



MERLIN MAGIXTM Integrated System

Installation

Release 2.1 and Earlier

555-721-140
Issue 1
November 2001

Notice

Every effort has been made to ensure that the information in this guide is complete and accurate at the time of printing. Information, however, is subject to change. See Appendix A, "Customer Support Information," in *Feature Reference* for important information.

Avaya Web Page

The world wide web home page for Avaya is <http://www.avaya.com>.

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Preventing Toll Fraud

Toll Fraud is the unauthorized use of your telecommunications system by an unauthorized party (for example, a person who is not a corporate employee, agent, subcontractor, or working on your company's behalf). Be aware that there is a risk of toll fraud associated with your system and that, if toll fraud occurs, it can result in substantial additional charges for your telecommunications services.

Avaya Fraud Intervention

If you suspect that you are being victimized by toll fraud and you need technical assistance or support, call the Avaya Customer Care Center at **1 800 628-2888**.

Providing Telecommunications Security

Telecommunications security of voice, data, and/or video communications is the prevention of any type of intrusion to, that is, either unauthorized or malicious access to or use of, your company's telecommunications equipment by some party.

Your company's "telecommunications equipment" includes both this Avaya product and any other voice/data/video equipment that could be accessed via this Avaya product (that is, "networked equipment").

An "outside party" is anyone who is not a corporate employee, agent, subcontractor, or working on your company's behalf. Whereas, a "malicious party" is anyone, including someone who may be otherwise authorized, who accesses your telecommunications equipment with either malicious or mischievous intent.

Such intrusions may be either to/through synchronous (time multiplexed and/or circuit-based) or asynchronous (character-, message-, or packet-based) equipment or interfaces for reasons of:

- Utilization (of capabilities special to the accessed equipment)
- Theft (such as, of intellectual property, financial assets, or toll-facility access)
- Eavesdropping (privacy invasions to humans)
- Mischief (troubling, but apparently innocuous, tampering)
- Harm (such as harmful tampering, data loss or alteration, regardless of motive or intent).

Be aware that there may be a risk of unauthorized or malicious intrusions associated with your system and/or its networked equipment. Also realize that, if such an intrusion should occur, it could result in a variety of losses to your company, including, but not limited to, human/data privacy, intellectual property, material assets, financial resources, labor costs, and/or legal costs.

Your Responsibility for Your Company's Telecommunications Security

The final responsibility for securing both this system and its networked equipment rests with you - an Avaya customer's system administrator, your telecommunications peers, and your managers. Base the fulfillment of your responsibility on acquired knowledge and resources from a variety of sources, including, but not limited to:

- Installation documents
- System administration documents
- Security documents
- Hardware-/software-based security tools
- Shared information between you and your peers
- Telecommunications security experts

To prevent intrusions to your telecommunications equipment, you and your peers should carefully program and configure your:

- Avaya provided telecommunications system and their interfaces
- Avaya provided software applications, as well as their underlying hardware/software platforms and interfaces
- Any other equipment networked to your Avaya products

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 their own expense. For further FCC information, see Appendix A, "Customer Support Information," in *Feature Reference*.

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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 applicables aux appareils numériques de la classe A prescrites dans le règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

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For more information about Avaya documents, refer to the section entitled "Related Documents" in "About This Guide" in *Feature Reference*.

Support Telephone Number

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

Warranty

Avaya provides a limited warranty on this product. Refer to "Limited Warranty and Limitation of Liability" in "Customer Support Information" in *Feature Reference*.

IMPORTANT SAFETY INSTRUCTIONS



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.

When installing telephone equipment, always follow basic safety precautions to reduce the risk of fire, electrical shock, and injury to person, 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 Avaya Inc.-manufactured MERLIN MAGIX Integrated System circuit modules, carrier assemblies, and power units in the MERLIN MAGIX Integrated System control unit.
- Use only Avaya Inc.-recommended/approved MERLIN MAGIX Integrated System accessories.
- If equipment connected to the TDL telephone modules (412 LS-ID-TDL and 024 TDL), the MLX telephone modules (008 MLX, 408 GS/LS-MLX, 408 GS/LS-ID-MLX, and 016 MLX), or the ETR telephone module (016 ETR) 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 MAGIX Integrated 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 MAGIX Integrated 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:

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.

ONLY an authorized technician or dealer representative shall install, set options, or repair an MFM.

SAVE THESE INSTRUCTIONS

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Enhancements

Release 2.1 Enhancements (November 2001)

Release 2.1 includes all Release 2.0 functionality plus the enhancements listed below.

- Several features are being added and/or enhanced to compliment the MERLIN MAGIX Release 2.0 CRM (Customer Relationship Management) solution:

NOTE ► The system Extension Status feature must be set to Group Calling Supervisor mode and not in the Hotel mode for the Release 2.1 enhancements to work. When the Extension Status feature is set to Hotel mode, the group calling supervisor mode operation is the same as previous releases.

- **Calling group agent in multiple calling groups.** A calling group agent can be a member of more than one calling group.

NOTE ► The calling group agent in multiple calling groups applies to extensions assigned as members of calling groups that are programmed as automatic login or automatic logout calling group types. Extensions assigned as members of integrated and VMI calling groups can be assigned to only one calling group.

- **Selective login.** A calling group agent can selectively log into individual calling groups or can log into all calling groups to which the agent has been assigned as a member. The agent selectively logs into a calling group by pressing a programmed Login button then dialing the extension number for the calling group, or by pressing the Feature button or # and dialing 764 and the extension number for the calling group.
- **Selective logout.** A calling group agent can selectively log out of individual calling groups or can log out of all calling groups. The agent selectively logs out of a calling group by pressing a programmed Logout button then dialing the extension number for the calling group, or by pressing the Feature button or # and dialing 765 and the extension number for the calling group.
- **Auxiliary Work Time.** When a calling group agent activates the Auxiliary Work Time feature, the calling group agent is unavailable to receive calling group calls. When the calling group agent activates or deactivates Auxiliary Work Time, the MERLIN MAGIX system maintains the agent's logged in or logged out status for calling groups. The agent activates Auxiliary Work Time by pressing a programmed Auxiliary Work Time button (the green LED next to the programmed button goes on), or by pressing the Feature button or # and dialing 766. The agent deactivates Auxiliary Work Time by pressing a programmed Auxiliary Work Time button (the green LED next to the programmed button goes off), or by pressing the Feature button or # and dialing *766.

- **Selective Supervisor mode.** The new Selective Supervisor mode allows a calling group supervisor to see the login/logout status for all assigned group members and delay announcement units (DAUs) assigned to the calling group. The calling group supervisor can see which extensions that have selectively logged into an individual calling group. In this mode, the supervisor can log in or log out any extension assigned the group. The calling group supervisor enters Selective Supervisor mode by pressing the Feature button or # and dialing 32 and the extension number for the calling group. The calling group supervisor returns to the normal call-handling mode by pressing the Feature button or # and dialing 32 then pressing the Drop button.
 - **Enhanced TSAPI events and services.** The MERLIN MAGIX system and the MERLIN MAGIX PBX Driver are enhanced to provide services providing more information about calling groups and extensions. This allows CRM applications to automatically configure their database with the support and overflow groups for an individual calling group. The application can also query the state of Do Not Disturb and Message Waiting lights at an extension allowing for a more accurate MERLIN MAGIX system view when the application is initiated. The restrictions that prevent the Deflect Call Service are removed.
- Release 2.1 also includes enhancements to address field-related issues:
- **Caller ID display enhancement.** For customers who do not subscribe to Caller ID service or who do not have loop-start lines connected to modules that support caller ID service (800 GS/LS-ID, 408 GS/LS-ID-MLX, or 412 LS-ID-TDL modules), only the programmed label for the line appears on display telephones when a call is received on the line. The No Caller ID label does not appear on display telephones as on previous releases. This enhancement is system wide and requires no system programming.
 - **100DCD/CSU/DSU maintenance enhancements.** The Data BERT tests for the 100DCD module are moved in the maintenance hierarchy to the same level as other data tests (for example, the Data Terminal test). When the system technician is not required to busy out the 100DCD module when running the data BERT test. The system technician can also select the direction of the test (either looped back to the MERLIN MAGIX system or going out to the network). Since 100DCD module does not provide LEDs for the Data Terminal Ready, Clear To Send, Request to Send, or Transmit and Receive data leads, new maintenance screen is available to help to diagnose problems. The new maintenance screen provides the on or off status for Data Terminal Ready, Clear to Send and Request to Send. The new maintenance screen also provides an indication of the speed of the data that is being transmitted.
 - **Conversion for previous releases.** Support for the conversion feature that allows a user to take a backed-up configuration of an earlier release of a MERLIN LEGEND system or MERLIN MAGIX system and have the file automatically mapped into a version that the new release can use. This functionality is provided as part of the WinSPM software. The user can select a backup file, select the desired product to CONVERT TO, and then select the Release number of that product. The user is prompted for all these inputs; choices for upgrades are based on the version of the backup file chosen to convert. In Release 2.1 of the MERLIN MAGIX system, there is an upgrade path from prior releases of MERLIN MAGIX and MERLIN LEGEND systems to MERLIN MAGIX Release 2.1.
 - **WinSPM Release 6.** New with the introduction of Release 6.0 for WinSPM is compatibility with Windows 2000 and, as well as a new telephone set label-making application. WinSPM Release 6.0 replaces WinSPM R5.0 for programming the MERLIN MAGIX systems. WinSPM R6.0 must be used to upgrade from a MERLIN MAGIX R1-R1.5/R2.0 to R2.1 system and to upgrade from a MERLIN LEGEND system to a MERLIN MAGIX R2.1 system. WinSPM R6.0 has been enhanced to automatically drop the programmer into

Standard SPM programming mode, if upgrading from a MERLIN LEGEND system to a MERLIN MAGIX system with supported modules that are not recognized. See the Upgrade Information section of this Offer Announcement for specific information regarding supported and non-supported MERLIN LEGEND system modules.

Release 2.0 Enhancements (January 2001)

Release 2.0 includes all Release 1.5 functionality, plus the enhancements listed below.

- **Enhanced CSTA services.** CSTA services are enhanced to provide more flexibility for lines and features and to provide new services and events to help support a Customer Relationship Management application
- **More TSAPI events and services.** More TSAPI events and services are made available to Customer Relationship applications that aid the application in real-time reporting and routing
- **New current delay announcement unit (DAU) functionality.** The new current DAU functionality is available through the MERLIN Messaging System Release 2.5 and later. There is a new system programming option added to associate an announcement number with a particular delay announcement number.
- **Support for the TransTalk 9040.** The TransTalk 9040 is a digital wireless telephone with programmable buttons, on 412 LS-TDL and 024 TDL modules for Release 1.5 and later systems, and on 016 ETR modules for all releases.
- **Conversion for previous releases.** Support for the conversion feature that allows a user to take a backed-up configuration of an earlier release of a MERLIN LEGEND system or MERLIN MAGIX system and have the file automatically mapped into a version that the new release can use. This functionality is provided as part of the WinSPM software. The user can select a backup file, select the desired product to CONVERT TO, and then select the Release number of that product. The user is prompted for all these inputs; choices for upgrades are based on the version of the backup file chosen to convert. In Release 2.0 of the MERLIN MAGIX system, there is an upgrade path from prior releases of MERLIN MAGIX and MERLIN LEGEND systems to MERLIN MAGIX Release 2.0.
- **Display integration.** Display integration with MERLIN Messaging System Release 2.5 and later allows users with display telephones to view basic voice mail message information such as the number of New and Old Messages.
- **Send Caller ID information.** The MERLIN MAGIX system enhanced functionality allows Caller ID information to be forwarded to the MERLIN Messaging system for use with other messaging system features.

Release 2.0 Enhancements (January 2001)

Release 2.0 includes all Release 1.5 functionality, plus the enhancements listed below.

- Enhanced CSTA services to provide more flexibility for lines and features and to provide new services and events to help support a Customer Relationship Management application
- More TSAPI events and services that aid the application in real-time reporting and routing
- New current delay announcement unit (DAU) functionality through the MERLIN Messaging System Release 2.5 and later. There is a new system programming option added to associate an announcement number with a particular delay announcement number.
- Support for the TransTalk 9040, a digital wireless telephone with programmable buttons, on 412 LS-TDL and 024 TDL modules for Release 1.5 and later systems, and on 016 ETR modules for all releases.
- Support for the conversion feature that allows a user to take a backed-up configuration of an earlier release of a MERLIN LEGEND system or MERLIN MAGIX system and have the file automatically mapped into a version that the new release can use. This functionality is provided as part of the WinSPM software.
- The user can select a backup file, select the desired product to CONVERT TO, and then select the Release number of that product. The user is prompted for all these inputs; choices for upgrades are based on the version of the backup file chosen to convert. In Release 2.0 of the MERLIN MAGIX system, there is an upgrade path from prior releases of MERLIN MAGIX and MERLIN LEGEND systems to MERLIN MAGIX Release 2.0.
- Display integration with MERLIN Messaging System Release 2.5 and later that allows users with display telephones to view basic voice mail message information such as the number of New and Old Messages.
- MERLIN MAGIX system enhanced functionality that forwards Caller ID information to the MERLIN Messaging system for use with other messaging system features.

Release 1.5 Enhancements (June 1999)

Release 1.5 includes all Release 1.0 functionality, plus the enhancements listed below.

- **100 DCD Module**

The 100 DCD module provides a built-in channel service unit (CSU) and data service unit (DSU). Using this module eliminates the need to attach an external CSU/DSU, thereby allowing easier routing of calls. The 100 DCD module has the same signaling modes as the 100D and 100R INA modules, including the ability to use T1 or PRI configuration. As such, the new module counts toward the combined system total of three 100D, 100R INA, and 100 DCD modules. The 100 DCD module can fit into both metal and plastic carriers. Therefore, it can be added to an existing MERLIN LEGEND Communications System, where it functions like other 100D modules. The CSU/DSU part of the 100 DCD module, however, only functions with Release 1.5 or later of the MERLIN MAGIX system.

- **Programming Options for 100R INA and 100 DCD Modules**

The 100R INA and 100 DCD modules use many of the same programming options as the 100D module. However, the 100R INA module has two new programming options: Activate/Deactivate the On-Board CSU and Channel Selection. The 100 DCD module has the same programming options, plus two additional ones: Activate/Deactivate the DSU and Programming Data Port Parameters.

- **Tests for the 100R INA and 100 DCD Modules**

Three new Tests apply to both the 100R INA and 100 DCD modules:

- Line Loopback Test
- Payload Loopback Test
- Bit Error Rate Test (BERT)

Three other tests have been added specifically for the 100 DCD module:

- Data-channel Loopback Test
- Data Terminal Loopback Test
- Data Port Local Loop Test

- **Automatic Daylight Savings Time Feature**

This new feature allows the system to automatically set the system clock ahead or back one hour when Daylight Savings Time starts or ends. You can use the factory setting of "USA ADST," or choose to customize the parameters of the feature. If you select "USA ADST," the system time moves one hour ahead at 2:00 a.m. on the first Sunday in April and moves one hour back at 2:00 a.m. on the last Sunday in October.

■ **Automatic Route Selection Feature Enhancement**

Because of the changes in facilities and dial plans across the USA and Canada, Release 1.5 offers new enhancements to the Automatic Route Selection feature:

- 10- and 11-digit dialing
- 24 programmable tables
- Wild card characters in 6-digit tables
- Enhanced 911 service

■ **Allowed Lists and Disallowed Lists Feature Enhancement**

Two enhancements for Allowed/Disallowed Lists are supported in Release 1.5:

- Maximum number of digits in Allowed Lists has been increased from 7 to 14.
- One-to-one wild card character matching is supported.

With the increase number of digits in Allowed Lists, you can allow Outward or Toll Restricted users to dial equal access codes to specific area codes and/or exchanges, for example, 1010xxx-1-xxx-xxx-xxxx.

Now you can also use one-to-one wild card character matching in Allowed/Disallowed List entries. Press Hold to enter a wild card character. The character appears as a "p" on telephone displays and in the printed report.

■ **WinSPM 4.0**

WinSPM 4.0 software offers an automatic conversion program via the DOS-emulator version of SPM and flow control for the programming serial port.

■ **Automatic Configuration of the MERLIN Messaging System**

To ease the amount of effort during a system installation, MERLIN MAGIX Release 1.5 can automatically configure a voice mail system when Release 2.0 of the MERLIN Messaging System is housed in one of the system's carriers. This capability takes the current data on the MERLIN MAGIX system and passes it to the MERLIN Messaging System, thereby allowing the System Administrator to configure the messaging system without having to manually enter a lot of data. Although primarily intended for installation, the automatic configuration can be used at any time.

■ **Release 1.5 Upgrade Card**

In Release 1.5, an Upgrade PCMCIA card is available which allows you to upgrade the entire system software or to upgrade only the firmware on the modules, thereby leaving the system programming intact.

■ **Maintenance Enhancements**

In addition to the new tests for the 100R INA and 100 DCD modules described earlier, Release 1.5 provides the following maintenance enhancements:

- **Station Responding Test.** Beginning in Release 1.5, you can run a Station Responding Test to check the connection between an extension and the system. When you select this test from the maintenance screen, the system sends a request to the telephone at that extension (station), asking for the telephone's classmark. You can request the Station Responding Test locally or remotely. This test does not work for tip/ring devices because they do not have a classmark.

- **Touch-Tone Receiver Test.** The Touch-Tone Receiver Test runs as an audit on the system. It is not a demand test but runs continuously in the background as a maintenance check. This test checks every touch-tone receiver (TTR) in the system modules, including those in the MERLIN Messaging System. If a TTR fails the test, a permanent error is logged and the TTR becomes maintenance busy. If 50% or more TTRs become maintenance busy at the same time, another permanent error is logged, and the system alarm LED lights. The Touch-Tone Receiver Test itself does not maintenance busy out 50% or more TTRs. When a maintenance-busy TTR is retested and passes the test, it is automatically placed back into service.
- **Viewing Module Serial Numbers.** You can view the serial numbers of the following modules in the Maintenance screens:
 - Processor module
 - 024-TDL
 - 100 DCD
 - 100R INA
 - 412 LS-ID-TDL
 - MERLIN Messaging System
- **E911 Service Error Codes.** Three new error codes have been added for E911 service.
 - E911 OVERFLOW (Error Code 0802)
 - E911 ADJUNCT OOS (Error Code 4001)
 - E911 NO OUTGOING SEIZURE (Error Code 8411)
- Support for the TransTalk 9031 and 9040 telephones, digital wireless telephones with programmable buttons, on 016 ETR modules.

About This Guide

The MERLIN MAGIX Integrated 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, Direct Voice Mail, and Tandem Switching. Data features allow both voice and data to be transmitted over the same system wiring.

Intended Audience

This book provides detailed information about system features, extension features, and system applications of the MERLIN MAGIX Integrated System. It is intended as a reference for anyone needing such information, including support personnel, sales representatives, System Managers, and account executives. It is also intended for technicians who are responsible for system installation, maintenance, and troubleshooting.

How to Use This Guide

This guide has been designed to provide optimal assistance to you in completing the planning forms—for example:

1. Since some chapters and/or sections apply to one or another of the configurations (Key or Behind Switch, Hybrid/PBX, or data communications), these sections are clearly marked—for example, “Hybrid/PBX Only.” Also, you are alerted to proceed to the next appropriate section, or to skip chapters or sections that do not apply to your particular system. Proceed through this guide as appropriate.
2. A list of forms or information that will be needed for particular procedures appears at the beginning of each chapter and section.
3. Where appropriate, examples of completed forms are included so you can confirm what you have done.

Since this guide assumes that you are familiar with the system, detailed information about equipment, features, and programming are not included. Refer to the following documentation for additional information:

- *System Programming* gives procedural instructions for programming system features.
- User and operator 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 USA only, Avaya provides a toll free customer Helpline 24 hours a day. Call the Helpline at 1 800 628-2888 (consultation charges may apply), or contact your Avaya representative if you need assistance when installing, programming, or using your system.

Outside the USA, if you need assistance when installing, programming, or using your system, contact your Avaya authorized representative.

Terms and Conventions Used

The terms described here 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 MAGIX Integrated System to the central office. Technically, a *line* is a loop-start facility or a communications path that does not connect switches—for example, an intercom line or a Centrex line. In actual usage, however, the terms *line* and *trunk* are often applied interchangeably. In this guide, we use *line/trunk* and *lines/trunks* to refer to facilities in general. Specifically, we refer to *digital facilities*. We also use specific terms such as *Personal Line*, *ground-start trunk*, *Direct Inward Dialing (DID) trunk*, and so on. When you talk to personnel at your local telephone company central office, ask them which terms they use for the specific facilities they connect to your system.

Some older terms have been replaced with newer terms, as follows:

Old Term	New Term
trunk module	line/trunk module
trunk jack	line/trunk jack
station	extension
station jack	extension jack
analog data station	modem data workstation
digital data station	terminal adapter workstation
7500B data station	ISDN terminal adapter data workstation
digital voice and analog data station	MLX voice and modem data workstation
analog data-only station	modem data-only workstation
digital data-only station	terminal adapter data-only workstation
7500B data-only station	ISDN terminal adapter data-only workstation
digital voice and digital data station	MLX voice and terminal adapter workstation
MLX voice and 7500B data station	MLX voice and ISDN terminal adapter data workstation

Typographical Conventions

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

Convention	Example
Italics or bold indicates emphasis.	It is <i>very</i> important that you follow these steps. WARNING: Do not remove modules from the carrier without following proper procedures.
Italics also sets off special terms.	The part of the headset that fits over one or both ears is called a <i>headpiece</i> .
Plain constant-width type indicates text that appears on the telephone display or PC screen, as well as characters you dial at the telephone or type at the PC.	Choose Ext Prog from the display screen. To activate Call Waiting, dial *11.

Product Safety Advisories

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 possible and limit distribution 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 in the Feature Reference*.”

Throughout this guide, toll fraud security hazards are indicated by an exclamation point inside a triangle and the words *SECURITY ALERT*.



SECURITY ALERT:

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

Related Documents

The documents listed in the following table are part of the MERLIN MAGIX documentation set. Within the continental United States, contact the Avaya Publications Center by calling 1 800 457-1235.

Document No.	Title
System Documents:	
555-721-110	<i>Feature Reference</i>
555-721-112	<i>System Planning</i>
555-721-113	<i>System Planning Forms</i>
555-721-119	<i>System Manager's Quick Reference</i>
555-661-150	<i>Network Reference</i>
555-721-800	<i>Customer CD-ROM:</i> Consists of <i>System Manager's Quick Reference</i> , <i>Feature Reference</i> (PDF version), and <i>Online Feature Reference tool</i> (HTML version).
555-721-801	<i>Reference CD-ROM:</i> Consists of <i>System Manager's Quick Reference</i> , <i>Feature Reference</i> (PDF version), <i>Online Feature Reference tool</i> (HTML version), <i>System Planning</i> (including forms), <i>Pocket Reference</i> , and <i>Installation, Basic System Programming & Maintenance and Troubleshooting</i> .
Telephone User Support:	
555-710-123 (U.S. English)	<i>4400/4400D Telephone User's Guide</i>
555-710-123FRC (Canadian French)	<i>4400/4400D Telephone User's Guide</i>
555-710-127 (U.S. English)	<i>4406D+, 4412D+, 4424D+, and 4424LD+ Telephone User's Guide</i>
555-710-127FRC (Canadian French)	<i>4406D+, 4412D+, 4424D+, and 4424LD+ Telephone User's Guide</i>
555-660-122	<i>MLX Display Telephone User's Guide</i>
555-630-150	<i>MLX- 5D, MLX-10D and MLX-10DP Display Telephone Tray Cards</i> (5 cards)
555-630-152	<i>MLX-28D and MLX-20L Telephone Tray Cards</i> (5 cards)
555-660-124	<i>MLX-5[®] and MLX-10[®] Nondisplay Telephone User's Guide</i>
555-630-151	<i>MLX-5 and MLX-10 Nondisplay Telephone Tray Cards</i> (6 cards)
555-630-155	<i>MLX-16DP Display Telephone Tray Cards</i> (5 cards)

Document No.	Title
555-670-151	<i>MLS and ETR Telephone Tray Cards</i>
555-670-152	<i>MLS and ETR Telephone Tray Cards (16 cards)</i>
555-660-126	<i>Single-Line Telephones User's Guide</i>
555-660-138	<i>MDC and MDW Telephones User's Guide</i>
System Operator Support:	
555-710-134	<i>Digital Direct Line Console Operator's Guide</i>
555-710-136	<i>Digital Queued Call Console Operator's Guide</i>
Miscellaneous User Support:	
555-661-130	<i>Calling Group Supervisor and Service Observer User Guide</i>
555-650-105	<i>Data and Video Reference</i>
555-721-140	<i>Installation, Programming Basics, Maintenance and Troubleshooting</i>
555-721-116	<i>Pocket Reference</i>
Toll Fraud Security:	
555-025-600	<i>BCS Products Security Handbook</i>

How to Comment on This Guide

We welcome your comments, both positive and negative. 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
Avaya Inc.
150 Allen Road, Room 3C-19
Liberty Corner, New Jersey 07938

We'd like your opinion . . .

We welcome your feedback on this document. Your comments can be of great value in helping us improve our documentation.

MERLIN MAGIX™ Integrated System
Installation
Issue 1, November 2001
555-721-140

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

	Excellent	Good	Fair	Poor
Ease of Finding Information	☐	☐	☐	☐
Clarity	☐	☐	☐	☐
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Organization	☐	☐	☐	☐
Appearance	☐	☐	☐	☐
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☐ Add more details	☐ Improve the index

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Overview

This chapter provides precautionary information that you should consider **before** installing the system. The topics include the space requirements and optimum environmental conditions. Procedures are given for grounding the power supply, grounding the control unit, and for testing the electrical grounds. Installing a backboard, power surge protection and unit loads are also discussed later in this chapter.

Space Requirements

When selecting an installation site, consider the following space and location requirements:

Metal Dimensions

- Basic carrier: 11 inches wide by 20 inches high by 11 inches deep
- Basic carrier and one expansion carrier: 22 inches wide by 20 inches high by 11 inches deep
- Basic carrier and two expansion carriers: 33 inches wide by 20 inches high by 11 inches deep

Location

- Within 5 feet (152 cm) of an AC power outlet that is not switch-controlled
- Within 25 feet (762 cm) of the network interface, or use an Off-Premises Range Extender (OPRE)
- Within 1000 cable feet of telephones (except MLX and 4400-Series), or use an OPRE (for basic telephones)
- Within 3000 cable feet of MLX telephone (IROBS if needed)
- Within 2000 cable feet of any 4400-Series telephone when using 26 gauge cable
- Within 3000 cable feet of any 4400-Series telephone when using 24 gauge cable
- Within 5000 cable feet of any 4400-Series telephone when using 22 gauge cable

Environmental Requirements

Approved Conditions

A good installation site meets all of the approved conditions listed below

**WARNING:**

Do not install the control unit outdoors.

Table 1-1. Environmental Requirements

Parameter	Value
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 inch (2.54 cm) on the right and left sides of the control unit and at least 12 inches (30.48 cm) 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

Electrical Noise

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

Radio-Frequency Interference

Radio-frequency interference (RFI) is generally caused by the following or similar type equipment:

- Radio transmitters (AM and FM)
- Television stations
- Induction heaters
- Motors (with commutators) of 0.25 horsepower (200 watts) or greater

Field strengths below 1.0 volt per meter are unlikely to cause interference. 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 Strength Calculation

To estimate the field strength produced by radio transmitters, divide ($\div$) by the square root ($\sqrt{}$) of the emitted power, in kilowatts, the distance from the antenna, in kilometers, which equals ($=$) the field strength in volts per meter.

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

This yields the approximate field strength in volts per meter and is relatively accurate for distances greater than about half a wavelength (492 feet, 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 "Customer Support Information," of the *Features Reference* for FCC Part 15 radio frequency regulations.

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 feet wide by 4 feet high
 - Without Systimax wiring: 6 feet wide by 3 feet high

How to Install the Backboard

When you are certain that the backboard meets the requirements indicated in (link) Backboard Requirements, attach the back board to the wall using the following mounting hardware.

- For a wood mounting surface, use wood screws.
- For brick, cinder block, or concrete, use masonry anchors.
- For plaster or plasterboard, use toggle bolts.

AC Grounding Requirements

Proper AC grounding is essential for the MERLIN MAGIX 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 AC grounding requirements are met:

- The load center of appropriate current rating must be equipped with circuit breakers labeled 120 V AC, 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 (link Grounding the AC Outlet).
- One outlet must have an attached ground bar connected by a #6 AWG copper wire to an approved ground. This ground bar is the system's single-point ground.
- 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 feet (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 feet (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.
- The AC power requirements indicated in Table 1-2, "[Power Requirements](#)," on page 6, must be met.

Grounding the AC Outlet

When grounding the AC outlet, use the following diagram to insure that all AC grounds are connected properly.



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.

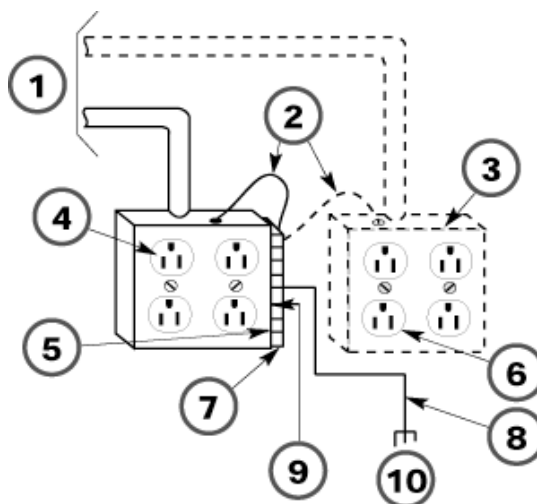


Figure 1-1. AC Grounding Requirements

- 1 From AC Load Center (2 separately fused 15A circuits)
- 2 Ground Wire #14 AWG
- 3 4" Box (RACO 230 or equivalent)
- 4 HUBBELL Receptacles (5262 15A or equivalent)
- 5 Single-Point Ground
- 6 4" Cover (RACO 807 or equivalent)
- 7 Ground Bar Mounted on a 4" Box (Square "D" PK9GTA or approved equivalent)
- 8 Ground Wire #6 AWG Copper
- 9 #12 or #14 AWG Copper Wire to Each Carrier Grounding Screw
- 10 Approved Building Ground

Testing the AC Outlet

Power Requirements

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

Table 1-2. Power Requirements

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

Fault Conditions

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

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

Follow these steps to use an Ideal 61-035 Circuit Tester or its equivalent:



WARNING:

Hazardous voltages are present during this test. Follow all instructions carefully when working with AC power line voltages.

1. Plug the circuit tester into the outlet that you want to test.
If the circuit is properly grounded, the yellow and white lights on the tester turn on.
2. Unplug the circuit tester.

Using a Volt-Ohm Millimeter (VOM)

Follow these steps to use a VOM:



WARNING:

Hazardous voltages are present during this test. Follow all instructions carefully when working with AC power line voltages.

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

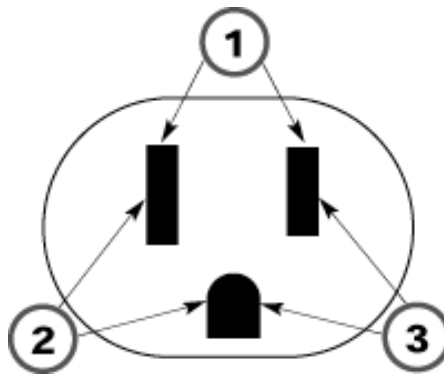


Figure 1-2. Measuring the AC Outlet Voltages

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



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.*

Control Unit 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)



WARNING:

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. See [Figure 2-6 on page 2-11](#).*
- *The AC outlet and the single-point ground bar must be properly grounded as shown. See [Figure 2-6 on page 2-11](#).*
- *Each control unit ground-screw terminal must be connected to the single-point ground bar by a #12 AWG or a #14 AWG solid copper wire. See [Figure 1-1 on page 1-5](#) and [Figure 2-6 on page 2-11](#).*
- *This wire run should be as short as possible, preferably within 5 feet (152 cm), and not to exceed 10 feet (305 cm). See [“Approved Grounds” on page 2-12](#).*
- *The AC outlet must be connected to the 145D protector with a #12 AWG or a #14 AWG9999 solid copper wire.*



WARNING:

An 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.

Central Office (CO) Surge Protection

The local 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 CO 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.

Using Power Surge Protectors

The MERLIN MAGIX 491D1 power supply has built-in AC line protection. This built-in protection handles almost all situations.

Occasionally, additional protection may be needed if the customer is located in a heavy lighting area. In such instances, the 145D and 146 protectors are available for the MERLIN MAGIX system as needed.

In addition to providing CO line protection, 146 protectors are designed as In-Range, Out-of-Building (IROB) protectors. An IROB protector is used when telephones are installed within 1,000 feet of the control unit but are in another building. You must use IROB protectors whenever out-of-building telephones are installed.

NOTE ► 146C and/or the 146F protectors are recommended for CO line protection at all potential lightning trouble sites.

Connect a 145D protector to the system to limit surges from the AC lines. For CO trunk and/or IROB protection, add any combination of 146 protectors shown in Table 1-3. For an example, see Figure 1-3.

Table 1-3. Capacities and Recommended Application for 146 Protectors

Protector	Recommended Application
146C	4 CO Lines 4 T/R IROB telephones
146D	2 T/R IROB telephones 2 MLS or ETR IROB telephones
146E	2 MLX IROB telephones 2 4400-Series IROB telephones
146F	25 CO Lines 25 T/R IROB telephones
145D	6 protected AC outlets

NOTE ► For detailed installation instructions, see the documentation packaged with the protectors.

Configuring Power Surge Protection

The following diagram represents a typical surge protection installation.

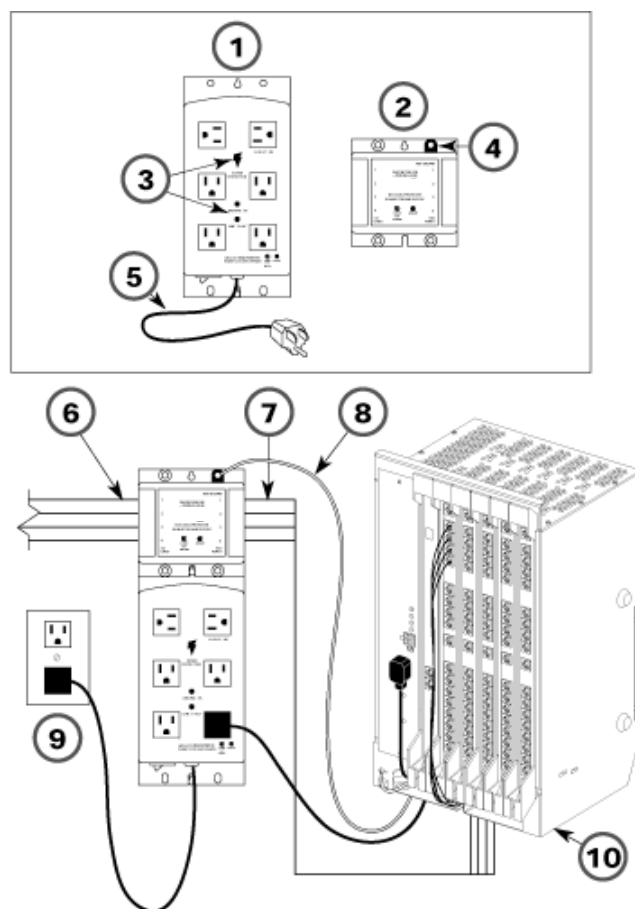


Figure 1-3. Configuring Power Surge and Protectors

1	145D Protector	6	To Central Office or IROB
2	146C Protector	7	To Control Unit
3	Statue Indicator Lights	8	#12 or #14 AWG GRound Wire
4	Ground Strap	9	AC Outlet
5	AC Connection	10	Basic Carrier

NOTE ► For detailed installation instructions, see the documentation packaged with the protectors.

Unit Load Calculation

WARNING:

When using high-density station modules (016- and 024-port), some configurations will be limited to three station modules per carrier due to exceeding the unit load capacity of the power supply. This unit load limitation typically occurs when a predominance (more than 50%) of large, multi-button telephones (4424LD+, 4424D+, 4412D+, MLX-20L, MLX-28D, ETR-34D, and/or ETR-18D telephones) are used. To prevent unit load problems in configuring systems, please follow the unit load configuration rules outlined below.

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.** 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 in the unit load calculation (for example: do not count the DSS).
- **Direct Inward Dial (DID) modules.**

Unit load and power requirements for a new system are computed automatically when the equipment for the system is initially ordered. These calculations are based on the assumption that each module is fully utilized—that is, all jacks are used.

WARNING:

Never have more than two (2) 800 BRI modules, two (2) DS1 modules (100D or 100 DCD), two (2) INA modules (100R INA), or more than one (1) 100D/100 DCD and one (1) 100R INA module in a carrier. A maximum of two Merlin Messaging R2.5 modules can be installed per MERLIN MAGIX R2.0 system, however, only the first module installed (left most slot in system) can be programmed for voice messaging and/or Delayed Announcement Service. The second Merlin Messaging module installed can only be programmed for Delayed Announcement Service. Whether both Merlin Messaging modules can be installed in the same carrier depends on how many other -5 volt modules are also installed in that carrier. Lastly, there can be any combination of the following three -5v dc modules per carrier, but do not exceed three per carrier (If you exceed three -5v dc modules in a single carrier, the system will fail to come on-line.):

- MAGIX/LEGEND processor
- Merlin Messaging Module
- 100D module
- 100 DCD module
- 100R INA Module
- 800 BRI Module

Configuration Rules for Power Supplies (assumes a mix of telephone types)

1. In Key mode, the MERLIN MAGIX 491D1 and the MERLIN LEGEND 391C1 power supplies can generally support up to **three 016 MLX, 024TDL (MAGIX only), or 016 ETR modules**, as long as no DID, OPT or E&M Tie Line modules are in the same carrier.
2. In the Hybrid/PBX mode, the 491D1 and 391C1 power supplies can generally support up to **four 016 MLX, 024TDL (MAGIX only) and 016 ETR modules**, as long as no DID, OPT or E&M Tie Line modules are in the same carrier.

In many circumstances a more accurate unit load calculation may be useful. This may include situations where modules are not fully utilized, a predominance of large multi-button telephones are used, there is a change in the equipment, or you suspect that a particular carrier has more unit loads than the power supply can handle.

Unit Load Capacity of Power Supplies

Following are the maximum unit loads for each of the power supplies:

- 391C1 & 491D1 = 96 unit loads
- 391A3 = 75 unit loads
- 391A1 & 319A2 = 54 unit loads

Here's how you determine which power supply is already installed in a plastic carrier:

- The 391A1 and 319A2 Power Supply's power switch toggles up and down, and have a gray jack between the power switch and the power "LED".
- The 391A3 Power Supply does not have a gray jack between the power switch and the power "LED", but the power switch still toggles up and down.
- The 391C1 Power Supply also does not have a gray jack between the power switch and the power "LED", but it's power switch toggles left to right.

The 491D1 Power Supply is the only power supply that can be installed in a metal carrier.

Unit Load Rules for Different Modes

A general rule to follow is that if you can distribute the DID modules and telephone modules equally across the carriers, you will prevent unnecessary drain on any one carrier.

Also, depending on the system's mode, the rules vary, as follows:

- **Unit Loads for the Hybrid/PBX Mode.** The 491D1 power supply has a maximum rating of 96 unit loads and can handle up to a total of 96 4400-Series, MLX, ETR, and MLS telephones.
- **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 generally supports four modules of any type in Key or Behind Switch mode.

Calculation of Unit Loads

1. Add up the unit load for each type of module using Table 1-4. If the total doesn't exceed 96, no further calculations are necessary. Table 1-4 assumes a mix of telephone types with no more than 50% of telephones being large, multi-button telephones (4424LD+, 4424D+, 4412D+, MLX-20L, MLX-28D, ETR-34D, and/or ETR-18D) telephones.
2. If unit loads calculated from Table 1-4 exceed 96 or if more than 50% of the telephones are large multi-button telephones, calculate the actual total using the unit load values in Table 1-5 for each type of station device and trunk (include DSS and adjuncts powered from the Processor).

If the total exceeds the maximum unit loads per power supply, try to exchange modules between carriers to reduce the load below the maximum. MERLIN LEGEND customers using a 391A1, 391A2, or 391A3 power supply may need to purchase a 391C1 power supply.

NOTE ► No empty slots are permitted between modules in MERLIN MAGIX Release 1.0 systems.

Table 1-4. Unit Loads per Module

Module App Code	Type	Unit Load
617A52	412 LS-TDL	13
617A58	024 TDL	24
617S15	100 DCD	0
617A59	100R INA	0
617N15	100D	0
617C21	008 MLX	13.5
617A54	016 MLX	27
617E34	016 T/R	12.8
617A56	016 ETR	24
617B35	800 NI-BRI	0
617G20	800 DID	8.0
617 E28	008 OPT	8.0
617D14	400 E&M	8.0
617B31	800 GS/LS-ID	0
617 E29	408 GS/LS-MLX-ID	13.5
617A49	MERLIN Messaging	0

Table 1-5. Unit Loads per Port

Port Load	Hybrid/PBX Mode	Key Mode
TDL module for 4400-Series telephones		
4424LD+	1.1	1.3
4412D+/4424D+	1.1	1.3
4400/4400D/4406D+	0.9	1.0
DSS	0	0
MLX telephone/adjunct		
MLX-20L	1.1	1.6
MLX-28	1.2	1.7
MLX-5/-10/-16 w/ or w/o display	0.9	1.2
DSS	0.7	0.9
MFM (use local PSU)	0	0
Tip/Ring telephone	0.6	0.7
ETR telephone/adjunct		
ETR-6	0.9	1.0
ETR-18	1.0	1.2
ETR-18D	1.2	1.4
ETR-34D	1.5	1.7
Trunk		
GS-LS	0	0
DID	1.0	1.0
E&M	1.4	1.4
DS1	0	0

Installing the Control Unit

2

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Overview

Installation of the basic and expansion carriers involves mounting the carriers to the backboard; connecting the ground; installing the power supply, processor, and modules into the carriers; and then attaching the front cover.

You can mount the carrier with the power supply and port modules removed from the carrier or already installed in the carrier.

Mounting an Empty Basic Carrier

This installation procedure does not require the 4 mounting brackets supplied with each carrier.

NOTE ► A basic carrier should be mounted on a backboard with 29 inches (73.66 cm) of empty space to the right. This allows enough room for system expansion of two additional carriers. There should be at least 12 inches of clearance from the top of the control unit to the ceiling to allow adequate ventilation for cooling.



WARNING:

Continue with this procedure only if you have met all of the requirements discussed in Chapter 1 of this guide.

To install an empty basic carrier, follow these steps:

1. Mark the screw-hole locations on the backboard using the carrier or the diagram in Figure 2-1 as a guide. Make sure the carrier is level before marking the holes.
-

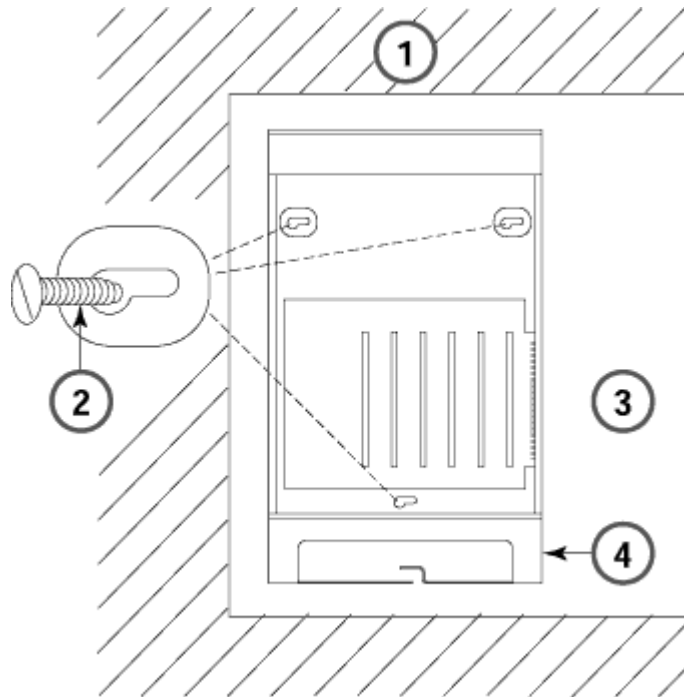


Figure 2-1. Marking the Basic Carrier Screw Holes

1	Mounting Surface
2	Mounting Screw
3	Backboard
4	Basic Carrier
-
2. Drill a pilot hole in the center of each of the three 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.
 6. Connect the ground-screw on the carrier to an approved ground using a #12 AWG or #14 AWG solid copper wire. See Figure 1-3 on page 1-10.

Mounting a Populated Basic Carrier

This installation procedure requires the use of 4 mounting brackets supplied with each carrier.

NOTE ► A basic carrier should be mounted on a backboard with 29 inches (73.66 cm) of empty space to the right. This allows enough room for system expansion of two additional carriers. There should be at least 12 inches of clearance from the top of the control unit to the ceiling to allow adequate ventilation for cooling.



WARNING:

Continue with this procedure only if you have met all of the requirements discussed in Chapter 1 of this guide.

To install a basic carrier with the power supply and port modules already installed, follow these steps:

1. Install the horizontal mounting bracket on the backboard using at least two #10 X 3/4" long wood screws supplied. Make sure that the bracket is level.
2. Install the top of the vertical mounting bracket into the slot on the horizontal mounting bracket to form a "T" as shown in the diagram below. Secure the vertical mounting bracket with at least one #10 X 3/4" long wood screw in the bottom hole.

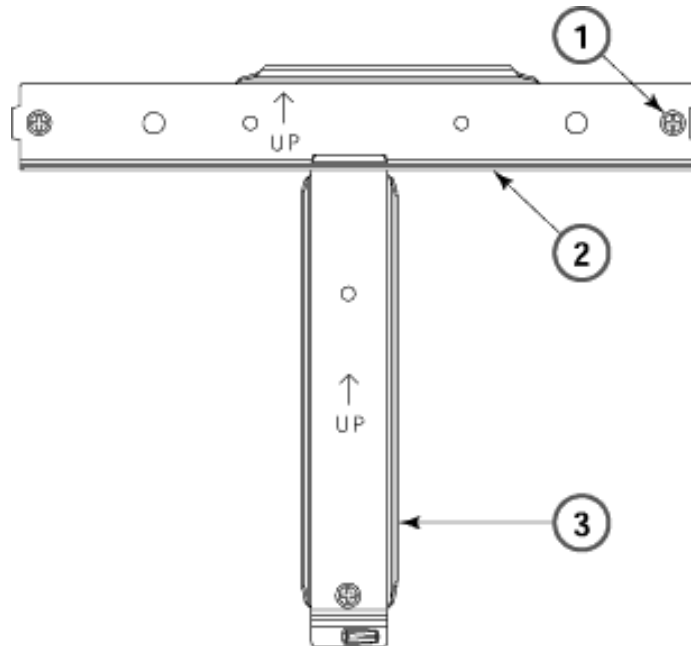


Figure 2-2. Mounting the T Brackets

- 1** #10 x 3/4" Wood Screw 3 Places
 - 2** Horizontal Mounting Bracket
 - 3** Vertical Mounting Bracket
3. Install the left and right mounting brackets on the rear of the carrier with the four #10 - 24 X 1/2" long machine screws supplied as shown in the diagram below.

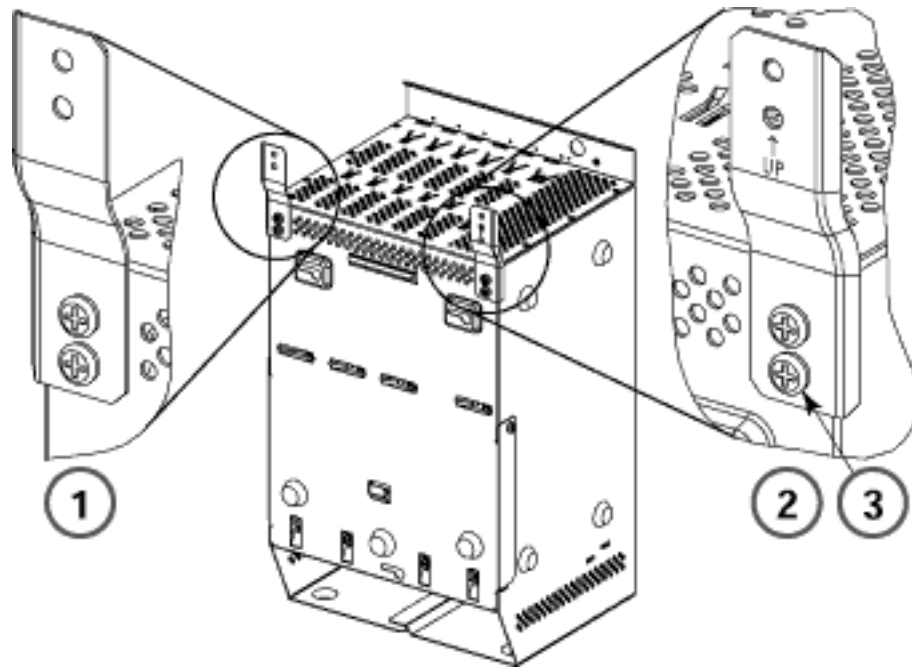


Figure 2-3. Fastening the Left and Right Brackets on the Carrier

- 1 Right Mounting Bracket
 - 2 Left Mounting Bracket
 - 3 #10 - 24 x 1/2" Machine Screws 4 Places
4. Place the carrier on to the horizontal mounting bracket approximately 2 inches to the right of its final position.
 5. The hook on the back of the carrier should rest on the top flange of the horizontal mounting bracket.
 6. Slide the carrier to the left until it stops when it bottoms out on the vertical mounting bracket.
 7. Make sure that the bottom of the carrier is secured by the vertical mounting bracket.
 8. Secure the left and right mounting brackets to the backboard with a minimum of one #10 X 3/4" long wood screw in each bracket as shown in Figure 2-4 on page 2-6.
 9. Connect the ground-screw on the carrier to an approved ground using a #12 AWG or #14 AWG solid copper wire. See Figure 1-3 on page 1-10.

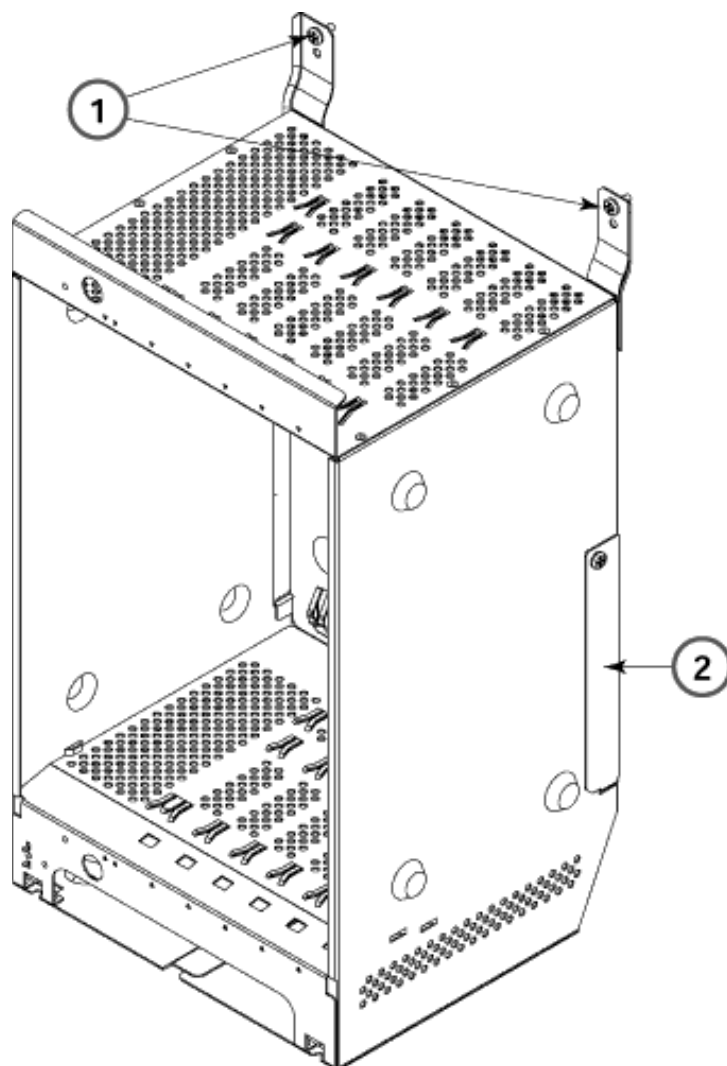


Figure 2-4. Securing the Left and Right Bracket

- 1 #10 x 3/4" Wood Screw 2 Places
- 2 Right Filler Plate

Mounting Empty Expansion Carriers

To install empty expansion carriers, follow these steps:

1. Remove the filler plate from the right side of the basic (first) carrier.
2. Align the two backplane connectors.
3. Repeat steps 1 through 3 in [“Mounting an Empty Basic Carrier”](#) on page 2-1.
4. Slide the expansion carrier to the left, align the backplane connectors and seat the expansion carrier with the basic carrier. Make sure the connectors are seated securely and completely as shown in Figure 2-5.
5. Secure the three screws.
6. Connect the ground-screw on the carrier to an approved ground using a #12 AWG or #14 AWG solid copper wire. See Figure 1-3 on page 1-10.

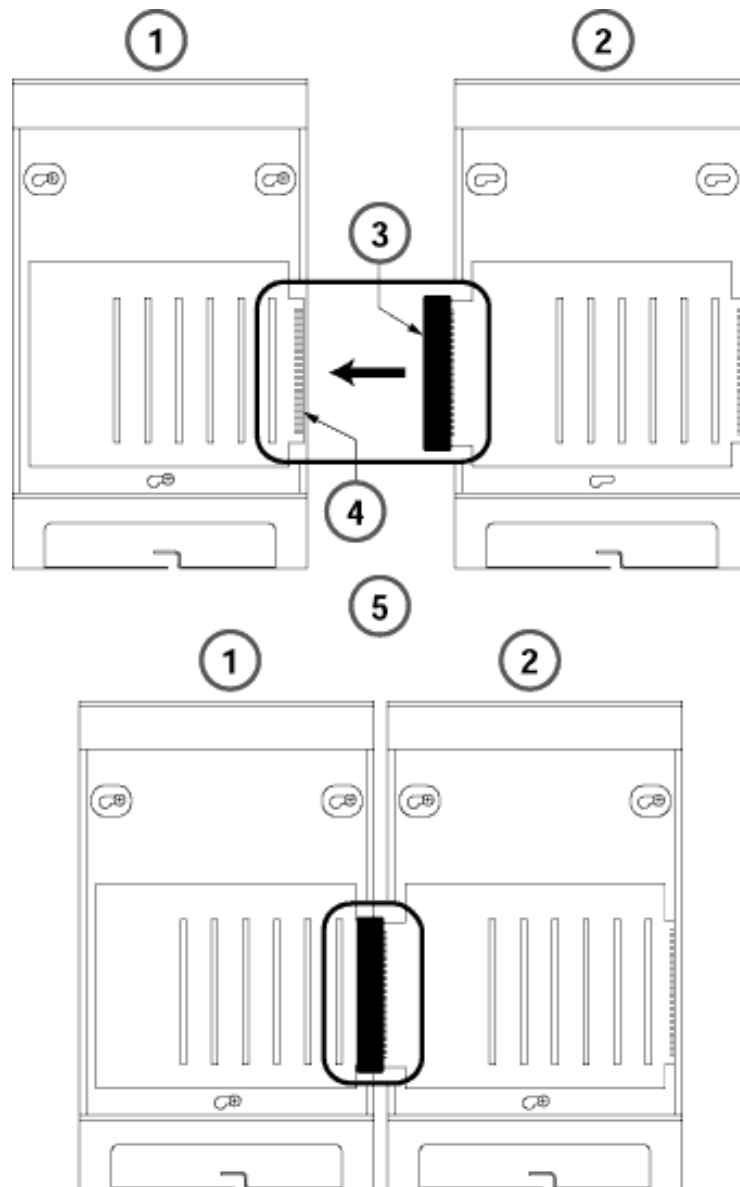


Figure 2-5. Connecting the Carriers

- 1 Basic Carrier
- 2 Expansion Carrier
- 3 Connector
- 4 Carrier Extender (under the breakaway tab)
- 5 Backboard

Mounting Populated Expansion Carriers

To install expansion carriers with modules already installed, follow these steps:

1. Abut the second horizontal mounting bracket to the first horizontal mounting bracket.
2. Repeat steps 1 through 3 in [“Mounting Empty Expansion Carriers”](#) on page 2-7 to secure the bracket and attach the mounts to the carrier.
3. Remove the filler plate from the right side of the basic (first) carrier.
4. Place the carrier on to the horizontal mounting bracket approximately 2 inches to the right of its final position. The hook on the back of the carrier should rest on the top flange of the horizontal mounting bracket.
5. Slide the expansion carrier to the left, align the backplane connectors and seat the expansion carrier with the basic carrier. Make sure the connectors are seated securely and completely as shown in Figure 2-5 on page 2-8.
6. Secure the left and right mounting brackets to the backboard with a minimum of one #10 X 3/4” long wood screw in each bracket as shown in Figure 2-4 on page 2-6.
7. Connect the ground-screw on the carrier to an approved ground using a #12 AWG or #14 AWG solid copper wire. See Figure 1-3 on page 1-10.

Installing the Power Supply

WARNING:

- *Do not install the power supply unless the carrier is connected to an approved ground.*
- *Before touching leads, connectors, pins, and other components, use a properly grounded wrist strap, to prevent damage from electrostatic discharge (ESD). The wrist strap can be clipped to the ground screw or plugged into the hole next to the ground screw.*
- *Do not attach any cables or power cords to the power supply until it is installed in the carrier.*
- *Do not power up the control unit until all of the modules and power equipment are installed. Once they are installed, refer to See [“Powering Up the System”](#) on page 2-24. Failure to comply with this procedure can result in shock hazard and/or damage to the equipment.*

CAUTION:

Grounding circuit continuity is vital for safe operation of the MERLIN MAGIX system. Never operate with grounding conductor disconnected. The ground-screw connection is located on the carrier.

The 491D1 (100-240 VAC) power supply modules can provide up to 96 unit loads of current per carrier; therefore, an auxiliary power unit is not required with these modules. In addition, three test points are provided for measuring DC voltage outputs.

NOTE ► Outside the North American continent, the power cord plug on the 491D1 power supply module may need to be replaced with an IEC (International Electrotechnical Commission) approved plug (at least 10 amps and 250 volts).

Power Specifications

Each 491D1 power supply draws a maximum current of 5.4 amperes at 117 VAC (60 Hz); the 491D1 power supply draws a maximum current of 3.1 amperes at 220 VAC (50 Hz). Output power is:

+5.1 VDC (10A), -5.1 VDC (1.5A), -48 VDC (3.0A)

Test Points

There are three voltage test points, one each for the +5.1 VDC, -5.1 VDC, and -48 Vdc outputs. These test points enable service personnel to measure the +5.1 ($\pm 5\%$), -5.1 ($\pm 5\%$) and -48 VDC ($\pm 10\%$) outputs delivered to the MERLIN MAGIX backplane. Use the ground terminal when measuring the output voltages at these test points.

Station Module Specifications

491D1 Power Supply Module:

- Power Input: 100-240 VAC, 5A, 50/60 Hz
- Power Output: +5.1 VDC $\pm 5\%$ (10A), -5.1 VDC $\pm 5\%$ (1.5A), -48 VDC $\pm 10\%$ (3.0A)
- Capacity: 96 unit loads

Installing the Power Supply Module in the Carrier

Follow these steps to install the power supply module in the carrier:

1. Align the circuit board guides inside the carrier, and slide the power supply module into the slot.
2. Make sure the connector on the back of the module mates properly with the connector on the carrier.
3. Secure the module with two screws, one on top and one on the bottom.

NOTE ► The power supply may make a ticking sound when plugged in but not turned on. This is normal operation.

Grounding the Control Unit

When grounding the control unit, use the following diagram to insure that all grounds are connected properly. For a detailed view of grounding the AC outlet see [“Grounding the AC Outlet”](#) on page 1-5.



WARNING:

An 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.

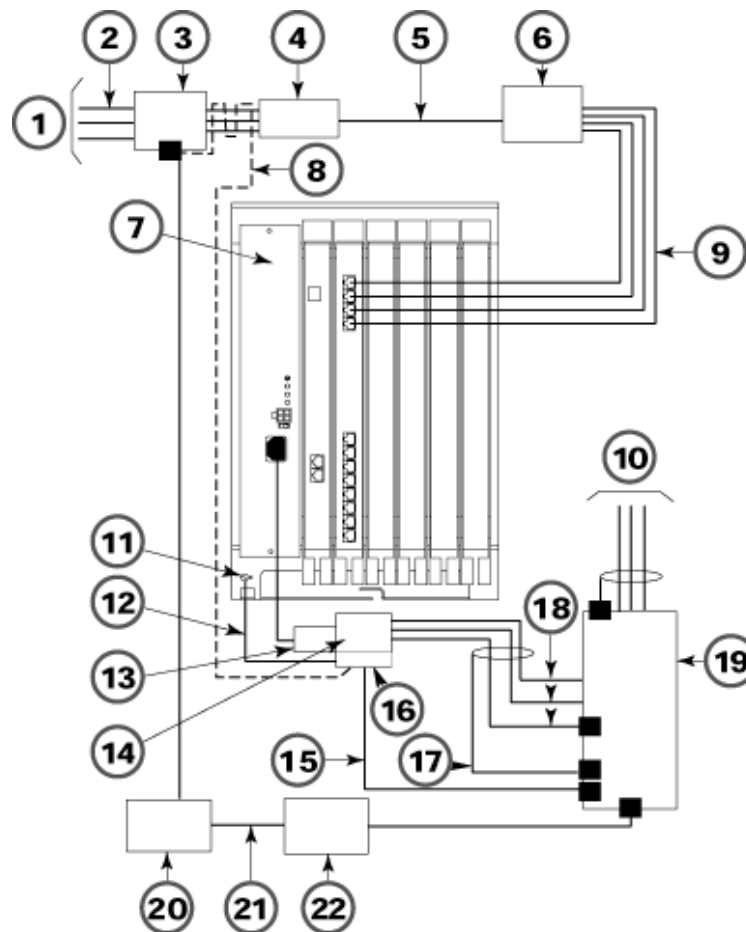


Figure 2-6. Central Office and AC Grounds

- 1 To Central Office or Serving Facility
- 2 C O Lines
- 3 C O Line Protector
- 4 Network Interface
- 5 DIW or 25 Pair Cable
- 6 C O Wiring Field
- 7 Power Supply
- 8 Coupled Bonding Conductor (optional)
- 9 D2R Cords
- 10 Commercial Power
- 11 Ground Screw Connection
- 12 #12 or #14 AWG Ground Wire
- 13 Plug
- 14 AC Outlet
- 15 #6 AWG Ground Wire
- 16 Single Point Ground Bar
- 17 Shield Ground
- 18 Black - White - GND (Green)
- 19 Power Service
- 20 Earth Ground
- 21 Bond Wire
- 22 Power Ground Rod

Approved Grounds

Approved grounds are listed below, in order of preference.

Most preferred ground:

- It must be a metal, not plastic or vinyl, underground water pipe at least inch (1.27 cm) in diameter, and in direct contact with the earth for at least 10 feet (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 inch (1.58 cm) solid rod or inch. (0.63 cm) conduit or pipe electrode driven to a minimum depth of 8 feet (244 cm).
- Plate electrode, a minimum of 2 square feet (61 square cm) of metallic surface exposed to the exterior soil.

Next preferred ground:

It must be an electrode consisting of one of the following:

- At least 20 feet (6.1 m) of one or more steel reinforcing rods, each at least inch (1.27 cm) in diameter
- 20 feet (6.1 m) of bare copper conductor not smaller than #4 AWG, encased in 2 inches (5 cm) of concrete

NOTE ► 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 feet (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 feet (77 cm) below the earth's surface.

**WARNING:**

Do not use a metal underground gas piping system--this is a safety risk.

**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). The wrist strap can be clipped to the ground-screw or plugged into the hole next to the ground-screw.

- NOTES** ►
- The ground-start pool never has trunks assigned to it automatically but must be programmed after the ground-start ports are designated. Ground-start trunks are assigned to the ground-start pool on initialization, except in a system switched for Permanent Key mode operation.
 - The 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 back up and restore system programming.

Installing the Processor

To install the processor in the carrier, follow these steps:

1. Align the circuit board guides inside the carrier, and slide the processor module into the slot.
2. Make sure that the connector on the module mates properly with the connector on the carrier as you push the processor back into place.

CAUTION:

- *To avoid damage, do not force the module. If the module does not insert easily, pry the bottom-front locking tab with a flat-blade screwdriver, remove the module, and inspect the module and carrier for damage or obstruction. The bottom-front locking tab is shown in Figure. 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.*
3. Firmly push the processor into the carrier until it locks into place.

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

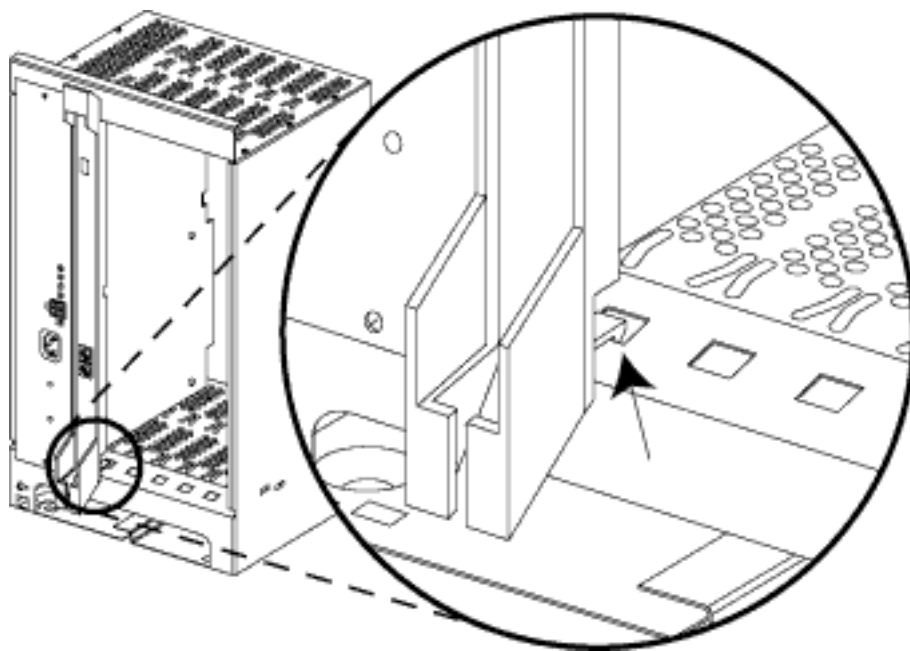


Figure 2-7. Installing the Processor into the Carrier

Installing the Modules

**CAUTION:**

When installing the modules, use a properly grounded wrist strap to prevent damage from electrostatic discharge (ESD), and avoid touching leads, connectors, pins, and other components. The wrist strap can be clipped to the ground-screw or plugged into the hole next to the ground-screw.

**WARNING:**

All unused slots must be covered with a blank panel. Remove back panels only from slots where modules will be installed.

Guidelines

Follow these guidelines when you install modules.

- 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.
- Remove a blank panel from a slot by prying up the latch at the bottom of the panel with a flat bladed screwdriver.
- 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.
- 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

Placing the Modules into the Carrier

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

1. For each 400 E&M tie line/trunk module, for jacks numbered 1 through 4 in 1-8,
Set the dual in-line packaging (DIP) switches on the front of the 400 E&M Tie Trunk module according to the E&M signaling type settings listed in 1-2 and 1-3 and shown in 1-8. The default E&M signal does not require any adjustments in the DIP switches. See [“Using Tie Trunks”](#) on page 2-18.
2. Align the circuit board guides inside the carrier, and slide the module into the slot.

3. Make sure the connector on the module mates properly with the connector on the carrier.
4. 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, pry the bottom-front locking tab with a flat-blade screwdriver, remove the module, and inspect the module and carrier for damage or obstruction. The bottom-front locking tab is shown in the illustration in *Installing the Processor*. 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.*
5. Repeat Steps 1 through 4 for each module you want to install.

Removing Modules

 CAUTION:

- *This section does not apply to the processor or power supply modules.*
- *Before inserting or removing a module, the power switch on all power supplies must be turned off.*
- *When you replace a module, use the same module type. For example, do not put a 008 MLX module in place of a 400 E&M 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 “Board Renumbering with the 016 MLX Module” in *Programming Basics* for information about board renumbering.*
- *To remove and replace a module in a carrier, follow the steps below. See Figure 2-8.*

 CAUTION:

Power down the system before removing or replacing modules. “Hot swaps” should not be performed.

1. 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 [“Installing Telephones and Adjuncts”](#) and [Connecting the Control Unit to the Network Interface.](#) For instructions on checking unlabeled wiring, see “Checking Unlabeled Wiring” in *Maintenance and Troubleshooting*.
2. Power down the system. To power down the system, follow the steps below.

⚠ CAUTION:

Follow these steps in the exact sequence.

- a. Turn off the power supply on the basic carrier.
 - b. Turn off the power supplies on the expansion carriers.
 - c. Unplug the system from the AC outlet.
3. Remove the module from the carrier. Follow these steps (see Figure 2-8 below).
 - a. Using a screwdriver, pry the tab at the bottom front of the module.
 - b. While prying the tab, pull the top handle on the module towards you and away from the carrier.
4. Inspect the module for visible damage.
5. Insert the new module (see [“Installing the Modules”](#) on page 2-15).
6. Restore the module. Refer to Chapter 7, [“Initializing and Testing the System”](#) for instructions.
7. Connect the trunk and extension cords.
8. Attach a tag, error printout, and any information that will help identify any visible problems or failure symptoms.

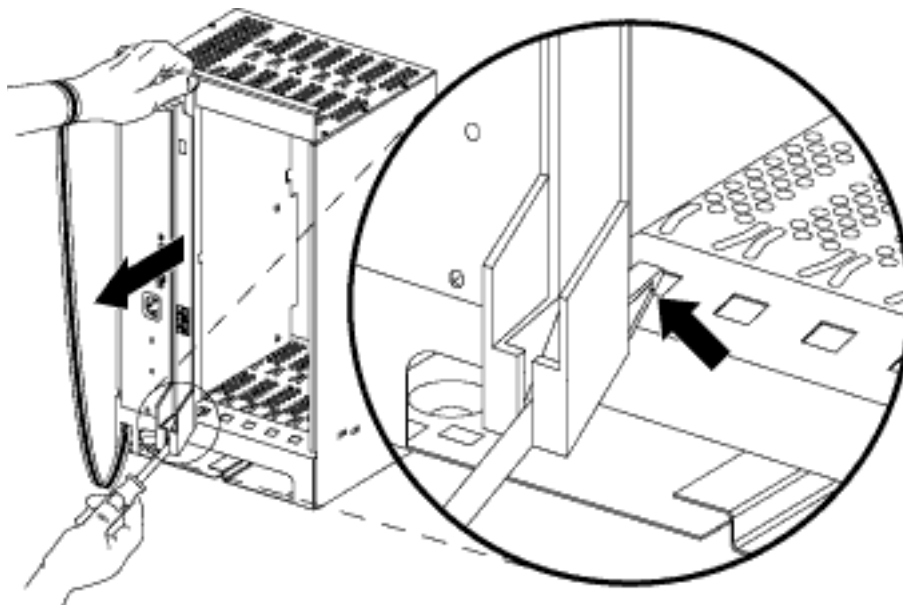


Figure 2-8. Removing a Module

Using 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 MAGIX Integrated System, the 400 E&M module is the originating and terminating unit for tie trunk operation.

The 400 E&M (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 400 E&M 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 local telephone company facilities.
 - **Type 1 Compatible.** This setting connects two systems directly (without using local telephone company facilities).
- **Type 5 Simplex Mode**
 - This setting is used on 4-wire (2-pair) circuits.

Setting the 400 E&M DIP Switches

During installation of 400 E&M (Tie Trunk) modules, refer to Table 2-1 and Table 2-2 and to Figure 2-9 for the correct DIP switch settings for varying signaling protocols.

Table 2-1. Setting the 400 E&M Module DIP Switches

Ports (as numbered in Figure 2-9)		DIP Switch Position	Signaling Type		
			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
		3	OFF	OFF	ON
		4	OFF	OFF	ON
		5	OFF	OFF	ON
1	3	6	ON	OFF	OFF or ON
		7	ON	OFF	OFF or ON
		8	OFF	OFF	ON
		9	OFF	OFF	ON
		10	OFF	OFF	ON

- NOTES** ■ 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 PBX systems it connects. The preferred signaling formats for a tie trunk originating in the system are shown in Table 2-2.

Table 2-2. Signaling Formats for the 400 E&M Module

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

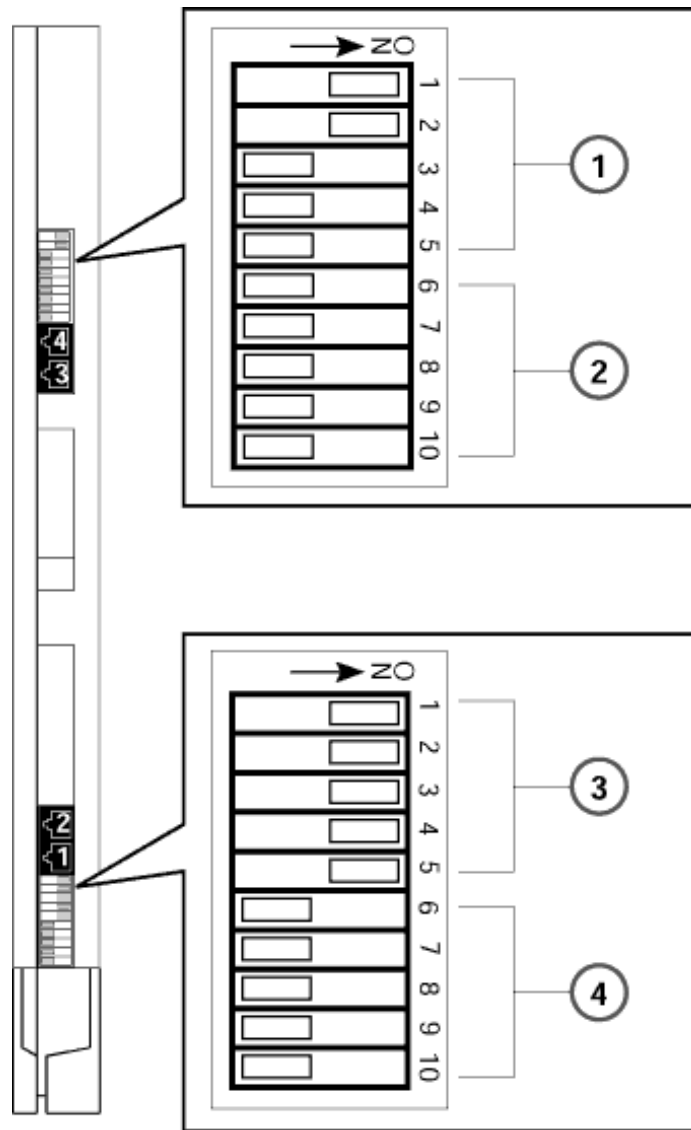


Figure 2-9. 400 E&M Module Sample Dip Switch Settings for Signaling Types 1C and 5

- 1 Switches 1 through 5 control Port 4 (1C. E&M unprotected)
- 2 Switches 6 through 10 control Port 3 (1C. E&M protected)
- 3 Switches 1 through 5 control Port 2 (5 simplex)
- 4 Switches 6 through 10 control Port 1 (1C. E&M protected)

Labeling the Jacks

After all modules have been installed, label the jacks by using the numbered labels provided with the feature module. There are two types of labels:

- Line/trunk labels have green numbers on off-white background.
- Telephone labels have blue numbers on off-white background.

Follow these steps to label the jacks on the modules:

1. 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 or carriers.

The 100D and 100R modules each have 24 numbers assigned to the line/trunk jack.

2. Label each telephone jack sequentially, 1 through 200. Begin with the module in slot 1, numbering from bottom to top on each module and working from left to right across the carrier or carriers.



CAUTION:

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

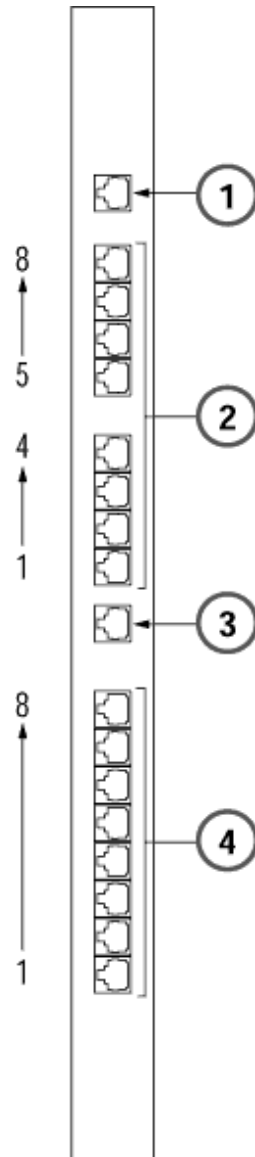


Figure 2-10. Line/Trunk and Telephone Jack Locations on Each Module

- 1 PFT Jack
Line Trunk Jacks or Extension Telephone Jacks on all 012 and 016 Modules or Off-Premise Telephone Jacks on 008 OPT Module
- 2
- 3 PFT
- 4 Extension Telephone Jacks (Analog or Digital)

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.*
- *Do not power up the system unless all carriers are connected to an approved ground.*

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 turns on.
 - The red light on the processor should turn on for 15 to 45 seconds and then turn off.
 - All indicators on the 100D, 100DCD, 100R, and 400 E&M line/trunk modules (if present) 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 these steps.

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

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

4. Unplug the system from the AC outlet.

Installing/Removing the Cover on the Carrier

WARNING:

The cover must be installed for continued safe operation of the control unit.

A front cover is needed for the carrier. Follow these steps to install the cover:

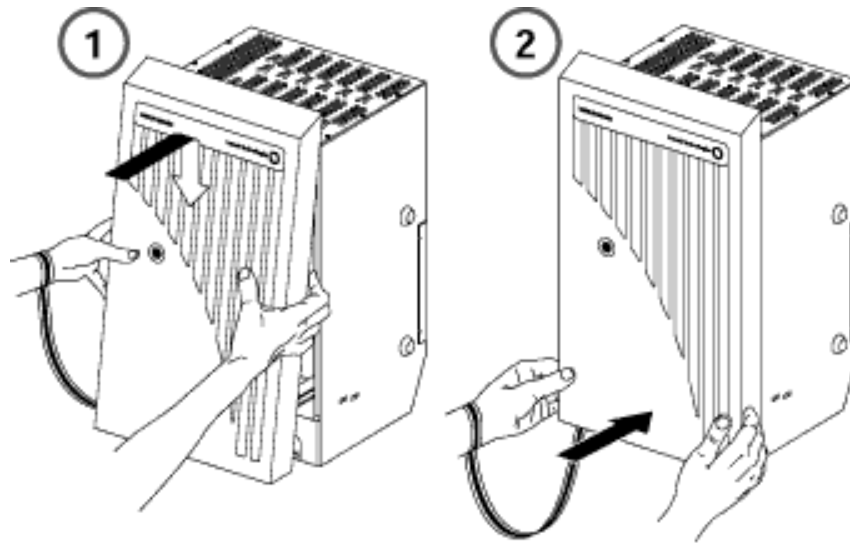


Figure 2-11. Installing the Cover for the Carrier

CAUTION:

Be sure all wires have been passed through the wire managers and wire trays at the bottom of the control unit.

1. Hook the top of the cover onto the top of the carrier.
2. Push in the bottom of the cover until it locks securely onto the base of the wire managers on the carrier.
3. Tighten the two screws at the bottom of the cover.

To remove the cover from the carrier, reverse steps 1, 2, and 3:

1. Loosen the two screws at the bottom of the cover.
2. Pull the bottom of the cover towards you until it unlocks from the base of the wire managers on the carrier.
3. Unhook the top of the cover from the top of the carrier.

Installing Telephones and Adjuncts

3

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Overview

The control unit supports MLX, 4400-Series, ETR, MLS, Transtalk 9040, Transtalk 9031, BC 905, and single-line telephones. Additionally, various adjuncts are supported that may require adapters for installation.

This chapter provides instructions for the following procedures:

- Assembling MLX telephones
- Installing Multi-Function modules
- Installing adjuncts
- Installing Direct Station Selectors
- Assembling 4400-Series telephones
- Connecting telephones to the control unit

For instructions on assembling the Transtalk 9040/9031, BC-905, or single-line telephones, refer to the instructions packaged with the telephone. For instructions on installing applications, refer to the instructions packaged with the application.

MLX Supported Phones

The control unit supports the following types of MLX telephones:

- MLX-5,
- MLX-5D,
- MLX-10,
- MLX-10D,
- MLX-10DP,
- MLX-16DP,
- MLX-20L with or without Direct Station Selector (DSS)
- MLX-28D with or without Direct Station Selector (DSS)

Various adjuncts are supported which may require Multi-Function Modules (MFMs) or other adapters for installation.

4400-Series Supported Phones

The control unit supports the following types of 4400-Series telephones:

- 4400
- 4400D
- 4406D+
- 4412D+
- 4424D+ with or without Direct Station Selector (DSS)
- 4424LD+ with or without Direct Station Selector (DSS)

The “+” sign after a model indicates that the telephone has a speakerphone. The “D” indicates a two-line display, while “LD” stands for “large display,” the seven-line display. All telephones are two-wire digital telephones.

Like the MLX telephones, each 4400-Series telephone uses two logical IDs, even though no MFM or adjunct can be attached to the 4400-Series telephone. The MERLIN MAGIX system can accommodate up to 200 4400-Series telephones.

NOTE ► When a single-line 4400 series telephone (4400/4400D) is replaced with a Multiline (4406D+, 4412D+, 4424D+, 4424LD+), or vice versa, the button maps are automatically reset to the factory settings for the new telephone.

The 4424D+ telephone can be a Direct-Line Console and can have one or two DSS4450s attached to it.

The 4424LD+ telephone has a seven-line display with eleven softkeys and 24 line buttons. Each line button has an associated pair of LEDs. Because of the larger display, you must use the external power supply that comes with the 4424LD+ telephone.

You can use the 4424LD+ telephone as a Direct-Line Console (DLC) or as a Queued Call Console (QCC). You can also use the 4424LD+ telephone as the system programming console. This telephone's functionality is almost identical to the MLX-20L telephone.

The 4424LD+ telephone can have one or two DSS4450s attached to it.

NOTE ► The power supply provided with the 4424LD+ telephone provides enough power to handle the DSS4450s as well.

The 4400-Series digital single-line and multiline telephones are designed for use with Lucent Technologies' MERLIN MAGIX? Integrated System. The 4400-Series includes display and non-display telephones and a 24-button model that can serve as the system programming console.

Most of the instructions for the use of these telephones appear in the 4400 and 4400D Telephone User's Guide and the 4406D+, 4412D+, 4424D+, and 4424LD+ Telephone User's Guide. Additionally, various adjuncts are supported which may require Multi-Function Modules (MFMs) or other adapters for installation.

ETR and MLS Supported Telephones

The control unit supports the following types of ETR (also called PARTNER telephones) and MLS telephones:

- ETR-34D Telephone
- ETR-18/18D Telephones
- ETR-6 Telephone
- MLS-34D Telephone
- MLS-18D Telephone
- MLS-12/12D Telephones
- MLS-6 Telephone
- ETR-34D Telephone
- ETR-18/18D Telephones
- ETR-6 Telephone
- MLS-34D Telephone
- MLS-18D Telephone
- MLS-12/12D Telephones
- MLS-6 Telephone
- ETR-34D Telephone
- ETR-18/18D Telephone
- ETR-6 Telephone
- MLS-34D Telephone
- MLS-18D Telephone
- MLS-12/12D
- MLS-6 Telephone

Assembling MLX Telephones

You will need to assemble an MLX telephone before connecting it 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. Adjust or Remove the Desk Stand”](#). (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-5, MLX-5D, MLX-10, MLX-10D, MLX-10DP, or MLX-16 DP telephone, you must remove the deskstand first. (Wall-mounting an MLX-5D, MLX-10D, MLX-10DP, or MLX-16DP telephone can make the display hard to read.)
- A 630B Phonemount (not included) is also required to mount an MLX-5, MLX-5D, MLX-10, MLX-10D, MLX-10DP, or MLX-16DP 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 installed the MFM, refer to [“Installing Multi-Function Modules”](#) on page 3-51.

Step 1. Adjust or Remove the Desk Stand

If you want to, you can adjust the angle of the deskstand, or remove it in order to wall-mount the telephone:

1. Place the telephone face down on a flat surface.
 2. Press on the top rear center of the deskstand to release the tab, then pull it up towards you.
 3. Insert the tab into the slot in the module cover to adjust the height.
 4. To remove the deskstand, continue to pull it up and away from the telephone.
 5. Release the deskstand from the front slot.
-

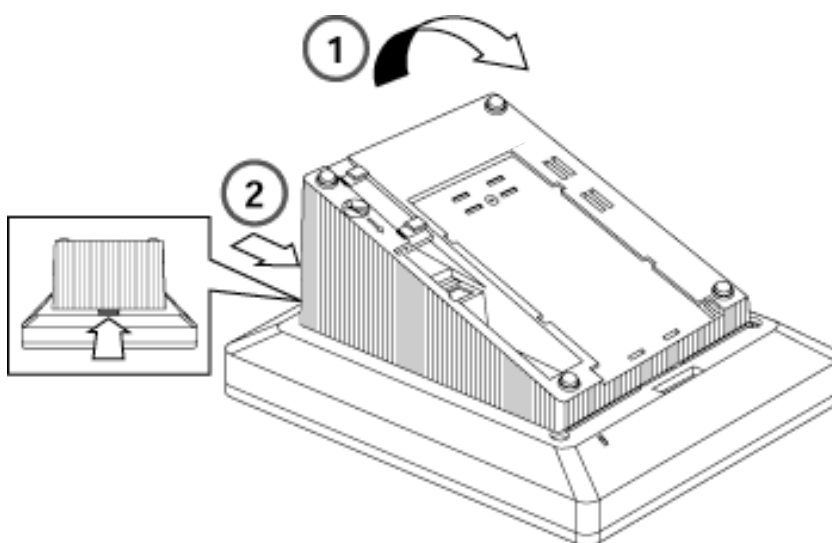


Figure 3-1. Adjusting or Removing the Desk Stand

- 1 Pull Up and Away
- 2 Press Center Tab

Step 2. Connect the Line Cords

To connect the line cords:

1. Plug one end of the D8W cord into the LINE jack on the bottom of the phone.
 2. Route the D8W cord through the cord channel on the back of the telephone.
 3. If the telephone is for desktop use, turn it face up and plug the D8W cord into the wall jack.
 4. Insert the other end of the coiled H4DU handset cord into the jack on the side of the telephone.
 5. Connect the handset.
 6. Insert one end of the coiled H4DU handset cord into the handset.
-

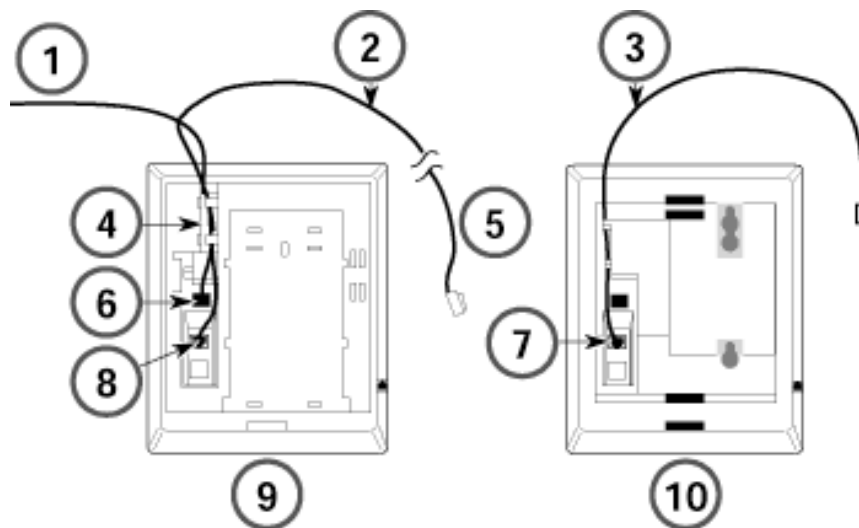


Figure 3-2. Connecting the Line Cords

1	To Adjunct
2	D6W
3	D6W
4	Cord Channel
5	To 400B
6	D4BU Connects to TEL/OTHER Jack
7	Line
8	Line
9	MLX-10 Desk Telephone
10	MLX Wall-Mounted Telephone

Step 3. Label the Extension

1. Remove the extension label by inserting 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 3-3.
2. Type or write the assigned extension number on the card. See Figure 3-4.

If you are wall-mounting the an MLX-10, MLX-10D, MLX-10DP telephone continue to Step 4 Preparing the handset holder for wall-mounting. If you are assembling a desk telephone, go to Step 5 Replace the extension label and plastic cover.

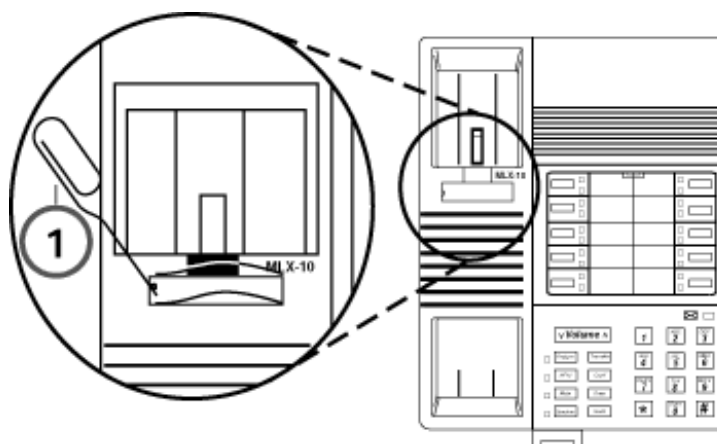


Figure 3-3. Removing the Extension Label

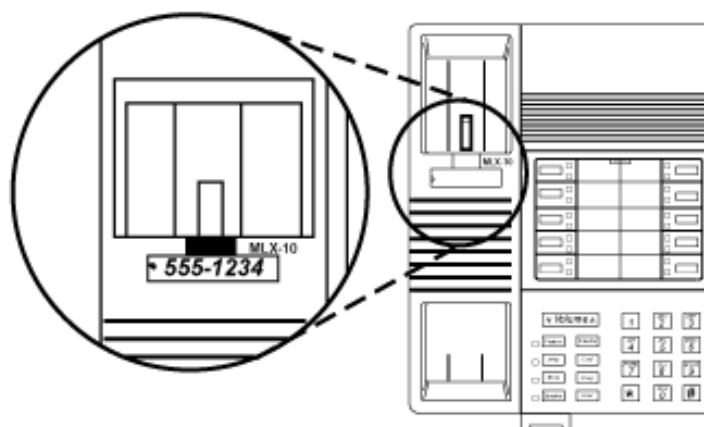


Figure 3-4. Labeling the Extension

Step 4. Preparing the handset holder for wall-mounting.

1. Remove the handset holder by pushing it up and pulling it out. See Figure 3-5.
2. Rotate the handset holder 180 degrees and replace it in its slot. See Figure 3-6.

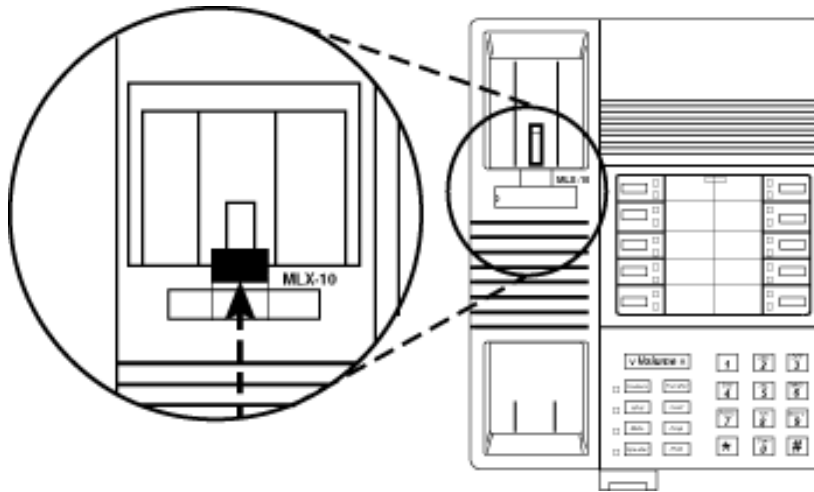


Figure 3-5. Removing the Handset Holder

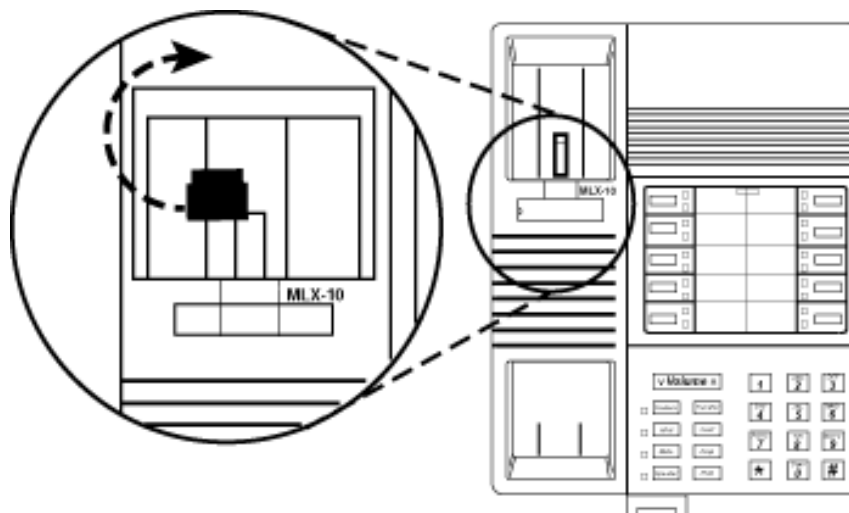


Figure 3-6. Labeling the Extension

Step 5. Replace the extension label and plastic cover

1. Insert one end into the slot and snap the other end into place. See Figure 3-7.

If you are mounting an MLX-5, MLX-5D, MLX-10, MLX-10D, MLX-10DP, or MLX-16DP wall telephone, go to Step 6 Wall mounting an MLX-5, MLX-5D, MLX-10, MLX-10DP, MLX-10D, or MLX-16DP telephone. If you are assembling a desk telephone, go to [“Step 7. Label the Button Assignment Card.”](#)

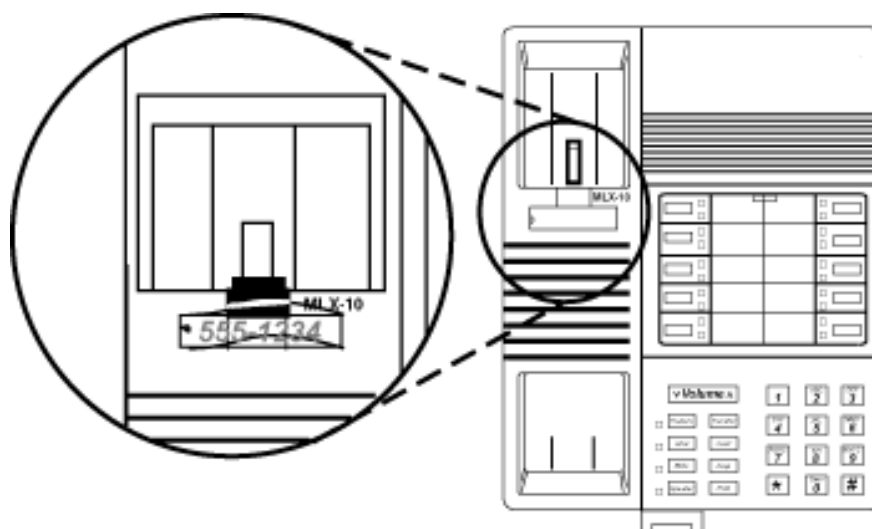


Figure 3-7. Replacing the Extension Label

Step 6. Wall mounting an MLX-5, MLX-5D, MLX-10, MLX-10DP, MLX-10D, or MLX-16DP telephone.

