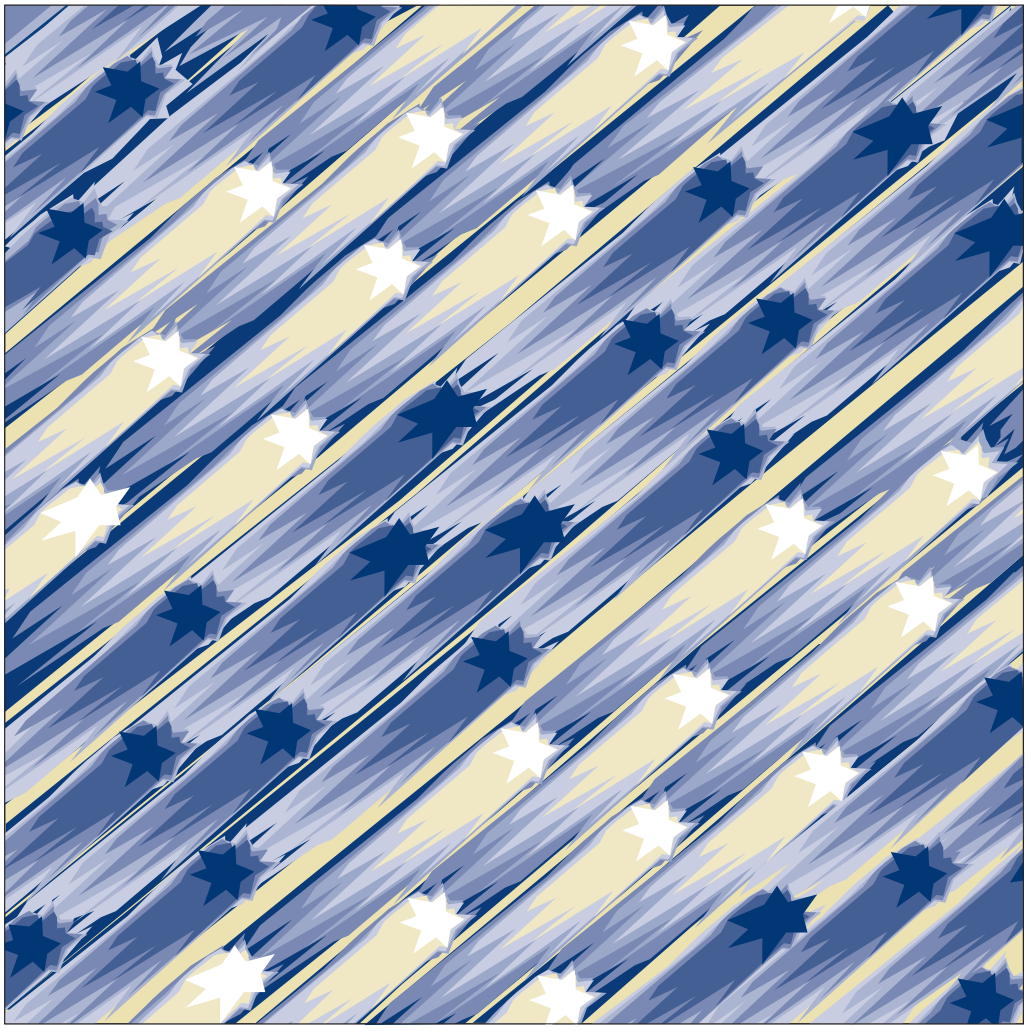
8265 Nways ATM Switch

Planning and Site Preparation Guide



GA33-0460-02

8265 Nways ATM Switch

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Note|

Before using this information and the product it supports, be sure to read the general information under Appendix D, “Notices” on page 133.

Third Edition (September 1998)

The information contained in this manual is subject to change from time to time. Any such changes will be reported in subsequent revisions.

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About this Book

This book describes how to plan for the installation of the IBM 8265 Nways® ATM Switch. It contains physical planning guidelines for ATM networks. Therefore, this documentation provides instructions with hardware specifications enabling installation for all sizes of user group. Examples are also provided throughout this manual, and descriptions for expanding the network are given for future requirements. There are appendixes, a list of abbreviations, and a bibliography at the back of this book.

This book must be used in conjunction with the following 8265 manuals:

- *IBM 8265 Nways ATM Switch: Product Description*, GA33-0449.
- *IBM 8265 Nways ATM Switch: Installation Guide*, SA33-0441.
- *IBM 8265 Nways ATM Switch: Media Module Reference Guide*, SA33-0459.
- *IBM 8265 Nways ATM Switch: User's Guide*, SA33-0456.

Who Should Use this Book

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

- Network Manager or Administrator
- Sysstem Manager or Administrator.

Prerequisite Knowledge

This book assumes that you are familiar with ATM networks and network management.

You should also read the release notes that may accompany the IBM 8265 and 8265 modules. These notes may provide important information about developments and changes that occurred after this publication went to press.

Where to Find More Information

Refer to the “Bibliography” on page 139 for a list of IBM manuals that contain related information and publications for the 8265 switch.

World Wide Web ;You can access the latest news and information about IBM network products, customer service and support, and microcode upgrades via the Internet, at the URL:

`http://www.networking.ibm.com`

Chapter 1. Choosing a Site for IBM 8265

Use the information in this chapter to choose a site for the IBM 8265 and to make any necessary preparations. Review this section to ensure that your chosen location meets the minimum standards required to operate the 8265 correctly.

Using the Cabling Charts

Blank cabling charts for the 8265s are found on page 129. These charts are used to record which modules are installed in the 8265, what segment the module is part of, and all of the cable connections made to the individual modules. The charts are used for planning, installation, and administration of your network. It is therefore imperative that they are accurate and up-to-date.

Network Documentation Update

Update the documentation for each network that is connected to the 8265 to show the location of:

- The 8265
- All equipment to be connected to the 8265
- The areas where the cables will be laid
- Power receptacles for all of the equipment.

Environment Specifications

Product Operating Environment

Air Temperature: 5 to 40°C (41 to 104°F)

Note: In the short term, the air temperature may fall to –5°C (–23°F) or rise to 55°C (131°F). *Short term* is considered to mean not more than 96 consecutive hours, and not exceeding 15 days in one year.

Relative humidity: 5 to 85%

Note: In the short term, the relative humidity can rise to 95% (not exceeding 0.024 Kg of water per Kg of dry air). *Short term* is considered to mean not more than 96 consecutive hours, and not exceeding 15 days in one year.

Wet bulb: 27°C (80.6°F)

Storage and Shipping Environment

Shipping temperature: -40 to 70°C (-40 to 158°F)

Storage temperature: 1 to 60°C (33.8 to 140°F)

Wet bulb: 29°C (84.2°F)

Shipping relative humidity: 5 to 95%

Storage relative humidity: 5 to 80%

Acoustics

Table 1. Acoustics

A weighted sound power level less or equal to:	**A weighted sound pressure level less or equal to:**
6.0 Bels	51.4 dB

Location Requirements

An 8265 ATM Switch must be installed in an area that meets the following requirements:

- Relative humidity: less than 95%, non-condensing
- Power source within 6 feet (approximately 2.7 meters)
- Safety regulations stipulate that the table or rack on which the switch rests should be able to support at least 360 lbs. (163 kg), three times the weight of a fully loaded switch.
- The surface on which the 8265 switch is installed is level.
- For rack installations, the selected rack must be grounded (preferably to a protective earth ground). Observe the following precautions and guidelines (particularly if your rack has an open back or open sides):
  - Before attempting to rack mount the switch, first make sure the selected rack can support at least 360 lbs. or 163 kg.
  - Bolt the rack to the floor.
  - Brace the top of the rack to the wall.
  - Provide sufficient vertical space in your rack for each switch you wish to install.
  - For proper ventilation, install the switch in a rack that has an open back.
  - Install patch panels in the rack for easier cable management.
  - Install the cable tray beneath the switch. The cable tray is designed to manage the cables exiting from the front of the switch by feeding them under and through the back of the unit.

Table 2 shows the amount of rack space needed to install an 8265 Switch in a Telco rack or a Metric rack.

Table 2. Telco and Metric Rack Space Requirements

Height[1]	Telco Rack	Metric Rack	Front Clearance[2]
67.4 cm (26.6 in.)	66.3 cm (26.1 in.)	67.5 cm)	8 cm (3 in.)

Notes:

1. The height of the switch chassis, allowing for some extension beyond the location of the upper and lower unit dividing lines.
2. This is the recommended minimum space required between the front of the switch and another vertical surface (such as a rack door).

Ventilation Requirements

Three fan units draw air in through the front and center of the chassis and exhaust air out the back. To ensure that the fans provide adequate ventilation, you must allow a minimum of 15 cm (6 in.) between the rear of the 8265 and the nearest wall (or other vertical surface).

The vent holes at the back of the switches are exhaust vents which serve to cool the power supply bay. Do not block these vents.

Electrostatic Discharge

The 8265 is a Class 2 product (RH not always > 20%, no specified minimum floor surface conductivity, and no specified furniture resistance).

Magnetic Compatibility

In some instances, the site chosen for setup of the 8265 may have surrounding magnetic fields.

These fields can result from nearby radio-frequency sources, such as transmitting antennas (AM radio, FM radio, television, and two-way radios), radar, and industrial equipment (radio-frequency induction heaters, arc welders, and insulation testers).

Other sources of interference are transformers (including those within other units), distribution displays, rotating machinery, fluorescent light fixtures, and electric floor heating.

Check with your building engineer or get help in identifying possible sources of magnetic interference at the site you choose to set up the 8265.

Before positioning control units or cabling, a setup planning review may be appropriate to evaluate the environment and to determine whether any special setup or product considerations are required to ensure normal system operation and maintenance. Consult your IBM representative or LAN installation provider.

Electrostatic Discharge

Electrostatic charges can build up on buildings and people as a result of:

- Movement of personnel, carts, or furniture in contact with floor covering
- Personnel in contact with furniture coverings, such as plastic seat covers.

Discharge of these static charges to the metal parts of the 8265, or on the furniture to which it is situated, may cause interference with the operation of the electronic equipment. The 8265 is a Class 2 product (RH not always > 20%, no specified minimum floor surface conductivity, and no specified furniture resistance).

Major factors that contribute to this problem include:

- High-resistance floor surface material
- Carpeting without antistatic properties
- Plastic seat coverings
- Very low humidity (usually less than 20%)
- Metal-framed furniture.

If any of the previous factors are present at your site, review the building with your IBM representative or LAN installation provider.

Lightning Protection

Power Lines: You should add lightning protection on your redundant power source when:

- The utility company installs lightning protectors on the primary source.
- The area is subject to electrical storms or equivalent power surges.

Signal Lines: You are responsible for selecting and setting up lightning protection, if needed.

Table Top Installation Requirements

The 8265 weighs approximately 57 kg (125 lb) fully loaded and with the supplied cable tray (the use of which is optional). Make sure the table or shelf on which the 8265 rests can support at least 170 kg (375 lb). The selected table or shelf must be less than 2 m (6 ft) from the nearest ac outlet.

Do not install an 8265 with a –48 V dc power supply on a table or shelf.

Physical Characteristics

The 8265 is designed to be either rack mounted or placed on a table, stand, or shelf.

Table 3. 8265 Weight and Dimensions

Item	Weight	Width	Depth	Height
Chassis	29.9 Kg[1] (65.9 lb)	44.4 cm (17.52 in.)	38.5 cm (15.14 in.)	67.4 cm (26.52 in.)
Cable Tray	4.4 Kg (9.7 lb)	47.1 cm (18.54 in.)	44.4 cm (17.48 in.)	4.37 cm (1.72 in.)
Bottom Cover	0.4 Kg (0.88 lb)	39.1 cm (15.38 in.)	1.9 cm (0.75 in.)	19.9 cm (7.84 in.)

[1] Unloaded, with blank filler plates, three fan units, one controller module and one power supply installed.

Power and Electrical Wiring Requirements

The power source (wall outlet or receptacle) at the place you have chosen for the 8265 must provide the electrical specifications shown in Table 4 to ensure that the 8265 will not be dam aged and will work satisfactorily.

Table 4. 8265 Operating Conditions	
Phase	Single phase + earth
Frequency	50 or 60 Hz ± 2%
110 Volt Range	90 Vac (minimum), 132 Vac (maximum)
220 Volt Range	180 Vac (minimum), 256 Vac (maximum)
-48 Volt DC	-40 Vdc (minimum), -57 Vdc (maximum)
Maximum Inrush Current per 415 W Power Supply	20 A
Site Power Requirement Recommendations	2.2 kVA (90-256 V, 47/63 Hz)
Leakage Current with Four 415 W Power Supplies	2.1 mA
Caloric Values (full chassis loaded with modules and power supplies)	2041 Watts or 6964 Btu/hour

Electrical Wiring

For safe operation of the 8265, IBM recommends using a 15-ampere electrical wire (branch circuit) to supply power. This circuit must be grounded to a safety ground, not to a neutral ground which would carry current back to the transformer.

Note: Do not use a conduit as the only means of grounding.

Important: Where a –48 V dc power supply is used with the 8265, refer to the *8265 Nways ATM Switch Installation Guide*, SA33-0441.

AC Power Requirements

It is recommended to use a dedicated 15 ampere circuit (or an equivalent method of providing this current) to supply power to the 8265 when operated at voltage between 90 and 130 volts ac for 110 volt range, and between 180 and 256 volts AC for 220 volt range. This will ensure adequate power for a fully loaded 8265 configuration. This circuit must be grounded to a safety protected ground (earth), NOT to a neutral ground that carries current back to the transformer. Do not use an electrical conduit pipe as your only means of grounding the 8265. There must be four ac power outlets available within 2 m (6 ft) of the 8265 in the event that there are four power supplies installed.

Caution: For use in Denmark, the end system using this power supply must receive power from a separately dedicated socket outlet having a 16 Amp fuse in the installation, or the equipment in which the power supply is to be used should be supplied with a relevant mains cord intended for fixed installation.

Note: When you use a single circuit to power multiple load-sharing power supplies, that single circuit may be required to deliver more than 15 Amps. This depends on the number of installed power supplies and on the voltage configuration. Load-sharing power supplies always draw power when inserted into the 8265. There is no low power standby mode of operation.

8265 load-sharing power supplies are autosensing. Each power supply can automatically sense (identify) the type of input AC voltage to which it is being connected at the wall outlet. Compatible voltages are as follows:

Europe 220 Volts to 240 Volts

North America 110 Volts to 220 Volts

Japan 100 Volts.

AC Power Cords and Plugs: Different countries use different power cord plugs and receptacles. Table 5 identifies, by country, which power cord can be shipped with the 8265. All power cords are 2.8 m (9 ft) in length unless otherwise specified. The letters in the table refer to the power plugs illustrated in Figure 1 on page 10. Use this table and the figure to ensure that you receive the correct power cord with your 8265, and to plan for the correct receptacles. This list does not include all countries. If the required country is not listed, consult your IBM representative.

Table 5. AC Power Cords and Plugs For Each Country

Country	Power Cord Part Number	Plug Type
Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Colombia, Costa Rica, Dominican Republic, El Salvador, Equador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Surinam, Taiwan, Thailand, Trinidad, U.S.A., Venezuela.	6952300 6952301 1.8 m (6 ft)	I
Bahrain, Brunei, Cyprus, Ghana, Hong Kong, Iraq, Ireland, Jordan, Kenya, Kuwait, Malawi, Malaysia, Malta, Nepal, Nigeria, Oman, Qatar, Sierra Leone, Singapore, Somalia, Tanzania, Uganda, United Arab Emirates, United Kingdom, Yemen, Zambia.	14F0033	II
Israel.	14F0087	III
Argentina.	13F9940 6952291	IV
Australia, China, New Zealand, Paraguay, Uruguay.	13F9940	IV
Afghanistan, Albania, Algeria, Angola, Austria, Belarus, Belgium, Bosnia, Bulgaria, Croatia, Czechia, Egypt, Finland, France, Germany, Greece, Hungary, Iceland, Indonesia, Iran, Kazakhstan, Lebanon, Luxembourg, Macau, Macedonia, Mauritius, Mozambique, Netherlands, Norway, Poland, Portugal, Rhodesia, Romania, Russia, Serbia, Slovakia, Slovenia, South Korea, Spain, Sudan, Sweden, Syria, Turkey, Ukraine, Swaziland, Zaire, Zimbabwe.	13F9979	V
Denmark.	13F9997	VI
Liechtenstein, Switzerland.	14F0051	VII
Chile, Ethiopia, Italy, Libya.	14F0069	VIII
Bangladesh, Myanmar, Pakistan, South Africa, Sri Lanka.	14F0015	IX

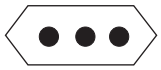
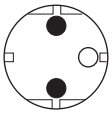
Plug Type	Voltage Rating	Amp Rating	Plug Configuration	Plug Type	Voltage Rating	Amp Rating	Plug Configuration
I	125 V	15 A		VI	250 V	10 A	
II	250 V	13 A		VII	250 V	10 A	
III	250 V	10 A		VIII	250 V	16 A	
IV	250 V	10 A		IX	250 V	10 A	
V	250 V	10 A		X	250 V	10 A	

Figure 1. AC Power Cord Plugs

–48 Volt DC Power Requirements

To comply with the UL requirements, an 8265 equipped with a –48 V dc power supply must be installed in a rack or enclosed cabinet. The power cord must be routed through a raceway up to the –48 volt dc distribution panel.

Connect the –48 volt dc power supply to Safety Extra Low Voltage (SELV) only.

To install an 8265 with –48 Volt DC (295 Watt) power supplies, the DC power source must provide:

- Voltage range: –40 Volt to –57 Volt
- Permanent power for 1 DC supply: 11 Amps
- Inrush current for 1 DC supply: maximum 60 Amps and 16 Amps within 16 ms. To accept the inrush current, it is recommended that you use a 100 Amp source to feed up to four –48 Volt DC power supplies.

Caution: Use only the power cord supplied in the –48 Volt DC power supply shipping box. Only qualified personnel must install the power cord to the DC power source.

Chapter 2. Planning for Power Supplies

This chapter describes how to plan the number of power supplies required to operate the 8265.

Types of Power Supply

The following types of power supply are available:

- 415 W AC, Feature Code 8027
- 295 W DC, –48 V, Feature Code 8026 or 8028 (NEBS Certified).

You can also install power supplies from an IBM 8260 (295 W and 415 W AC, or 295 W –48V DC).

Choose the type of power supply that suits your requirements. **You cannot mix AC and DC power supplies**. Up to four power supply units can be installed in the 8265.

Choosing Fault Tolerance

As a rule, it is recommended that you run the switch with at least one power supply more than the minimum number needed to operate it. The minimum number of power supplies is determined by the amount of power required to operate all of the installed components.

The availability of extra power can help prevent the switch from shutting down when modules demand more power than the switch can provide. An additional power supply minimizes the chance that power supply redundancy will be lost without warning.

For example, if the total power requirement of all installed modules is 470 watts, the switch can operate with only two power supplies. A third power supply, however, is needed to achieve power fault tolerance. If you use three power supplies and one power supply fails, the remaining two supplies can still support the load.

Caution: Fault-tolerance should only be used if there is sufficient reserve power to handle a power supply failure. If not, then the 8265 may reset unpredictably.

Determining the Number of Power Supplies Required

The number of power supplies required to operate the 8265 and all installed modules is determined by adding together:

- The system overhead, the power required by the 8265 to operate the fans and backplane, which is 1 Watt at +5.2 volts.
- The total power requirement (at +5.2 volts) of all installed modules, daughter cards, and universal feature cards).

When you have calculated the total power required, you can determine how many power supplies are needed (see page 18).

If power fault-tolerance is required, then at least one additional power supply should be installed.

8265 Module Power Requirements: Table 6 lists the power requirements for the 8265 modules.

Table 6. 8265 Module Power Consumption

Module	Feature Code	Slot Width	Power Required (Watts at +5 Volts)
Control Point & Switch	6501	2	80
Control Point & Switch 2	6502	2	60
Controller	8000	1	5
4-port 155 Mbps (MMF)	6540	1	29
4-port 155 Mbps (Flex)	6543	1	20
1-port 622 Mbps (MMF)	6511	1	28
1-port 622 Mbps (SMF)	6512	1	28
WAN 2.5	6561	1	34.2
MSS Server 2.5	5401	1	42

8265 Daughter Card Power Requirements: Table 7 lists the power requirements for the daughter cards that can be installed in 8265 media modules .

Table 7. 8265 Daughter Card Power Consumption

Type	Feature Code	Power Required (Watts at +5 Volts)
For 4-Port 155 Mbps Flex Module		
Multimode Fiber	6580	2.5
Singlemode Fiber	6581	2.5
UTP/STP	6582	2.5
For WAN 2.5 Module		
E1/T1/J1	See Note	7.9
E1/T1/J1 IMA (U.S.A/Canada)	6670	4.5
E1/T1/J1 IMA (CE, UK, Italy)	6671	4.5
E3	See Note	7.9
DS3	8502	7.9
STM-1 MMF	8506	7.9
STM-1 SMF	8505	7.9
OC3 MMF	8504	7.9
OC3 SMF	8503	7.9
Note: Feature Code varies according to country. See the *Product Description* for details.		

8260 Media Module Power Requirements: Table 8 lists the power requirements for the 8260 media modules.

Table 8. 8260 Media Module Power Consumption

Module	Feature Code	Slot Width	Power Required (Watts at +5 Volts)
4-port 100 Mbps	5104	1	35
12-port 25 Mbps	5012	1	25
WAN 2	5612	1	18.4
Video Distribution	5008	2	62.5
MSS Server	5400	1	33.1
ATM/Ethernet (8271)	5212	2	58.5
ATM/Ethernet (8271)	5312	3	58.5
ATM/Token-Ring (8272)	5208	2	30
ATM/Token-Ring (8272)	5308	3	30
Carrier	5015	1	20

8260 Daughter Card Power Requirements: Table 9 lists the power requirements for the daughter cards that can be installed in 8260 media modules .

Table 9. 8260 Daughter Card Power Consumption

Type	Feature Code	Power Required (Watts at +5 Volts)
For 12-Port 25 Mbps Module		
155 Mbps	8510	10
For WAN 2 Modules		
E1/T1/J1	See Note	7.9
E1/T1/J1 IMA (USA, Canada)	6670	4.5
E1/T1/J1 IMA (CE, UK, Italy)	6671	4.5
E3	See Note	7.9
DS3	8502	7.9
STM-1 MMF	8506	7.9
STM-1 SMF	8505	7.9
OC3 MMF	8504	7.9
OC3 SMF	8503	7.9
Note: Feature Code varies according to country.		

8260 Universal Feature Card Power Requirements: Table 10 lists the power requirements for the universal feature cards that can be installed in the 827x LAN Switch modules.

