has entered into an error condition. Table 19 describes the possible problems that may occur and the corrective action to take for each problem.

Table 19. ATMflex Problem Determination Using the Reset LED

Reset LED	Meaning	Possible Cause	Corrective Action
ON	ATMflex error condition	ATMflex module is faulty.	Perform the wrap tests described in "Determining the Failing Component Using a Wrap Test" on page 54.
		There is a bad connection on the ATM backplane.	1) Remove the ATMflex module and re-insert it in the same slot. 2) If the problem persists, insert the module in another slot.
Blinking	ATMflex error condition	No A-CPSW module is installed.	Install A-CPSW module in slots 9-10 (or 11-12 in A17 model).
		ATMflex module is either faulty or not securely plugged into the ATM backplane.	1) Remove the ATMflex module and re-insert it. 2) If the problem persists, replace the ATMflex module.
		There is a bad connection on the ATM backplane.	1) Remove the ATMflex module and re-insert it in the same slot. 2) If the problem persists, insert the module in another slot.

When the Wrong Slot LED Is ON

When the Wrong Slot LED of an ATMflex module is ON, the module is not installed in the correct slot. Remove the module from the hub and re-insert it into any blank slot in positions 1 to 8 (or 12 to 17 in A17 model). (Slots 9-10, and 11 in A17 model, are reserved for the A-CPSW module). Slot 12 in A17 models cannot be used if an A-CPSW module is installed in slot 11.

Appendix A. Technical Specifications

General Specifications

Feature Codes	5002 (Motherboard) 8800 (SC multimode fiber I/O card) 8801 (SC singlemode fiber I/O card) 8802 (RJ45 UTP/FTP/STP I/O card)
Face Plate Marking	A2-MB155 (Feature Code 5002) MF (Feature Code 8800) SF (Feature Code 8801) TP (Feature Code 8802)
Number of Ports	2
Connectors	SC fiber RJ45 copper

Electrical Specifications

Power Requirement	30 Watts for +5V (25 Watts for the motherboard plus 2.5 Watts for each I/O card 1.2 Watts for +12V
Power Consumption	6 Amps for +5V 0.10 Amps for +12V
Fuses	7 Amps for +5V 1 Amp for +12V

Environmental Specifications

Operating Temperature	0°C to 50°C (32°F to 122°F)
Storage Temperature	–10°C to +60°C (14°F to 140°F)
Humidity	0 to 95 % RH

Mechanical Specifications

Dimensions	1.0 in. (2.5 cm) Width 10.7 in. (27 cm) Length 15.2 in. (38.5 cm) Height
Weight	3.3 lbs (1.5 kg)

Optical Specifications

This section describes the optical specifications for ATMflex transmitters and receivers with SC singlemode and SC multimode connectors.

Additional information on ATMflex transmitter and receiver parameters is given in the notes at the end of each section. The note relevant for a parameter is shown by the superscript number(s) following the parameter name in each table.

ATMflex SC Singlemode Transmitters

- Light Source: LASER at 1300 ± 20 nm wavelength.
- Power coupled into fiber cable includes SC connector loss.

Table 20. ATMflex SC Singlemode Transmitters: Optical Specifications

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Optical Power Output (P_O): 9/125 micron cable[1]	-15	—	-8	dBm avg
Center Wavelength (λ_c)	1261	1300	1360	nm

Notes:

1. These optical power values are measured with the following conditions:
   - At the Beginning Of Life (BOL).
   - Over the specified operating voltage and temperature ranges.
   - With HALT Line State (12.5 MHz square-wave) input signal.
   - At the end of one meter of noted optical fiber with cladding modes removed.

   The average power value can be converted to a peak power value by adding 3 dB.

ATMflex SC Singlemode Receivers

Table 21. ATMflex SC Singlemode Receivers: Optical Specifications

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Optical Power Input: Minimum at Window Edge[1] ($P_{IN\ Min}$ W)	—	—	-32.5	dBm avg
Maximum ($P_{IN\ Max}$)	-8	—	—	dBm avg
Operating Wavelength (λ)	1261	—	1360	nm

Notes:

1. This specification is intended to indicate the performance of the receiver section of the transceiver when Input Optical Power signal characteristics are present per the following definitions. The Input Optical Power dynamic range from the minimum level (with a window time-width) to the maximum level is the range over which the receiver is guaranteed to provide output data with a Bit Error Ratio (BER) better than or equal to 2.5×10^{-10}.

ATMflex SC Multimode Transmitters

- Light Source: GaA1As LED at 1300 ± 20 nm wavelength.
- Power coupled into fiber cable includes SC connector loss.

