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MERLIN LEGEND[®] Communications System Release 3.0

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 Trobleshooting* in this binder.

Security of Your System Preventing Toll Fraud

As a customer of a new telephone system, you should be aware that there exists an increasing problem of telephone toll fraud. Telephone toll fraud can occur in many forms, despite the numerous efforts of telephone companies and telephone equipment manufacturers to control it. For important information regarding your system and toll fraud, see Appendix A, "Customer Support Information." It follows *Maintenance and Trobleshooting* in this binder.

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." It follows *Maintenance and Troubleshooting* in this binder.

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 applicable aux appareils numériques de la class A préscrites dans le reglement sur le brouillage radioélectrique édicté par le ministére des Communications du Canada.

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The ordering number for this document is 555-630-140. To order this document, call the AT&T Customer Information Center at 1-800-432-6600 (in Canada, 1-800-255-1242). For more information about AT&T documents, refer to the section entitled, "Related Documents" in "About This Book." The *Pocket Reference*, listed in that section, provides full ordering information for replacement parts, accessories, and other compatible equipment; or, contact your AT&T representative.

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 if you need assistance when installing or using your system.

Outside the continental U. S., contact your local AT&T representative.

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.



- 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

Safety

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 analog voice and analog data station

digital voice and analog data station

analog data only station digital data only station digital voice and digital data station line/trunk module line/trunk jack extension extension jack modem data station 7500B data station analog voice and modem data station MLX voice and modem data station modem data-only station 7500B data-only station MLX voice and 7500B data station

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 <i>headpiece</i> .	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*.



WARNING:

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

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.*

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 Customer Information Center by calling 1-800-432-6600.

Document No.	Title
	System Documents
555-630-117	Introduction
555-630-118	System Manager's Guide
555-630-110	Feature Reference
555-630-115	Equipment and Operations Reference
555-630-116	Pocket Reference
555-630-111	System Programming
555-630-112	System Planning
555-630-113	System Planning Forms
	Telephone User Support
555-630-122	MLX-10D™, MLX-10DP™, MLX-28D™, 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)
555-630-124	MLX-10™ Nondisplay Telephone User's Guide
555-630-151	MLX-10 Nondisplay Telephone Tray Cards (6 cards)
555-630-120	Analog Multiline Telephones User's Guide
555-630-126	Single-Line Telephones User's Guide
	System Operator Support
555-630-134	MLX Direct-Line Consoles Operator's Guide
555-630-132	Analog Direct-Line Consoles Operator's Guide
555-630-136	MLX Queued Call Console Operator's Guide
555-630-138	MDC 9000 and MDW 900 Telephones User's Guide
	Miscellaneous User Support
555-630-130	Calling Group Supervisor's Guide
555-630-129	Data User's Guide

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

FEEDBACK FORM MERLIN LEGEND Communications System Release 3.0

Title: Installation, Programming, & Maintenance Order No.: 555-630-140 Date: August 1994

1. Please rate the effectiveness of this book in the following areas:

	Excellent	Good	Fair	Poor	Not Applicable
Ease of Use					
Clarity					
Completeness					
Accuracy					
Organization					
Appearance					
Examples					
Illustrations					

2. Please check ways you feel we could improve this book:

Improve the overview	Add more examples	Add troubleshooting information
□ Improve the table of contents	Add more detail	Make it less technical
Improve the organization	Make it more concise	□ Add more/better quick reference aids
Include more illustrations	□ Add more step-by-step	procedures
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THIS FORM MAY BE PHOTOCOPIED

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.

Installling 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 Form 1b, 75006 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 3.0 from Release 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

2

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.

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

Table 2-1. Environmental Requirements

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 (\checkmark) 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: {49,000 kw = 7,000 + 10 km (6.2 miles) = 0.7 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)



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 Preassemble 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

- ³/₄-inch plywood
- Check with the local building code enforcement agency to see whether fire-retardant material is required.

- 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.



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 VAC, 15 amps.
- Each breaker must protect one dedicated quad 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 page 2-12 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



CAUTION:

The AC outlet for the control unit cannot be switch-controlled, Hugging 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	117VAC
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



WARNING:

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 ye low 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 singlepoint 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 $\frac{1}{2}$ 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 $\frac{1}{4}$ -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 1/2 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 risk.

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



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

Required Protectors
147A
147A and a 146A
147A and two 146As
147A and three 146As
Second 147A
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.



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 unil 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

The power supply (model 391A1) generally supports six modules of any type in Hybrid/PBX mode, without requiring an auxiliary power unit. If the following conditions are true, however, the unit loads on a carrier can exceed the 54-unit maximum and, therefore, require auxiliary power:

- 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 power supply (model 391A1) generally supports four modules of any type.

Auxiliary Power Units

The power supply provides 54 unit loads to each carrier. If the unit load requirement for a carrier exceeds 54, an auxiliary power unit is needed to allow that carrier to support up to an additional 27 unit loads.



CAUTION:

Running the system with more than 54 unit loads per carrier may not appear to do harm. However, this can cause the system to malfunction, creating "NO Trouble Found" situations, such as malfunctioning LEDs on multiline telephones or power unit failure.

Any extension that is connected to the modules in the last two slots receives power from the auxiliary power unit instead of from the power supply.

If an auxiliary power unit is required, refer to "Installing the Auxiliary Power Unit," later in this chapter, for instructions.

Installing the Basic Carrier

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

NOTE:

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

Installing the Power Supply



WARNING:

Do not attach any cab/es 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 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
- Installing the ferrite cores

NOTE:

It is not necessary to install ring generators in a new system with new012 (apparatus code 517G13 or later letter) modules or new 008 (apparatus code 5171328 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.

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 baron 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

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.
- 4 Plug the other end of the line cord into the AUX POWER jack on the auxiliary power unit.



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

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:

 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.



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.

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



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 bottomrear 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



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.
- 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:

¹ 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.



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:

- 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.

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

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

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.

Installation Situation		Preferred Signaling Format				
From System		Syste	em	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 1 C (Compatible)	Unprotected	E&M Type 1 S (Standard)	Unprotected	
Dimension PBX	Inter-office	E&M Type 1C (Compatible)	Protected	E&M Type 1 S (Standard)	Protected	
Other Systems	Same site co-located	E&M Type 1 C (Compatible)	Unprotected	E&M Type 1S (Standard)	Unprotected	
Other Systems	Inter-office	E&M Type 1 C (Compatible)	Unprotected	E&M Type 1 S (Standard)	Requires a protection unit	
MERLIN LEGEND	Same site co-located or inter-office	Type 5 Simplex	N/A	Type 5 Simplex	N/A	

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





Labeling

- 1 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.

2 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.

3 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).

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.
Replacing a Module



Figure 2-13. Removing Modules from the Carrier

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.

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



CAUTION:

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

Powering Up the System



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.

1 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 on.

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 idle.
- 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.



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.

Unplug the system from the AC outlet. 4

Installing Telephones and Adjuncts

3

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

RISK OF ELECTRICAL SHOCK: Follow all warnings and cautions.

WARNING:

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

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.



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.



Figure 3–5. Releasing the Module Cover Screw

- 3 Release and remove the module cover. See Figure 3-5, Figure 3-6, and Figure 3-7.
 - 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.



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.*





- 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.



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 themodule cover into the slot on the left side of the telephone.



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

- 9 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



- 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.



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 40013 or 40092 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).*



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 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 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:

- 1. 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 muitiline 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.

4 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
- 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
- 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
- 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:

- 012 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 quick-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.
- 3 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.	Unsupp	orted '	Telep	hones	and	Adjuncts

Model	Notes
51013 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 is 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 Dower-failure transfer (PFT) extensions.
CS6402UO ²	IA* 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.
*	
t	Vintage telephone, no longer available for sale or lease Although the 8102 can be connected to a speakerphone and the8110 has a 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.

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-V(TVVA	Touch-tone outdoor 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

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

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, 4006 adapter, and D6AP cord for each MLX telephone and DSS after the first two.
- The total length of cords between the KS22911-L2or406743419 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.
- c 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) faceup 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.

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 40052 adapter. Doing so can cause electrical damage to the control unit and to the telephone.

- c Insert the plug end of the 4008 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, MIX-10DP, or MIX-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 6306 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.

- 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% 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.



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 ah/e 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 cab/e 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.



A 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 Telephones to the Control Unit

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.



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) cab/e 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.

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

Table 4-1. Network Interfaces

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.

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	02 RV2-T	RJ11C, RJ14C, RJ21
OPS	0L13C	RJ11C
Tie trunk	TL31M	RJ2GX
DS1	04DU9-B	RJ48C/X
	04DU9-C	See note below.

Table 4-2. Central Office Network Interface Codes

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.

Wiring



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

Wiring



Figure 4-3. RJ21X Wiring Field Tools

To connect the RJ21 X 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 Cutoff 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

Test the central office trunks for proper connection. 8

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



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.

Label the network interface jacks, the control unit module jacks, and the 2 D2R cords properly.

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

- 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.



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.



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 1 line/trunk jack (either at the network interface or at the cross-connect field) and listen for dial tone.

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.

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

Connecting the Control Unit to the Network Interface 4-17

Installing the PC, CAT, or Printer

5

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 3.XX 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.



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.



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, BRIA-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 BRIA-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.

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."

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 *wlthin* 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."

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.

- 1 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.

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.

- 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 adapter.
- 3 Plug the 355AF into one end of an M7U null modem cable.
- 4 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.
- 6 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 insteadofa2012D-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 40062 power adapter.
- 11 Plug the 2012D-50M (or 201213) 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 201213) 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.

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
- BRIA-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.

- 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 adapter.
- 3 Plug the female end of the 355AF adapter into one end of an EIA crossover cable.
- 4 Plug the other end of the EIA cable into the 25-pin male connector of the Z3A2 ADU.



• 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.
- 7 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 400132 adapter.



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



Figure 5-7. Connecting the 24813 Adapter and the 201213 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 40092 adapter into a wall jack, BRI A-4P adapter, 102 connecting block, or 103 connecting block.
- 11 Complete the 400B2 connection.

- 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 BRIA-4P adapter, 102 connecting block, or 103 connecting block, use 4-pair plug-ended cable to connect the BRIA-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.)
| 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 |
| 77 | AUTO CR | 01 | CR + LF |
| 18 | ZERO | 01 | 0 |
| 22 | AUTO LF | 01 | CR ONLY |
| 31 | 1" SKIP | 01 | OFF |

Table 5–1. AT&T 572 Printer Options

Continued on next page

Table 5-1, Continued

No.	Function	Menu	Status
32	CHAR. SET (GO,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.

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

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

Open = off; Closed = on

*

Switch 1	Switch 2	Control Switch
DIP 1-On	DIP 1-On	DIP 1-Off
DIP 2-On	DIP 2-On	DIP 2-CM
DIP 3-On	DIP 3-Off	DIP 3-Off
DIP 4-On	DIP 4-Off	DIP 4-Off
DIP 5-On	DIP 5-On	DIP 5-On
DIP 6-On	DIP 6-On	DIP 6-Off
DIP 7-On	DIP 7-On	DIP 7-On
DIP 8-On	DIP 8-Off	DIP 8-Off

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

* 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

6

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 7500B 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 750013 Data Module instead of a modem.

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

Table 6-1	. Data	Station	Configurations
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Type of Station	Telephone (for voice)	GPA or MFM	DCE	DTE
Analog voice and modem data	Analog multiline telephone and BR-241-B1 bridging adapter	GPA	Modem	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 7500B data	Any MLX telephone	None	75006 Data module	Terminal, PC, fax, credit card verification, optical scanner, host computer, or video codec
7500B data-only	None	None	7500B Data module and	Terminal, PC, fax, credit card verification, optical scanner, host computer, or video codec
			a 440A4 terminating resistor adapter	

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 7500B data-only station requires a terminating resistor adapter to connect the 75006 data module 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 7500B data module to the telephone cannot be more than 80 ft. (24 m).
- 5. Do not connect two 7500B data modules 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.

7500B Data Stations

A 7500B data station uses a 7500B 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 7500B modules:

- MLX Voice and 7500B Data. This station includes a 7500B data module, data terminal, and an MLX telephone.
- **7500B Data-Only.** This station includes a 7500B data module, 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 7500B data stations.

NOTE:

A video conferencing data station is a synchronous 7500B 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 setup an analog voice and modem data station, follow the steps below:

I If Using an external modem use an EIA-232-D cable to connect the SERIAL potion 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 EVENI 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 setup 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 C0M2 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 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.
- 4 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

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 modem 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.

5 Connect all power cords to an AC outlet that is not controlled by a wall switch.

MLX Voice and 7500B Data Stations

Figure 6-4 shows the equipment configuration for MLX voice and 7500B data station.

The configuration shown in Figure 6-4 is for *asynchronous* 7500B data transmission. For information on setting up *synchronous* 7500B data stations, see "Video Conferencing Data Stations," later in this chapter.

The maximum cord length from the 75006 data module to the telephone is 80 ft. (24.38 m).

Setting Up

To set up an MLX voice and 75006 data station, follow the steps below:

1 Use an EIA-232-D cable to connect the serial port on the data terminal to the 7500B data module.

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 7500B data module 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 7500B data module and data terminal.

- 3 Plug the other end of the EIA-232-D cable into PORT 1 on the 75008 data module.
- 4 Plug the WP90110-L7 power supply cord into the POWER receptacle on the 7500B data module.
- 5 Connect the 7500B data module to the MLX telephone.
 - a Plug one end of a D8W cord into the PHONE jack on the 7500B data module.
 - b Plug the other end into the LINE jack on the MLX telephone.



Figure 6-4. MLX Voice and 7500B Data Equipment Configuration

6 Connect the 7500B data module to the control unit.

- a Plug one end of a D8W cord into the LINE jack on the 7500B data module
- 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.

7500B Data-Only Stations

Figure 6-5 shows an equipment configuration for a 7500B data-only station.

To set up a 7500B 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 7500B data module.

For any data terminal that has both COM1 and C0M2 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 7500B data module 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 75006 data module and the data terminal.

- 3 Plug the other end of the EIA-232-D cable into PORT 1 on the 7500B data module.
- 4 Plug the WP90110-L7 power supply cord into the POWER receptacle on the 7500B data module.
- 5 Use a 440A4 terminating resistor adapter to connect the 7500B data module to the control unit.
 - a Use a D8W cord to connect the 440A4 terminating resistor adapter to the LINE jack on the 7500B data module.
 - 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. 7500B Data-Only Equipment Configuration

Video Conferencing Data Stations

You can use the 7500B data module 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 75006 data module, see the documentation packaged with the 75006 data module.

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 7500B data modules with two 7500B data module feature package 2 upgrades (user manuals included)
- Two Multipurpose Enhancement Boards [install one of these in each 7500B data module for synchronous communication and an RS-366 Automatic Calling Unit (ACU) interface]
- Two WP901 10-L7 power supplies (one per stand-alone 7500B)
- 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 7500B data modules 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 7500B data module

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 7500B data module 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 7500B data modules.
- 2 Connect the other end of each D8W cord.
 - If Data Form 1 b 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 7500B data modules.

- 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 7500B data module.
- 5 Plug each WP901 10-L7 power supply cord into the POWER jacks on the 75006 data modules.

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

6 Connect each 7500B data module to the video conferencing data station.

- a Use the DB-25 cables to connect the PORT 2 jacks on each 7500B data module 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 7500B data module 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.

7500B Data Module and CSU Settings

You need to set the 7500B data modules 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.

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

Table 6-2. 7500B Data Module Settings

Initializing and Testing the System

7

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

Initializing the System

To initialize a Release 3.0 system, use one of the following methods:

- Restore from a 3.0 system programming disk or Translation memory card.
- Upgrade to Release 3.0 from Release 1.0, 1.1, 2.0, or 2.1. 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 3.0 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 00 \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 3,0 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 Mai ntenance \rightarrow SI ot \rightarrow Dial or Type 00 \rightarrow Enter \rightarrow Demand Test \rightarrow System Erase (Line 5, left button) twice \rightarrow Yes

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** \rightarrow SysProg \rightarrow System \rightarrow Date \rightarrow Drop \rightarrow Dial current date \rightarrow 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 *00 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 *09.

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 Pickup 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 pickup 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 button.

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 *03 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 *03 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 areas 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 pickup 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.

4 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 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, pickup 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, pickup the handset and dial the trunk that is programmed to ring for a particular calling group.
- 3 At the ringing telephone, have someone pickup 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, pickup 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 pickup 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, pickup 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.

- 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 group.

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, pickup 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:

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.

- 6 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 and 400 GS/LS modules each provide four touch-tone receivers (TTRs). The 008 OPT module, 800 DID module, 012 basic telephone modules, 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 toa012 or 008 OPT module.
- 2 Dial *04 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 *07* 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 test.

4 Dial 12345678*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:

- 1 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

Installing Applications

8

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
 - $\hfill\square CAS$ 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

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 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 TTRs: 012, 400, 400 GS/LS/TTR, and 008 OPT (but the 008 OPT module does not support VMS applications).

No. of VMS Ports	No. of TTRs Required	No. of 012 Modules	No. of 400 or 400 GS-LS/TTR Modules
1	1	1	0
2	1	1	0
3	2	1	0
4	2	1	0
6	3	1or2	0or1
8	4	1or2	0or1
12	6	2or3	0or1

Table 8-1. TTRs Required by VMS

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 H (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 D0S, 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

Cal/ 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.

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.

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.

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 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 Setup 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.

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 a 012 basic telephone module. You can use up to eight jacks on a 012 basic telephone module for AT&T Attendants. When using fewer than eight jacks, 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

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	1to6	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 a 012 basic telephone module for MERLIN MAIL. If you use all eight jacks for MERLIN MAIL, you cannot connect any other devices to the module.

When using fewer than eight jacks, 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 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 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 Passage Way 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. (I5.2 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

9

To upgrade the control unit, follow the steps below:

1 Remove the control unit housing.

See "Removing the Control Unit Housing," next in this chapter.

2 If the current system programming is to be used in the upgraded system, back up system programming.

See "Completing the Upgrade," later in this chapter, for details.

3 Power down the system.See "Powering Down the System," later in this chapter, for instructions.

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 Form 1.

If you are installing an expansion carrier, remove the rightmost module from the control unit and put it aside. See Figure 9-3.



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.

See "Installing the Modules" in Chapter 2.

5 Replace the processor module. See Figure 9-3.

- a Press up on the tab at the bottom rear of the old processor module.
- While the tab is unlocked, pull the processor module towards you, and b then lift it straight up.
- Install a Release 3.0 processor module. See "Installing the Processor" in С Chapter 2.



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

- 3 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, 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.

Remove the control unit housing. See Figure 9-1. 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 vour left.
- Unclip and remove the left side panel. See Figure 9-5. 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

WARNING:

The following procedures are for qualified technicians or service personnel only. installation or maintenance of this product by anyone other than qualified personnel may damage or impair the product—the limited warranty does not cover such damage. See the limited warranty for details. Hazardous electrical voltages are present inside this product.

To upgrade to Release 3.0, you need:

- SPM Version 3.xx or higher
- The version number of the SPM software currently installed (if any)
- Release 3.0 processor module and forced installation PCMCIA card
- DOS-formatted disk

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 upgrade to release 3.0 from Release 1.0, 1.1, 2.0, or 2.1:

1 Install SPM.

2 Backup system programming.

- 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.
- 3 Install a Release 3.0 processor module. See Chapter 2, "installing the Processor."

4 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:

```
Maintenance \rightarrow Slot \rightarrow OO \rightarrow Demand Test-System Erase (Line 5, left button) twice \rightarrow Yes
```

See Maintenance and Troubleshooting for more information on System Erase.

5 Convert the backup file.

This converts the backup file created in Step 2 to Release 3.0 format.

6 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 3.xx or higher of SPM and restore the file you converted in Step 5.

7 If applicable, program new features.

See System Programming for detailed programming procedures.

Upgrading from the MERLIN II Communications System

To upgrade from the MERLIN II Communications System to Release 3.0, follow the steps below.

1 Install SPM.

Install (or upgrade to) version 3.xx or higher of SPM.

2 Remove the control unit housing.

See "Installing the Control Unit" in Chapter 2 if you need instructions.

3 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 3.0 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 \rightarrow00 \rightarrowDemand Test \rightarrowSystem Erase (Line 5, left button) twice \rightarrow 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 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.

8 Replace the control unit housing.

See Chapter 2, "Installing the Control Unit," for additional instructions.

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 Pickup 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

Completing the Upgrade

System Numbering Forms

A

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 System*

2-Digit+ Selected Extension Numbers						ion Nur	nbers	🛛 3-D	igit 🗆 S	Set Up Space					
Mod. Type	Log. ID	Jao A	ck Ty D†	pe B	Eqpt.	2-Dig Ext. No. u	3-Dig. Ext. No.	Set Up Space	Renumber to	Label	Old Ext. No.	Wire No.	Person, Location or Function	VEX R1.1	AUDIX Voice Power™
	1					10	100	7100							
	2					11	101	7101							
	3					12	102	7102							
	4					13	103	7103		1 1 1 1 1 1					
	5					14	104	7104							
	6					15	105	7105							
	7					16	106	7106							
	8					17	107	7107		11 11					
	9					18	108	7108		 f					
	10					19	109	7109							
	11					20	110	7110							
	12					21	111	7111		1]					
	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							
ļ	20					29	119	7119							
	21					30	120	7120							
	22					31	121	7121							
	23					32	122	7122							
	24					33	123	7123							

Shaded lines indicate possible operator positions

♦ Factory Setting

Use Form 2b for adjuncts connected via MFM or ISDN 7500B Data Module The system capacity for Personal Directories is decreased by one whenever an MLX-20L telephone is connected to an MLX port

Figure A-1. Form 2a, System Numbering: Extension Jacks

The following explains how to complete Form 2a.

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

Maximu	m 127	Adjund	cts						
	Fa	ctory-S	et	MFM		/IFM		MLX	Deres Location
Log, ID	2-digit	3-digit	Set Up Space	Renumber to	SAA	T/R	7500B	Ext. No.	Function, and Equipment Type
1	710	300	7300						
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	710	308	7308						
10	719	303	7308						
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	728	319	7319						
21	730	320	7320						
22	731	321	7321						
23	732	322	7322						
24	733	323	7323						
25	724	324	7324						
26	735	325	7325						
27	736	326	7326						
28	737	327	7327						
29	738	328	7328						
30	738	329	7329						
31	740	330	7330						
32	741	331	7331						
33	742	332	7332			l			
34	743	333	7333						
35	744	334	7334			l			
36	745	335	7335						
37	746	336	7336						
38	747	337	7337						
39	748	338	7333						
40	749	339	7338						

Figure A-2. Form 2b, System Numbering: Digital Adjuncts

Form 2c, System Numbering: Line/Trunk Jacks

Music-c	on-Ho	old, Line/T	runk No	D		Source		Mainten	anc	e A	larm,	Line	/Trunk	No.			
Loudsp	eake	r Page, ∟	ine/Tru	nk No(s).				Loop-St	art l	Reli	able	Disc	onneo	ct			
I								No ♦			Yes						
Module Type and Slot No,	Log. ID	Jack Type (LS, GS, DID, Tie, etc.)	Line/ Trunk No.	Pool Dial- Out Code†‡	Re- number To	Incoming Line/Trunk Type (Main No., Personal Line, WATS, FX, etc)	Telephone Number or Equipment	Label	Outm Signa TT ♦	node aling R	Toll ⊺ Prefix for I Yes ♦	Гуре Req'd LD No	Hold Int Short	d Disc. erval Long +	QCC Queue Priority Level† (4+)	QCC Operator to Receive Calls† (No ♦)	Function
	1		801					1 1									
	2		802														
	3		803														
	4		804														
	5		805														
	6		806														
	7		807													-	
-	8		808														
	9		809					t 									
	10		810					1 1									
	11		811														
	12		812					t									
	13		813					1									
	14		814														
	15		815														
	16		816														
	17		817														
	18		818														
	19		819														
	20		820														
Factory	Setti	ing															

* If the system has AUDIX Voice Power/FAX Attendant System™, Integrated Administration will automatically set Loop-Starr Reliable Disconnect to Yes ‡ Maximum. 11 pools with up to 80 trunks per pool, Factory settings 70 (main), 891 (dial-in tie), 892 (automatic-in tie).

+ Hybrid/PBX mode only



Form 2d, System Numbering: **Special Renumbers**

		-	-			
Poo (Form Descr	ols* nl 2c) iption	Factory-Set Number	Renumber t o	Group Calling (Form 7d) Grow ID Label	Factory-Set Number	Renumber to
		70			770	
		890			771	
		891			772	
		892			773	
		893			774	
		894			775	
		895			776	
		896			777	
		897			778	
		808			779	
		888			780	
		000			781	
<u> </u>	- ·	1	1	· · · · · · · · · · · · · · · · · · ·	782	
Group	Paging	Factory-Set	Renumber		702	
(Form	17b)	Number	to		703	
Grou	p ID				704	
		793			785	
		784			786	
		795			787	
		796			788	
		797			789	
		798		-	790	
		799			7020	
					1920	
Park	Zone				7921	
/Earm	20110	Factory-Set	Renumber		7922	
(FUIII	10a)	Number	to		7923	
Descr	iption				7924'	
		881			7925'	
		882			7926'	
		883			7927'	
		884			7928'	
		885			7929'	
		886				
		887		Listed Directory	Factory act	- ·
		888		Number	Number	Renumber
				(QCC Queue)	Number	10
	DS	S Page Buttor	าร		800	
PAGE 1	Beginnii	ng extension	for range —			
PAGE 2	Beginnin	a extensio	n for range —	Remote Access	Factory-set	Renumber
DAGE 2	Poginnir	a extension	for range -	Code (Form 3a)	Number	to
FAGE 3	Deginin	.9 001101011	.o. rango	\rightarrow	869	
	ial_Out	Default	Renumber			
	hat-Out	Delault	to			
			10			
		9				

Hybrid/PBX mode only.
 ARS Dial-Out Code is idle Line Preference Code in Key mode.
 Reserved for AUDIX Voice Power/Fax Attendant System.

Figure A-4. Form 2d, System Numbering: Special Renumbers

Unit Load Calculation Worksheet

B

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.

Unit Load Worksheet

1.	Number of modules in carrier (excluding power supply and processor:		
	If fewer than five, auxiliary power is not required.		
	■ 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 □ No	
	If no, auxiliary power is not required		
	■ If yes, continue to Step 4.		
4. I	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		
Т	otal 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.		

Module	Qty x	Unit Load	= Total
008		12.0	
008 MLX		13.5	
008 OPT		8.0	
012		8.4	
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 GS/LS		0.0	
800 GS/LS-ID		8.0	
800 DID		8.0	

5. Calculate the estimated unit loads.

Total Estimated Unit Load

■ If the total is less than or equal to 54, auxiliary power is not required.

■ 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		1.0	1.0	
DS1		0.0	0.0	
GS/LS		0.0	0.0	
Tie		1.4	1.4	
Telephones				
MLX-10		0.9	1.2	
MLX-10D		0.9	1.2	
MLX-28D		1.2	1.7	
MLX-20L		1.1	1.6	
BIS-10		0.9	1.1	
BIS-22		1.0	1.3	
BIS-22D		1.0	1.3	
BIS-34		1.1	1.5	
BIS-34D		1.1	1.5	
MLC-5		0.0	0.0	
MDC-9000		0.0	0.0	
MDCW-9000		0.0	0.0	
10-Button Basic		0.9	1.1	
10-Button HFAI		1.0	1.2	
34-Button Basic		0.9	1.1	
34-Button DLX		1.2	1.7	
34-Button BIS		1.2	1.4	
34-Button BIS/DIS		1.2	1.4	
Single-Line Telephone		0.6	0.7	
Continued				

* Unit loads are computed per trunk for trunk-type network access lines.

Unit Load Calculation Worksheet

	Qty x	Unit Load		= Total
Equipment	-	Hybrid/PBX or Modified	Square	
Optional Equipment				
Direct Station Selector‡		0.7	0.9	
General Purpose		0.8	1.0	
Adapter		0.8	1.0	
Hands-Free Unit		0.8	1.0	
Headset Adapter				_
		Total Actual Uni	t Load	

† 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,

- If the total actual unit load is less than or al to 54, auxiliary power is not required.
- If the total actual unit load is greater than 54, continue to Step 7.

- 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, 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, auxiliary power is not required.
 - If the exchange does not reduce the unit load to 54 or less, auxiliary power is required. 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 Modified	Square	
Network Access Lines*					
DS1			0.0	0.0	
GS/LS			0.0	0.0	
Tie			1.4	1.4	
Telephones					
MLX-10			0.9	1.2	
MLX-10D			0.9	1.2	
MLX-28D			1.2	1.7	
MLX-20L			1.1	1.6	
BIS-10			0.9	1.1	
BIS-22			1.0	1.3	
BIS-22D			1.0	1.3	
BIS-34			1.1	1.5	
BIS-34D			1.1	1.5	
MLC-5			0.0	0.0	
MDC-9000			0.0	0.0	
MDW-9000			0.0	0.0	
10-Button Basic			0.9	1,1	
10-Button HFAI			1.0	1.2	
34-Button Basic			0.9	1.1	
34-Button DLX			1.2	1.7	
34-Button BIS			1.2	1.4	
34-Button BIS/DIS			1.2	1.4	
Single-Line Telephone			0.6	0.7	
Continued					

* Unit loads are computed per trunk for trunk-type network access lines.

	Qty x	Unit Load		= Total
Equipment		Hybrid/PBX or Modified	Square	
Optional Equipment				
Direct Station Selector*		0.7	0.9	
General Purpose		0.8	1.0	
Adapter		0.8	1.0	
Hands-Free Unit		0.8	1.0	
Headset Adapter		_		
		Total Unit Load and 6	for 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.

‡ 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.

- If the unit load for slots five and six is less than or equal to 27, auxiliary power is sufficient for the carrier.
- If the unit load for slots five and six is more than 27, continue to Step 9.

- Try to exchange modules between carriers to reduce the unit loads for slots five and six to 27. (Remember that the 100D, 400, 400 GS/LS/TTR, 800 GS/LS-ID, 800, 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 to 27 or less, auxiliary power is sufficient.
 - If the exchange does not reduce the unit loads for slots 5 and 6 to 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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MERLIN LEGEND® Communications System Release 3.0

Maintenance and Troubleshooting

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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.

Security of Your System: Preventing Toll Fraud

As a customer of a new telephone system, you should be aware that there exists an increasing problem of telephone toll fraud. Telephone toll fraud can occur in many forms, despite the numerous efforts of telephone companies and telephone equipment manufacturers to control it. 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)

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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 applicable aux appareils numériques de la class A prescribes clans le Réglement sur le brouillage radioélectrique édicté par le ministére des Communications du Canada.

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Tables

5 Central Office Problems

5-1. Troubleshooting Trunk Symptoms

5-2



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.

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

Safety

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 provides detailed information about system and telephone trouble reports and troubleshooting operations. It is intended for use by qualified field technicians who are responsible for system maintenance and troubleshooting, and as a reference by anyone needing such information, including support personnel, sales representatives, and account executives.

How to Use This Book

This book provides step-by-step procedures for isolating troubles both inside and outside the communications system. Refer to the chapter associated with the reported problem to initially start the troubleshooting procedure.

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 *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, 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			
analog voice and analog data station			
digital voice and analog data station			
analog data only station			
digital data only station			
digital voice and digital data station			

line/trunk module line/trunk jack extension extension jack modem data station 7500B data station analog voice and modem data MLX voice and modem data modem data only station 75005 data only station MLX voice and 7500B data station

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 <i>headpiece</i> .	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.

Continued on next page

Example	Purpose
Choose Ext Prog from the display screen.	Plain constant-width type indicates text that appears on the telephone display or 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.

Typographical Conventions Continued

Product Safety Labels

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



WARNING:

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



CAUTION:

Caution indicates the presence of a hazard that could cause minor persona/ 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."

Related Documents

In addition to this book, the following list of documents are part of the documentation set, Within the continental United States, these documents can be ordered from the AT&T Customer information Center by calling 1-800-432-6600.

Document No. Title

	System Documents
555-630-117	Introduction
555-630-118	System Manager's Guide
555-630-110	Feature Reference
555-630-115	Equipment and Operations Reference
555-630-116	Pocket Reference
555-630-111	System Programming
555-630-112	System Planning
555-630-113	System Planning Forms
	Telephone User Support
555-630-122	MLX- 10D™, MLX-10DP™, MLX-28D™, 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)
555-630-124	MLX-10™ Nondisplay Telephone User's Guide
555-630-151	MLX-10 Nondisplay Telephone Tray Cards (6 cards)
555-630-120	Analog Multiline Telephones User's Guide
555-630-126	Single-Line Telephones User's Guide
	System operator Support
555-630-134	MLX Direct-Line Consoles Operator's Guide
555-630-132	Analog Direct-Line Consoles Operator's Guide
555-630-136	MLX Queued Call Console Operator's Guide

Document No. Title			
	System Operator Support (Cont.)		
555-630-138	MDC 9000 and MDW 900 Telephones User's Guide		
	Miscellaneous User Support		
555-630-130	Calling Group Supervisor's Guide		
555-630-129	Data User's Guide		
Documentation for Qualified Technicians			
555-630-140	Installation, Programming, & Maintenance (IP&M) Binder.		

