

MERLIN LEGEND®
Communications
System
Releases 3.1
and 4.0

Installation

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Notice

Every effort was made to ensure that the information in this book was complete and accurate at the time of printing. However, information is subject to change.

See Appendix A, "Customer Support Information," for important information. It follows *Maintenance and Troubleshooting* in this binder.

Your Responsibility for Your System's Security

Toll fraud is the unauthorized use of your telecommunications system by an unauthorized party, for example, persons other than your company's employees, agents, subcontractors, or persons working on your company's behalf. Note that there may be a risk of toll fraud associated with your telecommunications system, and if toll fraud occurs, it can result in substantial additional charges for your telecommunications services.

You and your System Manager are responsible for the security of your system, such as programming and configuring your equipment to prevent unauthorized use. The System Manager is also responsible for reading all installation, instruction, and system administration documents provided with this product in order to fully understand the features that can introduce risk of toll fraud and the steps that can be taken to reduce that risk. AT&T does not warrant that this product is immune from or will prevent unauthorized use of common-carrier telecommunication services or facilities accessed through or connected to it. AT&T will not be responsible for any charges that result from such unauthorized use. For important information regarding your system and toll fraud, see Appendix A, "Customer Support Information."

Federal Communications Commission Statement

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 his own expense. For further FCC information, see Appendix A, "Customer Support Information."

Canadian Department of Communications (DOC) Interference Information

This digital apparatus does not exceed the Class A limits for radio noise emissions set out in the radio interference regulations of the Canadian Department of Communications.

Le Présent Appareil Numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la class A préscrites dans le reglement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

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For more information about AT&T documents, refer to the section entitled, "Related Documents" in "About This Book."

Support Telephone Number

In the continental U.S., AT&T provides a toll-free customer helpline 24 hours a day. Call the AT&T Helpline at **1 800 628-2888** or your AT&T authorized dealer if you need assistance when installing, programming, or using your system. Outside the continental U.S., contact your local AT&T authorized representative.

AT&T Corporate Security

Whether or not immediate support is required, *all* toll fraud incidents involving AT&T products or services *should be reported* to AT&T Corporate Security at **1 800 821-8235**. In addition to recording the incident, AT&T Corporate Security is available for consultation on security issues, investigation support, referral to law enforcement agencies, and educational programs.

AT&T Fraud Intervention

If you suspect you are being victimized by toll fraud and you need technical support or assistance, call GBCS National Service Assistance Center at **1 800 628-2888**.

Warranty

AT&T provides a limited warranty on this product. Refer to "Limited Warranty and Limitation of Liability" in Appendix A, "Customer Support Information," which follows *Maintenance and Troubleshooting* in this binder.

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The exclamation point in an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product.

IMPORTANT SAFETY INSTRUCTIONS

When installing telephone equipment, always follow basic safety precautions to reduce the risk of fire, electrical shock, and injury to persons, including:

- Read and understand all instructions.
- Follow all warnings and instructions marked on or packed with the product.
- Never install telephone wiring during a lightning storm.
- Never install a telephone jack in a wet location unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone wiring has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.
- Use only AT&T-manufactured MERLIN LEGEND Communications System circuit modules, carrier assemblies, and power units in the MERLIN LEGEND Communications System control unit.
- Use only AT&T-recommended/approved MERLIN LEGEND Communications System accessories.
- If equipment connected to the analog extension modules (008, 408, 408 GS/LS) or to the MLX telephone modules (008 MLX, 408 GS/LS-MLX) is to be used for in-range out-of-building (IROB) applications, IROB protectors are required.

- Do not install this product near water, for example, in a wet basement location.
- Do not overload wall outlets, as this can result in the risk of fire or electrical shock.
- The MERLIN LEGEND Communications System is equipped with a 3-wire grounding-type plug with a third (grounding) pin. This plug will fit only into a grounding-type power outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact an electrician to replace the obsolete outlet. Do not defeat the safety purpose of the grounding plug.
- The MERLIN LEGEND Communications System requires a supplementary ground.
- Do not attach the power supply cord to building surfaces. Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.
- Slots and openings in the module housings are provided for ventilation. To protect this equipment from overheating, do not block these openings.
- Never push objects of any kind into this product through module openings or expansion slots, as they may touch dangerous voltage points or short out parts, which could result in a risk of fire or electrical shock. Never spill liquid of any kind on this product.
- Unplug the product from the wall outlet before cleaning. Use a damp cloth for cleaning. Do not use cleaners or aerosol cleaners.
- Auxiliary equipment includes answering machines, alerts, modems, and fax machines. To connect one of these devices, you must first have a Multi-Function Module (MFM).
- Do not operate telephones if chemical gas leakage is suspected in the area. Use telephones located in some other safe area to report the trouble.



M WARNING:

- For your personal safety, DO NOT install an MFM yourself.
- ONLY an authorized technician or dealer representative shall install, set options, or repair an MFM.
- To eliminate the risk of personal injury due to electrical shock, DO NOT attempt to install or remove an MFM from your MLX telephone. Opening or removing the module cover of your telephone may expose you to dangerous voltages.

SAVE THESE INSTRUCTIONS

About This Book

The MERLIN LEGEND® Communications System is an advanced digital switching system that integrates voice and data communications features. Voice features include traditional telephone features, such as Transfer and Hold, and advanced features, such as Group Coverage and Park. Data features allow both voice and data to be transmitted over the same system wiring.

Intended Audience

This book is intended for qualified field technicians who install and upgrade the system.

How to Use This Book

Qualified technicians can use this book as a guide to installation and upgrading procedures. The technician is given specific steps for installing all units of the control unit, telephones, adjuncts and data equipment.

Refer to the following documentation for additional information:

- Equipment and Operations Reference provides detailed information on system hardware, telephones, and other equipment.
- Feature Reference provides details on the features of the communications system.
- System Planning provides procedures and forms for planning a system for installation.
- System Programming gives procedural instructions for programming system features.
- Users' guides and Operators' Guides give procedural instructions for programming and using telephone features.

"Related Documents," later in this section, provides a complete list of system documentation together with ordering information.

In the U.S.A. only, AT&T provides a toll-free customer Helpline (1 800 628-2888) 24 hours a day. Call the Helpline, or your AT&T representative, if you need assistance when installing, programming, or using your system.

Terms and Conventions Used

In this document, the terms in the following list are used in preference to other, equally acceptable terms for describing communications systems.

Lines, Trunks and Facilities

Facility is a general term that designates a communications path between a telephone system and the telephone company central office. Technically a trunk connects a switch to a switch, for example the MERLIN LEGEND Communications System to the central office. Technically, a line is a loop-start facility or a communications path that does not connect two switches (for example, an intercom line or a Centrex line). However, in actual usage, the terms line and trunk are often applied interchangeably. In this book, we use line/trunk and lines/trunks to refer to facilities in general. Specifically, we refer to digital facilities. We also use terms such as personal line, ground-start trunk, Direct Inward Dialing (DID) trunk, and so on. When you talk to your local telephone company central office, ask them what terms they use for the specific facilities they connect to your system.

Some older terms have been replaced with newer terms. The following list shows the old term on the left and the new term on the right:

trunk module
trunk jack
station
station jack
analog data station
digital data station
7500B data station
analog voice and analog data station
digital voice and analog data station
analog data only station
digital data only station
7500B data only station
digital voice and digital data station
digital voice and digital data station

MLX voice and 7500B data station

line/trunk module
line/trunk jack
extension
extension jack
modem data station
terminal adapter
terminal adapter
analog voice and modem data
MLX voice and modem data
modem data only station
terminal adapter only station

terminal adapter only station MLX voice and terminal

MLX voice and terminal

adapter station

adapter station

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Typographical Conventions

Certain type fonts and styles act as visual cues to help you rapidly understand the information presented:

| Example | Purpose |
|---|--|
| It is <i>very</i> important that you follow these steps. You <i>must</i> attach the wristband before touching the connection. | Italics indicate emphasis. |
| The part of the headset that fits over one or both ears is called a headpiece. | Italics also set off special terms. |
| If you press the Feature button on an MLX display telephone, the display lists telephone features you can select. A programmed Auto Dial button gives you instant access to an inside or outside number. | The names of fixed-feature, factory- imprinted buttons appear in bold. The names of programmed buttons are printed as regular text. |
| Choose Ext Prog from the display screen. | Plain constant-width type indicates text that appears on the telephone display or personal computer (PC) screen. |
| To activate Call Waiting, dial *11. | Constant-width type in italics indicates characters you dial at the telephone or type at the PC. |

Product Safety Labels

Throughout these documents, hazardous situations are indicated by an exclamation point inside a triangle and the word caution or warning.



M WARNING:

Warning indicates the presence of a hazard that could cause death or severe personal injury if the hazard is not avoided.

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A CAUTION:

Caution indicates the presence of a hazard that could cause minor personal injury or property damage if the hazard is not avoided.

Security

Certain features of the system can be protected by passwords to prevent unauthorized users from abusing the system. You should assign passwords wherever you can and limit knowledge of such passwords to three or fewer people.

Nondisplaying authorization codes and telephone numbers provide another layer of security. For more information, see Appendix A, "Customer Support Information" following Maintenance and Troubleshooting.

Throughout this document, toll fraud security hazards are indicated by an exclamation point inside a triangle and the words Security Alert.



A Security Alert:

Security Alert indicates the presence of toll fraud security hazard. Toll fraud is the unauthorized use of your telecommunications system by an unauthorized party (e.g., persons other than your company's employees, agents, subcontractors, or persons working on your company's behalf). Be sure to read "Your Responsibility for Your System's Security" on the inside front cover of this book and "Security" of Your System: Preventing Toll Fraud" in Appendix A, "Customer Support Information."

Related Documents

In addition to this book, the documents listed below are part of the documentation set. Within the continental United States, these documents can be ordered from the AT&T GBCS Publications Fulfillment Center by calling 1 800 457-1235.

| Document No. | Title |
|--------------|---|
| | System Documents |
| 555-640-110 | Feature Reference |
| 555-640-111 | System Programming |
| 555-640-112 | System Planning |
| 555-640-113 | System Planning Forms |
| 555-640-116 | Pocket Reference |
| 555-640-118 | System Manager's Guide |
| | Telephone User Support |
| 555-640-122 | MLX-10D TM , MLX-10DP TM , MLX-16DP TM , MLX-28D TM , and |
| | MLX-20L™ Display Telephones User's Guide |
| 555-630-150 | MLX-10D Display Telephone Tray Cards (5 cards) |
| 555-630-153 | MLX-28D and MLX-20L Telephone Tray Cards (5 cards) |
| 555-640-124 | MLX-10™ Nondisplay Telephone User's Guide |
| 555-630-151 | MLX-10 Nondisplay Telephone Tray Cards (6 cards) |
| 555-640-120 | Analog Multiline Telephones User's Guide |
| 555-640-126 | Single-Line Telephones User's Guide |
| 555-640-138 | MDC 9000 and MDW 9000 Telephones User's Guide |
| | System Operator Support |
| 555-640-134 | MLX Direct-Line Consoles Operator's Guide |
| 555-640-132 | Analog Direct-Line Consoles Operator's Guide |
| 555-640-136 | MLX Queued Call Console Operator's Guide |
| | Miscellaneous User Support |
| 555-640-130 | Calling Group Supervisor's Guide |
| 555-640-105 | Data and Video Reference |

| Document No. | Title |
|--------------|--|
| | Documentation for Qualified Technicians |
| 555-640-140 | Installation, Programming & Maintenance (IP&M) Binder [consists of Installation, System Programming & Maintenance (SPM), Maintenance & Troubleshooting |
| | Toll Fraud Security |
| 555-025-600 | GBCS Products Security Handbook |

How to Comment on This Document

We welcome your comments, both good and bad. Please use the feedback form on the next page to let us know how we can continue to serve you. If the feedback form is missing, write directly to:

Documentation Manager AT&T 211 Mount Airy Road Room 2W226 Basking Ridge, NJ 07920

xxvi Installation

Introduction

1

Installation of the MERLIN LEGEND Communications System involves the following:

- Installing the control unit
- Installing the telephones
- Connecting system wiring
- Installing optional equipment

This chapter provides an overview of the installation process, which varies from customer to customer.

Installation Sequence

The following is a list of the components that the system can include and shows the order in which you should install them. When installing your customer's system, try to adhere to this order as much as possible:

- 1. Install the control unit (required).
- 2. Connect power accessories to the control unit (optional).
- 3. Install the telephones (required) and adjuncts (optional).
- 4. Connect the telephones to the control unit (required).

- 5. Connect the control unit to the network interface (required).
- 6. Connect the channel service unit (CSU) to the 100D module on the control unit (required only with the 100D module).
- 7. Connect the printer and PC to the control unit (optional).
- 8. Connect data equipment to the control unit (optional).
- 9. Initialize and test the system (required).
- 10. Install the control unit housing (required).
- 11. Install applications (optional).

A list of required tools and equipment is given before each installation procedure.

System Forms

Some of the installation procedures in this guide refer to system forms. These forms indicate information that is specific to your customer's system. The forms you need should be included with the system programming disk or memory card, which contains all of the programming specifically for your customer's system.

If you are upgrading an existing system and do not have the required forms for your customer's system, you can load System Programming and Maintenance (SPM) and print out the required forms.

If you find that you do not have a completed set of system forms for your customer's system, contact your technical support organization or the Customer Service Center (CSC). See the inside front cover for telephone numbers.

The system forms that you need are specific for each system, and include some or all of those described in the following sections.

Installing the Control Unit

- Form 1, System Planning. Some procedures in Chapter 2, "Installing the Control Unit," refer to the Control Unit Diagram, which is printed on the reverse side of this form.
- Form 3c, Incoming Trunks: Tie. If you install a 400EM module in the control unit, use this form to determine the appropriate switch settings prior to installation.

Installing Telephones (Required) and Adjuncts (Optional)

The following forms indicate the telephones and adjuncts that you must install:

- Form 2a, System Numbering: Extension Jacks
- Form 2b, System Numbering: Digital Adjuncts
- Form 4b, Analog Multiline Telephone
- Form 4d, MLX Telephone
- Form 4e, MFM Adjunct: MLX Telephone
- Form 4f, Tip/Ring Equipment
- Form 5a, Direct-Line Console (DLC): Analog
- Form 5b, Direct-Line Console (DLC): Digital
- Form 5c, MFM Adjunct: DLC
- Form 5d, Queued Call Console (QCC)

Connecting the Network Interface

The following forms indicate the trunks that you must connect to the control unit. Information regarding the channel service unit (CSU) is included on these forms.

- Form 2c, System Numbering: Line/Trunk Jacks
- Form 3a, Incoming Trunks: Remote Access
- Form 3b, Incoming Trunks: DS1 Connectivity (100D Module)
- Form 3d, Incoming Trunks: DID

Connecting Data Equipment

The following forms indicate the data equipment you will need to set up data stations.

- Data Form 1a, Modem Data Station
- Data Form1b, 7500B Data Station
- Data Form 2, Data Hunt Groups

Programming the System

If you have a system programming disk created with SPM or a Translation memory card, you do not need to program the system. Instead, you can use the disk or memory card to restore the system; see Chapter 7, "Initializing and Testing the System," for instructions. If you did not receive a disk or a memory card and it is your responsibility to program the system, see *System Programming* for instructions.

Upgrading the System

If you are upgrading to Release 4.0 from Release 3.1, 3.0, 2.1, 2.0, 1.0, 1.1, or from the MERLIN® II Communications System, refer to Chapter 9, "Upgrading the System," then Chapter 7, "Initializing and Testing the System," for upgrade instructions.

NOTE:

You cannot retain the programming from the MERLIN II Communications System. You must first upgrade the hardware, then reprogram the system.

Installing the Control Unit

If you have not read Chapter 1, "Introduction," do so before continuing with this chapter.

Overview

Installing the control unit involves the following procedures:

- Preparation requirements
- Installing the backboard
- Meeting the power and grounding requirements
- Checking the total unit load
- Installing the basic carrier
- Installing any expansion carriers
- Installing the power supply
- Installing the processor
- Installing the line/trunk and extension modules
- Connecting the control unit to AC power
- Powering up the system
- Powering down the system

The following sections provide detailed instructions for these installation procedures. Follow the procedures in the order in which they are presented.

Environment

The control unit must be installed on a backboard. The placement of the backboard, and the control unit on it, requires careful consideration. Make sure you install the backboard in an area that meets all of the environmental requirements listed in Table 2-1.

Table 2-1. Environmental Requirements

| Operating Temperatures | 40°-104°F (4°-40°C) Optimal temperature: 60°F (15.6°C) |
|---------------------------|---|
| Humidity | 20%–80% |
| Airborne Contamination | Do not expose the control unit to moisture, corrosive gases, dust, chemicals, spray paint, or similar material. |
| Ventilation | Allow at least 1 in. (2.54 cm) on the right and left sides of the control unit and 12 in. (30.48 cm) minimum, above and below it, to prevent overheating. |
| | Do not place the control unit near extreme heat sources (for example: furnaces, heaters, attics, or direct sunlight). |
| Electrical Fields | Do not expose the control unit to devices that generate electrical currents causing interference (such as arc welders or motors). |
| Heat Dissipation | Basic carrier: 500 Btu/hr |
| _ | Basic carrier: with one expansion carrier 1000 Btu/hr |
| | Basic carrier: with two expansion carriers 1500 Btu/hr |



M WARNING:

Do not install the control unit outdoors.

Electrical Noise/Radio-Frequency Interference

In most cases, electrical noise is introduced to the system through trunk or telephone cables. However, electromagnetic fields near the control unit can also cause noise in the system. Therefore, you should *not* place the control unit and cable runs in areas where a high electromagnetic field strength exists.

Radio transmitters (AM and FM), television stations, induction heaters, motors (with commutators) of 0.25 horsepower (200 watts) or greater, and similar equipment are leading causes of radio-frequency interference (RFI). Small tools with universal motors are generally not a problem when they operate on separate power lines. Motors without commutators generally do not cause interference.

Field strengths below 1.0 volt per meter are unlikely to cause interference. To estimate the field strength produced by radio transmitters, divide the square root $(\sqrt{})$ of the emitted power, in kilowatts, (\div) by the distance from the antenna in kilometers which equals (=) the field strength in volts per meter.

Example: $\sqrt{49,000} \text{ kw} = 7,000 \div 10 \text{ km} (6.2 \text{ miles}) = 0.7 \text{ volts per meter}$

This yields the approximate field strength in volts per meter and is relatively accurate for distances greater than about half a wavelength (492 ft., or 150 m, for a frequency of 1000 Hz). If the result exceeds 1.0 volt per meter, you may have to install shielded cables and or Z200A filters. See Appendix A, "Customer Support Information," following Maintenance and Troubleshooting, for FCC Part 15 radio frequency regulations.

Control Unit Requirements

- Dimensions
 - Basic carrier: 14 in. wide by 23 in. high by 12 in. deep
 - Basic carrier and one expansion carrier: 25 in. wide by 23 in. high by 12 in. deep

— Basic carrier and two expansion carriers: 37 in. wide by 23 in. high by 12 in. deep

Location

- Within 5 ft. (152 cm) of an AC power outlet that is not switchcontrolled
- Within 25 ft. (762 cm) of the network interface, or use an Off-Premises Range Extender (OPRE)
- Within 1000 cable ft. (305 m) of telephones, or use an OPRE (for basic telephones)



A CAUTION:

The AC outlet for the control unit cannot be switch-controlled. Plugging the control unit into such an outlet invites accidental disconnection of the system.

Hardware Preassembly Process

If an installation is to be preassembled, wired, programmed, and tested on the new lightweight plastic backboard, see "Installing the Backboard."

Backboard Requirements

The backboard should be wide enough to accommodate the carrier and up to two additional carriers, assuming that system growth is anticipated. There should be enough room on each side of the control unit for the necessary wiring fields.

To accommodate the maximum control unit size, make sure the backboard meets the following requirements:

- Material
 - ¾-inch plywood
 - Check with the local building code enforcement agency to see whether fire-retardant material is required.

2–4 Installing the Control Unit

- Make sure that the material meets local building codes.
- Dimensions
 - With Systimax® wiring: 7 ft. wide by 4 ft. high
 - Without Systimax wiring: 6 ft. wide by 3 ft. high

Installing the Backboard

When you are certain that the backboard meets the requirements indicated above, or is the new lightweight plastic material backboard with preassembled equipment in place, attach the backboard to the wall.

Use the following mounting hardware:

- For a wood mounting surface, use wood screws.
- For brick, cinderblock, or concrete, use masonry anchors.
- For plaster or plasterboard, use toggle bolts.
- For sheet metal, use sheet-metal screws and attach them to the structural members.

NOTE:

The mounting hardware should resist a combined pullout force of at least 650 pounds (295 kilograms).

AC Power and Grounding

Proper power and grounding are essential for the system to run correctly and safely.



A CAUTION:

If any of the following requirements are not met, the customer must contact a licensed electrician. Do not install the system until all requirements are met.

Verify that all of the following power and grounding requirements are met:

- The load center of appropriate current rating must be equipped with circuit breaker(s) labeled 120 V AC, 15 amps.
- Each breaker must protect one dedicated guad AC outlet or two dedicated duplex AC outlets.
- All AC outlets must connect to the same load center and the ground wire must connect to the single-point ground bar on the first AC outlet (see Figure 2-1).
- One outlet must have an attached ground bar connected by a #6 AWG copper wire to an approved ground (see "Approved Grounds," later in this chapter, for a description of approved grounds). This ground bar is the system's single-point ground (see Figure 2-1).
- To prevent someone from accidentally shutting off the power, *do not* connect the control unit to a switch-controlled outlet.
- The AC outlet should be within 5 ft. (152 cm) of the control unit.
- Each carrier requires one AC outlet receptacle.
- Auxiliary equipment requires additional AC outlets.
- If a printer or PC is installed on the system, it must be plugged into the same AC branch as the power supply of the basic carrier.
 - If the printer or PC is 50 ft. (15 m) or more from the control unit, or is plugged into a different AC circuit, Asynchronous Data Units (ADUs) must be installed as well. Chapter 5, "Installing the PC, CAT, or Printer," includes complete installation instructions.
- The AC power requirements indicated in "AC Outlet Tests." below. must be met.

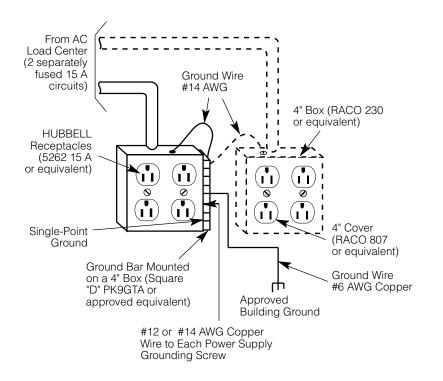


Figure 2-1. AC Grounding Requirements



A CAUTION:

The AC outlet for the control unit cannot be switch-controlled. Plugging the control unit into such an outlet invites accidental disconnection of the system. The AC outlet must be properly wired as described in "AC Outlet Tests."

Table 2-2. AC Power Requirements

| Parameter | Value |
|-------------------|----------------------------|
| Nominal voltage | 117 V AC |
| Voltage range | 110-125 V AC |
| Frequency | 60 Hz +/- 5% |
| Maximum current | 3 amps per power supply |
| Power consumption | 225 watts per power supply |
| | |

AC Outlet Tests

If the AC outlet tests indicate that any of the power requirements in Table 2–2 are not met, your customer must contact a licensed electrician. Do not install the system until all requirements are met.

If the AC outlet tests reveal any of the following conditions, they must be corrected before you install the system:

- Open ground
- Hot and neutral reversed
- Open hot
- Open neutral
- Hot and ground reversed



MARNING:

Hazardous voltages are present during the following tests. Follow all instructions carefully when working with AC power line voltages.

Using an Ideal 61-035 Circuit Tester (or Equivalent)

1 Plug the circuit tester into the outlet that you want to test.

If the circuit is properly grounded, the yellow and white lights on the tester turn on.

2 Unplug the circuit tester.

Using a Volt-Ohm Milliammeter (VOM)

1 Set the VOM to the lowest scale on which you can read 130 V AC.

2 Measure the AC outlet voltages. See Figure 2-2.

- Phase to ground should be 110 to 125 V AC.
- Neutral to ground should be less than 1 V AC.
- Phase to neutral should be 110 to 125 V AC.

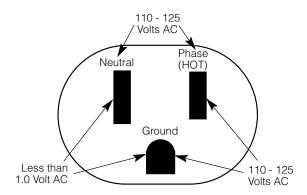


Figure 2-2. Measuring the AC Outlet Voltages



WARNING:

If the voltage readings do not measure the values required, the AC outlet is improperly wired—do not install the system. Advise the customer to have a licensed electrician correct the problem.

Grounding Requirements

Proper grounding of the installation site safeguards the system by protecting it from the following:

- Lightning
- Power surges
- Power crosses on central office trunks
- Electrostatic discharge (ESD)

When installing the control unit, make sure you meet the following grounding requirements:

- The control unit, the central office trunk protector, and the AC power service panel should be as close to each other as possible.
- Because equipment can be located throughout a building, the National Electrical Code requires that the ground point for the central office trunk protector be bonded to the AC power ground as shown in Figure 2–3.
- The AC outlet and the single-point ground bar must be properly grounded as shown in Figure 2–1 and Figure 2–3.
- Each power supply in the control unit must be connected to the single-point ground bar by a #12 AWG or a #14 AWG solid copper wire. Figures 2–1 and 2–3 show this connection.
 - This wire run should be as short as possible, preferably within 5 ft. (152 cm), not to exceed 10 ft. (305 cm). See "Approved Grounds," later in this chapter, for more information.
- The AC outlet must be connected to the 147A protector with #12 AWG or a #14 AWG solid copper wire.

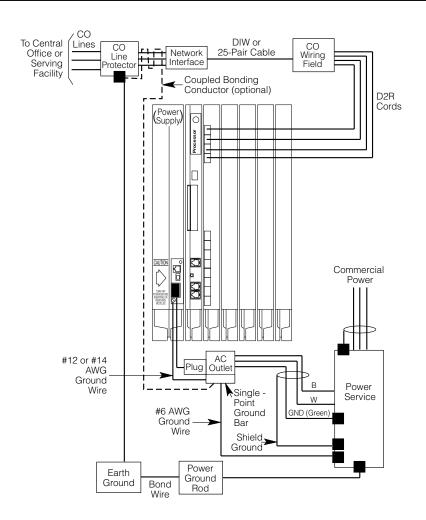


Figure 2–3. Central Office and AC Grounds



WARNING:

Improper ground can cause equipment failures, service outages, and electrical shock. Verify that the AC power uses an approved ground for its primary ground, that all voltage-limiting devices are grounded to an approved ground, and that the ground is one of the approved grounds listed below.

Approved Grounds

Approved grounds are listed below, in order of preference:

- Building Steel. The most preferred ground.
- Acceptable Water Pipe. Must be a metal, not plastic or vinyl, underground water pipe at least ½ in. (1.27 cm) in diameter, and in direct contact with the earth for at least 10 ft. (3 m).

It must be electrically continuous so that the protector ground is uninterrupted. (Check for insulated joints, plastic pipe, and plastic water meters that might interrupt electrical continuity.)

A metallic underground water pipe must be supplemented by the metal frame of the building, a concrete-encased ground, or a ground ring. If these grounds are not available, the water pipe ground can be supplemented by one of the following types of grounds:

- Other local metal underground systems or structures, such as tanks and piping systems, but not gas pipes
- Rod and pipe electrodes, a 5/8-in. (1.58-cm) solid rod or ¼-in. (0.63-cm) conduit or pipe electrode driven to a minimum depth of 8 ft. (244 cm)
- Plate electrode, a minimum of 2 square ft. (61 square cm) of metallic surface exposed to the exterior soil

- Concrete-Encased Ground. Must be an electrode, consisting of one of the following:
 - At least 20 ft. (6.1 m) of one or more steel reinforcing rods, each at least ½ in. (1.27 cm) in diameter
 - 20 ft. (6.1 m) of bare copper conductor not smaller than #4 AWG, encased in 2 in. (5 cm) of concrete
 - This electrode must be located within and near the bottom of a concrete foundation or footing that is in direct contact with the earth.
 - Ground ring, consisting of at least 20 ft. (6.1 m) of bare copper conductor (not smaller than #2 AWG) encircling the building. The ground ring must be in direct contact with the earth and buried at least 2.5 ft. (77 cm) below the earth's surface.



WARNING:

Do not use a metal underground gas piping system—this is a safety

Central Office Trunk Protection

The telephone company is responsible for providing the following protection of central office (co) trunks at the entrance to the site:

- Carbon blocks or gas discharge tubes connected to an approved ground
- Adequate bonding of the central office trunk protector ground and the power company ground



A CAUTION:

Check these requirements with a simple, visual inspection. If you cannot verify that the central office grounding requirements are met, contact the central office. **Do not** connect the control unit to the central office trunks until you are certain that these requirements are met.

Heavy Lightning Protection

For most surges, adequate protection is provided by meeting the previously listed requirements. Additional protection is required when the customer is located in a heavy lightning area.

Connect a 147A protector to the system to limit surges from the AC lines and up to four CO trunks.

For systems with more than four CO trunks, do the following:

- Connect a 146A protector to the 147A protector, providing protection for an additional four trunks.
- Connect up to three (maximum) 146A protectors to a 147A protector, allowing a maximum of 16 trunks on one 147A protector.
- For more than 16 trunks, add another 147A protector and continue adding 146A protectors as needed. See Table 2–3 for various configurations and Figure 2–4 for a typical 147A protector installation.

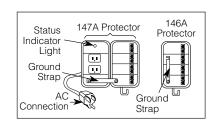
Table 2-3. Heavy Lightning Protection

| Number of CO Trunks | Required Protectors |
|---------------------|--------------------------|
| 1–4 | 147A |
| 5–8 | 147A and a 146A |
| 9–12 | 147A and two 146As |
| 13–16 | 147A and three 146As |
| 17–20 | Second 147A |
| 21–24 | Second 147A and one 146A |
| | |

NOTES:

- 1. When you use the second 147A, you can connect the 146As in any combination, up to a maximum of three 146As per 147A.
- 2. For detailed installation instructions, see the documentation packaged with the protectors.

2–14 Installing the Control Unit



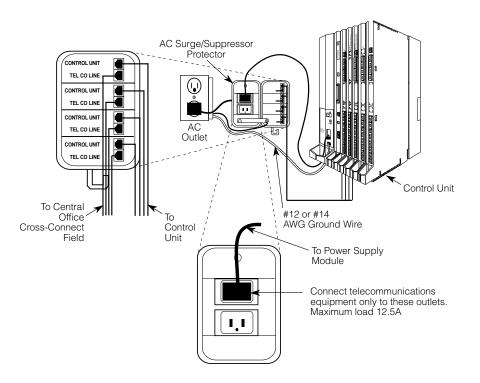


Figure 2-4. Installing 146A and 147A Protectors

Unit Loads

A unit load is a measure of power (1.9 watts) that you use to determine the electrical load that the components listed below place on the control unit's power supply.

- Telephones and adjuncts
- 800 DID modules

Only the telephones and adjuncts that connect to the analog and digital extension jacks (ports) on the control unit require unit load calculation. When calculating unit load, do not include any equipment with its own power supply.

Checking Unit Loads

In the event of maintenance or equipment changes, recalculate the unit loads for each carrier where there is a new configuration. Use the worksheet in Appendix B, "Unit Load Calculation Worksheet."

As a general rule, if you can distribute the 800 DID modules and telephone modules equally across the carriers, you prevent unnecessary drain on any one carrier. However, the rule varies depending on the system's mode. The next two sections provide the rules for calculating unit loads in various modes.

Unit Loads for Hybrid/PBX Mode

Older power supplies (models 391A1 or 391A2) generally supports six modules of any type in Hybrid/PBX mode, without requiring an upgrade to a newer power suppy (model 391A3). If the following conditions are true, however, the unit loads on a carrier can exceed the 54-unit maximum and, therefore, require a newer power suppy (model 391A3):

- All six carrier slots are occupied by MLX telephone or analog multiline telephone modules.
- The carrier has a total of more than 45 MLX-20L telephones or 34-button analog multiline telephones installed.

Unit Loads for Key or Behind Switch Mode

In a Key or Behind Switch system with four or fewer modules, no calculation is needed. The older power supplies (models 391A1 or 391A2) generally supports four modules of any type. With more than four modules, a newer power suppy (model 391A3) may be needed.

Installing the Basic Carrier

Continue with this procedure only if you have met all of the requirements discussed earlier in this chapter.

When you mount the basic carrier onto the backboard, leave 29 in. (73.66 cm) of backboard to the right. This allows you to easily install and remove the control unit cover, and also allows enough room for system expansion to the right for the total length of up to three carriers.

To install the basic carrier, follow the steps below:

1 Mark the screw-hole locations on the backboard, using the basic carrier or the template supplied with the plastic preassembled backboard as a guide. See Figure 2–5.

Make sure the carrier is level before marking the holes.

- 2 Drill a pilot hole in the center of each of the four screw-hole marks.
- 3 Anchor the screws approximately halfway into the backboard.
- 4 Position the carrier on the screws and slide the carrier to the left.
- 5 Tighten the screws.