Table 22. ATMflex SC Multimode Transmitters: Optical Specifications

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Optical Power Output (P_O):				
50/125 micron cable[1,2] NA 0.20 fiber	-22.5	-18	-14	dBm avg
62.5/125 micron cable[1] NA 0.275 fiber	-19	-16	-14	dBm avg
Center Wavelength[3] (λ_c)	1270	1300	1380	nm

Notes:

1. These optical power values are measured with the following conditions:
   - At the Beginning Of Life (BOL).
   - Over the specified operating voltage and temperature ranges.
   - With HALT Line State (12.5 MHz square-wave) input signal.
   - At the end of one meter of noted optical fiber with cladding modes removed.

   The average power value can be converted to a peak power value by adding 3 dB.
2. This transmitter is available on special request with coupled optical power guaranteed into 50/125 micron fiber cables. The value will depend on the specific NA of the 50/125 micron fiber used.
3. This parameter complies with the FDDI PMD requirements for the tradeoffs between center wavelength, spectral width, and rise/fall times. The temperature coefficient of the center wavelength is typically +0.37 nm/°C.

ATMflex SC Multimode Receivers

Table 23. ATMflex SC Multimode Receivers: Optical Specifications

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Optical Power Input: Minimum at Window Edge[1] ($P_{IN\ Min}$ W)	—	-34	-30	dBm avg
Maximum ($P_{IN\ Max}$)	-14	-13	—	dBm avg
Operating Wavelength (λ)	1270	—	1380	nm

Notes:

1. This specification is intended to indicate the performance of the receiver section of the transceiver when Input Optical Power signal characteristics are present per the following definitions. The Input Optical Power dynamic range from the minimum level (with a window time-width) to the maximum level is the range over which the receiver is guaranteed to provide output data with a Bit Error Ratio (BER) better than or equal to 2.5×10^{-10}.

Appendix B. ATM Components

Table 24 lists the part numbers of ATM components (wrap plugs, adapters, cables, and so on) that can be ordered for use with the ATMflex module.

Table 24 (Page 1 of 2). Part Numbers of ATM Components

ATM Component	IBM Part Number
SC wrap plug	16G5609
RJ45 wrap plug	42H0540
SC-to-SC Coupler	33G2744
MIC-to-SC 62.5/125 micron ATM jumper cable, 2 m (6.5 ft)	19G6707
MIC-to-SC 62.5/125 micron ATM jumper cable, 4 m (13 ft)	19G4797
MIC-to-SC 62.5/125 micron ATM jumper cable, 6 m (20 ft)	19G4798
MIC-to-SC 62.5/125 micron ATM jumper cable, 10 m (33 ft)	19G4799
MIC-to-SC 62.5/125 micron ATM jumper cable, 20 m (66 ft)	19G4800
MIC-to-SC 62.5/125 micron ATM jumper cable, 40 m (135 ft)	19G4801
MIC-to-SC 62.5/125 micron ATM jumper cable, custom lengths	19G4796
SC-to-SC 62.5/125 micron ATM jumper cable, 2 m (6.5 ft)	19G6706
SC-to-SC 62.5/125 micron ATM jumper cable, 4 m (13 ft)	19G4864
SC-to-SC 62.5/125 micron ATM jumper cable, 6 m (20 ft)	19G4865
SC-to-SC 62.5/125 micron ATM jumper cable, 10 m (33 ft)	19G4866
SC-to-SC 62.5/125 micron ATM jumper cable, 20 m (66 ft)	19G4867
SC-to-SC 62.5/125 micron ATM jumper cable, 40 m (135 ft)	19G4868
SC-to-SC 62.5/125 micron ATM jumper cable, custom lengths	19G4863
Cable with RJ45 connector and IBM data connector	42H0544

Table 24 (Page 2 of 2). Part Numbers of ATM Components	
ATM Component	**IBM Part Number**
Cable with RJ45 connector for SSI connection using UTP	51H3971
Optical fiber cleaning kit	5453521

Glossary

This glossary defines terms and abbreviations used in this manual. It includes terms and definitions from the *IBM Dictionary of Computing* (New York; McGraw-Hill, Inc., 1994).

(A) Identifies definitions from the *American National Standard Dictionary for Information Systems*, ANSI X3.172-1990, copyright 1990 by the American National Standards Institute (ANSI). Copies can be purchased from the American National Standards Institute, 1430 Broadway, New York, New York 10018.

(E) Identifies definitions from the *ANSI/EIA Standard - 440A: Fiber Optic Terminology*, copyright 1989 by the Electronics Industries Association (EIA). Copies can be purchased from the Electronic Industries Association, 2001 Pennsylvania Avenue N.W., Washington, DC 20006.

