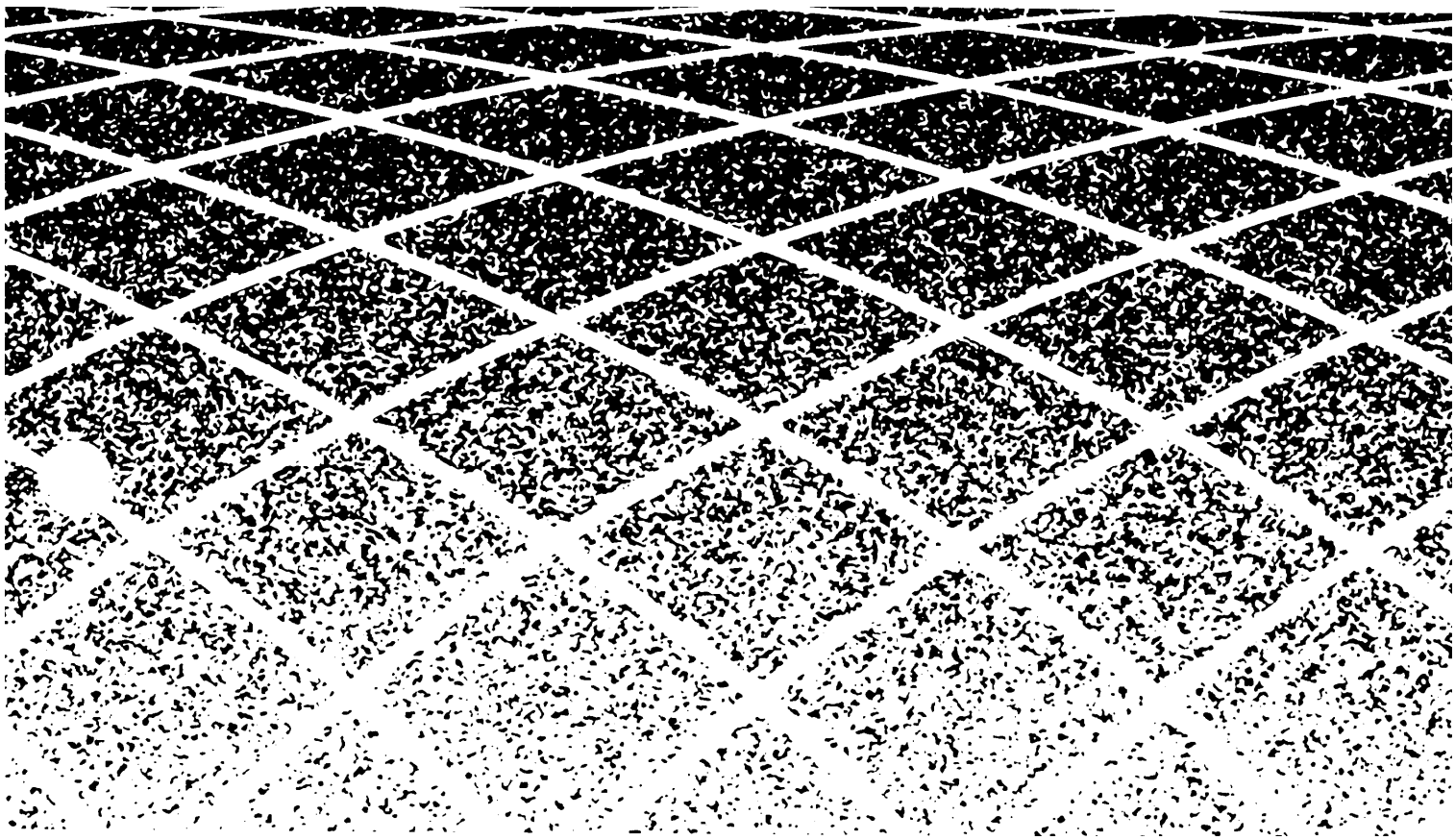
AT&T 555-620-143
Issue 1
October 1992

MERLIN LEGEND™ Communications System Release 2.0

Maintenance and Troubleshooting



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Notice

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

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

Trademarks

Magic On Hold and Megacom are registered trademarks, and MERLIN LEGEND, MLX-10, MLX-10D, MLX-20L, and MLX-28D are trademarks of AT&T in the U.S. and other countries.

Phillips is a registered trademark of the Phillips Screw Company.

UNIX is a registered trademark of UNIX System Laboratories, Inc.

Support Telephone Number

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

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CUSTOMER WARNING

This manual is designed for use **by qualified service technicians only.** Technician qualification includes completion of an AT&T hands-on instructor-led course covering installation and maintenance for this product. Installation or maintenance of this product by anyone other than a qualified service technician may void the warranty. **Hazardous electrical voltages are present inside this product.**

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

IMPORTANT SAFETY INSTRUCTIONS

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

- Read and understand all instructions.
- Follow all warnings and instructions marked on or packed with the product.
- Never install telephone wiring during a lightning storm.
- Never install a telephone jack in a wet location unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone wiring has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

- Use only AT&T-manufactured MERLIN LEGEND™ Communications System circuit modules, carrier assemblies, and power units in the MERLIN LEGEND Communications System (51 1A) control unit.
- Use only AT&T-recommended/approved MERLIN LEGEND Communications System accessories.
- If equipment connected to the analog station modules (008, 408, 408 GS/LS) or to the MLX telephone modules (008 MLX, 408 GS/LS-MLX) is to be used for in-range out-of-building (IROB) applications, IROB protectors are required.
- Do not install this product near water, for example, in a wet basement location.
- Do not overload wall outlets, as this can result in the risk of fire or electrical shock.
- The MERLIN LEGEND Communications System is equipped with a three-wire grounding-type plug with a third (grounding) pin. This plug will fit only into a grounding-type power outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact an electrician to replace the obsolete outlet. Do not defeat the safety purpose of the grounding plug.
- The MERLIN LEGEND Communications System requires a supplementary ground.
- Do not attach the power supply cord to building surfaces. Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.
- Slots and openings in the module housings are provided for ventilation. To protect this equipment from overheating, do not block these openings.
- Never push objects of any kind into this product through module openings or expansion slots, as they may touch dangerous voltage points or short out parts, which could result in a risk of fire or electrical shock. Never spill liquid of any kind on this product.
- Unplug the product from the wall outlet before cleaning. Use a damp cloth for cleaning. Do not use cleaners or aerosol cleaners.

Customer Support Information

Support Telephone Number

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

Outside the U. S.A., if you need assistance when installing, programming, or using your system, contact your authorized AT&T dealer.

Federal Communications Commission (FCC) Electromagnetic Interference Information

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Canadian Department of Communications (DOC) Interference Information

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FCC Notification and Repair Information

This equipment is registered with the FCC in accordance with Part 68 of its rules. In compliance with those rules, you are advised of the following:

- **Means of Connection.** Connection of this equipment to the telephone network shall be through a standard network interface jack: USOC RJ11C, RJ14C, RJ21X. Connection to E&M tie trunks requires a USOC RJ2GX. Connection to off-premises stations 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.

  This equipment may not be used with party lines or coin telephone lines.
- **Notification to the Telephone Companies.** Before connecting this equipment, you or your equipment supplier must notify your local telephone company's business office of the following:
  - The telephone number(s) you will be using with this equipment.
  - The appropriate registration number and ringer equivalence number (REN), which can be found on the back or bottom of the control unit, as follows:

    If this equipment is to be used as Key System, report the number AS593M-72914-KF-E.

    If the system provides both manual and automatic selection of incoming/outgoing access to the network, report the number AS593M-72682-MF-E.

    If there are no directly terminated trunks, or if the only directly terminated facilities are personal lines, report the number AS5USA-65646-PF-E.

    The REN for all three systems is 1.5A.
  - For tie line connection, the facility interface code (FIC) is TL31M and the service order code (SOC) is 9.0F.
  - For connection to off-premises stations, the FIC is OL13C and the SOC is 9.0F.
  - For equipment to be connected to 1.544-Mbps digital service, the FIC is 04DU9-B for D4 framing format or 04DU9-C for extended framing format, and the SOC is 6.0P.
  - For equipment to be connected to DID facilities, the FIC is 02RV2-T and the SOC is 9.0F.
  - The quantities and USOC numbers of the jacks required.
  - For each jack, the sequence in which lines are to be connected: the line types, the FIC, and the REN by position when applicable.

  You must also notify your local telephone company if and when this equipment is permanently disconnected from the line(s).

  The REN is used to determine the number of devices that may be connected to the telephone line. Excessive RENs on the line may result in the devices not

ringing in response to an incoming call. In most, but not all, areas the sum of the RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to the line, as determined by the total RENs, contact the telephone company to determine the maximum REN for the calling area.

Installation and Operational Procedures

The manuals for your system contain information about installation and operational procedures.

- **Repair Instructions.** If you experience trouble because your equipment is malfunctioning, the FCC requires that the equipment not be used and that it be disconnected from the network until the problem has been corrected. Repairs to this equipment can be made only by the manufacturers, their authorized agents, or others who may be authorized by the FCC. In the event repairs are needed on this equipment, contact your authorized AT&T dealer or, **in the U.S.A. only,** contact the National Service Assistance Center (NSAC) at 1-800-628-2888.
- **Rights of the Local Telephone Company.** If this equipment causes harm to the telephone network, the local telephone company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice is not practical, you will be notified as soon as possible. You will also be informed of your right to file a complaint with the FCC.

  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).**
  a. This equipment returns answer supervision signals to the Public Switched Telephone Network when:
     (1) answered by the called station
     (2) answered by the attendant
     (3) routed to a recorded announcement that can be administered by the customer premises equipment user
     (4) routed to a dial prompt

b. This equipment returns answer supervision on all DID calls forwarded back to the Public Switched Telephone Network. Permissible exceptions are when:
   (1) a call is unanswered
   (2) a busy tone is received
   (3) a reorder tone is received

Allowing this equipment to be operated in such a manner as not to provide proper answer supervision signaling is in violation of Part 68 rules.

DOC Notification and Repair Information

NOTICE: The Canadian Department of Communications (DOC) label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The DOC does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to connect it to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring for single-line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or any equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electrical inspection authority or electrician, as appropriate.

To prevent overloading, the Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop used by the device. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100.

DOC Certification No.: 230 4095A
CSA Certification No.: LR 56260
Load No.: 6

Renseignements sur la notification du ministère des Communications du Canada et la réparation

AVIS: L'étiquette du ministère des Communications du Canada identifie Ie materiel homologué. Cette étiquette certifie que Ie materiel est conforme à certaines normes de protection, d'exploitation et de sécurité des réseaux de telecommunications. Le Ministère n'assure toutefois pas que Ie matériel fonctionnera à la satisfaction de l'utilisateur.

Avant d'installer ce matériel, l'utilisateur doit s'assurer qu'il est permis de Ie raccorder aux installations de l'entreprise locale de telecommunication. Le matériel doit également être installé en suivant une méthode acceptée de raccordement. Dans certains cas, Ies fils intérieurs de l'enterprise utilises pour un service individual à ligne unique peuvent être prolongés au moyen d'un dispositif homologué de raccordement (cordon prolongateur téléphonique interne).

L'abonné ne doit pas oublier qu'il est possible que la conformity aux conditions énoncées ci-dessus n'empêchent pas la degradation du service clans certaines situations. Actuellement, Ies entreprises de telecommunication ne permettent pas que l'on raccorde Ieur matériel à des jacks d'abonné, sauf clans Ies cas précis prévus pas Ies tarifs particuliers de ces entreprises.

Les reparations de materiel homologué doivent être effectuées par un centre d'entretien canadien autorisé désigné par Ie fournisseur. La compagnie de telecommunications peut demander à l'utilisateur de débrancher un appareil a la suite de reparations ou de modifications effectuées par l'utilisateur ou à cause de mauvais fonctionnement.

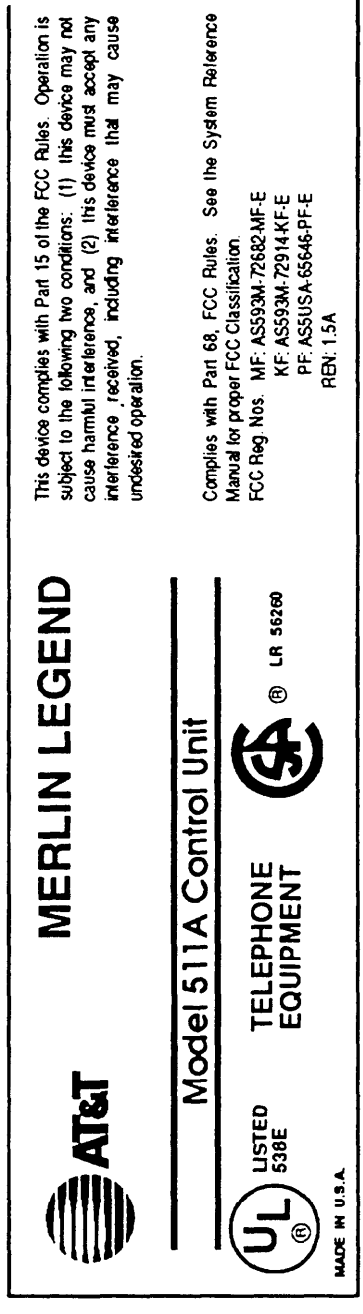
Pour sa propre protection, l'utilisateur doit s'assurer que tous Ies fils de mise à la terre de la source d'énergie électrique, des lignes téléphoniques et des canalisations d'eau métalliques, s'il y en a, sent raccordés ensemble. Cette précaution est particulièrement importance clans Ies régions rurales.

AVERTISSEMENT: L'utilisateur ne doit pas tenter de faire ces raccordements lui-même; il doit avoir recours à un service d'inspection des installations éctriques, ou à un electrician, selon Ie cas.

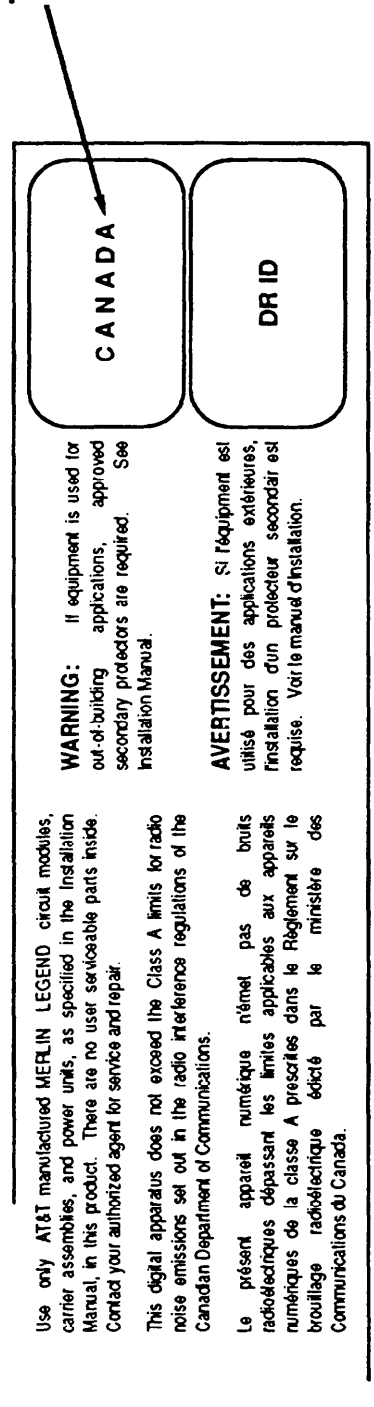
L'indite de charge (IC) assigné à chaque dispositif terminal indique, pour éviter toute surcharge, Ie pourcentage de la charge totale qui peut être raccordée à un circuit téléphonique bouclé utilisé par ce dispositif. La terminaison du circuit bouclé peut être constitute de n'importe quelle combinaison de dispositifs, pourvu que la somme des indices de charge de l'ensemble des dispositifs ne dépasse pas 100.

No d'homologation: 230 4095A
Node certification: CSA LR 56260
L'indite de charge: 6

MERLIN LEGEND D.O.C. Location Label Placement



Ministère des Communications du Canada emplacement de l'étiquette



Security of Your System—Preventing Toll Fraud

As a customer of a new telephone system, you should be aware that there exists an increasing problem of telephone toll fraud. Telephone toll fraud can occur in many forms, despite the numerous efforts of telephone companies and telephone equipment manufacturers to control it. Some individuals use electronic devices to prevent or falsify records of these calls. Others charge calls to someone else's number by illegally using lost or stolen calling cards, billing innocent parties, clipping on to someone else's line, and breaking into someone else's telephone equipment physically or electronically. In certain instances, unauthorized individuals make connections to the telephone network through the use of remote access features.

The Remote Access feature of your system, if you choose to use it, permits off-premises callers to access the system from a remote telephone by using an 800 number or a 7- or 10-digit telephone number. The system returns an acknowledgement signaling the user to key in his or her authorization code, which is selected and administered by the system manager. After the authorization code is accepted, the system returns dial tone to the user. If you do not program specific egress restrictions, the user will be able to place any call normally dialed from a telephone associated with the system. Such an off-premises network call is originated at, and will be billed from the system location.

The Remote Access feature, as designed, helps the customer, through proper administration, to minimize the ability of unauthorized persons to gain access to the network. Most commonly, phone numbers and codes are compromised when overheard in a public location, through theft of a wallet or purse containing access information, or through carelessness (writing codes on a piece of paper and improperly discarding it). Additionally, hackers may use a computer to dial an access code and then publish the information to other hackers. Enormous charges can be run up quickly. It is the customer's responsibility to take the appropriate steps to properly implement the features, evaluate and administer the various restriction levels, protect access codes, and distribute access codes only to individuals who have been fully advised of the sensitive nature of the access information.

Common carriers are required by law to collect their tariffed charges. While these charges are fraudulent charges made by persons with criminal intent, applicable tariffs state that the customer of record is responsible for payment of all long-distance or other network charges. AT&T cannot be responsible for such charges and will not make any allowance or give any credit for charges that result from unauthorized access.

To minimize the risk of unauthorized access to your communications system:

- Use a nonpublished Remote Access number.
- Assign authorization codes randomly to users on a need-to-have basis, keeping a log of ALL authorized users and assigning one code to one person.
- Use random sequence authorization codes, which are less likely to be easily broken.
- Deactivate all unassigned codes promptly.
- Ensure that Remote Access users are aware of their responsibility to keep the telephone number and any authorization codes secure.
- When possible, restrict the off-network capability of off-premises callers, via use of Call Restrictions and Disallowed List capabilities.
- When possible, block out-of-hours calling.
- Frequently monitor system call detail reports for quicker detection of any unauthorized or abnormal calling patterns.
- Limit Remote Call Forward to persons on a need-to-have basis.

Limited Warranty and Limitation of Liability

AT&T warrants to you, the customer, that your MERLIN LEGEND Communications System will be in good working order on the date AT&T or its authorized reseller delivers or installs the system, whichever is later ("Warranty Date"). If you notify AT&T or its authorized reseller within one year of the Warranty Date that your system is not in good working order, AT&T will without charge to you repair or replace, at its option, the system components that are not in good working order. Repair or replacement parts may be new or refurbished and will be provided on an exchange basis. If AT&T determines that your system cannot be repaired or replaced, AT&T will remove the system and, at your option, refund the purchase price of your system, or apply the purchase price towards the purchase of another AT&T system.

If you purchased your system directly from AT&T, AT&T will perform warranty repair in accordance with the terms and conditions of the specific type of AT&T maintenance coverage you selected. If you purchased your system from an AT&T-authorized reseller, contact your reseller for the details of the maintenance plan applicable to your system.

This AT&T limited warranty covers damage to the system caused by power surges, including power surges due to lightning.

The following will not be deemed to impair the good working order of the system, and AT&T will not be responsible under the limited warranty for damages resulting from

- failure to follow AT&T's installation, operation, or maintenance instructions
- unauthorized system modification, movement, or alteration
- unauthorized use of common carrier communication services accessed through the system
- abuse, misuse, or negligent acts or omissions of the customer and persons under the customer's control
- acts of third parties and acts of God

AT&T'S OBLIGATION TO REPAIR, REPLACE, OR REFUND AS SET FORTH ABOVE IS YOUR EXCLUSIVE REMEDY.

EXCEPT AS SPECIFICALLY SET FORTH ABOVE, AT&T, ITS AFFILIATES, SUPPLIERS, AND AUTHORIZED RESELLERS MAKE NO WARRANTIES, EXPRESS OR IMPLIED, AND SPECIFICALLY DISCLAIM ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Limitation of Liability

EXCEPT FOR PERSONAL INJURY, DIRECT DAMAGES TO TANGIBLE PERSONAL PROPERTY PROXIMATELY CAUSED BY AT&T, AND LIABILITY OTHERWISE EXPRESSLY ASSUMED IN A WRITTEN AGREEMENT SIGNED BY AT&T, THE LIABILITY OF AT&T, ITS AFFILIATES, SUPPLIERS, AND AUTHORIZED RESELLERS FOR ANY CLAIMS, LOSSES, DAMAGES, OR EXPENSES FROM ANY CAUSE WHATSOEVER (INCLUDING ACTS OR OMISSIONS OF THIRD PARTIES), REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT, TORT OR OTHERWISE, SHALL NOT EXCEED AN AMOUNT EQUAL TO THE LESSER OF THE DIRECT DAMAGES PROVEN OR THE PURCHASE PRICE OF THE SYSTEM. IN NO EVENT SHALL AT&T OR ITS AFFILIATES, SUPPLIERS, OR AUTHORIZED RESELLERS BE LIABLE FOR INCIDENTAL, RELIANCE, CONSEQUENTLY, OR ANY OTHER INDIRECT LOSS OR DAMAGE (INCLUDING LOST PROFITS OR REVENUES) INCURRED IN CONNECTION WITH THE SYSTEM. THIS LIMITATION OF LIABILITY SHALL SURVIVE FAILURE OF THE EXCLUSIVE REMEDY SET FORTH IN THE LIMITED WARRANTY ABOVE.

Voice Mail Systems

Your Voice Mail system permits callers to leave verbal messages for system users or gain access to the back-up position in an emergency as well as create and distribute voice messages among system users.

The Voice Mail system, through proper administration, can help you reduce the risk of unauthorized persons gaining access to the network. However, phone numbers and authorization codes can be compromised when overheard in a public location, are lost through theft of a wallet or purse containing access information, or through carelessness (writing codes on a piece of paper and improperly discarding them).

Additionally, hackers may use a computer to dial an access code and then publish the information to other hackers. Substantial charges can accumulate quickly. It is your responsibility to take appropriate steps to implement the features properly, evaluate and administer the various restriction levels, protect and carefully distribute access codes.

Under applicable tariffs, you will be responsible for payment of toll charges. AT&T cannot be responsible for such charges and will not make any allowance or give any credit resulting from unauthorized access.