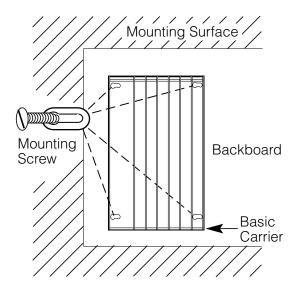


Figure 2–5. Marking the Basic Carrier Screw Holes

2–18 Installing the Control Unit

Installing the Power Supply



WARNING:

Do not attach any cables or power cords to the power supply until it is installed in the carrier.

Do not power up the control unit until all of the modules and power equipment are installed. Once they are installed, refer to "Powering Up the System," later in this chapter. Failure to comply with this procedure can result in shock hazard and or damage to the equipment.

If you are upgrading an older system and a ring generator is specified in the system forms (Control Unit Diagram), install it in the power supply before putting the power supply in the carrier. The procedure is detailed in Maintenance and Troubleshooting.

For expansion carriers with older power supply modules only, a copper shield must be installed on the power supply before installing it in the carrier. The procedure is explained in "Installing a Copper Shield," later in this chapter.

Before touching leads, connectors, pins, and other components, use a properly grounded wrist strap, to prevent damage from electrostatic discharge (ESD).

Remove the protective cover from the gold-finger connector (on the back of the power supply) before inserting it into the carrier.

Installing the power supply can involve as many as four procedures, depending on the system configuration. The procedures are:

- Turning off all power to the control unit
- Installing a copper shield [for older power supply modules (391A1, 391A2, 391B1) only]
- Installing the ferrite cores

NOTE:

It is not necessary to install ring generators in a new system with new 012 (apparatus code 517G13 or later) modules or new 008 (apparatus code 517D28 or later letter). If you are upgrading or using older modules, see *Maintenance and Troubleshooting*.

Turning Off the Power

- 1 Turn off *each* power supply.
- 2 Disconnect all power cords and auxiliary units.

Installing a Copper Shield

The added power supply in each expansion carrier can cause excessive noise in the module occupying the next slot. To eliminate this noise, a copper foil shield is installed over the power supply. These shields and their labels are packaged in the power unit shielding kit included with the expansion carrier.

NOTE:

The 391A3 and 391B2 power supply modules do not require copper shielding. Perform this procedure for older power supply modules (391A1, 391A2, and 391B1) only.

2-20 Installing the Control Unit

To install a copper shield, follow the steps below. Refer to Figure 2-6 throughout the procedure.

- 1 Make sure all power is off.
- 2 Place the power supply on a flat surface with the right side up (as viewed from the front edge).
- 3 Wipe the module free of any dust or dirt.
- 4 Peel the backing paper from the smaller copper-foil shield to expose the adhesive.

Check the positioning of the foil shields before sticking them to the side of the module. Once in place, the foil is difficult to remove.

- 5 Position the foil on the upper part of the module and work out any air bubbles as you press the foil firmly in place.
- 6 Peel the backing paper from the larger copper-foil shield to expose its adhesive.
- 7 Position the foil on the lower part of the module.
 - a The shields *must* meet.
 - b They should *not* overlap or have *any space* between them.

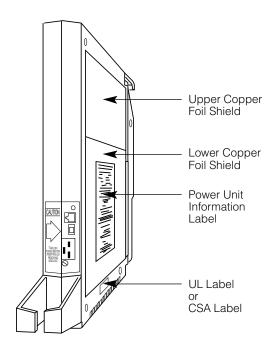


Figure 2-6. Installing a Copper Shield in the Power Supply

- 8 Tuck the foil shield tightly along the ledge (or crease) of the housing and work out any air bubbles as you press the foil firmly in place.
- 9 With the copper-foil shield in place, put the power unit information label on the lower piece of foil.
- 10 Attach the UL or CSA label on the power supply below the copper-foil shield.

Installing the Power Supply Module in the Carrier

- 1 Lower the power supply module hook onto the rod on top of the carrier.
- 2 Make sure the connector on the module mates properly with the connector on the carrier.
- 3 Push the module into the carrier until it locks into place.

Installing the Ferrite Cores

At this point, the power supply should have been installed in the carrier, but there should be no cables or power cords attached to the power supply module.

NOTE:

If you are upgrading a system, unplug the AC power cord and remove the ground wire attached to the grounding screw on the front of the power supply.

Follow these steps to install the ferrite cores:

- 1 Feed the AC power and ground wire through the wire manager (refer to Figure 2–7).
- 2 Open the ferrite cores by unsnapping the plastic case.
- 3 Attach a ferrite core around the AC power cord and the ground wire by snapping the plastic case shut.
- 4 Attach the second ferrite core adjacent to the first ferrite core by repeating Steps 2 and 3.
- 5 Slide the ferrite cores between the wire manager and the power supply module (refer to Figure 2–7).
- 6 Attach the ground wire to the grounding screw on the power supply module.
- 7 Check that the other end of the ground wire is connected to the terminals of the single-point ground bar on the AC outlet box.



A CAUTION:

Do not connect the power cord until the entire control unit is assembled.

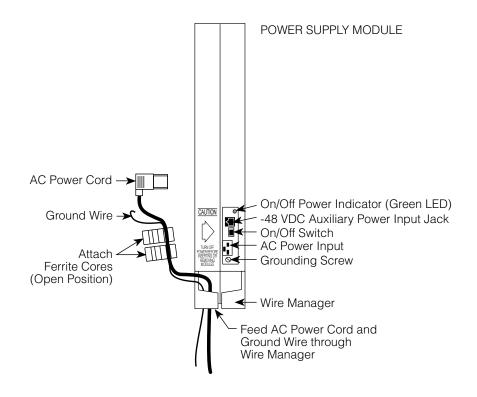


Figure 2–7. Installing the Ferrite Cores

2–24 Installing the Control Unit

Installing the Auxiliary Power Unit

The Control Unit Diagram on the back of Form 1, System Planning, indicates whether an auxiliary power unit is required for the carrier that you are installing.

NOTE:

Use the 9024 auxiliary power unit for new installations. You can continue to use a previously installed 335A auxiliary power unit, as long as no new telephones or modules are added to the carrier.

To install an auxiliary power unit, follow the steps below. Refer to Figure 2–8 throughout this procedure.

- 1 Turn off the switch on the power supply.
- 2 Mount the auxiliary power unit on a surface (preferably the backboard) within 2 ft. (61 cm) of the control unit.
- 3 Plug the power unit line cord into the AUX POWER INPUT jack on the power supply.
- Plug the other end of the line cord into the AUX POWER jack on the auxiliary power unit.



A CAUTION:

Do not plug the power supply or the auxiliary power unit into the AC outlet until you are ready to turn on the system, as described in "Powering Up the System" later in this chapter.

If the system is backed up by an Uninterruptible Power Supply (UPS), connect the auxiliary power to the UPS.

Do not attach the power cord(s) to any building surfaces.

Use only the power unit line cord supplied with the auxiliary power unit. An incorrect cord will damage the power supply and may damage modules.

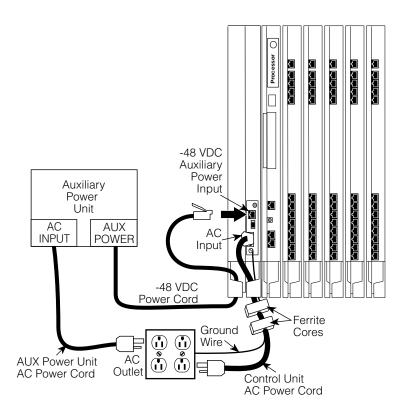


Figure 2–8. Installing an Auxiliary Power Unit

Installing Expansion Carriers

If you are adding an expansion carrier to an existing system, see "Upgrading the Control Unit" in Chapter 9 before continuing.

If you are to install one or more expansion carriers, follow the steps below to mount each one. Refer to Figure 2–9 and Figure 2–5 throughout the procedure.

- 1 Locate the breakaway plastic tab on the right side of the previously mounted carrier. Using a flat-blade screwdriver, gently pry the tab open to expose the card extender.
- 2 Align the connector of the expansion carrier with the card extender on the previously mounted carrier and slide the connector onto the extender.
- 3 Mark the screw-hole locations on the backboard, using the expansion carrier or the template that comes with the preassembled plastic backboard as a guide.

Make sure the carrier is level before marking the holes.

- 4 Disconnect the expansion carrier connector from the previously mounted carrier and put the expansion carrier aside.
- 5 Drill a pilot hole in the center of each of the four screw-hole marks.
- 6 Anchor the screws approximately halfway into the backboard.
- 7 If housing clips are to be installed on the housing and this is the last carrier in the control unit, place the housing clips around the right-hand molding for the screws on the back of the carrier.

If not, go to Step 8.

- 8 Position the expansion carrier on the screws and slide it to the left, to reconnect the expansion carrier card extender to the previous carrier's connector.
- 9 Make sure the connection is secure.
- 10 Make sure the carrier is level and that the housing clips extend as far as possible from the right side of the carrier.
- 11 Tighten the screws.

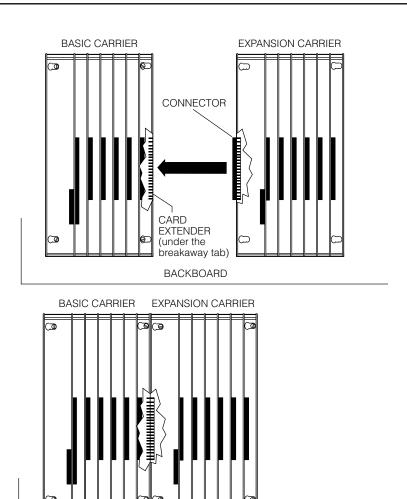


Figure 2–9. Connecting the Carriers

BACKBOARD

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Installing the Processor

Installing the processor includes the following procedures:

- If *both* of the following conditions are true, follow the procedures in Chapter 9, "Modifying the Processor for Key Mode."
 - Form 1, System Planning, indicates Permanent Key mode.
 - Form 2c, System Numbering: Line/Trunk Jacks, indicates no GS (ground-start) trunks in the Incoming Trunk Type column.
- Insert the processor into the carrier as indicated in "Installing the Processor in the Carrier," later in this chapter.

NOTES:

- 1. If the system is programmed for Permanent Key mode, check the switch setting. Refer to Chapter 9, "Modifying the Processor for Key Mode" for detailed procedures. If the switch is set to Permanent Key-only operation, all trunks revert to loop-start. If the switch is not set, any programmed designation for ground-start trunks is retained.
 - The ground-start pool never has trunks assigned to it automatically, but must be programmed after the ground-start ports are designated. Groundstart trunks are assigned to the ground-start pool on initialization, except in a system switched for Permanent Key mode operation. (In Release 1.0, ground-start and loop-start trunks automatically defaulted to loop-start.)
- 2. Beginning with Release 3.0, the feature module required for Release 2.1 and earlier is no longer needed. The Release 3.0 processor module contains a PCMCIA memory card interface capable of accommodating a 4-MB memory card. This card is used to install or upgrade system software and perform firmware upgrades on circuit modules. It can be used to backup and restore system programming,



A CAUTION:

Before touching leads, connectors, pins, and other components when handling the circuit board, use a properly grounded wrist strap to prevent damage from electrostatic discharge (ESD).

Installing the Processor in the Carrier

To install the processor in the carrier, follow the steps below. Refer to Figure 2–10.

- 1 Remove the protective cover from the gold-finger connector on the back of the processor.
- 2 Lower the hook on top of the processor module onto the rod on top of the carrier in Slot 0, the first slot next to the power supply.
- 3 Make sure that the connector on the module mates properly with the connector on the carrier as you swing the processor down into place.



A CAUTION:

To avoid damage, do not force the module. If the module does not insert easily, press the bottom rear locking tab, remove the module, and inspect the module and carrier for damage or obstruction. The bottom-rear locking tab is shown in Figure 2–10. This tab is used on all modules.

If there is no damage and no obstruction, reinsert the module.

A damaged carrier or module must be replaced.

4 Push firmly until the processor snaps into place.

The processor should be securely attached to the carrier and locked in place by the locking tab on the bottom rear of the processor.

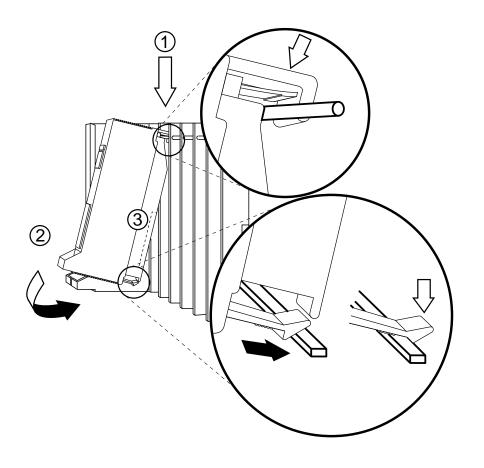


Figure 2–10. Installing the Processor into the Carrier

Installing the Modules



A CAUTION:

Use a properly grounded wrist strap to prevent damage from electrostatic discharge (ESD) when installing the modules, and avoid touching leads, connectors pins, and other components.

Guidelines

Follow these guidelines when you install modules, as indicated on the Control Unit Diagram of Form 1, System Planning:

- Do not leave empty slots between modules. The system ignores modules installed beyond any empty slot.
- If a phantom module (a programmed empty slot) is indicated on the Control Unit Diagram, make sure the slot remains empty and do not install any modules to the right of it. The system ignores any modules installed to the right of a programmed empty slot.
- Make sure you install each module in its assigned slot. If you install a module in the wrong slot, the system will not function properly.
- Be sure to place all 012 modules and all 008 OPT modules without built-in ring generators in carriers with modules that have ring generators so that the modules without ring generators can be supported.

NOTE:

All 016 modules and some 012 modules (apparatus code 517G13 or later) have built-in ring generators.

- Once you have installed the power supply and the processor in the basic carrier, use the remaining slots for the modules as follows:
 - Basic carrier: slots 1 through 5
 - First expansion carrier: slots 6 through 11

Second expansion carrier: slots 12 through 17

Installing Modules

To install modules starting from slot 1 (the first open slot next to the processor), follow the steps below:

For each 400EM tie line/trunk module, for jacks numbered 1 through 4 in Figure 2–11, check Form 3c, Incoming Trunks: Tie, for E&M signaling type.

Set the dual in-line packaging (DIP) switches on the front of the 400EM Tie Trunk module according to the E&M signaling type settings listed in Table 2-4 and Table 2–5 and shown in Figure 2–11. The default E&M signal does not require any adjustments in the DIP switches.

- 2 Remove the protective cover from each module's gold-finger connector.
- 3 Lower the hook on top of the module onto the rod on the top of the carrier in the appropriate slot. See Figure 2-10.
- 4 Make sure the connector on the module mates properly with the connector on the carrier.
- 5 Swing the module into the slot and firmly push the module into the carrier until it locks into place.



A CAUTION:

To avoid damage, do not force the module. If the module does not insert easily, press the bottom rear locking tab, remove the module, and inspect the module and carrier for damage or obstruction.

If there is no damage and no obstruction, reinsert the module. A damaged carrier or module must be replaced.

6 Repeat Steps 1 through 5 for each module you want to install.

Tie Trunks

Tie trunks connect two separate PBX communications systems either directly or through one or more central offices, as if they were one system at the same location. In the MERLIN LEGEND Communications System, the 400EM module is the originating and terminating unit for tie trunk operation.

Tie Trunk Signaling

The 400EM (tie trunk) module can transmit signals in three different formats. Each format is made up of a specific signaling mode and a specific signaling type. The DIP switches on the 400EM module allow you to select the signaling mode for tie trunk transmission. The signaling type is selected through system programming.

Signaling Modes

There are two signaling modes:

- **E&M.** This is a standard interface. The E&M signaling leads are separate from the transmission leads, requiring a 3-pair wire interface.
- **Simplex.** In Simplex, the two signaling leads are superimposed onto the analog transmission leads, providing a 2-pair wire interface for connecting two local systems at minimal cost.

Protected or Unprotected

Depending on the type of tie trunk installation, protective resistance may be installed to protect the circuit from outside interference from high-voltage transients or voltage fluctuations. In Simplex mode, the circuit always requires protective resistance. The E&M mode can be either protected or unprotected, depending upon the location of the distant PBX.

Signaling Types

Three different signaling types combine with the signaling modes. Together these create the proper signaling format for each system. Signaling types in each mode are as follows:

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■ E&M Mode

- —Type 1 Standard (default factory setting). This setting is used to connect two systems through telephone company facilities.
- —Type 1 Compatible. This setting connects two systems directly (without using telephone company facilities).

■ Simplex Mode

—**Type 5.** This setting is used on 4-wire (2-pair) circuits.

400EM (Tie Trunk) Module DIP Switches

During installation of 400EM (Tie Trunk) modules, refer to Table 2-4 and Table 2-5, and to Figure 2-11 for the correct DIP switch settings for varying signaling protocols.

Table 2-4. Setting the 400EM (Tie Trunk) Module DIP Switches

| Po | rts | DIP | Signaling Type | | e |
|---------------------------------|-----|--------------------|---|------------------------------------|----------------------|
| (as numbered in Figure 2–11) | | Switch Position | 1S (Default) and 1C Unprotected E&M Mode | 1C and 1S Protected E&M Mode | 5 Simplex Mode |
| | | 1 | ON | OFF | OFF or ON |
| _ | | 2 | ON | OFF | OFF or ON |
| 2 | 4 | 3 | OFF | OFF | ON |
| | | 4 | OFF | OFF | ON |
| | | 5 | OFF | OFF | ON |
| | | 6 | ON | OFF | OFF or ON |
| | 7 | ON | OFF | OFF or ON | |
| 1 | 3 | 8 | OFF | OFF | ON |
| | | 9 | OFF | OFF | ON |
| | | 10 | OFF | OFF | ON |

NOTE:

DIP switches 1, 2, 6 and 7 determine whether the tie trunks are protected or unprotected. DIP switches 3, 4, 5, 8, 9, and 10 determine the mode. Simplex mode is *always* protected. Therefore the Protected/Unprotected settings for DIP switches 1, 2, 6 and 7 have no effect.

The successful implementation of a tie trunk format is dependent upon matching the characteristics of both the PBX systems it connects. The preferred signaling formats for a tie trunk originating in the system are shown in Table 2–5 below.

Table 2-5. Signaling Formats for the 400EM (Tie Trunk) Module

| Installation Situation | | Preferred Signaling Format | | | |
|-----------------------------------|--------------------------------------|-----------------------------|-----------------------------|---------------------------|-----------------------------|
| From System | | System | | Distant Location | |
| То | Distant Location | Signaling Mode/Type | Protected or Unprotected | Signaling Mode/Type | Protected or Unprotected |
| MERLIN II | Same site co-located | Type 5 Simplex | N/A | Type 5 Simplex | N/A |
| System 25/75/85 or DEFINITY | Same site co-located | Type 5 Simplex | N/A | Type 5 Simplex | N/A |
| System 25/75/85 or DEFINITY | Inter-office | Type 5 Simplex | N/A | Type 5 Simplex | N/A |
| Dimension PBX | Same site co-located | E&M Type 1C (Compatible) | Unprotected | E&M Type 1S (Standard) | Unprotected |
| Dimension PBX | Inter-office | E&M Type 1C (Compatible) | Protected | E&M Type 1S (Standard) | Protected |
| Other Systems | Same site co-located | E&M Type 1C (Compatible) | Unprotected | E&M Type 1S (Standard) | Unprotected |
| Other Systems | Inter-office | E&M Type 1C (Compatible) | Unprotected | E&M Type 1S (Standard) | Requires a protection unit |
| MERLIN LEGEND | Same site co-located or inter-office | Type 5 Simplex | N/A | Type 5 Simplex | N/A |

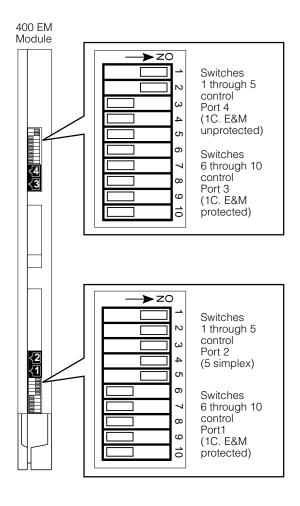


Figure 2–11. 400EM Module Sample Dip Switch Settings for Signaling Types 1C and 5

Labeling

- After all modules have been installed, label all jacks with the numbered labels provided with the feature module.
 - Line/trunk labels have green numbers on off-white background.
 - Telephone labels have blue numbers on off-white background.

See Figure 2–12 for the locations of line/trunk jacks and telephone jacks on each module, and label them as described next.

Label each line/trunk jack on the modules sequentially, 1 through 80. Begin with the module in slot 1, numbering from bottom to top on each module and working from left to right across the carrier(s).

The 100D module has 24 numbers assigned to the line/trunk jack.

Label each telephone jack sequentially, 1 through 144. Begin with the module in slot 1, numbering from bottom to top on each module and working from left to right across the carrier(s).



A CAUTION:

The 008 OPT module is assigned 12 logical IDs, and the last four numbers are not assigned to jacks. For example, if the previous module (on the left) is labeled with logical IDs 1 through 8, label the 008 OPT jacks with logical IDs 9 through 16. Skip numbers 17 through 20. When you label the next module (on the right), label the first jack as logical ID 21.

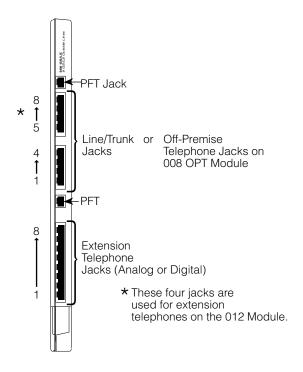


Figure 2–12. Line/Trunk and Telephone Jack Locations on Each Module

Replacing a Module



A CAUTION:

This section does not apply to the processor or power supply.

Although the system allows you to remove and replace modules without affecting call processing, partially inserting and removing a module can cause a cold start.

To add a 100D module or change any of its DS1 parameters, the system must be idle.

When you replace a module, use the same module type. For example, do not put a 008 MLX module in place of a 400 GS/LS/TTR module. If a module is replaced with another type of module, or if a module is added to the system without powering down the system first, a cold start (System Reset) occurs.

If you move any module to a different slot, be sure to renumber the modules by selecting Board Renumber from system programming. See System Programming for information about board renumbering.

NOTE:

You can remove and replace line/trunk and extension modules with the system power on, without affecting normal call processing.

To remove and replace a module, follow the steps below. Refer to Figure 2-13.

- 1 Busy-out or reset the module. (Busy-out is recommended.)
- 2 Label all cords (if they are not labeled already) and then unplug them from the module.

For information about labeling trunk and extension cords, see Chapter 3. "Installing Telephones and Adjuncts" and Chapter 4, "Connecting the Control Unit to the Network Interface." For instructions on checking unlabeled wiring, see "Checking Unlabeled Wiring" in Chapter 3 of the Maintenance and Troubleshooting guide.

- 3 Run a demand test by entering the test mode.
- 4 Power down the system, if required. See "Powering Down the System." later in this chapter, for instructions.
- 5 Remove the module by pushing up firmly on the tab at the bottom rear of the module.
- 6 While holding up the tab, swing the bottom of the module towards you and away from the carrier.
- 7 Lift up the module to disengage it from the rod on the top of the carrier.
- 8 Inspect the module for visible damage.
- 9 Insert the new module. See Figure 2–10.
- 10 Restore the module. Refer to Chapter 7, "Initializing and Testing the System," for instructions.
- 11 Connect the trunk and extension cords.
- 12 Attach a tag, error printout, and any information that will help identify any visible problems or failure symptoms.

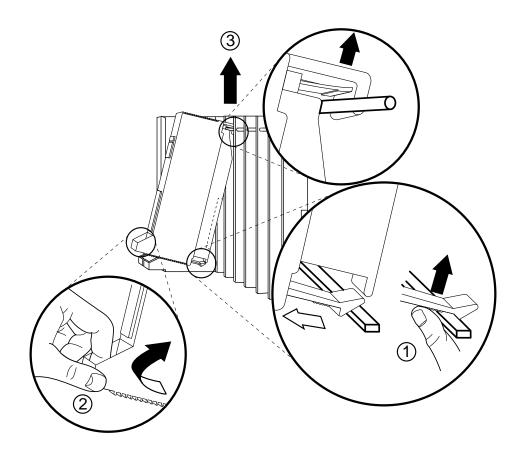


Figure 2–13. Removing Modules from the Carrier

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Connecting the Control Unit to an AC Outlet



A CAUTION:

Make sure the AC outlet has been tested for proper grounding. The outlet should be 117-V AC, 60-Hz, 3-wire (phase, neutral, ground). See "AC Outlet Tests," earlier in this chapter, for instructions.

To prevent someone from accidentally shutting off the power, do not connect the control unit to a switch-controlled outlet. The AC outlet should be within 5 ft. (152 cm) of the control unit.

To connect the control unit to a dedicated AC outlet, follow the steps below.

- 1 Turn the basic carrier's power supply switch to the OFF position.
- 2 Turn off the power supply switches on the expansion carriers.
- 3 Unplug the power cords from any auxiliary power units.
- 4 Plug one end of the power cord into the AC INPUT connector just below the power switch on the front of the basic carrier's power supply.
- 5 Plug the other end of the power cord into the AC outlet, allowing at least 1 ft. (30.4 cm) of slack in the cord.
- 6 Repeat Steps 4 and 5 for each expansion carrier.



A CAUTION:

Do not attach the power cord(s) to any building surfaces.

Powering Up the System



A CAUTION:

Follow the procedure below to power up the system only if the system is completely installed. Failure to comply with this procedure can result in shock hazard or damage to the equipment.

Turn on the power switch for each expansion carrier: start with the power supply in the *rightmost* carrier.

The green power lights on each expansion carrier power supply should turn

- 2 Turn on the power switch on the basic carrier power supply.
 - The dot on the one-character display LED flashes.
 - The green light on the power supply should turn on.
 - The red light on the processor should turn on for 15 to 45 seconds and then turn off.
 - All indicators on the 100D and 400EM line/trunk modules (if present) should turn on and then off. They remain off when the modules are
- 3 If any of these conditions are not met, refer to Maintenance and Troubleshooting.

Powering Down the System

You may need to power down the system for troubleshooting during installation, or to add new equipment to the carrier.



A CAUTION:

Follow these steps in the exact sequence.

To power down the system, follow the steps below.

- 1 Turn off the power supply on the basic carrier.
- 2 Turn off the power supplies on the expansion carriers.
- 3 Unplug any auxiliary power units.

Because the power supplies are already off, the sequence for removing auxiliary power cords is not important.

4 Unplug the system from the AC outlet.

Installing Telephones and Adjuncts

The control unit supports the MLX-10, MLX-10D, MLX-10DP, MLX-20L, and MLX-28D telephones, with or without Direct Station Selectors (DSSs), as well as analog multiline and single-line telephones. It also supports various adjuncts, which may require Multi-Function Modules (MFMs) or other adapters for installation.

This chapter provides installation instructions for the following procedures:

- Installing Multi-Function Modules
- Installing adjuncts
- Installing Direct Station Selectors
- Assembling MLX telephones
- Connecting telephones to the control unit

To connect data equipment to the system, see Chapter 6, "Connecting Data Equipment." To connect the MERLIN PFC, see Chapter 8, "Installing Applications."

Installing Multi-Function Modules

The Multi-Function Module (MFM) is an optional adapter that provides a modular jack connection to MLX telephones for the two classes of adjuncts listed below:

- Tip/ring (T/R) devices such as single-line telephones, fax machines, modems, and credit card verification terminals. Once connected, the MLX telephone and adjunct work independently of each other. This means they can send and receive calls at the same time. The MFM is the only T/R adapter you can use with MLX telephones.
- Supplemental alerts such as bells, chimes, horns, and strobes. These alerts notify people in noisy areas of incoming calls.

Considerations

Review the following items before you begin the procedure.

- If you install an MFM, do so *before* you assemble the MLX telephone.
- You *must* connect the KS 22911 power supply to an electrical outlet within 50 ft. (15 m) of cord length of the MLX telephone.
- If you connect an MFM and two DSSs to a telephone, you *must* install a 406743419 power unit.
- If a wall jack is more than 7 ft. (213 cm) from an MLX telephone, you must use a longer D8W cord.
- The MFM uses one of the two channels when it is active. This means that when an adjunct, such as a fax machine, and the MLX telephone are in use at the same time, Voice Announce to Busy is not possible. (Voice Announce to Busy is a feature that allows users to be paged on the speakerphone even if they are on a call.)
- The MFM has two jumper blocks that are factory-set for T/R operation. The MFM is packaged with the following items, shown in Figure 3–1:
 - KS22911 power supply
 - 400B or 400B2 adapter
 - D6AP cord

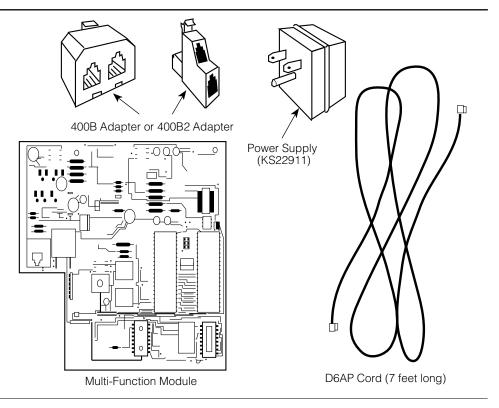


Figure 3-1. Multi-Function Module Packing List



acksim RISK OF ELECTRICAL SHOCK: Follow all warnings and cautions.



WARNING:

Only a qualified technician should install, repair, or set options for an

Do not touch the circuitry on the MFM. Touching the circuitry may result in component damage from electrostatic discharge.

Before installing an MFM, disconnect all trunk and/or power cords that are attached to the MLX telephone. This is to ensure that no hazardous voltages are present during installation. Ringing voltage from the MFM attached to the MLX telephone can cause electrical shock if adjustments are made while the cords are connected.

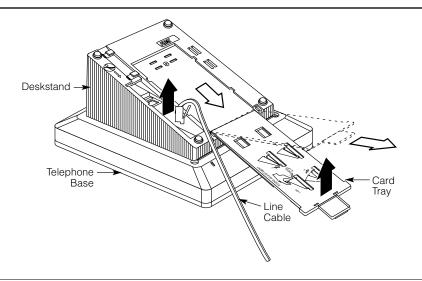


Figure 3–2. Removing the User Card Tray and Line Cable

To install or replace an MFM and change its pin settings, follow these steps.

NOTE:

If you are installing or replacing an MFM in a wall-mounted MLX-10, MLX-10D, or an MLX-10DP telephone, start at Step 3.

1 Place the telephone face down on a flat surface; remove the user card tray and line cable from the bottom of the deskstand. See Figure 3–2.

3–4 Installing Telephones and Adjuncts

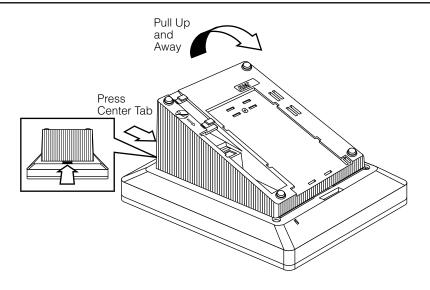


Figure 3–3. Releasing the Deskstand

- 2 Release and remove the deskstand from the telephone. See Figure 3–3 and Figure 3-4.
 - a Press on the top rear center of the deskstand to release the tab.
 - b Pull the deskstand up toward you and swing away from the telephone.

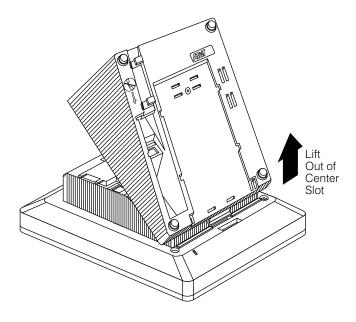


Figure 3–4. Removing the Deskstand

c Lift the deskstand out of the locating slot in the telephone base and place to one side.

3–6 Installing Telephones and Adjuncts

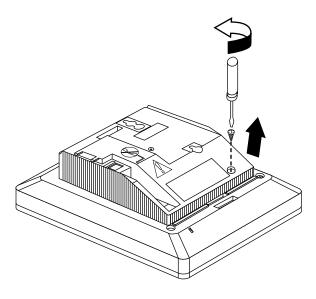


Figure 3–5. Releasing the Module Cover Screw

- 3 Release and remove the module cover. See Figure 3-5, Figure 3-6, and
 - a Use a screwdriver to remove the screw in the lower righthand corner of the module cover.

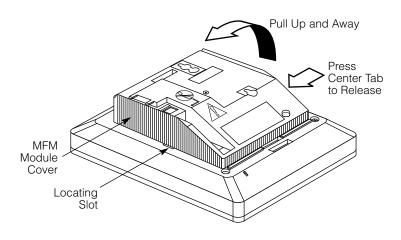


Figure 3–6. Releasing the Module Cover

- b Press the center of the right side of the module cover with one hand to release the locking tab.
- c Swing open the module cover to release it from the left side locating slot.

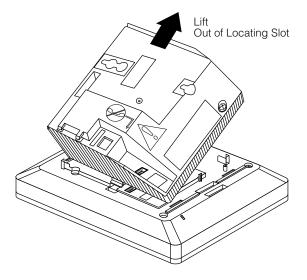


Figure 3–7. Removing the Module Cover

d Lift module cover out of locating slot and place to one side.