(I) Identifies definitions from the *Information Technology Vocabulary*, developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1).

(T) Identifies definitions from draft international standards, committee drafts, and working papers being developed by ISO/IEC JTC1/SC1.

The following cross-references are used in this glossary:

Contrast with
This refers to a term that has an opposed or substantively different meaning.

See
This refers the reader to multiple-word terms in which this term appears.

See also
This refers the reader to terms that have a related, but not synonymous, meaning.

Synonym for
This indicates that the term has the same meaning as a preferred term, which is defined in the glossary.

If you do not find the term you are looking for, refer to the index or to the *IBM Dictionary of Computing*.

A

A. ampere.

AAL. ATM Adaptation Layer

ac. Alternating current.

active. (1) Able to communicate on the network. A token-ring network adapter is active if it is able to transmit and receive on the network. (2) Operational. (3) Pertaining to a node or device that is connected or is available for connection to another node or device. (4) Currently transmitting or receiving.

adapter. In a LAN, within a communicating device, a circuit card that, with its associated software and/or microcode, enables the device to communicate over the network.

address. (1) In data communication, the IEEE-assigned unique code or the unique locally administered code assigned to each device or workstation connected to a network. (2) To refer to a device or an item of data by its address (A).

address mask. For internet subnetworking, a 32-bit mask used to identify the subnetwork address bits in the host portion of an IP address. Synonymous with *subnet mask* and *subnetwork mask*.

Address Resolution Protocol (ARP). A protocol for converting a higher level protocol address (for example, an IP address) into a physical network address (for example, an ATM address).

AFI. Authority and Format Identifier (1 byte) in an ATM address.

AIX. Advanced Interactive Executive.

alert. (1) For IBM LAN management products, a notification indicating a possible security violation, a persistent error condition, or an interruption or potential interruption in the flow of data around the network. In SNA, a record sent to a system problem management focal point to communicate the existence of an alert condition. In the NetView for AIX program, a high-priority event that warrants immediate attention. This database record is generated for certain event types that are defined by user-constructed filters.

American National Standard Code for Information Interchange (ASCII). The standard code, using a coded character set consisting of 7-bit coded characters (8 bits including parity check), used for information interchange among data processing systems, data communication systems, and associated equipment. The ASCII set consists of control characters and graphics characters. (A)

ARP. Address Resolution Protocol.

ASCII. American National Standard Code for Information Interchange.

Asynchronous Transfer Mode (ATM). A transfer mode in which the information is organized into cells. It is asynchronous in the sense that the recurrence of cells containing information from an individual user is not necessarily periodic.

ATM. Asynchronous Transfer Mode.

ATM campus network. A union of privately-owned ATM subnetworks interconnected by network node interfaces (NNIs). See also *network node interface (NNI)*.

ATM device. An end system that encapsulates data into ATM cells and forwards them to the ATM subsystem in the 8260 hub across an UNI interface.

ATM subnetwork. A set of ATM subsystems interconnected by ATM interfaces (UNI, SSI, NNI).

ATM subsystem. The ATM components in an &genatm. ATM switch.

attach. To make a device a part of a network logically. Contrast with *connect*, which implies physically connecting a device to a network.

attenuation. Level of optical power loss expressed in units of dB.

Authority and Format Identifier. One byte in an ATM address.

B

bandwidth. (1) The difference, expressed in hertz, between the highest and the lowest frequencies of a range of frequencies. For example, analog transmission by recognizable voice telephone requires a bandwidth of about 3000 hertz (3 kHz). (2) The bandwidth of an optical link designates the information-carrying capacity of the link and is related to the maximum bit rate that a fiber link can support.

baud. The rate at which signal conditions are transmitted per second. Contrast with *bits per second (bps)*.

BER. Bit error rate.

bit error rate (BER). The ratio of the number of bits experiencing error on a telecommunications link divided by the number of bits sent over the link.

bits per second (bps). The rate at which bits are transmitted per second. Contrast with *baud*.

bridge. (1) An attaching device that connects two LAN segments to allow the transfer of information from one LAN segment to the other. A bridge may attach the LAN segments directly by network adapters and software in a single device, or may connect network adapters in two separate devices through software and use of a telecommunications link between the two adapters. (2) A functional unit that connects two LANs that use the same logical link control (LLC) procedures but may use the same or different medium access control (MAC) procedures. (T) Contrast with *gateway* and *router*.

broadband. A frequency band divisible into several narrower bands so that different kinds of transmissions such as voice, video, and data transmission can occur at the same time. Synonymous with *wideband*.