Table 10. 8260 Universal Feature Card Power Consumption

Type	Feature Code	Power Required (Watts at +5 Volts)
For 8271 ATM/Ethernet LAN Switch Modules		
4-port Ethernet 10BASE-T	9195	5.5
3-port Ethernet 10BASE-FL	8603	6.7
1-port Ethernet 100BASE-Tx	6995	5.7
1-port Ethernet 100BASE-Fx	7000	6.0
1-port ATM/Ethernet	6988	25
For 8272 ATM/Token-Ring LAN Switch Modules		
4-port Token-Ring UTP/STP	5092	12
2-port Token-Ring Fiber	5087	11
1-port ATM/Token-Ring MMF	2762	25

Power Capacity for Modules: The following tables show the power capacity (at +5.2 volts) available in non-fault tolerant and fault-tolerant modes. When calculating the number of power supplies required, you must also allow for the system overhead (power used by the fan units and backplane) which is 1 Watt.

415 Watt AC Power Supplies:

Table 11. Power Capacity at +5.2 Volts (AC Power supplies)

Number of Power Supplies	Non-Fault Tolerant Mode	Fault Tolerant Mode
One	301	See note
Two	542	301
Three	813	542
Four	1084	813

Note: Power Fault Tolerance can only be established if the unallocated power budget (of at least one power supply) can be held in reserve.

215 W DC Power Supplies:

Table 12. Power Capacity at +5.2 Volts (DC Power supplies)

Number of Power Supplies	Non-Fault Tolerant Mode	Fault Tolerant Mode
One	204	See note
Two	367	204
Three	551	367
Four	734	551

Note: Power Fault Tolerance can only be established if the unallocated power budget (of at least one power supply) can be held in reserve.

Using 8260 295 W AC Power Supplies: Although you can install both 8265 415 W and 8260 295 W AC power supplies in the same switch, this should be avoided when running in power fault-tolerant mode. This is because the lower output power supply (295 Watt) cannot backup a higher output power supply (415 Watt). See the *IBM 8260 Nways Multiprotocol Switching Hub Product Description*, GA33-0415 for power capacities when a mixture of 415 W and 295 W AC power supplies are used.

Chapter 3. Cabling Recommendations

This chapter describes the cabling recommendations for an ATM system.

External and Internal Cabling Recommendations

Horizontal Cabling

The cabling choices provided by the standards include:

- 150–ohm shielded twisted pair (STP) cable (2 pair), 22 gauge, Types 1, 1A, 2, and 2A.
- 100–ohm unshielded twisted pair (UTP) cable, Categories 3, 4, and 5 (2 and 4 pair).
- 100–ohm twisted pair cable with an overall shield (FTP), Categories 3, 4, and 5 (2 and 4 pair).
- 120–ohm twisted pair cable with an overall shield (FTP) - primarily Category 5 (2 and 4 pair).

  Note: This option is not allowed in the U.S.A. and Canadian Standards.
- 62.5/125–micron optical fiber (50/125–micron cable is an allowed option).

IBM strongly recommends copper cabling for horizontal attachment. (The horizontal cabling is the set of cabling that runs from the telecommunications closets to offices or work areas.)

STP cables, carrying on the bulk cable the letter "A" and using enhanced data connectors (EDCs), meet the new specifications for STP cables in the draft U.S.A. and international standards. The original STP cable was specified only through 20 MHz. Although there have been minor changes to the specification at frequencies below 20 MHz, our testing indicates that the overwhelming majority of the original STP cable meets the performance specifications of the newly specified STP-A cable through 300 MHz. It should be noted, however, that the transmission characteristics of the original data connectors for STP do not meet the requirements of the new STP-A connectors, as specified in the draft U.S.A. and international cabling standards.

The copper cabling with the best transmission capacity is 150–ohm STP-A cabling (referred to as STP and STP-A by the EIA Standard, and as IBM Types 1, 1A, 2, and 2A within the IBM Cabling System). IBM strongly supports and endorses their use for horizontal cabling. For new construction we recommend 1A cabling because its performance is specified to frequencies up to 300 MHz. The most critical transmission parameters for copper cabling are attenuation, crosstalk, and the ability of the cable to suppress EMC emissions. For 150–ohm STP cable, the attenuation and crosstalk values are significantly better than the corresponding values for any of the defined 100– or 120–ohm cables. In addition, use of 150–ohm STP, with its combination of foil and braided shield, and its very well defined installation procedures, guarantees both dc and rf shield continuity. dc shield continuity is important for safety considerations. rf shield continuity provides significant suppression of EMC emissions compared with unshielded cable. Note that shielded cable may provide no more emission protection than comparable unshielded cable, unless the shielded cable has the same level of rf continuity that is built into the components and installation procedures for 150–ohm STP.

For installations where cable cross section or cable cost considerations prohibit the use of standard 150–ohm STP-A cable, and where cabling distances do not exceed 60 m (197 ft), use of thin STP or Type 9 cable is appropriate. This cable is similar to standard STP-A with the important exception that its attenuation is higher. However, applications that can be run on 90–meter lengths of standard STP-A cable will perform adequately on up to 60 meters of thin STP or Type 9 cable.

Where copper cable other than 150–ohm STP is desired, 4–pair Category 5 cable should be used for high-speed data transmission applications. In the U.S.A. and Canada, the only approved copper choice other than 150–ohm STP is 4 pair 100–ohm cable. Elsewhere, both 100– and 120–ohm copper cabling types are allowed. Since many LAN and high speed data transmission standards, both existing and in development, support 100–ohm and not 120–ohm cable, a decision to use 120–ohm cabling should be made with caution.

- Use of Category 3 UTP in new installations is strongly discouraged for any high-speed data applications. The tiny cost savings associated with this cable do not adequately compensate for the increased system performance risk from external noise sources, increased crosstalk, and increased cable attenuation compared with the Category 5 UTP choices. In addition, Category 3 cabling may limit allowable configurations. For example, for 16 Mbps token-ring, Category 3 cabling will not support 90 meter horizontal cabling runs using passive hubs.
- If shielded 100– or 120–ohm cable is used, care should be taken to guarantee rf shield continuity from the attaching products in the telecommunications closet to the attaching office product. Since there are presently no standards for shielded modular connectors, you will have to rely on manufacturers and installers guarantees, or on independent testing.
- Although 2–pair 100– and 120–ohm cable is allowed by DIS 11801, its use is discouraged. Note that the use of 2–pair 100–ohm cable for token ring, Ethernet, and FDDI, each requires different pair selections. Therefore, no 2–pair selection can be considered generic. Costly pair rearrangement would be necessary to support the different applications.
- IBM supports the standard multimode optical fiber cable and connectors for horizontal attachment. Although optical fiber may be the appropriate choice for specific applications, its use as the primary data cable for general application from telecommunications closet to office is discouraged since it may significantly limit the choice of economical attachments.

Cable Connectors and Attachment Cables

Since the standards do specify performance ranges of all elements of the cabling infrastructure, link performance is predictable when all components meet the performance requirements of the installed cable type. If not, the link should be characterized as meeting the performance class of its worst component. That is, Category 5 cable terminated in Category 3 connectors meets only Category 3 cabling requirements. Therefore, always terminate cabling with connecting equipment and attachment cables certified to meet or exceed the class of cabling installed.

Building and Campus Backbone Cabling

IBM supports the use of both multimode and singlemode optical fiber in building and campus backbone applications. Not all applications are supported on singlemode and multimode optical fiber. IBM products are designed to operate on cables and connectors as specified in both emerging cabling standards. Other cables and connectors are also supported, but support may be at reduced distances. Copper cabling, both 150-ohm STP or STP-A, and Category 5 UTP may be appropriate, generally, for inter-telecommunications closet distances not exceeding 90 meters, and within a single building. However, this copper cabling should be a supplement to, and not a substitute for, the recommended optical fiber cable interconnecting the telecommunications closets in a campus network.

Bibliography: The following U.S.A. standards are available for purchase from Global Engineering Documents, 1 (800) 854–7179.

- TIA/EIA SP–2840: Commercial Building Telecommunications Cabling Standard, out for second industry ballot, February 1993.
- EIA/TIA–569: Commercial Building Standard for Telecommunications Pathways and Spaces, October 1990.
- TIA/EIA–606: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, February 1993.
- TIA/EIA–607: Commercial Building Grounding and Bonding Requirements for Telecommunications, 1994.

Standards Used With Modular Wiring Connectors

50-Position to Modular Wiring

The 50–position to modular pin wiring in such components as the Harmonica, Octopus, and Mod Patch Panel is called the sequence. There are seven standard sequences: USOC, MMJ, 258A, 356A, 10BASE-T, EIA and OPEN DECconnect.

USOC: This is an adaptation of USOC especially suited to asynchronous EIA–232 and EIA–423 interface data equipment. Available in MMJ polarization, four and six wire channels.

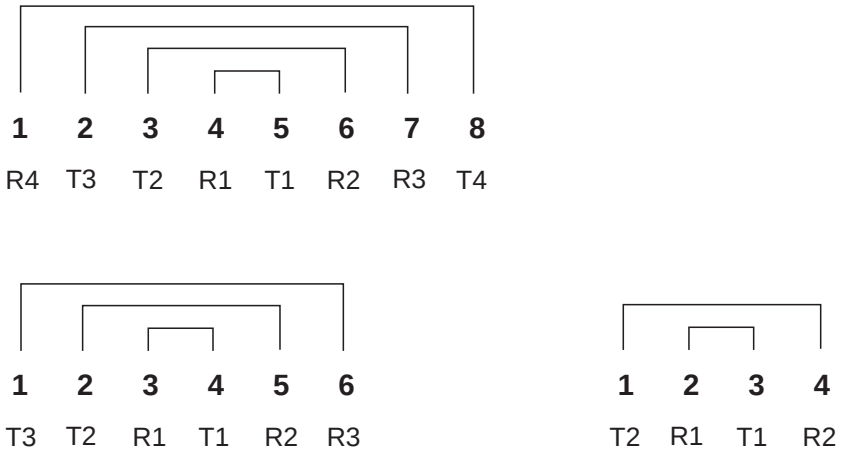


Figure 2. WEW4, WEW6, WE8W and WE8K Modular Polarization

MMJ: This is an adaptation of USOC especially suited to asynchronous EIA–232 and EIA–423 interface data equipment. Available in MMJ polarization, four and six wire channels.

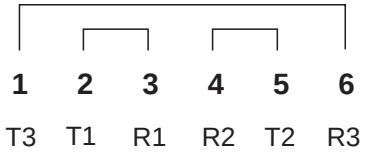


Figure 3. MMJ Polarization

Wall Plate Polarization UTP

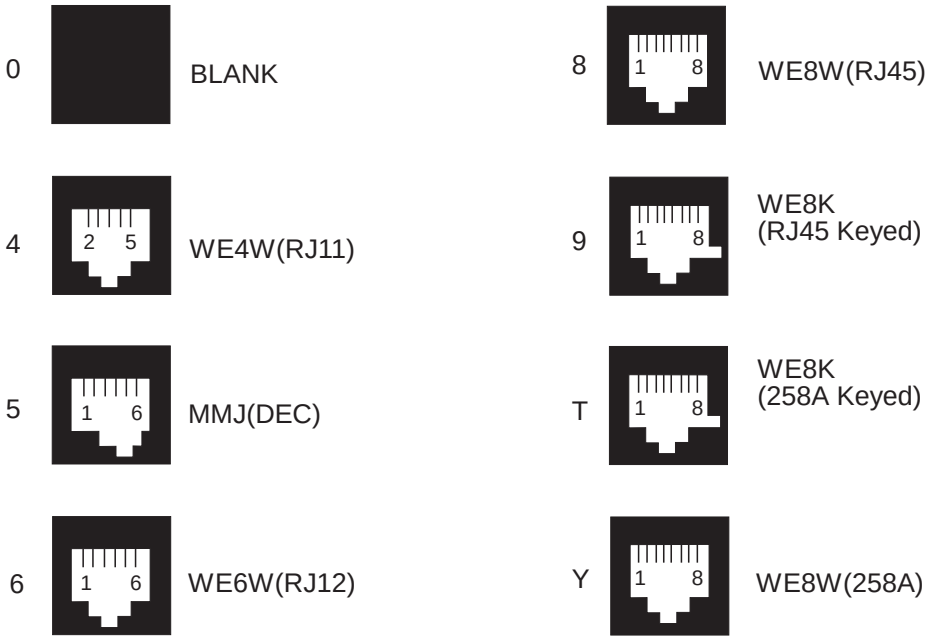


Figure 4. Wall Plate Polarizations UTP

10BASE-T: The 10BASE-T standard is a subset of the AT&T 258A specification and is used for Ethernet over twisted pair.

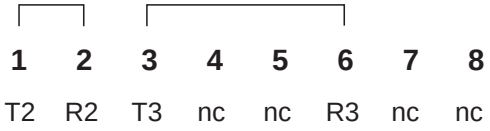


Figure 5. 10BASE-T Polarization

258A (EIA T568B): This is specified by AT&T for use in PDS applications. Eight wire channels in WE8W or WE8K polarization.

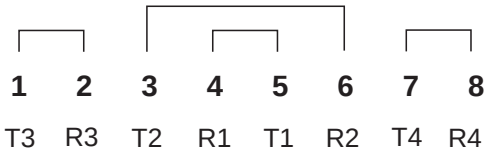


Figure 6. 258A (T568B) Polarization

356A: Same as 258A less pair 4 (7/8). Recommended by IBM for 8250 Terminal Server Application.

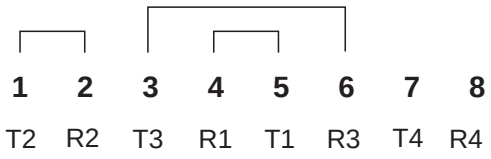


Figure 7. 356A Polarization

EIA T568A: The Electronic Industries Association has designed the following pin or pair assignments as their preferred sequence.

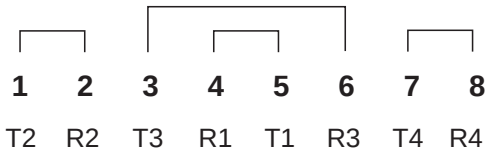


Figure 8. EIA T568A Polarization

OPEN DECconnect: DEC have designated the following pin and pair assignments as their preferred sequence.

Figure 9. OPEN DECconnect Polarization

Chapter 4. Planning for Fiber Connections

This chapter describes the steps necessary for planning fiber cable links in an ATM network:

- Choosing the type of fiber cable to be used, and understanding the basic principles of optical power transmission (see “Before You Start: General Guidelines”).
- Laying out valid ATM links (port-to-port and port-to-device connections) by calculating the optical power budget and computing the optical power losses for each link (see “Planning Cabling Distances” on page 29).
- Maintaining the valid ATM connections that you create (see “Verifying ATM Fiber Connections” on page 37).

In an ATM network, media modules are used to connect ATM devices (workstations, servers, concentrators, bridges, and so on) and ATM switches.). For information on the cables and connectors, see Appendix A, “Connectors, Cables, and Accessories” on page 95.

Before You Start: General Guidelines

Some general guidelines as to follow when planning and settings up an ATM network using fiber as the transmission 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 the IEEEE 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 fiber link and verify that the distance between the two ports, or between the port and a user device does not exceed the optical power budget.
- The power loss you calculate is valid for an ATM connection between two ports or between a port and a device. Each 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 and the optical power budget should be recalculated at each port in the end-to-end connection.
- Links between ports must be individually verified without limitation of the number of switches or ports interconnected.

Interfaces

Singlemode Fiber Interface

Singlemode fiber is also referred to as "mono-mode" fiber. It requires the use of lasers as the light source, allowing link distances between ATM ports to reach up to 20 km. The singlemode fiber cable size (in microns) is 9/125 NA 0.022 at 1300 nm wavelength.

Multimode Fiber Interface

The ATM cable rules follow the FDDI PMD specification. The optical transmitter and fiber bandwidth adheres to specification ISO DIS 9314—3 such that a 5 ms exit response time is achieved after 2 km (6600 ft) of fiber.

MIC or SC duplex connectors are recommended depending on the media module feature code. This allows single connector attachment and keying if desired. Transceivers with integrated connectors are used. The transmit and receive cables cannot be accidentally swapped with a duplex connector.

Each point-to-point connection is independent of the network. The maximum link length between two SC ports is shown in Table 13. The maximum link length between two MIC ports is shown in Table 14.

Table 13. Maximum Link Length on 62.5/125 Multimode Fiber (SC)

Connection Type	Maximum Link Length	Absolute Maximum Link Length	Recommended Link Length
End User Device to Network	2.0 km (1.24 miles)		
Port to Port		2.2 km (1.36 miles)	2.0 km (1.24 miles)

Table 14. Maximum Link Length on 62.5/125 Multimode Fiber (MIC)

Connection Type	Maximum Link Length	Absolute Maximum Link Length	Recommended Link Length
End User Device to Network	2.0 km (1.24 miles)		
Port to Port		3.0 km (1.86 miles)	2.5 km (1.55 miles)

Optical Fiber Cable Specifications

The IBM Cabling System currently recommends 100/140–micron optical fiber for extending token-ring transmission distances between wiring closets. But IBM now recommends the 62.5/125–micron optical fiber for most establishment cabling applications. The 100/140–micron optical fiber will continue to be supported for token-ring networks and fiber distributed data interface (FDDI) networks.

The 62.5/125-micron fiber specification is patterned after the fiber specification in the emerging Commercial Building Wiring Standard (developed by the TIA 41.8.1, and under study by the ISO SC25/WG2 working groups) which will meet most of the intra-building and campus link requirements. This specification is expected to become the accepted multimode standard for government and commercial buildings and meet the ATM and FDDI application requirements. The FDDI standard also provides the information for attaching FDDI cable using 50/125-, 100/140-, or 85/125-micron multimode optical fibers. IBM recommends 62.5/125-micron multimode optical fiber. IBM also supports 50/125- (preferred in Japan and other countries), 85/125-, and 100/140-micron multimode optical fibers, as defined in the ISO 9314/ANSI X3T9.5 standard for both the token-ring networks and FDDI applications.

Each cable specification parameter must be met over the full range of operating temperatures. A suggested temperature range of 0 - 52°C (32 - 125.6°F) is an appropriate choice for many installations. Maximum summer and minimum winter temperatures may differ from this range, particularly in installations where fiber cable will be installed in uninsulated and unheated areas (typically building attics).

Customers should select a grade of fiber that will perform to specification in those instances where the temperature may exceed the suggested range.

Recommended Optical Fiber Specifications for Commercial Building Wiring

Multimode Optical Fiber Cable

Table 15. Multimode Optical Fiber Cable Specifications

Description	62.5/125	50/125
Core diameter	62.5 ±3μm	50 ± 3 μm
Cladding diameter	127 ± 4 μm	127 ± 4 μm
Numerical aperture	0.275 ± 0.015	0.2 ± 0.015
Core/cladding offset	3 μm (max)	3 μm (max)
Core non-circularity	6% (max)	6% (max)
Cladding non-circularity	2% (max)	2% (max)
Maximum attentuation at wavelength: • 850 nanometers • 1300 nanometres	• 3.75 dB/km • 2.0 dB/km	• 3.5 dB/km • 1.5 dB/km
Minimum bandwidth at wavelength: • 850 nanometres • 1300 nanometres (wiring closet to office) • 1300 nanometres (channel extension application)	• 160 MHz • 500 MHz • 500 MHz	• 500 MHz • 500 MHz • 800 MHz

There are four basic types of optical fiber cables recommended for use in the IBM Cabling System:

Table 16. IBM Cabling System - Recommended Optical Fiber Cables

Cable Type	Description	Part Number
Type 5	2-100/140 micron fibers (OFM)	4716744
Type 5 J	2-50/125 micron fibers (OFMJ)	6339090 - Japan only meets UL OFN and OFNR
Type 5 R	X-100/140 micron fibers (OFM)	
Type 5 OD	X-100/140 micron fibers (OFM)	

The specifications for Type 5 and Type 5 J cables are sufficiently detailed so that ordering can be done without the need for additional information. The number of fibers in Type 5 R and Type 5 OD cable is not fixed by specifications, nor is the presence or absence of armor for Type 5 OD cable. This is due to the wide range of fiber counts, environments, and installation requirements covered by these cables. Since the tensile strength and the minimum bend radius are dependent on the size of the cable, these specifications are also left open.

Singlemode Fiber Cable

Table 17. Singlemode Fiber Cable Specifications

Cable Size	9/125 μm NA 0.022
Wavelength	1300 nanometers
Range Acceptable Loss	≤ 0.5 dB/km
Typical Loss	0.37 dB

Planning Cabling Distances

This section describes how to plan the cabling distance between two ports (or between a port and a user device) in a fiber network. To ensure that a 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
- Modal dispersion of the fiber (MHz/Km) when using multimode fiber cable.

Once you have the necessary information, you can plan the cabling distance between ports (or a port and a device) by following these steps:

1. Determine the optical power budget for the port and cable size using the tables given in Chapter 7, “Planning for Media Modules” on page 57.
2. Verify that the overall power loss in the link due to connectors, splices, cable type, patch panels, and jumper cables is less than the optical power budget.

   These steps are described in the following sections.

Notes:

1. The distances achievable depend not only on the fiber diameter, but also on the modal dispersion of the fiber given by the fiber manufacturer, as shown in the example in Table 18.

Table 18. Modal Dispersion and Range

Cable Diameter	Modal Dispersion (MHz/Km)	Range
50/125 micron	600	2.1 km
	1000	3.1 km
62.5 micron	500	2.0 km
	800	2.9 km

   For other modal dispersion values, use a linear interpolation. For example, for a 50/125 micron fiber of 800MHz/Km, the range is:

   2.1 + (3.1-2.1) * (800-600)/(1000-600) = 2.6 Km.

2. The (conservative) recommended distances between ports and transceivers are as follows:
   - Multimode fiber:
     - 500 meters (1,640 ft) for 62.5/125 micron fiber
     - 200 meters (656 ft) for 50/125 micron fiber
   - Singlemode fiber:
     - 15 km (9.32 miles)

   If these distances are exceeded, you must carefully calculate the power loss across the link to make sure that it does not exceed the total power budget.

Optical Power Budget

The Optical Power Budget is the difference between the power output of a transmitter at one end of a connection and the receiver capability at the other end of the connection. The value of the power budget determines how much power can be lost through splices, jumper cables, connectors and so on (see the following sections) while still maintaining an operational connection.

In order for a link to transmit data effectively, the optical power budget must be greater than the total power loss. See “Calculating Power Loss in an ATM Connection” on page 35. When validating cabling distance in fiber links, network planners and installers should calculate for maximum optical power losses in each link of an end-to-end connection.

The optical power budget and maximum link lengths are shown in the SC Transceiver specifications for each module that has fiber connection capability (see Chapter 7, “Planning for Media Modules” on page 57.). The Receiver Sensitivity figures are provided for estimating the validity of fiber connections. To check that the actual received power is greater than the minimum allowed, use an optical multimeter. By not exceeding these values, you can ensure the integrity of the ATM connections you create.