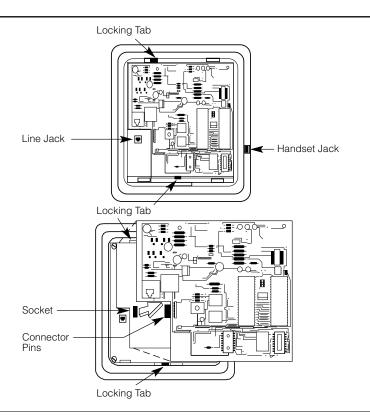


Figure 3–8. Removing an MFM Module

- 4 To install a new MFM, go to Step 5. To reset jumpers on an existing MFM, go to Step 6. To remove an existing MFM, continue (see Figure 3–8).
 - a Disconnect any cords attached to the phone and note the connections so that you can reconnect the cords to the appropriate jacks later.
 - b Locate the MFM locking tabs on the top and bottom of the telephone base, then spread the tabs apart to release the MFM.
 - c Grasp the MFM by the edges and pull it up to free the connector pins. *Do not touch the connector pins*.
 - d Set the MFM aside on a clean surface.

3–10 Installing Telephones and Adjuncts

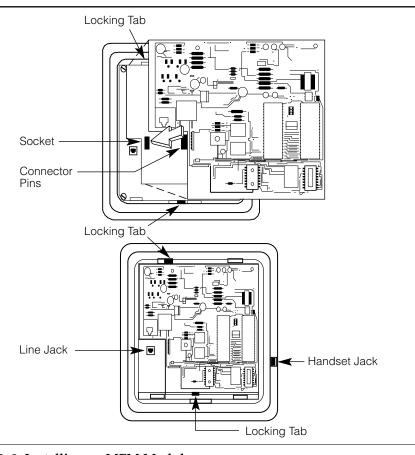


Figure 3-9. Installing an MFM Module

5 Install the new MFM. See Figure 3–9.

- a Hold the MFM circuit board by the edges with the long connector pins facing the socket. Take care not to touch the connector pins.
- b Lower the MFM to insert the pins into the socket in the telephone base.
- c Press firmly on the MFM board to snap the locking tabs into place. The connector pins and tabs must be secure.

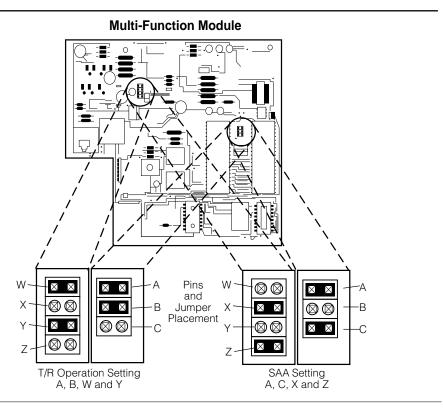


Figure 3–10. Setting and Adjusting the MFM Jumpers

- 6 Set or adjust the MFM jumpers for either a T/R device or a supplemental alert device. See Figure 3–10.
 - a Pull the four connectors off of the MFM module.
 - b Place the connectors over the appropriate pins for the required operation, and push down to secure into place.

3–12 Installing Telephones and Adjuncts

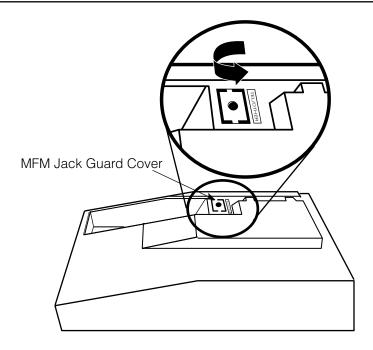


Figure 3–11. Removing the Jack Guard

7 To remove the jack guard, see Figure 3–11.

a If the module cover has a square jack guard that protects the TEL/OTHER jack area, grasp and twist the guard to remove it. Save the jack guard if you are wall-mounting an MLX-10 or MLX-10D telephone.

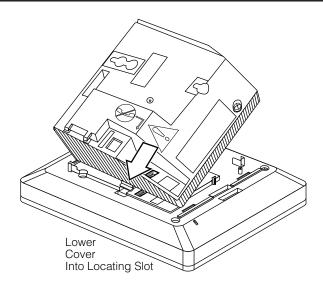


Figure 3–12. Placing the Module Cover into the Locating Slot

- 8 To replace the module cover, see Figure 3–12, Figure 3–13, and Figure 3–14.
 - a Place the locking tab on the module cover into the slot on the left side of the telephone.

3–14 Installing Telephones and Adjuncts

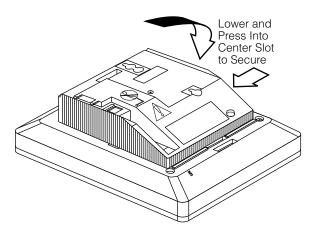


Figure 3–13. Lowering and Locking the Module Cover

b Lower the cover to the right and press firmly into the center slot to lock the tab in place. The tab must be secure.

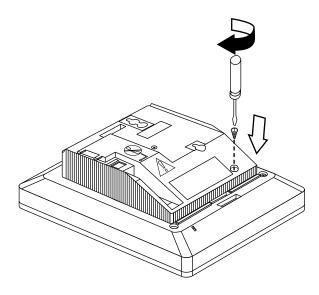


Figure 3–14. Replacing and Tightening the Module Cover Screw

c Replace and tighten the module cover screw that you removed in Step 3.

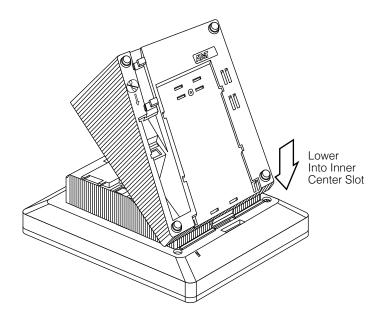


Figure 3–15. Replacing the Deskstand

- Replace the deskstand. See Figure 3-15. If you are wall-mounting an MLX-10, MLX 10D, or MLX-10DP telephone, go to Step 11; otherwise, continue with Step 9a.
 - a Place the tab on the narrow edge of the deskstand, into the locating slot on the telephone base.

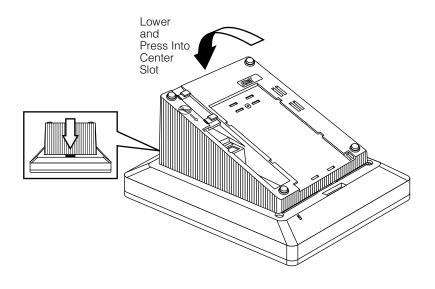


Figure 3–16. Lowering the Deskstand and Locking into Place

b Lower the deskstand and lock into place.

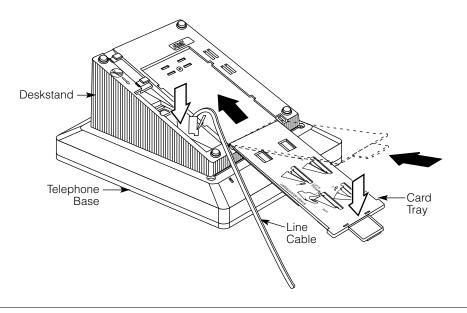


Figure 3–17. Replacing the User Card Tray and Line Cable

10 Replace the user card tray and line cable. See Figure 3–17.

- a Insert the user card tray at an angle, then lower and slide into the deskstand.
- b Replace the line cable into the line jack in the deskstand.

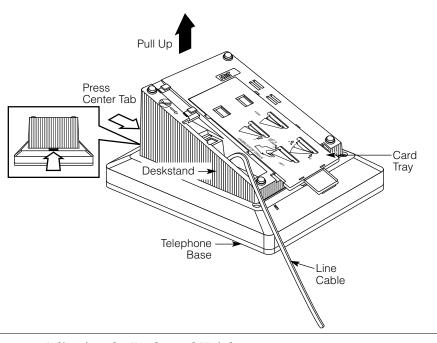


Figure 3-18. Adjusting the Deskstand Height

11 Adjust the deskstand height. See Figure 3–18.

- a To change the deskstand's height from low to high, press the top rear center of the deskstand to release the tab.
- b Pull the deskstand up and insert the tab into the slot in the module cover.
- c To readjust the stand, see the instructions on the bottom of the card tray.

12 Power up the telephone. See Figure 3–19.

a Plug the D8W cord from the telephone into the 8-conductor (large) modular jack of the 400B or 400B2 adapter.

3-20 Installing Telephones and Adjuncts

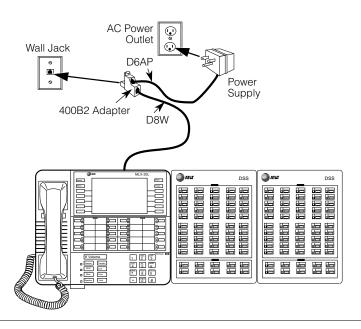


Figure 3–19. Powering Up the Telephone after Installing the MFM

b Connect one end of the D6AP cord to the 2-conductor (small) modular jack on the 400B or 400B2 adapter, and plug the other end into the modular jack of the 406943837 power supply. The total length of the cords connecting the power supply to the MLX telephone must be less than or equal to 50 ft. (15 m).



A CAUTION:

Do not plug the D6AP cord into the 8-conductor (large) modular jack on the 400B or 400B2 adapter; doing so can cause electrical damage to the control unit and to the telephone.

- c Plug the power supply into a 117-V AC outlet that is not controlled by a wall switch.
- d Insert the plug end of the 400B or 400B2 adapter into the wall jack.

13 Test the MFM for T/R operation.

See "Testing MLX Telephones with MFMs" in Chapter 7.

14 Attach the adjunct to the MFM. See "Installing Adjuncts."

Installing Adjuncts

This section provides general instructions for connecting most adjuncts.

NOTE:

If you need to connect the adjuncts differently from the instructions on the system forms, record each jack and adjunct change on the appropriate system numbering form. See Appendix A, "System Numbering Forms."

1 Connect one end of the cord packaged with the adjunct (usually a D4BU cord) to the adjunct.

See the documentation packaged with the adjunct for instructions.

- 2 Check the system form for the adjunct you want to connect. Then refer to the appropriate step below.
 - To connect an adjunct to an MLX telephone, go to Step 3.
 - To connect an adjunct to a single-line telephone, go to Step 4.
 - To connect an adjunct to an analog multiline telephone, go to Step 5.
 - To connect an adjunct to a 012 0r 016 module, go to Step 6.

When you connect adjuncts to telephones, make sure you route the adjunct and D8W telephone cords through the cord channel. See Figure 3–20.

3 Insert the other end of the adjunct cord into the TEL/OTHER jack on the back of the MLX telephone. Go to Step 7.

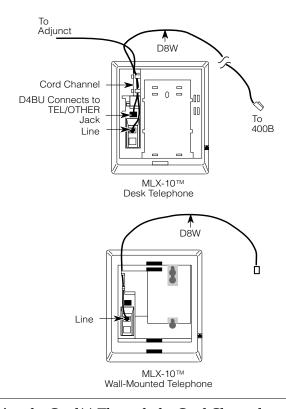


Figure 3–20. Routing the Cord(s) Through the Cord Channel

4 To connect an adjunct to a single-line telephone:

- a Connect a 26A2 bridging adapter to the telephone.
- b Connect the cord from the adjunct to the bridging adapter.
- c Reconnect the cord from the control unit to the bridging adapter.
- d Go to Step 7.

- 5 To connect an adjunct to an analog multiline telephone:
 - a Connect a 4-pair cord to the OTHER jack on the telephone.
 - b Connect the other end to the VT jack on a General Purpose Adapter (GPA).
 - c Connect the cord from the adjunct to the TEL/EQUIP jack on the GPA.
 - d Go to Step 7.

Refer to "General Purpose Adapter" below for additional information.

- 6 Insert the other end of the adjunct cord directly into the port for the logical ID on the 012 or 016 module as indicated on the system form. Go to Step 7.
- 7 Test the adjunct by dialing its associated extension.

General Purpose Adapter

A General Purpose Adapter (GPA) lets you connect a T/R device—such as a single-line telephone or modem—to an analog multiline telephone. The device must be touch-tone, not rotary.

NOTES:

- The GPA is intended for answer-only service, unless the telephone has direct access to a line. It does not have touch-tone receivers or pulse dial detectors; therefore, the associated analog multiline telephone must dial calls.
- 2. The GPA cannot be used with a MERLIN II System Display Console.
- 3. When the system forms indicate a GPA for installation of an adjunct, follow the steps below.
- 1 Plug one end of a 4-pair adjunct D8AC cord into the VT jack on the back of the GPA.
- 2 Plug the other end into the OTHER jack on the underside of the analog multiline telephone.
- 3 Plug the cord from the adjunct into the TEL EQUIP jack on the GPA.

Slide the switch on the back of the GPA to the setting that provides the required service.

- **Basic.** This setting is used to dial and answer calls from an analog multiline telephone or to attach a T/R adjunct such as a single-line telephone or answering machine. Incoming calls ring only on the analog multiline telephone. This setting also allows the user to originate and receive calls on the telephone while using a computer with a modem that is attached to the GPA. However, if this setting is used, data calls cannot be answered automatically.
- **Join.** This setting is used to add a recording device or a single-line telephone to a call that is in progress on the telephone. You cannot originate or answer calls on this setting.
- **Automatic.** Use this setting when a GPA connects a modem to an analog multiline telephone for answering calls or answering machine.

Dial Dictation Devices

You can connect a dial dictation device to one of the following, as described earlier in this chapter:

- 012 module
- 016 module
- MLX telephone with an MFM
- GPA and analog multiline telephone

You can also connect a dial dictation device through a commercially available trunk adapter or a Universal Paging Access Module (UPAM) on a loop-start line/trunk jack with an external power supply unit.

NOTE:

Using any of the devices listed above, you cannot connect dial dictation devices that require contact closure. You can connect such equipment through a UPAM, however, since it provides contact closure for the device.

Fax Machines

You can connect a fax machine to one of the following, as described earlier in this chapter:

- 012 module
- 016 module
- MLX telephone with an MFM

The fax machine can send and receive fax calls independently of the telephone. Dial calls either from the fax machine's dialpad or from an associated single-line telephone.

Do not use a GPA to connect a fax machine to the system, because the fax machine cannot dial out through the GPA.

Group Calling Delay Announcement Devices

You can connect a group calling delay announcement device to one of the following, as described earlier in this chapter:

- 012 module
- 016 module
- MLX telephone with an MFM
- GPA and analog multiline telephone

An industry-standard announcement device, such as a Digital Announcer Unit, provides Night Service information or announces to a caller that calling groups are busy.

Credit Card Verification Terminals

You can connect a credit card verification terminal to one of the following, as described earlier in this chapter:

3-26 Installing Telephones and Adjuncts

- 012 module
- 016 module
- MLX telephone with an MFM

If you connect a credit card verification terminal to an MFM, the terminal can place and receive calls independently of the MLX telephone.

Do not use a GPA to connect a credit card verification terminal to the system, because the terminal cannot dial out through the GPA.

Headsets

Headsets are designed for hands-free telephone use and consist of several components, depending upon whether manual or one-touch operation is used. Any AT&T headpiece works in either mode.

Headpieces

Six different headpieces are available. Each is light, comfortable, and uses a transparent voice tube to eliminate a cumbersome large microphone. Each comes with a 10-ft. (305-cm) coiled cord and a guick-disconnect latch.

- Mirage®. This is a small, almost unnoticeable, monaural headset that uses a disk-shaped receiver. It can be worn on either ear, instead of a headband or ear tip. This headset is not useful in noisy environments.
- StarSet®. This monaural headset is worn without a headband. It uses a soft, pliable ear tip that provides high-quality sound yet allows you to hear other conversations or instructions in the workplace.
- Supra® Monaural. This monaural headset has an adjustable headband. It offers a soft, comfortable ear cushion that reduces surrounding noise, making it easier to understand the caller.
- Supra Monaural Noise-Canceling (NC). Same as above with noisecanceling microphone to reduce background noise by up to 75 percent.

- Supra Binaural. Sound in both ears with soft ear cushion and adjustable headband.
- Supra Binaural Noise-Canceling (NC). Same as above with noisecanceling microphone on flexible boom features windscreen and reduces background noise transmission by up to 75 percent.

Manual Operation (Analog Multiline **Telephones Only**)

Manual operation is appropriate when a headset is used occasionally. You pick up the handset to answer a call and replace it to hang up. The headset consists of the headpiece, and a modular base unit. The headpiece plugs into the modular base unit, and the modular base unit connects to the telephone through the HANDSET jack on the side of the telephone. The telephone handset is plugged into the modular base unit. The modular base unit allows you to adjust the incoming volume, switch between the headset and handset as needed, and temporarily mute the line. (See Figure 3–21.)

One-Touch Operation (All Telephones)

One-touch operation allows you to touch a button to answer a call. On analog multiline telephones, use a headpiece with a plug prong base unit and an adapter (502C). The headpiece connects to the plug prong base unit, which in turn connects to the adapter. The adapter plugs into the OTHER jack on the underside of the telephone. The plug prong unit provides switchhook control for answering calls by pressing a button. You can also adjust the incoming volume. On MLX telephones, the headpiece is attached to a modular base unit, which is attached to the telephone. The handset is also attached to the modular base unit. (See Figure 3-21.)

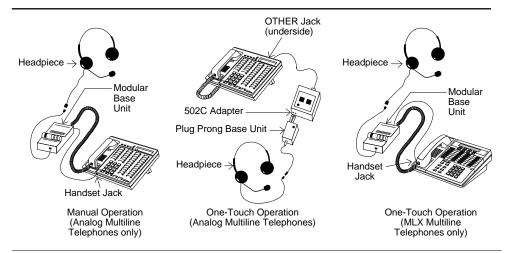


Figure 3-21. Manual and One-Touch Headset Operation

Loudspeaker Paging Systems

Use a loudspeaker paging system to page co-workers and make announcements. You connect the paging system to the jack of an LS or GS line/trunk that is programmed for paging.

Figures 3–22, 3–23, and 3–24 show various configurations for single-zone paging. Figures 3-25 and 3-26, later in this chapter, show single-zone and multizone paging configurations that include background music through a Magic on Hold audio source. Bidirectional paging, also called talk-back, is shown in Figure 3-26.

Dual-Tone Multifrequency (DTMF) Signaling

You can connect external paging systems that use dual-tone multifrequency (DTMF) signaling, such as PagePac® Plus with Zone Expansion Unit paging systems, to an LS or GS line/trunk jack programmed for paging operation, including bidirectional paging operation (talk-back). PagePac Plus does not require an adapter.

Zone paging systems, such as the PagePac series, require one LS or GS jack. You can use any zone once the paging jack is activated.

You must use a Universal Paging Access Module (UPAM), or PagePal (for PagePac series systems other than PagePac Plus) to connect a paging system that requires contact closure, an impedance-matching transformer, or both.

Use a Loop Start Trunk Adapter when a customer-supplied paging system does not require contact closure.

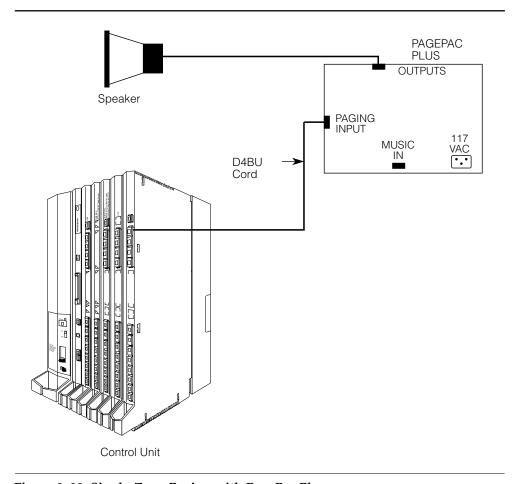


Figure 3–22. Single-Zone Paging with PagePac Plus

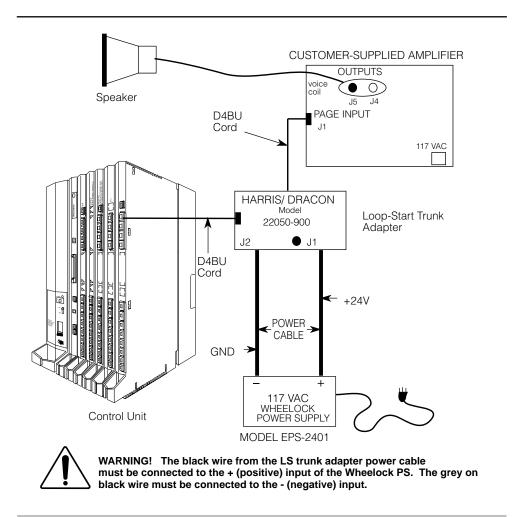


Figure 3-23. Single-Zone Paging with Customer-Supplied Amplifier

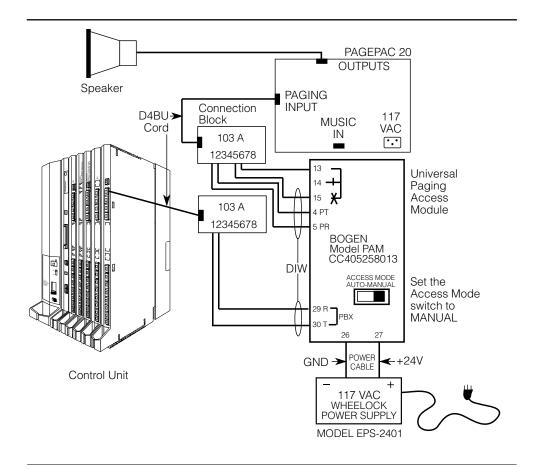


Figure 3-24. Single-Zone Paging with UPAM

MERLIN Identifier

MERLIN Identifier™ allows the use of local telephone company caller identification services to receive, store and use calling party number information. Before installation, verify that this service provided by the Central Office is available on the lines to be connected. Each MERLIN Identifier consists of the following:

- A control unit, which must be located near the MERLIN LEGEND control unit
- Up to four individual display units, which can be mounted on analog multiline telephones or wall-mounted for both analog and MLX telephones
- An administrative keyboard

Optional equipment includes an administrative display, a PC, and a serial printer.

For detailed instructions, see *MERLIN Identifier Installation and Administration*.

When MERLIN Identifier is used with MLX telephones, a pair of installer-wired 104A termination outlets are required for each MLX set that is connected to a MERLIN Identifier display unit.

Modems

You can connect a modem to one of the following:

- Single-line telephone
- MLX telephone with an MFM
- GPA and analog multiline telephone

NOTE:

When a modem is connected to the TEL/OTHER jack on the MLX telephone equipped with an MFM, data calls can be made from the modem independently of the MLX telephone. Users dial data calls from the data terminal keyboard.

See Chapter 6, "Connecting Data Equipment," for complete information on connecting data equipment.

Music On Hold and Magic on Hold

You can connect a Music On Hold device to an LS or GS line/trunk jack programmed for Music On Hold. The system supports one such connection, either Magic on Hold® or a customer-owned music source. The external music coupler (PEC 61398) uses an 8-ohm music source and two attenuation controls for setting the music level.

NOTES:

- 1. PagePac Plus equipment can be used with a loudspeaker system to provide music. Or it can provide paging without a music coupler.
- 2. If the equipment uses rebroadcasted music or other copyrighted materials, the customer is required to obtain a copyright release and may also require a copyright license from, and pay license fees to, a third party, such as the American Society of Composers, Artists, and Producers (ASCAP), or Broadcast Music Incorporated (BMI). To bypass the release and license requirement, the customer can purchase a Magic on Hold system from AT&T, which does not require such a license.

Figures 3–25 and 3–26 show different background music configurations with single-zone and multizone paging.

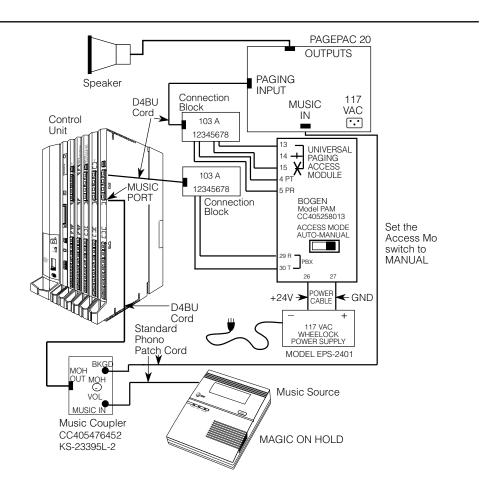


Figure 3-25. Single-Zone Paging with Background Music and Magic on Hold

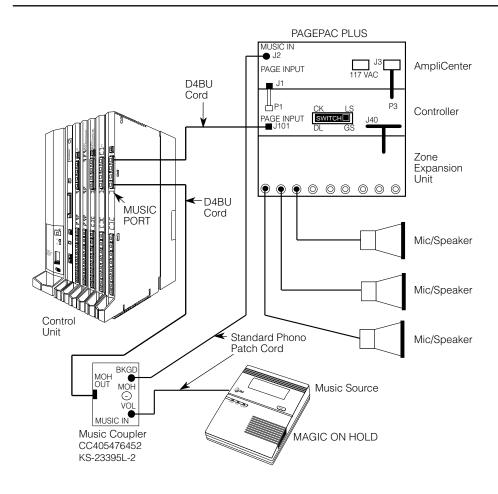


Figure 3-26. Multizone Paging with Background Music, Magic on Hold, and **Bidirectional Paging (Talk-Back)**

Supplemental Alerts

Alerting devices notify people working in noisy areas of outside, transferred, and intercom calls. Connect an alert to one of the following:

- Single-line telephone
- MLX telephone with an MFM
- Supplemental Alert Adapter (SAA) and analog multiline telephone

Alerts compatible with the SAA include horns, bells, chimes, and strobes. See "Supplemental Alert Adapter" for installation instructions.

NOTE:

The MFM in SAA mode and SAA support devices operate on 48 V DC. You can connect alerts operating on 20 through 30 Hz to an MFM in tip/ring mode or a single-line telephone jack.

Supplemental Alert Adapter

If the system forms indicate a bell, horn, chime, or strobe with an analog multiline telephone, follow the steps below to install an SAA. See Figure 3-27.

- 1 Plug the telephone cord into the TELEPHONE jack on the SAA.
- 2 Plug the cord from the alert device into the ALERTER jack on the SAA.
- Plug the cord from the telephone wall jack into the CONTROL UNIT jack on the SAA.

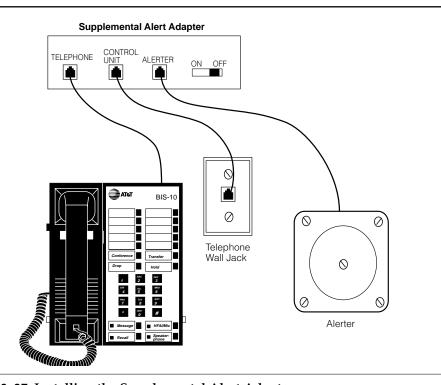


Figure 3-27. Installing the Supplemental Alert Adapter

Unsupported Telephones, Adjuncts, and Adapters

Do not connect the following analog telephone adjuncts and adapters to the system. Doing so may cause damage to the device or the system.

- Basic Telephone and Modem Interface (BTMI)
- Basic Telephone and Modem Interface 2 (BTMI-2)
- ATR Interface (ATRI)

- MTR Interface (MTRI)
- Off-Premises Extension Unit (OPX)
- System 25 Direct Extension Selector (DXS)

See Table 3–1 for additional notes on unsupported telephones and adjuncts.

Table 3-1. Unsupported Telephones and Adjuncts

| Model | Notes | |
|---|---|--|
| 510D Personal Terminals | Digital Communications Protocol (DCP) | |
| DCP telephones | 7400 telephones and adjuncts (asynchronous data units and multiple asynchronous data units) that use DCP and are supported on the MERLIN II Communications System | |
| MET telephones | Multibutton electronic telephones (METs) and adjuncts used with the Dimension PBX and Horizon systems | |
| Single-line telephones (with neon message-waiting lights) | Message light does not work | |
| Analog telephone adjuncts | Basic telephone modem interface (BTMI); BTMI-2; off- premises extension (OPX) unit; System 25 Direct Extension Selector (DXS); DSS attached to a 34-button Deluxe membrane | |

Single-Line Telephones

Releases prior to Release 3.0 system support the single-line telephones listed in Table 3–2.

Table 3–2. Single-Line Telephones

| Model | Description | | |
|---------------------------|--|--|--|
| 2500MMGB | Basic desk telephone | | |
| 2554MMGJ | Basic wall telephone | | |
| 2500YMGK* | Basic desk telephone with Message light and Recall button; Recall button used instead of switchhook for features that require a switchhook flash. | | |
| 2500SM | Basic desk telephone used with 4A speakerphone | | |
| 2514BMW | Basic desk telephone with built-in headset jack | | |
| 2526BMG | Outdoor telephone used with weatherproof enclosure | | |
| 7101A* | Basic desk telephone with Message light and Recall and Disconnect buttons. No adjuncts supported. | | |
| 7102A | Basic desk telephone with Message light lamp and Recall button. The 101 and 201 speakerphones and the 500 headsets are supported. Can be used for power-failure transfer (PFT) extensions. | | |
| CS6402UO1 | A* Basic desk telephone, Feature Phone Model 420. Has built-in speakerphone, memory, and redial. | | |
| 2500MMGJ | Basic desk telephone | | |
| 2500MMGK | Basic desk telephone with Recall button; Recall button used instead of switchhook for features that require switchhook flash. | | |
| 8102 [†] | Basic desk telephone with jack to support headset adapters and speakerphone adjuncts. | | |
| 8110 | Basic desk telephone with a built-in speakerphone with volume control and Mute button with LED indicator. | | |
| 500MM 554BMPA 500SM | Basic telephones equipped with rotary dials so no system features requiring * and # can be used. Telephones with neon Message lights are not supported. | | |
| * | /intage telephone, no longer available for sale or lease | | |
| † | Although the 8102 can be connected to a speakerphone and the 8110 has speakerphone, they cannot be used for group paging (not supported on single-line telephones). The auto answer function on the 8110 must be disabled. | | |

Single-Line Telephones in Release 3.0 and Later

In Release 3.0 and later, only single-line telephones with positive disconnect are fully supported as system telephones (any single-line telephones, equipped with a ground-start button if necessary, can be used as PFT telephones). Older single-line telephones can be used with Release 3.0, but their operation is slightly different. Table 3–3 lists the single-line telephones supported in Release 3.0 and later.

Table 3-3. Single-Line Telephones Supported by Release 3.0 and Later

| Model | Description |
|-------------------------------|--|
| 2500 YMGL | Basic desk telephone with Message light and Flash button; Flash button is used instead of the switchhook for features that require a switchhook flash, such as Transfer and Hold |
| 8101 | Basic desk telephone with Message light and Flash button; Flash button is used instead of the switchhook for features that require a switchhook flash, such as Transfer and Hold |
| VideoPhone 2500 | Provides interactive, small-screen video when both parties use one |
| Picasso Still- Image Phone | Allows 2 parties with Picasso Still-Image Phones to transmit and simultaneously discuss full-color images which they view over customer-supplied TV monitor or flat-panel LCD (liquid crystal display) monitor |
| 3129-WTWA | Touch-tone outoor telephone equipped with cast aluminum housing, armored handset cord with bell ringers |
| 3129-WRWA | Rotary dial outdoor telephone equipped with cast aluminum housing, armored handset cord with bell ringers |
| 3129-WAWA | Auto dial outdoor telephone equipped with cast aluminum housing, armored handset cord with bell ringers |
| 3129-WNWA | Non-dial, automatic ringing on dedicated circuit outdoor telephone equipped with cast aluminum housing, armored handset cord with bell ringers |

Installing Direct Station Selectors

The Direct Station Selector (DSS) is an optional piece of telephone equipment. You can connect up to two DSSs to an MLX-28D or MLX-20L telephone that is programmed as an operator console.

Considerations

Review the following items before you begin the installation procedure.

- Connect the DSSs before you assemble the MLX telephones.
- Auxiliary power is required under the following circumstances:
 - An MLX telephone with an MFM and two DSSs requires a 406743419 power unit.
 - An MLX telephone without an MFM, but with two DSSs, requires a 406943837 power unit, 400B adapter, and the D6AP cord that is provided with the MFM.
 - An MLX telephone with one DSS and an MFM requires a 406943837 power unit, 400B adapter, and the D6AP cord that is provided with the MFM.
 - If one carrier has three or more MLX telephones, each with a DSS attached, use a 406943837 power unit, 400B adapter, and D6AP cord for each MLX telephone and DSS after the first two.
- The total length of cords between the KS22911-L2 or 406743419 power supply and the MLX telephone must not be more than 50 ft. (15 m).
- Do not replace the 2-ft. (61-cm) D8AC cord (packaged with the DSS) with a longer cord. Improper operation may result.
- Connect each KS22911-L2 power supply to an AC outlet that is not controlled by a wall switch.

To connect a DSS, follow the steps below. If you are connecting two DSSs to the telephone, unpack the second DSS before you start.

1 Adjust the angle of the DSS.

- The DSS is packed fully assembled with the deskstand in the low position. If you prefer the low position, go to Step 2.
- To adjust the angle of the DSS to the high position:
 - a Place the DSS face down on a flat surface.
 - b Press on the top rear center of the stand to release the tab, then pull the stand toward you and away from the DSS.
 - c Insert the tab at the bottom of the stand into the other slot.
 - d Lower the stand and press the tab at the top into the corresponding slot on the DSS.