broadcast. Simultaneous transmission of data to more than one destination.

buffer. (1) A portion of storage used to hold input or output data temporarily. (2) A routine or storage used to compensate for differences in data rate or time of occurrence of events, when transferring data from one device to another. (A)

bus. (1) In a processor, a physical facility on which data is transferred to all destinations, but from which only addressed destinations may read in accordance with appropriate conventions. (I) (2) A network configuration in which nodes are interconnected through a bidirectional transmission medium. (3) One or more conductors used for transmitting signals or power. (A)

BUS. Broadcast and Unknown Server.

byte. (1) A string that consists of a number of bits, treated as a unit, and representing a character. (T) (2) A binary character operated upon as a unit and usually

shorter than a computer word. (A) (3) A string that consists of a particular number of bits, usually 8, that is treated as a unit, and that represents a character. (4) A group of 8 adjacent binary digits that represent one extended binary-coded decimal interchange code (EBCDIC) character.

C

C. Celsius.

cable loss (optical). The loss in an optical cable equals the attenuation coefficient for the cabled fiber times the cable length.

CBR. Constant bit rate.

CCITT. Comité Consultatif International Télégraphique et Téléphonique. The International Telegraph and Telephone Consultative Committee.

Class A network. In Internet communications, a network in which the high-order (most significant) bit of the IP address is set to 0, and the host ID occupies the three low-order bytes.

Class B network. In Internet communications, a network in which the two high-order (most significant and next-to-most significant) bits of the IP address are set to 1 and 0, respectively, and the host ID occupies the two low-order bytes.

Class C network. In Internet communications, a network in which the two high-order (most significant and next-to-most significant) bits of the IP address are both set to 1, and the next high-order bit is set to 0. The host ID occupies the low-order byte.

CLP. Cell loss priority.

community. An administrative relationship between Simple Network Management Protocol (SNMP) entities.

community name. An opaque string of bytes identifying a community.

configuration. (1) The arrangement of a computer system or network as defined by the nature, number, and chief characteristics of its functional units. More specifically, the term may refer to a hardware configuration or a software configuration. (I) (A) (2) The devices and programs that make up a system, subsystem, or network.

connect. In a LAN, to physically join a cable from a station to an access unit or network connection point. Contrast with *attach*.

connection. (1) In data communication, an association established between functional units for conveying information. (I) (A) (2) In Open Systems Interconnection architecture, an association established by a given layer between two or more entities of the next higher layer for the purpose of data transfer. (T) (3) In SNA, the network path that links two logical units (LUs) in different nodes to enable them to establish communications. (4) In X.25 communication, a virtual circuit between two data terminal equipments (DTEs). A switched virtual circuit (SVC) connection lasts for the duration of a call; a permanent virtual circuit (PVC) is a permanent connection between the DTEs. (5) In TCP/IP, the path between two protocol applications that provides reliable data stream delivery service. In Internet, a connection extends from a TCP application on one system to a TCP application on another system. (6) The path between two protocol functions, usually located in different machines, that provides reliable data delivery service. (7) A logical association between a call participant (party) and a switch. A party's connection represents that party's participation in a telephone call.

CPE. Customer premises equipment.

customer-replaceable unit (CRU). An assembly or part that a customer can replace in its entirety when any of its components fail. Contrast with *field replaceable unit (FRU)*.

D

daemon. A program that runs unattended to perform a standard service. Some daemons are triggered automatically to perform their task; others operate periodically. Synonymous with demon.

data communication. (1) Transfer of information between functional units by means of data transmission according to a protocol. (T) (2) The transmission, reception, and validation of data. (A)

data transfer rate. The average number of bits, characters, or blocks per unit of time passing between equipment in a data-transmission system. (I) The rate is expressed in bits, characters, or blocks per second, minute, or hour.

data transmission. The conveying of data from one place for reception elsewhere by telecommunication means. (I)

dB. Decibel.

dBm. Decibels based on 1 milliwatt.

dc. Direct current.

decibel (dB). (1) One tenth of a bel. (2) A unit that expresses the ratio of two power levels on a logarithmic scale. (3) A unit for measuring relative power. The number of decibels is 10 times the logarithm (base 10) of the ratio of the measured power levels; if the measured levels are voltages (across the same or equal resistance), the number of decibels is 20 times the log of the ratio.

decibels based on 1 milliwatt (dBm). A unit of absolute power measurement that is scaled such that 0 dBm equals 1 milliwatt.

default. Pertaining to an attribute, condition, value, or option that is assumed when none is explicitly specified. (I)

destination. Any point or location, such as a node, station, or particular terminal, to which information is to be sent.

device. (1) A mechanical, electrical, or electronic contrivance with a specific purpose. (2) An input/output unit such as a terminal, display, or printer.

diagnostics. Modules or tests used by computer users and service personnel to diagnose hardware problems.