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 19.

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

Table 19. 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
	62.5 to 50	2.0 (4.0 "worst case")
	50 to 62.5	0.0
	9 to 9	0.35 (0.8 "worse case")
Non-physical contact	62.5 to 62.5	0.7
	50 to 50	0.7
	62.5 to 50	5.0
	50 to 62.5	0.3

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 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 the SC Transceiver specifications as given in Chapter 7, “Planning for Media Modules” on page 57. Table 20 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 20. Optical Power Loss per Splice

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

Optical Power Loss By Fiber Cable Type

Although fiber optical cable can carry light signals over long distances, optical power loss can reduce this capability. Table 21 shows the ranges and typical amounts of power l oss 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 21. Optical Power Loss by Cable Type

Cable Type	Power Loss (dB/km)	Typical Loss (dB/km)
50/125 micron @ 1300 nm	0.5 to 2.5	1.0
62.5/125 micron @ 1300 nm	0.5 to 2.0	1.0
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 the media module port.

The optical power loss through a patch panel includes the loss resulting from the two connectors and the bulkhead. Table 22 shows the ranges and typical amounts of power loss for different typ es 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 22. Optical Power Loss per Patch Panel

Type of Patch Panel	Power Loss (dB/km)	Typical Loss (dB/km)
SC to MIC	0.1 to 1.0	0.6
ST to SC	0.1 to 1.0	0.6
SC to SC	0.1 to 1.0	0.6

Optical Power Loss Through Jumper Cables

When an 8265 is installed in a patch panel rack, IBM jumper cables are often used to connect a media port to the patch panel. The use of jumper cables in this type of configuration is recommended in your ATM network because each port regenerates the optical signal at full strength as it was originally transmitted from the source end system in the connection.

The total power loss at each IBM jumper cable is shown in Table 23.

Table 23. Optical Power Loss per IBM Jumper Cable

Cable Type	Total Loss	By Component
Singlemode fiber	0.75 dB	0.7 (0.35 x 2 connectors) + 0.05 (cable loss for 100 meters)
Multimode fiber	1.5 dB	1.4 (0.7 x 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 a connection, that is, between two ports, and between a port and a user device. The data used to calculate the distances is taken from the tables in the preceding sections:

- “Optical Power Budget” on page 30
- “Optical Power Loss Through Connectors” on page 30
- “Optical Power Loss Through Splicing” on page 31
- “Optical Power Loss By Fiber Cable Type” on page 32
- “Optical Power Loss Through Patch Panels” on page 33
- “Optical Power Loss Through Jumper Cables” on page 34.

Example: In the example shown in Figure 10, the connection between ATM Desktop A and ATM Desktop D uses multimode fiber cable (62.5/125 micron) and consists of the following three links:

1. The link from ATM Desktop A, via a patch panel, to a 155Mbps port of a module installed in 8265 B.
2. The link from a 622Mbps port of a module installed in 8265 B, via patch panels, to a 622Mbps port of a module installed in 8265 C.
3. The link from a 155Mbps port in 8265 C, via a patch panel, to ATM Desktop D.

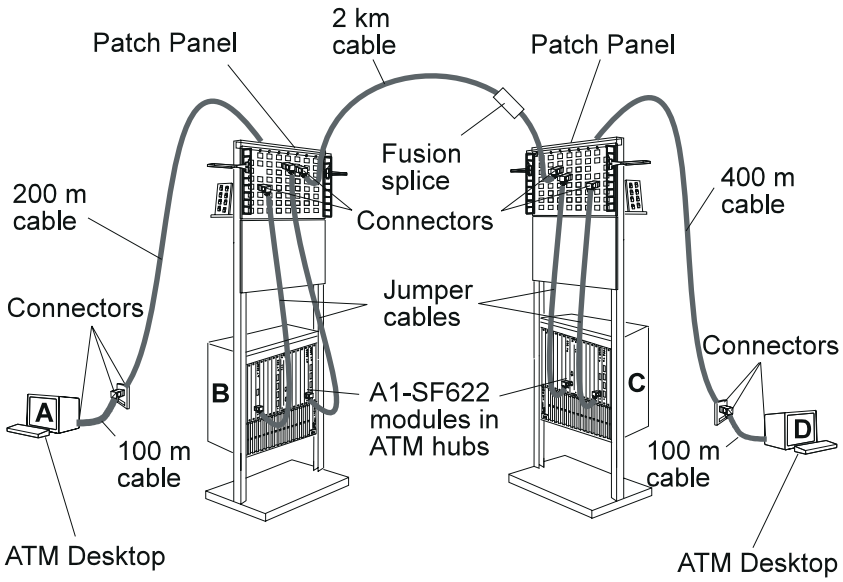


Figure 10. ATM Configuration Example

To calculate the total power loss on each of these links, the power loss for each component in the link must be added together. If the total power loss is less than the Optical Power Budget, then the link is valid.

Table 24 on page 36 shows the total power loss calculation for each link in the connection.

Table 24. Power Loss Calculation (Example)

Link	Component	Power Loss (dBm)	Reference
Desktop A to 8265 B	Cable connector (to ATM desktop)	0.7	Table 19
	100 meter cable	0.25 (worst case)	Table 21
	Cable connector (to wall socket)	0.7	Table 19
	Wall socket (physical contact)	0.4	Table 19
	Wall socket (non-physical contact in wall)	0.7	Table 19
	200 meter cable (in wall)	0.5 (worst case)	Table 21
	Cable connector (to patch panel)	0.7	Table 19
	Patch panel	1.0 (worst case)	Table 22
	Jumper cable (from patch panel to 8265 B)	0.75	Table 23
	Total Power Loss for Link =	**5.7**	
8265 B to 8265 C	Jumper cable (from 8265 B to patch panel)	0.75	Table 23
	Patch panel	1.0 (worst case)	Table 22
	Cable connector (to one patch panel)	0.7	Table 19
	2 km cable (between buildings)	5.0 (worst case)	Table 22
	Fusion splice	0.15	Table 20
	Cable connector (to other patch panel)	0.7	Table 19
	Patch panel	1.0 (worst case)	Table 22
	Jumper cable (from patch panel to 8265 C)	0.75	Table 23
	Total Power Loss for Link =	**10.05**	
8265 B to Desktop D	Jumper cable (from 8265 C to patch panel)	0.75	Table 23
	Patch panel	1.0	Table 22
	Cable connector (to patch panel)	0.7	Table 19
	400 meter cable (in wall)	1.0 (worst case)	Table 21
	Wall socket (non-physical contact in wall)	0.7	Table 19
	Wall socket (physical contact)	0.4	Table 19
	Cable connector (to wall socket)	0.7	Table 19
	100 m cable	0.25 (worst case)	Table 22
	Cable connector (to ATM desktop)	0.75	Table 19
	Total Power Loss for Link =	**6.25**	

Verifying ATM Fiber Connections

To verify that a fiber connection is valid for ATM data transmission, you check that the total power loss for a given link is less than the optical power budget for that link. In the previous example, the total power losses for each link were:

Table 25. Power Loss Calculation (Example)

Link	Total Power Loss (dBm)	Optical Power Budget
ATM Desktop A to 155 Mbps port in 8265 B	5.7	7.0
622 Mbps port in 8265 B to 622 Mbps port in 8265 C	10.05	6.0
155 Mbps port in 8265 C to ATM Desktop D	6.25	7.0

The links between ATM Desktop A and 8265B, and 8265 C to ATM Desktop D are valid, because the total power loss for the link is less than the optical power budget for that link.

The link between 8265 B and 8265 C is invalid, because the total power loss is greater than the power budget. If the link used singlemode fiber instead of multimode fiber, then the connection would be valid because the power budget would be 13 (see Table 37 on page 61).

Maintaining Fiber Connections

After calculating the optical power loss for 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 without verifying that the additional link will not cause the optical power budget to be exceeded.
- Maintain the homogeneity of links by using the same category of fiber cable for each link of a connection.
- When the margin between the total power loss on a connection and the optical power budget is less than, or equal to, 1 dB, check with your vendor to make sure you are using the power loss value set by the manufacturer for your cable, and recalculate the total power loss including the variance value for each component.
- The variance value for each optical fiber component (splices, connectors, cables, and so on) is given in previous sections of this chapter.

Chapter 5. Planning for Twisted Pair Cable Connections

This chapter describes how to plan for twisted pair connections to the ATM subsystem.

Unshielded Twisted Pair Cable Specifications

The 8265 media modules with twisted pair connectors may be attached to shielded or unshielded cables. The unshielded cables are either UTP 100 ohms or FTP 100/120 ohms.

UTP Media Standards

The first high-frequency specification for UTP media was the IBM Cabling System Type 3 specification, intended for use in token-ring networks of already installed, UTP cabling. This specification sought to address as much of the installed base of UTP cabling as practical, instead of creating difficult performance standards. It has provided a useful minimum standard for 4Mbps token-ring transmission on UTP media.

The American National Standards Institute (ANSI), the Electronics Industries Association (EIA), and the Telecommunications Industry Association (TIA) have developed a standard for wiring commercial buildings for telecommunication. This standard seeks to assist when wiring new commercial buildings. It specifies crosstalk and attenuation criteria up to and including 16 MHz. (For more information about this Standard, see the EIA/TIA Commercial Building Telecommunication Wiring Standard, ANSI/EIA/TIA, July 1991.)

Because cabling manufacturers have developed even higher performance UTP cables, EIA/TIA has issued Additional Cable Specifications for Unshielded Twisted Pair Cables, TSB-36, which establishes five categories of UTP cables described below.

Category 1: Voice.

Neither ANSI/EIA/TIA 568 nor EIA/TIA TSB-36 address this category.

Category 2 (IBM Cabling System Type 3): Low-speed data.

Neither ANSI/EIA/TIA 568 nor EIA/TIA TSB-36 specify this category.

IBM Cabling System Type 3 media is to be considered as EIA/TIA Category 2. IBM Cabling System Type 3 media can conform to standards higher than the EIA/TIA category; however, you must test the particular IBM Cabling System Type 3 media to verify its conformance to any higher EIA/TIA category.

Type 3 Media Accessories: The following accessories allow the existing installations that use the telephone twisted pair media to connect devices in the network.

Part Number 6466940	Type 3 media filter, 9-pin D-shell to RJ11 plug
Part Number 6466942	Type 3 media filter, 9-pin D-shell to 24 AWG conductor
Part Number 6466943	DGM to Type 3 filter
Part Number 6466944	Type 3 media jumper cable

Type 3 Media Specifications

Wire gauge:	22 or 24 AWG
Wire type:	Solid copper, twisted pair
Minimum twists per foot:	2
Characterstic impedance at:	256 kHz: 90 - 120 ohms 512 kHz: 87 - 117.5 ohms 772 kHz: 85 - 114 ohms 1 MHz: 84 - 113 ohms
Maximum attenuation at:	256 kHz: 4.00 dB/305 m (1000 ft) 512 kHz: 5.66 dB/305 m (1000 ft) 772 kHz: 6.73 dB/305 m (1000 ft)
Additional specifications:	Cables must conform to one of the following specifications: • ICEA S-80-576 • REA PE-71 • Bell System TR-48007

Category 3: Data, up to 16 MHz.

This category applies to cables currently specified in ANSI/EIA/TIA 568. It is intended for data transmission rates of up to 10 Mbps.

Category 4: Data, up to 20 MHz.

This category is intended for data transmission rates of up to 16Mbps.

Category 5: Data, up to 100 MHz.

This category is intended for data transmission rates of up to 100 Mbps. EIA/TIA Category 5 media exceeds the requirements of EIA/TIA Category 4. You can use the EIA/TIA Category 4 values for the maximum number of attaching devices and the maximum lobe length Category 5 wiring.

In addition to operating at higher frequencies, Category 4 and 5 cable must meet higher standards for mutual capacitance, attenuation, and near-end crosstalk than EIA/TIA Category 3 does.

Maximum Attenuation Standards for UTP/FTP

Table 26 gives, for Category 3, Category 4, and Category 5 cable, the maximum attenuation values for 305 m (1000 ft) of cable.

Table 26. Maximum Attenuation in Horizontal UTP/FTP Cables

Frequency (MHz)	Category 3	Category 4 UTP (100 ohm)	Category 4 FTP (120 ohm)	Category 5 UTP (100 ohm)	Category 5 FTP (120 ohm)
0.064	2.8	2.3	—	2.2	—
0.256	4	3.4	—	3.2	—
0.512	5.6	4.6	—	4.5	—
0.772	6.8	5.7	—	5.5	—
1	7.8	6.5	—	6.3	—
4	17	13	—	13	—
8	26	19	—	18	—
10	30	22	20.4	20	15.9
16	40	27	24.7	25	19
20	—	31	28	28	21.4
25	—	—	—	32	—
32.25	—	—	—	36	—
62.5	—	—	—	52	—
100	—	—	—	67	67

The attenuation values for frequencies of 0.512 MHz and below are provided for information only. These values are intended for engineering design purposes and are not required for conformance wiring.

The maximum attenuation in Table 26 should be adjusted at elevated temperatures by using a factor of 0.3% increase per °C for Category 4 and Category 5 cable. Cable attenuation should be verified at temperatures of 40° C (104 F) and 60° C (140 F) to determine that the requirements of the above table are met, after adjusting for temperature.

Near-End Crosstalk (NEXT)

The following crosstalk measurements between 772 KHz and 100 MHz were performed on 305 m (1000 ft) of cable.

Table 27. Near-End Crosstalk for UTP Cables

Frequency (MHz)	Category 3	Category 4	Category 5
0.772	43	58	64
1	41	56	62
4	32	47	53
8	28	42	48
10	26	41	47
16	23	38	44
20	—	36	42
25	—	—	41
31.25	—	—	40
62.5	—	—	35
100	—	—	32

Shielded Twisted Pair Cable Specifications

With the introduction of 100Mbps FDDI and ATM Networks using STP cable between hubs and workstations, the following specifications must be met.

STP Cable Characteristics

Contact your IBM representative or nearest branch office for a list of cable manufacturers whose STP cables have been certified using the following specifications.

Capacitance Unbalance: The capacitance unbalance of any pair, at 1 kHz and measured at a temperature of 25° ± 3°C, may not exceed 1000 pf/km. The measurements are to be performed on both 305 m (or greater) reels and 100 m reels.

Resistance: The dc resistance of a conductor measured at a temperature of 25° ± 3°C has a maximum value of 57.1 ohms/km for Type 1A, and 151 ohms/km for Type 6A and Type 9A.

Resistance Unbalance: The maximum % dc resistance unbalance between the two conductors of a pair as measured on 305 m (or greater) reels and 100 m reels is 4%. The % resistance unbalance is defined to be:

$$\frac{(\text{Maximum Resistance} - \text{Minimum Resistance}) \times 100}{\text{Minimum Resistance}}$$

Balanced Mode Attenuation: Balanced mode attenuation must be made with the cable-driven (source) and monitored (output) in a balanced mode and with the cable shield earthed (grounded) to the source and measuring instrument earth. Impedance matching baluns must be used for balanced mode. Baluns must be selected to match the nominal cable impedance at the frequency of interest to the impedance of the source and/or measuring equipment. Balun losses and differences in signal levels due to the impedance transforming characteristics of the baluns must be taken into account. A standard S-parameter network analyzer may be used to perform these tests.

Table 28 on page 44 shows the balanced mode attenuation in dB/km.

Table 28. Balanced Mode Attenuation in dB/km

Frequency	Type 1A	Type 9A	Type 6A	Notes
9.6 kHz	3	6	6	1
38.4 kHz	5	7.4	7.4	1
4 MHz	22	33	33	1
8 MHz	31.1	46.7	46.7	1
10 MHz	34.8	52.2	52.2	1
16 MHz	44	66	66	1
20 MHz	49.2	73.8	73.8	1
4-20 MHz	see note 3	see note 3	see note 3	1, 3
25 MHz	61.7	93.3	93.3	2
31.25 MHz	68.9	104.3	104.3	2
62.5 MHz	97.5	147.5	147.5	2
100 MHz	123.3	186.6	186.6	2
20-300 MHz	see note 4	see note 4	see note 4	2, 4

Notes:

1. The attenuation measurements from 9.6 kHz to 20 MHz were performed on 305 m (or greater) reels.
2. The attenuation measurements from 20 MHz to 300 MHz were performed on 100 m reels using a North Hills 13410 or equivalent balun.
3. The attenuation in dB/km must be bounded by the following function:

   $$A(f) \leq k_0 \sqrt{\frac{f}{4}}$$

   for all frequencies (f) in MHz between 4 MHz and 20 MHz. k_0 is the attenuation in dB/km at 4 MHz.
4. The attenuation in dB/km, measured on 100 m reels, must be bounded by the following function:

   $$A(f) \leq k_0 \sqrt{\frac{f}{62.5}}$$

   for all frequencies (f) in MHz between 20 MHz and 300 MHz. k_0 is the attenuation in dB/km at 62.5 MHz.

Common Mode Attenuation: Common mode attenuation measurements are made with the twisted pair driven and monitored common mode with respect to the shield using a 50 ohm network analyzer. No additional impedance matching devices are required.

Common mode attenuation in dB/km, measured on 100 m reels, must be bounded by the following function:

$$A(f) \leq k_0 \sqrt{\frac{f}{50}}$$

for all frequencies (f) in MHz between 50 MHz and 600 MHz, k_0 is 95 dB/km for Type 1A and 135 dB/km for Type 9A.

Near-End Crosstalk (NEXT)

Frequency	Type 1A	Type 9A	Type 6A	Notes
9.6 kHz- 5 MHz	-58.0 dB	-52.0 dB	-52.0 dB	1
8 MHz	-54.9 dB	-48.9 dB	-48.9 dB	1
10 MHz	-53.5 dB	-47.5 dB	-47.5 dB	1
16 MHz	-50.4 dB	-44.4 dB	-44.4 dB	1
20 MHz	-49.0 db	-43.0 dB	-43.0 dB	1
5-20 MHz	see note 3	see note 3	see note 3	1, 3
25 MHz	-47.5 db	-41.5 dB	-41.5 dB	2
31.25 MHz	-46.1 dB	-40.1 dB	-40.1 dB	2
62.5 MHz	-41.5 dB	-35.5 dB	-35.5 dB	2
100 MHz	-38.5 dB	-32.5 dB	-32.5 db	2
20-300 MHz	see note 3	see note 3	see note 3	2, 3

Notes:

1. Crosstalk measurements from 9.6 kHz to 20 MHz were performed on 305 m (or greater) reels.
2. Crosstalk measurements from 20 MHz to 300 MHz were performed on 100 m reels using a North Hills 13410 balun or equivalent.
3. $$NEXT(f) \leq NEXT(5) + 15\log\left(\frac{f}{5}\right)$$

   (f) in MHz.

Characteristic Impedance: Characteristic impedance, Z(0), must be measured under balanced conditions. Measurements should be taken with an impedance measuring device and high quality balun. For each frequency at which a measurement is made, three initial conditions must be measured. These are:

- Impedance with secondary balun terminated in a matched load
- Impedance with secondary balun shorted
- Impedance with secondary balun open.

Each measured impedance must then be converted to a reflection coefficient using the following equation:

$$p = \frac{Z(m) - Z(b)}{Z(m) + Z(b)}$$

Where Z(m) = measured impedance, and Z(b) = output impedance of balun.

The three reflection coefficients, p(match), p(short), and p(open) are then substituted into the following equations to determine the scattering parameters of the test setup:

$$S11 = p(match)$$

$$S22 = \frac{2 \times p(match) - p(short) - p(open)}{p(short) - p(open)}$$

$$S12 \times S21 = (p(match) - p(short)) \times (1 + S22)$$

After the scattering parameters are calculated, the cable to be tested must be connected to the secondary of the balun with the cable's braided shield connected to instrument earth. The cable is then tested under two conditions:

- With the far end of the cable shorted
- With the far end of the cable open.

Each result is then entered into the following equation as p(meas), along with the scattering parameters for the particular frequency of measurement in order to determine the actual reflection coefficient of the cable.

$$p(actual) = \frac{p(meas) - S11}{S22 \times (p(meas) - S11) + S12 \times S21}$$

Each actual reflection coefficient, p(shorted cable) and p(open cable), is converted to an impedance using the following equation:

$$Z(actual) = \frac{Z(b) \times (1 + p(actual))}{(1 - p(actual))}$$

where Z(b) = the output impedance of the balun.

The cable impedance is then calculated using the equation:

$Z(0)^2 = Z(open) \times Z(short)$

Note: Characteristic impedance measurements are performed on 305 m (or greater) reels at 25° ± 3°C, 10 percent tolerance, unless otherwise noted.

Frequency	Type 1A	Type 9A	Type 6A
9.6 kHz	270	390 (note 1)	390 (note 1)
38.4 kHz	185	235 (note 1)	235 (note 1)
3 MHz - 20 MHz	150 (note 2)	150 (note 2)	150 (note 2)

Notes:

1. Tolerance.
2. The specification must be met over the entire frequency range specified.

STP Connector Characteristics

The near-end crosstalk and insertion loss specifications below are intended to extend the specifications in ANSI/IEEE 802.5 when the connectors are to be used with a cable that meets the Type 1A, 2A, and 6A specifications described earlier.

Near-End Crosstalk (NEXT): Near-end crosstalk is a measure of signal coupling from one circuit to another within a connector, and is derived from swept frequency voltage measurements on short lengths of Type 1A STP test leads terminating at the connector under test. A balanced input signal is applied to a disturbed pair of the connector while the induced signal on the disturbed pair is measured at the near end of the test leads.

The near-end crosstalk of any pair must not exceed the values listed in the following table.

Table 29. Near-End Crosstalk for the 150-ohm STP Data Connector

Frequency	**dB**
100 kHz	-65
1 MHz	-65
4 MHz	-65
8 MHz	-65
10 MHz	-65
16 MHz	-62.4
20 MHz	-60.5
25 MHz	-58.5
31.25 MHz	-56.6
62.5 MHz	-50.6
100 MHz	-46.5
300 MHz	-36.9
11.89 to 300 MHz	see note

Note:

$$NEXT(f) \leq NEXT(16) + 20\log\left(\frac{f}{16}\right)$$

(f) in MHz

Insertion Loss: Insertion loss is a measure of signal power loss due to the connecting hardware and is derived from swept frequency voltage measurements on short lengths of Type 1A twisted pair test leads before and after splicing-in the connector under test. The insertion loss of any pair within a connector must not exceed the values listed in the following table.

Table 30 shows the maximum insertion loss for the 150-ohm STP Data Connector (applies to Prime and Self-Shorting paths).