2 Install the D8AC cord on the DSS.

- a Plug one end of the D8AC cord into the IN jack on the DSS.
- b Route the D8AC cord through the cord channel on the left side of the DSS.
- If you are installing only one DSS, go to Step 4.
 If you are installing two DSSs, repeat Steps 1 and 2 for the second DSS, then go to Step 3.

3 Wire the two DSSs. See Figure 3-28.

- a Place the two DSSs side by side and face down.
- b Route the D8AC cord from the IN jack on the second DSS (DSS2) through the cord channel on the first DSS (DSS1).
- c Plug this D8AC cord into the OUT jack on DSS1.

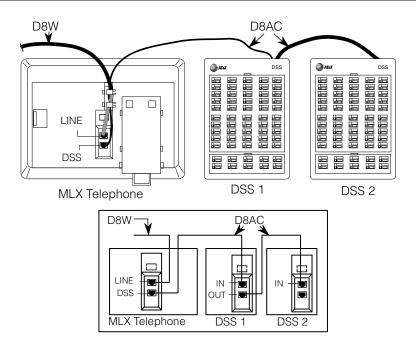


Figure 3-28. Connecting One or More DSSs

4 Wire the telephone to the DSS unit(s). See Figure 3–28.

- a Remove the handset from the telephone, then place the telephone face down on a flat surface to the right of the upside-down DSS unit(s).
- b Plug the D8AC cord from the IN jack on the DSS1 into the DSS jack on the telephone; then route the cord through the cord channel.
- c Plug the D8W line cord into the LINE jack on the MLX telephone. The D8AC and D8W cords share the cord channel on the telephone.

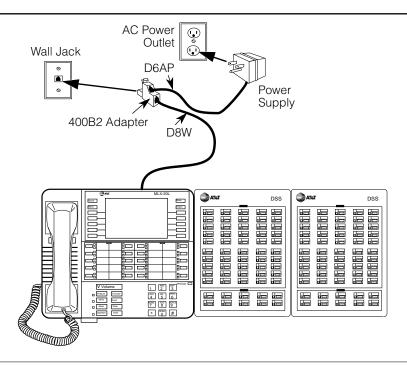


Figure 3-29. Wiring for Auxiliary Power

- 5 Turn the telephone and the DDS unit(s) face up with the telephone now to the left of the DDS unit(s). See Figure 3–29.
- 6 Insert one end of the coiled H4DU handset cord into the handset and the other end into the jack on the side of the telephone.
- 7 If auxiliary power is *not* required, plug the D8W cord into the wall jack and then go to Step 9.
- 8 If auxiliary power is required, refer to the following steps and Figure 3–29. The combined total length of the D6AP and D8W cords you use must not be more than 50 ft. (15 m).
 - a Plug the D8W cord from the telephone into the 8-conductor modular jack of the 400B or 400B2 adapter.

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b Connect one end of the D6AP cord to the 2-conductor (small) modular jack on the 400B or 400B2 adapter, and plug the other end of the D6AP cord into the modular jack of the 406943837 or 406743419 power supply.



A CAUTION:

Do not plug the D6AP cord into the 8-conductor (large) modular jack of the 400B or 400B2 adapter. Doing so can cause electrical damage to the control unit and to the telephone.

- c Insert the plug end of the 400B or 400B2 adapter into the wall jack.
- d Plug the power supply into a 117-V AC outlet.

9 Label the DSS designation cards.

- a Pull the tab at the top of the large plastic cover and rotate the cover towards you.
- b Remove the cover and the large designation card.
- c Write or type the button assignments on the card. (For DSS1, use the side that is labeled 00–49; for DSS2, use the side labeled 50–99.)
 - The button assignments on the designation card should be by dial plan extension number, not by logical ID port number.
- d Replace the card and the plastic cover; make sure the coated side of the cover is facing up.
- e Repeat this step to remove the small plastic cover and to label the small designation card.

NOTE:

If the MLX telephone attached to the DSS is unplugged from the control unit and then plugged in again, the display on the telephone may disappear. Press the **Home** button to bring back the display.

Assembling MLX Telephones

You will need to assemble an MLX telephone before connecting it to the control unit. For all other telephones, skip to "Connecting Telephones to the Control Unit."

Considerations

Review the following items before you begin the procedure:

- MLX telephones are packed with the deskstand in the low position. You can use the deskstand as is, raise it to a higher angle, or remove it. To adjust or remove the stand, see Step 1 of the following instructions. (The diagram on the bottom of the user card tray also shows how to adjust the stand.)
- You cannot wall-mount MLX-20L and MLX-28D telephones.
- If you wish to wall-mount an MLX-10, MLX-10D, or MLX-10DP telephone, you must remove the deskstand first. (Wall-mounting an MLX-10D or 10DP telephone can make the display hard to read.)
- A 630B Phonemount (not included) is also required to mount an MLX-10, MLX-10D, or MLX-10DP telephone on the wall.
- To connect an adjunct (such as an alert, modem, or fax machine) to an MLX telephone, the telephone must have an MFM installed in it. If you have not already done so, refer to "Installing Multi-Function Modules," earlier in this chapter.

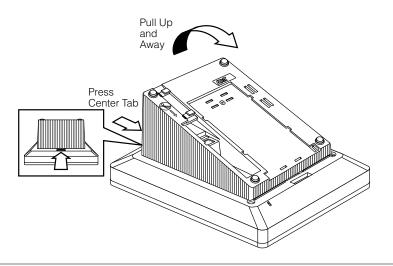


Figure 3-30. Adjusting or Removing the Deskstand

To assemble an MLX telephone, follow the steps below.

1 Remove or adjust the deskstand. See Figure 3–30.

- If you want to leave the deskstand in the low position, go to Step 2.
- If you want to adjust the angle of the deskstand, or remove it in order to wall-mount the telephone:
 - a Place the telephone face down on a flat surface.
 - b Press on the top rear center of the deskstand to release the tab, then pull it up towards you.
 - c Insert the tab into the slot in the module cover to adjust the height.
 - d To remove the deskstand, continue to pull it up and away from the telephone.
 - e Release the deskstand from the front slot.

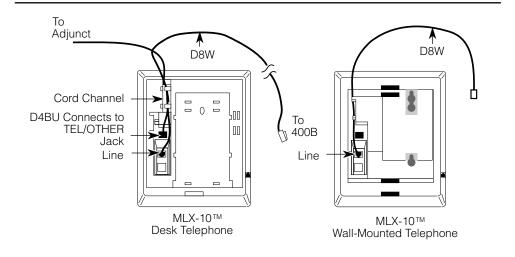


Figure 3–31. Connecting the Line Cords

2 Connect the line cords. See Figure 3–31.

- a Plug one end of the D8W cord into the LINE jack on the bottom of the phone.
- b Route the D8W cord through the cord channel on the back of the telephone.
- c If the telephone is for desktop use, turn it face up and plug the D8W cord into the wall jack.
- d Insert the other end of the coiled H4DU handset cord into the jack on the side of the telephone.

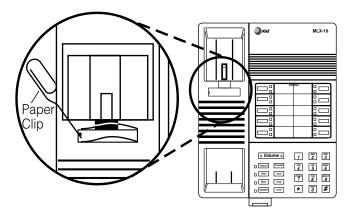


Figure 3–32. Removing the Extension Label

3 Connect the handset.

Insert one end of the coiled H4DU handset cord into the handset.

4 Label the extension identification card.

a Insert a straightened paper clip into the hole on the side of the plastic cover while holding your finger on the opposite edge; use the paper clip to push and lift the cover. See Figure 3–32.

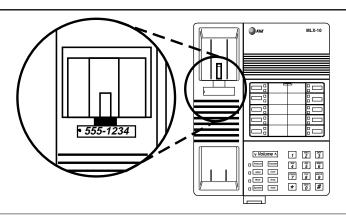


Figure 3–33. Labeling the Extension

- b Type or write the assigned extension number on the card. See Figure 3–33.
- c If you are wall-mounting an MLX-10, MLX-10D, or MLX-10DP telephone, go to Step 5. If you are assembling a desk telephone, go to Step 6.

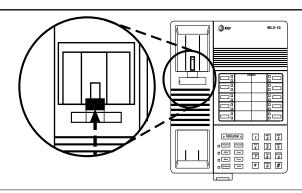


Figure 3-34. Removing the Handset Holder

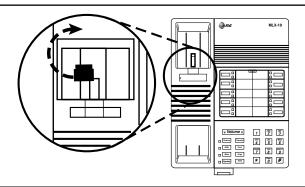


Figure 3–35. Rotating the Handset Holder

5 Prepare the handset holder for wall-mounting.

- a Remove the handset holder by pushing it up and pulling it out. See Figure 3-34.
- b Rotate the handset holder 180 degrees and replace it in its slot. See Figure 3–35.

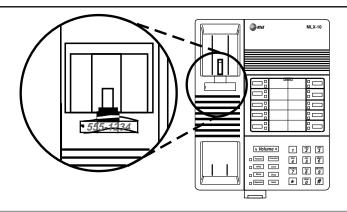


Figure 3–36. Replacing the Extension Label

6 Replace the extension label and plastic cover.

- a Insert one end into the slot and snap the other end into place. See Figure 3–36.
- b If you are mounting an MLX-10, MLX-10D, or MLX-10DP wall telephone, go to Step 7. If you are assembling a desk telephone, go to Step 8.

7 Wall mounting an MLX-10, MLX-10DP, or MLX-10D telephone.

- a Turn over the telephone and remove the jack guard from the TEL/OTHER jack area; set the telephone aside.
- b Unpack the 630B Phonemount and remove the modular jack from the backplate.
- c Route the D8W cord (or DIW cable) through the hole in the backplate and have it exit at the top of the backplate; leave 10 in. (25 cm) of cord to connect the telephone. See Figure 3–37.

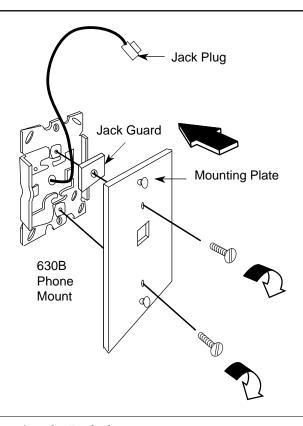


Figure 3–37. Mounting the Backplate

- d Attach the backplate to the wall; see the instructions provided with the 630B Phonemount.
- e Insert the two short screws provided with the Phonemount into the mounting plate. Be sure to thread the upper screw through the jack guard. See Figure 3–37.

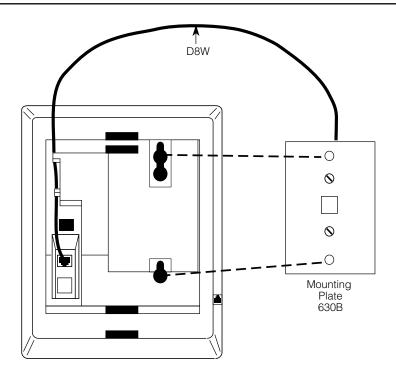


Figure 3–38. Routing the Cord Through the Backplate

- f Plug the free end of the cord into the LINE jack on the back of the telephone. Route the cord through the cord channel above the jack. See Figure 3–38.
- g Position the telephone on the mounting plate studs and then slide the telephone down to lock it in place. To remove the telephone, slide it up and off.

8 Label the button assignment card.

a Pull the tab at the top of the plastic cover toward you.

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- b Type or write the button assignments on the card.
- c Insert the card and replace the plastic cover. Be sure the textured side of the cover is facing you.

9 Adjust the contrast on the telephone's display.

- For an MLX-20L telephone, slide the lever on the top of the telephone.
- For an MLX-10D, MLX 10DP, or MLX-28D telephone, press the **Menu** button and select Cntrst; follow the display prompts.

Installing Cordless or Cordless/Wireless Telephones

The sections below describe the ways you can connect MDC 9000 cordless or MDW 9000 cordless and wireless telephones to the system.

MDC 9000 Cordless Telephone

You can connect the base unit of the MDC 9000 to an analog extension jack.

MDW 9000 Cordless/Wireless Telephones

The following is a brief overview of procedures and considerations for installation of the MDW 9000 telephone. For more detailed information, see the installation guide that comes with the telephone.

■ If possible, place the radio module of a wireless telephone in the same room and on the same wall as the MERLIN LEGEND Communications System control unit.

A minimum distance of 3 ft. is required between the radio base and the control unit. The radio module must be within 24 ft. of a properly grounded 3-prong AC outlet that is not controlled by a wall switch and connects to the control unit through an analog multiline jack with a line connector.

- The charging base station requires only a three-prong AC outlet that is not connected to a wall switch.
- The telephone handset must be within range of the radio base. The indoor range is 400 through 600 ft. and the outdoor range is up to 1000 ft.
- Except while charging, the handset does not need to be located near the charging base.

Connecting Telephones to the Control Unit

The way you connect telephones to the control unit depends on the number of telephones you are connecting. For 24 telephones or less, use a direct connection. For 25 telephones or more, use cross-connect fields.

For building cross-connect fields, use one of the following wiring kits:

- Interconnect Wire. This complete wiring kit contains 110 jack-panel blocks, a template, wiring troughs, D-rings, and D8W cords.
- **Systimax.** This complete wiring kit contains 110 termination blocks with modular jacks, a 110A field-termination block, a template, wiring troughs, D-rings, and patch cords.

Considerations

Review the following items before you begin the procedure:

- If the way you connect the telephones differs from the instructions on the system forms, record each jack and telephone change on Form 2a, System Numbering: Extension Jacks. See Appendix A, "System Numbering Forms."
- If you use staples to attach the cords to walls or baseboards, make sure you do not pierce the cords.

■ If an MLX telephone or analog multiline telephone is in a different building from the control unit, and is within 1000 ft. (305 m) of the control unit, connect the telephone to the control unit, using two In-Range Out-of-Building (IROB) protectors.

Make sure you use an MLX-specific IROB protector for an MLX telephone, and an analog multiline-specific IROB protector for an analog multiline telephone.

See the documentation packaged with the IROB protector for complete installation instructions.

■ If the single-line or T/R telephone is 1000 ft. (305 m) or further from the control unit, connect the telephone to the control unit using an Off-Premises Range Extender (OPRE).

See the documentation packaged with the OPRE for complete installation instructions.



A CAUTION:

Take extreme care to make sure that you connect MLX phones only to MLX modules; a mismatch could damage the ports and cause them to stop functioning.

Incorrect wiring can result in users not being able to place outgoing calls. Make sure you use the proper cord. For all GS/LS modules:

- Use a D2R cable from an RJ11 jack.
- Do not use the Brand-Rex Quad cable from an E66 block. If you cannot avoid using the Brand-Rex Quad cable, reverse the tip and ring leads at the E66 block to correct the mismatch.
- To avoid introducing power supply noise into system wiring, allow at least 3 in. (7.62 cm) of clearance between the basic carrier's power supply and any wiring or termination hardware located to the left of the control unit.



M WARNING:

National and local building codes specify the type of cable required for telecommunication wiring. For example, indoor wiring (DIW cable) cannot be used inside or on top of air plenums or ducts, along hot pipes, or across walkways.

Consult your local ordinances and regulations for proper cable selection.

Wiring a Telephone for Two Voice Pairs

If an analog telephone requires either the Voice Announce to Busy feature or voice and data operating independently, use a bridging adapter to assign two adjacent odd/even telephone jacks (for example, 01 and 02, 13 and 14) on an analog telephone module to that telephone. This provides the telephone with the two voice pairs needed to use these features. See Figure 3–39.

NOTE:

The numbers of these telephone jacks are boxed on the system forms. In Figure 3–39, the label on the bridging adapter refers to the default dial plan extension number, not the telephone port number.

The even jack on the bridging adapter should be connected to the oddnumbered telephone port, and the odd jack on the bridging adapter should be connected to the even-numbered telephone port.

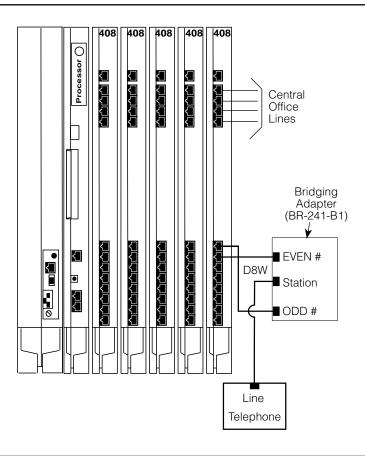


Figure 3-39. Connecting Two Voice Pairs to a Telephone Using a Bridging Adapter (BR-241-B1)

Removing Damaged Connecting Blocks

In some cases, a connecting block becomes damaged and must be removed.

To remove a damaged connecting block, follow the steps below:

- 1 Remove the wires or the patch cord from the connecting block.
 - If you have Interconnect Wiring, use long-nosed pliers to remove the telephone wires, and tag the wires with tape to identify their positions.
 - If you have Systimax wiring, pull off the patch cord.
- 2 Place a 788K1 retainer tool against the conductor pairs beneath the connecting block to be removed. See Figure 3–40.
- 3 Use pliers to grip the connecting block in the center. See Figure 3-40.
- 4 Move the block gently up and down and pull it out.
- 5 If a conductor wire is accidentally pulled from a block, pull it with the long-nosed pliers to get some slack.
 - Use your fingers to lay the conductor wire back in its slot in the index strip, and then reseat it with the D-impact tool.
- 6 Seat the new connecting block by using the 788J1 impact tool.
- 7 Replace the telephone wire onto the connecting block.
 - If you have Interconnect Wiring, remove the tag from the telephone wires and use the D-impact tool to reseat the wires.
 - If you have Systimax wiring, attach the patch cord to the connecting block.

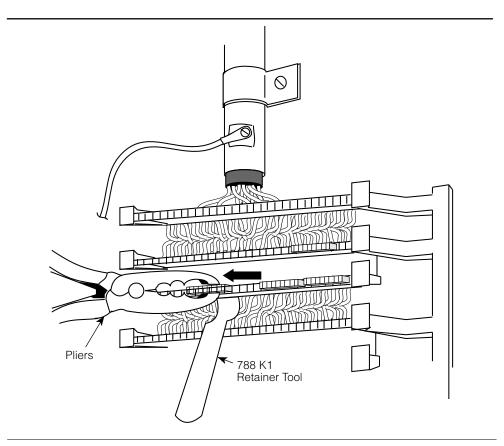


Figure 3–40. Removing the Connecting Block

Connecting the Control Unit to the Network Interface

The way you connect the control unit to the network interface depends on the type of network interface that is installed. While there are many ways you can do this, the methods discussed in this chapter are usually best.



A CAUTION:

The telephone company is responsible for providing appropriate protection for central office trunks. Do not connect the central office trunks until you are certain that they are properly protected. See "Central Office Trunk Protection" in Chapter 2 for details.

To avoid coupling power supply noise onto system wiring, allow at least 3 in. (7.62 cm) of clearance between the basic carrier's power supply and any wiring or termination hardware located to the left of the control unit.

If the network interface is greater than 25 ft. (7.62 m) from the control unit, connect the control unit to the network interface, using an Off-Premises Range Extender (OPRE). See the documentation packaged with the OPRE for complete installation instructions.

If you use staples to attach the cords to walls or baseboards, make sure you do not pierce the cords.

National and local building codes specify the type of cable required for telecommunication wiring. For example, you cannot use indoor wiring (DIW) cable inside or on top of air plenums or ducts, along hot pipes, or across walkways. Consult your local ordinances and regulations for proper cable selection.

Wiring

The local telephone company should have installed the network interface (the central office trunks) already. Before you install the system, verify that the network interface is the proper type and that it is within 25 ft. (7.6 m) of the control unit. If the network interface is more than 25 ft. (7.6 m) from the control unit, make sure you have an OPRE.

The adapter you need to connect the central office trunks to the control unit depends on the type of network interface installed, as shown in Table 4–1.

Table 4-1. Network Interfaces

| Network | | |
|-----------|---|--|
| Interface | Description | Adapter |
| RJ11 | Connects one outside ground-start (GS), loop-start (LS), or Direct Inward Dial (DID) trunk to one modular jack. | |
| RJ14 | Connects two outside trunks to one modular jack (GS, LS, or DID). | 2-line adapter (267C-type) |
| RJ21X | 50-pin connector connects 25 110AB1 jack-panel block to outside trunks (GS, LS or DID). | 110AB1 jack-panel block |
| RJ2GX | 50-pin connector for up to eight tie trunks. | 356A for eight or fewer tie trunks; 259A for one tie trunk |
| RJ48C/X | Connects DS1 facilities to a four-pair jack (two active pairs). | Z601A if modular cords are used |

After installing the adapter, label each jack that connects a central office trunk to the control unit with the trunk's number. Use the list provided by the local telephone company or System Form 2c, System Numbering: Line/Trunk Jacks for outside trunks as a reference.

NOTE:

If you need to connect the trunk cords differently from the instructions on the system forms, record each change on Form 2c, System Numbering: Line/Trunk Jacks. See Appendix A, "System Numbering Forms."

Also, you may need to know the interface codes for network facilities. These codes are shown in Table 4–2, by trunk type and adapter type.

Table 4–2. Central Office Network Interface Codes

| Trunk Type | Federal Interface Code for Trunk | Network Interface |
|-------------------------|-------------------------------------|--------------------|
| LS central office trunk | 02LS2 | RJ11C, RJ14C, RJ21 |
| GS central office trunk | 02GS2 | RJ11C, RJ14C, RJ21 |
| DID | 02RV2-T | RJ11C, RJ14C, RJ21 |
| OPS | OL13C | RJ11C |
| Tie trunk | TL31M | RJ2GX |
| BRI | 02B1Q | RJ11C, RJ14C, RJ21 |
| DS1 | 04DU9-B | RJ48C/X |
| | 04DU9-C | See note below. |

NOTE:

The preferred network interface is the RJ48X. If a customer's site uses the RJ48X interface and the customer's equipment does not provide connection, the T1 trunk's receive pair is looped back to the transmit pair. This simplifies troubleshooting the T1 trunk from the central office.

In most installations, the network interface is connected through a crossconnect field to the control unit. However, for systems with fewer than 24 extensions, you can connect the trunk wires directly to the control unit.

When constructing wiring fields between the network interface and the control unit, you must order hardware as individual parts. Do not use Interconnect Wiring or Systimax wiring kits.

RJ21X Interface

The RJ21X network interface has a female 50-pin (25-pair) amphenol connector, as shown in Figure 4–1.

To connect the RJ21X interface to the control unit, you must build a wiring field between the RJ21X interface and the control unit using a 66-type block (RJ21). This field converts the female amphenol connector to sets of four 1-pair modular jacks.

4–4 Connecting the Control Unit to the Network Interface

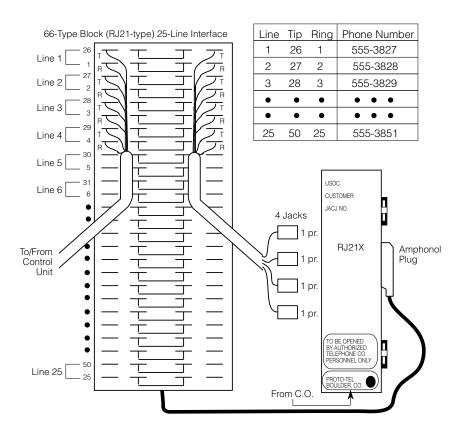


Figure 4–1. RJ21X Network Interface Connector

Building the Wiring Field

Build the wiring field between the network interface and the control unit using 110AB1-100JP12 termination blocks with modular jacks and associated hardware. Figure 4–2 shows the hardware you need, including 110AB1-100JP12 termination blocks with modular jacks, 110A1 wire troughs, D-rings, and D2R cords.

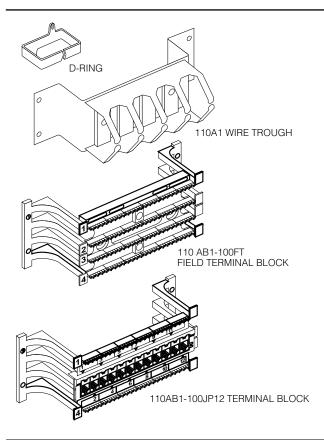


Figure 4-2. RJ21X Wiring Field Hardware

4–6 Connecting the Control Unit to the Network Interface

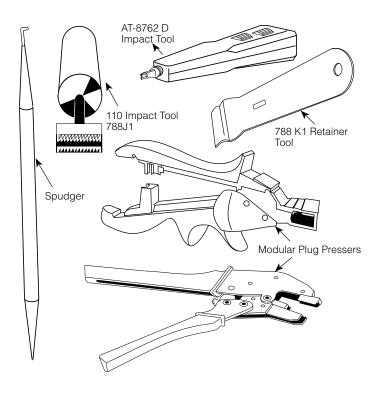


Figure 4–3. RJ21X Wiring Field Tools

To connect the RJ21X network interface to the control unit, follow the steps below. Figure 4–3 shows the tools you need.

- 1 For each piece of hardware, drill two diagonally opposite holes into the backboard, allowing for a 1/16-inch (1.6 mm) space between each piece of hardware.
- 2 Mount the wire troughs and the termination blocks.

There is a wire trough above and below each termination block.

- 3 If necessary, repeat Steps 1 and 2 for a second column.
- 4 Run the 25-pair amphenol cable on the RJ21X interface to the termination blocks.

If more length is needed, use an A25D male-connector, single-ended, 25-pair, nonplenum cable.

- 5 Mount the D-rings to properly dress the wires, as needed.
- 6 Cut off the amphenol connector nearest to the cross-connect field and strip the wires for each of the 25 pairs.
- 7 Punch down the 25-pair wires to the termination block.
 - a Route the wires through the fanning slots on the termination block.
 - b Insert the conductors into the designated 110 connecting blocks already on the termination block.
 - c Use the D-impact tool to seat the conductors. See Figure 4–4.
 - d Remove any insulation fragments with a spudger.

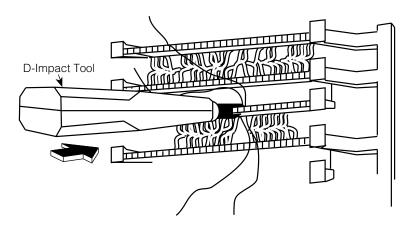


Figure 4–4. Using the D-Impact Tool to Seat the Conductors

4-8 Connecting the Control Unit to the Network Interface

8 Test the central office trunks for proper connection.

See "Testing Trunks," later in this chapter, for instructions.

9 Label the network interface jacks, control unit module jacks, termination blocks, and D2R cords.

See "Labeling Trunks," later in this chapter, for instructions.

10 For each trunk, plug one end of a D2R cord into the designated jack on the termination block and the other end into the line/trunk jack on the proper control unit module.

NOTE:

The modular jacks on the termination block are 8-wire jacks. The D2R cords, which are 6-wire, also plug into the 8-wire jacks.



A CAUTION:

Do not plug an analog multiline telephone, an MLX telephone, or anything else that should be plugged into an extension jack into this wiring field: doing so will busy-out the trunk.

RJ11 and RJ14 Interfaces

RJ11 and RJ14 interfaces are connected to the control unit similarly. However, note the following differences:

- RJ11 connects *one* central office trunk per jack.
- RJ14 connects *two* trunks per jack.

Plug a 267C-type adapter into each RJ14 jack. You need D2R cords for RJ11 jacks. See Figure 4–5.

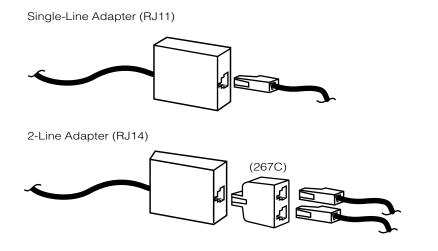


Figure 4-5. RJ11 and RJ14 Interfaces



A CAUTION:

Incorrect wiring can damage the ports and cause them to stop functioning. Make sure you use the proper cords. For all GS/LS modules, do the following:

- Use a D2R cable from an RJ11.
- Do not use the Brand-Rex Quad cable from an E66 block.

 If you cannot avoid using the Brand-Rex Quad cable, reverse the tip and ring leads at the E66 block to correct the mismatch.

To connect the RJ11 and RJ14 network interfaces to the control unit, follow the steps below:

- 1 Test the central office trunks for proper connection.
 See "Testing Trunks," later in this chapter, for instructions.
- 2 Label the network interface jacks, the control unit module jacks, and the D2R cords properly.

See "Labeling Trunks," later in this chapter, for instructions.

- 3 Plug one end of a D2R cord into the jack at the network interface and the other end into the appropriate line/trunk jack on the control unit.
- 4 Dress the wires properly.

RJ2GX Interface

The RJ2GX is a 25-pair amphenol interface that connects up to 8 tie trunks. Construct the cross-connect field in the same way you did for the RJ21X interface.

RJ21X and RJ2GX interfaces do not require separate termination blocks. If there is room on the termination block for the trunk wires, you can punch down both the RJ21X and the RJ2GX on the same 110AB1-100JP12 block. Leave any unused wires unterminated.



A CAUTION:

Be careful not to connect tie trunks to GS, LS, or DID ports. Since all the jacks on the termination block are 8-wire jacks, it is possible to interchange tie trunk wires with GS, LS, or DID wires accidentally.

RJ48C/X Interface

The RJ48C/X interface terminates a DS1 trunk at the customer's premises. Both RJ48C and RJ48X interfaces have 8-wire modular jacks. However, the RJ48X interface includes shorting bars that loop the DS1 trunk's receive pair to the transmit pair. This helps in testing the DS1 trunk from the central office.

Testing Trunks

Before you connect the central office trunks to the control unit, verify that there is dial tone and that you can dial out on every trunk. DID trunks can be tested only through the control unit. Do not test DID trunks at this time.



A CAUTION:

Do not use analog multiline telephones or MLX telephones for testing. They do not work for these tests and can be damaged if you use them for this purpose.

Testing Loop-Start Trunks

To perform this test, you need a single-line telephone or an installer's test telephone (craft set). If you are installing rotary-dial trunks, use a rotary telephone to perform this test.

To test loop-start trunks, follow the steps below:

Plug the single-line telephone or the craft set into each central office line/trunk jack (either at the network interface or at the cross-connect field) and listen for dial tone.

4–12 Connecting the Control Unit to the Network Interface

2 If you find a central office trunk that does not have dial tone, check for a bad adapter or loose connection.

If adapters and wiring are in working order but you still do not hear a dial tone. notify the AT&T Service Center acting as the customer's agent.

3 When you hear a dial tone, dial a known telephone number to verify dialing.

After the central office completes the connection, check that you have good two-way transmission.

4 If you cannot dial out on any of the trunks, notify the AT&T Service Center acting as the customer's agent.

It is the customer's responsibility (or that of the customer's agent) to report service outages to the local telephone company.

Testing Ground-Start Trunks

To perform this test, you need a single-line telephone with a ground key or a ground-start button.

NOTE:

If a single-line telephone with a ground key or ground-start button is not available, ground one side of the trunk.

To test ground-start trunks, follow the steps below:

- 1 Plug the single-line telephone into each central office line/trunk jack (either at the network interface or at the cross-connect field).
- 2 Pick up the handset.

You should hear a dial tone.

- 3 Ground the ring lead by pushing the ground key or ground button, or by grounding one side of the trunk.
- 4 Remove the ground from the ring lead.
- 5 Dial a telephone number to verify dialing.

Also, check that you have good two-way transmission after the central office completes the connection.

6 If you find a central office trunk that does not have dial tone, check for a bad adapter or loose connection.

If adapters and wiring are in working order but you still do not hear dial tone, notify the AT&T Service Center acting as the customer's agent.

7 If you cannot dial out on any of the trunks, notify the AT&T Service Center acting as the customer's agent.

Testing NI-BRI Provisioning

The NI-BRI Provisioning Test should be performed after installing an 800 NI-BRI module and connecting to the network. See *Maintenance and Troubleshooting* for the test procedure.

Labeling Trunks

You can have up to 80 central office line/trunk jacks on the system. This procedure describes how to label each D2R or D8W cord, network interface jack, and control unit module jack.

To label trunks, follow the steps below:

- 1 Review System Form 2c, System Numbering: Line/Trunk Jacks to determine each central office trunk assignment on the control unit.
- 2 Place a green cord label at each end of every D2R or D8W cord. (These labels are packaged with the basic carrier.)

The green label indicates the number of the central office line/trunk jack to which the cord is connected.

- 3 Label the jacks on the termination blocks.
- 4 Leave a copy of System Form 2c in a secure place near the control unit.

Installing the Channel Service Unit

The Channel Service Unit (CSU) provides the interface between the 100D module and the DS1 facilities. The system supports three basic models:

- ACCULINK 3150 CSU (You may also install an ACCULINK 3160 or 3164 CSU; these provide 2- or 4-data ports, respectively.)
- ESF (Extended Superframe format) T1 CSU
- 551 T1 CSU

Only the ACCULINK CSUs are available for installation. For more information about the ESF T1 CSU and the 551 T1 CSU, see *Maintenance and Troubleshooting*.

The operator's guides shipped with the ACCULINK CSUs provide detailed installation, set-up and operation, and maintenance and troubleshooting information. Refer to one of these guides if your installation calls for an ACCULINK channel service unit.

NOTE:

Before you can install a CSU, the local telephone company must provide information such as services available, equipment options, and 48-V DC power on the trunk.