To reduce the risk of unauthorized access through your Voice Mail system, please observe the following procedures:

- Employees who have voice mailboxes should be required to use the passwords to protect their mailboxes.
  - Have them use random sequence passwords.
  - Impress upon them the importance of keeping their passwords a secret.
  - Encourage them to change their passwords regularly.
- The administrator should remove any unneeded voice mailboxes from the system immediately.
- AUDIX Voice Power™ has the ability to limit transfers to subscribers only. You are strongly urged to limit transfers in this manner.
- Use the PBX or Key system administration capability to do the following:
  - Block direct access to outgoing lines and force the use of account codes/authorization codes.
  - Disallow trunk-to-trunk transfer unless required.
  - Assign toll restriction levels to all AUDIX Voice Power ports.
  - If you do not need to use the Outcalling feature, completely restrict the outward calling capability of the AUDIX Voice Power ports.
- Monitor SMDR reports or Call Accounting System reports for outgoing calls that might be originated by AUDIX Voice Power ports.

Remote Administration and Maintenance

The Remote Administration and Maintenance feature of your telecommunications system, if you choose to use it, permits users to change the system features and capabilities from a remote location.

The Remote Administration and Maintenance feature, through proper administration, can help you reduce the risk of unauthorized persons gaining access to the network. However, telephone numbers and authorization codes can be compromised when overheard in a public location, are lost through theft of a wallet or purse containing access information, or through carelessness (writing codes on a piece of paper and

improperly discarding them). Additionally, hackers may use a computer to dial an access code and then publish the information to other hackers. Substantial charges can accumulate quickly. It is your responsibility to take appropriate steps to implement the features properly, evaluate and administer the various restriction levels, and protect and carefully distribute access codes.

Under applicable tariffs, you will be responsible for payment of toll charges. AT&T cannot be responsible for such charges and will not make any allowance or give any credit resulting from unauthorized access.

To reduce the risk of unauthorized access through Remote Administration and Maintenance, please observe the following procedures:

- The System Administration and Maintenance capability of a PBX or Key system is protected by a password.
  - Change the default password immediately.
  - Continue to change the password regularly.
  - Only give the password to people who need it and impress upon them the need to keep it secret.
  - If anyone who knows the password leaves the company, change the password immediately.
- If you have a special telephone line connected to your PBX or Key system for Remote Administration and Maintenance, you should do one of the following:
  - Unplug the line when it is not being used.
  - Install a switch in the line to turn it off when it is not being used.
  - Keep the Remote Administration and Maintenance telephone number secret. Only give it to people who need to know it, and impress upon them the need to keep it a secret. Do not write the telephone number on the PBX or Key system, the connecting equipment, or anywhere else in the system room.
- If your Remote Administration and Maintenance feature requires that someone in your office transfer the caller to the Remote Administration and Maintenance extension, you should impress upon your employees the importance of only transferring authorized individuals to that extension.

About This Book

The *Maintenance and Troubleshooting* guide provides information and guidelines to assist you in resolving problems with the MERLIN LEGEND™ Release 2.0 Communications System.

Intended Audience

This book is intended for the qualified field technicians who respond to customer trouble reports.

Conventions

The following typographical conventions are used in this book:

- **Bold type is** used for telephone buttons.

  Press **Drop** to delete the current entry.

- *Italic type* is used for emphasis and as a substitute for information for which you must supply a specific value.

  Dial *feature code;* dial ✶ *ext. no.*

- `Constant width` type is used for information on telephone display screens or on a PC screen,

  Select `Sys Program.`

- **`Bold constant width`** type indicates information that you enter exactly as shown.

  Type **`install ;`** dial **#55.**

- Keys on the PC are shown in boxes.

  Press **[F7].**

- When two keys are to be pressed at the same time, the keys are connected by a hyphen.

  Press **[Alt]** - **[P]** .

Product Safety Labels

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

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

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

Related Documents

The books listed below comprise the entire MERLIN LEGEND Release 2.0 Communications System family of documentation. These documents are listed by their abbreviated titles. For example, *MERLIN LEGEND Release 2.0 Communications System Maintenance and Troubleshooting* is referred to as *Maintenance and Troubleshooting.*

Within the continental United States, these documents can be ordered from the AT&T Customer Information Center (CIC) by calling 1-800-432-6600.

NOTE:
For any application that runs on the MERLIN LEGEND Communications System, you can also order documentation from the CIC. If you do not know the exact title or number, they can provide you with a list of all documentation for each application.

Document No.	Title
	System Documents
555-620-114	*System Overview*
555-620-110	*Feature Reference*
555-620-115	*Equipment and Operations Reference*
555-620-116	*Pocket Reference*
555-620-111	*System Programming*
555-620-112	*System Planning*
555-620-113	*System Planning Forms*
	Telephone User Support
555-620-122	*MLX-10D™, MLX-28D™, and MLX-20L™ Display Telephones User's Guide*
555-620-123	*MLX-10D, MLX-28D, and MLX-20L Display Telephones Quick Reference*
555-620-150	MLX-10D Telephone Tray Cards (6 cards)
555-620-152	MLX-28D and MLX-20L Telephone Tray Cards (5 cards)
555-620-124	*MLX-10™ Non-Display Telephone User's Guide*
555-620-125	*MLX-10 Non-Display Telephone Quick Reference*
555-620-151	MLX-10 (non-display) Telephone Tray Cards (6 cards)
555-620-120	*Analog Multiline Telephones User's Guide*
555-620-121	*Analog Multiline Telephones Quick Reference*
555-620-128	*ML C-5 Cordless Telephone Quick Reference*
555-620-126	*Single-Line Telephones User's Guide*
555-620-127	*Single-Line Telephones Quick Reference*
	System Operator Support
555-620-134	*MLX Direct-Line Consoles Operator's Guide*
555-620-135	*MLX Direct-Line Consoles Quick Reference*
555-620-132	*Analog Direct-Line Consoles Operator's Guide*
555-620-133	*Analog Direct-Line Consoles Quick Reference*
555-620-136	*MLX Queued Call Console Operator's Guide*
555-620-137	*MLX Queued Call Console Quick Reference*
	Miscellaneous User Support
555-620-130	*Calling Group Supervisor's Guide*
555-620-131	*Calling Group Supervisor's Quick Reference*
555-620-129	*Data User's Guide*

Document No.	Title
	Documentation for Qualified Technicians
555-620-140	*Installation, Programming, & Maintenance (lP&M) Binder* (consists of 555-620-141,555-620-142, 555-620-143, and 555-620-144)
555-620-141	*Installation*
555-620-142	*System Programming & Maintenance (SPM)*
555-620-143	*Maintenance and Troubleshooting*
555-620-144	*Programming Summary*

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If the feedback form is not included in this section, write directly to the following address:

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Parsippany, NJ 07054

Introduction to System Maintenance

1

The purpose of maintenance is to detect, report, and clear problems quickly with minimum disruption of service. The system attempts to isolate each problem to a single replaceable unit whenever possible by running automatic tests. Errors that cannot be automatically corrected are usually recorded in error logs. Most of your troubleshooting will rely on checking these error logs and interpreting them using Table 2-1, “Error Codes,” in Chapter 2.

Equipment

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

Maintenance Terminal

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

- For on-site maintenance, use one of the following:
  - — MLX-20L console
  - — PC with System Programming and Maintenance (SPM)

NOTE:

- The PC can be a DOS PC or a Master Controller (MCII+ or MCIII)
- A 355 AF adapter and D8W-87 cord is required to connect the PC to the control unit

- For remote maintenance, use a DOS PC with SPM.

NOTE:
On-site maintenance is preferred; remote maintenance overrides on-site maintenance and programming, except when on-site backup or restore is in progress.

See “On-Site Maintenance” or “Remote Maintenance” later in this section for details.

Tools

In addition to setting up the maintenance terminal, you should have the following tools:

- EIA breakout box
- digital voltmeter (KS-20599 or equivalent)
- 110O/66-type punch down tool
- Dracon TS21 or equivalent touch-tone test telephone
- assorted flathead screwdrivers
- assorted Phillips®-head screwdrivers
- long-nosed pliers

- regular pliers
- wrist grounding strap

CAUTION:
Electrostatic discharge can destroy or severely damage the integrated circuits in the power supply, processor, and modules. 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.

- replacement parts recommended by your technical support organization

Removing the Control Unit Housing

1. Disconnect AC power from each auxiliary power unit at the wall outlet.
2. Disconnect AC power from each carrier by disconnecting the power cord at the wall outlet.
3. Remove the housing (see Figure 1-1):

   If the existing control unit is a MERLIN II Communications System, remove the housing as follows.

   a. Remove the front housing from each carrier by pulling the bottom-front towards you. When it releases, remove it by lifting up as shown in Figure 1-1.

   b. Remove the top from each carrier in the system by pushing it straight up from the front.

   If the existing control unit is a MERLIN LEGEND Communications System, remove the housing as follows.

   a. From both sides of the control unit, pry the clips from the housing, using a screwdriver if difficult to reach.

b. When the clips are freed from the housing, carefully pull the housing towards you.

NOTE:
If the system has more than one carrier, make sure you hold the housing only from the basic carrier side. Otherwise, the housing may disassemble.

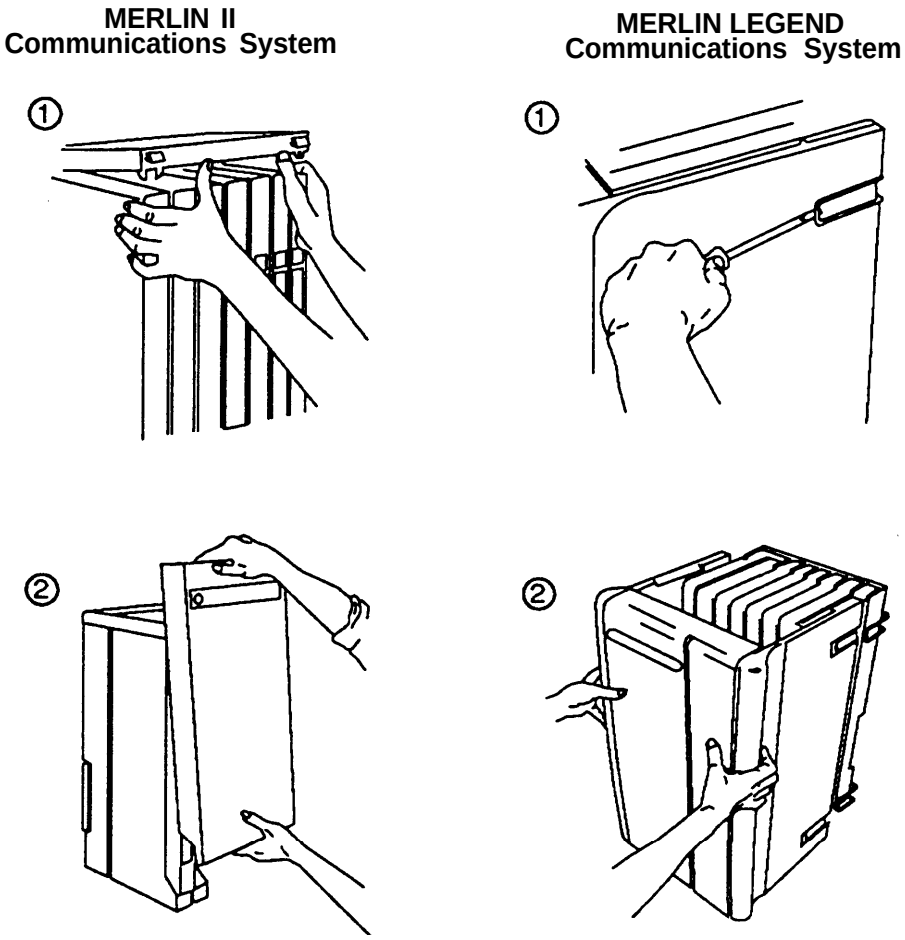


Figure 1-1. Removing the Control Unit Housing

Installing the Control Unit Housing

When you have completed maintenance and troubleshooting, install the control unit housing as follows:

1. If the housing is not already assembled, assemble it as follows:
   a. Lay the front panel(s) face down.
   b. If more than one carrier is being housed, connect the front panels together by lining up the arrows and then sliding the panels until the semicircles form a complete circle.
   c. Connect the side panels to the front panel(s) similarly.
2. Line up the wire clips that are attached to the carrier with the recesses on the outside of the side panels. See Figure 1-2.

   NOTE:
   If the wire clips are not already attached to both sides of the control unit, see "Installing the Housing Clips" in Chapter 2 of the *Installation* guide.

3. Push the panels back until the clips hook over the tabs and rest in the recesses.

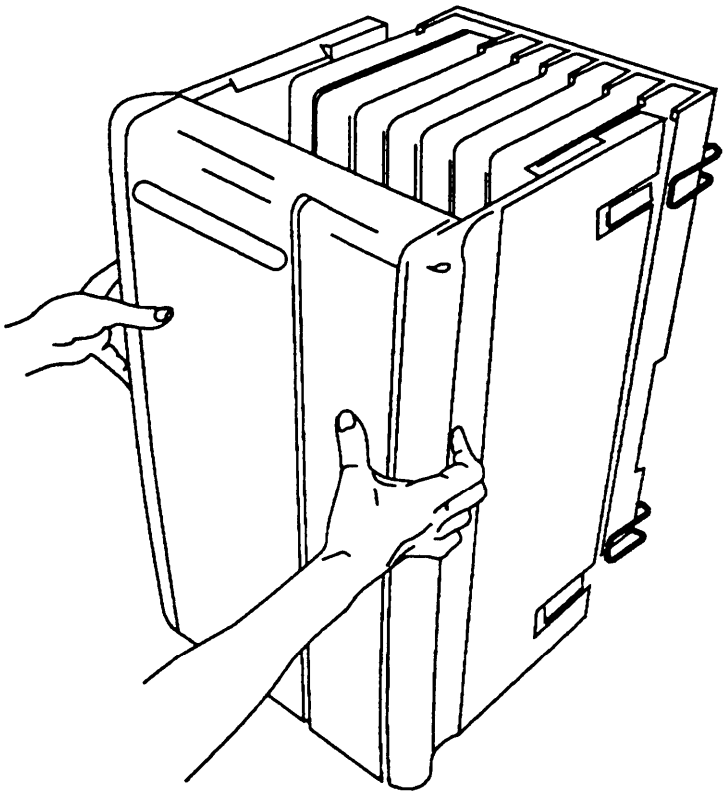


Figure 1-2. Installing the Control Unit Housing

On-Site Maintenance

You can do on-site maintenance with an MLX-20L console or a PC with SPM software. See the *System Programming & Maintenance (SPM)* guide for details. If you are in the UNIX® environment, see the documentation for Integrated Solution Ill (IS-III) as well.

Setting up the MLX-20L Maintenance Terminal

1. Connect the MLX-20L console to the control unit by plugging one end of the D8W-87 cord into one of the first five jacks on the leftmost MLX module.

   NOTE:
   Only the following modules qualify:

   - 008 MLX
   - 408 GS/LS-MLX

   The first MLX jack (the lowest telephone jack) is the default. See Figure 1-3.

   If the first MLX jack is being used for the attendant console (the customer receptionist or operator), use one of the other jacks. If one of these five jacks is already being used for system programming or maintenance, use that jack. Only one jack at a time can be used for system programming or maintenance.

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

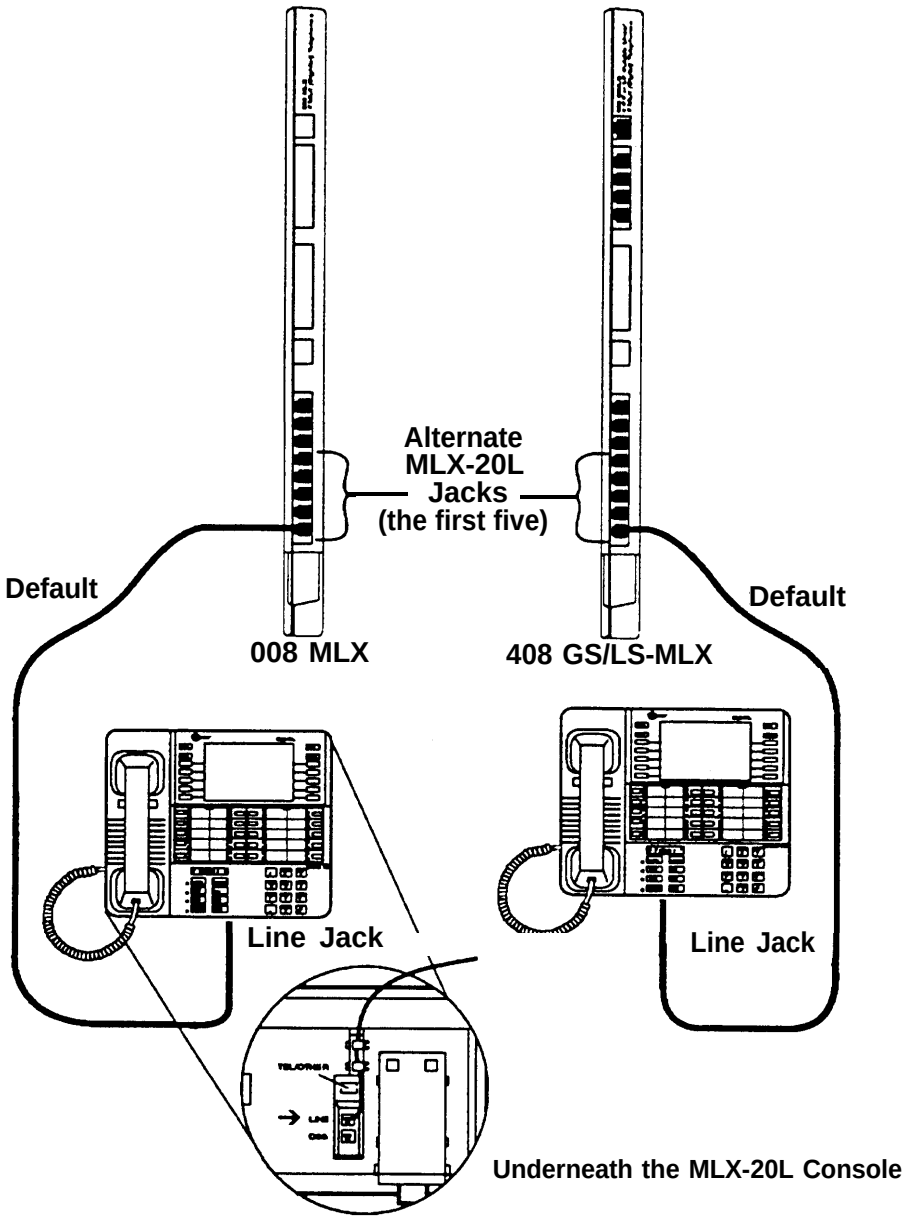


Figure 1-3. Setting up the MLX-20L Telephone

MLX-20L Failure

If the MLX-20L console does not work, troubleshoot it as follows:

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

   If not, use the PC as your maintenance terminal and then troubleshoot the leftmost MLX module.

   For details, see “Module Problems” in Chapter 4.

Setting up the PC

Plug your laptop or PC into the SPM jack on the processor as shown in Figure 1-4.

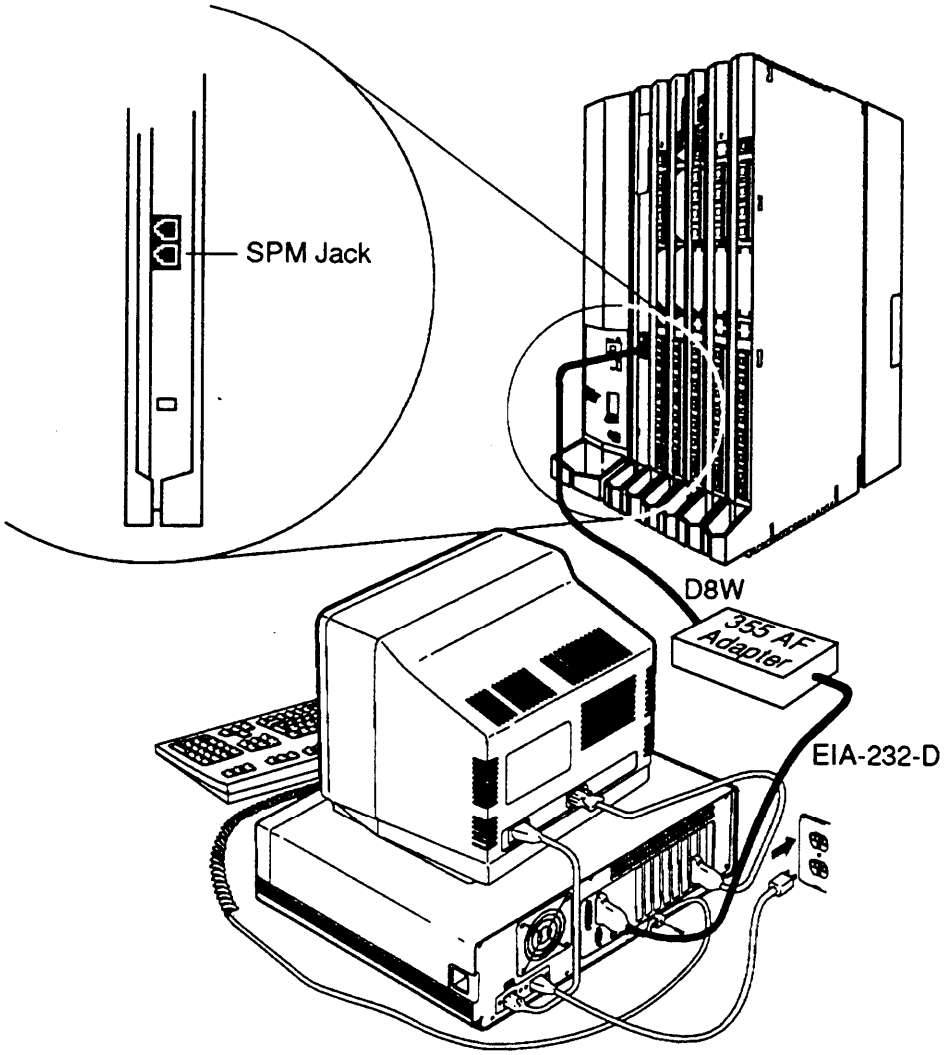


Figure 1-4. Setting up the PC

Remote Maintenance

Remote maintenance allows you to do everything as if you were on-site, including checking error logs, checking system status, and restarting the system.