Disk Operating System (DOS). An operating system for computer systems that use disks and diskettes for auxiliary storage of programs and data.

DMM. Distributed Management Module.

DOS. Disk operating system.

dump. (1) To record, at a particular instant, the contents of all or part of one storage device in another storage device. Dumping is usually for the purpose of debugging. (T) (2) Data that has been dumped. (T) (3) To copy data in a readable format from main or auxiliary storage onto an external medium such as tape, diskette, or printer. (4) To copy the contents of all or part of virtual storage for the purpose of collecting error information.

E

EIA. Electronic Industries Association.

EEPROM. Electrically erasable programmable read-only memory.

electrically erasable programmable read-only memory (EEPROM). A PROM that can be erased by a special process and reused. (T)

Electronic Industries Association (EIA). An organization of electronics manufacturers that advances the technological growth of the industry, represents the views of its members, and develops industry standards.

equipment rack. Synonym for *rack*.

Ethernet. A local area network that allows multiple stations to access the transmission medium at will without prior coordination, avoids contention by using carrier sense and deference, and resolves contention by using collision detection and delayed retransmission.

F

F. Fahrenheit.

FCC. Federal Communications Commission (USA).

FDDI. Fiber Distributed Data Interface.

fiber. Synonym for *optical fiber*.

fiber budget. The optical power loss as a result of the number of connections in the optical fiber link subtracted from the working budget. The loss as a result of connections includes the connector loss and the splice loss. The fiber budget is expressed in decibels.

Fiber Distributed Data Interface (FDDI). A high-performance, general-purpose, multi-station network. It uses token-ring architecture with optical fiber as the transmission medium over distances of several kilometers.

fiber optic cable. Synonym for *optical cable*.

fiber optics. The technology whereby optical signals from light-generating transmitters are propagated through optical fiber waveguides to light-detecting receivers.

field. On a data medium or a storage medium, a specified area used for a particular category of data; for example, a group of character positions used to enter or display wage rates on a panel. (T)

field-replaceable unit (FRU). An assembly that is replaced in its entirety when any one of its components fails. In some cases a FRU can contain other FRUs; for example, a brush and a brush block that can be replaced individually or as a single unit. Contrast with *customer-replaceable unit (CRU)*.

file. A named set of records stored or processed as a unit. (T)

File Transfer Protocol (FTP). (1) In TCP/IP, an application protocol used for transferring files to and from host computers. FTP requires a user ID and possibly a password to allow access to files on a remote host system. FTP assumes that the Transmission Control Protocol is the underlying protocol. (2) In the Internet suite of protocols, an application layer protocol that uses TCP and Telnet services to transfer bulk-data files between machines or hosts. See also *TFTP*.

FRU. Field-replaceable unit.

FTP. (1) File Transfer Protocol. (2) Foiled twisted pair.

G

gateway. A device and its associated software that interconnect networks or systems of different architectures. The connection is usually made above the reference model network layer. For example, a gateway allows LANs access to System/370 host computers. Contrast with *bridge* and *router*.

GFC. Generic Flow Control.

H

hardware. Physical equipment as opposed to programs, procedures, rules, and associated documentation. (I) (A)

header. The portion of a message that contains control information for the message such as one or more destination fields, name of the originating station, input sequence number, character string indicating the type of message, and priority level for the message.

HEC. Header Error Control.

host computer. (1) The primary or controlling computer in a multi-computer installation or network. (2) In a network, a processing unit in which resides a network access method. Synonymous with *host processor*.

Hz. Hertz; frequence in cycles/second.

I

I/O. Input/output.

ILMI. Interim Local Management Interface.

InARP. Inverse Address Resolution Protocol.

input/output (I/O). (1) Pertaining to input, output, or both (A). (2) Pertaining to a device, process, or channel involved in data input, data output, or both.

interface. (1) A shared boundary between two functional units, defined by functional characteristics, signal characteristics, or other characteristics, as appropriate. The concept includes the specification of the connection of two devices having different functions. (T) (2) Hardware, software, or both, that links systems, programs, or devices.

International Organization for Standardization (ISO). An organization of national standards bodies from various countries established to promote development of standards to facilitate international exchange of goods and services, and develop cooperation in intellectual, scientific, technological, and economic activity.

internet. A collection of networks interconnected by a set of routers that allow them to function as a single, large network. See also *Internet*

Internet. The internet administered by the Internet Architecture Board (IAB), consisting of large national backbone networks and many regional and campus networks all over the world. The Internet uses the Internet suite of protocols.