1. Turn over the telephone and remove the jack guard from the TEL/OTHER jack area; set the telephone aside.
 2. Unpack the 630B Phonemount and remove the modular jack from the backplate.
 3. 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 3-8.
-

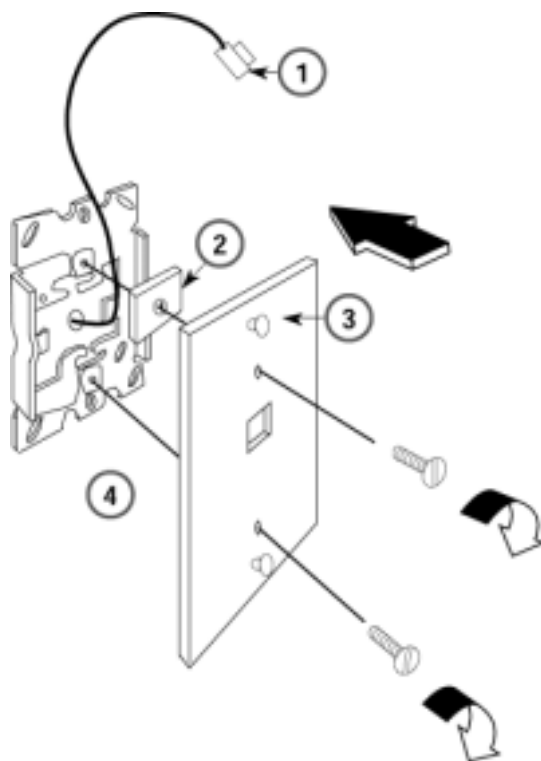


Figure 3-8. Mounting the Backplate

1	Jack Plug
2	Jack Guard
3	Mounting Plate
4	630B Phone Mount
-
4. Attach the backplate to the wall; see the instructions provided with the 630B Phonemount.
 5. 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 3-9.

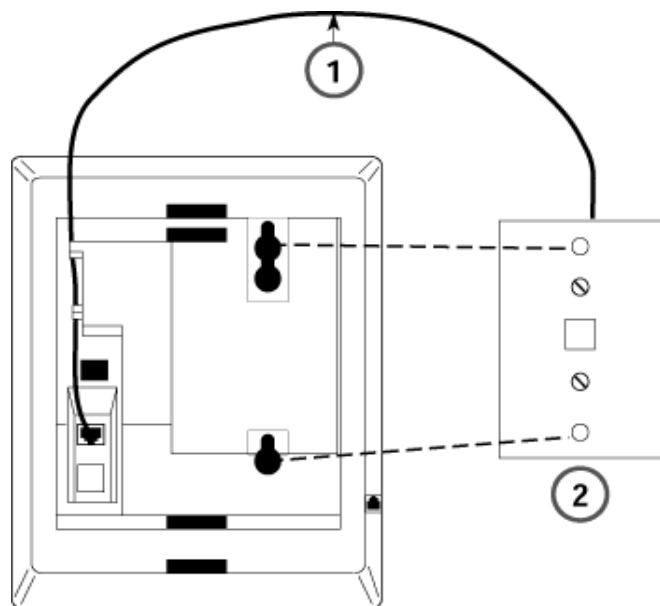


Figure 3-9. Routing the Cord Through the Backplate

- 1 D8W
- 2 Mounting Plate 630B

6. 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.
7. 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.

Step 7. Label the Button Assignment Card.

1. Pull the tab at the top of the plastic cover toward you.
2. Type or write the button assignments on the card.
3. Insert the card and replace the plastic cover. Be sure the textured side of the cover is facing you.

Step 8. Adjust the contrast on the telephone's display.

- For an MLX-20L telephone, slide the lever on the top of the telephone.
- For an MLX-5D, MLX-10D, MLX 10DP, MLX-16DP, or MLX-28D telephone, press the Menu button and select Cntrst; follow the display prompts.

Assembling 4400 Series Telephones

The icon-labeled 4400-Series telephones are digital single-line and multiline telephones designed for use with Lucent Technologies' MERLIN MAGIX? Integrated System Release 1.0i. Most of the instructions for the use of these telephones appear in the 4400 and 4400D Telephone User's Guide and the 4406D+, 4412D+, 4424D+, and 4424LD+ Telephone User's Guide.

Precautions

To reduce the risk of fire, electrical shock, and injury to persons, follow these basic safety precautions when installing telephone equipment:

- Read and understand all instructions.
- Placing equipment or other articles within two inches of the microphone, may decrease the quality of performance of the speakerphone. For 4424LD+ and 4424D+ telephones, care should be taken when connecting a DSS 4450 to ensure that placement of the DSS 4450 does not interfere with the performance of the microphone on the right side of the telephone.
- Follow all warnings and instructions marked on or packed with the product.
- This product is intended to be installed and serviced by qualified service personnel only. Do not disassemble this product. There are no user-serviceable parts inside.
- Never push objects of any kind into this product through cabinet slots, as they may touch dangerous voltage points or may short out parts, which could result in a risk of fire or electrical shock.
- Never install telephone wiring during a lightning storm.
- Never touch uninsulated telephone wires or terminals unless the telephone wiring has been disconnected at the network interface.
- Never install a telephone jack in a wet location (for example a wet basement) unless the jack is specifically designed for wet locations.
- Do not install this product near water--for example, in a wet basement location.
- Use caution when installing or modifying telephone lines.
- Use only Lucent Technologies 1151A Power Supply Unit (PEC 2404-010) with the appropriate input power cord PEC (24799). The Power Supply Unit is required for icon-labeled 4424LD+ telephones or with the icon-labeled 4424D+ when connecting a DSS 4450. The country-specific input power cord is ordered by selecting the appropriate country attribute.
- The 1151A Power Supply Unit is to be connected only to the type of main power source indicated on the marking label. The main power source wall outlet must be installed near the equipment and be readily accessible. Do not overload the wall outlet or use an extension cord.
- The input power cord used with the 1151A Power Supply Unit is equipped with a grounding-type plug appropriate for the country in which it is installed. 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.

- Do not staple or otherwise secure the input power cord to the building surfaces. Do not allow anything to rest on top of the cord. Do not locate the equipment where the cord will be abused by persons walking on top of it.
- Use only Lucent Technologies-recommended/approved 4400-Series telephone accessories.

Line Cords

Line cords are shipped with all 4400-Series telephones and the DSS 4450. The line cord varies according to the equipment:

- Clear 14-foot, 6-position line cord with two conductors (D2R)--used to connect the 4400, 4400D, 4406D+, 4412D+, and 4424D+ telephones to the communications system wall jack. If auxiliary power is needed, used to connect the 1151A Power Supply Unit to the communications system wall jack.
- Silver-Gray 14-foot, round line cord (M4BK)--used to connect the 1151A Power Supply Unit to the 4424LD+ telephone or the 4424D+ telephone when connected to a DSS 4450. One end of the M4BK cord has an 8-position plug and the other end has a 6-position plug.
- 3-foot, 8-position line cord with eight conductors (D8Y)--used to connect a DSS 4450 to a 4424LD+ or 4424D+ telephone or to another DSS 4450 via the jacks on the bottom of the DSS 4450 and the telephone.

1151A Power Supply Unit

An 1151A Power Supply Unit (PEC 2404-010) with the appropriate input power cord PEC (24799) is not automatically shipped with the telephone and must be ordered separately. The 1151A Power Supply Unit is required for icon-labeled 4424LD+ telephones or with the icon-labeled 4424D+ when connecting a DSS 4450. The country-specific input power cord is ordered by selecting the appropriate country attribute.

See [“4406D+, 4412D+, 4424D+, and 4424LD+ Jacks and the Placement of Cords”](#) on page 3-15 for instructions on installing the 1151A Power Supply Unit for an icon-labeled 4424LD+ or with the icon-labeled 4424D+ when connected to a DSS 4450.



CAUTION:

Do not use a different type of power supply from any other piece of equipment. Using another power supply can severely damage the DSS 4450, the 4424LD+ telephone, or the 4424D+ telephone.

Microphone

The microphone on the 4406D+ is located on the bottom right front of the telephone. The microphone on the 4412D+, 4424LD+, and 4424D+ telephones is located on the right side of each telephone.

⚠ CAUTION:

Placing equipment or other articles within two inches of the microphone, may decrease the quality of performance of the speakerphone. For 4424LD+ and 4424D+ telephones, care should be taken when connecting a DSS 4450 to ensure that placement of the DSS 4450 does not interfere with the performance of the microphone on the right side of the telephone.

4400 and 440D Jacks and the Placement of Cords

On the 4400 and 4400D telephones the jacks on the bottom accommodate the connection of the handset and the line cord. Refer to Figure 3-10 for jacks and placement of cords for the 4400 and 4400D telephones.

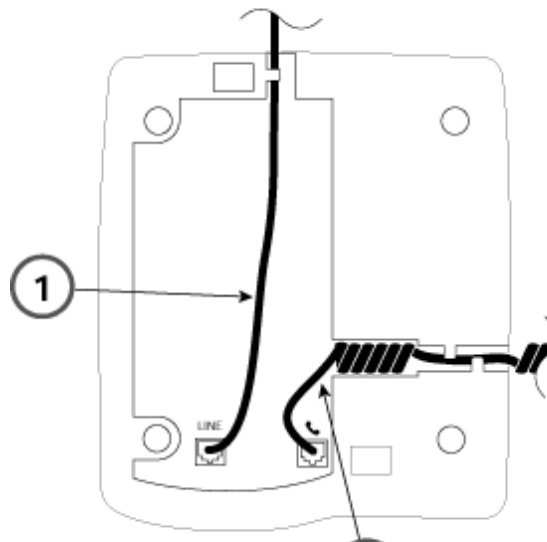


Figure 3-10. Jacks and Placement of Cords for the 4400 and 4400D Telephones

- 1** To Central Office or Serving Facility
- 2** C O Lnes

4406D+, 4412D+, 4424D+, and 4424LD+ Jacks and the Placement of Cords

On the 4406D+, 4412D+, 4424D+, and 4424LD+ telephones the jacks on the bottom accommodate the connection of the handset, the line cord, and a headset. For the 4424LD+ and the 4424D+ telephone, a wider jack marked “ADJ” is used to connect a DSS 4450.

Refer to Figure 3-11 for jacks and placement of cords for the 4406D+, 4412D+, and 4424D+ telephones when no auxiliary power is needed.

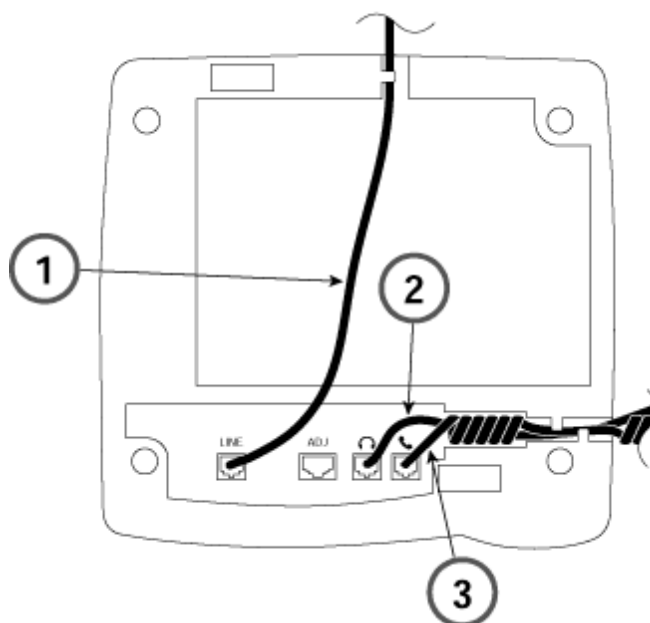


Figure 3-11. Jacks and Placement of Cords for the 4406D+, 4412D+ and 4424D+ Telephones (when no auxiliary power is needed)

- 1 Line Cord (D2R)
- 2 Headset Cord
- 3 Handset Cord

NOTE ► The 4406D+ telephone does not have a jack for the DSS 4450. The 4412D+ also has a jack marked “ADJ”, however, the jack is reserved for future use and cannot be used to connect a DSS 4450.

Wall-Mounting 4400 Series Telephones

You can mount all the 4400-Series telephones except the 4424LD+ on a wall by using the optional color-contrasted stand. The DSS 4450 cannot be wall mounted.

NOTE ► The optional wall-mounting stand can also be used with all 4400-Series telephones and the DSS 4450 to increase the viewing angle when used on a desk.

The wall-mounting stand is available in gray only. The ordering codes are as follows:

- Small Wall-Mounting Stand for use with the 4400, 4400D, and 4406D+ telephones:
PEC 4499-SML, comcode 108541210
- Large Wall-Mounting Stand for use with the 4412D+ and 4424D+ telephones:
PEC 4499-LRG, comcode 108541293

To wall mount a 4400-Series telephone, follow these steps to attach a stand to a 4400-Series telephone:

- NOTES** ►
- Before you assemble the stand, you must have all cords attached and running through their proper channels.
 - To use the stand to increase the angle of a 4400-Series telephone on a desk follow the steps below but turn the stand around so that the thinner end of the stand is at the bottom of the back side of the 4400-Series telephone and the thicker end is at the top of the 4400-Series telephone.
1. Place the tab on the thicker end of the stand (this is the moveable tab) into the slot at the bottom of the back side of the 4400-Series telephone.

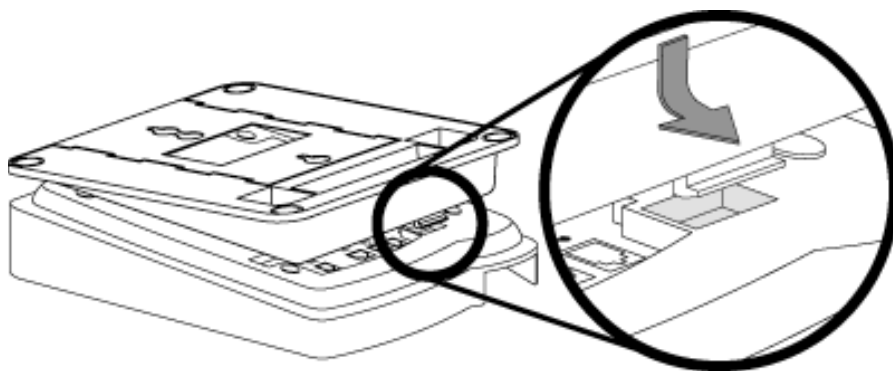


Figure 3-12. Attach Bottom of 4400-Series Telephones to Wall-Mounting Stand

2. Push up on the stand toward the top of the telephone, and place the tab on the thinner end of the stand into the slot at the top of the 4400-Series telephone.

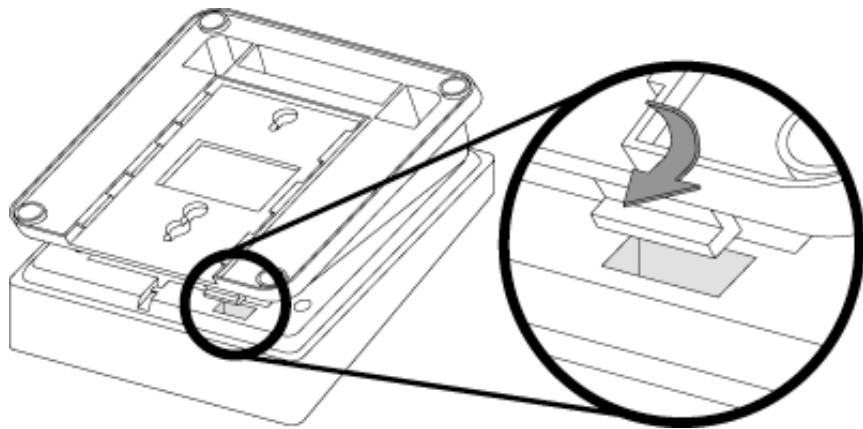


Figure 3-13. Attach Top of 4400-Series Telephones to Wall-Mounting Stand

3. After you have attached the stand to the telephone, plug the line cord into the wall jack and store the extra line cord in the open pocket space between the telephone and the stand.
4. Place the telephone against the wall so that the screwheads on the mounting plate enter the holes in the stand. Then pull the telephone down so that the screwheads slide into the cutout channels.

Single-Line Telephones

Single-line telephones are connected to tip/ring extension jacks. 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 the MERLIN MAGIX system, but their operation is slightly different. Table 3-1 lists the single-line telephones supported.

Table 3-1. Single-Line Telephones Supported

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

Table 3-1. Single-Line Telephones Supported

Model	Description
VideoPhone 2500	Provides interactive, small-screen video when both parties use one
3129-WTWA	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

Installing Cordless or Cordless/Wireless Telephones

Transtalk 9040 and Transtalk 9031 Cordless Telephones

You can connect the base unit of the Transtalk telephones as follows:

- Transtalk 9040 connects on TDL or ETR extension jack on MERLIN MAGIX Release 1.5 and later systems
- Transtalk 9040 connects only on ETR extension jack on MERLIN MAGIX Release 1.0 systems
- Transtalk 9031 connects on ETR extension jack on all releases

The following is a brief overview of procedures and considerations for installation of the MDW 9000/9010 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 MAGIX Integrated 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.

BC 905 Cordless Telephones

You can connect the base unit of the BC 905 telephone to an ETR extension jack. For instructions on installing BC 905 telephones, refer to the documentation packaged with the base unit and telephones.

Connecting Telephones to the Control Unit

Direct Connection and Cross-connect Fields

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 procedures.

- 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, and 4400-Series telephones to TDL modules; a mismatch could damage the ports and cause telephones to stop functioning.*

- *Incorrect wiring can result in users not being able to place outgoing calls. Make sure you use the proper cord. For all GS/LS modules:*
- *Use a D2R cable from an RJ11 jack.*
- *Do not use the Brand-Rex Quad cable from an E66 block.*

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

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



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.

Connecting Telephones to 412 LD-ID-TDL and 024-TDL Modules

The TDL modules have been designed using a 25-pair amphenol connector interface. Use a 25-pair cable and compatible connecting block to connect the station wiring.

The recommended cable is a B25A DE (comcode 846301000) and the connecting block is a Prewired 66 block (comcode 101238178)(Pec 2750-D02). There are two B25ADE cables available through Avaya: B25ADE in a 15 foot length (PEC 2720-01P) and B25ADE in a 20 foot length (PEC 2720-01R).

- NOTES** ►
- It is recommended that you stock up on the 25-pair cables, jumper wire, and connecting blocks in order to support the installation of the Merlin MAGIX system.
 - The 25-pair cables are available in many lengths and configurations. The cables can also be obtained from a variety of sources such as Avaya, Gray-Bar, Anixter, and many distributors of cable products.
 - It is your responsibility to decide which cables and connecting blocks to stock on your vehicle, since there are a variety of options available.

The TDL modules have a female 25-pair amphenol connector on the front of the module. The 25 pair cable is used to extend the station ports to the station wiring field. The stations are in color – coded order, beginning with white/blue as the first station port and violet/brown as station port 24. The color code scheme and information can be found in Table 3-2 on page 3-22.

To connect 4400-Series telephones to the TDL module, follow these steps:

1. Attach the male end of the 25-pair cable to the amphenol connector on the front of the TDL module as shown in Figure 3-14. Screw the top of the amphenol cable hood into the connector on the TDL module.

**CAUTION:**

Do not over tighten the screw. If the screw is over tightened, the cable will not seat at the bottom of the connector.

2. Use a tie wrap (supplied with the TDL module) to secure the cable to the loop in the module faceplate to prevent the cable from coming loose.

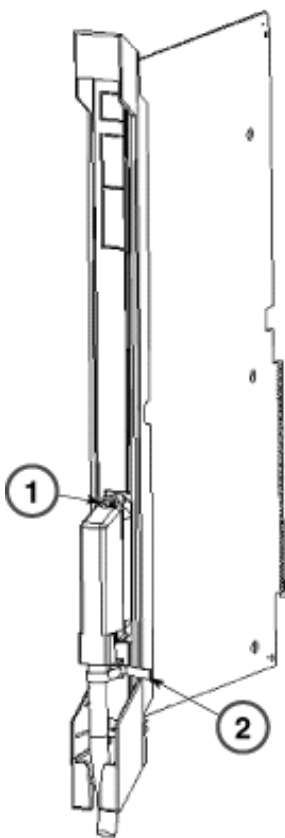


Figure 3-14. Connecting the Amphenol Connector to the Front of the TDL Module

- 1 Screw
- 2 Tie Wrap

3. Connect the loose end of the cable to a connecting block on the wall field in one of the following ways:
 - If a single ended cable is used, punch the raw end down on a 66 type block or a 110 type block.
 - If a double ended cable is used, plug it into a connecting block with a built-in amphenol connector.
4. Once you place the cable between the module and the connecting block, connect the station port to the station wiring. This is usually accomplished by using a 1-pair jumper wire between the station port connecting block and the station wire connecting block.

NOTE ► If you would like to have a modular connection available, there is an adapter that allows the 25-pair cable to plugged into it and provides 25 1-pair jacks. The adapter is: Cinch Super MOD 25, 25 Jack Adapter, comcode: 2992400125

Table 3-2. Installation Information for 412 LS-ID-TDL and 024 TDL Modules

Amphenol 25 Pair/50 pos Pin Number	66 Block/ 110 Block Position	Wire Color	412 TDL Function	024 TDL Function
26	1	White/blue	Station Tip 1	Station Tip 1
1	2	Blue/white	Station Ring 1	Station Ring 1
27	3	White/orange	Station Tip 2	Station Tip 2
2	4	Orange/white	Station Ring 2	Station Ring 2
28	5	White/green	Station Tip 3	Station Tip 3
3	6	Green/white	Station Ring 3	Station Ring 3
29	7	White/brown	Station Tip 4	Station Tip 4
4	8	Brown/white	Station Ring 4	Station Ring 4
30	9	White/slate	Station Tip 5	Station Tip 5
5	10	Slate/white	Station Ring 5	Station Ring 5
31	11	Red/blue	Station Tip 6	Station Tip 6
6	12	Blue/red	Station Ring 6	Station Ring 6
32	13	Red/orange	Station Tip 7	Station Tip 7
7	14	Orange/red	Station Ring 7	Station Ring 7
33	15	Red/green	Station Tip 8	Station Tip 8
8	16	Green/red	Station Ring 8	Station Ring 8
34	17	Red/brown	Station Tip 9	Station Tip 9
9	18	Brown/red	Station Ring 9	Station Ring 9

Table 3-2. Installation Information for 412 LS-ID-TDL and 024 TDL Modules—Continued

Amphenol 25 Pair/50 pos Pin Number	66 Block/ 110 Block Position	Wire Color	412 TDL Function	024 TDL Function
35	19	Red/slate	Station Tip 10	Station Tip 10
10	20	Slate/red	Station Ring 10	Station Ring 10
36	21	Black/blue	Station Tip 11	Station Tip 11
11	22	Blue/black	Station Ring 11	Station Ring 11
37	23	Black/orange	Station Tip 12	Station Tip 12
12	24	Orange/black	Station Ring 12	Station Ring 12
38	25	Black/green	Not Used	Station Tip 13
13	26	Green/black	Not Used	Station Ring 13
39	27	Black/brown	Not Used	Station Tip 14
14	28	Brown/black	Not Used	Station Ring 14
40	29	Black/slate	Not Used	Station Tip 15
15	30	Slate/black	Not Used	Station Ring 15
41	31	Yellow/blue	Not Used	Station Tip 16
16	32	Blue/yellow	Not Used	Station Ring 16
42	33	Yellow/orange	Not Used	Station Tip 17
17	34	Orange/yellow	Not Used	Station Ring 17
43	35	Yellow/green	Not Used	Station Tip 18
18	36	Green/yellow	Not Used	Station Ring 18
44	37	Yellow/brown	Not Used	Station Tip 19
19	38	Brown/yellow	Not Used	Station Ring 19
45	39	Yellow/slate	Not Used	Station Tip 20
20	40	Slate/yellow	Not Used	Station Ring 20
46	41	Violet/blue	Not Used	Station Tip 21
21	42	Blue/violet	Not Used	Station Ring 21
47	43	Violet/orange	Not Used	Station Tip 22
22	44	Orange/violet	Not Used	Station Ring 22
48	45	Violet/green	Not Used	Station Tip 23
23	46	Green/violet	Not Used	Station Ring 23
49	47	Violet/brown	Not Used	Station Tip 24

Table 3-2. Installation Information for 412 LS-ID-TDL and 024 TDL Modules—Continued

Amphenol 25 Pair/50 pos Pin Number	66 Block/ 110 Block Position	Wire Color	412 TDL Function	024 TDL Function
24	48	Brown/violet	Not Used	Station Ring 24
50	49	Violet/slate	CO Line 1 PFT Tip	Not Used
25	50	Slate/violet	CO Line 1 PFT Ring	Not Used

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:

- 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.
- Place a 788K1 retainer tool against the conductor pairs beneath the connecting block to be removed. See Figure 3-15.
- Use pliers to grip the connecting block in the center. See Figure 3-15.
- Move the block gently up and down and pull it out.
- 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 reseal it with the D-impact tool.
- Seat the new connecting block by using the 788J1 impact tool.
- 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 reseal the wires.
 - If you have Systimax wiring, attach the patch cord to the connecting block.

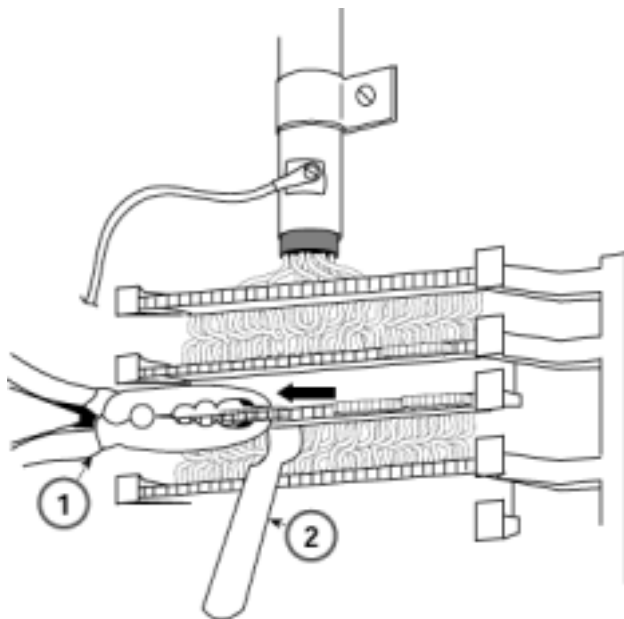


Figure 3-15. Removing the Connecting Block

- 1 Pliers
- 2 788 K1 Retainer Tool

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.

Installing an MLX Telephone Adjunct

To connect an adjunct to an MLX telephone:

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. Insert the other end of the adjunct cord into the TEL/OTHER jack on the back of the MLX telephone.

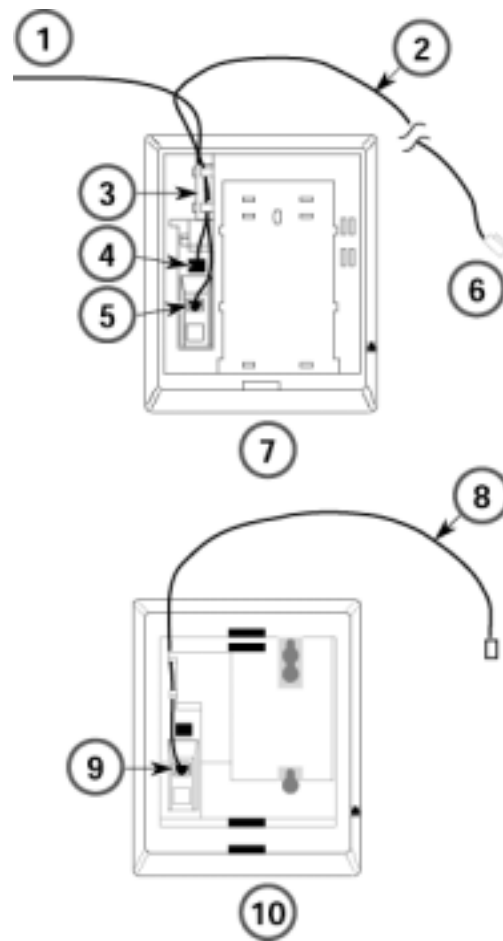


Figure 3-16. Routing the Cord(s) Through the Cord Channel

- 1** To Adjunct
- 2** D6W
- 3** Cord Channel
- 4** D4BU Connects to TEL/OTHER Jack
- 5** Line
- 6** To 400B
- 7** MLX-10 Desk Telephone
- 8** D6W
- 9** Line
- 10** MLX Wall-Mounted Telephone

Installing a Single-line Telephone Adjunct

To connect an adjunct to a single-line telephone:

NOTE ► To connect an adjunct to a 012 or 016 (T/R) module, follow the procedure [“Connecting an Adjunct to a 012 or 016 \(T/R\) Module”](#) on page 3-27.

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. Connect a 26A2 bridging adapter to the telephone.
3. Connect the cord from the adjunct to the bridging adapter.
4. Reconnect the cord from the control unit to the bridging adapter.
5. Test the adjunct by dialing its associated extension.

Connecting an Adjunct to a 012 or 016 (T/R) Module

To connect an adjunct to a 012 or 016 (T/R) module:

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. Insert the other end of the adjunct cord directly into the port for the logical ID on the 012 or 016 (T/R) module as indicated on the system form.
3. Test the adjunct by dialing its associated extension.

CTI Link

Two procedures for installing a Computer Telephony Integration (CTI) link are provided in this section. The New Installation Summary explains how to add a CTI link to the MERLIN MAGIX Integrated System. The Link Reinstatement Summary explains how to get a CTI link working again after a link shutdown.

Considerations

- The MERLIN MAGIX Integrated System supports one CTI link.
- The system must be in Hybrid/PBX mode.
- A telephone cannot be plugged into the CTI link port.
- A brand-new, 4-pair cable must be installed. No reuse of wire is supported. Proper Systimax hardware must be used, including cords and connecting blocks.

Hardware Requirements

The CTI link plugs into an available port on an 008 MLX, 016 MLX, 408 GS/LS-MLX, or 408 GS/LS-ID-MLX module. However, the firmware vintage for the module must be other than 29. An earlier or future vintage must be used for CTI link operation. If the firmware vintage is 29, the link administration is prevented and the System Programming screens tell you that the firmware 29 cannot be used.

Installation Instructions

Follow these steps in order; do not perform Step 2 before Step 1 or system programming will fail (procedure error beeps).

1. Identify a port on an 008 MLX, 016 MLX, or 408 GS/LS-ID-MLX module for the CTI link. Unplug any telephone/adjunct from that port.

- NOTES** ■ Make sure that the MLX board's firmware vintage is NOT 29. Any other vintage is acceptable, that is, earlier or future vintages after 29. If the port module has firmware vintage 29, the link administration is prevented and the System Programming screens tell the administrator that firmware 29 cannot be used.
- Do not assign the CTI link to the first and fifth ports normally reserved for the operator positions.

2. Program the communications system.

At the system programming console or on a PC using WinSPM, program the system in Hybrid/PBX mode, busy out the slot, then program that MLX port as a CTI link port. The functions for programming the system and the MLX port are in the Feature Reference under the System Programming section in the CTI feature. The functions to busy out and restore the slot are under the Maintenance option. Be sure to restore the slot after you finish the programming.

3. Plug in the CTI link. Tag the cable and/or the port as the CTI link.

As a general rule, do not plug in a CTI link unless the port is programmed as a CTI link port. Also, do not plug a telephone into a CTI link port. The other end of this wire is plugged into the ISDN link interface card installed in the NetWare server.

If you are installing an adjunct or an application into the CTI link, refer to the books that come with that adjunct/application.

Link Reinstatement Procedure

1. Plug in the CTI link, if unplugged.

As a general rule, do not plug in a CTI link unless the port is programmed as a CTI link port. Also, do not plug a telephone into a CTI link port. The other end of this wire is plugged into the ISDN link interface card installed in Step 3 of the "New Installation Summary" procedure.

2. Resume CTI link traffic.
3. Resume MERLIN MAGIX alarming for the CTI link.

Enhanced 911 Adjunct

The Enhanced 911 (E911) service allows the recipient of a 911 call to accurately identify the telephone number and physical location of the calling party. Emergency response personnel cross-check the incoming Automatic Number Identification (ANI) information with the Automatic Line Identification (ALI) or billing address associated with the telephone number. If the caller is in a multi-floor office or a multi-building campus, emergency response operators have little idea of the exact location of the caller, since the information presented is often just the main billing address of the company. You can use the E911 Partition option (the factory setting) or E911 Adjunct option to provide more specific ALI to identify the caller's location.

When programming the E911 service on the MERLIN MAGIX system and you select the E911 Adjunct option, you must connect a piece of auxiliary equipment called the E911 adjunct to the control unit. You also must program an E911 Alarm port on a T/R port and connect the E911 adjunct to this Alarm port.

The E911 Partition option requires no additional equipment.

For more information about the E911 service, including instructions on how to program the E911 service on the MERLIN MAGIX system, refer to "E911 Service" in the "Automatic Route Selection" section of the Feature Reference.

Follow these steps to connect the E911 adjunct to the control unit:

1. Program the E911 adjunct equipment according to its user manual.
2. Assign ground-start (recommended) or loop-start trunks to the E911 adjunct. Up to five trunks may be assigned.

NOTES ■ The system must be idle when you program the E911 Adjunct option.

■ Ground-start trunks assigned to the E911 adjunct must be connected to a 408 GS/LS-ID-MLX module with upgradeable firmware Release 3.2 or to a 800 GS/LS-ID module with upgradeable firmware Release 1.4

3. Connect each central office trunk cable to the appropriate port on the E911 adjunct.
4. Connect one end of a cable to the port on the E911 adjunct that connects to the system control unit and the other end to a ground-start or loop-start line port (corresponding to whether the central office trunk is ground-start or loop-start) on a module in the control unit.
5. Assign the E911 Adjunct Alarm Extension and the extension number (the first operator position is the factory setting) to which the E911 Adjunct Alarm calls will be sent.
6. Connect a cable from the Alarm port on the E911 adjunct to the E911 adjunct alarm relay.
7. Connect a T/R cable from the E911 adjunct alarm relay to a T/R extension port on a module in the control unit.
8. Change the E911 Option to "E911 Adjunct."

NOTE Do not enable the E911 Adjunct option until after the E911 adjunct has been connected and tested, the Adjunct Alarm port has been connected, and the E911 Adjunct trunks and the E911 Adjunct Alarm have been programmed.

9. Enable "Allow-11" as desired.
10. Remove 911 from any of the programmable ARS tables.
11. Create an Allowed List with 911 and assign it to Outward Restricted and Extension Status Restricted extensions that should be allowed to call the 911 Emergency Service.
12. Program an operator Alarm button on any operator Direct-Line Consoles (DLCs).

Dial Dictation Devices

You can connect a dial dictation device to one of the following:

- 016 (T/R) module
- MLX telephone with an MFM

See the ["Installing an MLX Telephone Adjunct"](#) on page 3-25 and ["Connecting an Adjunct to a 012 or 016 \(T/R\) Module"](#) on page 3-27 procedures.

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, however, connect such equipment through a UPAM, since it provides contact closure for the device.

Fax Machines

You can connect a fax machine to one of the following:

- 016 (T/R) module
- MLX telephone with an MFM

See the ["Installing an MLX Telephone Adjunct"](#) on page 3-25 and ["Connecting an Adjunct to a 012 or 016 \(T/R\) Module"](#) on page 3-27 procedures.

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:

- 016 (T/R) module
- MLX telephone with an MFM

See the [“Installing an MLX Telephone Adjunct”](#) on page 3-25 and [“Connecting an Adjunct to a 012 or 016 \(T/R\) Module”](#) on page 3-27 procedures.

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:

- 016 (T/R) module
- MLX telephone with an MFM

See the [“Installing an MLX Telephone Adjunct”](#) on page 3-25 and [“Connecting an Adjunct to a 012 or 016 \(T/R\) Module”](#) on page 3-27 procedures.

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

Headsets & Headpieces

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 Lucent Technologies 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 noise-canceling 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 noise-canceling microphone on flexible boom features windscreen and reduces background noise transmission by up to 75 percent.

Modems

You can connect a modem to one of the following:

- Single-line telephone
- MLX telephone with an MFM

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 [“Data and Video Applications”](#) 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 uses an 8-ohm music source and two attenuation controls for setting the music level.

NOTE ► PagePac Plus equipment can be used with a loudspeaker system to provide music. Or it can provide paging without a music coupler.

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 Avaya, which does not require such a license.

Figure [3-17](#) and Figure [3-18](#) show different background music configurations with single-zone and multizone paging.

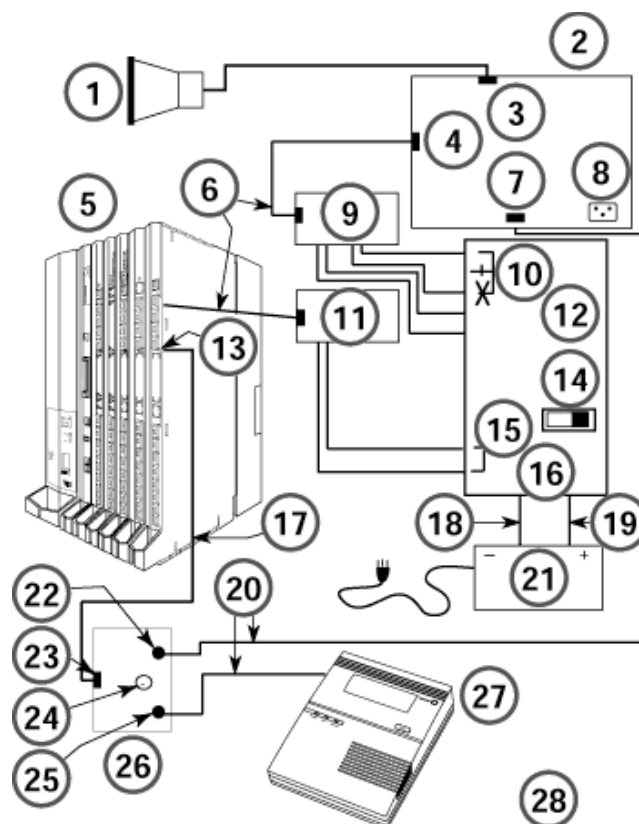


Figure 3-17. Single-Zone Paging with Background Music and Magic on Hold

1	Speaker	15	PBX
2	PagePac 20	16	Power Cable
3	Outputs	17	D4BU Cord
4	Paging Input	18	+24 V
5	Control Unit	19	GND
6	D4BU Cord	20	Standard Phono Patch Cord
7	Music In	21	117 VAC Wheelock Power Supply
8	117 VAC	22	BKGD
9	103 A	23	MOH Out
10	Universal Paging Access Module	24	MOH Vol
11	103 A	25	Music In
12	Bogen Model PAM CC405258013	26	Music Coupler CC405476452 KS-23395L-2
13	Music Port	27	Music Source
14	Access Mode Auto-Manual	28	Magic on Hold

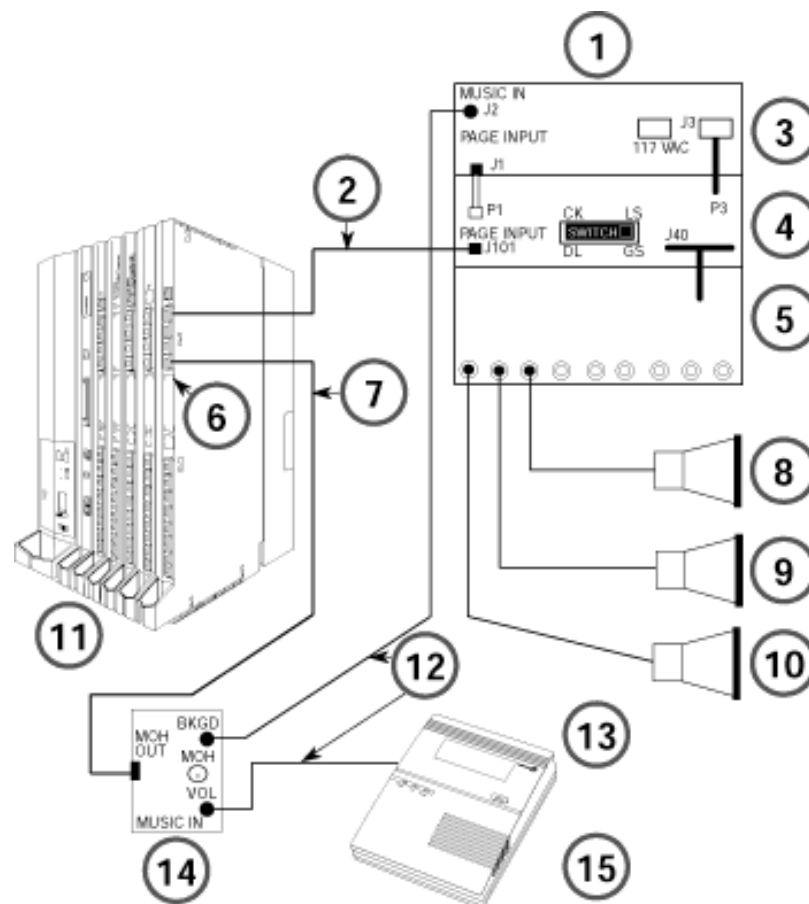


Figure 3-18. Multi-Zone Paging with Background Music, Magic on Hold, and Bidirectional Paging (Talk-Back)

1 PagePac Plus	9 Mic/Speaker
2 D4BU Cord	10 Mic/Speaker
3 AmpliCenter	11 Control Unit
4 Controller	12 Standard Phono Patch Cord
5 Zone Expansion Unit	13 Music Source
6 Music Port	14 Music Coupler CC405476452 KS-23395L-2
7 D4BU Cord	15 Magic on Hold
8 Mic/Speaker	

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

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 either an MFM in tip/ring mode or a single-line telephone jack.

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.

- 1 Speaker
- 2 PagePac 20
- 3 Outputs
- 4 Paging Input
- 5 Control Unit
- 6 D4BU Cord
- 7 Music In
- 8 117 VAC
- 9 103 A
- 10 Universal Paging Access Module
- 11 103 A
- 12 Bogen Model PAM CC405258013
- 13 Music Port

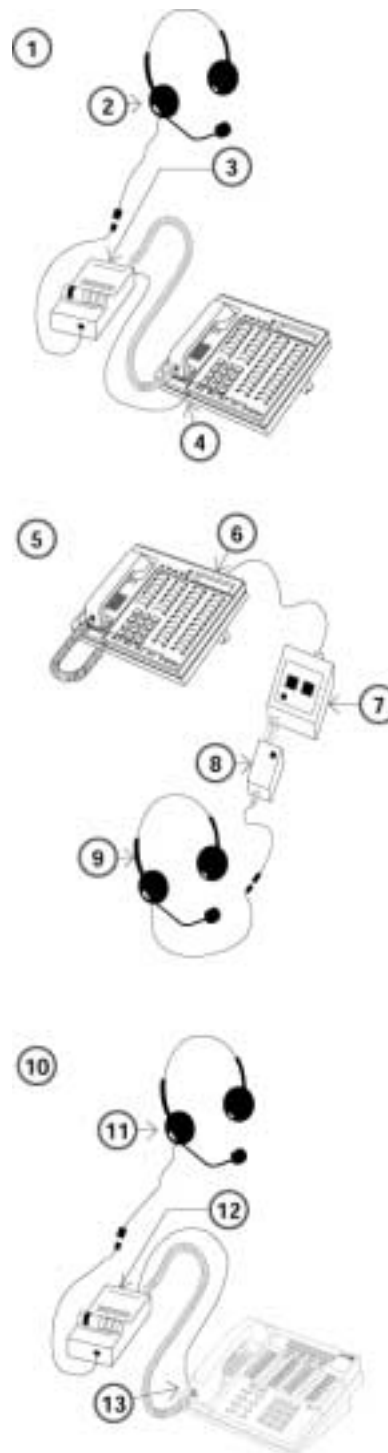


Figure 3-19. Manual and One-Touch Headset Operation

Unsupported Telephones, Adjuncts, and Adapter

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 the table below for additional notes on unsupported telephones and adjuncts.

Table 3-3. Unsupported Telephones and Adjuncts

Model	Notes
510D Personal Terminals	Digital Communications Protocol (DCP)
DCP telephones	7400 telephones and adjuncts (asynchronous data units and multiple asynchronous data units) that use DCP and are supported on the MERLIN II Communications System
MET telephones	Multi-button 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

Loudspeaker Paging Systems

You connect the paging system to the jack of an LS or GS line/trunk that is programmed for paging.

Figure 3-20, Figure 3-21, and Figure 3-22 on the following pages show various configurations for single-zone paging. Figure 3-17 on page 3-33 and Figure 3-18 on page 3-34 show single-zone and multi-zone paging configurations that include background music through a Magic on Hold audio source. Bidirectional paging, also called talk-back, is shown in Figure 3-18 on page 3-34.

Dual-Tone Multi-frequency (DTMF) Signaling

You can connect external paging systems that use dual-tone multi-frequency (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.

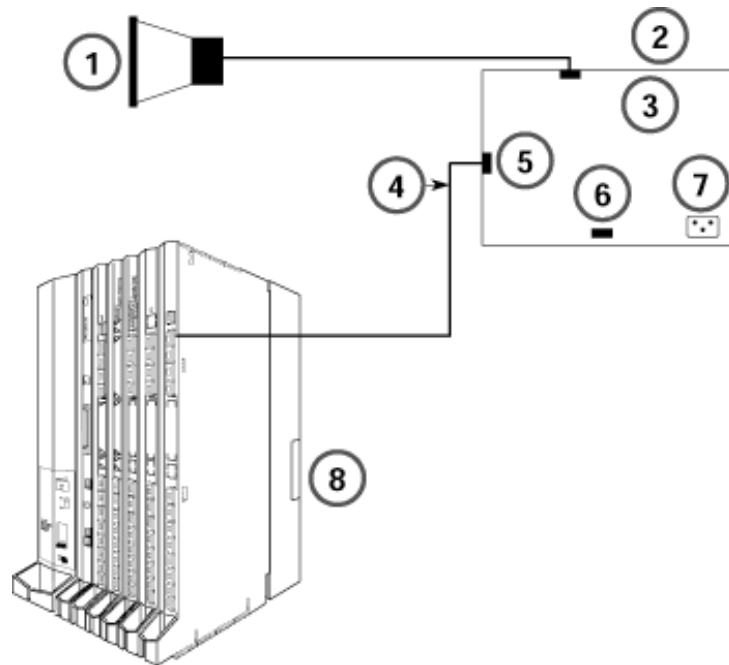


Figure 3-20. Single-Zone Paging with PagePac Plus

- 1 Speaker
- 2 PagePac Plus
- 3 Outputs
- 4 D4BU Cord
- 5 Paging Input
- 6 Music In
- 7 117 VAC
- 8 Control Unit

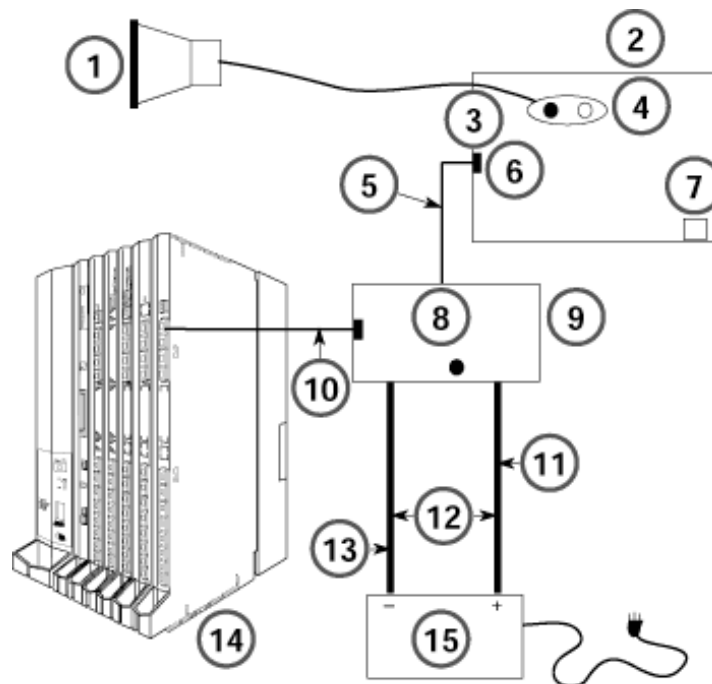


Figure 3-21. Single-Zone Paging with Customer-Supplied Amplifier

- 1 Speaker
- 2 Customer-Supplied Amplifier
- 3 Page Input
- 4 Outputs
- 5 D4BU Cord
- 6 J1
- 7 117 VAC
- 8 Harris/Dracon Model 22050-900
- 9 Loop-Start Trunk Adapter
- 10 D4BU Cord
- 11 +24V
- 12 Power Cable
- 13 GND
- 14 Control Unit
- 15 117 VAC Wheelock Power Supply

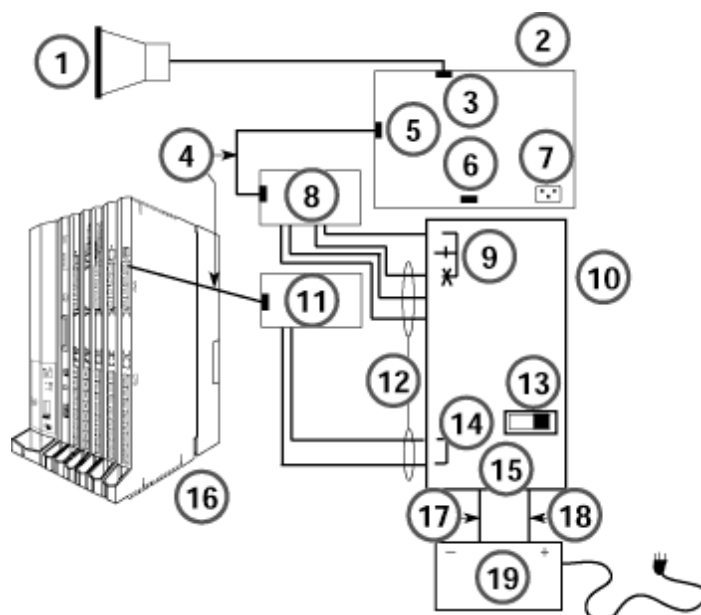


Figure 3-22. Single-Zone Paging with UPAM

1	Speaker	11	103A
2	PagePac 20	12	D/W
3	Output	13	Bogen Model PAM CC405258013
4	D4BU Cord	14	29R PBX 30T PBX
5	Paging Input	15	26, 27
6	Music In	16	Single Point Ground Bar
7	117 VAC	17	GND
8	103A	18	+24V
9	13, 14, 15	19	117VAC Wheelock Power Supply Model EPS-2401
10	Universal Paging Access Module		

Installing the DSS4450 for MLX Telephones

The Direct Station Selector (DSS) 4450 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.

The DSS 4450 has:

- 50 line buttons with one red LED by each button.
- 3 page buttons (with green LEDs) with 50 extensions each, for a total of 150 extensions that can be assigned.
- 6 buttons with green LEDs reserved for future use.

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 provided with the MFM.
 - An MLX telephone with one DSS and an MFM requires a 406943837 power unit, 400B adapter, and the D6AP cord provided with the MFM.
- If one carrier has three or more MLX telephones, each with a DSS attached, use a 406943837 power unit, 400B adapter, and D6AP cord for each MLX telephone and DSS after the first two.
- The total length of cords between the KS22911-L2 or 406743419 power supply and the MLX telephone must not be more than 50 ft. (15 m).
- Do not replace the 2-ft. (61-cm) D8AC cord (packaged with the DSS) with a longer cord. Improper operation may result.
- Connect each KS22911-L2 power supply to an AC outlet that is not controlled by a wall switch.

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

Step 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:

1. Place the DSS face down on a flat surface.
2. Press on the top rear center of the stand to release the tab, then pull the stand toward you and away from the DSS.
3. Insert the tab at the bottom of the stand into the other slot.
4. Lower the stand and press the tab at the top into the corresponding slot on the DSS.

Step 2. Install the D8AC cord on the DSS.

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

Step 3. Wire the two DSSs

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

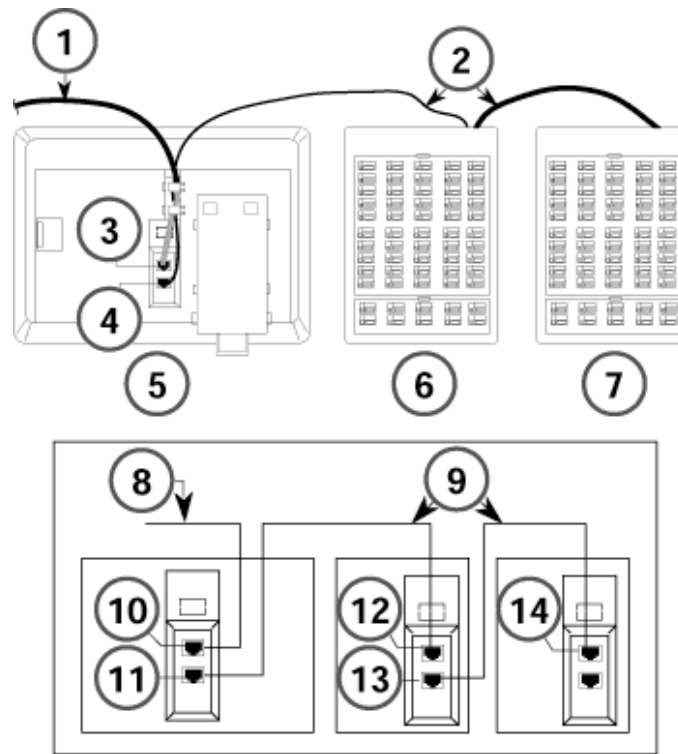


Figure 3-23. Connecting One or More DSS 4450 to an MLX Telephone

- 1 D8W
- 2 D8AC
- 3 Line
- 4 DSS
- 5 MLX Telephone
- 6 DSS 1
- 7 DSS 2
- 8 D8W
- 9 D8AC
- 10 Line
- 11 D000
- 12 In
- 13 Out
- 14 In

Step 4. Wire the telephone to the DSS unit(s).

See Figure 3-24.

1. 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).
2. 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.
3. 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.
4. Turn the telephone and the DSS unit(s) face up with the telephone now to the left of the DDS unit(s). See Figure 3-9 on page 3-11.
5. 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.
6. If auxiliary power is not required, plug the D8W cord into the wall jack and then go to [“Step 6. Label the DSS designation cards”](#) on page 3-47. If auxiliary power is required, proceed to [“Step 5. Wire for Auxiliary Power”](#).

Step 5. Wire for Auxiliary Power

1. Plug the D8W cord from the telephone into the 8-conductor modular jack of the 400B or 400B2 adapter. The combined total length of the D6AP and D8W cords you use must not be more than 50 ft. (15 m).
2. 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.

**CAUTION:**

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

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

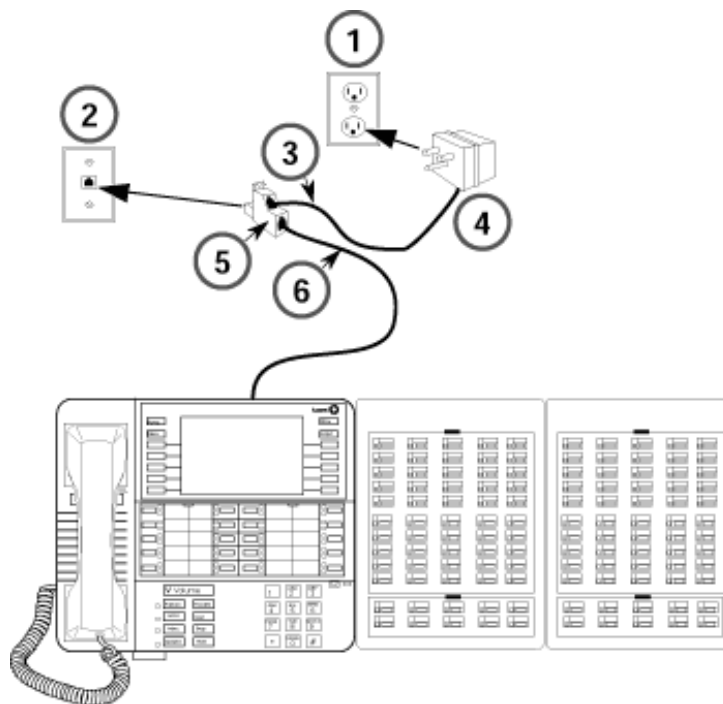


Figure 3-24. Wiring an MLX Telephone for Auxiliary Power

- 1 AC Power Outlet
- 2 Wall Jack
- 3 D6APr
- 4 Power Supply
- 5 400 B2 Adapter
- 6 D8W

Step 6. Label the DSS designation cards

1. Pull the tab at the top of the large plastic cover and rotate the cover towards you.
2. Remove the cover and the large designation card.
3. 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.)
4. The button assignments on the designation card should be by dial plan extension number, not by logical ID port number.
5. Replace the card and the plastic cover; make sure the coated side of the cover is facing up.
6. Repeat this step to remove the small plastic cover and to label the small designation card.
7. 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.

Installing the DSS 450 for 4400 Series Telephones

One or two Direct Station Selector (DSS) 4450s can be connected to a 4424LD+ or 4424D+ telephone to enhance the call-handling capabilities of a system operator with a Direct-Line Console (DLC) or a Queued Call Console (QCC). When connected to a 4424LD+ telephone used as a system programming console, the DSS 4450 facilitates system programming and centralized telephone programming procedures.

Most of the instructions for the use of the DSS 4450 by a system operator appear in the Direct-Line Console Operator's Guide and the Queued Call Console Operator's Guide. Instructions for use of the DSS 4450 during system programming or centralized telephone programming appear in System Programming.

The DSS 4450 has:

- 50 line buttons with one red LED by each button.
- 3 page buttons (with green LEDs) with 50 extensions each, for a total of 150 extensions that can be assigned.
- 6 buttons with green LEDs reserved for future use.

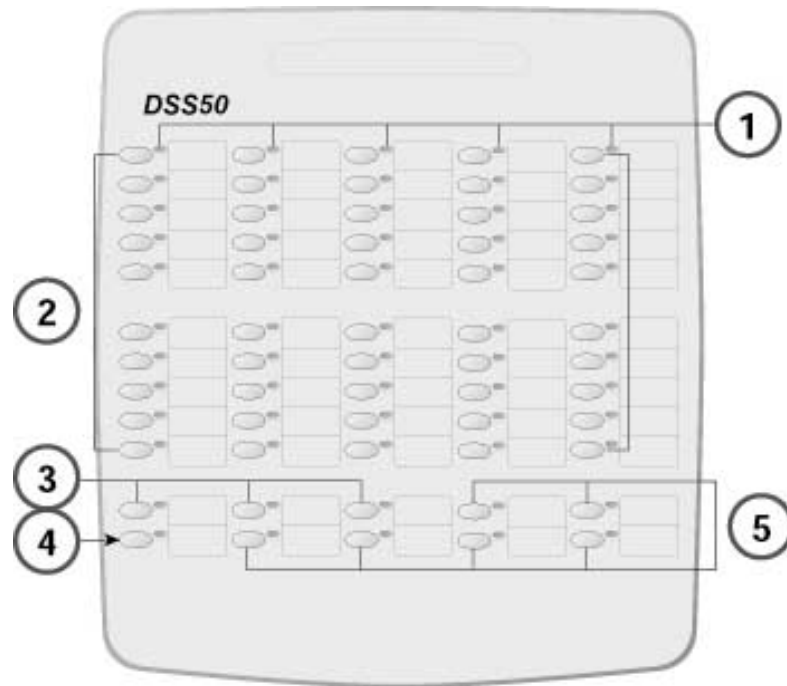


Figure 3-25. DSS4450 for 4400-Series Telephones

- 1 LEDs (50)
- 2 Line Buttons (50)
- 3 Page Buttons
- 4 Message Status Button
- 5 Reserved Buttons

Connecting the DSS 4450 and Auxiliary Power Supply Unit to the Telephone

You may connect up to two Direct Station Selector (DSS) 4450s to a 4424LD+ or 4424D+ telephone. Use the "ADJ" jack on the bottom of the telephone for this purpose. The 4412D+ also has a jack marked "ADJ", however, the jack is reserved for future use and cannot be used to connect a DSS 4450.

NOTE ► Use only the 8-position (D8Y) cord packaged with the DSS 4450 to connect it to a 4424D+ or 4424LD+ telephone or to another DSS 4450.

Follow these steps and refer to Figure 3-26:

1. Turn the telephone and each DSS 4450 face down.
2. Connect the one end of the D8Y line cord (supplied with the DSS 4450) to the ADJ jack on the telephone. Connect the other end of the D8Y line cord to the IN jack of the first DSS 4450 (next to the telephone).
3. If you are connecting only one DSS 4450, go to Step 4.

If you are connecting a second DSS 4450, connect one end of the D8Y line cord (supplied with the DSS 4450) to the OUT jack of the first DSS 4450 connected in Step 2. Connect the other end of the D8Y line cord to the IN jack on the second DSS 4450 (farthest from the telephone).
4. Connect one end of the satin-silver D4BU line cord (packaged with the 4424LD+ telephones) to the LINE jack of the telephone. Connect the other end of the satin-silver D4BU line cord to the TEL jack of the Auxiliary Power Supply Unit.
5. Connect one end of the clear D2R line cord (packaged with the 4400-Series telephones and the DSS 4450) to the LINE jack of the Auxiliary Power Supply Unit. Connect the other end of the clear D2R line cord to communications system wall jack.
6. Connect the Auxiliary Power Supply Unit into a 120 vac wall outlet.
7. Turn the telephone and the DSS 4450s face up.

NOTE ► If the telephone does not work properly after all cords are connected, check to be sure that the satin-silver D4BU line cord and the clear D2R line cords are connected properly as shown in Figure 3-26.

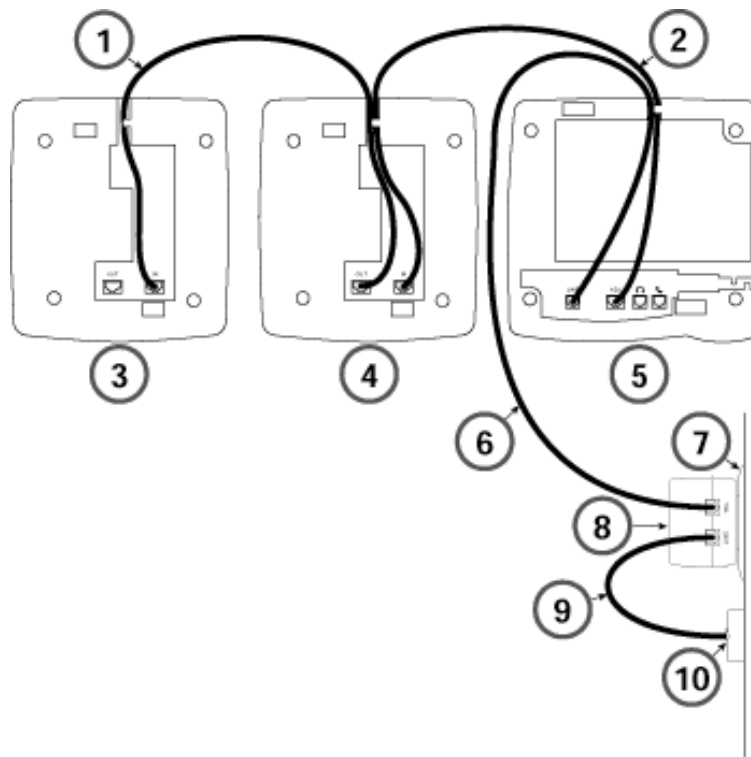


Figure 3-26. Connecting Two DSS 4450s and an Auxiliary Power Supply Unit to a 4424D+ or 4424LD+ Telephone

- 1 DSS 4450 Cord (D8Y)2
- 2 DSS 4450 Cord (D8Y)
- 3 2nd DSS
- 4 1st DSS
- 5 Telephone
- 6 Line Cord (D2R)
- 7 Grounding Type Power Outlet
- 8 Auxiliary Power Supply
- 9 Line Cord (D2R)
- 10 Communications System Wall Jack

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 both can send or 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 3-27:
 - KS22911 power supply
 - 400B or 400B2 adapter
 - D6AP cord

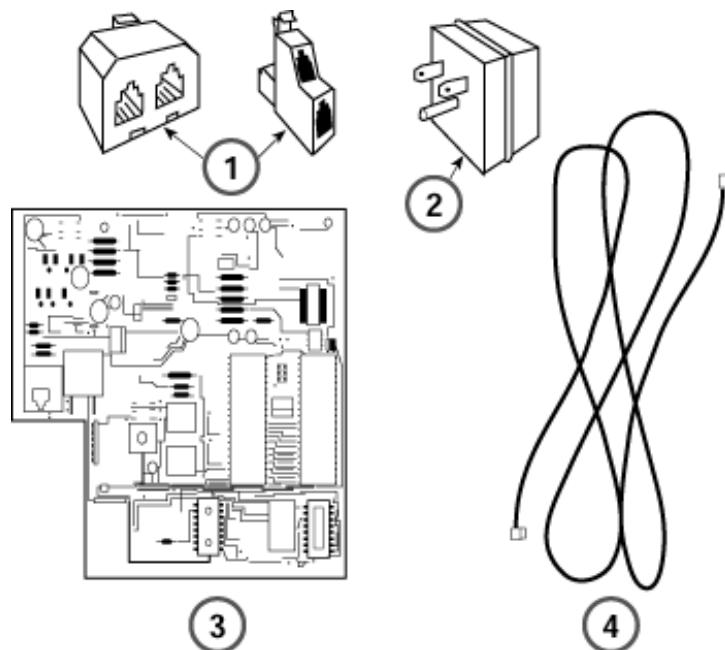


Figure 3-27. Multi-Function Module Packing List

- 1 400B Adapter or 400B2 Adapter
- 2 Power Supply (KS22911)
- 3 Multi-Function Module
- 4 D6AP Cord (7 feet long)



CAUTION:

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.

Step 1. Remove the User Card Tray and Line Cable

1. Place the telephone face down on a flat surface.
 2. Remove the user card tray and line cable from the bottom of the deskstand.
-

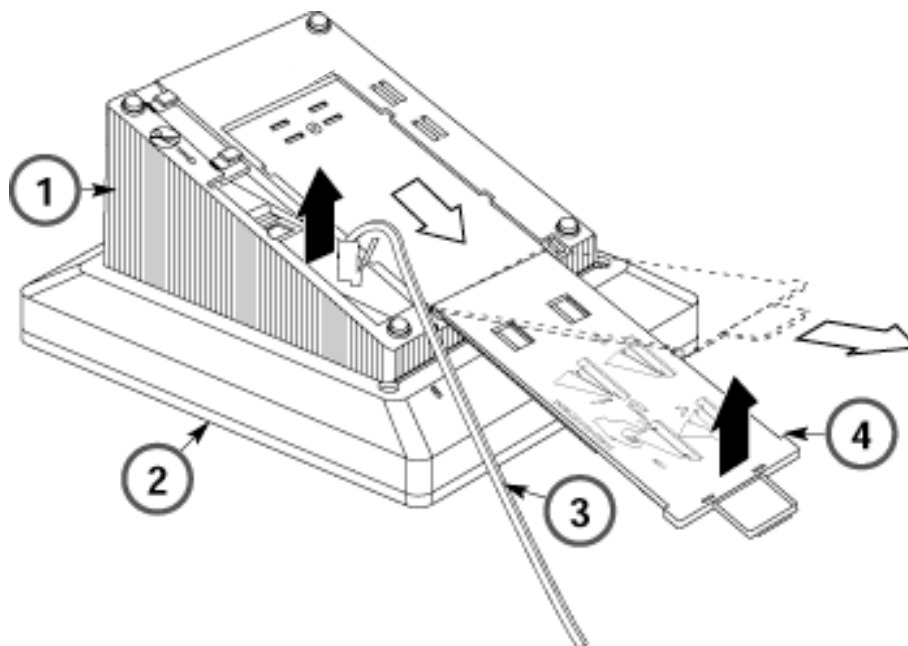


Figure 3-28. Removing the User Card Tray and Line Cable

1	Deskstand
2	Telephone Base
3	Line Cable
4	Card Tray

Step 2. Release and Remove the Desk Stand

1. Press on the top rear center of the deskstand to release the tab.
 2. Pull the deskstand up toward you and swing away from the telephone.
-

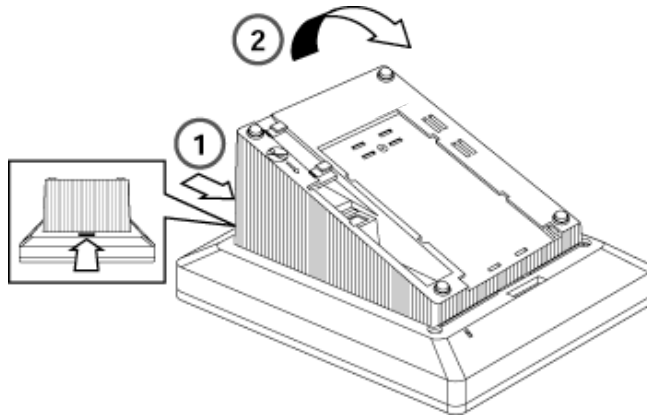


Figure 3-29. Releasing the Deskstand

- 1 Release tab
 - 2 Deskstand up and away from telephone
 3. Lift the deskstand out of the locating slot in the telephone base as shown in Figure 3-30 and place to one side.
-

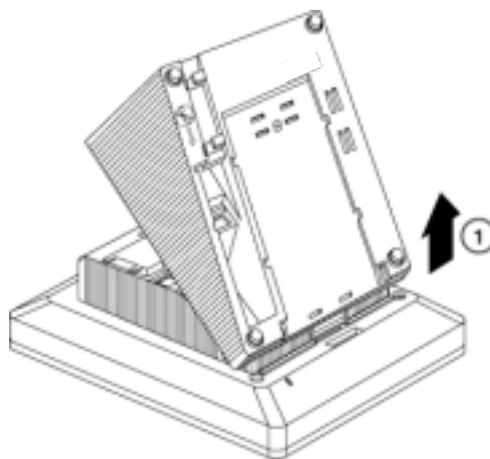


Figure 3-30. Removing the Deskstand

Step 3. Release and Remove the Module Cover

1. Use a screwdriver to remove the screw in the lower right-hand corner of the module cover.
-

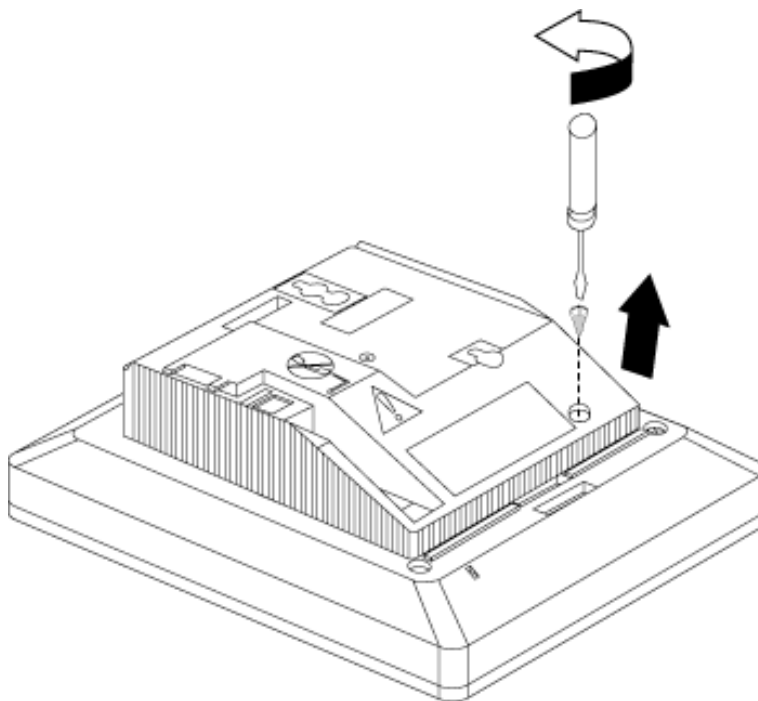


Figure 3-31. Releasing the Module Cover Screw

2. Press the center of the right side of the module cover with one hand to release the locking tab.

3. Swing open the module cover to release it from the left side locating slot. See Figure 3-32.
-

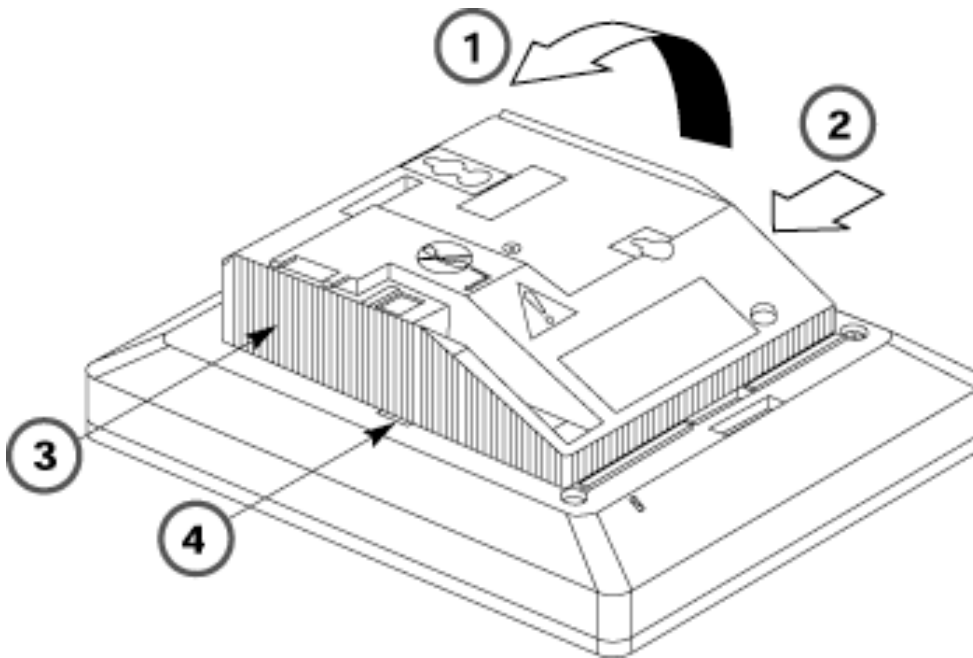


Figure 3-32. Releasing the Module Cover

- 1 Pull Up and Away
- 2 Press Center Tab to Release
- 3 MFM MModule Cover
- 4 Locating Slot

4. Lift module cover out of locating slot and set aside as shown in item 1 in Figure 3-33.

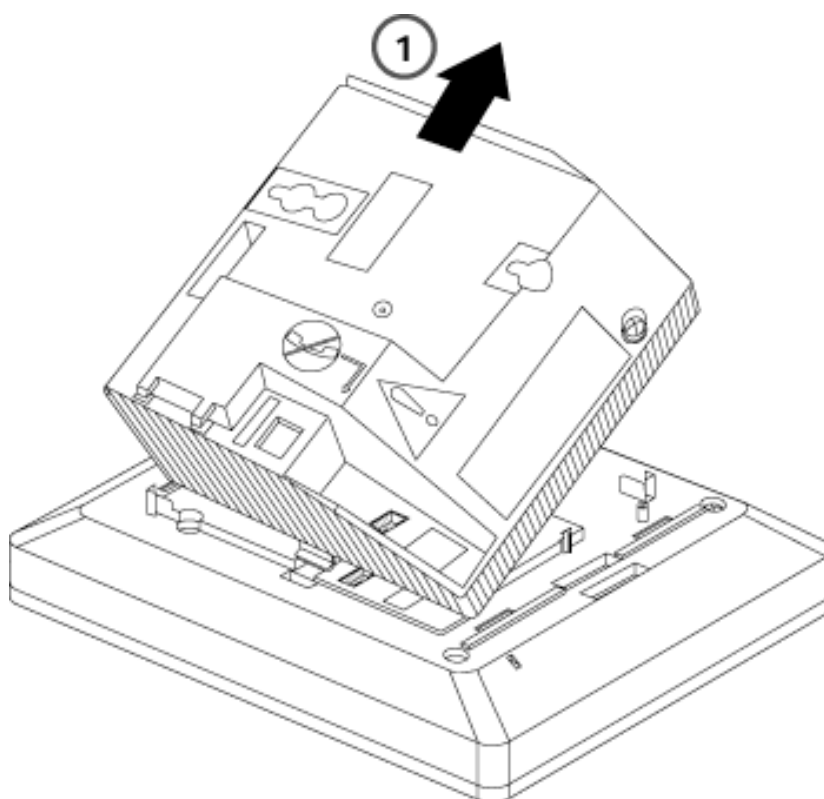


Figure 3-33. Removing the Module Cover

5. If you are installing a new MFM, go to [“Step 5. Install a New MFM”](#) on page 3-59. If you are resetting jumpers on an existing MFM, go to [“Step 6. Set Or Adjust the MFM Jumpers”](#) on page 3-60. If you are removing an existing MFM, continue to [“Step 4. Remove an Existing MFM Module”](#).

Step 4. Remove an Existing MFM Module

1. Disconnect any cords attached to the phone and note the connections so that you can reconnect the cords to the appropriate jacks later.
 2. Locate the MFM locking tabs on the top and bottom of the telephone base, then spread the tabs apart to release the MFM.
 3. Grasp the MFM by the edges and pull it up to free the connector pins. Do not touch the connector pins.
 4. Set the MFM aside on a clean surface.
-

- 1 Locking Tab
- 2 Line Jack
- 3 Headset Jack
- 4 Locking Tab
- 5 Socket
- 6 Connector Pins
- 7 Locking Tab

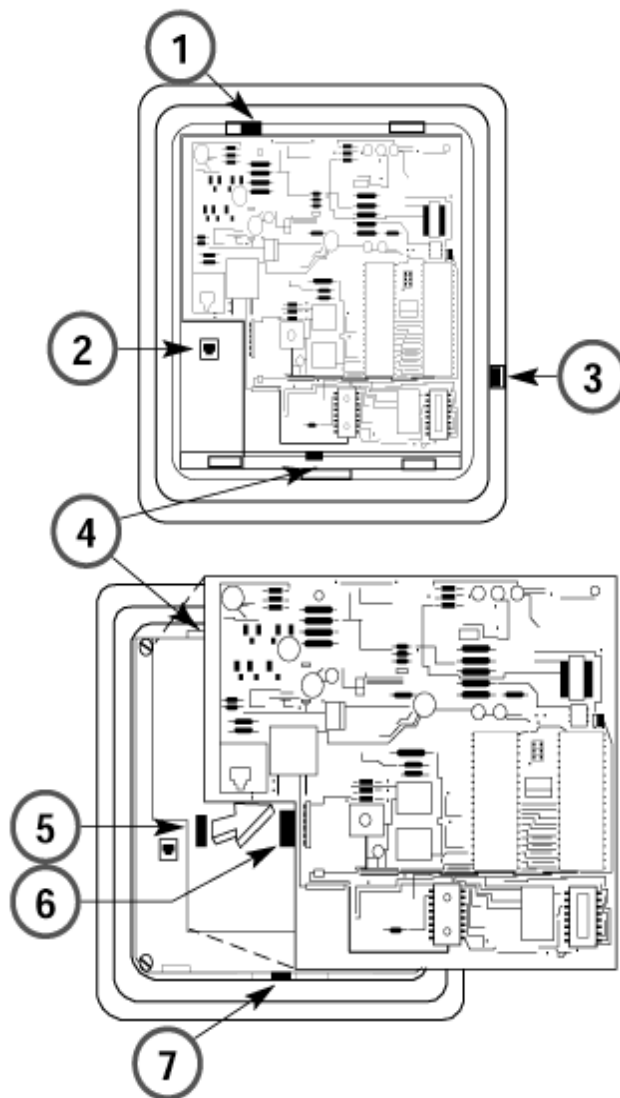
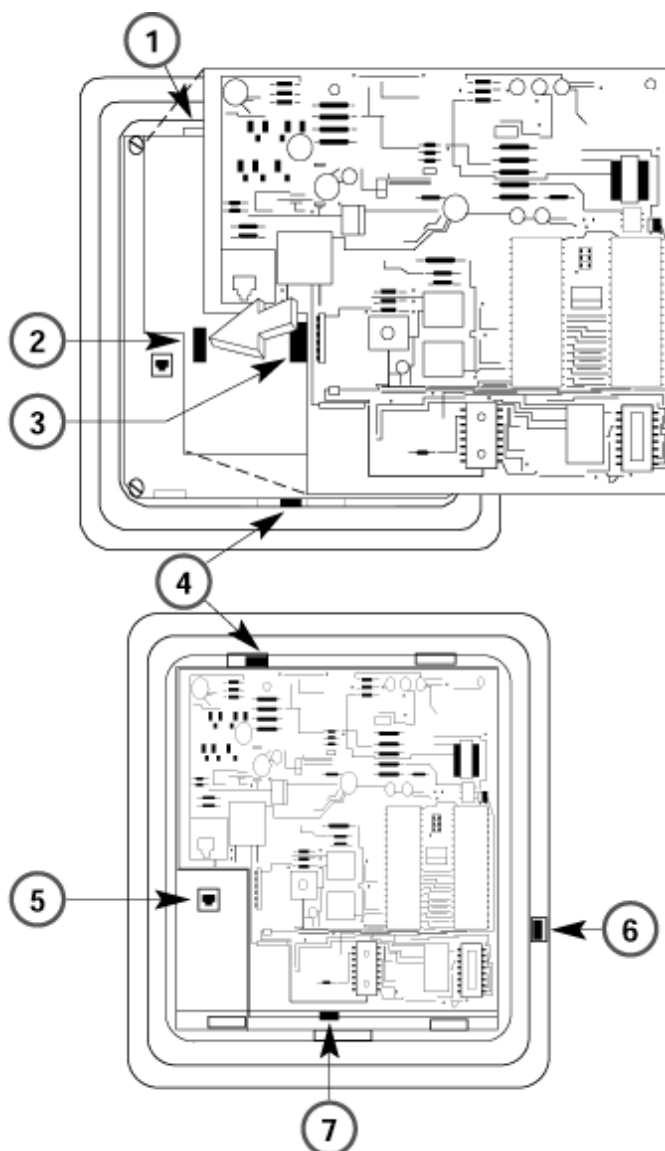


Figure 3-34. Removing an MFM Module

Step 5. Install a New MFM

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

- 1 Locking Tab
- 2 Socket
- 3 Connector Pins
- 4 Locking Tab
- 5 Line Jack
- 6 Handset Jack
- 7 Locking Tab

**Figure 3-35. Installing an MFM**

Step 6. Set Or Adjust the MFM Jumpers

1. Pull the four connectors off the MFM module.
2. Place the connectors over the appropriate pins for the required operation and push down to secure into place.

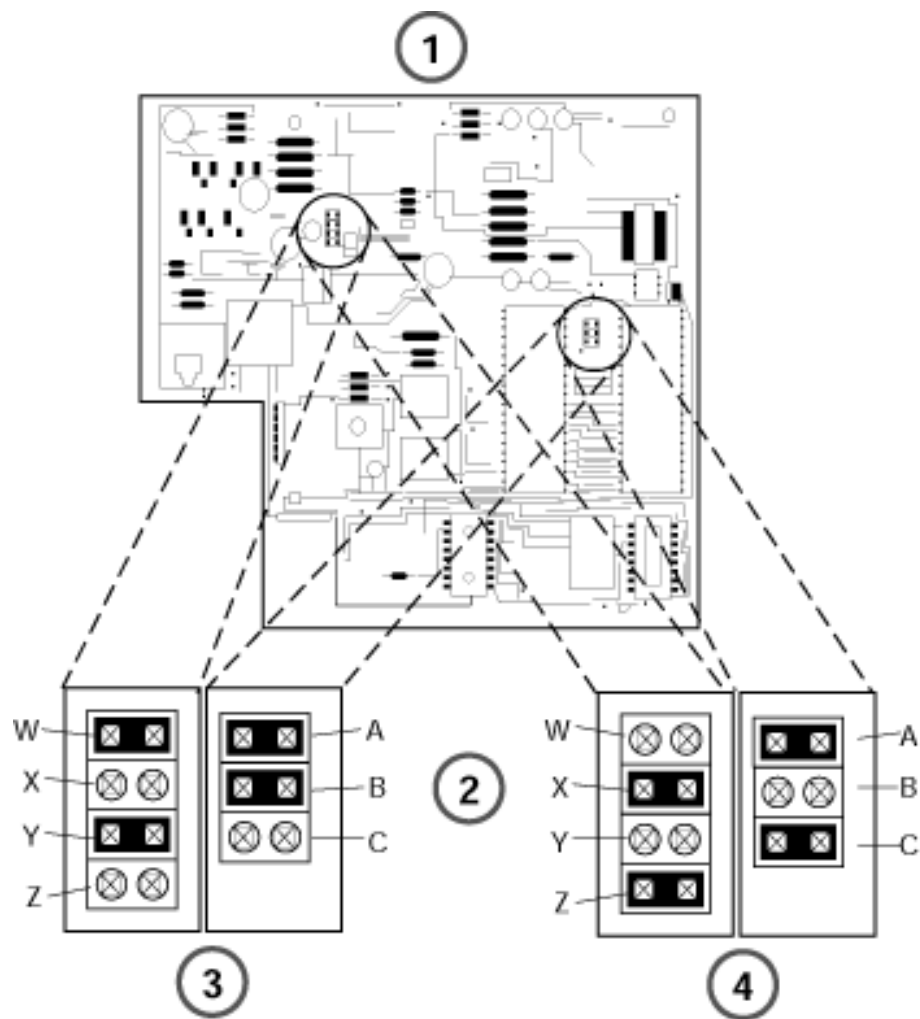


Figure 3-36. Setting and Adjusting the MFM Jumpers

- 1 Multi-Function Module
- 2 Pins and Jumper Placement
- 3 T/R Operation Setting A, B, W and Y
- 4 SAA Setting A, C, X and Z

Step 7. Removing the Jack Guard

1. If the module cover has a square jack guard (item 1 in Figure 3-37) 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-5, MLX-5D, MLX-10, MLX-10D, or MLX-16DP telephone.

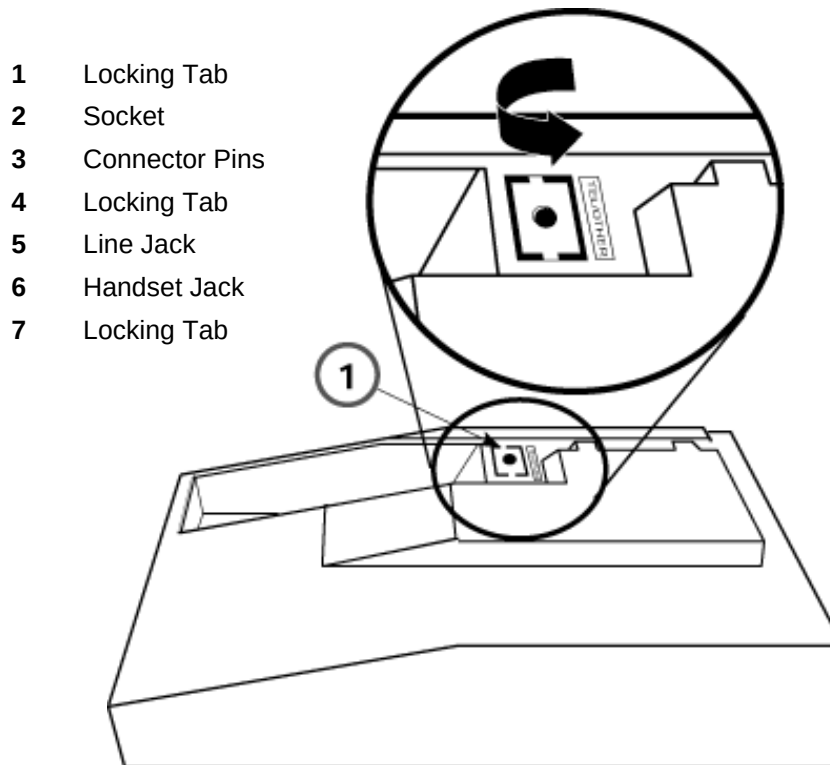


Figure 3-37. Removing the Jack Guard

Step 8. Replace the Module Cover

1. Place the locking tab on the module cover into the slot on the left side of the telephone as shown in item 1 in Figure 3-38.
-

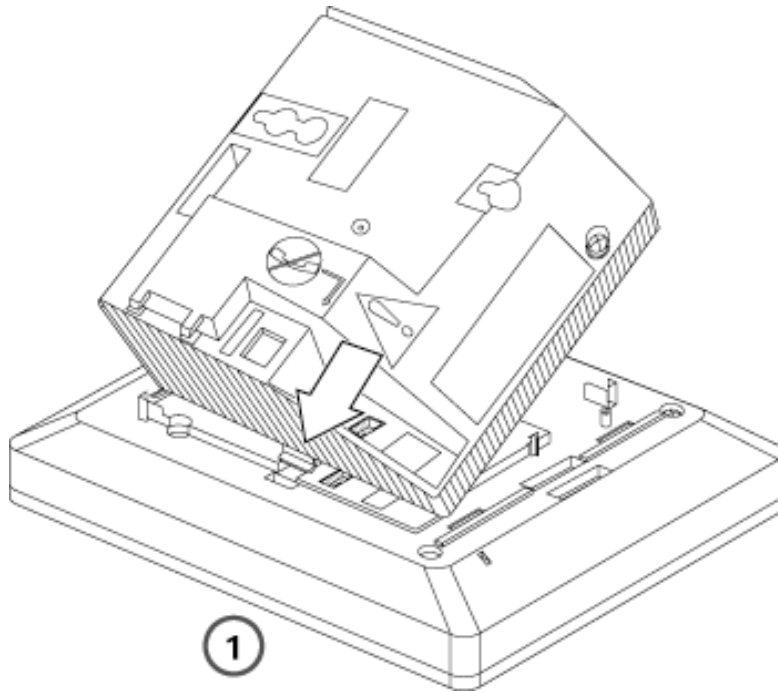


Figure 3-38. Placing the Module Cover into the Locating Slot

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

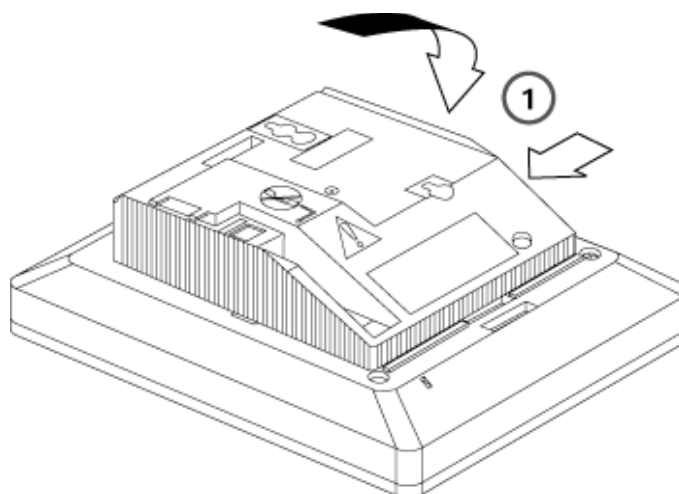


Figure 3-39. Lowering and Locking the Module Cover

3. Replace and tighten the module cover screw.
4. If you are wall-mounting an MLX-5, MLX-5D, MLX-10, MLX-10D, MLX-10DP, or MLX-16dp telephone, go to [“Step 11. Adjust the Deskstand Height”](#) on page 3-66; otherwise, go to [“Step 9. Replace the Deskstand”](#).

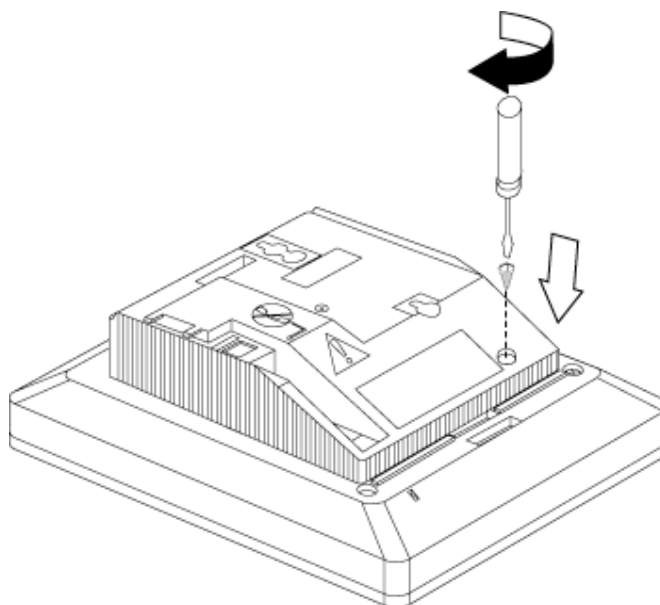


Figure 3-40. Replacing and Tightening the Module Cover Screw

Step 9. Replace the Deskstand

1. Place the tab on the narrow edge of the deskstand, into the locating slot on the telephone base as shown in item 1 in Figure 3-41.

If you are wall-mounting an MLX-5, MLX-5D, MLX-10, MLX 10D, MLX-10DP, or MLX-16DP telephone, go to “[Step 11. Adjust the Deskstand Height](#)” on page 3-66.