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Title:Maintenance and TroubleshootingOrder No.:555-630-140Date:August 1994

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THIS FORM MAY BE PHOTOCOPIED

Introduction

1

The purpose of maintenance is to detect, report, and clear problems quickly with minimal disruption of service, The system attempts to isolate each problem to a single replaceable unit, whenever possible, by running automatic tests. Errors that it cannot automatically correct are usually recorded in error logs. Most troubleshooting relies on checking the error logs and interpreting them, using Table 2–2, "Error Codes," in Chapter 2.

Equipment

To perform maintenance, you need a maintenance terminal and some additional tools, all of which are defined below.

Maintenance Terminal

Whether you perform on-site or remote maintenance, you need a maintenance terminal:

- For on-site maintenance, you can use either an MLX-20L console or a PC with System Programming and Maintenance (SPM) software.
- For remote maintenance, you must use a PC with SPM software.

Detailed information about system programming is included in *System Programming* and in *System Programming and Maintenance (SPM).* You can use either a DOS PC or a Master Controller (MCII or MCIII). To connect a PC to the control unit, you need a 355AF adapter and a D8W-87 cord.

NOTE:

On-site programming maintenance is preferred if it is feasible; remote programming overrides on-site programming, except when on-site backup or restore is in progress. See "On-Site Programming Maintenance" and "Remote Programming Maintenance," later in this chapter, for details.

Tools

In addition to the maintenance terminal, you need the following tools:

- EIA breakout box
- Digital voltmeter (KS-20599 or equivalent)
- 110/66-type punchdown tool
- Dracon TS21 or equivalent touch-tone telephone for testing
- Assorted flathead and Phillips-head screwdrivers
- Long-nosed and regular pliers
- Wrist grounding strap
- Replacement parts recommended by your technical support organization

CAUTION:

Should you ever need to open a module and handle the circuit board, use the wrist strap to connect your wrist to a suitable ground first. Electrostatic discharge can destroy or severely damage the integrated circuits in the power supply, processor, and modules.

On-Site Programming Maintenance

You can perform on-site maintenance with an MLX-20L console or a PC with SPM software. This book provides maintenance instructions from the console. If you are using a PC, refer to *System Programming and Maintenance (SPM)* for details. If you use the UNIX[®] System, see the documentation for Integrated Solution III (IS III).

Setting Up the MLX-20L Console

To connect an MLX-20L console to the control unit, follow the steps below. Refer to Figure 1-1.

1 Plug one end of a D8W-87 cord into one of the first five jacks on the leftmost 008 MLX module or 408 GS/LS-MLX module.

The first MLX jack is the default. If it is already being used for the attendant console, choose another jack. If one of the jacks is already being used for system programming or maintenance, use that jack. Only one jack at a time can be used for system programming or maintenance.

2 Plug the other end of the D8W-87 cord into the LINE jack on the underside of the MLX-20L console.

MLX-20L Failure

If the MLX-20L console does not work, follow the steps below.

- 1 Replace the MLX-20L console with one that is known to be working (if available).
- 2 If the failure persists, or if a working MLX-20L console is not available, connect the original MLX-20L console directly into the appropriate MLX jack on the control unit using a cord that is known to be working.
- 3 If the trouble clears, replace the original D8W-87 cord.

If not, use the PC as your maintenance terminal and then troubleshoot the leftmost MLX module. See "Module Problems" in Chapter 4 for instructions.



Figure 1–1. Setting Up the MLX-20L Console

Setting Up the PC

Plug a PC into the ADMIN jack on the processor module as shown in Figure 1-2. If you are using a remote PC for system programming, see "Remote Programming Maintenance."



Figure 1-2. Setting Up the PC

Remote Programming Maintenance

Remote maintenance allows you to support the system from an off-premises location. You can check error logs and system status and restart the system remotely.

To perform remote maintenance, you need a PC with SPM software, a tip/ring telephone, and a 1200-bps modem. Beginning with Release 3.0, a 2400-bps modem may also be used.

Considerations

Review the following points before you begin remote maintenance procedures.

- Remote maintenance overrides on-site maintenance and programming, except when on-site backup or restore is in progress. Before you perform remote maintenance, notify the customer's system manager.
- You can perform remote maintenance and programming only from a DOS PC, not from the UNIX environment, If you are running SPM under IS III, you cannot perform remote maintenance.
- Line noise can cause the SPM screen to display unpredictable results. If this occurs, hang up and redial.

NOTE:

Under applicable tariffs, the customer is responsible for any charges incurred through the remote use of system facilities. Precautions should be taken to prevent unauthorized use of the system's outside lines by remote callers, also called toll fraud. See Appendix A, "Customer Support Information," for more information on security.
Setting Up Equipment for Remote Maintenance

To setup equipment for remote maintenance, follow the steps below while referring to Figure 1–3 and to *Installation*.

1 Connect the PC and modem.

- If you have an external modem, use an EIA-232-D cable.
- If you have an internal modem, the connection is already established.

2 Use a D8W cord to connect the modem to a T/R trunk jack.

3 Use a D8W cord to connect the modem to a T/R telephone.



Figure 1-3. External Modem Setup

Using SPM

For more information on using SPM, see System Programming and *Maintenance*.

Starting SPM

The procedure for accessing SPM differs slightly, depending on whether your PC is connected directly or by modem to the control unit.

With a Direct Local Connection

To access SPM when your PC is connected directly to the control unit, follow the steps below.

- 1 If you do not have a hard drive, insert the SPM diskette into Drive A and switch to Drive A if it is not already the current drive.
- 2 Start the SPM program.

Type SPM.	The SPM Welcome screer	appears, as shown below.	
Console	e Display/Instructions	Additional Information	PC
Dross any	, kov		

3 Press any key.

Welcome to SPM The MERLIN LEGEND	If the main menu (see Step 4) does not appear, or if the information on
System Programming & Maintenance Utility	the screen is garbled, press any key again.
Please press any key	5
Versi on X. xx	

4 Select an option by pressing one of the function keys.

	SPM M	ain Menu	
	Menu: Select	Functi on	
F1)	Sys Program	Mai ntenance	<u>(F6)</u>
F2)	Backup	Restore	<u>(F7)</u>
<u>F3)</u>	Boards	Pass-Thru	<u>(F8)</u>
F4)	Print Opts	Password	<u>(F9)</u>
F5 <u>)</u>	Moni tor	Language	<u>(F10)</u>

With a Local or Remote Modem Connection

When the equipment is set up, you can perform remote maintenance by dialing the remote processor's built-in 2400/1200-bps modem. You can dial the modem directly or call the system operator and request to be transferred to the modem. Both procedures are explained below.

Dialing the System Operator

If you do not know the remote access trunk number, dial the number for the customer's system. To dial the operator, follow the steps below.

- 1 Start SPM. When the Welcome message appears, press any key.
- 2 Enter the command to put the modem in originate mode (this command varies depending on the type of modem you are using).
- 3 Pick up the handset on the T/R telephone and dial the customer's system operator (the Listed Directory Number for the customer's system).
- 4 When the attendant answers the call, explain what you are doing and ask for any passwords you may need; then ask the operator to transfer you to the modem by pressing the Transfer button and then dialing *10.

NOTES:

- 1. If the password is not known, check the System Information Report or ask to speak with the system manager.
- 2. You can change the password without knowing the old password only when you perform on-site maintenance through the ADMIN jack.

5 When you hear the modem tone, hang up.

If nothing appears on the SPM screen, press (Enter \downarrow).

6 Enter the password.

When the Password: prompt appears, type the password (do not press

<u>(Enter \downarrow)</u>). The SPM main menu appears, and you are ready to proceed with remote maintenance.

Dialing the Modem Directly

To dial the modem directly, follow the steps below.

- 1 Start SPM. When the Welcome message appears, press any key.
- 2 Enter the command to put the modem in originate mode (this command varies depending on the type of modem you are using).
- 3 Pick up the handset on the T/R telephone and dial the remote access trunk number.

This is possible only if a trunk is programmed as a dedicated trunk for remote access to the built-in modem.

4 If the dial tone begins with three short tones followed by a steady tone, dial the remote access barrier code from the T/R telephone; otherwise, go to Step 5.

If you do not know the remote access barrier code, contact the customer's system manager, or check Form 3a, Incoming Trunks: Remote Access. If the system accepts the barrier code, you hear ringing followed by dial tone.

NOTE:

You can change the barrier code without knowing the old one only when you perform on-site maintenance through the ADMIN jack.

5 Connect to the modem on the remote system.

When you hear dial tone, dial *10.

6 When you hear the modem tone, hang up.

If nothing appears on the SPM screen, press [Enter \downarrow].

	Console Disp	lay/Instructio	15	Additional Information	PC
7 EI	7 Enter the password.				
	Enter Password	1	Ty Tř ap	pe the remote access password. The password you enter does not pear as you type it.	
8	Select an optio	n.			
	SPM Mai	n Menu	Р	ress one of the function keys.	
	Menu: Select F	unction			
<u>(F1)</u>	Sys Program	Maintenance	<u>(F6)</u>		
<u>(F2)</u>	Backup	Restore	<u>(F7)</u>		
<u>(F3)</u>	Boards	Pass-Thru	<u>(F8)</u>		
<u>(F4)</u>	Print Opts	Password	<u>(F9)</u>		
<u>(F5)</u>	Moni tor	Language	<u>(F10)</u>		

NOTES:

- 1. If you do not know the password, check the System Information Report or ask to speak with the system manager.
- 2. You can change the password without knowing the old password only when you perform on-site maintenance through the ADMIN jack.

The SPM Display

SPM screens simulate the MLX-20L console (see Figure 1-4).



Figure 1-4. The SPM Display

Each SPM screen includes a 7-line by 24-character console simulation window that corresponds to the display area of the MLX-20L telephone. To the right and left of this console simulation window are columns, listing the keys that correspond to similarly located buttons on the MLX-20L telephone.

The 10 function keys, identified on screen as (F1) through (F10), are used to select screen options. When a screen displays several choices, press the function key identified by the label next to your choice. (If you were working on the console you would press the telephone button next to your choice.)

Below the console simulation window are 20 simulated line buttons. Using <u>(PgDn)</u> (Inspect), you can determine the status of each line.

.

A list of labels on the right side of the screen shows key combinations that correspond to buttons on the MLX-20L telephone. Table 1–1 describes the function of PC keys within SPM.

PC Key	Console	SPM Function
(Home)	Home	Quit. Exit from SPM and return to the DOS prompt when you have finished system programming. If you are using a modem, the call is disconnected.
<u>(End)</u>	Menu	Return to the SPM Main Menu.
(PgUp)	More	Display more menu items (when there is an additional screen and the > symbol appears next to the key.)
(<u>PgDn)</u>	Inspct	Show the current information that has been programmed for a feature or button.
<u>(Alt)</u> + <u>(P)</u>	Drop	Stop. Enter a stop in a speed dialing sequence.
		This combination also deletes an entry in a field in any screen except one in which you are entering a speed dialing sequence.
<u>(Alt)</u> + <u>(F)</u>	Conf	Flash. Enter a switchhook flash in a speed dialing sequence.
<u>(Alt)</u> + <u>(C)</u>	n/a	TopSP. Return to the top of the System Programming menu.
<u>(Alt)</u> + <u>(H)</u>	Hold	Pause. Enter a Pause in a speed dialing sequence.
<u>(ALT)</u> + <u>(U)</u>	n/a	Convert. Convert a backup file from an earlier release to Release 2.0 or later format.

Table 1-1. Function of PC Keys in SPM

Using SPM

Table 1–1 Continued

<u>(Ctrl)</u> + <u>(F1)</u>	n/a	Help. Display a help screen about SPM operations. To exit from Help, press <u>(End)</u> .
<u>(Ctrl)</u> + <u>(F5)</u>	n/a	Reset. Reset the communications port. For example, if the information on the screen is garbled, try exiting from and then recentering the screen. If the screen remains garbled, use $(Ctrl) + (F5)$ to clear the screen and return to the SPM Welcome screen. Note that using $(Ctrl) + (F5)$ drops the modem connection.
<u>(Ctrl)</u> + <u>(F8)</u>	n/a	Browse. View print reports saved with Print Opts.
<u>(Ctrl)</u> + <u>(F9)</u>	n/a	Escape to shell. To use this key in sequence, you must set DEBUG=1 in the SPM configuration file ams.cfg. You can then use this key sequence to execute DOS (or UNIX system) commands. To return to SPM, type <i>exi t</i> .
<u>(Enter ⊣)</u>	Enter	This key on your PC can be used instead of (F10) (Enter) when <i>Enter</i> appears as a choice in the 7-by- 24 console simulation window.
(<u>←Bksp</u>)	Backspace	The $(\leftarrow Bksp)$ can be used instead of (F9) when it appears as a choice in the 7-by-24 console simulation window.
<u>(Del)</u>	Delete	The <u>(Del)</u> key on your PC can be used instead of <u>(F8)</u> (Delete) when it appears as a choice in the 7-by-24 console simulation window.
(<u>↑)(↓)(↔(→)</u>	n/a	The up, down, left, and right arrow keys can be used to highlight selections in a menu and to select the 20 line buttons below the 7-by-24 console simulation window.

Exiting SPM

To exit SPM, follow these steps.

1 Return to the System Programming menu.

If the display gives directions for returning to the main menu, follow the directions. If not, press (F10) (Exit) to return to the previous menu. Continue to press (F10) (Exit) until the main menu appears.

Console Display/Instructions Additional Information PC

2 Select the Quit option.

	SPM Main Menu		1
	Menu: Select Function		
<u>(F1)</u>	Sys Program	(F6)	
<u>(F2)</u>	Backup	Restore	(F7)
<u>(F3)</u>	Boards	Pass-Thru	(F8)
<u>(F4)</u>	Print Opts	Password	(F9)
<u>(F5)</u>	Monitor	Language	(F10)

Press the (Home) key.

Preparation for Hardware Maintenance

If you are performing on-site hardware maintenance, first remove the control unit housing (the cover of the control unit), then the AC power.

Removing the Control Unit Housing

To remove the control unit's housing, see Figure 1-5.

- If you have a MERLIN II[®] Communications System or a MERLIN LEGEND Communications System (Release 2.1 or later):
 - 1. Pull the bottom front of the housing towards you, When it releases, remove it by lifting up as shown in Figure 1–5.
 - 2. Remove the top cover from each carrier by pushing it straight up from the front.

- If you have a MERLIN LEGEND Communications System (Release 2.0 or earlier):
 - 1. Pry the clips from the housing on both sides of the control unit; use a screwdriver if they are difficult to remove.
 - 2. Carefully pull the housing towards you.

NOTE:

If the MERLIN LEGEND (Release 2.0 or earlier) system has more than one carrier, make sure you hold the housing assembly on the basic carrier at the sides, otherwise, the housing may disassemble as the front and side panels are only slotted together.



Figure 1-5. Removing the Control Unit Housing

Disconnecting AC Power

To disconnect the AC power, see Figure 1-6, and follow the steps below.

- 1 Disconnect the AC power to each auxiliary power unit by unplugging the power cord from the wall outlet.
- 2 Disconnect the AC power to each carrier by unplugging the power cord from the wall outlet.



Figure 1-6. Disconnecting AC Power

Maintenance Strategy

The maintenance strategy presented in this section is only a guideline, not a fixed procedure. Refer to Figure 1-7 whenever you are uncertain as to how to proceed. As you become more experienced with maintaining and troubleshooting the system, you will most likely develop your own strategy.



Figure 1-7. Maintenance Strategy

Trouble Reports

System trouble can be reported in two ways:

- By users
- By system alarms (permanent errors)

Automatic Tests

The system performs ongoing maintenance automatically by running tests that:

- Monitor the status of equipment.
- Audit operations consistency.
- Detect hardware malfunctions.

Without disrupting normal service, the tests check hardware and software that are in service. The system registers any errors it detects in the error logs and corrects them automatically, if possible.

Alarms

If the automatic tests indicate serious error conditions, the system generates an alarm. Depending on how the system is programmed, the system announces an alarm condition in one of the following ways:

- An LED for a line or feature button turns on at an operator console or other designated telephone.
- The red status LED on the processor module lights.
- In Release 3.0, the error code/status display on the processor module displays F if a frigid start, or C if a cold start occurs. See "System Restart" for details about frigid start (System Erase) or cold start (Restart).

If a software installation or upgrade is taking place, a blinking character is displayed to indicate the status of the procedure. See "Forced Installation of System Software" in Chapter 4 for more information.

- The status display indicates an alarm (on an MLX-20L console or a PC running SPM), and can be viewed on the Error screen.
- A supplemental alert, bell, chime, or strobe, if installed, is activated.

If an LED is programmed to indicate the alarm, the LED stays lit until the error is cleared.

When the system indicates an alarm, check the permanent error log screen.

Clearing Alarms

The system clears alarms automatically when the error condition no longer exists.

To clear an alarm manually, select **Drop** on the MLX-20L console or (Alt) + (P) on a PC while viewing the error. See "Error Logs" in Chapter 2 for more information.

System Restarts

Depending on the severity and duration of a problem, you may need to restart the system manually. Some errors cause the system to restart automatically. Every restart causes an error log entry, and each type of restart has its own error code. A cold start (Restart) or frigid start (System Erase) also causes a C or F to appear on the error code/status display on the processor module.

There are three types of system restarts, all of which occur automatically:

- Warm start (you cannot select this from the Maintenance menu)
- Cold start (select Restart to do this manually)
- Frigid start (select System Erase to do this manually)

Warm Start

A loss of power for less than 250 ms can cause a warm start. If this occurs, calls in progress are not dropped, but calls in the process of being connected may be dropped.

Considerations

- Power interruptions of less than 100 ms usually do not affect the system.
- Warm starts may cause telephones without incoming calls to ring.

Cold Start (Restart)

If you need to restart the system, cold start (Restart) is recommended. Restart drops all calls but saves system programming.

To perform a cold start, select Restart as follows:

Console Procedure	$\begin{array}{l} \textbf{Menu} \rightarrow \textbf{SysProgram} \rightarrow \textbf{Exit} \rightarrow \textbf{System-Restart} \\ \rightarrow \textbf{Yes} \end{array}$
PC Procedure	$(\underline{F6}) (\underline{F5}) (\underline{F1}) (\underline{F1}) (\underline{F2})$

Considerations

- A cold start (Restart) occurs automatically after a power interruption of more than one second.
- A cold start (Restart) does not blank out the screen on an MLX-20L telephone until the cold start is completed.
- A cold start (Restart) can cause extensions with the Extension Status feature to lose their toll restrictions.
- For more information on the Restart procedure, see *System Programming.*

For more information on Restart, see "Processor Problems" in Chapter 4.

Frigid Start (System Erase)



CAUTION:

All system programming is erased. When you perform a frigid start (System Erase), all calls are dropped, and the system configuration information is erased. All system memory must be reinitialized, including system programming. Then the entire system must be rebooted.

To perform a frigid start, select System Erase as follows:

Console Procedure	Menu \rightarrow Mai ntenance \rightarrow SI ot \rightarrow Dial 00 \rightarrow Demand
	Test \rightarrow System Erase (Line 5 of the display, left
	button) \rightarrow System Erase \rightarrow Yes
PC Procedure	$(\underline{F6}) (\underline{F1}) Type 00 (\underline{F2}) (\underline{F3}) (\underline{F3}) (\underline{F2})$

Considerations

- System Erase is not displayed on the MLX-20L status display. To select System Erase, press the left button on Line 5 of the display twice.
- After a System Erase, the default printer is the PC printer, not the Station Message Detail Recording (SMDR) printer. If you want on-site printouts from the SMDR printer, make sure you change the option.

To change the printer option, see System Programming and Maintenance (SPM) for information on the Print Opts option on the SPM Main Menu.

For more information on System Erase, see "Processor Problems" in Chapter 4.

Isolating the Trouble

You can isolate any problem to one of the following areas:

- Telephone
- Control unit
- Central office

NOTE:

If you change the jack assignment of any telephone, be sure to record the extension jack change on Form 2a, System Numbering: Extension Jacks. See Appendix B, "System Numbering Forms," for details.

Check Telephone Problems

If a customer reports telephone problems, use the following steps as a guideline for determining the possible cause. Chapter 3, "Telephone Problems," discusses telephone problems in more detail.

- 1 Discuss the problem with the user who reported the problem.
- 2 Run the appropriate test to verify the complaint.
- 3 Replace the telephone with one that works properly.
- 4 If the problem persists, go to "Checking the Error Logs" below.
- 5 If the problem persists, replace the telephone wiring.

Check the Error Logs

If a system alarm turns on (see the top-right area of Figure 1-7), begin troubleshooting by checking the permanent errors in the error logs.

Use the following steps as a guideline to check the error logs. For more information on performing the procedures, see "Checking the Error Logs" in Chapter 2. Also, when you check the error logs, you should refer to Table 2-2, "Error Codes," in Chapter 2 for a detailed description of each problem.

- 1 Check the permanent errors.
- 2 If errors still exist, check the transient errors.
- 3 Check the last 10 errors whenever you want to review the 10 most recently recorded errors-either permanent or transient.

Trouble Accessing the Error Logs

If you cannot access the error logs, or if the system is inoperable, use the following steps as a guideline to troubleshoot the system.

- 1 Check the power supply LED.
 - a Is the power switch turned on?
 - b Is the power cord connected to an AC wall outlet that is not controlled by a wall switch?

If the LED is off and you are sure that the power is connected and turned on, see "Power Supply Problems" in Chapter 4.

- 2 If you still cannot access the error logs after checking the power supply, see "Processor Problems" in Chapter 4.
- 3 If you still cannot access the error logs after checking the processor, see "Carrier Problems" in Chapter 4.
- 4 If you still cannot access the error logs, review the "System Inventory" screen as detailed in Chapter 2 and escalate the problem to your technical support organization.

Check the Access Log

At any time during the maintenance process, you can check the access log for maintenance and system programming. This log indicates the last 20 times that someone accessed maintenance or system programming. If you find that someone accessed maintenance or system programming shortly before the problem originated, that person may be able to help you isolate the trouble by providing additional information on what they did. Once you receive that information, use any maintenance or system programming feature that may lead to the root of the problem. See "Access Log for Maintenance and System Programming" in Chapter 2 for additional information. See *System Programming* for information about system programming and the Inspect function.

Check the Power Supply

If the error logs indicate the power supply as the source of the problem, see "Power Supply Problems" in Chapter 4.

Check the Processor

If the error logs indicate the processor as the source of the problem, use the following as a guideline to check the processor.

- Back up system programming.
 - System programming can be backed up to a floppy disk, using SPM.
 - For Release 3.0, system programming can be backed up to a memory card, and later, using SPM or the MLX-20L console. See Appendix D, "Backing Up with a Memory Card," for more information.
- See "Processor Problems" in Chapter 4 to troubleshoot the processor.

Check the Modules

If the error logs indicate any modules, see "Module Problems" in Chapter 4.

Check the Control Unit Carrier

Within the control unit, the last possible cause of a problem is the carrier. If the carrier is damaged, it must be replaced. See "Carrier Problems" in Chapter 4 for instructions.

Check the Trunks

Troubleshoot the trunks that are connected to the control unit. See Chapter 5, "Central Office Problems."

Check the Central Office

If the error logs indicate the central office as the source of the problem, and you have resolved all other possible causes, notify the customer that they should call the central office and ask the central office to check the problem at their end (see Chapter 5, "Central Office Problems"):

- If the problem is in the central office, wait for the CO to fix it, Then duplicate the problem conditions to ensure that the problem is really fixed.
- If the problem persists, get the customer to again call the central office with the problem.
- If they indicate that the problem is not in the central office, escalate the problem as described below.

Escalating the Problem

Escalate any unresolved problems to your technical support organization. See "System Inventory" in Chapter 2, which explains how to access the System Inventory screen, This screen contains information (such as the hardware vintage, software vintage, and ROM ID for each module) that your technical support organization may request.

Unit Loads

A unit load is a measure of power (1.9 watts) used to determine the electrical load that the following components have on each carrier's power supply:

- Telephones and adjuncts
- Direct-Inward Dial (DID) modules

Only the telephones and adjuncts that connect to the analog and digital ports on the control unit require unit load calculation. Do not include any equipment with its own power supply (for example, an answering machine) in the unit load calculation.

Checking Unit Loads

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

Generally, if you can distribute the DID modules and telephone modules equally across the carriers, you prevent unnecessary drain on any one carrier.

The rules vary, however, 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

The power supply (model 391A1) generally supports six modules of any type in a Hybrid/PBX system. However, if both of the following conditions are true, the unit loads on a carrier can exceed the 54-unit (102.6-watts) maximum:

- All six carrier slots are occupied by MLX telephone or analog multiline telephone modules.
- The carrier has more than 45 MLX-20L telephones and/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 power supply (model 391A1) generally supports four modules of any type in Key or Behind Switch mode.

Auxiliary Power Units

The power supply provides 54 unit loads (102.6 watts) to each carrier. If the unit load requirement for a carrier exceeds 54 (102.6 watts), an auxiliary power unit is needed to allow that carrier to support an additional 27 unit loads (51.3 watts).



A CAUTION:

Running the system with more than 54 unit loads (102.6 watts) per carrier may not appear to do harm. However, this can cause the system to malfunction, creating "No Trouble Found" conditions.

An auxiliary power unit redirects the power requirements from the last two slots on the carrier. Any extension connected to the modules in the last two slots receives power from the auxiliary power unit instead of from the power supply. If an auxiliary power unit is required, complete installation instructions are provided in Installation.

Error Logs, Access Logs, and System Inventory

2

As described in "Maintenance Strategy" in Chapter 1, much of your troubleshooting relies on the error logs and the access log, for maintenance and system programming. Both of these maintenance features are described here in detail. This chapter also explains how to access the System Inventory screen, which you may need when you escalate problems to your technical support organization.

For information on entering and exiting maintenance functions on a console or a PC running SPM, see Chapter 1, "Introduction."

Error Logs

When an error occurs, the system records it in the error logs, which are stored in battery backed-up RAM. These errors indicate problems that span the entire system, including the control unit, telephones, adjuncts, and network interface.

Transient errors are less serious than permanent errors. However, some transient errors can become permanent if they occur a certain number of times, as shown in Table 2-1. The Threshold column indicates the number of occurrences at which a transient error becomes permanent.

Error Code	Error Description	Transient/Permanent Threshold
7402	LOOP BIT CONTROL NOT SET	4
7403	NO LOOP CURRENT	4
7404	STUCK RINGING	2
8403	NO EXTERNAL RELEASE	2
840B	NO LOOP CURRENT	4
840C	STUCK RINGING	2
840D	INCORRECT FIRMWARE STATE	2

Table 2-1. Transient/Permanent Error Thresholds

Checking the Error Logs

Once you have reviewed the error logs, you should print the error information. This will help you determine whether your work has resolved each problem. (Refer to "Summary" below or *System Programning* for additional information about printing.)

Summary

Console Procedure	Menu \rightarrow Maintenance \rightarrow System \rightarrow Error Log \rightarrow Last 10 or Permanent or Transient
PC Procedure	$(\underline{F6}) \rightarrow (\underline{F1}) \rightarrow (\underline{F2}) \rightarrow (\underline{F1})$ or $(\underline{F2})$ or $(\underline{F3})$
Printing from Console	System Programming \rightarrow Exit \rightarrow More \rightarrow Print \rightarrow More \rightarrow Error Log
Printing from PC	<u>(F1) – (F5) – (PgUp) – (F3) – (PgUp) – (PgUp) – (F6)</u>

To check the error logs, follow the steps below.



The most recent alarm message stays on the System Error Log screen until it is replaced by another one. The screen does not update the most recent alarm while displayed; to see any updates, you need to exit this screen and re-enter.

Checking Permanent Errors

Follow Steps 1 through 3 above for "Checking the Error Logs." In Step 3, select Permanent.

Console Display/Instructions		Additional Information	PC
	Permanent Errors: >		
	<i>xxxxxxxxxxxxxxxxxxxxxxxxx</i>		
	Slot xx Port xx count xxx	Press the More button to page	(PgUp)
	First mm/dd/yy hh:mm	through the permanent errors.	
	Last mm/dd/yy hh:mm		
	Code xxxx	Press the Drop button to delete	<u>(Alt)</u> + <u>(P)</u>
	Exi t	an error log entry.	

Line 2 provides a brief description of the error code identified on Line 6. For more information on an error code, see Table 2–2.

Line 3 indicates the slot and port where the error was detected.

Line 5 indicates the error's last occurrence.

NOTE:

Depending on which entry you delete, you might clear an alarm. See "Alarms" in Chapter 1 for additional information about alarms.

Checking Transient Errors

Follow Steps 1 through 3 above for "Checking the Error Logs." In Step 3, select Transi ent.

Transient Errors: >

Slot xx Port xx Count xxx
First mm/dd/yy hh:mm
Last mm/dd/yy hh:mm
Code xxxx
Fxi t

Press the **More** button to page (PgUp) through the transient errors.

Press the **Drop** button to delete an error log entry. (Alt) + (P)

Line 2 provides a brief description of the error code identified on Line 6. For more information on an error code, see Table 2–2.

Line 3 indicates the slot and port where the error was detected.

Line 5 indicates the error's last occurrence.

Checking the Last 10 Errors

Follow Steps 1 through 3 above for "Checking the Error Logs." In Step 3, select Last 10.

C	Console Display/Instructions	Additional Information	PC
	Last 10 System Errors>		
	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx		
	Last mm/dd/yy hh: mm		
	Code xxxx	Press the More button to page	
	Exi t	through the last 10 errors.	(<u>PgUp)</u>

Line 2 provides a brief description of the error code identified on Line 6. For more information on an error code, see Table 2–2.

Line 3 indicates the slot and port where the error was detected.

Line 5 indicates the error's last occurrence.

NOTE:

You cannot delete an error log entry from this screen.

Interpreting Error Codes

Table 2-2 explains how to interpret each error from the error logs. For additional information on how to use the error logs, read this entire chapter and see "Maintenance Strategy" in Chapter 1.

Table 2-2. Error Codes

Error		
Codes	Description	Action
0001	TIMEOUT COLD START:	No action required; however, if problem
	System programming is okay.	persists, troubleshoot the processor.
0002	POWER UP WARM START:	No action required; however, if problem
	System programming is okay.	persists, troubleshoot the processor.
0003	SOFTWARE COLD START:	If problem persists, troubleshoot the
	System programming is okay.	processor.
0004	SOFTWARE WARM START:	If problem persists, troubleshoot the
	System programming is okay.	processor.
0006	INCOMPLETE COLD START:	If problem persists, troubleshoot the
	System was cold-started while a	processor.
	restart was in progress.	
0007	SANITY TIMEOUT RESET:	Troubleshoot module and or processor.
	Faulty software, module, carrier, or	
	processor sanity timer.	
8000	MAX RESET COUNT EXCEEDED:	If problem persists, troubleshoot the
	System was cold-started (System	processor.
	Reset) because too many warm starts	
	occurred.	
	System programming is okay.	

Error		
Codes	Description	Action
0009	FRIGID START: System was restarted and initialized to default programming. This error is also logged after a System Erase.	If the processor was removed while in use, the system may perform a frigid start due to loss of system programming. Restore system as described in System <i>Programming and Maintenance (SPM),</i> or in Appendix D, "Backing up with a Memory Card".
000A	POWER UP COLD START: A RAM failure was detected in the processor. System programming is okay.	If problem persists, troubleshoot the processor.
000B	CARD INSERTED/REMOVED:	No action required.
000C	SLOT STREAM CNT EXCEEDED: Slot has generated excessive interrupts.	If problem persists, troubleshoot the module.
000D	FMWR NOT IN STANDBY MODE: Module firmware is not in standby mode.	If problem persists, troubleshoot the module.
000E	COMMAND BUFFER FULL:	If problem persists, troubleshoot the processor and module.
000F	TASK RUNNING TOO LONG:	No action required: however, if problem persists, troubleshoot the processor.
0010	INVALID SLOT INTERRUPT: Cannot determine module responsible for generating the interrupt.	Troubleshoot modules and replace if necessary. If problem persists. troubleshoot the processor.
0011	STACK OVERFLOW: Processor problem	Troubleshoot the processor.

Error		
Codes	Description	Action
0012	INVALID RESET FLAG:	Troubleshoot the processor.
	Processor problem.	
0013	DUART STREAMING INT:	Troubleshoot the processor.
	Processor problem.	
0014	PROCESSOR ERR INTERRUPT:	Troubleshoot the processor.
	Processor problem.	
0015	MODULE MI SMATCH:	Change system programming to reflect
	Physical and logical type mismatch.	the proper module or install the proper
	Module inserted into wrong slot.	module.
0016	POWER UP COLD START:	If problem persists, troubleshoot the
	A module dual port RAM failure was	module for the slot, indicated.
	detected.	
	System programming is okay.	
0C01	NO I-VMS PORT IN SERV:	No action required.
	This error indicates that the VMS	
	machine may be down.	
0C02	DID INTERDIGIT TIMEOUT:	No action required. If problem persists,
	May be noisy line or central office	troubleshoot the DID line and inform the
	problem.	central office if necessary.
1C01	POOL M-BUSY EXCEEDS 50%:	Troubleshoot trunk.
	More than half the trunks in the pool are	2
	busy.	
1CO2	FW UPGRADE ATTEMPT	If FW UPGRADE ATTEMPT is logged and FW
		UPGRADE COMPLETE is not, the firmware
		upgrade should be retried. The circuit
		module should be considered unreliable
		unui a successiui upgrade is performed.