Table 30. Maximum Insertion Loss for the 150-ohm STP Data Connector

Frequency	**dB**
100 kHz	0.05
1 MHz	0.05
4 MHz	0.05
8 MHz	0.1
10 MHz	0.1
16 MHz	0.15
20 MHz	0.15
25 MHz	0.15
31.25 MHz0.15	0.15
62.5 MHz	0.2
100 MHz	0.25
300 MHz	0.45

Data Grade Media (DGM): Plenum (P), non-plenum (NP), riser (R), and non-plenum office (NPO): all indoor cables except under-carpet require 65% (minimum) braid-over aluminum shielding. The shielding percentage is calculated per MIL-C-915E. Aluminum-backed insulating tape is wrapped around the two pairs. (Individual or S-shaped aluminum shielding must be used around Type 1 and Type 2 DGM pairs and is optional for Type 6 and Type 9 DGM pairs.) A tinned-copper braided shield envelopes these shielded pairs to complete the DGM core. The aluminum must make contact with the braided shield continuously along the entire cable length.

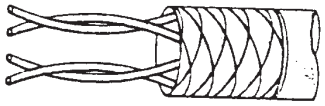
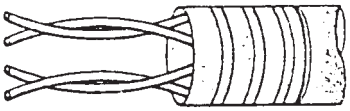
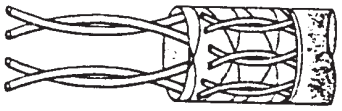
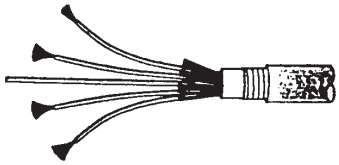
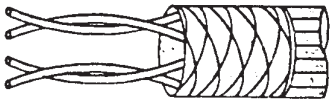
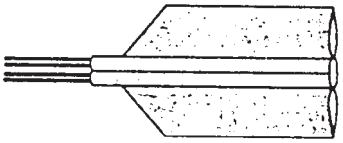
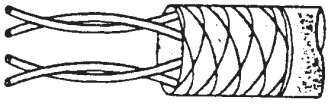
Under-carpet (UC) Shield: The under-carpet cable has a copper foil wrapped around each pair individually. The seam of each copper foil must face the center of the cable.

Outdoor (OD) Shields: Outdoor cable contains two shields. The inner screen shield is an aluminum S-shaped shield coated on both sides with insulating material. The shield is placed between the two pairs and then wrapped around each pair to form an S-shape. The outer shield is corrugated aluminum shield.

Table 31. IBM Cable Type Reference List

Cable Type	Wires	AWG	Use	Insulation	Reference	Length m (ft)
Type 1, non-plenum	2 TP	22	T/R	Polyethylene	4716748	2.3 (7.5)
Type 1A, non-plenum	2 TP	22	FDDI	Polyethylene	33G2772	2.3 (7.5)
Type 1, plenum	2 TP	22	T/R	Fluorocarbon	4716749	2.3 (7.5)
Type 1A, plenum	2 TP	22	FDDI	Fluorocarbon	33G8220	2.3 (7.5)
Type 1, riser	2 TP	22	T/R	Fluorocarbon Polyethylene	6339585	2.3 (7.5)
Type 1A, riser	2 TP	22	FDDI	Fluorocarbon Polyethylene	33G2774	2.3 (7.5)
Type 1, outdoor	2 TP	22	T/R	Polyethylene	4716734	2.3 (7.5)
Type 1A, outdoor	2 TP	22	FDDI	Polyethylene	33G8225	2.3 (7.5)
Type 2, non-plenum	2 TP 4 TP	22 28	T/R	Polyethylene	4716739	2.3 (7.5)
Type 2A, non-plenum	2 TP 4 TP	22 28	FDDI	Polyethylene	33G2773	2.3 (7.5)
Type 2, plenum	2 TP 4 TP	22 28	T/R	Fluorocarbon	4716738	2.3 (7.5)
Type 2A, plenum	2 TP 4 TP	22 28	FDDI	Fluorocarbon	33G8221	2.3 (7.5)
Type 2A, outdoor	2 TP 4 TP	22 28	T/R	Fluorocarbon	33G8226	2.3 (7.5)
Type 6, non-plenum	2 TP	26	FDDI	Polyethylene	4716738	1.65 (5.4)
Type 6A, non-plenum	2 TP	26	FDDI	Polyethylene	33G2775	1.65 (5.4)
Type 6, plenum	2 TP	26	T/R	Polyethylene	4716743	1.65 (5.4)
Type 6A, plenum	2 TP	26	FDDI	Polyethylene	33G8222	1.65 (5.4)
Type 8, under-carpet	2 TP	26	T/R	Polyethylene	4716750	1.45 (4.7)
Type 9, plenum	2 TP	26	T/R	Fluorocarbon	6339583	1.8 (5.9)
Type 9A, plenum	2 TP	26	FDDI	Fluorocarbon	33G8223	1.8 (5.9)
Type 9A, non-plenum	2 TP	26	FDDI	Polyethylene	33G8224	1.8 (5.9)
Type 9A, riser	2 TP	26	FDDI	Polyethylene	33G8226	1.8 (5.9)

Cabling System Cable Types

	**Type 1 specification number 4716748** **Type 1 Plenum specification number 4716749** **Type 1 Riser specification number 6339585** Braided cable shield around two twisted pairs of £22 AWG conductor for data communication.
	**Type 1 Outdoor specification number 4716734** Corrugated metallic cable shield around two twisted pairs of £22 AWG conductors for data communication. Type 1 outdoor cable is suitable for aerial installation or placement in underground conduit.
	**Type 2 specification number 4716739** **Type 2 Plenum specification number 4716738** Same as Type 1 cable with the addition of four twisted pairs of £22 AWG telephone conductors.
	**Type 5 (non-plenum only) specification number 4716744** Two optical fiber conductors. Type 5 cable is suitable for installation indoors or for aerial installation or placement in underground conduit.
	**Type 5 Riser** Multiple fiber cable suitable for horizontal and riser runs within a building. For more information refer to the IBM Cabling System Technical Interface Specification.
	**Type 5 Outdoor** Multiple fiber outdoor cable suitable for inter-building applications. For more information refer to the IBM Cabling System Technical Interface Specification.
	**Type 6 specification number 4716743** Two twisted pairs of £26 AWG stranded conductors for data communication. Type 6 cable is for use only as patch cable or jumper cable.
	**Type 8 specification number 4716750** Two parallel pairs of £26 AWG solid conductors for data communication. Type 8 cable is for use only under carpeting. Contact your IBM representative or the IBM branch office serving your locality for a list of authorized distributors of undercarpet cable.
	**Type 9 specification number 6339583** Two twisted pairs of £26 AWG stranded or solid conductors for data communication.

ATM 1.5 Mbps and 2 Mbps: This section details the supported cables and maximum allowable distances for attaching 1.5 Mbps and 2 Mbps ATM devices. These devices follow the cabling rules established in EIA/TIA-568 Commercial Building Telecommunications Cabling Standard and ISO/IEC DIS 11801, for horizontal cabling Class D.

Table 32. Maximum Link Distance over ATM (1.5 Mbps and 2 Mbps)

Cable Type	Maximum Allowable Distance
100 ohm STP	30 m (100 ft)
120 ohm STP	122 m (400 ft)

ATM 25 Mbps: This section details the supported cables and maximum allowable distances for attaching 25 Mbps ATM devices. These devices follow the cabling rules established in EIA/TIA-568 Commercial Building Telecommunications Cabling Standard and ISO/IEC DIS 11801.

Using Building Cabling: Building cabling extends from the office wall outlet to the wiring closet patch panel. The 8265 supports devices attached to RJ-45 jacks through the building by means of 100–ohm unshielded twisted pair (UTP) or foiled twisted pair (FTP) Category 3, 4, or 5, or 120–ohm UTP or FTP Category 4 or 5 cabling, including patch and equipment cabling. Termination hardware should always match the category of cable that is terminated on it.

IBM Cabling System 150–ohm, shielded twisted pair (STP) cables (type 1, 1A, 9, and 9A) may also be used.

Table 33 shows the maximum link distances of supported cables.

Table 33. Maximum Link Distance over ATM (25 Mbps)

Cable Type	Maximum Allowable Distance
100 ohm UTP Category 3	100 m (328 ft)
100 ohm UTP Category 4	148 m (486 ft)
100 ohm UTP Category 5	160 m (525 ft)
120 ohm FTP Category 4	162 m (532 ft)
120 ohm UTP Category 5	212 m (696 ft)
150 ohm STP Type 1	255 m (837 ft)
150 ohm STP Type 9	170 m (558 ft)

Although cables between the 8265 and 25 Mbps ATM adapters can be longer than 90 m (295 ft), note that standards support a maximum of 90 m (295 ft). If you install cables longer than 90 m, their reuse may be limited as technologies change.

ATM 155 Mbps: This section details the supported cables and maximum allowable distances for attaching 155 Mbps ATM devices. These devices follow the cabling rules established in EIA/TIA-568 Commercial Building Telecommunications Cabling Standard and ISO/IEC DIS 11801, for horizontal cabling Class D.

Table 34. Maximum Link Distance over ATM (155 Mbps)

Cable Type	Maximum Allowable Distance
100 ohm UTP Category 5	100 m (328 ft)
120 ohm FTP	100 m (328 ft)
150 ohm STP Type 1	150 m (493 ft)

Using Patch Cables: Patch cables are often used in the twisted pair link between ATM devices. Installations using patch cables to connect devices to the main trunk cable must reduce the maximum cable distances given in Table 33 on page 53 and Table 34 to ensure reliable operation

UTP/FTP Category 3, 4, and 5 patch cables assembled from patch cord and connectors of the same category that meet the U.S. or Canadian standards should not exceed 80 percent of the distances in Table 33 on page 53 and Table 34. For countries where cabling is ma nufactured according to the less stringent ISO standard, the maximum distances for such assemblies should be no more than 50 percent of the distances.

Installations using 150–ohm STP patch cables (IBM Type 6) should not exceed 70 percent of the maximum allowable distance using STP Type 1 cable. For example, the 155 Mbps link using patch cables will have a maximum link distance of 105 m (150 x 70%). This allows a main trunk of 95 m when using two patch cables of 5 m each.

Generally, it is not good practice to build networks with patch cables that even approach these maximum distances, because the cable is often unprotected and exposed to physical damage that might affect transmission performance.

Chapter 6. Planning for Coax Cable Connections

This chapter describes how to plan for coax cable connections to the ATM system.

Supported Cable Types

This section describes the supported coaxial cables for use with the E1, DS3, and E3 daughter cards of the 8265 WAN 2.5 module (Feature Code 6561) and 8260 WAN 2 modules (Feature Codes 5602 and 5612). Table 35 details the accepted coaxial cables for the E1, DS3, and E3 ATM ports.

Table 35. E1/DS3/E3 Coaxial Cabling Details

Daughter Card Type	Cable Type	Impedance	Attenuation
E1	RG59	75 ohm	6 dB Max @ 1.024 MHz
DS3	RG59	75 ohm	25 dB Max / 100 m @ 400 MHz
E3	RG59	75 ohm	25 dB Max / 100 m @ 400 MHz

Note: The 25 dB attenuation à 400 MHz given corresponds to an attenuation of 12 dB à 17 MHz, assuming that it follows approximately a $\sqrt{f}$ law.

Cabling Distances

The values given in Table 36 are for information only, as the distance is dependent on the quality of cable used.

Table 36. Coaxial Cabling Distances Details

Daughter Card Type	Cable Type	Maximum Proposed Distance
E1	RG59	300 m (984 ft)
DS3	RG59	68 m (225 ft) default 135 m (450 ft) (see note)
E3	RG59	100 m (328 ft) based on a power budget of 12 dB @ 17 MHz

Note: If the DS3 cable distance exceeds the default (68m), the configuration setting for the port must be changed using the SET PORT command. See the DS3 Line Buildout parameter in the *Media Module Reference Guide*.

Setting the Earthing on DS3 and E3 Daughter Cards

To adhere to country-specific regulations regarding the earthing of outer conductors on coaxial pairs (both receive and transmit ports), four jumpers are provided on the rear of the DS3 and E3 daughter cards. If the jumpers are not used, the outer connector is earthed through a 10nF capacitor.

Normally, only the outer connector of the transmit port is to be earthed, and not the receive port. This is dependent on individual country rulings. Check if your country requires the receive port to be earthed as well.

Refer to the *Media Module Reference Guide* to determine which jumpers are required to meet your requirements.

Chapter 7. Planning for Media Modules

This chapter describes how to plan for the installation of media modules.

The 8265 media modules can be used as the link in an ATM system to connect 8265 switches together. They can also be used to connect workstations, hubs, servers, and other ATM devices (such as the 8285 Workgroup Switch) in an ATM campus network.

These possible types of connections are shown in Figure 11.

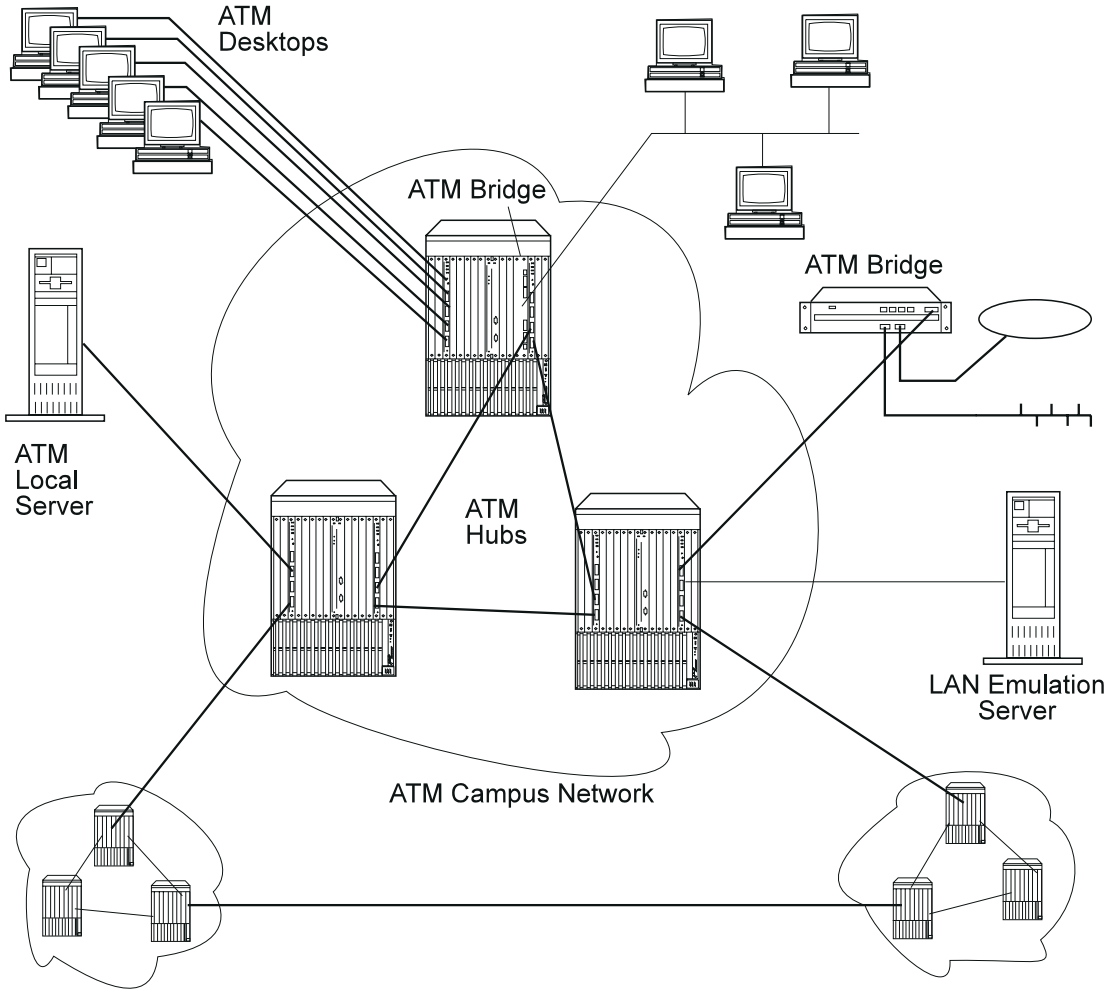


Figure 11. Media Module Connections in an ATM Campus Network

Supported Media

The ATM media modules support the following media types:

- Multimode fiber optic cable with SC connectors (at 100 Mbps, 155 Mbps, or 622 Mbps)
- Singlemode fiber optic cable with SC connectors (at 155 Mbps or 622 Mbps)
- Twisted Pair (UTP, FTP, or STP) cable with RJ-45 connectors (at 25 Mbps, 155 Mbps, 2 Mbps for E1 interface, or 1.5 Mbps for T1/J1 interface)
- Coaxial cable with BNC connectors at:

- 2 Mbps for E1 interface
- 34.3 Mbps for E3 interface
- 44.7 Mbps for DS3 interface.

The main characteristics of these media types, with the maximum link distances, are detailed in the remainder of this chapter.

Filling Out the Planning Documents

Using the final physical plan of your ATM network, update the IBM 8265 Cabling Charts given in Appendix C, “Cabling Charts” on page 129.

Select the appropriate chart or charts and make enough copies for all the ATM links that you have in your ATM system.

If a rack is used, the Rack Inventory Chart given in Appendix B, “Blank Planning Charts” on page 123 can be used.

622Mbps Modules

Feature Code 6511 (Multimode Fiber)

Number of ports:	1
Supported daughter cards:	none
Connectors:	SC
Supported cable types:	• 62.5/125 micron (preferred) • 50/125 micron
Maximum cable lengths:	800 m
Optical specifications:	See page 61

Feature Code 6512 (Singlemode Fiber)

Number of ports:	1
Supported daughter cards:	none
Connectors:	SC
Supported cable types:	9/125 micron
Maximum cable lengths:	15 km
Optical specifications:	See page 61

Optical Specifications

This section describes the optical specifications for 622 Mbps transmitters and receivers with SC singlemode and SC multimode connectors.

When taking the optical power budget for an ATM link between a 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.

Frequency 622.08 MHz

Wavelength (λ) 1300 nm

- Singlemode: 1274 min / 1356 max
- Multimode: 1270 min / 1380 max

Table 37. Optical Specifications for 1-port 622 Mbps Modules

Cable Type	Maximum (dBm)	Minimum (dBm)	Power Budget (dBm)	Max Length
Singlemode 9/125 micron Transmitter Power Receiver Sensitivity[1]	-8 -7	-15 -28	13	15 km (9.32 miles)
Multimode 50/125 micron Transmitter Power Receiver Sensitivity[1]	-14 -14	-24 -26.5	2.5	500 m (1640 ft)
Multimode 62.5/125 micron Transmitter Power Receiver Sensitivity[1]	-14 -14	-20 -26	6	800 m (2624 ft)

[1] 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}.

4–port 155 Mbps Modules

Feature Code 6540 (Multimode Fiber)

Number of ports:	4
Supported daughter cards:	none
Connectors:	SC
Supported cable types:	• 62.5/125 micron (preferred) • 50/125 micron
Maximum cable lengths:	2.2 km for multimode fiber
Optical specifications:	See page 63

Feature Code 6541 (Flex)

Number of ports:	Up to 4, depending on the number of I/O cards installed
Supported daughter cards:	• multimode fiber • singlemode fiber • twisted pair
Connectors:	SC for fiber I/O cards RJ-45 for twisted pair I/O cards
Supported cable types:	• 62.5/125 micron (preferred) or 50/125 micron for multimode fiber • 9/125 micron for singlemode fiber • UTP5 (100 ohm), FTP Category 5 (120 ohm), SFTP (Class D), or STP (150 ohm) twisted pair.
Maximum cable lengths:	• 2.2 km for multimode fiber • 20 km for singlemode fiber • 100 m for UTP5, FTP, and SFTP twisted pair • 150 m for STP twisted pair.
Optical specifications:	See page 63

Optical Specifications

Frequency 155.52 MHz

Wavelength (λ) 1300 nm

- Singlemode: 1261 min / 1360 max
- Multimode: 1270 min / 1380 max

Table 38. Optical Specifications for 4-port 155 Mbps Module Fiber Daughter Cards

Cable Type	Maximum (dBm)	Minimum (dBm)	Power Budget (dBm)	Max Length
Singlemode 9/125 micron Transmitter Power Receiver Sensitivity[1]	-8 -8	-15 -32.5	17.5	20 km (12.4 miles)
Multimode 50/125 micron Transmitter Power Receiver Sensitivity[1]	-14 -14	-22.5 -30	7.5	2 km (1.24 miles)
Multimode 62.5/125 micron Transmitter Power Receiver Sensitivity[1]	-14 -14	-19 -30	11	2.2 km (1.36 miles)

[1] 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 x 10^{-10}.

Twisted Pair Cabling Information

Table 39 details the accepted UTP, FTP, SFTP, and STP cables for use with the twisted pair I/O cards.

Table 39. Twisted Pair Cabling Information for 4-Port 155Mbps Module Twisted Pair I/O Cards

Cable Type	Impedance	Category	Trunk Attenuation @ 100 MHz	Patch Attenuation @ 100 MHz	RFI Class
UTP	100 ohm	5 / Class D	22 dB max / 100 m	33 dB max / 100 m	A
FTP/SFTP	100 ohm	5 / Class D	22 dB max / 100 m	33 dB max / 100 m	B
FTP/SFTP	120 ohm	5 / Class D	17 dB max / 100 m	25 dB max / 100 m	B
STP	150 ohm	IBM cabling	IBM Type 1/1A 12.3 dB max / 130 m	IBM type 6/6A 18.4 dB max / 130 m	B

WAN 2.5 Module

Feature Code 6561

Number of ports:	Up to 8, depending on the number of I/O cards installed.
Supported daughter cards:	• E1/T1/J1 (4-port) • E1/T1/J1 Inverse Multiplex (4-port) • E3 (1-port) • DS3 (1-port) • OC3 (1-port) • STM-1 (1-port)
Connectors:	• BNC for E1, E3, and DS3 • RJ-48 for T1/J1 • SC for OC3 and STM-1
Supported cable types:	• RG59 coax (75 ohm) or FTP (120 ohm) for E1 • FTP (120 ohm) for T1/J1 • RG59 coax (75 ohm) for E3 and DS3 • 9/125 micron fiber for OC3 and STM-1 singlemode • 62.5/125 micron fiber for OC3 and STM-1 multimode fiber
Maximum cable lengths:	• 300 m for RG59 coax cable for E1 • 750 m for FTP cable for T1/J1 • 100 m for RG59 cable for E3 • 135 m for RG59 coax cable for DS3 • 20 km for singlemode fiber • 2.2 km for multimode fiber.