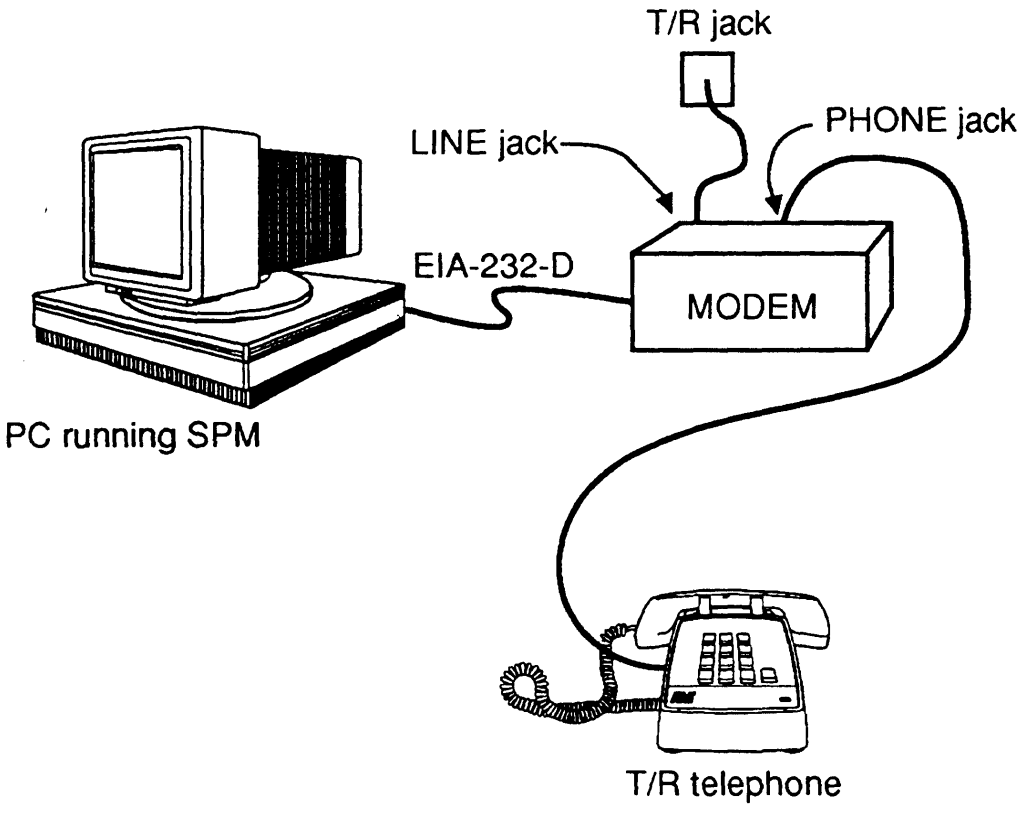


Figure 1-5. Remote Modem Setup

As shown in Figure 1-5, you need the following equipment to perform remote maintenance:

1. DOS PC with SPM
2. Tip/ring telephone
3. 1200-bps modem

Connect the equipment as follows:

1. Connect the PC and modem using EIA-232-D cable.

   NOTE:
   If the modem is a circuit board in the PC, this connection is already established.

2. Connect the modem to a T/R trunk jack using a D8W cord.
3. Connect the modem to a T/R telephone using a D8W cord.

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

Considerations

- Remote maintenance overrides on-site maintenance and programming, except when on-site backup or restore is in progress. Whenever you do remote maintenance, notify the customer administrator in advance.
- 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. When this happens during remote maintenance, hang up and redial.

NOTE:
Under applicable tariffs, the customer is responsible for any charges incurred through the remote use of system facilities. Precautions should be taken to prevent unauthorized use of the system's outside lines by remote callers, also called toll fraud, See "Customer Support Information" at the beginning of this guide for more information on security.

Dialing the Attendant

If you do not know the remote access trunk number, dial the number for the customer's system as indicated in this procedure:

1. Start SPM, press any key when the welcome message appears, and enter the command to put the modem in originate mode (this command varies depending on the type of modem used).
2. Pick up the handset on the tip/ring telephone and dial the customer's system attendant (the listed directory number for the customer's system).
3. When the call is answered, explain what you are doing and ask for any passwords you may need; then ask the attendant to transfer you to the modem by pressing **Transfer** and then dialing ✶ **10.**

   NOTE:

   - If the password is not known, check the System Information Report or ask to speak with the system administrator.
   - You can change the password without knowing the old password only when you are on-site and connected to the SPM jack on the processor.

4. When you hear the modem tone, hang up.
5. If nothing appears on the SPM screen, press **[Enter]** .

6. When the `Password:` prompt appears, type the password (do not press **[Enter]**).

   The SPM Main menu appears. You are ready to proceed with remote maintenance.

Dialing the Modem Directly

To dial the modem directly, do the following:

1. Start SPM, press any key when the welcome message appears, and enter the command to put the modem in originate mode (this command varies depending on the type of modem used).
2. Pick up the handset on the tip/ring telephone and dial the remote access trunk number.

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

   You will hear ringing, followed by dial tone.
3. If the dial tone begins with three short tones followed by a steady one, dial the access barrier code on the tip/ring telephone. Otherwise, go to the next step.

   NOTE:

   - If you do not know the remote access barrier code, contact the customer's system administrator, or check Form 3a, Incoming Trunks—Remote Access.
   - You can change the access barrier code without knowing the old one only when you are on-site and connected to the SPM jack on the processor.

4. When you hear the dial tone, dial ✶ **10** to connect to the modem on the remote system.

5. When you hear the modem tone, hang up.
6. If nothing appears on the SPM screen, press **[Enter]**.
7. When the `Password:` prompt appears in the SPM window, type the password (do not press **[Enter]**).

NOTE:

- If you do not know the password, check the System Information Report or ask to speak with the system administrator.
- You can change the password without knowing the old password only when you are on-site and connected to the SPM jack on the processor.

The SPM Main menu appears. You are ready to proceed with remote maintenance.

Maintenance Strategy

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

Trouble Reports

Trouble is reported in two ways:

- User-reported problems
- System alarms (permanent errors)

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

The tests check hardware and software that are in service *without* disrupting normal service. Any errors detected are registered in the error logs. Errors are corrected automatically whenever possible.

Alarms

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

- an LED for a line or feature button on an operator console or other designated telephone turns on
- the LED on the processor turns on
- the status display indicates alarm status (this is true for both maintenance terminals—the MLX-20L console and a PC running SPM)
- a supplemental alert, if installed, is activated (bell, chime, or strobe)

If an LED is programmed to indicate the alarm, the LED stays on until the error is cleared. When the system indicates an alarm, check the permanent error logs.

Clearing Alarms

Alarms are cleared automatically when the error condition no longer exists.

To clear an alarm manually, select **Drop** on the MLX-20L console or **[ALT]** - **[P]** on a PC.

System Restarts

Depending on the severity and duration of a problem, you may need to restart the system. 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.

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.

Effect on service: Calls in progress are not dropped, but calls in the process of being connected may be dropped.

NOTE:

- Power interruptions of less than 100 ms usually do not affect the system.
- Warm starts can cause telephones to ring inexplicably. To stop the ringing, call the telephone.

Restart (Cold Start)

If you need to restart the system, Restart (a cold start) is recommended.

Effect on service: As with System Erase (a frigid start), all calls are dropped. Restart saves the system programming, whereas System Erase does not.

To perform a cold start, select `Restart` as follows:

Menu →`SysProgram` →`Exit` →`System` →`Restart` →`Yes`

NOTE:

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

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

System Erase (Frigid Start)

CAUTION:
All system programming will be erased.

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

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

Menu →`Maintenance` →`Slot` →Type 00 →`Demand Test` →`System Erase` (Line 5, left button) twice →`Yes`

NOTE:

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

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

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

Isolating the Trouble

Any problem can be isolated to one of the following areas:

- Telephone
- Control unit
- Central office

NOTE:
If you change the jack assignment of any telephone, be sure to record the extension jack change on Form 2a, System Numbering—Station Jacks. See Appendix A for details.

Figure 1-6 diagrams the entire maintenance strategy. Refer to this figure and the text that follows whenever you need guidance in troubleshooting.

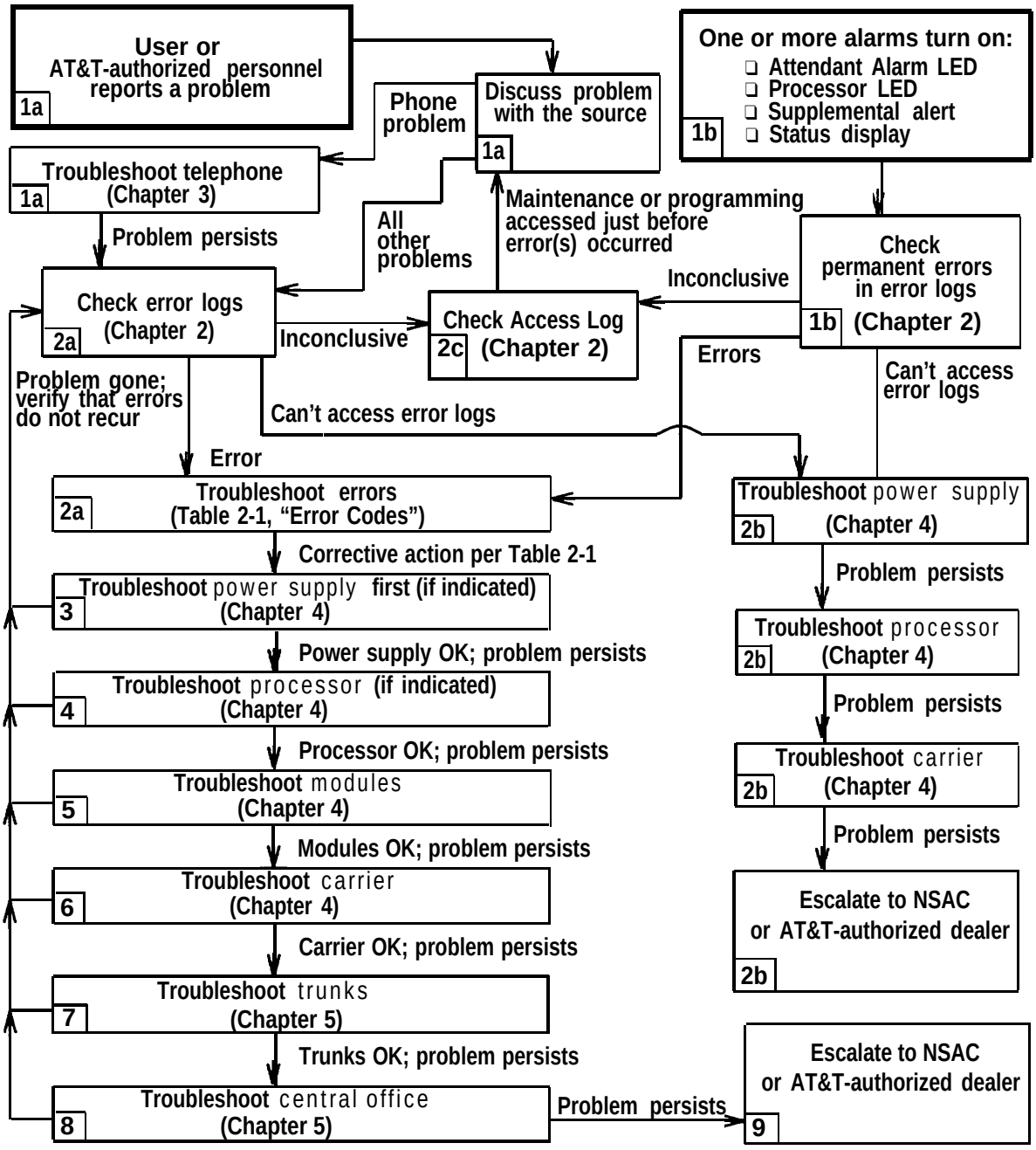


Figure 1-6. Maintenance Strategy

Step 1a: Check Telephone Problems

If the customer reported a telephone problem, do the following, which Chapter 3 describes in more detail:

1. Discuss the problem with the user who reported the problem.
2. Run the appropriate test to verify the complaint.
3. Replace the telephone with one that is known to be working properly.
4. If this does not resolve the problem, replace the telephone wiring.
5. If the problem persists, proceed to Step 2a.

Step lb: Check Permanent Errors

If a system alarm turns on (see the top-right of Figure 1-6), begin troubleshooting by checking the permanent errors in the error logs.

Step 2a: Check the Error Logs

For an unresolved telephone problem or any other problem, check the error logs. The problem is now isolated to the control unit or central office.

1. Check the permanent errors first; these are the most serious.
2. Check transient errors only if they remain after clearing all permanent errors.

   Transient errors are less serious. Some transient errors become permanent if they occur a certain number of times, as shown in Table 1-1. The `Threshold` column indicates the number of occurrences at which a transient error becomes permanent.
3. Check the last 10 errors whenever you want to see the 10 most recently recorded errors—both permanent and transient.

NOTE:
As you are checking the error logs, see Table 2-1, "Error Codes," in Chapter 2 for detailed descriptions of each problem.

Table 1-1. Transient/Permanent Error Thresholds

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

Step 2b: Trouble Accessing the Error Logs

If you cannot access the error logs, or if the system is inoperable, troubleshoot the system until the problem is resolved:

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

   If the LED is off and you are sure that the power is connected and turned on, see "Power Supply Problems" in Chapter 4.
2. If you still cannot access the error logs after checking the power supply, see "Processor Problems" in Chapter 4.

3. If you still cannot access the error logs after checking the processor, see “Carrier Problems” in Chapter 4.
4. If you still cannot access the error logs, escalate the problem to your technical support organization. See “Escalating the Problem” in Chapter 2 for details.

Step 2c: Check the Access Log for Maintenance and System Programming

At any time during the maintenance process, you may want to check the access log for maintenance and system programming. This log indicates the last 20 times that maintenance or system programming was accessed. If you find that someone accessed maintenance or system programming shortly before the problem originated, that person may be able to help you isolate the trouble by providing additional information.

Once you receive that information, use any maintenance or system programming feature that may lead to the root of the problem.

See “Access Log for Maintenance and System Programming” in Chapter 2 for additional information.

See the *System Programming* guide for information on system programming and Inspect.

Step 3: Check the Power Supply

If the error logs indicate the power supply, resolve this problem before continuing.

See “Power Supply Problems” in Chapter 4.

Step 4: Check the Processor

If the error logs indicate the processor, do the following:

1. Back up the system programming using SPM (see the *System Programming & Maintenance (SPM)* guide
2. Troubleshoot the processor as described under “Processor Problems” in Chapter 4.

Step 5: Check the Modules

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

Step 6: Check the Control Unit Carrier

The last possible cause *withln the control unit* is the carrier. If the carrier is damaged, it must be replaced.

See “Carrier Problems” in Chapter 4.

Step 7: Check the Trunks

Troubleshoot the trunks that are connected to the control unit. See Chapter 5.

Step 8: Check the Central Office

If the error logs indicate the central office, and you have resolved all other possible causes, troubleshoot as follows (see Chapter 5 for details):

1. Call the central office and ask them to check the problem at their end.
   - — If they indicate that the problem is in the central office, duplicate the original problem after they fix it.
   - — If the problem persists, repeat this process until the problem clears.
   - — If they indicate that the problem is not in the central office, escalate the problem as described in Step 9.

Step 9: Escalate

Escalate any remaining problems to your technical support organization.

See “Escalating the Problem, “ in Chapter 2. This section explains how to access the System Inventory screen, which contains information that your technical support organization may request (the hardware vintage, software vintage, and ROM ID for each module).

Unit Loads

A unit load is a measure of power (1,9 watts) used to determine the electrical load that the following components have on *each carrier's* power supply:

- telephones and adjuncts

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

- direct-inward dial (DID) modules

Checking Unit Loads

In the event of maintenance or equipment changes, recalculate the unit loads for each carrier resulting in a different configuration.

Use the worksheet in Appendix B.

General Rule: 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. The next two sections provide the rules for calculating unit loads in various modes.

Unit Loads for the Hybrid/PBX Mode

The power supply (model 391 Al) generally supports six modules of any type in a Hybrid/PBX system.

However, if both of the following conditions are true, the unit loads on a carrier can exceed the 54-unit maximum:

- all six carrier slots are occupied by MLX telephone or analog multiline telephone modules
- the carrier has more than 45 telephones installed (MLX-20L telephones and/or 34-button analog multiline 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 (model 391A1) generally supports four modules of any type in Key or Behind Switch mode.

Auxiliary Power Units

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

NOTE:
Running the system with more than 54 unit loads per carrier may not appear to do harm. However, this can cause the system to malfunction, creating “no trouble found” situations.

An auxiliary power unit redirects the power requirements from the last two slots on the carrier. Any station connected to the modules in the last two slots receives power from the auxiliary power unit instead of from the power supply.

If an auxiliary power unit is required, complete instructions are provided in the *Installation* guide.

Error Logs, the Access Log, and System Inventory

2

As described under “Maintenance Strategy” in Chapter 1, much of your troubleshooting will rely on the error logs and the Access Log for maintenance and system programming. Both of these maintenance features are described here in detail. This chapter also explains how to access the System inventory screen, which you may need when escalating unresolvable problems to your technical support organization.

Error Logs

Whenever 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.

Checking the Error Logs

Print the errors immediately after exiting the error logs. This will help you determine if your work has resolved each problem.

To print the errors, follow this procedure:

`System Programming` →**More** →`Print` →**More** →(twice) →`Error Log`

See the *System Programming* guide for additional information on printing.

Quick Reference

Menu →`Maintenance` →`System` →`Error Log` →`Last 10` or `Permanent` or `Transient`

Procedure: Check the Error Logs

Step	Display	Instructions
1	Maintenance > Make a selection System slot Port Exit	Select `System`.
2	System: Make a selection Status Error Log Inventory Access Log Exit Enter	Select `Error Log`.

Step	Display	Instructions
3	System Error Log: Make a selection Last 10 Permanent Transient *(most* recent *alarm)* Exit	Depending on your purpose, select Last 10, Permanent, or Transient. If you are not sure which selection to make, see ''Step 2a: Check the Error Logs" in Chapter 1 under "Maintenance Strategy." Once you make your selection, continue with one of the following subsections: "Checking Permanent Errors" "Checking Transient Errors" "Checking the Last 10 Errors"

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

Checking Permanent Errors

(continued from "Procedure: Check the Error Logs")

Step	Display	Instructions
4	Permanent Errors: > *xxxxxxxxxxxxxxxxxxxxxxx* Slot *xx* Port *xx* Count *xxx* First *mm/dd/yy hh:mm* Last *mm/dd/yy hh:mm* Code *xxxx* Exit	This screen appears when you select Permanent. Line 2 provides a brief description of the error code identified on Line 6. For more information on any error code, see Table 2-1. Line 3 indicates the slot and port where the error was detected, followed by the number of times it was detected. Lines 4 and 5 indicate the error's first and last occurrences.

More allows you to page through the permanent errors.

Drop (**[Alt] - [P]** on a PC) deletes an error log entry.

NOTE:
Depending on which entry that you delete, you might clear an alarm. See "Alarms" under "Maintenance Strategy" in Chapter 1 for additional information on alarms.

Checking Transient Errors

(continued from "Procedure: Check the Error Logs")

Step	Display	Instructions
4	Transient Errors: > *xxxxxxxxxxxxxxxxxxxxxxx* Slot *xx* Port *xx* Count *xxx* First *mm/dd/yy hh:mm* Last *mm/dd/yy hh:mm* Code *xxxx* Exit	This screen appears when you select `Transient`. Line 2 provides a brief description of the error code identified on Line 6. For more information on any error code, see Table 2-1. Line 3 indicates the slot and port where the error was detected, followed by the number of times it was detected. Lines 4 and 5 indicate the error's first and last occurrences.

More allows you to page through the transient errors.

Drop (**[Alt]** - **[P]** on a PC) deletes an error log entry.

Checking the Last 10 Errors

(continued from "Procedure: Check the Error Logs")

Step	Display	Instructions
4	Last 10 System Errors: > *xxxxxxxxxxxxxxxxxxxxxxxx* Slot *xx* Port *xx* Last *mm/dd/yy hh:mm* Code *xxxx* Exit	This screen appears when you select `Last 10`. Line 2 provides a brief description of the error code identified on Line 6. For more information on any error code, see Table 2-1. Line 3 indicates the slot and port where the error was detected. Line 5 indicate the error's last occurrence.

More allows you to page through the last 10 errors.

NOTE:
You cannot delete an error log entry from this screen.

Interpreting Error Codes

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

Table 2-1. Error Codes

Error Code	Description	Action
0001	TIMEOUT COLD START: System programming is okay.	No action required; however, if problem persists, troubleshoot the processor.
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.	Troubleshoot the power supply voltages. If problem persists, troubleshoot the processor.
0004	SOFTWARE WARM START: System programming is okay.	Troubleshoot the power supply voltages. If problem persists, troubleshoot the processor.
0006	INCOMPLETE COLD START: System was cold-started while a Restart was in-progress. System programming is okay.	Troubleshoot the power supply voltages. If problem persists, troubleshoot the processor.

Continued on next page

Table 2-1:- *(Continued)*

Error Code	Description	Action
0007	SANITY TIMEOUT RESET: Faulty software, module, carrier, or processor sanity timer.	Troubleshoot module or processor.
0008	MAX RESET COUNT EXCEEDED: System was cold-started because too many warm starts occurred. System programming is okay.	Troubleshoot the power supply voltages. If problem persists, troubleshoot the processor.
0009	FRIGID START: System was restarted and initialized to the 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 the *System Programming & Maintenance (SPM)* guide.
000A	POWER UP COLD START: A RAM failure was detected in the processor. System programming is okay.	Troubleshoot the power supply voltages. If problem persists, troubleshoot the processor.
000B	CARD INSERTED/REMOVED:	No action required.

Continued on next page

Table 2-1:- ***(Continued)***

Error Code	Description	Action
000C	SLOT STREAM CNT EXCEEDED: Slot has generated excessive interrupts.	If problem persists, troubleshoot the module.
000D	FMWR NOT IN STANDBY MODE: Module firmware is not in standby mode.	If problem persists, troubleshoot the module.
000E	COMMAND BUFFER FULL:	Troubleshoot the power supply voltages. If problem persists, troubleshoot the processor and module.
000F	TASK RUNNING TOO LONG:	No action required; however, if problem persists, troubleshoot the processor.
0010	INVALID SLOT INTERRUPT: Cannot determine module responsible for generating the interrupt.	Troubleshoot modules and replace if necessary. If problem persists, troubleshoot the processor.
0011	STACK OVERFLOW: Processor problem.	Troubleshoot the processor.
0012	INVALID RESET FLAG: Processor problem.	Troubleshoot the processor.
0013	DUART STREAMING INT: Processor problem.	Troubleshoot the processor.
0014	PROCESSOR ERR INTERRUPT: Processor problem.	Troubleshoot the processor.