Error		
Codes	Description	Action
1CO3	FW UPGRADE COMPLETE	No action required.
3001	ALARM TABLE FULL: The error logs are full, and no more errors can be added to them. Turns on the processor LED.	Correct indicated errors, and then remove entries from the transient system error log to free up space. If problem persists, cold-start the system before continuing with troubleshooting. Sys Program \rightarrow System-Restart
4401	USER REQUESTED SYS ERASE: This error is logged after a System Erase. If the System Erase is successful, this error is removed immediately.	If this error remains in the transient log, do the System Erase again. If problem persists, troubleshoot the processor.
6C01	DS1 LOSS OF SI GNAL ALARM: Service on the link has been lost.	Troubleshoot the T1 trunk. If problem persists, check the channel service unit (CSU) and the cable between the CSU and the 100D module. If problem persists, escalate to your technical support organization.
6C02	DS1 BLUE ALARM: All ones being received Service on the link has been lost.	The far end of the network interface is out of service. Troubleshoot the T1 trunk, channel service unit (CSU), and the cable between the CSU and the 10OD module. If problem persists, escalate to your technical support organization.
6C03	DS1 RED ALARM: Incoming signal does not have valid framing information. Service on the link has been lost.	Troubleshoot the T1 trunk. If problem persists, escalate to your technical support organization.

Error Codes	Description	Action
6C04	DS1 YELLOW ALARM: The far end of the network interface has lost frame synchronization. Service on the link has been lost.	Troubleshoot the T1 trunk. If problem persists, check the CSU and the DS1 configuration (the framing format). If problem persists, escalate to your technical support organization.
6C05	DS1 LOSS OF MULTIFRAME: Service on the link has been lost.	Troubleshoot the T1 trunk. If problem persists, escalate to your technical support organization.
6C06	DS1 REMOTE MULTI FRAME: The far end of the network interface is experiencing loss of multiframe. Service on the link has been lost.	Troubleshoot the T1 trunk. If problem persists, escalate to your technical support organization.
6C07	DS1 MAJOR ALARM: Average bit error rate exceeds 10E-3. Service on the link has been lost.	Troubleshoot the T1 trunk, If problem persists, escalate to your technical support organization, Maintenance \rightarrow Slot \rightarrow Error Events \rightarrow Current hr
6C08	DS1 MINOR ALARM: Average bit error rate exceeds 10E-6.	Troubleshoot the T1 trunk. If problem persists, escalate to your technical support organization. Maintenance \rightarrow Slot \rightarrow Error Events \rightarrow Current hr
6C09	DS1 MI SFRAME ALARM: Misframe count reached 18.	Troubleshoot the T1 trunk. If problem persists, escalate to your technical support organization. Mai ntenance \rightarrow Sl ot \rightarrow Error Events \rightarrow Current hr

Error		
Codes	Description	Action
6C0A	DS1 SLIP ALARM: Slip count reached 88.	Troubleshoot the T1 trunk. If problem persists, escalate to your technical support organization. Maintenance \rightarrow Slot \rightarrow Error Events \rightarrow Current hr
6COB	DS1 HARDWARE INOPERATIVE: DS1 hardware is not operating properly. If this is the only 100D (DS1) module, or if this is the module designated to have the active clock, its TDM bus clock generator was not activated.	If problem persists, escalate to your technical support organization.
7001	PRI SVC AUDIT TIMEOUT:	Troubleshoot the PRI trunk and report to service provider; otherwise, no action required. If problem persists, contact your technical support organization.
7002	PRI SVC STATE INCONSIST:	Troubleshoot the PRI trunk and report to service provider; otherwise, no action required. If problem persists, contact your technical support organization.
7003	PRI D-CHNL INOPERATIVE:	Troubleshoot the PRI trunk and report to service provider; otherwise, no action required. If problem persists, contact your technical support organization.
7004	PRI B-CHNL RELEASED:	Troubleshoot the PRI trunk and report to service provider; otherwise, no action required. If problem persists, contact your technical support organization.

Error	D	A -4 ⁰
Codes	Description	Action
7005	PRI B-CH GROUP INCONSIST:	Troubleshoot the PRI trunk and report to service provider; otherwise, no action required. If problem persists, contact your technical support organization.
7401	TRK UPLINK MESSAGE ERROR: Communication problems between processor and modules. Unrecognized message from module to processor.	Test the trunk with a single-line telephone. If the problem is not in the trunk, replace the module with one that is known to be working. If the problem is gone when using the known good module, replace the module and restart.
7402	LOOP CONTROL BIT NOT SET: No loop current on an outgoing call. If this error occurs four times consecutively, and if Automatic Maintenance-Busy is enabled and the 50% <i>maintenance busy limit</i> has not been exceeded, the trunk is busied- out automatically.	Test the trunk with a single-line telephone, If the problem is not in the trunk, replace the module with one that is known to be working. If the problem is gone when using the known good module, replace the module and restart.
7403	NO LOOP CURRENT: Communication problems between the module and central office. No loop current. If this error occurs four times consecutively, and if Automatic Maintenance-Busy is enabled and the 50% maintenance-busy limit has not been exceeded, the trunk is busied- out automatically.	Test the trunk with a single-line telephone. If the problem is not in the trunk, replace the module with one that is known to be working, If the problem is gone when using the known good module, replace the module and restart.

Error		
Codes	Descrption	Action
7404	STUCK RINGING: Communication problems between the module and central office. If this error occurs twice consecutively, the trunk is busied- out automatically, whether Automatic	Test the trunk with a single-line telephone. If the problem is not in the trunk, replace the module with one that is known to be working. If the problem is gone when using the known good module, replace the module and restart.
7801	NOT IN NORMAL OP MODE: Module not in normal operation mode. Reported in background module check.	Reset the board. If problem persists, troubleshoot the module. Maintenance \rightarrow Slot \rightarrow Slot Number \rightarrow Reset
7802	SANITY INT NOT GENERATED: Only applies to modules that have extension jacks.	Reset the board. If problem persists, troubleshoot the module.
7803	NO PORT BOARDS AVAI LABLE: This error is reported when modules are not present.	No action required. Delete this entry from the transient log.
7804	I NVALI D SANI TY RESPONSE: This error occurs when a sanity test gets invalid responses. Applies only to modules that have extension jacks.	Reset the board. If problem persists, troubleshoot the module.
7805	I NVALI D SLOT NUMBER: Rarely occurs. Software could not process an event detection because the slot number was invalid.	No action required; however, if problem persists, restart the system.

Error		
Codes	Description	Action
7806	NOT IN STANDBY MODE:	Reset the board. If problem persists,
	Reported during cold start or	troubleshoot the module.
	background check.	
7807	SELF TEST NOT COMPLETER	Reset the board. If problem persists,
	Reported during cold start.	troubleshoot the module.
7808	TEST RESULT REGISTER BAD:	Reset the board, If problem persists,
	A module error or processor error	troubleshoot the module.
	resulted while running test.	
7809	TEST STATUS REGISTER BAD:	Reset the board. If problem persists,
	A module error or processor error	troubleshoot the module.
	resulted while running test.	
780A	DPR TEST NOT COMPLETED:	If problem persists, troubleshoot the
	Reported during cold start.	module.
780C	RAM TEST FAILURE:	If problem persists, replace the
	Memory failed the RAM test. Turns	processor.
	on the processor LED.	
780D	UPPER ROM FAILURE:	If problem persists, replace the
	Memory failed the ROM test. Turns	processor.
	on the processor LED.	
780E	LOWER ROM FAILURE:	If problem persists, replace the
	Memory failed the ROM test. Turns	processor.
	on the processor LED.	
Error		
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Codes	Description	Action
8401	MI SCELLANEOUS ERROR:	No action required.
	currently not reported.	
8402	WINK TOO SHORT: Outbound dialing problems on tie trunks. For a tie trunk with delay dial or wink start, the wink from the far end of the network interface is less than the minimum 100 ms. The tie trunk remains waiting for a valid signal.	Troubleshoot the far end of the network interface to see if it is working and translated properly. Troubleshoot for faulty cable. Replace the module.
8403	NO EXTERNAL RELEASE: Communication problems between the module and central office. Far end has not disconnected within 4 minutes. If this error occurs twice consecutively, the trunk is busied-out automatically, whether Automatic Maintenance-Busy is enabled or not.	Troubleshoot the far end of the network interface to see if it is working and translated properly, Troubleshoot for faulty cable.
8404	ON HOOK BEFORE WINK: Outbound dialing problems on tie trunks, For a tie trunk with delay dial or wink start, the far end of the network interface went on-hook before the handshake was completed.	If problem persists, troubleshoot the tie trunk configuration. Troubleshoot the far end to see if it is working and translated properly. Troubleshoot for faulty cable. Replace the module.

Continued on next page

Error		
Codes	Description	Action
8405	ON HOOK BEFORE READY: Outbound dialing problems on tie trunks. For a tie trunk with delay dial or wink start, the far end of the network interface went on-hook before the guard time elapsed.	Troubleshoot the far end of the network interface to see whether it is working and translated properly. Troubleshoot for wink start and faulty cable. Troubleshoot the far end of the network. Replace the module.
8406	INTERDIGIT TOO SHORT: Inbound dialing problems on tie and DID trunks.	Troubleshoot the far end of the network interface to see if it is working and translated properly. Troubleshoot for faulty cable. Replace the module.
8407	BAD UPDATE: communication problems occurred between the processor and the modules. Module may need to be replaced.	Turn the processor off and then on. Repeat system programming procedure. [f problem persists, escalate to your technical support organization.
8408	ROTARY RATE > 12PPS: Inbound dialing problems on tie and DID trunks.	Troubleshoot the far end of the network interface to see if it is working and translated properly. Troubleshoot for faulty cable. Replace the module.
8409	ROTARY RATE < 8PPS: Inbound dialing problems on tie and DID trunks.	Troubleshoot the far end of the network interface to see if it is working and translated properly. Troubleshoot for faulty cable. Replace the module.
840A	BAD DOWNLINK MESSAGE: Communication problems occurred between the processor and the modules, The module received an unrecognized message from the processor.	Turn the processor off and then on. Repeat system programming procedure. If the problem persists, replace the module.

Continued on next page

Error		
Codes	Description	Action
840B	NO LOOP CURRENT: communication problems between the module and the central office. No loop current. If this error occurs 4 times consecutively, and if Automatic Maintenance-Busy is enabled and the 50% maintenance-busy limit has not been exceeded, the trunk is busied-out automatically.	Replace the module with a similar module and test, If the problem is resolved, replace the bad module. If the problem persists, reinstall the old module and test the trunk.
840C	STUCK RINGING: Communication problems between the module and central office. If this error occurs four times consecutively, and if Automatic Maintenance-Busy is enabled and the 50% maintenance-busy limit has not been exceeded, the trunk is busied-out automatically.	Replace the module with a similar module and test. If the problem is resolved, replace the bad module. If the problem persists, reinstall the old module and test the trunk.
840D	I NCORRECT FI RMWARE STATE: If this error occurs 4 times consecutively, and if Automatic Maintenance-Busy is enabled and the 50% maintenance-busy limit has not been exceeded, the trunk is busied-out automatically.	Turn power off for at least 1 second and then turn it on. Repeat system programming procedure. If problem persists, replace the module.

Continued on next page

Error		
Codes	Description	Action
840E	UPLINK MESSAGE ERROR: Communication problems between the processor and the modules. The module received an unrecognized message from the processor.	Turn the processor off and then on. Repeat system programming procedure. If the problem persists, replace the module.
8C01	SLOTS NOT EQUAL: The module that occupies the indicated slot does not match the slot information contained in the PC or PCMC1A card backup file.	Troubleshoot the slot descriptions in your backup file against the actual system modules that occupy those slots. After the mismatch is corrected, repeat the restore operation.

Access Log

In addition to checking the error logs, you can check the access log to help you troubleshoot. Each time maintenance or system programming is accessed, the event is recorded in an access log (up to the last 20 events), This information may be useful in determining whether one of those events caused an error detected shortly thereafter.

Reviewing the Access Log

Each event is documented by the time and date of occurrence, The station button (Sta) column indicates whether the event occurred from an MLX-20L console (if so, the extension number is displayed) or from SPM (SPMD if direct; SPMR if remote). The SP/M column indicates whether the event originated from System Programming (SP) or Maintenance (M).

Scanning the Log

The last 20 events are shown, beginning with the most recently accessed event. When you reach the end of the list, you hear a beep and all variable information is cleared from the screen. To return to the beginning of the list, select Exi t and then select Access Log again.

Summary

Console Procedure	Menu →Maintenance	→System	→Access	Log
PC Procedure	<u>(F6)</u> →(F1) →(F4)			

To check the access log, follow the steps below.



The screen below shows the access log.

Console Display/Instructions	Additional Information	PC
SysProg/Mai ntAccessLog >		
Date Time Sta SP/M		
<i>mm/dd/yy</i> hh:mm xxxx xx		
<i>mm/dd/</i> yy hh:mm xxxx xx		
<i>mm/dd/</i> yy hh:mm xxxx xx		
<i>mm/dd/</i> yy hh:mm xxxx xx	To page through the events, press	
Exi t	the More button.	<u>(PgUp)</u>
Exit	the More button.	(Pgup)

System Inventory

If you need to contact your technical support organization, you may also need to access the System Inventory screen. The System Inventory screen shows you the hardware vintage, software vintage, and ROM ID for each module in the control unit.

Summary

Console Procedure	Menu \rightarrow Maintenance \rightarrow System \rightarrow Inventory \rightarrow
	More
PC Procedure	$(\underline{F6}) \rightarrow (\underline{F1}) \rightarrow (\underline{F3}) \rightarrow (\underline{PgUp})$

To check System Inventory, follow the steps below.

1 From the Maintenance menu, select the System option.

Maintenance Make a selection System Slot Port Exit

<u>(F1)</u>



Reviewing the Screen

Lines 4, 5, and 6 indicate information that maybe asked of you when you call your technical support organization:

- Line 4, the hardware vintage, indicates the revision level of the processor board's firmware.
- Line 5 indicates the release number for the system software, followed by the official software version number.
- Line 6 indicates the revision levels of the ROM pairs on the processor board.

The screen below displays information for slots other than Slot 00.Console Display/InstructionsAdditional Information

PC

System Inventory:	
Slot xx	
Board <i>boardname</i>	
Hardware Vintage:	VV
Firmware Vintage:	VV

Exi t

xx = slot number entered in Step 2

Press the **More** button to review information for each subsequent slot. When you reach the display for the last slot, pressing the **More** button redisplays the Slot 00 information.

(PqUp)

Phantom Modules

If the system includes a phantom module (an empty slot that has been programmed), the System Inventory screen does not recognize it. When replacing or adding modules, make sure phantom module slots remain empty, and that no modules are installed to their right.

Telephone Problems

3

Once you isolate a problem to the telephone (or a group of telephones), you can run various tests to check a telephone's operation.

Use the procedure below as a general guideline for troubleshooting telephones.

1 Replace the telephone (or adjunct) with one that works properly.

- 2 If the problem persists, connect the telephone directly to the control unit, using a cord that works properly.
 - If this solves the problem, replace the original cord.
 - The power supply may be shorted or open. If the wiring has been crushed or severed, replace it.
 - a Test the power supply for 48 VDC with a voltmeter or by reconnecting the telephone or adjunct.
 - b If the test for 48 VDC fails, replace the circuit pack in the telephone or adjunct.

CAUTION:

A faulty circuit pack has the potential to damage the power supply, which can cause widespread damage throughout the system.

3 If the problem persists, replace the mounting cord.

4 If the problem persists, continue as described below.

If you change the jack assignment of any telephone, be sure to record the extension jack change on Form 2a, System Numbering: Extension Jacks. See Appendix B, "System Numbering Forms," for details.

Fixing Telephone Problems

If a reported telephone problem matches any symptom described in Table 3–1, refer to the proper section of this chapter.

Table 3–1. Troubleshooting Telephone Problems

Symptom	Section
Intermittent telephone problems	General Telephone and Wiring Problems
Analog multiline telephone LEDs and/or ringing tones do not work properly.	Analog Multiline Telephone Problems
Time appears on display of an analog multiline telephone, but incoming call information does not appear.	Analog Multiline Telephone Problems
Telephone does not receive tones from the control unit.	Voice Transmission Problems
Several single-line telephones cannot dial directly, even though they are receiving calls.	Single-Line Telephone Problems
Users cannot make outside calls on single- line, touch-tone telephones.	Single-Line Telephone Problems
Users are getting other people's calls.	Call Forwarding Problems

General Telephone and Wiring Problems

If intermittent telephone trouble occurs, use the following steps as a guideline to check for general telephone and wiring troubles.

NOTE:

Refer to "Troubleshooting Trunk Problems" in Chapter 5 if the reported problem is echo during conversations on T1 trunks with GS emulation connected to a toll office.

- 1 Check modular connections in the telephone for loose or broken connectors.
- 2 Check modular connections in the connecting blocks for loose or broken connectors.
- 3 Check modular connections in the control unit for loose or broken connectors.
- 4 Check transient errors in the error logs for any possible clues.
- 5 If local power is provided, check the power supply connectors and voltages.
- 6 Replace the telephone with a telephone that works to determine whether the problem is the telephone itself.
- 7 If trouble disappears, replace the problem telephone.
- 8 If the replacement telephone does not work properly, check the other telephones connected to the same module.
 - If these telephones work, the problem may be the wiring, or there may be a single-port failure on the module. To check the wiring, go to Step 12.
 - If these telephones do not work, the fault is probably in the module. To check the module, go to Step 9.

9 Check the LEDs on the module.

If the module does not have LEDs, see "System Status" in Chapter 4 for more information.

- 10 Check the error log for relevant messages. See Chapter 2, "Error Logs, Access Logs, and System Inventory."
- 11 Replace the faulty module.

12 Replace the wiring between the module jack field and the telephone to see if there is a wiring problem.

Analog Multiline Telephone Problems

If telephone LEDs and/or ringing tones do not work properly on analog multiline telephones, follow the steps below.

1 Move the T/P switch on the left-hand side to the T (test) position. You should hear tone ringing, and the red and green LEDs on the terminal should flash alternately.

2 If the LEDs do not light, replace the telephone with one that works. If the problem is resolved, go to Step 4.

3 If the LEDs do not light, retest the original telephone.

Plug it directly into the appropriate jack on the control unit, using a cord that is known to be working.

If this resolves the problem, replace the original cord (or local power unit, if used).

4 Move the T/P switch to its normal position.

The ringing tone should stop, and the LEDs should be off.

5 If any part of the test fails, replace the telephone.

If the time appears on the display but incoming call information does not, move the T/P switch on the side of the telephone to the center position.

Voice Transmission Problems

If the telephone does not receive tones, check the control unit and wiring with a telephone that works.

Single-Line Telephone Problems

If more than one single-line telephone cannot dial correctly, even though they are receiving calls, use the steps below to test the touch-tone receivers (TTRs) for a single-line telephone.

1 Pick up the handset; then dial *04 and the 2-digit number of the TTR you want to test.

- If you hear a busy tone, the receiver is in use/off hook.
- If you hear a reorder tone, you have misdialed or have reached an invalid TTR. Try again.
- If you hear a dial tone, go to Step 2.
- **2 Dial** *123456789*0#*.

You should hear a dual-tone multi-frequency (DTMF) signal as you press each button. If the test is successful, you hear a three-beep confirmation tone one to three seconds after you press #.

3 Hang up and repeat Steps 1 and 2 for each TTR.

4 If this test fails, replace the module containing the faulty TTR.

If all TTRs fail this test, repeat the test, using a different telephone that works. If the tests are successful, replace the original telephone.

If users cannot make outside calls on a touch-tone telephone, check the individual trunk for rotary-dial programming. See *System Programming* for details.

Call Forwarding Problems

Call Forwarding problems usually occur when someone activates Call Forwarding unintentionally, resulting in a user receiving other users' calls.

Cancel the Call Forwarding feature (for the receiving telephone):

- On multiline telephones, press the **Feature** button and dial *34*.
- On single-line telephones, pick up the handset, dial #*34*, and then hang up.

NOTE:

You can cancel Call Forwarding from the receiving telephone or from the forwarding telephone, providing that you know the number.

MLX Telephone Tests

If the LEDs, ringer, buttons, switchhook, or display appear not to be working, try the steps below.

- 1 Pickup the handset.
- 2 When you hear dial tone, press *00 (the feature access code).

The telephone enters test mode. For some tests, this means the LEDs turn on; for others, it means the phone starts ringing.

- This test connects a test tone to the B-channel and sends a repeated ring burst to the telephone.
- On an MLX telephone with a DSS attached, all LEDs light and the phone rings throughout the test.
- On an MLX display telephone, the display blanks out and is replaced with a grid of small dots.

3 Press each line/feature button (two LEDs each).

The red and green LEDs should toggle on and off.

4 Press each fixed-feature button that has an LED (Feature, HFAI, Mute, and Speaker).

Each LED should toggle on and off.

NOTE:

Mute and **Speaker** LEDs may not toggle consistently because they are managed by the control unit *and* the telephone.

5 Press each fixed-feature button that does not have an LED (Transfer, Conf, Drop, and Hold) and each dialpad button.

When you press each one of these buttons, the **Message** LED should toggle on and off.

- 6 Press the fixed-feature buttons and the dialpad buttons in the order shown below to turn on all the LEDs.
 - a Volume down
 - b Volume up
 - c Transfer
 - d Conf
 - e Drop
 - f Hold
 - g Dial 123456789*0#

The LEDs should toggle on and off.

7 If the MLX telephone does not have a display, hang up and go to Step 9; if it does, continue with the next step.

8 To test an MLX display, press each display button.

Each button name should display in the upper-left corner as described in Table 3-2 below.

9 If any of these tests fail, replace the MLX telephone.

10 Test the Multi-Function Module (MFM) if present.

- a Connect a single-line telephone to the MFM.
- b Pick up the handset on the single-line telephone.
- c When you hear the system access or intercom dial tone, dial *09 from the single-line telephone.

This connects the diagnostic test tone to the B-channel.

d Dial 123456789*0#; wait for silence, and then quickly press the **Recall** button to perform a switchhook flash.

You should hear a confirmation tone (three beeps).

e Hang up.

You should hear a ring burst, and the Message LED should turn on.

f Dial #54 to turn off the Message LED and resume normal operations.

11 If these tests fail, replace the MFM.

Button	Display
Home	HOME
Menu	MENU
More	MORE
Inspct	INSPECT
Each unlabeled display button	DI SPLAY BUTTON <i>nn;</i> where <i>nn</i> is 1–10, depending on which button you press.

Table 3–2. MLX Telephone Display Buttons

System Requirements for Touch-Tone Receivers

The following symptoms indicate that the system needs more touch-tone receivers (TTRs).

- Single-line telephone users do not get dial tone when they lift the handset to dial out.
- The voice messaging system fails to transfer calls.
- Calls ail to ring or go to coverage prematurely.

NOTE:

If these symptoms are present, use the following steps to calculate the system requirements for touch-tone receivers.

1 Determine the number of TTRs required for the voice messaging system (if present) from Table 3-3.

- 2 Estimate the hourly call volume for calls originating from single-line telephones, incoming calls on remote access and Direct Inward Dial (DID) lines, and calls on tie lines.
- 3 Use Table 3-4 to determine the number of TTRs required by the system.
 - Use Column 2 if account codes are not being used.
 - Use Column 3 if account codes are being used.
- 4 Add the number of TTRs obtained in Steps 1 and 3.
- 5 Use Table 3-5 to determine the number of TTRs already supplied.
- 6 Compare the numbers obtained in Steps 4 and 5 to see if additional TTRs need to be added.
- 7 Add a new module if indicated.

See Installation.

A voice messaging system requires a certain number of touch-tone receivers, (TTRs), in addition to any system requirements for TTRs. The number of TTRs required by the voice messaging system depends on the number of ports used by the voice messaging system.

Number of VMS Ports	Number of TTRs Required
1	1
2	1
3	2
4	2
6	3
8	4
12	6

Table 3–3. TTRs Required by VMS

Table 3-4 estimates the total number of TTRs required in the system, based on call volume and whether the system uses account codes. The call volume in this table includes all calls originating from single-line telephones, calls on tie lines, incoming remote access and Direct Inward Dial (DID) calls, and calls routed to the voice messaging system.

Account Codes Used	No Account Codes Used
2	4
4	4
4	4
6	8
6	6
8	8
	Account Codes Used 2 4 4 6 6 8

Table 3-4. System Requirement for TTRs

The following modules supply TTRs for the MERLIN LEGEND Communications System.

Module	No. of TTRs
008 OPT	2
012	2
400 GS/LS	4
400	4
800 DID	2
800 LS-ID	2

Table 3-5. Modules with TTRs

Control Unit Problems

4

The next step after resolving problems with telephones, adjuncts, and related wiring, is to troubleshoot the control unit. Troubleshoot the control unit components in the following order:

- Power supply
- Processor
- Line/trunk and extension modules (hereafter referred to as *modulles*)
- Carrier



WARNING:

Beware of hazardous voltages. Only qualified technicians should attempt to service the control unit. Follow all procedures care fully.

Backing Up System Programming

Before performing any procedure that requires powering down the system, save system programming in one of the following ways:

 Save the system programming to a floppy disk. See System Programming and Maintenance (SPM) for detailed instructions. Save the system programming to a memory card (beginning with Release 3.0). See Appendix D, "Backing up with a Memory Card," for detailed instructions. If automatic backups are performed, it may not be necessary to save system programming.

NOTE:

If the processor module is not functioning, it may not be possible to back up system programming.

Power Supply Problems

If the power supply fails, all components connected to the carrier are automatically shut down.

Checking the Power Supply

If you suspect power supply failure, check the following:

- Power supply LED
- Interlocking post (on the carrier, behind the power supply)
- Ring generator, if present
- Auxiliary power unit(s), if present

A WARNING:

Never remove the power supply without first turning off the power switch and disconnecting the power cord from the AC outlet.

Use the following procedures to check the power supply.

Checking the LED

If the power supply's LED is off, check the power switch. If it is off, turn on the power switch for each power supply in the control unit. *Start with the rightmost carrier and end with the basic carrier.* Watch for the following responses:

- The green power LED should light on *each* power supply.
- The red LED on the processor should turn on for 15 to 45 seconds and then turn off.
- All indicators on the 100D and 400EM modules (if present) should turn on and then off. They remain off when the modules are idle.

If any of these responses do not occur or if the console operator reports any problems, continue with "Checking the Interlocking Post" below.

Checking the Interlocking Post

If the power supply is not working, follow the steps below to check the interlocking post.

- 1 Follow Steps 1-4 in "Replacing the Power Supply," later in this chapter, to *remove* the power supply, then return to Step 2 below.
- 2 Check the small, cylindrical interlocking post on the carrier that locks into the power supply (see Figure 4-1).

If the post is broken, replace the carrier.



Figure 4-1. Power Supply Interlocking Post

3 If the interlocking post is not broken, *reinstall* the power supply; follow Steps 5-8 in "Replacing the Power Supply" later in this chapter.

Replacing the Ring Generator

If tip/ring devices (such as single-line telephones, fax machines, and answering machines) do not ring, and an older 012 module is installed, try the procedure below.

Current 012 modules contain built-in ring generators [apparatus code 517G13 (28) or higher letter]. If tip/ring devices connected to a newer module do not ring, see "Module Problems" later in this chapter. See Table 4–1 below to determine which 012 module is installed.

Table 4-1. PEC and Apparatus Codes for 012 Modules

012 Module	PEC	App. Code
with Ring Generator	61494	517G13 (28) or higher letter
Basic Telephone (without ring generator)	61487	517E13 or 517FI 3 or lower letter

WARNING:

Hazardous electrical voltages may be present if the following steps are not performed correctly.

To replace the ring generator, follow the steps below. Refer to Figure 4-2 throughout the procedure.

- 1 Follow Steps 14 in "Replacing the Power Supply," later in this chapter, to *remove* the power supply. Then return to Step 2 below.
- 2 Place the power supply on its left side and remove the five screws.
- 3 Carefully turn the power supply over on its right side and then remove the top of the power supply housing.
- 4 Detach the cables from the inside edge of the plastic housing by removing them from the clips.
- 5 Disconnect the 4-pin cable from the header labeled P202 on the left side of the power supply circuit board.

You may need to pry back the clip to free the cable.

6 Disconnect the other cable from the header labeled P101 on the right side of the power supply circuit board.

You need to grip this cable firmly and pull forcefully.

7 Remove the four screws from the ring generator, as shown in Figure 4-2.

8 Remove the ring generator.

9 Position the replacement ring generator, as shown in Figure 4-2. Align the screw holes.

Make sure the PI header on the ring generator is on the same side of the power supply housing as the P101 header on the circuit board.

10 Replace the four screws and fasten them to secure the ring generator.

11 Connect one end of the new ring generator's cable with the 3-pin connectors to the header labeled P101 on the power supply circuit board.

This cable connector, as with all four of the cable connectors, is keyed so that you cannot attach it to the header if it is turned the wrong way.

12 Connect the other end of the cable to the header labeled P1 on the ring generator.

The cable headers, P1 and P101, should be on the same side of the housing, so that the cables are not crossing each other.

- 13 Connect one end of the new 4-pin cable to the header labeled P202 on the power supply circuit board.
- 14 Connect the other end of the cable to the header labeled P2 on the ring generator.
- 15 Attach the cables to the clips on the inside edge of the plastic housing.
- 16 Replace the top of the module housing.

Take time to ensure that the on/off faceplate on the front of the power supply housing is aligned and inside the top cover.

17 Carefully, taking time to make sure the on/off faceplate stays aligned, turn the module over and replace the five screws.



Figure 4-2. Replacing a Ring Generator

18 Verify that the modification label (Equipped with 129B Freq Gen) is attached to the front of the power supply (shown in Figure 4-2).

If not, attach the label supplied with the new ring generator.

19 Reinstall the power supply; follow Steps 5-8 in "Replacing the Power Supply," later in this chapter.

Replacing Auxiliary Power Units

Follow this procedure if any of the following symptoms occur:

- The LEDs on the multiline telephones that are connected to the last two modules in the carrier do not light.
- The last two slots in the carrier do not have power.
- The power supply LED is off.

To replace the auxiliary power unit, follow the steps below. Refer to Figure 4-3 throughout this procedure.

- 1 Make sure the switch on the power supply module is turned off.
- 2 Unplug the power supply and the auxiliary power unit from the AC outlet.
- 3 Disconnect the cord from the AUX POWER INPUT jack on the power supply module.
- 4 Remove the auxiliary power unit (with the two cords still attached).
- 5 Mount the replacement auxiliary power unit in place of the old one.
- 6 Plug the power unit line cord into the J2 DC OUTPUT jack on the replacement auxiliary power unit.
- 7 Plug the other end of the power unit line cord into the AUX POWER INPUT jack on the power supply.



Figure 4-3. Replacing an Auxiliary Power Supply



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" in Chapter 2 of Installation.*

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

Replacing the Power Supply



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 ail procedures carefully.

To remove the power supply module, follow the steps below.

1 If possible, backup system programming on a memory card (Release 3.0 only) or floppy disk.

See System Programming and Maintenance (SPM) for information about backing up to a floppy. For information about backing up to a PCMCIA memory card, see Appendix D, "Backing Up with a Memory Card." If the basic carrier's power supply fails, you cannot back up system programming.

2 Power down the system.

- a Turn off the power supply in the basic carrier.
- b Turn off the power supply in each expansion carrier.
- c Unplug the auxiliary power unit, if present, from the AC outlet.

3 Unplug the system from the AC outlet.

4 Remove the power supply.

- a Unplug the AC power cord from the power supply.
- b Remove the ground wire attached to the grounding screw on the front of the power supply module.
- c Remove the two ferrite cores, if present, from around the AC power cord and ground wire.
- d Remove the power supply module.

To replace the power supply module, follow the steps below and refer to Figure 4-3.

Insert a new power supply. 1

- a Reinstall the power supply module by hooking the top into the basic carrier and then swinging it down into place. Push the lower end firmly until the locking tab clicks.
- Replace the ferrite cores around the AC power cord and ground wire and b slide the ferrite cores between the wire manager and the power supply module.
- Attach the ground wire to the grounding screw. С
- For each power supply and auxiliary power unit, connect the AC power 2 cord to the connector marked AC INPUT on the power supply.

3 Plug the other end of each AC power cord into the AC outlet.

- 4 Power up the system by turning on the components listed below in the order given.
 - a Power supply on each expansion carrier
 - b Power supply on the basic carrier

The system automatically cold starts.



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" in Chapter 2 of Installation.

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

Processor Problems

If the error logs (or any aspect of troubleshooting) indicate that the processor is the problem, back up system programming if possible. See *System Programming* and *Maintenance (SPM)* for instructions on backing up to a floppy disk. See Appendix D, "Backing Up with a Memory Card," for instructions on backing up to a PCMCIA card.