Optical Specifications

Frequency 155.52 MHz

Wavelength (λ) 1300 nm

- Singlemode: 1261 min / 1360 max
- Multimode: 1270 min / 1380 max

Table 40. Optical Specifications for OC3 and STM-1 Daughter Cards

Cable Type	Maximum (dBm)	Minimum (dBm)	Power Budget (dBm)	Max Length
Singlemode 9/125 micron Transmitter Power Receiver Sensitivity[1]	-8 -8	-15 -29	14	20 km (12.4 miles)
Multimode 50/125 micron Transmitter Power Receiver Sensitivity[1]	-14 -14	-22.5 -30	7.5	2 km (1.24 miles)
Multimode 62.5/125 micron Transmitter Power Receiver Sensitivity[1]	-14 -14	-19 -30	11	2.2 km (1.36 miles)

[1] 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}.

OC3 and STM-1 Line Characteristics

Table 41 summarizes the OC3 and STM-1 line characteristics.

Table 41. OC3 and STM-1 Line Characteristics

Distance Range:	• Up to 20 km (8μ singlemode fiber) • Up to 2 km (8μ multimode fiber)
Line Speed:	155.520Mbps
Payload:	149.760Mbps
Clock Extraction:	Yes
Connector Type:	SC
Number of Line Attachments:	1 line attachment per I/O card
Physical Interfaces:	OC3/STM-1
Laser:	• Singlemode fiber: 1310 nm, class 1 (ITU G.597) • Multimode fiber: 1310 nm, LED
Minimum Transmitted Power:	• Singlemode fiber: -15 dB • Multimode fiber: -19 dB
Minimum Receiver Sensitivity:	• Singlemode fiber: -19 dB • Multimode fiber: -30 dB
Optical Power Budget:	• Singlemode fiber: 14 dB • Multimode fiber: 11 dB
Frame Format:	• SONET STS-3c (T1-105) • SDH STM-1 (ITU-T G.708/G.709) • ATM cells in VC-4
Cell Delineation:	I.432
Rate Decoupling:	I.432, I.361, and ATM Forum 3.0/3.1
Idle Cell Character:	Not supported
Cell Discard Policy:	• ANSI, ANSI unassigned • ATM Forum, ATM Forum unassigned • CCITT, CCITT unassigned

DS3 Line Characteristics

Table 42 summarizes the DS3 line characteristics.

Table 42. DS3 Line Characteristics	
Fractional Support:	No
Line Speed:	44.736 Mbps
Payload:	42.209 Mbps
Clock Role:	DTE or DCE
Connector Type:	BNC, 75 Ω line impedance
Number of Line Attachments:	1 line attachment per I/O card
Physical Interfaces:	DS3
Code:	B8ZS
Frame Format:	C-bit parity multiplex
Transmission Convergence Layer:	• PCLP • HEC
Cell Payload Scrambling:	• PCLP: no • HEC: yes
Idle Cell Character:	Not supported
Cell Discard Policy:	• ANSI, ANSI unassigned • ATM Forum, ATM Forum unassigned • CCITT, CCITT unassigned

E3 Line Characteristics

Table 43 summarizes the E3 line characteristics.

Table 43. E3 Line Characteristics	
Fractional Support:	No
Line Speed:	34.368 Mbps
Payload:	33.920 Mbps
Clock Role:	DTE or DCE
Connector Type:	BNC, 75 Ω unbalanced line impedance
Number of Line Attachments:	1 line attachment per I/O card
Physical Interfaces:	ITU-T G.703
Code:	HDB3
Frame Format:	ITU-G.832
Transmission Convergence Layer:	Not applicable
Cell Payload Scrambling:	Not applicable
Idle Cell Character:	Not supported
Cell Discard Policy:	• ANSI, ANSI unassigned • ATM Forum, ATM Forum unassigned • CCITT, CCITT unassigned

E1 Line Characteristics

Table 44 summarizes the E1 line characteristics.

Table 44. E1 Line Characteristics	
Fractional Support:	No
Line Speed:	2.048 Mbps
Payload:	Clear channel: 1.920 or 1.984 Mbps
Clock Extraction:	Yes
Connector Type:	Coaxial: BNC, 75 Ω line impedance Twisted-pair: open wires, 120 Ω line impedance
Number of Line Attachments:	Up to 4 line attachments per I/O card
Physical Interfaces:	ITU-T G.703
Code:	HDB3
Frame Format:	• ITU-T G.703 unstructured • ITU-T G.704 with or without CRC • ITU-T G.706 support fro frame alignment/CRC procedure
Alarm:	ITU-T G.703

J1 Line Characteristics

Table 45 summarizes the J1 line characteristics.

Table 45. J1 Line Characteristics	
Fractional Support:	No
Line Speed:	1.544 Mbps
Payload:	Clear channel: 1.536 Mbps
Clock Extraction:	No
Connector Type:	ISO IS8867
Number of Line Attachments:	Up to 4 line attachments per I/O card
Physical Interfaces:	Interface type: • NTT • DS1 • DSX1 (maximum length of cable to DSU-end 110 ft) Standards: • JT-I411a • JT-I431a • ANSI T1.403 • NTT HSDLCS
Code:	B8ZS
Frame Format:	NTT-I interface format
Alarm:	ITU-T G.732

T1 Line Characteristics

Table 46 summarizes the T1 line characteristics.

Table 46. T1 Line Characteristics	
Fractional Support:	No
Line Speed:	1.544 Mbps
Payload:	Clear channel: 1.536 Mbps
Clock Extraction:	Yes
Connector Type:	RJ48C/CA48C DB15/CA31A
Number of Line Attachments:	Up to 4 line attachments per I/O card
Physical Interfaces:	Interface type: • DS1 • DSX1 (maximum length of cable to DSU-end 110 ft) Standards: • AT&T 62411 • ANSI T1.403 • EIA IA.547
Code:	B8ZS AMI
Frame Format:	D4 (SF), D5 (ESF) for: • T1.403 • T1.407 • AT&T 62411
Alarm:	T1.M1 AT&T 62411

Multiprotocol Switched Services (MSS) Server 2.5 Module

Feature Code 5401

Connectors:	• One RS-232 DB-9 connector for service port connection • One 10 Mbps Ethernet port • Two Type 3 PCMCIA slots
Switch interface:	16-bit, 20ns (768Mbps)
Processor:	PowerPC 603E at 166 MHz
Power requirements:	33.1 W at + 5 Vdc
Memory:	• 8 KB of non-volatile RAM • 512 KB of high-speed level 2 cache memory • 12 MB of Flash EPROM • 64 MB of dynamic RAM (two 32 MB SIMMs) • 10 MB of ATM packet memory
Special circuits:	ATM dedicated chip sets
Modem support:	• PCMCIA data/FAX 28.2Kbps modem • PCMCIA voice/data/FAX 28.2Kbps modem • 100% Hayes-compatible modem via RS-232 port

Note: The MSS Server 2.5 module requires Release 4, or higher, of the CPSW code.

Further Information

Refer to the following documents for additional information:

- *Multiprotocol Switched Services (MSS) Server Introduction and Planning Guide*, GC30-3820.

ATM Carrier Modules

The ATM Carrier modules are part of the IBM ATM Kit Development Program that provides companies and developers with a simple and inexpensive way to add their ATM technology to the 8265. This program allows you to build ATM functions and modules for the 8265, and develop new ATM applications.

The Carrier module inserts into the 8265 switch and acts as a generic motherboard that accepts a feature daughter board. The Carrier module uses the well-known standard interface UTOPIA 2 for communication with 1 or 2 daughter cards that contain the developer's function or application. Functions built on the daughter board benefit from the advanced features of the 8265 and the Carrier module. Two types of UTOPIA 2 interface are supported

By using the UTOPIA interface on the ATM Carrier motherboard, the PHY-specific functions are separated from the standard ATM functions that are common to all ATM applications:

- multi-phy 8–bit interface, with up to 160 Mbps of throughput
- multi-phy 16–bit interface, with up to 800 Mbps of throughput
- Standard ATM functions are located on the Carrier module motherboard
- All PHY-specific functions are concentrated on custom-designed daughter cards that are mounted on the Carrier module.

The daughter cards access all necessary ATM functions via the UTOPIA interface.

There are three types of 8265 Carrier module available:

- A generic version with symmetric connectors (both connectors are on the side of the Carrier module) that supports the UTOPIA 2 8–bit interface, Feature Code 6559.
- A generic version with asymmetric connectors (one connector is on the side of the carrier module, the other one is on the edge) that supports the UTOPIA 2 8–bit interface, Feature Code 6560.
- A generic version that supports the UTOPIA 2 16–bit interface, allowing up to 622 Mbps throughput (non-blocking), Feature Code 6558.

IBM's current partners in the IBM ATMKit Development program include:

- *Bus-Tech Inc.*, who have developed a S/390 ESCON (Enterprise System Connection) attachment daughter card for the symmetric carrier module. This card can be used with Feature Code 6559.
- *Odetics Telecom*, who have developed a Frame Relay/ATM daughter card for the symmetric carrier module. This card can be used with Feature Code 6559.
- *Fibercom*, a division of Litton Systems Inc., who have developed an ATM Circuit Emulation (ACE) daughter card for the asymmetric carrier module. This daughter card connects and transports circuit emulation (PBX) traffic over an ATM campus backbone. This card can be used with Feature Code 6560.

Up to fourteen modules can be used in the 8265.

For more information, refer to the *IBM 8260/8265 Nways ATM Kit Development Program, We Carry your Creativity to ATM*, GA33-0371.

Information about the ATM Kit Development Program and 8265 Carrier modules can be obtained from the Internet, at the following URL: `http://www.networking.ibm.com`.

ATM Carrier Module (Feature Code 6558)

Faceplate marking:	A-CMU 2
Internal clocking:	50/100 MHz
Number of ports:	1
Switch interface:	16-bit, 20 ns
Port connector:	120-pin AMP
Power requirements:	18 W at +5 Vdc
Daughter cards:	1
Daughter card interface:	UTOPIA-2 (16 bits)
Maximum allowable power per daughter card:	28.6 W at +5 Vdc 9.8 W at +12 Vdc 2.5 W at -5 Vdc 3 W at -12 Vdc

ATM Carrier Module (Feature Code 6559)

Faceplate marking:	A-CMU2.5S
Internal clocking:	20 MHz
Number of ports:	2
Switch interface:	16-bit, 20 ns
Port connector:	120-pin AMP symmetric
Power requirements:	30 W at +5 Vdc
Daughter cards:	2
Daughter card interface:	UTOPIA-2 (8 bits)
Maximum allowable power per daughter card:	28.6 W at +5 Vdc 9.8 W at +12 Vdc 2.5 W at -5 Vdc 3 W at -12 Vdc

ATM Carrier Module (Feature Code 6560)

Faceplate marking:	A-CMU2.5A
Internal clocking:	20 MHz
Number of ports:	2
Switch interface:	16-bit, 20 ns (800 Mbps)
Port connector:	120-pin AMP asymmetric
Power requirements:	30 W at +5 Vdc
Daughter cards:	2
Daughter card interface:	UTOPIA-2 (8 bits)
Maximum allowable power per daughter card:	28.6 W at +5 Vdc 9.8 W at +12 Vdc 2.5 W at -5 Vdc 3 W at -12 Vdc

Using 8260 ATM Media Modules

This section lists the 8260 ATM media modules that you can use with the 8265. If you are planning to use any of these modules in the 8265, be sure to read the section on “Required FPGA Levels” on page 79.

Notes:

1. 8260 media modules can only be installed in slots 1, 3, 5, and 7.
2. 8260 media modules will only operate in conjunction with the standard CPSW module (Feature Code 6501). They will not operate in conjunction with the enhanced CPSW2 module (Feature Code 6502).

ATM Modules

Module	Connector Type(s)	No. of ports	Slot Width	Faceplate Marking
4-port 100 Mbps	SC	4	1	A4-SC100
4-port 100 Mbps	MIC	4	1	A4-FB100
12-port 25 Mbps	RJ-45	12	1	A12-TP25
2-port 155 Mbps	—	2	1	A2-MB155
2-port 155 Mbps	—	3	1	A3-MB155
ATM WAN	—	2	1	A2-WAN
ATM WAN 2	—	8	1	A8-WAN
ATM Carrier	—	—	1	A-CMU1
ATM Carrier	—	—	2	A-CMU2
Video Distribution	BNC, mini-DIN	8	2	A8-MPEG
MSS Server	RS-232, DB9	—	2	A-MSS
8271 ATM/Ethernet	RJ-45	12	2	A-E12LS2
8271 ATM/Ethernet	RJ-45	12	3	A-E12LS4
8272 ATM/Token-Ring	RJ-45	8	2	A-TR8LS2
8272 ATM/Token-Ring	RJ-45	8	3	A-TR8LS4
8281 ATM LAN Bridge	RJ-45, DB-15	4	2	A04MB-BRG

Daughter Cards

Type	Connector Type(s)	No. of ports	Faceplate Marking
For 155 Mbps Modules			
Mulitmode fiber	SC	1	MF
Singlemode fiber	SC	1	SF
UTP/STP		1	TP
For WAN 2 Modules			
E1/T1/J1	BNC, RJ-48	4	E1/T1
E1/T1/J1 IMA	BNC, RJ48	4	E1/T1 IMA
E3	BNC	1	E3
DS3	BNC	1	DS3
OC3 Singlemode	SC	1	O-SF
OC3 Multimode	SC	1	O-MF
STM-1 Singlemode	SC	1	S-SF
STM-1 Multimode	SC	1	S-MF
For 25 Mbps Module			
Multimode fiber	SC	1	MF

Universal Feature Cards

Type	Connector Type(s)	No. of ports	Faceplate Marking
For 8271 ATM/Ethernet Modules			
ATM/Ethernet MMF	SC	1	—
100BASE-Tx	RJ-45	1	—
100BASE-Fx	ST	1	—
10BASE-FL	ST	3	—
10BASE-T	RJ-45	4	—
For 8272 ATM/Token-Ring Modules			
ATM/Token-Ring MMF	SC	1	—
Fiber (enhanced)	ST	2	—
UTP/STP (enhanced)	RJ-45	4	—

Required FPGA Levels

Some 8260 ATM modules must have a minimum FPGA level to operate in the 8265.

Table 47 lists the modules and the minimum FPGA levels required. **The modules must have this FPGA level, or higher, before being installed in the 8265.**

If your 8260 ATM module does not have the specified FPGA level (or higher), upgrade the module before removing it from the 8260, using MES 5099. For information on how to upgrade FPGA code, refer to *IBM 8260 Nways Multiprotocol Switching Hub, ATM Control Point and Switch Module Installation and User's Guide*, SA33-0326.

Other supported 8260 ATM modules (8271/8272 LAN Switch modules, for example), are fully compatible with the 8265, and have no minimum FPGA level requirement.

Table 47. Minimum FPGA Levels Required for 8260 ATM Modules

Module	Faceplate Marking	Required FPGA Level
4-port 100 Mbps	A4-SC100	B50
4-port 100 Mbps	A4-FB100	B50
12-port 25 Mbps	A12-TP25	C30
2-port 155 Mbps	A2-MB155	B50
3-port 155 Mbps	A3-MB155	C31
ATM WAN 2	A8-WAN	C32
ATM Carrier	A-CMU1	B50
ATM Carrier	A-CMU2	B50
MSS Server	A-MSS	B50
8281 ATM LAN Bridge	A04MB-BRG	B50

WAN 2 Modules

Feature Codes 5602 and 5612

Note: Feature Code 5612 for Japan.

Number of ports:	Up to 8, depending on the number of I/O cards installed.
Supported daughter cards:	• E1/T1/J1 (4-port) • E1/T1/J1 Inverse Mulitplex (4-port) • E3 (1-port) • DS3 (1-port) • OC3 (1-port) • STM-1 (1-port)
Connectors:	• BNC for E1, E3, and DS3 • RJ-48 for T1/J1 • SC for OC3 and STM-1
Supported cable types:	• RG59 coax (75 ohm) or FTP (120 ohm) for E1 • FTP (120 ohm) for T1/J1 • RG59 coax (75 ohm) for E3 and DS3 • 9/125 micron fiber for OC3 and STM-1 singlemode • 62.5/125 micron fiber for OC3 and STM-1 multimode fiber
Maximum cable lengths:	• 300 m for RG59 coax cable for E1 • 750 m for FTP cable for T1/J1 • 100 m for RG59 cable for E3 • 135 m for RG59 coax cable for DS3 • 20 km for singlemode fiber • 2.2 km for multimode fiber.

Optical Specifications

Frequency 155.52 MHz

Wavelength (λ) 1300 nm

- Singlemode: 1261 min / 1360 max
- Multimode: 1270 min / 1380 max

Table 48. Optical Specifications for OC3 and STM-1 Daughter Cards

Cable Type	Maximum (dBm)	Minimum (dBm)	Power Budget (dBm)	Max Length
Singlemode 9/125 micron Transmitter Power Receiver Sensitivity[1]	-8 -8	-15 -29	14	20 km (12.4 miles)
Multimode 50/125 micron Transmitter Power Receiver Sensitivity[1]	-14 -14	-22.5 -30	7.5	2 km (1.24 miles)
Multimode 62.5/125 micron Transmitter Power Receiver Sensitivity[1]	-14 -14	-19 -30	11	2.2 km (1.36 miles)

[1] 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}.

OC3 and STM-1 Line Characteristics: Table 49 summarizes the OC3 and STM-1 line characteristics.

Table 49. OC3 and STM-1 Line Characteristics

Distance Range:	• Up to 20 km (8μ singlemode fiber) • Up to 2 km (8μ multimode fiber)
Line Speed:	155.520Mbps
Payload:	149.760Mbps
Clock Extraction:	Yes
Connector Type:	SC
Number of Line Attachments:	1 line attachment per I/O card
Physical Interfaces:	OC3/STM-1
Laser:	• Singlemode fiber: 1310 nm, class 1 (ITU G.597) • Multimode fiber: 1310 nm, LED
Minimum Transmitted Power:	• Singlemode fiber: -15 dB • Multimode fiber: -19 dB
Minimum Receiver Sensitivity:	• Singlemode fiber: -19 dB • Multimode fiber: -30 dB
Optical Power Budget:	• Singlemode fiber: 14 dB • Multimode fiber: 11 dB
Frame Format:	• SONET STS-3c (T1-105) • SDH STM-1 (ITU-T G.708/G.709) • ATM cells in VC-4
Cell Delineation:	I.432
Rate Decoupling:	I.432, I.361, and ATM Forum 3.0/3.1
Idle Cell Character:	Not supported
Cell Discard Policy:	• ANSI, ANSI unassigned • ATM Forum, ATM Forum unassigned • CCITT, CCITT unassigned

DS3 Line Characteristics: Table 50 summarizes the DS3 line characteristics.

Table 50. DS3 Line Characteristics

Fractional Support:	No
Line Speed:	44.736 Mbps
Payload:	42.209 Mbps
Clock Role:	DTE or DCE
Connector Type:	BNC, 75 Ω line impedance
Number of Line Attachments:	1 line attachment per I/O card
Physical Interfaces:	DS3
Code:	B8ZS
Frame Format:	C-bit parity multiplex
Transmission Convergence Layer:	• PCLP • HEC
Cell Payload Scrambling:	• PCLP: no • HEC: yes
Idle Cell Character:	Not supported
Cell Discard Policy:	• ANSI, ANSI unassigned • ATM Forum, ATM Forum unassigned • CCITT, CCITT unassigned

E3 Line Characteristics: Table 51 summarizes the E3 line characteristics.

Table 51. E3 Line Characteristics

Fractional Support:	No
Line Speed:	34.368 Mbps
Payload:	33.920 Mbps
Clock Role:	DTE or DCE
Connector Type:	BNC, 75 Ω unbalanced line impedance
Number of Line Attachments:	1 line attachment per I/O card
Physical Interfaces:	ITU-T G.703
Code:	HDB3
Frame Format:	ITU-G.832
Transmission Convergence Layer:	Not applicable
Cell Payload Scrambling:	Not applicable
Idle Cell Character:	Not supported
Cell Discard Policy:	• ANSI, ANSI unassigned • ATM Forum, ATM Forum unassigned • CCITT, CCITT unassigned

E1 Line Characteristics: Table 52 summarizes the E1 line characteristics.

Table 52. E1 Line Characteristics

Fractional Support:	No
Line Speed:	2.048 Mbps
Payload:	Clear channel: 1.920 or 1.984 Mbps
Clock Extraction:	Yes
Connector Type:	Coaxial: BNC, 75 Ω line impedance Twisted-pair: open wires, 120 Ω line impedance
Number of Line Attachments:	Up to 4 line attachments per I/O card
Physical Interfaces:	ITU-T G.703
Code:	HDB3
Frame Format:	• ITU-T G.703 unstructured • ITU-T G.704 with or without CRC • ITU-T G.706 support fro frame alignment/CRC procedure
Alarm:	ITU-T G.703

J1 Line Characteristics: Table 53 summarizes the J1 line characteristics.

Table 53. J1 Line Characteristics

Fractional Support:	No
Line Speed:	1.544 Mbps
Payload:	Clear channel: 1.536 Mbps
Clock Extraction:	No
Connector Type:	ISO IS8867
Number of Line Attachments:	Up to 4 line attachments per I/O card
Physical Interfaces:	Interface type: • NTT • DS1 • DSX1 (maximum length of cable to DSU-end 110 ft) Standards: • JT-I411a • JT-I431a • ANSI T1.403 • NTT HSDLCS
Code:	B8ZS
Frame Format:	NTT-I interface format
Alarm:	ITU-T G.732

T1 Line Characteristics: Table 54 summarizes the T1 line characteristics.

Table 54. T1 Line Characteristics

Fractional Support:	No
Line Speed:	1.544 Mbps
Payload:	Clear channel: 1.536 Mbps
Clock Extraction:	Yes
Connector Type:	RJ48C/CA48C DB15/CA31A
Number of Line Attachments:	Up to 4 line attachments per I/O card
Physical Interfaces:	Interface type: • DS1 • DSX1 (maximum length of cable to DSU-end 110 ft) Standards: • AT&T 62411 • ANSI T1.403 • EIA IA.547
Code:	B8ZS AMI
Frame Format:	D4 (SF), D5 (ESF) for: • T1.403 • T1.407 • AT&T 62411
Alarm:	T1.M1 AT&T 62411

8271 Ethernet LAN Switch Modules

Feature Codes 5212 and 5312

Number of ports:	12 base, plus additional ports depending on the I/O cards installed.
Supported daughter cards:	• 10BASE-T (4-port) • 10BASE-FL (3-port) • 100BASE-TX (1-port) • 100BASE-FX (1-port) • ATM/Ethernet (1-port).
Connectors:	• RJ-45 (shielded) base • RJ-45 (shielded) for 10BASE-T and 100BASE-TX cards • ST for 10BASE-FL and 100BASE-FX cards • SC for ATM/Ethernet card
Supported cable types:	• UTP 3 (100 ohm), FTP (120 ohm), or STP (150 ohm) for base and 10BASE-T card ports • UTP 5 (100 ohm) for 100BASE-TX card ports • 62.5/125 micron multimode fiber for 10BASE-FL, 100BASE-FX, and ATM/Ethernet card ports
Maximum cable lengths:	• 100 m for UTP3, UTP5, FTP, and STP • 2 km for multimode fiber

Further Information: Refer to the following documents for additional information:

- *8271 LAN Switch Module Planning and Installation Guide*, GA27-4162.
- *100BASE-TX and 100BASE-FX Universal Feature Cards: Planning and Installation Guide*, GA27-4096.
- *4-Port 10BASE-T and 3-Port 10BASE-FL Universal Feature Cards: Planning and Installation Guide*, GA27-4120.
- *ATM 155Mbps Multimode Fiber Universal Feature Card Planning and Installation Guide*, GA27-4156.