Continued on next page

Table 2-1:- *(Continued)*

Error Code	Description	Action
0015	MODULE MISMATCH: Physical and logical type mismatch. Module insected 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.	Troubleshoot the power supply voltages. If problem persists, troubleshoot the module for the slot indicated.
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.
1C01	POOL M-BUSY EXCEEDS 50%: Over half the trunks in the pool are busy.	Troubleshoot trunk.
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**

Continued on next page

Table 2-1:- *(Continued)*

Error Code	Description	Action
4401	USER REQUESTED SYS ERASE: This error is logged after a System Erase. If the System Erase is successful, this error is removed immediately.	If this error remains in the transient log, do the System Erase again. If problem persists, troubleshoot the processor.
6C01	DS1 LOSS OF SIGNAL ALARM: Service on the link has been lost.	Troubleshoot the T1 trunk. If problem persists, check the CSU and the cable between the CSU and the 100D module. If problem persists, escalate to your technical support organization.
6C02	DS1 BLUE ALARM: All ones being received. Service on the link has been lost.	The far end of the network interface is out-of-service. Troubleshoot the T1 trunk, 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.

Continued on next page

Table 2-1:- *(Continued)*

Error Code	Description	Action
6C05	DS1 LOSS OF MULTIFRAME: Service on the link has been lost.	Troubleshoot the T1 trunk. If problem persists, escalate to your technical support organization.
6C06	DS1 REMOTE MULTI FRAME: The far end of the network interface is experiencing Loss-of-Multiframe. Service on the link has been lost.	Troubleshoot the T1 trunk. If problem persists, escalate to your technical support organization.
6C07	DS1 MAJOR ALARM: Average bit error rate exceeds 10 E-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**

Continued on next page

Table 2-1:- *(Continued)*

Error Code	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	DS1 HARDWARE INOPERATIVE: DS1 hardware is not operating properly, If this is the only 100D (DS1) module, or if this is the module designated to have the active clock, its TDM bus clock generator was not activated.	If problem persists, escalate to your technical support organization.
7001	PRI SVC AUDIT TIMEOUT:	Troubleshoot the PRI trunk and report to service provider; otherwise, no action required. If problem persists, contact your technical support organization.
7002	PRI SVC STATE INCONSIST:	Troubleshoot the PRI trunk and report to service provider; otherwise, no action required. If problem persists, contact your technical support organization.
7003	PRI D-CHNL INOPERATIVE:	Troubleshoot the PRI trunk and report to service provider; otherwise, no action required. If problem persists, contact your technical support organization.

Continued on next page

Table 2-1:- *(Continued)*

Error Code	Description	Action
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.
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 know to be working. If the problem is gone when using the known good module, replace the module.
7402	LOOP CONTROL BIT NOT SET: No loop current on an outgoing call. If this error occurs four times consecutively, and if auto-maintenance busy is enabled and the 50% auto-maintenance busy limit has not been exceeded, the trunk will be 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 know to be working. If the problem is gone when using the known good module, replace the module.

Continued on next page

Table 2-1:- *(Continued)*

Error Code	Description	Action
7403	NO LOOP CURRENT: Communication problems between the module and central office. No loop current. If this error occurs four times consecutively, and if auto-maintenance busy is enabled and the 50% maintenance-busy limit has not been exceeded, the trunk will be 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 know to be working. If the problem is gone when using the known good module, replace the module.
7404	STUCK RINGING: Communication problems between the module and central office. If this error occurs twice consecutively, the trunk will be busied-out automatically, whether auto-maintenance busy is enabled or not.	Test the trunk with a single-line telephone. If the problem is not in the trunk, replace the module with one that is know to be working. If the problem is gone when using the known good module, replace the module.
7801	NOT IN NORMAL OP MODE: Module not in normal operation mode. Reported in background module check.	Reset the board, if problem persists, troubleshoot the module. **Maintenance → Slot → Slot Number → Reset**
7802	SANITY INT NOT GENERATED: Only applies to modules that have station jacks.	Reset the board, if problem persists, troubleshoot the module.

Continued on next page

Table 2-1:- *(Continued)*

Error Code	Description	Action
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: This error occurs when a sanity test gets invalid responses. Applies only to modules that have station jacks.	Reset the board, if problem persists, troubleshoot the module.
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.

Continued on next page

Table 2-1:- *(Continued)*

Error Code	Description	Action
780A	DPR TEST NOT COMPLETED: Reported during cold start.	If problem persists, troubleshoot the module.
780C	RAM TEST FAILURE: Memory failed the RAM test. Turns on the processor LED.	If this problem persists, replace the processor.
780D	UPPER ROM FAILURE: Memory failed the ROM test. Turns on the processor LED.	If this problem persists, replace the processor.
780E	LOWER ROM FAILURE: Memory failed the ROM test. Turns on the processor LED.	If this problem persists, replace the processor.
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 dialer 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.

Continued on next page

Table 2-1: – *(Continued)*

Error Code	Description	Action
8403	NO EXTERNAL RELEASE: Communication problems between the module and central office. Far end has not disconnected within 4 minutes. If this error occurs twice consecutively, the trunk will be busied-out automatically, whether auto-maintenance busy is enabled or not.	Troubleshoot the far end of the network interface to see if it is working and translated properly. Troubleshoot for faulty cable.
8404	*ON* HOOK BEFORE WINK: Outbound dialing problems on tie trunks. For a tie trunk with delay dial or wink start, the far end of the network interface went on-hook before the handshake was completed.	If this 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 faulty cable. 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.

Continued on next page

Table 2-1:- *(Continued]*

Error Code	Description	Action
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.
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 auto-maintenance busy is enabled and the 50% maintenance-busy limit has not been exceeded, the trunk will be 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.

Continued on next page

Table 2-1: – *(Continued)*

Error Code	Description	Action
840C	STUCK RINGING: Communication problems between the module and central office. If this error occurs four times consecutively, and if auto-maintenance busy is enabled and the 50% maintenance-busy limit has not been exceeded, the trunk will be 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 auto-maintenance busy is enabled and the 50% maintenance-busy limit has not been exceeded, the trunk will be 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 modules. The module received an unrecognized message from the processor.	Turn the processor off and then on. Repeat system programming procedure, If the problem persists, replace the module.
8C01	SLOTS NOT EQUAL: The module that occupies the indicated slot does not match the slot information contained in the PC backup file.	Troubleshoot the slot descriptions in your backup file against the actual system modules that occupy those slots. After the mismatch is corrected, repeat the restore operation.

Access Log for Maintenance and System Programming

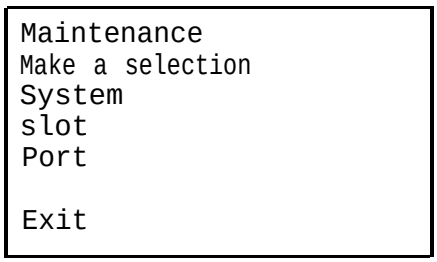
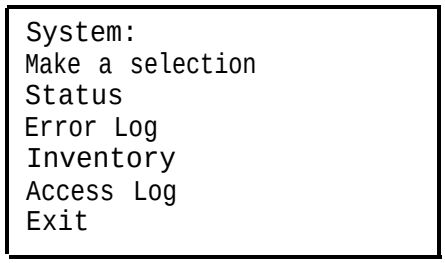
In addition to checking the error logs, you can check the Access Log to aid you in your troubleshooting.

Each time maintenance or system programming is accessed, the event is recorded in an Access Log (up to the last 20 events). This information could be useful to determine if one of those events caused an error detected shortly thereafter.

Quick Reference

Menu →Maintenance →System →Access Log

Procedure: Check the Access Log

Step	Display	Instructions
1		Select System.
2		Select Access Log.

Step	Display	Instructions
3	SysProg/Maint AccessLog> Date Time Sta SP/M *mm/dd/yy hh:mm xxxx xx* *mm/dd/yy hh:mm xxxx xx* *mm/dd/yy hh:mm xxxx xx* *mm/dd/yy hh:mm xxxx xx* Exit	The first screen of the Access Log appears. Each event is documented by the time and date of occurrence.

Reading the Access Log Screen

The `Sta` column indicates whether the event occurred from an MLX-20L console (if so, the extension number is displayed) or from SPM (`SPMD` if direct; `SPMR` if remote).

The `SP/M` column indicates whether the event originated from System Programming (`SP`) or Maintenance (`M`).

Scanning the Log

The last 20 events are shown, beginning with the most recently accessed event. To page through the events, press **More.**

When you reach the end of the list, you will hear a beep and all variable information will be cleared from the screen. To return to the beginning of the list, select `Exit` and then select `Access Log` again.

System Inventory

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

Quick Reference

Menu →Maintenance →System →Inventory →**More** (Only to see each next slot)

Procedure: Check the System Inventory

Step	Display	Instructions
1	Maintenance > Make a selection System slot Port Exit	Select System.
2	System: Make a selection Status Error Log Inventory Access Log Exit Enter	Select Inventory.
3	System Inventory: >* Slot 00 *Board xxxxxxxx* Hardware Vintage: xx LEGEND 2.0 Vx.x *(ROM Version)* Exit	Slot 00 information is displayed. See the following section, “Reading the System Inventory Screen” for additional information. Select **More** to display each next slot, beginning with Slot 01.

Step	Display	Instructions
4	System Inventory: > slot xx *Board xxxxxxxx* Hardware Vintage: xx Firmware Vintage: xx Exit	This screen appears for all slots except slot 00. To continue displaying each additional slot, continue pressing More. When you reach the last slot, pressing More returns you to slot 00.

Reading the System Inventory Screen

When you first access the System Inventory screen, Slot 00 information is displayed, as indicated in Line 2.

Line 3 indicates that the processor occupies Slot 00.

Lines 4, 5, and 6 indicate information that may be asked of you when you call your technical support organization.

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

Phantom Modules

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

Telephone Problems

3

Once a problem has been isolated to a telephone (or a group of telephones), you can run various tests to see if the telephone is working properly. The quickest approach is as follows:

1. Replace the telephone (or adjunct) with one that is known to be working properly.
2. If the problem persists, connect the telephone to the control unit using a cord that is known to be working. If this solves the problem, replace the original cord.

   NOTE:
   If the wiring has been crushed or severed, replace it. The power supply may be shorted.

   If the wire is shorted, do the following:

   a. Clear the short.
   b. Test the power supply for 48 VDC with a voltmeter or by reconnecting the telephone (or adjunct).
   c. If the test for 48 VDC fails, replace the circuit pack in the telephone or adjunct.

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

3. If the problem persists, replace the mounting cord.
4. If the problem persists, continue troubleshooting as described in this chapter.

If you change the jack assignment of any telephone, be sure to record the extension jack change on Form 2a, System Numbering—Station Jacks. See Appendix A for details.

Telephone Troubleshooting

if a reported telephone matches any symptom described in Table 3-1, see the section indicated.

Table 31. Troubleshooting Telephone Problems

Symptom	Section
Intermittent telephone problems	General Telephone and Wiring Problems
Telephone LEDs and/or ringing tones do not work properly	Analog Multiline Telephone Problems
Time appears on display, but incoming call information does not appear	Analog Multiline Telephone Problems

Continued on next page

Table 3-1. – *Continued*

Symptom	Section
Telephone does not receive tones from the control unit	Voice Transmission Problems
Several single-line telephones cannot dial directly even though they are receiving calls	Single-Line Telephone Problems
Users cannot make outside calls on single-line touch-tone telephones	Single-Line Telephone Problems
Users are getting other people's calls	Call Forward Problems

Fixing Telephone Problems

General Telephone and Wiring Troubles

Symptom

Intermittent telephone trouble occurs.

NOTE:
If the customer's problems pertain to single-line telephones and the customer indicates heavy call traffic, call your technical support organization to determine if additional touch-tone receivers (TTRs) should be added to the system.

Procedure

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. Replace the suspect telephone with a known good telephone to determine if the problem is localized to the suspect telephone.
6. If local power is provided, check the power supply.
7. If trouble disappears, replace the suspect telephone.
8. If the known good telephone does not work properly, replace the wiring or the module.
9. Check the other telephones connected to the same module. If they are working properly, the fault is probably in the wiring, or it may be a single-port failure on the module. Replace the wiring between the jack field and the telephone to see if it is a wiring problem. If so, fix the wiring problem.
10. If the other telephones connected to the same module are not working properly, the fault is probably in the module.
11. Check the LEDs on the module. If the module does not have LEDs, see “System Status” at the end of Chapter 4.
12. Check the error log for relevant messages.
13. Replace the faulty module.

Analog Multiline Telephone Troubles

Symptom

Telephone LEDs and/or ringing tones do not work properly.

Procedure

1. Move the **T/P** switch on the left-hand side to the **T** (test) position.

   You should hear tone ringing. All the red and green LEDs on the terminal should flash alternately.

2. If the LEDs do not light, replace the telephone with one that is known to be working.

   If this resolves the problem, skip the next step.

3. If the LEDs do not light, retest the original telephone by plugging it directly into the appropriate jack on the control unit, using a cord that is known to be working.

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

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

   Ringing tone should stop, and the LEDs should be off.

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

Symptom

Time appears on the display, but the incoming call information does not.

Procedure

Move the **T/P** switch on the side of the telephone to the center position.

Voice Transmission Troubles

Symptom

Telephone does not receive tones.

Procedure

Check the control unit and wiring with a telephone that is known to be working properly.

Single-Line Telephone Problems

Symptom

Many single-line telephones cannot dial correctly even though they are receiving calls.

Procedure

Using a single-line telephone, test the TTRs as follows:

1. Pickup the handset, dial ✶ **04** , and the 2-digit number of the TTR to be tested.
   - If you hear a busy tone, the receiver is in use.
   - If you hear a reorder tone, you have misdialed or have reached an invalid TTR.
   - If you hear a dial tone, continue this test.
2. Dial **123456789 ✶ 0#**

   You should hear a dual-tone multifrequency (DTMF) signal as each button is pressed. If the test is successful, you will hear a three-beep confirmation tone within one to three seconds after you enter # .
3. Hang up and repeat the test for each TTR.
4. Replace the module containing the faulty TTR if this test fails.

NOTE:
If all TTRs fail this test, repeat the test using a telephone that is known to be working. If the test completes successfully, replace the original telephone.

Symptom

User cannot make outside calls on touch-tone telephone.

Procedure

Check the individual trunk for rotary-dial programming.

See the *System Programming* guide for details.

Call Forward Problems

Symptom

Users are getting other people's calls.

Procedure

Usually this problem results when someone unknowingly activates Call Forward. Cancel the forwarding of calls to the receiving telephone as follows:

- For multiline telephones:
  1. Select **Feature.**
  2. Dial ✶ **34** ✶
- For single-line telephones:
  1. Pickup the handset.
  2. Dial # ✶ **34** ✶
  3. Hang up.

NOTE:
You can perform these procedures from the receiving telephone or from the forwarding telephone.

MLX Telephone Tests

Symptoms

LEDs, ringer, buttons, switchhook, or display do not appear to be working properly.

NOTE:
Telephones cannot be tested remotely.

Procedure

1. Pickup the handset.
2. At the dial tone, dial ✶ **00** (the feature access code).

   The telephone should go into test mode. For some tests, this means that the LEDs turn on. For others, it means that the phone starts ringing.

   - This test connects a test tone to the B-channel and sends a repeated ring burst to the telephone.
   - For an MLX telephone with a DSS attached, activating this test should turn on all of the LEDs and the phone should ring throughout the test.
   - For MLX display telephones, the display blanks out and is redrawn as a grid of small dots.

3. For each line/feature button with two LEDs, press that button to toggle the LEDs red and green.

   If the red and green LEDs do not toggle on and off, the LEDs are in error.

4. Press the fixed-feature buttons that have LEDs (**Feature, HFAl, Mute,** and **Speaker)** to toggle the LED on and off.

   If the LED does not toggle on and off, the LED is in error.

   NOTE:
   Mute and **Speaker** LEDs may not toggle consistently since they are managed by both the control unit and the telephone.

5. Press the fixed-feature buttons that do *not* have LEDs (**Transfer, Conf, Drop,** and **Add)** and the dialpad buttons. Each time you press one of these buttons, the **Message** LED toggles on or off.

   If any one of these buttons does not toggle the **Message** LED, the LED is in error.

6. Press the fixed-feature buttons and the dialpad button in the following sequence to turn on all the LEDs:

   a. **Volume** down

   b. **Volume** up

   c. **Transfer**

   d. **Conf**

   e. **Drop**

   f. **Hold**

   g. **123456789 * 0#**

   If any of these LEDs does not toggle on and off, the LED is in error.

7. If you are finished testing the telephone, hang up, If not, continue with the next step.

8. To test an MLX display, press each display button that you want to test. Each button displays in the upper-left corner as follows:

Table 3-2. MLX Telephone Display Buttons

Button	Displays as
Home	HOME
Menu	MENU
More	MORE
Inspct	INSPECT
Each soft display button	DISPLAY BUTTON *nn* where *nn* is 1 through 10, depending on which button you press.

9. If you are finished testing the telephone, hang up. If not, continue with the next step.

10. To test the Multi-Function Module, do the following:

    a. Connect a single-line telephone to the Multi-Function Module (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.

       The diagnostic test tone connects to the B-channel.

    d. Dial **123456789** ✶ **0#** , wait for silence, and then quickly press **Recall** 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.

Control Unit Problems

4

Once you resolve any problems with telephones, adjuncts, and any related wiring, you can move your troubleshooting to the control unit. Troubleshoot the control unit in the following order:

1. Power supply
2. Processor
3. Trunk/extension modules (referred to as modules throughout this guide)
4. Carrier

WARNING:
Beware of hazardous voltages; only qualified technicians should attempt to service the control unit. Follow all procedures carefully.

Power Supply Problems

Failure of the power supply shuts down everything connected to the carrier.

Checking the Power Supply

If you suspect the power supply of failure, check the following as described in this section:

1. LED on the power supply
2. Interlocking post on the carrier (behind the power supply)
3. Ring generator if present
4. Auxiliary power unit(s) if present

Checking the LED

If you suspect the power supply, first check the LED. If it is off, check the power switch. If it is off, turn it on as follows:

1. Starting from the rightmost power supply in the system, turn on the power switch for each expansion 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 green light on the power supply should turn on.

3. The red light on the processor should turn on for 15 to 45 seconds and then turn off.
4. All indicators on the 100D and 400EM modules (if present) should turn on and then off. They remain off when the modules are idle.

If any of the responses just indicated does not occur, or if the console operator reports any problems, continue troubleshooting.

Checking the Interlocking Post

If the power supply is not working, check the interlocking post:

1. Turn off the power and remove the power supply as described in the next section, “Replacing the Power Supply.”

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

2. As shown in Figure 4-1, the carrier has a small, cylindrical post that locks into the power supply.

   If this post is broken, replace the carrier.

3. If the interlocking post is in good condition, reinstall the power supply as described in the next section, “Replacing the Power Supply.”

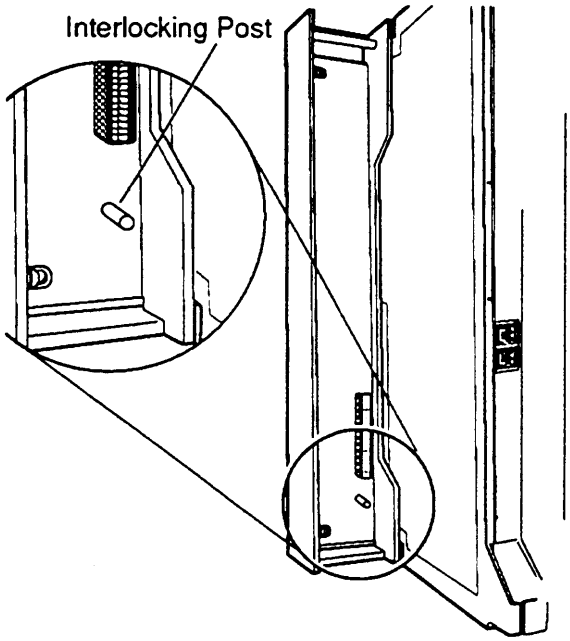


Figure 4-1. Power Supply Interlocking Post

Checking the Ring Generator

Symptom

Tip and ring devices, such as single-line sets, fax machines, and answering machines, do not ring.

If this symptom occurs, replace the ring generator as described in the following procedure.

Replacing the Ring Generator

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

Follow these steps to replace a ring generator (see Figure 4-2 throughout this procedure):

1. Make sure each power supply is turned off, including the module in the control unit and any auxiliary power units.
2. Unplug the power supply cord from the AC outlet (or from the auxiliary power unit) and then from the power supply.

   NOTE:
   At this point, all cords should be removed from the power supply.

3. Remove the power supply from the carrier.
4. Place the power supply on its left side and remove the five screws.
5. Carefully turn the module over on its right side and then remove the top of the power supply housing.
6. Detach the cables from the inside edge of the plastic housing by removing them from the clips.
7. Disconnect the 4-pin cable from the header labeled P202 on the left side of the power supply circuit board.

   NOTE:
   As shown in Figure 4-2, you may need to pry back the clip to free the cable.

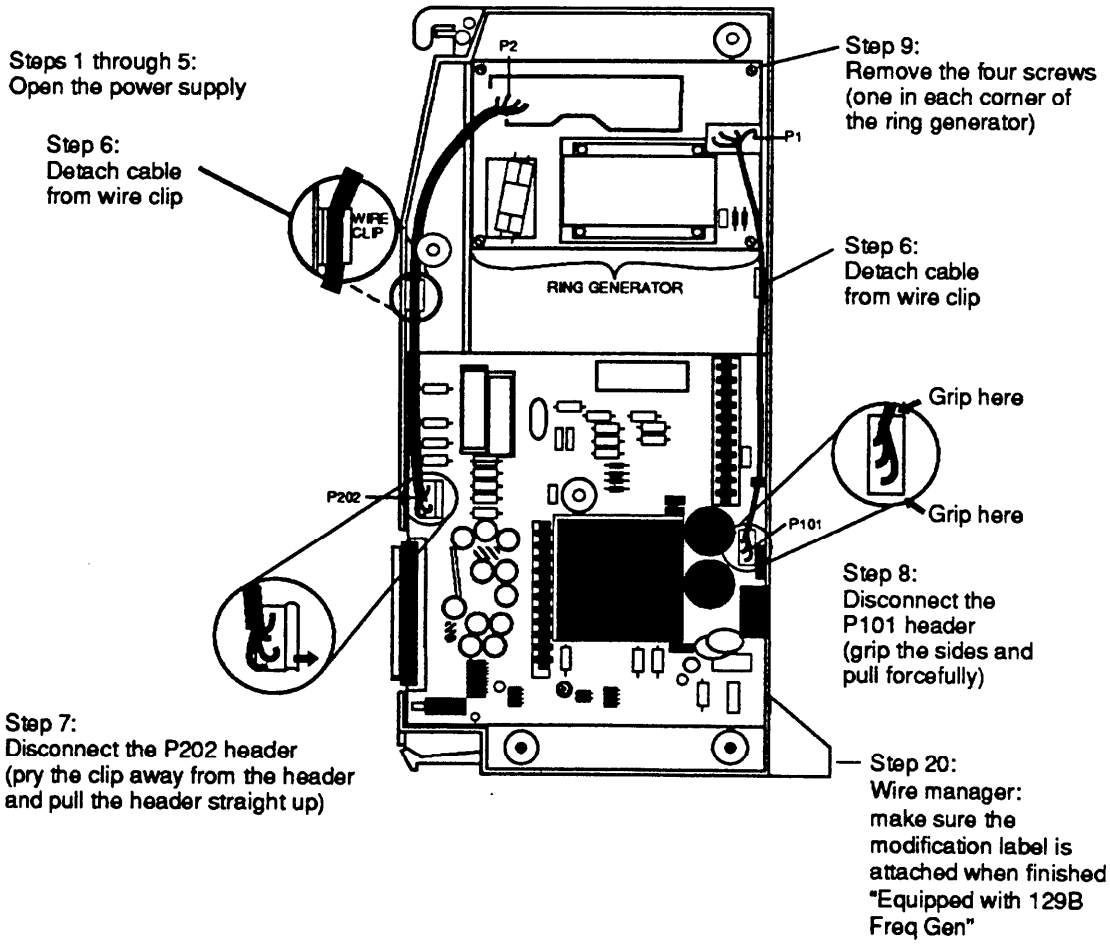


Figure 4-2. Replacing a Ring Generator

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

   NOTE:
   As shown in Figure 4-2, you need to grip this cable firmly and pull forcefully.