Call your technical support organization for troubleshooting instructions.

- If you are instructed to perform Peek, Poke, or System Erase, refer to the appropriate section below. Do not perform any of these procedures unless you are instructed to do so.
- If you are instructed to replace the processor, see "Replacing the Processor," later in this chapter.

Peek

Peek is a demand test that allows you to examine but not change system memory.



CAUTION:

Do not perform Peek unless you are following instructions from your technical support organization.

Summary

Console Procedure:	$\begin{array}{llllllllllllllllllllllllllllllllllll$
PC Procedure:	<u>(F6)</u> → <u>(F2)</u> →Type 00 → <u>(F2)</u> → <u>(F1)</u> →Type Address → (<u>PgUp</u>)

To perform Peek, follow the steps below.

C	Console Display/Instruction	ns Additional Information	PC
1 Frc	om the Maintenance menu	, select the Slot option.	
	Maintenance		
	Make a selection		
	System		
	Slot		
	Port		
	Exi t		<u>(F2)</u>
2 Spe	cify Slot 00.		
	SI ot:	Dial or type 00, then select Enter.	
	Enter Slot number (00-17)		
	00		
	Backspace		
	Exit Enter		
3 Sele	ect the Demand Test.		
	Slot 00:	For all MLX modules, BchLoopback is	
	Make a selection	also displayed as an option on this	
	Status	screen. For 100D modules, SU-I pbk,	
	Demand Test	Error Events, and Clock are also	
		displayed as options on this screen.	
	Exi t		(F2)

	Console Display/In	struction	s Additional Information	PC
4 Se	lect the Peek optio	n.		
	Demand Test Slot OG Make a selection Peek [Poke] [System Erase]):	Poke and System Erase are not displayed, which prevents customers from accidentally changing the processor memory.	
	Exi t			<u>(F1)</u>
5 Dia	al a memory addre	ss.		
	Slot 00 Enter Hex Address nnnnnnn		Dial [nnnnnnn], then select Enter.	
		Enter		
	Backspace	Exi t		
	А	В		
	С	D		
	E	F		

The screen below shows the details of the address you specified.

Peek	Address0xaaaa	aaaaa>
Oxaaa Oxaaa Oxaaa Oxaaa Exi t	98 98 98 98	Oxaaaa Oxaaaa Oxaaaa Oxaaaa

aaaaaaaa = address entered in Step 5

Press the More button to reviewthe next address.

Poke

Do not perform Poke unless you are following instructions from your technical support organization.

Summary

Console Procedure:	$\textbf{Menu} \rightarrow \textbf{Maintenance} \rightarrow \textbf{SIot} \rightarrow \textbf{Dial 00} \rightarrow$
	Enter \rightarrow Dernand Test \rightarrow Poke (Line 4, left
	button) \rightarrow Poke (Line 4, left button) \rightarrow Continue
PC Procedure	(F6) →(F2) →Type 00 →(F10) →(F2) →(F2) →(F2) →(F1)

To perform Poke, follow the steps below.

	Console Display/Instruction	Additional Information	PC
1 Fre	om the Maintenance menu,	select the Slot option.	
	Mai ntenance		
	Make a selection		
	System		
-	Slot		
	Port		
	Exi t		<u>(F2)</u>
2 Sp	ecify Slot 00.		
	SI ot:	Dial or type 00, then select Enter.	
	Enter Slot number (00-17)		
	00		
	Backspace		
	Exit Enter		



Console D	isplay	/Instructi	ons
Dxaaaaaaaa	Enter	data:	
аа			
		Enter	
Backspace		Exi t	
А		В	
С		D	
E		F	

Additional Information PC

System Erase (Frigid Start)



CAUTION:

Do not perform a System Erase unless you are installing a replacement processor or following instructions from your technical support organization. This procedure erases all system programming from the processor and resets the system to factory defaults.

Summary

Console Procedure	Menu \rightarrow Maintenance \rightarrow Slot \rightarrow Dial 00 \rightarrow Enter \rightarrow
	Demand Test \rightarrow System Erase (Line 5, left button)
	\rightarrow System Erase (Line 5, left button) \rightarrow Yes
PC Procedure	$(\underline{F6}) \rightarrow (\underline{F2}) \rightarrow \overline{Type 00} \rightarrow (\underline{F2}) \rightarrow (\underline{F3}) \rightarrow (\underline{F3}) \rightarrow (\underline{F2})$
Preparation Time	Approximately 1 minute.
To perform a System Erase	(Frigid Start), follow the steps below.




Forced Installation of System Software



CAUTION:

Forced installation should only be performed under emergency situations in which on-board system software has been corrupted.

All existing system programming will be erased by this procedure.

Beginning with Release 3.0, the system software can be installed or upgraded through the PCMCIA interface slot on the processor module. If system software becomes corrupted, attempt to reinstall software with a Forced Installation memory card. If that does not solve the problem, replace the processor module.

Summary

Console Procedure:

 $\begin{array}{c} \text{Menu} \rightarrow \text{Maintenance} \rightarrow \text{System} \rightarrow \\ \text{Upgrd/Instll} \rightarrow \text{Exit} \rightarrow \text{Exit} \rightarrow \text{Yes} \end{array}$

PC Procedure

 $(\underline{\mathsf{F6}}) \rightarrow (\underline{\mathsf{F1}}) \rightarrow (\underline{\mathsf{F5}}) \rightarrow (\underline{\mathsf{F2}})$

1 Backup system programming.

To back up system programming onto a floppy disk, see *System Programming maintenance (SPM).* To back up onto a memory card, see Appendix D, "Backing Up with a Memory Card." If the processor or system software is not working, you may not be able to back up system programming. If the system has been programmed to perform automatic backups, use the latest backup file to restore programming. See Step 12.

2 Insert a Forced Installation memory card into the PCMCIA interface slot on the processor module. See Figure 4-4.



Figure 4-4. Inserting a Memory Card



	Console Display/Instructi	ons Additional Information	PC
	Upgrade/Installation:		
	Validation of Memory Card		
	Successfully Completed.		
ļ	Exi t		<u>(F5)</u>
Ν	/hen completed, select Exit	t to continue.	
V	erify that the memory card o	or release number is the required one, and	1
S	elect Exit to continue.	·	
	Upgrade:		
	MemCard Rel: 3.y Vnn.mm		
	Current Rel: 3.y Vnn.mm		
	Releases are compatible.		
	Exi t		(E5)
lf	Exi t the releases are incompat	ible, the following screen appears.	<u>(F5)</u>
lf	Exit the releases are incompat	ible, the following screen appears.	<u>(F5)</u>
lf	Exit the releases are incompat Upgrade: MemCard Rel: 3.y Vnn.mm	ible, the following screen appears.	<u>(F5)</u>
lf	Exit the releases are incompat Upgrade: MemCard Rel: 3.y Vnn.mm Current Rel: 3.y Vnn.mm	ible, the following screen appears.	<u>(F5)</u>
lf	Exit the releases are incompat Upgrade: MemCard Rel: 3.y Vnn.mm Current Rel: 3.y Vnn.mm Incompatible releases.	ible, the following screen appears.	<u>(F5)</u>
lf	Exit the releases are incompate Upgrade: MemCard Rel: 3.y Vnn.mm Current Rel: 3.y Vnn.mm Incompatible releases.	ible, the following screen appears.	<u>(F5)</u>
If	Exit the releases are incompat Upgrade: MemCard Rel: 3.y Vnn.mm Current Rel: 3.y Vnn.mm Incompatible releases.	ible, the following screen appears.	<u>(F5)</u>

See Other Error Conditions, following this section, for continuing instructions.



Upgrade/Installation: Upgrade/Installation In Progress.

The error/status LED should show a flashing L during installation of system software. Upon successful completion, the system performs a frigid start (System Erase). While the frigid start is in progress, an F shows on the error/status display.

If the installation of system software was unsuccessful, an error code is displayed and the system may not function. See Table 4–2 and "Error Conditions During Forced Installation."

10 Remove the memory card from the interface slot.

11 Verify that system software has been correctly installed and that the default system programming is present.

No error condition is displayed on the error/status display,

12 Restore system programming.

After about 10 minutes, check to see if the red alarm status LED is lit, (RED). If it is not, the installation was successful. If the LED is lit, check the error log for one of the following:

- XRAY monitor ROM failure
- ■SYS software ROM failure

These indicate a ROM failure and unsuccessful installation.

If the forced installation was performed due to corrupt system software, it is possible that the backup of system programming might also be corrupt. Verify that the error condition that required a forced installation of software is not still present.

Error Conditions During Forced Installation

The error code/status display on the processor module or the maintenance screen informs you of problems during or after a forced installation. See Table 4–2 for error codes displayed. Also see the screens following the table for errors displayed on the maintenance console or PC.

The following error conditions can only occur during or immediately after a forced installation. Instructions for recovery follow the description of each error condition.

Table 4-2. Codes Displayed on the Error/Status Display During ForcedInstallation

Code	Meaning	Action
L	Upgrade is in progress.	No action required
U	Install is in progress.	No action required
2	Incorrect memory card type	Insert correct memory card and repeat forced installation procedure.
4	Memory card corrupted	Insert new memory card and repeat forced installation procedure.
3	Incorrectly inserted or missing memory card	Insert memory card correctly and repeat forced installation procedure.
7	Bad processor board	Check that memory card is inserted correctly and try installation again. If it fails again, replace the processor module.
9	Unknown	Try installation again with a new memory card. If it fails again, contact your technical support organization.

NOTE:

Certain conditions force the system to retry the forced installation. The dot on the error code/status display becomes lit at the start of the first retry. (Look carefully; the dot may be hard to see.)

Missing Card or Card Not Inserted Correctly

```
Upgrade/Installation
Verify that Memory Card
has been installed
correctly.
Exit
```

Insert the memory card correctly; then select Exit t and begin the forced installation procedure again.

Memory Card Is Wrong Type

```
Upgrade/Installation
Memory Card is not the
correct type.
Remove and insert MERLIN
LEGEND Upgrade or
Installation Memory Card
Exit
```

Select $\mathsf{Exi}\ t$ and repeat the forced installation procedure with a new memory card.

NOTE:

Forced installation can be performed successfully with an upgrade memory card only if the installation is performed through the maintenance screens.

Memory Card Is Corrupt

```
Upgrade/Installation
Information on the
Memory Card is corrupted,
Please remove the Memory
Card.
Exit
```

Select Exit and repeat the forced installation procedure with a new memory card.

System Busy

If the forced installation is attempted while a line/trunk or extension is busy, the following screen appears.

```
System Busy - PIs Wait
Dial Code:xxxx S/P:ss/pp
Exit
```

When all lines/trunks or extensions are freed, the installation continues. Select Exit to return to the System menu and cancel the installation. If system software is corrupted, system maintenance may not provide an accurate indication of busy lines/trunks or extensions. If this seems to be the case verify that the listed extensions are truly not busy; then perform the installation by power-cycling the system. See Step 3 above.

Other Error Conditions

The following error conditions may not be viewed on the error code/status display or the maintenance screens.

Power Cycle During Installation

The system automatically begins the installation procedure again. If the power source is unreliable, it is possible for the installation procedure to retry indefinitely. See "Power Supply Problems" or Chapter 2 of *Installation* for details on providing a reliable power source.

Removal of Memory Card During Installation

The system is in an indeterminate state. Re-initiate the forced installation by power-cycling the system after inserting the memory card.

Incompatible Releases

If releases are incompatible, see *System Programming and Maintenance (SPM)* for instructions on converting the system programming before upgrading to the new release.

If releases are incompatible, pressing the hidden key will delete existing programming. Before pressing the hidden key, make a backup of the system programming. Use the SPM or PCMCIA translation card.

Console Display/InstructionsAdditional InformationP CIf the releases are incompatible, the following screen appears.

Upgrade:	
MemCard Rel:	3.y Vnn.mm
Current Rel:	3.y Vnn.mm
Incompatible	rel eases.
Fxi †	

Pressing hidden key two times will delete existing program.

(F5)

See SPM for instructions on converting the system programming before upgrading to the new release.

If hidden key is pressed the following screen appears.

Installation: MemCard Rel: 3.y Vnn.mm Current Rel: 3. y Vnn.mm All translations will be DELETED.

Exi t

<u>(F5)</u>

Replacing the Processor Module

A failed processor module must be replaced immediately.

To replace the processor module, follow the steps below.

1 If possible, save system programming.

See Appendix D, "Backing Up with a Memory Card." To back up onto a floppy disk, see System Programming and Maintenance (SPM).

2 Power down the system.

a Turn off the power supply on the basic carrier.

b Turn off the power supply on each expansion carrier.

c Unplug the auxiliary power units (if present) from the AC outlet.

- 3 Unplug the D8W cord(s) connecting the SMDR printer and/or system programming PC.
- 4 Remove the processor module.
- 5 Inspect the processor module for any visible problems.
- 6 Inspect the carrier.
- 7 For Release 3.0 and later, skip to Step 8. For Release 2.1 and earlier, install a feature module in the new processor.

Use the feature module from the old processor if it appears to be functioning correctly; otherwise install a new feature module. See "Replacing the Feature Module" that follows this section.

8 Install the new processor module.

9 Power up the system.

- a Plug the auxiliary units (if present) into the AC outlet.
- b Turn on the power supply on each expansion carrier.

c Turn on the power supply on the basic carrier.

The system automatically cold-starts.

10 Perform a System Erase (frigid start).

See "System Erase" above for instructions.

11 Restore system programming using one of the following.

- The backup floppy disk or original system programming disk. See System Programming and Maintenance for instructions.
- The backup memory card or original system programming memory card (Release 3.0 and later). See Appendix D, "Backing Up with a Memory Card," for instructions.
- 12 Reconnect the D8W cord(s) connecting the SMDR printer and/or system programming PC.

13 Attach a tag to the old processor.

Use the tag to identify any visible problems and relevant error reports.

Replacing the Feature Module

NOTE:

This section applies only to releases earlier than Release 3.0.



Make sure that you have a backup of system programming before replacing the feature module. See "Backing Up System Programming."

To replace the feature module, follow the steps below.

1 Make sure system power is off.

2 Remove the processor from the carrier.

a Press up on the tab on the bottom rear of the module.

b Pull the bottom of the module away from the carrier.

c Lift upward to disengage the module from the rod on the top of the carrier.

- **3** Place the processor on a flat surface.
- 4 Grasp both metal rings on the outside of the feature module and pull straight up.



Grasping only one of the rings may cause damage to components on the processor circuit board or feature module.

5 Check the *HDR4* header on the processor circuit board for proper mode operation. (For more information about modifying the mode, see Chapter 2 of *Installation.*)



Figure 4-5. Replacing the Feature Module

- 6 Align the connectors on the new feature module with the connectors in the processor (see Figure 4-5).
- 7 Firmly press the new feature module into the processor.
- 8 Insert the processor back into the carrier. (For more information about inserting the processor, see Chapter 2 of *Installation.*)

Module Problems

If you suspect that a module is faulty, do the following:

- To identify the cause of module errors, run the module tests described below.
- To determine whether the module is faulty, replace it with a module of the same type. If the errors cease, the problem is solved.

Module Tests

The module tests in this section identify the cause of module malfunctions. After each module test, record any errors on the repair tag that will be shipped with the faulty module. If the module is sent for repair, this helps repair personnel troubleshoot the cause of the malfunction.

You should read through the following section, "Module Test Process," before running any module tests.

NOTE:

A module on which you run tests cannot be used for service. Because your customer depends on this service, run module tests during off hours, if possible. If you cannot, minimize the time required for each module's downtime whenever possible.

Module Test Process

Figure 4-6 shows the module test process. Refer to it and the text that follows for the recommended approach to testing modules.



Figure 4-6. Module Test Process

Considerations

Review the following items before you begin a module test procedure.

System Components

Before running a module test, make sure the following system components are working:

- Power supply
- Processor. Save the system programming onto a floppy disk. See System Programming and Maintenance (SPM.) To back up onto a memory card, see Appendix D, "Backing Up with a Memory Card."
- Maintenance Terminal (MLX-20L console or PC). To run tests on the MLX module connected to the MLX-20L console, you must run the test from the PC, not from the MLX-20L console.

Busy-Out/Reset

Before running a module test, busy-out or reset the modules. Busy-Out is the best method, but it will not work if any line or extension is on a stable call. See "Busy-Out" and "Reset," later in this chapter, for more information on these features.

Test Notes

For each test, you should note the following:

- When beginning the board controller test or the internal loopback module test, choose to run it once or repetitively.
- You can interrupt any module test by selecting Exit ((F5)) on the PC).
- A module test can fail for one of the following reasons:
 - The module being tested was not busied-out. Exit the test, busy-out the module, and try again.
 - The error messages indicate that the module is faulty.
- If errors indicate that the module is faulty, record them on the module repair tag immediately after running the test.

NOTE:

If the system does not recognize a 408 GS/LS-MLX module during testing, check the release number of the system. The 408 GS/LS-MLX module does not work with Releases 1.0 or 1.1. An 008 MLX module must be used to provide extension jacks with Releases 1.0 or 1.1.

To run a module test, follow the steps below.

- 1 To determine which modules are suspect, read the error logs and review any user-reported problems.
- 2 If the error logs indicate the processor is the problem, refer to "Processor Problems," earlier in this chapter, to service the processor before continuing.

Replacing a faulty processor may resolve module problems.

3 Busy-out or reset the module.

See "Busy-Out and Reset" for general guidelines.

4 Run the internal loopback test.

See "Internal Loopback Test," later in this chapter. If errors occur, record them as described in "Considerations" above.

5 Run the board controller test.

See "Board Controller Test," later in this chapter. If errors occur, record them as described in "Considerations" above.

6 For MLX modules (008 MLX and 408 GS/LS-MLX), continue with the B-Channel Loopback test.

See "B-Channel Loopback Test" later in this chapter. If errors occur, record them as described in "Considerations" above.

7 For 100D modules, continue with the CSU loopback test.

See "100D Module Problems" later in this chapter. If errors occur, record them as described in "Considerations" above.

- 8 Replace the module with a module of the same type, whether you are troubleshooting or replacing the module permanently.
- 9 Restore the module.

Menu \rightarrow Mai ntenance \rightarrow SI ot \rightarrow Dial the slot no. \rightarrow Restore \rightarrow Yes

Restoring automatically undoes the Busy-out and Reset. For additional information on restoring a module, see "Restore," later in this chapter.

Persistent Module Problems

If any of the module tests fail and replacing the module does not clear the trouble, then:

- Several modules may be faulty.
- The connector on the carrier may be faulty.

Busy-Out and Reset

Before running any module test, be sure to busy-out or reset the module.

- Busy-out discontinues service from the module being tested to each line and extension only as they become idle. Busy-out is the preferred method, because it does not disrupt calls in progress.
- Reset discontinues service to all lines and extensions on the module instantly.
 - In-progress calls are dropped if all of the calling parties on the call originate and terminate on the module being reset.
 - If a call is using a line or extension on the module being Reset and another line and/or extension is involved in the call, the call on the module being reset is put on hold. In this case, the module can be removed and replaced. However, a demand test cannot be performed, because the module is not busied-out.
- Check the status of the reset module before performing a demand test.

Menu \rightarrow Maintenance \rightarrow Slot \rightarrow Status

Once you finish testing a module, you must restore it. Restoring a module terminates the Busy-out or Reset condition, See "Restore," later in this chapter, for instructions.

Busy-Out

Summary

Console Procedure	Menu \rightarrow Mai ntenance \rightarrow SI ot \rightarrow Dial the slot no. \rightarrow Enter \rightarrow Busy-Out \rightarrow Yes.
PC Procedure	(F6) →(F2) →Type the slot no. →(F10) →(F2) →(F1)
Appropriate Modules	Any module that you are about to test
Time Estimate	Once all calls are terminated, the busy-out completes in less than 1 second. If calls in progress take too long, ask the callers to hang up.

To busy-out a module, follow the steps below.

Console Display/Instructions Additional Information PC 1 From the Maintenance menu, select the Slot option.



Exi t

	Console Di	spIay/Instructions	Additional Information	PC
3 Se	3 Select Busy-Out.			
	Slot <i>xx:</i> Make a sele	ection	xx = slot number entered in Step 2	
-	Status Busy-out Restore Exit	Demand Test Reset Upgrade	For all MLX modules, BChLoopbck is also displayed as an option on this screen. For 10OD modules, CSU-1pbk, Error Events, and Clock are also displayed as options on this screen	<u>(F2)</u>
4 Se	elect Yes.			
-	Busy-out SI Do you want Yes Cancel	ot <i>xx</i> to continue?	<i>xx</i> = slot number entered in Step 2	

The screen below appears while the module is discontinuing service to lines/trunks and extensions, without disrupting calls in progress.

Busy-Out Slot *xx:* Busy-Out in Progress Exit xx = slot number entered in Step 2

The screen below appears when the module is successfully busied-out.

Busy-out	slot	XX:
Busy-Out	Comp	lete
Exi t		

xx = slot number entered in Step 2

The screen below appears when the busy-out fails again; be sure to specify the correct slot.

Console	Display/Instruction	IS
---------	----------------------------	----

Additional Information PC

xx = slot number entered in Step 2

FAI LED	
	FAI LED

Busy-Out Slot xx:

Reset

Summary

Exi t

Procedure	$\begin{array}{llllllllllllllllllllllllllllllllllll$
PC Procedure	(F6) →(F2) →Type the slot no. →(F10) →(F7) →(F1)
Appropriate Modules	Any module that you are about to test
Time Estimate	Less than 1 second (all calls in progress are terminated or put on hold immediately). If you do not want to interrupt calls in progress, use Busy-Out instead of Reset, as described above.

To reset the module, follow the steps below.

1 From the Maintenance menu, select the Slot option.

	Mai ntenance		
	Make a selection		
	System		
-	Slot		
	Port		
	Exi t		

<u>(F2)</u>



The screen below appears while the module is discontinuing service to lines/trunks and extensions. All calls in progress are being dropped.

Cons	sole Display/Instructions	Additional Information	P
F	Reset Slot xx:	xx = slot number entered in Step 2	
F	Reset in Progress		
E	Exi t		

С

Step 2

The screen below appears when the module is successfully reset.

Reset slot xx:	xx = slot number entered in
Reset Complete	
Evi +	
a aaraan halaw annaara wh] on the Depot foile True again and

The screen below appears when the Reset fails. Try again, and be sure to specify the correct slot.

xx = slot number entered in Step 2

Reset Slot *xx:* Reset FAILED Exit

Restore

Once you complete module testing, restore it to terminate the Busy-Out or

Reset condition.

Summary

Backspace

Enter

Exi t

Console Procedure	$\textbf{Menu} \rightarrow \textbf{Maintenance} \rightarrow \textbf{SIot} \rightarrow \textbf{Dial the slot no.} \rightarrow$
	Enter \rightarrow Restore \rightarrow Yes.
PC Procedure	(F6) →(F2) →Type the slot no. →(F10) →(F3) →(F1)
Appropriate Modules	Any module after testing it
Time Estimate	Less than 1 second.

To restore the module, follow the steps below.

Console Display/Instructions	Additional Information	PC
1 From the Maintenance menu, select	the Slot option.	

-	Maintenance Make a selection System slot Port		
2 S	Exi t Exi t	00 to 17).	<u>(F2)</u>
	Slot: Enter Slot number (00-17) nn	Dial or type [nn], then select Enter.	

ect the Res	store option.		
Slot xx		xx = slot number entered in Step 2	
Make a sele	ection		
Status	Demand Test	For all MLX modules. BchLoopback is	
Busy-out	Reset	also displayed as an option on this	
Restore	Upgrade	screen. For 100D modules, CSU-I pbk,	
		Error Events, and Clock are also	
Exi t		displayed as options on this screen.	<u>(F3</u>
ect Yes.			
Restore Slo	t xx:	xx = slot number entered in Step 2	
Do you want	to continue?		
Yes			
Cancel			
Exi t			(F1)
Exit e screen be	low appears whil	le the module is restoring service to lines/t	<u>(F1)</u> trun
Exit e screen be d extensior	low appears whil	le the module is restoring service to lines/f	<u>(F1)</u> trun
Exit e screen be d extensior Restore slo	low appears whilns.	le the module is restoring service to lines/t xx = slot number entered in Step 2	<u>(F1)</u> trun
Exit e screen be d extension Restore slo	elow appears whilns.	le the module is restoring service to lines/t xx = slot number entered in Step 2	<u>(F1)</u> trun
Exit e screen be d extension Restore slo Restore in	low appears whilns.	le the module is restoring service to lines/t <i>xx</i> = slot number entered in Step 2	<u>(F1)</u> trun
Exit e screen be d extension Restore slo Restore in	elow appears whil ns. ht <i>xx:</i> Progress	le the module is restoring service to lines/t xx = slot number entered in Step 2	(<u>F1)</u> trunl
Exit e screen be d extension Restore slo Restore in	elow appears whil ns. ^{ot} xx: Progress	le the module is restoring service to lines/f <i>xx</i> = slot number entered in Step 2	<u>(F1)</u> trun
Exit e screen be d extensior Restore slo Restore in	elow appears whilns. Progress	le the module is restoring service to lines/t xx = slot number entered in Step 2	<u>(F1)</u> trun
Exit e screen be d extension Restore slo Restore in	e low appears whil n s. ^{ot} <i>xx:</i> Progress	le the module is restoring service to lines/t xx = slot number entered in Step 2	(<u>F1</u>) trun
Exit e screen be d extension Restore slo Restore in Exit e screen b	elow appears whil ns. ^{ot} <i>xx:</i> Progress <u>pelow smears w</u>	le the module is restoring service to lines/t xx = slot number entered in Step 2 when the module successfully restored.	<u>(F1)</u> trun
Exit e screen be d extension Restore slo Restore in Exit e screen b Restore Slo	elow appears while ns. ot xx: Progress pelow smears w t xx:	le the module is restoring service to lines/f xx = slot number entered in Step 2 then the module successfully restored. xx = slot number entered in Step 2	(<u>F1</u>) trun
Exit e screen be d extension Restore slo Restore in Exit e screen b Restore Slo	elow appears while ns. ot <i>xx:</i> Progress pelow smears w t <i>xx:</i>	le the module is restoring service to lines/f <i>xx</i> = slot number entered in Step 2 when the module successfully restored. <i>xx</i> = slot number entered in Step 2	(<u>F1</u>) trun
Exit e screen be d extension Restore slo Restore in Exit <u>e screen b</u> Restore Slo Restore Com	elow appears while ns. ot xx: Progress <u>pelow smears w</u> t xx: npl ete	le the module is restoring service to lines/f <i>xx</i> = slot number entered in Step 2 when the module successfully restored. <i>xx</i> = slot number entered in Step 2	(<u>F1</u>) trun
Exit e screen be d extension Restore slo Restore in Exit e screen b Restore Slo Restore Com	elow appears while ns. ot xx: Progress pelow smears w t xx: npl ete	le the module is restoring service to lines/f xx = slot number entered in Step 2 then the module successfully restored. xx = slot number entered in Step 2	<u>(F1)</u> trun
Exit e screen be d extension Restore slo Restore in Exit <u>e screen b</u> Restore Slo Restore Com	elow appears while ns. ot xx: Progress <u>pelow smears w</u> t xx: npl ete	le the module is restoring service to lines/f xx = slot number entered in Step 2 then the module successfully restored. xx = slot number entered in Step 2	(F1) trun
Exit e screen be d extensior Restore slo Restore in Exit e screen b Restore Slo Restore Com	elow appears while ns. ot xx: Progress pelow smears w t xx: npl ete	le the module is restoring service to lines/f <i>xx</i> = slot number entered in Step 2 then the module successfully restored. <i>xx</i> = slot number entered in Step 2	(<u>F1</u>) trun

The screen below appears when the Restore fails. Try again, and be sure to specify the correct slot.

ConsoleDisplay/InstructionsRestoreSI ot xx:RestoreFAI LEDBoardMi smatchExi t

Additional Information PC

xx = slot number entered in Step 2

Internal Loopback Test

This test checks communication between the processor and the module being tested. If you have not read "Module Test Process" above, do so before continuing.

Summary

Console Procedure	Menu \rightarrow Maintenance \rightarrow Slot \rightarrow Dial the slot no. \rightarrow Enter \rightarrow Demand Test \rightarrow IntLoopback \rightarrow Test Once or Test Repetitive.
PC Procedure	(F6) →(F2) →Type the slot no. →(F10) →(F6) →(F3) →(F2)
	or <u>(F3)</u>
Appropriate Modules	This test can be run on any module. The 100D module and the 408 GS/LS-MLX module each have two digital switch elements (DSEs); both DSEs are tested.
Time Estimate	It takes approximately 1.5 minutes to run each test, The 10OD module and 408 GS/LS-MLX module each take approximately 3 minutes, because they each have two DSEs.

Busy-Out or Reset	Busy-out or reset the module being tested prior to beginning the test. Both Busy-Out and Reset are in the Slot menu, which you can access by doing the following from the console:
	Menu \rightarrow Mai ntenance \rightarrow SI ot
	See "Busy-Out and Reset," earlier in this chapter, for additional information.
Interrupting the Test	You can interrupt the test (both Test Once and Repetitive) by selecting Exit.
Test Failure	If the test fails, record the errors on the repair tag and replace the module.
Restore	Restore the module if it successfully completes all module tests and the errors no longer occur. Restore is in the Slot menu, which you can access by doing the following from the console:
	Menu \rightarrow Maintenance \rightarrow Slot
	See the "Restore" procedure, earlier in this chapter, for additional information.

To run the Internal Loopback Module Test, follow the steps below.

	Console Display/Instrue	ctions	Additional	Information	РС
1 Fr	om the Maintenance menu	, select t	the Slot option		
	Maintenance				
	Make a selection				
	System				
	- Slot				
	Port				
	Exi t				<u>(F2)</u>

• •	Console Display/Instruction	Additional Information	РС
2 Sp	ecify the slot number (<i>nn</i> =	= 00 to 17).	
	Slot: Enter Slot number (00-17)	Dial or type [nn], then press Enter.	
	<i>nn</i> Backspace Exit Enter		
3 Se	lect Demand Test.		
4 Se	Slot xx: Make a selection Status Demand Test Busy-out Reset Restore Upgrade Exit Exit Demand Test Slot xx: Make a selection Note: Busy out slot first BoardCntrlr IntLoopback	 xx = slot number entered in Step 2 For all MLX modules, BchLoopback is also displayed as an option on this screen. For 100D modules, CSU-I pbk, Error Events, and Clock are also displayed as options on this screen. xx = slot number entered in Step 2 	<u>(F5)</u>
	Exi t		<u>(F3)</u>
5. To	run the test once or run it r	repeatedly, select Test Once or Repetitiv	/e.
	Demand Test Slot xx: Board <i>aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa</i>	xx = slot number entered in Step 2	
	Test Once Repetitive Exit	Select Test Once or Repetitive	<u>(F2)</u> (F3)

The screen below appears while the test is running. At the same time, if the module has a green LED, it flashes.

Console Display/Instruction	ons Additional Information	РC
Demand Test Slot xx:	xx = slot number entered in Step 2	
Board <i>aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa</i>		
Internal Loopback Test		
in Progress	If you are running the repetitive test,	
	the screen remains until the test fails.	
	To interrupt repetitive testing, select	
Exit	Exit.	(F5)
EXIT	EXI t.	<u>(F5)</u>

The screen below appears only if you selected Test Once and the module passes the test.

Demand Test Slot xx:
Board <i>aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa</i>
Internal Loopback Test
Successfully Completed
Exit

xx = slot number entered in Step 2

The screen below smears when either test (Test Once or Repetitive) fails.

Demand Test Slot xx:
Board <i>aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa</i>
Internal Loopback Test
FAI LED
<i>xxxxxxxxxxxxxxxxxxxxxxxxxx</i>
xx xx xx xx xx xx xx xx xx
Exi t

xx=slot number entered in Step 2

The 100D and 408 GS/LS-MLX module each have two DSEs. To display the second DSE's test results, press the **More** button.

(PgUp)

Lines 5 and 6 identify the cause of the failure or the number of errors found per DSE port. There are 16 DSE ports, numbered 0 through 15. Line 5 displays the results for ports 0 through 7; Line 6 is for ports 8 through 15.

Interpreting Test Results

If the test is successful, the module DSE ports are free from error. Continue with the next module test or restore the module if you are through testing.

If the test fails, find the error message in Table 4-3 and proceed as indicated.

Error Messages	Corrective Action
Slot is not busied-out	Exit the test, busy-out the slot, and try again.
Slot empty or not valid	Exit the test and try again; be sure to type the correct slot number. Do not indicate an empty slot or the processor (00).
FMWR not in Standby Mode	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Test running too long	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Not in TEST/STANDBY mode	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Any other error	Record the errors on the repair tag and replace the module.

Table 4-3. Internal Loopback Test Errors

NOTE:

Be sure to check the second screen if testing a 100D module or a 408 GS/LS-MLX module.

Restoring the Module

When you are finished running module tests, restore the module. See "Restore," earlier in this chapter.

Board Controller Test

This procedure tests the module's internal functions, such as ROM, RAM, the timer, dual-port RAM, and so on.