ACCULINK CSUs

The AT&T Paradyne ACCULINK CSUs replace the ESF T1 CSU. They are fully compatible with the ESF units.

The ACCULINK CSUs differ from the ESF T1 CSU in the following ways:

- The ACCULINK front panels include an LCD display and 7-button keypads composed of three functional and four directional keys.
- They contain integral 2400-bps modems for remote access and alarm reporting.

- The front-panel LEDs are labeled and colored differently from the ESF T1 CSU.
- The NETWORK connectors on the rear of the ACCULINK models are 8-pin modular jacks (RJ48C) instead of male 15-pin D-connectors. Cables are shipped with the units for the CSU-to-Smart Jack connection.
- There are no DIP switch options. All options are set via software commands. Access the options in the following ways:
 - Locally, from the front panel
 - Remotely, using the integral 2400-bps modem. The front panel of a local ACCULINK, in Passthrough mode, can access and option a remote CSU
 - Locally and remotely, through the COMPORT connector on the rear and a PC loaded with a Windows[™] software package (available at an extra charge from Paradyne)

The ACCULINK CSUs come equipped with two factory-set option configurations: Factory 1 (Fact 1) and Factory 2 (Fact 2). They leave the factory set at Fact 1. Two of the default parameters in Fact 1 are ESF/B8ZS. In the Fact 2 setting, two of the default parameters are D4/AMI.

The CSUs offer a number of front-panel alarms and monitor alarm conditions occurring either on the network interface or on the DTE interface. If an ACCULINK CSU detects two alarm conditions at the same time, it reports the higher priority alarm. Alarms remain active until the alarm condition is cleared.

Network performance is continually monitored and maintained by internal memory registers when the network interface is configured for ESF operation. The registers collect performance data for the previous 24-hour period.

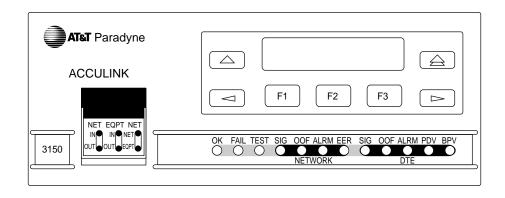


Figure 4-6. 3150 Front Panel

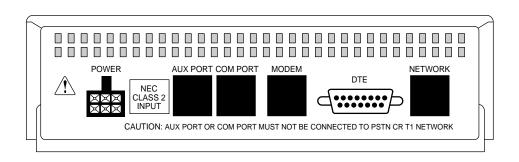


Figure 4–7. 3150 Back Panel

Installing the PC, CAT, or Printer

Once you complete the installation procedures presented in the previous chapters, you can connect a Station Message Detail Recording (SMDR) or Call Accounting Terminal (CAT) printer and a personal computer (PC), or a CAT and CAT printer, to the system.

Connecting a PC to the Control Unit

You can use a PC with MS-DOS 3.3 or higher and SPM 4.15 for SMDR, system programming, or maintenance. The method you use to connect the PC to the control unit depends on the distance between the hardware:

- If the PC is within 50 ft. (15.2 m) of the control unit, see "Connecting a PC Within 50 Feet" on the following page.
- If the PC is more than 50 ft. (15.2 m) from the control unit, see "Connecting a PC More Than 50 Feet Away" later on this chapter.



A CAUTION:

To prevent damage from electrostatic discharge (ESD), avoid touching leads, connectors, pins, and other components. Use a properly grounded wrist strap.

Connecting a PC Within 50 Feet

Use this procedure to connect a PC to the control unit when the PC is within 50 ft. (15.2 m) of the control unit.

You need the following hardware for this procedure:

- 355AF adapter
- D8W cord
- EIA-232-D cable (optional)

To connect a PC within 50 ft. (15.2 m) of the control unit, follow the steps below. See Figure 5–1.

1 Connect the D8W cord.

- For system programming or maintenance, plug one end of a D8W cord into the ADMIN jack on the control unit.
- For SMDR, plug one end of a D8W cord into the SMDR jack on the control unit.
- 2 Plug the other end of the D8W cord into a 355AF adapter.

3 Connect the 355AF adapter.

- If you are using an EIA-232-D cable, plug one end of the cable into the 355AF adapter and plug the other end into the COM1 port on the PC.
- If you are not using an EIA-232-D cable, plug the 355AF adapter directly into the COM1 port on the PC.

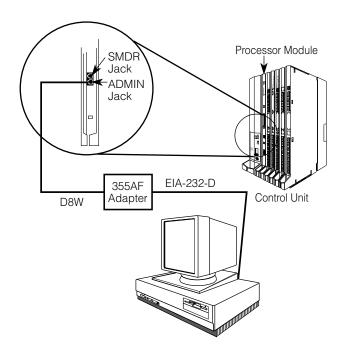


Figure 5–1. Connecting a PC Within 50 ft. (15.2 m)

Connecting a PC More Than 50 Feet (15.2 m) Away

Use this procedure to connect a PC to the control unit when the distance is 50 ft. (15.2 m) or more.

NOTE:

If you are installing the PC in a different room than the control unit, make sure that both locations have working wall outlets and wall jacks. Also make sure that the building wiring has been connected so that the wall jacks in each location connect to each other.

You need the following hardware for this procedure:

- 355AF adapter
- EIA crossover cable
- Two Z3A2 Asynchronous Data Units (ADUs)
- ADU crossover cable
- 400B2 power adapter
- 2012D transformer
- BR1A-4P adapter and 102 connecting block or 103 connecting block
- 248B adapter
- 8-position wall jacks
- 4-pair plug-ended cable
- D8W cords
- D6AP power cord
- EIA-232-D cables

To connect a PC 50 ft. (15.2m) or more distant, follow the steps below. See Figure 5–2.

- 1 Plug one end of a D8W cord into the ADMIN jack on the control unit.
- 2 Plug the other end of the D8W cord into a 355AF adapter.
- 3 Connect an EIA crossover cable to the 355AF adapter.
- 4 Connect one end of an EIA-232-D cable to the EIA crossover cable and plug the other end into the 25-pin male connector on the Z3A2 ADU.



A CAUTION:

If the PC is in a building outside the main building (control unit location), you must install an ADU and an additional protector in each building. The ADUs and protectors provide both the control unit and the PC with additional protection against lightning, inadvertent contact with power lines, and power currents induced by nearby power lines. For more information, see the installation notes packaged with the ADU.

- 5 Plug one end of a D8W cord into the WALL jack on the Z3A2 ADU and connect the other end to an ADU crossover cable.
- 6 Plug the other end of the ADU crossover cable into one of the jacks on a 400B2 power adapter.
- 7 Plug one end of a D6AP cord into the 400B2 power adapter.
- 8 Plug the other end of the D6AP cord into a 2012D-50M transformer.
- 9 Plug the 400B2 power adapter into a wall jack, BR1A-4P adapter, 102 connecting block, or 103 connecting block.
 - If you plug the 400B2 into a wall jack, make sure the building wiring has been set up so that the wall jack near the control unit is connected to the wall jack near the PC.
 - If you plug the 400B2 into a BR1A-4P adapter, 102 connecting block, or 103 connecting block, use 4-pair plug-ended cable to connect the BR1A-4P adapter (or connecting block) to the wall jack near the PC.

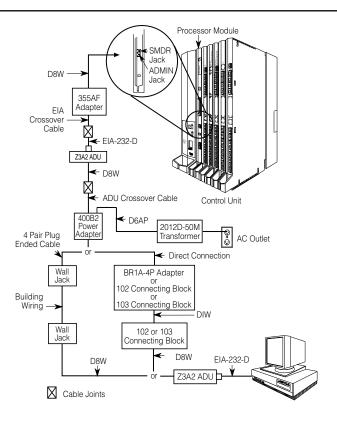


Figure 5–2. Connecting a PC More Than 50 ft. (15.2 m) Away

- 10 On the PC side, plug one end of a D8W cord into a wall jack and the other end into the WALL jack on the Z3A2 ADU.
- 11 Plug one end of an EIA-232-D cable into the 25-pin male connector on the Z3A2 ADU and the other end into the COM1 port on the PC.
- 12 Plug the 2012D-50M transformer into a wall outlet.
- 5–6 Installing the PC, CAT, or Printer

Connecting a CAT to the Control Unit

The Call Accounting Terminal (CAT) is a stand-alone unit that provides call accounting information. It connects to the SMDR jack on the control unit and links the control unit to the CAT printer. The connection of the CAT to the control unit depends on the distance and whether the CAT and control unit share the same AC outlet.

The CAT and CAT printer are connected at the same time. For more information, see "Call Accounting Terminal" in Chapter 8.

- If the CAT is grounded to the same AC outlet as the control unit and the CAT and CAT printer are within 14 ft. (4.27 m) and 50 ft. (15.2 m), respectively, of the control unit, refer to "Connecting a CAT and Printer on the Same AC Outlet."
- If the CAT is either not grounded to the same AC outlet as the control unit or is more than 14 ft. (4.27 m) from the control unit, refer to "Connecting a CAT and Printer on a Different AC Outlet."



A CAUTION:

To prevent damage from electrostatic discharge (ESD), avoid touching leads, connectors, pins, and other components. Wear a properly grounded wrist strap.

Connecting a Printer to the Control Unit

You can connect any 1200-bpi serial printer set at no parity and one stop bit. If necessary, consult the printer's manual to ensure that these settings are in effect. The system supports the following AT&T printers:

- AT&T 572 Printer
- AT&T 475/476 Printer

- AT&T Call Accounting Terminal (CAT) Printer
- AT&T Call Accounting System Printer
- AT&T Applications Printer

NOTE:

The AT&T 570 printer is not compatible with the system.

Printer connection varies depending on the printer model, whether the printer is grounded on the same AC outlet as the control unit, and whether the printer is within 50 ft. (15.2 m) of the control unit. The procedures covered in this chapter are described below:

- If the CAT serial printer is used with a CAT and is grounded to the same AC outlet as the control unit and is within 50 ft. (15.2 m) of the control unit, refer to "Connecting a CAT and Printer on the Same AC Outlet."
- If the CAT serial printer is used with a CAT and is either *not* grounded to the same AC outlet as the control unit or is *more* than 50 ft. (15.2 m) from the control unit, refer to "Connecting a CAT and Printer on a Different AC Outlet."
- If the SMDR or CAT printer is within 50 ft. (15.2 m) of the control unit and is connected to the same 117-V AC branch as the control unit, refer to "Connecting a Printer Within 50 Feet (15.2 m)."
- If the SMDR or CAT printer is *more* than 50 ft. (15.2 m) from the control unit and is not connected to the same 117-V AC branch as the control unit, refer to "Connecting a Printer 50 Feet (15.2 m) or More Away."



A CAUTION:

Before touching leads, connectors, pins, and other components, wear a properly grounded wrist strap, to prevent damage from electrostatic discharge (ESD).

Connecting a CAT and Printer on the Same AC Outlet

Use this procedure to connect a CAT and CAT serial printer into the same AC outlet as the control unit, provided the CAT is fewer than 14 ft. (4.27 m) and the printer is fewer than 50 ft. (15.2 m) from the control unit.

You need the following hardware for this procedure:

- Z200A EMI filter
- D8W cord
- 355A adapter

To connect a CAT and CAT printer on the same AC outlet, follow the steps below. See Figure 5–3.

- Plug the short end of the Z200A EMI cord into the SMDR jack on the control unit.
- 2 Plug the other end of the Z200A EMI cord into the SMDR jack on the back of the CAT.
- 3 Plug one end of a D8W cord into the PRINTER jack on the back of the CAT.
- 4 Plug the other end of the D8W cord into a 355A adapter.
- 5 Plug the 355A adapter into the serial port on the back of the printer.
- 6 Set the appropriate printer options for SMDR.

See "Setting Printer Options and DIP Switches," later in this chapter, for instructions.

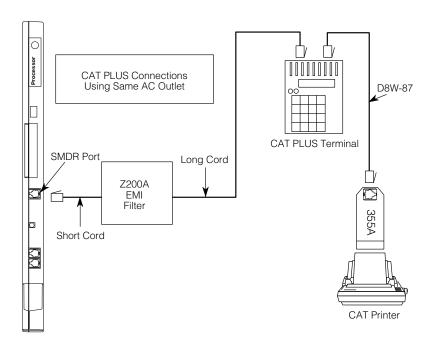


Figure 5-3. Connecting a CAT and Printer on the Same AC Outlet

Connecting a CAT and Printer on a Different AC Outlet

If the printer is not grounded to the same AC outlet as the control unit or CAT or if the printer is more than 50 ft. (15.2 m) from the control unit, use the following procedure to connect a CAT serial printer to the control unit.

5–10 Installing the PC, CAT, or Printer

NOTE:

If you are installing the printer in a different room than the control unit, make sure that both locations have working wall outlets and wall jacks, and that the building wiring has been connected so that the wall jacks in each location connect with each other.

You need the following hardware for the following procedure:

- 248B adapters
- 355AF, 355A adapters
- 400B2 power adapters
- D8W cords
- D6AP power cords
- D8AM modular crossover cable
- M7U null modem cable (25 pin cable)
- Z3A2, Z3A4 ADUs
- 2012D transformer
- Z200A EMI filter

To connect a CAT printer on a different AC outlet, first make the connections at the control unit, then at the printer.

- Follow the steps below to make the connections at the control unit. Refer to Figure 5–4 throughout the procedure.
- Plug the short end of a Z200A EMI cord into the SMDR jack on the control
- 2 Plug the other end of the Z200A EMI cord into a 355AF adapter.
- 3 Plug the 355AF into one end of an M7U null modem cable.
- Plug the other end of the M7U null modem cable into the 25-pin female connector on a Z3A4 ADU.
- 5 Plug one end of a D8W cord into the WALL jack on the Z3A4 ADU.
- Plug the other end of the D8W cord into a modular jack on the D8AM modular crossover cable.
- 7 Plug the other end of the D8AM modular crossover cable into the top jack on the 400B2 power adapter.
- 8 Plug the 400B2 power adapter into the wall jack for the control unit. Make sure the building wiring is set up so that the wall jack for the control unit can communicate with the wall jack for the printer.
- 9 Plug one end of a D6AP cord into the 2012D-50M transformer. If you are using a 248B adapter and 2012D transformer instead of a 2012D-50M transformer, plug the D6AP cord into the jack on the 248B adapter, and then connect the spade-tip wires on the 248B adapter to the screws on a 2012D transformer.

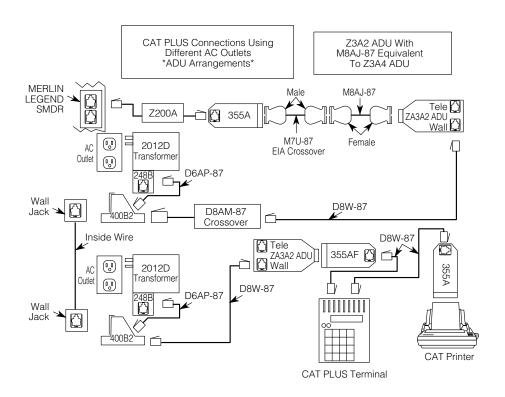


Figure 5–4. Connecting a CAT and Printer on Different AC Outlets: Control Unit Connections

- 10 Plug the other end of the D6AP cord into the lower jack on the 400B2 power adapter.
- 11 Plug the 2012D-50M (or 2012D) transformer into the wall outlet for the control unit.

To make the connections at the printer, follow the steps below. See Figure 5–4.

- 1 At the printer location, plug one end of a D6AP cord into a 2012D-50M transformer, or follow the instructions in Step 9 above.
- 2 Plug the other end of the D6AP cord into the lower jack on a 400B2 power adapter.
- 3 Plug the 400B2 power adapter into the wall jack.
- 4 Plug the 2012D-50M (or 2012D) transformer into the wall outlet for the printer.
- 5 Plug one end of a second D8W cord into the top jack on the second 400B2 power adapter.
- 6 Plug the other end of the second D8W cord into the WALL jack on the Z3A2 ADU.
- 7 Connect the 25-pin male connector on the Z3A2 ADU to the 25-pin female end on a second 355AF adapter.
- 8 Plug one end of a third D8W cord into the second 355AF adapter.
- 9 Plug the other end of the third D8W cord into the SMDR jack on the back of the CAT.
- 10 Plug one end of a fourth D8W cord into the PRINTER jack on the back of the CAT.
- 11 Plug the other end of the fourth D8W cord into a third 355A adapter.
- 12 Slide the third 355A adapter into the serial port on the back of the printer.
- 13 Set the appropriate printer options for SMDR.

See "Setting Printer Options and DIP Switches" for instructions.

Connecting a Printer Within 50 Feet (15.2 m)

If the printer is within 50 ft. (15.2 m) of the control unit and is connected to the same 117-V AC branch as the control unit, use this procedure to connect a printer to the control unit.

You need the following hardware for this procedure:

- Z200A EMI filter
- Adapter for the connector on the interface cable
 - 355A for a male connector
 - 355AF for a female connector

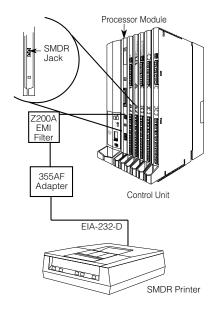


Figure 5-5. Connecting a Printer Within 50 ft. (15.2 m)

To connect a printer within 50 ft. (15.2 m), follow the steps below. Refer to Figure 5–5.

- 1 Plug the short end of a Z200A EMI cord into the SMDR jack on the control unit.
- 2 Plug the other end of the Z200A EMI cord into a 355AF or 355A adapter.
- 3 Plug the female end of the adapter into the 25-pin male connector on the printer's interface cable, or into the serial port on the printer.
- 4 Set the appropriate printer options for SMDR.

See "Setting Printer Options and DIP Switches" for instructions.

5–16 Installing the PC, CAT, or Printer

Connecting a Printer 50 Feet (15.2 m) or More Away

Use this procedure to connect a printer to the control unit if the following conditions apply:

- The printer is not a CAT printer connected to a CAT.
- The printer is 50 ft. (15.2 m) or more from the control unit.
- The printer is not grounded to the same AC outlet as the control unit. The printer is not grounded to an outlet that is on the same 117-V AC branch as the control unit and that is 50 ft. (15.2 m) or closer to the control unit.

NOTE:

If you are installing the printer in a different room than the control unit, make sure that both locations have working wall outlets and wall jacks, and that the building wiring has been connected so that the wall jacks in each location communicate with each other.

You need the following hardware for this procedure:

- Z200A EMI filter
- Adapter for the interface cable connector
 - 355A for the male connector
 - 355AF for the female connector
- 400B2 power adapter
- Z3A2 ADUs
- BR1A-4P adapter or 102 connecting block or 103 connecting block
- 8-position wall jacks
- EIA crossover cable
- ADU crossover cable
- 2012D transformer

- 248B adapter
- D8W cords
- D6AP power cord
- EIA-232-D cable
- 4-pair plug-ended cable

To connect a printer 50 ft. (15.2 m) or more away from the control unit, follow the steps below. See Figure 5-6.

- Plug the short end of a Z200A EMI cord into the SMDR jack on the control unit.
- 2 Plug the other end of the Z200A EMI cord into a 355AF adapter.
- Plug the female end of the 355AF adapter into one end of an EIA crossover cable.
- Plug the other end of the EIA cable into the 25-pin male connector of the Z3A2 ADU.



A CAUTION:

If the printer is in a building outside the main building (control unit location), you must install an ADU and an additional protector in each building. The ADUs and protectors provide both the control unit and the printer with additional protection against lightning, inadvertent contact with power lines, and power currents induced by nearby power lines. See the installation notes packaged with the ADU for more information.

- 5 Plug one end of a D8W cord into the WALL jack on the Z3A2 ADU.
- 6 Plug the other end of the D8W cord into an ADU crossover cable.
- Plug the other end of the ADU crossover cable into one of the jacks on a 400B2 power adapter.
- 8 Plug one end of a D6AP cord into the other jack of the 400B2 adapter.

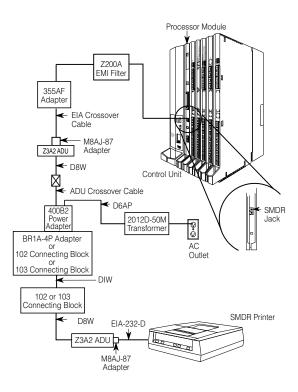


Figure 5-6. Connecting a Printer More Than 50 ft. (15.2 m) Away

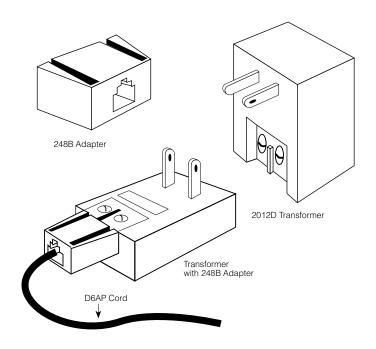


Figure 5-7. Connecting the 248B Adapter and the 2012D Transformer

9 Plug the other end of the D6AP cord into the 2012D-50M transformer.

If you are working with a 248B adapter and 2012D transformer instead of a 2012D-50M transformer, plug the D6AP cord into the jack on the 248B adapter, and then connect the spade-tip wires on the 248B adapter to the screws on a 2012D transformer. See Figure 5–7.

- 10 Plug the 400B2 adapter into a wall jack, BR1 A-4P adapter, 102 connecting block, or 103 connecting block.
- 11 Complete the 400B2 connection.

5–20 Installing the PC, CAT, or Printer

- If the 400B2 is plugged into a wall jack, make sure that building wiring has been set up so that the wall jack for the control unit can communicate with the wall jack for the printer.
- If the 400B2 is plugged into a BR1A-4P adapter, 102 connecting block, or 103 connecting block, use 4-pair plug-ended cable to connect the BR1A-4P adapter (or connecting block) to the wall jack for the printer.
- 12 On the printer side, plug one end of a D8W cord into the wall jack and the other end into the WALL jack on the Z3A2 ADU.
- 13 Plug one end of an EIA-232-D cable into the 25-pin male connector on the Z3A2 ADU and the other end into the serial port on the printer.
- 14 Plug the 2012D-50M (or 2012D) transformer into a wall outlet.
- 15 Set the appropriate printer options for SMDR.

See "Setting Printer Options and DIP Switches" for instructions.

Setting Printer Options and DIP Switches

If the customer has an AT&T 572, AT&T 475/476, CAT, or AT&T Applications printer, use this section to set up printer options. If another type of serial printer is being used, review these setup options for guidance and consult the manual for the printer. Use the information below to determine the correct printer setting for the printer:

- For the 572 printer, set the options on the printer according to Table 5–1. (See the user's guide supplied with the printer for more information.)
- For the 475/476 printer, set the DIP switches on the printer according to Table 5–2. (See the user's guide supplied with the printer for more information.)
- For the CAT printer, set the DIP switches on the printer according to Table 5–3. (See the user's guide supplied with the printer for more information.)
- For the Applications printer, set all the DIP switches on the printer to *off*. (See the user's guide supplied with the printer for more information.)

Table 5–1. AT&T 572 Printer Options

| No. | Function | Menu | Status |
|-----|-------------|------|------------|
| 01 | FORM LENGTH | 09 | 11 |
| 02 | LPI | 01 | 6 |
| 03 | CPI | 01 | 10 |
| 04 | LQ or NLQ | 01 | LQ |
| 05 | BUZZER | 01 | ON |
| 06 | FONT | 01 | BUILT-"IN" |
| 07 | RESOLUTION | 01 | 144 |
| 11 | BUFFER | 02 | ON-"LINE" |
| 13 | PW ON MODE | 01 | ON-"LINE" |
| 14 | DIRECTION | 01 | BI-DIR.1 |
| 15 | BUFFER FULL | 02 | LF + CR |
| 16 | P. E. | 01 | ACTIVE |
| 17 | AUTO CR | 01 | CR + LF |
| 18 | ZERO | 01 | 0 |
| 22 | AUTO LF | 01 | CR ONLY |
| 31 | 1" SKIP | 01 | OFF |

Continued on next page

Table 5–1, Continued

| No. | Function | Menu | Status |
|-----|--------------------|------|----------------|
| 32 | CHAR. SET (G0,GL) | 02 | USA |
| 33 | CHAR. SET (G1, GR) | 01 | UK |
| 34 | CHAR. SET (G2) | 03 | GE |
| 35 | CHAR. SET (G3) | 0 | "LINE" DRAWING |
| 81 | OFF-"LINE" STATE | 01 | ALL RECEIVE |
| 82 | DSR | 02 | OFF |
| 83 | RTS TIMING | 01 | RTS |
| 84 | CD | 02 | OFF |
| 85 | CTS | 02 | OFF |
| 91 | OVER RUN | 02 | 256 |
| 92 | DATA BIT | 02 | 8 |
| 93 | PROTOCOL | 03 | XON/XOFF* |
| 94 | STOP BIT | 01 | 2 |
| 95 | PARITY | 01 | NON |
| 96 | BPS | 04 | 1200 |

This is the default status, but the system cannot read the character sent by the printer.

Table 5–2. AT&T 475/476 Printer DIP Switch Settings*

| Switch 1 | Switch 2 | Switch 21 |
|--------------|--------------|--------------|
| DIP 1-Open | DIP 1-Open | DIP 1-Open |
| DIP 2-Closed | DIP 2-Open | DIP 2-Open |
| DIP 3-Open | DIP 3-Open | DIP 3-Open |
| DIP 4-Open | DIP 4-Open | DIP 4-Closed |
| DIP 5-Closed | DIP 5-Open | DIP 5-Open |
| DIP 6-Closed | DIP 6-Open | DIP 6-Open |
| DIP 7-Closed | DIP 7-Closed | DIP 7-Open |
| DIP 8-Open | DIP 8-Open | DIP 8-Closed |
| Switch 22 | Switch 23 | Switch 24 |
| DIP 1-Open | DIP 1-Closed | DIP 1-Open |
| DIP 2-Closed | DIP 2-Open | DIP 2-Closed |
| DIP 3-Closed | DIP 3-Open | DIP 3-Closed |
| DIP 4-Open | DIP 4-Open | DIP 4-Open |
| | DIP 5-Closed | DIP 5-Open |
| | DIP 6-Open | DIP 6-Closed |

DIP 7-Open
DIP 8-Closed

* Open = off; Closed = on

Table 5–3. AT&T CAT Printer DIP Switch Settings*

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|-------|
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| |

^{*} Open = off; Closed = on

Applications Printer DIP Switch Settings

For the Applications Printer, the only DIP switch setting is the control switch. Set all control switch DIP switches (1 through 8) to Off (open).

Connecting Data Equipment

This chapter explains how to set up data stations. A data station sends and/or receives data. If the data station includes a telephone, the station can also send and receive voice. If the system includes both modem and terminal adapter data stations that need to communicate with each other, then you need to set up a modem pool for those data stations. Modem pools are described in the applications note entitled MERLIN LEGEND Communication System Modem Pooling.

Data Stations

A data station is a combination of equipment that can include a telephone and a PC, printer, optical scanner, or fax machine. If the data station is connected to a tip/ring, analog, or MLX extension jack for data communications over analog trunks, it requires a modem to convert the signal from digital to analog or from analog to digital. If, however, the data station is connected to an MLX extension jack for data communications over a DS1 (Digital Signal Level 1) Primary Rate Interface (PRI) facility, it requires an ISDN terminal adapter instead of a modem.

Table 6–1 provides a detailed comparison of data station configurations.

Table 6–1. Data Station Configurations

| Type of Station Analog voice and modem data | Telephone (for voice) Analog multiline telephone and BR-241-B1 bridging adapter | GPA or MFM GPA | DCE Modem | DTE Terminal, PC, fax (cannot dial), optical scanner, or host computer |
|--|--|----------------------|--|--|
| Modem data-only* | None | None | Modem | Terminal, PC, fax, credit card verification, optical scanner, or host computer |
| MLX voice and modem data | Any MLX telephone | MFM | Modem | Terminal, PC, fax, credit card verification, optical scanner, or host computer |
| MLX voice and Terminal Adapter | Any MLX telephone | None | 7500B or ExpressRoute Terminal Adapter | Terminal, PC, fax, credit card verification, optical scanner, host computer, or video codec |
| Terminal Adapter data-only | None | None | 7500B or ExpressRoute Terminal Adapter and a 440A4 terminating resistor adapter | Terminal, PC, fax, credit card verification, optical scanner, host computer, or video codec |
| Synchronous Terminal Adapter for Video MLX 2B Data | Passive bus MLX | None | PE equipment or Terminal Adapter | A PC with video applications |

^{*} A single-line telephone may be attached for dialing purposes.

NOTES:

- 1. The analog voice and modem data station requires a bridging adapter to connect the telephone to the two adjacent analog extension jacks.
- 2. The terminal adapter data-only station requires a terminating resistor adapter to connect the terminal adapter to the MLX extension jack.
- 3. See "Video Conferencing Data Stations," later in this chapter, for configuration details on stations including video codecs.
- 4. The cord length from the terminal adapter to the telephone cannot be more than 80 ft. (24 m).
- 5. Do not connect two terminal adapters on one line.

Modem Data Stations

A modem data station uses a modem to convert digital signals so that it can send and receive analog signals. This type of station allows data communication without PRI facilities.

The system supports the types of modem data stations listed below.

- Analog Voice and Modem Data. This station includes a data terminal and an analog multiline telephone.
- **Modem Data-Only.** This station includes a data terminal and modem. If this station's modem has a phone jack, you can connect a single-line telephone; however, voice and data at the same time are not possible.
- MLX Voice and Modem Data. This station includes a data terminal, modem, and an MLX telephone.

See Form 2a, System Numbering: Extension Jacks for your customer's specifications. Then refer to the appropriate section later in this chapter for instructions on setting up modem data stations.

Terminal Adapter Data Stations

A terminal adapter data station uses a 7500B or ExpressRoute data module to convert MLX voice signals and DTE digital signals to the digital transmission signaling standard, so that it can send and receive digital signals. This type of station requires PRI facilities to send and receive data to and from digital data stations that are outside the system.

The system supports the following types of data stations connected to terminal adapters:

- MLX Voice and Terminal Adapter Data. This station includes a terminal adapter, data terminal, and an MLX telephone.
- Terminal Adapter **Data-Only.** This station includes a terminal adapter, data terminal, and no telephone.

For your customer's specifications, see Form 2a, System Numbering: Extension Jacks and Form 2b, System Numbering: Digital Adjuncts. Then refer to the appropriate section later in this chapter for instructions on setting up terminal adapter data stations.

NOTE:

A video conferencing data station is a synchronous terminal adapter data station. Refer to "Video Conferencing Data Stations" for more information.

Analog Voice and Modem Data Stations

Figure 6–1 shows the equipment configuration for an analog voice and modem data station.

GPA Settings

The switch on the back of the General Purpose Adapter (GPA) used in Step 4, provides two settings, Automatic and Basic (Join is not used).

Use the Basic setting to:

- Originate modem calls
- Originate telephone calls while using the modem

When the GPA is connected to an analog multiline telephone and configured using the Automatic setting, you can:

- Answer calls (if this is the case, an Auto Answer All button must be programmed so that calls can be answered automatically).
- Make and receive calls on the telephone while using the modem. The speakerphone must not be used.

Setting Up

To set up an analog voice and modem data station, follow the steps below:

- 1 If using an external modem use an EIA-232-D cable to connect the SERIAL port on the data terminal to the modem. If using an internal modem, it should already be connected to the correct serial port.
 - If the data terminal has both COM1 and COM2 ports, make sure you use the one designated for data transmission. See the customer's system manager if you are not sure.
- 2 Make sure that the modem has settings for speed and parity that are compatible with those of the data terminal.

If you are not sure, see the customer's system manager or the documentation packaged with the modem, data communications software, and data terminal.

3 Connect the modem to the GPA.

- a Plug one end of a D4BU cord into the TEL/EQUIP jack on the GPA.
- b Plug the other end into the modem as indicated in the modem's documentation.

4 Connect the GPA to the analog multiline telephone.

- a Plug one end of a D8AC cord into the VT jack on the back of the GPA.
- b Plug the other end into the OTHER jack on the bottom of the telephone.
- c Slide the switch on the back of the GPA to Automatic or Basic. See "GPA Settings" above for your options.
- 5 Use a D8W cord to connect the STATION jack on the BR-241-B1 bridging adapter to the LINE jack on the analog multiline telephone.
- 6 Use two D8W cords to connect the EVEN and ODD jacks on the BR-241-B1 bridging adapter to the extension jacks indicated on Form 2a, System Numbering: Extension Jacks.
 - Connect the EVEN jack on the bridging adapter to the extension jack that is associated with the even-numbered extension, *not* the logical ID.
- 7 Connect all power cords to an AC outlet that is not controlled by a wall switch.

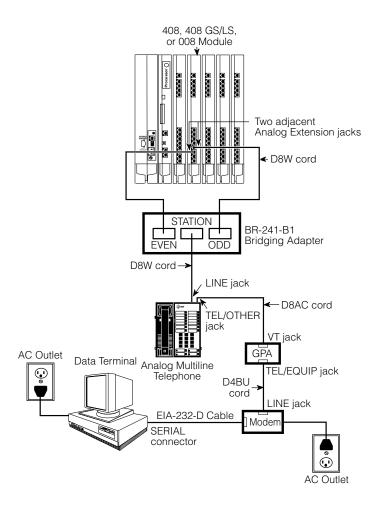


Figure 6-1. Analog Voice and Modem Data Equipment Configuration

Modem Data-Only Stations

Figure 6–2 shows the equipment configuration for a modem data-only station.