9. Remove the four screws from the ring generator as shown in Figure 4-2.
10. Remove the ring generator.
11. Position the replacement ring generator as shown in Figure 4-2 and align the screw holes.

    NOTE:
    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.

12. Replace the four screws and fasten them to secure the ring generator.
13. 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.

    NOTE:
    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.

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

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

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

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

19. Carefully, taking time to make sure the on/off faceplate stays aligned, turn the module over and replace the five screws.
20. Verify that the modification label Equipped with 129B Freq Gen as adhered to the wire manager (on the front of the power supply shown in Figure 4-2).

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

21. Reinstall the power supply by hooking the top into the carrier and then swinging it down into place. Push the lower end firmly until the locking tab clicks.
22. Reconnect the cords to the power supply and then the auxiliary power units (if any were connected before).
23. Connect the cord(s) to AC power when ready to power up the system.“

Checking the Auxiliary Power Unit(s)

Symptom

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

If these symptoms occur, replace the auxiliary power unit as described below.

Replacing Auxiliary Power Units

See Figure 4-3 throughout this procedure.

1. Make sure that the switch on the power supply is turned off.
2. Unplug both the power supply and the auxiliary unit from the outlet.
3. Disconnect the cord from the jack labeled AUX POWER INPUT on the power supply.
4. Remove the auxiliary power unit (with the two cords still attached).
5. Mount the replacement auxiliary power unit in place of the old one.

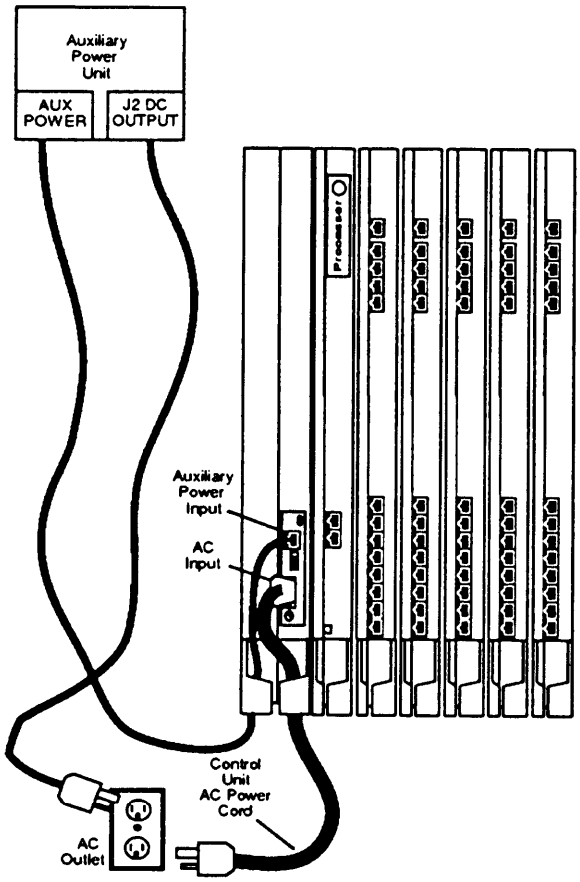


Figure 4-3. Replacing an Auxiliary Power Unit

6. Connect the cord into the jack labeled `J2 DC OUTPUT` on the replacement auxiliary power unit.
7. Connect the other end into the jack labeled `AUX POWER INPUT` on the power supply.

⚠ CAUTION:

- *Do not plug the power supply or the auxiliary power unit into the AC outlet until you are ready to turn on the system, as described in "Powering Up the System" in Chapter 2 of the Installation guide.*
- *Do not attach the power cord(s) to any building surfaces.*

Replacing the Power Supply

Whether replacing the power supply permanently or briefly for troubleshooting, follow these steps:

1. If possible, save the system programming on a floppy disk by using the backup procedure from the *System Programming & Maintenance (SPM)* guide.

   NOTE:
   If the power supply on the basic carrier has failed, the system cannot save the system programming to a disk.

2. Power down the system by turning off the following components in the order given:
   a. the power supply on the basic carrier
   b. the power supply on each expansion carrier
   c. any auxiliary power unit (if present)
3. Unplug the system from the AC outlet.
4. Remove the power supply and insert a new one.

WARNING:
Beware of hazardous voltages; whenever the carrier connections are exposed, use extreme caution; do not touch them directly or with any type of tool. Follow all procedures carefully.

5. Restore power by turning on the following components in the order given:
   a. any auxiliary power units (if present)
   b. the power supply on each expansion carrier
   c. the power supply on the basic carrier

   The system automatically cold starts.

Processor Problems

If the error logs (or any aspect of your troubleshooting) indicate the processor, do the following:

1. If possible, back up the system programming using SPM. See the *System Programming & Maintenance (SPM)* guide for the backup procedure.
2. After backing up the processor, call your technical support organization for troubleshooting instructions.

   You might be instructed to perform Peek, Poke, or System Erase. Each of these procedures is explained in the next few pages. Do not perform any of these procedures unless instructed to do so.
3. If you are instructed to replace the processor, see "Replacing the Processor," which immediately follows the System Erase procedure.

Peek

This demand test allows you to examine, but not change, system memory.

CAUTION:
Do not perform `Peek` *unless you are following instructions from your technical support organization.*

Quick-Reference Procedure

Menu → `Maintenance` → `Slot` → **00** → `Enter` → `Demand Test` → `Peek`

Procedure: Peek

Step	Display	Instructions
1	Maintenance Make a selection System slot Port Exit	Select `Slot`.
2	Slot: Enter Slot number (0 0-17) xx Backspace Exit Enter	Type **00** for the processor and then select `Enter`.
3	Slot 00: Make a selection Status Demand Test Exit	Select `Demand Test`. For all MLX modules, `BchLoopback` is also displayed as an option on this screen. For 100D modules, `CSU-lpbk`, `Error Events`, and `Clock` are also displayed as options on this screen.

Step	Display	Instructions
4	Demand Test Slot 00: Make a selection Peek [Poke] [System Erase] Exit	Poke and System Erase are not displayed so that the customer does not accidentally change the processor memory. Select Peek.
5	*Slot 00 EnterHexAddress:* *aaaaaaaa* Enter Backspace Exit A B C D E F	Enter the address that you want to examine and then Select Enter.
6	Peek Address *Oxaaaaaaaa>* *Oxaaaa* *Oxaaaa* *Oxaaaa* *Oxaaaa* *Oxaaaa* *Oxaaaa* *Oxaaaa* *Oxaaaa* Exit	This screen shows the details of the address you specified. Press **More** to see the next address.

Poke

CAUTION:
Do not perform `Poke` *unless you are following instructions from your technical support organization.*

Quick-Reference Procedure

Menu → `Maintenance` → `Slot` → **00** → `Enter` → `Demand Test` → `Poke` (Line 4, left button) twice → `Continue`

Procedure: Poke

Step	Display	Instructions
1	Maintenance Make a selection System slot Port Exit	Select `Slot`.
2	Slot: Enter Slot number (00-17) xx Backspace Exit Enter	Type **00** for the processor and then select `Enter`.

Step	Display	Instructions
3	Slot 00: Make a selection Status Demand Test Exit	Select Demand Test. For all MLX modules, BchLoopback is also displayed as an option on this screen. For 100D modules, CSU-lpbk, Error Events, and Clock are also displayed as options on this screen.
4	Demand Test Slot 00: Make a selection Peek [Poke] [System Erase] Exit	Poke and System Erase are not displayed so that the customer does not accidentally change the processor memory. To select Poke, select the left button on Line 4 twice.
5	Poke - WARNING!! SYSTEM MEMORY WILL BE MODIFIED! Continue Cancel Exit	Select Continue.

Step	Display	Instructions
6	Slot 00 EnterHexAddress: *aaaaaaaa* Enter Backspace Exit A B C D E F	Follow instructions from your technical support organization. If you enter information and then select Enter, go to the next step.
7	*Oxaaaaaaaa* Enter data: *aa* Enter Backspace Exit A B C D E F	Follow instructions from your technical support organization.

System Erase (Frigid Start)

CAUTION:
Do not perform a system erase unless you are installing a replacement processor or following instructions from your technical support organization. Performing this procedure erases all system programming from the processor and resets it to the factory defaults.

Preparation

Time Estimate Approximately 1 minute

Quick-Reference Procedure

Menu → Maintenance → Slot → **00** → Enter → Demand Test → System Erase (Line 5, left button) twice → yes

Procedure: System Erase (Frigid Start)

Step	Display	Instructions
1	Maintenance Make a selection System slot Port Exit	Select Slot.
2	Slot: Enter Slot number(00-17) xx Backspace Exit Enter	Type **00** for the processor and then select Enter.
3	slot 00: Make a selection Status Demand Test Exit	Select Demand Test. For all MLX modules, BchLoopback is also displayed as an option on this screen. For 100D modules, Csu-lpbk, Error Events, and Clock are also displayed as options on this screen.

Step	Display	Instructions
4	Demand Test Slot 00: Make a selection Peek [Poke] [System Erase] Exit	Poke and System Erase are not displayed so that the customer does not accidentally change the processor memory. To select System Erase, select the left button on Line 5 twice.
5	Slot 00 System Erase: System will be down. . . Do you want to continue? Yes No Exit	Select Yes.

Replacing the Processor

A failed processor must be replaced immediately, as follows.

1. If possible, save all the system programming to a floppy disk by using the backup function.

   NOTE:
   When the processor fails, backup is usually impossible.

2. Power down the system by turning off the following components in the order given:
   a. power supply on the basic carrier
   b. power supply on each expansion carrier
   c. auxiliary power units (if present)

3. Unplug the SMDR printer and/or system programming PC cords.
4. Remove the processor.
5. Inspect the processor for any visible problems.
6. Inspect the carrier.
7. Unless you are installing a new feature module, remove the feature module from the old processor and install it in the replacement processor.

   If you are installing a new feature module, install it in the replacement processor.

   See the *Installation* guide for instructions on installing or replacing a feature module.
8. Install the new processor.
9. Restore power by turning. off the following components in the order given:

   a. auxiliary units (if present)

   b. power supply on each expansion carrier

   c. power supply on the basic carrier

   The system automatically cold starts.
10. Perform a `System Erase` (frigid start), as described earlier in this section.
11. Restore the system programming from the backup floppy diskette (or from the original system programming diskette).
12. Plug in the SMDR printer and/or system programming PC cords.
13. Attach a tag identifying any visible problems and any error reports relevant to the replaced processor.

Module Problems

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

1. If you want to identify the cause of module errors, run the module tests described in this section.
2. To determine whether the module is faulty, replace it with a module of the same type. If the errors cease, the problem is solved.

Module Tests

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

Read through the following subsection, “Module Test Process,” before running any module test.

NOTE:
Running module tests requires that the module being tested be removed from service. Because your customer depends on this service, run module tests during off hours if possible. If not, minimize the time required for each module’s downtime whenever possible.

Module Test Process

Figure 4-4 diagrams the module test process. Refer to this figure and the text that follows for the recommended approach to module testing.

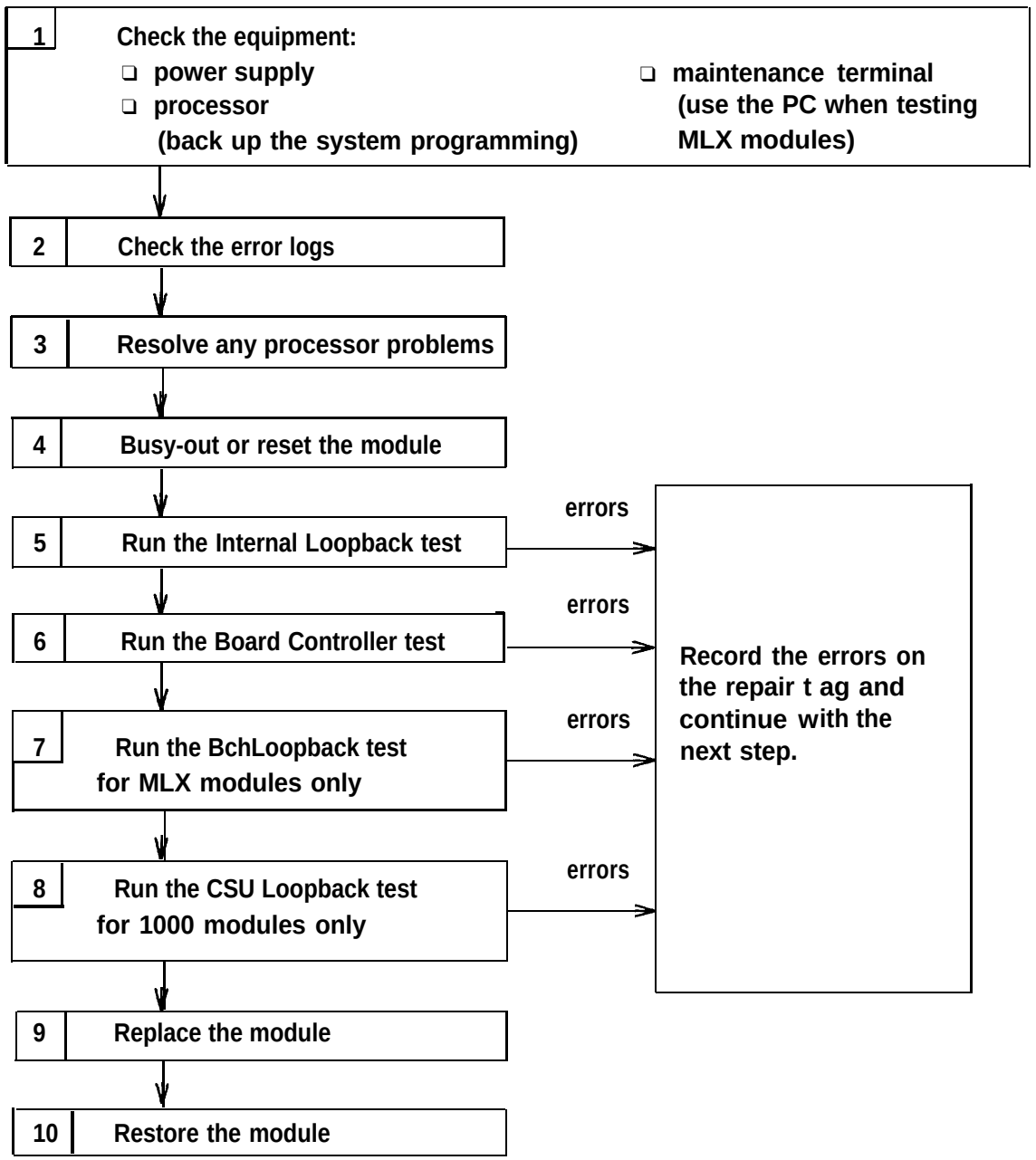


Figure 4-4. Module Test Process

1. Before running any module test, make sure the following system components are working:

   - Power supply
   - Processor

     If possible, save the system programming on a floppy disk by using the backup procedure from the *System Programming & Maintenance (SPM)* guide.

     NOTE:
     If the power supply on the basic carrier has failed, the system cannot save the system programming to a disk.

   - Maintenance terminal (MLX-20L console or the PC)

     To run tests on the MLX module that is connected to the MLX-20L maintenance terminal, run the test from the PC, *not from the MLX-20L console.*

2. Read the error logs and any user-reported problems to determine which modules are suspect.
3. If the error logs indicate the processor, resolve those errors first by following the procedures in “Processor Problems” earlier in this chapter.

   Replacing a faulty processor may resolve other module problems.
4. Before running any module test, be sure to busy-out or reset the module. Both Busy-Out and Reset are described later in this section. The Busy-Out procedure is preferred:

   - Busy-out discontinues service from the module being tested to each line and extension *only as they become idle.* Busy-out does not disrupt calls in progress.
   - Reset discontinues service to all equipment instantly. All in-progress calls are dropped.

For each test, note the following:

- When beginning the board controller test or the internal loopback module test, you have the option of running it once or repetitively.
- You can interrupt any module test by selecting `Exit`.
- A module test fails 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.

5. Run the internal loopback test.
   If errors occur, record them as described in Step 4.
6. Run the board controller test.
   If errors occur, record them as described in Step 4.
7. For MLX modules (008 MLX and 408 GS/LS-MLX), continue with the BchLoopback test.
   If errors occur, record them as described in Step 4.
8. For 100D modules, continue with the CSU loopback test, which is described later under "100D Module Problems."
   If errors occur, record them as described in Step 4.
9. Replace the module with a module of the same type, whether troubleshooting or replacing it permanently.
10. Restore the module as follows:

    Menu → `Maintenance` → `Slot` → Type the slot number → `Restore` → `Yes`

    For additional information on restoring a module, see "Restore" later in this section.

    Restoring automatically undoes the busy-out and reset.

Persistent Module Problems

If any of the module tests fail and replacing the module does not clear the trouble, one of the following could be the cause:

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

Busy-Out and Reset

Before running any module test, be sure to busy-out or reset the module. This procedure discontinues service from the module that you are about to test.

The Busy-Out procedure is preferred because it does not drop calls in progress:

- Busy-out discontinues service from the module being tested to each line and extension *only as they become idle.* Busy-out does not disrupt calls in progress.
- Reset discontinues service to all equipment instantly. All in-progress calls are dropped.

Once you complete module testing, restore it as described later in this section under “Restore.” Restoring a module terminates the busy-out or reset condition.

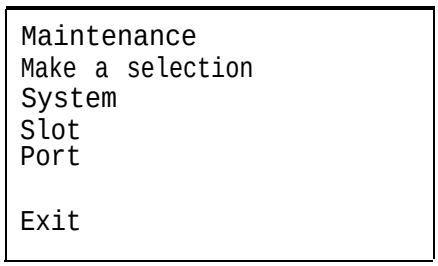
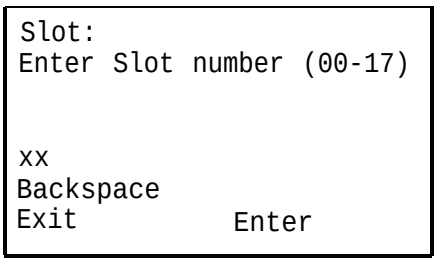
Preparation

Appropriate Modules	Any module that you are about to test
Time Estimate	Once all calls are terminated, the busy-out completes in less than 1 second. If calls in-progress take too long, ask the callers to hang up, or exit busy-out and do a reset instead. Reset terminates all calls in-progress.

Quick-Reference Procedure

Menu → `Maintenance` → `Slot` → Type the slot number → `Enter` → `Busy-Out` → `Yes`

Procedure: Busy-Out the Module

Step	Display	Instructions
1		Select `Slot`.
2		Type the slot number and select `Enter`.

Step	Display	Instructions
3	Slot xx: Make a selection Status Demand Test Busy-Out Reset Restore Exit	Select Busy-out. For all MLX modules, BchLoopback is also displayed as an option on this screen. For 100D modules, CSU–lpbk, Error Events, and Clock are also displayed as options on this screen.
4	Busy-Out Slot xx: Yes Cancel Exit	Select Yes.
5	Busy-Out Slot xx: Busy-Out in Progress Exit	This screen appears while the module is discontinuing service to lines/trunks and extensions—without disrupting calls in progress.

Step	Display	Instructions
6	Busy-Out Slot xx Busy-Out Complete Exit	This screen appears when the module is successfully busied-out.
7	Busy-Out Slot xx: Busy-Out FAILED Exit	This screen appears when the Busy-Out failed. Try again; be sure to specify the correct slot.

Preparation

Appropriate Modules	Any module that you are about to test
Time Estimate	Less than 1 second (all calls in-progress are terminated immediately) If you do not want to terminate calls in-progress, use busy-out instead of reset, as described in the last two pages.

Quick-Reference Procedure

Menu → Maintenance → Slot → Type the slot number → Enter → Reset → Yes

Procedure: Reset the Module

Step	Display	Instructions
1	Maintenance Make a selection System Slot Port Exit	Select `Slot`.
2	Slot: Enter Slot number (OO-17) xx Backspace Exit Enter	Type the slot number and select `Enter`.
3	Slot xx: Make a selection Status Demand Test Busy-Out Reset Restore Exit	Select `Reset`. For all MLX modules, `BchLoopback` is also displayed as an option on this screen, For 100D modules, the options `CSU-lpbk, Error Events,` and `Clock` are also displayed.
4	Reset Slot xx: Do you want to continue? Yes Cancel Exit	

Step	Display	Instructions
5	Reset Slot xx: Reset in Progress Exit	This screen appears while the module is discontinuing service to lines/trunks and extensions—all calls in progress are being dropped.
6	Reset Slot xx: Reset Complete Exit	This screen appears when the module is successfully reset.
7	Reset slot xx: Reset FAILED Exit	This screen appears when the Reset failed. Try again; be sure to specify the correct slot.

Restore

Once you complete module testing, restore it to terminate the busy-out or reset condition.

Preparation

Appropriate Modules	Any module after testing it
Time Estimate	Less than 1 second

Quick-Reference Procedure

Menu → `Maintenance` → `Slot` → Type the slot number → `Enter` → `Restore` → `Yes`

Procedure: Restore the Module

Step	Display	Instructions
1	Maintenance Make a selection System Slot Port Exit	Select `Slot`.
2	Slot: Enter Slot number (OO-17) xx Backspace Exit Enter	Type the slot number and select `Enter`.