Summary

Console Procedure	Menu \rightarrow Maintenance \rightarrow Slot \rightarrow Dial the slot number. \rightarrow Enter \rightarrow Demand Test \rightarrow BoardCntrlr \rightarrow Test Once or Test Repetitive.
PC Procedure	(F6) →(F2) →Type the slot no. →(F10) →(F6) →(F3) →(F2) or (F3)
Appropriate Modules	This test can be run on all modules except the processor.
Time Estimate	Less than 1 second
Busy-Out or Reset	Busy-out or reset the module being tested prior to beginning the test. Both Busy-Out and Reset are in the Slot menu, which you can access by doing the following from the console: Menu \rightarrow Mai ntenance \rightarrow Sl ot
	See "Busy-Out and Reset," earlier in this chapter, for additional information.
Interrupting the Test	You can interrupt the test (Test Once or Repetitive) by selecting Exit.
Test Failure	If the test fails, record the errors on the repair tag and replace the module.
Restore	Restore the module if it successfully completes all module tests and the errors no longer occur. Restore is in the Slot menu, which you can access by doing the following from the console: Menu \rightarrow Mai ntenance \rightarrow Sl ot
	See the "Restore" procedure, earlier in this chapter, for additional information.

To run the Board Controller Module Test, use the following steps.





Interpreting Test Results

If the test completes successfully, the module's board controller is functioning properly. Continue with the next module test or restore the module if you are finished testing. If the test fails, find the error message in Table 4-4 and proceed as indicated.

Table 4-4. Board Controller Test Errors

Error Messages	Corrective Action
Slot is not busied-out	Exit the test, busy-out the slot, and try again.
Slot empty or not valid	Exit the test and try again; be sure to type the correct slot number. Do not indicate an empty slot or the processor (00).
FMWR not in Standby Mode	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Test running too long	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Not in TEST/STANDBY mode	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Any other error	Record the errors on the repair tag and replace the module.

Restoring the Module

When you are finished running module tests, be sure to restore the module. See "Restore," earlier in this chapter.

B-Channel Loopback Test

This test verifies that specific communication paths on the MLX module are operational. If you have not read "Module Test Process" above, do so.

Module Problems

Summary

Console Procedure	$\begin{array}{llllllllllllllllllllllllllllllllllll$	
PC Procedures	(F6) \rightarrow (F2) \rightarrow Type the slot no. \rightarrow (F10) \rightarrow (F4)	
Appropriate Modules	This test can be run only on MLX modules.	
Time Estimate	Approximately 1.5 minutes.	
Busy-Out or Reset	Before beginning the test, busy-out or reset the module being tested. Both Busy-Out and Reset are in the Slot menu, which you can access by doing the following from the console:	
	Menu \rightarrow Mai ntenance \rightarrow SI ot	
	See "Busy-Out and Reset," earlier in this chapter, for additional information.	
Interrupting the Test	Interrupt the test by selecting Exit.	
Test Failure	If the test fails, record the errors on the repair tag and replace the module.	
Restore	Restore the module if it successfully completes all module tests and the errors no longer occur. Restore is in the Slot menu, which you can access by doing the following from the console: Menu \rightarrow Mai ntenance \rightarrow Sl ot	
	See "Restore," earlier in this chapter, for additional	
	information.	
To run the B-Channel Loopback Test, follow the steps below.		
Console Display/Instructions	Additional Information	РС
----------------------------------	---	-------------
1 From the main menu, select th	e Slot option.	
Maintenance		
Make a selection		
System		
Slot		<u>(F2)</u>
Port		
Exi t		
2 Specify the MLX module's 2-dig	git slot number (nn = 00 to 17).	
Slot:	Dial or type [nn], then select Enter.	
Enter Slot number (00-17)		
nn		
Evit Enter		
2 Select the D Chernel Leerber	L 40.04	
3 Select the B-Channel Loopbac	sk test.	
SLOT XX:	xx = slot number entered in Step 2	
Make a serection		
Busy out Peset		
Restore Ungrade		
Bchl oonback		(E4)
Exi t		<u>(14)</u>
The screen below appears while	e the test is running.	
BchLoopback SI ot xx:	xx = slot number entered in Step 2	
BchLoopback in Progress		
Exit		

The screen below appears onl Console Display/Instruction	y if the module passes the test. Additional Information	PC
BchLoopback Slot xx:	<i>xx</i> = slot number entered in Step 2	
BchLoopback Passed		
Exit		
The screen below appears only	if the test fails.	
BchLoopback Slot xx:	xx = slot number entered in Step 2	
BchLoopback Failed		

xx xx xx xx xx xx xx xx xx		
Exi t		

Lines 3 and 4 identify the cause of the failure or the number of errors found per B-channel. There are 16 B-channels, numbered 0 through 15. Line 3 displays the results for B-channels 0 through 7; Line 4 is for B-channels 8 through 15.

Interpreting Test Results

If the test completes successfully, the module's B-channels are functioning properly. Continue with the next module test or restore the module if you are finished testing. If the test fails, find the error message in Table 4-5 and proceed as indicated.

Table 4-5. Channel Loopback Errors

Error Messages	Corrective Action
Slot is not busied-out	Exit the test, busy-out the slot, and try again.
Slot empty or not valid	Exit the test and try again; be sure to type the correct slot number. Do not indicate an empty slot or the processor (00).
FMWR not in Standby Mode	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Test running too long	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Not in TEST/STANDBY mode	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Any other error	Record the errors on the repair tag and replace the module.

Restoring the Module

When you are finished running module tests, be sure to restore the module. See "Restore" earlier in this chapter for instructions.

Replacing Modules

You can remove and insert line/trunk and extension modules (separately or at the same time) with the system power on without affecting normal call processing.



CAUTION:

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

Although the system is designed so that you can remove and replace modules without affecting call processing, partially inserting and removing a module can cause a cold start.

Adding a 100D module or changing any of its DS1 parameters requires that the system be idle.

When you replace a module, be sure to use the same module type. For example. do not put a 008 MLX module in place of a 400 GS/LS 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 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 on board renumbering.

To replace a module, follow the steps below.

- 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 on labeling trunk and cords, see Chapter 4 in Installation. For instructions on checking poorly labeled wiring, see "Checking Unlabeled" Wiring" following Step 8.

- 3 Run a demand test by entering test mode.
- 4 Remove the module by pushing up firmly on the tab at the bottom rear of the module and inspect the module for visible damage.
- Insert the new module. While holding the tab, bring the bottom of the 5 module towards you and away from the carrier.

- 6 Restore the module. Lift up the module to disengage it from the rod at the top of the carrier.
- 7 Connect the trunk and extension cords.
- 8 Attach a tag, error printout, or any information that will help identify any visible problems, failure symptoms, and relevant error reports.

Checking Unlabeled Wiring

If a label is missing or damaged, use a tone device and a telephone handset to match like wires.

You need the following tools:

- Tone device
- Telephone handset
- Telephone cord with an 8-pin modular plug
- 4-pair patch cord
- Diagonal pliers or wire strippers

To match like wires, follow the steps below.

- 1 Insert the telephone cord's 8-pin plug into an outlet on the floor area.
- 2 Using diagonal pliers or wire strippers, cut off the end of the telephone cord to expose the pairs.
- 3 Choose a single pair and then untwist the wires.
- 4 Attach one wire from the pair you have chosen to each clip. The clips extend from the bottom of the tone device.
- 5 Turn on the switch on the outside of the tone device.

You hear a high-pitched, alternating signal.

6 Take the telephone handset and a 4-pair patch cord to the cross-connect field between the control unit and the telephone.

Module Problems

- 7 Go to the blue field on the cross-connect field and, starting at the top left corner, push the patch cord onto the first connecting block.
- 8 Using the diagonal pliers or wire strippers, cutoff the other end of the patch cord and expose the pairs.

Do not cut out too much of the cord, because you need the length to test the top rows of the cross-connect field.

- 9 Attach the handset's clips, which extend from the base, to the exposed wires of the patch cord.
- 10 Set the switch on the side of the handset to MONITOR.

11 Listen to the handset for the tone device signal.

- If you hear the signal, you have found the correct wires. Correctly label both the cross-connect field and the outlet.
- If you don't hear the signal, remove the patch cord from the connecting block and push the patch cord down onto the connecting block to the right of the one just tested. Keep moving the patch cord to the next connector block on the right until you find the pairs that carry the tone device signal.

Upgrading Circuit Module Firmware

Beginning with Release 3.0, MERLIN LEGEND Communications System allows upgrades or reinstallation of circuit module firmware through the PCMCIA interface slot on the Release 3.0 processor module. The interface slot is a standard interface through which information may be added to or retrieved from the system.

Circuit modules introduced with Release 3.0 or later may use flash ROM to retain circuit module firmware, Unlike traditional ROMs, flash ROM can be written and erased without being removed from the circuit module. The first circuit module to include this feature is the 800 GS/LS-ID.

Firmware on this circuit module can be upgraded or reinstalled with an Upgrade memory card. An upgrade is performed when a new release of firmware enhances a module's capabilities or corrects problems. Firmware can be reinstalled if the existing circuit module firmware has been corrupted.

Summary

Console Procedure	Menu \rightarrow Maintenance \rightarrow Slot \rightarrow Dial the slot no. \rightarrow Enter \rightarrow Upgrade \rightarrow Yes
PC Procedures	(F6) →(F2) →Type the slot no. →(F10) →(F8) →or (F10) →(F4)
Appropriate Modules	This procedure can be run only on the 800 LS-ID module or modules introduced after Release 3.0.
Time Estimate	Approximately 1.5 minutes.
Busy-Out or Reset	The module is automatically busied-out after the upgrade procedure begins. If Busy-Out is unsuccessful, you are given the option of waiting for a Busy-Out or selecting <i>Reset</i> .
Restore	Restore the module after the upgrade successfully completes. Restore is in the Slot menu, which you can access by doing the following from the console:
	Menu \rightarrow Mai ntenance \rightarrow SI ot
	See "Restore," earlier in this chapter, for additional information.



Figure 4-7. Inserting the Upgrade Memory Card

To upgrade or reinstall circuit module firmware, follow the steps below.

1 Insert an upgrade memory card containing the circuit module firmware into the PCMCIA interface slot on the processor board.

See Figure 4-7.



The screens below appe	ear during the procedure.
------------------------	---------------------------



If the firmware selected provides functionality that is different from the circuit module's current firmware, the Maintenance display indicates that a Board Renumber will be required once the installation is complete.

Console Display/Instruction	s Additional Information	РC
Upgrade Slot <i>xx:</i>	xx = slot number entered in Step 3	
Slot will be Busied Out.		
Renum board when done.		
Do you want to continue?		
Yes		
No		
Exit		(F3)

If the module Busy-Out is blocked by an active line or extension, the following screen appears.

7 Choose to wait for the module to busy-out or reset the module.

Slot <i>xx</i> in Use: Make a Selection	<i>xx</i> = slot number entered in Step 3
Continue Busy-Out Reset	Continue Busy-Out does not intrrupt calls in progress, but Reset does.
Exi t	

8 Observe the status screen below.

See the next section, "Error Conditions During Firmware Upgrade" if error messages appear.

Upgrade Slot *xx:* In Progress *xx* % Completed <u>(F1)</u> (F2) One of the following screens appears when the upgrade has successfully completed. If only a Restore is required to put the module back into service, the screen below appears.

С	onsole	Display/Instruct	ions	Additional	Information
	Upgrade	Slot xx:			
	Upgrade	Successfully			
	Complete	ed.			
	Slot Bus	sied Out.			
	Slot Re	store needed.			
	Exi t				

If a Board Renumber is also required, the screen below appears.

```
Upgrade Slot xx:
Upgrade Successfully
Completed.
Slot Busied Out.
Board Renumber needed.
Exit
```

<u>(F5)</u>

PC

(F5)

Perform a Board Renumber and/or Restore as indicated above.

Error Conditions During Firmware Upgrade

The following error conditions can occur during a firmware upgrade. Recovery procedures follow each error condition.

Memory Card In Use By Another Feature

Module Upgrade:
Memory Card in use by another feature
Exi t

Select Exit and begin the upgrade procedure again.

<u>(F5)</u>

Missing Card or Card Not Inserted Correctly

Console Display/Instructio	ns Additional	Information	PC
Modul e Upgrade:			
Verify that Memory Card			
has been inserted			
correctly.			
Exi t			

Insert the memory card correctly; then select $\mathsf{Exi}\ t$ and begin the upgrade procedure again.

Memory Card Is Corrupt

Modul de Upgrade: Information on the Memory Card is corrupted. Please remove the Memory Card. Exit

Select Exit and repeat the upgrade procedure with a new memory card.

Module Cannot Be Upgraded

Upgrade Slot *xx:* Module can not be upgraded. xx = slot selected in Step 3.

Exi t

This procedure can only be run on the 800 GS/LS-ID module or modules introduced after Release 3.0. Select Exit and repeat the upgrade procedure, being careful to select the correct slot. If upgrade canceled or upgrade incomplete appears on the error screen, the circuit module may be unreliable or unusable until a successful upgrade is performed on it.

Module Error

Console Display/Instructions Additional Information

Additional information

PC

Upgrade Slot *xx:* Module error xx = slot selected in Step 3.

xx = slot selected in Step 3.

```
Exi t
```

Select Exit and reinitiate the upgrade procedure.

Upgrade Slot <i>xx:</i> Module error	
Upgrade CANCELLED. Upgrade INCOMPLETE.	
Exi t	

Select Exit and reinitiate the upgrade procedure.

Memory Card File Error Console Display/Instructions Additional Information Upgrade Slot xx: xx = slot selected in Step 3. Memory Card file error. Exit

Select Exit, then make sure that the memory card is properly inserted, and reinitiate the upgrade procedure.

Upgrade Slot <i>xx:</i>
Memory Card file error.
Upgrade CANCELLED
Upgrade INCOMPLETE
13
Exi t

xx = slot selected in Step 3.

PC

Select Exit, then make sure that the memory card is properly inserted, and reinitiate the upgrade procedure. If the error occurs again, select Exit and insert a new memory card, then reinitiate the upgrade procedure.

Flash ROM Fails to Erase

Upgrade Slot xx:			
Memory on motile will			
not erase.			
Upgrade CANCELED			
Upgrade INCOMPLETE			
Exi t			

xx = slot selected in Step 3.

Repeat, the upgrade procedure. If the upgrade continues to fail after several attempts, the module should be replaced. See "Replacing the Module."

Upgrade Attempted on an Empty Slot

Console Display/Instructions

Additional Information xx = slot selected in Step 3. PC

```
Upgrade Slot xx:
No module in slot.
Exit
```

Select $\mathsf{Exi}\ t$ and repeat the upgrade procedure, being careful to select the correct slot.

Board Memory Programming Failure

Upgrade SI ot xx: **Board Memory Programming** Failure. Upgrade CANCELED. Upgrade INCOMPLETE. Exit xx = slot selected in Step 3.

Repeat the upgrade procedure. If the upgrade continues to fail after several attempts, the module should be replaced. See "Replacing the Module."

100D Module Problems

The 100D module requires the CSU Loopback Test, in addition to the other module tests, See Figure 4–6 for a diagram of the entire module testing process. If you have any questions about the 100D module that this section does not cover, contact your technical support organization.

Error Events

In addition to checking the error logs, the 100D module requires that you check the error events specific to the 100D module. See "Error Events, " later in this chapter, for details.

CSU Loopback Test

The Channel Service Unit (CSU) Loopback Test verifies that the communication path between the following CSUs, 551 T1, ESF T1, or the ACCULINK[®] 3150, and the 100D module is operational.

Summary

Console Procedure	Menu \rightarrow Maintenance \rightarrow Slot \rightarrow Dial the slot no. \rightarrow Enter \rightarrow CSU-1pbk
PC Procedure	$(F6) \rightarrow (F2) \rightarrow Type$ the slot no. $\rightarrow (F10) \rightarrow (F4)$
Appropriate Modules	This test can be run only on 100D modules.
Time Estimate	Approximately 2 minutes
EQ IN and EQ OUT (551 T1 CSU)	For the 551 T1 CSU only, connect a patch cord from the CSU EQ IN jack to the CSU EQ OUT jack. Details are provided below.
DTE LOOPBACK	For the ESF T1 CSU only, flip the DTE LOOPBACK
(ESF T1 CSU)	switch on the front panel to the up position to activate the loopback. Details are provided below.
LINE LOOPBACK	For the ACCULINK 3150 only, select front panel
(ACCULINK 3150 CSU)	Line Loopback command. Details are provided below.
Busy-Out or Reset	Prior to beginning the test, busy-out the 100D module. Both Busy-out and Reset are in the Slot menu, which you can access by doing the following from the console:
	Menu \rightarrow Maintenance \rightarrow Slot.
	See "Busy-Out and Reset," earlier in this chapter, for additional information.

100D Module Problems

Interrupting the Test	You can interrupt the test by selecting Exit.
Test Failure	If the test fails, record the errors on the repair tag and replace the module.
Restore	If the 100D module successfully completes the CSU Loopback Test, restore the module. Restore is in the Slot menu, which you can access by doing the following from the console:
	Menu →Maintenance →Slot.
	See the "Restore" procedure, earlier in this chapter, for additional information.

In preparation for running the CSU Loopback Test, perform the following steps at the CSU.

1 Busy-out the 100D module.

2 Prepare the CSU.

For the 551 T1 CSU, connect the EQ OUT and EQ IN jacks (see Figure 4-8).

- a Plug one end of a bantam-to-bantam patch cord (or a loopback fixture) into the EQ OUT jack on the front of the CSU.
- b Plug the other end of the patch cord into the EQ IN jack on the CSU.

This causes the 551 T1 CSU to either loop back the network signal or send the all-ones pattern, depending on the chosen CSU option.

For the ESF T1 CSU, flip the DTE LOOPBACK switch on the front panel to the up position to activate the loopback test (see Figure 4–9).

For the ACCULINK3150 CSU, Press F2 on the front panel to select "Test" from the menu screen. From the Test screen, press F2 to select "Lpbk". From the Loopback screen, press the right arrow once to display additional loopback tests. Press F3 to display "DLB" (DTE Loopback). When DLB is selected, "Test Started" appears on line 2 of the menu screen. (See Figures 4-10 through 4-13.)

The ACCULINK 3160/3164 DSU/CSU is physically similar to the 3150 CSU with programming on the front panel and menus appearing on the LCD screen. For the preparation of specific tests, see the operator's guide that comes with the unit.



Figure 4-8.551 T1 CSU Loopback Connection



Figure 4-9. ESF T1 CSU DTE Loopback Connection



Figure 4-10. ACCULINK 3150 CSU Front Panel



Figure 4-11. ACCULINK 3150 CSU DTE Loopback Command 1



Figure 4-12. ACCULINK 3150 CSU DTE Loopback Command 2

100D Module Problems



Figure 4-13. ACCULINK 3150 CSU DTE Loopback Command 3



Figure 4-14. ACCULINK 3150 CSU DTE Loopback Command 4

To run the CSU Loopback Test, follow the steps below.

	Console Di	isplay/Instructio	ons	Additional Information	РC
1 Fr	om the Mai	ntenance menu,	, selec	t the Slot option.	
-	Maintenance Make a sel System slot Port	e ection			
2 9	Spacify the	2-digit slot nu	l Imbor	(nn - 00 + 0.17)	<u>(F2)</u>
2 3	specify the	2-digit slot nu		$(m) = 00 \ (0 \ 17).$	
	Slot: Enter Slot	number (00-17)		Dial or type [nn], then select Enter.	
	nn				
	Backspace				
	Exi t	Enter			
3 S	Select the C	SU Loopback	Test.		
	Slot <i>xx:</i> Make a sel	ection		xx = slot number entered in Step 2	
	Status	Demand Test		Error Events and Clock are also	
	Busy-out	Reset		displayed only for the 100D module,	
	Restore	Error Events			
	CSU-I pbk	cl ock			
	Exit	Upgrade			(F4)

The screen below appears while the test is running. At the same time, the module's green LED flashes.

PC

Console Display/Instructions	Additional Information
CSU-Ipbk Slot xx:	<i>xx</i> = slot number entered in Step 2
CSU-Ipbk in Progress	
Exit	

The screen below appears only if the module passes the test. If the test is successful, contact the CO and ask them to check their end.

```
    CSU-I pbk SI ot xx:
    xx = slot number entered in Step 2

    CSU-I pbk Passed
    Exi t

    The screen below appears when the test fails.
```

CSU-Ipbk slot <i>xx:</i>	xx = slot number entered in Ste
CSU-Ipbk Failed	

xxx xxx xxx xxx xxx xxx	
xxx xxx xxx xxx xxx xxx	
xxx xxx xxx xxx xxx xxx	
Exi t	

Lines 3 through 6 identify the cause of the failure or the number of errors found per channel. There are 24 channels, numbered 1 through 24. Line 3 displays the results for channels 1 through 6; Line 4 is for channels 7 through 12. Line 5 is for channels 13 through 18. Line 6 is for channels 19 through 24.

Interpreting Test Results

If the testis successful, the connection between the CSU and the 100D module is good, and the 100D module is probably okay. Continue with the next module test; restore the module if you are finished testing.

If the test fails, find the error message in Table 4-6 and proceed as indicated. **Table 4-6. Internal Loopback Test Errors**

Error Messages	Corrective Action
Slot is not busied-out	Exit the test, busy-out the slot, and try again.
Slot empty or not valid	Exit the test and try again; be sure to type the correct slot number. Do not indicate an empty slot or the processor (00).
FMWR not in Standby Node	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Test running too long	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Not in TEST/STANDBY mode	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Any errors on the CSU-lpbk Failed screen	Check the cable between the 100D module and the CSU; then retest. If the problem persists, check the CSU settings.
	Exit the test and try again; if this error persists, record the errors on the repair tag and replace the module being tested.
Any other error	Record the errors on the repair tag and replace the module; if in doubt, escalate to your technical support organization.

Restoring the Module

After completing the CSU Loopback Test, follow the steps below to restore the module.

1 If you are finished testing modules, restore the 100D module. Refer to "Restore," earlier in this chapter, for instructions.

2 Reset the CSU.

- For the 551 T1 CSU, unplug the patch cord, first from the EQ IN jack and then from the EQ OUT jack.
- For the ESF T1 CSU, flip the DTE LOOPBACK switch down (to deactivate the loopback).
- For the ACCULINK 3150 CSU press the right arrow key once to display the Ctrl selection, then press F3 to select Ctrl. Press the right arrow key twice to display the reset selection. Now press F1 to initiate a reset of the CSU.

Automatic Tests for the 100D Module

Every 15 minutes, the system checks the 100D module for the following:

- Initialization. The system ensures that all T1 ports are properly initialized and placed into service, It also resolves the conflicts of different service levels (for example, between the individual ports or for the initialization of the ports to support features).
- Error Detection. The system detects errors and takes the trunk out of service, if appropriate. It attempts to restore the trunk and put it back into service.
- Error Recording. The system records all errors and outages in the error logs.
- Audits and Updates. The system checks the state of the T1 facilities through audits, status checks, and error logging.

Synchronization. The system maintains proper synchronization to the loop clock and switches to the local clock when the loop clock is not available (for example, during a loss of signal or a blue alarm). When the loop clock source is restored, the system switches back to the loop clocks.

100D Module Error Events

This procedure allows you to check for 100D module errors. If you have any questions about interpreting these errors, contact your technical support organization.

Summary

-

Console Procedure	Menu \rightarrow Mai ntenance \rightarrow SI ot \rightarrow Dial the slot no. \rightarrow Enter \rightarrow Error Events \rightarrow
Current hr or Previous hr	$(\underline{F6})$ →(F2) →Type the slot no. →(F10) →(F8) →(F1) or
PC Procedures	(F2)

To check for Errors, follow the steps below.

Console Display/Instructions	Additional Information	PC
From the Maintenance menu, select	the Slot option.	

Maintenance			
Make a selection			
System			
Slot			
Port			
Exi t			

<u>(F2)</u>



The current hour always begins at ##:00 and ends at the last complete 15minute interval. For example, if the current time is 09:46, selecting Current hr displays the errors that have accumulated between 09:00 and 09:45. mm/dd/yy

Exi t

The screen below displays the errors that have accumulated during the current hour.

Console Display/Instructions

CurAlm aaaa MaxAlm aaaa MIS SLP ES BS SEC FS xxx xxx xxx xxx xxx xxx

Current hr Slot xx:

Additional Information PC

ot xx: xx = slot number entered in Step 2 hh00-hh: mm

The screen below displays the errors that have accumulated during the previous hour.

```
Previous hr Slot xx:

mm/dd/yy hh: 00-hh: mm

CurAlm aaaa MaxAlm aaaa

MIIS SLP ES BS SEC FS

xxx xxx xxx xxx xxx

Exit
```

xx = slot number entered in Step 2

100D Module Clock Status

If you have not been trained to perform T1 maintenance, contact your technical support organization for instructions on using this procedure.

Summary

Console Procedure	$\begin{array}{llllllllllllllllllllllllllllllllllll$
PC Procedure	(F6) →(F2) →Type slot no. →(F10) →(F9) →(F5)





Carrier Problems

Typical carrier problems include power supply failure, sudden failure of one or more modules, or system problems that cannot be isolated to a specific module. If you find a problem with the carrier, it must be replaced; carriers cannot be repaired in the field.

Removing the Faulty Carrier

1 Remove the control unit housing.

If you need instructions, see "Removing the Control Unit Housing" in Chapter 1.

2 Backup system programming.

If you need instructions, see *System Programming and Maintenance (SPM)* (for disk backups) or Appendix D, "Backing Up with a Memory Card."

3 Power down the system by turning off the components listed below, in the order given.

- a Power supply on the basic carrier
- b Power supply on each expansion carrier
- c Auxiliary power units (if present)

4 Unplug the control unit from the AC outlet.

- 5 Remove the processor, the power supply, and all other modules from the faulty carrier. (If you prefer to remove the cords first, make sure they are labeled.)
- 6 Put the modules aside, in order, so that you can reinstall them later in the replacement carrier.
- 7 Remove all modules from the carriers to the right of the faulty carrier.
- 8 Starting with the *rightmost* carrier, loosen the four screws that secure the four corners of the carrier to the backboard.
- 9 Slide the carrier to the right until the connector disengages from the carrier to the left.
- 10 Pull the carrier away from the wall so that the screws slip through the large screw holes.
- 11 Repeat Steps 8-10 until the faulty carrier is removed.

Replacing the Carrier

After removing the faulty carrier, use the steps below as a guideline for installing a new carrier.

- 1 Install the replacement carrier(s). See *Installation* for instructions.
- 2 Replace the modules with all cords connected as they were before.

Checking System and Slot Status

In addition to checking error logs, the access log, and running module tests, you can request System Status and Slot Status information for each module.

System Status

The power supply, processor, 400EM module, and 10OD module are the only modules that have LEDs. The System Status screen displays simulated LEDs for the processor and each of these modules but not for the power supply.

The System Status procedure allows you to check simulated LEDs for the processor and other modules. This is explained in detail in "Reading the System Status Screen," later in this chapter.

Summary

Console Procedure	$\textbf{Menu} \rightarrow \textbf{Maintenance} \rightarrow \textbf{System} \rightarrow \textbf{Status}$
PC Procedure	<u>(F6)</u> →(F1) →(F1)

To check System Status, follow the steps below.



Interpreting the System Status Screen

Console Display/Instructions

```
System Status:
SI ot00: R aaa
SI ot01 R aaa Y aaa G aaa
SI ot02 R aaa Y aaa G aaa
SI ot03: R aaa Y aaa G aaa
SI ot04: R aaa Y aaa G aaa
Exi t
```

Additional Information PC

R *aaa* =status (On, Off, No) of red LED Y *aaa* =status (On, Off, No) of yellow LED G *aaa* =status (On, Off, No) of green LED

The System Status screen simulates LEDs for each module. The simulated LEDs are represented as R (red), Y (yellow), and G (green).

Immediately following R, Y, or G is its status (*aaa* in the screens shown above), which can be On, Off, or No status (an empty slot in the control unit).

Red LED

When the red LED is on, the module is not in service because it is in standby mode, being tested, or is in an alarm condition. When a module resumes normal operations, the red LED turns off.

Yellow LED

When the yellow LED is on, it usually means that at least one call is in progress on that module. This is usually true for modules with trunks, When this is the status, you must reset the board if you want to terminate any calls in progress rather than waiting for them to terminate during a Busy-Out.

Green LED

The green LED is usually off. It may be on during power up or when an Internal Loopback or CSU Loopback Test is running.

Sample LED Display (Slot 4)

If a call is in progress on a module that is in a working or normal state, the System Status display for that module appears as Roff Yon Goff.

If a slot is empty, R, Y, and G appear without indicating a status. Slot 4 is empty, according to the sample screen in the last procedure.

Slot Status

Slot Status provides the following information for a module in a particular slot:

- LED status
- Errors (yes or no)
- Mode (initialization, standby, test, or normal)
- Alarms (yes or no)
- Maintenance busy (yes or no)

Summary

Console Procedure:	$\textbf{Menu} \rightarrow \textbf{Mai ntenance } \rightarrow \textbf{SI ot } \rightarrow \textbf{Dial the slot no.}$
	→Enter →Status
PC Procedure	(F6) →(F2) →Type the slot no. →(F10) →(F1)

To check Slot Status, follow the steps below.

Console Display/InstructionsAdditional InformationPC1 From the Maintenance menu, select the Slot option.

Port	t Slot	System Slot
	† SLOT	System Slot

	Console D	isplay/Instructio	ons Additional Information	РС					
2 Sp	2 Specify the 2-digit slot number $(nn = 00 \text{ to } 17)$.								
	Slot: Enter Slot	number (00-17)	Dial or type [nn] and select Enter.						
	<i>nn</i> Backspace Exi t	Enter		<u>(F10)</u>					
3 Select the Status option.									
-	Slot <i>xx:</i> Make a sele Status Busy-out Restore CSU-lpbk Exit	ction Demand Test Reset Error Events Clock Upgrade	xx=slot number entered in Step 2 CSU-I pbk, Error Events, and Clock appear <i>only</i> when the 100D module occupies the selected slot, If an MLX module occupies the selected slot, BchLoopback appears in place of CSU-I pbk.	<u>(F1)</u>					
If you selected Slot 00, the screen below appears. For detailed information about this status screen, see "Slot Status, " earlier in this chapter.

Status	Slot	00:	
LED: Errors:		Raaa	
Al arms:			
Exi t			

R *aaa* =status (On, Off, No) of red LED.

If you selected a slot other than 00, the screen below appears. For detailed information about this status screen, see "Slot Status," earlier in this chapter,

Status Slot <i>xx:</i>	xx = slot number entered in Step 2
LED: R aaa Y aaa G aaa	R aaa =status (On, Off, No) of red LED.
Errors:	Y aaa =status (On, Off, No) of yellow LED.
Mode:	G aaa =status (On, Off, No) of green LED,
Alarms	
Maintenance Busy:	Select Next to go from one slot
Exit Next	to the next. (F10)

Checking System and Slot Status

Central Office Problems

5

If you have tested the telephones and the modules in the control unit, you have isolated the trouble to the trunks or the CO. To isolate the trouble further, follow the instructions in this chapter to troubleshoot the trunks. If the trouble persists after following these instructions, the customer should contact the CO and ask a representative to troubleshoot from that end.

Trunk Errors

The system records errors not only for trunks, but for T1 ports on the 100D module as well. In some cases, errors occur not because a single port fails, but because the entire T1 link fails. When this happens, 100D automatic testing activates an alarm.

Troubleshooting Trunk Problems

Table 5-1 provides a quick guide to troubleshooting trunks.

Table 5–1. Troubleshooting Trunk Symptoms

Symptom	Section
Incoming calls not being received	Incoming Trunk Problems
Cannot make outgoing calls	Outgoing Trunk Problems
General trunk problems	Manual Correction of Trunk Problems

NOTE:

If the customer reports ethos during conversations on T1 trunks with GS emulation to a toll office, check the system programming for T1 trunks. The system is not intended to work with GS emulation to a toll office. Tie trunk emulation must be programmed. Program the module to emulate tie trunks to the central office.

Manual Correction of Trunk Problems

If the system cannot seize a trunk even after repeated attempts, you may have to replace the module.

To identify the trunk problem, follow the steps below.

- 1 Check for dial tone at the control unit.
- 2 If you do not hear dial tone, check the error logs and make a trunk test call.
- 3 Check for dial tone at the network interface.

It is sometimes difficult for the customer to detect trunk troubles. If a trunk is down, the system records an error in the error log and takes the trunk out of service. However, if an incoming-only trunk is down, the only sign of trouble is customer complaints that incoming calls are not being received.

Check the error logs for messages about trunk type (such as DID, tie, and T1). Also check the wiring and the system parameters (for example, touch-tone/rotary, toll restriction, and disconnect time interval).

Outgoing Trunk Problems

If the system cannot sieze outgoing trunks, try the following procedure.

NOTE:

You cannot perform this procedure on a rotary telephone.

1 Check for outside dial tone at the network interface.

For GS trunks, apply ground to the ring lead to get dial tone. If dial tone is not present, notify the customer.