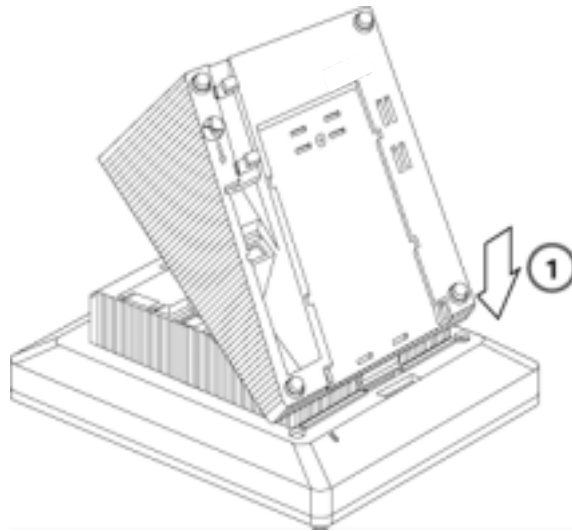


Figure 3-41. Replacing the Deskstand

2. Lower the deskstand and lock into place as shown in item 1 in Figure 3-42.
-

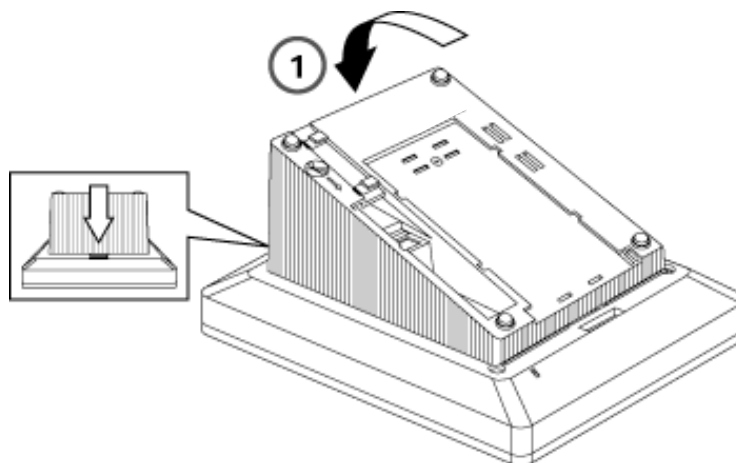
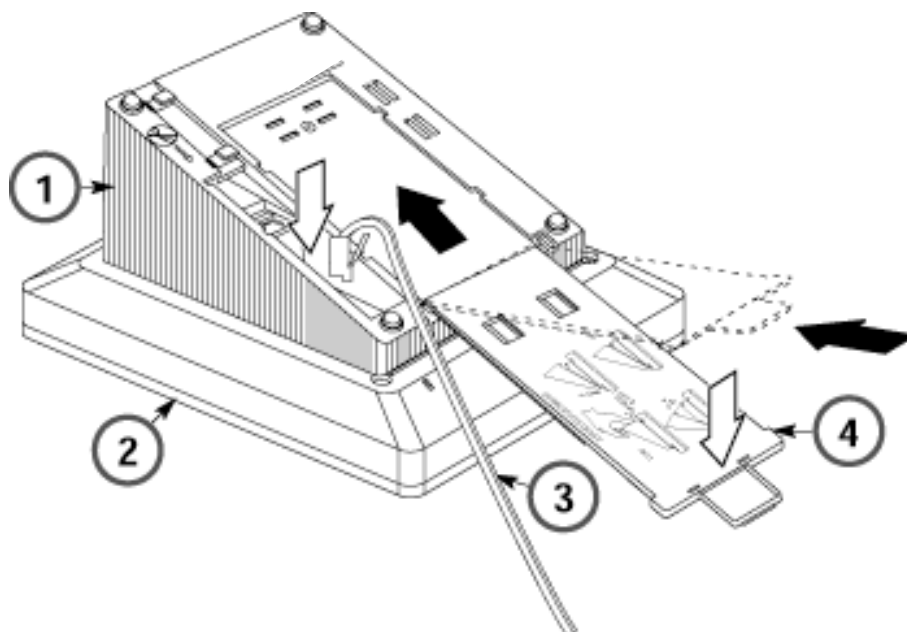


Figure 3-42. Lowering the Deskstand and Locking into Place

Step 10. Replace the User Card Tray and Line Cable

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

**Figure 3-43. Replacing the User Card Tray and Line Cable**

1	Deskstand
2	Telephone Base
3	Line Cable
4	Card Tray

Step 11. Adjust the Deskstand Height

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

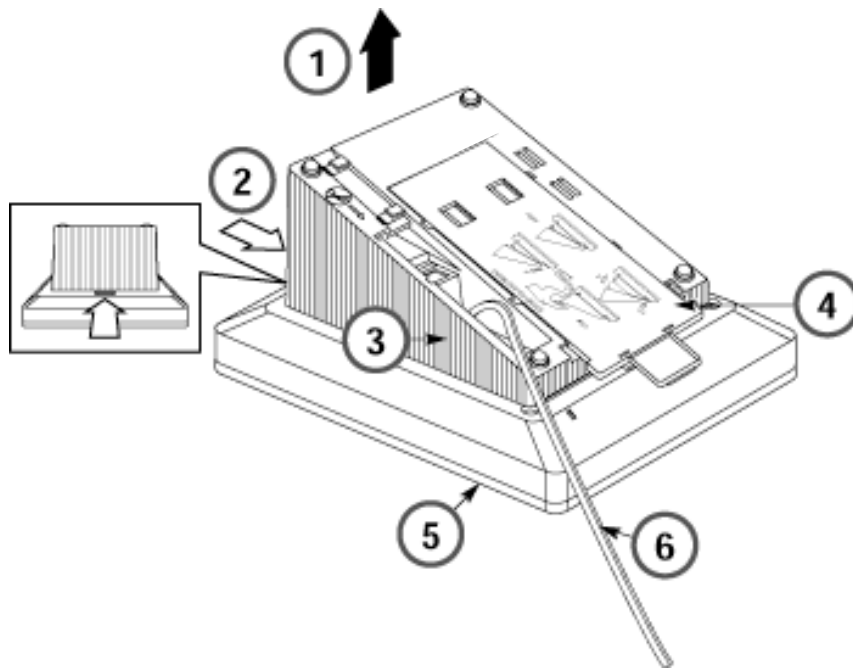


Figure 3-44. Adjusting the Deskstand Height

1	Pull UP
2	Press Center Tab
3	Deskstand
4	Card Tray
5	Telephone Base
6	Line Cable

Step 12. Power up the telephone.

1. Plug the D8W cord from the telephone into the 8-conductor (large) modular jack of the 400B or 400B2 adapter.
2. Connect one end of the D6AP cord to the 2-conductor (small) modular jack on the 400B or 400B2 adapter, and plug the other end into the modular jack of the 406943837 power supply. The total length of the cords connecting the power supply to the MLX telephone must be less than or equal to 50 ft. (15 m).

**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.

3. Plug the power supply into a 117-V AC outlet that is not controlled by a wall switch.
4. Insert the plug end of the 400B or 400B2 adapter into the wall jack.
5. Test the MFM for T/R operation. See [“Testing MLX Telephones with MFMs”](#) on page 7-5
6. Attach the adjunct to the MFM. See [“Installing an MLX Telephone Adjunct”](#) on page 3-25.

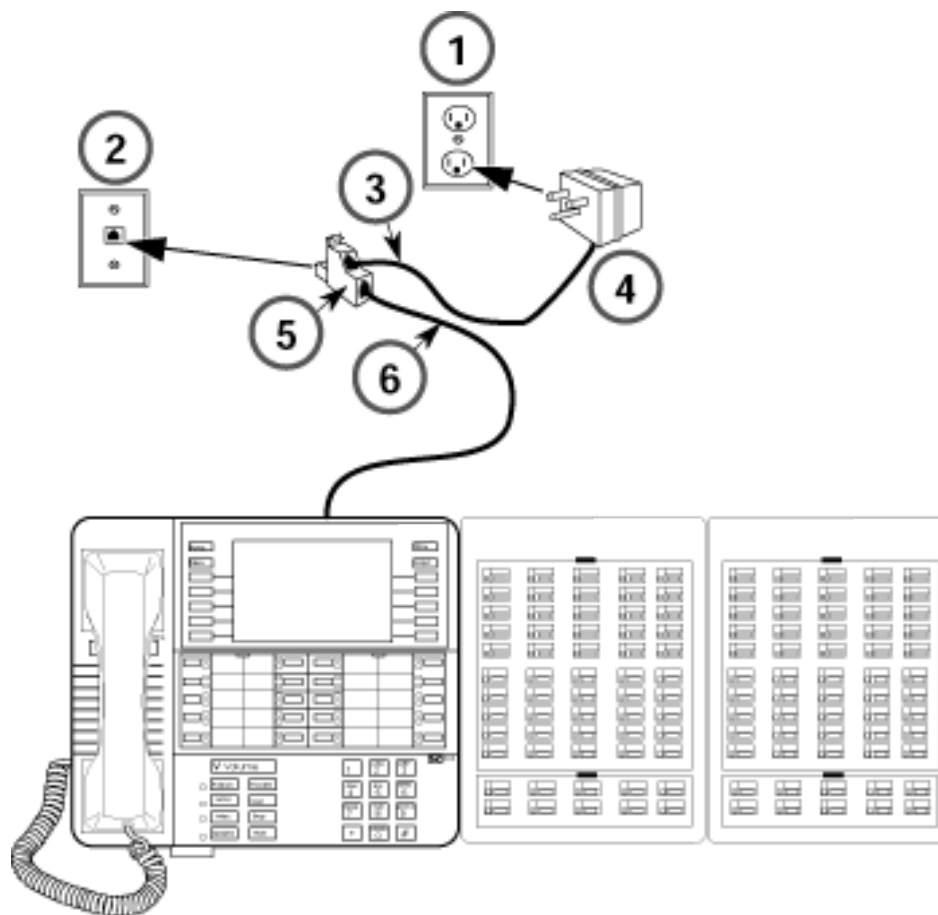


Figure 3-45. Powering Up the Telephone after Installing the MFM

- 1 AC Power Outlet
- 2 Wall Jack
- 3 D6APr
- 4 Power Supply
- 5 400B2 Adapter
- 6 D8W

Connecting the Control Unit to the Network

4

Contents

Interface

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Connecting the Control Unit to the Network Interface

4

Overview

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 following methods are usually best.

- Using an RJ21X Interface
- Using RJ11 and RJ14 Interfaces
- Using an RJ2GX Interface
- Using RJ48C/X Interface



CAUTION:

- *The local 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 ["Grounding the Control Unit"](#) on page 2-11 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 telecommunications wiring. For example, you cannot use indoor wiring (DIW) cable inside or on top of air plenums or ducts, along hot pipes, or across walkways. Consult your local ordinances and regulations for proper cable selection.*

Before You Begin

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 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 Off-Premises Range Extender OPRE.

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.

Common Interfaces and Adapters

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 the table below.

Table 4-1. Network Interface

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

Network Interface Codes

The following table lists federal interface codes that may be needed for Network facilities. These codes are organized by trunk type and adapter type.

Table 4-2. Central Office Network Interface Codes

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

- NOTES** ▶
- 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 cross-connect field to the control unit. However, for systems with fewer than 24 extensions, you can connect the trunk wires directly to the control unit.

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 as shown.

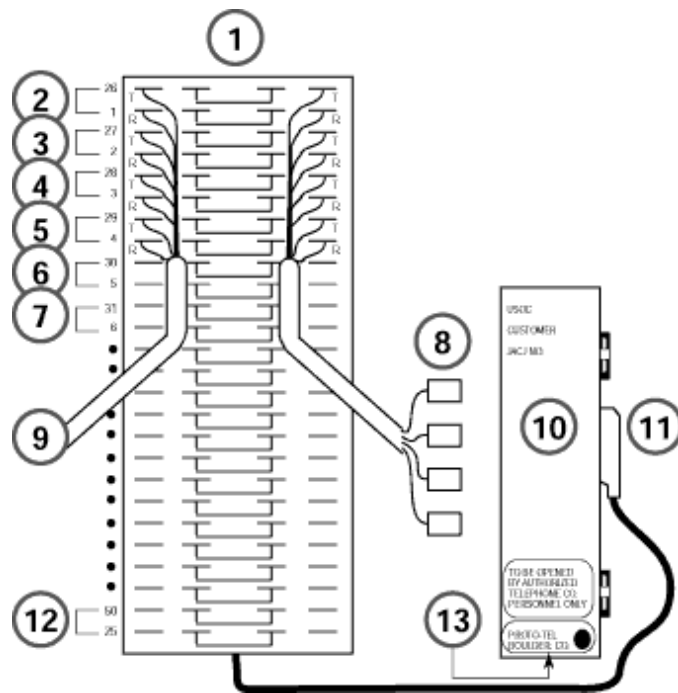


Figure 4-1. RJ21X Network Interface Connector

1	66-Type Block (RJ21-type) 25 Line Interface
2	Line 1
3	Line 2
4	Line 3
5	Line 4
6	Line 5
7	Line 6
8	4 Jacks
9	To / From Control Unit
10	RJ21X
11	Amphenol Plug
12	Line 25
13	From C.O.

Wiring Field Hardware

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 will need.

- 1 D-Ring
- 2 110A1 Wire Trough
- 3 110AB1-100FT
- 4 110AB1-100JP12 Terminal Block

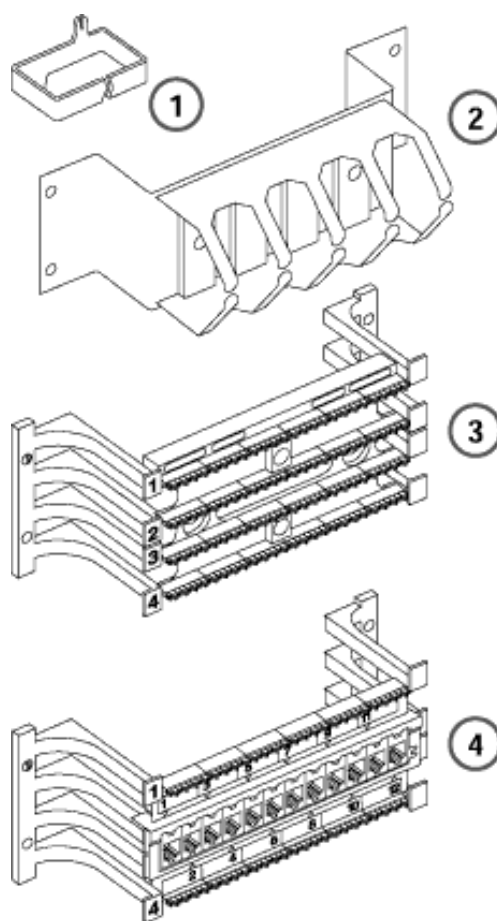


Figure 4-2. RJ21X Wiring Field Hardware

Wiring Field Tools

When building a wiring field you will need the following tools:

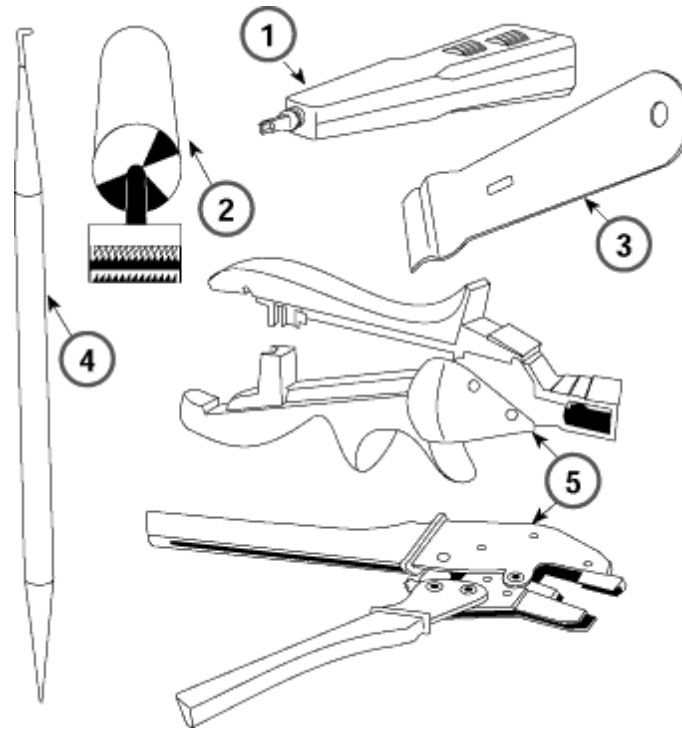


Figure 4-3. RJ21X Wiring Field Tools

- 1 AT-8762 D-Impact Tool
- 2 110 Impact Tool 788J1
- 3 788 K1 Retainer Tool
- 4 Spudger
- 5 Modular Plug Pressers

Connecting the RJ21X to the Control Unit

To connect the RJ21X network interface to the control unit, follow the steps below.

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. See Figure 4-2 “RJ21X Wiring Field Hardware” on page 4-5.

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

3. If necessary, repeat Steps 1 and 2 for a second column.
4. Run the 25-pair amphenol cable on the RJ21X interface to the termination blocks.
If more length is needed, use an A25D male-connector, single-ended, 25-pair, nonplenum cable.
5. Mount the D-rings to properly dress the wires, as needed.
6. Cut off the amphenol connector nearest to the cross-connect field and strip the wires for each of the 25 pairs.
7. Punch down the 25-pair wires to the termination block.
 - a. Route the wires through the fanning slots on the termination block.
 - b. Insert the conductors into the designated 110 connecting blocks already on the termination block.
 - c. Use the D-impact tool (item 1 in Figure 4-4) to seat the conductors.
 - d. Remove any insulation fragments with a spudger.

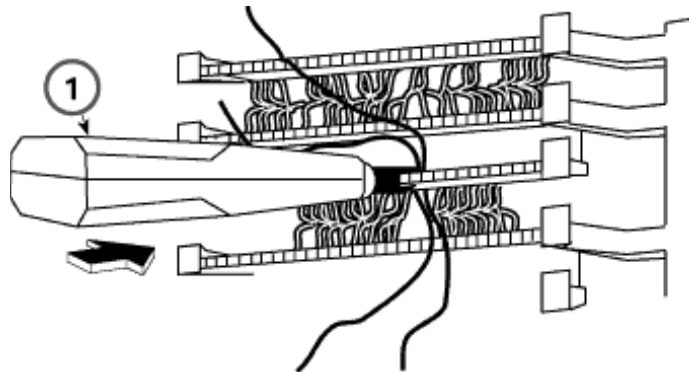


Figure 4-4. Using the D-Impact Tool to Seat the Conductors

8. Test the central office trunks for proper connection. See “Testing Trunks” on page 4-10.
9. Label the network interface jacks, control unit module jacks, termination blocks, and D2R cords. See “Labeling Trunks” on page 4-12.
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.



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.

Using a Break-out Box

You can use an optional break-out box to facilitate connecting line extensions. The Cinch SUPER MOD 25 (Part No. 299 24 00 125) connects 25 line extensions to an RJ21X using a 25 pin amphenol cable.

NOTE ► The Cinch SUPER MOD 25 uses a six position modular jack. You may need to convert the modular jack to an eight position jack. You can use a Hubbell (Part No. 95068) 8 position to 6 position converter. The comcode is 407124114.

RJ11 and RJ14 Interfaces

RJ11 and RJ14 interfaces are connected to the control in the same manner as the (Link)RJ21X. 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.

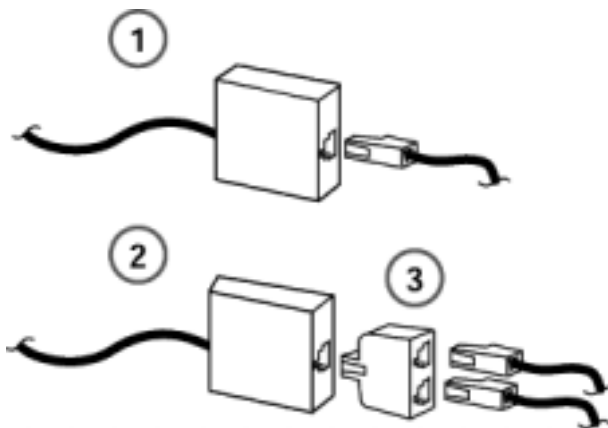


Figure 4-5. RJ11 and RJ14 Interfaces

- 1 Single-Line Adapter (RJ11)
- 2 2-Line Adapter (RJ14)
- 3 267C



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”](#) on page 4-10 for instructions.
2. Label the network interface jacks, the control unit module jacks, and the D2R cords properly. See [“Labeling Trunks”](#) on page 4-12 for instructions.
3. Plug one end of a D2R cord into the jack at the network interface and the other end into the appropriate line/trunk jack on the control unit.
4. Dress the wires properly.

RJ2GX Interface

The RJ2GX is a 25-pair amphenol interface that connects up to 8 tie trunks. Construct the cross-connect field in the same way you did for the (Link)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 preferred network interface is the RJ48X. 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.

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

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.



CAUTION:

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

Testing Loop-Start Trunks

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

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

1. Plug the single-line telephone or the craft set into each central office line/trunk jack (either at the network interface or at the cross-connect field) and listen for dial tone.
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 Lucent Technologies 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 Lucent Technologies 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 Lucent Technologies Service Center acting as the customer's agent.

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

Testing NI-BRI Provisioning

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

Labeling Trunks

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

To label trunks, follow these steps:

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

For existing MERLIN LEGEND systems, 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, refer to the documentation packaged with the CSU.

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 Lucent Technologies 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)

NOTE ► Make sure the CSU is programmed for PRI signalling at either end of a PRI tandem trunk. You may have an existing setting for T1 or robbed-bit signaling rather than PRI signaling. If the CSU is not set for PRI signalling, you will get an error message, "PRI D-channel inoperative."

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.

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■ Setting Printer Options and DIP Switches	5-19
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Once you complete the installation procedures presented in the previous chapters, you can connect a personal computer (PC) that can be used for system programming or maintenance, or a Station Message Detail Recording (SMDR) or Call Accounting Terminal (CAT) printer that can be used to print system reports.

**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 to the Control Unit for System Programming or Maintenance

To use the Win SPM software for system programming or maintenance, your PC must be connected to the MERLIN MAGIX system directly via a serial port on your PC or you must connect to the MERLIN MAGIX internal modem using your PC's modem.

Directly Connecting a PC to the Control Unit

You directly connect a PC to the control unit by connecting a serial port on your PC directly to the communications system programming jack—the lower RS-232 jack on the processor module.

The method you use to directly 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 \(15.2 m\)”](#) on page 5-2.
- If the PC is more than 50 ft. (15.2 m) from the control unit, see [“Connecting a PC More Than 50 Feet \(15.2 m\) Away”](#) on page 5-3.

Connecting a PC Within 50 Feet (15.2 m)

For a direct local connection, you must connect the PC to the system programming jack. This is the lower modular RS-232 jack on the processor module, as shown in Figure 5-1 on page 5-3. (The upper jack is reserved for the SMDR printer.) For direct local connections, the system supports speeds of 1,200 and 2,400 bps.

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, refer to Figure 5-1 on page 5-3 and follow these steps:

1. Connect the D8W cord.
2. For system programming or maintenance, plug one end of a D8W cord into the ADMIN jack on the control unit.
3. For SMDR, plug one end of a D8W cord into the SMDR jack on the control unit.
4. Plug the other end of the D8W cord into a 355AF adapter.
5. Connect the 355AF adapter.
6. 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.
7. If you are not using an EIA-232-D cable, plug the 355AF adapter directly into the COM1 port on the PC.

NOTE ► You must use a direct local connection to program in Surrogate mode.

8. Set up a Direct Connection site type in Win SPM for this configuration. Refer to “System Programming Basics” for complete instructions.

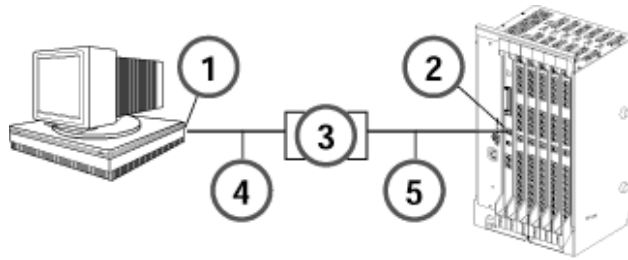


Figure 5-1. Direct Connection, PC Less Than 50 Feet Away

- 1 Serial Communications Port
- 2 System Programming Jack
- 3 355AF Adapter
- 4 RS-232
- 5 D8W

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

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 to the control unit when the distance is 50 ft. (15.2 m) or more, refer to Figure 5-2 on page 5-5 and follow these steps:

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, BR1A-4P adapter, 102 connecting block, or 103 connecting block.
 - If you plug the 400B2 into a wall jack, make sure the building wiring has been set up so that the wall jack near the control unit is connected to the wall jack near the PC.
 - If you plug the 400B2 into a BR1A-4P adapter, 102 connecting block, or 103 connecting block, use 4-pair plug-ended cable to connect the BR1A-4P adapter (or connecting block) to the wall jack near the PC.
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.
13. Set up a Direct Connection site type in Win SPM for this configuration. Refer to "System Programming Basics" for complete instructions.

- 1 Processor Module
- 2 SMDR Jack
- 3 8DW
- 4 ADMIN Jack
- 5 355 AF Adapter
- 6 Crossover Cable
- 7 EIA-232-D
- 8 Z3A2 ADU
- 9 D8W
- 10 ADU Crossover Cable
- 11 Control Unit
- 12 D6AP
- 13 400B2 Power Adapter
- 14 2012D-50M Transformer
- 15 AC Outlet
- 16 4-Pair Plug- Ended Cable
- 17 or
- 18 Direct Connection
- 19 Wall Jack
- 20 BR1A-4P Adapter
or
102 Connecting Block
or
103 Connecting Block
- 21 Building Wiring
- 22 DIW
- 23 Wall Jack
102 or 103
- 24 Connecting Block
- 25 D8W
- 26 D8W
- 27 EIA-232-D
- 28 or
- 29 Z3A2 ADU
- 30 Cable Joints

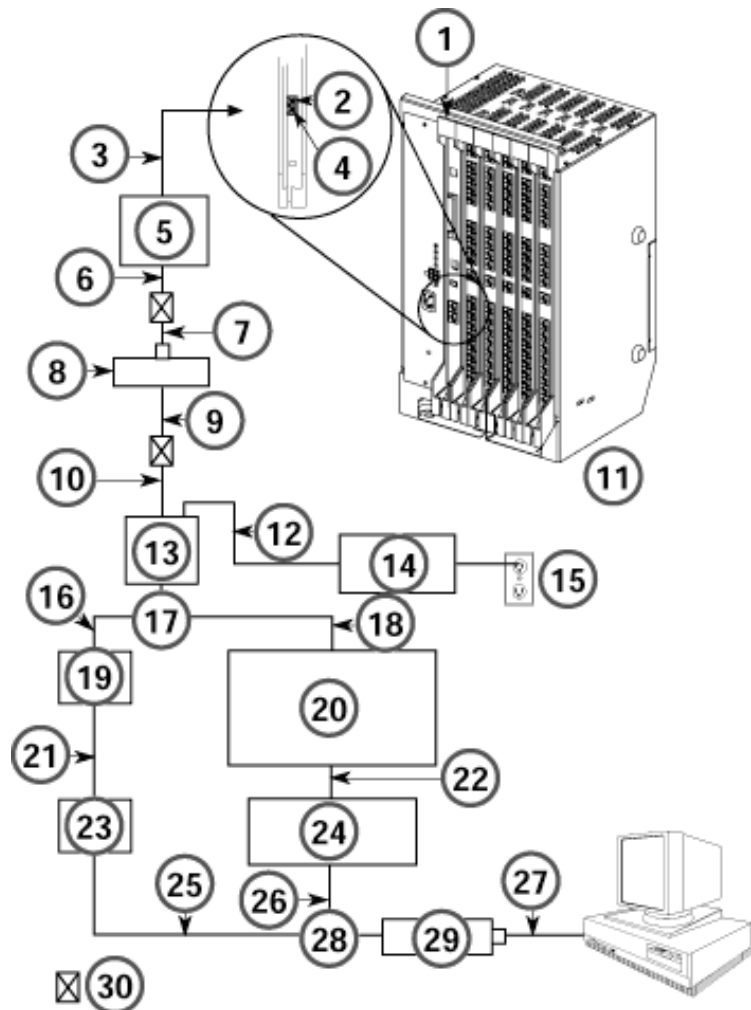


Figure 5-2. Direct Connection, PC More Than 50 Feet Away

Connecting to the MERLIN MAGIX Internal Modem Using a PC Modem

If you are not able to directly connect your PC to the RS-232 programming port on the control unit, you can connect to the system's internal modem using a modem. You can connect in the following ways:

- Connect the modem to a T/R extension jack
- Use the modem to dial into the MERLIN MAGIX system from an inside extension or from a remote location

Connecting a PC Modem to a Tip/Ring (T/R) Extension Jack

You must use a modem (either connected to, or built into, the PC) to access the internal modem in the control unit. Connect the modem to a T/R jack on an 012 (T/R) or 016 (T/R) module, or to a jack that has been programmed for T/R on an 016 ETR module in the control unit, as shown in Figure 5-3.

The internal modem operates at speeds of 1200 and 2400 bps.

Set up an Internal Connection site type in Win SPM for this configuration. Refer to "System Programming Basics" for complete instructions.

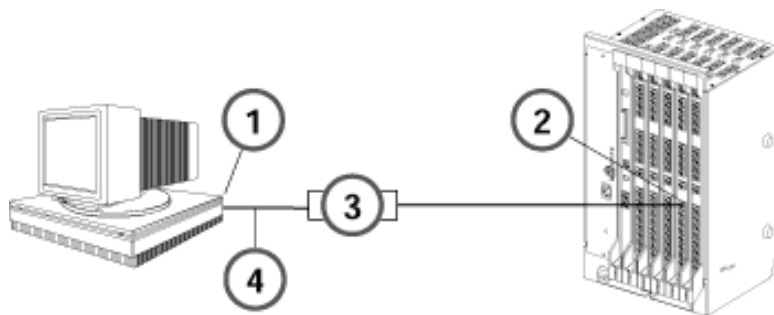


Figure 5-3. Connecting a Modem to a T/R Extension Jack

- 1 To Central Office or Serving Facility
- 2 CO Lines
- 3 CO Line Protector
- 4 Network Interface

Use a Modem to Dial Into the MERLIN MAGIX Internal Modem

If you are not able to connect the PC to the control unit via the RS-232 system programming jack or via a tip/ring extension jack, you can dial the MERLIN MAGIX internal modem from an inside extension or from a remote location. Figure 5-4 shows a dial-up connection from a remote connection.

The internal modem operates at speeds of 1200 and 2400 bps.

Set up an External Connection or Manual Connection site type in Win SPM for this configuration. Refer to "System Programming Basics" for complete instructions.

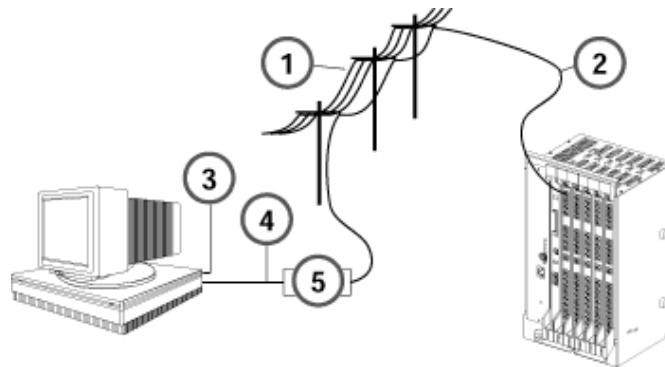


Figure 5-4. Connect to the MERLIN MAGIX Internal Modem from a Remote Location

- 1 Public or Private Telephone Network
- 2 Incoming Trunk Line
- 3 Serial Communications Port
- 4 RS-232
- 5 Modem

Connecting a CAT to the Control Unit

The Call Accounting Terminal (CAT) is a standalone unit that provides call accounting information. It connects to the SMDR jack on the control unit and also 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. See the installation notes packaged with the ADU for more information.

- 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, see [“Connecting a CAT and Printer on the Same AC Outlet”](#) on page 5-8.
- 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”](#) on page 5-10.



CAUTION:

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

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, refer to Figure 5-5 on page 5-9 and follow these steps.

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”](#) on page 5-19.

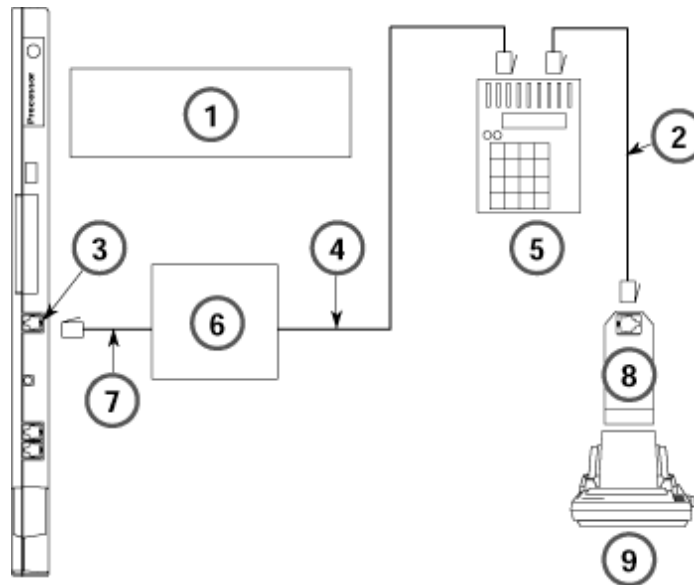


Figure 5-5. Connecting a CAT and Printer on the Same AC Outlet

- 1 CAT Plus Connections Using Same AC Outlet
- 2 D8W-87
- 3 SMDR Port
- 4 Long Card
- 5 CAT PLUS Terminal
- 6 Z200A EMI Filter
- 7 Short Card
- 8 355A
- 9 CAT Printer

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

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

You need the following hardware for the 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

Making the Connections at the Control Unit

To make the connections at the control unit, refer to Figure 5-6 on page 5-11 and follow these steps:

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 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.

10. Plug the other end of the D6AP cord into the lower jack on the 400B2 power adapter.
11. Plug the 2012D-50M (or 2012D) transformer into the wall outlet for the control unit.
- 12.

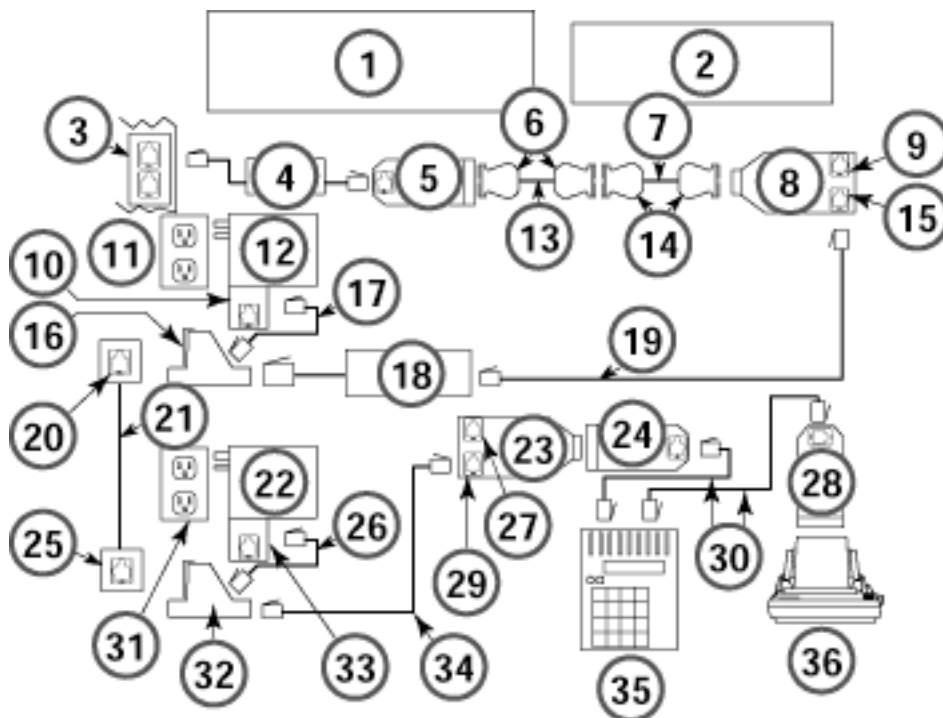


**Figure 5-6. Connecting a CAT and Printer on Different AC Outlets:
Control Unit Connections**

- 1 CAT PLUS Connections Using Different AC Outlets "ADU Arrangements"
- 2 Z3A2 ADU With M8AJ-87 Equivalent to Z3A4 ADU
- 3 MERLIN LEGEND SMDR
- 4 Z200A
- 5 355A
- 6 Male

- 7** M8AJ-87
- 8** ZA3A2ADU
- 9** Tele
- 10** 248B
- 11** AC Outlet
- 12** 2012D Transformer
- 13** M7U-87 EIA Crossover
- 14** Female
- 15** Wall
- 16** 400B2
- 17** DSAP-87
- 18** D8AM-87 Crossover
- 19** D8W-87
- 20** Wall Jack
- 21** Inside Wire
- 22** 2012D Transformer
- 23** ZA3A2 ADU
- 24** 355 AF
- 25** Wall Jack
- 26** D6AP-87
- 27** Tele
- 28** 355A
- 29** Wall
- 30** D8W-87
- 31** AC Outlet
- 32** 400B2
- 33** 248B
- 34** D8W-87
- 35** CAT PLUS Terminal
- 36** CAT Printer

Making the Connections at the Printer

To make the connections at the printer, refer to the Figure 5-6 on page 5-11 and follow these steps:

1. At the printer location, either plug one end of a D6AP cord into a 2012D-50M transformer or follow the instructions in Step 9 above.
2. Plug the other end of the D6AP cord into the lower jack on a 400B2 power adapter.
3. Plug the 400B2 power adapter into the wall jack.
4. Plug the 2012D-50M (or 2012D) transformer into the wall outlet for the printer.
5. Plug one end of a second D8W cord into the top jack on the second 400B2 power adapter.
6. Plug the other end of the second D8W cord into the WALL jack on the Z3A2 ADU.
7. Connect the 25-pin male connector on the Z3A2 ADU to the 25-pin female end on a second 355AF adapter.
8. Plug one end of a third D8W cord into the second 355AF adapter.
9. Plug the other end of the third D8W cord into the SMDR jack on the back of the CAT.
10. Plug one end of a fourth D8W cord into the PRINTER jack on the back of the CAT.
11. Plug the other end of the fourth D8W cord into a third 355A adapter.
12. Slide the third 355A adapter into the serial port on the back of the printer.
13. Set the appropriate printer options for SMDR. See [“Setting Printer Options and DIP Switches”](#) on page 5-19.

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 Avaya printers:

- 572 Printer
- 475/476 Printer
- Call Accounting Terminal (CAT) Printer
- Call Accounting System Printer
- Applications Printer

NOTE ► The 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.

- If the CAT serial printer is used with a CAT and is grounded to the same AC outlet as the control unit and is within 50 ft. (15.2 m) of the control unit, refer to [“Connecting a CAT and Printer on the Same AC Outlet”](#) on page 5-8.
- 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”](#) on page 5-10.
- 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 \(15.2 m\)”](#) on page 5-14.
- 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”](#) on page 5-16.



CAUTION:

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

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

To connect a printer within 50 ft. (15.2 m), follow the steps below. Refer to Figure 5-7.

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 either the 25-pin male connector on the printer's interface cable or the serial port on the printer.
4. Set the appropriate printer options for SMDR. See [“Setting Printer Options and DIP Switches”](#) on page 5-19.

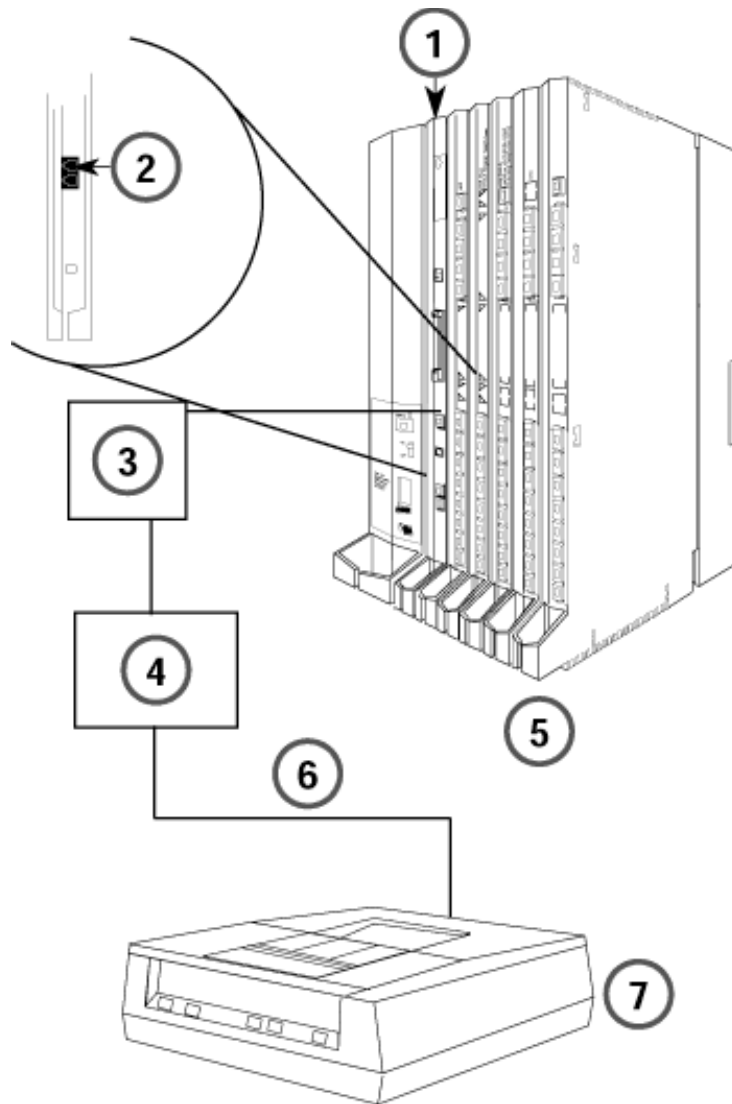


Figure 5-7. Connecting a Printer Within 50 ft. (15.2 m)

- 1 Processor Module
- 2 SMDR Jack
- 3 Z200A EMI Filter
- 4 355 AF Adapter
- 5 Control Unit
- 6 EIA-232-D
- 7 SMDR Printer

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

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

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

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

You need the following hardware for this procedure:

- Z200A EMI filter
- Adapter for the interface cable connector
- 355A for the male connector
- 355AF for the female connector
- 400B2 power adapter
- Z3A2 ADUs
- BR1A-4P adapter or 102 connecting block or 103 connecting block
- 8-position wall jacks
- EIA crossover cable
- ADU crossover cable
- 2012D transformer
- 248B adapter
- D8W cords
- D6AP power cord
- EIA-232-D cable
- 4-pair plug-ended cable

To connect a printer 50 ft. (15.2 m) or further away from the control unit, follow the steps below.

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 400B2 adapter.

- 1 To Central Office or Serving Facility
- 2 C O Lines
- 3 C O Line Protector
- 4 Network Interface
- 5 DIW or 25 Pair Cable
- 6 C O Wiring Field
- 7 Power Supply
- 8 Coupled Bonding Conductor (optional)
- 9 D2R Cords
- 10 Commercial Power
- 11 Ground Screw Connection
- 12 #12 or #14 AWG Ground Wire
- 13 Plug
- 14 AC Outlet
- 15 #6 AWG Ground Wire
- 16 Single Point Ground Bar
- 17 Shield Ground
- 18 Black - White - GND (Green)
- 19 Power Service
- 20 Earth Ground
- 21 Bond Wire

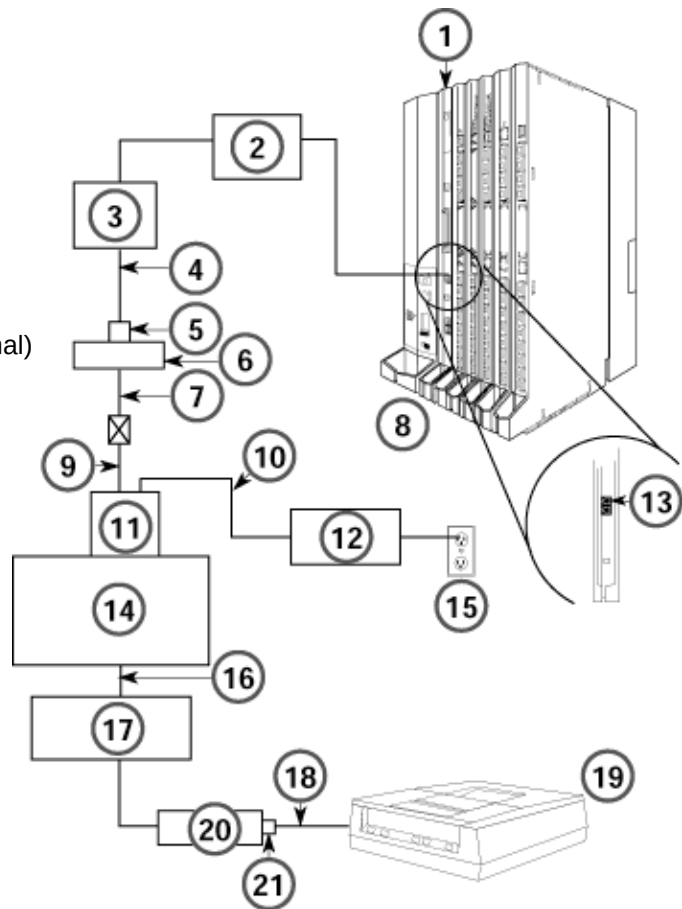


Figure 5-8. Connecting a Printer More Than 50 ft. (15.2 m) Away

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 5-8.

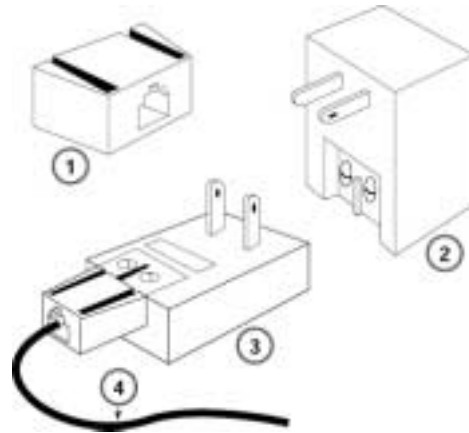


Figure 5-9. Connecting the 248B Adapter and the 2012D Transformer

- 1 To Central Office (CO) or Serving Facility
 - 2 CO Lines
 - 3 CO Line Protector
 - 4 Network Interface
10. Plug the 400B2 adapter into a wall jack, BR1 A-4P adapter, 102 connecting block, or 103 connecting block.
 11. Complete the 400B2 connection.
 - If the 400B2 is plugged into a wall jack, make sure that building wiring has been set up so that the wall jack for the control unit can communicate with the wall jack for the printer.
 - If the 400B2 is plugged into a BR1A-4P adapter, 102 connecting block, or 103 connecting block, use 4-pair plug-ended cable to connect the BR1A-4P adapter (or connecting block) to the wall jack for the printer.
 12. On the printer side, plug one end of a D8W cord into the wall jack and the other end into the WALL jack on the Z3A2 ADU.
 13. Plug one end of an EIA-232-D cable into the 25-pin male connector on the Z3A2 ADU and the other end into the serial port on the printer.
 14. Plug the 2012D-50M (or 2012D) transformer into a wall outlet.
 15. Set the appropriate printer options for SMDR. See [“Setting Printer Options and DIP Switches”](#) on page 5-19.

Setting Printer Options and DIP Switches

If the customer has a 572 printer, 475/476 printer, CAT printer, or other type of 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 on the following pages to determine the correct printer setting for the printer:

- For the 572 printer, see Table 5-1 on this page. See the user's guide supplied with the printer for more information.
- For the 475/476 printer, see Table 5-2 on page 5-20. See the user's guide supplied with the printer for more information.
- For the CAT printer, see Table 5-3 on page 5-21. See the user's guide supplied with the printer for more information.
- For an applications printer, set all the DIP switches on the printer to off. See the user's guide supplied with the printer for more information.

Table 5-1. 572 Printer Options

No.	Function	Menu	Status
01	FORM LENGTH	09	11
02	LPI	01	6
03	CPI	01	10
04	LQ or NLQ	01	LQ
05	BUZZER	01	ON
06	FONT	01	BUILT-"IN"
07	RESOLUTION	01	144
11	BUFFER	02	ON-"LINE"
13	PW ON MODE	01	ON-"LINE"
14	DIRECTION	01	BI-DIR. 1
15	BUFFER FULL	02	LF + CR
16	P.E.	01	ACTIVE
17	AUTO CR	01	CR + LF
18	ZERO	01	0
22	AUTO LF	01	CR ONLY
31	1" SKIP	01	OFF
32	CHAR. SET (G0, GL)	02	USA
33	CHAR. SET (G1, GR)	01	UK
34	CHAR. SET (G2)	03	GE
35	CHAR. SET (G3)	0	"LINE" DRAWING
81	OFF- "LINE" STATE	01	ALL RECEIVE

Table 5-1. 572 Printer Options—Continued

No.	Function	Menu	Status
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/XOFF1
94	STOP BIT	01	2
95	PARITY	01	NON
96	BPS	04	1200

Table 5-2. 475/476 Printer DIP Switch Settings

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

Table 5-3. CAT Printer DIP Switch Settings

Switch 1	Switch 2	Control Switch
DIP 1-On	DIP 1-On	DIP 1-Off
DIP 2-On	DIP 2-On	DIP 2-Off
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

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).

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Overview

This section describes how data communications applications work with the system. It covers the following topics:

- **Analog Data Workstations.** Describes hardware components for analog data workstations with and without an external modem.
- **Digital Data Workstations.** Provides an overview of the MERLIN MAGIX 2B data port and required facilities for digital data. Also describes hardware components for digital data workstations with an ISDN router, a digital data workstation with IMUX, and desktop and group video-conferencing workstations. T1 wiring requirements are also included.
- **100 DCD Module for T1 Capability.** Describes the 100 DCD module with integral Channel Service Unit/Data Service Unit (CSU/DSU).
- **100R INA Module for T1 Capability.** Describes the 100R Integrated Network Access (INA) module with integral CSU and router.
- **Data Communications Software.** Explains how data communications software functions with the Data Communications Equipment (DCE).
- **Video Communications Software.** Explains how video-conferencing standards and protocols are required for video-conferencing compatibility between endpoints.

Analog Data Workstations

An analog data workstation is a hardware configuration that includes two main components: Data Terminal Equipment (DTE) and Data Communications Equipment (DCE). The DTE allows data input and/or output. It is often a PC but can be a host computer or gateway Local Area Network (LAN) workstation, fax machine, or credit card verification terminal.

Analog data workstations require a modem, either external or built into the DCE, in order to connect to the MERLIN MAGIX system.

NOTE ► Analog data workstations cannot communicate with digital data workstations.

Analog Data Workstation with No External Modem

No external DCE is required for this data workstation. Fax machines, credit card verification machines and other analog data devices do not require an external modem. They connect to the MERLIN MAGIX system in any of the following ways:

- Directly through a Tip/Ring extension jack on a 016 T/R module or through an extension jack that has been programmed for Tip/Ring operation on an ETR module, as shown in Figure 6-1.
- Through an MFM installed in the base of an MLX telephone, as shown in Figure 6-2. Figure 3-36 “Setting and Adjusting the MFM Jumpers” on page 3-60 shows the required jumper settings for MFM Tip/Ring operation.

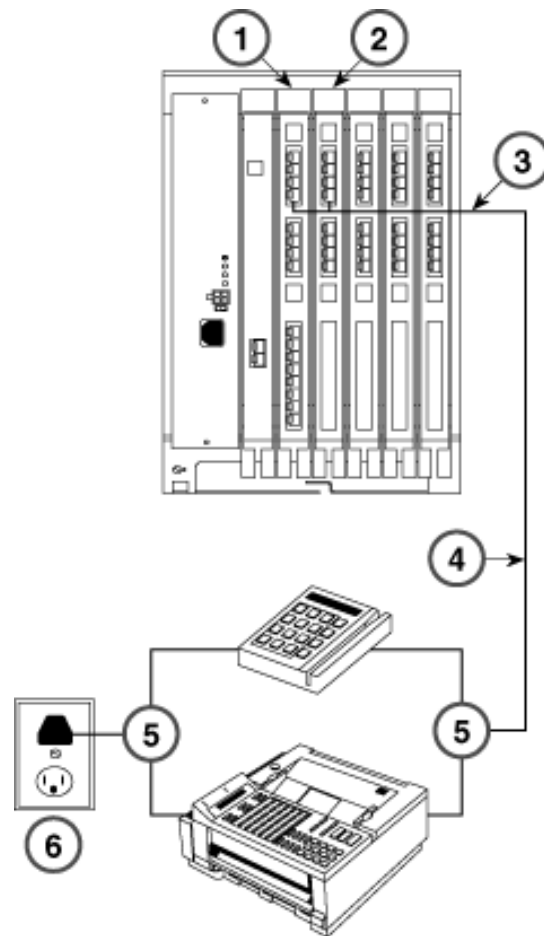


Figure 6-1. Analog Data with no External Modem through Tip/Ring Port

- 1 016 T/R or 016 ETR (programmed for Tip/Ring) module
- 2 008 OPT module
- 3 Connects to one Tip/Ring port
- 4 D4BU cord
- 5 Cord connects to either a fax machine or credit card machine
- 6 AC outlet

In Figure 6-2, the modem connects to the MLX telephone through the Tip/Ring interface of the Multi-Function Module (MFM), which is installed in the MLX telephone. The MFM allows the analog modem to connect to the digital telephone (the telephone plugs into the system through an MLX port on the control unit). Both the telephone and data terminal have their own extension numbers, operate independently, and are programmed independently. The telephone uses the main extension number (for example, extension 16 in a 2-digit numbering plan), and the modem

uses the adjunct extension number (for example, extension 716 in a 2-digit numbering plan). The DTE dials the outgoing data calls.

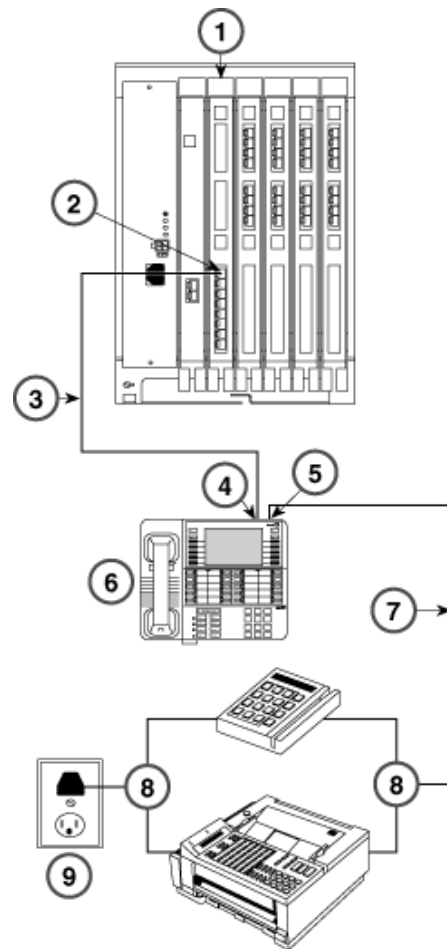


Figure 6-2. Analog Data with no External Modem through MLX Telephone with MFM

- 1 008 MLX or 408 GSLS-ID-MLX module
- 2 MLX port
- 3 D8W cord
- 4 Line jack
- 5 Tel/Other jack
- 6 MLX Telephone with MFM
- 7 D4BU cord
- 8 Cord connects to either a fax machine or credit card machine
- 9 AC outlet

Analog Data Workstation with External Modem

An external modem is required for this data workstation. The modem connects the workstation to the MERLIN MAGIX system directly through a Tip/Ring port (as shown in Figure 6-3) through an MFM installed in the base of an MLX telephone, or through a port on an ETR module that has been programmed as a Tip/Ring port. Modems allow data calls to be placed both between inside data extensions and over outside facilities.

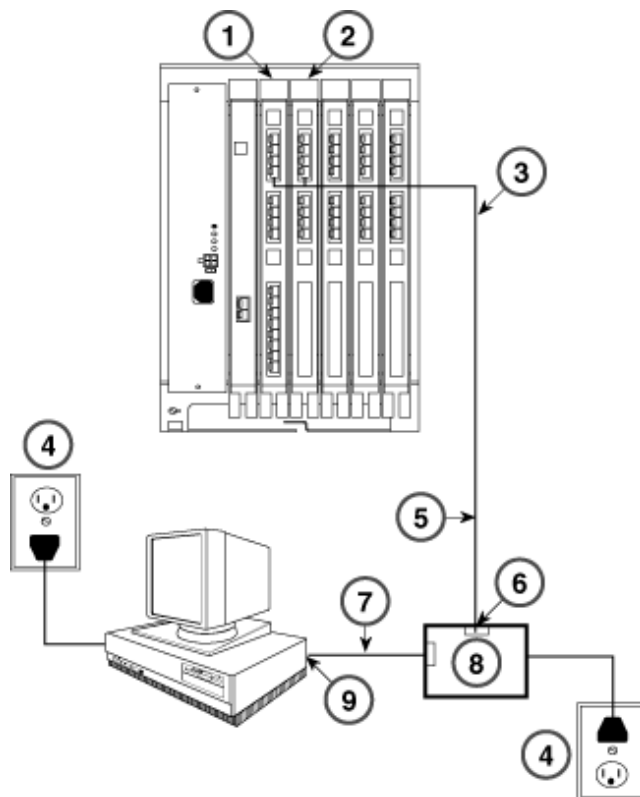


Figure 6-3. PC with External Modem

- 1 016 T/R or 016 ETR (programmed for Tip/Ring) module
- 2 008 OPT module
- 3 Connects to one Tip/Ring port
- 4 AC outlet
- 5 D4BU cord
- 6 Line jack
- 7 EIA-232-D cable
- 8 Modem
- 9 Serial connector

Digital Data Workstations

A digital data workstation is a hardware configuration that includes two main components: Data Terminal Equipment (DTE) and Data Communications Equipment (DCE). The DTE allows data input and/or output. It is often a PC but can be a host computer or gateway Local Area Network (LAN) workstation, fax machine, or credit card verification terminal.

Digital data workstations connect to the MLX port programmed as a 2B data port as shown in Figure 6-4. These endpoints take on the identity of the adjunct (MFM). Each MERLIN MAGIX 2B data port provides an industry standard ISDN-BRI S/T interface with AT&T Custom protocol and two 64K B-channels to the data workstation.

The term 2B data refers to the combination of both B-channels of an MLX jack into a single, high-speed, data connection. Each T1 Switched 56 B-channel can operate at speeds up to 56-kbps, while each ISDN-PRI and NI-1 BRI B-channel can operate at speeds up to 64-kbps. A desktop or ISDN group video-conferencing system combines the data from each of the two channels into one 112-kbps (T1) or 128-kbps (PRI or BRI) call. It is the use of both channels that allows the transmission of full-motion video. Depending upon the specific facilities and your system, you can use any combination of two PRI, NI-1 BRI, or T1 channels to achieve 2B data connectivity.

NOTE ► Digital data workstations cannot communicate with analog data workstations.

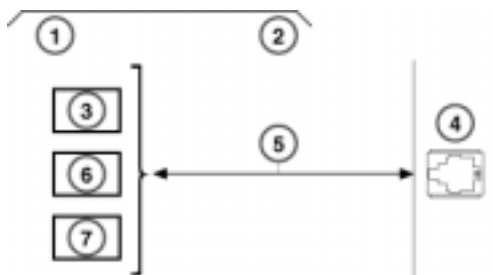


Figure 6-4. MERLIN MAGIX 2B Data Port

- 1 DTE
- 2 DCE
- 3 ISDN-BRI group video-conferencing workstation
- 4 MERLIN MAGIX MLX port configured as a 2B data port providing an ISDN-BRI S/T interface with AT&T Custom Protocol
- 5 D8W cord
- 6 ISDN-BRI IMUX
- 7 ISDN Router

To place a digital data call outside of the system, digital facilities are required, as shown in the Required Facilities for Digital Data illustration.

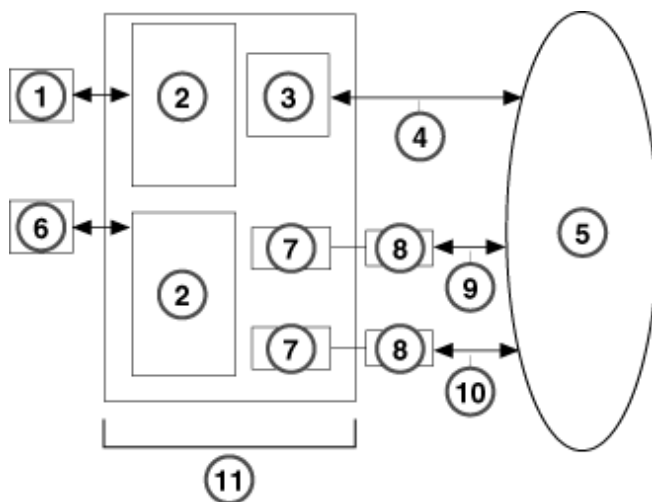


Figure 6-5. Required Facilities for Digital Data

- 1** To Central Office or Serving Facility
- 2** C O Lines
- 3** C O Line Protector
- 4** Network Interface
- 5** DIW or 25 Pair Cable
- 6** C O Wiring Field
- 7** Power Supply
- 8** Coupled Bonding Conductor (optional)
- 9** D2R Cords
- 10** Commercial Power
- 11** Ground Screw Connection

Refer to Table 6-1 to determine the actual speed supported at different data workstations.

Internet Service Providers (ISPs) and online service providers allow you to set up communications software to function according to the speed your data workstation can support and the DCE you are using. Supported speeds depend upon the provider.

Table 6-1. Data Workstation Configurations Summary

Type of Data Workstation	DCE	Outside Facility	Extension Jacks	Maximum Speed
Modem	Modem	Analog loop-start or ground-start	1 T/R	14.4 kbps
		T1 voice, NI-1 BRI voice, PRI voice	1 T/R	28.8 kbps
MLX voice with MFM and attached modem	Modem	Analog loop-start or ground-start	1 MLX and 2 ext. nos.	14.4 kbps
		T1 voice, NI-1 BRI voice, PRI voice	1 MLX and 2 ext. nos.	28.8 kbps
ISDN router, data-only programmed as 2B data	ISDN router	T1 Switched 56 data, NI-1 BRI, PRI	1 MLX and 1 ext. no.	56/64 or 112/128 kbps

Digital Data Workstation with ISDN Router

A digital data workstation with ISDN router is a workstation that sends and receives digital data using an Integrated Services Digital Network (ISDN) Router as its DCE. Digital data workstations connect to the MERLIN MAGIX system through MLX ports on the control unit.

Two types of workstations use the ISDN router. The Single User Workstation with ISDN Router illustration shows an individual PC connected to the ISDN router. The LAN Workstation with ISDN Router illustration shows how digital data is routed out of the LAN through an ISDN router.

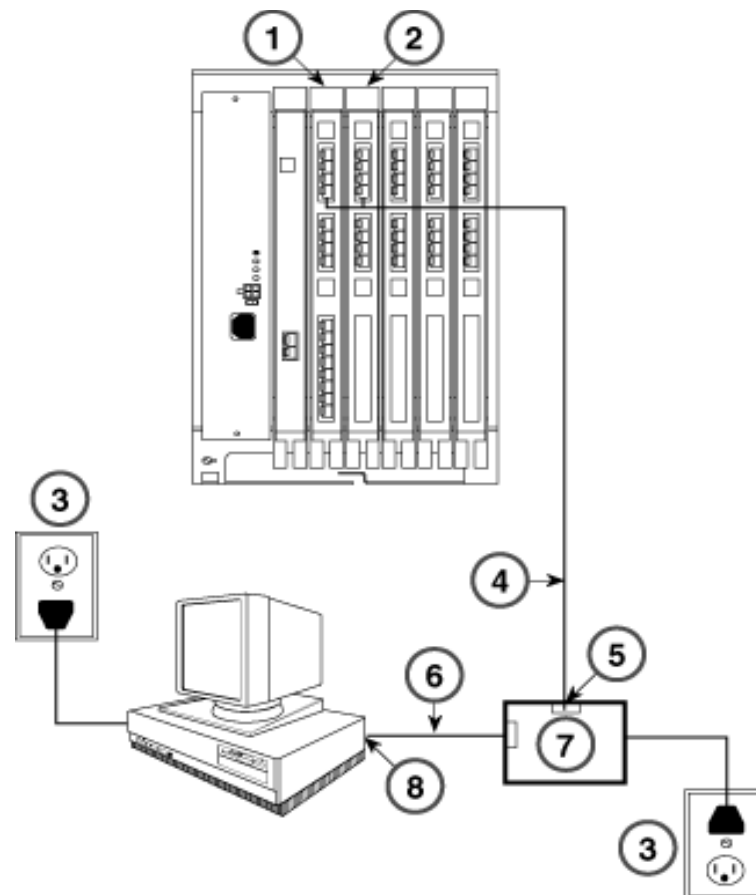


Figure 6-6. Single User Workstation with ISDN Router

- 1 408 GS/LS-ID-MLX module
- 2 008 MLX
- 3 AC Outlet
- 4 D8W cord
- 5 ISDN-BRI S/T interface
- 6 Ethernet Crossover Cable
- 7 ISDN Router
- 8 NIC card

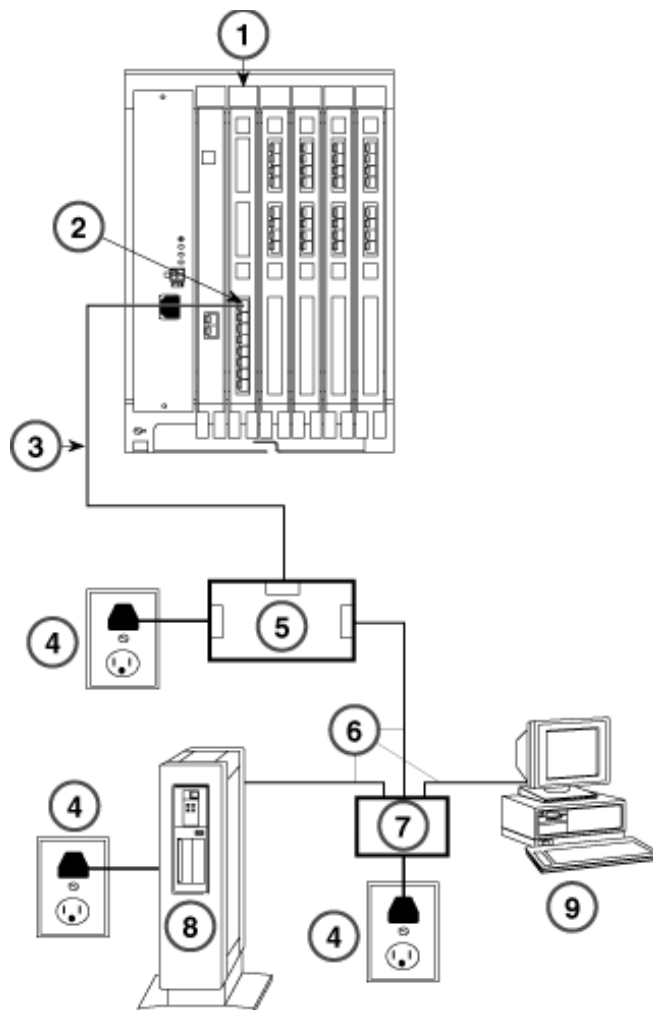


Figure 6-7. LAN Workstation with ISDN Router

- 1 To Central Office or Serving Facility
- 2 C O Lines
- 3 C O Line Protector
- 4 Network Interface
- 5 DIW or 25 Pair Cable
- 6 C O Wiring Field
- 7 Power Supply
- 8 Coupled Bonding Conductor (optional)
- 9 D2R Cords

Digital Data Workstation with IMUX

If the data workstation requires an interface other than Ethernet or Token Ring, use an Inverse Multiplexor (IMUX) as the DCE to provide V.35, RS232, RS449 or X.21 connectivity to the MERLIN MAGIX 2B data port.

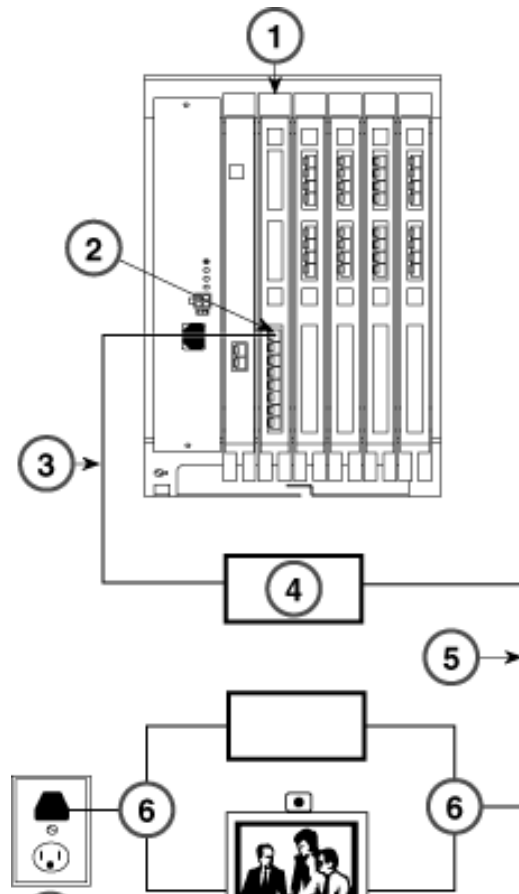


Figure 6-8. IMUX to MLX 2B Data Port

- 1 408 GS/LS-ID-MLX or 008 MLX module
- 2 MLX port
- 3 D8W cord
- 4 IMUX
- 5 V.35, RS-232, or V.366 cable
- 6 Connects to either video-conference equipment or other data equipment
- 7 AC outlet

Video-Conferencing Workstations

In the MERLIN MAGIX system, a video-conferencing workstation is a digital data workstation that connects video equipment to the system using an MLX extension jack programmed as a 2B data port (H.324 analog video equipment is not certified). For best results, a Video-Conferencing system requires twice the transmission speed (112 or 128 kbps) supported by a single digital facility B-channel (56 or 64 kbps).

Desktop Video-Conferencing Workstation

This type of workstation is PC-based and uses the PC's CPU as DTE with video-conferencing circuitry (including a codec) as its DCE. Desktop video-conferencing workstations use the 2B data feature.

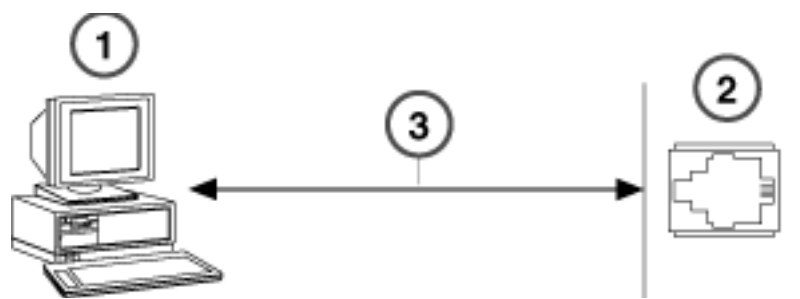


Figure 6-9. ISDN Desktop Video-Conferencing Workstation

- 1 Video Station (PC with ISDN-BRI S/T interface card)
- 2 MERLIN MAGIX MLX port configured as a 2B data port providing an ISDN-BRI S/T interface with AT&T Custom protocol
- 3 D8W Cord

Group Video-Conferencing Workstations

Group video-conferencing workstations include larger screens and higher-capability--more expensive equipment--than do desktop systems. They are typically built into a conference room or consolidated in a mobile rollabout unit.

There are two types of group video-conferencing workstations:

- **ISDN Group Video-Conferencing Workstation.** ISDN group Video-Conferencing systems use the 2B data feature. For one or two channel calls, most ISDN group Video-Conferencing systems do not require a separate IMUX if an ISDN-BRI interface card is built into the system. For higher speed calls up to the MERLIN MAGIX maximum 8 channel or 512kbps call, an IMUX is required.

- **V.35 Group Video-Conferencing Workstation.** This type of video workstation uses a standalone Video-Conferencing system as its DTE. An IMUX is required as a DCE to convert the MERLIN MAGIX ISDN-BRI interface to V.35 and RS366 interface for connectivity to the video workstation.

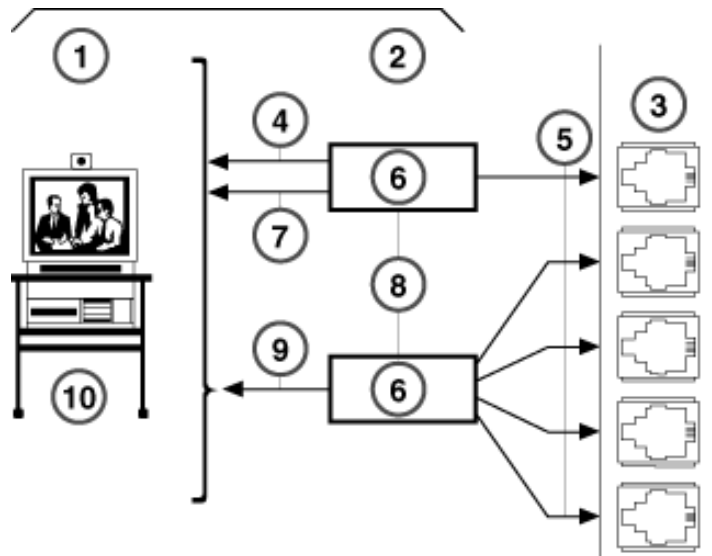


Figure 6-10. Group Video-Conferencing Workstation

- 1 DTE
- 2 DCE
- 3 MERLIN MAGIX MLX ports configured as 2B data ports providing ISDN-BRI S/T interface with AT&T Custom Protocol
- 4 V.35 interface
- 5 D8W cord
- 6 IMUX
- 7 V.366 interface
- 8 OR
- 9 Digital signal
- 10 Group Video-Conferencing system

Table 6-2. Video-Conferencing Workstation Configurations Summary

Type of Data Workstation	DCE	Outside Facility	Extension Jacks	Maximum Speed
ISDN desktop Video-Conferencing	Built-in or IMUX	T1 Switched 56 data, NI-1 BRI, or PRI	1-4 MLX extension jacks; uses 2 B-channels per port	448 or 512 kbps
V.35 group Video-Conferencing	IMUX	T1 Switched 56 data, NI-1 BRI, or PRI	1-4 MLX extension jacks; uses 2 B-channels per port	448 or 512 kbps
ISDN group Video-Conferencing	Built-in or IMUX	T1 Switched 56 data, NI-1 BRI, or PRI	1-4 MLX extension jacks; uses 2 B-channels per port	448 or 512 kbps

T1 Wiring Requirements

Use wiring which meets the specific electrical and physical requirements in order to properly transmit T1 signals. Lucent Comcode for specific lengths is 106557077. For a 1000-foot roll order, use Comcode 105367502. For the recommended 8-pin RJ48 connector, use Comcode 105265466. Wiring can extend 655 feet between the Smart jack and the CSU or between the CSU and the PBX. The shields are grounded only at one end.

- Physical Requirements:
 - Signal wires: 22awg solid tinned copper
 - Drain wires: 24awg sold tinned copper (the drain wire is connected to electrical ground only at one end)
 - Shields: transmit and receive pairs individually twisted and shielded with aluminum/polyester tape with positive overlap or braided shield
- Electrical Requirements:
 - Nominal impedance: 100 ohms +/- 5% at 772 kHz
 - Insertion loss: maximum of 10 dB per 1000 ft at 1.544 MHz or maximum of 7 dB per 1000 ft at 772 kHz
 - Far-end Crosstalk: minimum of 85 dB per 1000 ft at 1.544 MHz or minimum of 90 dB per 100 ft at 772 kHz
 - Near-end Crosstalk: minimum of 80 dB per 1000 ft at 1.544 MHz or minimum of 85 dB per 100 ft at 772 kHz

See [“Alternate Wiring Options”](#) on page 6-15 for more information.

Alternate Wiring Options

CAUTION:

- *Failure to use electrically compliant T-1 cable may cause T-1 transmission errors, bipolar violations, loss of signal continuity and other problems. Do not use flat modular telephone cable for network connections.*
 - *When using Unshielded Twisted Pair (UTP) cable, do not run T-1 transmit and receive pairs in the same sheath for any distance. Although, in the field, it is common practice to run the transmit and receive pairs of a T-1 through short distances (10 to 20 feet) of UTP, performance cannot be guaranteed.*
 - *A shielded cable is preferred over UTP cable for those installations where the cabling run is in close proximity to noise sources such as fluorescent light fixtures.*
1. 25 or 50 pair UTP binders can be used with good performance (though not guaranteed) up to 400 feet, if the transmit and receive pairs are separated by at least 25 pairs or for multiple T-1s by placing all the transmit pairs in one binder and all the receive pairs in a separate binder. There should not be any splices or connecting blocks in the wire run.
 Reference: ANSI/TIA/EIA-568, Annex D, pages 123 and 135
 "There are many issues to consider when deciding which applications and how many systems can share a common binder group in a multi-pair UTP cable." "The main problem occurs when systems with a common bandwidth share a common binder group in a multi-pair cable."
 "Signals with significantly different power levels should not share the same binder group."
 "25-pair inside cabling has been traditionally used for voice services between the telecommunications closet and a remote distribution termination."
 "Although such an arrangement may provide installation efficiencies, it is not recommended for the general case. Some services will co-exist, but the variety and demands of modern voice and data networks make it difficult to characterize and guarantee performance. In commercial buildings where occupancy is by more than one tenant, there would be the possibility of one users system interfering with another's. If interference occurred, finding the source and resolving the problem would be difficult and time consuming."
 "Transmission categories for multi-pair cables used in such configurations should be identical to those of multi-pair backbone cables as specified in 10.3."
 2. 2- or 4-pair UTP can be used with good performance (though not guaranteed) up to 400 feet if the transmit and receive pairs are not in the same sheath and the transmit sheath and receive sheath are separated by at least 4 inches the entire wire run. They should not be any splices or connecting blocks in the wire run.

100DCD Module for T1/PRI Capability

The 100 DCD module has a built-in channel service unit (CSU) and data service unit (DSU). Using this module eliminates the need to attach an external CSU/DSU, thereby allowing easier routing of calls.

The 100 DCD module has the same signaling modes as previous 100 DS1 modules, including the ability to use T1 or PRI configuration. This module can be installed in both a metal and plastic carrier (by adding a clamshell). Therefore, it can be added to an existing MERLIN LEGEND Communications System, where it functions like other 100 DS1 modules.

- NOTES** ►
- You can install a 100 DCD into a MERLIN MAGIX Release 1.0 or a MERLIN LEGEND system, but you need a MERLIN MAGIX system of Release 1.5 or later to support the CSU/DSU functionality
 - The 100 DCD module firmware can be upgraded using a PCMCIA card. If the 100 DCD module has no firmware installed, the System Inventory Report shows “100 D/CSU/S No FW.”

100 DCD Data Cable

The 100 DCD module is connected to the customer's equipment by use of a cable consisting of a 50 position centronic pin (male) connector to a molded V.35 socket (female) connector (port 1) and 25 position socket (female) d-sub molded connector (port 2) that is supplied with each circuit module:

- Data Port 1 provides a fixed V.35 interface terminated at an MS34 socket.
- Data Port 2 terminates in an EIA-530-A interface via a DB25 socket. The port supports multiple industry standard interfaces when used in conjunction with standard adapter cables. RS-449, X.21 and V.35 interfaces are supported. Data Port 2 must be used when an interface other than V.35 is required. It can also be used to provide a second V.35 interface. Nothing precludes using Data Port 2 in an application requiring a single V.35 port so long as the proper cabling is provided.

Regardless of which port is used, the customer is responsible for providing the cable that connects from ports 1 or 2 to the data endpoint.

The 100 DCD data cable is shown below.



Figure 6-11. 100 DCD Data Cable

Pin assignments for the 25-pair cable are shown in Table 6-3

Table 6-3. Data Port 25-Pair Cable (P1) Pin Assignments

PIN Number	Signal	PIN Number	Signal
1	RD-A1	26	FRAME GND
2	RD-B1	27	RD-A2
3	TXC-A1	28	RD-B2
4	TXC-B1	29	TXC-A2
5	RXC-A1	30	TXC-B2
6	RXC-B1	31	RXC-A2
7	TD-A1	32	RXC-B2
8	TD-B1	33	TD-A2
9	DSR1	34	TD-B2
10	SIG-GND	35	DSR2
11		36	SIG-GND
12		37	SIG-GND
13	CTS-A1	38	SIG-GND
14	CTS-B1	39	CTS-A2
15	RLSD-A1	40	CTS-B2
16	RLSD-B1	41	RLSD-A2
17	TT-A1	42	RLSD-B2
18	TT-B1	43	TT-A2

Table 6-3. Data Port 25-Pair Cable (P1) Pin Assignments—Continued

PIN Number	Signal	PIN Number	Signal
19	RTS-A1	44	TT-B2
20	RTS-B1	45	RTS-A2
21	LL1	46	RTS-B2
22	DTR1	47	LL2
23	RL1	48	DTR2
24	TM1	49	RL2
25	FRAME GND	50	TM2

- NOTES** ■ Connector shell pins G1 and G2 are connected to FRAME GND.
- Signals qualified by a 1 belong to Data Port 1, signals qualified by a 2 belong to Data Port 2.

Pin assignments for the Data Port 1 connector are shown in [Table 6-4](#)

Table 6-4. Data Port 1 Connector (P2) Pin Assignments

MS34 SOCKET DESIGNATION	CONNECTOR SIGNAL NAME	DIRECTION
A	FRAME GROUND	
P	TD-A1	TO DSU
S	TD-B1	TO DSU
R	RD-A1	FROM DSU
T	RD-B1	FROM DSU
Y	TXC-A1	FROM DSU
AA	TXC-B1	FROM DSU
V	RXC-A1	FROM DSU
X	RXC-B1	FROM DSU
C	RTS-A1	TO DSU
D	CTS-A1	FROM DSU
F	RLSD-A1	FROM DSU
E	DSR-A1	FROM DSU
B	SIGNAL GND.	

Table 6-4. Data Port 1 Connector (P2) Pin Assignments—Continued

MS34 SOCKET DESIGNATION	CONNECTOR SIGNAL NAME	DIRECTION
U	TT-A1	TO DSU
W	TT-B1	TO DSU
H	DTR1	TO DSU
N	RL1	TO DSU
L	LL1	TO DSU
NN	TM1	FROM DSU

- NOTES** ■ Data Port 1 supports V.35 only.
- MS34 connector is at the end of the 25-pair connector cable B.

Pin assignments for the Data Port 2 connector are shown in Table 6-5.

Table 6-5. Data Port 2 Connector Pin Assignments

CABLE DB25S PIN NUMBER	CONNECTOR SIGNAL NAME	DIRECTION
1	FRAME GND	
2	TD-A2	TO DSU
3	RD-A2	FROM DSU
4	RTS-A2	TO DSU
5	CTS-A2	FROM DSU
6	DSR2	FROM DSU
7	SIGNAL GND	
8	RLSD-A2	FROM DSU
9	RXC-B2	FROM DSU
10	RLSD-B2	FROM DSU
11	TT-B2	TO DSU
12	TXC-B2	FROM DSU
13	CTS-B2	FROM DSU
14	TD-B2	TO DSU
15	TXC-A2	FROM DSU
16	RD-B2	FROM DSU

Table 6-5. Data Port 2 Connector Pin Assignments—Continued

CABLE DB25S PIN NUMBER	CONNECTOR SIGNAL NAME	DIRECTION
17	RXC-A2	FROM DSU
18	LL2	TO DSU
19	RTS-B2	TO DSU
20	DTR2	TO DSU
21	RL2	TO DSU
22		
23		
24	TT-A2	TO DSU
25	TM2	FROM DSU

- NOTES** ■ V.35, RS449 and X.21 interfaces require an adapter cable.
- DB25S connector is at the end of the 25-pair connector cable A.

Data Port Interface signal descriptions are shown in Table 6-5.

Table 6-6. Data Port Interface Signal Descriptions

Signal	Description
RD-A, RD-B	Receive Data, differential pair, data transmitted to the DTE.
TXC-A, TXC-B	Transmit Clock, differential pair, DCE sourced timing reference for TD-A/B.
RXC-A, RXC-B	Receive Clock, differential pair, DCE sourced timing reference for RD-A/B.
TD-A, TD-B	Transmit Data, differential pair, data transmitted to the DCE.
DSR	Data Set Ready, DCE activated and ready to operate.
CTS-A, CTS-B	Clear To Send, differential pair, indicator to DTE that DCE is ready to receive data.
RLSD-A, RLSD-B	Receive Line Signal Detect, differential pair, activated by the DCE to indicate that a communications channel exists.

Table 6-6. Data Port Interface Signal Descriptions—Continued

Signal	Description
TT-A, TT-B	Transmit Clock, differential pair, DTE sourced timing reference for TD-A/B.
RTS-A, RTS-B	Request To Send, differential pair, indicator to DCE that the DTE is ready to transmit data.
LL	Local Loopback.
DTR	Data Terminal Ready. DTE activated and ready to operate.
RL	Remote Loopback.
TM	DCE Test Mode indicator to DTE.
SIG-GND	Common ground reference for balanced circuits on the data interfaces.
FRAME-GND	Protective ground, equipment frame ground.

DIP Switches

In addition to the different cabling required for the various physical level interfaces supported there are DIP switches on the module, shown in Figure 6-12, that must be set according to what interface is being used. Data Port 1's switches, shown in Figure 6-13 on page 6-22, are set at the factory and are fixed to support V.35 only, hence they should never need changing. Data Port 2's switches, shown in Figure 6-14 on page 6-23, can be set in either of two modes, V.35 (default) or RS-449/X.21.

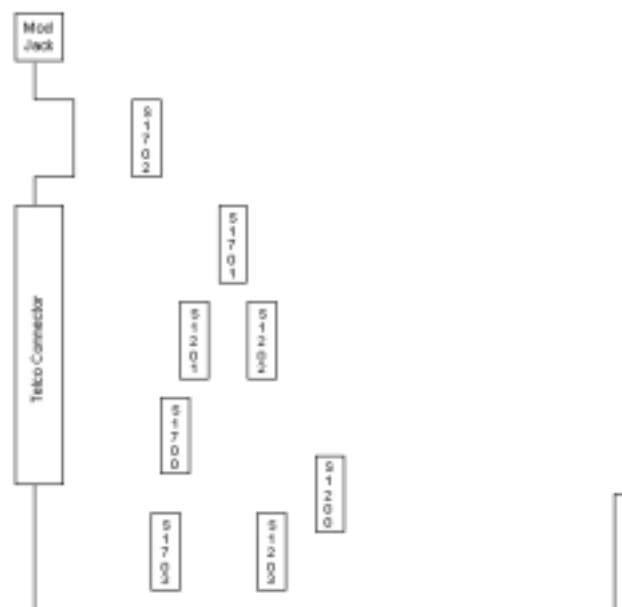


Figure 6-12. 100 DCD Data Port DIP Switch Placement

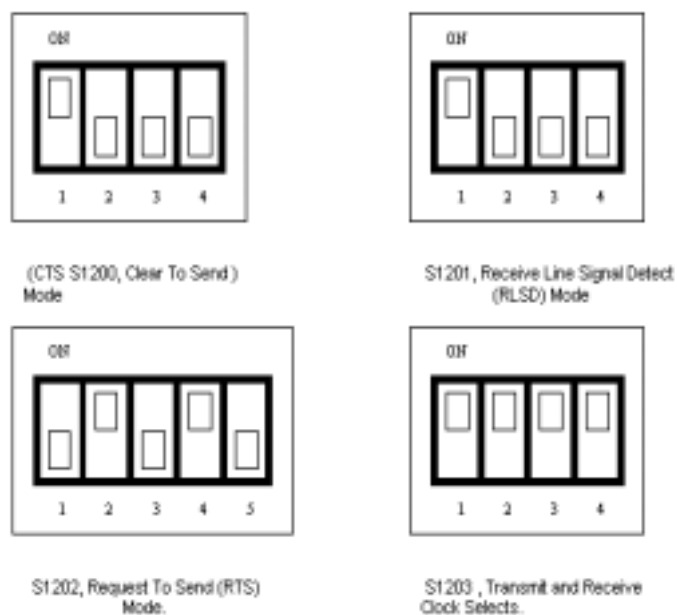


Figure 6-13. Data Port 1 DIP Switch Settings

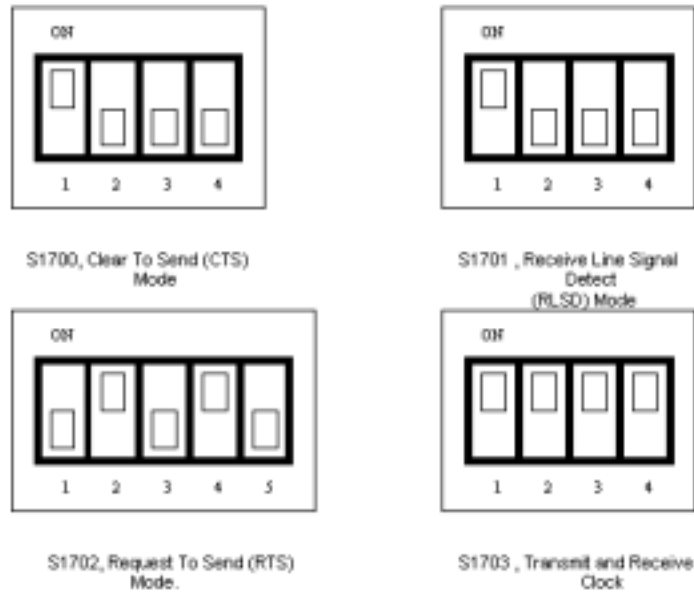


Figure 6-14. Data Port 2 DIP Switch Settings,V.35 Mode

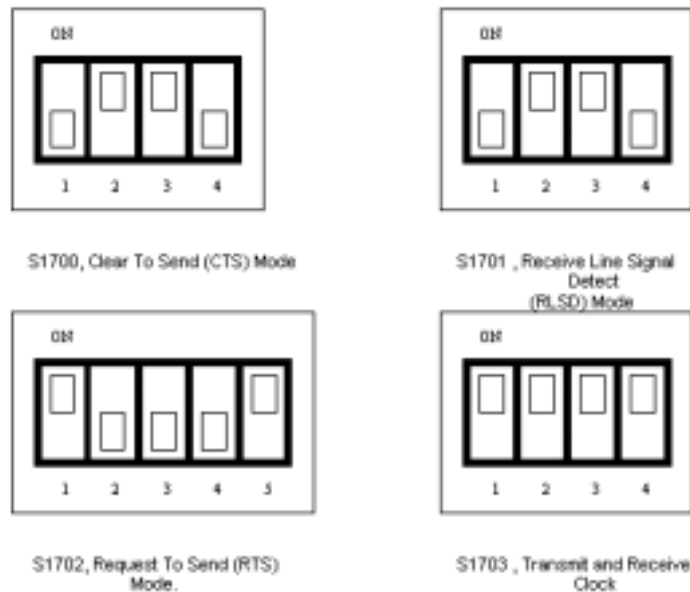


Figure 6-15. Data Port DIP Switch Settings RS-449 and X.21 Modes

Bantam Jacks

The module provides six CSU standard bantam jacks for signal insertion and/or passive monitoring of the T1 interface. See Figure 6-16.

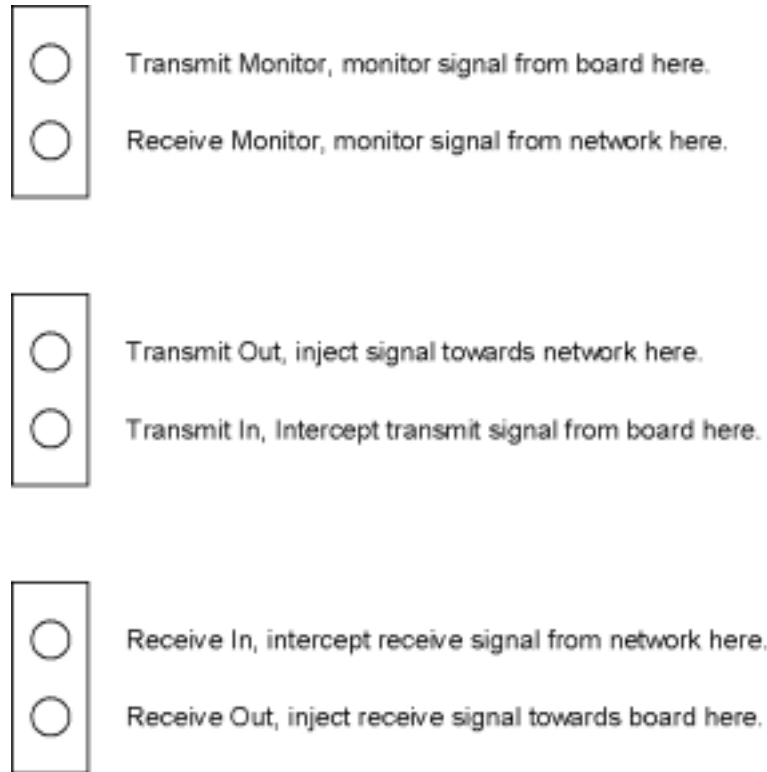


Figure 6-16. CSU Bantam Jacks. Ordering Is as They Appear on the Module Faceplate

100R INA Module for T1/PRI Capability

The 100R INA module combines the functioning of the 100 DS1 module, data routing, and a Channel Service Unit (CSU). Using a T1 or Primary Rate Interface (PRI), the 100R INA module gives the MERLIN MAGIX system fast access to the Internet without having to use an external CSU. See Figure 6-17 on page 6-26. Each 100R INA module accommodates up to 23 PRI channels or 24 T1 channels.

- Each 100R INA module accommodates up to 23 PRI channels or 24 T1 channels.
- Each channel can be configured to a router, to a switch, or to neither a router nor a switch.
- Combines the functionality of a CSU and a router.
- Voice and data multiplexing.
- You can have up to two 100R INA modules per carrier and as many as three in your system. However, because MERLIN MAGIX recognizes the 100R INA, 100 DS1, and 100 DCD as the same module, their combined total in your system *cannot* exceed three.

NOTE ► If a 100R INA module is used after the limit has been reached, the module starts, but the lines on the router are not recognized. However, you can program the B-Channels and lines so that the switch uses lines on the 100R INA module. For more detailed information, refer to the documentation packaged with the 100R INA module.

Routing functions are handled by an additional CPU that provides 32MB of dedicated RAM and special nonvolatile (Flash) RAM. The nonvolatile RAM contains router configuration data and operating firmware called ComOS. The module includes a 10BaseT Ethernet port to connect to the customer's network.