Internet address. See *IP address*.

Internet Protocol (IP). (1) A protocol that routes data through a network or interconnected networks. IP acts as an interface between the higher logical layers and the physical network. This protocol, however, does not provide error recovery, flow control, or guarantee the reliability of the physical network. IP is a connectionless

protocol. (2) A protocol used to route data from its source to its destination in an Internet environment.

interoperability. The capability to communicate, execute programs, or transfer data among various functional units in a way that requires the user to have little or no knowledge of the unique characteristics of those units. (T)

Inverse Address Resolution Protocol (InARP). A protocol for converting a physical network address (for example, an ATM address) into a higher level protocol address (for example, an IP address).

IP. Internet Protocol.

IP address. The 32-bit address defined by the Internet Protocol, standard 5, Request for Comment (RFC) 791. It is usually represented in dotted decimal notation.

ISO. International Organization for Standardization.

J

jumper cable. Synonym for *patch cable*.

K

Kbps. Kilobits per second.

kilobit (Kb). (1) For processor storage, real and virtual storage, and channel volume, 2^{10} or 1024 bits. (2) For disk storage capacity and communications volume, 1000 bits.

kilobyte (KB). (1) For processor storage, real and virtual storage, and channel volume, 2^{10} or 1024 bytes. (2) For disk storage capacity and communications volume, 1000 bytes.

L

LAN. Local area network.

LE. LAN emulation.

LEC. LAN emulation client.

LECS. LAN emulation configuration server.

LED. Light-emitting diode.

LES. LAN emulation server.

local. (1) Pertaining to a device accessed directly without use of a telecommunication line. (2) Contrast with *remote*.

local area network (LAN). (1) A computer network located on a user's premises within a limited geographical area. Communication within a local area network is not subject to external regulations; however, communication across the LAN boundary may be subject to some form of regulation. (T) (2) A network in which a set of devices are connected to one another for communication and that can be connected to a larger network. (3) See also *Ethernet* and *token ring*. (4) Contrast with *metropolitan area network (MAN)* and *wide area network (WAN)*.

M

m. meter

MAC. Medium access control.

MAN. Metropolitan area network.

Management Information Base (MIB). A tree-like data structure for the definition and use of information.

Mb. Megabit; 1 048 576 bits.

Mbps. One million bits per second.

MB. Megabyte; 1 048 576 bytes.

medium access control (MAC). In LANs, the sublayer of the data link control layer that supports medium-dependent functions and uses the services of the physical layer to provide services to the logical link control (LLC) sublayer. The MAC sublayer includes the method of determining when a device has access to the transmission medium.

megabyte. (1) For processor storage and real and virtual memory, 2^{20} or 1 048 576 bytes. (2) For disk storage capacity and transmission rates, 1 000 000 bytes.

MIB. Management Information Base.

mm. Millimeter, millimeters.

multimode optical fiber. (1) A graded-index or step-index optical fiber that allows more than one bound mode to propagate. (E) Contrast with *single mode optical fiber*. (2) In FDDI, an optical fiber waveguide

usually characterized by a core diameter of 50 to 100 μm that will allow a large number of modes to propagate.

N

network. (1) A configuration of data processing devices and software connected for information interchange. (2) An arrangement of nodes and connecting branches. Connections are made between data stations. (T)

network administrator. A person who manages the use and maintenance of a network.

network node interface (NNI). The interface between two network nodes.

NNI. Network node interface.

node. A generic term applying to an active element in an ATM network (station or concentrator).

NSAP. Network Service Access Point.

O

optical cable. A fiber, multiple fibers, or a fiber bundle in a structure built to meet optical, mechanical, and environmental specifications. (E)

optical fiber. A small-diameter strand made from glass and/or polymer that consists of a core surrounded by a lower-index-of-refraction cladding. It guides light from one end to another by a combination of a graded index in the core and internal reflectance.

optical fiber cable. Synonym for *optical cable*.

optical fiber connector. A hardware component that transfers optical power between two optical fibers or bundles and is designed to be repeatedly connected and disconnected.

OSPF. Open Shortest Path First

output device. A device in a data processing system by which data can be received from the system. (I) (A) Synonymous with *output unit*.

output unit. Synonym for *output device*.