2 Pick up the handset of a test telephone to check for system dial tone.

For a Hybrid/PBX system, dial *03.

- 3 Dial the 2-digit trunk number (01-80) of the trunk you want to test.
- 4 Listen for dial tone.
 - If dial tone is not present, use a test telephone to isolate the problems either to the module where the trunk terminates or to the location in the trunk access equipment.
 - If dial tone is present, dial a working outside number to verify that the call can be completed.

Dialing an outside number on a single-line telephone works only if the trunk accepts touch-tone dialing.

If you are using a single-line telephone to dial out to an E&M tie trunk or a T1 tie trunk, wait for a click before dialing the outside number.

If the trunk is busy, you hear a busy tone. If you dial a wrong trunk type (such as DID) or an invalid trunk number, you hear a reorder tone.

5 If the module continues to malfunction, replace it.

Incoming Trunk Problems

If incoming trunks do not work properly, try the following procedure.

1 Place an incoming call through the troubled trunk.

- For a loop-start (LS) trunk, connect a single-line telephone to the trunk at the network interface.
- For a ground-start (GS) trunk, connect a single-line telephone to the trunk at the network interface and press the GS button. (For GS trunks, the telephone must have a GS button attached to it.)

2 Listen for ringing.

- 3 Pick up the handset and check line seizure.
- 4 Dial an outside number and verify that you have good two-way transmission.
- 5 At the maintenance terminal, check the trunk programming to be sure this trunk has been properly translated.

See the system planning forms.

6 If the module continues to malfunction, replace it.

Testing Trunks Automatically

The automatic maintenance program takes the ports out of service when a trunk is malfunctioning. When a port is out of service, it is *maintenance-busy*. The trunk is periodically tested and put back into service if possible.

Maintenance-Busy Status

When maintenance-busy is enabled and a trunk cannot be seized for an outgoing call, the trunk is automatically put into a maintenance-busy state. When a trunk is in a maintenance-busy state, no outgoing calls can be placed on it. However, the trunk can still receive incoming calls.

NOTE:

Maintenance-busy does not apply to DID trunks, since DID trunks cannot be used to make outgoing calls.

While the trunk is in a maintenance-busy state, the software periodically runs tests, attempting to seize the trunk:

- If the seizure is unsuccessful, the trunk stays in a maintenance-busy state.
- If the seizure is successful, the trunk is placed back in service.
- If a test is running when an incoming call is received on the trunk, the test is dropped and the call is processed.

No more than 50 percent of trunks in a pool can be maintenance-busy at one time. The only exceptions are as follows:

- User-imposed maintenance-busy (for example, module replacement)
- Module maintenance-busy (for example, a loss-of-service alarm in the 100D module)
- No external release at the central office end of the line

Permanent Errors

A permanent error is entered in the error logs when more than 50 percent of the trunks in a pool are maintenance-busy. When the maintenance-busy level falls below 50 percent, the system automatically removes the permanent error.

NOTE:

Make sure that modules are not in a maintenance-busy state during a backup procedure. Any module in a maintenance-busy state is recorded as such on the backup disk.

Maintenance-Busy Causes

The causes of maintenance-busy vary according to the type of trunk and are detailed in the following sections.

Ground-Start (GS) Trunk

The following events cause maintenance-busy on a ground-start trunk:

A seizure of the trunk is attempted that results in incomplete handshaking (or no loop current) between the CO and the system.

After four occurrences, the trunk is put into a maintenance-busy state and a permanent error is logged.

The CO fails to disconnect when the GS trunk is dropped by the system.

After two occurrences, the trunk is put into a maintenance-busy state and a permanent error is logged.

Loop-Start (LS) Trunk

No loop current exists when the LS trunk is seized. The port is marked *maintenance-busy,* and a permanent error is logged after four occurrences.

TieTrunk

The following events cause maintenance-busy on a tie trunk.

A seizure of an outgoing tie trunk fails.

A transient error is reported. After four unsuccessful seizure attempts, the port is marked *maintenance-busy* and the error becomes permanent.

The CO fails to disconnect.

A transient error is reported. After two occurrences, the port is marked *maintenance-busy* and the error becomes permanent.

NOTE:

The test is not run on auto-out tie trunks.

Maintenance-Busy Programming

You can select Maintenance-Busy as a system programming option. If you do, there is also a menu selection to include tie trunks.

Maintenance-Busy Status

See "Checking Ports" below for information on maintenance-busy status.

Checking Ports

You perform the following procedures from the maintenance terminal. By selecting Port from the Maintenance screen, you can check the maintenancebusy status and other information for individual trunks and extensions. Once you determine the maintenance-busy status, you might also be interested in the other features on the Port menu, which include the following:

- Resetting EIA-232 ports and modems
- Busying-out and restoring trunks and extensions
- Auditing DS1 PRI lines or calls

Checking Trunk Maintenance-Busy Status

Summary

Console Procedure	Menu \rightarrow Maintenance \rightarrow Port \rightarrow Line/Trunk \rightarrow
	Dial the dial plan no. \rightarrow Enter \rightarrow Status
PC Procedure	(F6) → (F3) → Type the dial plan no. → (F10) → (F1)

To check a trunk's maintenance-busy status, follow the steps below.



Console Display/Instruction	ns Additional Information PC
4 Select trunk Status.	
Li ne/Trunk xxx:	xxx = line number entered in Step 3
Make a selection	
Status	
Busy out	
Restore	
Exi t	(F1)
The maintenance-busy status	for the trunk you selected is displayed as a Yes
or a No, in that field (line 6) on	the screen below.
Line xxx:	xxx = line number entered in Step 3
Dial Plan: xxxx	
SlotPort: sspp	
Logi cI d: xxx	
Label: xxxxxxx	
Maintenance Busy <i>xxx</i>	Select Next to see the status of the

Checking Extension Maintenance-Busy Status

Next

Summary

Exi t

Console Procedure	Menu \rightarrow Maintenance \rightarrow Port \rightarrow Extension \rightarrow Dial
	the dial plan no. \rightarrow Enter \rightarrow Status
PC Procedure	(F6) →(F3) →(F2) →Type the dial plan no. →(F10) →(F1)

next trunk.

To check an extension's maintenance busy status, follow the steps below.

<u>(F10)</u>



The maintenance-busy status for the extension selected is displayed as a Yes or a No in the field (line 6) on the screen below.

Console Display/Instruction	s Additional Information	PC
Station: xxxx		
Di al Pl an: xxxx		
SlotPort: <i>sspp</i>		
Logi cI d: xxx		
Profile: xxxxxxxxxx		
Maintenance Busy:	Select Next to see the status of the	
Exit Next	next extension.	<u>(F10)</u>

Busying-Out a Trunk

Summary

Console Procedure	Menu \rightarrow Maintenance \rightarrow Port \rightarrow Line/Trunk \rightarrow
	Dial the dial plan no. \rightarrow Enter \rightarrow Busy-Out
PC Procedure	(F6) →(F3) →(F1) →Type the dial plan no. →(F10) →(F2)

To busy-out a trunk, follow the steps below.

1 From the Maintenance menu, select the Port option.

Maintenance				
Make a selection				
System				
Slot				
Port				
Exi t				

<u>(F3)</u>

	Console Display/Instru	ctions	Additional Information	РС
2 Se	lect the Line/Trunk op	tion.		
-	Port: Make a Selection Line/Trunk Modem Station B-Channe RS232 Port1 RS232 Port2			
	Exit Enter			<u>(F1)</u>
3 Sp	ecify the dial plan num	ber (line)	for the trunk (nnn = 801 to 880).
	Line/Trunk: Enter line number		Dial or type [nnn], then select Er	nter.
	nnn Backspace Exit Enter			
4 Se	elect Busy-Out.			
-	Line/Trunk xxx: Make a Selection Status Busy out Restore		xxx = line number entered in Step 3	3
Ŧ	Exit		en Out finishes on fails	<u>(F2)</u>
I	ne screen below is show Li ne/Trunk <i>xxx:</i> Busy-Out in Progress		sy-Out finishes of fails. xxx = line number entered in Step 3	3
	Exi t			

The screen below appears when Busy-Out is completed successfully.



The screen below appears when Busy-Out fails. If this occurs, exit and try again.

Line/Trunk xxx:	
Busy-Out FAILED	
Exi t	

xxx = line number entered in Step 3

PC

Busying-Out an Extension

Summary

Console Procedure	Menu \rightarrow Maintenance \rightarrow Port \rightarrow Extension \rightarrow Dial
	the dial plan no. \rightarrow Enter \rightarrow Busy-Out
PC Procedure	(F6) →(F3) →(F2) →Type the dial plan no. →(F10) →(F2)
To busy-out an extension, fo	ollow the steps below.



Console Display/Instructio	ns Additional Information PC
4 Select Busy-out.	
Station xxxx: Make a Selection Status Busy out Restore	xxxx = extension number entered in Step 3
Exi t	<u>(F2)</u>
The screen below is shown un	til Busy-Out finishes or fails.
Station xxxx:	xxxx = extension number entered in Step 3
Busy-Out in Progress	
Exi t	
The screen below appears wh	en Busy-Out is completed successfully.
Station <i>xxx:</i>	xxxx = extension number entered in Step 3
Busy-Out Successfully Completed	,
Exi t	
The screen below appears what again.	en Busy-Out fails. If this occurs, exit and try
Station xxxx:	<i>xxxx</i> = extension number entered

in Step 3

Exit

Busy-Out FAILED

Central Office Problems 5-15

Restoring a Trunk

Summary

Console Procedure	Menu →Maintenance →Port →Line/Trunk →	
	Dial the dial plan no. \rightarrow Enter \rightarrow Restore	
PC Procedure	(F6) \rightarrow (F3) \rightarrow (F1) \rightarrow Type the dial plan no. \rightarrow (F10) \rightarrow (F3)	

To restore a trunk, follow the steps below.

Console Display/Instructions	Additional Information	PC
-------------------------------------	------------------------	----

1 From the Maintenance menu, select the Port option.

	System	
	Slot	
_	Port	
	Fxit	(F3)
		<u>(1 0)</u>

2 Select the Line/Trunk option.

	Port:	
	Make a Selec	tion
-	Li ne/Trunk	Modem
	Stati on	B-Channel
	RS232 Portl	
	RS232 Port2	
	Exi t	Enter

3 Specify the dial plan number (line) for the trunk (nnn = 801 to 880).

Li ne/Trunk:	Dial or type [nnn], then select Enter.
Enter line number	
nnnn	
Backspace	
Exit Enter	

Console Display/Instruction	ons Additional Information	PC
4 Select Restore.		
Line/Trunk <i>xxx:</i> Make a Selection Status Busy Out	xxx= line number entered in Step 3	3
Exi t The screen below is shown un	til Restore finishes or fails.	<u>(F3)</u>
Restore LIne/Trunk xxx:	xxx = line number entered in Step 3	
Restore in Progress		
Exi t		
The screen below appears whe	en Restore is completed successfully.	
Restore Line/Trunk xxx:	xxx = line number entered in Step 3	
Restore Successfully Completed		
Exi t		
The screen below appears whe	en Restore fails. If this occurs, exit and try	

again.

Restore Line/Trunk xxx: Restore FAILED Exit

xxx = line number entered in Step 3

Restoring an Extension

Procedure	Menu →Maintenance →Port →Station → Dia l
	the dial plan no. \rightarrow Enter \rightarrow Restore
PC Procedure	(F6) →(F3) →(F2) →Type the dial plan no. →(F10) →(F3)

To restore an extension, follow the steps below.

Console Display/Instructions	Additional Information	РС
1 From the Maintenance menu, select	the Port option.	



	Console Display/Instruction	ns Additional Information	PC
3	Specify the dial plan extension	on number <i>(nnnn</i> = 1- to 4-digit number).
	Station:	Dial or type [nnnn], then select Enter.	
	Enter station number		
	0000		
	1		
	Backspace		
	Exit Enter		
4	Select Restore.		
	Station: xxxx	xxxx = extension number entered	
	Make a Selection	in Step 3	
	Status		
	Busy Out		
	Restore		
			(
		til Destave fiziehee er feile	<u>(F3)</u>
	The screen below is shown un	til Restore finisnes of fails.	
	Restore Station: XXXX	xxxx = extension number entered	
	Postoro in Progress	III Step 3	
	Restore III Frogress		
	Exi t		
	The screen below appears	when Restore is completed successfully.	
	Restore Station: xxxx	xxxx = extension number entered	
		in Step 3	
	Restore Successfully		
	Completed		
	Fxit		
	EXIT		

The screen below appears when Restore fails. If this occurs, exit and try again.Console Display/InstructionsAdditional InformationPC

Restore	Stati on:	XXXX
Restore	FAI LED	
Exi t		

xxxx = extension number entered in Step 3

Resetting an RS-232 Port

The ADMIN (SPM) port is RS-232 Port 1, and the SMDR port is RS-232 Port 2.

Summary

Console Procedure	$\begin{array}{llllllllllllllllllllllllllllllllllll$
PC Procedure	(F6) → (F3) → (F3) or → Type the dial plan no. → (F10) → (F1) → (F3)

To reset an RS-232 port, follow the steps below.

1 From the Maintenance menu, select the Port option.

Maintenance		
Make a	selection	
Syster	ı	
Slot		
Port		
Exi t		

<u>(F3)</u>



The screen below appears when Reset is completed successfully.Console Display/InstructionsAdditional Information

PC

try again.

1	
RS232 Port x Reset:	x = port selected in Step 2
Reset Successfully Completed	
Exit	on React fails of this accurs wit and
The screen below appears will	

RS232 Port x Reset: Reset FAILED

Exi t

Resetting the Processor's Internal Modem

Summary

Console Procedure	$\textbf{Menu} \rightarrow \textbf{Maintenance} \rightarrow \textbf{Port} \rightarrow \textbf{Modem} \rightarrow \textbf{Reset} \rightarrow \textbf{Yes}$
PC Procedure	<u>(F6)</u> → (F3) → (F6) → (F1) → (F2)



	Console Display/Instructio	ns Additional Information	РС
4	Select Yes.		
	Modem Port Reset:		
	Do you want to continue?		
	Cancel		
	Exit		<u>(F2)</u>
	The screen below is shown	until Reset fininshes or fails.	
	Modem Port Reset:		
	Reset in Progress		
	Exi t		
	The screen below appears wi	hen Reset is completed successfully.	
	Modem Port Reset:		
	Reset Successfully		
	compreted		
	Exi t		
	The screen below appears when	Reset fails. If this occurs, exit and try again.	
	Modem Port Reset:		
	Reset FALLED		
	EXIT		

Auditing DS1 PRI B-Channels

The Auditing Lines and Auditing Calls procedures initiate an audit. Once an audit is initiated, you need to wait for the far end to send a message, which usually takes about four minutes. After waiting four minutes, check the error logs to see if any new PRI errors have occurred.

- Auditing Lines. If troubleshooting indicates problems with PRI lines between the control unit and the CO, this audit, if successful, fixes the problem. It allows either side of the PRI interface to synchronize both ends by exchanging messages.
- Auditing Calls. If troubleshooting indicates problems with PRI calls to or from MLX telephones, this audit, if successful, fixes the problem. It allows either side of the PRI interface to synchronize both ends by exchanging messages.

NOTE:

If an audit fails, the customer should call the CO to correct the problem from that end. Repeat the audit when the problem is fixed.

Auditing Lines

Summary

Procedure	$\begin{array}{llllllllllllllllllllllllllllllllllll$
PC Procedure	$\underbrace{(F6)}_{(F1)} \rightarrow \underbrace{(F7)}_{F1} \rightarrow \text{Type the slot and Port no } . \rightarrow \underbrace{(F10)}_{F1} \rightarrow$
Appropriate Slot or Port	This test can be run only on the slot and port of a DS1 PRI B-channel.
Time Estimate	4 minutes
Backup Procedure	Not required
Busy-Out or Reset	Not required
Interrupting the Test	You cannot interrupt this test.
Restore	Not required

To audit lines, follow the steps below.





BChannel	XXXX	Audi t	Li ne	
Audit Ini	tiate	ed		
Exi t				

xxxx = slot and port number entered in Step 3.

After about four minutes, check the error logs.

- If new PRI errors occur, contact your technical support organization for help on interpreting the results and your action.
- If no new PRI messages appear, the ends are most likely in agreement.

The screen below appears when the message cannot be sent due to signaling failure.

BChannel	XXXX	Audi t	Li ne
Audit Fai	led		
Exi t			

xxxx = slot and port number entered in Step 3.

This indicates that the problem may beat the central office (CO) end. First, make sure the correct B-channel is selected. If the correct B-channel is selected, the customer or AT&T representative acting as the customer's agent should ask the CO to clear the problem from that end. If the problem is not at the CO end, select the correct B-channel and repeat the Audit Lines procedure.

Auditing Calls

Summary

Console Procedure	$Menu \rightarrow Mai \text{ ntenance } \rightarrow Port \rightarrow B-Channel \rightarrow Dial the$
	slot and port no. \rightarrow Enter \rightarrow Audit Call
PC Procedure	(F6) →(F3) →(F7) →Type the slot and port no. →(F10) →
	<u>(F2)</u>
Appropriate Slot or	This test can be run only on the slot and port of a
Port	DS1 PRI B-channel.
Time Estimate	Four minutes
Backup Procedure	Not required
Busy-Out or Reset	Not required
Interrupting the Test	You cannot interrupt this test.
Restore	Not required

To audit calls, follow the steps below.



(F3)

Exi t



After about four minutes, check the error logs.

- If new PRI errors occur, contact your technical support organization for help on interpreting the results and your action.
- If no new PRI messages appear, the ends are most likely in agreement.

The screen below appears when the message cannot be sent.

Console]	Display/Instruction	IS
BChannel	xxxx Audit call	
Audit Fa	i l ed	
Exi t		

Additional Information xxxx = slot and port number entered in Step 3.

PC

If this occurs, make sure an active call is in progress on the specified B-channel and try the audit again.

Conclusion of Hardware Maintenance

Installing the Control Unit Housing (Release 2.1 or Later)

After you have completed maintenance and troubleshooting on Release 2.1 or later, follow the steps below to reinstall the control unit housing.

Installing the Top Cover

To install the top cover, see Figure 5-1 and follow these steps.

1 Be sure the cords have been pressed through the wire managers at the base of the modules.

Conclusion of Hardware Maintenance

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 that the legs lock into the vents on the module.

Installing the Front Cover

To install the front cover, see Figure 5-2 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 5–1. Installing the Control Unit Top Cover (Release 2.1 and Later)



Figure 5-2. Installing the Control Unit Front Cover (Release 2.1 and Later)

Installing the Control Unit Housing (Release 2.0 or Earlier)

After you have completed maintenance and troubleshooting, follow the steps below to reinstall the Release 2.0 or earlier control unit housing.

1 Assemble the control unit housing. See Figure 5-3.

- If the housing is already assembled, go to Step 2.
- If the housing is not assembled:
 - a Lay the front panel(s) face down.
 - b If you are housing more than one carrier, connect the front panels together by lining up the arrows and then sliding the panels until the semicircles form a complete circle.
 - c Connect the side panels to the front panel(s) similarly.


Figure 5-3. Assembling the Control Unit Housing (Release 2.0 and Earlier)



Figure 5-4. Installing the Control Unit Housing (Release 2.0 and Earlier)

2 Line up the wire clips attached to the carrier with the recesses on the outside of the side panels. See Figure 5-4.

If the wire clips are not attached to the control unit, see "Installing the Housing Clips" in Chapter 2 of *Installation*.

3 Push the panels back until the clips hook over the tabs and rest in the recesses.

Customer Support Information

A

Support Telephone Number

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

Outside the U.S.A., if you need assistance when installing, programming, or using your system, contact your AT&T representative.

Federal Communications Commission (FCC) Electromagnetic Interference Information

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 or her own expense.

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 radioelectriques dépassant les limites applicable aux appareils numériques de la class A prescribes dans le reglement sur le brouillage radioélectrique edicté par le ministére des Communications du Canada.

FCC Notification and Repair Information

This equipment is registered with the FCC in accordance with Part 68 of its rules. In compliance with those rules, you are advised of the following:

- Means of Connection. Connection of this equipment to the telephone network shall be through a standard network interface jack, USOC RJ11C, RJ14C, RJ21X. Connection to E&Mtie trunks requires a USOC RJ2GX. Connection to off-premises extensions requires a USOC RJ11C or RJ14C. Connection to 1.544-Mbps digital facilities must be through a USOC RJ48C or RJ48X, Connection to DID requires a USOC RJ11C, RJ14C, or RJ21X. These USOCs must be ordered from your telephone company.
- Party Lines and Coin Telephones. This equipment may not be used with party lines or coin telephone lines.
- Notification to the Telephone Companies. Before connecting this equipment, you or your equipment supplier must notify your local telephone company's business office of the following:
 - The telephone number(s) you will be using with this equipment.
 - The appropriate registration number and ringer equivalence number (REN), which can be found on the back or bottom of the control unit, as follows:
 - If this equipment is to be used as a Key system, report the number AS593M-72914-KF-E.
 - If the system provides both manual and automatic selection of incoming/outgoing access to the network, report the number AS593M-72682-MF-E.

- If there are no directly terminated trunks, or if the only directly terminated facilities are personal lines, report the number AS5USA-65646-PF-E.
- The REN (Ringer Equivalency Number) for all three systems is 1.5A.
- For tie line connection, the facility interface code (FIC) is TL31M and the service order code (SOC) is 9.0F.
- For connection to off-premises stations, the FIC is OL13C and the SOC is 9.0F.
- For equipment to be connected to 1.544-Mbps digital service, the FIC is 04DU9-B for D4 framing format or 04DU9-C for extended framing format, and the SOC is 6. OP.
- For equipment to be connected to DID facilities, the FIC is 02RV2-T and the SOC is 9.0F.
- The quantities and USOC numbers of the jacks required.
- For each jack, the sequence in which lines are to be connected, the line types, the FIC, and the REN by position when applicable.
- Disconnection. You must also notify your local telephone company if and when this equipment is permanently disconnected from the line(s).
- REN. The REN is used to determine the number of devices that may be connected to the telephone line. Excessive RENs on the line may result in the devices not ringing in response to an incoming call. In most, but not all, areas the sum of the RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to the line, as determined by the total RENS, contact the telephone company to determine the maximum REN for the calling area.

Installation and Operational Procedures

The manuals for your system contain information about installation and operational procedures.

- Repair Instructions. If you experience trouble because your equipment is malfunctioning, the FCC requires that the equipment not be used and that it be disconnected from the network until the problem has been corrected. Repairs to this equipment can be made only by the manufacturers, their authorized agents, or others who may be authorized by the FCC. In the event repairs are needed on this equipment, contact your authorized AT&T dealer or, in the U.S.A. only, contact the National Service Assistance Center (NSAC) at 1-800-628-2888.
- Rights of the Local Telephone Company. If this equipment causes harm to the telephone network, the local telephone company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice is not practical, you will be notified as soon as possible. You will also be informed of your right to file a complaint with the FCC.
- Changes at Local Telephone Company. Your local telephone company may make changes in its facilities, equipment, operations, or procedures that affect the proper functioning of this equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.
- Hearing Aid Compatibility. The custom telephone sets for this system are compatible with inductively coupled hearing aids as prescribed by the FCC.
- Automatic Dialers. WHEN PROGRAMMING EMERGENCY NUMBERS AND/OR MAKING TEST CALLS TO EMERGENCY NUMBERS:
 - Remain on the line and briefly explain to the dispatcher the reason for the call.

- Perform such activities in off-peak hours, such as early morning or late evening.
- Direct Inward Dialing (DID). This equipment returns answer supervision signals to the Public Switched Telephone Network when:
 - Answered by the called station
 - Answered by the attendant
 - Routed to a recorded announcement that can be administered by the customer premises equipment user
 - Routed to a dial prompt

This equipment returns answer supervision on all DID calls forwarded back to the Public Switched Telephone Network. Permissible exceptions are when:

- A call is unanswered
- A busy tone is received
- A reorder tone is received

Allowing this equipment to be operated in such a manner as not to provide proper answer supervision signaling is in violation of Part 68 rules.

DOC Notification and Repair Information

NOTICE: The Canadian Department of Communications (DOC) label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The DOC does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to connect it to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring for single-line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or any equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected. This precaution may be particularly important in rural areas.

Users should not attempt to make such connections themselves, but should contact the appropriate electrical inspection authority or electrician, as appropriate.

To prevent overloading, the Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop used by the device, The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100.

DOC Certification No.: 230 4095A CSA Certification No.: LR 56260 Load No.: 6

Renseignements sur la notification du ministère des Communications du Canada et la reparation

AVIS: L'étiquette du ministère des Communications du Canada identifie le materiel homologué. Cette étiquette certifie que le matériel est conforme à certaines normes de protection, d'exploitation et de sécurité des réseaux de telecommunications. Le ministère n'assure toutefois pas que le matériel fonctionnera à la satisfaction de l'utilisateur.

Avant d'installer ce matériel, l'utilisateur doit s'assurer qu'il est permis de le raccorder aux installations de l'entreprise locale de telecommunication. Le matériel doit également être installé en suivant une méthode acceptée de raccordement. Dans certains cas, les fils intérieurs de l'enterprise utilises pour un service individual à ligne unique peuvent être prolongés au moyen d'un dispositif homologué de raccordement (cordon prolongateur téléphonique interne). L'abonné ne doit pas oublier qu'il est possible que la conformity aux conditions énoncées ci-dessus n'empêchent pas la degradation du service clans certaines situations. Actuellement, les entreprises de telecommunication ne permettent pas que l'on raccorde leur matériel aux jacks d'abonné, sauf dans les cas précis prévus pas les tarifs particuliers de ces entreprises.

Les réparations de matériel homologué doivent être effectuées par un centre d'entretien canadien autorisé désigné par le fournisseur. La compagnie de telecommunications peut demander à l'utilisateur de débrancher un appareil à la suite de reparations ou de modifications effectuées par l'utilisateur ou a cause de mauvais fonctionnement.

Pour sa propre protection, l'utilisateur doit s'assurer que tous les fils de mise à la terre de la source d'energie électrique, des lignes téléphoniques et des canalisations d'eau métalliques, s'il y en a, sent raccordés ensemble. Cette précaution est particulièrement importance clans les régions rurales.

AVERTISSEMENT: L'utilisateur ne doit pas tenter de faire ces raccordements lui-même; il doit avoir recours à un service d'inspection des installations électriques, ou à un electrician, selon le cas.

L'indite de charge (IC) assigné à chaque dispositif terminal indique, pour éviter toute surcharge, le pourcentage de la charge totale qui peut être raccordée à un circuit téléphonique bouclé utilisé par ce dispositif. La terminaison du circuit bouclé peut être constitute de n'importe quelle combinaison de dispositifs, pourvu que la somme des indices de charge de l'ensemble des dispositits ne dépasse pas 100.

> No d'homologation: 230 4095A No de certification: CSA LR 56260 L'indite de charge: 6



Security of Your System: Preventing Toll Fraud

As a customer of a new telephone system, you should be aware that there is an increasing problem of telephone toll fraud. Telephone toll fraud can occur in many forms, despite the numerous efforts of telephone companies and telephone equipment manufacturers to control it. Some individuals use electronic devices to prevent or falsify records of these calls. Others charge calls to someone else's number by illegally using lost or stolen calling cards, billing innocent parties, clipping on to someone else's line, and breaking into someone else's telephone equipment physically or electronically. In certain instances, unauthorized individuals make connections to the telephone network through the use of remote access features.

The Remote Access feature of your system, if you choose to use it, permits off-premises callers to access the system from a remote telephone by using a telephone number with or without a barrier code. The system returns an acknowledgment signaling the user to key in his or her barrier code, which is selected and administered by the system manager. After the barrier code is accepted, the system returns dial tone to the user. If you do not program specific outward calling restrictions, the user will be able to place any call normally dialed from a telephone associated with the system. Such an off premises network call is originated at, and will be billed from, the system location. The Remote Access feature, as designed, helps the customer, through proper administration, to minimize the ability of unauthorized persons to gain access to the network. Most commonly, phone numbers and codes are compromised when overheard in a public location, through theft of a wallet or purse containing access information, or through carelessness (for example, writing codes on a piece of paper and improperly discarding it). Additionally, hackers may use a computer to dial an access code and then publish the information to other hackers. Enormous charges can be run up quickly. It is the customer's responsibility to take the appropriate steps to properly implement the features, evaluate and administer the various restriction levels, protect access codes, and distribute access codes only to individuals who have been fully advised of the sensitive nature of the access information.

Common carriers are required by law to collect their tariffed charges. While these charges are fraudulent charges made by persons with criminal intent, applicable tariffs state that the customer of record is responsible for payment of all long-distance or other network charges. AT&T cannot be responsible for such charges and will not make any allowance or give any credit for charges that result from unauthorized access.

To minimize the risk of unauthorized access to your communications system:

- Use a nonpublished Remote Access number.
- Assign access codes randomly to users on a need-to-have basis, keeping a log of *all* authorized users and assigning one code to one person.
- Use random-sequence access codes, which are less likely to be easily broken.
- Deactivate all unassigned codes promptly.
- Ensure that Remote Access users are aware of their responsibility to keep the telephone number and any access codes secure.

- When possible, restrict the off-network capability of off-premises callers, using calling restrictions, Facility Restriction Levels, and Disallowed List capabilities.
- When possible, block out-of-hours calling.
- Frequently monitor system call detail reports for quicker detection of any unauthorized or abnormal calling patterns.
- Limit Remote Call Forwarding to persons on a need-to-have basis.

Limited Warranty and Limitation of Liability

AT&T warrants to you, the customer, that your MERLIN LEGEND Communications System will be in good working order on the date AT&T or its authorized reseller delivers or installs the system, whichever is later ("Warranty Date"). If you notify AT&T or its authorized reseller within one year of the Warranty Date that your system is not in good working order, AT&T will without charge to you repair or replace, at its option, the system components that are not in good working order. Repair or replacement parts may be new or refurbished and will be provided on an exchange basis. If AT&T determines that your system cannot be repaired or replaced, AT&T will remove the system and, at your option, refund the purchase price of your system, or apply the purchase price towards the purchase of another AT&T system.

If you purchased your system directly from AT&T, AT&T will perform warranty repair in accordance with the terms and conditions of the specific type of AT&T maintenance coverage you selected. If you purchased your system from an AT&T-authorized reseller, contact your reseller for the details of the maintenance plan applicable to your system.

This AT&T limited warranty covers damage to the system caused by power surges, including power surges due to lightning.

The following will not be deemed to impair the good working order of the system, and AT&T will not be responsible under the limited warranty for damages resulting from:

- Failure to follow AT&T's installation, operation, or maintenance instructions
- Unauthorized system modification, movement, or alteration
- Unauthorized use of common carrier communication services accessed through the system
- Abuse, misuse, or negligent acts or omissions of the customer and persons under the customer's control
- Acts of third parties and acts of God

AT&T'S OBLIGATION TO REPAIR, REPLACE, OR REFUND AS SET FORTH ABOVE IS YOUR EXCLUSIVE REMEDY.

EXCEPT AS SPECIFICALLY SET FORTH ABOVE, AT&T, ITS AFFILIATES, SUPPLIERS, AND AUTHORIZED RESELLERS MAKE NO WARRANTIES. EXPRESS OR IMPLIED, AND SPECIFICALLY DISCLAIM ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Limitation of Liability

EXCEPT FOR PERSONAL INJURY, DIRECT DAMAGES TO TANGIBLE PERSONAL PROPERTY PROXIMATELY CAUSED BY AT&T, AND LIABILITY OTHERWISE EXPRESSLY ASSUMED IN A WRITTEN AGREEMENT SIGNED BY AT&T, THE LIABILITY OF AT&T, ITS AFFILIATES, SUPPLIERS, AND AUTHORIZED RESELLERS FOR ANY CLAIMS, LOSSES, DAMAGES, OR EXPENSES FROM ANY CAUSE WHATSOEVER (INCLUDING ACTS OR OMISSIONS OF THIRD PARTIES), REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT, TORT OR OTHERWISE, SHALL NOT EXCEED AN AMOUNT EQUAL TO THE LESSER OF THE DIRECT DAMAGES PROVEN OR THE PURCHASE PRICE OF THE SYSTEM. IN NO EVENT SHALL AT&T OR ITS AFFILIATES. SUPPLIERS, OR AUTHORIZED RESELLERS BE LIABLE FOR INCIDENTAL. RELIANCE, CONSEQUENTLY, OR ANY OTHER INDIRECT LOSS OR DAMAGE (INCLUDING LOST PROFITS OR REVENUES) INCURRED IN CONNECTION WITH THE SYSTEM. THIS LIMITATION OF LIABILITY SHALL SURVIVE FAILURE OF THE EXCLUSIVE REMEDY SET FORTH IN THE LIMITED WARRANTY ABOVE.

Voice Mail Systems

Your voice mail system permits callers to leave verbal messages for system users or gain access to the backup position in an emergency as well as create and distribute voice messages among system users.