8272 Token-Ring LAN Switch Modules

Feature Codes 5208 and 5308

Number of ports:	8 base, plus additional ports depending on the I/O cards installed.
Supported daughter cards:	• UTP/STP (4-port) • Fiber (2-port) • RMON LAN probe • ATM/Token-Ring (1-port).
Connectors:	• RJ-45 (shielded) base • RJ-45 (shielded) for UTP/STP • ST for fiber • SC for ATM/Token-Ring
Supported cable types:	• UTP 3 (100 ohm), UTP5 (100 ohm), FTP (120 ohm), or STP (150 ohm) for base and UTP/STP card • 62.5/125 micron multimode fiber for 1fiber and ATM/Token-Ring cards
Maximum cable lengths:	• 100 m for UTP3 • 350 m for UTP5 cable at 4 Mbps, 200 m at 16 Mbps • 350 m for FTP cable at 4 Mbps, 200 m at 16 Mbps • 750 m for STP cable at 4 Mbps, 290 m at 16 Mbps • 2 km for multimode fiber

Further Information: Refer to the following documents for additional information:

- *8272 LAN Switch Module Planning and Installation Guide*, GA27-4163.
- *2-Port Fiber and 4-Port UTP/STP Token-Ring Enhanced Universal Feature Card Planning and Installation Guide*, GA27-4168.
- *ATM 155Mbps Multimode Fiber Universal Feature Card Planning and Installation Guide*, GA27-4156.

Multiprotocol Switched Services (MSS) Server Module

Feature Code 5400

Connectors:	• One RS-232 DB-9 connector for service port connection • One 10 Mbps Ethernet port • Two Type 3 PCMCIA slots
Switch interface:	16-bit, 20ns (768Mbps)
Processor:	PowerPC 603E at 166 MHz
Power requirements:	42 W at + 5 Vdc
Memory:	• 8 KB of non-volatile RAM • 512 KB of high-speed level 2 cache memory • 12 MB of Flash EPROM • 32 MB of dynamic RAM (two 16 MB SIMMs) • 10 MB of ATM packet memory
Special circuits:	ATM dedicated chip sets
Modem support:	• PCMCIA data/FAX 28.2Kbps modem • PCMIA voice/data/FAX 28.2Kbps modem • 100% Hayes-compatible modem via RS-232 port

Further Information: Refer to the following documents for additional information:

- *Multiprotocol Switched Services (MSS) Server Introduction and Planning Guide*, GC30-3820.

Video Distribution Module

Feature Code 5008

Number of ports:	8 video, 8 audio
Connectors:	BNC for video, 5-pin mini-DIN for audio
Cable type:	• RG59/U (75 ohm) for video • unbalanced audio cable for audio
Power requirements:	62.5 W at + 5 Vdc

Further Information: Refer to the following documents for additional information:

- *IBM Video Distribution Module, User's Guide*, GA27-4173.

12–port 25 Mbps Module

Feature Code 5102

Number of ports:	12 (13 if I/O card installed)
Supported daughter cards:	1 multimode fiber (155 Mbps)
Connectors:	Shielded RJ-45 SC for fiber daughter card
Supported cable types:	• UTP Categories 3, 4, and 5 (100 ohm) • FTP/SFTP (100 and 120 ohm) • STP (150 ohm) • 62.5/125 micron fiber for daughter card
Maximum cable lengths:	• 100 m (330 ft) for Category 3 UTP cabling • 150 m (495 ft) for Category 4 UTP cabling • 160 m (528 ft) for Category 5 UTP cabling • 162 m (535 ft) for FTP cabling • 300 m (990 ft) for STP cabling • 2.2 km (1.36 miles) for fiber.

Optical Specifications: The optical specifications below concern the multimode fiber 155 Mbps daughter card only.

Frequency 155.52 MHz

Wavelength (λ) 1300 nm

- Multimode: 1270 min / 1380 max

Table 55. Optical Specifications for 12-port 25 Mbps Module Fiber Daughter Card

Cable Type	Maximum (dBm)	Minimum (dBm)	Power Budget (dBm)	Max Length
Multimode 62.5/125 micron	-14	-19	11	2.2 km (1.36 miles)
Transmitter Power	-14	-30		
Receiver Sensitivity[1]				

[1] 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}.

Twisted Pair Cabling Information: Table 56 details the accepted UTP, FTP, SFTP, and STP cables for use with the 12 RJ-45 ports..

Table 56. Twisted Pair Cabling Information for 12-Port 25 Mbps Module

Cable Type	Impedance	Category	Trunk Attenuation @ 100 MHz	Patch Attenuation @ 100 MHz	RFI Class
UTP	100 ohm	5 / Class D	22 dB max / 100 m	33 dB max / 100 m	A
FTP/SFTP	100 ohm	5 / Class D	22 dB max / 100 m	33 dB max / 100 m	B
FTP/SFTP	120 ohm	5 / Class D	17 dB max / 100 m	25 dB max / 100 m	B
STP	150 ohm	IBM cabling	IBM Type 1/1A 12.3 dB max / 130 m	IBM type 6/6A 18.4 dB max / 130 m	B

4–port 100 Mbps Module

Feature Code 5104 (Multimode Fiber)

Number of ports:	4
Supported daughter cards:	none
Connectors:	SC
Supported cable types:	62.5/125 micron fiber
Maximum cable lengths:	2.2 km (1.36 miles)
Optical specifications:	See page 94

Optical Specifications

Frequency 100 MHz

Wavelength (λ) 1300 nm

- Multimode: 1270 min / 1380 max

Table 57. Optical Specifications for 4-port 100 Mbps Module

Cable Type	Maximum (dBm)	Minimum (dBm)	Power Budget (dBm)	Max Length
Multimode 50/125 micron Transmitter Power Receiver Sensitivity[1]	-18 -14	-21 -30	9	2 km (1.24 miles)
Multimode 62.5/125 micron Transmitter Power Receiver Sensitivity[1]	-14 -14	-19 -30	11	2.2 km (1.36 miles)

[1] 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 A. Connectors, Cables, and Accessories

You can obtain a catalog of cables and accessories from any IBM branch office or you can call IBM Direct -toll free- from anywhere in the United States, Monday through Friday, 8 A.M. to 8 P.M. Eastern time. The toll-free number is 1-800-IBM-2468.

To obtain information outside the United States, contact your local IBM branch office.

To order cables and accessories, call the IBM Direct toll-free number above or mail the order form provided in the catalog to:

IBM Direct
Systems Products Depertment
One Culver Road
Dayton, NJ 08810
U.S.A.

Twisted Pair Connections

IBM ATM Twisted Pair Hardware

Table 58 gives the IBM part numbers of recommended ATM twisted pair hardware.

Table 58. IBM Twisted Pair Hardware

Description	IBM Part Number
Compliant/Non-Compliant Converter	10H3904
RJ45 Wrap Plug (ATM Forum Compliant)	42H0540
Cable with RJ45 Connector and IBM Data Connector	42H0544
Port-to-Port Cable with RJ45 Connector	51H3971
E1/T1/J1 Wrap Plug	57G8097
E1 Twisted Pair Connector Kit	57G8075
Port-to-Port Cable with Open Wires (for E1), 15m (50 ft)	57G8029 (Germany 80G3983)
Port-to-Port Cable with Open Wires (for E1), 30m (100 ft)	57G8030 (Germany 80G3984)
Port-to-Port Cable with Open Wires (for E1), 70m (230 ft)	57G8031 (Germany 80G3983)
Port-to-Port Cable with Open Wires (for E1), 100m (328 ft)	57G8032 (Germany 80G3983)
Port-to-Port Cable with Open Wires (for E1), 122m (428 ft)	57G8033 (Germany 80G3983)
T1/J1 Twisted Pair Connector Kit	57G8075
Port-to-Port Cable with DB15 Connector (for T1), 15m (50 ft)	02L4270
Port-to-Port Cable with RJ-48 Connector (for T1), 15m (50 ft)	02L4258
Port-to-Port Cable with RJ-48 Connector (for J1), 15m (50 ft)	57G8042 (Japan)
Port-to-Port Plenum Cable with RJ-48 Connector (for T1), 15m (50 ft)	57G0700 (U.S.A)
Port-to-Port Cable with RJ-48 Connector (for T1), 30m (100 ft)	57G8021
Port-to-Port Cable with RJ-48 Connector (for J1), 30m (100 ft)	57G8043 (Japan)
Port-to-Port Plenum Cable with RJ-48 Connector (for T1), 30m (100 ft)	57G0701 (U.S.A.)

ATM RJ45 8-Pin Connector and Cable

The following 8265 modules have ports that require the use of an RJ-45 8-pin connector and cable:

- 12–port 25 Mbps module
- 4–port 155 Mbps module, when twisted pair I/O cards (Feature Code 6582) are installed.

Shielded RJ45 connectors are used for data transmission over twisted pair cables. The recommended twisted pair cabling specifications are:

- 100 ohm UTP Category 3 or better for 25 Mbps
- 100 ohm UTP Category 5 or better for 155 Mbps.

The RJ45 pin assignments are shown in Figure 12.

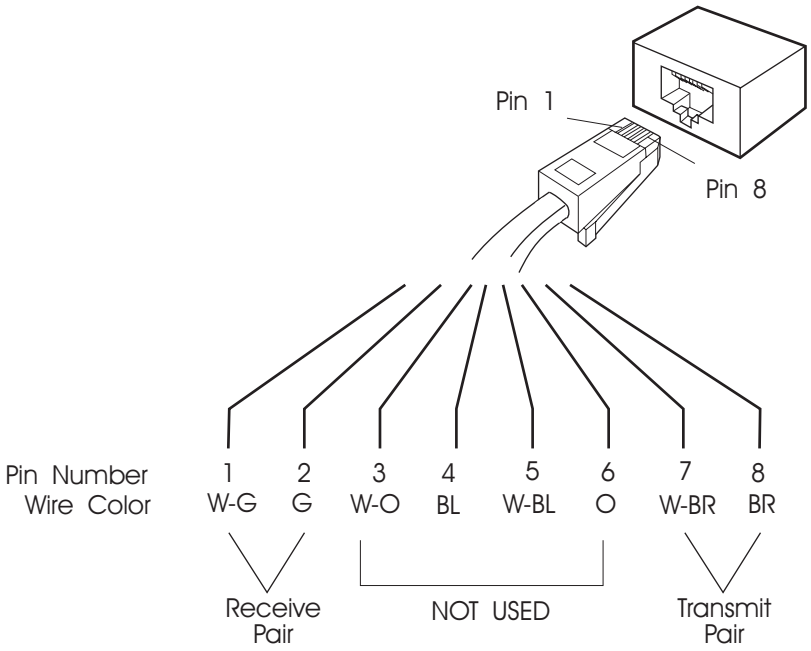


Figure 12. ATM 8–Pin Connector

The ATM ports comply with the ATM forum, with the pin assignment in the RJ45 modular jack as described in Table 59.

Table 59. ATM RJ45 8-Pin Connector, ATM Forum Pin Assignment

Pin	Network Equipment	User Device
1	Receive +	Transmit +
2	Receive -	Transmit -
7	Transmit +	Receive +
8	Transmit -	Receive -

ATM Device Interconnection: For UNI (User-to-Network Interface) port connections complying with the ATM forum, a straight-through cable should be used, with the pin assignment shown in Figure 13.

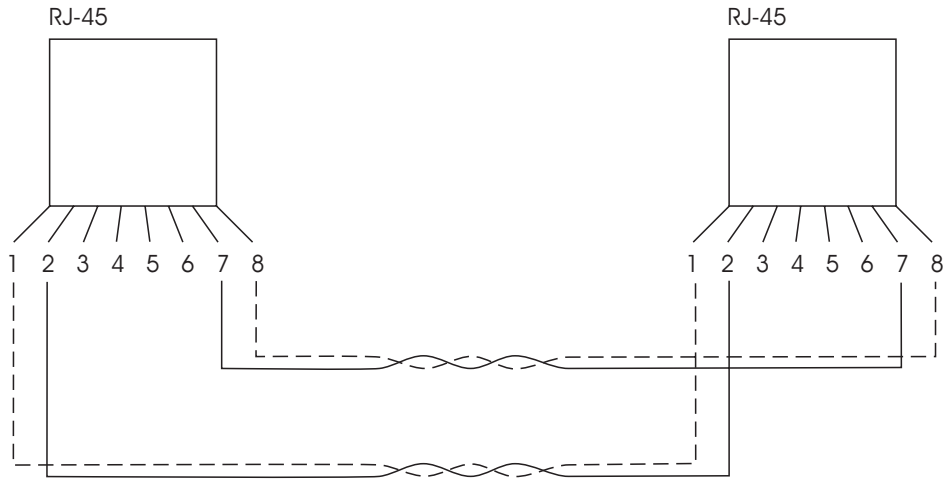


Figure 13. Straight-Through UTP Cable

For port-to-port connections, the transmit and receive pairs must be crossed (Pin 1 to Pin 7, and Pin 2 to Pin 8) according to Table 60.

Table 60. Pin Assignment for Cabling Port-to-Port Connections

Pin	Local Port	Remote Port	Pin
1	Receive +	Transmit +	7
2	Receive -	Transmit -	8
7	Transmit +	Receive +	1
8	Transmit -	Receive -	2

A cable with this pin assignment is available from IBM, Part Number 51H3971.

Early models of ATM adapters do not comply to the ATM Forum. To connect non-ATM Forum compliant devices to ATM Forum compliant ports, you must use a twisted pair cable that connects the pins as shown in Table 56 on page 93.

Table 61. Pin Assignment for Non-ATM Forum Compliant Devices

Pin	Compliant Port	Non-compliant Port	Pin
1	Receive +	Transmit +	3
2	Receive -	Transmit -	6
7	Transmit +	Receive +	4
8	Transmit -	Receive -	5

A cable with this pin assignment is available from IBM, Part Number 10H3904.

Attention:

Be careful of the different pin assignments when interconnecting ATM forum compliant and non-compliant devices.

ATM Connection to IBM Cabling System

When connecting to the IBM Cabling System, use patch cables to convert from the shielded 8-pin connector to the IBM universal data connector.

Table 62. Twisted Pair 8-Pin Connector Patch Cable

Overall Length	Part Number
2.49 m (8 ft)	42H0544

The pin layout is described in Table 63.

Table 63. Shielded 8-Pin Conversion to IBM Data Connectors

8-Pin	UDC Pin	IBM Connector Pin Color	Pin Function
1	1	Black	Station Transmit +
2	2	Orange	Station Transmit -
7	4	Green	Station Receive +
8	5	Red	Station Receive -
Shield	Shield	Shield	—

E1 Twisted Pair Cables and Connectors

The section details the twisted pair cables and connectors for use with the WAN 2.5 module E1 daughter card.

Table 64. E1 Twisted Pair Connection	
Number of ports:	4
Characteristics:	E1 (120 ohm)
Speed:	2.048 Mbps
Feature Code:	8505

Wrap Plug: The part number of the wrap plug is 57G8097.

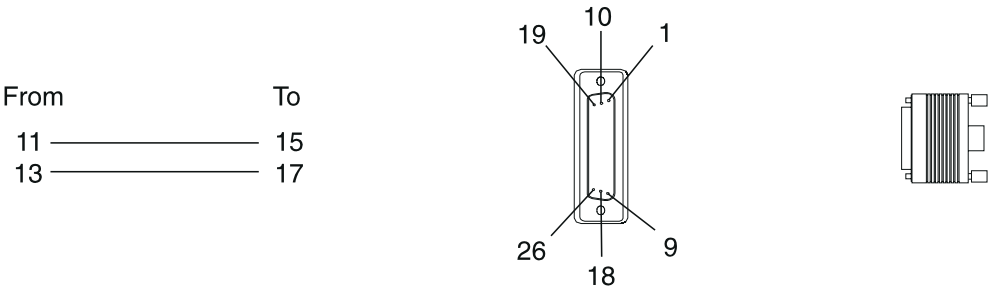


Figure 14. E1 Twisted Pair Wrap Plug Pin Assignment

Cable and Connectors

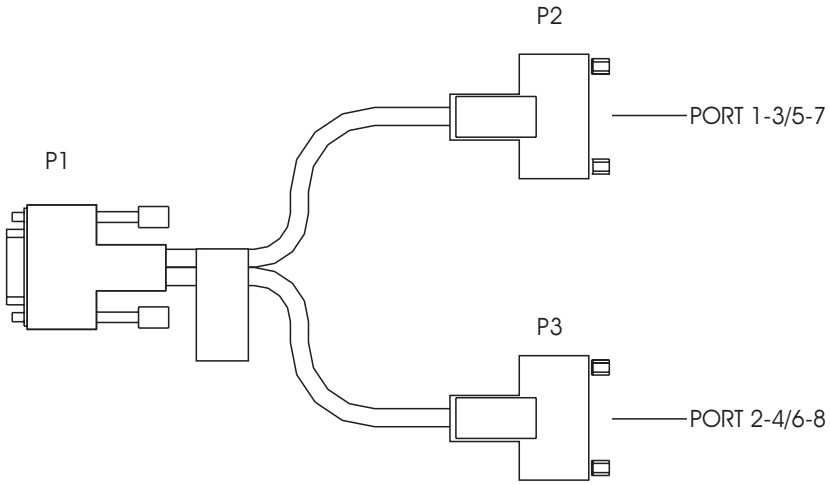


Figure 15. E1 Twisted Pair Connector Cable

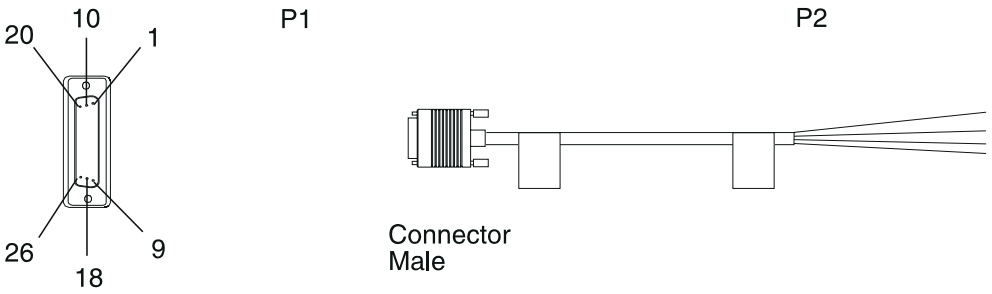


Figure 16. E1 Twisted Pair Cable

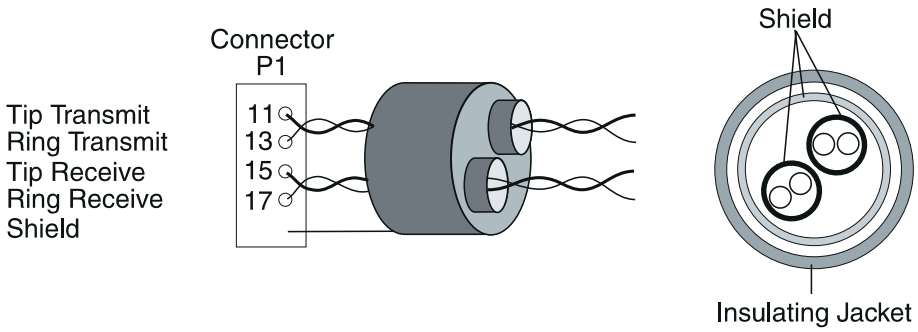


Figure 17. E1 Twisted Pair Cable Pin Assignment

Connector Kit (Feature Code 5701): The part number of the Connector Kit is 57G8075.

Bulk Cable Specifications

- Two twisted pairs, AWG 24, 120 ohm.
- Shielding on each twisted pair, plus overall shielding.
- Maximum length 122 m.

Connector P2

- Not predefined. Depends on the customer equipment.
- ETSI 300-11 standard.

Note: If a cable not supplied by IBM is used, IBM does not guarantee electromagnetic compatibility (EMC) compliance for the 8265 machine.

Cable List

Table 65. E1 Twisted Pair Cables			
Length m (ft)	**Feature Code**	**Part Number (Worldwide except Germany)**	**Part Number (Germany)**
15 (50)	5260	57G8029	80G3983
30 (100)	5261	57G8030	80G3984
70 (230)	5262	57G8031	80G3985
100 (328)	5263	57G8032	80G3986
122 (400)	5264	57G8033	80G3987

Homologation and Notes: E1 twisted pair complies with the following EU directives:

EMC 89/336/EEC

LVD 73/23/EEC

Telecommunications 91/263/EEC

If the PTT require an ISO/IEC 10173 plug to connect the E1 daughter card, then the IBM Service Engineer installs this plug on the fly-leads of the supplied cable.

T1/J1 Twisted Pair Cables and Connectors

The section details the twisted pair cables and connectors for use with the WAN 2.5 module T1/J1 daughter card.

Table 66. T1/J1 Twisted Pair Connection	
Number of ports:	4
Characteristics:	T1 or J1
Speed:	Up to 1.536 Mbps
Feature Code:	8507

Wrap Plug: The part number of the wrap plug is 57G8097.