Step	Display	Instructions
3	Slot xx: Make a selection Status Demand Test Busy-Out Reset Restore Exit	Select `Restore`. For all MLX modules, `BchLoopback` is also displayed as an option on this screen. For 100D modules, `CSU-lpbk`, `Error Events`, and `Clock` are also displayed as options on this screen.
4	Restore Slot xx: Do you want to continue? Yes Cancel Exit	Select `Yes`.
5	Restore Slot xx: Restore in Progress Exit	This screen appears while the module is restoring service to lines/trunks and extensions.
6	Restore Slot xx: Restore Complete Exit	This screen appears when the module is successfully restored.

Step	Display	Instructions
7	Restore Slot xx: Restore FAILED Exit	This screen appears when the Restore failed. Try again; be sure to specify the correct slot.

Module Test #l: Internal Loopback Test

This test checks communication between the processor and the module being tested.

If you have not already read “Module Test Process” at beginning of this section, do so before continuing.

Preparation

Appropriate Modules This test can be run on any module.

NOTE:
The 100D module and the 408 GS/LS-MLX module each have two DSEs; both DSEs will be tested.

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 have two DSEs each.

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

Quick-Reference Procedure

Menu → `Maintenance` → `Slot` → Type the slot number → `Enter` → `Demand Test` → `Int Loopback` → `Test Once` or `Test Repetitive.`

Procedure: Run Internal Loopback Test

Step	Display	Instructions
1	Maintenance Make a selection System Slot Port Exit	Select `Slot`.
2	Slot : Enter Slot number (OO-17) xx Backspace Exit Enter	Type the slot number and select `Enter`.
3	Slot xx: Make a selection Status Demand Test Busy-Out Reset	Select `Demand Test`. For all MLX modules, `BchLoopback` is also displayed as an option on this screen. For 100D modules, `CSU-lpbk`, `Error Events`, and `Clock` are also displayed as options on this screen.
4	Demand Test Slot xx: Make a selection Note: Busy out slot first BoardCntrlr IntLoopback Exit	Select `IntLoopback`.

Step	Display	Instructions
5	Demand Test Slot xx: Board *aaaaaaaaaaaaaaaaaa* Internal Loopback: Test Once Repetitive Exit	Select `Test Once` to run the Internal Loopback Test only once. Select `Repetitive` to run the Internal Loopback Test repeatedly.
6	Demand Test Slot xx: Board *aaaaaaaaaaaaaaaaaa* Internal Loopback Test In Progress Exit	This screen appears while the test is running. At the same time, if the module has a green LED, it will flash. If you are running the repetitive test, this screen remains until the test fails, To interrupt repetitive testing, select `Exit`.
7	Demand Test Slot xx: Board *aaaaaaaaaaaaaaaaaa* Internal Loopback Test Successfully Completed Exit	This screen appears only if you selected

Step	Display	Instructions
8	Demand Test Slot xx: > Board *aaaaaaaaaaaaaaaaa* Internal Loopback Test FAILED xxxxxxxxxxxxxxxxxxxxxx xx xx xx xx xx xx xx xx Exit	This screen appears when either test (`Once` or `Repetitive`) fails. Lines 5 and 6 identify the cause of the failure or the number of errors found per DSE port. There are 16 DSE ports. numbered 0 through 15. Line 5 displays the results for ports 0 through 7; Line 6 is for ports 8 through 15. The 100D module and 408 GS/LS-MLX module each have two DSES. To display the second DSE's test results, press **More.**

Interpreting the Test Results

If the test completes successfully, the module DSE ports are free from error. Continue with the next module test or restore the module if finished testing.

If the test fails, find the error message in Table 4-1 and proceed as indicated.

Table 4-1. Internal Loopback Test Errors

Error Message	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).

Continued on next page

Table 4-1. – *Continued*

Error Message	Corrective Action
`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:
(Be sure to check the second screen if testing a 100D module or a 408 GS/LS-MLX module)

Restoring the Module

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

Module Test #2: Board Controller Test

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

Preparation

Appropriate Modules	This test can be run on all modules, except the processor.
Time Estimate	Less than 1 second
Busy-Out or Reset	Busy-out or reset the module being tested prior to beginning the test. **NOTE:** Both `Busy-out` and `Reset` are in the Slot menu, which you can access by doing the following from the console: **Menu** →`Maintenance` →`Slot` See "Busy-Out and Reset" earlier in this chapter for additional information.
Interrupting the Test	You can interrupt the test (`Test Once` or `Repetitive`) by selecting `Exit`.
Test Failure	If the test fails, record the errors on the repair tag and replace the module.
Restore	Restore the module if it successfully completes all module tests and the errors no longer occur. **NOTE:** `Restore` is in the Slot menu, which you can access by doing the following from the console: **Menu** →`Maintenance` →`Slot` See the "Restore" procedure earlier in this chapter for additional information.

Quick-Reference Procedure

Menu → Maintenance → Slot → Type the slot number → Enter → Demand Test → BoardCntrlr → Test Once or Test Repetitive .

Procedure: Run Board Controller Module Test

Step	Display	Instructions
1	Maintenance Make a Selection System Slot Port Exit	Select Slot.
2	Slot : Enter Slot number (00-17) xx Backspace Exit Enter	Type the slot number and select Enter.
3	Slot xx: Make a selection Status Demand Test Busy-Out Reset Restore Exit	Select Demand Test. For all MLX modules, BchLoopback is also displayed as an option on this screen. For 100D modules, CSU-lpbk, Error Events, and Clock are also displayed as options on this screen.
4	Demand Test Slot xx: Make a selection Note:Busy out slot first BoardCntrlr IntLoopback Exit	Select BoardCntrlr.

Step	Display	Instructions
5	Demand Test Slot xx: Board *aaaaaaaaaaaaaaaaaa* Board Controller: Test Once Repetitive Exit	Select `Test Once` to run the Board Controller Test only once. Select `Repetitive` to run the Board Controller Test repeatedly.
6	Demand Test Slot xx: *Board xxxxxxxxxxxxxxxxxx* Board Controller Test In Progress Exit	This screen appears while the test is running. At the same time, if the module has a green LED, it will flash. If you are running the repetitive test, this screen remains until the test fails. To interrupt repetitive testing, select `Exit`.
7	Demand Test Slot xx: *Board xxxxxxxxxxxxxxxxxx* Board Controller Test Successfully Completed Exit	This screen appears only if you selected `Test once` and the module passes the `test`.
8	Demand Test Slot xx: > *Board xxxxxxxxxxxxxxxxxx* Board Controller Test FAILED *xxxxxxxxxxxxxxxxxxxxxx* *xxxxxxxxxxxxxxxxxxxxxx* Exit	This screen appears when either test (`Once` or `Repetitive`) fails. Lines 5 and 6 show error messages. If there are more than two messages, select **More** to see them.

Interpreting the 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 finished testing.

If the test fails, find the error message in Table 4-2 and proceed as indicated.

Table 4-2. Board Controller Test Errors

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

Restoring the Module

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

Module Test #3: B-Channel Loopback Test

This test verifies that specific communication paths on the MLX module are operational.

If you have not already read “Module Test Process” at beginning of this section, do so before continuing.

Preparation

Appropriate Modules	This test can be run only on MLX modules.
Time Estimate	Approximately 1.5 minutes
Busy-Out or Reset	Busy-out or reset the module being tested prior to beginning the test. **NOTE:** Both `Busy-out` and `Reset` are in the Slot menu, which you can access by doing the following from the console: **Menu** → `Maintenance` → `Slot` See “Busy-Out and Reset” earlier in this chapter for additional information.
Interrupting the Test	You can interrupt the test by selecting `Exit`.
Test Failure	If the test fails, record the errors on the repair tag and replace the module.

Restore	Restore the module if it successfully completes all module tests and the errors no longer occur. **NOTE:** `Restore` *is* in the Slot menu, which you can access by doing the following from the console: **Menu** →`Maintenance` →`Slot` See the "Restore" procedure earlier in this chapter for additional information.

Quick-Reference Procedure

Menu →`Maintenance` →`Slot` →Type the slot number →`Enter` → `BchLoopback`

Procedure: Run B-Channel Loopback Test

Step	Display	Instructions

1	`Maintenance`
	`Make a Selection`
	`System`
	`Slot`
	`Port`
	
	`Exit`
		Select `Slot.`

2	`Slot:`
	`Enter Slot number (OO-17)`
	
	`xx`
	`Backspace`
	`Exit  Enter`
		Type the slot number *for the MLX module* and select `Enter.`

Step	Display	Instructions
3	Slot xx: Make a selection Status Demand Test Busy-out Reset Restore BchLoopback Exit	Select BchLoopback, which appears on the Slot screen *only* when you are testing an MLX module.
4	BchLoopback Slot xx: BchLoopback in Progress Exit	This screen appears while the test is running.
5	BchLoopback Slot xx: BchLoopback Passed Exit	This screen appears only if the module passes the test.
6	BchLoopback Slot xx: BchLoopback Failed *xxxxxxxxxxxxxxxxxxxxx* xx xx xx xx xx xx xx xx Exit	This screen appears when the test fails. Lines 3 and 4 identify the cause of the failure or the number of errors found per B-channel. There are 16 B-channels, numbered 0 through 15. Line 3 displays the results for B-channels 0 through 7; Line 4 is for B-channels 8 through 15.

Interpreting the Test Results

If the test completes successfully, the module's B-channels are functioning properly. Continue with the next module test or restore the module if finished testing. If the test fails, find the error message in Table 4-3 and proceed as indicated.

Table 43. B-Channel Loopback Errors

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

Restoring the Module

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

Replacing Modules

Modules can be removed and inserted (separately or at the same time) without affecting normal call processing. Leave the system power on.

⚠ CAUTION:

- *This section does not apply to the processor or power supply.*
- *Although the system is designed for modules to be removed and replaced 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 replacing a module, be sure to use the same module type. For example, do not put an 008 MLX module in place of 400 GS/LS/TTR. 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 the System Programming guide for information on Board Renumber.

Follow these steps to replace a module:

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

   For information on labeling trunk and extension cords, see Chapters 3 and 4 in the *Installation* guide.

   For instructions on checking poorly labeled wiring, see the procedure that follows this one, "Checking Poorly Labeled Wiring."
3. Run a demand test by entering the test mode.
4. Remove the module and inspect it for visible damage.
5. Insert the new module.
6. Restore the module as described earlier in this chapter.
7. Plug-in the trunk and extension cords.
8. Attach a tag, error printout, or any information that will help identify any visible problems, failure symptoms, and relevant error reports.

Checking Poorly Labeled Wiring

If you do not understand the labeling system used or a label is missing or damaged, use a tone device and a telephone handset to match like wires.

Hardware

- tone device
- telephone handset
- telephone cord with an 8-pin modular plug
- 4-pair patch cord

Tools

- diagonal pliers or wire strippers

Procedure

1. Insert the 8-pin plug of the telephone cord 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 untwist the wires.
4. Extending from the bottom of the tone device are two clips. Attach one wire from the pair you have chosen to each clip.
5. Turn on the switch on the outside of the tone device. You will hear a high-pitched, alternating signal.
6. Take the telephone handset and a 4-pair patch cord to the cross-connect field between the control unit and the telephone.
7. Go to the blue field on the cross-connect field and, starting at the top left corner, push the patch cord onto the first connecting block.
8. Using the diagonal pliers or wire strippers, cut off the other end of the patch cord and expose the pairs. Do not cut off too much of the cord because you'll need the length to test the top rows of the cross-connect field.
9. The handset also has two clips with teeth that extend from its base. Attach the clip of the handset to the exposed wires of the patch cord. Set the switch on the side of the handset to MONITOR.
10. Listen in the handset for the tone device signal.
11. If you hear the signal, you have found the correct wires. Correctly label both the cross-connect field and the outlet.
12. If you don't hear the signal, remove the patch cord from the connecting block and push the patch cord down onto the connecting block to the right of the one just tested. Keep moving the patch cord to the next connector block on the right until you find the pairs that carry the tone device signal.

100D Module Problems

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

Error Events

In addition to checking the error logs, the 100D module requires that you check the error events that are specific to the 100D module.

See the Error Events procedure later in this section for details.

CSU Loopback Test

This test verifies that the communication path between the channel service unit (CSU) and the 100D module is operational.

Preparation

Appropriate Modules	This test can be run only on 100D modules.
Time Estimate	Approximately 2 minutes
EQ IN and EQ OUT	For the 551 T1 CSU only (not the ESF T1 CSU), connect a patch cord from the CSU EQ IN jack to the CSU EQ OUT jack. Details are provided on the next page.
DTE LOOPBACK	For the ESF T1 CSU only (not the 551 T1 CSU), flip the DTE LOOPBACK switch, on the front panel, to the UP position (to activate the loopback).
Busy-Out or Reset	Prior to beginning the test, busy-out the 100D module (see “Busy-Out” earlier in this section).

NOTE:
Both `Busy-out` and `Reset` are in the Slot menu, which you can access by doing the following from the console:

Menu →`Maintenance` →`Slot`

See "Busy-Out and Reset" earlier in this chapter for additional information.

Interrupting the Test

You can interrupt the test by selecting `Exit.`

Test Failure

If the test fails, record the errors on the repair tag and replace the module.

Restore

If the 100D module successfully completes the CSU loopback test, restore the module.

NOTE:
`Restore` is in the Slot menu, which you can access by doing the following from the console:

Menu →`Maintenance` →`Slot`

See the "Restore" procedure earlier in this chapter for additional information.

Quick-Reference Procedure

Menu →`Maintenance` →`Slot` →Type the slot number →`Enter` →`CSU-lpbk`

Procedure: Run CSU Loopback Test

Before you run the channel service unit (CSU) loopback test, be sure to do the following:

1. Busy-out the 100D module.

2. For the 551 TI CSU, do the following as well:

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

   b. Plug the other end of the patch cord into the EQ IN jack on the CSU.

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

      Figure 4-5 shows this connection.

3. For the ESF T1 CSU only (not the 551 T1 CSU), flip the DTE LOOPBACK switch, on the front panel, to the UP position (to activate the loopback).

   Figure 4-6 shows this connection.

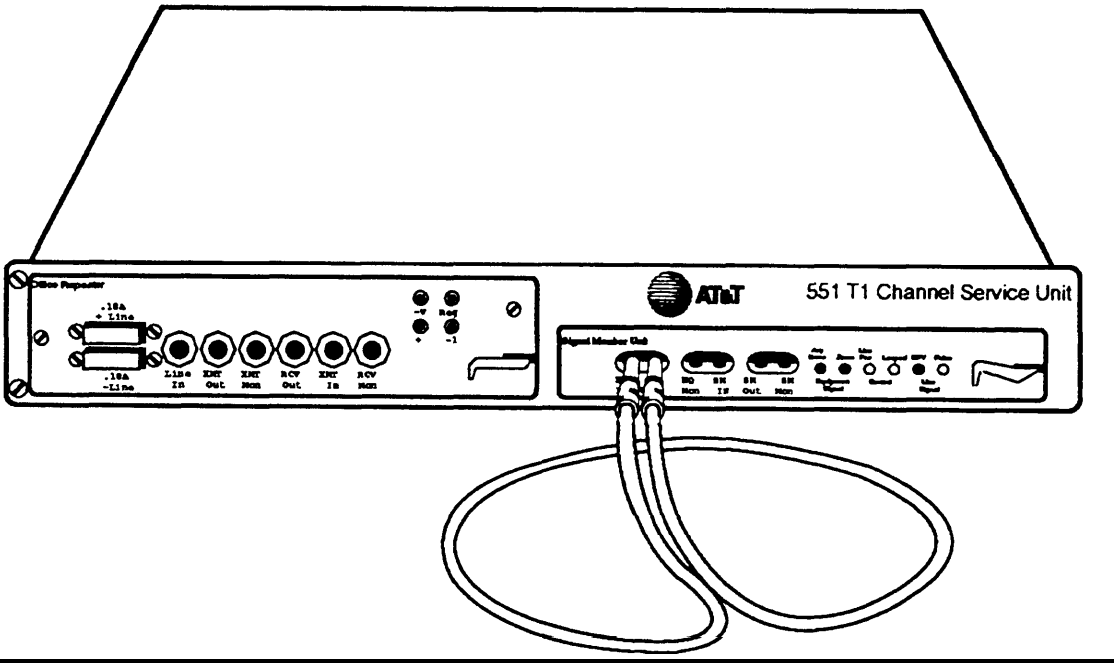


Figure 4-5. 551 T1 CSU Connection

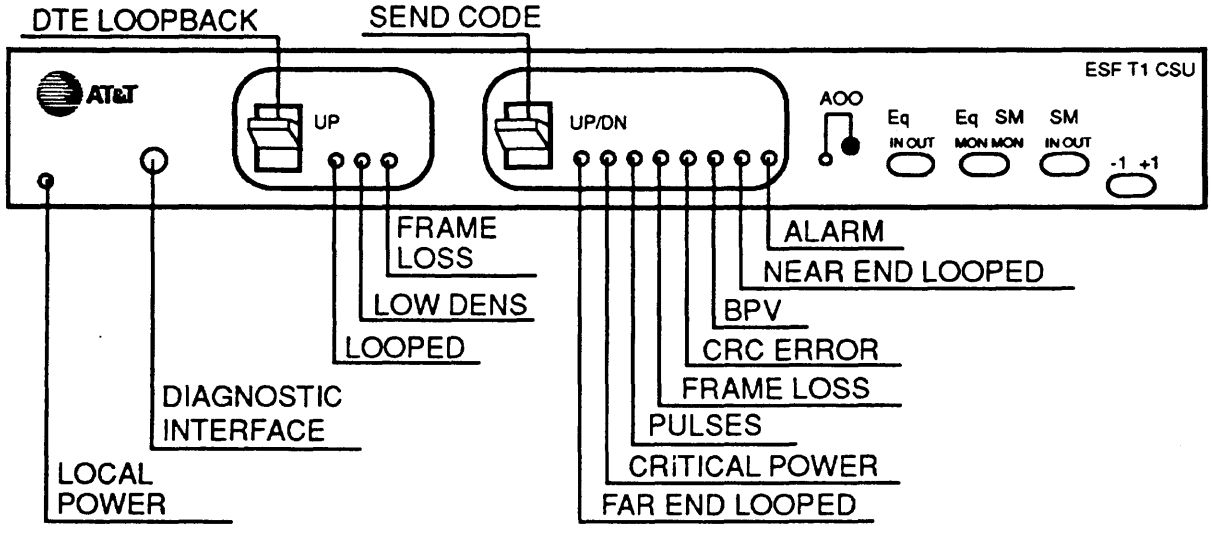
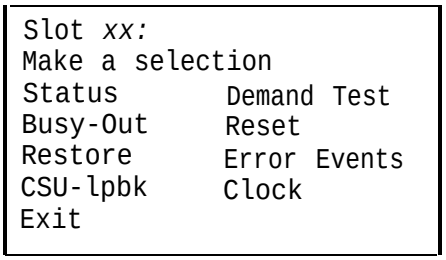
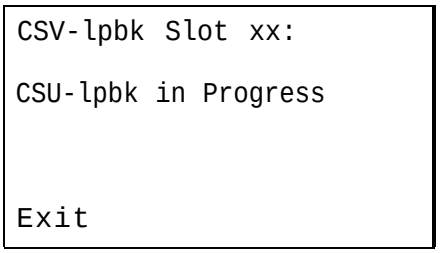
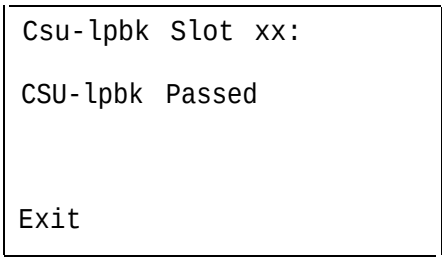


Figure 4-6. ESF T1 CSU, DTE Loopback Switch (on Front Panel)

Procedure: Run CSU Loopback Test (Continued)

Step	Display	Instructions
4	Maintenance Make a Selection System Slot Port Exit	Select `Slot`.
5	Slot : Enter Slot number (00-17) x x Backspace Exit Enter	Type the slot number *for the 100D module* and select `Enter`.

Step	Display	Instructions
6		Select `Csu-lpbk,` which appears on the `Slot` screen *only* when the 100D module's slot is selected. `Error Events,` and `Clock` are also displayed only for the 100D module.
7		This screen appears while the test is running. At the same time, the module's green LED will flash.
8		This screen appears only if the module passes the test. If this test passes, contact the central office and ask them to check their end.

Step	Display	Instructions
9	CSU-lpbk Slot xx: CSU-lpbk Failed *xxxxxxxxxxxxxxxxxxxxxx* xxx xxx xxx xxx xxx xxx xxx xxx xxx xxx xxx xxx xxx xxx xxx xxx xxx xxx Exit	This screen 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.

Interpreting the Test Results

If the test completes successfully, the connection between the CSU and the 100D module is good, and the 10OD module is probably OK. Continue with the next module test or restore the module if finished testing.

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

Table 4-4. CSU Loopback Test Errors

Error Message	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.

Continued on next page

Table 4-4. – *Continued*

Error Message	Corrective Action
`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 options. 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, do the following:

1. If you are finished testing all modules, restore the 10OD module using the procedure under “Restore” earlier in this chapter.
2. For the 551 T1 CSU, unplug the patch cord, first from the `EQ IN` jack and then from the `EQ OUT` jack.
3. For the ESF T1 CSU only, flip the `DTE LOOPBACK` switch down (to deactivate the loopback).

Automatic Tests for the 100D

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

Initialization	The system ensures that all T1 ports are properly initialized and placed into service. It also resolves the conflicts of different service levels (for example, between the individual ports or for the initialization of the ports to support features).
Error detection	The system detects errors and takes the trunk out of service, if appropriate. It attempts to restore the trunk and put it back into service.
Error recording	The system records all errors and outages in the error logs.
Audits and updates	The system checks the state of the T1 facilities through audits, status checks, and error logging.
Synchronization	The system maintains proper synchronization to the loop clock and switches to the local clock when the loop clock is not available (for example, during a loss of signal or a blue alarm). When the loop clock source is restored, the system switches back to the loop clock.

100D 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.

Quick-Reference Procedure

Menu →`Maintenance` →`Slot` →Type the slot number →`Enter` →`Error Events` →`Current hr` or `Previous hr`

Procedure: Check Error Events

Step	Display	Instructions
1	Maintenance Make a Selection System Slot Port Exit	Select `Slot`.
2	Slot: Enter Slot number (0 0-17) xx Backspace Exit Enter	Type the slot number *for the 100D module* and select `Enter`.
3	Slot xx: Make a selection Status Demand Test Busy-Out Reset Restore Error Events CSU-lpbk Clock Exit	Select `Error Events`, which appears on the slot screen on/y when the 100D module's slot is selected, Csu-lpbk and `Clock` are also displayed only for the 1000 module.