The voice mail system, through proper administration, can help you reduce the risk of unauthorized persons gaining access to the network. However, phone numbers and authorization codes can be compromised when overheard in a public location, are lost through theft of a wallet or purse containing access information, or through carelessness (writing codes on a piece of paper and improperly discarding them). Additionally, hackers may use a computer to dial an access code and then publish the information to other hackers. Substantial charges can accumulate quickly. It is your responsibility to take appropriate steps to implement the features properly, evaluate and administer the various restriction levels, protect and carefully distribute access codes.

Under applicable tariffs, you will be responsible for payment of toll charges. AT&T cannot be responsible for such charges and will not make any allowance or give any credit resulting from unauthorized access.

To reduce the risk of unauthorized access through your voice mail system, please observe the following procedures:

- Employees who have voice mailboxes should be required to use the passwords to protect their mailboxes.
 - Have them use random sequence passwords.
 - Impress upon them the importance of keeping their passwords a secret.
 - Encourage them to change their passwords regularly.
- The administrator should remove any unneeded voice mailboxes from the system immediately.
- AUDIX Voice Power[™] has the ability to limit transfers to subscribers only. You are strongly urged to limit transfers in this manner.
- Use the Hybrid/PBX or Key system administration capability to do the following:
 - Block direct access to outgoing lines and force the use of account codes/authorization codes.
 - Disallow trunk-to-trunk transfer unless required.

- Assign toll restriction levels to all AUDIX Voice Power ports or other voice mail ports.
- If you do not need to use the Outcalling feature, completely restrict the outward calling capability of the AUDIX Voice Power ports. Use voice mail application features to do this.
- Monitor SMDR reports or Call Accounting System reports for outgoing calls that might be originated by AUDIX Voice Power ports or other voice mail ports.

Remote Administration and Maintenance

The Remote Administration and Maintenance feature of your telecommunications system, if you choose to use it, permits users to change the system features and capabilities from a remote location.

The Remote Administration and Maintenance feature, through proper administration, can help you reduce the risk of unauthorized persons gaining access to the network. However, telephone numbers and access codes can be compromised when overheard in a public location, are lost through theft of a wallet or purse containing access information, or through carelessness (for example, writing codes on a piece of paper and improperly discarding them). Additionally, hackers may use a computer to dial an access code and then publish the information to other hackers. Substantial charges can accumulate quickly. It is your responsibility to take appropriate steps to implement the features properly, evaluate and administer the various restriction levels, and protect and carefully distribute access codes.

Under applicable tariffs, you will be responsible for payment of toll charges. AT&T cannot be responsible for such charges and will not make any allowance or give any credit resulting from unauthorized access.

To reduce the risk of unauthorized access through Remote Administration and Maintenance, please observe the following procedures:

- The System Administration and Maintenance capability of a Hybrid/PBX or Key system is protected by a password.
 - Change the default password immediately.

Continue to change the password regularly.

Only give the password to people who need it and impress upon them the need to keep it secret.

If anyone who knows the password leaves the company, change the password immediately.

- If you have a special telephone line connected to your Hybrid/PBX or Key system for Remote Administration and Maintenance, you should do one of the following:
 - Unplug the line when it is not being used.

Install a switch in the line to turn it off when it is not being used.

Keep the Remote Administration and Maintenance telephone number secret, Only give it to people who need to know it, and impress upon them the need to keep it a secret, Do not write the telephone number on the Hybrid/PBX or Key system, the connecting equipment, or anywhere else in the system room.

If your Remote Administration and Maintenance feature requires that someone in your office transfer the caller to the Remote Administration and Maintenance extension, you should impress upon your employees the importance of only transferring authorized individuals to that extension.

System Numbering Forms

B

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 B-1)
■ Form 2b,	System Numbering:	Digital Adjuncts	(Figure B-2)

- Form 2c, System Numbering: Line/Trunk Jacks (Figure B-3)
- Form 2d, System Numbering: Special Renumbers (Figure B-4)

See *System Planning* for completed forms which contain more detailed information regarding the configuration of your customer's system.

Form 2a, System Numbering: **Extension Jacks**

Renumber System*

D 2-D	Digit <	•		Selec	ted Extens	sion Nun	nbers	🗆 3-D	igit 🗆 S	Set Up Space					
Mod. Type	Log. ID	Ja I D	ck Ty D†	/pe B	Eqpt.	2-Dig Ext. No. ♦	3-Dig. Ext. No.	Set Up Space	Renumber to	Label	Old Ext. No.	Wire No.	Person,Location, or Function	VEX R1.1	AUDIX Voice Power™
	1					10	100	7100							
	2					11	101	7101		1 11					
	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							
	10					19	109	7109							
	11					20	110	7110							
	12					21	111	7111		11 11					
	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							

 Shaded lines indicate possible operator positions.
 ♦ Facfory Setting
 † Use Form 2b for adjuncts connected via MFM or ISDN 7500B Data Module.
 * The system capacity for Personal Directories is decreased by one whenever an MLX-20L telephone is connected to an MLX port

Figure B-1. Form 2a, System Numbering: Extension Jacks

The following explains how to complete Form 2a.

The number in the logical ID column refers to the number of the extension jack in the control unit.

- 1. 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

Maximu	m: 127	Adjun	cts				-		
Log	Fac	tory	-Set			MFM		MLX Telephone	Porcon Location
ID.	2-digit	3-digit	Set Up Source	Renumbe	r to	SAA T/R	7500B	Ext. No.	Function, and Equipment Type
1	710	300	7300						
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						
26	735	325	7325						
27	736	326	7326						
28	737	327	7327						
29	738	328	7328						
30	739	329	7329						
31	740	330	7330						
32	741	331	7331						
33	742	332	7332						
34	743	333	7333						
35	744	334	7334						
36	745	335	7335						
37	746	336	7336						
38	747	337	/337						
39	748	338	/338						
40	749	339	7339						

Figure B-2. Form 2b, System Numbering: Digital Adjuncts

Form 2c, System Numbering: Line/Trunk Jacks

Music-o Loudspe	n-Hole eaker	d, Line/Tro Page, Lin	unk No. e/Trunł	No(s).	S	Source		Maintena Loop-Sta □ No ♦	ance art I	Ala Reli	arm, L able I ⊃Yes	.ine/T Disco	runk	No :t			
Module Type and Slot	Log.	Jack Type (LS, GS, DID, Tie,	Line/ Trunk	Pool Dial- Out	Re- number	Incoming Line/Trunk Type (Main No., Persona Line, WATS,	Telephone Number or		Ourm Signa	node aling	Toll T Prefix for I	⁻ype Req'd _D	Hold	l Disc. erval	QCC Queue Priority Level†	QCC Operator to Receive Calls †	
No	ID	etc)	No.	Code†‡	10	FX, etc.)	Equipment	Label	♦	к	Yes♦	NO	Short	Long +	(4 ♦)	(NO ♥)	Function
	1		801					1									
	2		802		-			11111								-	
	3		804		-												
	4		004 005					1 1111									
	2 6		000					1									
	7		806														
	0		807					1		-							
	0		808													-	
	10		810														
	11		811		-												
	12		812														
	13		813														
	14		814							1	l		l	İ	İ		
	15		815							1							
	16		816							1							
	17		817														
	18		818							1							
	19		819							1							
	20		820														

If the system has AUDIX Voice Power/FAX Attendant Sysfem™, Integrated Adminisfrafion will automatically set Loop-Sfarf Reliable Disconnect to Yes

† Hybrid/PBX mode only



Form 2d, System Numbering: Special Renumbers

Po (Forr	ols* n 2c)	Factory-Set	Renumber		Group Calling (Form 7d)	Factory-Set	Renumber
Desc	ription		to		Label		
		70				770	
		890				771	
		891				772	
		892				773	
		893		1 -		774	
		894				775	
		895				776	
		896				777	
		897				778	
		898				779	
		899		'		780	
			1	. –		781	
Group	Paging					782	
(Form	n 7b)	Factory-Set	Renumber			783	
Grou	n ID	Number	to	_		784	
0100	рю			.		785	
		793				786	
		794		. -		787	
		795		. -		788	
		796		. -		789	
		797		. -		790	
		798		.		791	
		799				7920	
				n -		7921	
Park	Zone	Factory-Set	Renumber			7922	
(Form	n 6a)	Number	to			7923	
Descr	ription	Number	10			7924‡	
		881				7925‡	
		882				7926‡	
		883				7927‡	
		884				7928‡	
		885				7929‡	
		886]			•
		887		1	Listed Directory	Factory Set	Popumbor
		888]	Number*	Number	to
					(QCC Queue)	Number	10
	DS	S Page Buttor	IS		\sim	800	
PAGE 1	Beginni	ng extensio	on for range_			-	
PAGE 2	Beginni	ng extensior	for range —		Remote Access	Factory-Set Number	Renumber
PAGE 3	Beginnn	ing extensior	i for range —			888	10
	Niel Out	Defeuilt	Denverhen	-		000	
AKS L	nal-Out	Delault	to				
		0	10				
	-			1			

* Hybrid/PBX mode only. † ARS Dial-Out Code is Idle Line Preference Code in Key mode. ‡ Reserved for AUDIX Voice Power/FAX Attendant System.

Figure B-4. Form 2d, System Numbering: Special Renumbers

Unit Load Calculation Worksheet

C

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.

Unit Load Worksheet

 Number of modules in carrier (excluding power supply and processor: 	
If fewer than five, auxiliary power is not required.	
■ 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.	
3. Hybrid/PBX mode only:	
Do all modules in the carrier have MLX and/or analog multiline telephone jacks?	□ Yes □ No
If no, auxiliary power is not required	
■ 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.

Module	Qty x	Unit Load	= Total				
008		12.0					
008 MLX		13.5					
008 OPT		8.0					
012		8.4					
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 GS/LS		0.0					
800 GS/LS-ID		8.0					
800 DID		8.0					
	Total Estimated Unit Load						

5. Calculate the estimated unit loads.

■ If the total is less than or equal to 54, auxiliary power is not required.

■ 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		1.0 0.0 0.0 1.4	1.0 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 MDCW-9000 10-Button Basic 10-Button HFAI 34-Button Basic 34-Button BIS 34-Button BIS 34-Button BIS 34-Button BIS Single-Line Telephone		$\begin{array}{c} 0.9\\ 0.9\\ 1.2\\ 1.1\\ 0.9\\ 1.0\\ 1.0\\ 1.0\\ 1.0\\ 1.1\\ 1.1\\ 0.0\\ 0.0$	$\begin{array}{c} 1.2 \\ 1.2 \\ 1.7 \\ 1.6 \\ 1.1 \\ 1.3 \\ 1.3 \\ 1.5 \\ 1.5 \\ 0.0 \\ 0.0 \\ 0.0 \\ 0.0 \\ 0.0 \\ 1.1 \\ 1.2 \\ 1.1 \\ 1.7 \\ 1.4 \\ 1.4 \\ 0.7 \end{array}$	
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	

† 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.

- If the total actual unit load is less than or equal to 54, auxiliary power is not required.
- If the total actual unit load is greater than 54, continue to Step 7.

- 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, 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, auxiliary power is not required.
 - If the exchange does not reduce the unit load to 54 or less, auxiliary power is required. Continue to Step 8.

NOTE:

Empty slots are not permitted between modules.

8. Calculate the unit loads for slots 5 and 6 of the carr	ier.
---	------

	Qty x	Unit Load		= Total
Equipment		Hybrid/PBX or Modiffied	Square	
Network Access Lines*				
DS1		0.0	0.0	
GS/LS		0.0	0.0	
Tie		1.4	1.4	
Telephones				
MLX-10		0.9	1.2	
MLX-10D		0.9	1.2	
MLX-28D		1.2	1.7	
MLX-20L		1.1	1.6	
BIS-10		0.9	1.1	
BIS-22		1.0	1.3	
BIS-22D		1.0	1.3	
BE-34		1.1	1.5	
BIS-34D		1.1	1.5	
MLC-5		0.0	0.0	
MDC-9000		0.0	0.0	
MDW-9000		0.0	0.0	
10-Button Basic		0.9	1.1	
10-Button HFAI		1.0	1.2	
34-Button Basic		0.9	1.1	
34-Button DLX		1.2	1.7	
34-Button BIS		1.2	1.4	
34-Button BIS/DIS		1.2	1.4	
Single-Line Telephone		0.6	0.7	
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*		0.7	0.9	
General Purpose		0.8	1.0	
Adapter		0.8	1.0	
Hands-Free Unit Headset Adapter		0.8	1.0	
		Total Unit Load f 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.

‡ 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.

- If the unit load for slots five and six is less than or equal to 27, auxiliary power is sufficient for the carrier.
- If the unit load for slots five and six is more than 27, continue to Step 9.

- 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, 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, auxiliary 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.
Backing Up with a Memory Card

D

A PCMCIA (Personal Computer Memory Card International Association) interface slot is present on the processor module. The slot is a standard interface through which information can be added to or obtained from the system using a memory card. The PCMCIA interface slot accepts one memory card at a time.

This section covers the following memory card functions:

- Memory card formatting
- Restore

Summary information is included for the following procedures:

- Backup
- Automatic backup

Card Types

The types of memory cards are described below. The card type is identified by a preprinted, color-coded label.

Upgrade Card. This card is used for MERLIN LEGEND Communication System software upgrades. The upgrade can be performed by the system manager using the memory card and the Mai ntenance option on the SPM Main Menu.

This card is identified by an orange label with black lettering.

Translation Card. The backup and restore procedures previously available to system managers through SPM (using the PC and floppy disks) can now be performed using the memory card and the new Backup/Restore option on the System menu. A new automatic backup feature permits you to set the system to perform automatic backups to the memory card on a daily or weekly basis. See "Backup" and "Restore" for more information.

This card is identified by a white label with black lettering.

Forced Installation. For use by qualified service technicians only, this card is used when the system software has been corrupted and a re-installation must be done at the customer site. The use of the card for forced installation is reserved for emergency situations in which the system software on the processor module has been damaged.

This card is identified by an orange label with black lettering. In addition, black stripes are present on the card to distinguish it from an upgrade card.

Figure D-1 shows a sample Translation card.





Figure D-1. PCMCIA Transition Memory Card

Inserting the Card

To insert the card, hold the card with the AT&T logo facing up and the arrow pointing toward the slot. See Figure D–2 for the proper way to insert the memory card into the slot on the processor module.



Figure D-2. Inserting the Memory Card

Memory Card Formatting

The memory card may have to be formatted before you begin any manual or automatic backup procedures. This section details the screens and messages that appear during the format procedure.



CAUTION:

Formatting overwrites previous data on the memory card. Make certain that there is no important information on the card before you begin formatting.

Unformatted Card

	Memory Card Backup
	Inserted Memory Card is
	not the correct type.
	Do you want it formatted?
H	Yes
H	No
H	Exi t

If you begin a backup procedure with an unformatted or incorrectly formatted card, this screen appears.

The inserted memory card is not the correct type, You have the option of formatting the memory card as a translation memory card or repeating the backup procedure with a different translation memory card.

NOTES:

- 1. Only 4-MB Series I or Series II PCMCIA memory cards may be formatted, except those already formatted as translation cards.
- 2. If a memory card cannot be formatted, a message appears on screen. These messages are noted in the procedures as appropriate.

3. A memory card may need to be formatted if it is intended for use as a translation card but is currently blank, or contains data other than backup files for the system.

Format Warning

	Format Memory Card:
	All data on card will be
	DELETED.
	Do you want to continue?
_	Yes
	No
_	Exi t

This screen appears if you respond to the system prompt to format the memory card.

Select Yes (or press (F3)) to begin the memory card format. Table D-1 lists the screen messages that may appear while formatting is in progress.

Table D-1. Memory Card Formatting Messages

Message	What it Means
Formatting Memory Card	The format is in progress.
Formatting of Memory Card Completed.	The format was successful and has completed.
Memory Card cannot be formatted.	The memory card cannot be formatted. Remove the card and repeat the procedure with another card.
Formatting of Memory Card FAILED.	The format was unsuccessful. Remove the card and repeat the procedure with another card.
Missing Card or Card Not Inserted correctly	Verify that the card is inserted correctly and repeat the procedure.

Backup

Use this procedure to make a copy of your customized system data. You should create a backup at least three times during system installation (so that programmed information is not lost), and once after each system upgrade, service technician visit, or major system reconfiguration.

Summary: Backup

Programmable by	System Manager
Mode	All
Idle Condition	System Forced Idle
Planning Form	Form 1, System Planning
Factory Setting	Not applicable
Valid Entries	1- to 11-character filename
Inspect	Yes
Copy Option	No
Console Procedure	$\begin{array}{llllllllllllllllllllllllllllllllllll$
PC Procedure	Insert memorty card $\rightarrow (\underline{F1}) \rightarrow (\underline{F9}) \rightarrow (\underline{F1}) \rightarrow Select$ backup file \rightarrow Type the new backup file name $\rightarrow (\underline{F6})$ $\rightarrow (\underline{F1}) \rightarrow (\underline{F5}) \rightarrow (\underline{F5}) \rightarrow (\underline{F5})$

Procedure: Backup

1 Insert the memory card into the PCMCIA interface slot on the processor module.





Console Display/Instructions	s Additional Information PC
8 Respond to the prompt.	
Backup <i>filename:</i>	<i>filename</i> = file selected in Step 5 or entered in Step 6
Do you want to continue?	
Yes No	Select No to abort the backup. (F2) Go to Step 11.
Exi t	Select Yes to continue the backup. (F1)
9 Observe the backup progress	s screen.
Backup filename:	<i>filename</i> = file selected in Step 5
Backup in Progress, Please Wait.	entered in Step 6
xx% completed	<pre>xx% = percentage of backup completed</pre>
Exit	C
10 Observe the backup complet	ion screen.
Backup <i>nnnnnnnnnnn:</i> Backup Successfully Completed.	<i>nnnnnnnnn</i> = backup filename
Exi t	
11 Return to the System Program	nming menu.

Select Exi t three times.

<u>(F5)(F5)(F5)</u>

Automatic Backup

If an automatic backup fails for any reason, except when the failure results from the memory card being write-protected, the automatic backup feature is turned off. Follow the procedure below to reprogram automatic backup.

Summary: Automatic Backup

Programmable by	System Manager
Mode	All
Idle Condition	Not required
Planning Form	Form 1, System Planning
Factory Setting	Weekly backup (Sunday at 2:00 am)
Valid Entries	Daily: hhmm (00 to 23; 00 to 59) Weekly: dhhmm (0 to 6; 00 to 23; 00 to 59)
Inspect	No
Copy Option	No
Console Procedure	To program daily backup: Insert memory card →System →Back/Restore → Auto Backup →Daily → Drop →Dial time →Enter →Exit →Exit
	To program weekly backup: Insert memory card \rightarrow System \rightarrow Back/Restore \rightarrow Auto Backup \rightarrow Weel ky \rightarrow Drop \rightarrow Dial day and time \rightarrow Enter \rightarrow Exit \rightarrow Exit
PC Procedure	To program daily backup: Insert memory card \rightarrow (F1) \rightarrow (F9) \rightarrow (F3) \rightarrow (F2) \rightarrow (Alt) + (P) \rightarrow Type time \rightarrow (F10) \rightarrow (F5) \rightarrow (F5) To program weekly backup: Insert memory card \rightarrow (F1) \rightarrow (F9) \rightarrow (F3) \rightarrow (F3) \rightarrow (Alt) + (P) \rightarrow Type day and time \rightarrow (F10) \rightarrow (F5) \rightarrow (F5)

Procedure: Automatic Backup



1 Insert the memory card into the PCMCIA interface slot on the processor module.

2 Select the System menu.





Daily Backup Procedure			
	Console Display/Instructions	s Additional Information	PC
1	Erase the current daily back	up time (xxxx).	
	Daily MemCard Backup: Enter hour (00-23) and minutes (CID-57) HHMM <i>xxxx</i>		
	Backspace		
	Exit Enter	Press Drop.	<u>(Alt)</u> + <u>(P)</u>
2	2 Enter the time when you want the automatic backup to run everyday (hh= 00 to 23, mm= 00 to 59).		
	Daily MemCard Backup: Enter hour (00-P2) and minutes (00-57) HHMM		
	Backspace Exit Enter	Dial or type [hhmm].	¢
3	Save your entry.		
	Select Enter.		<u>(F10)</u>
4	Return to the System Program	mming menu.	
	Select Exi t two times.		<u>(F5)(F5)</u>

•	♦ Weekly Backup Procedure		
	Console Display/Instruction	ns Additional Inf	ormation PC
1	Erase the current weekly bac	kup day and time <i>(xxxxx)</i> .	
	Weekly MemCard Backup:		
	Enter day (0-6) hr (00-23)		
	and min (00-59) DHHMM		
	XXXXX		
	Backsnace		
	Exit Enter	Press Drop.	<u>(Alt)</u> + <u>(P)</u>
	Weekly MemCard Backup: Enter day (0-6), hr (00-23) and min (00-59) DHHMM	0 = Sunday, 1 = Monda on.	iy, and so
	Backspace Exit Enter	Dial or type [<i>dhhmm</i>].	C
3	Backspace Exi t Enter Save your entry.	Dial or type [<i>dhhmm</i>].	C
3	Backspace Exit Enter Save your entry. Select Enter.	Dial or type [<i>dhhmm</i>].	C (F10)
3	Backspace Exit Enter Save your entry. Select Enter. Return to the System Progra	Dial or type [<i>dhhmm</i>]. mming menu.	C (F10)

Backup Messages

During manual or automatic backup procedures, additional screens may appear to alert you to problems with the translation memory card, the backup file, or the backup procedure. This section contains illustrations of each screen and information about what to do if the screen appears.

NOTE:

The screens shown in this section are from the manual backup procedure; however, the screens that may appear in both the manual and automatic backup procedures are similar. The screens in both procedures differ only in the appearance of the first line. On the automatic backup screens, AutoMemory Card Backup replaces the word Backup shown on the screens below.

Backup Canceled

Exi t

Console Display/Instructions Backup x: BACKUP IS CANCELED. File has been DELETED.

Additional Information PC

x = backup filename

If the system detects an error, either on the memory card or with the backup file, or if you abort the backup, this screen appears.

The backup file being created is deleted, and the backup is aborted.

You must repeat the backup procedure.

Card Removed While Backup Is in Progress

x = backup filename

Backup x: BACKUP IS CANCELED. Verify that Memory Card has been inserted correctly. File has been DELETED. Exi t

The memory card is not inserted or is inserted incorrectly while a backup is in progress. The backup file that was being created is deleted and the backup is aborted. You must reinsert the memory card and repeat the backup procedure.

Card Missing or Card Not Inserted Correctly

Memory Card Backup: Verify that Memory Card has been inserted correctly. Exit

The memory card is either not inserted or is inserted incorrectly. The backup is aborted. You must reinsert the memory card and repeat the backup procedure. This screen may also appear if the wrong type of memory card is inserted and a backup or automatic backup is requested within one minute of insertion. Verify that the card is a translation memory card.

Card Is Write-Protected

Memory Card Backup: Memory Card is Write-Protected. Reset Write-Protect Tab on Memory Card. Exit

The memory card is write-protected. You must remove the memory card, flip the write-protect tab, reinsert the memory card, and repeat the backup procedure.



CAUTION:

The memory card may be write-protected to avoid the accidental erasure of the backup files. Make certain this is not the case before you change the write-protect tab.

Card Failure

Memory Card Backup: Backup Failure Try a different file or a new Memory Card. Exi t

If the card is damaged, repeat the backup with a different card. If a backup is in progress and fails, the system makes two additional attempts at the backup. At the start of each attempt, a message appears with the percentage of the backup that is completed. If the backup fails after three attempts, the screen shown above appears. Repeat the backup procedure using a different file and/or memory card.

Restore

Use this procedure to restore system conditions that were backed up onto a translation memory card. The information in a backup file on the translation card is copied to the system.

The restore procedure is necessary under the following conditions:

- System RAM is corrupt.
- A previously stored set of system conditions is preferred over the current set.
- The processor module is replaced.
- After a System Erase (frigid start) has been performed.
- The system software has been reinstalled.

The Inspect feature **(Inspct** or [PgDn]) is available to view the attributes of the backup files on the memory card prior to initiating the restore procedure. The attributes included on the Inspect screen are the filename, the time and day of the file backup/update, the location of the system programming port, and information about the system software release from which the backup was made.

If any type of programming is taking place at another extension when you begin the restore procedure, the restore is canceled and the number of the busy extension appears on the screen. Repeat the restore procedure when the busy extension becomes idle.

If a line is busy (incoming call or active call) when you begin the restore procedure, the restore is canceled and the number of the active line appears on the screen. Repeat the restore procedure when the line becomes idle.

Also see "Restore Messages" for information about errors that may occur during the restore procedure.

Programmable by	System Manager
Mode	All
Idle Condition	System Forced Idle
Planning Form	Not applicable
Factory Setting	Not applicable
Valid Entries	Not applicable
Inspect	Yes
Copy Option	No
Console Procedure	$\begin{array}{llllllllllllllllllllllllllllllllllll$
PC Procedure	Insert memory card \rightarrow (F1) \rightarrow (F9) \rightarrow (F2) \rightarrow Select restore file \rightarrow (F3)

Summary: Restore



Console Display/Instructions Additional Information PC

1 Insert the memory card into the PCMCIA interface slot on the processor module.



System Prog	gramming: >
Make a select	tion
System	Extensi ons
SysRenumber	Opti ons
Operator	Tabl es
Li nesTrunks	AuxEqui p
Exi t	Night Srvce

3 Select Back/Restore.

System			
Make a selection			
Restart	Mai ntenBusy		
SProg Port	Date		
Mode	Time		
Board Renum	Back/Restore		
Exi t			

4 Select Restore.

Memory Card:
Make a selection
Backup
Restore
Auto Backup
Exi t

<u>(F9)</u>

<u>(F1)</u>

<u>(F2)</u>



Console Display/Instruction	s Additional Information PC
9 Observe the restore file validation	ition screen.
Restore <i>n:</i> Restore Successfully Completed. System is Restarting.	n = filename selected in Step 5
Please Wait.	system restarts. You must enter system programming again to continue

Restore Messages

During the restore procedure, additional screens may appear to alert you to problems with the translation memory card, the backup file or the restore procedure. This section contains displays of each screen and information about what to do if the screen appears.

Card Missing or Card Not Inserted Correctly



The memory card is either not inserted or inserted incorrectly. The restore is aborted. You must reinsert the card and repeat the restore procedure. This screen may also appear if the wrong type of memory card is inserted and a restore is requested within one minute of insertion. Verify that the card is a translation memory card.

Card Removed after Confirmation

Memory Card Restore RESTORE IS CANCELED. System is DOWN.

The memory card was removed from the processor slot while the restore was in progress. The restore is aborted and the system performs a System Erase (frigid start). You must reinsert the memory card and repeat the restore procedure.

Wrong System Programming Port

Console Display/Instructions

Restore *n* : Change Sys Programming Port to Extension *xxxx* before Restoring.

Exi t

Additional Information PC

n = filename selected *xxxx* = system programming port extension

The system programming port is not set to the same system programming port as that set in the backup file. The restore is aborted. Use the **Inspect** feature to view the port of the file on the card. Change the system programming port to match the port shown on the card (see "System Programming Position Assignment" in System Programming, or System Programming Summary) and repeat the restore procedure.

Release Mismatch

Restore *n:* File is Not Compatible for Release *X.Y* Restore Canceled. Conversion Required. n = filename selected X. Y = release number

This screen only appears if you are upgrading from Release 3.0 or higher and the releases are not compatible.

Card Failure

Exi t

Console Display/instructions

Memory Card Restore: Restore Failure. Try a different file or a new Memory Card. Exit

Additional Information PC

If the restore fails because the card is damaged, the system performs a System Erase (frigid start). Repeat the restore procedure using a different file and/or memory card.

Card Failure after Confirmation



x = filename selected

System is DOWN.

If the restore fails because the card is damaged, the system performs a System Erase (frigid start). Repeat the restore procedure using a different file and/or memory card.

Wrong Type of Card

Memory Card Restore:	
Inserted Memory Card is	
not the correct type.	
Remove and insert MERLIN	
LEGEND Backup/Restore	
Card.	
Exi t	

The inserted card does not match the card option selected from the System menu. Remove the card and repeat the restore procedure with the correct type of card. See "Card Types" for information about the card labels.

Board Mismatch

Console Display/Instructions

Restore x: Restore Failure RESTORE IS CANCELED. Board mismatch between control unit and file. Exit Additional InformationPCx = filename selected

A mismatch exists between the hardware components present on the current system and the hardware components reflected in the backup file, The restore is aborted. You can do one of the following:

- Repeat the restore procedure with another file.
- Modify the system hardware to match the configuration of the backup file and repeat the restore procedure with the same file.

Strap in Place for Key Mode but Mode is Set to Hybrid

n = filename selected

Restore n: Restore Failure RESTORE IS CANCELED. Restore File Mode is Hybrid/PBX. Control Unit strap in place for KEY. Exit



CAUTION:

This procedure should be performed only by qualified service personnel.

If the processor module has been strapped for Permanent Key mode, a restore to Hybrid/PBX mode is not possible. See chapter 9 in the *Installation Guide* for details on modifying the processor.

Modifying a Release 2.1 or Earlier Processor for Key Mode

E

Release 2.1 and Earlier



CAUTION:

This procedure must be performed for KF registration with the FCC.

This procedure prevents the system from being programmed as a Hybrid-PBX system. Do this only if the system is programmed for Key mode and GS trunks are not indicated on Form 2c, System Numbering: Line/Trunk Jacks.

To modify the processor for Permenant Key mode, follow the steps below. Refer to Figure E-1.

- 1 Remove the processor from its packaging.
- 2 Place the processor on a flat surface.
- 3 If the feature module is installed, remove it.

See "Replacing the Feature Module" in Chapter 4 for instructions.

Maintenance and Troubleshooting E-1



Figure E-1. Modifying the Processor for Key Mode



CAUTION:

Do not touch the HDR3 header on the processor board; the header is exposed when the feature module is not installed in the processor. if the HDR3 header is removed, system programming may be deleted and will have to be restored. 4 On the exposed portion of the processor board, find the header marked HDR4; it is in the upper-left area.

A shunt is attached to one of the pins on the HDR4 header.

- 5 Remove the shunt from the single header pin; then reinsert it so that it covers both pins on the header.
- 6 Take the KF label from the Jack Numbering Labels Sheet, which is packaged with the feature module, and fasten it to the wire manager at the base of the module.

Installing the Control Unit Housing (Release 2.1 and Earlier)

To install the control unit's housing, follow the steps below.

- 1 Lay 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 E-2.
- 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 E-2. Installing the Control Unit Housing

Glossary

#

7500B data module See ISDN 7500B Data Module.

7500B data station A type of data station that includes an *ISDN 7500B Data Module* as its DCE and connects to an MLX extension jack for *digital transmission* of data over a DS1 facility. It may also include an MLX telephone for simultaneous voice and data.

A

account code	Code used to associate incoming and outgoing calls with corresponding accounts, employees, projects, and clients.
Accunet	AT&T's switched digital service for 56-kbps, 64-kbps restricted, and 64-kbps clear circuit-switched data calls.
address	A coded representation of the destination of data or of the data's originating terminal, such as the dialed extension number assigned to the data terminal. Multiple terminals on one communication line must each have a unique address.
ADDS	(Automated Document Delivery System) Computer-based application that stores documents in a database and automatically faxes them on request.
adjunct	Optional equipment used with the communications system, such as an alerting device or <i>modem</i> that connects to a multiline telephone or to an extension jack.
ALS	(Automatic Line Selection) Programmed order in which the system makes outside lines available to a user.

AMI	(alternate mark inversion) Line coding format in which a binary one is represented by a positive or negative pulse, a binary zero is represented by no line signal, and subsequent binary ones must alternate in polarity; otherwise, a <i>bipolar violation</i> occurs. AMI is used in the <i>DS1</i> interface.
analog transmission	Mode of transmission in which information is represented in continuously variable physical quantities such as amplitude, frequency, phase, or resistance. See also <i>digital transmission.</i>
analog data station	See modem data station.
ANI	(automatic number identification) Process of automatically identifying a caller's billing number and transmitting that number from the caller's local central office to another point on or off the public network.
application	Software and/or hardware that adds functional capabilities to the system. For example, MERLIN Identifier is an application that provides caller identification information (if available in the local area or jurisdiction).
ARS	(Automatic Route Selection) System feature that routes calls on outside trunks according to the number dialed and trunk availability.
ASCAP	(American Society of Composers, Artists, and Producers)
ASN	(AT&T Switched Network) AT&T telecommunications services provided through an Integrated Digital Services Network Primary Rate Interface (ISDN-PRI) trunk, Accunet switched digital service, Megacom, <i>Megacom 800</i> , Software Defined Network (SDN), Multiquest, and Shared Access for Switch Services (SASS).

asynchronous data transmission	A method of transmitting a short bitstream of digital data, such as printable characters represented by a 7- or 8- <i>bit</i> ASCII code. Each string of data bits is preceded by a start bit and followed by a stop bit, permitting data to be transmitted at irregular intervals. See also <i>synchronous</i> <i>data transmission</i> .
AT&T Attendant	Application with equipment that connects to one or more <i>tip/ring</i> extension jacks and automatically answers incoming calls with a recorded announcement; directs calls in response to touch tones.
AT&T Switched Network	See ASN.
AUDIX Voice Power	A voice-processing application, part of <i>IS II/III</i> , that provides Automated Attendant, Call Answer, Information Service, Message Drop, Voice Mail, and, optionally, <i>Fax</i> <i>Attendant System</i> for use with the system.
Automated Attendant	<i>IS II/III, MERLIN MAIL,</i> and <i>AT&T Attendant</i> application that automatically answers incoming calls with a recorded announcement and directs callers to a department, an extension, or the system operator.
Automatic Line Selection	See ALS.
Automatic Number Identification	See ANI.
automatic ringdown tie-trunk	See automatic-start tie trunk
Automatic Route Selection	See ARS.

automatic-start tie trunk	<i>Tie trunk</i> on which incoming calls are routed to an operator or other designated destination without a start signal, as soon as the trunk is seized; the destination is specified during programming. Also called "automatic ringdown" or "auto-in" tie trunk.
auxiliary power unit	Device that provides additional power to the system.