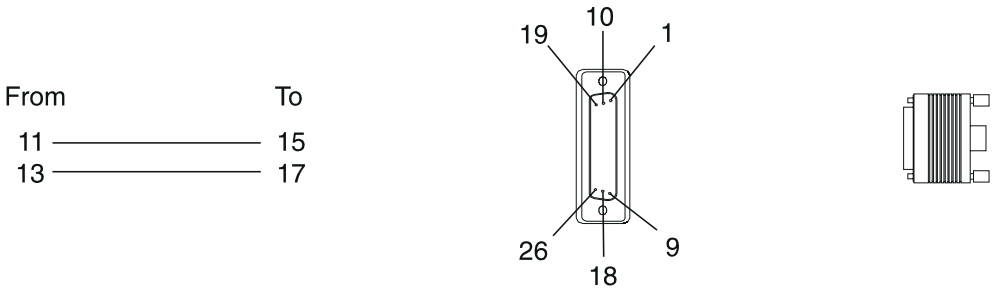


Figure 18. T1 Twisted Pair Wrap Plug Pin Assignment

Cable and Connectors

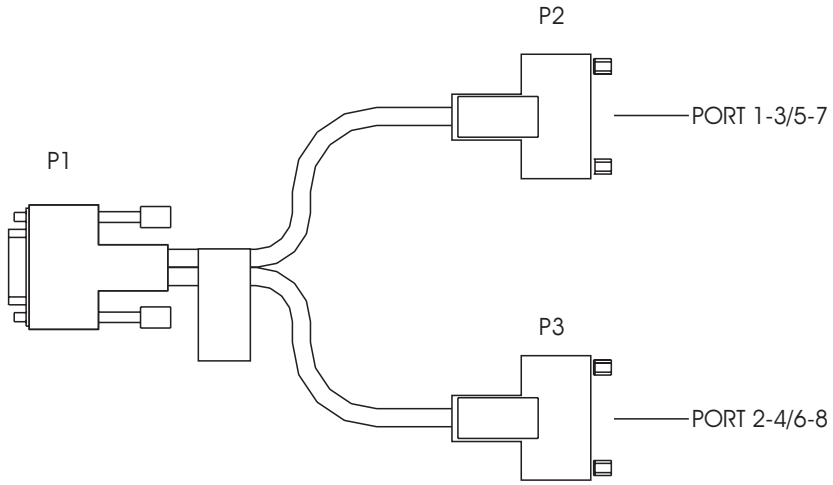


Figure 19. T1 Twisted Pair Connector Cable

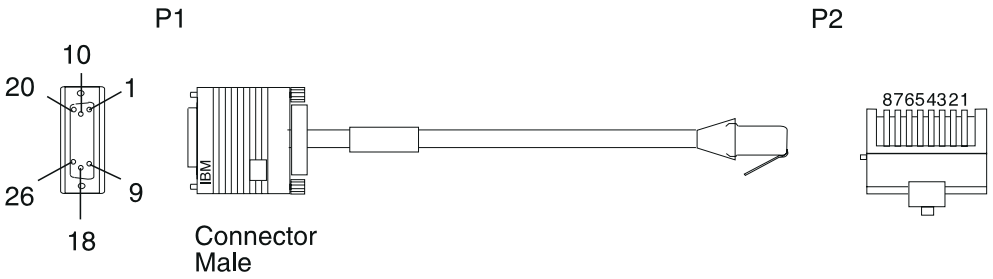


Figure 20. RJ-48 Twisted Pair T1 and J1 Cable

Interchange Circuit for RJ-48 T1 Cable

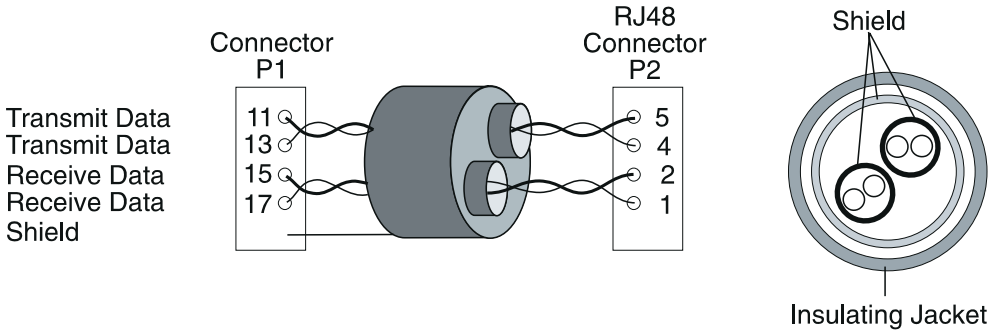


Figure 21. RJ-48 Twisted Pair T1 Cable

Interchange Circuit for RJ-48 J1 Cable (Japan only)

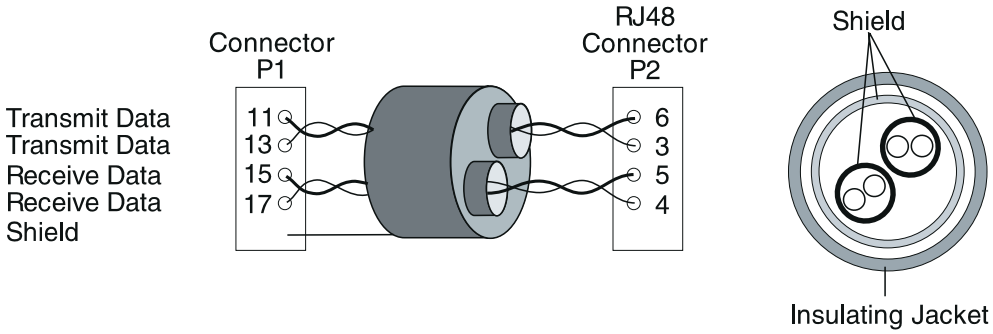


Figure 22. RJ-48 Twisted Pair J1 Cable

Connector Kit (Feature Code 5701): The part number of the Connector Kit is 57G8075.

Bulk Cable Specifications

- Two twisted pairs, AWG 24, 120 ohm.
- Shielding on each twisted pair, plus overall shielding.
- 1500V over-voltage minimum between signal wires and shielding.
- Shielding connected on connector shell of P1 but not connected at P2.
- Maximum length 30 m.

Connector P2

- Not predefined. Depends on the customer equipment.
- ETSI 300-11 standard.

Note: If a cable not supplied by IBM is used, IBM does not guarantee electromagnetic compatibility (EMC) compliance for the 8265 machine.

Cable List

Table 67. T1/J1 Twisted Pair Standard Cables			
Cable Type	**Length m (ft)**	**Feature Code**	**Part Number**
DB15 T1	15 (50)	5243	02L4270
RJ-48 T1/J1	15 (50)	5241	02L4258
RJ48 T1	30 (100)	5242	57G8021
RJ-48 J1 (See Note)	30 (100)	5242	57G8043
Note: Japan only, shipment triggered by Japan country code.			

Coax Cables and Connectors

E1 Coax Cables and Connectors

The section details the coax cables and connectors for use with the WAN 2.5 module E1 daughter card.

Table 68. E1 Coax Cable Connection	
Number of ports:	4 (using two BNC cables for each interface)
Characteristics:	E1 (75 ohm)
Speed:	Up to 2.048 Mbps
Feature Code:	8507

Wrap Plug: The part number of the wrap plug is 57G8093.

Figure 23. E1 Coaxial Wrap Plug (75 ohm)

Cable and Connectors

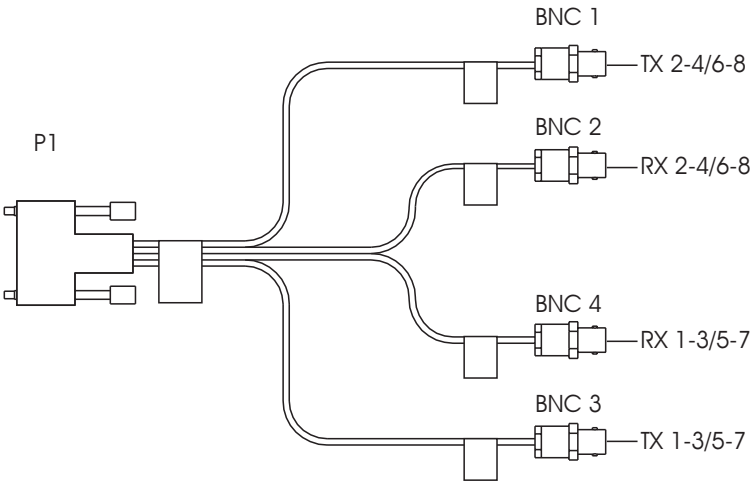


Figure 24. E1 Coaxial Connector Cable

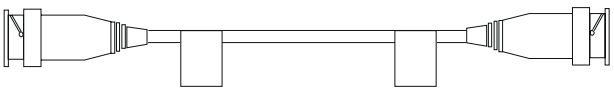


Figure 25. E1 Coaxial Cable (75 ohm)

Cable List

Table 69. E1 Coaxial Cables (BNC 75 ohm)		
Length m (ft)	**Feature Code**	**Part Number**
15 (50)	5250	80G0714
30 (100)	5251	80G0715
70 (230)	5252	80G0716
100 (328)	5253	80G0717
122 (400)	5254	80G0718

The maximum attenuation of the associated cables shall not exceed 6 dB when measured at 1024 KHz for the 2Mb adapter. The frequency/attenuation characteristics shall follow the root F law.

IBM E1 coaxial cables meet these characteristics.

Customer Cables: Be very careful when selecting cables:

- Only 75 ohm coaxial cables must be used (93 ohm or 50 ohm coaxial cables are not acceptable).
- Shielding must have an aluminium foil shield, and a braid shield (minimum 90 % coverage).
- BNC connectors must be connected to cable with a 360 degree shield continuity.

E3 and DS3 Coax Cables and Connectors

The section details the coax cables and connectors for use with the WAN 2 and WAN 2.5 module E3 and DS3 daughter cards.

The media for both E3 and DS3 daughter cards is a 75 ohm impedance coaxial pair with BNC connectors for each direction of transmission.

Cabling Information

Table 70. E3/DS3 Cabling Details (BNC 75 ohm)

Cable Type	Impedance	Attenuation @ 400 MHz
RG59	75 ohm	25 dB max / 100 m

Note: The 25 dB attenuation @ 400 MHz corresponds to an attenuation of 12 dB @ 17 MHz, assuming that follows approximately a $\sqrt{f}$ law.

Cabling Distances: Because the maximum recommended distance depends on the quality of cabling used, the values given in are approximate.

Table 71. E3/DS3 Cabling Distances

I/O Card Type	Cable Type	Maximum recommended Distance
E3	RG59 coax	100 m (330 ft) based on a power budget of 12 dB @ 17 MHz
DS3	RG59 coax	68 m (225 ft) default, 135 m (450 ft). If cable distance exceeds 68 m (225 ft), the default configuration setting for the port must be changed. See the *Media Module Reference Guide* for details on how to do this).

Fiber Connections

General Purpose Optical Fiber Hardware

Table 72 gives IBM part numbers of recommended optical fiber hardware.

Table 72. Miscellaneous Optical Fiber Hardware

Description	IBM Part Number
Fiber Distribution Panel (Rack)	74F8658
Fiber Splice Panel (Rack)	74F8659
Fiber Storage Panel (Rack)	74F8660
Fiber Splice Drawer (Rack)	74F8661
Fiber Distribution Panel (Wall)	74F8662
Fiber Storage Panel (Wall)	74F8663
Fiber Splice Panel (Wall)	74F8664
ST Distribution Panel Retainer Clips	74F8665
FC/PC Distribution Panel Retainer Clips	74F8666
Biconic Distribution Panel Retainer Clips	74F8667
Splice Tray - Fusion	74F8668
Splice Tray - Heat Shrink	74F8669
Splice Tray - Mechanical	74F8670
Splice Tray - Rotary	74F8671
Splice Tray - 3M FibrLok®	74F8672

IBM Optical Fiber Cleaning Kit

The IBM Optical Fiber Cleaning Kit Part Number is: 5453521

IBM Optical Fiber Hardware

Table 73 gives IBM part numbers of recommended optical fiber hardware.

Table 73. IBM Optical Fiber Hardware

Description	IBM Part Number
SC Attenuator	80G3425
Biconic -to- Biconic Coupler	18F6989
SC -to- SC Coupler	33G2744
FC/PC -to- FC/PC Coupler	74F5443
ST -to- ST Coupler	74F5444
SC Wrap Plug (singlemode) SC Wrap Plug (multimode)	78G9610 19G5609
MIC Wrap Plug	92F9003
MIC -to- FC/PC Adapter	92F9004
MIC -to- MIC Coupler	92F9008
MIC -to- ST Adapter	92F9009
Multiple-Port Wall Outlet Assembly (MIC -to- ST)	92F9010
Dual-Port Wall Outlet Assembly (MIC -to- ST)	92F9011
Blank Insert Assembly (Optional for Multiple-Port Wall Outlet)	92F9012
Data Connector Assembly (Optional for Multiple-Port Wall Outlet)	92F9014
Modular Jack Assembly (Optional for Multiple-Port Wall Outlet)	92F9015
Multiple-Port Wall Outlet Assembly (MIC -to- FC)	92F9016
Dual-Port Wall Outlet Assembly (MIC -to- FC)	92F9017

Optical Connectors

IBM recommends that high-quality, low-loss, physical-contact connectors or non-physical-contact connectors be installed.

IBM Duplex Connector: The IBM duplex connector is required for connection to ESCON devices. It contains both receive and transmit fibers in one connector. The connector is keyed to provide correct transmit and receive polarity and uses release tabs to prevent accidental removal.

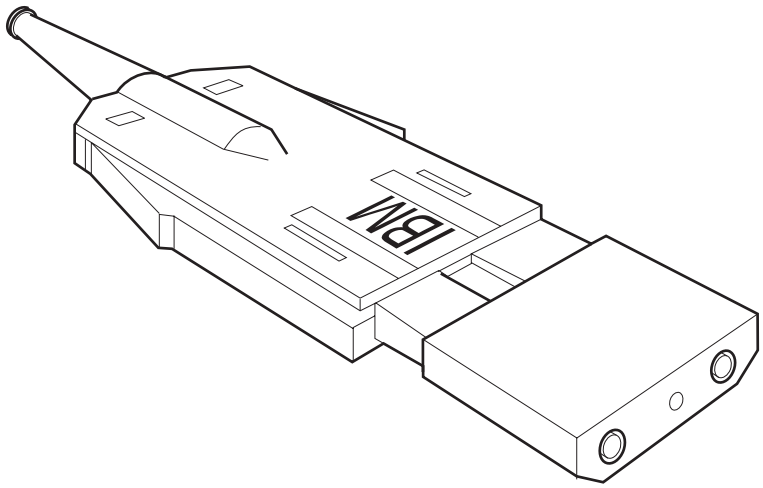


Figure 26. IBM Duplex Connector

The IBM jumper cables for ESCON devices are available with a duplex connector at each end, or a duplex connector at one end and two simplex connectors at the other. Other types of connectors may be obtained through IBM.

IBM MIC Connector: The MIC connector is designed to meet all requirements of the ATM Forum standards and is enhanced to ensure correct connection with IBM ATM products. IBM jumper cables for ATM devices are available with IBM MIC connectors at each end, or a combination of one IBM MIC connector and two simplex connectors. (Protective covers are shown over the ferrules in the following illustration.)

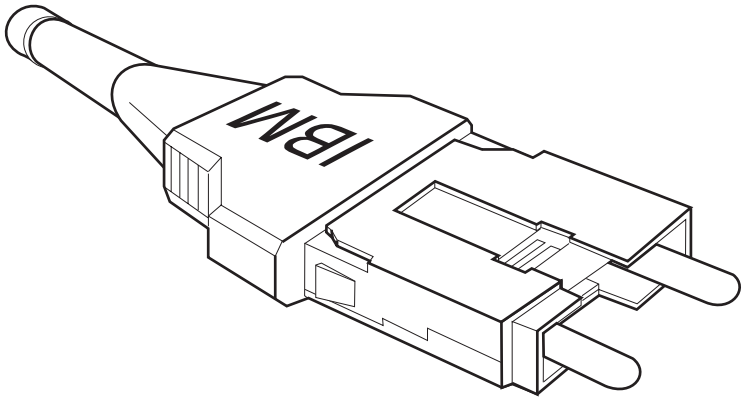


Figure 27. IBM MIC Connector

Transmitter Electrical Characteristics

Table 74. Transmitter Electrical Characteristics for MIC Connectors

Description	Minimum	Maximum	Unit
Data rate (NRZ encoding)	10	125	Mbps
Average optical power (BOL)[1]	-18.5	-14	dBm
Output rise time/fall time[2]	0.6	3.5	ns
Optical wavelength (center)[2]	1270	1380	nm

Notes:

1. Measured average power coupled into 0.29 NA, 62.5/125 μm fiber.
2. The optical rise time, fall time, center wavelength, and spectral width fit within the boundaries outlined in ANSI X3T9.5 PMD.

Receiver Electrical Characteristics

Table 75. Receiver Electrical Characteristics for MIC Connectors			
Description	**Minimum**	**Maximum**	**Unit**
Data rate (NRZ encoding)	10	125	Mbps
Average optical sensitivity[1]	-35	-33	dBm
Average maximum input power[2]	—	-14	dBm
Optical wavelength for rated sensitivity	1270	1380	nm

Notes:

1. Average optical power coupled from a 0.29 NA, 62.5/125 μm fiber at 125 Mbps with a 2^7-1 pseudo random data pattern with a 50% duty cycle for a Bit Error Ratio (BER) of 2.5 x 10^{-10} (optimum sensitivity with 0 eyewidth).
2. The maximum average input power corresponds to a minimum eyewidth of 2.1 ns at 2.5 x 10^{-10} BER.

SC Connector: The SC (subscriber connector) terminates one singlemode or multimode optical fiber strand. A field termination kit is needed to install the connector.

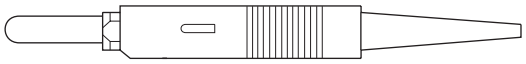


Figure 28. SC Connector

Transmitter Electrical Characteristics

Table 76. Transmitter Electrical Characteristics for SC Connectors			
Description	**Minimum**	**Maximum**	**Unit**
Data rate (NRZ encoding)	10	160	Mbps
Average optical power (BOL)[1]	-19	-14	dBm
Output rise time/fall time[2]	0.6	3.0	ns
Optical wavelength (center)[2]	1270	1380	nm

Notes:

1. Measured average power coupled into 0.29 NA, 62.5/125 μm fiber.
2. The optical rise time, fall time, center wavelength, and spectral width fit within the boundaries outlined in ANSI X3T9.5 PMD.

Receiver Electrical Characteristics

Table 77. Receiver Electrical Characteristics for SC Connectors

Description	Minimum	Maximum	Unit
Data rate (NRZ encoding)	10	160	Mbps
Average optical sensitivity[1]	-30	—	dBm
Average maximum input power[2]	—	-14	dBm
Optical wavelength for rated sensitivity	1270	1380	nm

Notes:

1. Average optical power coupled from a 0.29 NA, 62.5/125 μm fiber at 125 Mbps with a 2^7-1 pseudo random data pattern with a 50% duty cycle for a Bit Error Ratio (BER) of 2.5 x 10^{-10} (optimum sensitivity with 0 eyewidth).
2. The maximum average input power corresponds to a minimum eyewidth of 2.1 ns at 2.5 x 10^{-10} BER.

ST Connector: The ST (straight-tipped) connector terminates one singlemode or multimode optical fiber strand. It is available in two types: physical contact and non-physical contact. A field termination kit is needed to install the connector.

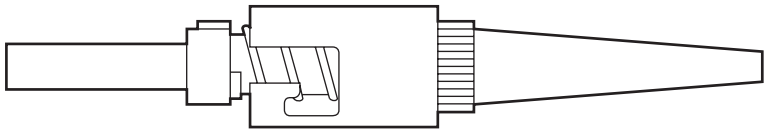


Figure 29. ST Connector

FC/PC Connector: The FC/PC (ferrule connector/physical contact) connector terminates one singlemode or multimode optical fiber strand. A field termination kit is needed to install the connector.

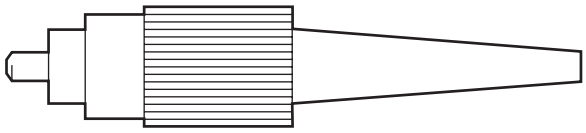


Figure 30. FC/PC Connector

BNC Connector: The BNC (bayonet node connector) terminates one singlemode or multimode optical fiber strand. This connector is not recommended for distribution panel installation. A field termination kit is needed to install the connector.

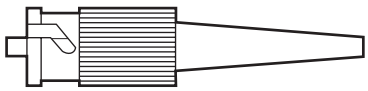


Figure 31. Bayonet Connector (BNC)

SMA Connector: The SMA (straight medium adaptor) connector terminates one optical fiber strand. A field termination kit is needed to install the connector.

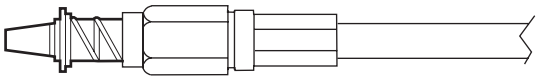


Figure 32. SMA Connector

Biconic Connector: The biconic connector terminates one optical fiber strand. A field termination kit and a plug assembly jig are needed to install the connector. It is not recommended for new installations.

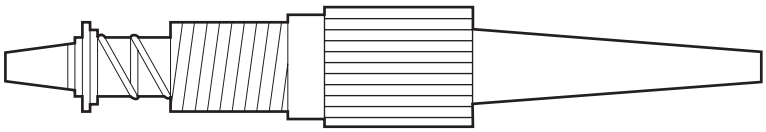


Figure 33. Biconic Connector

Optical Fiber Couplers and Adapters

Optical fiber couplers are available to connect similar types of optical fiber connectors. Adapters are available to connect dissimilar optical fiber connectors. The following adapters and couplers are currently available from IBM distributors:

- Biconic-to-Biconic
- IBM Duplex-to-IBM Duplex
- IBM Duplex-to-ST
- IBM Duplex-to-FC/PC
- IBM Duplex-to-IBM FDDI
- FC/PC-to-FC/PC
- IBM FDDI-to-ST
- IBM FDDI-to-FC/PC
- MIC-to-MIC
- ST-to-ST.

Optical Fiber Bypass Switches

Optical fiber bypass switches are used to physically bypass an attached device. Their use should be carefully considered because, when activated, the physical length of the link could extend beyond that allowed for the supported product. Optical fiber bypass switches also contribute significant additional attenuation to a link whether they are activated or not.

IBM does not currently offer optical fiber bypass switches.

Optical Fiber Wall Plates

IBM offers two different wall plates that can be configured with various optical and copper adapters and connections. For more information, see your IBM Marketing Representative.

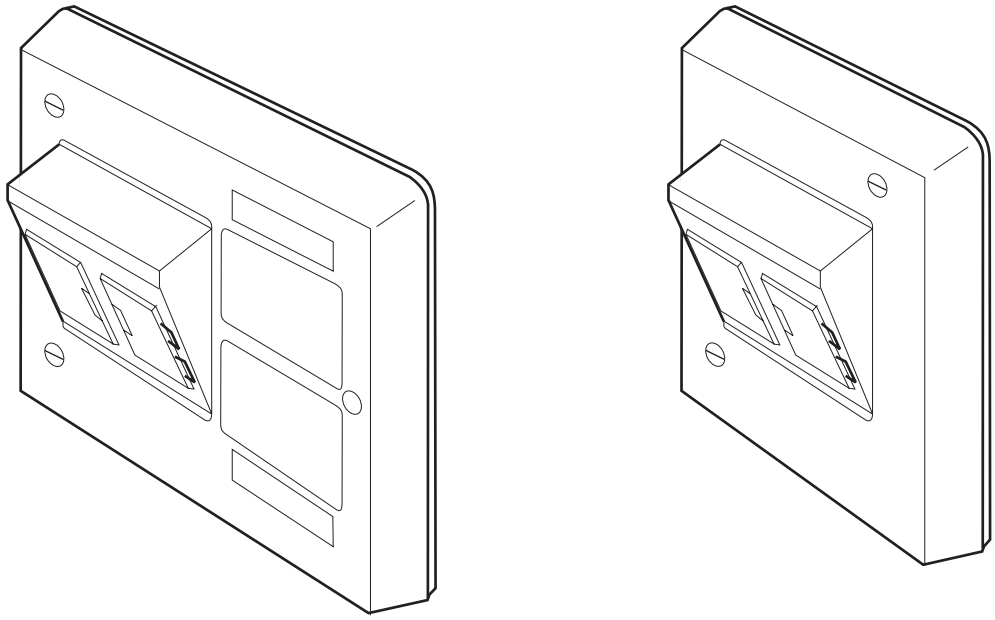


Figure 34. Optical Fiber Wall Plates

IBM Multimode Fiber Jumper Cables

ATM jumper cables are not provided with the product and must be ordered separately through your IBM Marketing Representative.