To set up a modem data-only station, follow the steps below:

If using an external modem, use an EIA-232-D cable to connect the modem to the serial port on the data terminal. If using an internal modem, it should already be connected.

For a data terminal that has both COM1 and COM2 ports, make sure you use the one designated for data transmission. See the customer's system manager if you are not sure.

Make sure that the modem has settings for speed and parity that are compatible with those of the data terminal.

If you are not sure, see the customer's system manager or the documentation packaged with the modem, data communications software, and data terminal.

- 3 Connect the modem to the control unit.
 - a Plug one end of a D4BU cord into the appropriate modem jack; see the modem's documentation if you are not sure.
 - b Plug the other end into the appropriate basic extension jack on the 012 or 008 OPT module. See Form 2a, System Numbering: Extension Jacks for the appropriate module and extension jack.
- Connect all power cords to an AC outlet that is not controlled by a wall switch.

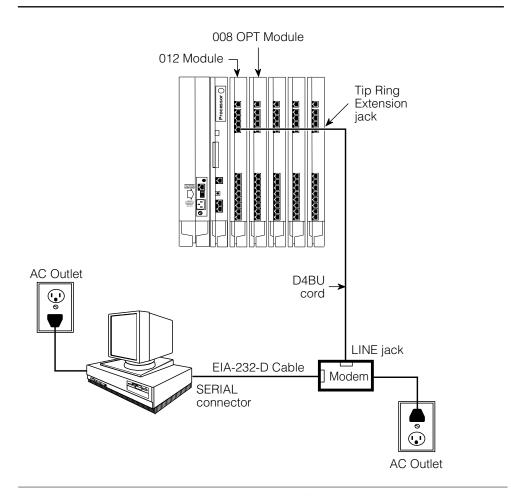


Figure 6-2. Modem Data-Only Equipment Configuration

MLX Voice and Modem Data Stations

Figure 6–3 shows the equipment configuration for an MLX voice and modem data station.

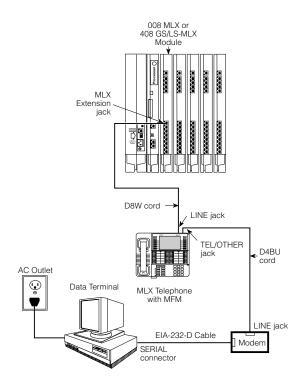


Figure 6-3. Modem Data and MLX Voice Equipment Configuration

6-10 Connecting Data Equipment

To set up a modem data and MLX voice station, follow the steps below:

1 Use an EIA-232-D cable to connect the serial port on the data terminal to the modem.

For a data terminal that has both COM1 and COM2 jacks, make sure you use the one designated for data transmission. See the customer's system manager if you are not sure.

2 Make sure that the modem has settings for speed and parity that are compatible with those of the data terminal.

If you are not sure, see the customer's system manager or the documentation packaged with the modem, data communications software, and data terminal.

3 Connect the modern to the MFM in the MLX telephone.

If the MFM is not installed already, refer to "Installing Multi-Function Modules" in Chapter 3.

- a Plug one end of a D4BU cord into the appropriate modem jack, as described in the modem's documentation.
- b Plug the other end into the TEL/OTHER jack on the bottom of the MLX telephone.
- c Route the D4BU cord through the telephone's cord channel.

4 Connect the MLX telephone to the control unit.

- a Plug one end of a D8W cord into the LINE jack on the bottom of the MLX telephone.
- b Plug the other end into the appropriate MLX extension jack. See Form 2a, System Numbering: Extension Jacks for the appropriate module and extension jack.
- Connect all power cords to an AC outlet that is not controlled by a wall switch.

MLX Voice and Terminal Adapter Data Stations

Figure 6–4 shows the equipment configuration for MLX voice and terminal adapter data station.

The configuration shown in Figure 6–4 is for *asynchronous* terminal adapter data transmission. For information on setting up *synchronous* terminal adapter data stations, see "Video Conferencing Data Stations," later in this chapter.

The maximum cord length from the terminal adapter to the telephone is 80 ft. (24.38 m).

Setting Up

To set up an MLX voice and terminal adapter data station, follow the steps below:

1 Use an EIA-232-D cable to connect the serial port on the data terminal to the terminal adapter.

If the data terminal that has both COM1 and COM2 connectors, make sure you use the one designated for data transmission. See the customer's system manager if you are not sure.

2 Make sure the terminal adapter option settings for parity and speed are compatible with the data terminal. (Speed is synchronized automatically if the factory setting has not changed.)

If you are not sure about the speed and parity of the data terminal, see the customer's system manager or the documentation packaged with the terminal adapter and data terminal.

- 3 Plug the other end of the EIA-232-D cable into PORT 1 on the terminal adapter.
- 4 Plug the WP90110-L7 power supply cord into the POWER receptacle on the terminal adapter.

5 Connect the terminal adapter to the MLX telephone.

- a Plug one end of a D8W cord into the PHONE jack on the terminal adapter.
- b Plug the other end into the LINE jack on the MLX telephone.

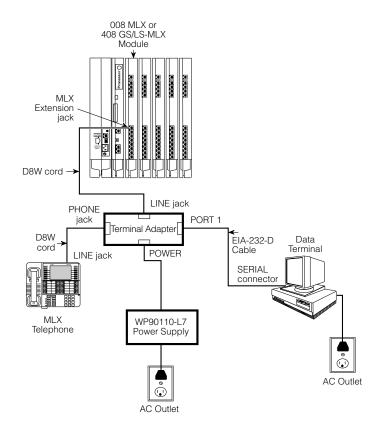


Figure 6-4. MLX Voice and Terminal Adapter Data Equipment Configuration

- 6 Connect the terminal adapter data module to the control unit.
 - a Plug one end of a D8W cord into the LINE jack on the terminal adapter.
 - b Plug the other end into the appropriate MLX extension jack. See Form 2a, System Numbering: Extension Jacks for the appropriate module and extension jack.
- 7 Connect all power cords to an AC outlet not controlled by a wall switch.

Terminal Adapter Data-Only Stations

Figure 6–5 shows an equipment configuration for a terminal adapter data-only station.

To set up a terminal adapter data-only station, follow the steps below:

- 1 Use an EIA-232-D cable to connect the SERIAL port on the data terminal to the terminal adapter.
 - For any data terminal that has both COM1 and COM2 connectors, make sure you use the one designated for data transmission. See the customer's system manager if you are not sure.
- 2 Make sure that the terminal adapter option settings for parity and speed are compatible with the data terminal. (Speed is synchronized automatically if the factory setting has not been changed.)
 - If you are not sure about the speed and parity of the data terminal, see the customer's system manager or the documentation packaged with the terminal adapter and the data terminal.
- 3 Plug the other end of the EIA-232-D cable into PORT 1 on the terminal adapter.
- 4 Plug the WP90110-L7 power supply cord into the POWER receptacle on the terminal adapter.
- 5 Use a 440A4 terminating resistor adapter to connect the terminal adapter to the control unit.

- a Use a D8W cord to connect the 440A4 terminating resistor adapter to the LINE jack on the terminal adapter.
- b Use a second D8W cord to connect the other end of the adapter to the appropriate MLX extension jack. See Form 2b, System Numbering: Digital Adjuncts for the appropriate module and extension jack.
- 6 Connect all power cords to an AC outlet not controlled by a wall switch.

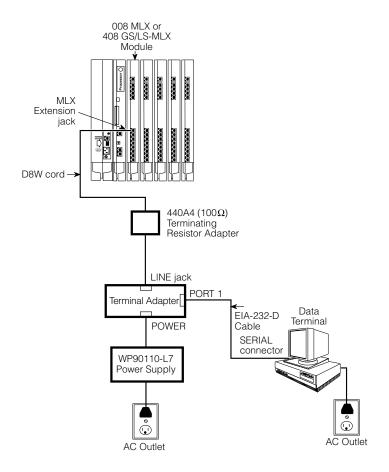


Figure 6-5. Terminal Adapter Data-Only Equipment Configuration

6-16 Connecting Data Equipment

Video Conferencing Data Stations

You can use the terminal adapter with a Multipurpose Enhancement Board for synchronous data communication. This type of station allows data transmission at speeds of 56 or 64 kbps.

This section is only a guideline for connecting video conferencing equipment to the system. For additional information, refer to the documentation packaged with the video codec.

Also, for instructions on using the Multipurpose Enhancement Board or for additional information on setting up the terminal adapter, see the documentation packaged with the terminal adapter.

You need the following hardware:

- 008 MLX module or 408 GS/LS-MLX module and a 100D module in the control unit
- ACCULINK 3150 CSU
- Two terminal adapters:
 - Two 7500B data modules with two 7500B data module feature package 2 upgrades (user manuals included)
 - Two ExpressRoute terminal adapters
- Two Multipurpose Enhancement Boards [install one of these in each terminal adapter for synchronous communication and an RS-366 Automatic Calling Unit (ACU) interface]
- Two WP901 10-L7 power supplies (one per stand-alone terminal adapter)
- Two 440A4 terminating resisting adapters
- Z77A multiple mounting (mounting for multiple 7500B data modules)
- PictureTel video codec unit

- Two Shore Microsystems SM-100EIA-232/V.35 converters (or equivalent)
- Cables:
 - Two male/male EIA-232-D cables, 8 ft. (24 m), to connect the PORT 1 connectors on the terminal adapters to the EIA-232/V.35 converters
 - Two male/male V.35 DB-37 cables, 8 ft. (24 m), to connect the V.35 communication ports on the video codec to the EIA-232/V.35 converters
 - Two male/male RS-366 DB-25 cables, 8 ft. (24 m), to connect the RS-366 dialing port of the video codec to PORT 2 on the terminal adapters

Figure 6-6 shows an example of a video conferencing configuration.

NOTES:

- 1. If you are connecting MLX telephones, omit both 440A4 terminating resistors.
- 2. The maximum cord length from the terminal adapters to the telephone is 80 ft. (24.38 m).

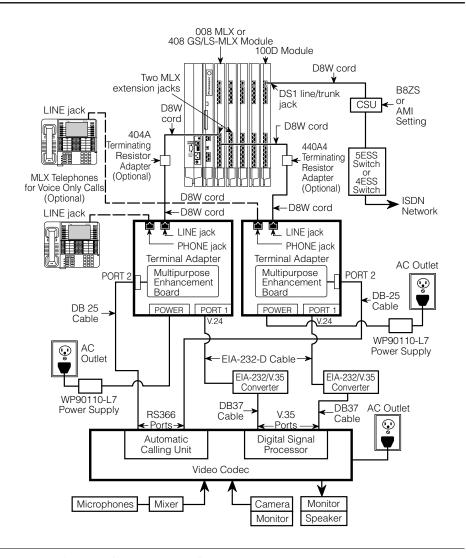


Figure 6-6. Video Conferencing Configuration

To set up the video conferencing configuration, follow the steps below. See Figure 6-6.

- 1 Plug one end of a D8W cord into the LINE jack on each of the terminal adapter.
- 2 Connect the other end of each D8W cord.
 - If Data Form 1b indicates that you are to install MLX telephones, plug the D8W cords into the MLX extension jacks specified on Data Form 1b, then go to Step 4.
 - If Data Form 1b does not indicate that you are to install MLX telephones, plug each D8W cord into a 440A4 terminating resistor.
- 3 Using two more D8W cords connect each 440A4 terminating resistor to the MLX extension jacks specified on Data Form 1b, then go to Step 6.
- 4 Connect the MLX telephones to the terminal adapter.
 - a Plug a D8W cord into the LINE jack on each MLX telephone.
 - b Plug the other end of each D8W cord into the PHONE jack on each terminal adapter.
- 5 Plug each WP901 10-L7 power supply cord into the POWER jacks on the terminal adapter.

Do not plug the power supplies into the outlets until the end of this procedure.

- 6 Connect each terminal adapter to the video conferencing data station.
 - a Use the DB-25 cables to connect the PORT 2 jacks on each terminal adapter to the dialing ports in the video codec's automatic calling unit. See the documentation packaged with the video codec for instructions.
 - b Use the EIA-232-D cables to connect the PORT 1 jacks on each terminal adapter to the EIA-232/V.35 converters.
 - c Use the DB-37 cables to connect the EIA-232/V.35 converters to the video codec's V.35 communication ports. See the documentation packaged with the video codec for instructions.

7 If it is not already connected, connect the CSU to the 100D module on the control unit and to the 5ESS or 4ESS exchange switch.

See "Installing the Channel Service Unit" in Chapter 4.

8 When you are ready to power up the system, plug the power supplies, CSU, video conferencing equipment, and control unit into the AC outlets.

Terminal Adapter and CSU Settings

You need to set the terminal adapter and the CSU as indicated in Table 6-2. If the customer's system is running at 56 kbps, set the CSU line-coding DIP switches according to the instructions in "Setting the CSU DIP Switches" in Chapter 4.

Table 6-2. Terminal Adapter Settings

| Settings | 56 Kbps | 64 Kbps |
|-----------|---------|---------|
| Auto-dial | Off | Off |
| Busy out | Off | Off |
| Datarest | On | Off |
| DTR | Follow | Follow |
| Duplex | Full | Full |
| Mode | Cs | Cs |
| Speed | 56,000 | 64,000 |
| | | |

Initializing and Testing the System

When you have finished installation, you are ready to initialize the system as described in this chapter.

Initializing the System

To initialize a Release 4.0 system, use one of the following methods:

- Restore from a 4.0 system programming disk or Translation memory card.
- Upgrade to Release 4.0 from Release 1.0, 1.1, 2.0, 2.1, 3.0, or 3.1. See Chapter 9, "Upgrading the System."
- Use system programming forms and the procedures from one of the guides listed in the next section, "Programming Guides."

This section describes how to restore the system from the Translation memory card or the system programming disk.

NOTE:

On initial installations, make sure you perform a System Erase (frigid start), as described in Maintenance and Troubleshooting, immediately before you restore from a disk or memory card or before you program the system. Failure to perform the System Erase (frigid start) can result in incorrect programming.

Programming Guides

The following guides are available to assist you:

- Programming Summary for quick-reference procedures (document number 555-630-111)
- System Programming for detailed procedures (document number 555-630-140, in the binder accompanying this one)
- System Programming and Maintenance (SPM) for detailed SPM procedures (document number 555-630-140, in the binder accompanying this one)

Restoring from the Translation Memory Card

If you received the Release 4.0 Translation memory card, follow the steps below to initialize the system:

1 Perform a System Erase (frigid start).

See *Maintenance and Troubleshooting* for detailed instructions. Console Procedure: **Menu** \rightarrow **Maintenance** \rightarrow **Slot** \rightarrow Dial or Type $\square\square\rightarrow$ Enter \rightarrow **Demand Test** \rightarrow **System Erase** (Line 5, left button) twice \rightarrow **Yes**

2 Use the programming console and the translation memory card to perform the Restore procedure.

See Appendix D of *Maintenance and Troubleshooting* for instructions.

Restoring from the System Programming Disk

If you received the Release 4.0 system programming disk, follow the steps below to initialize the system:

1 Perform a System Erase (frigid start).

See *Maintenance and Troubleshooting* for detailed instructions. Console Procedure: **Menu** \rightarrow **Maintenance** \rightarrow **Slot** \rightarrow Dial or Type $\square\square\rightarrow$ Enter \rightarrow **Demand Test** \rightarrow **System Erase** (Line 5, left button) twice \rightarrow **Yes**

7-2 Initializing and Testing the System

2 Use SPM and the system programming disk to perform the Restore procedure.

See System Programming and Maintenance (SPM) for instructions.

NOTE:

You must restore the system using the system programming (or backup) disk or memory card whenever a frigid start (System Erase) occurs.

Setting the Time and Date

If the Control Unit Diagram indicates that you should set the time and date, do so before you test the system.

Follow this procedure:

Menu→**SysProg**→**System**→**Date**→**Drop**→**Dial** current date→**Enter**

See System Programming if you need additional instructions.

Testing the System

Once you have initialized the system, it is ready for system acceptance testing. Perform the basic tests below to test trunks, telephones, and features.

If any equipment is not working properly, see Maintenance and *Troubleshooting* for troubleshooting instructions.

Testing MLX Telephones

This switch-based software test verifies that the LEDs, ringer, buttons, switchhook, and B-channel operation for MLX telephones are working correctly. You cannot run this test when the telephone is in programming, forced-idle, or maintenance mode. When an MLX telephone is in test mode, the system considers it busy and therefore not available for use.

If you hang up during any of these procedures, test mode ends automatically.

Keep the following in mind when using the speakerphone:

- If the **Mute** button is pressed before the **Speaker** button, the Mute LED cannot be turned off; it winks.
- The Mute and Speaker LEDs remain steady during test mode.
- The pressing of the **Mute** button is processed within the telephone.
- When the telephone test is originated from the **Speaker** button, every second press of the **Mute** button causes the Mute LED to flash off momentarily. Also, both the Mute and Speaker LEDs may occasionally remain on after disconnecting with the **Speaker** button.
- Press the fixed-feature buttons repeatedly to toggle the LEDs on and off.

To test the basic features of an MLX telephone, follow the steps below:

- 1 Pick up the handset of the telephone you are testing and push an ICOM button in Key or Behind Switch mode or an SA button in Hybrid/PBX mode.
- 2 When you hear dial tone, dial *DD to activate test mode.

You should hear a steady test tone over the handset and a ring burst over the speaker. The telephone's red and green LEDs should be on.

3 To test the line buttons, press any line button with two LEDs (red and green).

The diagnostic tone should stop, and the LEDs for that button should go off.

- 4 Press the same line button repeatedly to toggle between the green and red LEDs. For a QCC, the display should show the name of the feature programmed on the button.
- 5 To test a fixed-feature button with one LED, press the button.

The Feature and HFAI LEDs should turn off. The first press of the **Speaker** button should turn off the Mute LED. The second press of the **Speaker** button should turn off the Speaker LED.

6 To test the red Message light, press a fixed-feature button without an LED (such as Transfer, Conf., or Drop) or any dialpad button.

The Message light should turn off.

7 Hang up the handset to leave test mode.

Testing MLX Display Telephones

While the MLX display telephone is in test mode, follow the steps below to test the display buttons:

1 Press each fixed display button (Home, Menu, Inspct, and More).

The display should spell out these button labels.

2 Press the unlabeled display buttons.

The display should indicate **Display Button** n, where n is the number of the display button, 1 through 4.

Testing MLX Telephones with MFMs

You should test MLX telephones with MFMs for proper channel operation and test the MFM circuitry for the TTR, the ring generator, and the Message light.

To test an MLX telephone with an MFM installed and configured as a T/R adapter, follow the steps below:

- 1 Connect a working 2500-type single-line telephone with a Message light to the MFM adapter (the 2500 telephone also must have a mechanical ringer).
- 2 Pick up the handset and listen for dial tone. Dial *□7.

You should hear another dial tone.

3 Press any button.

This will deactivate the test tone.

4 Dial 123456789*0#. Press the switchhook quickly.

You should hear a confirmation tone.

5 Hang up.

The control unit should send a ring burst, and the Message light on the 2500 telephone should turn on.

6 Turn off the Message light.

Dial the appropriate feature code.

Testing Telephones for Dial Tone

To test for dial tone, follow the steps below:

1 Press an ICOM or SA button (depending on the mode of operation).

The red LED next to this button should go on.

2 Press the Speaker button.

The green LED next to **ICOM** or **SA** button should turn on; you should hear a dial tone, and the green LED next to the **Speaker** button should turn on.

3 Press the Speaker or ICOM or SA button again to disconnect intercom.

The green LEDs next to **ICOM** or **SA** and **Speaker** buttons should turn off, and the dial tone should stop. The red LED remains on in some cases.

Testing Telephones for Outside Dial Tone

To test for outside line dial tone, follow the steps below:

1 Without lifting the handset, press one of the outside line buttons.

The red LED next to this button should turn on.

2 Pick up the handset or press the Speaker button.

The green LED next to the line button should turn on, and you should hear a dial tone.

3 Hang up and repeat Steps 1 and 2 for each line button on the telephone.

Testing Analog Multiline and Single-Line Telephones

To test the basic operation of analog multiline and single-line telephones, follow the steps below:

- 1 If you are testing a multiline telephone, press an ICOM or SA button.
- 2 Pick up the handset and wait for dial tone.
- 3 Dial the extension number of another working telephone.

You should hear ringback on your telephone and ringing at the called telephone.

- 4 At the called telephone, have someone pick up the handset; verify that you have good two-way communication.
- 5 At both telephones, hang up.

If you are testing a single-line telephone, this is the end of the procedure.

6 If you are testing a multiline telephone, press an outside line or SA

In Hybrid/PBX mode, make sure that the destination telephone has a personal line or is a DLC operator.

- a Pick up the handset and wait for the dial tone.
- b If you pressed an **SA** button, dial the dial-out code.
- c Dial the destination telephone.
 - You should hear ringback on your telephone and ringing at the destination telephone.
- d Have someone pick up the handset at the destination telephone; verify that you have good two-way communication.
- e At both telephones, hang up.
- 7 If the extension is toll-restricted, place a toll call.

You should hear a reorder tone.

Testing Ground-Start and Loop-Start Trunks (Hybrid/PBX Systems Only)

To test the GS and LS outgoing and incoming trunks at a telephone, follow the steps below:

1 Dial *D3 followed by the trunk ID number (01 through 80).

You should hear dial tone for a working trunk, a reorder tone for a DID trunk or an invalid trunk number, or a busy tone if the trunk is in use.

NOTE:

Dialing *D3 on a single-line telephone works only if telephone has a touchtone dialpad and the trunk accepts touch-tone dialing.

- 2 Repeat Step 1 for all outgoing trunks.
- 3 Dial an incoming trunk on the system.
- 4 Have someone answer the call at another telephone; verify that you have good two-way communication.
- 5 Repeat Steps 3 and 4 for all incoming trunks.
- 6 Hang up to exit test mode.

Testing DID Trunks

To test DID trunks, follow the steps below:

- 1 Have someone at the central office check all DID trunks, or have someone call from the outside to check each DID trunk.
- 2 When the first trunk rings, answer it.
- 3 Instruct the caller to put the call on hold or put down the handset while making the next call.
- 4 When the next trunk rings, put the previous call on hold and repeat this procedure until all eight DID trunks have been connected successfully.
- 5 When all trunks are connected with good communication, disconnect each call and have the caller do the same.

Testing Tie Trunks

Before you test tie trunks, make sure that the tie trunks for the system are connected and properly programmed. Have someone at the far end ready to place and receive calls throughout the testing procedures listed below.

The tie trunk testing procedures in this section are as follows:

- Automatic-start two-way (both incoming and outgoing)
- Automatic-start incoming only
- Automatic-start outgoing only
- Dial-repeating two-way (both incoming and outgoing)
- Dial-repeating incoming only
- Dial-repeating outgoing only

NOTE:

Dial-repeating tie trunks are also called wink-, immediate-, and delay-type tie trunks. These terms are used in system programming to describe the type of signaling used on the trunk.

Testing Two-Way Automatic-Start Tie Trunks

For two-way automatic-start tie trunks, perform both the incoming and outgoing automatic-start tie trunk tests.

NOTE:

Before testing outgoing or two-way automatic-start tie trunks, have someone ready to take your call at the receiving telephone.

Testing Incoming Automatic-Start Tie Trunks

Perform this test for automatic-start tie trunks that are two-way or incoming only. If you are testing two-way automatic-start tie trunks, perform the outgoing test as well.

To test incoming automatic-start tie-trunks, follow the steps below:

1 At the far-end tie-trunk site, have someone pick up the handset and dial a tie trunk assigned to a button on your telephone.

Your telephone should ring, and the LEDs next to the tie-trunk button should respond as follows: the red LED should turn on, and the green LED should flash.

2 Pick up your handset and verify that you have good two-way communication.

The green LED should change from flashing to steady.

3 At both telephones, hang up.

The green LED should turn off, the red LED should turn off, and another red LED may turn on.

4 Repeat Steps 1 through 3 for all incoming and two-way automatic-start tie trunks.

Testing Outgoing Automatic-Start Tie Trunks

Perform this test for automatic-start tie trunks that are two-way or outgoing only. If you are testing two-way automatic-start tie trunks, perform the incoming test as well.

To test outgoing automatic-start tie trunks, follow the steps below:

1 At any telephone that has access to an automatic-start tie trunk, press the first tie-trunk button.

The red LED next to the tie-trunk button just pressed turns on.

2 Pick up the handset. (In Hybrid/PBX systems with pooled tie trunks, press an SA button and dial the pool dial-out code.)

The green LED next to the selected button turns on, and you hear ringing.

3 When the person answers, verify that you have good two-way communication and hang up.

The green LED should turn off, the red LED should turn off, and another red LED may turn on.

4 Repeat Steps 1 through 3 for each outgoing and two-way automatic-start tie trunk.

Testing Two-Way Dial-Repeating Tie Trunks

For two-way dial-repeating tie trunks, perform both the incoming and outgoing dial-repeating tie trunk tests.

Testing Incoming Dial-Repeating Tie Trunks

Perform this test for dial-repeating tie trunks that are two-way or incoming only. If you are testing two-way dial-repeating tie trunks, perform the outgoing test as well.

To test incoming dial-repeating tie trunks, follow the steps below:

1 Have the person at the far end place a dial-repeating call to your telephone by dialing the proper tie-trunk number.

Your telephone rings, and the green LED next to ICOM (or SA for Hybrid/PBX systems) flashes.

2 Pick up the handset.

The red LED next to the ringing button turns on, and the green LED changes from flashing to steady.

- 3 Verify that you have good two-way communication and hang up.
 - The green LED should turn off, the red LED should turn off, and another red LED may turn on.
- Repeat Steps 1 through 3 for each incoming or two-way dial-repeating tie trunk.

Testing Outgoing Dial-Repeating Tie Trunks

Perform this test for dial-repeating tie trunks that are two-way or outgoing only. If you are testing dial-repeating two-way tie trunks, perform the incoming test as well.

To test outgoing dial-repeating tie trunks, follow the steps below:

1 At any telephone that has access to a dial-repeating tie trunk, press the first tie-trunk button.

The red LED next to the pressed tie-trunk button lights.

2 Pick up the handset. (In Hybrid/PBX systems with pooled tie trunks, press an SA button and dial the pool dial-out code.)

The green LED next to the selected button lights.

3 Dial the tie-trunk number of the extension where someone is waiting for your call.

You should hear ringing.

4 When the person answers, verify that you have good two-way communication, then hang up.

The green LED should turn off, the red LED should turn off, and another red LED may turn on.

5 Repeat Steps 1 through 4 for each outgoing or two-way dial-repeating tie trunk.

Testing BRI Trunks

Perform the testing described in "800 NI-BRI Module Problems" in Chapter 4 of Maintenance and Troubleshooting.

Testing Selected System Features

This section provides procedures to test the following system features:

- Automatic Route Selection (ARS). For Hybrid/PBX mode only. Use the same test for Idle Line Preference, a similar feature used in Key mode only. Use the same test for Station Message Detail Recording (SMDR) as explained in the test procedure. Refer to Planning Forms 3e, 3f, and 3g for ARS information.
- **Group Calling.** Use the same test for the Listed Directory Number (the QCC queue), which is for Hybrid/PBX only. Use the same test for Group Paging. Refer to Planning Form 7d for Group Calling information.
- **Coverage.** Refer to Planning Form 7c for Group Coverage information.

If any feature does not work properly, check system programming. You can run these tests easily from an MLX telephone or an analog multiline telephone.

ARS and SMDR Tests

If ARS patterns have been programmed, you can test routing by placing toll calls and checking the trunk indicated on the SMDR printout. Check the report to see which line/trunk the system selected for an outgoing call.

The length of each toll call must be equal to or greater than the minimum SMDR recording time. Otherwise, SMDR will not recognize the attempt as a call. To determine the minimum SMDR recording time, check with the customer's system manager (the factory setting is 40 seconds).

To verify ARS patterns, follow the steps below:

- 1 In Hybrid/PBX mode, determine which toll numbers to call by examining the system manager's ARS patterns.
- 2 At any multiline telephone, pick up the handset and dial the ARS access code and one of the toll numbers.

Make sure the call is completed before hanging up.

- 3 Repeat Step 2 for additional toll numbers.
- 4 At the SMDR printer, verify that the call was made on the correct trunk group and check the number of seconds before the call is reported on the SMDR printout.

If there are errors, check system programming.

Group Calling Test

To test Group Calling features, follow the steps below:

1 Make sure that each group member is logged into the group.

To log in, each member dials #44.

2 At any telephone, pick up the handset and dial the trunk that is programmed to ring for a particular calling group.

- 3 At the ringing telephone, have someone pick up the handset and verify that you have good two-way communication.
- 4 Repeat Steps 2 and 3 for each calling group.
- 5 Make additional calls to check each member of each calling group.
- 6 At any telephone, pick up the handset and dial the group extension number.
- 7 Test the calling group delay announcement (if provided) for each group.
 - a Make the group busy or have all members log out of the group (by dialing #*44 at each group extension).
 - b Repeat Step 2.
 - c After listening to the delay announcement, hang up.
 - d Repeat these steps for each group.
- 8 At the ringing telephone, have someone pick up the handset and verify that you have good two-way communication.

System Speed Dial Test

To test System Speed Dial numbers, follow the steps below:

- 1 Find out which numbers have been programmed for System Speed Dial.
 - See the system manager or use Form 10b as a reference for System Speed Dial numbers.
- 2 From the test telephone, pick up the handset and dial a System Speed Dial code.

Verify that you have good two-way communication and that the correct party was reached.

Coverage Test

To verify that coverage is in effect, follow the steps below:

- 1 Have someone call the covered telephone.
- 2 Count the number of rings at the covered telephone before the covering telephone starts ringing.

This should be the same as the programmed number of rings.

7–14 Initializing and Testing the System

- 3 Pick up the handset at the covering telephone and verify that you have good two-way communication.
- 4 Hang up the handset at the covering telephone.
- 5 Check both Individual and Group Coverage.

Testing the DSS

At each Direct Station Selector (DSS), check that all lights are operational. Then use the DSS to call a telephone in the system. Test the **Page** buttons on the DSS.

Testing Night Service

To test the Night Service feature on the system operator console, follow the steps below:

1 At the system operator console, press the Night Service button.

If Night Service with Outward Restriction is programmed, you must also enter the password. (You can also activate Night Service on a DLC by pressing the **Feature** button and dialing **39**.)

The Night Service LED turns on.

- 2 Pick up the handset and press a button for an outside trunk.
- 3 Dial the outside number that reaches an operator console that is programmed to receive Night Service coverage.
- 4 Verify that the telephones assigned to the Night Service group are ringing.
- 5 Have someone pick up the handset at a telephone in the Night Service

Verify that you have good two-way communication.

- 6 At both telephones, hang up.
- 7 Repeat Steps 2 through 6 for each operator console that is programmed to receive Night Service coverage.

- 8 Test telephones that are programmed for Night Service with Outward Restriction.
 - a Pick up a handset on a restricted telephone and verify that outside calls are not allowed.
 - b Using the password, make an outside call.
 - c Hang up the handset.
 - d Press the **Recall** button and dial the password. (On an MLX telephone without a programmed Recall button, press the **Feature** button and dial **775** and the password before picking up the handset.)
 - e Pick up the handset and make an outside call.
 - f Verify that you have good two-way communication and hang up.
- 9 At the operator console, press the Night Service button again. If you used a password in Step 1, enter the password again. Verify that the Night Service LED turns off.

Testing the Dictation System

If dictation equipment has not been installed, skip this test. Place a call to verify that you can access the dictation system.

To access the dictation system, follow the steps below:

- 1 At the test telephone, pick up the handset.
- 2 Dial the access code and the number associated with the dictation equipment.
- 3 Verify that the ready tone is transmitted.
- 4 Test the transmission in both directions; make a recording and play it back.
- 5 Hang up.

Testing the Paging System

To test the paging system, follow the steps below:

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1 Pick up the handset at the test telephone and dial the number for a particular zone.

If ZoneMate 9 paging equipment is in use with PagePac 20, get an acknowledge tone first and then dial the zone code to make an announcement. You may hear a confirmation tone.

2 Make an announcement into the handset.

You should hear the announcement over the loudspeaker(s).

- 3 Hang up.
- 4 Repeat Steps 1 through 3 for all paging zones.

Testing Music On Hold

To verify that music is provided to outside callers placed on hold, follow the steps below. Inside callers do not hear Music On Hold.

- 1 Pick up the handset at the test telephone.
- 2 Dial the central office trunk access code and the system's published directory number; or, if you are using a DID trunk, dial any extension.
- 3 At the destination extension, answer the incoming call.
- 4 At the destination extension, press the Hold button.

The line button's green LED should flash.

- 5 Verify that music is heard at the destination extension and adjust the volume as required.
- 6 Hang up.

NOTE:

If the customer uses equipment that rebroadcasts music or other copyrighted materials, the customer may be required to obtain a copyright license and pay license fees from a third party such as the American Society of Composers, Artists, and Producers (ASCAP) or Broadcast Music Incorporated (BMI). Or the customer can purchase a Magic on Hold system, which does not require the customer to obtain such a license, from an AT&T representative.

Testing the Power Failure Transfer Jacks

To test a power failure transfer (PFT) jack for proper operation, the outside line numbers to the module's line/trunk jacks must be assigned and the trunks must be operational. A PFT telephone on a GS line must have a GS button attached to the telephone. See Figure 7–1.