P

Packet Internet Groper (PING). (1) In Internet communications, a program used in TCP/IP networks to test the ability to reach destinations by sending the destinations an Internet Control Message Protocol (ICMP) echo request and waiting for a reply. (2) In communications, a test of reachability.

parameter. (1) A variable that is given a constant value for a specified application and that may denote the application. (I) (A) (2) An item in a menu or for which the user specifies a value or for which the system provides a value when the menu is interpreted. (3) Data passed between programs or procedures.

parity. (1) A transmission error-checking scheme in which an extra bit is added to some unit of data, usually a byte, in order to make the total number of one bits even or odd. No-parity means that no parity bit is sent or expected. Mark and space mean that the parity position is always set to one or zero, respectively, and that received parity is not checked. (2) The state of being either even-numbered or odd-numbered.

parity (even). A condition when the sum of all of the digits in an array of binary digits is even.

parity (odd). A condition when the sum of all of the digits in an array of binary digits is odd.

patch cable. A length of cable with data connectors at both ends that is normally used to interconnect two sections of building cable at a patch panel or to connect a product to the building cable. Synonymous with *jumper cable*.

patch panel. An organized concentration of cable terminations, usually mounted in a flat panel, that facilitates the interconnection of communication cables.

path. (1) In a network, any route between any two nodes. (T) (2) The route traversed by the information exchanged between two attaching devices in a network.

PC. Personal computer

permanent virtual connection (PVC). (1) In X.25 and frame-relay communications, a virtual connection that has a logical channel permanently assigned to it at each data terminal equipment (DTE). Call-establishment protocols are not required. Contrast with *switched virtual connection (SVC)*. (2) The logical connection between two frame-relay terminating equipment stations, either

directly or through one or more frame-relay frame handlers. A PVC consists of one or more PVC segments.

PING. Packet Internet Groper.

port. (1) An access point for data entry or exit. (2) A connector on a device to which cables for other devices such as display stations and printers are attached. Synonymous with *socket*. (3) A PHY entity and a PMD entity in a node, together creating a PHY/PMD pair, that may connect to the fiber media and provide one end of a physical connection with another node.

POST. Power-on self-test.

power budget. Synonym for *fiber budget*.

power-on self-test (POST). A series of diagnostic tests that are run automatically by a device when the power is switched on.

protocol. (1) A set of semantic and syntactic rules that determines the behavior of functional units in achieving communication. (I) (2) In SNA, the meanings of and the sequencing rules for requests and responses used for managing the network, transferring data, and synchronizing the states of network components. (3) A specification for the format and relative timing of information exchanged between communicating parties.

PS/2. Personal System/2.

PVC. Permanent virtual connection.

Q

QOS. Quality of service

quality of service (QOS). A set of communication characteristics required by an application. Each QOS defines a specific transmission priority, level of route reliability, and security level. Each QOS also defines whether the sessions are interactive.

R

rack. Synonym for *equipment rack*.

RAM. Random access memory.

random access memory (RAM). A computer's or adapter's volatile storage area into which data may be entered and retrieved in a nonsequential manner.

receiver (optical). An optoelectronic circuit that converts an optical signal to an electrical logic signal.

remote. (1) Pertaining to a system, program, or device that is accessed through a telecommunication line. (2) Contrast with *local*.

Request for Comments (RFC). In Internet communications, the document series that describes a part of the Internet suite of protocols and related experiments. All Internet standards are documented as RFCs.

RFC. Request for Comments.

router. An attaching device that connects two LAN segments, which use similar or different architectures, at the reference model network layer. Contrast with *bridge* and *gateway*.

routing. (1) The assignment of the path by which a message will reach its destination. (2) In SNA, the forwarding of a message unit along a particular path through a network, as determined by the parameters carried in the message unit, such as the destination network address in a transmission header.

RS-232. In data communications, a specification of the Electronic Industries Association (EIA) that defines the interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE), using serial binary data interchange.

RX. Receive.

S

server. (1) A device, program, or code module on a network dedicated to providing a specific service to a network. (2) On a LAN, a data station that provides facilities to other data stations. Examples are a file server, print server, and mail server.

session. (1) In network architecture, for the purpose of data communication between functional units, all the activities which take place during the establishment, maintenance, and release of the connection. (T) (2) The period of time during which a user of a terminal can communicate with an interactive system, usually, elapsed time between logon and logoff.

SFTP. Screened and foiled twisted pair.

signaling. Establishment of an ATM connection from a call set up by an end device.

Simple Network Management Protocol (SNMP). In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB).

single mode optical fiber. (1) An optical fiber in which only the lowest-order bound mode (which can consist of a pair of orthogonally polarized fields) can propagate at the wavelength of interest. (E) Contrast with *multimode optical fiber*.