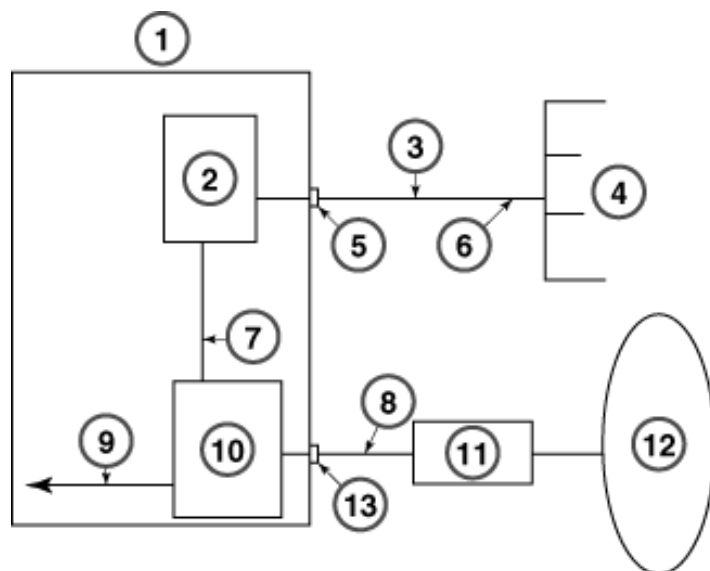


Figure 6-17. 100R INA Module Connectivity

- 1** MERLN MAGIX 100R INA Module
- 2** Router
- 3** Ethernet 10BaseT
- 4** Local Area Network (LAN)
- 5** Ethernet port
- 6** CAT 5 cable
- 7** Router channels
- 8** D8W cord
- 9** Voice channels to MERLIN MAGIX backplane
- 10** CSU
- 11** Network Smart Jacks
- 12** Network
- 13** DS1 Port

Connecting Cables

This section describes the 100R INA module cable connections. Figure 6-18 shows the front panel of the module.

- 1 DS-1 Status LEDs
- 2 C1 Serial Port
- 3 DIP Switches
- 4 System LED
- 5 Console Port
- 6 Network Activity LED
- 7 Ethernet Port
- 8 Ethernet Link LED
- 9 Reboot Button
- 10 T1/PRI Port
- 11 DS1 Test Jacks

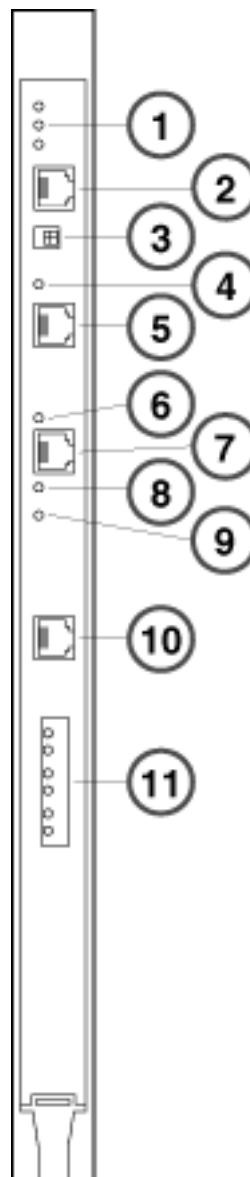


Figure 6-18. 100R INA Module Front Panel

C1 Serial Port

Connect the supplied straight-through RJ-45 cable between the C1 Serial Port on the 100R INA module and the administration port (labeled ADMIN) on the MERLIN MAGIX processor module. This cable allows the user to connect to the INA command line interface by dialing in to the internal modem in the MERLIN MAGIX processor module.

DIP Switches

In order for the 100R INA module to operate properly, the DIP switches must be set as follows:

1. **Set DIP switch 1 to the right.** When DIP Switch 1 is set to the right and the 100R INA module is turned on, the console port is set to 9600bps, 8 data bits, 1 stop bit, no parity, and no flow control. This is the default setting and is used for connecting the console port to a console.

When DIP switch 1 is set to the left, the port settings can be controlled by ComOS. Use this setting for an external modem that is set up to provide access to the command line interface, for example.

2. **Set DIP switch 2 to the left.** When DIP Switch 2 is set to the left and the 100R INA module is turned on, the INA module boots (loads the ComOS software) from the internal nonvolatile RAM. This is the default setting for the module.

When DIP Switch 2 is set to the right, and the 100R INA module is turned on, the module boots from an external BOOTP and TFTP server. Use this setting only when serious hardware or software problems have occurred. You should only use this DIP switch setting under the direction of Lucent technical support personnel.

NOTE ► When you change the position of a DIP switch, you must restart the 100R INA module for the change to take effect. To reboot, press the recessed reboot button on the front panel of the module. Pushing this button reboots the router software only and does not affect voice services.

Console Port (Optional)

You can connect a PC or terminal to the 100R INA module's console port to access the command line interface of ComOS.

Follow these instructions to connect a PC or terminal:

1. If necessary, ensure that your PC or terminal has the same settings as the console port on the 100R INA module. The settings are 9600 baud, 8 data bits, 1 stop bit, no parity, and no flow control.
2. Connect a console cable to the console port on your 100R INA module and PC or terminal. See ["Cable Specifications"](#) on page 6-32 for more information about this cable.
3. Reboot the 100R INA module by pressing the recessed reboot button. Verify that the login prompt appears.

T1/PRI Port

Use a category 5 twisted pair cable, as specified by the EIA/TIA-568-B wiring standard, with an RJ-48C connector to connect the T1/PRI port to the T1/PRI line. See [“Cable Specifications”](#) on page 6-32 for more information about this cable.

Ethernet Port

Use a category 5 twisted pair cable, as specified by the EIA/TIA-568-B wiring standard, with an RJ-48C connector to connect the Ethernet port to the nearest network hub. See [“Cable Specifications”](#) on page 6-32 for more information about this cable.

Observing LED Behavior

On the 100R INA module front panel, check the DS-1 Status LEDs, System LED, and Ethernet LEDs to verify that the installed module is operating properly.

DS1 Status LEDs

The DS1 Status LEDs indicate the status of the T1/PRI line and operate in the same way as on a 100D module. Make sure they indicate that the T1/PRI line is operating properly.

- Red illuminated indicates that there is an error condition on the line or that the 100R INA module is in the standby mode. When in standby mode, the module is not operational for T1/PRI services. This LED stays illuminated for approximately 15 to 30 seconds when an active line is first connected.
- Green illuminated indicates that the 100R INA module is in test mode.
- Amber illuminated indicates that one or more voice calls are currently active on the T1/PRI interface.

System LED

The System LED operates as follows:

- During the initial hardware self-test the LED stays unlit.
- When the ComOS starts to boot up, the LED lights and remains on.
- When the system is fully operational, the LED remains on, blinking off once every 5 seconds.

After the module has been powered up and loading is complete, make sure that the LED is blinking off once every 5 seconds. The 100R INA module takes about 20 seconds to reach this state.

Ethernet LEDs

The Ethernet Link LED and Network Activity LED show the status of the Ethernet connection to the 100R INA module.

- The green Ethernet Link LED is on when the module has link integrity to a 10BaseT hub, switch, or router. Make sure that this LED lights when a cable has been connected between the module and an Ethernet hub. If the LED does not light, check the cable itself and the network connections.
- The amber Network Activity LED blinks to indicate Ethernet traffic. During heavy traffic, this LED might appear solid due to its rapid blinking. Depending on your network, you might not necessarily see much traffic.

DS1 Test Jacks

Several DS1 Test Jacks are located on the front panel of the INA Module (refer to Figure 6-18 for the location of the DS1 Test Jacks). Table 6-7 lists and describes the usage of each DS1 Test Jack.

Table 6-7. DS1 Test Jacks Description and Usage

Test Jack Label	Description and Usage
MON In	Monitor In. This jack allows external test equipment to passively monitor the T1/PRI signal coming from the network to the 100R INA module. The use of this jack does not disrupt the T1/PRI signal received by the 100R INA module from the network.
MON Out	Monitor Out. This jack allows external test equipment to passively monitor the T1/PRI signal going to the network from the 100R INA module. The use of this jack does not disrupt the T1/PRI signal transmitted by the 100R INA module to the network.
NET In	Network In. An intrusive, break-in jack that allows external test equipment to inject a T1/PRI signal to the network. The use of this jack disrupts the T1/PRI signal transmitted by the 100R INA module to the network.
EQPT Out	Equipment Out. An intrusive, break-in jack that allows external test equipment to intercept and terminate the T1/PRI signal coming from the 100R INA module. The use of this jack disrupts the T1/PRI signal transmitted by the 100R INA module to the network.
NET Out	Network Out. An intrusive, break-in jack that allows external test equipment to intercept and terminate the T1/PRI signal coming from the network. The use of this jack disrupts the T1/PRI signal received by the 100R INA module from the network.
EQPT In	Equipment In. An intrusive, break-in jack that allows external test equipment to inject a T1/PRI signal to the 100R INA module. The use of this jack disrupts the T1/PRI signal received by the 100R INA module from the network.

Troubleshooting the 100R INA Module

Table 6-8 identifies 100R INA module LED behavior, possible causes of the behavior, and potential solutions.

Table 6-8. LED Behavior

LED Behavior	Possible Cause	Solution
System LED does not light.	Power is not present.	Check that the module is correctly seated in the carrier. Check that the MERLIN MAGIX system is properly turned on.
T1/PRI line is connected to the T1/PRI port and the red DS-1 status LED stays lit for more than 30 seconds.	The 100R INA module does not recognize service from the telephone company.	Check the T1 cable and modular jack. If the problem is not resolved, contact the telephone company.
During startup, the system LED fails to light or stays continuously lit.	A hardware problem has occurred.	Contact Avaya technical support.
Twenty seconds after booting, the system LED stays solidly lit or does not light.	A component might have loosened during shipping, or the module is defective.	Contact Avaya technical support.
During operation, the system LED stays solidly lit for more than 20 seconds or does not light.	A hardware problem might have been caused by an external device.	If the LED stays solidly lit for more than 20 seconds or does not light after you have checked all external cables, contact Avaya technical support.
No console login prompt is displayed.	Terminal settings are incorrect or a connection or cable is inoperable.	Do the following: ■ Verify terminal settings of 9600 baud, 8 data bits, 1 stop bit, a parity of none, and software control (XON/XOFF). ■ Verify that DIP switch 1 is set to the right. ■ Verify that you have a working null modem cable and that it is properly connected at both ends. See “Console Cable” on page 6-33.

Table 6-8. LED Behavior—Continued

LED Behavior	Possible Cause	Solution
Ethernet link LED is not lit when connected to a 10BaseT Ethernet hub.	There is no link integrity.	Verify that you have a working 10BaseT cable properly connected to the 100R INA module and to the hub.
Network activity LED is solidly lit.	Heavy traffic can cause the network LED to blink so rapidly that it appears to be solidly lit.	Verify that the network cables are correctly installed.
Network activity LED is not lit.	If the 100R INA module is not receiving or sending traffic, the network LED is not lit.	Verify that the network cables are correctly installed.
An undefined difficulty occurred at startup, but the cause cannot be determined from LED behavior.	Refer to the solution column.	Try booting in console mode and observe the boot messages. Record the information and contact Avaya technical support.

Cable Specifications

Specifications are provided for the following cables:

- **Console Cable.** This null modem cable is used to connect a terminal or PC to the console port of the 100R INA module.
- **T1/PRI Cable.** This cable is used to connect a T1/PRI line to the 100R INA module.
- **Ethernet Interface Cable.** This cable is used to connect the Ethernet connector on the 100R INA module to an Ethernet hub.
- **Crossover Cable.** This cable is used to make a simulated network connection between the 100R INA module's Ethernet port and a free-standing computer workstation.

Console Cable

Table 6-9 shows the cable pinouts for an RJ-45 to DB-25 null modem cable. The 100R INA module does not use Data Set Ready (DSR).

Table 6-9. Cable Pinouts for an RJ-45 to DB-25 Null Modem Cable

100R INA Module Serial Port (CO)				PC or Terminal Serial Port	
RJ-45	Name	Description	Direction	DB-25 (DTE)	Signal
1	RTS	Request to Send	Output	5	CTS
2	DTR	Data Terminal Ready	Output	8 1	DCD
3	TXD	Transmit Data	Output	3	RXD
4	GND	Signal Ground		NC 2	
5	GND	Signal Ground		7	GND
6	RXD	Receive Data	Input	2	TXD
7	DCD	Data Carrier Detect	Input	20	DTR
8	CTS	Clear to Send	Input	4	RTS
NC 2		Data Set Ready		6 1	DSR

- NOTES** ►
- Pins 8 and 6 in the DB-25 connectors are connected internally.
 - Not connected.

Ethernet Interface

Table 6-10 provides specifications for the 10Mbps baseband IEEE 802.3-compatible Ethernet interface.

Table 6-10. Specifications for the Ethernet Interface

Ethernet Type	Connector Type	Cable Type	Transmission Distance
RJ-48C	RJ-48C for 10BaseT	Category 5 unshielded twisted pair	Hub distance: 328ft (100m) maximum Repeaters: 4 maximum

Crossover Cable

Table 6-11 shows wiring for the RJ-45 crossover cable which is used to connect two (and only two) machines using 10BaseT Ethernet without the use of a hub. The cable must be fabricated from category 5 unshielded twisted pair.

Table 6-11. Wiring for the RJ-45 Crossover Cable

RJ-45 Connector	RJ-45 Connector
pin 1	pin 3
pin 2	pin 6
pin 3	pin 1
pin 6	pin 2

Configuring the 100R INA Module

This section provides examples of how to configure the INA module router for anticipated configurations. This information is in addition to the documentation packaged with the 100R INA module. Knowledge of IP addressing concepts, routing concepts, packet filtering concepts and variations of Command Line Interface (CLI) commands is required for configurations not directly addressed here.

Prerequisites and Assumptions

For the purposes of these example configurations, it is assumed that:

- The T1/PRI interface has been installed and is operational using ESF framing and B8ZS suppression. It is not required that voice channels be operational in order to bring INA module router services up. The T1/PRI programming to support voice services may be done before or after router programming. It is anticipated that, in most instances, voice services will be brought up first. Programming the INA module for voice services is not covered here but is the same as it is for the 100D and 100 DCD module and is performed using MERLIN MAGIX programming using a system programming console or a PC with WinSPM.
- For public network connections, the service provider has properly mapped the channels to be used for data so that they are delivered to an ISP or a frame relay provider or both.
- For public network connections, the ISP and/or frame relay provider has properly configured their router or frame relay switch and is ready to receive data from the 100R INA module.
- The CSU internal to the 100R INA module is either left activated or is deactivated and the appropriate compensation/gain is set. This programming is performed using MERLIN MAGIX system programming and is described in the *INA Module Installation and Configuration Guide*. In most cases, the internal CSU will be left activated and the default compensation/gain of “1” representing 0 dB will be used.
- The programming required to direct T1/PRI channels to the 100R INA module router has been completed. This programming is performed using MERLIN MAGIX system programming and is described in the *INA Module Installation and Configuration Guide*. Note that after the data channels are assigned on the MERLIN MAGIX system, the 100R INA module router must be rebooted. This can be done by either issuing a reboot command in the router's CLI or by depressing the router reboot button on the 100R INA module.
- A PC is used to program the 100R INA module router via the CLI of the router using the serial port on the INA module. This requires the use of the DB9 to RJ45 cable that is shipped with the 100R INA module. The DB9 end of the cable is connected to the serial port of the PC and the RJ45 end of the cable is connected to the c0 port of the 100R INA module. The c0 port is the second modular jack from the top of the 100R INA module and is labeled “CONSOLE”. The portable PC should be set to use a terminal emulator on its serial port with serial port settings of 9600 bps, 8 data bits, no parity, 1 stop bit and no flow control. In most cases, the c0 port will be set to match these settings since these are the factory default settings. If a CLI session cannot be established, the uppermost DIP switch (DIP 0) can be set to the right and the router rebooted. This forces the c0 port to match the above settings even if the c0 port settings have been changed in router software.
- The necessary configuration data as discussed in Table 6-12 has been collected from the appropriate contact person.

Successful implementation of 100R INA module depend upon the collection of WAN and LAN information. This is over and above the information that is collected for a pure voice T1/PRI configuration. This new information is summarized below.

Table 6-12. WAN and LAN Information for a 100R INA Module Implementation

Area	Source of Information
Use of NAT or NAPT	Customer and data contact. Use of NAT and NAPT will depend on: How IP addresses are currently used in the customers network. Willingness of the customer to pay for additional public IP addresses for PC endpoints The term “data contact” is used to refer to whoever is providing data support for the customer. This may be an internal resource at the company or may be a third party data consultant.
Number of T1/PRI channels used for data	Customer and data contact. The number of channels is determined by the customer's overall needs (e.g. frame relay channels in addition to channels for ISP access) and is based on the customer's willingness to pay for bandwidth.
Specific T1/PRI channels used for data	Telco/carrier. The telco/carrier must map these channels over to the ISP. When configuring the INA router, WAN ports begin at one less than the lowest numbered T1/PRI channel. For example, if channels 22 and 23 are used for ISP access and have been assigned as data channels on the MERLIN MAGIX system, then a w21 WAN interface is available for programming on the INA module router.
Channel rate for data channels (64 kbps or 56 kbps)	Telco/carrier with confirmation from the ISP that the ISP is set up for the same rate. This will almost always be 64 kbps (the default on the INA router) even when the voice channels are robbed-bit T1. One exception may be where a single data channels is used. In this case, 56 kbps might be implemented.
WAN port numbered PPP link info: INA module WAN port IP address Destination ISP router IP address Subnet mask for the WAN port PPP link	ISP. ISP's may sometimes refer to this as serial link information. They may, for example, call the IP address for the INA module a serial port address. This is because they are accustomed to implementations involving an external router connected to a CSU/DSU via a serial port. The IP addresses supplied will be routable, public IP addresses. The subnet mask will typically be 255.255.255.252 so that only two IP addresses are consumed for this small subnet. The WAN port PPP link is actually considered to be an IP subnetwork but since it's a point to point link, only two endpoints are participating in the subnetwork.

Table 6-12. WAN and LAN Information for a 100R INA Module Implementation—Continued

Area	Source of Information
Other public IP addresses available to the customer	ISP. With ISP accounts, the customer would typically be given a handful of usable, public IP addresses.
DNS server IP addresses: Primary DNS server Secondary DNS server	ISP. The scenarios here assume that the customer is using DNS servers provided by the ISP and that they don't have their own internal DNS server.
INA module Ethernet port info: IP address Subnet mask	Data contact. The data contact will be able to provide the subnet mask in use on the customer's network and provide an available IP address for use on the INA modules Ethernet port.
How e-mail is handled: Individual users will access ISP hosted accounts. In this case, obtain the name of the POP and SMTP e-mail servers of the ISP. Or There will be an e-mail server on site. In this case, get the IP address of the e-mail server.	Customer, ISP and data contact. There is no router specific programming needed to handle the case where individual users access ISP hosted accounts. Knowing the names of the ISP mail servers may be helpful to the customer since the customer will have to configure their e-mail clients to access the ISP hosted accounts. When there is an e-mail server on-site, a filter rule will have to be established to allow connections to this server.
IP addresses for Internet accessible servers on the customer's LAN: Web server E-mail server FTP server	Data contact. The customer may or may not have these servers. If these servers are present AND they need to be accessible from the Internet, then the IP addresses for the servers must be available in order to establish packet filtering rules for these servers. If such servers are present but do not need to be accessible from the Internet, then they do not have to be accounted for in packet filtering rules. It may be the case that a single PC is providing multiple server capabilities.
Frame relay information: Type of management protocol used: Annex-d or LMI Value of keep alive timer in seconds For each location, the list of DLCI's and which other locations these DLCI's are mapped to.	Data carrier. The data carrier may or may not be the same as the voice telco/carrier. In either case, the data carrier will provide, by location, the list of DLCI's that have been provisioned and where each DLCI has been mapped to. Note that the data carrier will not specify nor be concerned with the IP addresses associated with each location. The IP to DLCI associations will be determined by you.

IP Address Examples

The Internet standards bodies have reserved the following IP addresses as private IP addresses:

- 192.168.0.0 – 192.168.255.255 (192.168.0.0/16)
- 172.16.0.0 – 171.31.255.255 (172.16.0.0/12)
- 10.0.0.0 – 10.255.255.255 (10.0.0.0/8)

These private IP addresses may be used by anyone setting up a private IP network and therefore are used and re-used in many different networks. As such, the public Internet cannot properly route packets containing these addresses. These addresses are not public, registered addresses and do not uniquely identify a single endpoint on the global Internet. You may find that, in planning for an 100R INA module implementation, private IP addresses are in use on a customer's network. If the customer's network will be attached to the Internet, features like NAT and NAPT must be used to avoid sending packets with private IP addresses into the Internet. An alternative is for the customer to use public IP addresses assigned to them by their ISP.

Both global and private IP addresses come into play in the configurations discussed here. For the purposes of the examples discussed here, the following conventions are used:

- IP addresses beginning with 10 are used in cases where global registered IP addresses are used in an actual implementation. In other words, even though addresses beginning with 10 are private IP addresses, they are used here to represent global IP addresses. In actual implementations, addresses beginning with 10 should be replaced with global, registered IP addresses. In most cases, the global IP addresses to use come from the customer's ISP.
- IP addresses beginning with 192.168 are used in cases where private network addresses are used in actual implementations. In actual implementations, these addresses should be replaced with whatever private IP addresses are in use. In most cases, the actual private IP addresses to use are determined by what is already in use on the customer's network and are from one of the three private IP address spaces listed above.

This convention is different than the one used in most of the examples in the *PortMaster* documentation. This convention, however, is more consistent with what is likely to be found in customer's networks. In particular, if customers are using private IP addresses in their networks, they will most likely be using private IP addresses from the 192.168.0.0/16 space. If a choice is available, it is better to use the private IP addresses in this space rather than addresses in the 172.16.0.0/12 or 10.0.0.0/8 space.

Security

The scenarios described here include steps to create packet filters. This is so that relatively complete configuration examples can be presented. Although these example filters can be used as a guide to create packet filters appropriate for a given customer, it is important to note the following:

- Properly implemented, packet filters can help contribute to a customer's overall security plan. Packet filtering, however, is just one of the many techniques, products, and architectures that can be used to implement an overall security plan. Many things that the customer controls can strengthen or weaken a security plan. Examples include:
 - Use of other security products such as standalone firewall or proxy servers.
 - Need to allow for inbound access to servers such as an on-site web, FTP, or e-mail server.
 - The customer's policy for access to logins and passwords (especially the INA router).
 - Use of virus protection software on personal computers.
 - Corporate policy for accessing the Internet and downloading applications.
- Even though a packet filter may be configured as part of the service of installing the 100R INA module, the customer is solely responsible for the security of their network.

The steps that should be taken to ensure that the customer understands the above information are:

- Review the specific packet filter rules with the customer to ensure that the customer knows exactly what is being filtered and what is not.
- Let the customer know that even though the installation may include the configuration of a packet filter, the customer is ultimately and solely responsible for the security of the network and the customer's own security plan.
- Review the *INA Module System Security Statement* with the customer. This statement appears on the INA module CD-ROM and is also printed in the *INA Module Installation and Configuration Guide*.

Filter Examples

In order to understand packet filtering, the following information is provided:

- IP packets contain IP addresses: a source and a destination IP address. The source IP address is the address of the sender of the packet and the destination address is the IP address of the receiver of the packet. Packet filters can deny or permit packets based on the source or destination IP address or both. A filter rule at the IP address level is called an IP rule.
- There are protocols that ride on top of IP. The most well known one is the Transmission Control Protocol (TCP). TCP carries most of what is familiar on the web, such as web browser traffic, FTP traffic, e-mail traffic, and telnet traffic. There is an alternative to TCP, however, which is called the User Datagram Protocol (UDP). The most important thing that's carried on UDP is the Directory Name Server (DNS) traffic. DNS servers are used to resolve a URL such as www.yahoo.com to an IP addresses. The IP address instead of the URL is needed in order

for the client to establish an IP connection out to an Internet server. This is similar to the phone network in that you can't dial someone's name directly—you first need to look up the phone number using a directory service.

- TCP and UDP communication involves the use of ports. Think of ports as different people in a house. A person can call a house to get connected, but also needs to know who they want to talk to. There can be many people in a house, all of whom can be reached through the same phone number. The phone number is like an IP address and the port is like the specific person being called. Popular services have something called well-known ports. For example, a web browser makes connections to TCP port 80. TCP port 80 is the well-known port for browser connections using HTTP. The server that you connect to could support more than one service just as there can be more than one person living at a house. E-mail, FTP, HTTP, and other services might be supported on the same server. Port numbers allow clients and servers to determine what service is being requested. These port numbers are included in IP packets and can be used as the basis for filtering. As a result, specific types of TCP and UDP traffic can be permitted or denied. These rules are called TCP or UDP rules.
- There are other protocols that work side by side with the IP protocol stack. One important example from a filtering perspective is the Internet Control Message Protocol (ICMP). ICMP is used, for example, to implement the popular ping utility. Filters can contain rules to permit or deny certain types of ICMP messages.

The examples in this section include steps on how to configure a single incoming WAN port filter. The filter is set up to allow or prevent certain types of packets as follows:

- Prevent IP spoofing attacks. A complete discussion of IP spoofing attacks is beyond the scope of this discussion. However, in summary, we want to drop incoming WAN port packets that claim to be coming from our own internal network (i.e. the packet claims to have a source IP address that is in use somewhere on our internal network). This is an IP rule blocking such packets regardless of what type of protocol is carried in the packet.
- Permit return traffic from established TCP sessions using a TCP rule. This allows users on the internal network to establish outbound TCP sessions (e.g. FTP, HTTP, telnet, POP e-mail access) and have the return traffic get back from the Internet. This rule takes advantage of the fact that packets in an established TCP session have a special flag set. This flag can be used to identify such packets and the corresponding rule has the keyword "established" in it.
- Permit DNS traffic from the ISP's DNS servers into the customer's internal network. INA customers typically use DNS servers provided by the ISP. ISP-provided DNS servers are on the Internet side of the WAN port so you need a rule to allow DNS traffic to get to the clients on the customer's network. Since DNS traffic is UDP based, the second rule above doesn't permit this type of traffic. Two UDP rules are needed since the ISP typically has a primary and a secondary DNS server. The rules permit incoming WAN port packets that have a source port of 53. This is because the client's request for UDP services is directed initially at the well-known UDP port 53 of the DNS server. The return traffic, therefore, has a source UDP port of 53.
- If required, permit incoming access to a server or servers that need to be accessible from the Internet. The examples cover web, e-mail, and FTP servers. This incoming traffic is allowed only for the specific IP address of the server or servers on the customer's network. Furthermore, the incoming traffic is limited to only those destination TCP ports that are needed. These ports are TCP port 80 for HTTP web traffic, TCP port 21 for FTP traffic, and TCP port 25 for SMTP e-mail traffic. See ["Additional Filtering Considerations"](#) on page 6-72 for additional information on filtering for FTP traffic.

- Allow echo replies to endpoints on the internal network. Echo replies are the ICMP messages that return to a client that has used the ping utility to ping an IP endpoint. This rule allows endpoints on the customer's internal network to ping Internet endpoints. Echo replies are ICMP type 0 messages so the rule includes this information in its syntax. This rule does not allow external endpoints to ping into the customer's network. See [“Additional Filtering Considerations”](#) on page 6-72 for additional information on filtering ICMP traffic.
- Deny everything else. The idea is that anything not explicitly permitted should be denied. The 100R INA module includes an implicit or “hidden” deny rule as the last rule of every filter. This has the effect of denying anything that wasn't permitted by previous rules in the filter. An explicit “deny” step is included in the examples. It is good practice to explicitly include the “deny” step as the last step in a filter.

The following considerations are also taken into account when constructing the rules:

- For incoming packets to client endpoints, the packets are only allowed to get to the clients at destination ports greater than 1023. Clients should choose random ports above 1023 to initiate a request for service such as a request for DNS service or a request to connect to a particular web site. Hence, the return traffic to clients is destined for ports greater than 1023. More importantly, ports below 1023 are reserved for special services and should therefore be protected from general incoming traffic.
- As discussed above, incoming packets to server endpoints are limited to only those specific destination ports where the well-known service lies.
- Incoming traffic is only permitted to destination IP addresses that are in use on the customer's internal network. This is as opposed to permitting packets that are destined for any IP address. This helps prevent having the customer's network be a tandem network for another network's traffic.

The filters described in this document are assembled using the following steps:

1. Add a filter to the system using a command like “add filter wan.in” substituting “wan.in” with the desired name for the filter. A good convention for naming filters is to add “.in” or “.out” as a suffix to indicate the direction that the filter applies to. The example filters here are all incoming WAN port filters and are named “wan.in” and permit or deny packets incoming from the Internet to an 100R INA module WAN port.
2. Add rules to the filter. See Table 6-13 for a summary of how rules are added to filters.
3. Assign the filter to an interface. Once created, filters are not automatically assigned to an interface and are not therefore in effect. A filter can be assigned to an interface as either an input or output filter. Input filters permit or deny packets that are received at the particular interface. An output filter permits or denies packets that are to be sent out of the particular interface. An interface can be either a WAN port or the ether0 Ethernet interface. The example filters here are all incoming WAN port filters and are assigned to the WAN port with a command like “set w20 ifilter wan.in” where “ifilter” indicates that the filter will be applied as an incoming filter. “ifilter” can be changed to “ofilter” if the filter is meant to be applied as an output filter.
4. Reset the interface that the filter is applied. In order for changes or additions to filters to come into effect, the interface that the filter is assigned to must be reset. For WAN ports, this is done with a command like “reset w20” substituting “w20” with the appropriate WAN port number.

Most rules are created using the following general syntax:

```
set filtername X permit|deny sourceIPAddress/NM destinationIPAddress/
NM protocolinfo
```

Refer to Table 6-13 for a definition of the syntax.

Table 6-13. Definition of Syntax

filtername	The name of the filter (e.g. wan.in) to which the rule is being added.
X	The rule number. A filter may contain up to 256 rules.
permit deny	The keyword “permit” is used if the rule is to permit a certain type of packet or the keyword “deny” is used if the rule is to deny a certain type of packet.
sourceIPAddress / NM	The range of source IP addresses to be permitted or denied. The “slash” notation is used which incorporates a netmask (NM) to enter the IP address range. For example, 192.168.1.0/24 is used to represent the addresses from 192.168.1.0 to 192.168.1.255 (i.e. those addresses on the 192.168.1.0 subnetwork with a 24 bit subnet mask). Two special cases for entering address ranges are supported: 0.0.0.0/0 – indicates any IP address sourceIPAddress/32 – indicates the one specific source IP address.
destinationIPAddre ss/NM	The range of destination IP addresses to be permitted or denied. The slash notation is used which incorporates a netmask (NM) to enter the IP address range. For example, 192.168.1.0/24 is used to represent the addresses from 192.168.1.0 to 192.168.1.255 (i.e. those addresses on the 192.168.1.0 subnetwork with a 24 bit subnet mask). Two special cases for entering address ranges are supported: 0.0.0.0/0 – indicates any IP address sourceIPAddress/32 – indicates the one specific destination IP address.
protocolinfo	Information about the specific protocols or ports to be permitted or denied. This can, for example, include the keywords “tcp” or “udp” to indicate a TCP or UDP rule. Also, specific source and destination port numbers can be targeted using “src” for source port, “dst” for destination port, “eq” for equals, “gt” for greater than, and “lt” for less than. The keyword “established” can also be used in conjunction with the keyword “tcp” to indicate established TCP sessions.

Depending on the rule, some of the above fields may be omitted. Two specific examples of rules are:

set filter wan.in 1 deny 192.168.1.0/24 0.0.0.0/0	As the first rule in filter wan.in, this rule denies packets having a source IP address in the 192.168.1.0/24 network with any destination IP address. This rule filters packets based on just IP address information since no protocol or port information is specified. As a result, any packet matching the IP address criteria will be denied, regardless of what type of protocol is carried in the packet.
set filter wan.in 2 permit 0.0.0.0/0 10.10.123.66/32 tcp established dst gt 1023	As the second rule in filter wan.in, this rule permits packets with any source IP address to the single IP address 10.10.123.66 where the packet carries established TCP traffic and the destination TCP port is greater than 1023. This rule incorporates protocol (i.e. TCP) as well as port information (i.e. destination ports greater than 1023). In addition, this rule makes use of the TCP established flag.

To display a list of what filters have been created on a 100R INA module, issue the command "show table filters". To see a specific filter, issue a command such as "show filter wan.in" substituting "wan.in" with the name of the filter you want to see.

Configurations

The following scenarios are covered in this section:

1. Internet Access Without NAT/NAPT. This scenario is covered first since it is the simplest. It's more likely, however, that a small business customer would use NAT/NAPT as covered in ["Internet Access With NAT/NAPT"](#) on page 6-49.
2. Internet Access Without NAT/NAPT (see ["Internet Access Without NAT/NAPT"](#) on page 6-44).
3. Private Network T1/PRI (see ["Private Network T1/PRI"](#) on page 6-54). This configuration covers a point-to-point private T1/PRI connection with two INA modules and with IP routing and voice networking between the two sites.
4. Private Network T1/PRI Plus Internet Access (see ["Private Network T1/PRI Plus Internet Access"](#) on page 6-58). This configuration is a combination of Scenario 2 (Internet Access with NAT/NAPT) and Scenario 3 (Private Network T1/PRI) utilizing two INA modules at a central location and one INA module at a remote location.
5. Frame Relay Private Network Plus Internet Access (see ["Frame Relay Private Network Plus Internet Access"](#) on page 6-65). This configuration combines Scenario 2 (Internet Access with NAT/NAPT) with frame relay data connectivity to two remote sites.

Internet Access

Internet access is the primary application for the 100R INA module. Two variants of Internet access are covered: with and without the use of NAPT and NAT. Notes are also included to handle cases where the customer does and does not have servers that need to be accessible from the Internet.

Internet Access Without NAT/NAPT

In this scenario, the following information has been collected and is summarized in Figure 6-19:

From the customer:

- Has a small network of 6 PC's that need to access the Internet from one location. Currently uses modem dial-up accounts.
- Has a Windows NT server that supports e-mail, FTP, and web services.
- Will use 2 channels of Internet access based on ISP pricing and discussions with the ISP on expected data traffic.
- Will get global IP addresses for all PC's and the server from the ISP.

From the telco/carrier:

- Channels 23 and 24 will be used for data with a channel rate of 64 kbps.
- Channels have been mapped to the ISP.

From the ISP:

- Confirmed that 2 channels will be used with a channel rate of 64 kbps.
- Provided the PPP link information as follows: IP address at ISP end is 10.10.123.65, IP address at INA module end is 10.10.123.66, subnet mask is 255.255.255.252.
- Primary DNS server is at 10.10.121.1, secondary DNS server is at 10.10.122.1.
- Additional public IP addresses that the customer can use are 10.10.124.145 through 10.10.124.158 (14 usable addresses). The ISP has also expressed this as giving the customer the 10.10.124.144/28 network where the subnet mask is 255.255.255.240.
- Confirmed that the ISP routers WAN port is configured and ready.
- Confirmed that they had entered routes for both the PPP connection and the 14 usable, public IP addresses above.

From the customer's data consultant:

- The customer will use the 14 usable global IP addresses on the LAN. They will use the 10.10.124.144/28 network as provided by the ISP. The subnet mask is 28 bits long or equivalent to 255.255.255.240 in dotted decimal notation. This corresponds to a network where addresses 10.10.124.145 through 10.10.124.158 are used (10.10.124.144 and 10.10.124.159 are reserved for this network).
- The IP address to use for the INA module's Ethernet port is 10.10.124.145.
- Confirmed that there is an available 10BaseT port on the hub in the switch room and that a connecting cable is available.
- The customer has a Windows NT based server at 10.10.124.146. This server supports incoming e-mail, web, and FTP traffic

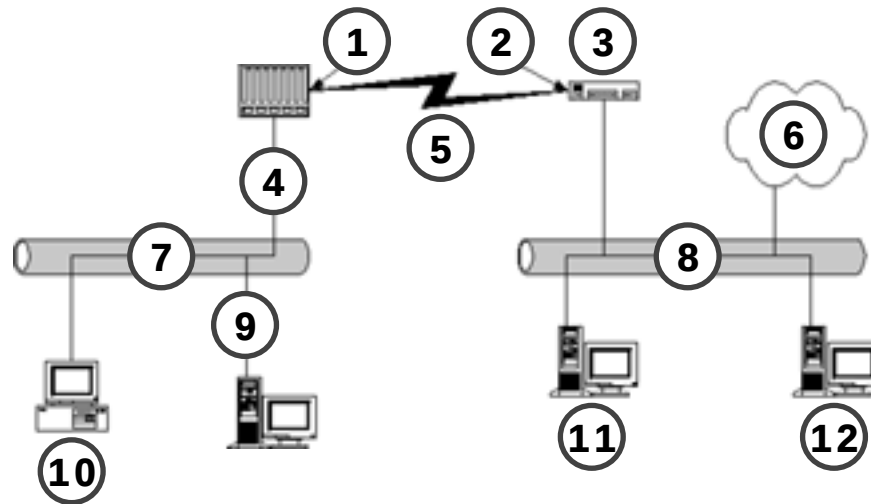


Figure 6-19. Internet Access Without NAT/NAT

1	10.10.123.66
2	10.10.123.65
3	ISP Router
4	MERLIN MAGIX INA 10.10.124.145
5	PPP WAN Link over T1/PRI Netmask is 255.255.255.252
6	Internet
7	10.10.124.144/28
8	ISP Network
9	E-mail, Web, FTP Server 10.10.124.146
10	Other PCs
11	Primary DNS 10.10.121.1
12	Secondary DNS 10.10.122.1

The customer will not use NAT/NAPT since global addresses will be assigned to the customer's internal endpoints. The major tasks to configure the router are:

- Configure the ether0 Ethernet port.
- Configure the WAN port.
- Configure a WAN port filter that allows for outbound connections from clients and allows incoming access to the customer's server.

The steps required to configure the INA module for this scenario are as follows:

Step	Command	Notes/Explanation
1	set password mypassword	Set the system password if the person who did the physical installation did not set it.
2	set ether0 address 10.10.124.145	Set the ether0 IP address.
3	set ether0 netmask 255.255.255.240	Set the ether0 netmask. Note that a shortened form combining steps 2 and 3 is "set ether0 address 10.10.124.145/28" which uses the slash notation for the netmask. This command would set the netmask at the same time the IP address is set.
4	set ether0 broadcast high	Cause the ether0 port to broadcast high vs. low (i.e. use all ones in the host part of the IP address vs. all zeroes as the broadcast address for the ether0 network). Low is the default and almost always needs to be changed to high.
5	save all	Save configuration data before the reboot in the next step.
6	reboot	Reboot to have the ether0 IP address become operational. Wait for the reboot to complete then log back in using the correct password.
7	set w22 address 10.10.123.66	Set the WAN port IP address. Note that a w22 WAN port is available because the lowest numbered data channel on the T1 interface is 23. By default, all T1 data channels are grouped together to form a single WAN port. The command "show line0" can be used to see this grouping. A "show all" command can be used to see what WAN ports are available to be configured (towards the end of the report).
8	set w22 destination 10.10.123.65	Set the WAN port destination IP address. The ISP's router at the far end of the PPP link uses this address as it's own IP address for the PPP link.
9	set w22 netmask 255.255.255.252	Set the netmask for the numbered PPP link.
10	set gateway 10.10.123.65	Set the default gateway for the INA module to be the ISP's router. This will cause the INA module to route Internet destined traffic to the ISP's router. At this point all the data needed to perform basic routing has been entered. The w22 port could be reset and Internet connectivity would be established. It's best to wait to get a filter in place, however, before the WAN port is brought up.
11	add filter wan.in	Adds a new filter called wan.in. This filter will be used to filter incoming packets on the w22 port. Steps 12 through 21 will be used to add packet filtering rules to this filter.

Step	Command	Notes/Explanation
12	set filter wan.in 1 deny 10.10.124.144/28 0.0.0.0/0	Blocks IP spoofing attempts by denying packets claiming to have a source IP address which matches the IP addresses the customer is using on their Ethernet network.
13	set filter wan.in 2 permit 0.0.0.0/0 10.10.124.144/28 tcp established dst gt 1023	Allows return traffic for TCP sessions that were initiated by endpoints on the customer's network.
14	set filter wan.in 3 permit 10.10.121.1/32 10.10.124.144/28 udp src eq 53 dst gt 1023	Permits incoming DNS responses from the primary DNS sever at the ISP. DNS requests are carried over UDP and the responses from the DNS server would have a source UDP port of 53.
15	set filter wan.in 4 permit 10.10.122.1/32 10.10.124.144/28 udp src eq 53 dst gt 1023	Permits incoming DNS responses from the secondary DNS sever at the ISP.
16	set filter wan.in 5 permit 0.0.0.0/0 10.10.124.146/32 tcp dst eq 25	Permits incoming e-mail from any other e-mail server (i.e. any IP address) to the customer's e-mail server. SMTP traffic is sent over TCP with sessions directed to TCP port 25.
17	set filter wan.in 6 permit 0.0.0.0/0 10.10.124.146/32 tcp dst eq 80	Permits incoming HTTP requests from any IP address to the customer's web server. HTTP web browser traffic is sent over TCP with sessions directed to port 80.
18	set filter wan.in 7 permit 0.0.0.0/0 10.10.124.146/32 tcp dst eq 21	Permits incoming FTP command channel connections from any IP address to the customer's FTP server. FTP control channel information is sent over TCP with connections directed to TCP port 21.
19	set filter wan.in 8 permit 0.0.0.0/0 10.10.124.144/28 icmp type 0	Permits echo replies (ICMP Type 0 messages) to return to endpoints on the customer's LAN. This allows IP endpoints on the customers LAN to ping external IP endpoints (i.e. initiate echo requests) and have the echo replies return. This rule can be omitted if the customer does not have a need to ping Internet endpoints.
20	set filter wan.in 9 permit 0.0.0.0/0 10.10.123.66/32 icmp type 0	Permits echo replies (ICMP Type 0 messages) to return to the WAN port of the INA module. This gives you the ability to ping from the CLI of the INA module and have the echo replies return. When pings are initiated from the INA module itself, the WAN port IP address is used as the source address in the original echo request. This rule permits replies to such requests to return. This rule can be omitted if you do not have a need to ping Internet endpoints from the INA module CLI.
21	set filter wan.in 10 deny	Denies all packets not explicitly permitted in other rules. This rule is not technically needed since there is an implicit deny rule at the end of every filter but it is a good practice to include it.

Step	Command	Notes/Explanation
22	set w22 ifilter wan.in	Makes the filter wan.in which was created in the above steps the incoming filter for WAN port w22. Note that the WAN port must be reset in order for this change to come into operation.
23	save all	Save all the configuration data entered so far.
24	reset w22	Resets WAN port w22 to bring all the WAN port settings into effect.

NOTE ► Steps 16, 17, and 18 are used to allow incoming access to the customer's server. Some variations on this example configuration are:

- If the customer has no servers that need to be accessible from the Internet, Steps 16, 17, and 18 can be omitted.
- If the customer has just an e-mail server that needs to be accessible from the Internet, Steps 17 and 18 can be omitted.
- If the customer has more than one server that needs to be accessible from the Internet with each providing one or more service, change Steps 16, 17, and 18 to reflect the IP address of the server that the particular service resides on. If a particular service does not need to be accessible from the Internet, then omit any step that would permit the particular service.

In all the above variations, the filter is created with the other rules listed and the filter should be assigned to the WAN port. **Whenever a filter is created or changed, the WAN port that the filter is applied to must also be reset. This is required to allow the newly created or modified filter to become active.**

At this point, assuming all data is accurate and that all network services have been provisioned properly, the Internet connection should be enabled. This can be checked with a "show w22" command. The state of the WAN port should be reported as "ESTABLISHED". A simple way to test the connectivity is to ping the ISP's router from the CLI of the INA module. The command is "ping 10.10.123.65" in this case since the ISP's IP address for the PPP link is 10.10.123.65. Also, the configuration should now be backed up using the backup capabilities of PMVision.

The customer may want to verify connectivity to the Internet from one of their own PC's at this point as well. In order to do this, the customer or data contact can set the following PC parameters:

- The PC should have an IP address and subnet mask consistent with the IP address and subnet mask used on the INA module's ether0 port.
- The default gateway of the PC should be set to the INA module's ether0 IP address.
- The DNS server info on the PC should be changed to reference the primary and secondary DNS servers provided by the ISP.
- If necessary, the Internet connection properties on the PC should be adjusted to make use of LAN connections instead of dial-up connections.

Internet Access With NAT/NAPT

In this scenario, the following information has been collected and is summarized in Figure 6-20:

From the customer:

- Has about 20 PC's that need to access the Internet from one location. Currently uses an ISDN dial-up router.
- Has an e-mail, FTP, and web server that need to be accessible from the Internet. The customer believes that there are actually two different servers: one for e-mail and one for web and FTP.
- Will use 4 channels of Internet access based on ISP pricing and discussions with the ISP on expected data traffic.
- Doesn't want to acquire additional global IP addresses for all PC's.

From the telco/carrier:

- Channels 21, 22, 23, and 24 will be used for data with a channel rate of 64 kbps.
- Channels have been mapped to the ISP.

From the ISP:

- Confirmed that 4 channels will be used with a channel rate of 64 kbps.
- Provided the PPP link information as follows: IP address at ISP end is 10.10.123.65, IP address at INA module end is 10.10.123.66, subnet mask is 255.255.255.252.
- Primary DNS server is at 10.10.121.1, secondary DNS server is at 10.10.122.1.
- Additional public IP addresses that the customer can use are 10.10.124.135 through 10.10.124.140 (6 usable addresses). The ISP has also expressed this as giving the customer the 10.10.124.134/29 network where the subnet mask is 255.255.255.248. Note that these addresses do not get utilized in this example nor in the other examples in other sections.
- Confirmed that the ISP router's WAN port is configured and ready.
- Confirmed that they had entered routes for both the PPP connection and the 6 usable, public IP addresses above.

From the customer's data consultant:

- The customer is using private network IP addresses on the LAN. They are using the 192.168.1.0/24 network. The subnet mask is 24 bits long or equivalent to 255.255.255.0 in dotted decimal notation. This corresponds to a network where addresses 192.168.1.1 through 192.168.1.254 are used (192.168.1.0 and 192.168.1.255 are reserved for this network).
- An available IP address for the INA module's Ethernet port is 192.168.1.25.
- Confirmed that there is an available 10BaseT port on the hub in the switch room and that a connecting cable is available.
- The customer has a Windows NT based e-mail server at 192.168.1.2.
- The customer has a Windows NT based web and FTP server at 192.168.1.3

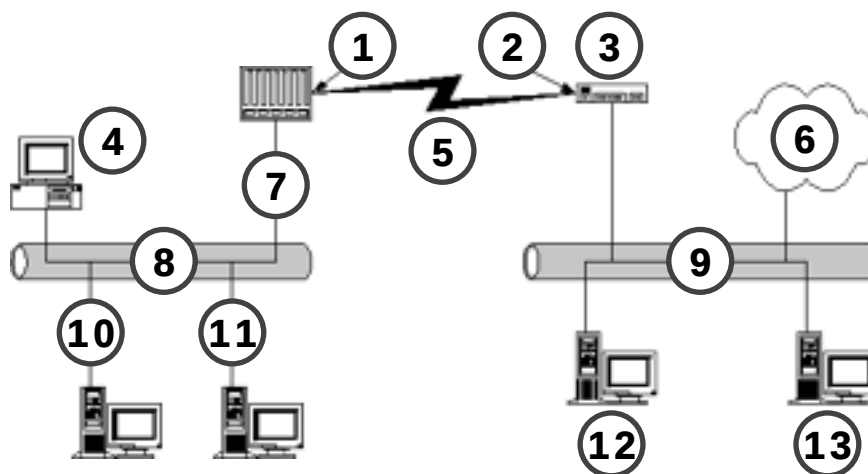


Figure 6-20. Internet Access with NAT/NAT

1	10.10.123.66
2	10.10.123.65
3	ISP Router
4	Other PCs
5	PPP WAN Link over T1/PRI Netmask is 255.255.255.252
6	Internet
7	MERLIN MAGIX INA 192.168.1.25
8	192.168.1.0/24 LAN
9	ISP Network
10	E-mail Server 192.168.1.2
11	Web and FTP Server 192.168.1.3
12	Primary DNS 10.10.121.1
13	Secondary DNS 10.10.122.1

The customer will use NAT/NAPT since private IP addresses will be assigned to the customer's internal endpoints. The major tasks to configure the router are:

- Configure the ether0 Ethernet port.
- Configure the WAN port.
- Create an outbound NAT map.
- Create an inbound NAT map.

- Configure a WAN port filter that allows for outbound connections from clients and allows incoming access to the customer's servers.

The steps required to configure the INA module for this scenario are as follows:

Step	Command	Notes/Explanation
1	set password mypassword	Set the system password if the person who did the physical installation did not set it.
2	set ether0 address 192.168.1.25	Set the ether0 IP address.
3	set ether0 netmask 255.255.255.0	Set the ether0 netmask. Note that a shortened form combining steps 2 and 3 is "set ether0 address 192.168.1.25/24" which uses the slash notation for netmask. This command would set the netmask at the same time the IP address is set.
4	set ether0 broadcast high	Cause the ether0 port to broadcast high vs. low (i.e. use all ones in the host part of the IP address vs. all zeroes as the broadcast address for the ether0 network). Low is the default and almost always needs to be changed to high.
5	save all	Save configuration data before the reboot in the next step.
6	reboot	Reboot to have the ether0 IP address become operational. Wait for the reboot to complete then log back in using the correct password.
7	set w20 address 10.10.123.66	Set the WAN port IP address. Note that a w20 WAN port is available because the lowest numbered data channel on the T1 interface is 21. By default, all T1 data channels are grouped together to form a single WAN port. The command "show line0" can be used to see this grouping. A "show all" command can be used to see what WAN ports are available to be configured (towards the end of the report).
8	set w20 destination 10.10.123.65	Set the WAN port destination IP address. The ISP's router at the far end of the PPP link uses this address as it's own IP address for the PPP link.
9	set w20 netmask 255.255.255.252	Set the netmask for the numbered PPP link.
10	set gateway 10.10.123.65	Set the default gateway for the INA module to be the ISP's router. This will cause the INA module to route Internet destined traffic to the ISP's router. At this point all the data needed to perform basic routing has been entered. The w20 port could be reset and Internet connectivity would be established. It's best to wait to get a filter in place, however, before the WAN port is brought up. Also, in this example, some NAT/NAPT parameters need to be configured.

Step	Command	Notes/Explanation
11	set w20 nat outmap defaultnapt	Sets the outgoing NAT map for the w20 port to be a map called "defaultnapt". The defaultnapt map is provided on the INA as a convenience for this common scenario where all outbound sessions hide behind the single WAN port address. The use of this map saves the steps that would normally be required to create a map and add rules to it. When the defaultnapt map is used, all outbound sessions will be port mapped to the IP address for the WAN port (10.10.123.66 in this case). In other words, NAPT has been invoked and all outgoing sessions will hide behind the single WAN port IP address. Note that the mapping will not come into effect until the port is reset. In other scenarios, a specific outbound map may have to be created and rules added to it.
12	add map nat.in	Adds a new map called nat.in. This map will be used for inbound NAT mapping on the w20 port. The mapping rules will allow the customer's two internal servers to be accessible from the Internet. The customer is using private network IP addresses on their Ethernet network. These private network endpoints cannot therefore be directly reached by external IP endpoints. In order for the endpoints to be accessible, they must be known outside of the customer's network by a real, public IP address. There are two choices to accomplish this: 1) use the WAN port address and port mapping or 2) make use of one or more of the usable, public addresses that the customer has gotten from the ISP. In the example here, the single WAN port IP address and port mapping will be used. Via NAT and the use of an inbound NAT map, the customer's servers can be known to external endpoints by the WAN port address. The NAT feature will translate this public IP address to a matching internal private IP address depending upon which service is being requested in the inbound packets (e-mail, web, or FTP).
13	set map nat.in 1 statictcpudppportmap 10.10.123.66:smtp 192.168.1.2:smtp	Adds the first mapping rule to nat.in. This rule redirects incoming SMTP packets to the IP address of the customer's e-mail server. Note that in this step and the next two steps the keyword "statictcpudppportmap" can be replaced with the shorthand version "stupm".
14	set map nat.in 2 statictcpudppportmap 10.10.123.66:http 192.168.1.3:http	Adds the second mapping rule to nat.in. This rule redirects incoming HTTP packets to the IP address of the customer's web server.

Step	Command	Notes/Explanation
15	set map nat.in 3 statictcpudppportmap 10.10.123.66:ftp 192.168.1.3:ftp	Adds the third mapping rule to nat.in. This rule redirects incoming FTP packets to the IP address of the customer's FTP server.
16	set w20 nat inmap nat.in	Sets the incoming NAT map for the w20 port to be the nat.in map that was constructed earlier. Note that the mapping will not come into effect until the port is reset.
17	add filter wan.in	Adds a new filter called wan.in. This filter will be used to filter incoming packets on the w20 port. Subsequent steps will be used to add packet filtering rules to this filter.
18	set filter wan.in 1 deny 192.168.1.0/24 0.0.0.0/ 0	Blocks IP spoofing attempts by denying packets claiming to have a source IP address which matches the IP addresses the customer is using on their Ethernet network.
19	set filter wan.in 2 permit 0.0.0.0/0 10.10.123.66/32 tcp established dst gt 1023	Allows return traffic for TCP sessions that were initiated by endpoints on the customer's network.
20	set filter wan.in 3 permit 10.10.121.1/32 10.10.123.66/32 udp src eq 53 dst gt 1023	Permits incoming DNS responses from the primary DNS sever at the ISP. DNS requests are carried over UDP and the responses from the DNS server would have a source UDP port of 53.
21	set filter wan.in 4 permit 10.10.122.1/32 10.10.123.66/32 udp src eq 53 dst gt 1023	Permits incoming DNS responses from the secondary DNS sever at the ISP.
22	set filter wan.in 5 permit 0.0.0.0/0 10.10.123.66/32 tcp dst eq 25	Permits incoming e-mail to the customer's e-mail server (SMTP traffic is sent over TCP with sessions directed to TCP port 25). Note that this rule uses the global IP address that the customer's e-mail server is known by instead of the private IP address used on the LAN. This is because the filter is applied before the inbound NAT translation is performed.
23	set filter wan.in 6 permit 0.0.0.0/0 10.10.123.66/32 tcp dst eq 80	Permits incoming HTTP requests from any IP address to the customer's web server. HTTP web browser traffic is sent over TCP with sessions directed to port 80. Note that the rule uses the global IP address that the customer's web server is known by instead of the private IP address used on the LAN.
24	set filter wan.in 7 permit 0.0.0.0/0 10.10.123.66/32 tcp dst eq 21	Permits incoming FTP command channel connections from any IP address to the customer's FTP. FTP control channel information is sent over TCP with connections directed to TCP port 21. Note that the rule uses the global IP address that the customer's FTP server is known by instead of the private IP address used on the LAN.

Step	Command	Notes/Explanation
25	set filter wan.in 8 permit 0.0.0.0/0 10.10.123.66/32 icmp type 0	Permits echo replies (ICMP Type 0 messages) to enter the customer's network. This allows IP endpoints on the customer's LAN to ping external IP endpoints (i.e. initiate echo requests) and have the echo replies return. This rule can be omitted if the customer does not have a need to ping Internet endpoints. Note that this rule also allows you to ping Internet endpoints from the CLI of the INA module router since NAT/NAPT is being used.
26	set filter wan.in 9 deny	Denies all packets not explicitly permitted in other rules. This rule is not technically needed since there is an implicit deny rule at the end of every filter but it is a good practice to include it.
27	set w20 ifilter wan.in	Makes the filter wan.in which was created in the above steps the incoming filter for WAN port w20. Note that the WAN port must be reset in order for this change to come into operation.
28	save all	Save all the configuration data entered so far.
29	reset w20	Resets WAN port w20 to bring all the WAN port settings into effect.

At this point, assuming all data is accurate and that all services have been provisioned properly, the Internet connection should be enabled. This can be checked with a "show w20" command. The state of the WAN port should be reported as "ESTABLISHED". Also, the configuration should be backed up using the backup capabilities of PMVision.

Private Network T1/PRI

In this scenario, the following information has been collected and is summarized in Figure 6-21:

From the customer:

- Has two locations that will be networked together: a main site and a remote site. LAN's are in place at both locations.
- Believes that only IP applications are used in both places.
- There is no dedicated Internet access at either location. People who need Internet access use dial up accounts.
- Wants to use PRI for the additional features.
- Needs 12 voice channels, the rest can be used for data.

From the telco/carrier:

- Private line T1 is installed and equipped at both locations.

From the customer's data consultant:

- The customer is using private network IP addresses on both LAN's. They are using the 192.168.1.0/24 network at the main site and the 192.168.2.0/24 network at the remote site.

- Confirms that only IP routing is required between the two sites.
- Available IP addresses for the INA modules are 192.168.1.25 at the main site and 192.168.2.25 at the remote site.
- Confirmed that there is an available 10BaseT port on the hub in the switch room at both sites and that a connecting cable is available at both sites.

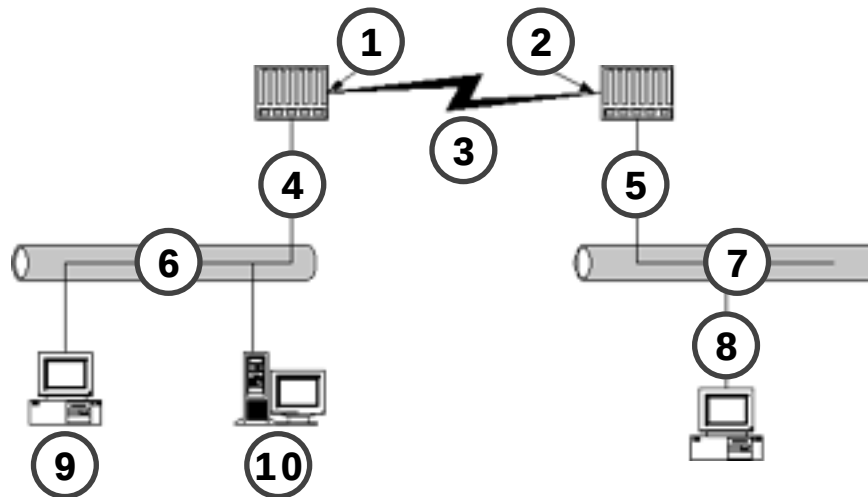


Figure 6-21. Private Network T1/PRI

1	192.168.100.1
2	192.168.100.2
3	PPP WAN Link over T1/PRI Netmask is 255.255.255.252
4	INA Main 192.168.1.25
5	INA Remote 192.168.2.25
6	192.168.1.0/24 LAN
7	192.168.2.0/24 LAN
8	PCs
9	PCs
10	Servers

The major tasks to configure the routers are:

- Choose IP addresses for the WAN PPP link. Since an ISP is not involved, you will need to determine which IP addresses to use for the WAN PPP link. Any private IP addresses may be used. The example here assumes that the 192.168.100.0/30 network is used.

- Configure the ether0 port at both locations.
- Configure the WAN port at both locations.

Since this is a private T1/PRI connection, NAT/NAPT is not required and no packet filters need to be provided. For this scenario it is assumed that channels 1 through 12 on the PRI link have been configured to support voice services and that channels 13 through 23 have been assigned to the INA module router. Channel 24 is reserved for the PRI D channel.

The steps required to configure the INA module at the main site are as follows:

Step	Command	Notes/Explanation
1	set password mypassword	Set the system password if the person who did the physical installation did not set it.
2	set ether0 address 192.168.1.25	Set the ether0 IP address.
3	set ether0 netmask 255.255.255.0	Set the ether0 netmask. Note that a shortened form combining steps 2 and 3 is "set ether0 address 192.168.1.25/24" which uses the slash notation for netmask. This command would set the netmask at the same time the IP address is set.
4	set ether0 broadcast high	Cause the ether0 port to broadcast high vs. low (i.e. use all ones in the host part of the IP address vs. all zeroes as the broadcast address for the ether0 network). Low is the default and almost always needs to be changed to high.
5	save all	Save configuration data before the reboot in the next step.
6	reboot	Reboot to have the ether0 IP address become operational. Wait for the reboot to complete then log back in using the correct password.
7	set w12 address 192.168.100.1	Set the WAN port IP address. Note that a w12 WAN port is available because the lowest numbered data channel on the T1 interface is 13. By default, all T1 data channels are grouped together to form a single WAN port. The command "show line0" can be used to see this grouping. A "show all" command can be used to see what WAN ports are available to be configured (towards the end of the report).
8	set w12 destination 192.168.100.2	Set the WAN port destination IP address. The INA module at the remote site will use this address as it's IP address for the PPP link.
9	set w12 netmask 255.255.255.252	Set the netmask for the numbered PPP link.
10	set gateway 192.168.100.2	Set the default gateway for the main INA module to be the remote INA module.

Step	Command	Notes/Explanation
11	save all	Save all the configuration data entered so far.
12	reset w12	Resets WAN port w20 to bring all the WAN port settings into effect.

The steps required to configure the INA module at the remote site are as follows:

Step	Command	Notes/Explanation
1	set password mypassword	Set the system password if the person who did the physical installation did not set it.
2	set ether0 address 192.168.2.25	Set the ether0 IP address.
3	set ether0 netmask 255.255.255.0	Set the ether0 netmask. Note that a shortened form combining steps 2 and 3 is “set ether0 address 192.168.1.25/24” which uses the slash notation for netmask. This command would set the netmask at the same time the IP address is set.
4	set ether0 broadcast high	Cause the ether0 port to broadcast high vs. low (i.e. use all ones in the host part of the IP address vs. all zeroes as the broadcast address for the ether0 network). Low is the default and almost always needs to be changed to high.
5	save all	Save configuration data before the reboot in the next step.
6	reboot	Reboot to have the ether0 IP address become operational. Wait for the reboot to complete then log back in using the correct password.
7	set w12 address 192.168.100.2	Set the WAN port IP address. Note that a w12 WAN port is available because the lowest numbered data channel on the T1 interface is 13. By default, all T1 data channels are grouped together to form a single WAN port. The command “show line0” can be used to see this grouping. A “show all” command can be used to see what WAN ports are available to be configured (towards the end of the report).
8	set w12 destination 192.168.100.1	Set the WAN port destination IP address. The INA module at the main site uses this address as it’s IP address for the PPP link.
9	set w12 netmask 255.255.255.252	Set the netmask for the numbered PPP link.
10	set gateway 192.168.100.1	Set the default gateway for the remote INA module to be the main INA module.
11	save all	Save all the configuration data entered so far.
12	reset w12	Resets WAN port w12 to bring all the WAN port settings into effect.

Private Network T1/PRI Plus Internet Access

In this scenario, the following information has been collected and is summarized in Figure 6-22:

From the customer:

- Has two locations that will be networked together using a private T1/PRI facility: a main site and a remote site. LAN's are in place at both locations. Internet access is required at both locations.
- Believes that only IP applications are used in both locations.
- Wants to use PRI between the two locations for the additional voice features.
- Needs 12 voice channels between the two private network locations, the rest can be used for data services.
- Has about 20 PC's that need to access the Internet from each of the two locations.
- Has an e-mail server that needs to be accessible from the Internet. This server is at the main location.
- Will use 4 channels of Internet access from the main location based on ISP pricing and discussions with the ISP on expected data traffic.
- Doesn't want to acquire additional global IP addresses for all PC's.

From the telco/carrier:

- Channels 21, 22, 23, and 24 will be used for Internet access from INA Module A at the main location with a channel rate of 64 kbps and these channels have been mapped to the ISP.
- The private line T1 is installed and equipped at both locations.

From the ISP:

- Confirmed that 4 channels will be used with a channel rate of 64 kbps.
- Provided the PPP link information as follows: IP address at ISP end is 10.10.123.65, IP address at INA module A end is 10.10.123.66, subnet mask is 255.255.255.252.
- Primary DNS server is at 10.10.121.1, secondary DNS server is at 10.10.122.1.
- Additional public IP addresses that the customer can use are 10.10.124.135 through 10.10.124.140 (6 usable addresses). The ISP has also expressed this as giving the customer the 10.10.124.134/29 network where the subnet mask is 255.255.255.248.
- Confirmed that the ISP routers WAN port was configured and ready.
- Confirmed that they had entered routes for both the PPP connection and the 6 usable, public IP addresses above.

From the customer's data consultant:

- The customer is using private network IP addresses on both the LAN's at the main and remote sites. They are using the 192.168.1.0/24 network at the main site and the 192.168.2.0/24 network at the remote site.
- Available IP addresses for the INA modules are 192.168.1.25 and 192.168.1.26 at the main site and 192.168.2.25 at the remote site.

- Confirms that only IP routing is required between the two sites.
- Confirms that there is an available 10BaseT port on the hub in the switch room at both sites and that a connecting cable is available at both sites.
- The customer has a Windows NT based e-mail server at 192.168.1.2.

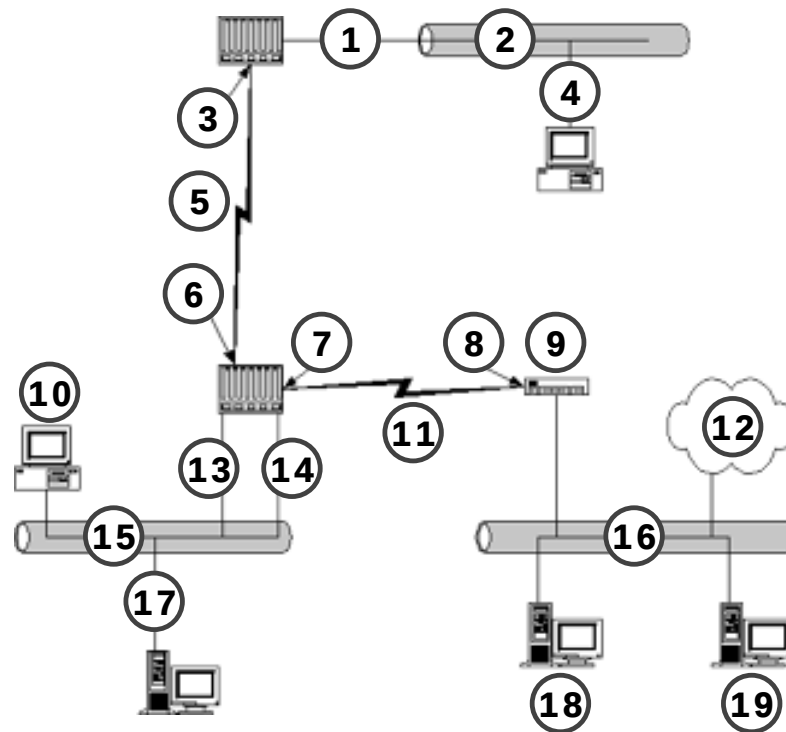


Figure 6-22. Private Network T1/PRI Plus Internet Access

1	INA Remote C 192.168.2.25
2	192.168.2.0/24 LAN
3	192.168.100.2
4	PCs at Remote location
5	PPP WAN Link over Private PRI Netmask is 255.255.255.252 INA Main B to INA Remote C
6	192.168.100.1
7	10.10.123.66
8	10.10.123.65
9	ISP Router

- 10 Other PCs at Main location
- 11 PPP WAN Link to ISP
Netmask is 255.255.255.252
INA Main A to ISP
- 12 Internet
- 13 INA Main B 192.168.1.25
- 14 INA Main A 192.168.1.26
- 15 192.168.1.0/24 LAN
- 16 ISP Network
- 17 E-mail Server 192.168.1.2
- 18 Primary DNS 10.10.121.1
- 19 Secondary DNS 10.10.122.1

The steps required to configure the INA Module A at the main location are as follows:

Step	Command	Notes/Explanation
1	set password mypassword	Set the system password if the person who did the physical installation did not set it.
2	set ether0 address 192.168.1.26	Set the ether0 IP address.
3	set ether0 netmask 255.255.255.0	Set the ether0 netmask. Note that a shortened form combining steps 2 and 3 is "set ether0 address 192.168.1.26/24" which uses the slash notation for netmask. This command would set the netmask at the same time the IP address is set.
4	set ether0 broadcast high	Cause the ether0 port to broadcast high vs. low (i.e. use all ones in the host part of the IP address vs. all zeroes as the broadcast address for the ether0 network). Low is the default and almost always needs to be changed to high.
5	save all	Save configuration data before the reboot in the next step.
6	reboot	Reboot to have the ether0 IP address become operational. Wait for the reboot to complete then log back in using the correct password.
7	set w20 address 10.10.123.66	Set the WAN port IP address. Note that a w20 WAN port is available because the lowest numbered data channel on the T1 interface is 21. By default, all T1 data channels are grouped together to form a single WAN port. The command "show line0" can be used to see this grouping. A "show all" command can be used to see what WAN ports are available to be configured (towards the end of the report).

Step	Command	Notes/Explanation
8	set w20 destination 10.10.123.65	Set the WAN port destination IP address. The ISP's router at the far end of the PPP link uses this address as it's own IP address for the PPP link.
9	set w20 netmask 255.255.255.252	Set the netmask for the numbered PPP link.
10	set gateway 10.10.123.65	Set the default gateway for the INA module to be the ISP's router. This will cause the INA module to route Internet destined traffic to the ISP's router. At this point all the data needed to perform basic routing has been entered. The w20 port could be reset and Internet connectivity would be established. It's best to wait to get a filter in place, however, before the WAN port is brought up. Also, in this example, some NAT/NAPT parameters need to be configured.
11	set w20 nat outmap defaultnapt	Sets the outgoing NAT map for the w20 port to be a map called "defaultnapt". The defaultnapt map is provided on the INA as a convenience for this common scenario where all outbound sessions hide behind the single WAN port address. The use of this map saves the steps that would normally be required to create a map and add rules to it. When the defaultnapt map is used, all outbound sessions will be port mapped to the IP address for the WAN port (10.10.123.66 in this case). In other words, NAPT has been invoked and all outgoing sessions will hide behind the single WAN port IP address. Note that the mapping will not come into effect until the port is reset. In other scenarios, a specific outbound map may have to be created and rules added to it.
12	add map nat.in	Adds a new map called nat.in. This map will be used for inbound NAT mapping on the w20 port.
13	set map nat.in 1 statictcpudppportmap 10.10.123.66:smtp 192.168.1.2:smtp	Adds the first mapping rule to nat.in. This rule redirects incoming SMTP packets to the IP address of the customer's e-mail server at the main site.
14	set w20 nat inmap nat.in	Sets the incoming NAT map for the w20 port to be the nat.in map that was constructed earlier. Note that the mapping will not come into effect until the port is reset.
15	add filter wan.in	Adds a new filter called wan.in. This filter will be used to filter incoming packets on the w20 port. Subsequent steps will be used to add packet filtering rules to this filter.
16	set filter wan.in 1 deny 192.168.1.0/24 0.0.0.0/ 0	Blocks IP spoofing attempts by denying packets claiming to have a source IP address which matches the IP addresses the customer is using on their main site Ethernet network.
17	set filter wan.in 2 deny 192.168.2.0/24 0.0.0.0/ 0	Blocks IP spoofing attempts by denying packets claiming to have a source IP address which matches the IP addresses the customer is using on their remote site Ethernet network.

Step	Command	Notes/Explanation
18	set filter wan.in 3 permit 0.0.0.0/0 10.10.123.66/32 tcp established dst gt 1023	Allows return traffic for TCP sessions that were initiated by endpoints on the customer's network.
19	set filter wan.in 4 permit 10.10.121.1/32 10.10.123.66/32 udp src eq 53 dst gt 1023	Permits incoming DNS responses from the primary DNS sever at the ISP. DNS requests are carried over UDP and the responses from the DNS server would have a source UDP port of 53.
20	set filter wan.in 5 permit 10.10.122.1/32 10.10.123.66/32 udp src eq 53 dst gt 1023	Permits incoming DNS responses from the secondary DNS sever at the ISP.
21	set filter wan.in 6 permit 0.0.0.0/0 10.10.123.66/32 tcp dst eq 25	Permits incoming e-mail to the customer's e-mail server. Note that this rule uses the global IP address that the customer's e-mail server is known by instead of the private IP address used on the LAN. This is because the filter is applied before the inbound NAT translation is performed.
22	set filter wan.in 7 permit 0.0.0.0/0 10.10.123.66/32 icmp type 0	Permits echo replies (ICMP Type 0 messages) to enter the customer's network. This allows IP endpoints on the customers LAN to ping external IP endpoints (i.e. initiate echo requests) and have the echo replies return. This rule can be omitted if the customer does not have a need to ping Internet endpoints.
23	set filter wan.in 8 deny	Denies all packets not explicitly permitted in other rules. This rule is not technically needed since there is an implicit deny rule at the end of every filter but it is a good practice to include it.
24	set w20 ifilter wan.in	Assigns the filter wan.in to be the incoming filter for WAN port w20. Note that the WAN port must be reset in order for this change to come into operation.
25	add route 192.168.2.0/ 24 192.168.1.25	Add a static route to permit the routing of packets to the network at the remote site. The addition of this static route enables INA Main A to route packets destined for the remote through INA Main B. This is required because INA Main B is an intermediate router leading to the remote site.
26	save all	Save all the configuration data entered so far.
27	reset w20	Resets WAN port w20 to bring all the WAN port settings into effect.

The primary difference between this configuration and the Internet access configuration in ["Internet Access With NAT/NAPT"](#) on page 6-49 is the static route added in Step 25.

The steps required to configure INA Module B at the main site are as follows:

Step	Command	Notes/Explanation
1	set password mypassword	Set the system password if the person who did the physical installation did not set it.
2	set ether0 address 192.168.1.25	Set the ether0 IP address.
3	set ether0 netmask 255.255.255.0	Set the ether0 netmask. Note that a shortened form combining steps 2 and 3 is "set ether0 address 192.168.1.25/24" which uses the slash notation for netmask. This command would set the netmask at the same time the IP address is set.
4	set ether0 broadcast high	Cause the ether0 port to broadcast high vs. low (i.e. use all ones in the host part of the IP address vs. all zeroes as the broadcast address for the ether0 network). Low is the default and almost always needs to be changed to high.
5	save all	Save configuration data before the reboot in the next step.
6	reboot	Reboot to have the ether0 IP address become operational. Wait for the reboot to complete then log back in using the correct password.
7	set w12 address 192.168.100.1	Set the WAN port IP address. Note that a w12 WAN port is available because the lowest numbered data channel on the T1 interface is 13. By default, all T1 data channels are grouped together to form a single WAN port. The command "show line0" can be used to see this grouping. A "show all" command can be used to see what WAN ports are available to be configured (towards the end of the report).
8	set w12 destination 192.168.100.2	Set the WAN port destination IP address. The INA module at the remote site will use this address as it's IP address for the PPP link.
9	set w12 netmask 255.255.255.252	Set the netmask for the numbered PPP link.
10	set gateway 192.168.1.26	Set the default gateway INA Module B to be the ether0 address of INA Module A.
11	add route 192.168.2.0/24 192.168.100.2	Add a static route to permit the routing of packets to the network at the remote site. The addition of this static route enables INA Main B to send packets destined for the remote network to the WAN port address of INA Remote C. INA Remote C will, in turn, send these packets out its ether0 interface.
12	save all	Save all the configuration data entered so far.
13	reset w12	Resets WAN port w20 to bring all the WAN port settings into effect.

The primary difference between this configuration and the private network T1/PRI configuration in ["Private Network T1/PRI"](#) on page 6-54 is the static route added in Step 11.

The steps required to configure the INA Module C at the remote site are as follows:

Step	Command	Notes/Explanation
1	set password mypassword	Set the system password if the person who did the physical installation did not set it.
2	set ether0 address 192.168.2.25	Set the ether0 IP address.
3	set ether0 netmask 255.255.255.0	Set the ether0 netmask. Note that a shortened form combining steps 2 and 3 is “set ether0 address 192.168.1.25/24” which uses the slash notation for netmask. This command would set the netmask at the same time the IP address is set.
4	set ether0 broadcast high	Cause the ether0 port to broadcast high vs. low (i.e. use all ones in the host part of the IP address vs. all zeroes as the broadcast address for the ether0 network). Low is the default and almost always needs to be changed to high.
5	save all	Save configuration data before the reboot in the next step.
6	reboot	Reboot to have the ether0 IP address become operational. Wait for the reboot to complete then log back in using the correct password.
7	set w12 address 192.168.100.2	Set the WAN port IP address. Note that a w12 WAN port is available because the lowest numbered data channel on the T1 interface is 13. By default, all T1 data channels are grouped together to form a single WAN port. The command “show line0” can be used to see this grouping. A “show all” command can be used to see what WAN ports are available to be configured (towards the end of the report).
8	set w12 destination 192.168.100.1	Set the WAN port destination IP address. The INA module at the main site uses this address as it’s IP address for the PPP link.
9	set w12 netmask 255.255.255.252	Set the netmask for the numbered PPP link.
10	set gateway 192.168.100.1	Set the default gateway for the remote INA module to be the main INA module.
11	save all	Save all the configuration data entered so far.
12	reset w12	Resets WAN port w12 to bring all the WAN port settings into effect.

Frame Relay Private Network Plus Internet Access

In this scenario, the following information has been collected and is summarized in Figure 6-23:

From the customer:

- Has three locations that will be networked together using a frame relay network: a main site and two remote sites. LAN's are in place at all three locations. Internet access is required at all three locations with the Internet access centralized through the main location.
- Believes that only IP applications are used in all three locations.
- Has about 20 PC's that need to access the Internet from the main location and 10 PC's from each of the other two locations.
- Has an e-mail server that needs to be accessible from the Internet. This server is at the main location.
- Will use 4 channels of Internet access from the main location based on ISP pricing and discussions with the ISP on expected data traffic.
- Will use 2 channels of frame relay from the main site to the other two sites. The two remote sites will be served by routers on fractional T1 lines. These routers will have two channels worth of bandwidth.
- There is no voice networking between the main site and the two remote sites.
- Doesn't want to acquire additional global IP addresses for all PC's.

From the telco/carrier:

- Channels 21, 22, 23, and 24 will be used for Internet access from INA Module A at the main location with a channel rate of 64 kbps and these channels have been mapped to the ISP.
- Channels 19 and 20 will be used for access to the frame relay network with a channel rate of 64 kbps and these channels have been mapped to the frame relay data carrier.

From the frame relay data carrier:

- 2 channels worth of bandwidth with a channel rate of 64 kbps are configured and ready.
- The management protocol used at all three sites is annex-d.
- The keep alive timer value for all three sites has been set at the frame relay switch side to 15 seconds.
- DLCI 100 at the main site is mapped to remote location A. At remote site A, DLCI 100 is also used for this connection (this information is useful but is not required to configure the INA module at the main site).
- DLCI 101 at the main site is mapped to remote location B. At remote site B, DLCI 101 is also used for this connection (this information is useful but is not required to configure the INA module at the main site).

From the ISP:

- Confirmed that 4 channels will be used with a channel rate of 64 kbps.
- Provided the PPP link information as follows: IP address at ISP end is 10.10.123.65, IP address at INA module A end is 10.10.123.66, subnet mask is 255.255.255.252.
- Primary DNS server is at 10.10.121.1, secondary DNS server is at 10.10.122.1.
- Additional public IP addresses that the customer can use are 10.10.124.135 through 10.10.124.140 (6 usable addresses). The ISP has also expressed this as giving the customer the 10.10.124.134/29 network where the subnet mask is 255.255.255.248.
- Confirmed that the ISP routers WAN port was configured and ready.
- Confirmed that they had entered routes for both the PPP connection and the 6 usable, public IP addresses above.

From the customer's data consultant:

- The customer is using private network IP addresses on the LAN's at all three sites. They are using the 192.168.1.0/24 network at the main site, the 192.168.2.0/24 network at remote site A, and the 192.168.2.0/24 network at remote site B.
- An available IP address for the INA module at the main site is 192.168.1.25.
- Confirms that only IP routing is required between the three sites.
- Confirms that there is an available 10BaseT port on the hub in the switch room at both sites and that a connecting cable is available at both sites.
- The customer has a Windows NT based e-mail server at 192.168.1.2.

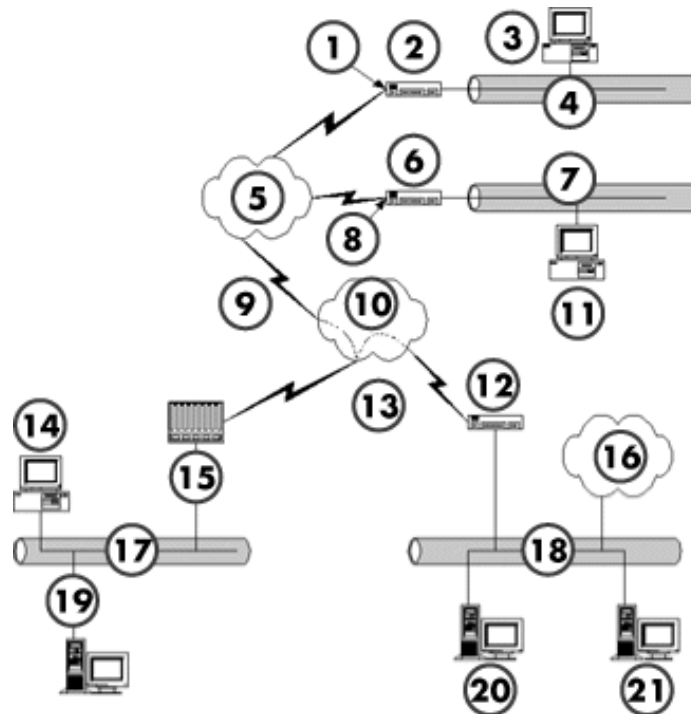


Figure 6-23. Frame Relay Private Network Plus Internet Access

NOTE: Both the ISP PPP link and the frame relay link are carried on the same T1 interface from the INA module at the main location. The central office breaks out the channels and delivers them to the correct network.

- 1 192.168.100.2
- 2 Fractional T1 Router
- 3 PCs at Remote Location A
- 4 192.168.2.0/24 LAN
- 5 Frame Relay Network
- 6 Fractional T1 Router
- 7 192.168.3.0/24 LAN
- 8 192.168.100.3
- 9 Frame Relay WAN Link Info:
Interconnects Main site, A site, B site
INA Main WAN IP address: 192.168.100.1
Frame interface netmask: 255.255.255.240
DLCI 100 to Remote A from Main
DLCI 101 to Remote B from Main

- 10 Central Office
- 11 PCs at Remote Location B
- 12 ISP Router
- 13 PP WAN Link Info:
Connects INA Main to ISP
INA Main WAN IP address: 10.10.123.66
ISP router WAN IP address: 10.10.123.65
PPP interface netmask: 255.255.255.252
- 14 Other PCs at Main location
- 15 INA Main 192.168.1.25
- 16 Internet
- 17 192.168.1.0/24 LAN
- 18 ISP Network
- 19 E-mail Server 192.168.1.2
- 20 Primary DNS 10.10.121.1
- 21 Secondary DNS 10.10.122.1

NOTE ► This example assumes that channels 19 through 24 have been assigned to the 100RINA module router (frame relay channels plus Internet PPP channels).

The steps required to configure the 100R INA module at the main site are as follows:

Step	Command	Notes/Explanation
1	set password mypassword	Set the system password if the person who did the physical installation did not set it.
2	set ether0 address 192.168.1.25	Set the ether0 IP address.
3	set ether0 netmask 255.255.255.0	Set the ether0 netmask. Note that a shortened form combining steps 2 and 3 is “set ether0 address 192.168.1.25/24” which uses the slash notation for netmask. This command would set the netmask at the same time the IP address is set.
4	set ether0 broadcast high	Cause the ether0 port to broadcast high vs. low (i.e. use all ones in the host part of the IP address vs. all zeroes as the broadcast address for the ether0 network). Low is the default and almost always needs to be changed to high.

Step	Command	Notes/Explanation
5	set line0 group 2 channels 21 22 23 24	Establishes a second channel group consisting of just the channels that will be used for Internet access. With channels 19 through 24 originally assigned to the INA module router, this will leave channels 19 and 20 in a separate channel group. This implies that a w18 and a w20 interface will be available for configuration. Note that a change in channel group assignments requires a reboot of the router.
6	save all	Save configuration data before the reboot in the next step.
7	reboot	Reboot to have the ether0 IP address and channel groupings become operational. Wait for the reboot to complete then log back in using the correct password.
8	set w20 address 10.10.123.66	Set the WAN port IP address. Note that a w20 WAN port is available because the lowest numbered data channel on the T1 interface is 21. By default, all T1 data channels are grouped together to form a single WAN port. The command "show line0" can be used to see this grouping. A "show all" command can be used to see what WAN ports are available to be configured (towards the end of the report).
9	set w20 destination 10.10.123.65	Set the WAN port destination IP address. The ISP's router at the far end of the PPP link uses this address as it's own IP address for the PPP link.
10	set w20 netmask 255.255.255.252	Set the netmask for the numbered PPP link.
11	set gateway 10.10.123.65	Set the default gateway for the INA module to be the ISP's router. This will cause the INA module to route Internet destined traffic to the ISP's router. At this point all the data needed to perform basic routing has been entered. The w20 port could be reset and Internet connectivity would be established. It's best to wait to get a filter in place, however, before the WAN port is brought up. Also, in this example, some NAT/NAPT parameters need to be configured.

Step	Command	Notes/Explanation
12	set w20 nat outmap defaultnapt	Sets the outgoing NAT map for the w20 port to be a map called "defaultnapt". The defaultnapt map is provided on the INA as a convenience for this common scenario where all outbound sessions hide behind the single WAN port address. The use of this map saves the steps that would normally be required to create a map and add rules to it. When the defaultnapt map is used, all outbound sessions will be port mapped to the IP address for the WAN port (10.10.123.66 in this case). In other words, NAPT has been invoked and all outgoing sessions will hide behind the single WAN port IP address. Note that the mapping will not come into effect until the port is reset. In other scenarios, a specific outbound map may have to be created and rules added to it.
13	add map nat.in	Adds a new map called nat.in. This map will be used for inbound NAT mapping on the w20 port.
14	set map nat.in 1 statictcpudpportmap 10.10.123.66:smtp 192.168.1.2:smtp	Adds the first mapping rule to nat.in. This rule redirects incoming SMTP packets to the IP address of the customer's e-mail server.
15	set w20 nat inmap nat.in	Sets the incoming NAT map for the w20 port to be the nat.in map that was constructed earlier. Note that the mapping will not come into effect until the port is reset.
16	add filter wan.in	Adds a new filter called wan.in. This filter will be used to filter incoming packets on the w20 port. Subsequent steps will be used to add packet filtering rules to this filter.
17	set filter wan.in 1 deny 192.168.1.0/24 0.0.0.0/0	Blocks IP spoofing attempts by denying packets claiming to have a source IP address which matches the IP addresses the customer is using on their main site Ethernet network.
18	set filter wan.in 2 deny 192.168.2.0/24 0.0.0.0/0	Blocks IP spoofing attempts by denying packets claiming to have a source IP address which matches the IP addresses the customer is using on their remote site A Ethernet network.
19	set filter wan.in 3 deny 192.168.3.0/24 0.0.0.0/0	Blocks IP spoofing attempts by denying packets claiming to have a source IP address which matches the IP addresses the customer is using on their remote site B Ethernet network.
20	set filter wan.in 4 permit 0.0.0.0/0 10.10.123.66/32 tcp established dst gt 1023	Allows return traffic for TCP sessions that were initiated by endpoints on the customer's network.
21	set filter wan.in 5 permit 10.10.121.1/32 10.10.123.66/32 udp src eq 53 dst gt 1023	Permits incoming DNS responses from the primary DNS server at the ISP. DNS requests are carried over UDP and the responses from the DNS server would have a source UDP port of 53.

Step	Command	Notes/Explanation
22	set filter wan.in 6 permit 10.10.122.1/32 10.10.123.66/32 udp src eq 53 dst gt 1023	Permits incoming DNS responses from the secondary DNS sever at the ISP.
23	set filter wan.in 7 permit 0.0.0.0/0 10.10.123.66/32 tcp dst eq 25	Permits incoming e-mail to the customer's e-mail server. Note that the rule uses the global IP address that the customer's e-mail server is known by instead of the private IP address used on the LAN. This is because the filter is applied before the inbound NAT translation is performed.
24	set filter wan.in 8 permit 0.0.0.0/0 10.10.123.66/32 icmp type 0	Permits echo replies (ICMP Type 0 messages) to enter the customer's network. This allows IP endpoints on the customers LAN to ping external IP endpoints (i.e. initiate echo requests) and have the echo replies return. This rule can be omitted if the customer does not have a need to ping Internet endpoints.
25	set filter wan.in 9 deny	Denies all packets not explicitly permitted in other rules. This rule is not technically needed since there is an implicit deny rule at the end of every filter but it is a good practice to include it.
26	set w20 ifilter wan.in	Makes the filter wan.in which was created in the above steps the incoming filter for WAN port w20. Note that the WAN port must be reset in order for this change to come into operation.
27	save all	Save all the configuration data entered so far.
28	reset w20	Resets WAN port w20 to bring all the WAN port settings into effect.
29	set w18 protocol frame	Set the protocol for WAN port w18 to frame relay.
30	set w18 annex-d 10	Set the management protocol for WAN port w18 to annex-d with a keep alive value of 10. This is five seconds less that the keep alive value set on the frame relay switch which is recommended.
31	set w18 address 192.168.100.1	Set the IP address of the w18 WAN port.
32	set w18 address 255.255.255.240	Set the netmask of the w18 WAN port. A 28 bit subnet mask allows for up to 14 locations to be connected over the frame relay network. A shorter netmask (smaller dotted decimal number) would allow for more locations.
33	add ipdlci w18 100 192.168.100.2	Binds DLCI 100 to 192.168.100.2 which is remote site A.
34	add ipdlci w18 101 192.168.100.3	Binds DLCI 101 to 192.168.100.2 which is remote site B.
35	add route 192.168.2.0/ 24 192.168.100.2	Add a static route allowing packets to be routed to remote site A.
36	add route 192.168.3.0/ 24 192.168.100.3	Add a static route allowing packets to be routed to remote site B.

Step	Command	Notes/Explanation
37	save all	Save the configuration data entered thus far.
38	reset w18	Reset the w18 WAN port.

Additional Filtering Considerations

Additional filtering considerations for FTP and ICMP are provided below.

FTP

There are two different versions of FTP, each with its own filtering characteristics. These are summarized below.

Normal-mode FTP sessions:

- An FTP client first establishes an FTP control channel connection to server TCP port 21 on an FTP server. The client uses a port above 1023 for this control channel connection.
- Actual data transfers are carried over a second, data channel connection that the **server** initiates back to the client. The FTP server connects back to the client at a client TCP port above 1023. Depending upon the FTP server, this data channel connection will be initiated from a server TCP port of 20 **OR** a server TCP ports above 1023.

Hence, in normal-mode FTP sessions, the client establishes the first connection (for control data) whereas the server establishes the second connection (for data transfer).

Passive-mode FTP sessions:

- An FTP client first establishes an FTP control channel connection to server TCP port 21 on an FTP server. The client uses a port above 1023 for this control channel connection. This is the same as for a normal-mode FTP session.
- Actual data transfers are carried over a second, data channel connection that the **client** initiates to the server. The FTP client initiates this connection from a client TCP port above 1023 and connects to the server at a server TCP port above 1023.

Hence, in passive-mode FTP sessions, the client establishes **both** the control channel connection and the data channel connection.

Web browsers typically use passive-mode sessions while other FTP clients such as the MS-DOS FTP client use normal-mode sessions. The example filters in previous sections allow for normal-mode FTP sessions where the FTP server initiates data channel connections from a server TCP port above 1023. This is the safest approach but will, unfortunately, block traffic for other types of

FTP sessions. To accommodate the other types of FTP sessions, one or both of the following rules must be added to your filters:

set filter wan.in X permit 0.0.0.0/0 **IPAddressFTPServer/32** tcp established dst eq 20

Permits return traffic from normal-mode, FTP **server** initiated data channel connections. This rule would be needed when external FTP clients use normal-mode sessions AND the internal FTP server initiates data channel connections from server TCP port 20 (as opposed to ports above 1023). Here, the following values are substituted:

X - the rule number

IPAddressFTPServer - The IP address of the FTP server. If NAT/NAPT is used and private IP addresses are used on the LAN, the IP address of the WAN port connecting to the ISP would be inserted. Otherwise, if global addresses are used on the LAN, the global IP address of the FTP server would be inserted.

set filter wan.in X permit 0.0.0.0/0 **IPAddressFTPServer/32** tcp dst gt 1023

Permits incoming traffic from passive-mode, FTP **client** initiated data channel connections. This rule would be needed when external FTP clients use passive-mode sessions. Here, the following values are substituted:

X - the rule number

IPAddressFTPServer - The IP address of the FTP server. If NAT/NAPT is used and private IP addresses are used on the LAN, the IP address of the WAN port connecting to the ISP would be inserted. Otherwise, if global addresses are used on the LAN, the global IP address of the FTP server would be inserted.

The need to include the first rule above will depend on whether or not the customer's FTP server will be accessed by external, normal-mode FTP clients. If so, and if the customer's FTP server initiates data channel connections from server TCP port 20, then the first rule must be included. Microsoft's FTP server, for example, uses server port 20 to initiate data channel connections for normal-mode FTP sessions. This is the standard for normal-mode FTP sessions even though some servers may use server ports above 1023 to initiate data channel connections.

It is likely that the second rule above will have to be added to your filters since most FTP sessions are likely to be supported via web browsers. As such, chances are that both of the above rules will have to be added to your filters to avoid problems with FTP sessions. The filtering examples in the previous sections are on the conservative side and do not include these rules.

Note that the type of FTP clients that the customer uses on their own internal network can effect filtering rules as well. The customer can use either normal-mode or passive-mode FTP clients to access external FTP servers. The filters presented in previous sections allow the customer to use passive-mode clients where the FTP client initiates both the control and data channel connections out to the FTP server. Our "tcp established" rule permits the data for both types of connections to return to the client in this case. The exclusive use of passive-mode FTP clients is strongly recommended. Otherwise, if normal-mode FTP clients were used, the filters previously described would have to be expanded to allow external FTP servers to connect to internal FTP clients at TCP ports above 1023. Since it is not known ahead of time which external IP addresses are potential FTP servers and which internal addresses are potential FTP clients, the corresponding filter rule

must allow any external IP address to connect to any internal IP address at TCP ports above 1023. This is not recommended.

ICMP

The example filters in previous sections permit only ICMP type 0 messages (echo replies) to enter the customer's network. This allows internal endpoints to ping external endpoints. Among other things, permitting only ICMP type 0 messages has the following implications:

- External endpoints will not be able to ping to internal endpoints on the customer's LAN. Echo requests (ICMP type 8 messages) may be permitted to allow this but this will open up the customer to a denial of service attack (ping flood) and will allow external endpoints to discover more about the customer's network. This is not recommended.
- Internal endpoints will not be able to traceroute to external endpoints and vice versa. Permitting ICMP type 3 and ICMP type 11 messages into the customer's network will allow internal endpoints to traceroute to external endpoints. Permitting these two types of ICMP messages may be useful and is not particularly risky.