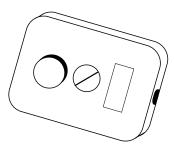


Figure 7–1. Ground-Start Button

To test PFT jacks, follow the steps below:

- 1 Plug a touch-tone or rotary dial telephone into a PFT jack.
- 2 Note the outside line number assigned to the lowest line/trunk jack on the module and be sure that the outside trunk is connected to the system.
- 3 Turn off power to the control unit.

Follow the procedure in "Powering Down the System" in Chapter 9.

- 4 If the telephone is connected to a GS trunk, push the GS button attached to the telephone.
- 5 Pick up the handset on the touch-tone or rotary dial telephone.

You should hear a dial tone.

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- If the telephone is connected to a GS trunk, push the GS button attached to the telephone again.
- 7 Dial an outside number—make sure someone can answer the call.
- 8 After the call is answered and you have verified that you have good twoway communication, tell the person the telephone number assigned to the outside line bridged by the PFT jack to which you are connected.

This is the number noted in Step 2.

- 9 Have that person call the number after you hang up. Your phone should ring after the caller completes dialing the number.
- 10 Answer the phone and verify that you have good two-way communication. Hang up.
- 11 Repeat Steps 1 through 2 and 4 through 10 to test all PFT jacks.
- 12 Turn the power back on.

Follow the procedure in "Powering Up the System" in Chapter 2.

Testing Touch-Tone Receivers

The 400, 400 GS/LS and 016 T/R modules each provide four touch-tone receivers (TTRs). The 008 OPT module, 800 DID module, 012 T/R, and 800 GS/LS-ID modules each provide two TTRs.

To test TTRs, follow the steps below:

- 1 Pick up the handset of a touch-tone single-line telephone that is connected to a 012, 016, or 008 OPT module.
- 2 Dial *□4 and the 2-digit number (starting with 01) of the TTR that you want to test.

You should hear a busy tone if the receiver is in use, or a reorder tone if you misdialed or addressed a receiver not in your system. (This can happen if you dialed **D7** and your system has only a 012 module and one 400 module, for a total of six TTRs.)

3 If you hear reorder tone, try again.

If you hear dial tone after one to three seconds of silence, proceed with this

4 Dial 123456789*0#.

You should hear a dual-tone multifrequency (DTMF) signal as each button is pressed. When you finish dialing, you should hear a 3-beep confirmation tone.

5 Repeat the test for each TTR.

Installing the Control Unit's Housing

After you complete system acceptance testing and if you are confident that the system is completely installed, you can install the control unit's housing.

NOTE:

Beginning with Release 2.1 or later, the control unit covers are identical to those on the MERLIN II Communications System. If you need to install control unit covers on a system prior to Release 2.1, see Chapter 9, "Upgrading the System."

Installing the Top Cover

To install the top cover, see Figure 7–2 and follow these steps:

- Be sure the cords have been pressed through the wire managers at the base of the modules.
- 2 Hold the top cover with the hooks facing you.
- 3 Engage the tabs at the rear of the top cover with the carrier.
- 4 Lower the top cover so the legs lock into the vents on the module.

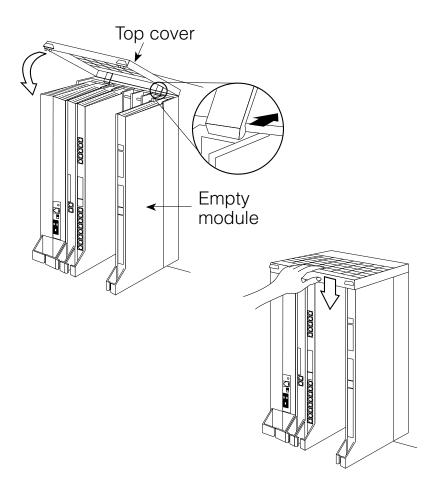


Figure 7–2. Installing the Control Unit Top Cover

Installing the Front Cover

To install the front cover, see Figure 7–3 and follow these steps:

- 1 Hook the top of the front cover onto the top cover.
- 2 Push down on the bottom of the front cover until it locks securely on the base of the wire manager on the modules.

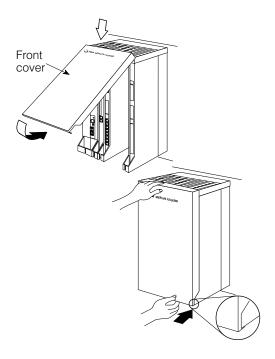


Figure 7–3. Installing the Control Unit Front Cover

7–22 Initializing and Testing the System

Installing Applications

This chapter provides installation guidelines and documentation references for the applications that the system supports. You can install the following software and hardware products on the system. See the documentation packaged with each application for detailed installation instructions.

- Stand-alone products
 - Call Accounting Terminal (CAT)
 - CAT Business (CAT/B)
 - CAT Hospitality (CAT/H)
 - MERLIN PFC Telephone
 - AT&T Attendant™
 - MERLIN MAIL™
 - CONVERSANT®
- DOS-based products
 - Call Accounting System (CAS) for the MERLIN LEGEND Communications System
 - CAS Plus V3 Business
 - □ HackerTracker™ System for CAS Plus V3
 - CAS for Windows

- Call Management System (CMS)
- PassageWay™ Direct Connect Solution for Microsoft® Windows
- System Programming and Maintenance (SPM)
- Integrated Solution III (IS III) UNIX System-based products
 - AUDIX Voice Power™ IS III
 - Call Accounting System (IS CAS)
 - System Programming and Maintenance (SPM) IS III
 - Fax Attendant System™ IS III



A Security Alert:

Products that are connected through a voice port must be properly restricted to prevent toll fraud. See Appendix A following Maintenance and Troubleshooting for more information.

Voice Messaging Systems and **Touch-Tone Receivers**

The following applications are voice messaging systems (VMSs):

- MERLIN MAIL Voice Messaging System
- AT&T Attendant
- AUDIX Voice Power IS III
- Automated Document Delivery System (ADDS)

Considerations

You must connect applications that use mode codes to integrated VMI ports. Applications that do not use mode codes, such as AT&T Attendant, connect to generic VMI ports. The T/R ports on 012 or 016 basic telephone modules are programmed as either generic VMI or integrated VMI.

A VMS requires a certain number of touch-tone receivers (TTRs), depending on the number of VMS ports—see Table 8–1. The following modules supply 2 TTRs: 012, 400, 400 GS/LS/TTR, and 008 OPT (but the 008 OPT module does not support VMS applications). The 016 module supplies 4 TTRs.

Table 8–1. TTRs Required by VMS

| No. of VMS Ports | No. of TTRs Required | |
|---------------------|-------------------------|--|
| 1 | 1 | |
| 2 | 1 | |
| 3 | 2 | |
| 4 | 2 | |
| 6 | 3 | |
| 8 | 4 | |
| 12 | 6 | |

Automated Document Delivery System

Automated Document Delivery System (ADDS) is a computer-based system for faxing documents. ADDS stores the documents in a database and automatically faxes them on request 24 hours a day.

Prompts guide a caller using a touch-tone telephone through the process of selecting a document and indicating the fax number where he or she will receive the information. The caller then receives the requested information in minutes.

Considerations

Using one line for fax transmission limits ADDS to approximately 100 calls per day. Businesses anticipating more than 100 calls per day may need more than one system to handle the call volume efficiently.

Use ADDS in a two-line configuration to maximize performance and minimize busy signals. ADDS can work behind an automated attendant. ADDS does not function with an MFM.

Hardware Requirements

To set up ADDS, a business must have the following:

- Automated Document Delivery System unit
- Touch-tone telephone
- Group III (G3) fax machine with an integrated handset

To request and receive information, a caller must have a touch-tone telephone and a Group III (G3) fax machine.

For backup, one of the following is required:

- AT&T 705 MT Multitasking Terminal
- AT&T 6386/SX WGS (or compatible) with ProComm Plus® software.

See the AT&T Automated Document Delivery System (ADDS) Administrator's Guide for installation instructions.

Call Accounting System

Call Accounting System (CAS) is ideal for medium and large companies that want to manage telephone usage and control costs by tracking calls placed from and received by the system.

NOTE:

CAS is also available as part of the UNIX System-based Integrated Solution II (IS II) and Integrated Solution III (IS III) software applications.

CAS runs on an approved DOS PC. Two versions of the product are offered: CAS for Windows and CAS Plus V3.

HackerTracker System for CAS Plus V3 is a software enhancement designed to help detect fraudulent use of the communication system. The HackerTracker software can detect abnormal calling activity by monitoring facilities and account code usage. It then logs the activity and issues a realtime alarm.

Considerations

You can connect only one CAS to the system. CAS operates on a dedicated PC running DOS.

Hardware and Software Requirements

A typical CAS Plus V3 system consists of the following:

- An approved DOS PC with:
 - 640K RAM
 - Hard disk drive with at least 3 MB of available space for the application software
 - Parallel printer output
 - Serial SMDR input
- One parallel printer
- D8W cord and 355AF adapter connecting the SMDR port on the communications system to the COM1 serial port on the PC
- DOS version 3.3 or later
- CAS software

To use CAS for Windows with the system, the following components are recommended:

- For a single-site system, an NCR 3315 PC (20-MHz 386) with 6 MB of RAM and a 120-MB hard disk
- For a multi-site system, an NCR 3332 PC (66-MHz 486) with 16 MB of RAM and a 340-MB hard disk
 - MS-DOS 5.0 or higher
 - Windows 3.1 or later
- VGA color monitor
- Bus mouse
- For a single-site system, a 525-MB tape drive
- For a multi-site system, a 120-MB tape drive
- Okidata® Microline 184T dot matrix or OL830 laser parallel printer

For communications using CAS for Windows, the following components are recommended:

- For a single-site system, one parallel port and two built-in serial ports (DB9 for direct switch connection and DB25 for other connections)
- For a multi-site system, one parallel port and a four-port Equinox Mark-IV board with four RJ45 connections for direct switch hookup
- For remote diagnostics, a Remote Maintenance Board
- If a modem is used, an AT&T COMSPHERE 3830 or compatible
- If you are using the 9-pin port on your PC for the direct switch connection, you need a DB9-to-modular adapter
- An RJ45 modular cable to connect the PC's COM1 port with the control unit's SMDR port

A summary of the installation procedure is provided below:

- 1 Connect the hardware. See "Connecting a PC to the Control Unit" in Chapter 5.
- 2 Complete the CAS worksheets.

Make sure that they show all information you need on telephone lines and extensions, calling patterns and processing options, and departments and personnel.

- 3 Load and test DOS version 3.3 or later and CAS. If you are installing CAS for Windows, load and test DOS version 5.0 or later, Windows version 3.1 or later, and CAS.
- 4 Use the planning worksheets to program the software to meet the needs of the customer.

CAS Documentation

Call Accounting System Plus V3 Installation

Call Accounting System Plus V3 Administration and Operation

Call Accounting System for Windows Installation, Administration, and Operation

Call Accounting Terminal

Call Accounting Terminal (CAT) Plus is a stand-alone application that provides accurate and flexible call accounting at a low cost. Two versions of this product are offered: CAT Plus Hospitality for hotels and health care facilities and CAT Plus Business for other types of businesses. For more information, see "Connecting a Printer to a Control Unit" in Chapter 5.

Considerations

You can connect only one CAT to the system. You must use a serial printer such as the CAT printer. You must locate the CAT Plus within the distances noted below:

- Control unit
 - 14 ft. (4.27 m) direct connection
 - 1000 ft. (305 m) using building wiring
- Serial printer, 50 ft. (15.2 m)
- Power supply-grounded wall outlet, 4 ft. (1.22 m)

Hardware Requirements

The following hardware is required for CAT installation:

- Call Accounting Terminal, CAT Plus
- Serial printer (AT&T CAT Printer is recommended) connected by a Z200A EMI cable to the PRINTER jack of the CAT
- D8W cord and 355AF adapter connecting the SMDR port on the communications system to the SMDR jack of the CAT

A summary of the installation procedure is provided below:

- 1 Before connecting the CAT, set the 10 CAT switches to establish the speed or baud rate for the CAT and its associated printer.
- 2 Connect the control unit, CAT, printer, and power supply. See Chapter 5, "Connecting a Printer to the Control Unit." Do not use an outlet that is controlled by a wall switch.
- 3 Test the CAT Plus, following the instructions provided in the documentation packaged with the application.

CAT Documentation

Call Accounting Terminal, CAT Plus V3 for Business Installation and Use

Call Accounting Terminal, CAT Plus V3 for Hospitality Installation and Use

Call Management System

Call Management System (CMS) is a DOS-based software application that simulates the actions of a system operator by answering calls and distributing them to individual telephones.

Considerations

You cannot connect a CMS in Behind Switch mode.

If a business requires more than 28 lines or employs more than 28 agents, you can install up to two CMSs on a system to handle a second set of lines.

CMS operates on a dedicated PC with DOS, version 3.3 or higher.

The CMS supervisor's console is a Direct-Line Console.

CMS agents can use any MLX or analog multiline telephone that the system supports.

You must connect agent telephones to the first 58 telephone jacks on the control unit. (CMS allows only a 2-digit method to specify an extension number; jacks 59 to 144 are designated by 4 digits.)

Because CMS is compatible only with 2-digit dialing, do not use flexible numbering on any telephone associated with CMS.

The two CMS interface card ports on the PC must be connected to two analog multiline telephone jacks on the same analog multiline telephone module; these jacks must be operator positions. If two operator position jacks are not available on the same module, another analog multiline telephone module must be installed in the control unit to provide these jacks.

CMS trunks can be loop-start, ground-start, T1 emulated ground-start, or Primary Rate Interface (PRI).

Up to four CMS external alerts can be used for agents and supervisors. For example, an alert sounds if the number of calls waiting to be answered nears a programmed threshold.

AT&T Attendant can be used to direct callers to the appropriate CMS group.

To play music for waiting callers, you must attach a Music On Hold (MOH) product that is compatible with an MOH coupler.

NOTE:

If the customer uses equipment that rebroadcasts music or other copyrighted materials, the customer may be required to obtain a copyright license from and pay license fees to a third party such as the American Society of Composers, Artists, and Producers (ASCAP) or Broadcast Music Incorporated (BMI). Or the customer can purchase a Magic-on-Hold system, which does not require that you obtain such a license, from AT&T.

Hardware and Software Requirements

The following hardware and software are required for CMS installation:

- An approved PC with 640K RAM, 3.5-inch floppy disk drive, and a 20-MB hard disk drive
- An approved monochrome or color monitor
- CMS interface card with two 14-ft. (4.27-m), 4-pair modular plug telephone cords and one 14-ft. (4.27-m) DIN connector cord for connection to Digital Announcement Unit.
- CMS software
- Digital Announcement Unit for CMS
- Parallel printer and cable to connect the printer to the PC
- Supervisor console (MERLIN II System Display Console)
- Agent telephones (any MLX or analog multiline telephones supported by the system)
- Two analog multiline modules (008 or 408); one to connect the two PC ports to the operator positions, and one to connect the CMS supervisor console
- DOS, version 3.3 or higher

See the CMS documentation for a list of optional hardware that you can use with CMS.

CMS comes with a hardware installation checklist and information on installing the CMS software, creating an agent directory, programming lines and groups, and testing and managing calls. The control unit permits the connection of two CMS applications, and each application can have one PC.

CMS Documentation

Call Management System (CMS) for the MERLIN LEGEND Communications System Installation and System Programming Guide

Call Management System for MERLIN LEGEND Communications System User's Quick Reference

Call Management System for MERLIN LEGEND Communications System Supervisor's Guide

Call Management System for MERLIN LEGEND Communications System Planning Guide and Forms

CONVERSANT

CONVERSANT is an entry-level voice response system that enables you to run integrated voice response (IVR) applications. CONVERSANT can automatically answer and route calls and execute telephone transactions. CONVERSANT consists of the hardware and software that supports transaction processing, data retrieval, and data entry using a touch-tone telephone connected to a public telephone network.



A Security Alert:

Products that are connected through a voice port must be properly restricted to prevent toll fraud. See Appendix A following Maintenance and Troubleshooting for more information.

Consideration

CONVERSANT supports a maximum of 24 channels of analog ports, or up to 6 IVP4 boards. In a co-resident environment, such as CONVERSANT and AUDIX Voice Power, the system supports a maximum of 16 channels. The number of channels assigned to AUDIX Voice Power can never exceed 12.

Hardware Requirements

The platform for CONVERSANT is the Master Controller III (Tower). The Master Controller III is a desktop 20 MHz, 486-SX PC with six available EISA bus slots (with the tape drive installed). It has 8 MB of RAM. It includes a system unit, a monitor, and a keyboard. The Master Controller III has the following components:

- 500-MB fixed disk drive
- 250-MB tape drive
- 3.5-inch floppy disk drive
- Two serial ports and one parallel port are integrated on the main board with connectors on the back panel of the system unit. A diskette drive controller and fixed disk drive interface also are integrated on the main board.
- A Video Graphics Array (VGA) video display controller and a tape drive controller are provided on separate add-in boards.
- AT&T UNIX System V version 3.2.2

CONVERSANT Intro Documentation

CONVERSANT Intro Application Support Software Installation Guide

CONVERSANT Intro Application Support Software User's Guide

Integrated Solution III

Integrated Solution III (IS III) is a complete package of UNIX System-based voice processing and call analysis software that helps to manage telephone usage and costs. IS III offers a single interface and can include:

- Call Accounting (IS CAS)
- AUDIX Voice Power IS III R 2.1.1
- System Programming and Maintenance (SPM) IS III Release 3.xx or higher
- Fax Attendant (FA)

The number of incoming lines and subscribers programmed for AUDIX Voice Power and the number of busy-hour calls determine how many voice channels are required for the customer's system.



A Security Alert:

Products that are connected through a voice port must be properly restricted to prevent toll fraud. See Appendix A following Maintenance and Troubleshooting for more information.

Considerations

IS III uses AT&T UNIX System V, Release 3.2.2.

For AUDIX Voice Power, program the loop-start ports for reliable far-end disconnect.

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For AUDIX Voice Power, you cannot use an 008 OPT module.

If IS III includes AUDIX Voice Power (or Fax Attendant) when users receive voice mail (or fax mail) messages, the Message LEDs on their telephones light (as long as a mailbox or fax mailbox has been assigned to each of those telephones).

The system may need more touch-tone receivers if:

- Single-line telephone users do not get dial tone.
- AUDIX Voice Power fails to transfer calls.
- Calls fail to ring or go to coverage prematurely.
- Message-waiting lights fail to light.

CAS IS III uses the call information provided by the system's built-in SMDR feature to process calls.

SPM IS III reports can be printed out or can be written to a disk (hard or floppy).

SPM IS III reports should not be printed while the system is handling more than 100 calls per hour.

Only the CAS IS III and the SPM IS III applications can be connected to a system operating in Behind Switch mode.

Hardware Requirements

The Master Controller II+ (Desktop) and the Master Controller III (Tower) are the PC platforms for IS III. The Master Controller II+ is a desktop 20-MHz, 386-SX PC with three available AT bus slots (with the tape drive installed). It has 8 MB of RAM memory, either a 100-MB or a 200-MB hard disk drive, 3.5-inch floppy drive, and a 125-MB streaming tape drive.

The Master Controller III is a tower 20-MHz 486-SX PC with six available EISA bus slots (with the tape drive installed). It has 8 MB of RAM memory, either 200- or 500-MB hard disk drive, and a 250-MB streaming tape drive.

The following hardware is also required:

- A 355AF adapter for connecting the Master Controller to the serial port on the control unit if they are within 50 ft. (15.2 m) of each other and are on the same AC branch circuit
- ADUs for connecting the Master Controller to the serial port on the control unit, if they are not within 50 ft. (15.2 m) of each other and/or they are not on the same AC branch circuit
- Any additional hardware required by the individual applications included in IS III, including the cables and adapters for connecting the applications to the system
- IVP4 boards or IVP6 cards for AUDIX Voice Power and FAX Attendant
- 012 or 016 basic telephone module to provide the tip/ring interface for AUDIX Voice Power
- TR114 boards for FAX Attendant

A summary of the installation procedure is provided below:

- 1 Set up the equipment and identify the hardware for IS III.
- 2 Connect the hardware as shown in the instructions.
- 3 Install the software and test the IS III application.

If a voice application is installed, you will need two 125-MB tape cartridges for system backup.

For more information, consult *Integrated Solution III Installation and Maintenance Guide.*

AT&T Attendant

AT&T Attendant is a stand-alone application that provides operator-like services through the use of prerecorded messages and electronic switching.



A Security Alert:

Products that are connected through a voice port must be properly restricted to prevent toll fraud. See Appendix A following Maintenance and Troubleshooting for more information.

Considerations

You cannot connect AT&T Attendant to a system that operates in Behind Switch mode.

You cannot connect AT&T Attendant to a system that has an AUDIX application or a voice mail system installed.

You can connect a maximum of four Attendants to the system.

You should program all lines to AT&T Attendant for reliable far-end disconnect.

The system may need more touch-tone receivers if:

- Single-line telephone users do not get a dial tone.
- AT&T Attendant fails to transfer calls.
- Calls fail to ring or go to coverage prematurely.

When Attendant is set up for both daytime and after-hours operation, the time on each Attendant's clock must match the system clock so that the system recognizes the end of the business day.

Hardware Requirements

AT&T Attendant requires connection to an 012 or 016 basic telephone module. You can use up to eight jacks on an 012 basic telephone module or up to 16 jacks on an 016 basic telephone module for AT&T Attendants.

If you use all eight jacks on an 012 module for AT&T Attendant, you cannot connect any other devices to the module. When using fewer than eight jacks on the 012 module, you can use the remaining jacks for tip/ring devices.

The following hardware is also required:

- AT&T Attendant unit and cords
- Some AC power strips may be needed, since the Attendant is powered by wall-mounted transformers (10 V AC).
- Powering and grounding procedures must follow those established for T/R telephones that require auxiliary power.

For more information, consult AT&T Attendant Installer's Guide.

MERLIN MAIL

MERLIN MAIL Voice Messaging System provides the following integrated call management services:

- Automated Attendant
- Call answering
- Voice-mail



A Security Alert:

Products that are connected through a voice port must be properly restricted to prevent toll fraud. See Appendix A following Maintenance and Troubleshooting for more information.

The number of incoming trunks and subscribers programmed for Automated Attendant service and the number of busy-hour calls determine how many MERLIN MAIL Voice Messaging System jacks are required for the user's system. See Table 8-2.

Table 8-2. MERLIN MAIL Ports Required

| Number of Jacks Required | 2 | 4 |
|--|---------|----------|
| Incoming Trunks | 1 to 6 | 7 to 18 |
| Number of Subscribers or Busy-Hour Calls | 1 to 20 | 21 to 60 |

Considerations

You cannot connect MERLIN MAIL Voice Messaging System to a system operating in Behind Switch mode.

MERLIN MAIL Voice Messaging System is available in 2-port and 4-port configurations. Both models have four hours of message storage capacity.

You can use up to eight jacks on an 012 basic telephone module or up to 16 jacks on an 016 basic telephone module for MERLIN MAIL.

If you use all eight jacks on an 012 module for MERLIN MAIL, you cannot connect any other devices to the module. When using fewer than eight jacks on the 012 module, you can use the remaining jacks for tip/ring devices.

When a mailbox user receives voice mail messages, the Message LEDs on his or her telephone is on, provided that a physical telephone has been assigned to that mailbox.

Trunks to be answered by MERLIN MAIL should be programmed for reliable far-end disconnect.

Callers who dial from rotary telephones cannot use MERLIN MAIL features.

The system may need more touch-tone receivers if:

- Single-line telephone users do not get a dial tone.
- MERLIN MAIL fails to transfer calls.
- Calls fail to ring or go to coverage prematurely.
- Message-waiting lights fail to light.

MERLIN MAIL and AT&T Attendant should not be used on the same system.

Programming of MERLIN MAIL is through a touch-tone interface.

MERLIN MAIL has an EIA-232-D serial port and an external modem to support remote diagnostics.

You cannot use the first four logical IDs on a 008 OPT module to physically connect telephone equipment; however, you can use the extension numbers of these logical IDs for phantom extensions.

Additional touch-tone receivers (TTRs) may be needed for the 012 or 016 module to handle a large number of voice connections.

The MERLIN MAIL unit can be desk- or wall-mounted and should be placed in an area with low humidity and proper ventilation.

Follow the power and ground procedures for T/R telephones that require auxiliary power.

Hardware Requirements

The following hardware is required for MERLIN MAIL installation:

- MERLIN MAIL Voice Messaging System unit and power cords
- Remote maintenance device (with a wall-mount transformer)

- Modem cable with a 9-pin connector at one end and a 25-pin connector at the other end to connect the remote maintenance device to the serial port on the MERLIN MAIL Voice Messaging System unit
- D4BU modular cords (two for a 2-port system or four for a 4-port system, plus one for the remote maintenance device)
- 012 or 016 basic telephone module

For more information, consult MERLIN MAIL Voice Messaging System for the MERLIN LEGEND Communications System, Installation, System Programming, and Maintenance.

MERLIN PFC

The MERLIN PFC (Phone-Fax-Copier) telephone is a 34-button display telephone with a built-in fax and personal copier that provides the convenience of a fax machine and personal copier in one compact unit. The MERLIN PFC allows the user to make and receive inside and outside calls using the built-in speakerphone, and to send and receive faxes or make quick copies while using the telephone.

Considerations

The fax machine component of the MERLIN PFC telephone does not transmit date, time, and fax number.

In Behind Switch mode, a dedicated fax line for incoming fax calls is also required; in Hybrid/PBX or Key mode, the system can have either a dedicated fax line or Direct Inward Dialing (DID).

You cannot install the MERLIN PFC telephone outside a building.

You must remove all button assignments except the one for the fax line from the fax extension.

You should remove the Voice Announce feature from the fax extension.

If the dedicated fax line is shared for outgoing calls only, you must program the Ringing option to No Ring at every extension except the MERLIN PFC fax extension.

The MERLIN PFC can operate in Hybrid/PBX mode, Behind Switch mode, or in Key mode. The following sections list differences in operation between the two modes.

Hybrid/PBX and Key Modes

The dedicated fax line for incoming fax calls from the central office must be connected to a line jack on the control unit, and the line cannot be assigned to a pool.

If DID is used, a DID number must be assigned to the fax extension.

If a dedicated private line is used, assign a fax line to the voice extension.

No lines or pools can be programmed to the fax extension. At the fax extension, the dedicated fax line should be programmed to Immediate Ring and any other lines should be programmed to No Ring.

Behind Switch Mode

The dedicated fax line should be programmed to the MERLIN PFC fax extension.

The dedicated fax line should be assigned as a secondary (no ring) line at the voice extension.

Hardware Requirements

The MERLIN PFC telephone requires two analog ports: one for the voice line and one for the fax line.

The telephone wiring between the control unit and the MERLIN PFC telephone must be installed in the same building.

For more information, consult MERLIN PFC Telephone Phone-Fax-Copier Installation and Maintenance Guide.

PassageWay Direct Connect Solution

PassageWay Direct Connect Solution is a collection of five software applications that provide an interface between an approved DOS PC and the system through an MLX-28D, MLX-20L, or MLX-10DP telephone:

- **AT&TCall.** A card file application that enables a user to maintain names, addresses, telephone numbers and other information.
- AT&TSet. A telephone programming application that enables users to program telephone features for their MLX-28D, MLX-20L, or MLX-10DP telephones from the PC. Multiple button programming files can be created, saved, and exchanged with other users.
- **Log Viewer.** An application that enables users to access information from the call log, which stores a record of every call made while using AT&TCall.
- **AT&TConnect.** Management software that provides the basis for all the other PassageWay applications. AT&TConnect also provides autodialing using the command set used by most modems.

■ AT&T Buzz. An application that enables users to manage incoming calls (answer, hold, or drop) and view the calling party number (Caller ID) for each incoming call at their telephones.

Considerations

MERLIN LEGEND Communications System Release 3.0 or later is required for caller identification display capabilities.

Local telephone power is required if the MLX telephone is not wired with 4-pair extension wiring or if you use a MLX-20L or MLX-28D with a Direct Station Selector (DSS).

The MLX telephone must have Idle Line Preference activated.

The Automatic Line Selection on the MLX telephone should be programmed so that Idle Line Preference is on an **ICOM** button (in Key and Behind Switch modes) or an **SA** button (Hybrid/PBX mode).

Hardware Requirements

The following hardware is required:

- An approved DOS PC with the following
 - An 80286 or higher processor (80386 or higher recommended)
 - An available serial port
 - A minimum of 2 MB of RAM
 - A 3.5-inch, 1.44-MB, high-density drive or a 5.25-inch, 1.2-MB, high-density drive
 - A hard disk drive with 2 MB of space available
 - A Windows-compatible color video monitor

- A Windows-compatible pointing device (a mouse or trackball is recommended)
- Microsoft Windows, version 3.1 or later
- PassageWay adapter
- 9-pin to 25-pin adapter for 9-pin serial ports
- 4-ft., 4-pair, keyed modular telephone cord (D8AC)

For more information, consult PassageWay Solution User's Guide.

System Programming and Maintenance (SPM)

System Programming and Maintenance (SPM) is a DOS-based software application that allows you to use a PC to program and maintain the system. SPM performs the same functions as an MLX-20L telephone used as a system programming console and has some additional features, such as the ability to back up and restore files and print reports. The PC display shows the same button and screen layout as an MLX-20L telephone.

Considerations

SPM operates with DOS version 3.3 or later.

Unless the system is being backed up or restored, a remote user takes priority over a local user. If the local user is programming when a remote user connects to the system, the system sends a message to the local user that a remote connection has been made and disconnects the local user.

The PC with SPM connects to the EIA-232-D ADMIN jack on the processor of the control unit. The EIA-232-D baud rate is 1200/2400 bps with autobaud adjust.

A printer connected to the PC with SPM can print system programming reports. Reports can also be sent to the printer that is connected to the SMDR port on the control unit.

However, SMDR information may be lost while system programming reports are printed through the SMDR jack.

A UNIX System-based version of System Programming and Maintenance is available as part of Integrated Solution III, as discussed earlier in this chapter.

Hardware Requirements

The following hardware is required:

- An approved PC or other DOS-compatible PC with:
 - At least 512K of RAM
 - A double-sided floppy disk drive (either 5.25-inch or 3.5-inch)
 - A serial port assigned to COM1 or COM2. The serial port can use either a DB-9 or DB-25 connector. If a DB-9 connector is used, a 9-pin to 25-pin adapter is also required. The 9-pin side must be female.
- Video monitor (monochrome or color)
- D8W cord and 355AF adapter if the PC is within 50 ft. (15.2 m) of the control unit. Distances of greater than 50 ft. (15.2 m) require back-toback ADUs.

See System Programming and Maintenance (SPM) for installation instructions.

Upgrading the System

To upgrade to Release 4.0, you need:

- SPM Version 4.15 or higher
- The version number of the SPM software currently installed (if any)
- One of the following:
 - Release 4.0 processor module (when converting from Release 2.1 or earlier.)
 - An upgrade PCMCIA memory card with Release 4.0 system software (when converting from Release 3.0.)
- DOS-formatted disk

To upgrade the control unit, follow the steps below:

1 If the current system programming is to be used in the upgraded system, back up system programming.

See "Backing Up System Programming," next in this chapter, for details.

2 Remove the control unit housing.

See "Removing the Control Unit Housing," later in this chapter, for instructions.

3 Power down the system.

See "Powering Down the System," later in this chapter, for instructions.

Upgrading the System 9-1

4 Upgrade the control unit.

See "Upgrading the Control Unit," later in this chapter, for instructions.

5 If the current system programming is to be used in the upgraded system, convert the backup file and restore system programming.

See "Completing the Upgrade," later in this chapter, for instructions.

Backing Up System Programming

NOTE:

You cannot upgrade system programming for the MERLIN II Communications System; *it must be reprogrammed*. To upgrade a MERLIN II Communications System, see "Upgrading from the MERLIN II Communications System," later in this chapter.

Use the following procedure to back up programming from Release 1.0, 1.1, 2.0, 2.1, 3.0, or 3.1:

1 Install SPM.

2 Back up system programming.

See the Backup command in System Programming and Maintenance (SPM).

- To back up system programming from Release 1.0 or 1.1, you can use any version of SPM (1.16 is recommended).
- To back up system programming from Release 2.0, you must use version 2.09 or higher of SPM.
- To back up system programming from Release 2.1, you must use version 2.16 or higher of SPM.
- To back up system programming from Release 3.0 or 3.1, you must use version 3.18 or higher of SPM.

Removing the Control Unit Housing

Remove the control unit housing as described below. See Figure 9–1.

- For a MERLIN II or a MERLIN LEGEND (Release 2.1 or later) Communications System:
 - 1. Remove the front housing from each carrier by pulling the bottomfront towards you, and lifting it up as shown in Figure 9-1.
 - 2. Remove the top from each carrier in the system by pushing it straight up from the front.
 - 3. Do not discard the housing unless new housing is provided. You will reassemble the housing when installation is complete.
- For a MERLIN LEGEND (Release 2.0 or earlier) Communications System:
 - 1. From both sides of the control unit, pry the clips free from the housing, using a screwdriver if they are difficult to reach.
 - 2. Carefully pull the housing towards you.
 - 3. If the system has more than one carrier, make sure you remove the housing only from the basic carrier side, otherwise the housing may disassemble.
 - 4. If the housing clips need to be replaced, follow the procedure in "Replacing the Housing Clips."
 - 5. Discard the housing only if upgraded housing has been provided.