Step	Display	Instructions
4	Error Events Slot xx: Make a selection Current hr Previous hr Exit	Select `Current hr` to display any errors that have accumulated during the current hour. 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` will display the errors that have accumulated between 09:00 and 09:45. Select `previous hr` to display any errors that have accumulated during the previous hour.
5	Current 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 Exit	This screen displays the errors that have accumulated during the current hour.
6	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 Exit	This screen displays the errors that have accumulated during the previous hour.

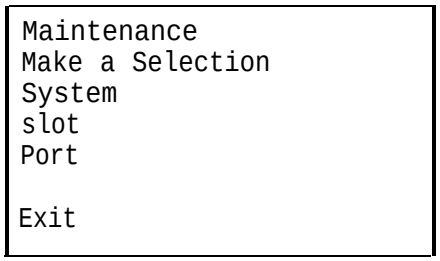
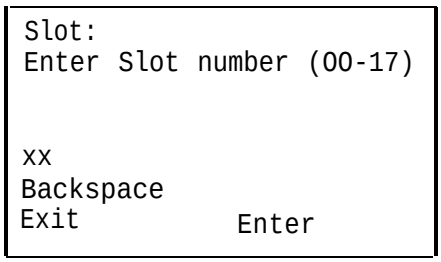
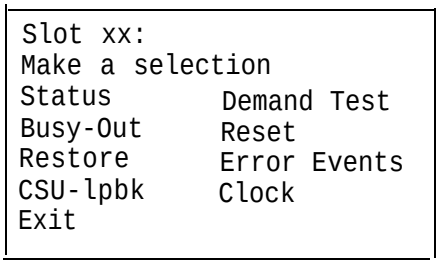
100D Clock Status

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

Quick-Reference Procedure

Menu → `Maintenance` → `Slot` → Type the slot number → `Enter` → `Clock`

Procedure: Checking the Clock Status

Step	Display	Instructions
1		Select `Slot`.
2		Type the slot number *for the 100D module* and select `Enter`.
3		Select `Clock`, which appears on the `Slot` screen *only* when the 100D module's slot is specified. `Csu-lpbk` and `Error Events` are also displayed only for the 100D module.

Step	Display	Instructions
4	Clock Slot xx: mm/dd/yy hh:00-hh:mm Admin as: Active: Synch source : PPM: xxx Exit	Contact your technical support organization if you have not been trained how to interpret the information displayed on this screen.

Carrier Problems

Checking the Carrier

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. If you have not already removed the control unit housing, see Chapter 1 for those instructions.
2. If you have not already backed up the system programming, see the *System Programming & Maintenance (SPM)* guide for those instructions.

3. Power down the system by turning off the following components in the order given:
   a. power supply on the basic carrier
   b. power supply on each expansion carrier
   c. auxiliary power units (if present)
4. Unplug the system from the AC outlet.
5. Remove all modules from the faulty carrier, including the processor and power supply. (If you prefer to remove the cords first, make sure they have been labeled.)
6. Put the modules aside, in order, so that you can reinstall them later in the replacement carrier.
7. Similarly, remove all modules from the carriers to the right of the faulty module.
8. Starting with the rightmost carrier, loosen the four screws that secure the four corners of the carrier to the backboard.
9. Slide the carrier to the right until the connector disengages from the carrier to the left.
10. Pull the carrier away from the wall so that the screws slip through the large screw holes.
11. Continue this process until the faulty carrier is removed.

Replacing the Carrier

After removing the carrier as just described under, “Removing the Faulty Carrier," replace it as follows:

1. Install the replacement carrier(s) following the instructions in the *Installation* guide.
2. Replace the modules with all cords connected as they were before.

Checking System Status and Slot Status

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

System Status

The power supply, processor, 400 EM module, and 100D module are the only modules that have LEDs. The System Status screen displays simulated LEDs for the processor and each module, but not the power supply.

This procedure allows you to check the simulated LEDs for the processor and modules. This is explained in detail later under “Reading the System Status Screen.”

Quick-Reference Procedure

Menu →`Maintenance` →`System` →`Status`

Procedure: Check System Status

Step	Display	Instructions
1	Maintenance Make a selection System Slot Port Exit	Select `System`.
2	System: Make a selection Status Error Log Inventory Access Log Exit Enter	Select `Status`.
3	System Status: >` Slot00: Raaa Slot0l: Raaa Yaaa Gaaa slot02: Raaa Yaaa Gaaa slot03: *Raaa Yaaa Gaaa* Slot04: R Y G Exit	The System Status screen appears. Press **More** to display more modules, up to 17. See the following section for more details.

Reading the System Status Screen

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

Immediately following `R, Y,` or `G` is its status (`aaa` in the screens shown above), which can be `on, off,` or no status an empty slot in the control unit).

Red LED

When the red LED is on, the module is not in service because it is in standby mode, being tested, or 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 maybe on during power up or when one of the module loopback tests is running (Internal Loopback or CSU Loopback).

Sample LED Display

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

If a slot is empty, `R, Y,` and `G` will 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 about the 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)

Quick-Reference Procedure

Menu →Maintenance →Slot →Type the slot number →Enter → Status

Procedure: Checking Slot Status

Step	Display	Instructions
1	Maintenance Make a selection System Slot Port Exit	Select Slot.
2	Slot: Enter Slot number (00-17) xx Backspace Exit Enter	Type the slot number and select Enter
3	Slot 00: Make a selection Status Demand Test Exit	If you selected Slot 00, this screen appears. Select Status. Skip to Step 5.

Step	Display	Instructions
4	Slot xx: Make a selection Status Demand Test Busy-Out Reset Restore *Error Events* *Csu-lpbk* *Clock* Exit	If you selected any slot other than 00, this screen appears. CSU-lpbk, Error Events, and Clock appear *only* when the 100D module occupies the selected slot. Also, if an MLX module occupies the selected slot, BchLoopback appears in place of CSU-lpbk. Select Status. Skip to Step 6.
5	Status Slot 00: LED: Raaa Errors: Alarms: Exit	This screen appears when the selected slot is 00. For detailed information about the status screen, seethe beginning of this section, “Slot Status.”
6	Status Slot xx: LED: *Raaa Yaaa Gaaa* Errors: Mode: Alarms: Maintenance Busy: Exit Next	This screen appears when the selected slot is *not* 00. Select Next to go from one slot to the next. For detailed information about the status screen, seethe beginning of this section, “Slot Status.”

Central Office Problems

5

If you have tested everything from the telephones to the modules in the control unit, you have isolated the trouble to the trunks or the central office. To isolate the trouble further, troubleshoot the trunks as indicated in this section. If the trouble persists after following these procedures, contact the central office and ask a representative to troubleshoot from that end.

Trunk Errors

Trunk errors are recorded not only for trunks, but also for T1 ports on the 100D module.

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 alarms.

Troubleshooting Trunk Problems

Table 5-1 provides a quick-reference guide to trunk troubleshooting.

Table 5-1. Troubleshooting Trunk Symptoms

Symptom	Section
Incoming calls are not being received	"Incoming Trunk Problems"
Cannot make outgoing calls	"Outgoing Trunk Problems"
Trunk problems in general	"Manual Correction of Trunk Problems"

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, do the following:

1. Check for a dial tone at the control unit.
2. If you do not hear a 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, an error is recorded in the error log and the trunk is taken out of service. If an incoming-only trunk is down, however, the only sign of trouble is customer complaints that incoming calls are not being received.

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

Outgoing Trunk Problems

Symptom

Outgoing trunks cannot be seized.

NOTE:
You cannot perform this procedure on a rotary telephone.

Procedure

1. At the network interface, check for a dial tone from the central office. If a dial tone is not present, notify the customer.

   NOTE:
   For GS trunks, apply ground to the ring lead to get a dial tone.

2. Pick up the handset at a test telephone to get a system dial tone.
3. For a Hybrid/PBX system, dial ✶ **03** .
4. Dial the 2-digit trunk number of the trunk to be tested (01 - 60).
5. Listen for a dial tone.
6. If a dial tone is not present, use a test telephone to isolate the fault to the module where the trunk terminates or to the location in the trunk access equipment.
7. If a dial tone is present, dial a working outside number to verify that the call is complete.

   NOTE:

   - 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 will hear a busy tone.

You will hear a reorder tone if a wrong trunk type (such as DID) or an invalid trunk number was dialed.

8. If the module continues to malfunction, replace it.

Incoming Trunk Problems

Symptom

Incoming trunks do not work properly.

Procedure

1. Place an incoming call through the troubled trunk.
2. For an LS or GS trunk, connect a single-line telephone to the trunk at the network interface. (If the trunk is a GS trunk, you need to have a GS button attached to the telephone.)
3. Press the GS button for a GS trunk.

   Listen for ringing.
4. Pick up the handset and check line seizure.
5. Dial an outside number and verify that you have good two-way transmission.
6. At the maintenance terminal, check the trunk programming to be sure this trunk has been properly translated. (See the system planning forms.)
7. If the module continues to malfunction, replace it.

Automatic Testing for Trunks

The automatic maintenance program takes the ports out of service when a trunk is malfunctioning. When a port is out of service, it is *maintenance-busy.* The trunk is periodically tested to put it back in service whenever 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 still receives incoming calls.

NOTE:
Maintenance-busy does not apply to DID trunks because DID trunks cannot be used to make outgoing calls.

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

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

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

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

Permanent Errors

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

NOTE:
Make sure that no modules are in a maintenance-busy state during a backup procedure. Any module in a maintenance-busy state will be recorded as such on the backup disk.

Maintenance-Busy Causes

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 central office 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 Trunk

- No loop current exists when the LS trunk is seized.

  The port is marked maintenance-busy and a permanent error is logged after four occurrences.

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.

Maintenance-Busy Programming

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

Maintenance-Busy Status

See the following section, “Checking Ports.”

Checking Ports

You will perform the procedures in this section from the maintenance terminal. By selecting `Port` from the Maintenance screen, you can check the maintenance-busy status and other information for individual trunks and extensions. Once you determine the maintenance-busy status, you might also be interested in the other functions under `Port,` which include the following:

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

Chekcing Trunk Maintenance Status

Follow the procedure in this section to see if a trunk is maintenance-busy.

Quick-Reference Procedure

Menu → Maintenance → Port Line/Trunk → Type the dial plan number → Enter → Status

Procedure: Check Trunk Maintenance-Busy Status

Step	Display	Instructions
1	Maintenance Make a Selection System Slot Port Exit	Select Port.
2	Port: Make a Selection Line/Trunk Station B-Channel RS232 Port1 RS232 Port2 Exit	Select Line/Trunk.

Step	Display	Instructions
3	Line/Trunk: Enter line number *xxxx* Backspace Exit Enter	Type the dial plan number for the trunk and select `Enter`.
4	Line/Trunk *xxxx:* Make a selection Status Restore Exit	Select `Status`.
5	Line xxxx: Dial Plan: xxxx SlotPort: *sspp* LogicId: xxx Label: xxxxxxxxxx Maintenance Busy: Exit Next	If the trunk you selected is maintenance-busy, this screen will show `Yes` in that field. Select `Next` to see the status of the next trunk.

Checking Station Maintenance-Busy Status

Follow the procedure in this section to see if an extension is maintenance-busy.

Quick-Reference Procedure

Menu →Maintenance →Port →Station →Type the dial plan number →Enter →Status

Procedure: Check Station Maintenance-Busy Status

Step	Display	Instructions
1	Maintenance Make a Selection System slot Port Exit	Select Port.
2	Port : Make a selection Line/Trunk Modem Station B-Channel RS232 Portl RS232 Port2 Exit Enter	Select Station.

Step	Display	Instructions
3	Station: Enter station number *xxxx* Backspace Exit Enter	Type the dial plan number for the station and select `Enter`.
4	Station *xxxx:* Make a selection Status Busy Out Restore Exit	Select `Status`.
5	Station xxxx: Dial Plan: xxxx SlotPort: *sspp* LogicId: xxx Profile: Maintenance Busy: Exit Next	If the station that you selected is maintenance-busy, this screen will show `Yes` in that field. Select `Next` to see the status of the next station.

Busying-Out a Trunk

Follow the procedure in this section to busy-out a trunk.

Quick-Reference Procedure

Menu → `Maintenance` → `Port` → `Line/Trunk` → Type the dial plan number → `Enter` → `Busy Out`

Procedure: Busy-Out a Trunk

Step	Display	Instructions
1	Maintenance > Make a Selection System slot Port Exit	Select Port.
2	Port : Make a selection Line/Trunk Modem Station B-Channel Rs232 Portl RS232 Port2 Exit Enter	Select Line/Trunk.
3	Line/Trunk: Enter line number xxxx Backspace Exit	Type the dial plan number for the trunk and select Enter.
4	Line/Trunk xxxx: Make a selection Status Busy Out Restore Exit	Select Busy Out.

Step	Display	Instructions
5	Line/Trunk xxxx: Busy-Out in Progress Exit	This screen appears until the busy-out finishes or fails.
6	BusyOut Line/Trunk xxxx: Busy-Out Successfully Completed Exit	This screen appears when busy-out successfully completes.
7	BusyOut Line/Trunk xxxx: Busy-Out FAILED Exit	This screen appears when busy-out fails. Exit and try again.

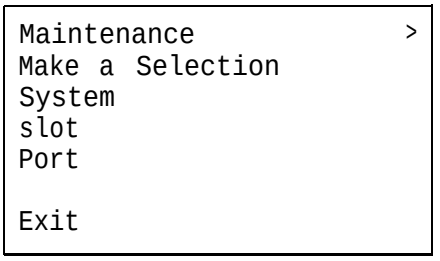
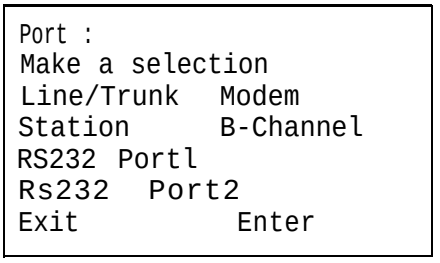
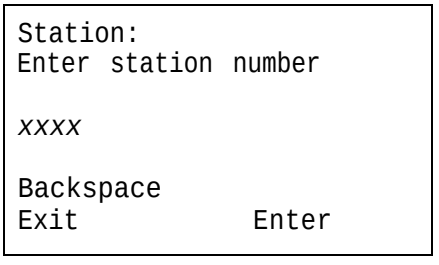
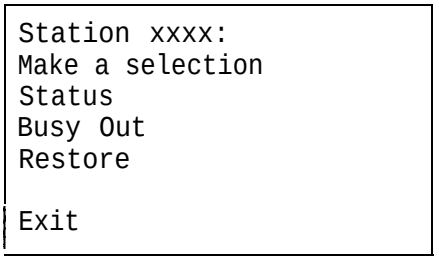
Busying-Out a Station

Follow the procedure in this section to busy-out an extension (a station).

Quick-Reference Procedure

Menu →Maintenance →Port →Station →Type the dial plan number →Enter →Busy Out

Procedure: Busy-Out a Station

Step	Display	Instructions
1		Select `Port`.
2		Select `Station`.
3		Type the dial plan number for the station and select `Enter`.
4		Select `Busy Out`.

Step	Display	Instructions
5	Station *xxxx:* Busy-Out in Progress Exit	This screen appears until the busy-out finishes or fails.
6	BusyOut Station xxxx: Busy-Out Successfully Completed Exit	This screen appears when busy-out successfully completes.
7	BusyOut Station xxxx: Busy-Out FAILED Exit	This screen appears when busy-out fails. Exit and try again.

Restoring a Trunk

Follow the procedure in this section to restore a trunk.

Quick-Reference Procedure

Menu →Maintenance →Port →Line/Trunk →Type the dial plan number →Enter →Restore

Procedure: Restore a Trunk

Step	Display	Instructions
1	Maintenance > Make a Selection System slot Port Exit	Select Port.
2	Port : Make a selection Line/Trunk Modem Station B-Channel RS232 Port 1 RS232 Port 2 Exit Enter	Select Line/Trunk.
3	Line/Trunk: Enter line number xxxx Backspace Exit	Type the dial plan number for the trunk and select Enter.

Step	Display	Instructions
4	Line/Trunk *xxxx:* Make a selection Status Busy Out Restore Exit	Select `Restore`.
5	Restore Line/Trunk *xxxx:* Restore in Progress Exit	This screen appears until the restore finishes or fails.
6	Restore Line/Trunk *xxxx:* Restore Successfully Completed Exit	This screen appears when restore successfully completes.
7	Restore Line/Trunk *xxxx:* Restore FAILED Exit	This screen appears when restore fails. Exit and try again.

Restoring a Station

Follow the procedure in this section to restore an extension (a station).

Quick-Reference Procedure

Menu →Maintenance →Port →Station →Typethe dial plan →Enter →Restore

Procedure: Restore a Station

Step	Display	Instructions
1	Maintenance > Make a Selection System Slot Port Exit	Select Port.
2	Port : Make a selection Line/Trunk Modem Station B-Channel Rs232 Portl Rs232 Port2 Exit Enter	Select Station.
3	Station: Enter Station number *xxxx* Backspace Exit Enter	Type the dial plan for the station and select

Step	Display	Instructions
4	Station *xxxx:* Make a selection Status Busy Out Restore Exit	Select `Restore`.
5	Restore Station *xxxx:* Restore in Progress Exit	This screen appears until the restore finishes or fails.
6	Restore Station *xxxx:* Restore Successfully Completed Exit	This screen appears when restore successfully completes.
7	Restore Station *xxxx:* Restore FAILED Exit	T his screen appears when restore fails. Exit and try again.

Resetting an RS-232 Port

Follow the procedure in this section to reset an RS-232 port.

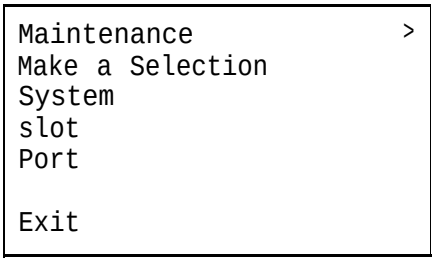
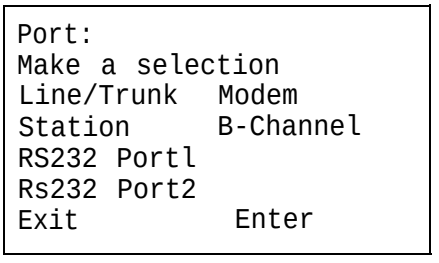
NOTE:
RS-232 Port 1 is the SPM port.

RS-232 Port 2 is the SMDR port.

Quick-Reference Procedure

Menu →Maintenance →Port →RS232 Portl or RS232 Port2 → Reset →Yes

Procedure: Reset an RS-232 Port

Step	Display	Instructions
1		Select Port.
2		Select RS232 Portl or RS232 Port2

Step	Display	Instructions
3	Rs232 Portx: Make a selection Reset Exit	Select Reset.
4	Rs232 Portx Reset: Do you want to continue? Yes Cancel Exit	Select Yes.
5	RS232 Portx Reset: Reset in Progress Exit	This screen appears until the reset finishes or fails.
6	RS232 Portx Reset: Reset Successfully Completed Exit	This screen appears when reset successfully completes.

Step	Display	Instructions
7	RS232 Portx Reset: Reset FAILED Exit	This screen appears when reset fails. Exit and try again.

Resetting the Processor's Internal Modem

Follow the procedure in this section to reset the processor's internal modem.

Quick-Reference Procedure

Menu →Maintenance →Port → Modem →Reset →Yes

Procedure: Reset a Modem

Step	Display	Instructions
1	Maintenance >` Make a Selection System slot Port Exit	Select Port.
2	Port : Make a selection Line/Trunk Modem Station B-Channel Rs232 Portl Rs232 Port2 Exit Enter	Select Modem.

Step	Display	Instructions
3	Modem Port: Make a selection Reset Exit	Select Reset.
4	Modem Port Reset: Do you want to continue? Yes Cancel Exit	Select Yes.
5	Modem Port Reset: Reset in Progress Exit	This screen appears until the reset finishes or fails.
6	Modem Port Reset: Reset Successfully Completed Exit	This screen appears when reset successfully completes.

Step	Display	Instructions
7	Modem Port Reset: Reset FAILED Exit	This screen appears when reset fails. Exit and try again.

Auditing DS1 PRI B-Channels

General Procedure:. These procedures (Auditing Lines and Auditing Calls) initiate an audit. Once 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.

NOTE:
If an audit fails, call the central office to correct the problem from that end, and then try the audit again.

Auditing Lines

If your troubleshooting indicates problems with PRI lines between the control unit and the central office, this audit will fix the problem if successful. This audit allows either side of the PRI interface to synchronize both ends by exchanging messages.

Auditing Calls

If your troubleshooting indicates problems with PRI calls to or from MLX telephones, this audit will fix the problem if successful. This audit allows either side of the PRI interface to synchronize both ends by exchanging messages.

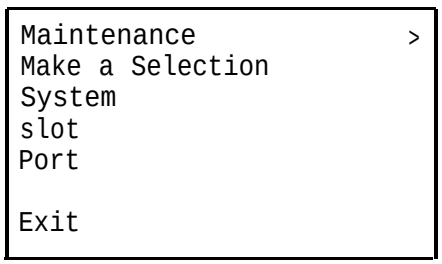
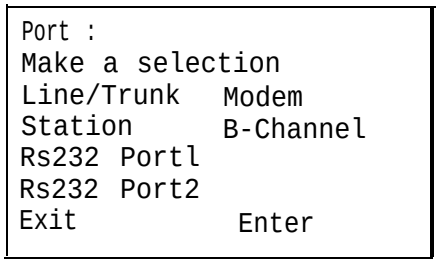
Preparation

Appropriate Slot or Port	This test can be run only on the slot and port of a DS1 PRI B-channel
Time Estimate	4 minutes
Backup Procedure	Not required
Busy-Out or Reset	Not required
Interrupting the Test	You cannot interrupt this test.
Restore	Not required

Quick-Reference Procedure

Menu → `Maintenance` → `Port` → `B-Channel` → Type the slot and port number → `Enter` → `Audit Line`

Procedure: Auditing Lines

Step	Display	Instructions
1		Select `Port`.
2		Select `B-Channel`.

Step	Display	Instructions
3	B-Channel Enter B-Channel *(sspp)* *xxxx* Backspace Exit	Type the slot and port number for the B-channel and select `Enter`.
4	B-Channel *xxxx:* Make a selection Audit Line Audit Call Exit	Select `Audit Line`.
5	Bchannel xxxx Audit Line Audit Initiated Exit	This screen appears only if the audit message is successfully created and sent. After about four minutes, check the error logs, If new PRI errors occur, contact your technical support organization for help on interpreting the results and your action. If no new PRI messages appear, the ends should be in agreement.

Step	Display	Instructions
6	Bchannel xxxx Audit Line Audit Failed Exit	This screen appears when the 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, ask the central office to clear the problem from that end.