SLIP. Serial Line Internet Protocol.

SNMP. Simple network management protocol.

SMIT. System Management Interface Tool used on RISC System/6000.

SSI. Switch-to-switch interface.

station. (1) A communication device attached to a network. The term most often used in LANs is an *attaching device* or *workstation*. (2) An input or output point of a system that uses telecommunication facilities. (3) An addressable node on an FDDI network capable of transmitting, repeating, and receiving information. A station has exactly one SMT, at least one MAC, at least one PHY, and at least one PMD.

STP. Shielded twisted pair.

subnet. (1) In TCP/IP, a part of a network that is identified by a portion of the IP address. (2) Synonym for *subnetwork*.

subnet address. In Internet communications, an extension of the basic IP addressing scheme where a portion of the host address is interpreted as the local network address.

subnet mask. Synonym for *address mask*.

subnetwork. (1) A group of nodes that have a set of common characteristics, such as the same network ID. (2) Synonymous with *subnet*.

SVC. Switched virtual connection.

switch-to-switch interface (SSI). The interface between A-CPSW modules in 8260 hubs.

T

TCP/IP. Transmission Control Protocol/Internet Protocol

Telnet. In TCP/IP, an application protocol that allows a user at one site to access a remote system as if the user's display station were locally attached. Telnet uses the Transmission Control Protocol as the underlying protocol.

TFTP. Trivial File Transfer Protocol.

token ring. A network with a ring topology that passes tokens from one attaching device (node) to another. A node that is ready to send can capture a token and insert data for transmission.

topology. The physical or logical arrangement of nodes in a computer network. Examples include ring topology and bus topology.

trace. (1) A record of the execution of a computer program. It exhibits the sequences in which the instructions were executed. (A) (2) A record of the frames and bytes transmitted on a network.

transceiver. Any terminal that can transmit and receive data.

Transmission Control Protocol (TCP). A communications protocol used in the Internet. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.

Transmission Control Protocol/Internet Protocol (TCP/IP). A set of communications protocols that support peer-to-peer connectivity functions for both local and wide area networks.

transmission medium. (1) A physical carrier of electrical energy or electromagnetic radiation. (2) The physical medium that conveys data between data stations; for example, twisted-pair wire, optical fiber, coaxial cable. (T)

transmit. (1) The action of a station in generating a token, frame, or other symbol sequence and placing it on the outgoing medium. (2) The action of a station that consists of generating a frame, token, or control sequence, and placing it on the medium to the next station.

trap. Trajectory analysis program.

trunk. A physical topology, either open or closed, employing two optical fiber signal paths, one in each direction (that is, counter-rotating), forming a sequence of peer connections between FDDI nodes. When the trunk forms a closed loop it is sometimes called a trunk ring.

TRS. Topology Routing Service.

twisted pair. A transmission medium that consists of two insulated conductors twisted together to reduce noise. (T)

TX. Transmit.

U

UNI. User-network interface.

UNIX operating system. An operating system developed by Bell Laboratories that features multiprogramming in a multiuser environment. The UNIX operating system was originally developed for use on minicomputers, but has been adapted for mainframes and microcomputers.

Note: The AIX operating system is IBM's implementation of the UNIX operating system.

user-network interface (UNI). Physical and logical definition of the interface between an ATM user device and the ATM network.

UTP. Unshielded twisted pair.

V

V. Volt.

V ac. Volts alternating current.

variable. (1) In computer programming, a character or group of characters that refers to a value and, in the execution of a computer program, corresponds to an address. (2) A quantity that can assume any of a given set of values. (A)

VBR. Variable bit rate.

VCC. Virtual channel connection.

VCI. Virtual channel identifier (in ATM cell header).

VPI. Virtual path identifier (in ATM cell header).

W

WAN. Wide area network.

wide area network (WAN). (1) A network that provides communication services to a geographic area larger than that served by a local area network or a metropolitan area network, and that may use or provide public communication facilities. (T) (2) A data communications network designed to serve an area of hundreds or thousands of miles; for example, public and private packet-switching networks and national telephone networks. (3) Contrast with *local area network (LAN)* and *metropolitan area network (MAN)*.

wiring closet. A room that contains one or more distribution panels and equipment racks that are used to interconnect cables. Sometimes called a *network wiring closet* to distinguish it from a telephone wiring closet.

workstation. (1) A functional unit at which a user works. A workstation often has some processing capability. (T) (2) One or more programmable or nonprogrammable devices that allow a user to do work. (3) A terminal or microcomputer, usually one that is connected to a mainframe or to a network, at which a user can perform applications.

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Installation and User's Guide

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