Data Communications Software

Communications software enables your data terminal and data communications equipment to work together. The software routes data and commands to and from the DCE. It also may instruct the DCE to use the correct communications protocol when communicating with the remote system. A protocol is an agreed-upon procedure for controlling data transfer between the workstations.

Internet service providers supply communications software as part of their offering. It usually detects the type of DCE you are using and sets it up automatically. In some cases, you may have to perform some of the installation yourself. If this is necessary in your case, this section helps you understand the functions of data communications software.

Communications software packages are also available separately or come with data communications equipment. Some data communications software allows you to issue commands directly to the DCE; other packages let you perform some setup steps and then handle the commands to the DCE without your intervention.

Before you can make and receive data calls, you may need to ensure that the communications software is installed and that its parameters (which define the protocol) are agreed upon and set for both data workstations in the communications link. Ensure that both data workstations are using the same settings or compatible settings or that you are using the settings required by a service provider. When you are communicating with an individual at an outside data workstation, the settings should be the same at both data workstations.

You may need to use your communications software to perform certain setup commands so that your DCE can work with your data workstation. For details, refer to the manuals provided with your modem or ISDN router and communications software.

If you are setting up your data workstation to receive data, you may need to enable an auto answer feature for your communications software or DCE. Refer to the manual provided with your modem software or ISDN router for details.

Video Communications Software

The software that comes with your Video-Conferencing system should help you to set up each video session, check the network facilities for problems, and provide information about the progress of a call.

To help video sessions to go smoothly, you should find out which Video-Conferencing standards or proprietary protocols you and the other party are using. If they match, you should be able to communicate. H.320 is an industry-standard protocol to which many systems adhere. When two systems are H.320-compliant, they use compatible video encoding, channel multiplexing (this part of the standard is sometimes called px64), and control signaling.

H.320 compatibility should guarantee basic Video-Conferencing compatibility between endpoints that adhere to the standard, but does not guarantee compatibility for advanced Video-Conferencing features, such as data-sharing.

T.120 is a standard that defines the standard requirements of data-sharing. The standard, when systems are compliant with it, assures that data can be routed among Video-Conferencing participants and that shared resources are allocated correctly.

If the hardware and software participating in a Video-Conferencing session do not adhere to industry standards, the guides that accompany the video systems should specify the requirements for protocol compatibility. In addition to these broad protocols, the audio and video mode settings on your system should be compatible with those of the party with whom you are communicating. These settings determine how much of the bandwidth is allocated to audio (voice and sound) and how much is allocated to video (moving images).

The following settings are examples of audio mode choices offered by Video-Conferencing systems:

- G.711 Pulse Code Modulation (PCM). Provides 3 kiloHertz (KHz) audio; uses an entire 56-kbps or 64-kbps B-channel for audio.
- G.728 Low-Delay Codebook Excited Linear Prediction (LD-CELP) Low-Delay Codebook Excited Linear Prediction. Provides 3 KHz audio; compressed format, uses 16 kbps for audio. The rest of the bandwidth is for video.
- G.722 PCM. Provides 7 KHz audio; uses 32 kbps for audio; higher bandwidth and better audio but less video bandwidth than G.728.

Examples of video modes are full Common Intermediate Format (CIF), providing the best video resolution at 352 x 288 pixels and quarter CIF, providing a coarser image at 88 x 72 pixels.

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Initializing the System

To initialize a MERLIN MAGIX 1.5 System, use one of the following methods:

- Restore from a PCMCIA memory card.
- Upgrade to the most current release of the MERLIN MAGIX system. See [“Upgrading the System.”](#)
- Use system programming forms and the procedures from the System Programming section of each feature in the *Feature Reference*.

Restoring from the PCMCIA Memory Card

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

NOTE ► On initial installations, make sure you perform a System Erase (frigid start) either 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.

To initialize the system from a MERLIN MAGIX 1.5 PCMCIA memory card, first perform a System Erase, then a Restore as described below.

1. Follow these steps to perform a System Erase (frigid start):
MenuMaintenance→Slot→Dial or Type 00→Enter→Demand Test→System Erase (Line 5, left button) twice→Yes
2. Use the programming console and the memory card to perform the Restore procedure. See *“Maintenance and Troubleshooting”* for instructions.

Restoring from the System Programming Backup Disk

To initialize the system from a MERLIN MAGIX system programming backup disk, first perform a System Erase, then a Restore using the system programming backup disk, as described below:

1. Follow these steps to perform a System Erase (frigid start):
Menu→Maintenance→Slot→Dial or Type 00→Enter→Demand Test→System Erase (Line 5, left button) twice→Yes
2. Use SPM and the system programming backup disk to perform the Restore procedure.
See “*System Programming Basics*” for instructions.

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

Setting the Time and Date

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

Follow this procedure: Menu→SysProg→System→Date→Drop→Dial current date→Enter

Testing the System

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

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

Testing 4400 Series Telephones

Use the following steps to check if the LEDs, ringer, buttons, switchhook, or display are working.

1. Pick up the handset.
2. When you hear the 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 telephone starts ringing.

- This test connects a test tone to the B-channel and sends a repeated ring burst to the telephone.

- On 4400, 4400D, 4406D+, and telephones with a DSS attached, all LEDs light and the telephone rings throughout the test.
- On 4412D+, 4424D+, and 4424LD+, the left-most column of feature buttons that have associated LEDs light and the telephone rings periodically.

To switch to another column of feature buttons that have associated LEDs, press a feature button in the column you want to select.

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

The first press turns the red and green LEDs off. Subsequent presses should toggle the red and green LEDs on and off.

4. Press each fixed feature button that has an LED (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 or line/feature button that does not have an LED, and each dialpad button.

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

NOTE ► For 4412D+ telephones, pressing a fixed-feature button or line/feature button will turn the current column of LEDs off (if lit), and toggle the Message Waiting Light (MWL) on and off.

6. Press the fixed-feature buttons and dialpad buttons in the order shown below to turn on all the LEDs.
 - a. Redial
 - b. Conference
 - c. Transfer
 - d. Hold
 - e. Dial 123456789*0#

The LEDs should toggle on and off.

7. If the 4400-Series telephone does not have a display, hang up the telephone to end the test. If it does have a display continue to the next step.
8. To test a 4400-Series telephone display, press each display button.
Each button name should display in the upper-left corner.
9. If any of these tests fail, replace the telephone.

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.

Testing Basic Features of MLX Telephones

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

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 these steps 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 these steps:

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

Testing for Any Dial Tone

To test for dial tone, follow these steps:

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 these steps:

1. Without lifting the handset, press one of the outside line buttons.
The red LED next to this button should turn on.
2. Pick up the handset or press the Speaker button.
The green LED next to the line button should turn on and you should hear a dial tone.
3. Hang up and repeat Steps 1 and 2 for each line button on the telephone.

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

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

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 on a single-line telephone works only if the telephone has a touch-tone 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 these steps:

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

Testing Tie Trunks

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

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

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

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

Testing Two-Way Automatic-Start Tie Trunks

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

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 these steps:

1. At the far-end tie-trunk site, have someone pick up the handset and dial a tie trunk assigned to a button on your telephone.
Your telephone should ring, the red LED next to the tie-trunk button should turn on, and the green LED next to the tie-trunk button 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 these steps:

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 these steps:

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 these steps:

1. At any telephone that has access to a dial-repeating tie trunk, press the first tie-trunk button.
The red LED next to the pressed tie-trunk button lights.
2. Pick up the handset. (In Hybrid/PBX systems with pooled tie trunks, press an SA button and dial the pool dial-out code.)
The green LED next to the selected button lights.
3. Dial the tie-trunk number of the extension where someone is waiting for your call.
You should hear ringing.
4. When the person answers, verify that you have good two-way communication, then hang up.
The green LED should turn off, the red LED should turn off, and another red LED may turn on.
5. Repeat Steps 1 through 4 for each outgoing or two-way dial-repeating tie trunk.

Testing BRI Trunks

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

Testing Selected System Features

This section provides procedures to test the following system features:

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

If any feature does not work properly, check system programming. You can run these tests easily from an MLX, 4400-Series, or MLS/ETR 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 does 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 these steps:

1. In Hybrid/PBX mode, determine which toll numbers to call by examining the system manager's ARS patterns.
2. At any multiline telephone, pick up the handset and dial the ARS access code and one of the toll numbers.
Make sure the call is completed before hanging up.
3. Repeat Step 2 for additional toll numbers.
4. At the SMDR printer, verify that the call was made on the correct trunk group and check the number of seconds before the call is reported on the SMDR printout.

If there are errors, check system programming.

Group Calling Test

To test Group Calling features, follow these steps:

1. Make sure that each group member is logged into the group.
To log in, each member dials #44.
2. At any telephone, pick up the handset and dial the trunk that is programmed to ring for a particular calling group.

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

System Speed Dial Test

To test System Speed Dial numbers, follow these steps:

1. Find out which numbers have been programmed for System Speed Dial.
See the system manager or use Form 10b as a reference for System Speed Dial numbers.
2. From the test telephone, pick up the handset and dial a System Speed Dial code.
Verify that you have good two-way communication and that the correct party was reached.

Coverage Test

To verify that coverage is in effect, follow these steps:

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 these steps:

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.
Have someone pick up the handset at a telephone in the Night Service group.
5. 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 been installed, follow these steps to verify that you can access the dictation system:

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

Testing the Paging System

To test the paging system, follow these steps:

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 acknowledgement 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

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

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 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 a license, from Lucent Technologies.

Testing the Power Failure Transfer Jacks

To test a power failure transfer (PFT) jack for proper operation, you must assign the outside line numbers to the module's line/trunk jacks and the trunks must be operational. A PFT telephone on a GS line must have a GS button, shown below, attached to the telephone.



Figure 7-1. Ground-Start Button

To test PFT jacks, follow these steps:

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. See [“Powering Down the System”](#) on page 2-24.
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 two-way communication, give 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, 2, and 4 through 10 to test all PFT jacks.
12. Turn the power back on. See [“Powering Up the System”](#) on page 2-24.

Testing Touch-Tone Receivers

The 016 (T/R), 016 ETR, 400 GS/LS, and 412 LS-ID-TDL modules each provide four touch-tone receivers (TTRs). The 008 OPT, 012 T/R, 800 DID, 800 GS/LS-ID and MERLIN Messaging System modules each provide two TTRs.

To test TTRs, follow these steps:

1. Pick up the handset of a touch-tone single-line telephone that is connected to one of the modules that provide TTRs.
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. You will hear a reorder tone if you misdialed or addressed a receiver not in your system. (This can happen if, for example, you dialed 07 and your system has only one 016 (T/R) module and one 800 GS/LS-ID 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 123456789*0#. You should hear a dual-tone multifrequency (DTMF) signal as each button is pressed. When you finish dialing, you should hear a 3-beep confirmation tone.
5. Repeat the test for each TTR.

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Overview

You can upgrade to the Release 2.0 of the MERLIN MAGIX Integrated System from either a MERLIN MAGIX Release 1.5 or earlier system or a MERLIN LEGEND Communications System. Many of the modules used in the MERLIN LEGEND system are supported in the MERLIN MAGIX Release 1.5 system. Also, you can encase all but one of the modules introduced in the MERLIN MAGIX system in a plastic shell and use them in a MERLIN LEGEND plastic carrier after you upgrade system software. The 100R INA module is the one module that must be used in a metal carrier.

NOTE ▶ Upgrading from a MERLIN LEGEND system to a MERLIN MAGIX system is very similar to upgrading to a Release 2.0 MERLIN MAGIX system. Any differences between the two upgrades are noted in [“Upgrading from a MERLIN LEGEND System”](#) on page 8-2.

Upgrading from MERLIN MAGIX Release 1.5 or Earlier

You can upgrade from a Release 1.5 or earlier MERLIN MAGIX system by using the PCMCIA upgrade card for Release 2.0. See [“PCMCIA Upgrade Card”](#) on page 8-13. With MERLIN MAGIX Release 2.0 you receive the following feature enhancements:

- Enhanced CSTA services to provide more flexibility for lines and features and also provides new services and events to help support a Customer Relationship Management application
- More TSAPI events and services that will aid the application in real-time reporting and routing
- New current delay announcement unit (DAU) functionality through the MERLIN Messaging System Release 2.5 and later. There is a new system programming option added to associate an announcement number with a particular delay announcement number.
- Support for the TransTalk 9040, a digital wireless telephone with programmable buttons that will work on 412 LS-TDL and 024 TDL boards for Release 1.5 and later systems, and on 016 ETR modules for all releases.

- Support for the conversion feature that allows a user to take a backed up configuration of an earlier release of a MERLIN LEGEND system or MERLIN MAGIX system and have the file automatically mapped into a version that the new release can use. This functionality is provided as part of the WinSPM software.

The user can select a backup file and then select the product they would like to CONVERT TO and then select the Release number of that product. The user is prompted for all these inputs and their choices for upgrades are based on the version of the backup file that they wish to convert. In Release 2, there is an upgrade path from prior releases of MERLIN MAGIX and MERLIN LEGEND systems to MERLIN MAGIX Release 2.0.

- Display integration with MERLIN Messaging System Release 2.5 and later that allows users to with display telephones to view basic voice mail message information such as the number of New and Old Messages.
- MERLIN MAGIX system enhanced functionality that forwards caller id information to the MERLIN Messaging system for use with other messaging system features.

Upgrading from a MERLIN LEGEND System

Many customers want to use the capabilities of a MERLIN MAGIX system (especially the 100R INA module) without overhauling their entire MERLIN LEGEND system. To accomplish this, you can encase the modules introduced in the MERLIN MAGIX system in a plastic shell and place them into the MERLIN LEGEND plastic carrier (see instructions [“Installing and Removing the Plastic Shell”](#) on page 8-4). You also can add a metal expansion carrier to any MERLIN LEGEND system that has one or two plastic carriers and place modules into the metal carrier. (Three carriers is the maximum for the system.)

- NOTES** ►
- You cannot add plastic expansion carriers to the end of a metal carrier.
 - The 100R INA module is supported only in the metal carrier.
 - Version 2.0 of the 100R INA module is required. All INA modules manufactured beginning in May 2000 are Version 2.0.
 - The INA module must be in the first slot of the metal expansion carrier. Any empty slot/s in the preceding plastic carrier are programmed as Bridge Boards (see Step 5 on page 8-13 in the [“Upgrading to the MERLIN MAGIX System”](#) procedure for instructions)
 - For 100R INA modules, earlier than Version 2.0, there can be no more than one empty slot in the preceding plastic carrier. Add more modules to fill the empty slots or upgrade the entire system to a metal carrier system.

You can place the following modules into a plastic or metal carrier:

- 100 DCD
- 100 DS1
- 400 E&M
- 408 GS/LS-ID-MLX
- 412 LS-ID-TDL module
- 800 DID
- 800 LS-ID
- 800 NI-BRI
- 008 MLX
- 008 OPT
- 016 ETR
- 016 MLX
- 016 T/R
- 024 TDL module
- MERLIN Messaging System

The following modules cannot be placed into a metal carrier but are supported by the Release 1.5 software:

- 400 GS/LS/TTR
- 408 GS/LS-MLX
- 800 LS
- 800 GS/LS
- 800 GS/LS-ID
- 008 OPT with ring generator
- 012 T/R with ring generator
- 012 T/R without ring generator
- MERLIN LEGEND Mail[®]

The software for Release 1.5 of the MERLIN MAGIX system introduces a new phantom module called the Bridge module. This module does not physically exist and has no lines or extensions. It serves to fill up the one empty slot at the end of the plastic carrier before the metal expansion carrier when a 100R INA module is installed (see Step 5 on page 8-13 in the [“Upgrading to the MERLIN MAGIX System”](#) procedure for instructions).

The following sections explain the upgrade process in full detail.

NOTE ► The MERLIN LEGEND system must have a CKE4 or CKE5 processor module.

Installing and Removing the Plastic Shell

You can add or remove a plastic shell to or from modules, depending on whether you are going to use them in a plastic carrier (with shell) or a metal carrier (without shell).

NOTE ► The 100R INA module cannot be encased in a plastic shell.

Installing the Plastic Shell

Follow these steps to enclose a module with a plastic shell so that the module can be used in a plastic carrier (see Figure 8-1):

1. Insert the two alignment tabs on the left housing through the two circuit board slots behind the module faceplate.
2. Rotate the module into position so that it aligns correctly on the five pins in the left housing.
3. Insert the two alignment tabs on the right housing behind the faceplate (see Figure 8-2).
4. Rotate the right housing into position so that the five snaps lock into position.

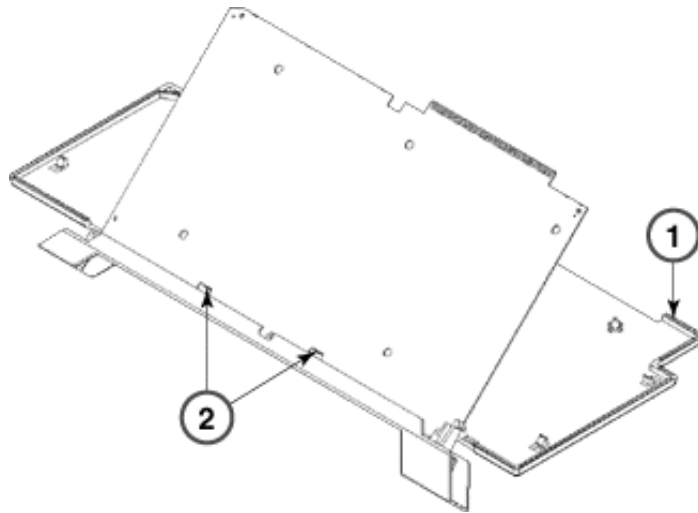


Figure 8-1. Inserting the Module into the Left Housing

- 1** Left Housing
- 2** Alignment Tabs

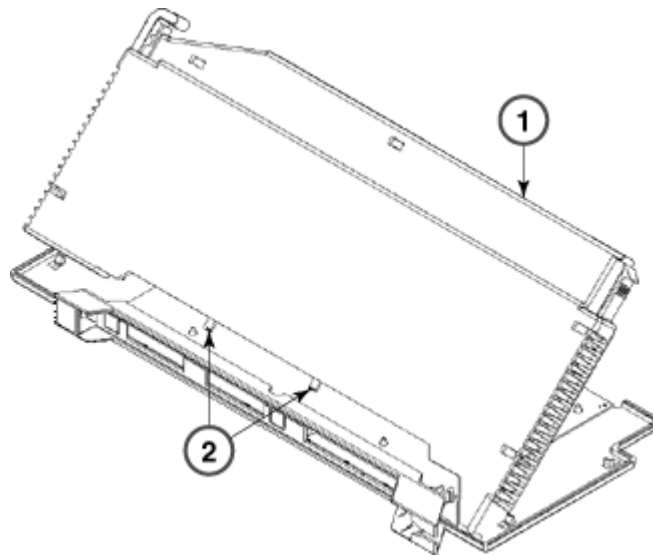


Figure 8-2. Attaching the Right Housing

- 1 Right Housing
- 2 Alignment Tabs

Removing the Plastic Shell

Follow these steps to remove the plastic shell from a module:

1. Use a flat-bladed screwdriver to pry apart the five snaps.
2. Separate the left and right housings from the module.

Preparing the MERLIN LEGEND System

All domestic versions of the MERLIN LEGEND Communications System that have a CKE4 or CKE5 processor module, except MERLIN LEGEND R2B systems, can be upgraded to the latest release of MERLIN MAGIX.

NOTE ► Release 2B was primarily sold to Government Solution customers.

The MERLIN LEGEND system carriers must have either a 391A3 or 391C1 power supply before upgrading to a MERLIN MAGIX system. Also be sure that each carrier's power supply supports the amount of new stations and/or modules you may be adding.

**CAUTION:**

If you are reusing 012 Tip/Ring modules without a ring generator, make sure the ring generator is removed from the old power supply and added to the new power supply, if replacing the power supply. Refer to "Replacing the Ring Generator (Plastic Carrier)" in Chapter 4 of Maintenance and Troubleshooting for instructions.

Following are the maximum unit loads for each of the MERLIN power supplies:

- 391C1 & 491D1 = 96 Unit Loads
- 391A3 = 75 Unit Loads
- 391A1 & 319A2 = 54 Unit Loads

Use the following to determine which power supply is already installed in a plastic carrier:

- The 391A1 and 319A2 Power Supply's power switch toggles up and down, and have a gray jack between the power switch and the power LED.
- The 391A3 Power Supply does not have a gray jack between the power switch and the power LED, but the power switch still toggles up and down.
- The 391C1 Power Supply also does not have a gray jack between the power switch and the power LED, but its power switch toggles left to right.

**CAUTION:**

The 491D1 Power Supply is the only power supply that can be installed in a metal carrier.

Follow these steps to prepare the MERLIN LEGEND system for upgrading to the MERLIN MAGIX Release 1.5 system:

1. Remove any of the unsupported modules shown in Table 8-1:

Table 8-1. Unsupported Modules from MERLIN LEGEND Communications System

Board Description	Apparatus Code	COMCODE
4 CO Loop Start Lines	517A2	103983490
	517B2	105351084
4 CO Loop Start Lines w/ 4TTRs	517B12	105408892
8 ATL stations	517A3	103983508
	517B3	105351092

Table 8-1. Unsupported Modules from MERLIN LEGEND Communications System

Board Description	Apparatus Code	COMCODE
4 CO Loop Start Lines and 8 ATL stations	517A1	103983482
	517B1	105351076
	517C1	105512495
	517D1	106397516
4 CO Loop Start/Ground Start Lines and 8 ATL stations	517A26	106064678
	517B26	106939366
	517C26	107044877
	517D26	107091407
8 CO-BRI—sold primarily to Government Solutions customers	517A32	107025793

- If you are upgrading to a MERLIN MAGIX Release 1.0 system, move modules to the left of the carrier as necessary to eliminate any empty slots.

If you are adding a 100R INA module while upgrading a MERLIN LEGEND system to a MERLIN MAGIX, system, a metal expansion carrier and a Version 2.0 of the 100R INA module are required. All INA modules manufactured beginning in May 2000 are Version 2.0. The INA module must be in the first slot of the metal expansion carrier. Any empty slot/s in the preceding plastic carrier are programmed as Bridge Boards (see Step 5 on page 8-13 in the [“Upgrading to the MERLIN MAGIX System”](#) procedure for instructions).

NOTE ► If you are adding a 100R INA module earlier than Version 2.0 (requires a metal carrier) **only one empty slot is allowed before the 100R INA module**, otherwise no empty slots are allowed. The one empty slot is programmed as a Bridge Board. Add more modules to fill the empty slots or upgrade the entire system to a metal carrier system.

- Do a board renumber each time you remove or move a module.
- Relabel extensions.
- Back up the system onto a floppy disk or a PC (not onto the PCMCIA card).

Upgrading to the MERLIN MAGIX System

Upgrading to the MERLIN MAGIX system from a MERLIN LEGEND system involves the following:

- Converting and restoring the backup file
- Programming for Bridge modules
- Attaching the metal carrier as necessary
- Adding the MERLIN MAGIX modules
- Performing a board renumbering

- NOTES** ► ■ You can upgrade from a MERLIN LEGEND system to a MERLIN MAGIX system without installing a metal carrier. However, the 100R INA module only fits into a metal carrier.
- **Only one empty slot is allowed** in the plastic carrier to the left of the INA module, otherwise no empty slots are allowed.
 - You cannot add plastic expansion carriers to the end of a metal carrier.

Follow these steps to upgrade to the MERLIN MAGIX system:

1. Back up the system programming.

This step creates a file containing system programming information. Be sure to use WinSPM Release 5.0 or later to back-up the system when upgrading to the latest release of MERLIN MAGIX, because only the latest release of WinSPM has the convert files. If you do not have the correct release of WinSPM, install it now then continue.

When using WinSPM, you may see the message WinSPM cannot recognize the circuit pack in slot #. This indicates one of the following:

- You must remove unsupported modules before Quick Access will be available. Be sure to remove all non-supported modules before beginning the upgrade. Refer to Table 8-1 on page 8-7 for a list of unsupported modules.
- One of the following supported MERLIN LEGEND modules is installed. However, if you are using WinSPM R5, the Standard SPM mode is automatically selected so you can continue to upgrade a system with the modules listed in Table 8-2 installed.

NOTE ► These modules are unlike the modules listed above, because these modules *still work* in a plastic carrier that has been upgraded to the latest release of MERLIN MAGIX.

Table 8-2. Supported MERLIN LEGEND Modules That Cause WinSPM Error Message

Module Description	Apparatus Code	COMCODE
4 CO Loop Start/Ground Start Lines and 8 MLX stations (Not Caller ID compatible)	517A29	106698590
8 CO Loop Start Lines	517A4	103983516
	517B4	105351100
4 CO Loop Start/Ground Start Lines w/ 4TTRs	517A18	105627988
	517B18	105628044
	517C18	107044869
	517D18	107091399
8 CO Loop Start/Ground Start Lines (Not Caller ID compatible)	517A19	105627996
	517B19	105628069
	517C19	107091381
DS1 (Non-upgradeable)	517A15, 517B15	105486260
	517C15	105512438
	517E15	107533853
8 MLX stations (Non-upgradeable)	517A21	105628010, 106215155
	517B21	107798183
	517B21B	108406547

- Using WinSPM, convert the MERLIN LEGEND backup file to the latest release of the MERLIN MAGIX system. (See [“Automatic Conversion of Backup Files”](#) on page 8-15.).

**CAUTION:**

A new file name must be created for the converted file.

- Do one of the following:
 - Only a CKE4 and CKE5 Processor module can be upgraded to the latest release of the MERLIN MAGIX system. If the customer has an earlier version of the Processor module, install a new metal control unit and Processor module with the latest release of software already loaded. Refer to Chapter 2, [“Installing the Control Unit”](#) for complete instructions. After the new Processor is installed, download the new converted file into the system.
 - If you are adding a 100R INA module that only fits in a metal carrier, attach a MERLIN MAGIX metal expansion carrier to the right of the existing MERLIN LEGEND carrier(s). (See Chapter 2, [“Installing the Control Unit”](#) for information on mounting carriers.)
 - If you are using mounting brackets to mount the expansion carrier, see Figure 8-3.
 - If you are not using mounting brackets to mount the expansion carrier, see Figure 8-4 for the correct positioning of the mounting screws.

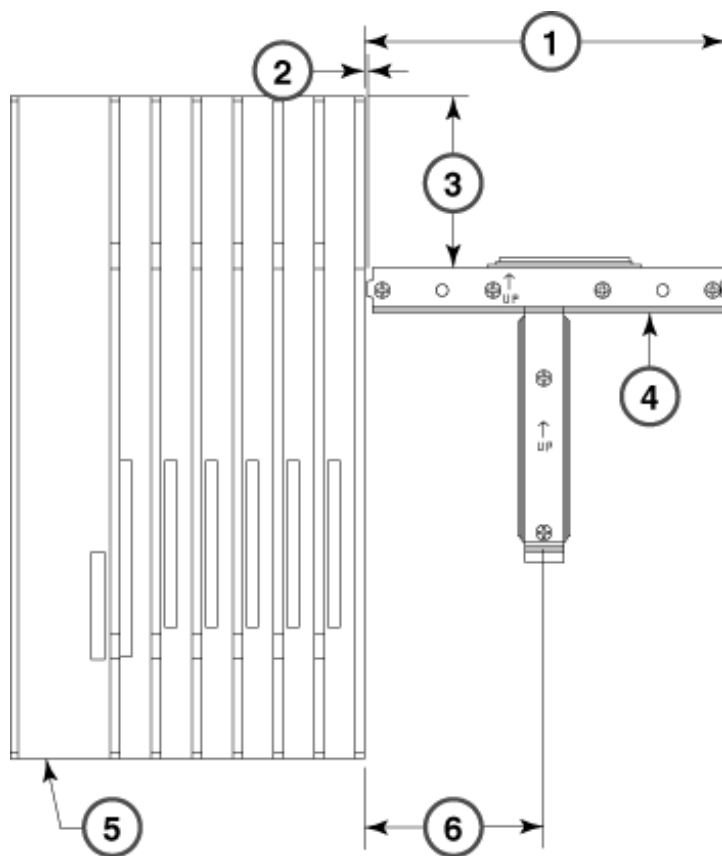


Figure 8-3. Using a Mounting Bracket

- 1** 11.472"
- 2** .097"
- 3** 5.480"
- 4** MERLIN MAGIX Metal Carrier Mounting Brackets
- 5** MERLIN LEGEND Plastic Carrier
- 6** 5.673"

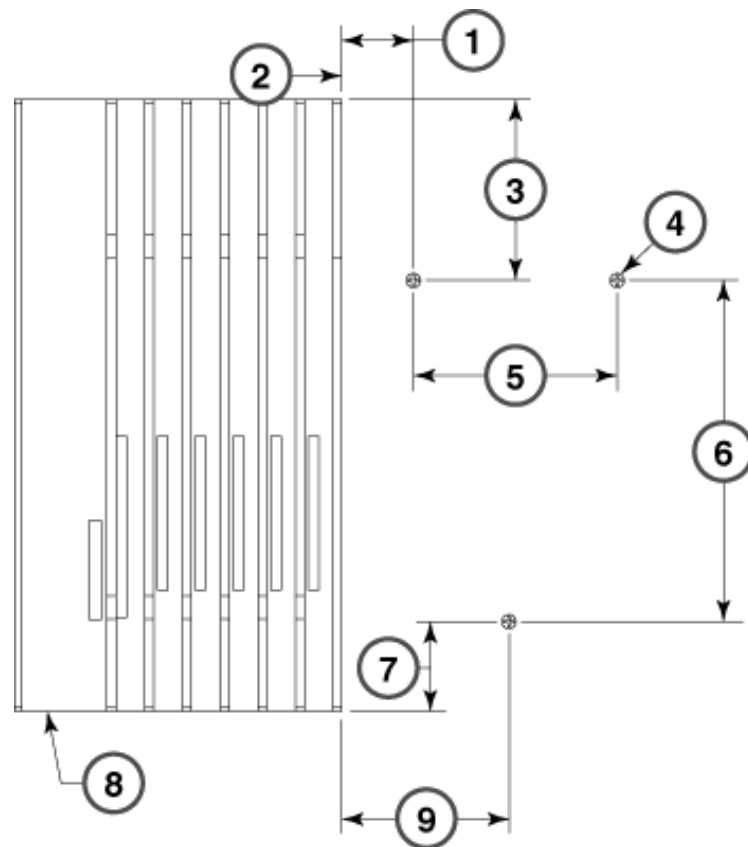


Figure 8-4. Positioning Mounting Screws

1	2.454"
2	.097"
3	6.130"
4	MERLIN MAGIX Metal Carrier Mounting Screw Locations
5	7.000"
6	11.750"
7	3.102"
8	MERLIN LEGEND Plastic Carrier
9	5.704"

4. For customers who already have installed a CKE4 or CKE5 Processor module, upgrade the software after the convert is completed. Insert the Upgrade Card into the CKE4 or CKE5 Processor module's PCMCIA slot. (See ["Upgrading the System Software"](#) on page 8-13.)

5. As necessary, add a Bridge module you need to fill up the single empty slot at the end of the last plastic carrier before the metal carrier. To add a Bridge module, select "Bridge" from the Boards screen in System Programming. (Bridge module programming is available in Release 1.5 or later of the MERLIN MAGIX system.)

NOTE ► You can program a Bridge module only from a PC running WinSPM.

6. If you are adding a 100R INA module, place it in the first slot of the metal carrier.
7. Add any other modules you want to the metal carrier.
8. Power up the system.
9. Perform a board renumber.
10. If you have added a MERLIN Messaging System Release 2.0 or later module to the metal carrier, you must program for it in one of the two following ways:
 - If you have chosen to use the existing Voice Mail Calling Group, add the extension numbers assigned to the MERLIN Messaging ports to this calling group. Also, add the line numbers that go to this calling group. As needed, enable rotary dialing.
 - Run the automatic configuration for Release 2.0 of the MERLIN Messaging System. (See the Automatic Configuration feature in *Feature Reference*) As necessary, program the restriction for outcalling and program the lines that are to ring in the Voice Mail Calling Group.

PCMCIA Upgrade Card

You can use the PCMCIA Upgrade card provided in Release 2.0 of the MERLIN MAGIX system to do one of two things: upgrade the system software to Release 2.0 or upgrade only the firmware on modules. If you choose to upgrade only the firmware on the modules, you leave the system software unchanged.

NOTE ► You must be running WinSPM Release 4.0 or later on a PC to upgrade the system.

Upgrading the System Software

Follow these steps to upgrade the system software to Release 2.0 of the MERLIN MAGIX system:

1. Back up system programming. See *"Maintenance and Troubleshooting."*
2. Insert the Upgrade card into the PCMCIA slot on the processor module.
3. Follow this system programming path: Maintenance→System→Upgrade.

The screen shows **Validation of MemoryCard in Progress** and then **Validation of MemoryCard Successfully Completed**.

4. Select **Exit**.

The next screen shows each release name and **Incompatible releases**.

5. Press **F10** twice or press the bottom right hand button next to the display if you are using the 4424LD+ or MLX 20L telephone for programming.
6. Answer **Yes** to the next screen and the system continues with the upgrade.
7. After the system goes through a cold start **restore** the converted backup file and set the system date and time.
8. After the system cold-starts, make some test calls to ensure that all types of calls can be made.
9. Backup the customer's translations using a PCMCIA Backup and Restore Card, floppy (PC) or hard drive (PC).

Upgrading Module Firmware

Follow these steps to upgrade module firmware without changing system programming:

1. Insert the Upgrade card into the PCMCIA slot on the processor module.
2. Follow this system programming path: **Menu→Maintenance→Slot**.
3. Enter the slot number of the module that needs a firmware upgrade. (You can upgrade only one module at a time.)
4. Select **Busyout**.
5. Answer "Yes" to **Do you want to continue?**
6. When you see **Busy -Out Complete** on the screen, select **Exit**.
7. Select **Upgrade** from the Maintenance Menu.

Validation of MemoryCard in Progress appears on the screen followed by **Validation of MemoryCard Successfully Completed**.

8. Select **Exit**.
9. The current module and version appears on the screen, followed by **Select one:** and the available versions for upgrading this module.
10. Select the version desired (you may only have one choice).
11. Press **Enter**, and select **Yes** when **Do you want to continue?** appears.
12. **In Progress** and the percentage completed appear as the upgrade is loaded.

13. When the upgrade is complete, the following appears:

If the upgrade was successful:

Upgrade Successfully Completed.
Slot Busied Out.
Slot Restore Needed.

If the upgrade was not successful (for example, you chose the wrong firmware for the module:

Upgrade Slot nn:
Board Memory Programming
Failure.
Upgrade CANCELLED.
Upgrade INCOMPLETE.

14. If the upgrade failed in Step 13, re-attempt the upgrade and choose the correct firmware. The upgrade will fail again, staying at 00% completed, and you will see the following error screen:

Upgrade Slot nn:
Memory on module will
not erase.
Upgrade CANCELLED.
Upgrade INCOMPLETE.

Repeat the upgrade again with the correct firmware and the upgrade will succeed.

15. When finished, select Exit.
16. Select Restore from the Maintenance Menu.
17. Select Yes when Do you want to continue? appears.
18. Repeat Steps 2 through 16 for each module to be upgraded.

When the upgrades are completed, verify the application version of each module by selecting its slot under Maintenance→System→Inventory.

Automatic Conversion of Backup Files

WinSPM 4.0 or later features a new upgrade feature that automatically converts previous releases of the MERLIN MAGIX and MERLIN LEGEND systems to later releases, including Release 2.0 of the MERLIN MAGIX system. With WinSPM 4.0 and earlier, you can take a backup file of an earlier release of a system and have the file automatically mapped into a version that a later release can use. The automatic conversion runs in the DOS Emulator portion of WinSPM 4.0.

NOTE ► Releases 1.4i and BRI of the MERLIN LEGEND Communications System cannot be upgraded.

To use this automatic conversion, you must have a PC loaded with WinSPM 4.0 or later connected to the System Administration port on the processor module; you cannot convert by using the 4424LD+ or MLX-20L system programming console.

NOTE ► If you are upgrading from a MERLIN LEGEND system to a MERLIN MAGIX system and the MERLIN LEGEND configuration contains modules that are not supported in the MERLIN MAGIX system (such as analog multiline telephone modules), the conversion is blocked. You can remove the unsupported modules, perform a system renumbering, and start the conversion again; or you can program the MERLIN MAGIX system from scratch.

Follow these steps to automatically convert the backup file of a previous release to Release 2.0 or late3r of the MERLIN MAGIX system:

1. Type `A + u` to start the conversion function from the SPM Main Menu.
2. Select the backup file to convert from (either on a floppy disk or on the PC's hard drive).
3. Select the system to convert to (MERLIN MAGIX).
4. Select the release to convert to.
5. Select a filename to convert to, or create a new file to convert to (either on a floppy disk or on the PC's hard drive).

On the hard drive, the file is placed in the BACKUP directory under the SPM directory. On the floppy disk, the file is placed in whatever directory is currently being used.

NOTE ► Once the conversion process starts, you cannot halt it until it finishes.

6. After the new processor module (CKE4 or CKE5) is installed as necessary or the system software has been upgraded, start the Restore procedure and select the file you converted to.

As you follow the procedure, WinSPM prompts you for the necessary entries, such as "Please select file name to convert to, or select NEW FILE to create a new file on selected drive."

Flow Control

WinSPM provides flow control for the system programming serial port. Flow control prevents buffer overflow between WinSPM Release 4.0 or later and the MERLIN MAGIX Release 1.5 and later system. WinSPM automatically engages or disengages flow control as needed.

Overview

WARNING:

When using high-density station modules (016- and 024-port), some configurations will be limited to three station modules per carrier due to exceeding the unit load capacity of the power supply. This unit load limitation typically occurs when a predominance (more than 50%) of large, multi-button telephones (4424LD+, 4424D+, 4412D+, MLX-20L, MLX-28D, ETR-34D, and/or ETR-18D telephones) are used. To prevent unit load problems in configuring systems, please follow the unit load configuration rules outlined below.

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.** 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 in the unit load calculation (for example: do not count the DSS).
- **Direct Inward Dial (DID) modules.**

Unit load and power requirements for a new system are computed automatically when the equipment for the system is initially ordered. These calculations are based on the assumption that each module is fully utilized—that is, all jacks are used.

WARNING:

Never have more than two (2) 800 BRI modules, two (2) DS1 modules (100D or 100 DCD), two (2) INA modules (100R INA), or more than one (1) 100D/100 DCD and one (1) 100R INA module in a carrier.

A maximum of two Merlin Messaging R2.5 modules can be installed per MERLIN MAGIX R2.0 system, however, only the first module installed (left most slot in system) can be programmed for voice messaging and/or Delayed Announcement Service. The second Merlin Messaging module installed can only be programmed for Delayed Announcement Service. Whether both Merlin Messaging modules can be installed in the same carrier depends on how many other -5 volt modules are also installed in that carrier.

Lastly, there can be any combination of the following three -5v dc modules per carrier, but do not exceed three per carrier:

- *MAGIX/LEGEND processor*
- *Merlin Messaging Module*
- *100D module (with or without built-in CSU/DSU)*
- *100R INA Module*
- *800 BRI Module*

If you exceed three –5v dc modules in a single carrier, the system will fail to come on-line.

Configuration Rules for Power Supplies (assumes a mix of telephone types)

1. In Key mode, the MERLIN MAGIX 491D1 and the MERLIN LEGEND 391C1 power supplies can generally support up to **three 016 MLX, 024TDL (MAGIX only), or 016 ETR modules**, as long as no DID, OPT or E&M Tie Line modules are in the same carrier.
2. In the Hybrid/PBX mode, the 491D1 and 391C1 power supplies can generally support up to **four 016 MLX, 024TDL (MAGIX only) and 016 ETR modules**, as long as no DID, OPT or E&M Tie Line modules are in the same carrier.

In many circumstances a more accurate unit load calculation may be useful. This may include situations where modules are not fully utilized, a predominance of large multi-button telephones are used, there is a change in the equipment, or you suspect that a particular carrier has more unit loads than the power supply can handle.

Unit Load Capacity of Power Supplies

Following are the maximum unit loads for each of the power supplies:

- 391C1 & 491D1 = 96 unit loads
- 391A3 = 75 unit loads
- 391A1 & 319A2 = 54 unit loads

Here's how you determine which power supply is already installed in a plastic carrier:

- The 391A1 and 319A2 Power Supply's power switch toggles up and down, and have a gray jack between the power switch and the power "LED".
- The 391A3 Power Supply does not have a gray jack between the power switch and the power "LED", but the power switch still toggles up and down.
- The 391C1 Power Supply also does not have a gray jack between the power switch and the power "LED", but it's power switch toggles left to right.

The 491D1 Power Supply is the only power supply that can be installed in a metal carrier.

Unit Load Rules for Different Modes

A general rule to follow is that if you can distribute the DID modules and telephone modules equally across the carriers, you will prevent unnecessary drain on any one carrier.

Also, depending on the system's mode, the rules vary, as follows:

- **Unit Loads for the Hybrid/PBX Mode.** The 491D1 power supply has a maximum rating of 96 unit loads and can handle up to a total of 96 4400-Series, MLX, ETR, and MLS telephones.
- **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 generally supports four modules of any type in Key or Behind Switch mode.

Calculation of Unit Loads

1. Add up the unit load for each type of module using Table A-1. If the total doesn't exceed 96, no further calculations are necessary. Table A-1 assumes a mix of telephone types with no more than 50% of telephones being large, multi-button telephones (4424LD+, 4424D+, 4412D+, MLX-20L, MLX-28D, ETR-34D, and/or ETR-18D) telephones.
2. If unit loads calculated from Table A-1 exceed 96 or if more than 50% of the telephones are large multi-button telephones, calculate the actual total using the unit load values in Table A-2 for each type of station device and trunk (include DSS and adjuncts powered from the Processor).

If the total exceeds the maximum unit loads per power supply, try to exchange modules between carriers to reduce the load below the maximum. MERLIN LEGEND customers using a 391A1, 391A2, or 391A3 power supply may need to purchase a 391C1 power supply.

NOTE ► No empty slots are permitted between modules in MERLIN MAGIX Release 1.0 systems.

Table A-1. Unit Loads per Module

Module App Code	Type	Unit Load
617A52 617B52	412 LS-TDL	13
617A58 617B58	024 TDL	24
617S15 617T15	100 DCD	0
617A59	100R INA	0

Table A-1. Unit Loads per Module —*Continued*

Module App Code	Type	Unit Load
617N15	100D	0
617C21	008 MLX	13.5
617A54	016 MLX	27
617E34	016 T/R	12.8
617A56	016 ETR	24
617B35	800 NI-BRI	0
617G20	800 DID	8.0
617 E28	008 OPT	8.0
617D14	400 E&M	8.0
617B31	800 GS/LS-ID	0
617 E29	408 GS/LS-MLX-ID	13.5
617A49	MERLIN Messaging	0

Table A-2. Unit Loads per Port

Port Load	Hybrid/PBX Mode	Key Mode
TDL module for 4400-Series telephones		
4424LD+	1.1	1.3
4412D+/4424D+	1.1	1.3
4400/4400D/4406D+	0.9	1.0
DSS	0	0
MLX telephone/adjunct		
MLX-20L	1.1	1.6
MLX-28	1.2	1.7
MLX-5/-10/-16 w/ or w/o display	0.9	1.2
DSS	0.7	0.9
MFM (use local PSU)	0	0
Tip/Ring telephone	0.6	0.7
ETR telephone/adjunct		
ETR-6	0.9	1.0

Table A-2. Unit Loads per Port—Continued

Port Load	Hybrid/PBX Mode	Key Mode
ETR-18	1.0	1.2
ETR-18D	1.2	1.4
ETR-34D	1.5	1.7
Trunk		
GS-LS	0	0
DID	1.0	1.0
E&M	1.4	1.4
DS1	0	0

Unit Load Worksheet

Use this worksheet to calculate unit loads for each carrier. Make a copy of all pages of the worksheet for each carrier.

- Number of modules in carrier (excluding power supply and processor):
 - If fewer than 5, no further calculation is required. _____
 - If 5 or 6, continue to Step 2.
- Key or Behind Switch mode only: ☐ Key
 Indicate the configuration of lines; then go to Step 5. ☐ Modified
- Hybrid/PBX mode only:

Do all modules in the carrier have 4400-Series and/or MLX telephone jacks? ☐ Yes ☐ No

 - If no, no further calculation is required.
 - If yes, continue to Step 4.

4. Hybrid/PBX mode only:

Calculate the total number of multiline 4400-Series and MLX telephones.

Number of 4424LD+ telephones connected to modules in the carrier: _____

Number of 4424D+ telephones connected to modules in the carrier: _____

Number of 4412D+ telephones connected to modules in the carrier: _____

Number of MLX-20L telephones connected to modules in the carrier: _____

Number of MLX-28D telephones connected to modules in the carrier: _____

Total of 4424LD+, 4424D+, 4412D+, MLX-20L, and MLX-28D telephones: _____

■ If the total is less than 45, no further calculation is required.

■ If the total is 45 or more, continue to Step 5.

5. Calculate the estimated unit loads by using the following table.

Module	Qty x	Unit Load	= Total
008 MLX		13.25	
016 MLX		27	
008 OPT		8.0	
016 ETR		24	
016 (T/R)		12.8	
024 TDL		24	
100 DCD		0.0	
100D		0.0	
100R INA		0.0	
400 EM		8.0	
408 GS/LS-ID-MLX		13.5	
412 LS-ID-TDL		13	
800 GS/LS-ID		0.0	
800 DID		8.0	
800 NI-BRI		0.0	
Total estimated unit load:			

- If the total is less than 96, no further calculation is required.
 - If the total is 96 or more, continue to Step 6.
6. Calculate the actual carrier unit load using the following table.
- If the total actual unit load is less than or equal to 96, no further calculation is required.
 - If the total actual unit load is more than 96, continue to Step 7.

Qty x		Unit Load		= Total
Equipment		Hybrid/PBX or Modified	Key	
Network Access Lines¹				
DID		1.0	0.0	
DS1		0.0	0.0	
NI-1 BRI		0.0	0.0	
GS/LS		0.0	0.0	
Tie		1.4	1.4	
Telephones				
4400		0.9	1.0	
4400D		0.9	1.0	
4406D+		0.9	1.0	
4412D+		1.1	1.3	
4424D+		1.1	1.3	
4424LD+		1.1	1.3	
MLX-5		0.9	1.2	
MLX-5D		0.9	1.2	
MLX-10		0.9	1.2	
MLX-10D		0.9	1.2	
MLX-10DP		0.9	1.2	
MLX-16DP		1.5	1.5	
MLX-28D		1.2	1.7	
MLX-20L		1.1	1.6	
ETR-6		0.9	1.0	
ETR-18		1.0	1.2	
ETR-18D		1.0	1.2	
ETR-34D		1.5	1.7	
MLS-6		0.7	0.7	
MLS-12		0.8	0.8	
MLS-12D		0.8	0.8	

	Qty x	Unit Load		= Total
Equipment		Hybrid/PBX or Modified	Key	
Telephones (continued)				
MLS-18D		0.8	0.8	
MLS-34D		0.9	0.9	
Business Cordless 905		0.0	0.0	
TransTalk 9031/9040		0.0	0.0	
Single-Line Telephone		0.6	0.7	
Optional Equipment²				
Direct Station Selector (DSS) ³		0.7	0.9	
DSS 4450 ⁴		0.0	0.0	
Hands-Free Unit		0.8	1.0	
Headset Adapter		0.8	1.0	
EICON board		0.0	0.0	
Total actual unit load:				

- 1 Unit loads are computed for each trunk for trunk-type network access lines.
- 2 The MFM has its own wall power unit located at the telephone and, therefore, is not added to the unit load calculation.
- 3 For MLX telephones, up to two DSSs (one DSS for each MLX-28D or MLX-20L) can be powered from each control unit carrier. For example, a three-carrier system can have six system operator positions, each with one DSS powered from the control unit.
- 4 The power supply unit that comes with the 4424LD+ telephone also can power up to two DSSs attached to the telephone. When you connect one or two DSSs to a 4424D+ telephone, you must use a power supply unit to power these DSSs.

7. Try to exchange modules between carriers to reduce the unit loads to 96. (Remember that the 100D, 100DCD, 100R INA, 800 NI-BRI, and 800 GS/LS modules have unit loads of 0.0.) Repeat Steps 1 through 6 to recalculate unit loads for the new configuration.
 - Empty slots are not permitted between modules.
 - If the exchange reduces the unit load to below the rated maximum for your power supply module, no further calculation is required.
 - If the exchange does not reduce the unit load to 96, install wall power units for the appropriate number of telephones to reduce the unit load to 96.



MERLIN MAGIXTM Integrated System

Maintenance and Troubleshooting
Release 2.1 and Earlier

555-721-140
Issue 1
November 2001

Notice

Every effort has been made to ensure that the information in this guide is complete and accurate at the time of printing. Information, however, is subject to change. See Appendix A, "Customer Support Information," in *Feature Reference* for important information.

Avaya Web Page

The world wide web home page for Avaya is <http://www.avaya.com>.

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Preventing Toll Fraud

Toll Fraud is the unauthorized use of your telecommunications system by an unauthorized party (for example, a person who is not a corporate employee, agent, subcontractor, or working on your company's behalf). Be aware that there is a risk of toll fraud associated with your system and that, if toll fraud occurs, it can result in substantial additional charges for your telecommunications services.

Avaya Fraud Intervention

If you suspect that you are being victimized by toll fraud and you need technical assistance or support, call the Avaya Customer Care Center at **1 800 628-2888**.

Providing Telecommunications Security

Telecommunications security of voice, data, and/or video communications is the prevention of any type of intrusion to, that is, either unauthorized or malicious access to or use of, your company's telecommunications equipment by some party.

Your company's "telecommunications equipment" includes both this Avaya product and any other voice/data/video equipment that could be accessed via this Avaya product (that is, "networked equipment").

An "outside party" is anyone who is not a corporate employee, agent, subcontractor, or working on your company's behalf. Whereas, a "malicious party" is anyone, including someone who may be otherwise authorized, who accesses your telecommunications equipment with either malicious or mischievous intent.

Such intrusions may be either to/through synchronous (time multiplexed and/or circuit-based) or asynchronous (character-, message-, or packet-based) equipment or interfaces for reasons of:

- Utilization (of capabilities special to the accessed equipment)
- Theft (such as, of intellectual property, financial assets, or toll-facility access)
- Eavesdropping (privacy invasions to humans)
- Mischief (troubling, but apparently innocuous, tampering)
- Harm (such as harmful tampering, data loss or alteration, regardless of motive or intent).

Be aware that there may be a risk of unauthorized or malicious intrusions associated with your system and/or its networked equipment. Also realize that, if such an intrusion should occur, it could result in a variety of losses to your company, including, but not limited to, human/data privacy, intellectual property, material assets, financial resources, labor costs, and/or legal costs.

Your Responsibility for Your Company's Telecommunications Security

The final responsibility for securing both this system and its networked equipment rests with you - an Avaya customer's system administrator, your telecommunications peers, and your managers. Base the fulfillment of your responsibility on acquired knowledge and resources from a variety of sources, including, but not limited to:

- Installation documents
- System administration documents
- Security documents
- Hardware-/software-based security tools
- Shared information between you and your peers
- Telecommunications security experts

To prevent intrusions to your telecommunications equipment, you and your peers should carefully program and configure your:

- Avaya provided telecommunications system and their interfaces
- Avaya provided software applications, as well as their underlying hardware/software platforms and interfaces
- Any other equipment networked to your Avaya products

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 their own expense. For further FCC information, see Appendix A, "Customer Support Information," in *Feature Reference*.

Canadian Department of Communications (DOC) Interference Information

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

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

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Write:	Avaya Publications Center 2855 North Franklin Road Indianapolis, IN 46219-1385

Order:	Document No. 555-721-140 Issue 1, November, 2001

For more information about Avaya documents, refer to the section entitled "Related Documents" in "About This Guide" in *Feature Reference*.

Support Telephone Number

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

Warranty

Avaya provides a limited warranty on this product. Refer to "Limited Warranty and Limitation of Liability" in "Customer Support Information" in *Feature Reference*.

IMPORTANT SAFETY INSTRUCTIONS



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.

When installing telephone equipment, always follow basic safety precautions to reduce the risk of fire, electrical shock, and injury to person, 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 Avaya Inc.-manufactured MERLIN MAGIX Integrated System circuit modules, carrier assemblies, and power units in the MERLIN MAGIX Integrated System control unit.
- Use only Avaya Inc.-recommended/approved MERLIN MAGIX Integrated System accessories.
- If equipment connected to the TDL telephone modules (412 LS-ID-TDL and 024 TDL), the MLX telephone modules (008 MLX, 408 GS/LS-MLX, 408 GS/LS-ID-MLX, and 016 MLX), or the ETR telephone module (016 ETR) 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 MAGIX Integrated 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 MAGIX Integrated 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:

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.

ONLY an authorized technician or dealer representative shall install, set options, or repair an MFM.

SAVE THESE INSTRUCTIONS

Maintenance and Troubleshooting

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About This Guide

The MERLIN MAGIX Integrated 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, Direct Voice Mail, and Tandem Switching. Data features allow both voice and data to be transmitted over the same system wiring.

Intended Audience

This book provides detailed information about system features, extension features, and system applications of the MERLIN MAGIX Integrated System. It is intended as a reference for anyone needing such information, including support personnel, sales representatives, System Managers, and account executives. It is also intended for technicians who are responsible for system installation, maintenance, and troubleshooting.

How to Use This Guide

This guide has been designed to provide optimal assistance to you in completing the planning forms—for example:

1. Since some chapters and/or sections apply to one or another of the configurations (Key or Behind Switch, Hybrid/PBX, or data communications), these sections are clearly marked—for example, “Hybrid/PBX Only.” Also, you are alerted to proceed to the next appropriate section, or to skip chapters or sections that do not apply to your particular system. Proceed through this guide as appropriate.
2. A list of forms or information that will be needed for particular procedures appears at the beginning of each chapter and section.
3. Where appropriate, examples of completed forms are included so you can confirm what you have done.

Since this guide assumes that you are familiar with the system, detailed information about equipment, features, and programming are not included. Refer to the following documentation for additional information:

- *System Programming* gives procedural instructions for programming system features.
- User and operator 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 USA only, Avaya provides a toll free customer Helpline 24 hours a day. Call the Helpline at 1 800 628-2888 (consultation charges may apply), or contact your Avaya representative if you need assistance when installing, programming, or using your system.

Outside the USA, if you need assistance when installing, programming, or using your system, contact your Avaya authorized representative.

Terms and Conventions Used

The terms described here 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 MAGIX Integrated System to the central office. Technically, a *line* is a loop-start facility or a communications path that does not connect switches—for example, an intercom line or a Centrex line. In actual usage, however, the terms *line* and *trunk* are often applied interchangeably. In this guide, we use *line/trunk* and *lines/trunks* to refer to facilities in general. Specifically, we refer to *digital facilities*. We also use specific terms such as *Personal Line*, *ground-start trunk*, *Direct Inward Dialing (DID) trunk*, and so on. When you talk to personnel at your local telephone company central office, ask them which terms they use for the specific facilities they connect to your system.

Some older terms have been replaced with newer terms, as follows:

Old Term	New Term
trunk module	line/trunk module
trunk jack	line/trunk jack
station	extension
station jack	extension jack
analog data station	modem data workstation
digital data station	terminal adapter workstation
7500B data station	ISDN terminal adapter data workstation
digital voice and analog data station	MLX voice and modem data workstation
analog data-only station	modem data-only workstation
digital data-only station	terminal adapter data-only workstation
7500B data-only station	ISDN terminal adapter data-only workstation
digital voice and digital data station	MLX voice and terminal adapter workstation
MLX voice and 7500B data station	MLX voice and ISDN terminal adapter data workstation

Typographical Conventions

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

Convention	Example
Italics or bold indicates emphasis.	It is <i>very</i> important that you follow these steps. WARNING: Do not remove modules from the carrier without following proper procedures.
Italics also sets off special terms.	The part of the headset that fits over one or both ears is called a <i>headpiece</i> .
Plain constant-width type indicates text that appears on the telephone display or PC screen, as well as characters you dial at the telephone or type at the PC.	Choose Ext Prog from the display screen. To activate Call Waiting, dial *11.

Product Safety Advisories

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 possible and limit distribution 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 in the Feature Reference.”

Throughout this guide, toll fraud security hazards are indicated by an exclamation point inside a triangle and the words *SECURITY ALERT*.



SECURITY ALERT:

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

Related Documents

The documents listed in the following table are part of the MERLIN MAGIX documentation set. Within the continental United States, contact the Avaya Publications Center by calling 1 800 457-1235.

Document No.	Title
System Documents:	
555-721-110	<i>Feature Reference</i>
555-721-112	<i>System Planning</i>
555-721-113	<i>System Planning Forms</i>
555-721-119	<i>System Manager's Quick Reference</i>
555-661-150	<i>Network Reference</i>
555-721-800	<i>Customer CD-ROM:</i> <i>Consists of System Manager's Quick Reference, Feature Reference (PDF version), and Online Feature Reference tool (HTML version).</i>
555-721-801	<i>Reference CD-ROM:</i> <i>Consists of System Manager's Quick Reference, Feature Reference (PDF version), Online Feature Reference tool (HTML version), System Planning (including forms), Pocket Reference, and Installation, Basic System Programming & Maintenance and Troubleshooting.</i>
Telephone User Support:	
555-710-123 (U.S. English)	<i>4400/4400D Telephone User's Guide</i>
555-710-123FRC (Canadian French)	<i>4400/4400D Telephone User's Guide</i>
555-710-127 (U.S. English)	<i>4406D+, 4412D+, 4424D+, and 4424LD+ Telephone User's Guide</i>
555-710-127FRC (Canadian French)	<i>4406D+, 4412D+, 4424D+, and 4424LD+ Telephone User's Guide</i>
555-660-122	<i>MLX Display Telephone User's Guide</i>
555-630-150	<i>MLX- 5D, MLX-10D and MLX-10DP Display Telephone Tray Cards (5 cards)</i>
555-630-152	<i>MLX-28D and MLX-20L Telephone Tray Cards (5 cards)</i>
555-660-124	<i>MLX-5[®] and MLX-10[®] Nondisplay Telephone User's Guide</i>
555-630-151	<i>MLX-5 and MLX-10 Nondisplay Telephone Tray Cards (6 cards)</i>
555-630-155	<i>MLX-16DP Display Telephone Tray Cards (5 cards)</i>

Document No.	Title
555-670-151	<i>MLS and ETR Telephone Tray Cards</i>
555-670-152	<i>MLS and ETR Telephone Tray Cards (16 cards)</i>
555-660-126	<i>Single-Line Telephones User's Guide</i>
555-660-138	<i>MDC and MDW Telephones User's Guide</i>
System Operator Support:	
555-710-134	<i>Digital Direct Line Console Operator's Guide</i>
555-710-136	<i>Digital Queued Call Console Operator's Guide</i>
Miscellaneous User Support:	
555-661-130	<i>Calling Group Supervisor and Service Observer User Guide</i>
555-650-105	<i>Data and Video Reference</i>
555-721-140	<i>Installation, Programming Basics, Maintenance and Troubleshooting</i>
555-721-116	<i>Pocket Reference</i>
Toll Fraud Security:	
555-025-600	<i>BCS Products Security Handbook</i>

How to Comment on This Guide

We welcome your comments, both positive and negative. 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
Avaya Inc.
150 Allen Road, Room 3C-19
Liberty Corner, New Jersey 07938

We'd like your opinion . . .

We welcome your feedback on this document. Your comments can be of great value in helping us improve our documentation.

MERLIN MAGIX™ Integrated System Maintenance and Troubleshooting Issue 1, November 2001 555-721-140

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

	Excellent	Good	Fair	Poor
Ease of Finding Information	☐	☐	☐	☐
Clarity	☐	☐	☐	☐
Completeness	☐	☐	☐	☐
Accuracy	☐	☐	☐	☐
Organization	☐	☐	☐	☐
Appearance	☐	☐	☐	☐
Examples	☐	☐	☐	☐
Illustrations	☐	☐	☐	☐
Overall Satisfaction	☐	☐	☐	☐

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

☐ Improve the overview/introduction	☐ Make it more concise
☐ Improve the table of contents	☐ Add more step-by-step procedures/tutorials
☐ Improve the organization	☐ Add more troubleshooting information
☐ Add more figures	☐ Make it less technical
☐ Add more examples	☐ Add more/better quick reference aids
☐ Add more details	☐ Improve the index

Please add details about your major concerns. _____

3. What did you like most about this document? _____

4. Feel free to write any comments below or on an attached sheet. _____

If we may contact you concerning your comments, please complete the following:

Name: _____ Telephone Number: (____) _____

Company/Organization: _____ Date: _____

Address: _____

You may FAX your response to 908 953-6912. Thank you.

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This section describes the equipment required for both on-site and remote programming maintenance; describes Automatic Tests, Alarms, System Restarts; provides direction on isolating the trouble; and discusses Centralized Voice Messaging.

Required Equipment

To perform maintenance, you need a maintenance console as well specific tools and some additional documentation, all of which are defined on the following pages.

Maintenance Console

Whether you perform onsite or remote programming maintenance, you need a maintenance console:

- For onsite maintenance, you can use either a 4424LD+ or MLX-20L system programming console or a PC with the Windows System Programming and Maintenance (WinSPM) software.
- For remote maintenance, you must use a PC with WinSPM software.

Detailed information about the 4424LD+ or MLX-20L system programming console and WinSPM software is provided in *Programming Basics*.

Tools and Documentation

In addition to the maintenance console, you need the following tools and documentation:

- Trouble report documentation
- NSAC contact name
- 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
- Modular cord (D8W-87)
- Replacement parts recommended by NSAC (if necessary)
- Programming terminal, MS-DOS PC (Zenith Sport 184) and 355AF Adapter



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 onsite maintenance with a 4424LD+ or MLX-20L console or a PC running WinSPM software. Onsite programming maintenance is preferred over remote programming maintenance, if feasible, because remote programming overrides onsite programming, except when onsite backup or restore is in progress.

If programming maintenance is being done by a local PC, both the 4424LD+ telephone and the MLX-20L telephone can continue normal call processing and station programming operations. However, if you attempt to access maintenance tasks with a 4424LD+ or a MLX-20L telephone while a local PC is performing the same maintenance operations, you are denied access to the task and notified with a beep.

Setting Up the 4424LD+ Programming Console

To be used for system programming a 4424LD+ telephone must be connected to the first jack on the leftmost (Slot 1) 024 TDL or 412 LS-ID-TDL module. For complete installation instructions, refer to “Connecting Telephones to 412 LS-ID-TDL and 024-TDL Modules” in *Installation*.

4424LD+ Failure

If the 4424LD+ console does not work, follow the steps below.

1. Replace the 4424LD+ console with one that is known to be working (if available).
2. If the failure persists, or if a working 4424LD+ console is not available, connect the original 4424LD+ console directly into the appropriate TDL jack on the control unit using a cord that is known to be working.
3. If the trouble clears, replace the original cord.

4. If not, use the PC as your maintenance terminal and then troubleshoot the leftmost TDL module. See [“Module Problems” on page 4-18](#) for instructions.

Setting Up the MLX-20L Console

To be used for system programming an MLX-20L telephone must be connected to one of the first five jacks on the leftmost 008 MLX, 016 MLX, or 408 GS/LS-MLX module. For complete installation instructions, refer to “Connecting Telephones to the Control Unit” in *Installation*.

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.
4. If not, use the PC as your maintenance terminal and then troubleshoot the leftmost MLX module. See [“Module Problems” on page 4-18](#) for instructions.

Setting Up the PC

To use the Win SPM software for system programming or maintenance, your PC must be connected to the MERLIN MAGIX system directly via a serial port on your PC or you must connect to the MERLIN MAGIX internal modem using your PC's modem. Refer to “Connecting a PC to the Control Unit for System Programming or Maintenance” in *Installation* for complete instructions.

Remote Programming Maintenance

Remote maintenance allows you to support the system from an off-premises location. You can check error logs and system status, execute a trace on one or more facilities to verify call progression to isolate the source of a problem, and restart the system remotely. Remote programming maintenance is particularly useful for private networked switches (Hybrid/PBX mode only). Where systems are private networked and only one system has public switched networked trunks, you must use the Remote Access feature in order to access WinSPM on private networked systems.

To perform remote maintenance, you need a PC with WinSPM software, a tip/ring telephone, and a 1,200-bps or 2,400-bps modem. “Connecting a PC to the Control Unit for System Programming or Maintenance” in *Installation* for complete instructions for connecting the PC to the control unit from a remote location. Refer to “Setting Up a Site” in *Programming Basics* for instructions on setting up remote connection sites in WinSPM.

Considerations

Review the following points before you begin remote maintenance procedures.

- Remote maintenance overrides onsite maintenance and programming, except when onsite 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.
- 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 about security.

Preparation for Hardware Maintenance

If you are performing onsite hardware maintenance where you need to access hardware inside the carrier, for example remove a module, you must first remove the control unit housing, power down the system, and then disconnect AC power.

- See "Installing/Removing the Cover on the Carrier" in *Installation*.
- See "[Powering Down the System](#)" below.

Powering Down the System

To power down the system, follow these steps:



CAUTION:

Follow these steps in the exact sequence.

1. Turn off the power supply on the basic carrier.
2. Turn off the power supplies on the expansion carriers.
3. Unplug the system from the AC outlet.

Using WinSPM

To perform remote maintenance procedures, you must use a PC with Windows System Programming and Maintenance (WinSPM) software. For information on setting up and using WinSPM, see *Programming Basics*.

Conclusion of Hardware Maintenance

At the conclusion of hardware maintenance, replace the control unit housing as follows:

- See “Installing/Removing the Cover on the Carrier” in *Installation* for instructions for a metal carrier.
- See “[Installing the Control Unit Housing \(plastic\)](#)” below for instructions for a plastic carrier.

NOTE ► Whenever you power up a system after working on it, be sure that you power up all the carriers. If you do not turn on all the carriers, you may cause a cold-start.

Installing the Control Unit Housing (plastic)

After you have completed maintenance and troubleshooting, follow these steps to reinstall the control unit housing on a plastic carrier.

Installing the Top Cover

To install the top cover, refer to the illustration 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 that the legs lock into the vents on the module.

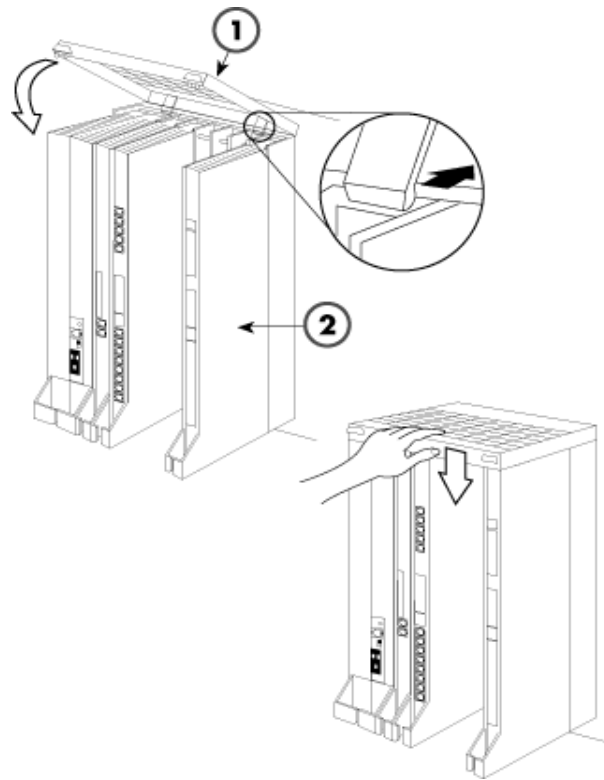


Figure 1-1. Installing the Plastic Carrier Top Cover

- 1 Top cover
- 2 "Empty module"

Installing the Front Cover

To install the front cover, refer to the illustration 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.

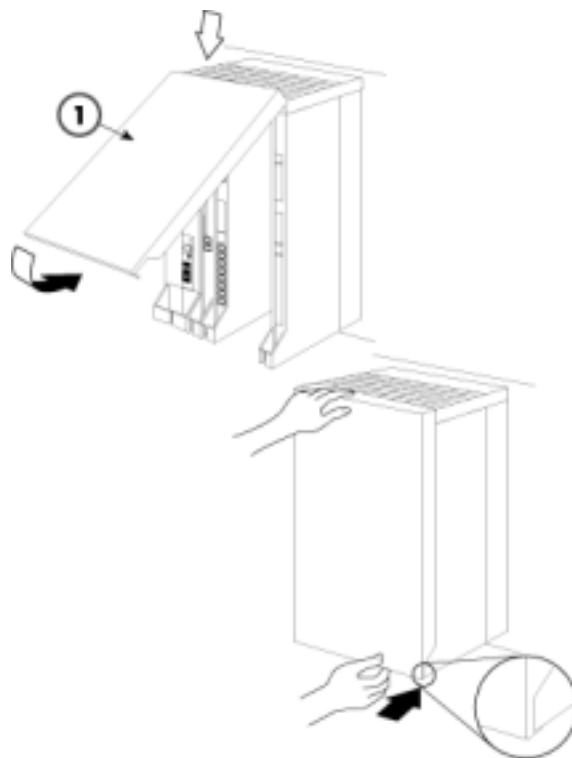


Figure 1-2. Installing the Plastic Carrier Front Cover

About Automatic Tests

The system performs ongoing maintenance automatically by running tests that do the following:

- 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, if possible, corrects them automatically.

About 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.
- The error code/status display on the processor module displays F if a frigid start, or C if a cold start, occurs. See [“About System Restarts”](#) on page 1-9 for more information.
- If a software installation or upgrade is taking place, a blinking character is displayed to indicate the status of the procedure. See “PCMCIA Upgrade Card” in *Installation* for more information.
- The status display indicates an alarm (on a 4424LD+ or MLX-20L console or on a PC running WinSPM) 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.

Clearing Alarms

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

To clear an alarm manually, select **Drop** on the 4424LD+ or MLX-20L programming console. If you are using WinSPM in Standard SPM Mode on a PC, select **Drop** on the emulation display of the programming console. See [“Error Logs”](#) on page 2-1 for more information.

NOTE ► There is no fixed **Drop** button on the 4424LD+ console. The **Drop** button must be programmed onto a fixed feature key.

About 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.

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.

NOTE ► Non-network systems continually update in the event of a cold start.

Procedure

To perform a Cold Start (Restart) from the programming console or from WinSPM in Standard SPM mode, select:

Menu→Sys Program→Start→System→Restart→Yes

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 a 4424LD+ or MLX-20L console until the cold start is completed.
- A cold start (Restart) can cause extensions with the Extension Status feature to lose their toll restrictions.

- A cold start is performed to refresh the Message Waiting Lights on a local system and on all remote MERLIN MAGIX systems that use the local system's Voice Messaging System. If, after a cold start, any Message Waiting Lights on any of the systems are not refreshed, perform a manual update. See [“Centralized Voice Messaging”](#) on page 1-11 for more information.

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.*
- *Do not perform a Frigid Start unless you are installing a replacement processor or following instructions from your TSO.*

Procedure

To perform a Frigid Start (System Erase) from the programming console or from WinSPM in Standard SPM mode, select:

Menu→Maintenance→Slot→Dial 00→Enter→Demand Test→System Erase (Line 5 of the display, left button)→System Erase (Line 5 of the display, left button)→Yes

Considerations

- System Erase is not displayed on the 4424LD+ or MLX-20L status display to prevent processor memory from being accidentally changed. 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 onsite printouts from the SMDR printer, make sure you change the option. See “Print Opts” in *Programming Basics* for the procedure to change the printer option.

Centralized Voice Messaging

Centralized Voice Messaging enables a single Voice Messaging System (VMS) to be used by other directly connected systems in a private network. When the Message Waiting Lights appear on the local system and on all remote MERLIN MAGIX systems that use the local system's VMS, the Messaging Waiting Lights may need to be updated. The lights are updated manually by using the maintenance screens.

Updating the Message Waiting Lights

Consider a manual update of the Message Waiting Lights if:

- a processor is changed
- a VMS is changed on the hub system
- a cold start did not successfully refresh
- if deemed necessary by a qualified technician

NOTE ► Non-networked systems continually and automatically update in the event of a cold start.

You must clear all the Message Waiting Lights on the local MERLIN MAGIX system, and then refresh the Message Waiting Lights on extensions that use a specific VMS, including telephones on a private networked MERLIN MAGIX system (see the *Network Reference* for more information). Multiple refreshes across a private network, using tandem tie lines, can cause congestion and delayed refresh time, it is advisable to coordinate refresh operations in a private network to send only one refresh message.

Clearing the Message Waiting Lights

Use this procedure to clear the Message Waiting Lights on the telephones on the local MERLIN MAGIX system.

Procedure

To perform this procedure from the programming console or from WinSPM in Standard SPM mode, select:

Menu→Maintenance→MW LP Update→Clear MWL→Back

After you select Clear MWL, a Clear in Progress message appears. When all the lights are cleared, a Clear Complete message appears. Wait until Clear Complete appears before exiting.

Refreshing the Message Waiting Lights

Use this procedure to refresh the Message Waiting Lights on all telephones, including those across a private network that use the Voice Messaging System.

Procedure

To perform this procedure from the programming console or from WinSPM in Standard SPM mode, select:

Menu→Maintenance→MW LP Update→Refresh MWL→Dial the VMI group extension number for the VMS→Enter→Back

NOTE ► Selecting Back does not stop the process; the process continues in the background.

Checking Unit Loads

In the event of maintenance or equipment changes, recalculate the unit loads for each carrier where there is a different configuration. See “Calculating Unit Loads” in *Installation*.

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

Isolating the Trouble

Trouble is typically reported to you either by a user, or when a system alarm turns on.

If a User Reports a Problem

If a user reports a problem, gather enough information so that you can attempt to isolate the problem to one of the following areas:

- Telephone Problems (see “[Telephone Problems](#)” on page 3-1.)
- Control Unit Problems (see “[Control Unit Problems](#)” on page 4-1.)
- Central Office/Network Problems
(see “[Central Office and Private Network Problems](#)” on page 5-1.)
- Private Network Problems (Hybrid/PBX mode) (see “[Central Office and Private Network Problems](#)” on page 5-1.)

If a System Alarm Turns On

If a system alarm turns on, begin troubleshooting by checking the permanent errors in the error logs. See Error Logs for information on checking the error logs and interpreting error codes.

Error logs may indicate the source of the problem. Depending upon the types of errors, begin troubleshooting as directed in the following table.

Table 1-1. Source of Problem—Section Reference

If error log indicates a problem with...	See...
Power supply	“Power Supply Problems” on page 4-2
Module	“Module Problems” on page 4-18
Control Unit Carrier	“Carrier Problems” on page 4-32
Trunks	“Central Office and Private Network Problems” on page 5-1
Central Office	“Central Office and Private Network Problems” on page 5-1

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Overview

Troubleshooting relies on viewing the error logs and access log for maintenance and system programming. System Inventory is required if you need to escalate problems to the Avaya Technical Support Organization (TSO) or authorized dealer. This section describes the error logs and access logs and explains how to access the System Inventory screen.

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 the table on this page. The Threshold column indicates the number of occurrences at which a transient error becomes permanent.

Table 2-1. Transient/Permanent Error Thresholds

Error Code	Error Description	Transient/Permanent Threshold
0C04	MWL FAC TIMEOUT	3
0C05	MWL DELIVERY DELAY	15
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

Table 2-1. Transient/Permanent Error Thresholds—Continued

Error Code	Error Description	Transient/Permanent Threshold
840C	STUCK RINGING	2
840D	INCORRECT FIRMWARE STATE	2
2E01	T1 ACC VIOL	10

Checking the Error Logs

You can check the Last 99 errors, Permanent errors, or Transient errors. If you are responding to a system alarm, it is recommended that you check the Permanent errors first. Once you have reviewed the error logs, you should print the error information. This helps you determine whether your work has resolved each problem.

Procedure to View Error Logs

To view the Error Logs from the programming console or from WinSPM in Standard SPM mode:

Menu→Maintenance→System→Error Log→Last 99 or Permanent or Transient→More or  (to page through the errors)→Drop (to delete an error log entry)

Procedure to Print Error Logs

To print the Error Logs from the programming console or from WinSPM in Standard SPM mode

Menu→System Programming→Exit→More or →Print→More or →More or →Error Log

About the Error Logs

The most recent alarm message stays on the Error Log screen until it is replaced by another. The screen does not update the most recent alarm while displayed; to see any updates, you need to exit the Error Log and then view it again.

You can delete an error log entry from a Permanent or Transient Error Log. You cannot delete an error log entry from the log showing the Last 99 Errors. Depending on which entry you delete, you might clear an alarm. See [“About Alarms”](#) on page 1-8 for additional information about alarms.

Regarding entries on the Error Log screen:

- Line 2 provides a brief description of the error code identified on Line 6.
- Line 3 indicates the slot and port where the error was detected.
- Line 5 indicates the error's last occurrence.

Interpreting Error Codes

Following is a description of each error code and recommended action.

Table 2-2. Error Codes

Error Codes	Description	Action
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. or The system was powered down incorrectly, e.g. carrier 2 was powered down before carrier 1. If errors exist because of the improper power-down, then no action is required.	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.
00DE	MERLIN Messaging System software was upgraded.	If the MERLIN Messaging System software was upgraded, no action is required.
0001	TIMEOUT COLD START: System programming is okay.	No action required; however, if problem persists, troubleshoot the processor.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
0002	POWER UP WARM START : System programming is okay.	No action required; however, if problem persists, troubleshoot the processor.
0003	SOFTWARE COLD START : System programming is okay.	If problem persists, troubleshoot the processor.
0004	SOFTWARE WARM START : System programming is okay.	If problem persists, troubleshoot the processor.
0005	Reset - DIAGNOSTIC SWITCH :	
0006	INCOMPLETE COLD START : System was cold-started while a restart was in progress.	If problem persists, troubleshoot the processor.
0007	SANITY TIMEOUT RESET : Faulty software, module, carrier, or processor sanity timer.	Troubleshoot module and or processor.
0008	MAX RESET COUNT EXCEEDED : System was cold-started (System Reset) because too many warm starts occurred. System programming is okay.	If problem persists, troubleshoot the processor.
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 "Restore" on page 6-6, or in Appendix D, "Backing up with a Memory Card."
0010	INVALID SLOT INTERRUPT : Cannot determine module responsible for generating the interrupt. or The system was powered down incorrectly, e.g. carrier 2 was powered down before carrier 1. If errors exist because of the improper power-down, then no action is required.	Troubleshoot modules and replace if necessary. If the problem persists, troubleshoot the processor.
0011	STACK OVERFLOW : Processor problem.	Troubleshoot the processor.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
0012	INVALID RESET FLAG: Processor problem.	Troubleshoot the processor.
0013	DUART STREAMING INT: Processor problem. or The system was powered down incorrectly; for example, carrier 2 was powered down before carrier 1. If errors exist because of the improper power-down, no action is required.	Troubleshoot the processor.
0014	PROCESSOR ERR INTERRUPT: Processor problem.	Troubleshoot the processor.
0015	MODULE MISMATCH: Physical and logical type mismatch. Module inserted into wrong slot.	Change system programming to reflect the proper module or install the proper module.
0016	POWER UP COLD START: A module dual port RAM failure was detected. System programming is okay.	If problem persists, troubleshoot the module for the slot indicated.
0017	REAL TIME CLOCK FAULT: Date and/or Time incorrect or unreadable.	If this problem persists, replace the processor module.
0018	RTC COLD START: This error is not displayed.	
0019	RESET TIME & DATE: The system performs a cold start because the real time clock chip is not working correctly.	If this problem persists, replace the processor module.
0C01	NO I-VMS PORT IN SERV: This error indicates that the VMS machine may be down.	No action required.
0C02	DID INTERDIGIT TIMEOUT: May be noisy line or central office problem.	No action required. If problem persists, troubleshoot the DID line and inform the central office if necessary.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
0C03	ALL TTRs UNAVAILABLE : The system needed to use a TTR but one was not available for any and all reasons including: in use, not physically present, and out of service.	Check count and first and last occurrences to determine if error occurs too frequently. If so, check to see if you can add TTRs to the system. If you have prompt out of queue active, you may want to shorten the delay announcement message length. If you have the prompt out of queue feature and secondary announcement(s) active, you may want to increase the interval between the announcements. If you reprogram the delay announcement unit, recheck it to verify that the problem no longer exists. Check to see if you can add TTRs to the system.
0C04	MWL FAC TIMEOUT : Two consecutive messages to update Message Waiting lights have been sent across the private network on the same tandem trunk and have not been acknowledged. When this happens three times, the error becomes permanent. The alarm remains in the log until a message for the facility is acknowledged or five days pass.	Check the 100D module or the 400EM module for any other alarm indications. Replace the module as necessary. If the module is functioning properly, the problem may be with the outside lines; contact your local telephone company.
0C05	MWL DELIVERY DELAY : A message to update non-local Message Waiting lights has exceeded the time period for delivery. A transient alarm occurs after one minute, and a permanent alarm occurs after 15 minutes. The alarm remains in the error log until a message is delivered or five days pass.	Check the module and line used to send the message. Check that the system receiving the message has enough TTRs to handle the volume of calls. Check the error logs on the sending system and then on the receiving system. More facilities or TTRs may be needed.
0401	ABK CARD NOT INSERTED : A PCMCIA memory card for Translation is not inserted.	Insert a Translation card or a card that has not been formatted.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
0402	ABK INCORRECT CARD TYPE: A PCMCIA card other than a Translation card is inserted.	Remove the current card and insert a Translation card or a card that has not been formatted.
0403	ABK CARD WRITE-PROTECTED: The Translation card has the write protection switch on.	Flip the write protection switch on the card to off (non-write protect mode/position.) If this problem persists, try another card, then replace the processor module if the problem remains.
0404	ABK EXTENSION BUSY: An extension is in program, administration, or maintenance mode.	Wait until the extension changes mode. Make sure the programming device (SPM or the console) is not in programming mode when automatic backup is scheduled to occur.
0405	ABK FAULTY CARD: Unknown cause of a bad card.	Reset card and retry. If the problem remains, try another card. If the problem still remains, replace the processor module.
0802	E911 OVERFLOW: One of the following has occurred: All lines assigned to E911 Partition or Adjunct are busy or bad. No lines are assigned to E911 Partition or Adjunct. No physical line is connected to the system, the network, or the E911 Adjunct.	Do the following: Make sure the proper number of trunks are assigned to E911 Partition or Adjunct. Assign lines to E911 Partitions or Adjunct. Check that ground-start or loop-start trunks are connected to the E911 Adjunct. Check the network interface connection. When the condition returns to normal, the external alarm turns off automatically. You must remove the entry from the permanent error log.
1C01	POOL M-BUSY EXCEEDS 50%: More than half the trunks in the pool are busy.	Troubleshoot trunk.
1C02	DPR TEST NOT COMPLETED:	Slot did not complete initializing.
1C03	FW UPGRADE ATTEMPT:	No action required.
1C04	FW UPGRADE COMPLETE:	No action required.
1C05	INVALID FMW 29 DETECTED: Incompatibility problem. The specified video system or data device is connected to an 008 or 408 GS/LS MLX with firmware vintage 0x29.	Replace the 008 or 408 MLX board with one of another firmware vintage and retire this permanent alarm manually.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
1C06	BAD TTR: Touch Tone Receiver failed the internal Touch Tone Receiver Test and has been busied out.	If TTR passes the next test, the system automatically restores it.
1C07	>= 50% of TTRs failed: 50% or more TTRs failed and have been busied out.	Check the modules containing the TTRs. Try to manually restore some TTRs. If necessary, replace the modules.
1C08	BAD BOARDS IN SYSTEM: At least one incompatibility problem of type HER 0x1c05 detected. Turns on CPU red LED.	Replace the 008 or 408MLX board with one of another firmware vintage and retire this permanent alarm manually.
2C01	T1 ACCESS VIOLATION: T1 Services (Channels-Voice/Data) programmed incorrectly.	Check facility provisioning and reprogram channels appropriately for voice or data. If the problem persists, contact the NSAC.
2C02	BEARER CAPABILITY/INCOMPATIBILITY: A 64 kbps clear-channel data call was routed to a facility that does not have sufficient bandwidth to handle the call.	Verify that the ARS or UDP routing tables route a data call to a DS1 facility. Check the DS1 Type administration item for the specified facility. If the programmed value is <i>T1</i> , the caller must initiate a 56 kbps call. Check the DS1 Suppression administration item for the specified facility. If the programmed value is <i>AMI-ZCS</i> , the caller must initiate a 56 kbps call.
0801, and 5801	CTI LINK DELETED: A board renumber or slot restore moved the CTI Link to an unacceptable port and the system has removed the link.	Check that the following are true: The system is in Hybrid/PBX mode. The link is on an 008 MLX or 408 MLX board. The MLX board firmware vintage is not 29. Board renumber has not moved the extension to an operator position. An MLX telephone is not connected to that port. Board renumber has not moved the MLX extension to the system programming port.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
0802	E911 OVERFLOW One of the following has occurred: All lines assigned to E911 Partition or Adjunct are busy or bad. No lines are assigned to E911 Partition or Adjunct. No physical line is connected to the system, the network, or the E911 Adjunct.	Do the following: Make sure the proper number of trunks are assigned to E911 Partition or Adjunct. Assign lines to E911 Partitions or Adjunct. Check that ground-start or loop-start trunks are connected to the E911 Adjunct. Check the network interface connection. When the condition returns to normal, the external alarm turns off automatically. You must remove the entry from the permanent error log.
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→System→Restart
4001	E911 ADJUNCT OOS : The E911 Adjunct has detected an error condition (such as the disconnection of the trunk cable). This error condition has caused an E911 Adjunct alarm, and the trunks connected to the E911 Adjunct are in the Trunk Maintenance Busy state.	Check the E911 Adjunct to make sure it is in working condition. Check the cable connections to this unit. The alarm and Trunk Maintenance Busy state automatically clear when the E911 Adjunct returns to normal operation.
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.
4402	USER REQST UPGRD/INSTALL : This is just a record of the event.	No action required.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
4C01	POOL EMPTY : The system needed to use a trunk in a pool but no trunks were physically present in the pool, that is, all of the boards were removed from the system. See first argument number on the screen for pool index (1–11).	Check that the pool has a trunk assigned to it. If a trunk is assigned and the problem persists, replace the boards.
4C02	POOL BUSY : The system needed to use a trunk in a pool. Trunks are physically present; however, none are idle and available for use, therefore they must be in use or out of service. See first argument number on the screen for pool index (1–11).	Check the count and first and last occurrences. If occurring too frequently, determine if facilities can be added or moved to this pool.
4C03	POOL BUSY &/OR OOS : The system needed to use a trunk in a pool. Trunks are physically present, some may be busy but some are idle. However, the idle trunks are not in service. See first argument number on the screen for pool index (1–11).	Restore if out of service.
5801	See error code 0801	
5802	BOARD RENUMBERING : A board renumbering procedure has occurred.	If system is functioning properly, remove the error from the Transient Error Log. If the system is not functioning properly, check the Transient Error Log to verify that a board renumber took place. Then compare the system's previous configuration to the one after board renumbering to determine if the board renumber caused logical IDs to shift.
6C01	DS1 LOSS OF SIGNAL ALARM : Service on the link has been lost.	Usually no action is required. Troubleshoot the T1 trunk, channel service unit (CSU), and the cable between the CSU and the 100D module. If problem persists, escalate to your technical support organization.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
6C02	DS1 BLUE ALARM: All unframed ones signal being received. The link cannot be used for communication.	Blue alarms are generated by intermediate equipment, such as a CSU or DDM 1000/2000. The far end of the network interface may be out of service. Troubleshoot the T1 trunk, channel service unit (CSU), and the cable between the CSU and the 100D 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.
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 MULTIFRAME: 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→Slot→Error Events→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→Slot→Error Events→Current hr
6C09	DS1 MISFRAME ALARM: Misframe count reached 18.	Troubleshoot the T1 trunk. If problem persists, escalate to your technical support organization. Maintenance→Slot→Error Events→Current hr

Table 2-2. Error Codes—Continued

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→Slot→Error Events→Current hr
6C0B	HARDWARE INOPERATIVE: Hardware is not operating properly. If this is the only 100D (DS1) or 800 CO-BRI 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.
6C0C	BRI LOSS OF SYNC:	Usually no action is required. Troubleshoot the BRI trunk. If problem persists, contact your technical support organization.
6C0D	BRI NET DEACTIVATED:	Usually no action is required. The link should return to normal once the test is completed. If problem persists, contact your technical support organization.
6C0E	BRI NET INV 2B+D LB ACT:	Usually no action is required. The link should return to normal once the test is completed. If problem persists, contact your technical support organization.
6C0C	BRI LOSS OF SYNC:	Usually no action is required. Troubleshoot the BRI trunk. If problem persists, contact your technical support organization.
6C0D	BRI NET DEACTIVATED:	Usually no action is required. The link should return to normal once the test is completed. If problem persists, contact your technical support organization.
6C0E	BRI NET INV 2B+D LB ACT:	Usually no action is required. The link should return to normal once the test is completed. If problem persists, contact your technical support organization.
6C0F	BRI NET INV B1 LB ACT:	Usually no action is required. The link should return to normal once the test is completed. If problem persists, contact your technical support organization.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
6C10	BRI NET INV B2 LB ACT:	Usually no action is required. The link should return to normal once the test is completed. If problem persists, contact your technical support organization.
6C11	BRI NET INV IL LB ACT:	Usually no action is required. The link should return to normal once the test is completed. If problem persists, contact your technical support organization.
6C12	BRI NET INV QM LB ACT:	Usually no action is required. The link should return to normal once the test is completed. 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 NOT RELEASED:	Troubleshoot the PRI trunk and report to service provider; otherwise, no action required. If problem persists, contact your technical support organization.
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.
7006	PRI PROTOCOL MISMATCH: A mismatch in the protocol being supplied versus the protocol expected by MERLIN MAGIX.	Inform the service provider to change the administration for this circuit. After the service provider restarts the circuit, verify that all alarms for this slot are cleared.
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.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
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% 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.
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.
7404	STUCK RINGING: Communication problems between the module and central office. If this error occurs twice consecutively, the trunk is busied-out automatically, whether or not Automatic Maintenance-Busy is enabled.	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. or MERLIN Messaging System reset at 2:00 A.M or the MERLIN Messaging System software was upgraded.	Reset the board. If problem persists, troubleshoot the module. Maintenance→Slot→Slot Number→Reset If the MERLIN Messaging System software was upgraded, then no action is required.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
7802	SANITY INT NOT GENERATED: Only applies to modules that have extension jacks. or MERLIN Messaging System software was upgraded.	Reset the board. If problem persists, troubleshoot the module. If MERLIN Messaging System module was upgraded, no action is required.
7803	NO PORT BOARDS AVAILABLE: This error is reported when modules are not present.	No action required. Delete this entry from the transient log.
7804	INVALID SANITY RESPONSE: Sanity test receives invalid responses. Applies only to modules that have extension jacks. or MERLIN Messaging System software was upgraded.	Reset the board. If problem persists, troubleshoot the module. If MERLIN Messaging System module was upgraded, no action is required.
7805	INVALID 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.
7806	NOT IN STANDBY MODE: Reported during cold start or background check.	Reset the board. If problem persists, troubleshoot the module.
7807	SELF TEST NOT COMPLETED: Reported during cold start.	Reset the board. If problem persists, troubleshoot the module.
7808	TEST RESULT REGISTER BAD: A module error or processor error resulted while running test.	Reset the board. If problem persists, troubleshoot the module.
7809	TEST STATUS REGISTER BAD: A module error or processor error resulted while running test.	Reset the board. If problem persists, troubleshoot the module.
780A	DPR TEST NOT COMPLETED: Reported during cold start.	If problem persists, troubleshoot the module.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
780C	RAM TEST FAILURE: Memory failed the RAM test. Turns on the processor LED.	If problem persists, replace the processor.
780D	UPPER ROM FAILURE: Memory failed the ROM test. Turns on the processor LED.	If problem persists, replace the processor.
780E	LOWER ROM FAILURE: Memory failed the ROM test. Turns on the processor LED.	If problem persists, replace the processor.
8001	UNEXPECTED ETR MESSAGE: Can appear for any of the following reasons: -- An unsupported enhanced tip/ring telephone is connected to a module. -- An ETR or MLS telephone is faulty. -- An 016 ETR module is faulty. -- The software is showing the message in error.	If a single user complains that an ETR or MLS telephone is not working properly, check that the telephone is a supported model. If the telephone is a supported model, replace the faulty telephone. (Obviously, if the telephone is not a supported model, replace it with a telephone that is supported.) If multiple ETR or MLS telephone users connected to the same ETR module complain that the telephones are not working properly, troubleshoot the module and replace it if necessary. If no telephone users are complaining, clear the error from the error log.
8401	MISCELLANEOUS ERROR: Currently not reported.	No action required.
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.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
8403	NO EXTERNAL RELEASE : Communication problems between the module and central office. Far end has not disconnected within four minutes. If this error occurs twice consecutively, the trunk is busied-out automatically, whether or not Automatic Maintenance-Busy is enabled.	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.
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 if it is working and translated properly. Troubleshoot for wink start and faulty cable. Troubleshoot the far end of the private 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. If 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.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
8411	E911 NO OUTGOING SEIZURE : The system has tried to seize a trunk assigned either to E911 Partition or E911 Adjunct for a 911 call and cannot seize the trunk. The trunks assigned to the E911 Partition or to the E911 Adjunct go into a Trunk Maintenance Busy state. An E911 Partition trunk in a Trunk Maintenance Busy state can still be used to make and receive non-E911 calls.	For an E911 Partition trunk, any one of the following can occur: The trunk may automatically clear if the line is seized for an outgoing call. The trunk may be manually seized by dialing *03 and dialing some digits. The trunk may automatically clear if the line is used for an incoming call. The error message is dropped, and the trunk clears. For an E911 Adjunct trunk, do the following: Check the connections on the E911 Adjunct. If the situation is corrected, the TMB state ends during the system's TMB recovery. Manually drop the error message. Manually seize the trunk by dialing *03. If you manually seize the E911 Adjunct trunk, the adjunct may place a call to the E911 Service.
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.
840B	NO LOOP CURRENT : Communication problems between the module and the 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.	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.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
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	INCORRECT FIRMWARE STATE: 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.	Turn power off for at least 1 second and then turn it on. Repeat system programming procedure. If problem persists, replace the module.
840E	UPLINK MESSAGE ERROR: Communication problems between the processor and the module. 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.
840F	LOST IDLE MESSAGE ERROR:	
8C01	SLOTS NOT EQUAL: The module that occupies the indicated slot does not match the slot information contained in the PC or PCMCIA 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.
9801	MCARD WRITE ERROR: Write to the memory card is not succeeding or is too slow.	Reset the card and try again. If the problem persists, replace the card and try again. If the problem still persists, replace the processor.
9802	MCARD ERASE ERROR: Erasure of the memory card is not succeeding or is too slow.	Reset the card and try again. If the problem persists, replace the card and try again. If the problem still persists, replace the processor.
9803	MCARD 12-VOLT ERROR: The memory card voltage is incorrect.	Reset the card and try again. If the problem persists, replace the card and try again. If the problem still persists, replace the processor.