B	
B8ZS	(bipolar 8 zero substitution) Line-coding format that encodes a string of eight zeros in a unique binary sequence to detect <i>bipolar violation</i> . See also <i>bipolar</i> <i>signal</i> .
backup	Procedure for saving a copy of system programming onto a floppy disk or <i>memory card. See</i> also <i>restore.</i>
bandwidth	Difference, expressed in hertz, between the highest and lowest frequencies in a range that determines channel capacity.
barrier code	Password used to limit access to the <i>Remote Access</i> feature of the system.
basic carrier	Hardware that holds and connects the <i>processor, power supply,</i> and up to five modules in the system. See also <i>expansion carrier.</i>
baud rate	Strictly speaking, a measurement of transmission speed equal to the number of signal level changes per second, In practice, often used synonymously with <i>bit rate</i> and <i>bps.</i>
B-channel	(Bearer-channel) 64-kbps channel that carries a variety of digital information streams, such as voice at 64 kbps, data at up to 64 kbps, wideband voice encoded at 64 kbps, and voice at less than 64 kbps, alone or combined.

Glossary

Bearer-channel	See B-channel.
Behind Switch mode	One of three modes of system operation, in which the control unit is connected to (behind) another telephone switching system, such as <i>Centrex</i> or DEFINITY, which provides features and services to telephone users. See also <i>Hybrid/PBX mode</i> and <i>Key mode</i> .
binary code	Electrical representation of quantities or symbols expressed in the base-2 number system, which includes zeros and ones.
bipolar 8 zero substitution	See B8ZS.
bipolar signal	Digital signal in which pulses (ones) alternate between positive and negative. See also <i>AMI</i> , B8ZS, and <i>bipolar violation</i> .
bipolar violation	Condition occurring when two positive or two negative pulses are received in succession. See also <i>AMI</i> and <i>B8ZS</i> .
BIS	(Built-in Speakerphone) Part of the model name of some analog multiline telephones.
bit	(binary digit) One unit of information in binary notation; it can have one of two values, zero or one.
bit rate	Speed at which bits are transmitted, usually expressed in <i>bps.</i> Also called "data rate." See also <i>baud rate.</i>
blocking	Condition in which end-to-end connections cannot be made on calls because of a full load on all possible services and facilities. See also <i>glare</i> .
BMI	(Broadcast Music Incorporated)
board	A <i>module,</i> for example, 100D or 408 MLX GS/LS, that allows you to connect lines/trunks and extensions to the communications system or holds the processor or power supply*

Glossary

board assignment	SPM procedure for assigning <i>line/trunk and extension modules</i> to slots on the <i>control unit</i> .
board renumbering	System programming procedure for renumbering <i>line/trunk and extension</i> modules that have already been assigned to specific <i>slots</i> on the <i>control unit.</i>
bus	Multiconductor electrical path used to transfer information over a common connection from any of several sources to any of several destinations.
button	Key on the face of a telephone that is used to access a line, activate a feature, or enter a code on a communications system.
byte	Sequence of <i>bits</i> (usually eight) processed together. Also called "octet."

С

Call Accounting System	See CAS.
Call Accounting Terminal	See CAT.
Caller ID	In Release 3.0 and later, a system feature that supports a caller identification service provided by some local telephone companies (if local regulations allow) supplying the calling party telephone number. An 800 GS/LS-ID module on the system can capture this information and display it on the screens of MLX telephones. See also <i>ANI</i> .
Calling group	Team of individuals who answer the same types of calls.
Call Management System	See CMS.
campus cable	Cable that runs between buildings connected to the same communications system.
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CAS	(Call Accounting System) DOS- or UNIX System-based application that monitors and manages telecommunications costs.
САТ	(Call Accounting Terminal) Stand-alone unit with a built-in microprocessor and data buffer that provides simple call accounting at a low cost.
CCS	(common-channel signaling) Signaling in which one channel of a group of <i>channels</i> carries signaling information for each of the remaining channels, permitting each of the remaining channels to be used to nearly full capacity. In the system's 100D module, channel 24 can be designated as the signaling channel for channels 1-23.
centralized telephone programming	Programming of features on individual telephones; performed at a central location by the system manager. See also system programming and extension programming.
central office	See CO.
Centrex	Set of system features to which a user can subscribe on telephone lines/trunks from the local telephone company.
channel	Telecommunications transmission path for voice and/or data.
channel service unit	See CSU.
checksum	Sum of ones in a sequence of ones and zeros used to detect or correct errors in data transmission.
circuit-switched data call	Data call made through an exclusively established and maintained connection between <i>data stations.</i>
class of restriction	See COR.

clock synchronization	Operation of digital facilities from a common clock.
CMS	(Call Management System) DOS-based application that simulates the actions of a system operator by answering and distributing calls. Also produces reports for call analysis.
CO	(central office) Location of telephone switching equipment that provides local telephone service and access to toll facilities for long-distance calling.
coaxial cable	Cable consisting of one conductor, usually a small copper tube or wire within and insulated from another conductor of larger diameter, usually copper tubing or copper braid.
codec	(coder-decoder) Device used to convert analog signals such as speech, music, or television to digital form for transmission over a digital medium and back to the original analog form.
common channel	See CCS.
signaling	
signaling communications system	Software-controlled processor complex that interprets dialing pulses, tones, and/or keyboard characters and makes the proper interconnections both inside and outside. Consists of a computer, software, a storage device, and <i>carriers</i> with special hardware to perform the actual connections. Provides voice and/or data communications services, including access to public and private networks, for telephones and other equipment. Also referred to in this guide as "system," short for MERLIN LEGEND Communications System.
signaling communications system control unit	Software-controlled processor complex that interprets dialing pulses, tones, and/or keyboard characters and makes the proper interconnections both inside and outside. Consists of a computer, software, a storage device, and <i>carriers</i> with special hardware to perform the actual connections. Provides voice and/or data communications services, including access to public and private networks, for telephones and other equipment. Also referred to in this guide as "system," short for MERLIN LEGEND Communications System. <i>Processor module, power supply modules, line/trunk and</i> <i>extension modules, carriers,</i> and housing of the system.

CONVERSANT	Voice response application that automatically answers and routes calls and executes telephone transactions.
conversion resource	See modem pool.
COR	(class of restriction) Various types of restrictions that can be assigned to <i>remote access</i> trunks or barrier codes. These restrictions consist of calling restrictions, <i>ARS</i> Facility Restriction Levels <i>(FRLs)</i> , Allowed Lists, Disallowed Lists, and pool dial out restrictions.
Coverage	Set of system features that can determine how extensions' calls are covered when the person at the extension is busy or not available.
CRC	(cyclic redundancy check) An error-detection code used on DS1 facilities with the extended superframe format (ESF).
CSU	(channel service unit) Equipment used on customer premises to provide <i>DS1</i> facility terminations and signaling compatibility.
cyclic redundancy check	See CRC.

D

D4 framing format	<i>Framing format</i> consisting of a sequence of individual frames of 24 eight- <i>bit</i> slots and one signal bit(193 bits) in a 12-frame superframe. See also <i>ESF</i> .
Data-channel	See D-channel.
data communications equipment	See DCE.
data hunt group	See DHG.

data module	See ISDN 7500B Data Module.
data rate	See bps.
data station	Special type of extension where data communications take place; includes <i>DTE</i> and <i>DCE;</i> sometimes a telephone is also part of a data station.
data terminal	An input/output (I/O) device (often a personal computer) that can be connected to the control unit via an interface.
data terminal equipment	See DTE and data terminal.
DCE	(data communications equipment) Equipment such as <i>modems</i> or data modules used to establish, maintain, and terminate a connection between the system and data terminal equipment <i>(DTE)</i> , such as printers, personal computers, host computers, or network workstations.
D-channel	(Data-channel) 64-kbps channel that carries signaling information or data on a <i>PRI</i> or 16-kpbs channel to carry signaling information on <i>BRI</i> .
dedicated feature buttons	The imprinted feature buttons on a multiline telephone: Conf or Conference, Drop, Feature, HFAI (Hands Free Answer on Intercom), Hold, Message, Mute or Microphone, Recall, Speaker or Speakerphone, and Transfer.
delay-dial start tie trunk	See dial-repeating tie trunk
DFT	(direct facility termination) See personal line.
DHG	(data hunt group) Group of modem or 7500B <i>data stations</i> that share a common access code. Calls are connected in a round-robin fashion to the first available data station in the group.
dial access	See feature code.

Dialed Number identification Service	See DNIS.
dial-out code	Digit (usually a 9) or digits dialed by telephone users to get an outside line.
dial plan	Numbering scheme for system extensions, lines, and trunks.
dial-repeating tie trunk	<i>Tie trunk</i> on which the originating end of the tie trunk transmits an off-hook signal to the receiving end and waits for the receiving end to send an off-hook signal followed by an on-hook signal. Also called "delay dial start tie trunk."
DID	(Direct Inward Dialing) Service that transmits from the telephone company central office and routes incoming calls directly to the called extension, <i>calling group</i> , or outgoing trunk <i>pool</i> , bypassing the system operator.
DID trunk	Incoming trunk that receives dialed digits from the local exchange, allowing the system to connect directly to an extension without assistance from the system operator.
digital	Representation of information in discrete elements such as off and on or zero and one. See also <i>analog transmission</i> .
Digital Communications Protocol	See DCP.
digital data station	See 7500B data station.
Digital Signal 0	See DS0.
Digital Signal 1	See DS1.
digital switch element	See DSE.

digital transmission	Mode of transmission in which the information to be transmitted is first converted to digital form and then transmitted as a serial stream of pulses. See also <i>analog transmission</i> .
DIP switch	(dual in-line package) Switch on a 400EM module used to select the signaling format for tie-line transmission. Also used on other equipment for setting hardware options.
direct facility termination	(DFT) See personal line.
Direct Inward Dialing	See DID.
Direct-Line Console	See DLC.
Direct Station Selector	See DSS.
display buttons	Buttons on an MLX display telephone used to access the telephone's display.
DLC	(Direct-Line Console) Telephone used by a system operator to answer outside calls (not directed to an individual or a group) and inside calls, transfer calls, make outside calls for users with outward calling restrictions, set up conference calls, and monitor system operation.
DNIS	(Dialed Number Identification Service) Service provided by the AT&T Switched Network (ASN); it routes incoming 800 or 900 calls according to customer-selected parameters, such as area code, state, or time of call.
door answering unit	Device connected to a basic telephone jack and used at an unattended extension or front desk.
DOS	(disk operating system)
DS0	(Digital Signal 0) Single 64-kbps voice or data channel.

Glossary	
DS1	(Digital Signal Level 1) <i>Bit</i> -oriented signaling interface that multiplexes twenty-four 64-kbps channels into a single 1.544-Mbps stream.
DSS	(Direct Station Selector) 60-button <i>adjunct</i> that enhances the call-handling capabilities of an <i>MLX-20L or MLX-28D telephone</i> used as an operator console.
DTE	(data terminal equipment) Equipment that makes the endpoints in a connection over a data connection, for example, a data terminal, personal computer, host computer, or printer.
DTMF signaling	(dual-tone multifrequency signaling) Touch-tone signaling from telephones using the voice transmission path. DTMF signaling provides 12 distinct signals, each representing a dialed digit or character, and each composed of two voiceband frequencies.

E

E&M signaling	Trunk supervisory signaling, used between two communications systems, in which signaling information is transferred through 2-state voltage conditions (on the Ear and Mouth leads) for analog applications and through two <i>bits</i> for digital applications, See also <i>tie trunk</i> .
EIA	(Electronic Industries Association)
EIA-232-D	Physical interface, specified by the <i>HA</i> , that transmits and receives asynchronous data at speeds of up to 19.2-kbps over cable distances of 50 ft. (15 m.)
Electronic Switching System	See ESS.
endpoint	Final destination in the path of an electrical or telecommunications signal.

ESF	(extended superframe format) <i>Framing format</i> consisting of individual frames of 24 eight- <i>bit</i> slots and one signal bit (193 bits) in a 24-frame extended superframe. See also <i>D4 framing format.</i>
ESS	(Electronic Switching System) Class of central office (CO) switching systems developed by AT&T in which the control functions are performed principally by electronic data processors operating under the direction of a stored program.
expansion carrier	<i>Carrier</i> added to the control unit when the basic carrier cannot house all of the required modules. Houses a power supply and up to six additional modules.
extension	An endpoint on the internal side of the communications system. An extension can be a telephone with or without an adjunct. Also called "station." See also <i>data station</i> .
extension jack	An analog, digital, or <i>tip/ring</i> physical interface on a module in the control unit for connecting a telephone or other device to the system. Also called "station jack."
extension programming	Programming performed at an extension to customize telephones for personal needs; users can program features on buttons, set the telephone ringing pattern, and so on. See also <i>centralized telephone programming</i> and <i>system programming</i> .
extended superframe	See ESF.

format

F

facility

Equipment (often a *trunk*) constituting a telecommunications path between the system and the telephone company central office (CO).

Facility Restriction Level	See FRL.
factory setting	Default state of a device or feature when an optional setting is not programmed by the user or system manager.
fax	(facsimile) Scanning and transmission of a graphic image over a telecommunications facility, or the resulting reproduced image, or the machine that does the scanning and transmitting.
Fax Attendant System	Fax-handling and processing application available with AUDIX Voice Power.
FCC	(Federal Communications Commission)
feature	Function or service provided by the system.
feature code	Code entered on a dialpad to activate a feature.
feature module	Prior to Release 3.0, a circuit pack inserted into the <i>processor</i> module, used to provide system features and replaced when the system is upgraded.
Feature screen	Display screen on MLX display telephones; provides quick access to commonly used features.
ferrite core	Attachment to the AC power cord and ground wire of the carrier power supply for compliance with FCC, part 15 requirements.
Flash ROM	Beginning with Release 3.0, a type of read-only memory provided on the <i>processor module,</i> used to supply system features.
foil shield	Copper foil sheet (for power units) used to prevent excessive noise on the module.
forced idle	Condition of the system during certain programming or maintenance procedure; system prevents initiation of new calls.
foreign exchange	See FX.

frame	One of several segments of an analog or digital signal that has a repetitive characteristic. For example, a <i>DS1</i> frame consists of a framing <i>bit</i> and 24 bytes, which equals 193 bits.
framing format	Pattern of frames used in transmissions.
frequency generator	See ring generator.
FRL	(Facility Restriction Level) <i>ARS</i> calling restriction type that restricts outgoing calls to certain specified routes.
FX	(foreign exchange) Central office (CO) other than the one that is providing local access to the public telephone network.

G

General-Purpose Adap See GPA.

glare	Condition that occurs when a user tries to call out on a <i>loop-start</i> trunk at the same time that another call arrives on the same trunk.
GPA	(General-Purpose Adapter) Device that connects an analog multiline telephone to optional equipment such as an answering machine or a fax machine.
ground-start trunk	Trunk on which the communications system, after verifying that the trunk is idle (no ground on tip lead), transmits a request for service (puts ground on ring lead) to the telephone company central office <i>(CO)</i> .
Group IV (G4) fax mach A fax unit, offering 400 by 100 dots per inch (DPI) in fine mode, that can operate at any speed for communication with a Group III (G3) fax machine or another Group IV (G4) fax machine.	

Η

Hands Free Answer on Intercom	See HFAI.
hands-free unit	See HFU.
headset	Lightweight earpiece, microphone, and adapter used for hands-free telephone operation.
HFAI	(Hands Free Answer on Intercom) Feature that allows a user to answer a voice-announced call.
HFU	(Hands-Free Unit) Unit for older analog multiline telephones that allows users to make and receive calls on the speakerphone without using the handset.
Home screen	Display normally shown on an MLX display telephone; shows time, date, and call information, and shows when some features are in use.
host	Telephone company or other switch providing features and services to the system users, usually when the system is operating in <i>Behind Switch mode</i> .
Hybrid/PBX mode	One of three modes of system operation, in which the system uses trunk <i>pools</i> and <i>ARS</i> in addition to <i>personal lines</i> . Provides a single interface (SA <i>buttons)</i> to users for both inside and outside calling, See also <i>Behind Switch mode</i> and <i>Key mode</i> .

Ι

ICLID	(Incoming Call Line Identification) See Caller ID.
ICOM buttons	(intercom buttons) Telephone buttons that provide access to inside system lines for calling other extensions or receiving calls from them.

immediate-start tie trunk	<i>Tie trunk</i> on which no start signal is necessary; dialing can begin immediately after the trunk is seized.
in-band signaling	See robbed-bit signaling.
inside dial tone	A tone users hear when they are off-hook on an SA or ICOM button.
Inspect screen	Display screen on an MLX display telephone that allows the user to preview incoming calls and see a list of the features programmed on line buttons.
Integrated Administration	Capability of <i>IS III</i> that simplifies the programming of common information for the system, <i>AUDIX Voice Power</i> , and, if it is also installed, <i>Fax Attendant System</i> .
Integrated Services Digital Network	See ISDN.
Integrated Solution	See IS II/III.
Integrated Voice Power Automated Attendant	<i>IS II</i> application that automatically answers incoming calls with a recorded announcement and directs callers to a department, an extension, or the system operator.
intercom buttons	See ICOM buttons.
interface	Hardware and/or software that links systems, programs, or devices.
IROB protector	(in-Range Out-of-Building protector) Surge-protection device for off-premises telephones at a location within 1000 feet (305 m) of cable distance from the control unit.
IS II/III	(Integrated Solution II or Integrated Solution III) Set of UNIX System-based applications that augments and provides additional services using the system.

ISDN	(Integrated Services Digital Network) Public or private network that provides end-to-end digital connectivity for a services to which users have access by a limited set of standard multipurpose user and <i>network interfaces;</i> provides digital circuit-switched or packet-switched connections within the network and to other networks for national and international digital connectivity.
ISDN 7500B Data Module	Data communications device that allows connection between an RS-232 <i>DTE</i> device and the control unit via MLX extension jacks on the 008 MLX or 408 GS/LS-MLX module.
J	
jack	Physical connection point to the system for a telephone, trunk, or other device. Also called "port."

kbps

Kilobits per second.

Key mode One of three modes of system operation, in which the system uses *personal lines* on line buttons for outside calls, with a separate interface (*ICOM buttons*) for internal calling, See also *Behind Switch mode* and *Hybrid/PBX mode*.

L	
LAN	(local area network) Arrangement of interconnected personal computers or terminals, sometimes accessing a host computer, sometimes sharing resources like files and printers.
LDN	(Listed Directory Number)
LED	(light-emitting diode) Semiconductor device that produces light when voltage is applied; light on a telephone.
line	Connection between extensions within the communications system or loop-start communications path with CO; often, however, used synonymously with <i>trunk.</i>
line and trunk assignment	Assignment of lines and trunks connected to the system control unit to specific buttons on each telephone.
line coding	Pattern that data assumes as it is transmitted over a communications channel.
line compensation	Adjustment for the amount of cable loss in decibels (dB), based on the length of cable between a 100D module and a channel service unit <i>(CSU)</i> or other far-end connection point.
line/trunk	Refers to inside system lines and outside trunks in general terms. See also <i>line</i> and <i>trunk.</i>
line/trunk jack	Physical interface on a module in the control unit for connecting an outside trunk to the communications system. Also called "trunk jack."
line/trunk and extension module	Module on which the jacks for connecting central office lines/trunks and/or the jacks for connecting the extensions are located.

local host computer access	A method for connecting an extension jack to an on-site computer for data-only calls through a <i>modem</i> or data module.
local loop	See access line.
logical ID	Unique numeric identifier for each extension and <i>line/trunk jack</i> in the system control unit.
loop-start trunk	Trunk on which a closure between the tip and ring leads is used to originate or answer a call. High-voltage 20-Hz AC ringing current from the central office signals an incoming call.

Μ

Magic on Hold	An AT&T Music on Hold enhancement that promotes a company's products or services or provides custom music selection.
Mbps	megabits per second
Megacom	AT&T's tariffed digital WATS offering for outward calling.
Megacom 800	AT&T's tariffed digital 800 offering for inward calling.
memory card	Storage medium, similar in function to a floppy disk, that allows information to be added to or obtained from the communication system through the PCMCIA interface slot on the processor module.
MERLIN Identifier	Adjunct that allows users to receive, store, and use information provided by caller identification services provided by the local telephone company.
MERLIN Mail Voice Messaging System	Application that provides automated attendant, call answering, and voice-mail services on the system.

MFM	(Multi-Function Module) Adapter that has a <i>tip/ring</i> mode for answering machines, modems, fax machines, and tip/ring alerts, and an <i>SAA</i> mode for -48 VDC alerts. Installed inside an MLX telephone, and is used to connect optional equipment to the telephone. The optional equipment and the telephone operate simultaneously and independently.
MLX-10 or MLX-10D telephone	10-line button digital telephone offered with (MLX-10D) or without (MLX-10) a 2-line by 24-character display.
MLX-10DP	Same as an MLX-10D except it has an adjunct in the back for connecting the <i>Passageway Direct Connect Solution</i> application.
MLX-20L telephone	20-line button digital telephone with a 7-line by 24- character display.
MLX-28D telephone	28-line button digital telephone with a 2-line by 24- character display.
mode codes	Streams of touch-tone codes used by voice messaging applications to communicate with the system's control unit.
modem	(modulator-demodulator) device that converts digital data signals to analog signals for transmission over a telephone line, and analog signals received on a telephone line to digital signals.
modem data station	A type of data station that includes a modem as its DCE. It may also include an MLX telephone for simultaneous voice and data (MLX voice and modem data station), an analog multiline telephone (analog voice and modem data station), or a single-line telephone for dialing only (modem data-only station). These data stations connect respectively to MLX, analog, or tip/ring extension jack modules. They provide analog transmission of data.

modem pool	Pair, or group of pairs, of <i>modems</i> and data modules with interconnected RS-232 interfaces that converts digital signals to analog, or analog signals to digital, thereby allowing users with 7500B <i>data stations</i> to communicate with users who have analog <i>modem data stations</i> .
module	Circuit pack in the control unit that provides the physical jacks for connection of telephones and/or outside lines/trunks to the communications system. In the name of a module, the first digit indicates the number of <i>line/trunk</i> jacks it contains; the last digit indicates the number of <i>extension jacks</i> it contains. If no letters appear after the number, a line/trunk module provides <i>loop-start trunks</i> or an extension jack module provides analog or <i>tip/ring</i> jacks. For example, a 408 GS/LS MLX module contains four line/trunk jacks and eight digital (MLX) extension jacks, provides either loop-start (LS) or <i>ground-start (GS)trunks</i> . There are also modules for the processor and power supply.
Multi-Function Module	See MFM.
multiline telephone	An analog or digital (MLX) telephone that provides multiple line buttons for making or receiving calls or programming features.
multiplexing	The division of a transmission channel into two or more independent channels, either by splitting the frequency band into a number of narrower bands or by dividing the channel into successive time slots.
Music On Hold	Customer-provided music source or <i>Magic On Hold</i> connected to the system through a <i>loop-start</i> jack.

Ν

network	Configuration of communications devices and software connected for information interchange.
network interface	Hardware, software, or both that links two systems in an interconnected group of systems, for example, between the local telephone company and a PBX.

0

off-hook	Telephone is said to be off-hook when the user has lifted the handset, pressed the Speaker button to turn on the speakerphone, or used a headset to connect to the communications system or the telephone network.
off-premises telephone	See OPT.
ones density	Requirement for channelized <i>DS1</i> service to the public network that eight consecutive zeros cannot occur in a digital data stream.
on-hook	Telephone is said to be on-hook when the handset is hung up, the speakerphone is turned off, and the user is not using a headset to connect to the communications system or the telephone network.
OPT	(off-premises telephone) <i>Single-line telephone</i> or other <i>tip/ring</i> device connected to the system by an 008 OPT module in the control unit. Appears as an inside extension to the system, but may be physically located away from the system.
ОРХ	(off-premises extension)

out-of-band signaling	Signaling that uses the same path as voice-frequency transmission and in which the signaling is outside the band used for voice frequencies.
P	
parity	The addition of a <i>bit</i> to a bit string so that the total number of ones is odd or even, used to detect and correct transmission errors.
PassageWay Direct Connect Solution	Set of software applications to provide an interface between a personal computer and the system: cardfile, telephone programming application, call log and viewer, incoming call management and identification and applications manager.
pass-through	Connection from the internal <i>modem</i> to an attached IS II/IS III application on the system.
PBX	(private branch exchange) Local electronic telephone switch that serves local stations (for example, extensions within a business) and provides them with access to the public network.
PC	(personal computer)
PCMCIA memory card	Personal Computer Memory Card International Association memory card) See <i>memory card</i> .
personal line	Central office trunk that terminates directly on one or more telephones. In <i>Hybrid/PBX mode,</i> a personal line cannot be part of a trunk <i>pool.</i> Also called "DFT" (direct facility termination). Also refers to lines represented on line buttons in <i>Key Mode.</i>

PFT	(Power Failure Transfer) Feature that provides continuity of telephone service during a commercial power failure by switching some of the system's trunk connections to telephones connected to specially designated extension jacks.
pool	In <i>Hybrid/PBX mode,</i> a group of outside trunks that users can access with a Pool button or by dialing an access code on an SA button. Also used by the <i>ARS</i> feature when choosing the least expensive route for a call.
port	See <i>jack.</i> Also, refers to <i>extension</i> or <i>line jacks</i> before these are numbered according to the <i>dial plan</i> during programming. The lowest jack on a module is always Port 1.
Power Failure Transfer	See PFT.
power supply module	Device that directs electricity to modules and telephones on the system. One power supply module is needed for each carrier, and an <i>auxiliary power unit</i> is added if the module exceeds capacity.
PRI	(Primary Rate Interface) Standard interface that specifies the protocol used between two or more communications systems. As used in North America, provides twenty-three 64-kbps <i>B-channels</i> for voice and/or data and one 64-kbps <i>D-channel</i> , which carries multiplexed signaling information for the other 23 channels.
primary system operator position	First jack on the first MLX or analog multiline extension module in the control unit, that is, the extension jack with the lowest <i>logical ID</i> in the system.
prime line	Individual extension number assigned to a telephone in a system operating in <i>Behind Switch mode</i> . Each telephone user has his or her own prime line and is automatically connected to that line when he or she lifts the handset.

processor module	Module in the second slot of the control unit (Slot 0, to the right of the <i>power supply module</i>). <i>Includes</i> the software and memory that runs the system.
programming port reassignment	Reassignment of the system programming jack position to any of the first five extension jacks on the first MLX module in the control unit.
protocol	Set of conventions governing the format and timing of message exchanges between devices, such as an MLX telephone and the control unit.
public network	Network that is commonly accessible for local or long- distance calling. Also called "public switched telephone network."

Q QCC

(Queued Call Console) MLX-20L telephone used by a system operator in *Hybrid/PBX mode* only. Used to answer outside calls (directed to a system operator position) and inside calls, direct inside and outside calls to an extension or an outside telephone number, serve as a message center, make outside calls for users with outward calling restrictions, set up conference calls, and monitor system operation.

R

RAM

(random-access memory) Computer memory in which an individual *byte* or range of bytes can be addressed and read or changed without affecting other parts of memory.

read-only memory See ROM.

Remote Access	System feature that allows an outside caller to gain access to the system, almost as if at a system extension.
restore	Procedure whereby saved and archived system programming is reinstated on the system, from a floppy disk or <i>memory card. See also backup.</i>
ring generator	Circuit pack added to the power supply that generates a high-voltage, 20–30 Hz signal to ring a telephone.
riser cable	Cable that runs between floors in a multistory building and connects wiring closets.
RS-232	Physical interface, specified by the Electronics Industries Association <i>(EIA)</i> , that transmits and receives <i>asynchronous</i> data at distances of up to 50 feet (15 m).
robbed-bit signaling	Signaling in which the least significant <i>bit</i> every sixth frame per channel is used for signaling in that channel.
ROM	(read-only memory) Computer memory that can be read but cannot be changed.

S	
SAA	(Supplemental Alert Adapter) Device that permits -48-VDC alerting equipment to be connected to an analog multiline telephone jack so that people working in noisy or remote areas of a building can be alerted to incoming calls.
SA buttons	Telephone buttons that provide a single interface to users for both inside and outside calling.
SDN	(Software Defined Network) AT&T private networking service created by specialized software within the public network.
SID	(station identification)

simplex signaling	Transmission of signals in one direction only across a telecommunications channel.
signaling	Sending of control and status information between devices to set up, maintain, or cease a connection such as a telephone call.
single-line telephone	Industry-standard touch-tone or rotary-dial telephone that handles only one call at a time and is connected to the system via an <i>extension jack</i> on a basic 012 or 008 OPT module.
slot	Position in a <i>carrier</i> for a module; numbered from 0 (processor <i>module).</i>
SMDR	(Station Message Detail Recording) Feature that captures detailed usage information on incoming and outgoing voice and data calls.
SMDR printer	Printer used to produce SMDR reports. Connected to the system via an RS-232 jack on the <i>processor</i> module.
Software Defined Network	See SDN.
special character	Pause, Stop, or End-of-Dialing signal in a programmed dialing sequence such as an Auto Dial or Personal Speed Dial number.
SPM	(System Programming and Maintenance) <i>DOS</i> or UNIX system-based application for programming and maintaining the system.
square key	Configuration in <i>Key mode</i> operation in which all outside lines appear on all telephones.
station	See extension.
station jack	See extension jack.
Station Message Detail Recording	See SMDR.

Supplemental Alert Adapter	See SAA.
switchhook flash	Momentary (320 ms to 1 second) on-hook signal used as a control signal. May be directed either to the control unit or to a <i>host</i> switch outside the system. Also called "Recall" or "timed flash."
synchronous data transmission	Method of transmitting a continuous digital data stream in which the transmission of each binary <i>bit</i> is synchronized with a master clock. See also <i>asynchronous data</i> <i>transmission</i> .
system acceptance test	Test of all trunks, telephones, data terminals, and features after installation to ensure that they are working correctly.
System Access buttons	See SA buttons.
system date and time	Date and time that appear on MLX display telephones and <i>SMDR</i> reports.
system programming	Programming of system functions and features that affect most users, performed from an <i>MLX-20L telephone</i> or a <i>PC</i> using <i>SPM</i> . See also <i>extension programming</i> and <i>centralized telephone programming</i> .
System Programming and Maintenance	See SPM.
system renumbering	Procedure used to change the numbers assigned to telephones, adjuncts, <i>calling groups</i> , paging groups, park zones. <i>remote access</i> , and lines/trunks.

Т

T1

Type of digital transmission facility that in North America transmits at the *DS1* rate of 1.544 Mbps.

TDM	(time-division multiplex) Process where the transmission channel is divided into time slots.
telephone power supply unit	Equipment that provides power to an individual telephone.
tie trunk	Private trunk directly connecting two telephone switches. See also automatic-start tie trunk, delay-dial-start tie trunk, immediate-start tie trunk, and wink-start tie trunk.
timed flash	See switchhook flash.
tip/ring	Contacts and associated conductors of a <i>single-line telephone</i> plug or jack.
touch-tone receiver	See TTR.
T/R	See tip/ring.
trunk	A telecommunications path between the communications system and the telephone company central office (CO) or another switch. Often used synonymously with <i>line</i> .
trunk jack	See line/trunk jack.
trunk pool	See pool.
TTR	(touch-tone receiver) Device used to decode <i>DTMF</i> touch- tones dialed from <i>single-line telephones</i> or <i>Remote</i> <i>Access</i> telephones.

U

uninterruptible power supply	See UPS.
unit load	Measure of the power load drain of a module, telephone, or <i>adjunct</i> .

UPS	(uninterruptible power supply) Device that connects to the system to provide 117 VAC to the equipment when the commercial power source fails.
V	
VAC	Alternating-current voltage.
VDC	Direct-current voltage.
VMI	(voice messaging interface) An enhanced tip/ring port.
voice-band channel	A transmission channel. generally in the 300-3400-Hz frequency band.
voice mail	Application that allows users to send messages to other extensions in the system, forward messages received with comments, and reply to messages.
voice messaging interface	See VMI.
W	
WATS	(Wide Area Telecommunications Service) Service that allows calls to certain areas for a flat-rate charge based on expected usage.
wink-start tie trunk	<i>Tie trunk</i> on which the originating end transmits an off- hook signal and waits for the remote end to send back a signal (a wink) that it is ready for transmission.

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