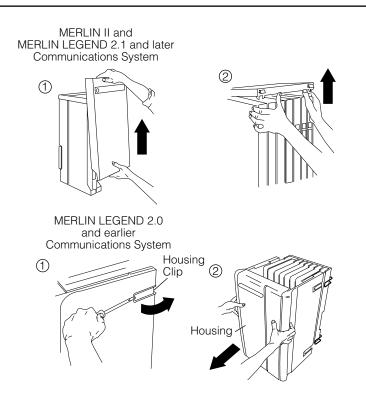


Figure 9–1. Removing the Control Unit Housing

Powering Down the System

You may need to power down the system to add upgraded equipment to the carrier.



CAUTION:

Follow these steps in the exact sequence.

To power down the system, follow the steps below and see Figure 9–2:

- 1 Turn off the power supply on the basic carrier.
- 2 Turn off the power supplies on the expansion carriers.
- 3 Unplug any auxiliary power units.

Because the power supplies are already off, the sequence for removing auxiliary power cords is not important.

4 Unplug the system from the AC outlet.

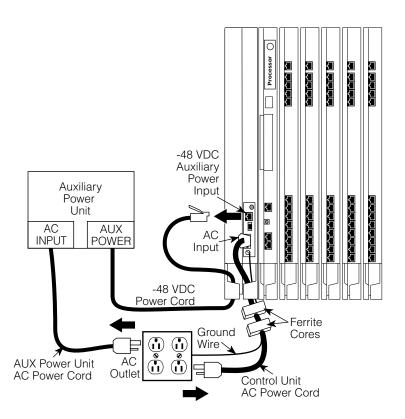


Figure 9–2. Powering Down the System

Upgrading the Control Unit

- 1 Do not remove any of the existing carriers.
- 2 Refer to the Control Unit Diagram on the flip side of System Planning

If you are installing an expansion carrier, remove the rightmost module from the control unit and put it aside. See Figure 9-3.



A CAUTION:

Before removing any cords from the module, make sure they are labeled first for easier replacement.

3 Install any expansion carriers.

See "Installing Expansion Carriers" in Chapter 2.

4 Install or replace any modules. If you are upgrading from Release 3.0 or later, go to Step 6.

See "Installing the Modules" in Chapter 2.

NOTE:

If you are replacing an 012 module with an 016 module, you will need to perform a Board Renumber after completing the upgrade. See System Programming for more information about Board Renumber.

System→Board Renum→Yes

5 Replace the processor module. See Figure 9–3. Then go to Step 7.

NOTE:

If the processor module is to be modified for Key mode, perform Step 4 through Step 10 of "Modifying the Processor for Key Mode" before proceeding.

- a Press up on the tab at the bottom rear of the old processor module.
- b While the tab is unlocked, pull the processor module towards you, and then lift it straight up.
- c Install a Release 4.0 processor module. See "Installing the Processor" in Chapter 2.
- d Power up the system.

6 Upgrade the processor module to Release 4.0 (when upgrading from Release 3.0 or 3.1).

NOTE:

If the processor module is to be modified for Key mode, see "Modifying the Processor for Key Mode" later in this chapter.

- a. Insert an Upgrade memory card into the PCMCIA interface slot on the processor module.
- b. Perform the software installation.

 $\textbf{Menu} \rightarrow \texttt{Maintenance} \rightarrow \texttt{System} \rightarrow \texttt{Upgrd/Instll} \rightarrow \texttt{Yes}$

See "Forced Installation/Upgrade of System Software" in *Maintenance and Troubleshooting* for more details on this procedure.

7 Program the system.

- If the current system programming is to be used in the upgraded system, see "Completing the Upgrade" later in this chapter.
- If the system is to be re-programmed, see the System Planning Forms and *System Programming*.

8 Test the system.

See Chapter 7, "Initializing and Testing the System."

9–8 Upgrading the System

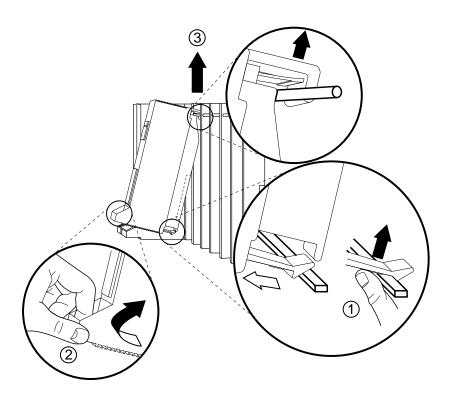


Figure 9–3. Removing a Module from the Carrier

Replacing the Housing Clips

1 Remove the housing clips from the right side of the module.

- a Remove the rightmost module from the control unit. See "Removing a Module" in Chapter 2 for instructions.
- b Using a flat-blade screwdriver, unscrew the upper-right corner of the carrier only far enough to free the clip.
- c Pull the top-right corner of the carrier toward you while grasping the housing clip and pushing it away from you (to free it from the carrier).
- d When the clip is free enough to clear the screw molding on the back of the carrier, slide the clip out and discard it.
- e Compare the Control Unit Diagram with the existing control unit. If you are installing an additional expansion carrier in this upgrade, do not replace the clips on the right side until the last expansion carrier is installed. If no more carriers are to be installed, replace the clip now, making sure the clip is as far to the right as possible.
- f Secure the screw, and then repeat Steps b, c, and d for the lower right corner of the carrier.

2 Remove the power supply module to access the housing clips on the leftmost side of the carrier. See Figure 9–3.

- a Press up on the tab at the bottom rear of the power supply.
- b While the tab is unlocked, pull the power supply towards you, and then lift it straight up.



WARNING:

Beware of hazardous voltages.

Whenever the carrier connections are exposed, use extreme caution; do not touch them directly or with any type of tool.

Follow all procedures carefully.

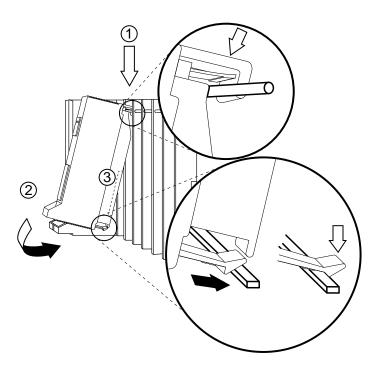


Figure 9–4. Replacing a Module in the Carrier

- Remove the clips from the left side of the control unit as you did in Step 1; however, make sure you replace the clips before securing the screws again.
- 4 Reinstall the power supply module by hooking it onto the rod at the top of the carrier and then swinging it down into place. See Figure 9-4.
- 5 Push the power supply module firmly until you hear it lock.

Modifying the Processor for Key Mode

To modify the processor for Key mode in Release 3.0 and later, follow the steps below. For earlier releases, see Appendix E in *Maintenance and Troubleshooting*.

Prepare a non-metallic surface, such as a table, on which to work.



WARNING:

Do not touch the gold connectors on the rear of the processor module. Electrostatic discharge (ESD) can damage the circuitry, as can the oil from your fingertips. Use a properly grounded wrist strap to prevent damage from electrostatic discharge.

Only a qualified technician should perform this procedure.

- 1 Remove the control unit housing. See Figure 9–1.
- 2 Power down the system as described earlier in this chapter. See Figure 9–2.
- 3 Remove the processor module from the carrier. See Figure 9–3.
- 4 Place the processor module on a flat surface with the wiring manager on your left.
- 5 Unclip and remove the left side panel. See Figure 9-5.

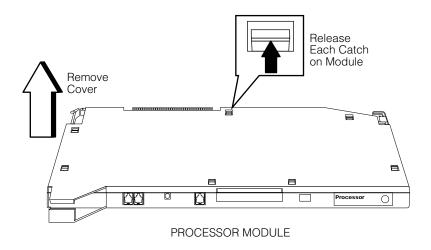


Figure 9–5. Removing the Processor Module Cover

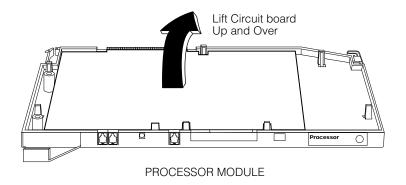


Figure 9-6. Removing the Processor Module Circuit Board

- 6 Holding the processor circuit board at each end, lift it up and turn it over and away from you. See Figure 9–6.
- 7 Place the processor circuit board on a flat non-metallic surface.
- 8 Carefully support the dip switch assembly with the index finger, while moving the switch to the closed position. See Figure 9–7.
- 9 Replace the processor circuit board face (components) down into the module housing.
- 10 Replace the processor module side panel and clip into place.
- 11 Replace the processor module into the carrier. See Figure 9-4.
- 12 Power up the system.

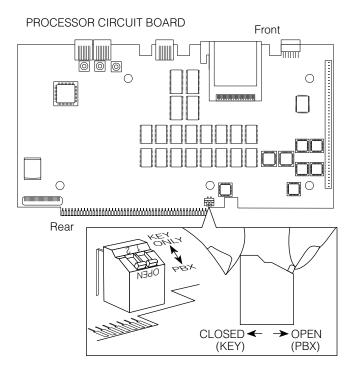


Figure 9–7. Changing the Key Mode Switch Position to Closed

Completing the Upgrade

1 Perform a frigid start (System Erase) to ensure that all system programming is returned to default values.

Use **System Erase** from the SPM Maintenance menu:

 $\label{lem:maintenance} \textbf{Maintenance} \rightarrow \textbf{Slot} \rightarrow 00 \rightarrow \textbf{Demand Test} \rightarrow \textbf{System Erase} \text{ (Line 5, left button)} \\ \textbf{twice} \rightarrow \textbf{Yes}$

See Maintenance and Troubleshooting for more information on System Erase.

2 Convert the backup file.

This converts the backup file created in Step 2 to Release 4.0 format. See the Convert menu option in *System Programming and Maintenance (SPM)* for details.

3 Restore system programming; this puts the system in an idle state, and it cannot be used for the duration of the procedure. Refer to "Restoring from the System Programming Diskette" in Chapter 7 for more information.

Use version 4.15 or higher of SPM and restore the file you converted in Step 5.

4 If applicable, program new features.

See Chapter 2, Programming with SPM in System Programming for a list of new features to be programmed.

Upgrading from the MERLIN II Communications System

To upgrade from the MERLIN II Communications System to Release 4.0, follow the steps below.

1 Install SPM.

Install (or upgrade to) version 4.15 or higher of SPM.

2 Remove the control unit housing.

See "Installing the Control Unit" in Chapter 2 if you need instructions.

Replace old modules and add new modules as specified on the Control Unit Diagram of Form 1, System Planning.

See "Installing the Control Unit" in Chapter 2 if you need instructions.

4 Install the Release 4.0 processor module in the carrier.

See "Installing the Processor" in Chapter 2.

5 Perform a frigid start (System Erase) to ensure that system programming is returned to default values.

Use **System Erase** from the SPM Maintenance menu:

Maintenance \rightarrow Slot \rightarrow 00 \rightarrow Demand Test \rightarrow System Erase (Line 5, left button) **twice**→Yes

See Maintenance and Troubleshooting for more information on System Erase.

6 Program the system.

- Restore the system programming from a system programming disk or Translation Memory Card (Release 3.0 and later only), if available.
 - See "Restoring from the System Programming Disk" or "Restoring from the Translation Memory Card," in Chapter 7.
- If a disk or memory card is not available, see System Programming for details on programming the system.

7 If applicable, program new features.

See System Programming for detailed programming procedures.

Replacing the Control Unit Housing

See Chapter 2, "Installing the Control Unit," for instructions on replacing the control unit housing for Release 2.1 and later.

Release 2.0 or Earlier

To install the control unit's housing, follow the steps below.

- 1 Place the front panel(s) face down.
- 2 If you are housing more than one carrier, connect the front panels together.
 - a Line up the arrows.
 - b Slide the panels until the semicircles form a complete circle. See Figure 9–8.
- 3 Connect the side panels to the front panel(s) in the same way.
- 4 Pick up the housing and place it on the control unit. If the system has more than one carrier, make sure you hold the housing only from the basic carrier side; otherwise, the housing can disassemble.
 - a Line up the wire clips that are attached to the carrier with the recesses on the outside of the side panels.
 - b Push back the panels until the clips hook over the tabs and rest in the recesses.

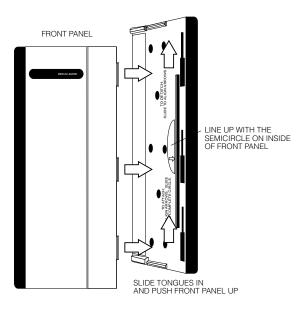


Figure 9–8. Installing the Control Unit Housing

System Numbering Forms



When you change any existing trunk or extension wiring, record information about the wiring on the appropriate system numbering form. This appendix includes examples of all of the system numbering forms, and instructions for completing Form 2a, "System Numbering: Extension Jacks." The system numbering forms, which are included in this appendix, are as follows:

- Form 2a, System Numbering: Extension Jacks (Figure A-1)
- Form 2b, System Numbering: Digital Adjuncts (Figure A-2)
- Form 2c, System Numbering: Line/Trunk Jacks (Figure A-3)
- Form 2d, System Numbering: Special Renumbers (Figure A-4)

See *System Planning* for completed forms that contain more detailed information regarding the configuration of your customer's system.

Form 2a, System Numbering: **Extension Jacks**

| Renumber Sy | stem* | | |
|-------------|----------------------------|---------|--------------|
| ☐ 2-Digit ◆ | Selected Extension Numbers | 3-Diait | Set Up Space |

| Mod. | | Ja | ck Ty | /ре | | 2-Dig Ext. | 3-Dig. Ext. | Set Up | Renumber | | Old | | Person, Location, | Ring | Voice |
|------|----|----|-------|-----|-------|---------------|----------------|--------|----------|-------------|----------|-----|-------------------|--------|-------|
| Туре | ID | Α | D† | В | Eqpt. | No.◆ | No. | Space | to | Label | Ext. No. | No. | or Function | Freq.‡ | Mail |
| | 1 | | | | | 10 | 100 | 7100 | | | | | | | |
| | 2 | | | | | 11 | 101 | 7101 | | | | | | | |
| | 3 | | | | | 12 | 102 | 7102 | | | | | | | |
| | 4 | | | | | 13 | 103 | 7103 | | | | | | | |
| | 5 | | | | | 14 | 104 | 7104 | | | | | | | |
| | 6 | | | | | 15 | 105 | 7105 | | | | | | | |
| | 7 | | | | | 16 | 106 | 7106 | | | | | | | |
| | 8 | | | | | 17 | 107 | 7107 | | | | | | | |
| | 9 | | | | | 18 | 108 | 7108 | | 1 1 1 1 1 1 | | | | | |
| | 10 | | | | | 19 | 109 | 7109 | | | | | | | |
| | 11 | | | | | 20 | 110 | 7110 | | | | | | | |
| | 12 | | | | | 21 | 111 | 7111 | | | | | | | |
| | 13 | | | | | 22 | 112 | 7112 | | | | | | | |
| | 14 | | | | | 23 | 113 | 7113 | | | | | | | |
| | 15 | | | | | 24 | 114 | 7114 | | | | | | | |
| | 16 | | | | | 25 | 115 | 7115 | | | | | | | |
| | 17 | | | | | 26 | 116 | 7116 | | | | | | | |
| | 18 | | | | | 27 | 117 | 7117 | | | | | | | |
| | 19 | | | | | 28 | 118 | 7118 | | | | | | | |
| | 20 | | | | | 29 | 119 | 7119 | | | | | | | |
| | 21 | | | | | 30 | 120 | 7120 | | | | | | | |
| | 22 | | | | | 31 | 121 | 7121 | | | | | | | |
| | 23 | | | | | 32 | 122 | 7122 | | | | | | | |
| | 24 | | | | | 33 | 123 | 7123 | | | | | | | |

Figure A-1. Form 2a, System Numbering: Extension Jacks

The following explains how to complete Form 2a.

A-2 Installation

Shaded lines indicate possible operator positions.

Factory Setting

The system capacity for Personal Directories is decreased by one whenever an MLX-20L telephone is connected to an MLX port.

Use Form 25 for adjuncts connected via MFM or ISDN Terminal Adapter (such as the ExpressRoute 1000 or 7500B data module).

Ringing Frequency is programmable on the 016 T/R module only.

The number in the logical ID column refers to the number of the extension jack in the control unit.

- In the "Eqpt." (Equipment) column, enter the type of device (such as an MLX-20L console) that is connected to the extension jack. On the second line, enter any attached adjuncts (such as an answering machine).
- 2. In the "Old Ext. No." column, if the wire run is being changed, enter the extension number of the old extension. If you are working with a new installation, leave this space blank.
- 3. In the "Renumber to" column, enter the extension number of the extension, if not already filled in. (This includes new installations.)
- 4. In the "Wire No." column, enter the number of the wire as indicated by the label on the wire.
- 5. In the "Person, Location, or Function" column, enter the name of the person at the location of, or the function of (such as a fax machine) the extension, and any miscellaneous information particular to that extension.

Form 2b, System Numbering: Digital Adjuncts

| | Fa | actory | -Set | | | | | MLX | Barrar Lauren |
|------|---------|---------|-----------------|-------------|----------|----|--------------|-----------------------|---|
| Log. | 2-digit | 3-digit | Set Up Space | Renumber to | Adjuncts | 2B | Pass. Bus | Telephone Ext. No. | Person, Location, Function, and Equipment Type |
| 1 | 710 | 300 | 7300 | | ., | | | | 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| 2 | 711 | 301 | 7301 | | | | | | |
| 3 | 712 | 302 | 7302 | | | | | | |
| 4 | 713 | 303 | 7303 | | | | | | |
| 5 | 714 | 304 | 7304 | | | | | | |
| 6 | 715 | 305 | 7305 | | | | | | |
| 7 | 716 | 306 | 7306 | | | | | | |
| 8 | 717 | 307 | 7307 | | | | | | |
| 9 | 718 | 308 | 7308 | | | | | | |
| 10 | 719 | 309 | 7309 | | | | | | |
| 11 | 720 | 310 | 7310 | | | | | | |
| 12 | 721 | 311 | 7311 | | | | | | |
| 13 | 722 | 312 | 7312 | | | | | | |
| 14 | 723 | 313 | 7313 | | | | | | |
| 15 | 724 | 314 | 7314 | | | | | | |
| 16 | 725 | 315 | 7315 | | | | | | |
| 17 | 726 | 316 | 7316 | | | | | | |
| 18 | 727 | 317 | 7317 | | | | | | |
| 19 | 728 | 318 | 7318 | | | | | | |
| 20 | 729 | 319 | 7319 | | | | | | |
| 21 | 730 | 320 | 7320 | | | | | | |
| 22 | 731 | 321 | 7321 | | | | | | |
| 23 | 732 | 322 | 7322 | | | | | | |
| 24 | 733 | 323 | 7323 | | | | | | |
| 25 | 734 | 324 | 7324 | | | | | | |

Figure A-2. Form 2b, System Numbering: Digital Adjuncts

A-4 Installation

Form 2c, System Numbering: Line/Trunk Jacks

| /lusic O | n Ho | ld, Line/T | runk No | o | | Source | | Maintenance Alarm, Line/Trunk No. | | | | | | | | | |
|-------------------------------------|------|------------------------------------|----------------|----------------------|---------------|--|---------------------------|-----------------------------------|-------------|-------|------|-------|-------|----------------|--|------------------------------------|----------|
| .oudspeaker Page, Line/Trunk No(s). | | | | | | Loop-Start Reliable Disconnect* | | | | | | | | | | | |
| | | | | | | | | □ No ◆ | | | Yes | | | | | | |
| Module Type and Slot | Log. | Jack Type (LS, GS, DID, Tie, | Line/ Trunk | Pool Dial- Out | Re- number | Incoming Line/Trunk Type (Main No., Personal Line, WATS, | Telephone Number or | | Sign | aling | | Řeg'd | | Disc. erval | QCC Operator to Receive Calls† | QCC Queue Priority Level† | |
| No. | IĎ | etc.) | No. | Code†‡ | to | FX, etc.) | Equipment | Label | TT ÷ | R | Yes◆ | No | Short | Long + | (No ◆) | (4 🔷) | Function |
| | 1 | | 801 | | | | | | | | | | | | | | |
| | 2 | | 802 | | | | | | | | | | | | | | |
| | 3 | | 803 | | | | | | | | | | | | | | |
| | 4 | | 804 | | | | | | | | | | | | | | |
| | 5 | | 805 | | | | | | | | | | | | | | |
| | 6 | | 806 | | | | | | | | | | | | | | |
| | 7 | | 807 | | | | | | | | | | | | | | |
| | 8 | | 808 | | | | | | | | | | | | | | |
| | 9 | | 809 | | | | | | | | | | | | | | |
| | 10 | | 810 | | | | | | | | | | | | | | |
| | 11 | | 811 | | | | | | | | | | | | | | |
| | 12 | | 812 | | | | | | | | | | | | | | |
| | 13 | | 813 | | | | | | | | | | | | | | |
| | 14 | | 814 | | | | | | | | | | | | | | |
| | 15 | | 815 | | | | | | | | | | | | | | |
| | 16 | | 816 | | | | | | | | | | | | | | |
| | 17 | | 817 | | | | | | | | | | | | | | |
| | 18 | | 818 | | | | | | | | | | | | | | |
| | 19 | | 819 | | | | | | | | | | | | | | |
| | 20 | | 820 | | | | | | | Γ | | | | | | | |

Factory setting
 If the system has AUDIX Voice Power/FAX Attendant System™, Integrated Administration will automatically set Loop-Start Reliable Disconnect to Yes.
 † Hybrid/PBX mode only.

Figure A-3. Form 2c, System Numbering: Line/Trunk Jacks

[‡] Maximum: 11 pools with up to 80 trunks per pool. Factory settings: 70 (main), 891 (dial-in tie), 892 (automatic-in tie).

Form 2d, System Numbering: Special Renumbers

| DSS Page Buttons | | 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 | |
|--|--------------------------------|--|----------------|
| 891 892 893 894 895 896 896 897 898 899 | | 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 | |
| 892 893 894 895 896 897 898 899 | | 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 | |
| 893 894 895 896 897 898 899 | | 774 775 776 776 777 778 779 780 781 782 783 784 784 785 786 787 | |
| 894 895 896 897 898 899 | | 775 776 777 778 779 780 781 782 783 784 784 786 786 | |
| Section | | 776 777 778 778 779 780 781 782 782 783 784 785 786 787 | |
| Section | | 776 777 778 778 779 780 781 782 782 783 784 785 786 787 | |
| Section | | 778 779 780 781 782 783 784 785 786 787 | |
| Section | | 779 780 781 782 783 784 785 786 787 | |
| Section | | 780 781 782 783 784 785 786 787 | |
| Section Sect | | 780 781 782 783 784 785 786 787 | |
| Group Paging (Form 7b) (Factory-Set Number to Service Paging (Form 7b) (Factory-Set Number to Service Paging Pagin | | 781 782 783 784 785 786 787 | |
| Factory-Set Number | | 782 783 784 785 786 787 | |
| Factory-Set Number | | 783 784 785 786 787 | |
| Section Sect | | 784 785 786 787 | |
| 793 794 795 795 796 797 798 799 Park Zone (Form 6a) Description 881 882 883 884 885 884 885 886 887 888 BSS Page Buttons | | 785 786 787 | |
| 794 795 796 796 797 798 799 | | 786 787 | |
| 795 796 797 798 799 | | 787 | |
| 796 797 798 799 | | | |
| 797 798 799 799 | | | |
| 798 799 | | 789 | |
| 799 | | 790 | |
| Park Zone (Form 6a) Pactory-Set Number to 881 882 883 884 885 886 886 887 888 DSS Page Buttons | | 791 | |
| Factory-Set Number Numbe | | 7920 | |
| Factory-Set Renumber Number to | | 7921 | |
| Number to | | 7922 | |
| 881 882 883 884 885 886 887 888 | | 7923 | |
| 882 883 884 885 886 887 888 DSS Page Buttons | | 7924 [‡] | |
| 882 883 884 885 886 887 888 DSS Page Buttons | | 7925 [‡] | |
| 883 884 885 886 886 887 888 | | 7926 [‡] | |
| 884 885 886 887 888 DSS Page Buttons | | 7927 [‡] | |
| 885 886 887 888 | | 7928 [‡] | |
| 886 887 888 DSS Page Buttons | | 7929 [‡] | |
| 887 888 DSS Page Buttons | | 1323 | |
| DSS Page Buttons | | | |
| DSS Page Buttons | isted Directory Number* | Factory-Set | Renumber |
| DSS Page Buttons | (QCC Queue) | Number | to |
| | (QCC Queue) | 200 | |
| PAGE 1 Beginning extension for range | _ | 800 | |
| | | Factory-Set | Renumber |
| PAGE 2 Beginning extension for range | A | Number | Renumber to |
| PAGE 3 Beginning extension for range | emote Access | | to |
| | emote Access dode (Form 3a) | 889 | |
| ARS Dial-Out Default Renumber | | | |
| Code [†] to | | | |
| 9 | | | |
| Hybrid/PBX mode only. | | | |

Figure A-4. Form 2d, System Numbering: Special Renumbers

A-6 Installation

Unit Load Calculation Worksheet

If you determine that you need to recalculate the unit load for any carrier, use the instructions on the following worksheet.

NOTE:

- You should have a separate copy of the worksheet for each carrier.
- See "Unit Loads" in Chapter 1 for information on recalculating unit loads.

The 391A3 power supply has a maximum rating of 75 unit loads. If your system contains a 391A1 or 391A2 power supply module, and the unit loads for that carrier will exceed 54, it is recommended that a 391A3 power supply be installed in the system. Auxiliary Power Units cannot be used with the 391A3 power supply.

Unit Load Worksheet

| Number of modules in carrier (excluding power supply and processor: | |
|---|--------------|
| If fewer than five, power is adequate. | |
| If five or six, continue to Step 2. | |
| 2. Key or Behind Switch mode only: | ☐ Square |
| Indicate configuration of lines; then go to Step 5. | ■ Modified |
| 3. Hybrid/PBX mode only: | |
| Do all modules in the carrier have MLX and/or analog multiline telephone jacks? | □ Yes |
| If no, a newer power supply is not needed. | - 110 |
| ■ If yes, continue to Step 4. | |
| 4. Hybrid/PBX mode only: | |
| Calculate the total number of MLX and analog multiline telephones: | |
| Number of MLX-20L consoles connected to modules in the carrier | |
| Number of MLX-28D consoles connected to modules in the carrier | |
| Number of 34-button analog multiline telephones connected to modules in the carrier | |
| Total of MLX-20L, MLX-28D, and 34-button analog telephones | |
| If total is less than or equal to 45, auxiliary power is not required. | |

■ If the total is greater than 45, continue to Step 5.

5. Calculate the estimated unit loads.

| Module | Qty x | Unit Load | = Total |
|---------------|-------|-----------|---------|
| 008 | | 12.0 | |
| 008 MLX | | 13.5 | |
| 008 OPT | | 8.0 | |
| 012 | | 8.4 | |
| 016 | | 12.8 | |
| 100D | | 0.0 | |
| 400 | | 0.0 | |
| 400 EM | | 8.0 | |
| 400 GS/LS/TTR | | 8.0 | |
| 408 | | 12.0 | |
| 408 GS/LS | | 12.0 | |
| 408 GS/LS-MLX | | 13.5 | |
| 800 | | 0.0 | |
| 800 NI-BRI | | 0.0 | |
| 800 GS/LS | | 0.0 | |
| 800 GS/LS-ID | | 8.0 | |
| 800 DID | | 8.0 | |

Total Estimated Unit Load

- If the total is less than or equal to 54, any power supply module is sufficient.
- If the total is greater than 54, continue to Step 6.

6. Calculate the actual carrier unit load.

| | Qty x | Unit Load | | = Total |
|---|-------|---|--|---------|
| Equipment | | Hybrid/PBX or Modified | Square | |
| Network Access Lines* | | | | |
| DID DS1 GS/LS Tie Telephones | | 1.0 0.0 0.0 1.4 | 1.0 0.0 0.0 1.4 | |
| MLX-10 MLX-10D MLX-28D MLX-20L | | 0.9 0.9 1.2 1.1 | 1.2 1.2 1.7 1.6 | |
| BIS-10 BIS-22 BIS-22D BIS-34 | | 0.9 1.0 1.0 1.1 | 1.1 1.3 1.3 1.5 | |
| BIS-34D MLC-5 MDC-9000 MDCW-9000 10-Button Basic 10-Button HFAI | | 1.1 0.0 0.0 0.0 0.0 0.9 1.0 | 1.5 0.0 0.0 0.0 1.1 1.2 | |
| 34-Button Basic 34-Button DLX 34-Button BIS 34-Button BIS/DIS Single-Line Telephone | | 1.0 0.9 1.2 1.2 1.2 0.6 | 1.2 1.1 1.7 1.4 1.4 0.7 | |
| Continued | | | | |

^{*} Unit loads are computed per trunk for trunk-type network access lines.

B–4 Installation

| • | Qty x | Unit Load | | = Total |
|--|-------|----------------------------|--------------------------|---------|
| Equipment | | Hybrid/PBX or Modiffied | Square | |
| Optional Equipment [†] | | | | |
| Direct Station Selector [‡] General Purpose Adapter Hands-Free Unit Headset Adapter | | 0.7 0.8 0.8 0.8 | 0.9 1.0 1.0 1.0 | |
| | | Total Actual Unit | Load | |

- If the total actual unit load is less than or equal to 54, any power supply module is sufficient.
- If the total actual unit load is greater than 54, continue to Step 7.

[†] The MFM has its own wall power unit located at the telephone and therefore is not added to the unit load calculation.

[‡] Up to two DSSs (one DSS per MLX-28D or MLX-20L console) can be powered from each control unit carrier. For example, a 3-carrier system can have 6 system operator positions, each with one DSS powered from the control unit.

- 7. Try to exchange modules between carriers to reduce the unit loads to 54. (Remember that the 100D, 400, 400 GS/LS/TTR, 800 GS/LS-ID, 800, 800 NI-BRI, and 800 GS/LS modules have unit loads of 0.0.) Repeat Steps 1 through 6 to recalculate unit loads for the new configuration.
 - If the exchange reduces the unit load to 54 or less, any power supply module is sufficient.
 - If the exchange does not reduce the unit load to 54 or less, a 391A3 power supply is needed. Continue to Step 8.

NOTE:

Empty slots are not permitted between modules.

8. Calculate the unit loads for slots 5 and 6 of the carrier.

| | Qty x | Unit Load | | = Total |
|---|-------|---|---|---------|
| Equipment | | Hybrid/PBX or Modiffied | Square | |
| Network Access Lines* | | | | |
| DS1 GS/LS Tie | | 0.0 0.0 1.4 | 0.0 0.0 1.4 | |
| Telephones MLX-10 MLX-10D MLX-28D MLX-20L BIS-10 BIS-22 BIS-22D BIS-34 BIS-34D MLC-5 MDC-9000 MDW-9000 10-Button Basic 10-Button HFAI 34-Button Basic 34-Button BIS 34-Button BIS 34-Button BIS Single-Line Telephone | | 0.9 0.9 1.2 1.1 0.9 1.0 1.0 1.1 1.1 0.0 0.0 0.0 0.0 0.9 1.0 0.9 1.2 1.2 1.2 1.2 0.6 | 1.2 1.7 1.6 1.1 1.3 1.3 1.5 1.5 0.0 0.0 0.0 1.1 1.2 1.1 1.7 1.4 1.4 | |
| Continued | | | | |

^{*} Unit loads are computed per trunk for trunk-type network access lines.

| | Qty x | Unit Load | | = Total |
|--|-------|-----------------------------|--------------------------|---------|
| Equipment | | Hybrid/PBX or Modiffied | Square | |
| Optional Equipment [†] | | | | |
| Direct Station Selector [‡] General Purpose Adapter Hands-Free Unit Headset Adapter | | 0.7 0.8 0.8 0.8 | 0.9 1.0 1.0 1.0 | |
| | | Total Unit Load fo and 6 | or Slots 5 | |

[†] The MFM has its own individual wall power unit located at the telephone and therefore is not added to the unit load calculation.

- If the unit load for slots five and six is less than or equal to 27, power is sufficient for the carrier.
- If the unit load for slots five and six is more than 27, continue to Step 9.

[‡] Up to two DSSs (one DSS per MLX-28D or MLX-20L console) can be powered from each control unit carrier. For example, a 3-carrier system can have 6 system operator positions, each with one DSS powered from the control unit.

- Try to exchange modules between carriers to reduce the unit loads for slots five and six through 27. (Remember that the 100D, 400, 400 GS/LS/TTR, 800 GS/LS-ID, 800, 800 NI-BRI, and 800 GS/LS modules have unit loads of 0.0.) Repeat Steps 1 through 8 to recalculate unit loads for new configuration.
 - If the exchange reduces the unit load for slots five and six through 27 or less, power is sufficient.
 - If the exchange does not reduce the unit loads for slots 5 and 6 through 27, install wall power units for the appropriate number of telephones to reduce the unit load to 27.

NOTE:

Empty slots are not permitted between modules.

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