Table 2-2. Error Codes—Continued

Error Codes	Description	Action
9C01	NW REJECTS SPID: Service on the link has been lost.	Check the programmed SPID for correctness. If it is incorrect, modify the programming; otherwise, contact the central office to correct the problem.
9C03	LINK ESTABLISHMENT FAIL: Service on the link has been lost.	Check that the line is securely connected to the port and that the LEDs on the board show proper operation. If the card appears to be working properly, make sure the CO has activated the line.
9C04	NW NOT RESPOND TO SETUP: Service on the link has been lost.	The private network is not responding to the MERLIN MAGIX messages. Contact the central office to correct the problem.
9C05	NW NOT RESPOND TO RELEASE: Service on the link has been lost.	The private network is not responding to the MERLIN MAGIX messages. Contact the central office to correct the problem.
9C07	ENDPOINT UNINIT (L2/L3): Service on the link is uninitialized.	The link is in the process of initializing. If this error remains logged for more than a half hour, try re-plugging the DSL. If the problem persists, contact the central office to correct the problem.
9C08	PROTOCOL ERROR: Service on the line may be affected.	The private network has indicated that a protocol error has occurred. Verify the line provisioning by running the NI-BRI Provisioning Test or through other means. If the provisioning is correct, contact your technical support organization.
A401	CTI LINK BROADCAST RESET: Occurs during a broadcast reset. The Red LED on the CPU will not turn on, but the Red LED for the slot <i>will</i> turn on.	If several of these occur: Check that the system is in Hybrid/PBX mode. Validate the wiring and the connections. Press the Restart Button. See Restart. Call the Avaya TSO for the procedures to unload and reload the PBX driver.
A801	CTI LINK HIDDEN RESET: Occurs during a hidden reset.	If several of these occur, and the client application has “slow” response time: Validate the wiring and the connections. Press the Restart Button. See Restart. Call the Avaya TSO for the procedures to unload and reload the PBX driver.

Access Log

In addition to checking the error logs, checking the access log helps 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.

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

Scanning the Access 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 Exit and then select Access Log again.

Procedure

To view the Access Log from the programming console or from WinSPM in Standard SPM mode, select:

Menu→Maintenance→System→Access Log→More or  (to page through the log)

System Inventory

If you need to contact the Avaya Technical Services Organization or authorized dealer, you may need to access the System Inventory screen in order to answer questions that may be asked. The System Inventory screen shows you the hardware vintage, software vintage, and ROM ID for each module in the control unit.

Procedure

To view System Inventory from the programming console or from WinSPM in Standard SPM mode, select:

Menu→Maintenance→System→Inventory→More or  (to review information about the module in each subsequent slot)

The System Inventory screen for Slot 00 (the Processor module) is displayed first. When you reach the display for the last slot, pressing More redisplays Slot 00 information.

About the System Inventory Screen

The System Inventory screen provides the following information:

- Line 2 on the System Inventory screen indicates the slot number.
- Line 3 indicates the board name.
- Line 4 indicates the hardware vintage which shows the revision level of the processor board's firmware.
- For slots other than Slot 00, line 5 indicates the firmware vintage which is the boot ROM release number for the board software, followed by the official software version number.
- For slots other than Slot 00, line 6 indicates the application vintage which is the revision levels of the ROM pairs on the processor board.

Module Serial Numbers

Beginning in MERLIN MAGIX Release 1.5, serial numbers are provided on the System Inventory screen for the following modules:

- 024-TDL
- 100 DCD
- 100R INA
- 412 LS-ID-TDL
- MERLIN Messaging System

The module serial numbers for these modules also appear in the System Information Report.

A serial number indicates the year and month of manufacture, the location of manufacture, and a counter number that is unique to that module. The digits are arranged as follows:

- First two digits are the year manufactured.
- The next two letters show the place of manufacture.
- The next two digits are the month manufactured.
- The last six digits are the unique counter number.

For example, in the serial number 99DR11034567, "99" is the year, "DR" represents Denver, "11" indicates November, and "034567" is the unique counter.

Bridge Modules

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

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Overview

This section provides a general telephone troubleshooting procedure as well as recommended troubleshooting procedures based on reported telephone problems. Also provided are 4400-Series telephone tests, MLX telephone tests, Touch Tone Receiver tests, and a review of system requirements for Touch Tone Receivers.

Fixing Telephone Problems

If a reported telephone problem matches any symptom described in the following table, refer to the corresponding procedure.

Table 3-1. Source of Telephone Problem—Section Reference

If this symptom occurs...	See...
No specific problem identified; telephone does not work.	“General Telephone Troubleshooting” on page 3-2
Intermittent telephone problem.	“General Telephone and Wiring Problems” on page 3-2
Telephone does not receive tones from the control unit.	“Voice Transmission Problems” on page 3-3

General Telephone Troubleshooting

Use this procedure as a general guideline for troubleshooting telephones.

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

2. If the problem persists, replace the mounting cord.
3. If the problem continues, proceed as described in the next sections.

If you change the jack assignment of any telephone, be sure to record the extension jack change on Form 2a, System Numbering: Extension Jacks, shown in Appendix B.

General Telephone and Wiring Problems

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

NOTE ▶ Refer to [“Trunk Errors”](#) on page [5-1](#) 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. Go to Step 12.
 - If these telephones do not work, the fault is probably in the module. Continue with Step 9.
9. Check the LEDs on the module.
10. If the module does not have LEDs, see [“Checking System and Slot Status”](#) on page 4-33 for more information.
11. Check the error log for relevant messages. See [“Error Logs”](#) on page 2-1.
12. Replace the faulty module.
13. Replace the wiring between the module jack field and the telephone to see if there is a wiring problem.

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 misdialled 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 system programming for the individual trunk for rotary-dial programming.

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.

4400-Series Telephones Test

Use the following steps to check if the LEDs, ringer, buttons, switchhook, or display are working.

1. Pick up the handset.
2. When you hear the 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 telephone starts ringing.

- This test connects a test tone to the B-channel and sends a repeated ring burst to the telephone.
- On 4400, 4400D, 4406D+, and telephones with a DSS attached, all LEDs light and the telephone rings throughout the test.
- On 4412D+, 4424D+, and 4424LD+, the left-most column of feature buttons that have associated LEDs light and the telephone rings periodically.
 - To switch to another column of feature buttons that have associated LEDs, press a feature button in the column you want to select.

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

The first press turns the red and green LEDs off. Subsequent presses should toggle the red and green LEDs on and off.

4. Press each fixed feature button that has an LED (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 or line/feature button that does not have an LED, and each dialpad button.

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

NOTE ► For 4412D+ telephones, pressing a fixed-feature button or line/feature button will turn the current column of LEDs off (if lit), and toggle the Message Waiting Light (MWL) on and off.

6. Press the fixed-feature buttons and dialpad buttons in the order shown below to turn on all the LEDs.
 - a. Redial
 - b. Conference
 - c. Transfer
 - d. Hold
 - e. Dial 123456789*0#

The LEDs should toggle on and off.

7. If the 4400-Series telephone does not have a display, hang up the telephone to end the test. If it does have a display continue to the next step.
8. To test a 4400-Series telephone display, press each display button.

Each button name should display in the upper-left corner.
9. If any of these tests fail, replace the telephone.

Attendant Position Programmed on a 4400-Series Telephone that Does Not Support Attendant Position

If a port is administered as an attendant position, but the telephone in that port is one that is not supported as an attendant, the administration will be accepted as far as the administrator is concerned (no warnings, no beeps) but the message, Invalid 44XX QCC or Invalid 44XX DLC is displayed at that telephone (where XX represents one of the 4400-Series telephones). Once this message is displayed, the telephone is inoperative (no incoming or outgoing calls). If the telephone does not have a display, the telephone is dead and beeping.

Through system administration, remove the attendant position administration from the port.

MLX Telephone Tests

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

1. Pick up 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 as shown in Table 3-2 should display in the upper-left corner.

Table 3-2. MLX Telephone Display Buttons

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

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.

Station Responding Test

Beginning in MERLIN MAGIX Release 1.5, you can run a Station Responding Test to check the connection between an extension and the system. When you select this test from the maintenance screen, the system sends a request to the telephone at that extension (station), asking for the telephone's classmark. You can request the Station Responding Test locally or remotely.

NOTE ► The Station Responding Test does not work for tip/ring devices because tip/ring devices do not have classmarks.

Procedure

Menu→Maintenance→Port→Type station no.→Enter→Test

The system responds with one of four results:

- **Pass**—An identifiable classmark was received. This screen also indicates the name of the device that returns the classmark ("Profile").
- **No Response**—No classmark was received. (Tip/ring devices respond this way.)
- **Invalid Response**—A classmark was received, but the system cannot identify it.
- **Intermittent Response**—A classmark was not consistently received.

Touch Tone Receiver Problems

Touch Tone Receivers (TTRs) are required for:

- The voice messaging system; the number of TTRs depends on the number of ports used by the Voice Messaging System (VMS), as shown in TTRs Required by VMS/AA.

NOTE ► For MERLIN Messaging Systems of Release 2.5 or later, TTRs are not allocated for calls made from the MERLIN Messaging System module ports but are allocated for calls made to the MERLIN Messaging System module ports. To ensure correct operation, use the TTR requirements shown in System Requirements for TTRs.

- System requirements based on call volume and use of account codes, as shown in System Requirements for TTRs.
- Private networks using E&M, T1 tie, and tandem tie trunks.
- Primary and secondary delay announcement devices used with the Prompt-Based Overflow feature which allows callers to request overflow coverage while waiting in a calling group queue. See [Table 3-6, "TTRs Required for Primary Delay Announcement Devices When Using Prompt-Based Overflow,"](#) on page 10 and [Table 3-7, "TTRs Required for Secondary Delay Announcement Devices When Using Prompt-Based Overflow,"](#) on page 11.

Table 3-3. Modules that Supply TTRs

Module	No. of TTRs
008 OPT	2
012 (T/R)	2
016 (T/R)	4
016 ETR	4
024 TDL	8
400 GS/LS/TTR	4

Table 3-3. Modules that Supply TTRs—Continued

Module	No. of TTRs
412 LS-ID-TDL	4
800 DID	2
800 GS/LS	2
800 GS/LS-ID	2
MERLIN LEGEND Mail module	2
MERLIN Messaging System module	2

System Requirements for Touch Tone Receivers

The tables on the following pages show the TTRs required by VMS/AA systems, general system requirements for TTRs, and TTRs required for Primary Delay Announcement Devices when using Prompt-Based Overflow.

Table 3-4. TTRs Required by VMS/AA

Number of VMS Ports	Number of TTRs Required
1	1
2	1
3	2
4	2
6	3
8	4
12 ¹	6 ¹
16	8
18	8

¹ If a 12-port MERLIN MAGIX Enhanced Customer Care Solution is used, 8 TTRs are required.

In the following table, the call volume per hour includes all calls originating from single-line telephones, calls on tie lines, incoming remote access and DID calls.

Table 3-5. System Requirement for TTRs

Calls/Hour	TTRs Required	
	No Account Codes Used	Account Codes Used
110	2	4
180	4	6
350	4	8
420	6	8
610	6	10
710	8	10

Table 3-6. TTRs Required for Primary Delay Announcement Devices When Using Prompt-Based Overflow

Number of Devices	Number of TTRs Required
1	1
2	2
3	3
4	4
5	4
6	5
7	5
8 or more	6

Table 3-7. TTRs Required for Secondary Delay Announcement Devices When Using Prompt-Based Overflow

Number of Devices	Number of TTRs Required
1	1
2	1
3	1
4	2
5	2
6	2
7	3
8	3
9	3
10 or more	4

Private Network Considerations

You must consider the call traffic across a private network when estimating the number of required TTRs. This includes calls on analog tandem tie trunks and T1-emulated tandem tie trunks. In addition, if your private network includes Centralized Voice Messaging, you must consider the call traffic coming across the private network for the voice messaging system and the TTRs required for the updating of Message Waiting Lights. For this updating, a TTR is required at the sending end and the receiving end. If the systems in the private network are connected by PRI trunks, no additional TTRs are needed.

Symptoms Indicating Need for More TTRs

The following symptoms indicate that the system needs more 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 fail to ring or go to coverage prematurely.
- Reorder tone on UDP/ARS calls using tandem tie trunks.
- Delay in MWL tie trunks when tie trunks are available.

Calculating TTR Requirements

If symptoms indicate more TTRs are required, use the following steps to calculate the system requirements for TTRs.

1. Determine the number of TTRs required for the voice messaging system, if one is present. See Table 3-4, “[TTRs Required by VMS/AA,](#)” on page 9.
2. Estimate the hourly call volume for calls originating from single-line telephones, incoming calls (including private network tandem tie trunks) on remote access and Direct Inward Dial (DID) lines, all calls on tie lines, and calls routed to the voice messaging system.
3. Determine the number of TTRs required by the system. See “[System Requirements for Touch Tone Receivers](#)” on page 3-9.
4. Use Column 2 if account codes are not being used.
5. Use Column 3 if account codes are being used.
6. Add the number of TTRs obtained in Steps 1 and 3. If the Group Calling Prompt-Based Overflow setting is not being used, go to Step 8.
7. If the Group Calling Prompt-Based Overflow setting is being used by calling groups, first add the number of TTRs needed for the primary delay announcement devices assigned to those calling groups, then add the number of TTRs needed for the secondary delay announcement devices assigned to those calling groups. See Table 3-6, “[TTRs Required for Primary Delay Announcement Devices When Using Prompt-Based Overflow,](#)” on page 10 and Table 3-7, “[TTRs Required for Secondary Delay Announcement Devices When Using Prompt-Based Overflow,](#)” on page 11.

NOTE ► If no announcement is used on a primary or secondary delay announcement device, no TTRs are needed.

8. Determine the number of TTRs already supplied. See Table 3-3, “[Modules that Supply TTRs,](#)” on page 8.
9. Compare the total TTRs needed to the total TTRs already supplied to determine if additional TTRs are required.
10. Add a new module if more TTRs are needed.

Touch Tone Receiver Test

The Touch-Tone Receiver Test runs as an audit on the system. It is not a demand test but runs continuously in the background as a maintenance check. This test checks every Touch Tone Receiver (TTR) in the system modules, including those in the MERLIN Messaging System.

If a TTR fails the test, a permanent error is logged and the TTR becomes maintenance busy. If 50% or more TTRs become maintenance busy at the same time, another permanent error is logged. See Error Codes 1C06 and 1C07 in Table 2-2 on page 2-3. The Touch Tone Receiver Test itself does not maintenance busy out 50% or more TTRs.

When a maintenance-busy TTR is retested and passes the test, it is automatically placed back into service

NOTE ► Release 1.0 of the MERLIN Messaging System resets itself at 3:00 a.m. every day. In MERLIN Messaging System Release 1.1 and later, you can change or disable the reset time. During the first 30 seconds of the messaging system's reset, its TTRs do not function. If the Touch Tone Receiver Test tests these TTRs at this time, it removes the TTRs when they fail. Unless you manually restore these TTRs, they will remain maintenance busied-out until the next audit.

You can manually place a TTR into a maintenance busy state. The TTR remains in the busy-out state until you manually restore it and place it back into service. You can manually restore a busied-out TTR regardless of whether the TTR was busied out by the TTR audit or manually busied out.

- NOTES** ►
- The Touch-Tone Receiver Test does not test touch-tone receivers that are manually placed into maintenance busy. Therefore, these TTRs cannot automatically be placed back into service. They must be manually restored.
 - The Touch-Tone Receiver Test does not test TTRs on busied-out slots.

Following are additional considerations for TTRs:

- When the system puts a slot in the Slot-Busy mode, the TTRs are unavailable as a system resource but are not considered by the system to be in the Busy-Out mode.
- You can manually busy out a TTR on a slot in the Slot-Busy mode.
- You cannot manually restore a TTR on a slot in the Slot-Busy mode.
- A Warm Start restores service to all TTRs that were busied out by a TTR Audit. However, a Warm Start does not restore TTRs manually busied out.
- A Cold Start restores service to all TTRs that were busied out by a TTR Audit. However, a Cold Start does not restore TTRs manually busied out.
- A Frigid Start restores service to all TTRs that were busied out by a TTR Audit and will also restore TTRs manually busied out.
- When a slot is returned to service, the TTRs are available as system resources. This includes TTRs busied out by a TTR Audit and TTRs manually busied out.
- A Slot Reset restores service to all TTRs that were busied out by a TTR Audit. However, a Slot Reset does not restore TTRs manually busied out.
- The TTR test (*04) fails if the TTR is in a slot in the Slot-Busy mode or if the TTR was busied

Procedures to View Status, Busy Out, or Restore TTRs

Use these maintenance procedures to view the Status, Busy Out, or Restore TTRs.

Procedure to View TTR Status

Menu→Maintenance→Port→TTR→Type TTR no.→Enter→Status

Procedure to Busy Out TTRs

Menu→Maintenance→Port→TTR→Type TTR no.→Enter→Busy Out

Procedure to Restore TTRs

Menu→Maintenance→Port→TTR→Type TTR no.→Enter→Restore

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Overview

If you are able to isolate reported problems to the control unit, or if after troubleshooting and resolving telephone problems the system is still not working properly, you should 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 modules)
- Carrier



WARNING:

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

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 “Backup” in *Programming Basics* for detailed instructions.
- Save the system programming to a memory card. 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. If you suspect power supply failure, check the following parts:

- Power supply LED
- For metal carriers, connectors on the Power Supply module and on the carrier
- For plastic carriers, Interlocking post (on the carrier, behind the power supply)
- For plastic carriers, ring generator, if present

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 responses below.

- 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, 800 NI-BRI, 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 Connectors \(Metal Carrier\)”](#) on page 4-3 or [“Checking the Interlocking Post \(Plastic Carrier\)”](#) on page 4-3.

Checking the Connectors (Metal Carrier)

If the power supply is not working, follow these steps to check the check the connectors on the Power Supply module and on the carrier:

WARNING:

- *Never remove the power supply without first turning off the power switch and disconnecting the power cord from the AC outlet.*
- *Do not install the power supply unless the carrier is connected to an approved ground.*
- *Before touching leads, connectors, pins, and other components, use a properly grounded wrist strap, to prevent damage from electrostatic discharge (ESD). The wrist strap can be clipped to the ground screw or plugged into the hole next to the ground screw.*
- *Do not attach any cables or power cords to the power supply until it is installed in the carrier.*
- *Do not power up the control unit until all of the modules and power equipment are installed. Once they are installed, refer to See 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.*

CAUTION:

Grounding circuit continuity is vital for safe operation of the MERLIN MAGIX system. Never operate with grounding conductor disconnected. The ground-screw connection is located on the carrier.

1. Remove the power supply. See [“Removing the Power Supply Module \(Metal Carrier\)”](#) on page 4-8.
2. Check the connectors on the Power Supply module and on the carrier for damage such as bent pins.
3. If the connector on the carrier is damaged, replace the carrier; if the connector on the Power Supply module is damaged, replace the Power Supply module.
4. If the connectors are not damaged, reinstall the power supply. See [“Reinstalling the Power Supply Module \(Metal Carrier\)”](#) on page 4-10.

Checking the Interlocking Post (Plastic Carrier)

If the power supply on a plastic carrier is not working, follow these steps to check the interlocking post.

1. Remove the power supply. See [“Removing the Power Supply Module \(Plastic Carrier\)”](#) on page 4-9.
2. Check the small, cylindrical interlocking post on the plastic carrier that locks into the power supply as shown in the illustration.

If the post is broken, replace the carrier.

3. If the interlocking post is not broken, reinstall the power supply. See Reinstalling the Power Supply.
-

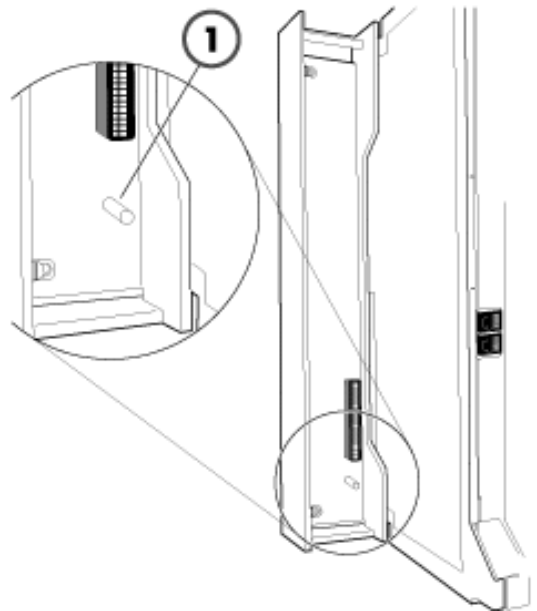


Figure 4-1. Power Supply Interlocking Post on Plastic Carrier

- 1** Interlocking Post

Replacing the Ring Generator (Plastic Carrier)

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” on page 4-18](#). For plastic carriers, see the following table to determine which 012 module is installed.

NOTE ► All 016 (T/R) modules contain built-in ring generators.

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

012 Module	PEC	App. Code
With Ring Generator	61494	517G13 (28) or higher letter
Basic Telephone (without ring generator)	61487	517E13 or 517F13 or lower letter

**WARNING:**

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

To replace the ring generator, follow these steps while referring to the illustration.

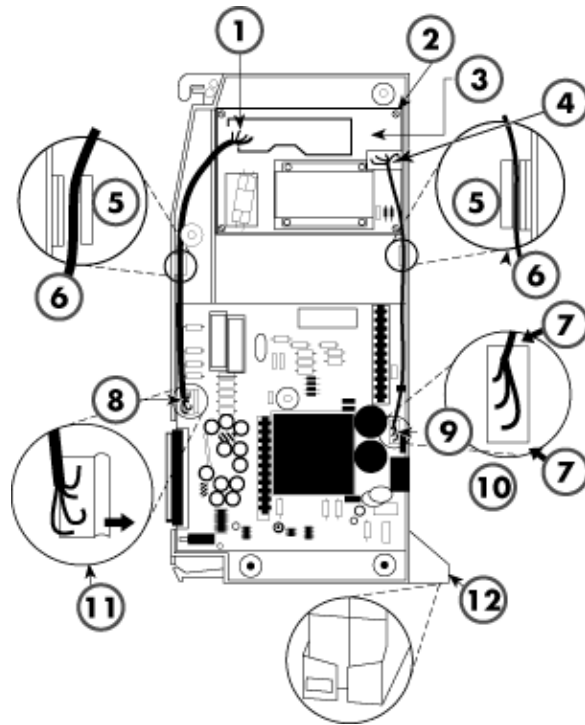


Figure 4-2. Replacing a Ring Generator

- 1 P2
- 2 Remove the four screws (one on each corner of the ring generator).
- 3 Ring Generator Unit
- 4 P1
- 5 Wire Clip
- 6 Step 4: Detach cable from wire clip.
- 7 Grip here
- 8 P202
- 9 P101
- 10 Step 6: Disconnect the P101 header (grip both sides and pull forcefully)
- 11 Step 5: Disconnect the P202 header (pry the clip away from the header and pull the header straight up.
- 12 Step 18: Wire manager: when finished, make sure the modification label "Equipped with 129B Freq Gen" is attached

Remove the power supply. See [“Removing the Power Supply Module \(Plastic Carrier\)”](#) on page 4-9.

1. Place the power supply on its left side and remove the five screws.
2. Carefully turn the power supply over on its right side and then remove the top of the power supply housing.
3. Detach the cables from the inside edge of the plastic housing by removing them from the clips.
4. 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.
5. 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.
6. Remove the four screws from the ring generator, as shown in the illustration.
7. Remove the ring generator.
8. Position the replacement ring generator. Align the screw holes.

Make sure the P1 header on the ring generator is on the same side of the power supply housing as the P101 header on the circuit board.

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

11. 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.

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

16. Carefully, taking time to make sure the on/off faceplate stays aligned, turn the module over and replace the five screws.
17. Verify that the modification label (Equipped with 129B Freq Gen) is attached to the front of the power supply. If not, attach the label supplied with the new ring generator.
18. Reinstall the power supply. See [“Reinstalling the Power Supply Module \(Plastic Carrier\)”](#) on page 4-11.

Replacing the Power Supply

This section contains instructions for removing and re-installing the Power Supply module for both metal and plastic carriers.



WARNING:

- *Never remove the power supply without first turning off the power switch and disconnecting the power cord from the AC outlet.*
- *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.*
- *Do not install the power supply unless the carrier is connected to an approved ground.*
- *Before touching leads, connectors, pins, and other components, use a properly grounded wrist strap, to prevent damage from electrostatic discharge (ESD). The wrist strap can be clipped to the ground screw or plugged into the hole next to the ground screw.*
- *Do not attach any cables or power cords to the power supply until it is installed in the carrier.*
- *Do not power up the control unit until all of the modules and power equipment are installed. Failure to comply with this procedure can result in shock hazard and/or damage to the equipment.*



CAUTION:

Grounding circuit continuity is vital for safe operation of the MERLIN MAGIX system. Never operate with grounding conductor disconnected. The ground-screw connection is located on the carrier.

Removing the Power Supply Module (Metal Carrier)

Follow these steps to install the power supply module in the carrier:

1. If possible, back up system programming on a floppy disk or memory card.
 - See “Backup” in *Programming Basics* 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.

NOTE ► If the basic carrier’s power supply fails, you cannot back up system programming.

2. Power down the system. To power down the system, follow the steps below.

 CAUTION:

Follow these steps in the exact sequence.

- a. Turn off the power supply on the basic carrier.
 - b. Turn off the power supplies on the expansion carriers.
 - c. Unplug the system from the AC outlet.
3. Remove the power supply.
 - a. Unplug the AC power cord from the power supply.
 - b. Use a screw driver to remove the screw on the top of the module and the screw on the bottom of the module.
 - c. Using a screwdriver, pry the tab at the bottom front of the module.
 - d. While prying the tab, pull the top handle on the module towards you and away from the carrier.
4. Inspect the module for visible damage.

Removing the Power Supply Module (Plastic Carrier)

To remove the power supply module on a plastic carrier, follow these steps:

1. If possible, back up system programming on a floppy disk or memory card.
 - See “Backup” in *Programming Basics* 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.

NOTE ► 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 system from the AC outlet.
3. 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.

Reinstalling the Power Supply Module (Metal Carrier)



WARNING:

- *Do not install the power supply unless the carrier is connected to an approved ground.*
- *Before touching leads, connectors, pins, and other components, use a properly grounded wrist strap, to prevent damage from electrostatic discharge (ESD). The wrist strap can be clipped to the ground screw or plugged into the hole next to the ground screw.*
- *Do not attach any cables or power cords to the power supply until it is installed in the carrier.*
- *Do not power up the control unit until all of the modules and power equipment are installed. Failure to comply with this procedure can result in shock hazard and/or damage to the equipment.*

Follow these steps to install the power supply module in the metal carrier:

1. Align the circuit board guides inside the carrier, and slide the power supply module into the slot.
2. Make sure the connector on the back of the module mates properly with the connector on the carrier.
3. Secure the module with two screws, one on top and one on the bottom.



NOTE The power supply may make a ticking sound when plugged in but not turned on. This is normal operation.

4. Power 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.*
 - *Do not power up the system unless all carriers are connected to an approved ground.*
- a. 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.
 - b. 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 turns on.
 - The red light on the processor should turn on for 15 to 45 seconds and then turn off.
 - All indicators on the 100D, 100R, and 400 E&M line/trunk modules (if present) turn on and then off. They remain off when the modules are idle.
5. If any of these conditions are not met, continue troubleshooting the system.

Reinstalling the Power Supply Module (Plastic Carrier)



WARNING:

- *Do not install the power supply unless the carrier is connected to an approved ground.*
- *Before touching leads, connectors, pins, and other components, use a properly grounded wrist strap, to prevent damage from electrostatic discharge (ESD). The wrist strap can be clipped to the ground screw or plugged into the hole next to the ground screw.*
- *Do not attach any cables or power cords to the power supply until it is installed in the carrier.*
- *Do not power up the control unit until all of the modules and power equipment are installed. Failure to comply with this procedure can result in shock hazard and/or damage to the equipment.*

To reinstall the power supply module, follow these steps:

1. Insert a new power supply.
 - 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.
 - b. Replace the ferrite cores around the AC power cord and ground wire and slide the ferrite cores between the wire manager and the power supply module.
 - c. Attach the ground wire to the grounding screw.
2. For each power supply, connect the AC power 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 following components in the order given.
 - a. Power supply on each expansion carrier
 - b. Power supply on the basic carrierThe system automatically cold starts.



CAUTION:

- *Do not plug the power supply into the AC outlet until you are ready to turn power up the system*
- *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, in one of these ways:

- Backup system programming to a floppy disk. See “Backup” in *Programming Basics* for detailed instructions.
- Backup system programming to a memory card. See Appendix D, “Backing up with a Memory Card” for detailed instructions.

Call the Avaya Technical Support Organization (TSO) for troubleshooting instructions.

- See “System Inventory” in *Programming Basics* for instructions on how to identify information about the processor that the TSO may ask you.
- If you are instructed to perform a System Erase, see “[Frigid Start \(System Erase\)](#)” on page 1-10. Do not perform this procedure unless you are instructed to do so.
- If you are instructed to replace the processor, see “[Replacing the Processor Module](#)” on page 4-17.

Forced Installation/Upgrade of System Software



CAUTION:

- *Forced installation should be performed only under emergency situations in which on-board system software has been corrupted.*
- *All existing system programming will be erased by this procedure.*

System software can be installed or upgraded through the PCMCIA interface slot on the processor module. Use this procedure when one of the following occurs:

- System software becomes corrupted
- Upgrade to a later release of system software

Forced Installation Procedure

1. Backup system programming to a floppy disk or memory card.

See “Backup” in *Programming Basics* for instructions on performing a backup to floppy disk, or Appendix D, “Backing up with a Memory Card” to backup to a memory card.



NOTE 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.

2. Insert a Forced Installation or Upgrade Memory Card into the PCMCIA interface slot on the processor module as shown in Figure 3.

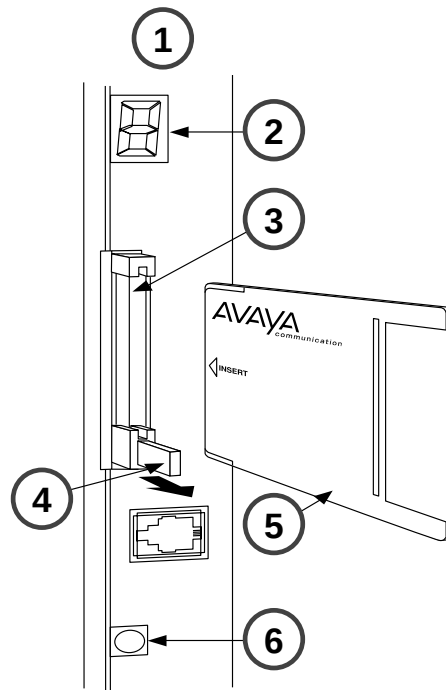


Figure 4-3. Inserting a Memory Card

- 1 Processor Module
 - 2 Error/Status Code Display
 - 3 PCMCIA Interface Slot
 - 4 Push in to remove Memory Card
 - 5 Memory Card
 - 6 Alarm Status LED
3. Inserting a Memory Card
4. From the programming console or from WinSPM in Standard SPM mode, do the following:
Menu→Maintenance→System→Upgrd/Instll→Back→Back→Yes

NOTE ► If maintenance screens are unreliable or not available, power cycle the system by turning off the system and leaving it off for at least one second. Turn the system back on. The system boots from the memory card and automatically starts the installation software. Go to Step 6.

The error/status display on the processor module 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 [“Error Conditions During Forced Installation”](#) on page 4-14.

5. Remove the memory card from the interface slot.
6. Verify that system software has been correctly installed and that the default system programming is present. Do this by confirming no error condition appears on the error/status display on the processor module.
7. Restore system programming.

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

SYS software ROM failure

This indicates a ROM failure and unsuccessful installation.

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

Error Conditions During Forced Installation

The error/status codes on the processor module or the error/status messages on the maintenance console or PC inform you of problems during or after a forced installation. These error conditions occur only during or immediately after a forced installation. See the following topics:

- [Table 4-2, “Error/Status Codes Displayed on Processor Module During Forced Installation,”](#) on page 15
- [Table 4-3, “Error/Status Codes Displayed on Maintenance Console or PC During Forced Installation,”](#) on page 16
- [Table 4-4, “Error Conditions During Firmware Upgrade,”](#) on page 21

Table 4-2. Error/Status Codes Displayed on Processor Module During Forced Installation

Error/Status Codes	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/status code display becomes lit at the start of the first retry. (Look carefully; the dot may be hard to see.)

Table 4-3. Error/Status Codes Displayed on Maintenance Console or PC During Forced Installation

Error/Status Message	Meaning	Action
Verify that Memory Card has been installed correctly.	Incorrectly inserted or missing memory card.	Insert the memory card correctly. Then select Back and begin the forced installation procedure again.
Memory Card is not the correct type. Remove and insert MERLIN MAGIX Upgrade or Installation Memory Card.	Memory card is wrong type.	Select Back and repeat the forced installation procedure with a new memory card. Forced installation can be performed successfully with an upgrade memory card only if the installation is performed through the maintenance screens.
Information on the Memory Card is corrupted. Please remove the Memory Card.	Memory Card is corrupted.	Select Back and repeat the forced installation procedure with a new memory card.
System Busy - Pls Wait Dial Code:xxxx S/ P:ss/pp	The forced installation is attempted while a line/trunk or extension is busy.	When all lines/trunks or extensions are freed, the installation continues. Select Back 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.
Upgrade: MemCard Rel: 4.y Vnn.mm Current Rel: 4.y Vnn.mm Incompatible Releases	 CAUTION: If releases are incompatible, pressing the hidden key twice deletes existing programming. Before pressing the hidden key, make a backup of the system programming. Use WinSPM or a PCMCIA translation card.	See "Upgrading the System" in the Installation section of this guide for instructions on converting the system programming before upgrading to the new release.

Other Error Conditions

The following error conditions may not be viewed on the processor module or on the maintenance console or PC.

- **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.
- **Removal of Memory Card During Installation.** The system is in an indeterminate state. Reinitiate the forced installation by power-cycling the system after inserting the memory card.

Replacing the Processor Module

A failed processor module must be replaced immediately. To replace the processor module, follow these steps:

1. Backup system programming to a floppy disk or memory card.
See "Backup" in *Programming Basics* to backup to floppy disk, or Appendix D, "Backing up with a Memory Card" to backup to a memory card.
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. Install the new processor module.
8. Power up the system.
 - a. Turn on the power supply on each expansion carrier.
 - b. Turn on the power supply on the basic carrier. The system automatically cold starts.
9. Perform a System Erase (frigid start). See "[Frigid Start \(System Erase\)](#)" on page 1-10.
10. Restore system programming using one of the following:
 - The backup floppy disk or original system programming disk. See "Using Standard SPM" in *Programming Basics* for instructions to restore system programming.
 - The backup memory card or original system programming memory card. See Restore in Appendix D, "Backing Up with a Memory Card," for instructions.
11. Reconnect the D8W cord(s) connecting the SMDR printer and/or system programming PC.
12. Attach a tag to the old processor.
Use the tag to identify any visible problems and relevant error reports.

Module Problems

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

- **Run module tests.** Module tests identify the cause of module malfunctions. For complete instructions for tests, refer to Chapter 6, “Tests” in this guide. 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.

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.

- **Replace module.** Replace the module with a module of the same type to determine whether the module is faulty. If the errors cease, the problem is solved.

Beginning in MERLIN MAGIX Release 1.5, serial numbers are provided for some modules. See Module Serial Numbers for more information.

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 an 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 Renumbering” in the Feature Reference] in the Basic System Programming section of this guide for information about board renumbering.*

To replace a module, follow these steps:

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 cords, see “Labeling Trunks” in *Installation*. For instructions on checking poorly labeled wiring, see “[Checking Unlabeled Wiring](#)” on page 4-19.

3. Run a demand test by entering test mode.
4. Remove the module. See "Removing Modules" in *Installation* for instructions. Inspect the module for visible damage.
5. Install the new module. See "Installing Modules" in *Installation* for instructions.
6. Restore the module.
7. Connect the trunk and extension cords.
8. Attach a tag, error printout, or any information to the module that you removed to identify any visible problems, failure symptoms, or 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 to each clip one wire from the pair you have chosen. The clips extend from the bottom of the tone device.
5. Turn on the switch on the outside of the tone device.
6. You hear a high-pitched, alternating signal.
7. Take the telephone handset and a 4-pair patch cord to the cross-connect field between the control unit and the telephone.
8. 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.
9. Using the diagonal pliers or wire strippers, cut off 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.
10. Attach the handset's clips, which extend from the base, to the exposed wires of the patch cord.

11. Set the switch on the side of the handset to MONITOR.
12. 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 do not 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 Module Firmware

The MERLIN MAGIX Integrated System allows upgrades or reinstallation of module firmware through the PCMCIA interface slot on the processor module. The interface slot is a standard interface through which information may be added to or retrieved from the system.

Circuit modules may use flash ROM to retain module firmware. Unlike traditional ROMs, flash ROM can be written and erased without being removed from the circuit module. The circuit modules that include this feature are the 016 (T/R), the 800 GS/LS-ID, and the 800 NI-BRI.

Firmware on these circuit modules 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. The label of PCMCIA card identifies the Application Vintage of firmware that is included on the card.

The label of the PCMCIA Upgrade card identifies the Application Vintage of firmware that is included on the card. Use this card to upgrade **only** the modules that this card identifies as having a new Application Vintage of firmware. Upgrading other modules may cause unexpected system operation.

NOTE ► You do not have to upgrade the system software to upgrade a module's firmware.

1. Insert the Upgrade Card into the PCMCIA slot on the processor module.
2. Select Maintenance from the System Programming Main Menu. (Menu > Maintenance >)
3. Select Slot.
4. Enter slot number of module that needs a firmware upgrade. You can upgrade only one module at a time.
5. Select Busyout and answer Yes to Do you want to continue?.
- When you see Busy-out Complete on the screen, select Exit.
6. Select Upgrade from the Maintenance Menu.
- Validation of MemoryCard in Progress appears on the screen followed by Validation of MemoryCard Successfully Completed,

Select Exit.

7. The current module and version is shown on the screen, followed by Select one: and the available versions for upgrade of this module.
8. Select the version desired (you may have only one choice). The selection is highlighted.
9. Press Enter, and select Yes when Do you want to continue? is displayed.
10. In Progress and the percentage completed is displayed as the upgrade is loaded.
11. When the upgrade is complete, the following appears:
 Upgrade Successfully Completed.
 Slot Busied Out.
 Slot Restore Needed.
12. Select Exit, and select Restore from the Maintenance menu, then select Yes when Do you want to continue? is displayed.
13. Repeat steps 3 through 12 above for each module to be upgraded.

When Upgrade(s) are completed, verify the application version of the each module by selecting in Maintenance > System > Inventory, to assure the proper version.

Table 4-4. Error Conditions During Firmware Upgrade

Error Messages	Corrective Action
Memory card is in use by another feature	Select Exit and try again.
Verify that Memory Card has been inserted correctly	Insert the memory card correctly; then select Exit and begin the upgrade procedure again.
Information on the Memory Card is corrupted. Please remove the Memory Card.	Select Exit. Remove the memory card and repeat the upgrade procedure with a new memory card.
Module can not be upgraded.	This procedure can be run only on the 800 GS/LS-ID, 016 (T/R), or 800 NI-BRI modules or other modules. 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	Select Exit and begin the upgrade procedure again.

Table 4-4. Error Conditions During Firmware Upgrade—Continued

Error Messages	Corrective Action
Memory Card file error	Select Exit. Make sure the memory card is inserted correctly and repeat the upgrade procedure.
Memory on module will not erase	The flash ROM fails to erase. Repeat the upgrade procedure. If the upgrade continues to fail after several attempts, replace the module.
Board Memory Programming failure	Repeat the upgrade procedure. If the upgrade continues to fail after several attempts, replace the module.

800 NI-BRI Module Problems

An 800 NI-BRI module requires running the NI-1 BRI Provisioning Test, in addition to the other module tests, under the following circumstances:

- The module has data endpoints that use the BRI lines.
- Voice Call manual testing of the module's BRI lines indicates problems.

The NI-1 BRI Provisioning Test supports the NI-1 BRI IOC Package "S" service configuration. Multiline-Hunt Group/Series Completion testing is included.

016 MLX Module Problems

Sometimes Ports 1 through 8 on an 016 MLX module work, but not Ports 9 through 16. A possible cause is that the processor module installed in the system is a CKE3 or earlier model.

Check the system inventory screens to determine if a CKE3 or earlier processor module is installed. If so, replace it with a CKE4 or later model.

100D Module Problems

The 100D module requires the Channel Service Unit (CSU) Loopback Test, in addition to the other module tests.

In addition to checking the error logs, the 100D module requires that you check the error events specific to the 100D module. See ["100D Module Error Events"](#) on page 4-23 for details.

Private Networked Systems

The Channel Service Unit (CSU) or Data Service Unit (DSU) at either end of a PRI tandem trunk over which a call could be routed, may be programmed for T1 or robbed-bit signaling rather than PRI signaling. This will cause the MERLIN MAGIX to raise a channel inoperative alarm. Verify that any CSU on the DS1 circuit between the MERLIN MAGIX and the public switched telephone network (PSTN) is programmed for the same framing as is the DS1 slot on the MERLIN MAGIX. Also, verify that any CSU on the PRI circuit between the MERLIN MAGIX and the PSTN is programmed for PRI signaling and not for T1 or robbed-bit signaling.

NOTE ► If your existing MERLIN MAGIX system is now going to be used for a private network using tandem trunks, check the framing to be sure PRI signaling is supported.

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.

Procedure

Menu→Maintenance→Slot→Dial the 2-digit slot no. (01–17)→Enter→Error Events→Current hr or Previous hr

The current hour always begins at ##:00 and ends at the last complete 15-minute 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.

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
MIS SLP ES	BS SEC FS
xxx xxx xxx xxx xxx xxx	
Back	

100D Module Clock Status

If you have not been trained to perform T1 maintenance, contact the TSO for instructions on using this procedure.

Procedure

Menu→Maintenance→Slot→Dial the 2-digit slot no. (01–17)→Enter→Clock→Back

After selecting C Lock, the following screen appears. Contact the TSO if you need assistance interpreting this information.

Clock Slot xx:	
mm/dd/yy	hh:00-hh:mm
Admin as:	
Active:	
Synch source:	
PPM: xxx	
Back	

100R INA and 100 DCD Module Problems

In addition to other module tests, both the 100R INA and 100 DCD modules require the following tests:

- ["Line Loopback Test"](#) on page 6-32
- ["Payload Loopback test"](#) on page 6-32
- ["Bit Error Rate Test \(BERT\)"](#) on page 6-33

In addition, the 100 DCD module requires the following tests:

- ["Data-Channel Loopback Test"](#) on page 6-34
- ["Data-Terminal Loopback Test"](#) on page 6-34
- ["Data-Port Local Loop Test"](#) on page 6-34

In addition to checking the error logs, the 100R INA and 100 DCD modules require that you check the error events specific to these modules. See ["100R INA and 100 DCD Module Error Events"](#) for details.

100R INA and 100 DCD Module Error Events

Four additional error events apply to the 100R INA and 100 DCD modules:

- ["24-Hour Total"](#) on page 4-25
- ["Current Event"](#) on page 4-26
- ["Interval Event"](#) on page 4-26
- ["Clear Error Events"](#) on page 4-26

From your system programming console, use the following sequence to access the 100R INA or 100 DCD module Error events screen (be sure to select the corresponding 100R INA or 100 DCD module slot number).

Procedure

Menu→Maintenance→Slot→Slot#→Enter→Error Event

24-Hour Total

The 24-Hour Total error event reports cumulative error statistics spanning the past 24 hours. From your system programming console, use the following sequence to access the 100R INA or 100 DCD module 24-Hour Total screen (be sure to select the corresponding 100R INA or 100 DCD module slot number).

Procedure

Menu→Maintenance→Slot→Slot#→Enter→Error Event→24 hr total

This screen functions similarly to the current screens on the 100 DS1 module except that this new screen reports on totals for the error events over a longer period of time. Therefore the counts are increased from three digits to four.

Table 4-5 describes the information on the 24 Hour Total error event screen.

Table 4-5. 24-Hour Total Line Descriptions

Line	Description
24-Hour Slot xx	xx is the slot currently being reported on.
nn Valid Intervals	nn is the number of valid 15-minute intervals from the past 24 hours. Reporting on the number of valid intervals allows you to distinguish a truly error-free interval from one that contains zeroes due to other reasons.
MIS, SLP, ES, BS	Misframes (MIS), Slips (SLP), Errored Seconds (ES), Bursty Errored Seconds (BS). Each error figure is the sum of all error events from all available intervals. 9999 represents an overflow situation.
SEC, FS, BPV	Severely Errored Seconds (SEC), Failed Seconds (FS), Bipolar Violations (BPV). Each error figure is the sum of all error events from all available intervals. 9999 represents an overflow situation.

NOTE ► You can refresh the 24-Hour Total screen by pressing Back and then pressing 24 hr total again.

Current Event

The Current Event reports error statistics for the 15-minute interval which is currently active. Because intervals are not synchronized with the system clock, the Elapsed minutes line displays the number of minutes that have elapsed for the current interval. The number of minutes reported is rounded to the nearest minute and can be a value between zero and 15.

From your system programming console, use the following sequence to access the Current screen (be sure to select the corresponding 100R INA or 100 DCD module slot number).

Procedure

Menu→Maintenance→Slot→Slot#→Enter→Error Events→Current

NOTE ► You can refresh the Current screen by pressing Back and then pressing Current again.

Interval Event

The Interval Event reports error statistics for a specific 15-minute interval from the past 24 hours. There are 96 15-minute intervals in a 24-hour period segment. Interval one is the most current and interval 96 is the oldest. From your system programming console, use the following sequence to select an interval number from the Interval screen (be sure to select the corresponding 100R INA or 100 DCD module slot number).

Procedure

Menu→Maintenance→Slot→Slot#→Enter→Error Events→Interval→Interval #→Enter

NOTE ► Invalid intervals have all zeroes for error data, but no visual indication is given to show that the interval is not valid. You can use the Valid interval count on the 24-hour total screen to determine which intervals are valid so as to distinguish how many intervals are invalid.

Clear Error Events

The Clear Error Events causes error events for intervals, including the current interval, to be cleared and reset to zero. If you select a slot containing a 100 DCD module, you can choose to clear individual intervals or all intervals. If you select a slot containing a 100R INA module, you may clear only all intervals.

From your system programming console, use the following sequence to access the Clear screen (be sure to select the corresponding 100R INA or 100 DCD module slot number).

Procedure to Clear All Intervals

Menu→Maintenance→Slot→Slot#→Enter→Error Events→Clear

Procedure to Clear Individual Intervals

Menu→Maintenance→Slot→Slot#→Enter→Error
Events→Clear→Interval→Enter Interval #→Enter→Yes

NOTE ► To stop the clear event and retain all error events press Back or Cancel. You will return to the Error Events screen.

MERLIN Messaging Module Problems

The MERLIN Messaging maintenance reset will cause telephone users to experience unanticipated interruptions in the normal operation during the time when the MERLIN Messaging is performing a maintenance reset on itself.

The MERLIN Messaging System, Release 1, performs a maintenance reset on itself every day at 3:00am. On the MERLIN Messaging System Release 1.1 and later releases, the maintenance reset time can be changed or the maintenance reset can be disabled. The maintenance reset is an option in MERLIN MAGIX Release 2.0 software but is not an option in MERLIN MAGIX Release 1.0 software. The reset time averages approximately 1.5 minutes to complete for a system with a small to medium number of mailboxes. The reset will take longer for a large number of mailboxes (approximately 4 to 5 minutes). Voice mail traffic and TTR functionality will be not be available from the MERLIN Messaging module during the reset as follows:

- **Voice Mail Traffic.** For the entire duration of the reset the voice mail traffic will be interrupted. Coverage calls being routed to MERLIN Messaging will not be answered. Users will hear busy tone or during some intervals of the reset they may get routed to the operator. Users attempting to retrieve messages will experience the same operation.
- **The TTR operation.** During the first 30 seconds of the maintenance reset, the TTRs on the MERLIN Messaging module will not function. However, the current MERLIN Messaging software does not inform the MERLIN MAGIX system of the reset and allows the TTRs to be selected. This means that a Tip/Ring user could attempt to make a call and it would not go through. This is because the MERLIN MAGIX system did not know that the TTRs were not available for use.

If the TTR audit was testing a messaging system with the current MERLIN Messaging software, the TTR audit will fail the TTRs and remove them from service. The TTRs would remain out of service until the TTR audit tested them again and they passed. In a small system this would take a minimum of 10 minutes. In a large system this could take nearly two hours, depending on the number of TTRs in the system.

Computer Telephony Integration (CTI) Link Problems

If you experience CTI link problems, you can perform the following maintenance procedures:

- [“Viewing Status”](#) on page 4-28
- [“CTI Link Test”](#) on page 4-29.
- [“Restart”](#) on page 4-29.
- [“Varying Hiding Time”](#) on page 4-30.

NOTE ► Review the procedures in Module Problems [programmers: make link to this section which appears earlier in this chapter] to confirm that the module into which you have plugged is not faulty.

Before you start maintenance or troubleshooting procedures for the CTI link, verify the following:

- The MERLIN MAGIX system is operating in Hybrid/PBX mode.
- The CTI link is plugged into a port on an 008 MLX, 016 MLX or a 408 MLX module.
- The link is plugged into the RJ45 jack on the ISDN card in the Telephony Server and the wire connection to the server is complete.
- The firmware for the MLX module is of vintage earlier or later than 29. Link administration is prevented on modules using firmware 29.

Viewing Status

This procedure checks extension status and identifies whether the MERLIN MAGIX system recognizes that the link is physically connected and operational.

Procedure

Menu→Maintenance→Port→Station→Dial port number→Enter→Status→Back

After selecting Status, the following screen appears.

CTI Link xxxx:
SlotPort: xxxx
Physical Link:
PBX Driver Conn:
Alarms:
Maintenance Busy:
Back

This screen provides the following information:

- xxxx is dial plan number, slot/port, or logical ID.
- Physical Link is up or down.
- PBX Driver Conn is up or down.
- Alarms are suspended or active.
- Maintenance Busy is yes or no. A yes in the Maintenance Busy field means that the slot shown in the Slot/Port field of this screen is maintenance busy. Do a slot restore on that slot.

NOTE ► The status screen cannot be used to check the router portion of the 100R INA and 100 DCD modules. You must use 100R INA and 100 DCD management interfaces to determine the status of the router. For information on the Router Management interface, refer to the documentation packaged with the 100R INA and 100 DCD modules.

CTI Link Test

This test allows you to check whether the MERLIN MAGIX system and the PBX driver are communicating across the link without involving the Telephony Services product. This is helpful in isolating a problem to the Telephony Services product.

Procedure

Menu→Maintenance→Port→Station→Dial port number→Enter→Test→Back

If the test fails, verify wiring. Then view a status screen; see Viewing Status. [programmers: make link to previous section.] On the status screen, see if Physical Link and PBX Driver Conn are both designated as up; if the PBS driver is not loaded, PBX Driver Conn is down.

Restart

This procedure cleans up a link that is experiencing problems, then reconnects the link and makes it operational again. Restart does not shut down the link, but does affect traffic on that port.

Procedure

Menu→Maintenance→Port→Station→Dial port number→Enter→Restart→
Yes→Back

Varying Hiding Time



CAUTION:

This procedure should be done only under the direction of NSAC/Tier 3 engineers. It is not recommended for users or service technicians. If this value is changed, a corresponding change must be made for the PBX driver under the direction of Technical Support Organization (TSO) personnel.

Hiding time is the amount of time (in seconds) that the link could be broken but users would not notice. This interval occurs when the link experiences a hidden reset until the system generates a broadcast reset. A broadcast reset affects CTI link operations and reinitializes the link. The factory setting for hiding time is 25 seconds, with a range of settings from 0 to 90 seconds.

Varying the hiding time may be helpful if the link displays problems. If broadcast resets would help identify when a CTI link problem occurs, reduce the hiding time to 10. This broadcasts all link troubles that cause resets. If broadcast resets inhibit troubleshooting a CTI link problem, increase the hiding time. If the broadcast reset messages still interfere with troubleshooting the problem, set the hiding time to zero(0). Setting the value to zero eliminates all broadcast resets; everything is hidden.

Procedure

Menu→Maintenance→Port→Station→Dial port number→Enter→Hiding Time is not shown on the display; press the associated softkey twice→Enter seconds for hiding a broken link (0–90)→Back

The default for the number of seconds to hide a broken link is 25 seconds. If you enter 1 through 9 in the procedure above, the value is changed to 10.

Removing a CTI Link

The following two procedures are used for CTI link removal:

- Permanent Removal, when you want to permanently remove a CTI link from the MERLIN MAGIX system.
- Link Shutdown, when you want to temporarily idle a CTI link before working on it.

Permanent Removal

For a permanent CTI link removal, follow these steps:

1. (optional) Suspend MERLIN MAGIX alarming for the CTI link.

Refer to the *MERLIN MAGIX PBX Driver Network Manager's Guide* for the steps to suspend the alarming. If Step 1 is not performed, the system may generate an alarm about the CTI link before Step 5 is performed.

2. Upload the PBX Driver (MLPD).

Refer to the *MERLIN MAGIX PBX Driver System Manager's Guide* for instructions.

3. Unplug the CTI link.
4. Remove the ISDN link interface card, if desired.

Refer to the PC/ISDN Platform Installation and Reference, or similar installation manual from the ISDN link interface card vendor.

5. Remove the MERLIN MAGIX administration.

Delete the MLX port from the list of CTI link ports, using MERLIN MAGIX system programming (at the 4425LD+ or MLX-20L console, or with WinSPM). After this, it is safe to plug in an MLX telephone, a data module, or an ISDN terminal adapter. See the CTI feature in *Feature Reference*.

Link Shutdown

Temporarily idling a CTI link before performing maintenance is an optional procedure on the server side; it can prevent unwanted MERLIN MAGIX system alarms. However, a link shutdown is not required before performing maintenance.

For a link shutdown, perform the following steps:

1. Suspend MERLIN MAGIX alarming for the CTI link.

If Step 1 of the link shutdown is not performed, then the MERLIN MAGIX may generate alarms about the CTI link while under maintenance. See the *MERLIN MAGIX PBX Driver Network Manager's Guide* for detailed instructions on this procedure.

2. Prevent new CTI link traffic.

If Step 2 is not performed before working on the CTI link, an application may get confused. For example, if an application sent a service request (such as Make Call) but the CTI link is taken down for maintenance before the MERLIN MAGIX sends a reply, the application will think the request failed even if it succeeded. In contrast, if this step is performed, the application will immediately receive a failure reply. See the *MERLIN MAGIX PBX Network Manager's Guide* for detailed instructions on the Block, Offline, and mloam commands.

3. Wait for CTI link traffic to subside.
4. If the Offline or mloam command was used in Step 2, skip to Step 4. This step applies only if the Block command was used in Step 2.
5. Determine when traffic has stopped. On the NetWare server, start the mloam or wmloam tool, then go to the Link Status screen. View the line CTI Link Msg. Rate. If the value shown is 0, then traffic on the link has stopped. Refer to the *MERLIN MAGIX PBX Network Manager's Guide* for details.
6. Unplug the CTI link or perform appropriate maintenance.

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 cover from the carrier. See “Installing/Removing the Cover on the Carrier” in *Installation*.
2. Backup system programming to a floppy disk or memory card.
See “Backup” in *Programming Basics* to backup to floppy disk, or Appendix D, “Backing up with a Memory Card” to backup to 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
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 that 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. Disconnect the ground-screw on the carrier from the approved ground.
9. Loosen the screws holding the carrier onto the backboard.
10. Slide the carrier to the right until the connector disengages from the carrier to the left.
11. Pull the carrier away from the wall so that the screws slip through the large screw holes.

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 “Mounting an Empty Carrier” or “Mounting a Populated Carrier” in *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, and 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, 100D, 100DCD, 100R, and 400 E&M module are the only modules that have LEDs. The System Status screen displays simulated LEDs for the processor and for 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.

Procedure

Menu→Maintenance→System→Status

Interpreting the System Status Screen

Following is a sample System Status screen:

```
System Status:
Slot00:Raaa
Slot01:Raaa Yaaa Gaaa
Slot02:Raaa Yaaa Gaaa
Slot03:Raaa Yaaa Gaaa
Slot04:R    Y    G
```

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 screen 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)

Procedure

Menu→Maintenance→Slot→Dial the slot no. (00-17)→Enter→Status

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Overview

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 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.

Beginning with MERLIN MAGIX Release 1.5, when there is a T1 link failure the system busies out the 100R INA and 100 DCD modules and the following occurs:

- Calls are dropped, allowing the system to be idle so that programming and maintenance functions can be performed.
- Automatic Route Selection (ARS) calls immediately overflow to alternate pools.

When a circuit failure occurs on a 100R INA or 100 DCD module, the following can be observed on site:

- On the 100R INA module, when the T1 link goes down, there is a DS1 Loss of Signal alarm in the permanent alarm log, a red LED is illuminated on the module, and the module becomes maintenance-busy.
- When the Loss of Signal alarm is allowed to automatically retire once the T1 link is re-established, the red LED goes out and the module restores the functions properly.
- When a call is active and the T1 link goes down, the call is dropped by the 100R INA and 100 DCD modules. (The 100D module does not drop the call.)
- When the T1 link is in a Loss of Signal, calls to the pool receive a fast-busy, allowing calls to roll over to the next ARS route.

Troubleshooting Trunk Problems

This table provides a quick guide to troubleshooting trunks.

Table 5-1. Source of Trunk Problem—Section Reference

Symptom	Section
General trunk problems	“Manual Correction of Trunk Problems” on page 5-2
Incoming calls not being received	“Incoming Trunk Problems” on page 5-3
Cannot make outgoing calls	“Outgoing Trunk Problems” on page 5-3

NOTE ► If the customer reports echoes 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 these steps:

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).

Incoming Trunk Problems

If incoming trunks do not work properly, follow these steps:

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 console, check the trunk programming to be sure this trunk has been properly translated. Refer to a copy of the completed System Planning Forms.
6. If the module continues to malfunction, replace it.

Outgoing Trunk Problems

If the system cannot seize outgoing trunks, follow these steps for analog lines:

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.

NOTE ► Steps 2 through 4 only apply to Hybrid/PBX mode. Go to Step 5 for systems in Key or Behind Switch mode.

2. Pick up the handset of a test telephone to check for system dial tone;
Dial ***03**, then dial the maintenance password.
 - If the password is not known, check the System Information Report or ask to speak with the system manager.
 - You can change the password without knowing the old password only when you perform on-site maintenance through the ADMIN jack.
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.

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 has a maintenance-busy status. 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 in maintenance-busy states 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
- Digital Trunks

Permanent Errors

A permanent error is entered in the error logs when more than 50 percent of analog 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, as follows:

- **Ground-Start (GS) Trunks.** 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 central office 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) Trunks.** 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.
- **Tie Trunks.** 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 central office 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.

Checking Ports

Perform the procedures in this section from the maintenance console. By selecting Port from the Maintenance screen, you can check the maintenance-busy status and other information for individual trunks and extensions.

Checking Trunk Maintenance-Busy Status

Procedure

Menu→Maintenance→Port→Line/Trunk→Dial the dial plan no.→Enter→Status→Next (to check status of next trunk)

Checking Extension Maintenance-Busy Status

Procedure

Menu→Maintenance→Port→Station→Dial the dial plan no.→Enter→Status→Next (to check status of next extension)

Checking Digital Subscriber Line (DSL) Maintenance-Busy Status

Procedure

Menu→Maintenance→Port→DSL→Dial the dial plan no. for the DSL (dial sspp where ss equals the slot no. and pp equals the port no.)→Enter→Status→Next (to check status of next DSL)

Busying-Out a Trunk

Procedure

Menu→Maintenance→Port→Line/Trunk→Dial the dial plan no.→Enter→Busy-Out

At the conclusion of this procedure, Busy-Out in Progress appears on the display. At successful completion, Busy-Out Successfully Completed appears. If Busy-Out Failed appears, exit and try again.

Busying-Out an Extension

Procedure

Menu→Maintenance→Port→Station→Dial the dial plan no. extension (1- to 4-digits)→Enter→Busy-Out

If the extension number you enter is a CTI link, a CTI link screen appears. Press Back or 0 and enter another extension number.

At the conclusion of this procedure, Busy-Out in Progress appears on the display. At successful completion, Busy-Out Successfully Completed appears. If Busy-Out Failed appears, exit and try again.

Busying-Out a Digital Subscriber Line (DSL)

Procedure

Menu→Maintenance→Port→DSL→Dial the dial plan no. for the DSL (dial sspp where ss equals the slot no. and pp equals the port no.)→Enter→Busy-Out

At the conclusion of this procedure, Busy-Out in Progress appears on the display. At successful completion, Busy-Out Successfully Completed appears. If Busy-Out Failed appears, exit and try again.

Restoring a Trunk

Procedure

Menu→Maintenance→Port→Line/Trunk→Dial the dial plan no.→Enter→Restore

At the conclusion of this procedure, Restore in Progress appears on the display. At successful completion, Restore Successfully Completed appears. If Restore Failed appears, exit and try again.

Restoring an Extension

Procedure

Menu→Maintenance→Port→Station→Dial the dial plan no. extension (1- to 4-digits)→Enter→Restore

At the conclusion of this procedure, Restore in Progress appears on the display. At successful completion, Restore Successfully Completed appears. If Restore Failed appears, exit and try again.

Restoring a Digital Subscriber Line (DSL)

Procedure

Menu→Maintenance→Port→DSL→Dial the dial plan no. for the DSL (dial sspp where ss equals the slot no. and pp equals the port no.)→Enter→Restore

At the conclusion of this procedure, Restore in Progress appears on the display. At successful completion, Restore Successfully Completed appears. If Restore Failed appears, exit and try again.

Resetting an RS-232 Port

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

Procedure

Menu→Maintenance→RS232 Port 1 or RS232 Port 2→Dial the dial plan no. of the port (dial sspp where ss equals the slot no. and pp equals the port no.)→Enter→Reset→Yes

At the conclusion of this procedure, Reset in Progress appears on the display. At successful completion, Reset Successfully Completed appears. If Reset Failed appears, exit and try again.

Resetting the Processor's Internal Modem

Procedure

Menu→Maintenance→Port→Modem→Reset→Yes

At the conclusion of this procedure, Reset in Progress appears on the display. At successful completion, Reset Successfully Completed appears. If Reset Failed appears, exit and try again.

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 central office, 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 central office to correct the problem from that end. Repeat the audit when the problem is fixed.

Auditing Lines

This test can be run only on the slot and port of a DS1 PRI B-channel. The estimated time for this test is approximately four minutes. A Backup, Restore, Busy-Out and Reset are not required when performing this test. This test cannot be interrupted.

Procedure

Menu→Maintenance→Port→B-Channel→Enter the 2-digit slot and 2-digit port no.
(enter sspp where ss equals the slot no. and pp equals the port no.)→Enter→Audit Line

Audit Initiated appears on the display if the audit message is successfully created and sent.

After about four minutes, check the error logs.

- If new PRI errors occur, contact the TSO for help on interpreting the results and your action.
- If no new PRI messages appear, the ends are most likely in agreement.

Audit Failed appears on the display if the audit message cannot be sent due to signaling failure. This indicates that the problem may be at the central office end. First, make sure the correct B-channel is selected. If the correct B-channel is selected, the customer or Avaya representative acting as the customer's agent should ask the central office to clear the problem from that end. If the problem is not at the central office end, select the correct B-channel and repeat the Auditing Lines procedure.

Auditing Calls

This test can be run only on the slot and port of a DS1 PRI B-channel. The estimated time for this test is approximately four minutes. A Backup, Restore, Busy-Out and Reset are not required when performing this test. This test cannot be interrupted.

Procedure

Menu→Maintenance→Port→B-Channel→Enter the 2-digit slot and 2-digit port no.
(enter sspp where ss equals the slot no. and pp equals the port no.)→Enter→Audit Call

Audit Initiated appears on the display if the audit message is successfully created and sent.

After about four minutes, check the error logs.

- If new PRI errors occur, contact the TSO for help on interpreting the results and your action.
- If no new PRI messages appear, the ends are most likely in agreement.

Audit Failed appears on the display if the audit message cannot be sent. If this occurs, make sure an active call is in progress on the specified B-channel and try the audit again.

Private Network Calling Problems

When a system is configured in a private network, various calls placed on one switch to another switch may not complete correctly.

NOTE ► If your private network consists of more than two systems, a system manager in the private network should be appointed to maintain system forms for all systems in the private network. Any local modifications should be cleared with this coordinating system manager, who must ensure that changes to a local system do not have undesirable effects on the private network as a whole. When modifications are made, he or she should see that corresponding changes are made, as necessary, at private networked systems. If your private network consists of two systems, the managers should work together to assess and agree upon any changes.

Troubleshooting Guidelines and Preparation

Before troubleshooting problems, obtain copies of your system's planning forms. Many of the solutions offered in this chapter require that you contact the coordinating system manager in your private network, who maintains records of how systems in your private network are programmed and keeps them up to date. Problems can occur when changes are made in a private network without considering the needs of the private network as a whole. In particular, changes to local and non-local dial plans, Uniform Dial Plan (UDP) routes, Automatic Route Selection (ARS) routes, and remote access settings can have unintended effects on other systems in your private network.

To solve a problem, you may need to perform system programming using your MLX-20L programming console or PC equipped with System Programming and Maintenance (SPM) software.

Most of the problems outlined here can be solved by system managers working together in a two system private network or with the coordinating system manager in a larger private network. However, some problems require the intervention of an Avaya technician. In the USA only, Avaya provides a toll-free customer helpline, called the Technical Support Organization, (1 800 628-2888) 24 hours a day. You may want to allow only the coordinating system manager to contact the Helpline, because this person has the complete information that allows Avaya technicians to understand problems that you are experiencing. Under certain circumstances, you may be charged for consultation with Helpline personnel. Contact your Avaya representative or authorized dealer, if you have any questions concerning consultation charges.

The troubleshooting instructions in this chapter provide information about reviewing current programming on your local system. You can find out about current programming in the following three ways:

- **System Forms.** Review the filled-out system form that includes the programming information you need. This method requires that forms be available and up-to-date.
- **System Reports.** Appendix B, "Sample Reports," in the *Network Reference* provides samples of reports that you may require when troubleshooting private network problems, along with the menu options for selecting each report. To see a report, select the Print option on the System Programming menu and then choose a report. Note that if you select the ALL option, the reports take from 30 minutes to 6 hours to print, depending on the size of the system. You may want to schedule printing during off-peak hours. Appendix F in the *Feature Reference* provides samples of all system reports.
- **System Programming.** Many of the system programming procedures that you may need to perform are summarized in Chapter 5, "System Management" of the *Network Reference*. Programming Basics in this guide provides instructions for accessing system programming through a 4424LD+ console, an MLX-20L console, or using WinSPM software on a personal computer.

Reviewing the Non-Local Dial Plan and Routing

Some of the troubleshooting steps in this section require that you review the extension ranges programmed in the non-local dial plan and/or the routing for private network calls. Use one of the following three methods to do this:

- **System Form.** Check System Non-Local UDP Administration Form in the Installation Specification before proceeding. This form summarizes the extension ranges and routing for the patterns programmed in your system. For each route, the pool number, programmed digit manipulation, the Facility Restriction Level (FRL) value are listed, and the voice/data attribute is listed.
- **System Report.** To see a system print report of existing non-local extension ranges, patterns, and routes, select the Print option on the System Programming menu and then choose NonLcl UDP. Appendix B, "Network Reports" in the *Network Reference* provides a sample of this report.

- **System Programming.** To check the current call routing on a system, follow this procedure:

Procedure

Tables→UDP Routing→Press Inspct to view current patterns in use→Back→Dial the number of the pattern that you want to review→Enter→Press Inspct to view the current routing for the pattern→Back→Back→Back→Back

Call to a Non-Local Extension: Unexpected Busy Tone

This topic discusses unexpected busy tones that may be caused by system features. It applies not only to regular calls from one private network extension to another but also to remote access calls that are routed among private network systems. Call to Non-Local Extension: Silence or Fast Busy Tone outlines possible causes for a busy tone that relate either to system programming of facilities or to call routing.

As a first step, the caller should try using Callback. All available local routes for the call may be busy, and Automatic or Selective Callback allows the call to queue for the next available tandem trunk assigned to the Route 1 pool.

If a user is having trouble with the Callback feature, see [“Callback Does Not Work”](#) on page 5-24.

If the wait time for an available local trunk is unacceptable, you may be able to change the local extension or barrier code FRL and/or route FRLs for the UDP pattern in order to make more routes available for the call.

If you want to make changes in FRLs for routes, speak with the coordinating system manager for your private network and consult the following resources:

- “How Facility Restrictions Levels Work in a Network” in Chapter 4 of *Network Reference* discusses FRL planning in detail.
- To change a UDP route FRL, see “Uniform Dial Plan Routing” in Chapter 5 of the *Network Reference*.
- To change the extension FRL, see “Programming Procedures” in the Automatic Selection feature in *Feature Reference*.
- To change the FRL assigned to a remote access barrier code, see “Remote Access” in *Feature Reference*. Follow the guidelines in “Remote Access Default Class-of-Restriction Settings” in Chapter 4 of *Network Reference*.



SECURITY ALERT:

FRLs, applied to ARS and UDP routes, default class-of-restrictions (COR) for all tie and/or all non-tie tandem trunks, extensions, and remote access barrier codes are particularly important for maintaining security in a private network. Before changing FRLs in your system, check with the coordinating system manager, who should understand the security implications for your local system and for the private network as a whole.

Changing local FRLs may not work simply because the problem is not on the local system. In this case, see [“Call to Non-Local Extension: Silence or Fast Busy Tone”](#) on page 5-13.

Call to Non-Local Extension: Silence or Fast Busy Tone

The following are likely circumstances in which silence occurs when a call is attempted:

- A selected tie or analog facility between the caller or called extension is out of service. If your system is linked by tandem tie trunks and silence occurs, call the other system on a PSTN line/trunk in order to determine whether a tie trunk is out of service. If it is not, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.
- No Touch-Tone Receivers (TTRs) available at a remote system when using tie trunks. This can be verified by checking for the 0C03 error on the error log on the remote switches. If this error persists, contact your local service representative.

A fast busy tone can have one of several causes. Before investigating further, check the following possibilities:

- A technician may be performing maintenance on local tandem trunks or non-local tandem trunks included in the routes for the call.
- A power failure may have occurred at the destination system or at another private networked system whose tandem trunks are included in routes for the call.
- Some of the problems described in this section can occur when a system manager makes a change in a private networked system's local dial plan, non-local dial plan, switch identifier, or DS1 Switch Type setting. Ensure that your private network system forms are kept up-to-date and that changes are cleared with the coordinating system manager.

Possible Cause 1: All programmed available routes for the call are busy.

What to do: Note the extension number range(s) being called. Check that the pattern assigned to the range includes routes that include pools that have a sufficient number of trunks to handle the call volume.

- If you're not sure of the pattern number being used to route calls in your local system, see [“Reviewing the Non-Local Dial Plan and Routing”](#) on page 5-11.
- To add different routes that can handle the call, consult the coordinating system manager and see “Uniform Dial Plan Routing” in Chapter 5 of *Network Reference*.
- If you do not have enough tandem trunks to handle intersystem calls, consider assigning pools of PSTN trunks to less preferred routes (4 or 3 and 4, for example). If you program such routes and they involve higher toll costs than routes that specify tandem facilities, you may need to adjust extension and route FRLs in order to restrict access to them. Be sure that you discuss any changes with the coordinating system manager.

- If the routing is correct and enough routes are included in the pattern, but the problem persists, check if PRI lines are used. If they are, check the error log for D-channel inoperative and loss of signal alarms indicating lines are inoperative. If the D-channel inoperative alarm has occurred, check the CSU/DSU associated with the line for correct programming. If the loss of signal alarm has occurred, check for open cables, etc. If these conditions are not present, go to Possible Cause 3.

Possible Cause 2: Callback Queuing is not used.

What to Do: All available local routes for the call may be busy, and Automatic or Selective Callback allows the call to queue for the next available tandem trunk assigned to the Route 1 pool. As a first step, the caller should try using Callback.

If a user is having trouble with the Callback feature, see [“Callback Does Not Work”](#) on page 5-24.
[programmers: make link]

Possible Cause 3: Not enough trunks are assigned to the pools for UDP routes.

What to Do: Consult System Form 2c, System Numbering: Line/Trunk Jacks to determine the assignments. To see a report of pool assignments, select the Print option on the System Programming menu and then choose Trunk Info and General.

- If more trunks are available and need to be assigned, follow the procedure in the System Programming section of the Pools feature in the *Feature Reference* to assign more tandem trunks. All the tandem trunks in a pool must be of the same type (tie or PRI).
- If not enough trunks are available, consider adding more to your system.
- If there are sufficient trunks assigned but the problem persists, go to Possible Cause 4.

Possible Cause 4: Facilities are available but restricted and the caller is not able to access them.

What to Do: Verify that the extension's FRL is higher than or equal to the UDP route FRL.

If you want to make changes in FRLs for routes, speak with the coordinating system manager for your private network and consult the following resources:

- “How Facility Restrictions Levels Work in a Network” in Chapter 4 of *Network Reference* discusses FRL planning in detail.
- To change a UDP route FRL, see “Uniform Dial Plan Routing” in Chapter 5 of *Network Reference*.
- To change the extension FRL, see *System Programming*, Chapter 3, “Programming Procedures.”
- To change the FRL assigned to a remote access barrier code, see “Remote Access” in *Feature Reference*. Follow the guidelines in “Remote Access Default Class-of-Restriction Settings” in Chapter 4 of *Network Reference*.

 SECURITY ALERT:

FRLs, applied to ARS and UDP routes, default CORs for all tie and/or all non-tie tandem trunks, extensions, and remote access barrier codes are particularly important for maintaining security in a private network. Before changing FRLs in your system, check with the coordinating system manager, who should understand the security implications for your local system and for the private network as a whole.

Changing local FRLs may not work simply because the problem is not on the local system. In this case, go to Possible Cause 5.

Possible Cause 5: The FRL for the default COR for non-tie trunks (PRI) on the remote system may be blocking tandem calls. The private network is an all-PRI network.

What to Do: Check with the coordinating system manager so that he or she can determine where the problem exists. This may involve more than one system, depending upon how your private network is set up. For example, a call might be routed across the private network in a fashion such as this:

Origin System A→System B→System C→Destination System D

In this configuration, the coordinating system manager must check routes and default COR attributes for Systems B and C.

- Check to make sure the calling restriction of the default COR is set to unrestricted. The factory setting is outward restricted, which blocks calls across the private network.
- Check that the routes voice/data capability is correct for the type of call being made. The factory setting is Both, which will support both voice and data calls.
- In each intervening system, compare the FRLs assigned to routes for the call with the default COR FRL. The route FRL must be equal to or lower than the default COR value or the call is blocked. The factory setting is 3.
- If FRL settings are not the cause, go to Possible Cause 6.

Possible Cause 6: There may be a numbering conflict in the switch identifiers for the trunks that carry the call. Within a private network, switch identifiers should be unique and unambiguous. If they are not, calls may terminate prematurely or continue to route unexpectedly.

What to Do: The coordinating system manager must check system planning Form Non-Local UDP Administration Form in the Installation Specification and review the switch identifiers for all systems over which calls travel to reach the destination extension(s). To review a report including the switch identifiers programmed on your local system, select the Print option on the System Programming menu and then choose Trunk Info and General.

- If the switch identifiers are not correct, the coordinating system manager must see that a change is made at one or more non-local systems where the conflict exists. To change the current switch identifiers at your local system, see “Switch Identifiers” in Chapter 5 of *Network Reference*.

- If the switch identifiers are correct and the problem persists, do one of the following:
 - If the call is being routed over any tandem PRI facilities, go to Possible Cause 7.
 - If the call is being routed over tandem tie trunks only, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Possible Cause 7: The Switch Type setting at both ends of a tandem PRI facility may match.

What to Do: The coordinating system manager must check the programmed Switch Type settings at private networked systems. Calls are not routed properly unless the Switch Type setting is correctly programmed at the systems on both ends of any tandem PRI facilities on the call route. If only MERLIN MAGIX systems are included in the routing, the switch type settings on the systems must be different. For example, if System A is connected to System B by tandem PRI trunks, System A can be set to a switch type of MAGIX-PBX and System B can be set to MAGIX-Ntwk. It does not matter which system is assigned the PBX or Network switch type as long as the switch types are different.

If a DEFINITY ECS or DEFINITY ProLogix Solutions system has its Interface field set to Network, any MERLIN MAGIX systems connected to it by tandem PRI trunks must specify MAGIX-Ntwk. If the Interface field specifies User, the MERLIN MAGIX system facilities must be programmed with the MAGIX-PBX setting.

If the call is routed over a tandem PRI facility connected to your system, ensure that the system at the other end of the facility is programmed correctly to work with your own setting. Run the PRI Tandem Trunk Mode Demand Test by using the following procedure:

Procedure

Menu→Maintenance→Enter slot no (00–17)→Enter→ or More→PriSwTypTst
→Back →Back→Back

- **Test Passed** appears If the MERLIN MAGIX system at the other end of the PRI tandem trunk is programmed in the opposite mode, the screen below appears.
- **Test Failed** appears if the MERLIN MAGIX system at the other end of the PRI tandem trunk is programmed in the same mode, or does not respond within the timeout, the screen below appears.
- If the system at the other end does not respond, the 100D module at the other end may not be programmed for PRI, or the system at the other end of the PRI circuit may not be a MERLIN MAGIX system.

If the call is carried over other systems connected by tandem PRI facilities, the coordinating system manager must ensure that the settings are correct, as in this example of MERLIN MAGIX systems:

System A LEGEND-PBX→System B LEGEND-Ntwk→System C LEGEND-PBX

If you want more information about the Switch Type setting, consult the system Non-Local UDP Administration Form in the Installation Specification. To see a report including the switch type programmed for PRI facilities on your system, select the **Print** option on the System Programming menu, and then choose **PRI Info**. See “PRI Facilities Switch Type” in Chapter 5 of the *Network Reference* for instructions on changing the switch type programmed at your system.

If the switch type settings are correct and problem persists, do one of the following:

- If the call is a data call, go to Possible Cause 8.
- If the call is not a data call, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Possible Cause 8: The FRL for the default COR for tie trunks (T1-emulated voice or data, or analog) on the remote system may be blocking tandem calls. The private network includes at least one analog tie trunk.

What to Do: Check with the coordinating system manager so that he or she can determine where the problem exists. This may involve more than one system, depending upon how your private network is set up. For example, a call might be routed across the private network in a fashion such as this:

Origin System A→System B→System C→Destination System D

In this configuration, the coordinating system manager must check routes and default COR attributes for Systems B and C.

- Check to make sure the calling restriction of the default COR is set to unrestricted. The factory setting is outward restricted, which blocks calls across the private network.
- Check that the routes voice/data capability is correct for the type of call being made. The factory setting is Both, which will support both voice and data calls.
 - In each intervening system, compare the FRLs assigned to routes for the call with the default COR FRL. The route FRL must be equal to or lower than the default COR value or the call is blocked. The factory setting is 3.
 - If FRL settings are not the cause, go to Possible Cause 9.

Possible Cause 9: If the call is a 64-kbps data call, all routing facilities may not support this data speed.

What to Do: Unless you are directly connected to the destination system, the coordinating system manager must check the routes for the call. To check the local routes, see *Reviewing the Non-Local Dial Plan and Routing*. To change the routing in order to specify facilities that can handle the call, see “Uniform Dial Plan Routing” in Chapter 5 of *Network Reference*.

If the call is routed over any analog facilities (tie or loop-start, for example), T1-emulated voice or data facilities, it cannot go through. If the call is routed over PRI and/or BRI facilities, a speed of 64 kbps may be possible. If this is not the cause of the problem, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Possible Cause 10: Switch B has more B-channels than Switch A. When Switch B calls Switch A, it is trying to establish contact on a higher number B-channel than Switch A has. Therefore, Switch B receives the fast busy tone.

What to Do: Remove the extra B-channel from Switch B so that Switch B has the same number of B-channels as Switch A.

Call to Non-Local Extension: Warble Tone (Error Tone)

There are several reasons why a call to a non-local extension receives warble tone. The first two possibilities are easy to check, because they all derive from the local system. The third possible cause only occurs when there are tandem PRI facilities included in the route for the call.

Possible Cause 1: The extension number is omitted from the non-local dial plan.

What to do: Check your system's non-local dial plan to see whether the destination extension number is included in a programmed extension range. If it is not, you have solved the problem. If it is included, check all tandem switches to ensure that the extension is in their non-local dial plans. To add the extension to the non-local dial plan, consult the coordinating system manager and see *Reviewing the Non-Local Dial Plan Numbering or System Renumbering* in the *Feature Reference*. If it is included in all programmed extension ranges, proceed to Possible Cause 2.

Possible Cause 2: The remote system rejects the dialed number on an all PRI network route.

What to do: Check that the number that arrived is in the non-local dial plan. If the number is in the non-local dial plan, verify that it is a valid extension number for a station, adjunct, calling group, Listed Directory Number (LDN), Remote Access, Dial 0, or ARS.

Possible Cause 3: The pattern does not have pools assigned to any routes.

What to do: Verify that the correct pattern is assigned to the range. If the pattern is correct, assign the pools to the routes.

Possible Cause 4: The FRL assigned to the extension may not permit the call on any of the routes included in the pattern for the call.

What to do: Look at the system form for the caller's extension. Depending on the type of extension (TDL, MLX, digital or analog data, operator, and so on) the extension form varies. You can see a report that lists all extension FRLs by choosing the *Print* option on the *System Programming* menu, then selecting *Ext Direct*. You can see programmed route FRLs by choosing *Non-Lc1 UDP* from the same menu.

For the call to go through, the extension FRL must be equal to or greater than at least one of the route FRLs for the pattern that is programmed to reach the destination extension range.

- If it is appropriate to change the extension FRL, see "ARS Restriction Levels for Extensions" in the *Automatic Route Selection* feature in the *Feature Reference*.

- If you change one or more route FRLs, the modification may restrict or unrestrict calling from some private network extensions. Be sure to clear any changes with the coordinating system manager for the private network. If you decide to make this change, see “Uniform Dial Plan Routing” in Chapter 5 of the *Network Reference*. For details about FRLs in private networks, see “Facility Restriction Levels and Remote Access” in Chapter 4 of the *Network Reference*.
- If a local extension or route FRL is not the problem, the coordinating system manager must determine the private network route for the call once it leaves your local system. If there is an intervening system between yours and the destination, proceed to Possible Cause 5.
- If there is no intervening system between yours and the destination, go to Possible Cause 5.

Possible Cause 5: The FRL for the default COR for non-tie trunks (PRI) on the remote system may be blocking tandem calls. The private network is an all PRI network.

What to Do: Check with the coordinating system manager so that he or she can determine where the problem exists. This may involve more than one system, depending upon how your private network is set up. For example, a call might be routed across the private network in a fashion such as this:

Origin System A→System B→System C→Destination System D

In this configuration, the coordinating system manager must check routes and default COR attributes for Systems B and C.

- Check to make sure the calling restriction of the default COR is set to unrestricted. The factory setting is outward restricted, which blocks calls across the private network.
- Check that the routes voice/data capability is correct for the type of call being made. The factory setting is Both, which will support both voice and data calls.
- In each intervening system, compare the FRLs assigned to routes for the call with the default COR FRL. The route FRL must be equal to or lower than the default COR value or the call is blocked. The factory setting is 3.
- If FRL settings are not the cause, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Calls to Non-Local Extensions: Unexpected Busy Tone

This topic discusses unexpected busy tones that may be caused by system features. It applies not only to regular calls from one private network extension to another but also to remote access calls that are routed among private network systems.

Possible Cause: Intersystem callers may receive a busy tone that is unexpected because they know that the call recipient has coverage. However, in a private network non-local calls are treated as outside calls by the system. The non-local extension may not have coverage for outside calls turned on.

What to Do: Depending upon how the non-local system is set up, try one of the following techniques in order to reach the extension:

- If the destination extension can be dialed directly via Direct Inward Dialing (DID) or PRI dial-plan routing, try calling the destination extension over public switched telephone network tandem trunks. If you receive the same busy tone, then the Coverage setting may be the problem. Call the system manager or receptionist at the non-local system and have them check the extension to ensure that coverage is correct and that the extension is functional.
- If you cannot dial the extension directly, use public switched telephone network facilities or the non-local dial plan in order to reach the operator for the non-local system. Have the operator transfer you to the extension. You should be able to leave a message for the extension user with voice mail or with the operator.

If neither of the above methods solves the problem, call the non-local system's system manager or the private network coordinating system manager and explain the situation.

Call to Non-Local Extension Reaches Wrong Extension

Possible Cause: If a call to a non-local extension connects to the wrong extension, one or more non-local dial plan extension ranges and/or routes may be incorrectly programmed. Non-local dial plan numbers must be unique and unambiguous or calls can be misrouted. Furthermore, digit absorption and prepending for the routes must be programmed correctly.

What to Do: First, review the local routing for the call. See [“Reviewing the Non-Local Dial Plan and Routing”](#) on page 5-11. Then follow the steps below.

1. At your local system, ensure that routing for the destination extension specifies pools of trunks connecting to the correct adjacent system (if there is more than one). If digit prepending or absorption is needed, make sure that it is correctly programmed. If you find an error, you have solved the problem. If not, proceed to Step 2.
2. If you are directly connected to the system where the destination extension is located, go to Step 3. Otherwise, the coordinating system manager should repeat Step 1 for each system through which the call is routed until you reach the system where the destination extension is located.
3. Check with the system manager at the destination system or with the coordinating system manager to ensure that the extension number is in the local dial plan for that system.

NOTE ► The system does not permit programming of non-local extension ranges that conflict with extension numbers included in the local or non-local dial plan. However, conflicts can still arise due to digit prepending or absorption as a call is routed across the private network.

If this is not the problem, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Call to Non-Local Extension: Message from CO

Possible Cause: If someone calls a non-local extension and connects to a central office message announcing a misdialled number or some other problem, the call is routed over a PSTN trunk (PSTN facility pools rather than tandem trunk pools are sometimes assigned to secondary UDP routes such as Routes 3 or 4). Problems can occur when the programming for a PSTN route does not at least prepend the correct digits (as in 555, for a local access call, or 1555 for a toll access call prefixed before a 4-digit extension number) and possibly absorb digits as well, in order for the call to be directed properly.

What to Do: Check the UDP range for the pattern to which the dialed extension is assigned. See *Reviewing the Non-Local Dial Plan and Routing*.

If there is no error in the local programming and there is an intervening system between yours and the system where the destination extension is located, speak with the coordinating system manager. The coordinating system manager should check the intervening system's UDP tables for proper digit manipulation. He or she can determine whether the routing problem is on that system.

If this is not the problem, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Transfer to Non-Local Extension Not Completed

There are several possible causes for an incomplete transfer. They are very easy to check.

- **Voice-Announced Transfer.** Voice-announced transfers cannot be made to non-local extensions.
- **Transfer from PassageWay Telephony Services Client.** Transfers with consultation cannot be made from PassageWay Telephony Services clients to non-local extensions. The user must make such a transfer by using a telephone.

NOTE ► PassageWay Telephony Services clients cannot use an application to transfer calls across the private network. The user must make transfers manually using a telephone. If the transfer recipient is a PassageWay Telephony Services client, only the transfer originator calling information is delivered to the extension, not information about the original caller.

- **PSTN Trunk Transfer.** The system permits trunk-to-trunk transfers of inside or outside calls to non-local extensions, regardless of whether system programming has prohibited trunk-to-trunk transfer. However, trunk-to-trunk transfer does not work under the following circumstances:
 - Trunk-to-trunk transfer is prohibited at the transferring extension and the call is an outside call being transferred to a local PSTN line/trunk.
 - The transfer originator is attempting to transfer an outside PSTN or private network call to or from a loop-start line that does not have reliable disconnect. All loop-start lines connected to private networked systems must have reliable disconnect.

If the problem persists, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Transfer Call to Non-Local Extension Does Not Return

Possible Cause: If a transfer to a non-local extension cannot be completed (due to the extension being busy, for example), it only returns when the call is routed over tandem PRI facilities, not tandem tie trunks or the PSTN trunks that may be used for less preferred routes.

What to Do: Review the routing for the call. See *Reviewing the Non-Local Dial Plan and Routing* and check with the coordinating system manager if necessary. If the call is routed over any tandem tie trunks or over any PSTN facilities, you have solved the problem.

If the call is routed only over tandem PRI facilities, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Conference: Cannot Add Call

Non-local extensions are treated as outside parties for the purpose of transfer. A non-local conference participant takes up one of the two outside calls permitted in a conference.

NOTE ► A PassageWay Telephony Services client cannot add a non-local extension to a conference. The user must add the conferee by using a telephone. If a conferee is dropped, the PassageWay Telephony Services client display does not so indicate. A PassageWay Telephony Services client, when added to a conference, only sees information about the conference originator, not about other conferees.

If this is not the problem, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

DID Calls Not Completed

There are several reasons why Direct Inward Dialing (DID) calls across a private network may not complete, either due to busy facilities or to faulty programming. The coordinating system manager may need to address the problem.

Possible Cause 1: All programmed and available routes for the call are busy.

What to do: This problem solves itself when traffic decreases. Only address the problem if it persists.

Note the extension number range for the DID destination. At the system where the call is received from the PSTN, check that the pattern assigned to the range includes sufficient different routes with pools (of tandem and/or PSTN facilities) to handle the call volume. This is accomplished by checking the error for errors 4C01 (Pool Empty), 4C02 (Pool Busy), or 4C03 (Pool Busy and/or Out-of-Service). If any of these error codes are present, check the pool index on the maintenance screen to determine if it matches the pool used to deliver the call. If it matches, check occurrence times and count. If the count is too high and the occurrences indicate the problem occurred within

the duration of the occurrences, consider changing the routing of the call, pool sizes, or add trunks to the pool if empty.

- To add more routes that can handle the call, see “Uniform Dial Plan Routing” in Chapter 5 of *Network Reference*.
- If more trunks are available and need to be assigned, follow the procedure in “Trunks to Pools Assignment” in the Pools feature in the *Feature Reference* to assign more tandem trunks. All the tandem trunks in a pool must be of the same type (tie or PRI).
- If not enough trunks are available, consider adding more to the system.
- If there are sufficient trunks assigned and the problem persists, the cause of the problem may be at an intervening system between the one where the calls are received from the PSTN and the destination. Go to Possible Cause 2.
- If there are sufficient trunks and routes and there are no intervening systems between the one where the calls are received from the PSTN and the destination, contact the provider of the DID service. If this does not solve the problem, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Possible Cause 2: The FRL for the default COR for all tie (T-1 emulated voice or data, or analog) or non-tie trunks (PRI) on the remote system may be blocking tandem calls.

What to Do: Check with the coordinating system manager so that he or she can determine where the problem exists. This may involve more than one system, depending upon how your private network is set up. For example, a call might be routed across the private network in a fashion such as this:

Origin System A→System B→System C→Destination System D

In this configuration, the coordinating system manager must check routes and default COR attributes for Systems B and C.

- Check to make sure the calling restriction of the default COR is set to unrestricted. The factory setting is outward restricted, which blocks calls across the private network.
- Check that the routes voice/data capability is correct for the type of call being made. The factory setting is Both, which will support both voice and data calls.
- In each intervening system, compare the FRLs assigned to routes for the call with the default COR FRL. The route FRL must be equal to or lower than the default COR value or the call is blocked. The factory setting is 3.
- If FRL settings are not the cause, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

ARS Calls Are Blocked

Check Possible Cause 2 listed in “DID Calls Not Completed” of the previous section. When an ARS call is routed across the private network, it can be intercepted because the default COR FRL at a private networked system is lower than the ARS route (or the UDP route if the system is sending the call to another private networked system).

If this is not the cause, check the Disallowed List entries applied to default COR settings at systems where the call is routed either to the PSTN or to another system in the private network. Compare the entries to the dialed digits; a Disallowed List may be blocking the call. If it is necessary to change the Disallowed List, see “Revising Allowed and Disallowed Lists” under “Managing Lines and Telephones” in the *System Manager’s Quick Reference*. Check the ARS programming to verify that the remote machine’s ARS code is being prepended. Verify that switch identifiers have been assigned to all private network tandem trunks.

If this does not solve the problem, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Callback Does Not Work

Callback allows queueing for an available line/trunk connected to the local system. If a user attempts an ARS- or UDP-routed call and hears a busy signal or warble tone, the signal may be derived from a non-local system’s tandem or PSTN facilities. If this is the case, Callback does not work. When all available routes on the local system are busy, a caller can use Callback to wait for an available facility in the Route 1 pool.

Private Network Call Transmission Level (Volume) Too Low or Too High

When transmission levels are too high or too low, the coordinating system manager must investigate the cause.

Possible Cause 1: Switch identifiers programmed incorrectly.

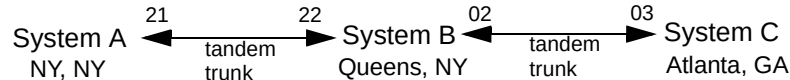
What to Do: Refer to the table below as you examine the problem. It lists the rules for programming switch identifiers. At each system in a private network, each tandem trunk is programmed (individually or as part of a block of trunks) to indicate the type of system connected to the other end of the trunk as well as the distance between the connected systems.

- 1–20 = trunk connected to a MERLIN MAGIX system that is more than 200 miles away
- 21–40 = trunk connected to a MERLIN MAGIX system that is within 200 miles
- 41–50 = trunk connected to a system that is not a MERLIN MAGIX system (for example, a DEFINITY ECS communications system) and is more than 200 miles away
- 51–60 = trunk connected to a system that is not a MERLIN MAGIX system (for example, a DEFINITY ProLogix Solutions communications system) and is within 200 miles

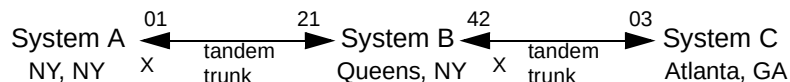
NOTE ► DEFINITY ECS and DEFINITY ProLogix Solutions systems are beyond the scope of this guide. For information about how these systems identify tandem facilities, see the documentation for the applicable system.

Follow the steps below to check on the problem.