Table 78 lists the available 62.5/125 micron multimode fiber jumper cables.

Table 78. IBM Multimode Fiber Jumper Cable List

Description	Length	IBM Part Number
SC -to- SC	2 m (6.5 ft)	19G6706
	4 m (13 ft)	19G4864
	6 m (20 ft)	19G4865
	10 m (33 ft)	19G4866
	20 m (66 ft)	19G4867
	40 m (135 ft)	19G4868
	Custom Lengths	19G4863
MIC -to- SC	2 m (6.5 ft)	19G6707
	4 m (13 ft)	19G4797
	6 m (20 ft)	19G4798
	10 m (33 ft)	19G4799
	20 m (66 ft)	19G4800
	40 m (135 ft)	19G4801
	Custom Lengths	19G4796
ST -to- SC	2 m (6.5 ft)	19G6708
	4 m (13 ft)	19G4817
	6 m (20 ft)	19G4818
	10 m (33 ft)	19G4819
	20 m (66 ft)	19G4820
	40 m (135 ft)	19G4821
	Custom Lengths	19G4816

COMM Port Connectors

Two different types of connectors can be used with the 25-pin D-shell COMM port.

CCITT V.24/V.28 (EIA 232-D) Connector

The CCITT V.24/V.28 (EIA 232-D) connector is on the communication interface cable. It is used to connect modules to modems or other signal converters.

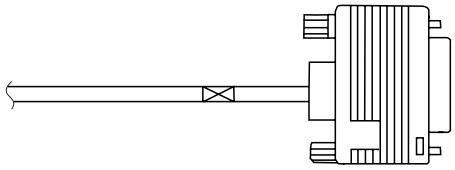


Figure 35. CCITT V.24/V.28 (EIA 232–D) Connector

CCITT V.35 Connector

The CCITT V.35 connector is on the communication interface cable. It is used to connect modules to modems or other signal converters.

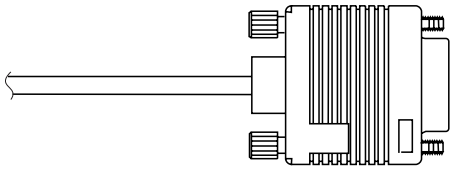


Figure 36. CCITT V.35 Connector

DTE and DCE Cable Attachments

This section gives the specifications for DTE and DCE cable attachments.

DTE Direct Attachment Interposer and Wiring

Part Number: 58F2861

CCITT	EIA-232	V.24 Pin Layout	
101	Shield	1	1
103	Transmit	2	2
104	Receive	3	3
105	RTS	4	4
106	RFS	5	5
102	Ground	7	7
107	DSR	6	6
109	CD	8	8
108	DTR	20	20

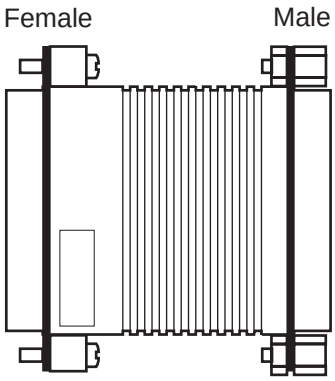


Figure 37. DTE-to-DTE Cables Pin Assignment

Note: This part is shipped with the 8265.

Gender Changer Interposer

Part Number: 58G4422.

When the EIA-232 terminal attachment has a male connector, the connector inverter (male-female) must be used to fit the adapter cable pin offered.

Modem Attachment Cable for CPSW Modules

Part Number: 59G0278.

Length: 3.05 m (10 ft).

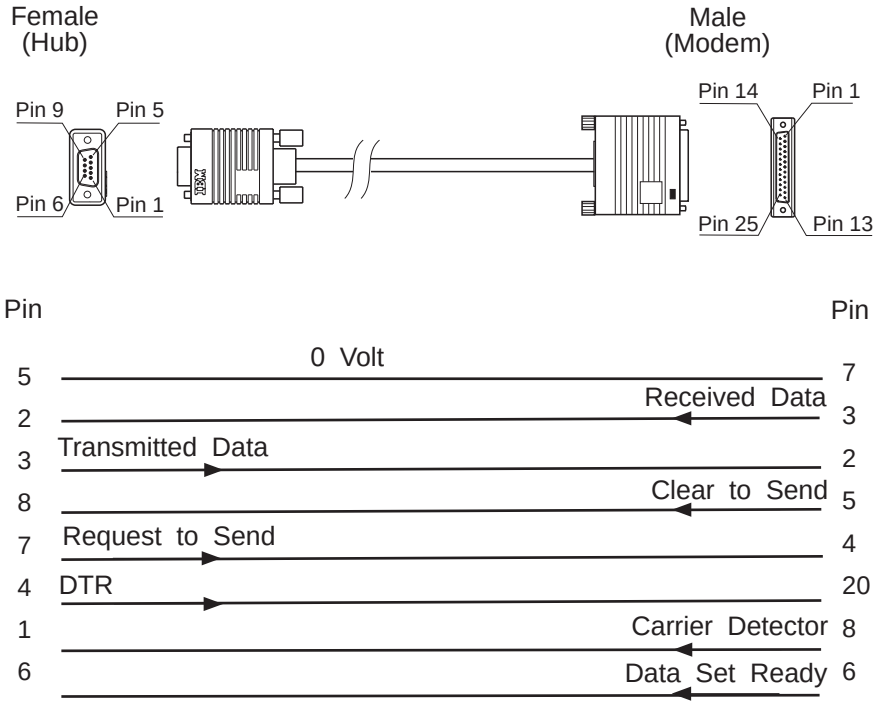


Figure 38. Modem Cable Wiring for Part Number 59G0278

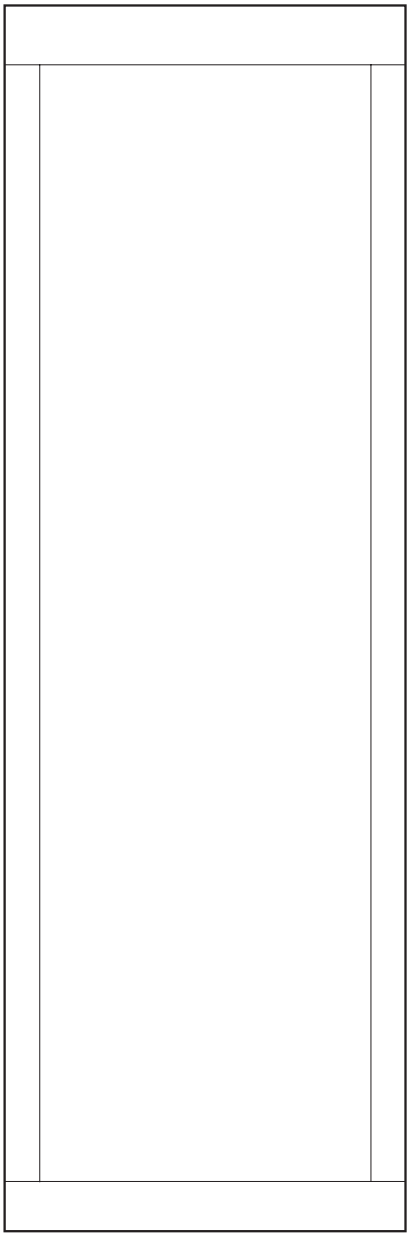
Note: This part is shipped with the 8265.

When the EIA-232 terminal attachment has a male connector, the connector inverter (male-female) must be used to fit the adapter cable pin offered. Use the adapter metal shell (Part Number 58G4422, AMP Reference: 747112-1). This shell is delivered with the 8265.

Appendix B. Blank Planning Charts

Rack Inventory Chart

Wiring closet number _____
Rack number _____
Date _____
Planner's initials _____

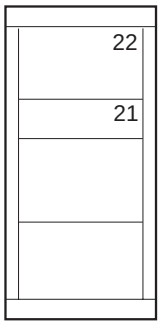


Instructions

Fill out a Rack Inventory Chart for each equipment rack.

1. Enter the wiring closet location number, the equipment rack identification number, and the planner's initials.
2. Write the unit identification number and component type of each component on the chart.

Example:



Physical Location to Adapter Address Locator Chart

Physical Location	Adapter Address	Device Identification	Segment Number	8265 Number

Adapter Address to Physical Location Locator Chart

Adapter Address	Physical Location	Device Identification	Segment Number	8265 Number

8265 Cabling Chart

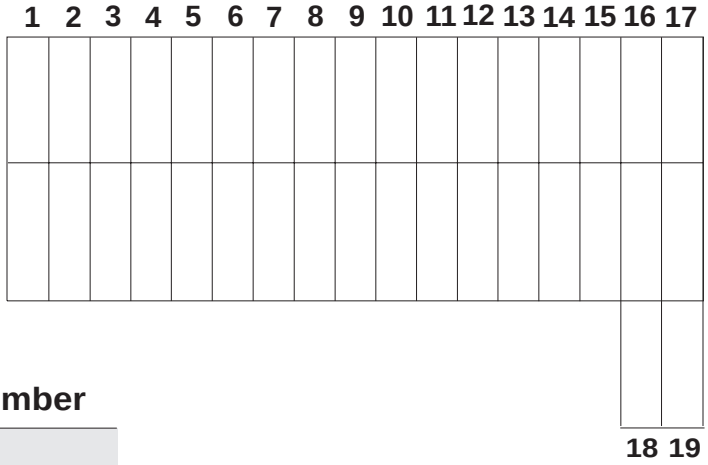
Sheet ____ of ____

Section 1 Identification

8265 Unit Number: _____ Date: _____

Building Number: _____ Wiring Closet: _____ Rack Number: _____

Section 2 Slot Assignments



Slot	Module	Sheet Number
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18	Controller	
19	Controller	

Port Cabling Chart

Sheet ____ of ____

Unit Number ____ Slot Number ____

Feature Number ____ Number of Ports ____

Port Number	Connect to	Module Type	Cable	Connector
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Appendix C. Cabling Charts

Determining Which Cabling Chart to Use

The following diagram shows which chart to fill out for your ATM connections.

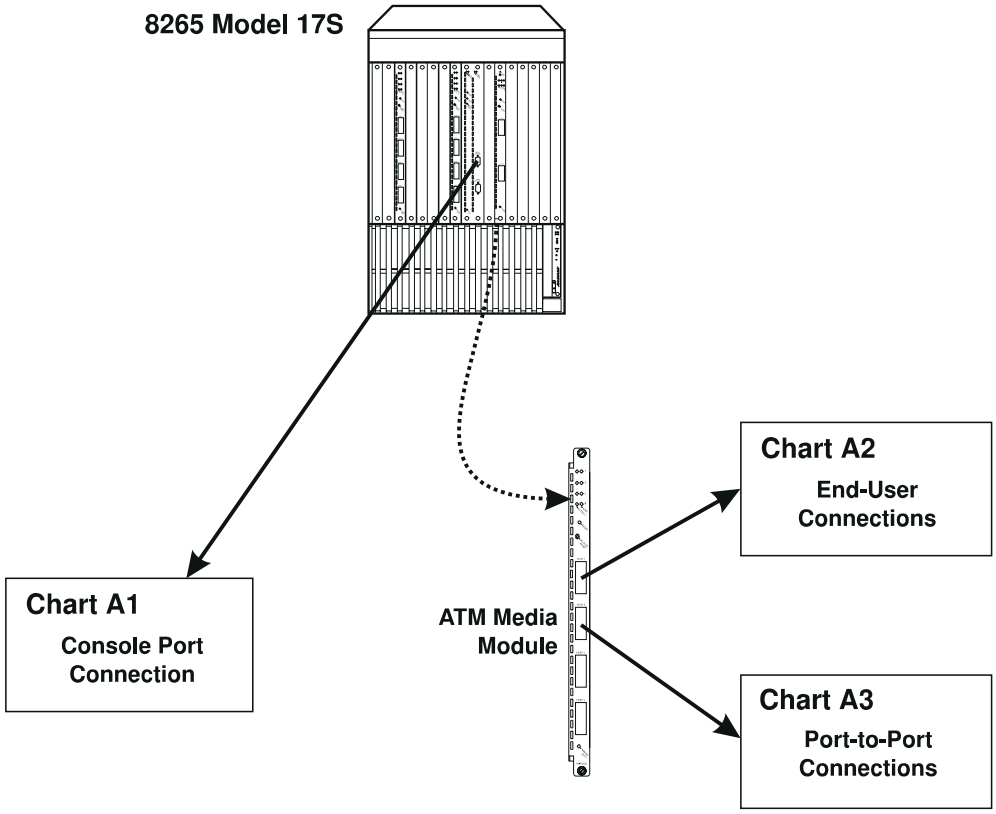


Figure 39. Selecting Cabling Charts

Chart A1 – Console Port Connection

Use this chart to identify the cabling from the console EIA-232 (RS-232) port directly to a management console.

8265 Unit Number	Slot Number	Sheet Number

Cable Type	
Modem Type	
Dial Out Number	
Console Type	
Console Location Number	

Chart A2 – End–User Device Connections

Use this chart to identify the cabling from the console EIA-232 (RS-232) port directly to a management console.

8265 Unit Number	Slot Number	Sheet Number

Module Faceplate Marking	Feature Code	No. of Ports	Comments

ATM Media Port	ATM Cable Type	ATM Device Cable ID	ATM Device Type	ATM Device Location	ATM Device Adapter Address
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

Chart A3 – Port-to-Port Conections between ATM Media Modules

Use this chart to identify the cabling from the console EIA-232 (RS-232) port directly to a management console.

8265 Unit Number	Slot Number	Sheet Number

From ATM Media Module:	To ATM Media Module:

ATM Media Port	Port Type	Cable ID	Unit Type/Address	Slot Number	Port Number
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

Appendix D. Notices

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Safety Information

General Safety

The IBM 8265 Nways ATM Switch complies with the following industry safety standards or their updated versions:

Safety of Information Technology Equipment:

Number	Date	Description
IEC 950	1991	International Standard
C22.2 No. 950	1989	(Canadian Standard)
UL 1950	1991	(U.S.A. Standard)
EN 60 950	1992	(European CENELEC Standard)
AS/NZS 3260	1993	(New Zealand Standard)

Safety of Laser Products:

Number	Date	Description
IEC 825-1	1993	Equipment Classification, Requirements, and User's Guide
IEC 825-2	1993	Safety of Optical Fiber Communications Systems
EN 60825-1	1993	(European CENELEC IEC 825-1 Standard)
EN 60825-2	1993	(European CENELEC IEC 825-2 Standard)

Safety Notice for United Kingdom

The network adapter interfaces housed within the IBM 8265 Nways ATM Switches are approved separately, each one having its own independent approval number. These interface adapters, supplied by IBM, do not use or contain excessive voltages. An excessive voltage is one that exceeds 42.4 V peak ac or 60 Vdc. They interface with the IBM 8265 Nways ATM Switch using Safety Extra Low Voltages (SELV) only. In order to maintain the separate (independent) approval of the IBM adapters, it is essential that other optional cards, not supplied by IBM, do not use mains voltages or any other excessive voltages. Seek advice from a competent engineer before installing other adapters not supplied by IBM.

Industry Standards Reflected in This Product

The IBM 8265 Nways ATM Switch is designed according to the specifications of the following industry standards as understood and interpreted by IBM as of October 1992.

International Organization for Standardization (ISO)

- ISO 8802/1
- ISO 8802/3
- ISO 8802/5

IEEE (Institute of Electrical and Electronic Engineers)

- 802.1 Local area network (LAN) management and Internet working
- 802.3 Carrier sense multiple access and collision detection
- 802.5 Token passing ring

ANSI (American National Standard Institute)

The IBM Fiber Distribution Data Interface (FDDI) network is an implementation of the American National Standards Institute (ANSI) X3T9.5 family of standards.

The IBM base standards for the implementation of the FDDI are:

- ANSI X3.166-1990, FDDI physical layer medium-dependent (PMD), ISO 93/4-3
- ANSI X3.148-1988, FDDI token-ring physical layer protocol (PHY), ISO 93/4-1
- ANSI X3.139-1987, FDDI token-ring media access control (MAC)
- ANSI X3.T9, 5/84-49 RFC 1285 FDDI station management (SMI).

ITU-T (International Telecommunications Union - Telecommunication)

The IBM standards for the implementation of ATM are:

- Q.2110 Service Specific Connection-Oriented Protocol (SSCOP)
- Q.2130 Service Specific Coordination Function (SSCF)

ATM Standards

The IBM 8265 Nways ATM Switch complies with the following ATM standards:

- ATM User-Network Interface (UNI) Specifications V3.0, V3.1, and V4.0 ATM Forum
- ATM Interim Inter-Switch Signalling (IISP), ATM Forum
- ATM Public Network-to-Network Interface (PNNI) Phase 1, ATM Forum
- LAN Emulation over ATM Specifications V1.0, ATM Forum
- Q.2110 Service Specific Connection-Oriented Protocol (SSCOP), ITU, March 17, 1994
- Q.2130 Service Specific Coordination Function (SSCF) for support of signaling at the user-network interface, March 17, 1994
- RFC1577 — Classical IP and ARP (Address Resolution Protocol over ATM.

European Union (EU) Statement

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM can not accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

Year 2000 Statement

This product is Year 2000 ready. When used in accordance with its associated documentation, is capable of correctly processing, providing, and/or receiving date data within and between the 20th and 21st centuries, provided all other products (for example, software, hardware, and firmware) used with the product properly exchange acurate date data with it.

Electronic Emission Notices

Federal Communications Commission (FCC) Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Compliance Statement

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Avis de conformité aux normes d'Industrie Canada

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Japanese Voluntary Control Council for Interference (VCCI) Statement

This equipment is Class 1 Equipment (information equipment to be used in commercial and industrial districts) which is in conformance with the standard set by Voluntary Control for Interference by Data Processing Equipment and Electronic Office Machines (VCCI) with an aim to prevent radio interference in commercial and industrial districts. This equipment could cause interference to radio and television receivers when used in and around residential districts. Please handle the equipment properly according to the instruction manual.

Power Line Harmonics (JEIDA) Statement

The guidelines of the power line harmonics required by JEIDA are satisfied.

Korean Communications Statement

Please note that this device has been approved for business use with regard to electromagnetic wave interference. If you find this is not suitable for your use, you may exchange it for one designated for non-business purposes.

New Zealand Statement

Attention: This is a Class A product. In a domestic environment, this product may cause radio interference in which case you may be required to take adequate measures.

Taiwanese Class A Warning Statement

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user will be required to take adequate measures.

警告使用者:
這是甲類的資訊產品，在
居住的環境中使用時，可
能會造成射頻干擾，在這
種情況下，使用者會被要
求採取某些適當的對策。

Radio Frequency Interference (RFI) Compliance

- Class A digital device pursuant to part 15 of the Federal Communications Commissions (FCC) rules
- VDE Class B
- VCCI Class 1
- EN 55022 requirement
- CISPR22 Class A.

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Bibliography

8265 Documentation

For additional information on the IBM 8265 Nways ATM Switch, please refer to the following documents. The documents are included on the *IBM 8265 Nways ATM Switch Documentation Library* CD, SA33–0454.

IBM 8265 Nways ATM Switch Product Description, GA33-0449.

IBM 8265 Nways ATM Switch User's Guide, SA33-0456.

IBM 8265 Nways ATM Switch Command Reference Guide, SA33-0458.

IBM 8265 Nways ATM Switch Installation Guide, SA33-0441.

IBM 8265 Nways ATM Switch Planning and Site Preparation Guide, GA33-0460.

IBM 8265 Nways ATM Switch Media Module Reference Guide, SA33-0459.

IBM 8265 Nways ATM Switch Problem Determination and Service Guide, SY33-2128.

These documents are also available via the Internet:

`http://www.networking.ibm.com/did/8265bks.html`

Related Documentation

The following related publications are included on the *IBM 8265 Nways ATM Switch Documentation Library* CD, SA33–0454.

Multiprotocol Switched Services (MSS) Server Introduction and Planning Guide, GC30-3820.

A-MSS 2.5 Server Module / A-MSS Server Module Quick Reference Card, GX27-4018.

Nways Multiprotocol Switched Services Server Interface Configuration and Software User's Guide, SC30-3818.

Nways Multiprotocol Switched Services Configuring Protocols and Features, SC30-3819.

Multiprotocol Switched Services (MSS) Server Service and Maintenance Manual, GY27-0354.

Nways Multiprotocol Switched Services (MSS) Server Module Installation and Initial Configuration Guide, GA27-4141.

Nways MAS/MRS/MSS/MSSC Library, Configuration Program User's Guide for Nways Multiprotocol Access, Routing and Switched Services, GC30-3830.

Nways Event Logging System Messages Guide, SC30-3682.

8271 LAN Switch Module Planning and Installation Guide, GA27-4162.

8272 LAN Switch Module Planning and Installation Guide, GA27-4163.

4-Port 10BASE-T & 3-Port 10BASE-FL UFCs Planning and Installation Guide, GA27-4120.

100BASE-TX and 100BASE-FX Universal Feature Cards Planning and Installation Guide, GA27-4096.

ATM 155 Mbps Multimode Fiber Universal Feature Card Planning and Installation Guide, GA27-4156.

2-Port Fiber and 4-Port UTP/STP Token-Ring Enhanced Universal Feature Card Planning and Installation Guide, GA27-4168.

IBM Video Distribution Module User's Guide, GA27-4173.

The 8260 Nways ATM Kit Development Program, We Carry Your Creativity to ATM, GA33-0371.

ATM Forum

For more information on ATM Forum specifications, refer to the following:

- *UNI Specification – Versions 3.0, 3.1, and 4.0*
- *P-NNI Specification Version 1.0*
- *ILMI Specification Version 4.0*
- *UNI Traffic Management Version 4.0*

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8265 Nways ATM Switch
Planning and Site Preparation Guide

Publication No. GA33-0460-02

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