1. Check the routing for the call, and identify each system where the call is routed, including the system where the call originated or was received from the public switched telephone network. See *Reviewing the Non-Local Dial Plan and Routing*.
2. As necessary, note the switch identifier programmed on each system for the trunks that carry the calls. To review a report including the switch identifiers programmed on a system, select the **Print** option on the System Programming menu and then choose **Trunk Info** and **General**.
3. Look for switch identifiers that incorrectly specify the distance between systems or that specify the incorrect type of system. The diagram below shows how switch identifiers might be programmed at either end of tandem trunks in a hypothetical private network. A switch identifier is programmed to identify the system at the *opposite* end of the tandem trunk. In the example, all three switches are MERLIN MAGIX systems. On the facility that links Systems A and B, the system managers program identifiers to indicate that they are within 200 miles of one another. Next to the name of each system, is the switch identifier associated with that switch. The switch is programmed on the switches on the other end of the tandem trunk. Systems B and C are linked by trunks whose identifiers indicate distant systems.



The example below shows programming that would be incorrect in the same private network. The link between Systems A and B has mismatched identifiers, because System B specifies that System A is more than 200 miles away. System C incorrectly specifies System B as a non-MERLIN MAGIX system.



4. If any of the programming is incorrect, one or more system managers must correct it. The coordinating system manager must clear any changes. To change the switch identifiers at your local system, see the UDP feature in the *Feature Reference*. If the programming appears to be correct, skip to Step 6.
5. Make some test calls across the private network. If calls are at the proper levels, the problem is solved. If transmission levels are still incorrect, proceed to Step 6.
6. If the identifiers appear correct but the distance between systems is between 180 and 220 miles, you may need to experiment with switch identifiers in order to achieve the correct transmission levels. Return to Step 4.

If changing one or more switch identifiers do not solve the problem, see Possible Cause 2.

Possible Cause 2: More than three analog spans are involved in the call.

What to Do: This may occur when calls are transferred or forwarded multiple times across analog facilities. Consider changing to digital facilities if this situation occurs frequently. Contact your Avaya representative or local authorized dealer for instructions.

If the problem is not solved with the above instructions, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

MLX Displays: Private Network Call Display Problems

There are several possible causes for this problem, all of them easy to check.

Possible Cause 1: Non-local extension calls and outside calls routed on tandem tie trunks display at recipient MLX display telephones as outside calls, for example, TIE - TRK.

What to Do: Check the call routing and find out whether any tandem tie trunks are included in the route. You may need to contact the coordinating system manager. If the call originated from the PSTN on a PRI or BRI facility with Automatic Number Identification (ANI), the original calling party information displays when private network routing is over tandem PRI trunks only. Check the call routing and see whether any tandem tie trunks are included in the route.

Possible Cause 2: Call transferred to the extension.

What to Do: If the call was transferred to the extension, only the transfer originator information displays, not the name and/or number of the original caller, even if PRI ANI was available for the original call.

Possible Cause 3: Display Preference setting for MLX incorrect

What to Do: If the call route for an intersystem call includes only tandem PRI trunks and the call was not transferred, the Display Preference setting for the MLX display telephone extension may not be programmed as you expect. The factory setting displays the caller's extension number. Check System Planning Form, MLX Telephones, for the recipient extension or see "Display Preferences for Intersystem Calls" in Chapter 5 of *Network Reference* to check the setting through system programming. If you see the word "Ext" in the display, change the programming to Both.

You can see a report for the extension, showing the display preference, by choosing the Print option on the System Programming menu, then selecting Ext Info and entering the extension number. If the display shows a 10-digit ANI as PRI - TRK Ext 9089575555, you may want to change the display option from Name to Both and then the display would look like PRI - TRK 9089575555.

Possible Cause 4: Transfer completed too quickly.

What to Do: Callers must wait at least two seconds before completing transfers.

If none of these factors caused the problem, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

PassageWay Call Display Problems

In private networks, calls to and from PassageWay Telephony services clients may not display or initiate screen pop as expected. The operation varies according to the application, according to the following rules:

- For an outgoing call, if the PassageWay Telephony Services application uses the length of a destination telephone number to differentiate PSTN calls from UDP calls, a PassageWay Telephony Services client displays a non-local extension call in the same way as it does inside calls.
- For an outgoing call, if the PassageWay Telephony Services application uses receipt of the *Network Reached* event to differentiate PSTN calls from inside calls, a PassageWay Telephony Services client displays a non-local extension call or other UDP-routed call in the same way as it does an outside call made to the public switched telephone network.
- For an incoming call, if the PassageWay Telephony Services application uses the length of ANI information to differentiate PSTN calls from UDP calls, a PassageWay Telephony Services client displays a non-local dial plan call as an inside call.
- For an incoming call, if the PassageWay Telephony Services application uses the presence of a trunk identifier in the *delivered event* to differentiate PSTN calls from UDP calls, a PassageWay Telephony Services client displays a non-local dial plan call in the same way it does a PSTN call.
- For an incoming PSTN call that enters the private network on a PRI trunk with an ANI of length shorter than seven digits and crosses PRI tandem trunks only, the recipient PassageWay Telephony Services client display depends on the PassageWay Telephony Services application implementation.

If none of these factors explain the problem, contact the application provider. If the application provider instructs you to do so, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

ARS Calls Go to System Operator (Unassigned Extension)

Possible Cause: System managers in your private network may have set up ARS and remote access to route outgoing calls to PSTN facilities on switches where these calls are most economical.

What to Do: If such calls are reaching a system operator (unassigned extension) on a private networked system, rather than being routed to the PSTN, the coordinating system manager must check the tandem facilities that carry calls to the system where the operator is located. The problem is caused when one or more tandem trunks has no switch identifier (the factory setting).

If this is not the problem, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

DID or PRI Dial-Plan Routed Calls Not Completed

There are two possible causes for this occurring

Possible Cause 1: DID and PRI calls cannot be routed to a 5-digit DEFINITY ECS or DEFINITY ProLogix Solutions system.

What to Do: Verify system programming and the digits received from the PSTN. Refer to “Non-Local Dial Plan Number” in Chapter 5 of the *Network Reference* for details on programming required.

Possible Cause 2: DID or PRI routing not correct.

What to Do: The coordinating system manager should check the DID or PRI routing. These calls may come into one private networked switch and be routed across the private network to an extension on another system in the private network. The routing must specify the correct tandem trunk pools, extension numbers, and digit manipulation.

If the routing is correct, contact the service provider. If the service provider instructs you to do so, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Excessive Line Noise on Voice and Data Calls

Possible Cause: Clocks are not properly synchronized.

What to Do: The coordinating system manager should check error logs at problem systems. If slips are occurring at a high rate or an alarm was raised, clock synchronization is a problem. The coordinating system manager should then check the programming for the PRI tandem trunk(s) and/or PSTN digital facilities that carry the calls. A single clock source is used for all private networked systems so that calls are properly synchronized. For details about clock synchronization in a private network, see “Clock Synchronization” in Chapter 5 of the *Network Reference*.

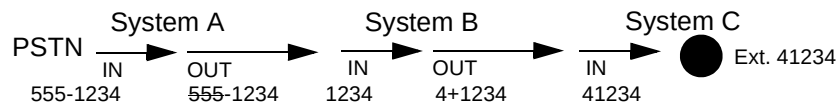
If the clock source is correct, ensure that the specified port is functioning properly and has an in-service facility connected to it.

If this does not solve or explain the problem, call the Technical Support Organization at 1 800 628-2888; consultation charges may apply.

Station Message Detail Recording (SMDR) Reports

Do Not Include Calls across the Private Network

SMDR reports may report calls using more than one call record on more than one system. Depending upon how SMDR is programmed and how calls are routed, you may need to consult several SMDR records to trace a call that is routed over private network tandem trunks. To log private network calls, SMDR should be programmed to report both incoming and outgoing calls.



The diagram above shows how a single call, routed across a private network, is both an incoming and an outgoing call in the same system. For private network calls, outgoing call records report the incoming tandem trunk number in the STN. field (see System B above). Dialed digits shown on the report do not reflect any digit manipulation (addition or absorption) performed by the local system.

Calls across the private network are not recorded, even at a tandem switch, if the call is not answered unless the outgoing facility is a loop-start or ground-start trunk. Then calls are logged, even unanswered calls.

If the system date and time are not synchronized across the private network, it may be hard to recognize the records for a single call, even when the systems are in the same time zone. When they are not, time zone differences must also be considered.

T1 to PRI Conversion Fails

T1 to PRI conversion sometimes fails. Here is a typical scenario. The hub system in a private network has two 100D modules configured as tandem PRI. The 100D module in Slot 5 used B-channel group 80, and the 100D module in Slot 10 used B-channel group 79. Then the 100D module in Slot 5 was reconfigured for T1, and the translations were backed up.

Whenever the 100D module in Slot 5 needs to be converted back to PRI, follow these steps to populate a B-channel group:

1. Move a B-channel from group 79 to 80.
2. Select PRI for Slot 5.
3. Change the switch type to something other than MAGIX-PBX or MAGIX-Ntwk.
4. Change the switch type back to MAGIX-PBX or MAGIX-Ntwk.

The B-channel group 78 will be occupied.

PRI B-Channel Alarms are Not Dropped

When a B-channel that has been assigned to a PRI B-channel group is removed from the group, the alarms on that B-channel are not automatically dropped. This causes the system to track alarms on facilities that are not in service. It also renders the channel useless when you try to reassign the B-channel.

In addition, even when you manually drop the PRI SVC AUDIT TIMEOUT alarm from the permanent alarm table, it reappears 15 minutes later after it tries to remove alarms from the B-channel.

To remove alarms from a B-channel that has been taken out of a PRI B-channel group, follow these steps:

1. Manually drop the alarm or alarms.
2. Immediately back up the programming.
3. Verify that the alarm or alarms dropped in Step 1 has not been re-logged. If the alarm or alarms has been re-logged, return to Step 1 and follow the procedure.
4. Frigid-start the MERLIN MAGIX System.
5. Restore the backed-up programming.

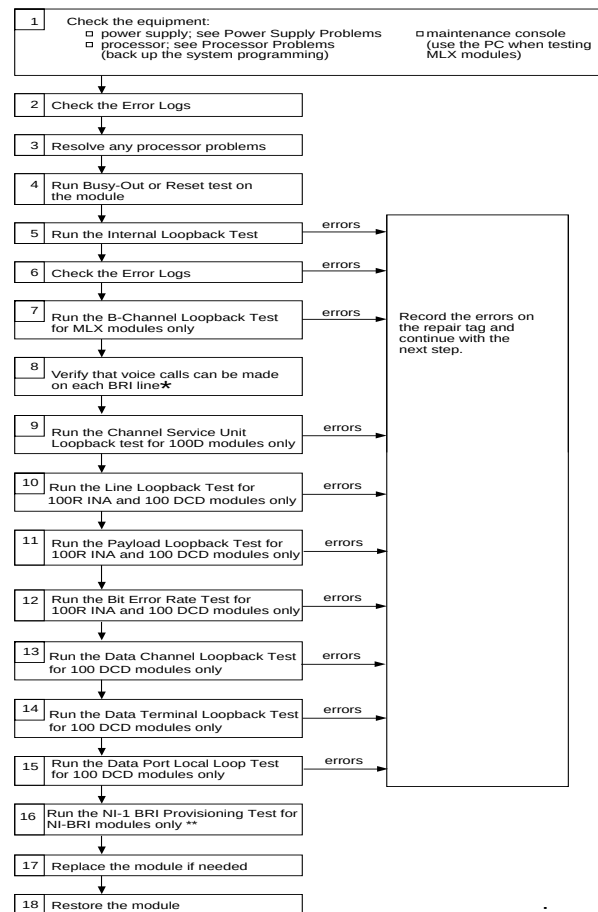
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This section provides the module tests.

Module Test Process

This flow chart illustrates the recommended approach to testing modules. Review flow chart as well as Considerations before you begin a module test.



* If any problem arises with the voice call on an NI-BRI module, run the NI-BRI Provisioning Test next. While the BRI test is running, you can run the voice test on the next module.

** Run the NI-BRI Provisioning Test on any NI-BRI module that is going to be used for data calls or that had a problem with voice calls and was not previously tested with the tool.

Figure 6-1. Module Test Process

Considerations

- Before running a module test, make sure the following system components are working:
 - Power supply
 - Processor
 - Maintenance Console (4424LD+ or MLX-20L console)
- Before running a module test, backup system programming to a floppy disk or memory card. See “Backup” in the Programming Basics section of this guide to backup to floppy disk, or Appendix D, Backing up with a Memory Card to backup to a memory card.
- To run tests on the TDL module connected to the 4424LD+ console, or on the MLX module connected to the MLX-20L console, you must run the test from the PC, not from the console.
- 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.
- 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`.
- 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 MERLIN MAGIX Releases 1.0 or 1.1. An 008 MLX module *must* be used to provide extension jacks with Releases 1.0 or 1.1.

- If any of the module tests fail and replacing the module does not clear the trouble, then either several modules may be faulty or 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; use this procedure:
Menu→Maintenance→Slot→Status

NOTE ► The status screen cannot be used to check the router portion of the 100R INA and 100 DCD modules. You must use 100R INA and 100 DCD management interfaces to determine the status of the router. For information on the Router Management interface, refer to the documentation packaged with the 100R INA and 100 DCD modules.

- Once you finish testing a module, you must restore it. Restoring a module terminates the Busy-out or Reset condition.

Busy-Out

Before running any test, be sure to busy-out or reset the module. Busy-out discontinues service to each line/trunk and extension connected to the module being tested only as the line or extension becomes idle. Busy-out is the preferred method, because it does not disrupt calls in progress.

Procedure	Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→Busy-Out→Yes While the module is discontinuing service to the lines/trunks and extensions, a Busy-Out in Progress message is shown on the screen. When the module is successfully busied-out, Busy-Out Complete is displayed.
Appropriate Modules	Any module that you are about to test. In the procedure above, when you select Enter, the following additional options appear, depending on the module: ■ For all MLX modules, BChLoopback is also displayed. ■ For 100D modules, CSU-lpbk, Error Events, and Clock are also displayed. ■ For all 800 NI-BRI modules, Clock, BChLoopback, and Provisioning are also displayed
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. When you Busy-Out the 100R INA or 100 DCD modules, router services are disrupted at the module level during the time the module is busied-out.

Reset

Before running any test, be sure to busy-out or reset the module. 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, a demand test cannot be performed because the module is not busied out. If you reset a module, be sure to check the status of that module before performing a demand test.

NOTE ► Busy-out is the preferred method of discontinuing service to a module, because it does not disrupt calls in progress

Procedure	Menu→Maintenance→Slot→Enter the slot no. (01-17)→ Enter→ Reset→Yes While the module is discontinuing service to the lines/trunks and extensions, a Reset in Progress message is shown on the screen. When the module is successfully reset, Reset Complete is displayed. If the reset fails, Reset FAILED is displayed.
Appropriate Modules	Any module that you are about to test. In the procedure above, when you select Enter, the following additional options appear, depending on the module: ■ For all MLX modules, BChLoopback is also displayed. ■ For 100D modules, CSU-lpbk, Error Events, and Clock are also displayed. ■ For all 800 NI-BRI modules, Clock, BChLoopback, and Provisioning are also displayed. To reset a 100 DCD module, you select each of the two data ports or slots separately. The system indicates if the reset completed successfully or failed. When the 100 DCD module is not installed in the carrier, the maintenance screens do not display the maintenance options to busy-out the data ports.
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.

Restore

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

Procedure	Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→Restore→Yes While the module is restoring service to the lines/trunks and extensions, a Restore in Progress message is shown on the screen. When the module is successfully restored, Restore Complete is displayed. If the restore fails, Restore FAILED Board Mismatch is displayed. In this case, try the restore again and be sure you specified the correct slot.
Appropriate Modules	Any module after testing it. In the procedure above, when you select Enter, the following additional options appear, depending on the module: ■ For all MLX modules, BChLoopback is also displayed. ■ For 100D modules, CSU-lpbk, Error Events, and Clock are also displayed. ■ For all 800 NI-BRI modules, Clock, BChLoopback, and Provisioning are also displayed.
Time Estimate	Less than 1 second. When the 100R INA and 100 DCD modules are restored, router service is restored at the module level.

Internal Loopback Test

This test checks communication between the processor and the module being tested. If you have not read [“Module Test Process”](#) on page 6-1, do so before performing this test.

NOTE ► Remove Music-On-Hold before conducting this test. If Music-On-Hold is assigned to any line/trunk ports on the module you are testing, this test will fail even though the line/trunks are functioning properly.

Procedure	Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→Demand Test→IntLoopback→Test Once or Test Repetitive
Appropriate Modules	In the procedure above, when you select Enter, the following additional options appear, depending on the module: ■ For all MLX modules, BChLoopback is also displayed. ■ For 100D modules, CSU-lpbk, Error Events, and Clock are also displayed. ■ For all 800 NI-BRI modules, Clock, BChLoopback, and Provisioning are also displayed.
Time Estimate	It takes approximately 1.5 minutes to run each test. The 100D 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. See “Busy-Out” on page 6-4 and “Reset” on page 6-5.
Interrupting the Test	You can interrupt the test (both Test Once and Repetitive) by selecting Back.
Test Failure	If the test fails, record the errors on the repair tag and replace the module. Lines 5 and 6 on the failure test results identify the cause of the failure or the number of errors found per port. There are up to 16 ports, numbered 0 through 15. Line 5 displays the results for ports 0 through 7; Line 6 is for ports 8 through 15.
Restore	Restore the module if it successfully completes all module tests and the errors no longer occur. See “Restore” on page 6-6.

Interpreting Internal Loopback Test Results

If the test is successful, the module ports are free from error. 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 6-1 “Internal Loopback Test Errors”](#) and proceed as indicated in the “Corrective Action” column.

Table 6-1. 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 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.

- NOTE** ►
- If Music-On-Hold is assigned to any line/trunk ports on the module you are testing, the test will fail even though the line/trunks are functioning properly. Remove the Music-On-Hold assignment and perform this test again.
 - Be sure to check the second screen if testing a 100D module or a 408 GS/LS-MLX module. Press the **More** button to check the second screen.

Board Controller Test

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

Procedure	Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→Demand Test→BoardCntrlr→Test Once or Test Repetitive
Appropriate Modules	This test can be run on all modules except the processor. In the procedure above, when you select Enter, the following additional options appear, depending on the module: ■ For all MLX modules, BChLoopback is also displayed. ■ For 100D modules, CSU-lpbk, Error Events, and Clock are also displayed. ■ For all 800 NI-BRI modules, Clock, BChLoopback, and Provisioning are also displayed.
Time Estimate	Less than 1 second
Busy-Out or Reset	Busy-out or reset the module being tested prior to beginning the test. See "Busy-Out" on page 6-4 and "Reset" on page 6-5.
Interrupting the Test	You can interrupt the test (Test Once or Repetitive) by selecting Back.
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. See "Restore" on page 6-6.

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 6-2 "Board Controller Test Errors"](#) and proceed as indicated in the "Corrective Action" column.

Table 6-2. 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.

B-Channel Loopback Test

This test verifies that specific communication paths on the MLX or 800 NI-BRI modules are operational. If you have not read [“Module Test Process”](#) on page 6-1, do so before performing this test.

Procedure	Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→BchLoopback
Appropriate Modules	This test can be run only on MLX or 800 NI-BRI modules. In the procedure above, when you select Enter, the following additional options appear, depending on the module: ■ For all MLX modules, BChLoopback is also displayed. ■ For all 800 NI-BRI modules, Clock, BChLoopback, and Provisioning are also displayed.
Time Estimate	Approximately 1.5 minutes.
Busy-Out or Reset	Busy-out or reset the module being tested prior to beginning the test. See “Busy-Out” on page 6-4 and “Reset” on page 6-5.
Interrupting the Test	Interrupt the test by selecting Back.
Test Failure	If the test fails, record the errors on the repair tag and replace the module. Lines 3 and 4 of the test failure results identify the cause of the failure or the number of errors found per B-channel. On an MLX module, 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.
Restore	Restore the module if it successfully completes all module tests and the errors no longer occur. See “Restore” on page 6-6.

Interpreting Test Results

If the test completes successfully, the communication paths on the MLX or 800 NI-BRI modules 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 6-3 “B-Channel Loopback Errors”](#) and proceed as indicated in the “Corrective Action” column.

Table 6-3. B-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.

NI-1 BRI Provisioning Test

This test verifies that each communication path on the 800 NI-BRI module is operational by establishing and disconnecting a series of voice and data calls between any two communication paths on the module.

The NI-BRI Provisioning Test includes testing for BRI facilities that are part of Multiline Hunt Groups (MLHGs). Prior to testing, the BRI facility must have a MLHG group number programmed. The number (up to 10 digits) is appended to the end of the Directory Number (DN) (separated by a # character) programmed for the BRI line.

Before proceeding with this test, obtain completed copies of System Planning Form 3-i, Incoming Trunks: BRI Options and the NI-1 BRI Planner Form.

NOTE ► If an 800 NI-BRI module has only one DN/SPID provisioned on it, the provisioning test cannot be run on that module. To test the line, move one DSL from another 800 NI-BRI module to this module. The DSL that is moved should have been tested successfully and, to make testing easier, should not be part of a MLHG. This move involves administering a line on the DSL and connecting the cable on the target module. Run the test on the two DNs. When the test is successfully completed, remove the programming from the board just tested so that the single line is left on the board. Then reconnect the cable to the original slot and port.

All 800 NI-BRI modules must be busied out and those BRI boards not being tested must be unplugged from the carrier before testing can begin.

Procedure	Menu→Maintenance→Slot→Enter the BRI slot no. (01-17)→Enter→Provisioning
Busy-Out or Reset	Busy-out or reset the module being tested prior to beginning the test. See “Busy-Out” on page 6-4 and “Reset” on page 6-5.
Appropriate Modules	This test can be run only on 800 NI-BRI modules.
Time Estimate	Approximately 20 minutes for a fully utilized board. However, communication paths with errors increase the time. Boards with fewer programmed lines and no errors decrease the time.
LEDs	While the test is running, the LEDs are in the following states: ■ Green – blinks to indicate the test is running ■ Yellow – flashes on and off while calls are being established and disconnected ■ Red – stays on until Layers 1–3 are initialized for all programmed communication paths on the module
Interrupting the Test	Interrupt the test by selecting Back.
Test Failure	If the test fails, see NI-1 BRI Provisioning Test Errors and NI-1 BRI Provisioning Test Result Codes. If the module must be replaced, 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. See “Restore” on page 6-6.

Interpreting Test Results

The following screen appears when the testing for all 16 communication paths is completed.

```

Provisioning slot xx:

XXXXX XXXXX XXXXX XXXXX
XXXXX XXXXX XXXXX XXXXX
XXXXX XXXXX XXXXX XXXXX
XXXXX XXXXX XXXXX XXXXX
Back

```

Lines 3 through 6 of the test results provide test result codes. On a module with fewer than 16 programmed paths, the screen shows OKNOH or OKH for all successful paths; error codes for all failed paths; and SPID for any path that was not programmed. Be sure to record all the result codes on this screen, in the correct order.

Locate the test result codes in the NI-1 BRI Provisioning Test Result Codes table and follow the corrective action provided.

If the test fails, find the error message in [Table 6-4 “NI-1 BRI Provisioning Test Errors”](#) and proceed as indicated in the “Corrective Action” column.

Table 6-4. NI-1 BRI Provisioning 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). If the problem persists, replace the 800 NI-BRI module.
Test running too long	Exit the test. Remove half of the DSL connectors and rerun the test. Note the result codes of those that fail and then disconnect them. Reconnect the untested DSLs and rerun the test. Note those that fail. Reconnect all DSLs.
Test won't start	Check that all BRI boards not being tested are busied out and unplugged from the carrier. Run the test again.

Table 6-5. NI-1 BRI Provisioning Test Result Codes

Result Code	Description	Corrective Action
CO-V	CO provisioning error for voice calls on that facility	The facility is correctly programmed and established on Layers 1, 2, and 3. However, a problem associated with the provisioning at the CO for voice calls was detected. If the facility is intended to provide voice calls, perform the following tests and record the results before contacting the LEC: Outgoing Voice Call Test Incoming Voice Call Test Possible causes of this error are: Outgoing voice calls are not possible. Error identified at Outgoing Voice Call Test. Incoming voice calls are not possible. Error identified at Incoming Voice Call Test. If MLH is expected, the possible cause is that CO provisioning does not allow incoming voice calls, but either the DN or MLHG DN has been verified to be correct. IF MLH is not expected, the possible cause is that provisioning on the facility does not allow incoming voice calls. Additional call offering is provisioned. Additional call offering allows a voice call to be presented to a busy facility without either party recognizing the condition. Therefore, this condition cannot be detected by manual testing. This cause is valid if incoming voice calls can be received successfully. Features provisioned. Supplementary features such as transfer and conference are provisioned at the CO. This condition cannot be detected by manual testing. This cause is valid if incoming voice calls can be received successfully. Provisioning on the facility does not always allow outgoing and/or incoming calls. Error identified at Outgoing Voice Call Test and/or Incoming Voice Call Test. This condition may or may not be detected by any single manual test. Therefore, a sequence of calls may be necessary to determine the condition for the failure.

Table 6-5. NI-1 BRI Provisioning Test Result Codes—Continued

Result Code	Description	Corrective Action
CO-D	CO provisioning error for data calls on that facility	The facility is correctly programmed and established on Layers 1, 2, and 3. However, a problem associated with the provisioning at the CO for data calls was detected. If the facility is intended to provide data calls, perform the following tests with either digital data terminals or analog data terminals and modem pools. Record the results before contacting the LEC: Outgoing Data Call Test Incoming Data Call Test If data terminals are not available, contact the LEC and advise them that the provisioning for data on the facility requires checking. If more information is required, contact the TSO and provide them with the result code, the slot number, the port number, and the site information (remote access number, etc.). The possible causes of this error are: Outgoing data calls are not possible. Error identified at Outgoing Data Call Test. Incoming data calls are not possible. Error identified at Incoming Data Call Test. If MLH is expected, the possible cause is that CO provisioning does not allow incoming data calls, but either the DN or MLHG DN has been verified to be correct. If MLH is not expected, the possible cause is that provisioning on the facility does not allow incoming data calls. Provisioning on the facility does not allow incoming data calls. Error identified at Outgoing Data Call Test and/or Incoming Voice Call Test. This condition may or may not be detected by any single manual test. Therefore, a sequence of calls may be necessary to determine the condition for the failure.

Table 6-5. NI-1 BRI Provisioning Test Result Codes—Continued

Result Code	Description	Corrective Action
CO-DNV	Error in MERLIN MAGIX administration of DN and/or CO provisioning error for voice calls on that facility	The facility is correctly programmed and established with layers 1, 2, and 3. However, no incoming voice calls can be received. Check that the facility is programmed with the DN provided by the LEC. If the facility is part of an MLHG, check if the voice MLHG DN is absent. If the voice MLHG DN is absent, administer it and rerun the test. The possible causes of this error are: Incorrect DN/MLHG DN Incoming voice calls are not possible. Error identified at Incoming Voice Call Test and the DN and MLHG DN cannot be verified.
CO-DND	Error in MERLIN MAGIX administration of DN and/or CO provisioning error for data calls on that facility	The facility is correctly programmed and established with Layers 1, 2, and 3. However, no incoming data calls can be received. Check that the facility is programmed with the DN provided by the LEC. If the facility is part of an MLHG, check if the data MLHG DN is absent. If the data MLHG DN is absent, administer it and rerun the test. The possible causes of this error are: Incorrect DN/MLHG DN Incoming data calls are not possible. Error identified at Incoming Voice Call Test and the DN and MLHG DN cannot be verified.
CO-DDV	Error in MERLIN MAGIX administration of DN and/or CO provisioning error for voice and data calls on that facility	The facility is correctly programmed and established with Layers 1, 2, and 3. However, no incoming data calls can be received. Check that the facility is programmed with the DN provided by the LEC. If the facility is part of an MLHG, check if the MLHG DN is absent. If the MLHG DN is absent, administer it and rerun the test. The possible cause of this error is any combination of the causes of CODNV and CODND.
DN	Incorrect DN administration	The facility is established in Layers 1, 2, and 3. Check that the facility is programmed with the DN provided by the LEC and rerun the test. If the error persists, contact the LEC. If the facility is part of an MLHG, check if the MLHG DN is absent. If the MLHG DN is absent, administer it and rerun the test.

Table 6-5. NI-1 BRI Provisioning Test Result Codes—*Continued*

Result Code	Description	Corrective Action
MLHV	No voice hunting, or Incorrect voice MLHG DN and DN if MLHG DN is present, or Voice hunting was observed with no MLHG DN	The facility is correctly programmed and established with Layers 1, 2, and 3 with functioning voice capabilities. The possible causes of this error are: Incoming voice calls using the MLHG DN are not possible, but incoming voice calls using the DN are possible. If voice hunting is expected, with the programmed MLHG DN, check that the facility is programmed with the MLHG DN provided by the LEC and rerun the test. If the error persists, contact the LEC. Incoming voice calls using either the MLHG DN or DN are not possible, and both the MLHG DN and DN have been verified to be incorrect. Reprogram the MLHG DN or DN and rerun the test. If the error persists, contact the LEC. MLH is not expected. The MLHG DN is not programmed and voice calls to the facility using the DN are terminated at the facility as a hunt call. Contact the LEC.
MLHD	No data hunting, or Incorrect data MLHG DN if MLHG DN is present, or Data hunting was observed with no MLHG DN	The facility is correctly programmed and established with Layers 1, 2, and 3 with functioning data capabilities. The possible causes of this error are: Incoming data calls using the MLHG DN are not possible, but incoming data calls using the DN are possible. If data hunting is expected, with the programmed MLHG DN, check that the facility is programmed with the MLHG DN provided by the LEC and rerun the test. If the error persists, contact the LEC. Incoming data calls using either the MLHG DN or DN are not possible, and both the MLHG DN and DN have been verified to be correct. Reprogram the MLHG DN or DN and rerun the test. If the error persists, contact the LEC. MLH is not expected. The MLHG DN is not programmed and data calls to the facility using the DN are terminated at the facility as a hunt call. Contact the LEC.

Table 6-5. NI-1 BRI Provisioning Test Result Codes—*Continued*

Result Code	Description	Corrective Action
MLHDV	No voice or data hunting, or Incorrect voice and data MLHG DN if MLHG DN is present, or Voice and data hunting was observed with no MLHG DN	The facility is correctly programmed and established with Layers 1, 2, and 3 with functioning voice and data capabilities. Combination of the causes of MLHV and MLHD.
OKH	BRI facility that is part of an MLHG is provisioned with functioning voice and data capabilities	No action is required if the MLH voice and data functionalities are expected. If MLH is not expected, verify that the MLHG DN is present and, if so, remove it and rerun the test.
OKNOH	BRI facility that is <i>not</i> part of an MLHG is provisioned with functioning voice and data capabilities	No action is required if non-MLH voice and data functions are expected. If MLH is expected, verify that the MLHG DN is not present and, if so, administer it and rerun the test.
SPID	No or incorrect SPID administration	Check that the facility is programmed with the SPID provided by the LEC and rerun the test. If the error persists, contact the LEC.
LG	MERLIN MAGIX BRI error on that facility	This result should never appear; if it does, contact the TSO.

Table 6-5. NI-1 BRI Provisioning Test Result Codes—Continued

Result Code	Description	Corrective Action
ADMC0	MERLIN MAGIX administration error and/or CO provisioning error on that facility	Check that the facility is programmed with the DN provided by the CO. If the DN was not programmed properly, correct it and rerun the test. If the error persists, perform the appropriate set of tests and record the results before contacting the LEC: “Outgoing Voice Call Test” on page 6-22 “Incoming Voice Call Test” on page 6-23 and/or “Outgoing Data Call Test” on page 6-23 “Incoming Data Call Test” on page 6-24 The possible causes of this error are: Incorrect DN. Error identified at Incoming Voice/Data Call Test. Incoming calls fail. Any of the causes listed for C0-V and C0-D
ADMIN	No administration or incorrect administration on that facility	Check that the facility is programmed with the SPID and DN provided by the CO. If the SPID and DN were not programmed properly, correct it and rerun the test. If the error persists, perform the appropriate set of tests and record the results before contacting the LEC: “Outgoing Voice Call Test” on page 6-22 “Incoming Voice Call Test” on page 6-23 and/or “Outgoing Data Call Test” on page 6-23 “Incoming Data Call Test” on page 6-24 The possible causes of this error are: Incorrect SPID. Error identified at Incoming Voice Call Test; Outgoing Data Call Test, and/or Incoming Data Call Test. Both outgoing and incoming calls fail. Incorrect DN. Error identified at Incoming Voice/Data Call Test. Incoming calls fail.

Table 6-5. NI-1 BRI Provisioning Test Result Codes—Continued

Result Code	Description	Corrective Action
LAYR1	LAYER 1 BRI Provisioning error on facility	Examine the wiring for the line, ensuring that all connections have been closed. Rerun the test if a wiring problem is identified. If the problem persists, or if there is no wiring problem identified, swap the DSL and its administration to another port on the board. If the problem follows the DSL, contact the LEC. If the problem remains on the original port, mark the port defective and replace the 800 NI-BRI board.
LAYR2	LAYER 2 BRI Provisioning error on facility	Layer 1 is established. Unplug the connector and replug it into the same port. Rerun the test. If the problem persists, contact the LEC. The possible causes of this problem are: The DSL is provisioned with only one active DN (rather than two) at the CO. Two lines are programmed when only one line is provided by the CO. Check that the facilities are programmed properly and rerun the tests if you made any corrections.
LAYR3	LAYER 3 BRI Provisioning error on facility	Layers 1 and 2 are established. This result indicates that the CO does not do Layer 3 initialization. This error may not affect service, but the LEC must be contacted.
NOTST	Testing was not performed on this facility because no other Layer 3 initialized facility was available in the time allowed for testing.	Layers 1, 2 and 3 are established. Correct the known problems on the other facilities and rerun the test.
?????	Testing was inconclusive because the line(s) used to test this one had problems.	Correct the known problems on other facilities and rerun the test.

Outgoing Voice Call Test

Place a voice call from the BRI line under test. Call either a working facility on the system or a phone on the premises that is connected to the central office (CO).

NOTE ► The 800 NI-BRI module must be restored (removed from the Maintenance-Busy state) before performing this test. See Restoring the Module.

1. Assign the BRI line to a button on a 4400-Series or MLX display phone.
If using a facility on the system as a destination, also assign the destination facility to a button on another 4400-Series or MLX display phone.
2. Press the button associated with the BRI line under test.
The red LED next to this button should be on and steady. If not, check that the BRI line has been correctly assigned to this button.
3. Go off-hook by lifting the handset or pressing the speakerphone button.
4. The red and green LEDs on this button should be on and steady. A dial tone should be heard. If not, record that the outgoing voice call test has failed.
5. Dial the destination number. (In a Centrex environment, it is necessary to dial a 9 before the destination number.)
Verify the following results and note any failures:
 - Dial tone should be off after the first digit is dialed.
 - Verify that the originating end hears ringback after the last digit is dialed and that the destination phone is ringing.
 - If either indication is absent, check that the dialed digits are those of the destination Directory Number (DN).
 - If the destination telephone can display calling party number, verify that the DN of the BRI line under test is displayed correctly.
If not, record that the calling party information displayed is either incorrect or absent at the destination telephone.
6. Answer the call at the destination telephone and verify the connection.
7. Disconnect the call at either the originating or receiving end.
8. Verify that the green LED next to this button turns off and the connection is removed.

Incoming Voice Call Test

Place a voice call from a known working telephone to the BRI line under test.

NOTE ► The 800 NI-BRI module must be restored (removed from the Maintenance-Busy state) before performing this test. See [“Restoring the Module”](#) on page 6-31.

1. Assign the BRI line to a button on a 4400-Series or MLX display phone.
If using a facility on the system as a destination, also assign the destination facility to a button on another 4400-Series or MLX display phone.
2. Dial the DN of the BRI line under test at the originating telephone.
3. Verify that alerting is indicated on the button associated with the BRI line being tested.
4. Verify that the originating number appears on the display of the 4400-Series or MLX telephone programmed with the BRI line under test. Verify that the associated green LED flashes.
5. If the correct number is not displayed, verify that the number dialed and the DFT administration are correct. If they are incorrect, repeat the test.
6. Answer the call (press line button if necessary) and verify the connection.
7. Verify that the green LED next to this button is on and steady.
8. Disconnect the call at either the originating end or the receiving end.
9. Verify that the green LED next to the button associated with the BRI line under test turns off.

Outgoing Data Call Test

Place a data call from the BRI line under test to either a working facility on the system or a data endpoint on the premise that is connected to the central office (CO). See the *Data and Video Reference* for details regarding setting up a data call with specific equipment.

NOTE ► The 800 NI-BRI module must be restored (removed from the Maintenance-Busy state) before performing this test. See [Restoring the Module](#).

1. Assign the BRI line to a data terminal.
If using a facility on the system as a destination, assign the destination facility to another data terminal.
2. Dial the destination number. (In a Centrex environment, it is necessary to dial a 9 before the destination number.)

Verify the following results and note any failures:

- You may hear dial tone at the beginning of dialing and ringback after completion. Alerting may be indicated at the destination.

- If both ringback and alerting are absent, check that the dialed digits are those of the destination DN. Redial, if necessary. If the call could not be established and the dialing was correct, record that an outgoing data call cannot be completed from this line and indicate the type of tone, if any, that was present at both ends.
 - If the destination telephone can display the calling party number, verify that the DN of the BRI line under test is displayed correctly.
If not, record that the calling party information displayed at the destination telephone is incorrect or absent.
3. Answer the call at the destination telephone and verify the connection.
The destination data extension may be programmed for auto-answer. Verify that the red and green LEDs next to this button are on steady and the communication path is established.
 4. Disconnect the call from either the originating or receiving end.
Verify that the green LED turns off and the communication path is removed.

Incoming Data Call Test

Place a data call from a known working facility to the BRI line under test. See the *Data and Video Reference* for details regarding answering a data call with specific equipment.

NOTE ► The 800 NI-BRI module must be restored (removed from the Maintenance-Busy state) before performing this test. See [“Restoring the Module”](#) on page 6-31.

1. Assign the BRI line to a data terminal.
If using a facility on the system as a destination, assign the destination facility to another data terminal.
2. Place a test call to the BRI line under test.
Verify that alerting is indicated at the data extension associated with the BRI line. If not, check that the dialed number corresponds to the DN of the line.
 - If the number is not correct, redial the call.
 - Otherwise, record that the incoming data call test has failed and note the type of tone (busy, reorder, ringback, etc.) heard at the originating end.
3. If the data extension associated with the BRI line under test can display calling party number, verify that the originating DN appears on its display.
4. If not, record that the calling party information displayed at the destination telephone is either incorrect or absent.
5. Answer the call and verify the connection.
6. The data extension may be programmed for auto-answer. Verify that the green LED flashes until the call is answered.
7. Disconnect the call from either the originating or receiving end.

800 NI-BRI Module Clock Status

If you have not been trained to perform BRI maintenance, contact the TSO for instructions on using this procedure.

Procedure	Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→Clock→Back
Results Displayed	Clock Slot xx: mm/dd/yy hh:00-hh:mm Active: xxxx Synch: xxxxx Source: xxxx Port: xx Back

If you need assistance in interpreting the results displayed on the screen, contact the TSO.

Channel Service Unit (CSU) Loopback Test

The CSU Loopback Test verifies that the communication path between the 551 T1, ESF T1, or the ACCULINK 3150 CSU and the 100D module is operational.

Procedure	Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→CSU- lpbk
Appropriate Modules	This test can be run only on 100D modules. In the procedure above, when you select Enter, the options Error Events and Clock appear only for the 100D module.
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.
DTE LOOPBACK (ESF T1 CSU)	For the ESF T1 CSU only, flip the DTE LOOPBACK switch on the front panel to the up position to activate the loopback. Details are provided below.
LINE LOOPBACK (ACCULINK 3150 CSU)	For the ACCULINK 3150 only, select front panel Line Loopback command. Details are provided below.
Busy-Out or Reset	Busy-out or reset the 100D module prior to beginning the test. See “Busy-Out” on page 6-4 and “Reset” on page 6-5.
Interrupting the Test	You can interrupt the test by selecting Back.
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 the CSU Loopback test. See “Restore” on page 6-6.

Preparing for the CSU Loopback Test

In preparation for running the CSU Loopback Test, first Busy-Out the 100D module and then perform the steps for the appropriate CSU from the CSUs listed under below.

551 T1 CSU

For the 551 T1 CSU, connect the EQ OUT and EQ IN jacks.

1. 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.
2. 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 private network signal or send the all-ones pattern, depending on the chosen CSU option.

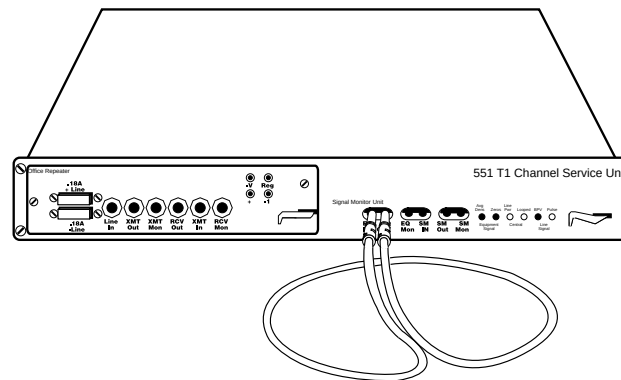


Figure 6-2. 551 T1 CSU Loopback Connection

ESF T1 CSU

For the ESF T1 CSU, flip the DTE LOOPBACK switch on the front panel to the up position to activate the loopback test.

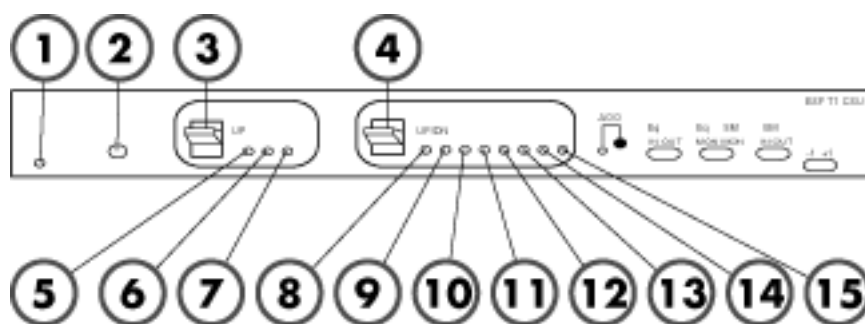


Figure 6-3. ESF T1 CSU DTE Loopback Connection

- 1** Local Power
- 2** Diagnostic Interface
- 3** DTE Loopback
- 4** Send Code
- 5** Looped
- 6** Low Dens
- 7** Frame Loss
- 8** Far End Looped
- 9** Critical Power
- 10** Pulses
- 11** Frame Loss
- 12** CRC Error
- 13** BPV
- 14** Near End Looped
- 15** Alarm

ACCULINK 3150 CSU

For the ACCULINK 3150 CSU, press the F2 button on the front panel to select Test from the menu screen. From the Test screen, press the F2 button to select Lpbk. From the Loopback screen, press the right arrow once to display additional loopback tests. Press the F3 button to display DLB (DTE Loopback). When DLB is selected, Test Started appears on line 2 of the menu screen.

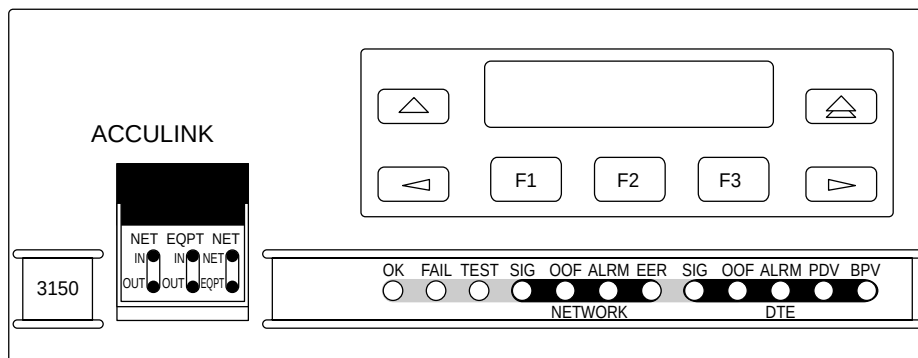


Figure 6-4. ACCULINK 3150 CSU Front Panel

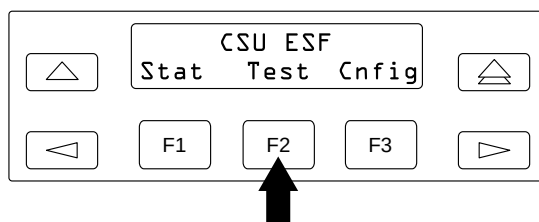


Figure 6-5. ACCULINK 3150 CSU DTE Loopback Command 1

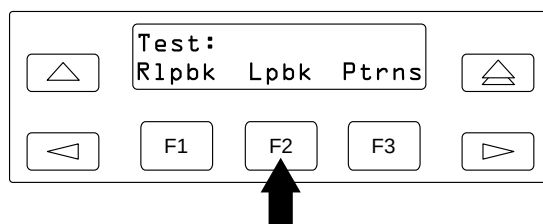


Figure 6-6. ACCULINK 3150 CSU DTE Loopback Command 2

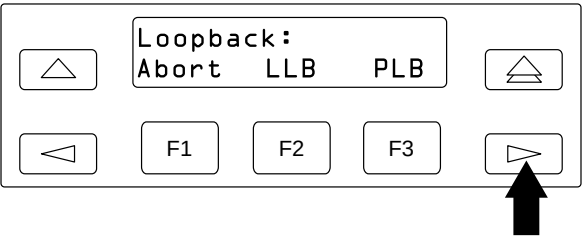


Figure 6-7. ACCULINK 3150 CSU DTE Loopback Command 3

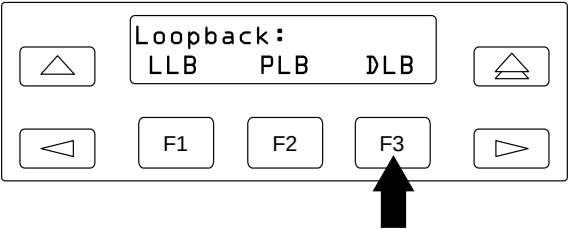


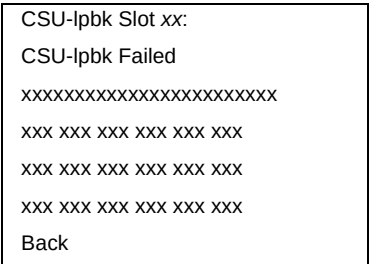
Figure 6-8. ACCULINK 3150 CSU DTE Loopback Command 4

ACCULINK 3160/3164

The ACCULINK 3160/3164 DSU/CSU is physically similar to the ACCULINK 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.

Interpreting Test Results

The screen below appears when the test fails.



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.

If the test is successful, the connection between the CSU and the 100D module is good, and the 100D module is probably okay.

If the test fails, find the error message below and proceed as indicated.

Table 6-6. CSU 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 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 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 (see [“Restore”](#) on page 6-6).
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 **Ct r l** selection, then press the **F3** button to select **Ct r l**. Press the right arrow key twice to display the reset selection. Now press the **F1** button to initiate a reset of the CSU.

Automatic Tests for the 100D, 100DCD, and 100R INA Modules

Every 15 minutes, the system checks the 100D, 100DCD and 100R modules 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 clock.

Line Loopback Test

The Line Loopback Test is used for both the 100R INA and for the 100 DCD modules. This test loops the T1 interface back towards the network on the network side of the framer. To perform this test, you must first busy-out the module. From your system programming console, use the following sequence to access the Line loopback test.

NOTE ► When this test is activated, the far end generates the test pattern using the built-in BERT Tests or other data-generating equipment.

Procedure Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→
Demand test→LineLpbk

Appropriate Modules This test can be run on the 100R INA and 100 DCD modules only.

Payload Loopback test

The Payload Loopback Test is used for both the 100R INA and for the 100 DCD modules. This test loops the T1 interface back towards the network on the communications system side of the framer. To perform this test, you must first busy-out the board. From your system programming console, use the following sequence to access the Payload loopback test.

NOTE ► When this test is activated, the far end generates the test pattern using the built-in BERT Tests or other data-generating equipment.

Procedure Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→
Demand test→PayloadLpbk

Appropriate Modules This test can be run on the 100R INA and 100 DCD modules only.

Bit Error Rate Test (BERT)

The Bit Error Rate Test is used for both the 100R INA and for the 100 DCD modules. This test allows you to generate several test patterns and monitor the progress of the test to see if the pattern being generated is being received back. The error count and state of the test represents a real-time snapshot of the information available in dual-port RAM (DPRAM).

Procedure	To select BERT for all channels (100 DCD and 100R INA modules): Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→More→BERT→Data Port 1 or Data Port 2→Yes (perform a loopback, test is kept on the board) or No (information is sent out to the data port)→Enter →Select test pattern (See Table 6-7 below)→Monitor (to monitor the pattern) or Back (to exit)
Appropriate Modules	This test can be run on the 100R INA and 100 DCD modules only.

Table 6-7. BERT Test Pattern Options

Test Options	Description
511	This produces a pseudo- random test pattern that is 511 bits long. To monitor the test, press →Monitor. To refresh the monitoring information, press →Back, and re-select →Monitor. This does not affect or terminate the test.
All ones	This produces a test pattern of all ones. To monitor the test, press →Monitor. To refresh the monitoring information, press →Back, and re-select →Monitor. This does not affect or terminate the test.
All zeroes	This produces a test pattern of all zeroes. To monitor the test, press→Monitor. To refresh the monitoring information, press→Back, and re-select →Monitor. This does not affect or terminate the test.
2047	This produces a pseudo-random pattern that is 2047 bits long. To monitor the test press →Monitor. To refresh the monitoring information, press →Back, and re-select→Monitor. This does not affect or terminate the test.

Test Results

- **No Synch** – Indicates that the BERT test pattern is not being successfully received back.
- **Sync-Errors** – Indicates that the BERT test pattern is being successfully received back. The console displays the number of bit error detected. For overflow situations “9999” is displayed.

Data-Channel Loopback Test

The Data-Channel Loopback Test is used for both the 100R INA and for the 100 DCD modules. This test takes all the channels assigned to a particular data port and loops them towards the T1 network. All 1's are transmitted across the channels assigned to the data port. To perform this test, you must first busy-out the module. From your system programming console, use the following sequence to access the Data-Channel Loopback Test.

Procedure	Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→ More→Data-Channel→Data Port 1 or Data Port 2→ Enter→Back (to exit)

Appropriate Modules	This test can be run on the 100 DCD module only.

Data-Terminal Loopback Test

The Data-Terminal Loopback Test is used for the 100 DCD module only. This test loops the data received on one data port to the same data port. All 1's are transmitted to the channels assigned to the data port. *You do not have to busy out this module to perform this test.* From your system programming console, use the following sequence to access the Data Terminal Loopback Test.

Procedure	Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→ More→Data-Terminal→Data Port 1 or Data Port 2→ Enter →Back (to exit)

Appropriate Modules	This test can be run on the 100 DCD module only.

Data-Port Local Loop Test

The Data-Port Local Loop Test is used for the 100 DCD module only. This test loops the data port back to the system. A test pattern is generated on all transmit data channels for the selected port. All receive T1 channels are monitored by the module to determine if the test pattern is being received back accurately. To perform this test, you must first busy-out the module. From your system programming console, use the following sequence to access the Data Port Local Loop test.

Procedure	Menu→Maintenance→Slot→Enter the slot no. (01-17)→Enter→ More→Lcal D. Prt→Data Port 1 or Data Port 2→511, 2047, All ones, or All zeroes→Back (to exit)

Appropriate Modules	This test can be run on the 100 DCD module only.

Customer Support Information



Support Telephone Number

In the USA only, Avaya 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 Avaya representative. Consultation charges may apply.

Outside the USA, if you need assistance when installing, programming, or using your system, contact your Avaya 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 radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le règlement sur le brouillage radioélectrique édicté par le ministère 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, or RJ21X. Connection to E&M tie 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. Connection to 56-kbps or 64-kbps facilities requires a USOC RJ11C, RJ14C, or RJ21.
- **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 or numbers 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 AS593M-65646-PF-E.
 - The REN (Ringer Equivalence Number) for all three systems is 1.5A.
 - The facility interface code (FIC) and service order code (SOC): For tie line connection, the FIC is TL31M and the 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 DID facilities, the FIC is 02RV2-T and the SOC is AS.2.
- For equipment to be connected to 1.544-MBps digital service, the SOC is 6.0P and the FIC is:
 - 04DU9-BN for D4 framing format with AMI zero code suppression.
 - 04DU9-DN for D4 framing format with bipolar 8 zero code suppression (B8ZS).04DU9-IKN for extended superframe format (ESF) with AMI zero code suppression.
 - 04DU9-ISN with ESF and B8ZS.
- For equipment to be connected to 56-kbps or 64-kbps digital facilities, the FIC is 02IS5.
- 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.
- **Ringer Equivalence Number (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 local telephone company to determine the maximum REN for the calling area.
- **Disconnection.** You must also notify your local telephone company if and when this equipment is permanently disconnected from the line or lines.

Installation and Operational Procedures

The guides 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 Avaya dealer or, **in the USA only**, contact the Avaya Helpline 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.

New Network Area and Exchange Codes. The MERLIN MAGIX Integrated System software does not restrict access to any new area codes or exchange codes established by a local telephone company. If the user has established Toll Restrictions on the system that could restrict access, then the user should check the lists of allowed and disallowed dial codes and modify them as needed.

Equal Access Codes. This equipment is capable of providing users access to interstate providers of operator services through the use of access codes. Modifications of this equipment by call aggregators to block access dialing codes is a violation of the Telephone Operator Consumers Act of 1990.

DOC Notification and Repair Information

NOTICE: The Canadian Department of Communications (DOC) label identifies certified equipment. This certification means that the equipment meets certain protective, operational, and safety requirements of the telecommunications network. 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.

**CAUTION:**

Users should not attempt to make such connections themselves, but should contact the appropriate electrical inspection authority or electrician. 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 Réparation

AVIS: L'étiquette du ministère des Communications du Canada identifie le matériel homologué. Cette étiquette certifie que le matériel est conforme à certaines normes de protection, d'exploitation et de sécurité des réseaux de télécommunications. 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 télécommunication. Le matériel doit également être installé en suivant une méthode acceptée de raccordement. Dans certains cas, les fils intérieurs de l'entreprise utilisés pour un service individuel 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 conformité aux conditions énoncées ci-dessus n'empêchent pas la dégradation du service dans certaines situations. Actuellement, les entreprises de télécommunication ne permettent pas que l'on raccorde leur matériel à des jacks d'abonné, sauf dans les cas précis prévus par 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 télécommunications peut demander à l'utilisateur de débrancher un appareil à la suite de réparations ou de modifications effectuées par l'utilisateur ou à 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'énergie électrique, des lignes téléphoniques et des canalisations d'eau métalliques, s'il y en a, sont raccordés ensemble. Cette précaution est particulièrement importante dans 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 électricien, selon le cas.

L'indice 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 constituée de n'importe quelle combinaison de dispositifs, pourvu que la somme des indices de charge de l'ensemble des dispositifs ne dépasse pas 100.

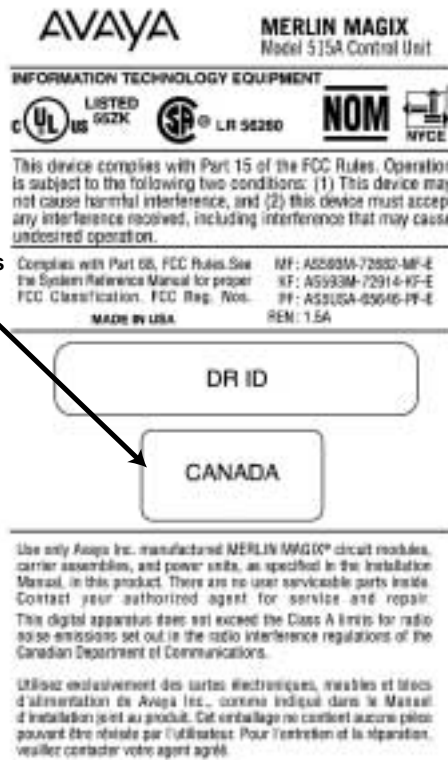
No d'homologation: 230 4095A

No de certification: CSA LR 56260

L'indice de charge: 6

MERLIN MAGIX D.O.C. Location Label Placement

Ministère des
Communications
du Canada
emplacement
de l'étiquette



Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

Use only circuit modules, carrier assemblies and power units manufactured by Avaya Inc. in this product. No user parts of maintenance in the interior of the system. Contact a service agent authorized for service and repair.

Cette équipe digital ne excède les limites de la Classe A pour radiations de radio envoyées en un radio major a lo permitido en la regulaciones del Departamento de Comunicaciones de Canada.

Use somente no MERLIN MAGIX as placas (módulos), gabinetes e fontes de alimentação fabricados pela Avaya Inc., conforme especificado no Manual de Instalação. Não há partes para serviços de reparo internos. Contatar seu distribuidor autorizado para os serviços de reparo.

Este aparelho digital não excede os limites para equipamentos Classe A, com relação às perturbações eletromagnéticas emitidas, conforme a regulamentação de radio perturbação em Equipamentos de Tecnologia da Informação (ETI), no NBR 12304.

WARNING: IF EQUIPMENT IS USED FOR OUT-OF-BUILDING APPLICATIONS, APPROVED SECONDARY PROTECTORS ARE REQUIRED. SEE INSTALLATION MANUAL.

AVERTISSEMENT: SI L'ÉQUIPEMENT EST UTILISÉ POUR DES APPLICATIONS EXTÉRIEURES, L'INSTALLATION D'UN PROTECTEUR SECONDAIRE EST REQUISE. VOIR LE MANUEL D'INSTALLATION.

PRECAUCION: SI EL EQUIPO VA SER UTILIZADO PARA APLICACIONES EN EL EXTERIOR DE UN EDIFICIO, DEBEN USARSE PROTECTORES ADICIONALES DEBIDAMENTE APROVADOS. VEA EL MANUAL DE INSTALACION.

AVISO: CASO O EQUIPAMENTO FOR INSTALADO EM APLICACOES EXTERNAS AO PRÉDIO, DISPOSITIVOS PROTETORES EXTERNOS AUTORIZADOS PARA REDES EXTERNAS SÃO NECESSARIOS. VER O MANUAL DE INSTALACÃO.

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 the Remote Access features of your system.

The Remote Access features of your system, if you choose to use them, permit 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. Barrier codes are, by default, restricted from making outside calls.

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, telephone 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. Avaya 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 an unpublished 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 each person.
- Use random-sequence access codes, which are less likely to be broken.
- Use the longest-length access codes the system will allow.
- 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 (Hybrid/PBX mode only), and Disallowed List capabilities. A prepared Disallowed List (number 7) is provided and is designed to prevent the types of calls that toll-fraud abusers often make.
 - 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.
 - Change access codes every 90 days.
 - Use the longest-length barrier codes possible, following the guidelines for passwords. (See [“Choosing Passwords”](#) on page 16.)
-

Toll Fraud Prevention

Toll fraud is the unauthorized use of your telecommunications system by third parties to make long-distance telephone calls. Under the law, you, the customer, are responsible for paying part or all of those unauthorized calls. Thus, the following information is of critical importance.

Unauthorized persons concentrate their activities in two areas with the MERLIN MAGIX Integrated System:

- They try to transfer out of the MERLIN MAGIX Integrated System to gain access to an outgoing trunk and make long-distance calls.
- They try to locate unused or unprotected mailboxes and use them as drop-off points for their own messages.

The following is a discussion of how toll fraud is often perpetrated and ways to prevent unauthorized access that can lead to toll fraud.

Physical Security, Social Engineering, and General Security Measures

Criminals called hackers may attempt to gain unauthorized access to your communications system and voice messaging system in order to use the system features. Hackers often attempt to trick employees into providing them with access to a network facility (line/trunk) or a network operator. This is referred to as social engineering. Hackers may pose as telephone company employees or employees of Avaya or your authorized dealer. Hackers will go through a company's trash to find directories, dialing instructions, and other information that will enable them to break into the system. The more knowledgeable they appear to be about the employee names, departments, telephone numbers, and the internal procedures of your company, the more likely it is that they will be able to trick an employee into helping them.

Preventive Measures

Take the following preventive measures to limit the risk of unauthorized access by hackers:

- Provide good physical security for the room containing your telecommunications equipment and the room with administrative tools, records, and System Manager information. These areas should be locked when not attended.
- Provide a secure trash disposal for all sensitive information, including telephone directories, call accounting records, or anything that may supply information about your communications system. This trash should be shredded.
- Educate employees that hackers may try to trick them into providing them with dial tone or dialing a number for them. All reports of trouble, requests for moving extensions, or any other administrative details associated with the MERLIN MAGIX Integrated System should be handled by one person (the System Manager) or within a specified department. Anyone claiming to be a telephone company representative should be referred to this person or department.
- No one outside of Avaya needs to use the MERLIN MAGIX Integrated System to test facilities (lines/trunks). If a caller claims to be an Avaya employee, the System Manager should ask for a telephone number where the caller can be reached. The System Manager should be able to recognize the number as an Avaya telephone number. *Before connecting the caller to the administrative port of the MERLIN MAGIX Integrated System, the System Manager should feel comfortable that a good reason to do so exists.* In any event, it is not advisable to give anyone access to network facilities or operators, or to dial a number at the request of the caller.
- Any time a call appears to be suspicious, call the Avaya Helpline at 1 800 628-2888 (fraud intervention for System 25, PARTNER® and MERLIN Systems).
- Customers should also take advantage of Avaya monitoring services and devices, such as the NetPROTECT® family of fraud-detection services, CAS with HackerTracker®, and CAT Terminal with Watchdog. Call 1 800 638-7233 to get more information on these Avaya fraud detection services and products.

Security Risks Associated with Transferring through Voice Messaging Systems

Toll fraud hackers try to dial into a voice mailbox and then execute a transfer by dialing *T. The hacker then dials an access code (either 9 for Automatic Route Selection or a pooled facility code), followed by the appropriate digit string to either direct dial or access a network operator to complete the call.

NOTE ► All extensions are initially, and by default, restricted from dial access to pools. In order for an extension to use a pool to access an outside line/trunk, this restriction must be removed.

Preventive Measures

Take the following preventive measures to limit the risk of unauthorized transfers by hackers:

- Outward restrict all MERLIN MAGIX Integrated System voice mail port extension numbers. This denies access to facilities (lines/trunks). Voice mail ports are, by default, outward restricted.
- As an additional security step, network dialing for all extensions, including voice mail port extensions, should be processed through ARS using dial access code 9.



SECURITY ALERT:

*The MERLIN MAGIX Integrated System ships with ARS activated with all extensions set to Facility Restriction Level 3, allowing all international calling. **To prevent toll fraud**, ARS Facility Restriction Levels (FRLs) should be established using:*

- FRL 0 for restriction to internal dialing only
- FRL 2 for restriction to local network calling only
- FRL 3 for restriction to domestic long-distance (excluding area code 809 for the Dominican Republic as this is part of the North American Numbering Plan, unless 809 is required)
- FRL 4 for international calling



WARNING:

Default local and default toll tables are factory-assigned an FRL of 2. This simplifies the task of restricting extensions: the FRL for an extension merely needs to be changed from the default of 3.



WARNING:

Each extension should be assigned the appropriate FRL to match its calling requirements. All voice mail port extensions not used for Outcalling should be assigned to FRL 0 (the default setting).

- Deny access to pooled facility codes by removing pool dial-out codes 70, 890–899, or any others on your system.
- Create a Disallowed List or use the pre-prepared Disallowed List number 7 to disallow dialing 0, 11, 10, 1700, 1809, 1900, and 976 or 1 (wildcard) 976. Disallowed List number 7 does not include 800, 1800, 411, and 1411, but Avaya recommends that you add them.



NOTE Assign all voice mail port extensions to this Disallowed List. Avaya recommends assigning Disallowed List number 7. This is an added layer of security, in case outward restriction is inadvertently removed. (Voice messaging ports are assigned, by default, to Disallowed List number 7.)

If Outcalling is required by voice messaging system extensions:

- Program an ARS Facility Restriction Level (FRL) of 2 on voice mail port extensions used for Outcalling.
- If 800 and 411 numbers are used, remove 1800, 800, 411, and 1411 from Disallowed List number 7.
- If Outcalling is allowed to long-distance numbers, build an Allowed List for the voice mail port extensions used for Outcalling. This list should contain the area code and the first three digits of the local exchange telephone numbers to be allowed.

Additional general security for voice messaging systems:

- Use a secure password for the General Mailboxes.
- The default administration mailbox, 9997, must be reassigned to the System Manager's mailbox/extension number and securely password protected.
- All voice messaging system users must use secure passwords known only to the user.

Security Risks Associated with the Automated Attendant Feature of Voice Messaging Systems

Two areas of toll fraud risk associated with the Automated Attendant feature of voice messaging systems are:

- Pooled facility (line/trunk) access codes are translated to a menu prompt to allow Remote Access. If a hacker finds this prompt, the hacker has immediate access. (Dial access to pools is initially factory-set to restrict all extensions: to allow pool access, this restriction must be removed by the System Manager.)
- If the Automated Attendant prompts callers to use Remote Call Forwarding (RCF) to reach an outside telephone number, the system may be susceptible to toll fraud. An example of this application is a menu or submenu that says, "To reach our answering service, select prompt number 5," and transfers a caller to an external telephone number.

Remote Call Forwarding can be used securely only when the Central Office provides "reliable disconnect" (sometimes referred to as forward disconnect or disconnect supervision), which guarantees that the Central Office does not return a dial tone after the called party hangs up. In most cases, the Central Office facility is a loop-start line/trunk which does not provide reliable disconnect. When loop-start lines/trunks are used, if the calling party stays on the line, the Central Office does return a dial tone at the conclusion of the call, enabling the caller to place another call as if it were being placed from your company. Ground-start trunks provide reliable disconnect and should be used whenever possible.

Preventive Measures

Take the following preventive measures to limit the risk of unauthorized use of the Automated Attendant feature by hackers:

- *Do not* use Automated Attendant prompts for Automatic Route Selection (ARS) codes or Pooled Facility codes.
- Assign all unused Automated Attendant selector codes to zero, so that attempts to dial these are routed to the system attendant.
- If Remote Call Forwarding (RCF) is required, MERLIN MAGIX Integrated System owners should coordinate with their Avaya Account Team or authorized dealer to verify the type of Central Office facility used for RCF. If it is a ground-start line/trunk, or if it is a loop-start line/trunk and Central Office reliable disconnect can be ensured, then nothing else needs to be done.

NOTE ► In most cases, these are loop-start lines/trunks without reliable disconnect. The local telephone company must be involved in order to change the facilities used for RCF to ground-start line/trunks. Usually, a charge applies for this change. Also, hardware and software changes may be necessary in the MERLIN MAGIX Integrated System. The Octel Messaging 100 Automated Attendant feature merely accesses the RCF feature in the MERLIN MAGIX Integrated System. Without these changes being made, this feature is highly susceptible to toll fraud. These same preventive measures must be taken if the RCF feature is active for MERLIN MAGIX Integrated System extensions, whether or not it is accessed by an Automated Attendant menu.

Security Risks Associated with the Remote Access Feature

Remote Access allows the MERLIN MAGIX Integrated System owner to access the system from a remote telephone and make an outgoing call or perform system administration using the network facilities (lines/trunks) connected to the MERLIN MAGIX Integrated System. Hackers, scanning the public switched network by randomly dialing numbers with war dialers (a device that randomly dials telephone numbers, including 800 numbers, until a modem or dial tone is obtained), can find this feature, which will return a dial tone to them. They can even employ war dialers to attempt to discover barrier codes.

Preventive Measures

Take the following preventive measures to limit the risk of unauthorized use of the MERLIN MAGIX Integrated System Remote Access feature:

- The Remote Access feature can be abused by criminal toll fraud hackers if it is not properly administered. Therefore, this feature should not be used unless there is a strong business need.

- It is strongly recommended that customers invest in security adjuncts, which typically use one-time passcode algorithms. These security adjuncts discourage hackers. Since a secure use of the Remote Access feature generally offers savings over credit-card calling, the break-even period can make the investment in security adjuncts worthwhile.
- If a customer chooses to use the Remote Access feature without a security adjunct, then multiple barrier codes should be employed, with one per user, if the system permits. The MERLIN MAGIX Integrated System permits a maximum of 16 barrier codes.
- The maximum length should be used for each barrier code, and should be changed periodically. Barrier codes, like passwords, should consist of a random, hard-to-guess sequence of digits. The MERLIN MAGIX Integrated System permits a barrier code of up to 11 digits.

Other Security Hints

Make sure that the Automated Attendant selector codes do not permit outside line selection.

Multiple layers of security are always recommended to keep your system secure.

A number of measures and guidelines that can help you ensure the security of your communications system and voice messaging system follows:

Educating Users

Everyone in your company who uses the telephone system is responsible for system security. Users and attendants/operators need to be aware of how to recognize and react to potential hacker activity. Informed people are more likely to cooperate with security measures that often make the system less flexible and more difficult to use.

- Never program passwords or authorization codes onto Auto Dial buttons. Display telephones reveal the programmed numbers and internal abusers can use the Auto Dial buttons to originate unauthorized calls.
- Discourage the practice of writing down barrier codes or passwords. If a barrier code or password needs to be written down, keep it in a secure place and never discard it while it is active.
- Instruct operators and attendants to inform tell their System Manager whenever they answer a series of calls where there is silence on the other end or the caller hangs up.
- Advise users who are assigned voice mailboxes to frequently change personal passwords and not to choose obvious passwords.
- Ensure that the System Manager advises users with special telephone privileges (such as Remote Access, Outcalling, and Remote Call Forwarding) of the potential risks and responsibilities.
- Be suspicious of any caller who claims to be with the telephone company and wants to check an outside line. Ask for a callback number, hang up, and confirm the caller's identity.

- Never distribute the office telephone directory to anyone outside the company; be careful when discarding it (shred the directory).
- Never accept collect telephone calls.
- Never discuss your telephone system's numbering plan with anyone outside the company.

Educating Operators

Operators or attendants need to be especially aware of how to recognize and react to potential hacker activity. To defend against toll fraud, operators should follow the guidelines below:

- Establish procedures to counter *social engineering*. Social engineering is a con game that hackers frequently use to obtain information that may help them gain access to your communications system or voice messaging system.
- When callers ask for assistance in placing outside or long-distance calls, ask for a callback extension.
- Verify the source. Ask callers claiming to be maintenance or service personnel for a callback number. Never transfer to *10 without this verification. Never transfer to extension 900.
- Remove the headset and/or handset when the console is not in use.

Detecting Toll Fraud

To detect toll fraud, users and operators should look for the following:

- Lost voice mail messages, mailbox lockout, or altered greetings
- Inability to log into voice mail
- Inability to get an outside line
- Foreign language callers
- Frequent hang-ups
- Touch-Tone sounds
- Caller or employee complaints that the lines are busy
- Increases in internal requests for assistance in making outbound calls (particularly international calls or requests for dial tone)
- Outsiders trying to obtain sensitive information
- Callers claiming to be the "telephone" company
- Sudden increase in wrong numbers

Establishing a Policy

As a safeguard against toll fraud, follow these guidelines for your MERLIN MAGIX Integrated System and voice messaging system:

- Change passwords frequently (at least quarterly). Changing passwords routinely on a specific date (such as the first of the month) helps users to remember to do so.
- Always use the longest-length password allowed.
- Establish well-controlled procedures for resetting passwords.
- Limit the number of invalid attempts to access a voice mailbox to five or less.
- Monitor access to the MERLIN MAGIX Integrated System dial-up maintenance port. Change the access password regularly and issue it only to authorized personnel. Disconnect the maintenance port when not in use. (This however, eliminates Avaya's 24-hour maintenance surveillance capability and may result in additional maintenance costs.)
- Create a communications system management policy concerning employee turnover and include these suggestions:
 - Delete all unused voice mailboxes in the voice mail system.
 - If a terminated employee had Remote Access calling privileges and a personal authorization code, remove the authorization code immediately.
 - If barrier codes and/or authorization codes were shared by the terminated employee, these should be changed immediately.
- Regularly back up your MERLIN MAGIX Integrated System files to ensure a timely recovery should it be required. Schedule regular, off-site backups.
- Keep the Remote Maintenance Device turned off when not in use by Avaya or your authorized dealer.
- Limit transfers to registered subscribers only.
- Use the Security Violations Notification options (Mailbox Lock or Warning Message) to alert you of any mailbox break-in attempts. Investigate all incidents.
- Review security policies and procedures and keep them up to date.

Choosing Passwords

Passwords should be the maximum length allowed by the system.

Passwords should be hard to guess and should not contain:

- All the same numbers (for example, 1111, 666666)
- Sequential characters (for example, 123456)
- Numbers that can be associated with you or your business, such as your name, birthday, business name, business address, telephone number, or social security number
- Words and commonly used names

Passwords should be changed regularly—at least on a quarterly basis. Recycling old passwords is not recommended. Never program passwords (or authorization codes or barrier codes) onto a speed dial button.

Physical Security

You should always limit access to the system console (or attendant console) and supporting documentation. The following are some recommendations:

- Keep the system console and supporting documentation in an office that is secured with a changeable combination lock. Provide the combination only to those individuals having a real need to enter the office.
- Keep telephone wiring closets and equipment rooms locked.
- Keep telephone logs and printed reports in locations that only authorized personnel can enter.
- Design distributed reports so they do not reveal password or trunk access code information.
- Keep the voice messaging system Remote Maintenance Device turned off.

Limiting Outcalling

When Outcalling is used to contact subscribers who are off-site, use the MERLIN MAGIX Integrated System Allowed Lists and Disallowed Lists or Automatic Route Selection features to minimize toll fraud.

If the Outcalling feature will not be used, outward restrict all voice messaging system ports. If Outcalling will be used, ports not used for Outcalling should be Outward Restricted. Use Outward Restriction, Toll Restrictions, Allowed Lists, Disallowed Lists and Facility Restrictions Levels, as appropriate, to minimize the possibility of toll fraud.

Limited Warranty and Limitation of Liability

Avaya Inc. warrants to you, the customer, that your MERLIN MAGIX Integrated System will be in good working order on the date Avaya or its authorized reseller delivers or installs the system, whichever is later ("Warranty Date"). If you notify Avaya or its authorized reseller within one year of the Warranty Date that your system is not in good working order, Avaya 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 you purchased your system directly from Avaya, Avaya will perform warranty repair in accordance with the terms and conditions of the specific type of Avaya maintenance coverage you selected. If you purchased your system from an Avaya-authorized reseller, contact your reseller for the details of the maintenance plan applicable to your system.

The following will not be deemed to impair the good working order of the system, and Avaya will not be responsible under the limited warranty for damages resulting from:

- Failure to follow Avaya's installation, operation, or maintenance instructions
- Unauthorized system modification, movement, or alteration
- Unauthorized use of common carrier communications services accessed through the system

- Abuse, misuse, or negligent acts or omissions of the customer and persons under the customer's control
- Power surges, including power surges due to lightning
- Acts of third parties and acts of God

AVAYA'S OBLIGATION TO REPAIR, REPLACE, OR REFUND AS SET FORTH ABOVE IS YOUR EXCLUSIVE REMEDY.

EXCEPT AS SPECIFICALLY SET FORTH ABOVE, AVAYA, 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 as provided below, the liability of Avaya and its affiliates and suppliers 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 the lesser of: (1) the direct damages proven; or (2) the repair cost, replacement cost, license fee, annual rental charge, or purchase price, as the case may be, of the equipment that gives rise to the claim. Except as provided below, Avaya and its affiliates and suppliers shall not be liable for any incidental, special, reliance, consequential, or indirect loss or damage incurred in connection with the equipment. As used in this paragraph, consequential damages include, but are not limited to, the following: lost profits, lost revenues, and losses arising out of unauthorized use (or charges for such use) of common carrier telecommunications services or facilities accessed through or connected to the equipment. For personal injury caused by Avaya's negligence, Avaya's liability shall be limited to proven damages to person. **No action or proceeding against Avaya or its affiliates or suppliers may be commenced more than twenty-four (24) months after the cause of action accrues.** THIS PARAGRAPH SHALL SURVIVE FAILURE OF AN EXCLUSIVE REMEDY.

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, or 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. Avaya 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.
 - Give the password only 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. Give it only 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 transferring only authorized individuals to that extension.

Overview

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 appendix covers the following memory card functions:

- Memory card formatting
- Restore
- 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 Memory Card.** This card is used for MERLIN MAGIX Integrated System software upgrades. The upgrade can be performed by the system manager using the memory card and the Maintenance option on the SPM Main Menu. This card is identified by an orange label with black lettering.
- **Translation Memory Card.** This card is used for MERLIN MAGIX Integrated System Backup and Restore procedures performed through the Backup/Restore option on the System Menu. An automatic backup feature permits you to set the system to perform automatic backups to the memory card on a daily or weekly basis. This card is identified by a white label with black lettering, as shown in Figure [B-1](#).
- **Forced Installation Memory Card.** 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.

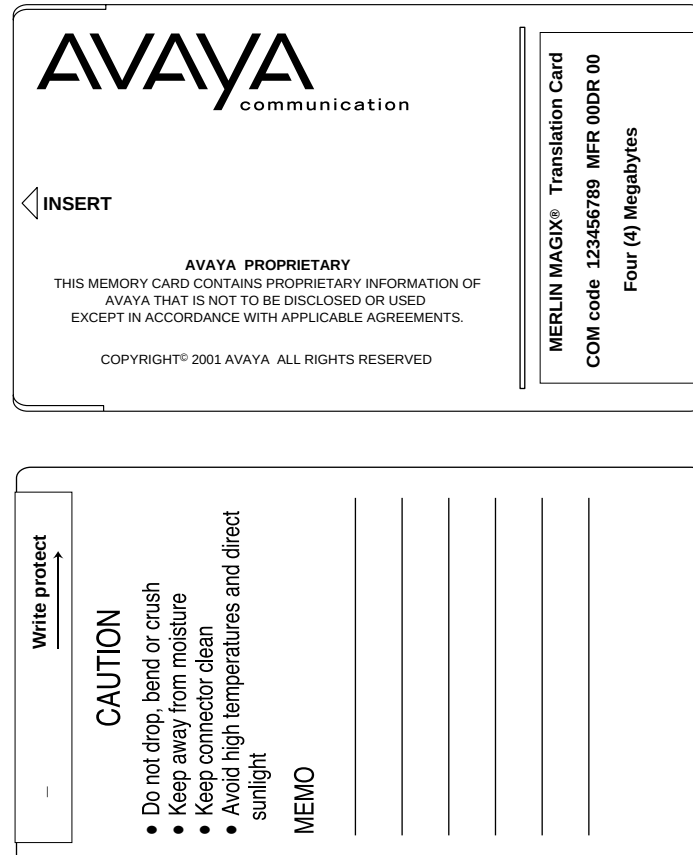


Figure B-1. PCMCIA Translation Memory Card

Inserting the Card

To insert the card, hold the card with the Avaya logo facing up and the arrow pointing toward the slot. See [Figure 4-3 on page 4-13](#) for the proper way to insert the memory card into the slot on the processor module.

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

If you begin a backup procedure with an unformatted or incorrectly formatted card, this screen appears:

```
Memory Card Backup:
Inserted Memory Card is
not the correct type.
Do you want it
formatted?
Yes
No
Exit
```

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.

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.

NOTE ► Only 4-MB Series I or Series II PCMCIA memory cards may be formatted, except those already formatted as translation cards.

This screen appears if you respond to format the memory card:

```
Format Memory Card:
All data on card will be
DELETED.
Do you want it
formatted?
Yes
No
Exit
```

Select Yes to begin the memory card format. Table [B-1](#) lists the screen messages that may appear while formatting is in progress.

Table B-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.

Procedure	Insert memory card→System→Back/Restore→Backup→Select backup file (if you select AUTO . BACK1 or AUTO . BACK2, you cannot rename the file)→Dial the new backup filename→Enter→Yes→Back→Back→Back (When entering the new backup filename, select Punctuation to toggle between the letters and punctuation. Use the buttons next to the display to specify the letters A through I and punctuation. Use the line/feature buttons to specify additional alpha-numeric characters for labels. Use the template provided with the 4424LD+ or MLX-20L telephone to see which line buttons correspond to which alphanumeric characters.)
Programmable by Mode	System Manager 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

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 this procedure to reprogram automatic backup.

Procedure	To program daily backup: Insert memory card→System→Back/Restore→Auto Backup→Daily→Drop (erases current daily backup time)→Dial time→Enter→Back→Back To program weekly backup: Insert memory card→System→Back/Restore→Auto Backup→Weekly→Drop (erases current weekly backup day and time)→Dial day and time→Enter→Back→Back
Programmable by Mode	System Manager
Idle Condition	All
Planning Form	Not required
Factory Setting	Form 1, System Planning
Valid Entries	Weekly backup (Sunday at 2:00 am)
	Daily: hhmm (00 to 23; 00 to 59)
	Weekly: dhhmm (0 to 6, where 0 equals Sunday; 00 to 23; 00 to 59)
Inspect	No
Copy Option	No

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. Table B-2 lists the messages that can appear during a Backup and describes what action to take.

Table B-2. Messages That Can Appear During a Backup

Backup Message	What It Means	What To Do
BACKUP IS CANCELED. File has been DELETED.	If the system detects an error, either on the memory card or with the backup file, or if you abort the backup, this message appears. The backup file being created is deleted, and the backup is aborted.	Repeat the backup procedure.
BACKUP IS CANCELED. Verify that Memory Card has been inserted correctly. File has been DELETED.	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.	Reinsert the memory card and repeat the backup procedure.

Table B-2. Messages That Can Appear During a Backup—Continued

Backup Message	What It Means	What To Do
Verify that Memory Card has been inserted correctly.	The memory card is either not inserted or is inserted incorrectly. The backup is aborted. This message 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.	Reinsert the memory card and repeat the backup procedure. Verify that the card is a translation memory card
Memory Card is Write-Protected. Reset Write-Protect tab on Memory Card.	Memory card is write-protected. 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.	Remove the memory card, flip the write-protect tab, reinsert the memory card, and repeat the backup procedure.
Backup Failure. Try a different file or new Memory Card.	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, this message 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 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.

Procedure	Insert memory card→System→Back/Restore→ Restore→ Select the restore file→Yes
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

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. Table B-3 lists the messages that can appear during a Restore and describes what action to take.

Table B-3. Message That Can Appear During a Restore

Restore Message	What It Means	What To Do
Verify that Memory Card has been inserted correctly.	The memory card is either not inserted or is inserted incorrectly. The restore is aborted. This message may also appear if the wrong type of memory card is inserted and a restore is requested within one minute of insertion.	Reinsert the memory card and repeat the restore procedure. Verify that the card is a translation memory card.
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; the system performs a System Erase (frigid start).	Reinsert the memory card and repeat the restore procedure.
Change Sys Programming Port to Extension xxxx before Restoring.	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 and repeat the restore procedure.
File is not Compatible for Release X.Y. Restore Canceled. Conversion Required.	This message appears only if Releases are not compatible.	Conversion required.
Restore Failure. Try a different file or a new Memory Card.	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.
Restore Failure. RESTORE IS CANCELED. 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.

Table B-3. Message That Can Appear During a Restore—*Continued*

Restore Message	What It Means	What To Do
Inserted Memory Card is not the correct type. Remove and insert MERLIN MAGIX Backup/Restore Card.	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 ” on page B-1 for information about the card labels.
Restore Failure. RESTORE IS CANCELED. Board mismatch between control unit and file.	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.	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.
Restore Failure. RESTORE IS CANCELED. Restore file Mode is Hybrid/PBX. Control Unit strap in place for KEY.	If the processor module has been strapped for Permanent Key mode, a restore to Hybrid/PBX mode is not possible.	Modify the processor.  CAUTION: <i>This procedure should be performed only by qualified service personnel.</i>

NI-1 BRI Provisioning

This appendix provides detailed information concerning the features and translations that make up the ISDN Ordering Code (IOC) standardized capability package “S,” as well as the Multiline Hunt (MLH) feature. The MLH feature is provisioned using either the Multiline Hunt Group or the Series Completion feature, depending on the central office switch type.

Specific translations are provided for the following switches:

- Lucent Technologies 5ESS
- Northern Telecom DMS-100
- Siemens SSC EWSD

After determining that the local service provider offers National ISDN-1 service, the information contained in this appendix should be given to the local service provider, if necessary.

NOTE ► The programming screens shown in this appendix are representative samples only. The local service provider will need to enter applicable data (such as the telephone numbers) where necessary. Also note that the programming covered in this appendix *does not* take place on the MERLIN MAGIX Integrated System. All programming is performed by the local service provider on the central office switch.

Lucent Technologies 5ESS Switch Translations

For the Lucent Technologies 5ESS switch, Capability Package “S” includes alternate voice/circuit-switched data on two B-channels. It also supports Calling Number Identification on data and voice connections. Please note that in order to have simultaneous calls on the two B-channels, two Directory Numbers (DNs) must be assigned with this package.

The Lucent Technologies 5ESS switch also allows alternate voice and data hunting on one DN using the Series Completion feature.

ISDN Capability Package “S”

The information listed below provides the DN translations that define Capability Package “S,” and the screens and fields that must be programmed.

The information provided shows the translations for one Digital Subscriber Line (DSL) and two DNs. For multiple DSLs/DNs, the central office will duplicate these screens and enter the applicable DSL and DN values as needed.

ISDN Ordering Code: Capability S

VIEW 23.2

DN1 Translations

Fields that must be programmed on Screens 1, 2, 3, and 4:

1	DSL TN	<C plus <i>Telephone number</i> >
9	ASSOC	<U>
11	OE	<enter <i>OE and type</i> >
14	D ISCN	<enter <i>value</i> >
15	DSERV	<SX>
16	B1SERV	<DMD>
17	B2SERV	<DMD>
18	NT1 TYPE	<enter <i>NT1 type</i> >
20	DSL CLS	<STD>
21	RSTR MP	<N>
23	MDPKT	<0>
24	MTERM	<2>
28	USPID	<enter <i>value</i> >
29	MAXB CHL	<2>
30	ACT USER	<Y>

Fields that must be populated on Screens 4, 5, and 6:

34	CKT TN	<enter TN>
35	CKT LCC	<enter LCC>
36	CKT RAX	<enter RAX value>
41	TERMTYP	<TYPEA>
42	DISPLAY	<Y>
46	CSV	<1>
47	CSV CHL	<ANY>
49	CSV LIMIT	<1>
55	CSD	<2>
56	CSD CHL	<ANY>
58	CSD LIMIT	<2>
126	CPN SCRN	<Y>
91	PIC	<enter PIC>

The Calling Number Identification feature is assigned using the standard BRCS preconstructed features /LICNDA and /CPCOFA. If it is possible, request /CPCPFA for the Calling Number Identification feature, as it provides a clearer display of the CPN information.

The Redirecting Number Delivery (RND) feature is assigned using the preconstructed RND feature, /RND. These features are assigned to the user in View 23.8, Field 109.

DN2 Translations (Note: DSL information was built with DN1)

Fields that must be populated on Screens 1, 2, 3, and 4:

1	DSL TN	<C plus second <i>Telephone number</i> >
9	ASSOC	<U>
11	OE	<enter OE and type>
28	USPID	<enter value>
29	MAXB CHL	<2>
30	ACT USER	<Y>

Fields that must be populated on Screens 4, 5, and 6:

34	CKT TN	<enter TN>
35	CKT LCC	<enter LCC>
36	CKT RAX	<enter RAX value>
41	TERMTYP	<TYPEA>
42	DISPLAY	<Y>
46	CSV	<1>
47	CSV CHL	<ANY>
49	CSV LIMIT	<1>
55	CSD	<2>
56	CSD CHL	<ANY>
58	CSD LIMIT	<2>
126	CPN SCRIN	<Y>
91	PIC	<enter PIC>

The Calling Number Identification feature is assigned using the standard BRCS preconstructed features /LICNDA and /CPCOFA. If it is possible, request /CPCPFA for the Calling Number Identification feature, as it provides a clearer display of the CPN information.

The Redirecting Number Delivery (RND) feature is assigned using the preconstructed RND feature, /RND. These features are assigned to the user in View 23.8, Field 109.

Series Completion Feature Translations

The sample screens shown below illustrate the translations for alternate voice and data hunting on one main DSL and three DNs forming a linear series completion group. Voice hunting is provided using Series Completion (Field 87, SERHLN). Data hunting is provided with Call Forward Data Busy Line (/CFDBLAC).

The 5ESS limits the number of members of a series completion group to 16 DNs, and the number of lines forwarded using /CFDBLAC to the value specified on Screen 9, Field 176 (SIMINTRA). This value is currently set to 99 series completion groups, but can be changed.

```

SCREEN 1 OF 14          RECENT CHANGE 23.8
                        DSL/BRCS ASSIGNMENT
(*)1. DSL TN C 2228700  SERVICES AND FEATURES  SCREENS
(*)4. MLHG_____      -----
(*)5. TERM_____      BRCS FEATURE LIST          6
(*)6. DSL OE  _ _____ BRCS FEATURE PARAMETERS 7 to 9
(*)9. ASSOC  UCKT          4 & 5

                        DELFEAT LIST          14
                        DPKT                  10
                        DSL INFO              2
                        ODB                  11
                        PPB1                  C
                        PPB2                  13
                        USER INFO            3

```

```

5ESS SWITCH LABNSC1
SCREEN 2 OF 14          RECENT CHANGE 23.8
                        DSL/BRCS ASSIGNMENT (DSL INFO)
>11. OE  I 00101209    25. CUT DGTS                2228
14. D ISCN 007096      26. ACSR GRP_____
15. D SERV SX          27. DFLT SRV_____
16. B1 SERV DMD
17. B2 SERV DMD
18. NT1 TYPE AULC
19. PM GRP PMDEF
20. DSL CLS STD
21. RSTR MP N
22. ACSR INH Y
23. MDPKT 8
24. MTERM 2

```

```

                    5ESS SWITCH LABNSC1
SCREEN 3 OF 14      RECENT CHANGE 23.8
                    DSL/BRCS ASSIGNMENT (USER INFO)

>28. USPID      0122287000
29. MAXB CHL1
30. ACT USERY
31. PPB1 USRN
32. PPB2 USRN
33. AGI      _
  
```

```

SCREEN 4 OF 14      5ESS SWITCH LABNSC1
                    RECENT CHANGE 23.8
                    DSL/BRCS ASSIGNMENT (CKT)

>34. CKT TN      2228700      CIRCUIT VOICE (CSV)      CIRCUIT DATA (CSD)
35. CKT LCC      DSL      46. CSV      1      55. CSD      1
36. CKT RAX      1      47. CSV CHL      ANY      56. CSD CHL      ANY
37. CKT MLHG      ____      48. CSV ACO      57. CSD ACO      ____
38. CKT TERM      ____      49. CSV LIMIT      1      58. CSD LIMIT      1
39. NEW TN      ____      50. CSV NBLIMIT      ____      59. CSD NBLIMIT      ____
40. CONFIG GRP      NI17507B      50. CSV NBLIMIT      ____      60. K56 DNA      ____
41. TERMTYP      TYPEA      51. SP DNA      ____      61. K56 DNA QTY      ____
42. DISPLAY      Y      52. SP DNA QTY      ____      62. K64 DNA      ____
43. EKTS      ____      53. AU DNA      63. K64 DNA QTY      ____
44. CA      ____      54. AU DNA QTY
45. CA QT      ____
  
```

SCREEN 5 OF 14

5ESS SWITCH LABNSC1
RECENT CHANGE 23.8
DSL/BRCS ASSIGNMENT (CKT)

>64. TKS	72. SAR QTY__	82. BUSY MONITOR
65. TAUTON	73. SAR ORIGIN	83. ATT MLHG__
66. SHAREDN	74. SAR TERM N	84. RBV TGN__
67. SAUTON	75. INCOMING N	85. ERCS ASGN
68. PRIVACY N	76. INTERCOM N	86. ERCS ACTN
69. ICPN	77. ORIG CWN	87. SERHLN2228701
70. SUSON	78. PPN	88. BCK LNKN
71. SUSTN	79. CA PREF	90. CIDIALLOW
	80. AUTO HOLD	91. PIC__
	81. ONE TOUCHN	92. PTC__
		95. E911 PSAPN

SCREEN 6 OF 14

5ESS SWITCH LABNSC1
RECENT CHANGE 23.8
DSL/BRCS ASSIGNMENT

>106. BFGN _____ 109. FEATURE LIST (FL)

ROW	FEATURE	A	P	C	R	FEATURE	A	P	C	R	FEATURE	A	P	C	R	FEATURE	A	P	C	R	
1	/LIDLXA	Y	_	N	N	10	_____	_	_	_	19	_____	_	_	_	28	_____	_	_	_	_
2	/CPCPFA	Y	_	N	N	11	_____	_	_	_	20	_____	_	_	_	29	_____	_	_	_	_
3	/CFDBLAC	Y	_	N	N	12	_____	_	_	_	21	_____	_	_	_	30	_____	_	_	_	_
4	_____	_	_	_	_	13	_____	_	_	_	22	_____	_	_	_	31	_____	_	_	_	_
5	_____	_	_	_	_	14	_____	_	_	_	23	_____	_	_	_	32	_____	_	_	_	_
6	_____	_	_	_	_	15	_____	_	_	_	24	_____	_	_	_	33	_____	_	_	_	_
7	_____	_	_	_	_	16	_____	_	_	_	25	_____	_	_	_	34	_____	_	_	_	_
8	_____	_	_	_	_	17	_____	_	_	_	26	_____	_	_	_	35	_____	_	_	_	_
9	_____	_	_	_	_	18	_____	_	_	_	27	_____	_	_	_	36	_____	_	_	_	_

SCREEN 7 OF 14

5ESS SWITCH LABNSC1
RECENT CHANGE 23.8

DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)

>134. TG:GRPID	0	146. ACSR GRPNM	_____	158. QALWD	—
135. MOH ALW	—	147. EDS:GRPNM	_____	159. PRIORITY Q	—
136. IDP NAME	_____	148. BCLID GR	_____	160. ARSSI	—
137. DPAT CAT	0	149. PFA:VGRPN	_____	161. DIALPLN	—
138. ICR SFG	0	150. PFA:DGRPNM	_____	162. ALWMDR	—
139. SC1NAME	_____	151. ATH:VGRPNM	_____	163. ACSR PINREQ	—
140. SC1S	—	152. ATH:DGRPNM	_____	164. DRING	—
141. SC2NAME	_____	153. MDR:GRPNM	_____	165. DCW DRING	—
142. SC2S	_____	154. ACCT:GRPNM	_____	166. CWO DRING	—
143. CPU0:SELQ1	0	155. ARS:VGRPNM	_____	167. MWY DRING	—
144. CPU0:SELQ2	0	156. ARS:DGRPNM	_____		
145. CPUT:TPREDQ	0	157. FRL	_____		

SCREEN 8 OF 14

5ESS SWITCH LABNSC1
RECENT CHANGE 23.8

DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)

>172. MESSAGE SERVICE (MSS)	175. MW:DCNDN	_____

ROW	FEATURE	GRPNM
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____

SCREEN 9 OF 14

5ESS SWITCH LABNSC1
RECENT CHANGE 23.8

DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)

>176. CALL FORWARDING FEATURE PARAMETERS (CF)

ROW	FEATURE	FWD TO DN	TIMEOUT	BSRING	SIMINTER	SIMINTRA
1	/CFDBLAC2228701	0	N	1	99	
2	_____	0	—	0	0	
3	_____	0	—	0	0	
4	_____	0	—	0	0	
5	_____	0	—	0	0	
6	_____	0	—	0	0	

SCREEN 10 OF 14

5ESS SWITCH LABNSC1

RECENT CHANGE 23.8

DSL/BRCS ASSIGNMENT (DPKT)

>183. DPKT TN	_____	192. IECN DNIC	_____	198. H PVC LCN	_____
184. LCC	_____	193. PB GRP	_____	199. L IN LCN	_____
185. RAX	_____	194. NOTIF	NO	200. H IN LCN	_____
186. MLHG	_____	195. ICP	N	201. L 2W LCN	_____
187. TERM	_____	196. HUNT NOTIF	_____	202. H 2W LCN	_____
188. LNR HNT TN	_____	197. TCID	_____	203. L OUT LCN	_____
190. CHL SEL	N			204. H OUT LCN	_____
191. NEW TN	_____			206. PMDR GRP	_____
				207. PMDR ACT	_____
				208. DNA	_____
				209. DNA QTY	_____

SCREEN 11 OF 14

5ESS SWITCH LABNSC

RECENT CHANGE 23.8

DSL/BRCS ASSIGNMENT (ODB)

>210. ODB TN	_____	222. RATE	_____	234. L IN LCN	_____
211. LCC	_____	223. N2	_____	235. H IN LCN	_____
212. RAX	0	224. T1	_____	236. L 2W LCN	_____
213. MLHG	_____	225. T3	_____	237. H 2W LCN	_____
214. TERM	_____	226. WNDZ	_____	238. L OUT LCN	_____
215. LNR HNT TN	_____	227. NEW TN	_____	239. H OUT LCN	_____
216. HUNT DEACT	_____	228. IECN DNIC	_____	240. BUSY LIMIT	_____
217. CHL SEL	N	229. PB GRP	_____	241. PMDR GRP	_____
218. ISCN1	_____	230. NOTIF	_____	242. PMDR ACT	_____
219. ISCN2	_____	231. T3XX	0	243. DNA	_____
220. BAND	0	232. ICP	N	244. DNA QTY	_____
221. ODB	_____	233. HUNT NOTIF	_____		

```

SCREEN 12 OF 14          5ESS SWITCH LABNSC1
                        RECENT CHANGE 23.8
                        DSL/BRCS ASSIGNMENT (PPB1)

>245. PPB1 TN           _____ 254. RATE           _____ 264. H PVC LCN           _____
246. LCC                _____ 255. N2             _____ 265. L IN LCN           _____
247. RAX                0          256. T1             _____ 266. H IN LCN           _____
248. MLHG               _____ 257. T3             _____ 267. L 2W LCN           _____
249. TERM               _____ 258. WNDZ           _____ 268. H 2W LCN           _____
250. LNR HNT TN         _____ 259. NEW TN         _____ 239. H OUT LCN          _____
251. HUNT DEACT         _____ 260. IECN DNIC      _____ 269. L OUT LCN          _____
252. CHL SEL           N          261. PB GRP         _____ 270. H OUT LCN          _____
253. ISCN              _____ 262. ICP            N          271. BUSY LIMIT         _____
                        263. HUNT NOTIF _____ 272. PMDR GRP          _____
                        273. PMDR AC           _____

```

```

SCREEN 13 OF 14          5ESS SWITCH LABNSC1
                        RECENT CHANGE 23.8
                        DSL/BRCS ASSIGNMENT (PPB2)

>274. PPB2 TN           _____ 283. RATE           _____ 293. H PVC LCN           _____
275. LCC                _____ 284. N2             _____ 294. L IN LCN           _____
276. RAX                0          285. T1             _____ 295. H IN LCN           _____
277. MLHG               _____ 286. T3             _____ 296. L 2W LCN           _____
278. TERM               _____ 287. WNDZ           _____ 297. H 2W LCN           _____
279. LNR HNT TN         _____ 288. NEW TN         _____ 298. L OUT LCN          _____
280. HUNT DEACT         _____ 289. IECN DNIC      _____ 299. H OUT LCN          _____
281. CHL SEL           N          290. PB GRP         _____ 300. BUSY LIMIT         _____
282. ISCN              _____ 291. ICP            N          301. PMDR GRP          _____
                        292. HUNT NOTIF _____ 302. PMDR ACT           _____

```

```

SCREEN 14 OF 14          5ESS SWITCH LABNSC1
                        RECENT CHANGE 23.8
                        DSL/BRCS ASSIGNMENT

WARNING: These fields delete features currently on the view or in a BFG.
         Deletion of a feature in BFG may invoke BFG reselection.

303. DELFEAT

ROW FEATURE
1  _____
2  _____
3  _____

```

SCREEN 14 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT

No Messages

SCREEN 1 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT

(*)1. DSL	TN C	2228701	SERVICES AND FEATURES	SCREENS
(*)4. MLHG	_____		-----	-----
(*)5. TERM	_____		BRCS FEATURE LIST	6
(*)6. DSL	_____		BRCS FEATURE PARAMETERS	7 to 9
(*)9. ASSOC	U	CKT		4 & 5
			DELFEAT LIST	14
			DPKT	10
			DSL INFO	2
			ODB	11
			PPB1	12
			PPB2	13
			USER INFO	3

SCREEN 2 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (DSL INFO)

>11. OE I	00101209	25. CUT DGTS	2228
14. D ISCN	007096	26. ACSR GRP	_____
15. D SERV	SX	27. DFLT SRV	_____
16. B1 SERV	DMD		
17. B2 SERV	DMD		
18. NT1 TYPE	AULC		
19. PM GRP	PMDEF		
20. DSL CLS			
21. RSTR MP	N		
22. ACSR INH	Y		
23. MDPKT	8		
24. MTERM	2		

SCREEN 3 OF 14

5ESS SWITCH LABNSC1
RECENT CHANGE 23.8
DSL/BRCS ASSIGNMENT (USER INFO)

>28. USPID0122287010
29. MAXB CHL1
30. ACT USERY
31. PPB1 USRN
32. PPB2 USRN
33. AGI _____

SCREEN 4 OF 14

5ESS SWITCH LABNSC1
RECENT CHANGE 23.8
DSL/BRCS ASSIGNMENT (CKT)

>34. CKT TN	2228701	CIRCUIT VOICE	(CSV)	CIRCUIT DATA	(CSD)
35. CKT LCC	DSL	46. CSV	1	55. CSD	1
36. CKT RAX	1	47. CSV CHL	ANY	56. CSD CHL	ANY
37. CKT MLHG	_____	48. CSV ACO	_____	57. CSD ACO	_____
38. CKT TERM	_____	49. CSV LIMIT	1	58. CSD LIMIT	1
39. NEW TN	_____	50. CSV NBLIMIT	_____	59. CSD NBLIMIT	_____
40. CONFIG GRP	NI17507A	51. SP DNA	_____	60. K56 DNA	_____
41. TERMTYP	TYPEA	52. SP DNA QTY	_____	61. K56 DNA QTY	_____
42. DISPLAY	Y	53. AU DNA	_____	62. K64 DNA	_____
43. EKTS	_____	54. AU DNA	_____	63. K64 DNA QTY	_____
44. CA	_____				
45. CA QTY	_____				

SCREEN 5 OF 14

5ESS SWITCH LABNSC1
RECENT CHANGE 23.8
DSL/BRCS ASSIGNMENT (CKT)

>64. TKS	72. SAR QTY__	82. BUSY MONITOR
65. TAUTON	73. SAR ORIGIN	83. ATT MLHG_____
66. SHAREDN	74. SAR TERMN	84. RBV TGN_____
67. SAUTON	75. INCOMINGN	85. ERCS ASGNN
68. PRIVACYN	76. INTERCOMN	86. ERCS ACTN2228703
69. ICPN	77. ORIG CWN	87. SERHLN
70. SUSON	78. PPN	88. BCK LNKY
71. SUSTN	79. CA PREFI	89. ACD POS NUM_____
	80. AUTO HOLDN	90. CIDIALALLOW
	81. ONE TOUCHN	91. PIC_____

SCREEN 5 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (CKT)

92. PTC_____

95. E911 PSAPN

SCREEN 6 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT

>106. BFGN _____ 109. FEATURE LIST (FL)

ROW	FEATURE	A	P	C	R	FEATURE	A	P	C	R	FEATURE	A	P	C	R	FEATURE	A	P	C	R
1	/CPCPFA	Y	_	N	N	10	_____	-	-	-	19	_____	-	-	-	28	_____	-	-	-
2	/LIDLXA	Y	_	N	N	11	_____	-	-	-	20	_____	-	-	-	29	_____	-	-	-
3	/CFDBLAC	Y	_	N	N	12	_____	-	-	-	21	_____	-	-	-	30	_____	-	-	-
4	_____	-	-	-	-	13	_____	-	-	-	22	_____	-	-	-	31	_____	-	-	-
5	_____	-	-	-	-	14	_____	-	-	-	23	_____	-	-	-	32	_____	-	-	-
6	_____	-	-	-	-	15	_____	-	-	-	24	_____	-	-	-	33	_____	-	-	-
7	_____	-	-	-	-	16	_____	-	-	-	25	_____	-	-	-	34	_____	-	-	-
8	_____	-	-	-	-	17	_____	-	-	-	26	_____	-	-	-	35	_____	-	-	-
9	_____	-	-	-	-	18	_____	-	-	-	27	_____	-	-	-	36	_____	-	-	-

SCREEN 7 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)

>134. TG:GRPID	0	146. ACSR GRPNM	_____	158. QALWD	_____
135. MOH ALW	_____	147. EDS:GRPNM	_____	159. PRIORITY Q	_____
136. IDP NAME	_____	148. BCLID GRP	_____	160. ARSSI	_____
137. DPAT CAT	0	149. PFA:VGRPNM	_____	161. DIALPLN	_____
138. ICR SFG	0	150. PFA:DGRPNM	_____	162. ALWMDR	_____
139. SC1NAME	_____	151. ATH:VGRPNM	_____	163. ACSR PINREQ	_____
140. SC1S	_____	152. ATH:DGRPNM	_____	164. DRING	_____
141. SC2NAME	_____	153. MDR:GRPNM	_____	165. DCW DRING	_____
142. SC2S	_____	154. ACCT:GRPNM	_____	166. CWO DRING	_____
143. CPU0:SELQ1	0	156. ARS:DGRPNM	_____	167. MWY DRING	_____
144. CPU0:SELQ2	0	157. FRL	_____		
145. CPUT:TPREDQ	0				

SCREEN 8 OF 14 5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)
 >172. MESSAGE SERVICE (MSS) 175. MW:DCNDN _____

ROW	FEATURE	GRPNM
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____

SCREEN 9 OF 14 5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)
 >176. CALL FORWARDING FEATURE PARAMETERS (CF)

ROW	FEATURE	FWD TO DN	TIMEOUT	BSRING	SIMINTER	SIMINTRA
1	/CFDBLAC2228703		0	N	1	99
2	_____		0	—	0	0
3	_____		0	—	0	0
4	_____		0	—	0	0
5	_____		0	—	0	0
6	_____		0	—	0	0

SCREEN 1 OF 14 5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT

(*)1. DSL	TN C	2228703	SERVICES AND FEATURES	SCREENS
(*)4. MLHG	_____		-----	-----
(*)5. TERM	_____		BRCS FEATURE LIST	6
(*)6. DSL OE	— _____		BRCS FEATURE PARAMETERS	7 to 9
(*)9. ASSOC	U	CKT		4 & 5
			DELFEAT LIST	14
			DPKT	10
			DSL INFO	2
			ODB	11
			PPB1	12

```

SCREEN 1 OF 14          5ESS SWITCH LABNSC1
                        RECENT CHANGE 23.8
                        DSL/BRCS ASSIGNMENT
                        PPB2                      13
                        USER INFO                 3

```

```

SCREEN 2 OF 14          5ESS SWITCH LABNSC1
                        RECENT CHANGE 23.8
                        DSL/BRCS ASSIGNMENT (DSL INFO)
>11. OE      I      00101221  25. CUT DGTS      2228
14. D ISCN    007105  26. ACSR GRP      _____
15. D SERV    SX      27. DFLT SRV      _____
16. B1 SERV   DMD
17. B2 SERV   DMD
18. NT1 TYPE  TLC
19. PM GRP    _____
20. DSL CLS   STD
21. RSTR MP   N
22. ACSR INH  Y
23. MDPKT     8
24. MTERM     2

```

```

SCREEN 3 OF 14          5ESS SWITCH LABNSC1
                        RECENT CHANGE 23.8
                        DSL/BRCS ASSIGNMENT (USER INFO)
>28. USPID0122287030
29. MAXB CHL1
30. ACT USERY
31. PPB1 USRN
32. PPB2 USRN
33. AGI      _____

```

```

SCREEN 4 OF 14          5ESS SWITCH LABNSC1
                        RECENT CHANGE 23.8
                        DSL/BRCS ASSIGNMENT (CKT)
>34. CKT TN    2228703  CIRCUIT VOICE  (CSV)  CIRCUIT DATA  (CSD)
35. CKT LCC    DSL      46. CSV          1          55. CSD          1
36. CKT RAX    1        47. CSV CHL      ANY        56. CSD CHL      ANY

```

SCREEN 4 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (CKT)

37. CKT MLHG	_____	48. CSV ACO	_____	57. CSD ACO	_____
38. CKT TERM	_____	49. CSV LIMIT	1	58. CSD LIMIT	1
39. NEW TN	_____	50. CSV NBLIMIT	_____	59. CSD NBLIMIT	_____
40. CONFIG GRP	_____	51. SP DNA	_____	60. K56 DNA	_____
41. TERMTYP	TYPEA	52. SP DNA QTY	_____	61. K56 DNA QTY	_____
42. DISPLAY	Y	53. AU DNA	_____	62. K64 DNA	_____
43. EKTS	_____	54. AU DNA	_____	63. K64 DNA QTY	_____
44. CA	_____				
45. CA QTY	_____				

SCREEN 5 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (CKT)

>64. TKS	_____	72. SAR QTY	_____	82. BUSY MONITORN	
65. TAUTON		73. SAR ORIGN		83. ATT MLHG	_____
66. SHAREDN		74. SAR TERMN		84. RBV TGN	_____
67. SAUTON		75. INCOMINGN		85. ERCO ASGNN	
68. PRIVACYN		76. INTERCOMN		86. ERCO ACTN	
69. ICPN		77. ORIG CWN		87. SERHLN2228704	
70. SUSON		78. PPN		88. BCK LNKY	
71. SUSTN		79. CA PREFI		89. ACD POS NUM	_____
		80. AUTO HOLDN		90. CIDIALALLOW	
		81. ONE TOUCHN		91. PIC	_____
				92. PTC	_____
				95. E911 PSAPN	

SCREEN 6 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT
 109. FEATURE LIST (FL)

ROW	FEATURE	A	P	C	R	FEATURE	A	P	C	R	FEATURE	A	P	C	R	FEATURE	A	P	C	R	
1	/CPCPFA	Y	_	N	N	10	_____	-	-	-	19	_____	-	-	-	28	_____	-	-	-	-
2	/LIDLXA	Y	_	N	N	11	_____	-	-	-	20	_____	-	-	-	29	_____	-	-	-	-
3	/CFDBLAC	Y	_	N	N	12	_____	-	-	-	21	_____	-	-	-	30	_____	-	-	-	-
4	_____	-	-	-	-	13	_____	-	-	-	22	_____	-	-	-	31	_____	-	-	-	-
5	_____	-	-	-	-	14	_____	-	-	-	23	_____	-	-	-	32	_____	-	-	-	-
6	_____	-	-	-	-	15	_____	-	-	-	24	_____	-	-	-	33	_____	-	-	-	-

SCREEN 6 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT

7 _____	16 _____	25 _____	34 _____
8 _____	17 _____	26 _____	35 _____
9 _____	18 _____	27 _____	36 _____

SCREEN 7 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)

>134. TG:GRPID	0	146. ACSR GRPNM	_____	158. QALWD	_____
135. MOH ALW	_____	147. EDS:GRPNM	_____	159. PRIORITY Q	_____
136. IDP NAME	_____	148. BCLID GRP	_____	160. ARSSI	_____
137. DPAT CAT	0	149. PFA:VGRPNM	_____	161. DIALPLN	_____
138. ICR SFG	0	150. PFA:DGRPNM	_____	162. ALWMDR	_____
139. SC1NAME	_____	151. ATH:VGRPNM	_____	163. ACSR PINREQ	_____
140. SC1S	_____	152. ATH:DGRPNM	_____	164. DRING	_____
141. SC2NAME	_____	153. MDR:GRPNM	_____	165. DCW DRING	_____
142. SC2S	_____	154. ACCT:GRPNM	_____	166. CWO DRING	_____
143. CPU0:SELQ1	0	156. ARS:DGRPNM	_____	167. MWY DRING	_____
144. CPU0:SELQ2	0	157. FRL	_____		
145. CPUT:TPREDQ	0				

SCREEN 8 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)

>172. MESSAGE SERVICE (MSS) 175. MW:DCNDN _____

ROW	FEATURE	GRPNM
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____

SCREEN 9 OF 14 5ESS SWITCH LABNSC1

RECENT CHANGE 23.8

DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)

>176. CALL FORWARDING FEATURE PARAMETERS (CF)

ROW	FEATURE	FWD TO DN	TIMEOUT	BSRING	SIMINTER	SIMINTRA
1	/CFDBLAC2228704		0	Y	1	99
2	_____		0	—	0	0
3	_____		0	—	0	0
4	_____		0	—	0	0
5	_____		0	—	0	0
6	_____		0	—	0	0

SCREEN 1 OF 14

5ESS SWITCH LABNSC1

RECENT CHANGE 23.8

DSL/BRCS ASSIGNMENT

(*)1. DSL	TN C	2228704	SERVICES AND FEATURES	SCREENS
(*)4. MLHG	_____		-----	-----
(*)5. TERM	_____		BRCS FEATURE LIST	6
(*)6. DSL OE	— _____		BRCS FEATURE PARAMETERS	7 to 9
(*)9. ASSOC	U	CKT		4 & 5
			DELFEAT LIST	14
			DPKT	10
			DSL INFO	2
			ODB	11
			PPB1	12
			PPB2	13
			USER INFO	3

SCREEN 2 OF 14

5ESS SWITCH LABNSC1

RECENT CHANGE 23.8

DSL/BRCS ASSIGNMENT (DSL INFO)

>11. OE	I	00101221	25. CUT DGTS	2228
14. D ISCN		007105	26. ACSR GRP	_____
15. D SERV	SX		27. DFLT SRV	_____
16. B1 SERV	DMD			
17. B2 SERV	DMD			
18. NT1 TYPE	TLC			

SCREEN 2 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (DSL INFO)

19. PM GRP	_____
20. DSL CLS	STD
21. RSTR MP	N
22. ACSR INH	Y
23. MDPKT	8
24. MTERM	2

SCREEN 3 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (USER INFO)

>28. USPID0122287040
 29. MAXB CHL1
 30. ACT USERY
 31. PPB1 USRN
 32. PPB2 USRN
 33. AGI_

SCREEN 4 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (CKT)

>34. CKT TN	2228704	CIRCUIT VOICE	(CSV)	CIRCUIT DATA	(CSD)
35. CKT LCC	DSL	46. CSV	1	55. CSD	1
36. CKT RAX	1	47. CSV CHL	ANY	56. CSD CHL	ANY
37. CKT MLHG	_____	48. CSV ACO	_____	57. CSD ACO	_____
38. CKT TERM	_____	49. CSV LIMIT	1	58. CSD LIMIT	1
39. NEW TN	_____	50. CSV NBLIMIT	_____	59. CSD NBLIMIT	_____
40. CONFIG GRP	_____	51. SP DNA	_____	60. K56 DNA	_____
41. TERMTYP	TYPEA	52. SP DNA QTY	_____	61. K56 DNA QTY	_____
42. DISPLAY	Y	53. AU DNA	_____	62. K64 DNA	_____
43. EKTS	_____	54. AU DNA	_____	63. K64 DNA QTY	_____
44. CA	_____				
45. CA QTY	_____				

SCREEN 5 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (CKT)

>64. TKS	N	72. SAR QTY	—	82. BUSY MONITOR	N
65. TAUTO	N	73. SAR ORIG	N	83. ATT MLHG	—
66. SHARED	N	74. SAR TERM	N	84. RBV TGN	—
67. SAUTO	N	75. INCOMING	N	85. ERCS ASGN	N
68. PRIVACY	N	76. INTERCOM	N	86. ERCS ACT	N
69. ICP	N	77. ORIG CW	N	87. SERHLN	—
70. SUSO	N	78. PP	N	88. BCK LNK	Y
71. SUST	N	79. CA PREF	I	89. ACD POS NUM	—
		80. AUTO HOLD	N	90. CIDIAL	ALLOW
		81. ONE TOUCH	N	91. PIC	—
				92. PTC	—
				95. E911 PSAP	N

SCREEN 6 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT

>106. BFGN _____ 109. FEATURE LIST (FL)

A					A					A					A						
ROW	FEATURE	A	P	C	R	FEATURE	A	P	C	R	FEATURE	A	P	C	R	FEATURE	A	P	C	R	
1	/CPCPFA	Y	—	N	N	10	_____	—	—	—	19	_____	—	—	—	28	_____	—	—	—	—
2	/LIDLXA	Y	—	N	N	11	_____	—	—	—	20	_____	—	—	—	29	_____	—	—	—	—
3	_____	—	—	—	—	12	_____	—	—	—	21	_____	—	—	—	30	_____	—	—	—	—
4	_____	—	—	—	—	13	_____	—	—	—	22	_____	—	—	—	31	_____	—	—	—	—
5	_____	—	—	—	—	14	_____	—	—	—	23	_____	—	—	—	32	_____	—	—	—	—
6	_____	—	—	—	—	15	_____	—	—	—	24	_____	—	—	—	33	_____	—	—	—	—
7	_____	—	—	—	—	16	_____	—	—	—	25	_____	—	—	—	34	_____	—	—	—	—
8	_____	—	—	—	—	17	_____	—	—	—	26	_____	—	—	—	35	_____	—	—	—	—
9	_____	—	—	—	—	18	_____	—	—	—	27	_____	—	—	—	36	_____	—	—	—	—

SCREEN 7 OF 14

5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)

>134. TG:GRPID	0	146. ACSR GRPNM	_____	158. QALWD	_____
135. MOH ALW	_____	147. EDS:GRPNM	_____	159. PRIORITY Q	_____
136. IDP NAME	_____	148. BCLID GRP	_____	160. ARSSI	_____
137. DPAT CAT	0	149. PFA:VGRPNM	_____	161. DIALPLN	_____
138. ICR SFG	0	150. PFA:DGRPNM	_____	162. ALWMDR	_____

SCREEN 7 OF 14 5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)

139. SC1NAME	_____	151. ATH:VGRPNM	_____	163. ACSR PINREQ	_____
140. SC1S	_____	152. ATH:DGRPNM	_____	164. DRING	_____
141. SC2NAME	_____	153. MDR:GRPNM	_____	165. DCW DRING	_____
142. SC2S	_____	154. ACCT:GRPNM	_____	166. CWO DRING	_____
143. CPU0:SELQ1	0	155. ARS:VGRPNM	_____	167. MWY DRING	_____
144. CPU0:SELQ2	0	156. ARS:DGRPNM	_____		
145. CPUT:TPREDQ	0	157. FRL			

SCREEN 8 OF 14 5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)

>172. MESSAGE SERVICE (MSS) 175. MW:DCNDN _____

ROW	FEATURE	GRPNM
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____

SCREEN 9 OF 14 5ESS SWITCH LABNSC1
 RECENT CHANGE 23.8
 DSL/BRCS ASSIGNMENT (HIGH RUNNER FEATURE PARAMETERS)

>176. CALL FORWARDING FEATURE PARAMETERS (CF)

ROW	FEATURE	FWD TO DN	TIMEOUT	BSRING	SIMINTER	SIMINTRA
1	_____		0	—	0	0
2	_____		0	—	0	0
3	_____		0	—	0	0
4	_____		0	—	0	0
5	_____		0	—	0	0
6	_____		0	—	0	0

Northern Telecom DMS-100 Switch Translations

For the Northern Telecom DMS-100 switch, Capability Package “S” includes alternate voice/circuit-switched data on two B-channels. It also supports Calling Number Identification on data and voice connections. Please note that the assignment of two DNs is required for this package.

The DMS-100 switch also allows alternate voice and data hunting on one DN through the Multiline Hunt Group feature.

ISDN Capability Package “S”

The information listed below provides the DN translations that define Capability Package “S,” and the commands that must be executed.

ISDN Ordering Code: Capability S

Provision DN1 using the following translations

Define a new Logical Terminal Identifier (LTID) using the SLT command:

SONUMBER	<<cr> or \$>
LTID	<enter identifier value>
FUNCTION	<enter identifier value>
LTCLASS	<BRAFS>
CS	<Y>
PS	<N>
MAXKEYS	<64>
TEI_TYPE	<DTEI>
ABS	<NOPMD>
ABS	<\$>
EKTS	<N>
SPIDSFX option	
SPID_SUFFIX	<enter spid suffix value>
PVC option	
VERSION	<FUNCTIONAL>
ISSUE	<2>

Associate new DN with LTID using the NEW command:

SONUMBER	<<cr> or \$>
DN	<enter DN>
LCC	<ISDNKSET>
GROUP	<enter group name>
SUBGRP	<enter subgrp value>
NCOS	<enter ncos value>
SNPA	<enter NXX value>
KEY	<1>
RINGING	<Y>
LATANAME	<enter value>
LTG	<enter value>
LEN_OR_LTID	<enter assigned value>

DMS-100 normally delivers the Calling Party Number and the Redirecting Number, if available.

Attach LTIDs to LEN using the SLT command:

SONUMBER	<<cr> or \$>
LTID	<enter value>
FUNCTION	<ATT>
LEN	<enter LEN to which LTID will be attached>

Provision DN2 using the following translations

Define a new Logical Terminal Identifier (LTID) using the SLT command:

SONUMBER	<<cr> or \$>
LTID	<enter identifier value>
FUNCTION	<ADD>
LTCLASS	<BRAFS>
CS	<Y>
PS	<N>
MAXKEYS	<64>
TEI_TYPE	<DTEI>
ABS	<NOPMD>
ABS	<\$>
EKTS	<N>
SPIDSFX option	
SPID_SUFFIX	<enter spid suffix value>
PVC option	
VERSION	<FUNCTIONAL>
ISSUE	<2>

Associate new DN with LTID using the NEW command:

SONUMBER	<<cr> or \$>
DN	<enter DN>
LCC	<ISDNKSET>
GROUP	<enter group name>
SUBGRP	<enter subgrp value>
NCOS	<enter ncos value>
SNPA	<enter NXX value>
KEY	<1>
RINGING	<Y>
LATANAME	<enter value>
LTG	<enter value>
LEN_OR_LTID	<enter assigned value>

DMS-100 normally delivers the Calling Party Number and the Redirecting Number, if available.

Attach LTIDs to LEN using the SLT command:

SONUMBER	<<cr> or \$>
LTID	<enter value>
FUNCTION	<ATT>
LEN	<enter LEN to which LTID will be attached>

Multiline Hunt Group Feature Translations

The sample screens shown below illustrate the translations for alternate voice and data hunting on three Digital Subscriber Lines (DSLs) and six Directory Numbers (DNs) forming a circular hunt group. This hunting is provided using the Multiline Hunt Group feature.

The screens shown in this section are examples, DNs shown on these screens should be replaced with applicable data.

QDN 2257141

```

DN:      2257141
TYPE: PILOT OF DNH HUNT GROUP
SNPA: 201SIG: N/A LNATTIDX: N/A
HUNT GROUP: 22      HUNT MEMBER: 0
LTID: PSATS      141
LTCLASS: BRAFS
LINE CLASS CODE: ISDNKSET
KEY: 1
CUSTGRP: MDCSCA SUBGRP: 0 NCOS: 0 RING: Y
OPTIONS:
SFC
6GROUP OPTIONS:
CIR RCVD
MEMBER INFO:
  1      2257146
  2      2257145
  3      2257144
  4      2257143
  5      2257142

```

QLT PSATS 141

LTID: PSATS 141
 SNPA: 201
 DIRECTORY NUMBER: 2257141
 LT GROUP NO: 13
 LTCLASS: BRAFS DEFAULT LOGICAL TERMINAL: N
 EKTS: N CACH: N
 BEARER SERVICE RESTRICTIONS: NOPMD
 CS: Y PS: N
 VERSION: FUNCTIONAL ISSUE: 2
 SPID-SUFFIX: 01
 LEN: HOST 01 1 10 01 TEI: DYNAMIC
 CUSTGRP: MDCSCA SUBGRP: 0 NCOS: ORING: Y
 LINE CLASS CODE: ISDNKSET
 MAXKEYS: 64
 DN IS ASSIGNED AS A DNH HUNT PILOT.
 HUNT GROUP: 22 HUNT MEMBER: 0
 OPTIONS:
 SFC

KEY	DN
---	--
1	DN 2257141

KEY	FEATURE
---	-----
	NONE

6GROUP OPTIONS:
 CIR RCVD
 MEMBER INFO:
 1 2257146
 2 2257145
 3 2257144
 4 2257143
 5 2257142

QLT PSATS 142

LTID: PSATS 142
SNPA: 201
DIRECTORY NUMBER: 2257142
LT GROUP NO: 13
LTCLASS: BRAFS DEFAULT LOGICAL TERMINAL: N
EKTS: N CACH: N
BEARER SERVICE RESTRICTIONS: NOPMD
CS: Y PS: N
VERSION: FUNCTIONAL ISSUE: 2
SPID-SUFFIX: 01
LEN: HOST 01 1 10 02 TEI: DYNAMIC
CUSTGRP: MDCSCA SUBGRP: 0 NCOS: 0 RING: Y
LINE CLASS CODE: ISDNKSET
MAXKEYS: 64
DN IS ASSIGNED AS A DNH HUNT MEMBER (NOT PILOT).
HUNT GROUP: 22 HUNT MEMBER: 5
OPTIONS:
SFC

KEY	DN
---	--
1	DN 2257142

KEY FEATURE
--- -----
NONE

PILOT DN: 2257141
GROUP OPTIONS:
CIR RCVD

DN: 2257143
TYPE: MEMBER OF DNH HUNT GROUP
SNPA: 201 SIG: N/A LNATTIDX: N/A
HUNT GROUP: 22 HUNT MEMBER: 4
LTID: PSATS 143
LTCLASS: BRAFS
LINE CLASS CODE: ISDNKSET
KEY: 1
CUSTGRP: MDCSCA SUBGRP: 0 NCOS: 0 RING: Y
OPTIONS:
SFC
PILOT DN: 2257141
GROUP OPTIONS:
CIR RCVD

LTID: PSATS 143
 SNPA: 201
 DIRECTORY NUMBER: 2257143
 LT GROUP NO: 13
 LTCLASS: BRAFS DEFAULT LOGICAL TERMINAL: N
 EKTS: N CACH: N
 BEARER SERVICE RESTRICTIONS: NOPMD
 CS: Y PS: N
 VERSION: FUNCTIONAL ISSUE: 2
 SPID-SUFFIX: 01
 LEN: HOST 01 0 07 01 TEI: DYNAMIC
 CUSTGRP: MDCSCA SUBGRP: 0 NCOS: 0 RING: Y
 LINE CLASS CODE: ISDNKSET
 MAXKEYS: 64
 DN IS ASSIGNED AS A DNH HUNT MEMBER (NOT PILOT).
 HUNT GROUP: 22 HUNT MEMBER: 4
 OPTIONS:
 SFC

KEY	DN	
---	--	
1	DN	2257143

KEY FEATURE
 --- -----
 NONE

PILOT DN: 2257141
 GROUP OPTIONS:
 CIR RCVD

QDN 2257144;QLT PSATS 144

DN: 2257144
 TYPE: MEMBER OF DNH HUNT GROUP
 SNPA: 201 SIG: N/A LNATTIDX: N/A
 HUNT GROUP: 22 HUNT MEMBER: 3
 LTID: PSATS 144
 LTCLASS: BRAFS
 LINE CLASS CODE: ISDNKSET
 KEY: 1
 CUSTGRP: MDCSCA SUBGRP: 0 NCOS: 0 RING: Y
 OPTIONS:
 SFC
 PILOT DN: 2257141
 GROUP OPTIONS:
 CIR RCVD

LTID: PSATS 144
SNPA: 201
DIRECTORY NUMBER: 2257144
LT GROUP NO: 13
LTCLASS: BRAFS DEFAULT LOGICAL TERMINAL: N
EKTS: N CACH: N
BEARER SERVICE RESTRICTIONS: NOPMD
CS: Y PS: N
VERSION: FUNCTIONAL ISSUE: 2
SPID-SUFFIX: 01
LEN: HOST 01 1 10 01 TEI: DYNAMIC
CUSTGRP: MDCSCA SUBGRP: 0 NCOS: 0 RING: Y
LINE CLASS CODE: ISDNKSET
MAXKEYS: 64
DN IS ASSIGNED AS A DNH HUNT MEMBER (NOT PILOT).
HUNT GROUP: 22 HUNT MEMBER: 3
OPTIONS:
SFC

KEY	DN
---	--
1	DN 2257144

KEY FEATURE
--- -----
NONE

PILOT DN: 2257141
GROUP OPTIONS:
CIR RCVD

QDN 2257145;QLT PSATS 145

DN: 2257145
TYPE: MEMBER OF DNH HUNT GROUP
SNPA: 201 SIG: N/A LNATTIDX: N/A
HUNT GROUP: 22 HUNT HENBER: 2
LTID: PSATS 145
LTCLASS: BRAFS
LINE CLASS CODE: ISDNKSET
KEY: 1
CUSTGRP: MDCSCA SUBGRP: 0 NCOS: 0 RING: Y
OPTIONS:
SFC
PILOT DN: 2257141
GROUP OPTIONS:
CIR RCVD

LTID: PSATS 145
 SNPA: 201
 DIRECTORY NUMBER: 2257145
 LT GROUP NO: 13
 LTCLASS: BRAFS DEFAULT LOGICAL TERMINAL: N
 EKTS: N CACH: N
 BEARER SERVICE RESTRICTIONS: NOPMD
 CS: Y PS: N
 VERSION: FUNCTIONAL ISSUE: 2
 SPID-SUFFIX: 01
 LEN: HOST 01 1 10 02 TEI: DYNAMIC
 CUSTGRP: MDCSCA SUBGRP: 0 NCOS: 0 RING: Y
 LINE CLASS CODE: ISDNKSET
 MAXKEYS: 64
 DN IS ASSIGNED AS A DNH HUNT MEMBER (NOT PILOT).
 HUNT GROUP: 22 HUNT MEMBER: 2
 OPTIONS:
 SFC

KEY	DN	
---	--	
1	DN	2257145

KEY	FEATURE
---	-----
	NONE

PILOT DN: 2257141
 GROUP OPTIONS:
 CIR RCVD

QDN 2257146;QLT PSATS 146

DN: 2257146
 TYPE: MEMBER OF DNH HUNT GROUP
 SNPA: 201 SIG: N/A LNATTIDX: N/A
 HUNT GROUP: 22 HUNT MEMBER: 1
 LTID: PSATS 146
 LTCLASS: BRAFS
 LINE CLASS CODE: ISDNKSET
 KEY: 1
 CUSTGRP: MDCSCA SUBGRP: 0 NCOS: 0 RING: Y
 OPTIONS:
 SFC
 PILOT DN: 2257141
 GROUP OPTIONS:
 CIR RCVD

LTID: PSATS 146
 SNPA: 201
 DIRECTORY NUMBER: 2257146
 LT GROUP NO: 13
 LTCLASS: BRAFS DEFAULT LOGICAL TERMINAL: N
 EKTS: N CACH: N
 BEARER SERVICE RESTRICTIONS: NOPMD
 CS: Y PS: N
 VERSION: FUNCTIONAL ISSUE: 2
 SPID-SUFFIX: 01
 LEN: HOST 01 0 07 01 TEI: DYNAMIC
 CUSTGRP: MDCSCA SUBGRP: 0 NCOS: 0 RING: Y
 LINE CLASS CODE: ISDNKSET
 MAXKEYS: 64
 DN IS ASSIGNED AS A DNH HUNT MEMBER (NOT PILOT).
 HUNT GROUP: 22 HUNT MEMBER: 1
 OPTIONS:
 SFC

KEY	DN	
---	--	
1	DN	2257146

KEY FEATURE
 --- -----
 NONE

PILOT DN: 2257141
 GROUP OPTIONS:
 CIR RCVD

QLEN 1 1 10 1;QLEN 1 1 10 2;QLEN 1 0 7 1

LEN: HOST 01 1 10 01
 ISG: 0 DCH: 1 ISG BRA Channel: 21
 CARCODE: BX27AA PADGRP: NPDGP
 PM NODE NUMBER: 32
 PM TERMINAL NUMBER: 322

TEI	LTID	CSPSBCH/ISG Bd			
---	-----	--	--	-----	
DYNAMIC	PSATS	141	Y	N	-
DYNAMIC	PSATS	144	Y	N	-

LEN: HOST 01 1 10 02
 ISG: 0 DCH: 1 ISG BRA Channel: 21
 CARCODE: BX27AA PADGRP: NPDGP
 PM NODE NUMBER: 32
 PM TERMINAL NUMBER: 323

TEI	LTID	CSPSBCH/ISG	Bd		
---	-----	--	--	-----	
DYNAMIC	PSATS	142	Y	N	-
DYNAMIC	PSATS	145	Y	N	-

LEN: HOST 01 0 07 01
 ISG: 0 DCH: 1 ISG BRA Channel: 24
 CARCODE: BX27AA PADGRP: NPDGP
 PM NODE NUMBER: 31
 PM TERMINAL NUMBER: 226

TEI	LTID	CSPSBCH/ISG	Bd		
---	-----	--	--	-----	
DYNAMIC	PSATS	143	Y	N	-
DYNAMIC	PSATS	146	Y	N	-
STOP2					

Siemens SSC EWSD Switch Translations

For the Siemens SSC EWSD switch, Capability Package "S" includes alternate voice/circuit-switched data on two B-channels. It also supports Calling Number Identification on data and voice connections. Please note that the assignment of two Directory Numbers (DNs) is required for this package.

The Siemens SSC EWSD switch allows either voice or data hunting on one DN using the Series Completion feature. The same provisioning is used for either a voice or data series completion group.

ISDN Capability Package "S"

The information listed below provides the DN translations that define Capability Package "S," and the screens and fields that must be populated.

The information provided shows the translations for one DSL and two DN. For multiple DSLs/ DNs, the central office will duplicate these screens and enter the applicable DSL and DN values as needed.

ISDN Ordering Code: Capability S

DISPACCESS:EQN=20-0-5-4;	EXEC'D
ACCESS DATA	MASKNO:04328
	MASKNO:00000
EQN =20-0-5-4,	
CLOSS = 0,	
BCHEQN =2,	
BCEQN = SP & AU3 & C56 & C64,	
CPDDN = 2156855917-VI & 2156855917-CMD,	
CPVDN2 = 2156855917,	
COE = CLASS1,	
LINKOPT = DYNNOPAL,	
BAPROF = 0;	

DISPSUB:DN=6855917;	
NPA = 215 DN = 6855917 EQN = 20-0-5-4	MASKNO:03800
CAT = IBA	MASKNO:03774
BCHDN = 2	MASKNO:03798
BCDN = SP &AU3 &C56 &C64	MASKNO:04535
CT = VI	MASKNO:04396
LCC = BVCE RAX = 1	MASKNO:03785
BCHCT = 2	MASKNO:06282
IBCHCT = 2	MASKNO:06288
OBCHCT = 2	MASKNO:06291
PIC = 0288-SP	MASKNO:04398
& 0288-AU3	
CHRG = FRSA1	MASKNO:03775
COS = ICND & RND	MASKNO:03777
CRBLIM = 2	MASKNO:03798
CT = CMD	MASKNO:04396
LCC = BCMD RAX = 1	MASKNO:03785
BCHCT = 2	MASKNO:06282
IBCHCT = 2	MASKNO:06288
OBCHCT = 2	MASKNO:06291
PIC = 0288-C56	MASKNO:04398
& 0288-C64	
CHRG = FRSA1	MASKNO:03775
COS = ICND &RND	MASKNO:03777
CRBLM = 2	MASKNO:03798
 DISPTSP:TSPID=215685591701	 MASKNO:04383
EQN: 20-0-5-4	
USID: 5	
TSPID: 215685591701	
TERMLIM: 1	MASKNO:04386
DN: 6855917	MASKNO:04382
CT: VI	MASKNO:04385
DN: 6855917	MASKNO:04382
CT: CMD	MASKNO:04385

```

DISPSUB:DN=6855919;
NPA = 215    DN = 6855919    EQN = 20-0-5-4MASKNO:03800
    CAT = IBA                MASKNO:03774
    BCHDN = 2                MASKNO:03798
    BCDN = SP    &AU3    &C56    &C64    MASKNO:04535
    CT = VI                MASKNO:04396
    LCC =BVCE    RAX = 1    MASKNO:03785
    BCHCT = 2                MASKNO:06282
    IBCHCT = 2                MASKNO:06288
    OBCHCT = 2                MASKNO:06291
    PIC = 0288-SP            MASKNO:04398
        & 0288-AU3
    CHRG = FRSA1                MASKNO:03775
    COS = ICND & RND            MASKNO:03777
    CRBLIM = 2                MASKNO:03798
    CT = CMD                MASKNO:04396
    LCC = BCMD    RAX = 1    MASKNO:03785
    BCHCT = 2                MASKNO:06282
    IBCHCT = 2                MASKNO:06288
    OBCHCT = 2                MASKNO:06291
    PIC = 0288-C56            MASKNO:04398
        & 0288-C64
    CHRG = FRSA1                MASKNO:03775
    COS = ICND    &RND            MASKNO:03777
    CRBLIM = 2                MASKNO:03798

DISPTSP:TSPID=215685591901;    MASKNO:04383
EQN: 20-0-5-4
USID: 1
TSPID: 215685591901
TERMLIM: 1                MASKNO:04386
DN: 6855919                MASKNO:04382
CT: VI                MASKNO:04385
DN: 6855919                MASKNO:04382
CT: CMD                MASKNO:04385

```

Series Completion Feature Translations

The information listed below provides the translation for either voice or data hunting on three Digital Subscriber Lines (DSLs) and six Directory Numbers (DNs) forming a circular series completion group.

The screens shown in this section are examples. DNs shown on these screens should be replaced with applicable data.

M	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000 0959	OMT-00/LEONLY	2816/04328	96-01-18	16:22:05
	DISPSDNDAT:EQN=20-0-0-1&20-0-5-0&40-0-2-4:			EXEC'D	
	ISDN ACCESS DATA			MASKNO:04328 MASKNO:00000	
	VIEW = EQN. EQN = 20-0-00-01. BCHEQN = 2. BCEQN = SP. BCEQN = AU3. BCEQN = C56. BCEQN = C64. CPDDN = 2156851189-VI. CPDDN = 2156851189-CMD. COE = CLASS1. LINKOPT = DYNNOPAL. NCCSL = D1--4. NCCSL = D2--4. NPCSL = P1--0. NPCSL = P2--0. NSL = 10. L2TIM = T200-10. L2TIM = T201-10. L2TIM = T203-3. L2COUNT = N200-3. L2COUNT = OIFDCC-1. L2COUNT = OIFDPC-3. CPVDN2 = 2156851189. CPVDN2 = 2156851289:				
	INTERRUPTION TEXT JOB 0959				

CONTINUATION TEXT 0001

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:22:08

SUBSCRIBER

MASKNO:04328

MASKNO:00000

VIEW = DN.
NPA = 215.
DN = 6851189.
EQN = 20-0-00-01.
BCHDN = 2.
BCDN = SP.
BCDN = AU3.
BCDN = C56.
BCDN = C64.
BCHCT = 2-VI.
BCHCT = 2-CMD.
BCHCT = 0-PMD.
IBCHCT = 2-VI.
IBCHCT = 2-CMD.
IBCHCT = 0-PMD.
OBCHCT = 2-VI.
OBCHCT = 2-CMD.
OBCHCT = 0-PMD.
CT = VI.
C1 = CMD:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0002

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:22:31

SUBSCRIBER

MASKNO:04328

MASKNO:00000

VIEW = DNCT.
NPA = 215.
DN = 6851189.
EQN = 20-0-00-01.
CT = VI.
CAT = IBA.
LCC = PKGSV.
RAX = 1.
COS = ICND.
COS = RND.
COSDAT = SERCOMP-6851289.
PIC = 222-SP.
PIC = 288-AU3.
CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0003

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:22:15
M	0959 OMT-00/LEONLY2816/04328		

SUBSCRIBER

MASKNO:04328
MASKNO:00000

VIEW = DNCT.
NPA = 215.
DN = 6851189.
EQN = 20-0-00-01.
CT = CMD.
CAT = IBA.
LCC = PKGSD.
RAX = 1.
COS = ICND.
COS = RND.
COSDAT = SERCOMP-6851289.
PIC = 222-C56.
PIC = 288-C64.
CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0004

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:22:19
M	0959 OMT-00/LEONLY2816/04328		

SUBSCRIBER

MASKNO:04328
MASKNO:00000

VIEW = DN.
NPA = 215.
DN = 6851289.
EQN = 20-0-00-01.
BCHDN = 2.
BCDN = SP.
BCDN = AU3.
BCDN = C56.
BCDN = C64.
BCHCT = 2-VI.
BCHCT = 2-CMD.
BCHCT = 0-PMD.
IBCHCT = 2-VI.
IBCHCT = 2-CMD.
IBCHCT = 0-PMD.
OBCHCT = 2-VI.
OBCHCT = 2-CMD.
OBCHCT = 0-PMD.
CT = VI.
CT = CMD:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0005

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:22:22

SUBSCRIBER

MASKNO:04328

MASKNO:00000

VIEW = DNCT.

NPA = 215.

DN = 6851289.

EQN = 20-0-00-01.

CT = VI.

CAT = IBA.

LCC = PKGSV.

RAX = 1.

COS = ICND.

COS = RND.

COSDAT = SERCOMP-6852199.

PIC = 222-SP.

PIC = 288-AU3.

CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0006

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:22:26

SUBSCRIBER

MASKNO:04328

MASKNO:00000

VIEW = DNCT.

NPA = 215.

DN = 6851289.

EQN = 20-0-00-01.

CT = CMD.

CAT = IBA.

LCC = PKGSD.

RAX = 1.

COS = ICND.

COS = RND.

COSDAT = SERCOMP-6852199.

PIC = 222-C56.

PIC = 288-C64.

CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0007

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:22:29
M	0959 OMT-00/LEONLY2816/04328		

TERMINAL SERVICE PROFILE DATAMASKNO:04328

MASKNO:00000

VIEW = TSP.

EQN = 20-0-00-01.

USID = 1.

TSPID = 2156851189.

TERMLIM = 1.

TSPCOS = CHDBCHR:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0008

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:22:32
M	0959 OMT-00/LEONLY2816/04328		

TERMINAL SERVICE PROFILE DATA

MASKNO:04328

MASKNO:00000

VIEW = TSPDNCT.

EQN = 20-0-00-01.

TSPID = 2156851189.

NPA = 215.

DN = 6851189.

CT= VI:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0009

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:22:35
M	0959 OMT-00/LEONLY2816/04328		

TERMINAL SERVICE PROFILE DATA

MASKNO:04328

MASKNO:00000

VIEW = TSPDNCT.

EQN = 20-0-00-01.

TSPID = 2156851189.

NPA = 215.

DN = 6851189.

CT= CMD:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0010

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:22:38

TERMINAL SERVICE PROFILE DATA

MASKNO:04328

MASKNO:00000

VIEW = TSP.

EQN = 20-0-00-01.

USID = 2.

TSPID = 2156851289.

TERMLIM = 1.

TSPCOS = CHDBCHR:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0011

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:22:40

ISDN ACCESS DATA

MASKNO:04328

MASKNO:00000

VIEW = EQN.

EQN = 20-0-05-01.

BCHEQN = 2.

BCEQN = SP.

BCEQN = AU3.

BCEQN = C56.

BCEQN = C64.

CPDDN = 2156852199-VI.

CPDDN = 2156852199-CMD.

COE = CLASS1.

LINKOPT = DYNNOPAL.

NCCSL = D1--4.

NCCSL = D2--4.

NPCSL = P1--0.

NPCSL = P2--0.

NSL = 10.

L2TIM = T200-10.

L2TIM = T201-10.

L2TIM = T203-3.

L2COUNT = N200-3.

L2COUNT = OIFDCC-1.

L2COUNT = OIFDPC-3.

CPVDN2 = 2156852199.

CPVDN2 = 2156852299:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0012

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:22:44
M	0959 OMT-00/LEONLY2816/04328		

SUBSCRIBER

MASKNO:04328
MASKNO:00000

VIEW = DN.
NPA = 215.
DN = 6852199.
EQN = 20-0-05-00.
BCHDN = 2.
BCDN = SP.
BCDN = AU3.
BCDN = C56.
BCDN = C64.
BCHCT = 2-VI.
BCHCT = 2-CMD.
BCHCT = 0-PMD.
IBCHCT = 2-VI.
IBCHCT = 2-CMD.
IBCHCT = 0-PMD.
OBCHCT = 2-VI.
OBCHCT = 2-CMD.
OBCHCT = 0-PMD.
CT = VI.
CT = CMD:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0013

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:22:48
M	0959 OMT-00/LEONLY2816/04328		

SUBSCRIBER

MASKNO:04328
MASKNO:00000

VIEW = DNCT.
NPA = 215.
DN = 6852199.
EQN = 20-0-05-00.
CT = VI.
CAT = IBA.
LCC = PKGSV.
RAX = 1.
COS = ICND.
COS = RND.
COSDAT = SERCOMP-6852299.
PIC = 222-SP.
PIC = 288-AU3.
CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0014

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:22:51

SUBSCRIBER

MASKNO:04328

MASKNO:00000

VIEW = DNCT.

NPA = 215.

DN = 6852199.

EQN = 20-0-05-00.

CT = CMD.

CAT = IBA.

LCC = PKGSD.

RAX = 1.

COS = ICND.

COS = RND.

COSDAT = SERCOMP-6852299.

PIC = 222-C56.

PIC = 288-C64.

CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0015

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:22:55

SUBSCRIBER

MASKNO:04328

MASKNO:00000

VIEW = DN.

NPA = 215.

DN = 6852299.

EQN = 20-0-05-00.

BCHDN = 2.

BCDN = SP.

BCDN = AU3.

BCDN = C56.

BCDN = C64.

BCHCT = 2-VI.

BCHCT = 2-CMD.

BCHCT = 0-PMD.

IBCHCT = 2-VI.

IBCHCT = 2-CMD.

IBCHCT = 0-PMD.

OBCHCT = 2-VI.

OBCHCT = 2-CMD.

OBCHCT = 0-PMD.

CT = VI.

CT = CMD:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0016

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:22:58
M	0959 OMT-00/LEONLY2816/04328		

SUBSCRIBER

MASKNO:04328
MASKNO:00000

VIEW = DNCT.
NPA = 215.
DN = 6852299.
EQN = 20-0-05-00.
CT = VI.
CAT = IBA.
LCC = PKGSV.
RAX = 1.
COS = ICND.
COS = RND.
COSDAT = SERCOMP-6853119.
PIC = 222-SP.
PIC = 288-AU3.
CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0017

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:23:01
M	0959 OMT-00/LEONLY2816/04328		

SUBSCRIBER

MASKNO:04328
MASKNO:00000

VIEW = DNCT.
NPA = 215.
DN = 6852299.
EQN = 20-0-05-00.
CT = CMD.
CAT = IBA.
LCC = PKGSD.
RAX = 1.
COS = ICND.
COS = RND.
COSDAT = SERCOMP-6853119.
PIC = 222-C56.
PIC = 288-C64.
CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0018

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:23:05

TERMINAL SERVICE PROFILE DATA

MASKNO:04328

MASKNO:00000

VIEW = TSP.

EQN = 20-0-05-00.

USID = 1.

TSPID = 2156852199.

TERMLIM = 1.

TSPCOS = CHDBCHR:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0019

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:23:07

TERMINAL SERVICE PROFILE DATA

MASKNO:04328

MASKNO:00000

VIEW = TSPDNCT.

EQN = 20-0-05-00.

TSPID = 2156852199.

NPA = 215.

DN = 6852199.

CT= VI:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0020

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:23:11

TERMINAL SERVICE PROFILE DATA

MASKNO:04328

MASKNO:00000

VIEW = TSPDNCT.

EQN = 20-0-05-00.

TSPID = 2156852199.

NPA = 215.

DN = 6852199.

CT= CMD:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0021

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:23:13
M	0959 OMT-00/LEONLY2816/04328		

TERMINAL SERVICE PROFILE DATA

MASKNO:04328
MASKNO:00000

VIEW = TSP.

EQN = 20-0-05-00.

USID = 2.

TSPID = 2156852299.

TERMLIM = 1.

TSPCOS = CHDBCHR:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0022

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:23:16
M	0959 OMT-00/LEONLY2816/04328		

ISDN ACCESS DATA

MASKNO:04328
MASKNO:00000

VIEW = EQN.

EQN = 40-0-02-04.

BCHEQN = 2.

BCEQN = SP.

BCEQN = AU3.

BCEQN = C56.

BCEQN = C64.

CPDDN = 2156853119-VI.

CPDDN = 2156853119-CMD.

COE = CLASS1.

LINKOPT = DYNNOPAL.

NCCSL = D1--4.

NCCSL = D2--4.

NPCSL = P1--0.

NPCSL = P2--0.

NSL = 10.

L2TIM = T200-10.

L2TIM = T201-10.

L2TIM = T203-3.

L2COUNT = N200-3.

L2COUNT = OIFDCC-1.

L2COUNT = OIFDPC-3.

CPVDN2 = 2156853119.

CPVDN2 = 2156853219:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0023

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:23:20

SUBSCRIBER

MASKNO:04328

MASKNO:00000

VIEW = DN.
NPA = 215.
DN = 6853119.
EQN = 40-0-02-04.
BCHDN = 2.
BCDN = SP.
BCDN = AU3.
BCDN = C56.
BCDN = C64.
BCHCT = 2-VI.
BCHCT = 2-CMD.
BCHCT = 0-PMD.
IBCHCT = 2-VI.
IBCHCT = 2-CMD.
IBCHCT = 0-PMD.
OBCHCT = 2-VI.
OBCHCT = 2-CMD.
OBCHCT = 0-PMD.
CT = VI.
CT = CMD:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0024

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:23:23

SUBSCRIBER

MASKNO:04328

MASKNO:00000

VIEW = DNCT.
NPA = 215.
DN = 6853119.
EQN = 40-0-02-04.
CT = VI.
CAT = IBA.
LCC = PKGSV.
RAX = 1.
COS = ICND.
COS = RND.
COSDAT = SERCOMP-6853219.
PIC = 222-SP.
PIC = 288-AU3.
CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0025

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:23:27
M	0959 OMT-00/LEONLY2816/04328		

SUBSCRIBER

MASKNO:04328
MASKNO:00000

VIEW = DNCT.
NPA = 215.
DN = 6853119.
EQN = 40-0-02-04.
CT = CMD.
CAT = IBA.
LCC = PKGSD.
RAX = 1.
COS = ICND.
COS = RND.
COSDAT = SERCOMP-6853219.
PIC = 222-C56.
PIC = 288-C64.
CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0026

	NAVK1/BELLCORNJRB/APS 13.0 PS0071/000	96-01-18	16:23:30
M	0959 OMT-00/LEONLY2816/04328		

SUBSCRIBER

MASKNO:04328
MASKNO:00000

VIEW = DN.
NPA = 215.
DN = 6853219.
EQN = 40-0-02-04.
BCHDN = 2.
BCDN = SP.
BCDN = AU3.
BCDN = C56.
BCDN = C64.
BCHCT = 2-VI.
BCHCT = 2-CMD.
BCHCT = 0-PMD.
IBCHCT = 2-VI.
IBCHCT = 2-CMD.
IBCHCT = 0-PMD.
OBCHCT = 2-VI.
OBCHCT = 2-CMD.
OBCHCT = 0-PMD.
CT = VI.
CT = CMD:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0027

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:23:34

SUBSCRIBER

MASKNO:04328

MASKNO:00000

VIEW = DNCT.

NPA = 215.

DN = 6853219.

EQN = 40-0-02-04.

CT = VI.

CAT = IBA.

LCC = PKGSV.

RAX = 1.

COS = ICND.

COS = RND.

COSDAT = SERCOMP-6851189.

PIC = 222-SP.

PIC = 288-AU3.

CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0028

M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000
0959 OMT-00/LEONLY2816/04328

96-01-18

16:23:37

SUBSCRIBER

MASKNO:04328

MASKNO:00000

VIEW = DNCT.

NPA = 215.

DN = 6853219.

EQN = 40-0-02-04.

CT = CMD.

CAT = IBA.

LCC = PKGSD.

RAX = 1.

COS = ICND.

COS = RND.

COSDAT = SERCOMP-6851189.

PIC = 222-C56.

PIC = 288-C64.

CRBLIM = 1:

INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0029
M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000 96-01-18 16:23:40
0959 OMT-00/LEONLY2816/04328

TERMINAL SERVICE PROFILE DATA MASKNO:04328
MASKNO:00000

VIEW = TSP.
EQN = 40-0-02-04.
USID = 1.
TSPID = 2156853119.
TERMLIM = 1.
TSPCOS = CHDBCHR:
INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0030
M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000 96-01-18 16:23:43
0959 OMT-00/LEONLY2816/04328

TERMINAL SERVICE PROFILE DATA MASKNO:04328
MASKNO:00000

VIEW = TSPDNCT.
EQN = 40-0-02-04.
TSPID = 2156853119.
NPA = 215.
DN = 6853119.
CT= VI:
INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0031
M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000 96-01-18 16:23:46
0959 OMT-00/LEONLY2816/04328

TERMINAL SERVICE PROFILE DATA MASKNO:04328
MASKNO:00000

VIEW = TSPDNCT.
EQN = 40-0-02-04.
TSPID = 2156853119.
NPA = 215.
DN = 6853119.
CT= CMD:
INTERRUPTION TEXT JOB 0959

CONTINUATION TEXT 0032
M NAVK1/BELLCORNJRB/APS 13.0 PS0071/000 96-01-18 16:23:49
0959 OMT-00/LEONLY2816/04328

TERMINAL SERVICE PROFILE DATA MASKNO:04328
MASKNO:00000

VIEW = TSP.
EQN = 40-0-02-04.
USID = 2.
TSPID = 2156853219.
TERMLIM = 1.
TSPCOS = CHDBCHR:

END JOB 0959 EXEC'D

Glossary

NOTE ► The use of italics in this glossary denotes a cross-reference to other glossary entries or the expanded name for an acronym.

Numerics

2B Data

Digital information carried by two *B-Channels* for better performance and quality; the *Bit Rate* is twice that of one B-channel used alone.

4400-Series Telephones

A family of digital multiline and digital single-line telephones.

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

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 communications line each must 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 *Modem* 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.

Ambiguous Numbering

Numbering of extension ranges, remote access codes, or other system components that causes conflicts in network operations. These numbers can be unique and still be ambiguous. For example, Extension 441 is different from Extension 4410; for *UDP* routing purposes, however, the two numbers are ambiguous and a call intended for Extension 4410 would be misrouted, on the first three digits sent, to Extension 441. See also *Unambiguous Numbering*.

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 *Bipolar Violation* occurs. AMI is used in the *DS1* interface.

Analog Data Station

See *Modem Data Station*.

Analog Transmission

Mode of transmission in which information is represented in continuously variable physical quantities, such as amplitude, frequency, phase, or resistance. See also *Digital Transmission*.

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 MAGIX Reporter is an application that provides call management information (if available in the local area or jurisdiction).

ARS

Automatic Route Selection. System feature that routes calls on outside facilities according to the number dialed and line/trunk availability. To initiate ARS, the user dials a *Dial-Out Code*, also called an "*ARS* access code."

ASCAP

American Society of Composers, Artists, and Producers.

Ascend Pipeline

ISDN-BRI bridge/router that enables high-speed Internet access over a digital facility. It makes outgoing calls only.

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*, *Megacom 800*, Software Defined Network (*SDN*), Multiquest, and Shared Access for Switch Services (SASS).

Asynchronous Data Transmission

Method of transmitting a short bitstream of digital data, such as printable characters represented by a 7- or 8-*Bit* ASCII code. Each string of data bits is preceded by a start bit and followed by a stop bit, thus permitting data to be transmitted at irregular intervals. See also *Synchronous Data Transmission*.

AT&T Attendant

Application with equipment that connects to one or more *Tip/Ring* extension jacks and automatically answers incoming calls with a recorded announcement; directs calls in response to touch tones.

AT&T Switched Network

See *ASN*.

Automated Attendant

An application that automatically answers incoming calls with a recorded announcement and directs callers to a department, an extension, or the system operator.

Automated Document Delivery System

See *ADDs*.

Automatic Immediate Cycling

Process that occurs in a *Private Network* when all available routes for a call specify systems with a matching *Switch Identifier*. The call is routed from the originating system to the destination system and back to the originating system in a continuous loop. *Switch Identifier* labeling systems must be unique across a network.

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

Tie Trunk 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.

B

B8ZS

Bipolar 8 Zero Substitution. Line-coding format that encodes a string of eight zeros in a unique binary sequence to detect bipolar violations.

Backup

Procedure for saving a copy of system programming onto a floppy disk or *Memory Card*. See also *Restore*.

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 *Remote Access* feature of the system. In a *Private Network*, it is especially important that barrier codes be required for all types of remote access.

Basic Carrier

Hardware that holds and connects the *Processor Module*, *Power Supply Module*, and up to five other modules in the system. See also *Expansion Carrier*.

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 *Bit Rate* and *bps*.

B-Channels

Bearer-Channel. 64- or 56-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.

Basic Rate Interface

See *BRI*.

Bearer-Channel

See *B-Channels*.

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 [Centrex](#) or DEFINITY, which provides features and services to telephone users. See also [Hybrid/PBX Mode](#) and [Key Mode](#).

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 [AMI](#), [B8ZS](#), and [Bipolar Violation](#).

Bipolar Violation

Condition occurring when two positive or two negative pulses are received in succession. See also [AMI](#) and [B8ZS](#).

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 [bps](#). Also called “data rate.”

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 [Glare](#).

BMI

Broadcast Music Incorporated.

Board

Module—for example, 100D or 408 MLX GS/LS—that allows you to connect lines/trunks and extensions to the communications system.

Board Assignment

System Programming and Maintenance (SPM) procedure for assigning line/trunk and extension modules to slots on the control unit.

Board Renumbering

System programming procedure for renumbering boards that have already been assigned to specific slots on the control unit.

bps

Bits per second.

BRI

[Basic Rate Interface](#). Standard protocol for accessing Integrated Service Digital Network (ISDN) services.

Broadband

Transmission path having a bandwidth greater than a voice-grade channel.

Bus

Multiconductor electrical path used to transfer information over a common connection from any of several sources to any of several destinations.

Business Cordless 905

Wireless multiline telephone that connects to an ETR port.

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 eight [Bits](#) processed together. Also called “octet.”

C

Call Accounting System

See [CAS](#).

Call Accounting Terminal

See [CAT](#).

Caller ID

Service provided by some local telephone companies (if local regulations allow) that supplies the calling party telephone number and name. An 800 GS/LS-ID, 408 GS/LS-ID-MLX, or 412 LS-ID-TDL module can capture both the number and name of the calling party and display them on the screens of 44xx, MLX, ETR, and MLS telephones. See also [ANI](#).

Calling Group

Team of individuals who answer the same types of calls.

Calling Party Name on Caller ID

This central office service allows a subscriber to view the name of the calling party on a 44xx, MLX, ETR, or MLS display telephone.

Calling Party Number on Caller ID

This central office service allows a subscriber to view the number of the calling party on a 44xx, MLX, ETR, or MLS display telephone.

CAS

Call Accounting System. DOS- or UNIX System-based application that monitors and manages telecommunications costs.

CAT

Call Accounting Terminal. Stand-alone unit with a built-in microprocessor and data buffer that provides simple call accounting at a low cost.

CCITT

International Telegraph and Telephone Consultative Committee.

CCS

Common Channel Signaling. Signaling in which one channel of a group of channels 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*.

Centralized Voice Messaging

Sharing of a voice messaging system by two or more directly connected MERLIN MAGIX, MERLIN LEGEND (Release 6.1 or higher), DEFINITY ECS, DEFINITY BCS, or DEFINITY ProLogix Solutions systems in a *Private Network*.

Central Office

See *CO*.

Centrex

Set of system features to which a user can subscribe on telephone 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 [Data Stations](#).

Class of Restriction

See [COR](#).

Clear Data Channel

Clear data channels (also called unrestricted data channels) allow the transmission of occurrences of more than seven contiguous zero bits. If a clear data channel is requested and only restricted channels are available, the call will be rejected. See also [Restricted Data Channel](#).

Clock Synchronization

When digital signals are transmitted over a communications link, the receiving end must be synchronized with the transmitting end to receive the digital signals without errors using clock synchronization. A system synchronizes itself by extracting a timing signal from an incoming digital stream. All the digital facilities in a network operate from a single common clock—preferably a port connected to a digital [PSTN](#) facility on a [Hub System](#) or a system that connects two network systems. In this case, all digital facilities specify a loop clock source. One system in a network may be specified as a local clock source when no functioning digital facility in the network is connected to the [PSTN](#). All other digital facilities then use this clock and specify their clock sources as loop. Primary, secondary, and tertiary clock sources are specified to allow backup synchronization in the event that the primary source is out of service.

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.

Collected Digits

Digits that a caller dials in response to an integrated voice response application's menus; collected digits may be used to initiate a [Screen Pop](#) at a system extension. See also [CTI Link](#) and [Enhanced Customer Care Solution](#).

Combination Configuration

[Private Network](#) arrangement that combines characteristics of [Virtual Private Network \(VPN\)](#), a [Series Configuration](#), and a [Star Configuration](#).

Common Channel Signaling

See [CCS](#).

Control Unit

[Processor Module](#), [Power Supply Module](#), other [Modules](#), carriers, and housing of the system.

Console

Telephone and [Adjuncts](#) (if any) at an operator or system programmer extension.

CONVERSANT

Entry-level voice response application that automatically answers and routes calls and executes telephone transactions.

Conversion Resource

See [Modem Pool](#).

Coordinating System Manager

In a [Private Network](#) that includes more than two systems, the system manager who acts as a clearinghouse for any changes made on local systems that affect the network, assuring that all system managers work together and that local system changes do not have undesirable effects on the network as a whole.

COR

Class of Restriction. Various types of restrictions that can be assigned to *Remote Access* trunks or barrier codes. These restrictions consist of calling restrictions, *ARS* Facility Restriction Levels (*FRLs*), Allowed Lists, Disallowed Lists, and Automatic Callback queuing.

Coverage

Set of system features that can determine how an extension's calls are covered when the person at the extension is busy or not available.

CRC

Cyclic Redundancy Check. Error-detection code used on *DS1* facilities with the extended superframe format (*ESF*).

CSU

Channel Service Unit. Equipment used on customer premises to provide *DS1* facility terminations and signaling compatibility.

CTI Link

Computer Telephony Integration. Hardware/software feature that is part of the PassageWay Telephony Services application. It allows the use of Lucent Technologies-certified software applications on a *LAN* running Novell NetWare or Windows NT software in a *Hybrid/PBX Mode* system. These applications may provide special features for client control of such calling activities as power dialing. See also *Screen Pop*.

Cyclic Redundancy Check

See *CRC*.

D

D4 Framing Format

Framing Format consisting of a sequence of individual frames of 24 eight-*Bit* slots and one signal bit (193 bits) in a 12-frame superframe. See also *ESF*.

Data-Channel

See *D-Channel*.

Data Communications Equipment

See *DCE*.

Data Module

Type of *ISDN Terminal Adapter* that acts as the *DCE* at a *Data Workstation* that communicates over high-speed *Digital* facilities.

Data Rate

See *bps*.

Data Service Unit

See *DSU*.

Data Station

Special type of extension where data communications take place; includes *DTE* and *DCE*; sometimes a telephone is also part of a data station.

Data Terminal

Input/output device (often a personal computer) that can be connected to the control unit via an interface.

Data Terminal Equipment

See and *Data Terminal*.

Data Workstation

Special type of extension where data communications take place; includes *DTE* and *DCE*; sometimes a telephone is also part of a data workstation.

DCE

Data Communications Equipment. Equipment, such as *Modems* or ISDN terminal adapters, used to establish, maintain, and terminate a connection between the system and data terminal equipment (*DTE*)—such as printers, personal computers, host computers, or network workstations.

DCP

Digital Communications Protocol. AT&T proprietary protocol to transmit digitized voice and data over the same communications link.

D-Channel

Data-Channel. 16- or 64-kbps channel that carries signaling information or data on a *PRI* or *BRI*.

Dedicated Feature Buttons

The imprinted feature buttons on a telephone: for example, Conf or Conference, Drop, Feature, HFAI (Hands-Free Answer on Intercom), Hold, Message, Mute or Microphone, Recall, Speakerphone or Spkrphone, and Transfer.

Delay-Start Tie Trunk

Tie Trunk or *Tandem Tie Trunk* 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 “dial-repeating tie trunk.”

Desktop Videoconferencing System

System application that allows face-to-face, simultaneous video and voice communications between individuals and requires high-speed data transmission facilities. See also *Group Videoconferencing System*.

DFT

Direct Facility Termination. See *Personal Line*.

DHG

Data Hunt Group. Group of analog or digital *Data Station* 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

Tie Trunk 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.

DID

Direct Inward Dial. Service that transmits from the telephone company central office and routes incoming calls directly to the called extension, *Calling Group*, or outgoing line/trunk *Pool*, 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 [Analog Transmission](#).

Digital Communications Protocol

See [DCP](#).

Digital Data Station

See [ISDN Terminal Adapter Data Station](#).

Digital Signal 0

See [DS0](#).

Digital Signal 1

See [DS1](#).

Digital Subscriber Line

See [DSL](#).

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 [Analog Transmission](#).

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 Dial

See [DID](#).

Direct-Line Console

See [DLC](#).

Direct Station Selector

See [DSS](#).

Display Buttons

Buttons on a 4412D+, 4424D+, 4424LD+, or 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, to transfer calls, to make outside calls for users with outward calling restrictions, to set up conference calls, and to monitor system operation.

DNIS

Dialed Number Identification Service. Service provided by AT&T and MCI to route 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 *Tip/Ring* jack and used at an unattended extension or front desk.

DOS

Disk Operating System.

Drop-and-Insert Equipment

Device that can be installed between systems connected by *Tandem PRI Trunks* or T1-Emulated *Tandem Tie Trunks* to allow fractional use of the facility—that is, use of fewer than 23 of the PRI *B-Channels* or fewer than 24 of the T1 *Channels*. In a PRI facility, the equipment must never drop Channel 24, the *D-Channel*. All channels must still be programmed and all count towards the system maximum of 80 lines.

DS0

Digital Signal 0. Single 64-kbps voice or data channel.

DS1

Digital Signal 1. *Bit*-oriented signaling interface that multiplexes twenty-four 64-kbps channels into a single 1.544-mbps stream.

DSL

Digital Subscriber Line. Digital Subscriber Line provides full-duplex service on a single twisted metallic pair (2-wire) at a rate sufficient to support ISDN Basic Rate Access.

DSS

Direct Station Selector. Fifty-button *Adjunct* that enhances the call-handling capabilities of a 4424D+, 4424LD+, MLX-20L, or MLX-28D telephone used as an operator console.

DSU

Data Service Unit. A device used to connect to a [DS1](#) facility.

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**E911**

Enhanced 911 service; available in Release 1.5 and later systems. E911 service speeds up the handling of emergency calls and helps to pinpoint the location of the caller. The two types of E911 service are the E911 Partition and the E911 Adjunct.

E&M Signaling

Trunk supervisory signaling, used between two communications systems, in which signaling information is transferred through two-state voltage conditions (on the Ear and Mouth leads) for analog applications and through two [Bits](#) for digital applications. See also [Tie Trunk](#).

EIA

Electronic Industries Association.

EIA-232-D

Physical interface, specified by the [EIA](#), that transmits and receives asynchronous data at speeds of up to 19.2-kbps over cable distances of 50 feet (15 meters).

Electronic Switching System

See [ESS](#).

Endpoint

Final destination in the path of an electrical or telecommunications signal.

Enhanced Customer Care Solution

Application that sends calls to available agents in a calling group. The Enhanced

Customer Care Solution places calls in queue, plays announcements, tracks agent activity and availability, and provides real-time reports.

ESF

Extended Superframe Format. PRI framing format consisting of individual frames of 24 eight-bit slots and one signal bit (193 bits) in a 24-frame extended superframe.

ESS

Electronic Switching System. Class of central office (CO) switching systems developed by Lucent Technologies in which the control functions are performed principally by electronic data processors operating under the direction of a stored program.

ETR Telephone

Enhanced tip/ring telephone (Series 4).

Expansion Carrier

Carrier added to the control unit when the basic carrier cannot house all of the required modules. Houses a power supply module and up to six additional modules.

Extended Superframe Format

See *ESF*.

Extension

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 *Data Workstation*.

Extension Jack

An analog, digital, or *Tip/Ring* 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 *Centralized Telephone Programming* and *System Programming*.

F

Facility

Equipment (often a *Line/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.

FCC

Federal Communications Commission.

Feature

Function or service provided by the system.

Feature Code

Code entered on a dialpad to activate a feature.

Feature Screen

Display screen on 4412D+, 4424D+, 4424LD+, and MLX display telephones; provides quick access to commonly used features.

Flash ROM

Type of read-only memory provided on the [Processor Module](#), 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 procedures; system prevents initiation of new calls.

Foreign Exchange

See [FX](#).

Fractional-T1

A digital transmission facility consisting of at least one, and fewer than 24, [DS0](#)

channels using robbed-bit signaling, and connecting a [PBX](#) and a [Central Office](#) or toll office.

Frame

One of several segments of an analog or digital signal that has a repetitive characteristic. For example, a [DS1](#) frame consists of a framing [Bit](#) and 24 bytes, which equals 193 bits.

Framing Format

Pattern of [Frames](#) used in transmissions.

FRL

[Facility Restriction Level](#). Calling restriction type that restricts calls to certain specified [ARS](#) and [UDP](#) routes.

FX

[Foreign Exchange](#). [Central Office](#) other than the one that is providing local access to the public telephone network.

G

Glare

Condition that occurs when a user tries to call out on a [Loop-Start Line](#) at the same time that another call arrives on the same line.

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](#).

Group IV (G4) Fax Machine

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.

Group Videoconferencing System

System application that allows face-to-face, simultaneous video and voice communications between groups and requires high-speed data transmission facilities. See also [Desktop Videoconferencing System](#).

H

Hands-Free Answer Intercom

See [HFAI](#).

Headset

Lightweight earpiece and microphone used for hands-free telephone operation.

HFAI

[Hands-Free Answer Intercom](#). Feature that allows a user to answer a voice-announced call.

Home Screen

Display normally shown on a 44xx or MLX display telephone; shows time, date, and call information, as well as 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 [Behind Switch Mode](#).

Hub System

In a [Private Network](#) that is arranged in a [Star Configuration](#), the communications system through which all calls across the network pass.

Hybrid/PBX Mode

One of three modes of system operation in which the system uses line/trunk [Pools](#) and [ARS](#) in addition to [Personal Lines](#). Provides a single interface (SA buttons) to users for both internal and external calling. See also [Behind Switch Mode](#) and [Key Mode](#).

I

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

[Tie Trunk](#) 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

Tone users hear when they are off-hook on an SA or ICOM *Button*.

Inspect Screen

Display screen on a multiline 44xx or MLX display telephone that allows the user to preview incoming calls and view a list of the features programmed on line buttons.

Integrated Services Digital Network

See [ISDN](#).

Integrated Solution III

See [IS III](#).

Integrated 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 carriers 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 MAGIX Integrated System.

Intercom Buttons

See [ICOM Buttons](#).

Interface

Hardware and/or software that links systems, programs, or devices.

Intersystem Calls

In a [Private Network](#), calls between a local extension and a [Local Dial Plan](#) or [Non-Local Dial Plan](#) extension.

Intuity

Set of integrated applications that provides voice mail, fax messaging, Automated Attendant, call accounting, and system programming.

Intuity CONVERSANT

Voice response application that automatically answers and routes calls and executes telephone transactions.

I/O Device

Input/Output Device. Equipment that can be attached to a computer internally or externally for managing a computer system's input and output of information.

IROB Protector

In-Range Out-of-Building protector. Surge-protection device for off-premises telephones at a location within 1000 feet (305 meters) of cable distance from the control unit.

IS III

Integrated Solution III. Set of UNIX System-based applications that augments and provides additional services using the system. IS III is no longer available.

ISDN

Integrated Services Digital Network. Public or private network that provides end-to-end digital connectivity for all services to which users have access by a limited set of standard multipurpose user and [Network Interface](#); provides digital circuit-switched or packet-switched connections within the network and to other networks for national and international digital connectivity.

ISDN Terminal Adapter

Integrated Services Digital Network Terminal Adapter. A device that connects the communications system with [Data Terminal Equipment \(DTE\)](#).

ISDN Terminal Adapter Data Station

Type of data station that includes an ISDN terminal adapter as its DCE. It may also include an MLX telephone for simultaneous voice and data (ISDN terminal adapter data-only station). These data stations connect to MLX extension jack modules for digital transmission of data over a DS1 facility.

J**Jack**

Physical connection point to the system for a telephone, line/trunk, or other device. Also called "port."

K**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 inside calling. See also *Behind Switch Mode* and *Hybrid/PBX Mode*.

L

LAN

Local Area Network. Arrangement of interconnected personal computers or terminals, which sometimes access a host computer, and sometimes sharing resources such as 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; often, however, used synonymously with *Trunk*.

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 (*CSU*) or other far-end connection point.

Line/Trunk

Refers to inside system lines and outside lines/trunks in general terms. See also *Line* and *Trunk*.

Line/Trunk Jack

Physical interface on a module in the control unit for connecting an outside line/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 Dial Plan

In a system that is part of a [Private Network](#), list of extension ranges that the local system refers to in order to route local [Intersystem Calls](#) via [UDP](#).

Local Extension

In a system that is part of a [Private Network](#), extension that is listed in the system's [Local Dial Plan](#).

Local Host Computer Access

Method for connecting an extension jack to an on-site computer for data-only calls through a [Modem](#) or [ISDN Terminal Adapter](#).

Local Loop

The two-way connection between a customer's premises and the [Central Office](#).

Local User

In a [Private Network](#), person whose extension is connected to the local control unit.

Logical ID

Unique numeric identifier for each [Extension](#) and [Line/Trunk Jack](#) in the system control unit.

Loop-Start Line

Line 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.

M

Magic On Hold

Lucent Technologies Music-On-Hold enhancement that promotes a company's products or services.

mbps

megabits per second.

Megacom

AT&T tariffed digital [WATS](#) offering for outward calling.

Megacom 800

AT&T 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 communications system through the PCMCIA interface slot on the processor module.

MERLIN Messaging System

Voice-messaging system that provides Automated Attendant, call answering, and voice-mail services. It is housed in its own module.

Messaging 2000

See [Octel 100 Messaging](#).

MFM

[Multi-Function Module](#). Adapter that has a [Tip/Ring](#) mode for answering machines, modems, fax machines, and tip/ring alerts, and an SAA mode for -48 VDC alerts. It is 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.

MLS Telephone

An enhanced [Tip/Ring](#) (Series 3) telephone. No longer available.

MLX Telephone

Multiline button telephone that transmits and receives digital signals.

Mode Codes

Streams of touch-tone codes used by voice messaging applications to communicate with the system's control unit.

Modem

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

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 [Modems](#) and data modules with interconnected RS-232 interfaces that converts digital signals to analog, or analog signals to digital, thereby allowing users with [ISDN Terminal Adapter Data Station](#) to communicate with users who have analog [Modem Data Stations](#).

Module

Circuit pack in the control unit that provides the physical jacks for connecting telephones and/or outside lines/trunks to the communications system. In the name of a module, the first digit indicates the number of [Line/Trunk Jacks](#) it contains; the last digit indicates the number of [Extension Jacks](#) it contains. If no letters appear after the number, a line/trunk module provides [Loop-Start Lines](#) or an extension jack module provides analog or [Tip/Ring](#) jacks. For example, a 408 GS/LS-MLX module contains four line/trunk jacks and eight digital (MLX) extension jacks, and provides either Loop Start (LS) or [Ground-Start Trunks](#) (GS).

Monitored Extension

Extension for which one or more CTI applications is receiving call information. The CTI application does not have to be directly attached to the equipment at the extension in order to monitor calls. The call information may appear on the PC screen of another extension that has been programmed to receive it. See also [CTI Link](#) and [Unmonitored Extension](#).

Multi-Function Module

See [MFM](#).

Multiline Telephone

Telephone that provides multiple line buttons for making or receiving calls or programming features.

Multiplexing

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 Magic On Hold connected to the system through a loop-start jack.

N**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.

NI-1 BRI

National Integrated Services Digital Network 1 Basic Rate Interface. Type of digital facility that carries the equivalent of three lines. Two are called *B-Channels* and provide voice and data communications services. A third *D-Channel* controls signaling and maintains operations on the B-channels.

Non-Local Dial Plan

In a system that is part of a *Private Network*, list of extension ranges that the local system references in order to route non-local *Intersystem Calls* via *UDP*.

Non-Local Extension

In a system that is part of a *Private Network*, extension that is in the *Non-Local Dial Plan*.

Non-Local User

In a *Private Network*, user who is connected to another system in the network and not to the local system.

Non-Satellite System

In a *Private Network*, communications system that is directly connected to and located more than 200 miles from the local system.

O

Octel 100 Messaging

Voice-messaging system housed in a PC that connects to *Tip/Ring* ports on the system's modules. Messaging 2000 provides voice mail, Automated Attendant, call answering, and fax messaging services.

Off-Hook

Telephone is said to be off-hook when the user has lifted the handset, pressed the speakerphone 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 *DS1* service to the public network that prohibits eight consecutive zeros 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. *Single-Line Telephone* or other *Tip/Ring* device connected to the system via a 008 OPT module in the control unit. Appears as an inside extension to the system, but may be physically located away from the system.

OPX

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**

Addition of a *Bit* to a bit string so that the total number of ones is odd or even; used to detect and correct transmission errors.

PassageWay Direct Connection Solution

Set of software applications that provides an interface between a personal computer and an MLX telephone.

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 *Memory Card*.

Peripheral System

In a *Private Network*, system that does not connect to more than one other system, sometimes called an "end node."

Personal Line

Central Office line/trunk that terminates directly at one or more extensions. In *Hybrid/PBX Mode*, a personal line cannot be part of a line/trunk *Pool*. Also called "DFT" (Direct Facility Termination).

PFT

Power Failure Transfer. Feature that provides continuity of telephone service during a commercial power failure by switching some of the system's line/trunk connections to telephones connected to specially designated extension jacks.

Phantom Extension

Extension that is not actually plugged into the system, but is used, for example, as a calling group member covered by a *Voice Messaging Interface*.

Pool

In *Hybrid/PBX Mode*, a group of outside lines/trunks that users can access with a Pool button or by dialing an access code on *SA buttons*. Also used by the *ARS* feature when choosing the least expensive route for a call.

Point-to-Point Facility

In a *Private Network*, a line/trunk that passes through the *PSTN* without using the switching capabilities of the PSTN.

Port

See *Jack*. Also, refers to *Extension* or *Line/Trunk Jack* before these are numbered according to the *Dial Plan* 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.

PRI

Primary Rate Interface. Standard interface that specifies the protocol used between two or more communications systems. As used in North America, it provides twenty-three 64-kbps *B-Channels* for voice and/or data and one 16-kbps *D-Channel*, which carries multiplexed signaling information for the other 23 channels.

Primary System Operator Position

First extension *Jack* on the first TDL or MLX module in the control unit—that is, the extension jack with the lowest logical ID in the system.

Prime Line

Individual extension number assigned to a telephone in a system operating in *Behind Switch Mode*. Each telephone user has his or her own prime line and is automatically connected to that line when he or she lifts the handset.

Priority Call Queuing

System function that prioritizes calling groups, thereby allowing certain incoming calls to be answered before others.

Private Communications Network

See [Private Network](#).

Private Network

Interconnected group of communications systems, which may consist of MERLIN MAGIX Integrated Systems, MERLIN LEGEND Communications Systems, DEFINITY Enterprise Communications Servers (ECS), DEFINITY Business Communications Servers (BCS), and/or DEFINITY ProLogix Solutions.

Private Network Trunks

Facilities that connect communications systems in a [Private Network](#). See also [Tandem Tie Trunk](#) and [Tandem PRI Trunk](#).

Processor Module

Module in the second slot of the control unit (Slot 0, to the right of the [Power Supply Module](#)). Includes 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 TDL or 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.

PSTN

[Public Switched Telephone Network](#). Network that is commonly accessible for local or long-distance calling. Also called “public network” or “public switched network.”

PSTN Trunk

In a [Private Network](#), facility that connects a networked system to the [Public Switched Telephone Network](#).

Public Switched Telephone Network

See [PSTN](#).

Q

QCC

Queued Call Console. A 4424LD+ or 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, to direct inside and outside calls to an extension or to an outside telephone number, to serve as a message center, to make outside calls for users with outward calling restrictions, to set up conference calls, and to 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. In a [Private Network](#), remote access settings are used to control calls routed via [ARS](#) or [UDP](#) routing across the network.

Restore

Procedure whereby saved and archived system programming is reinstated on the system, from a floppy disk or [Memory Card](#). See also [Backup](#).

Restricted Data Channel

Channels that do not allow the transmission of occurrences of more than seven contiguous zero bits. See also [Unrestricted Data Channels](#).

Rotary Dial Enable

Through centralized programming, T/R ports (including the T/R ports on the new ETR modules) can be programmed to accept rotary-dial and touch-tone digits or just touch-tone digits.

Riser Cable

Cable that runs between floors in a multi-story building and connects wiring closets.

RS-232

Physical interface, specified by the Electronics Industries Association (EIA), that transmits and receives asynchronous data at distances of up to 50 feet (15 meters).

Robbed-Bit Signaling

Signaling in which the least significant *Bit* of 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**SA buttons**

Telephone buttons that provide access to both inside and outside calls.

Satellite System

In a *Private Network*, a communications system that is directly connected to, and located within 200 miles of the local system.

Screen Pop

Refers to a computer-telephony software application that takes caller information (for example, the calling party number provided by Caller ID service), queries a database, and displays a screen with information about the caller onto a user's PC screen. Screen pop requires that an identifying number or code be available to identify the calling party. See also *CTI Link*.

SDN

Software Defined Network. AT&T private networking service created by specialized software within the public network.

Series Configuration

Private Network arrangement whereby either two or four or more communications systems are connected in a line, with no particular system acting as the *Hub System*. See also *Star Configuration*.

Service Observing

Feature that allows one extension to listen in (observe) on calls that arrive at another extension.

SID

Station (Extension) Identification.

Signaling

Sending of information between devices to set up, maintain, or cease a connection, such as a telephone call.

Simplex Signaling

Transmission of signals in one direction only, across a telecommunications channel.

Single-Line Telephone

Industry-standard touch-tone or rotary dial telephone that handles one call at a time. It is connected to the system via an [Extension Jack](#) on a 016 (T/R) or 008 OPT module, or via a [Port](#) on an 016 ETR module programmed for [Tip/Ring](#) operation.

Slot

Position in a carrier for a module; numbered from 0.

SMDR

[Station Message Detail Recording](#). Feature that captures usage information on incoming and outgoing calls.

SMDR Printer

Printer used to produce [SMDR](#) reports. Connected to the system via an RS-232 [Jack](#) on the [Processor Module](#).

Software Defined Network

See [SDN](#).

Special Character

Pause, Stop, or End-of-Dialing signal in a programmed dialing sequence, such as a speed dial number.

Square Key

Configuration in [Key Mode](#) operation in which all outside lines appear on all telephones.

Star Configuration

[Private Network](#) arrangement whereby either three or more communications systems are connected with one system acting as the [Hub System](#). See also [Series Configuration](#).

Station

See [Extension](#).

Station Jack

See [Extension Jack](#).

Station Message Detail Recording

See [SMDR](#).

Switch

See [Integrated System](#).

Switched 56 Service

[DS1](#) Switched 56 service is an end-to-end digital, 56-kbps, full-duplex, synchronous, circuit-switched service offering. The service is offered by network service providers and by some Local Exchange Carriers (LECs) as circuit-switched, 56-kbps service. T1-emulated [Tandem Tie Trunks](#) in a [Private Network](#) can be programmed for data.

Switchhook Flash

Momentary (320 ms to 1 sec) on-hook signal used as a control; may be directed to the control unit or to a [Host](#) switch outside the system. Also called "Recall" or "timed flash."

Switch Identifier

Number assigned to a [Tandem Trunk](#) in a [Private Network](#). It identifies the system connected to the far end of the trunk. A switch identifier is based on the type of system and its distance from the system where the identifier is assigned. See also [Satellite System](#) and [Non-Satellite System](#).

Synchronous Data Transmission

Method of transmitting a continuous digital data stream in which the transmission of each binary [Bit](#) is synchronized with a master clock. See also [Asynchronous Data Transmission](#).

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 44xx, MLX, and ETR display telephones and [SMDR](#) reports.

System Programming

Programming of system functions and features that affect most users, performed from a 4424LD+ or MLX-20L telephone or a computer using [WinSPM](#). See also [Extension Programming](#) and [Centralized Telephone Programming](#).

System Programming and Maintenance

See [WinSPM](#).

System Renumbering

Procedure used to change the numbers assigned to telephones, [Adjuncts](#), [Calling Groups](#), paging groups, park zones, [Remote Access](#), and lines/trunks.

T

T1

Type of digital transmission facility that, in North America, transmits at the [DS1](#) rate of 1.544 mbps.

T1-Emulated Data

A T1 [Tie Trunk](#) programmed for S56DATA for use by data calls at speeds up to 56 kbps. These trunks may be used for tandem and non-tandem operation.

T1-Emulated Voice

A T1 [Tie Trunk](#) programmed for Tie-PBX or Tie-Toll for use by voice calls.

T1 Switched 56 Service

[T1](#) digital data transmission over the [Private Network](#) or over a private network at 56 kbps. See [Switched 56 Service](#).

Tandem Switching

Capability of [Private Network](#) communications systems that allows them to direct outside calls from one facility to another, rather than just to an extension. Calls may be sent, for example, from a [PSTN](#) facility to a [Tandem Trunk](#), or vice versa.

Tandem Trunk

Private outside facility (as opposed to an inside system line) that connects two communications systems in a [Private Network](#) and can carry calls to another outside facility through [Tandem Switching](#). The trunk is not connected to the [PSTN](#).

Tandem Tie Trunk

Tandem Trunk that is an analog *Delay-Start Tie Trunk*, providing a single line/trunk per facility and allowing *Analog Transmission* of voice and low-speed data; or a T1 facility offering 24 channels on emulated tie trunks and programmed for voice or data.

Tandem PRI Trunk

Tandem Primary Rate Interface Trunk. See also *Private Network Trunks*.

TAPI

Telephony Application Programming Interface. Application programming interface that allows computer telephony applications to be used with MLX telephones. See also *PassageWay Direct Connection Solution*.

Telephone Power Supply Unit

Equipment that provides power to an individual telephone.

Terminal Adapter

See *ISDN Terminal Adapter*.

Tie Trunk

Private trunk directly connecting two telephone switches.

Timed Flash

See *Switchhook Flash*.

Tip/Ring

Contacts and associated conductors of a *Single-Line Telephone* plug or jack.

Touch-Tone Receiver

See *TTR*.

T/R

See *Tip/Ring*.

TransTalk Telephones

The TransTalk 9031 and TransTalk 9040 are wireless multiline telephones.

Trunk

Telecommunications path between the communications system and the telephone company *Central Office* or another switch. Often used synonymously with *Line*.

Trunk Jack

See [Line/Trunk Jack](#).

Trunk Pool

See [Pool](#).

TSAPI

Telephony Services Application Programming Interface. Application programming interface that allows computer telephony applications to be used. See also [TAPI](#) and [CTI Link](#).

TTR

Touch-Tone Receiver. Device used to decode DTMF touch-tones dialed from [Single-Line Telephones](#) or [Remote Access](#) telephones.

U

UDP

Uniform Dial Plan. Composed of the [Local Dial Plan](#) and [Non-Local Dial Plan](#). A dial plan that allows a caller at any [Extension](#) in a [Private Network](#) to dial the same number of digits to reach any other extension in the private network, even if the originating extension is physically connected to one communications system and the terminating extension is physically connected to a different communications system.

Unambiguous Numbering

Practice of numbering of extension ranges, remote access codes, or other system components to avoid routing conflicts in network or local calling. For example, Extension 441 is unique when compared to Extension 4410; however, this is ambiguous, because the system routes as soon as it matches the digits sent for a call with the digits in a [Local Dial Plan](#) or in a [Non-Local Dial Plan](#) extension range. When a caller dials 4410, therefore, the system routes the call to Extension 441 without considering the last dialed digit.

Uniform Dial Plan

See [UDP](#).

Uninterruptible Power Supply

See [UPS](#).

Unit Load

Measure of the power load drain of a module, telephone, or [Adjunct](#).

Unmonitored Extension

Extension for which no CTI application is receiving call information. See also *CTI Link* and *Monitored Extension*.

Unrestricted Data Channels

Also called *Clear Data Channel*. Allow the transmission of occurrences of more than seven contiguous zero bits. If an unrestricted data channel is requested and only restricted channels are available, the call will be rejected. See also *Restricted Data Channel*.

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. Enhanced *Tip/Ring* port.

VideoconferencingSystem

System application that allows face-to-face meetings, with voice and video, between individuals or groups. This application requires high-speed data transmission facilities. See also *Desktop Videoconferencing System* and *Group Videoconferencing System*.

Virtual Private Network

See *VPN*.

VPN

Virtual Private Network. Type of *Private Network* that uses the switching capabilities of the *PSTN*, rather than *Tandem Switching*, to direct calls between connected communications systems. A VPN may constitute a part of a private network.

Voice Announce

System feature that allows users to receive voice announcements on their telephones. In Release 7.0 and later systems, the VA On Idle Only option (only for MLX telephones) allows voice announcement calls to go through only when the telephone is idle.

Voice-Band Channel

Transmission channel, generally in the 300–3400-Hz frequency band.

Voice Mail

Application that allows users to send messages to other system extensions, to forward messages received with comments, and to 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

[Tie Trunk](#) 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.

WinSPM

Windows [System Programming and Maintenance](#). Windows-based application for programming the system.