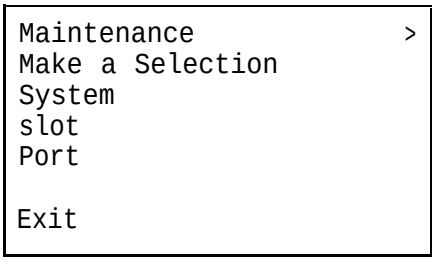
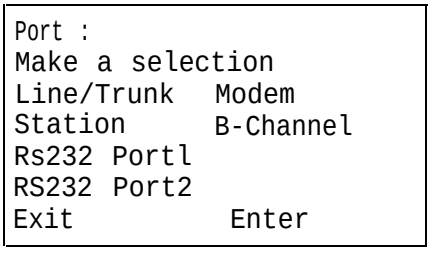
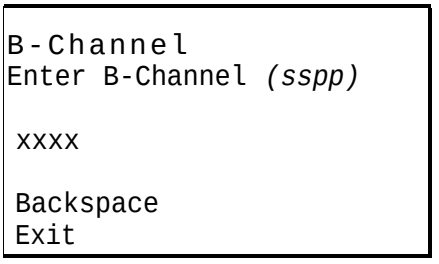
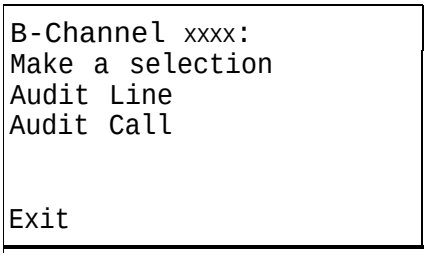
Preparation

Appropriate Slot or Port	This test can be run only on the slot and port of a DS1 PRI B-channel
Time Estimate	4 minutes
Backup Procedure	Not required
Busy-Out or Reset	Not required
Interrupting the Test	You cannot interrupt this test.
Restore	Not required

Quick-Reference Procedure

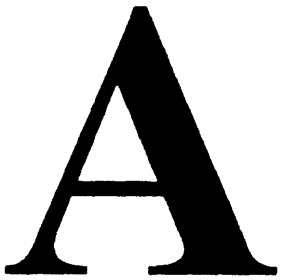
Menu → `Maintenance` → `Port` → `B-Channel` → Type the slot and port number → `Enter` → `Audit Call`

Procedure: Auditing Calls

Step	Display	Instructions
1		Select `Port`.
2		Select `B-Channel`.
3		Type the slot and port number for the B-channel and select `Enter`.
4		Select `Audit Call`.

Step	Display	Instructions
5	Bchannel *xxxx* Audit Call Audit Initiated Exit	This screen appears only if the audit message is successfully created and sent. After about four minutes, check the error logs. If new PRI errors occur, contact your technical support organization for help on interpreting the results and your action. If no new PRI messages appear, the ends should be in agreement.
6	Bchannel *xxxx* Audit Call Audit Failed Exit	This screen appears when the message cannot be sent. Make sure an active call is in-progress on the specified B-channel, and try the audit again.

System Numbering Forms



When you install a new system or when you change any existing trunk or extension wiring, record information about the wiring on the appropriate system numbering form. This appendix includes all of the system numbering forms and instructions for completing Form 2a, "System Numbering—Station Jacks." This is a newly designed form for Release 2.0 that combines system numbering information with additional information previously noted on the System Technician's Run Sheet. The system numbering forms, which are included in this appendix, are as follows:

- Form 2a, System Numbering—Station Jacks
- Form 2b, System Numbering—Digital Adjuncts
- Form 2c, System Numbering—Trunk Jacks
- Form 2d, System Numbering—Special Renumbers

Form 2a, System Numbering— Station Jacks

Form 2a, System Numbering — Station Jacks

Renumber System
❑ 2-Digit ◆ ❑ Selected Extension Numbers q 3-Digit ❑ Set Up Space

Mod. Type	Log. ID	Jack Type A	Jack Type D*	Jack Type B	Eqpt.	2-Dig Ext. No.◆	3-Dig. Ext. No.	Set Up Space	Renumber to	Label	Old Ext. No.	Wire No.	Person, Location, or Function	AUDIX Voice Power™
	1					10	100	7100						
	2					11	101	7101						
	3					12	102	7102						
	4					13	103	7103						
	5					14	104	7104						
	6					15	105	7105						
	7					16	106	7106						
	8					17	107	7107						
	9					18	108	7108						
	10					19	109	7109						
	11					20	110	7110						
	12					21	111	7111						
	13					22	112	7112						
	14					23	113	7113						
	15					24	114	7114						
	16					25	115	7115						
	17					26	116	7116						
	18					27	117	7117						
	19					28	118	7118						
	20					29	119	7119						
	21					30	120	7120						
	22					31	121	7121						
	23					32	122	7122						
	24					33	123	7123						

Shaded lines indicate possible operator positions.
** Use Form 2b for adjuncts connected via MFM or ISDN 7500B Data Module.* ◆ *Factory Setting*

Figure A-1. Form 2a, System Numbering—Station Jacks

The following explains how to complete Form 2a.

The number in the logical ID column refers to the number of the extension jack in the control unit.

1. In the “Equipment” column, enter the type of device (such as an MLX-20L console) that is connected to the extension jack. On the second line, enter any attached adjuncts (such as an answering machine).
2. In the “Old Ext. No.” column, if the wire run is being changed, enter the extension number of the old extension. If you are working with a new installation, leave this space blank.
3. In the “Renumber To” column, enter the extension number of the extension, if not already filled in. (This includes new installations.)
4. In the “Wire No." column, enter the number of the wire as indicated by the label on the wire.
5. In the “Person, Location, or Function” column, enter the name of the person at, the location of, or the function of (such as fax machine) the extension, and any miscellaneous information particular to that extension.

Form 2b, System Numbering— Digital Adjuncts

Form 2b, System Numbering - Digital Adjuncts

(Make additional copies of this form= needed.)
Maximum: 127 Adjuncts

Logical ID	Factory-Set Extension No.	Renumber to	MFM		75008	MLX Telephone Ext No.	Person, Location, Function, and Equipment Type
			SAA	T/R			

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

Form 2c, System Numbering— Trunk Jacks

Form 2c, System Numbering — Trunk Jacks

Music-on-Hold, Trunk No. _____ Source _____

Loudspeaker Page, Trunk No(s). _____

Maintanance Alarm, Trunk No. _____

Loop-Start Reliable Disconnect*
❑ No ◆ ❑ Yes

Module Type and Slot No.	Log. ID	Jack Type (LS, GS, DID, Tie, etc.)	Trunk No.	Pool Dial-Out Code†‡	Re-number To	Incoming Trunk Type (Main No., Personal Line, WATS, FX, etc.)	Telephone Number or Equipment	Label	Outmode Signaling		Toll Type Prefix Req'd for LD		Hold Disc. Interval		QCC Queue Priority Level† (4◆)	QCC Operator to Receive Calls† (No.◆)	Function
									TT◆	R	Yes◆	No	Short	Long◆			
	1		801														
	2		802														
	3		803														
	4		804														
	5		805														
	6		806														
	7		807														
	8		808														
	9		809														
	10		810														
	11		811														
	12		812														
	13		813														
	14		814														
	15		815														
	16		816														
	17		817														
	18		818														
	19		819														
	20		820														

◆ Factory Setting
* If the system has AUDIX Voice Power/FAX Attendant System™, Integrated Administration will automatically set Loop-Start Reliable Disconnect to "Yes."
† Hybrid/PBX mode only

‡ Maximum: 11 pools with up to 80 trunks per pool.
Factory settings: 70 (main), 891 (dial-in tie), 892 (automatic-in tie).

Figure A-3. Form 2c, System Numbering-Trunk Jacks

Form 2d, System Numbering— Special Renumbers

Form 2d, System Numbering — Special Renumbers

Pools (Form 3c) Description	Factory-Set Number	Renumber to
	70	
	890	
	891	
	892	
	893	
	894	
	895	
	896	
	897	
	898	
	899	

Group Paging (Form 6c) Group ID	Factory-Set Number	Renumber to
	793	
	794	
	795	
	796	
	797	
	798	
	799	

Call Park (Form 6a)	Factory-Set Number	Renumber to
	881	
	882	
	883	
	884	
	885	
	886	
	887	
	888	

Remote Access Code (Form 3a)	Factory-Set Number	Renumber to
	889	

Group Calling (Form 6e) Group ID Label	Factory-Set Number	Renumber to
	770	
	771	
	772	
	773	
	774	
	775	
	776	
	777	
	778	
	779	
	780	
	781	
	782	
	783	
	784	
	785	
	786	
	787	
	788	
	789	
	790	
	791	
	7920	
	7921	
	7922	
	7923	
	7924**	
	7925**	
	7926**	
	7927**	
	7928**	
	7929**	

Listed Directory Number* (QCC Queue)	Factory-Set Number	Renumber to
	800	

*Hybrid/PBX mode only.
** Reserved for AUDIX Voice Power/PBX Attendant System.

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

Unit Load Calculation Worksheet

B

If you determine that you need to recalculate the unit load for any carrier, use the instructions on the following worksheet.

NOTE:

- You should have a separate copy of the worksheet for each carrier.
- See “Unit Loads” in Chapter 1 for information on recalculating unit loads.

Unit Load Worksheet

1. Number of modules in carrier (excluding power supply and processor): _____
   - If fewer than 5, auxiliary power is not required.
   - If 5 or 6, continue to Step 2.

2. Key or Behind Switch mode only: ❑ Square
   Indicate configuration of lines; then go to Step 5. ❑ Modified

3. Hybrid/PBX mode only: ❑ Yes
   Do all modules in the carrier have MLX and/or analog multiline telephone jacks? ❑ No
   - If no, auxiliary power is not required.
   - If yes, continue to Step 4.

4. Hybrid/PBX mode only:
   Calculate the total number of MLX and analog muitiline telephones.

   Number of MLX-20L consoles connected to modules in the carrier _____

   Number of MLX-28D consoles connected to modules in the carrier _____

   Number of 34-button analog multiline telephones connected to modules in the carrier _____

   Total of MLX-20L, MLX-28D, and 34-button analog telephones _____
   - If the total is less than or equal to 45, auxiliary power is not required.
   - If the total is greater than 45, continue to Step 5.

5. Calculate the estimated unit loads.

Module	Qty x	Unit Load	= Total
008		12.0	
008 MLX		13.5	
008 OPT		8.0	
012		8.4	
100D		0.0	
400		0.0	
400 EM		8.0	
400 GS/LS/TTR		0.0	
408		12.0	
408 GS/LS		12.0	
408 GS/LS-MLX		13.5	
800		0.0	
800 GS/LS		0.0	
800 DID		8.0	
		Total Estimated Unit Load	

- If the total is less than or equal to 54, auxiliary power is not required.
- If the total is greater than 54, continue to Step 6.

6. Calculate the actual carrier unit load.

	Qty x	Unit Load		= Total
Equipment		**Hybrid/PBX or Modified**	**Square**	
Network Access Lines*				
DID		1.0	1.0	
DS1		0.0	0.0	
GS/LS		0.0	0.0	
Tie		1.4	1.4	
Telephones				
MLX-10		.9	1.2	
MLX-1OD		.9	1.2	
MLX-28D		1.2	1.7	
MLX-20L		1.1	1.6	
BIS-10		0.9	1.1	
BIS-22		1.0	1.3	
BIS-22D		1.0	1.3	
BIS-34		1.1	1.5	
BIS-34D		1.1	1.5	
MLC-5		0.0	0.0	
10-Button Basic		0.9	1.1	
10-Button HFAI		1.0	1.2	
34-Button Basic		0.9	1.1	
34-Button DLX		1.2	1.7	
34-Button BIS		1.2	1.4	
34-Button BIS/DIS		1.2	1.4	
Single-Line Telephone		0.6	0.7	
Continued				

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

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

† The MFM has its own wall power unit located at the telephone and therefore is not added to the unit load calculation.

‡ Up to two DSSs (one DSS per MLX-28D or MLX-20L console) can be powered from each control unit carrier. For example, a three-carrier system can have s system operator positions, each with one DSS powered from the control unit.

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

7. Try to exchange modules between carriers to reduce the unit loads to 54. (Remember that the 10OD, 400, 400 GS/LS/TTR, 800, and 800 GS/LS modules have unit loads of 0.0.) Repeat Steps 1 through 6 to recalculate unit loads for the new configuration.

   - If the exchange reduces the unit load to 54 or less, auxiliary power is not required.
   - If the exchange does not reduce the unit load to 54 or less, auxiliary power is required. Continue to Step 8.

NOTE:
Empty slots are not permitted between modules.

8. Calculate the unit load for slots 5 and 6 of the carrier.

	Qty x	Unit Load		= Total
Equipment		**Hybrid/PBX or Modified**	**Square**	
Network Access Lines*				
DS1		0.0	0.0	
GS/LS		0.0	0.0	
Tie		1.4	1.4	
Telephones				
MLX-10		.9	1.2	
MLX-1OD		.9	1.2	
MLX-28D		1.2	1.7	
MLX-20L		1.1	1.6	
BIS-10		0.9	1.1	
BIS-22		1.0	1.3	
BIS-22D		1.0	1.3	
BIS-34		1.0	1.3	
BIS-34D		1.1	1.5	
MLC-5		1.1	1.5	
10-Button Basic		0.0	0.0	
10-Button HFAI		1.0	1.2	
14-Button Basic		0.9	1.1	
14-Button DLX		1.2	1.7	
34-Button BIS		1.2	1.4	
34-Button BIS/DIS		1.2	1.4	
Single-Line Telephone		0.6	0.7	
Continued				

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

	Qty x	Unit Load		= Total
Equipment		**Hybrid/PBX or Modified**	**Square**	
Optional Equipment †				
Direct Station Selector ‡		0.7	0.9	
General Purpose Adapter		0.8	1.0	
Hands-Free Unit		0.8	1.0	
Headset Adapter		0.8	1.0	
		Total Unit Load for Slots 5 and 6		

† The MFM has its own individual wall power unit located at the telephone and therefore is not added to the unit load calculation.

‡ Up to two DSSs (one DSS per MLX-28D or MLX-20L) 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.

- If the unit load for slots 5 and 6 is less than or equal to 27, auxiliary power is sufficient for the carrier.
- If the unit load for slots 5 and 6 is more than 27, continue to Step 9.

9. Try to exchange modules between carriers to reduce the unit loads for slots 5 and 6 through 27. (Remember that the 100D, 400, 400 GS/LS/TTR, 800, and 800 GS/LS modules have unit loads of 0.0.) Repeat Steps 1 through 8 to recalculate unit loads for new configuration.

- If the exchange reduces the unit load for slots 5 and 6 through 27 or less, auxiliary power is sufficient.
- If the exchange does not reduce the unit load for slots 5 and 6 through 27, install wall power units for the appropriate number of telephones to reduce the unit load to 27.

NOTE:
Empty slots are not permitted between modules.

Glossary

GL

adjunct
Optional equipment used with the communications system such as an alerting device that connects to a multiline telephone or to a telephone jack.

alternate mark inversion (AMI)
A line coding format in which a binary 1 is represented by a positive or negative pulse, a binary 0 is represented by no line signal, and subsequent binary 1‘s must alternate in polarity or there will be a bipolar violation. AMI is used in the DS1 interface.

ANI
automatic number identification

ARS
Automatic Route Selection

ASCAP
American Society of Composers, Artists, and Producers

automatic number identification (ANI)
The process of automatically identifying a caller’s billing number and transmitting that number from the caller’s local central office (CO) to another point on or off the public network.

automatic-start tie trunk
A tie trunk on which incoming calls are routed to an operator or other designated destination without a start signal. Also called automatic-ringdown tie trunk or auto-in tie trunk.

auxiliary power unit
A device that provides additional power to the communications system.

B channel
A 64 kbps channel that carries a variety of digital information streams, such as voice at 64 kbps, data at up to 64kpbs, wideband voice encoded at 64 kpbs, and voice at less than 64 kbps, alone or combined with other digital information streams. Also called bearer channel.

barrier code
A password used to limit access to the Remote Access feature of the communications system.

basic carrier
A piece of hardware that holds and connects the processor; power supply; and up to five modules in the communications system, See also expansion carrier.

Basic Rate Interface (BRI)
A standard digital frame format that specifies the protocol used between the communications system and a terminal. BRI runs at 192 kbps and provides two 64-kbps voice or B channels and one 16-kbps signaling or D channel per port. The remaining 48 kbps are used for framing and D-channel contention.

Behind Switch
A mode of operation in which the communications system control unit is connected to (is “behind”) another communications system.

BMI
Broadcast Music Incorporated

broadband
A transmission path having a bandwidth greater than a voice-grade channel.

BTMI
basic telephone modem interface

bus
A multiconductor electrical path used to transfer information over a common connection from any of several sources to any of several destinations.

campus cable
Cable that runs between buildings connected to the same communications system.

CCITT
Committee Consultant Internatioale Telephonique et Telegraphique

CCS
common-channel signaling

Centrex
A set of communications system features a user can subscribe to on telephone lines from the local telephone company.

channel
A telecommunications transmission path for voice and/or data.

coaxial cable
A cable consisting of one conductor, usually a small copper tube or wire, within and insulated from another conductor of large diameter, usually copper tubing or copper braid.

codec (coder-decoder)
A 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.

control unit
The housing, carriers, power supply, processor, and modules of a communications system.

DCE
data communications equipment

D channel
The 16-kbps or 64-kbps channel carrying signaling or data on BRI or 64-kbps channel carrying signaling or data on Rate Interface (PRI).

D4 framing format
A framing format consisting of a sequence of individual frames of 24 eight-bit slots and 1 signal bit (193 bits) in a 12 frame superframe. See also extended superframe format.

data communications equipment (DCE)
Equipment such as modems or data modules used to establish, maintain, and terminate a connection between the communications system and data terminal equipment (DTE), such as printers, host computers, or workstations.

data module
A data communications device that allows connection between EIA-232-D data terminal equipment (DTE) and the communications system control unit via MLX telephone jacks. The data module is used together with a modem in a modem pool to change digital data signals to analog signals, and vice versa, which allows transmission between digital and analog data stations.

data terminal
An input/output (I/O) device that can be connected to the communications system control unit via an interface.

data terminal equipment (DTE)
The equipment that makes up the endpoints in a connection over a data circuit — for example, a data terminal, host computer, or printer.

DCP
Digital Communications Protocol

DFT
direct facility termination

DID
direct inward dialing

DID (direct inward dialing) trunk
An incoming trunk that receives dialed digits from the local exchange, allowing the communications system to connect directly to an extension without assistance from the system operator.

Digital Communications Protocol (DCP)
A protocol used to transmit both digitized voice and data over the same communications link. A DCP link is made up of two 64-kbps information (I) channels and one signaling (S) channel similar to the B and D channels used in communications.

digital switch element (DSE)
A device in each jack on each module in the communications system control unit that interfaces with the TDM (time-division multiplex) bus.

direct facility termination (DFT)
A central office (CO) trunk that terminates directly on one or more telephones; in PBX mode a OFT cannot be part of a trunk pool.

direct inward dialing (DID)
A service that transmits the called extension to the communications system from the central office (CO) and routes incoming calls directly to the called extension, calling group, or outgoing trunk pool, bypassing the system operator.

Direct Station Selector (DSS)
A 60-button adjunct that enhances the call-handling capabilities of an MLX-20L or MLX-28D telephone when used as an operator console.

display buttons
The buttons on an MLX display telephone used to access the telephone's display.

DLC
direct-line console

door answering unit
A device that is connected to a basic telephone jack and used at an unattended extension or front desk.

DS0 (Digital Signal 0)
A single 64-kbps voice or data channel.

DS1 (Digital Signal 1)
A bit-oriented signaling (BOS) interface that multiplexes 24 64-kbps channels into a single 1.544-Mbps stream.

DSS
Direct Station Selector

DTE
data terminal equipment

dual-tone multifrequency (DTMF) signaling
touch-tone signaling from telephones using the voice transmission path. The code for DTMF signaling provides 12 distinct signals, each composed of two voice-band frequencies.

E&M
ear and mouth (receive & transmit)

E and M signaling
Tie-trunk supervisory signaling, used between two communications systems, in which information is transferred through two-state voltage conditions (on the E and M leads) for analog applications and through two bits for digital applications.

EIA-232-D
A physical interface, specified by the EIA (Electronics Industries Association), that transmits and receives asynchronous data at speeds of up to 19.2 kbps over cable distances of 50 ft (15 m).

electronic switching system (ESS)
A class of modern switching central office (CO) systems in which the control functions are performed principally by electronic data processors operating under the direction of a stored program.

expansion carrier
A carrier added to the control unit when the basic carrier cannot house all the modules needed. An expansion carrier houses a power supply module and up to six additional modules.

extended superframe format (ESF)
A framing format consisting of individual frames of 24 eight-bit slots and 1 signal bit (193 bits) in a 24-frame extended superframe. See also D4 framing format.

FCC
Federal Communications Commission

frequency generator
A circuit pack added to the power unit module that generates a high-voltage, 20-30 Hz signal to ring a telephone. Also called a ring generator.

FX (foreign exchange)
A central office (CO) other than the one providing local access to the public network.

glare
The loud dual-tone multi-frequency (DTMF) signal an incoming caller hears when another caller tries to call out on a trunk at the same time the call is coming in on that trunk.

ground-start (GS) trunk
A trunk on which, after verifying that the trunk is idle (no ground on tip), the communications system transmits a request for service (puts ground on ring) to a distant central office (CO).

headset
An ultralight earpiece and microphone for hands-free telephone operation.

HFAI
Hands Free Answer on Intercom

Hybrid/PBX
A mode of operation in which the communications system uses trunk pools and Automatic Route Selection (ARS) in addition to personal lines — that is, direct facility terminations (DFTs) on line buttons. The Hybrid/PBX mode also provides a single interface to users for both internal and external calling.

ICOM
Intercom

immediate-start tie trunk
A tie trunk on which no start signal is necessary and dialing can begin immediately after the tie trunk is seized.

IROB (in-range out-of-building) protector
A surge protection device for off-premises telephones at a location within 1000 ft (305 m) of cable distance from the communications system control unit.

Key mode
A mode of operation in which the communications system uses direct facility terminations (DFTs) on line buttons with a separate path for internal calling.

LAN
local area network

LDN
listed directory number

line coding
The pattern data assumes as it is transmitted over a communications channel,

line compensation
An adjustment for the amount of cable loss in decibels (dBs), based on the length of cable between a DS1 module and a channel service unit (CSU) or other far-end connection point.

local host computer access
A method for connecting a telephone jack to an on-site computer for data-only calls through a modem or data module.

logical ID
A numbering sequence used to identify station and trunk locations on the communications system control unit.

loop-start (LS) trunk
A trunk on which a closure between the tip and ring leads is used to originate or answer a call. High-voltage 20-Hz AC ringing from the central office (CO) signals an incoming call.

Magic on Hold®
A customized Music-on-Hold (MOH) system that promotes the customer's products and services.

Mbps
megabits per second

Megacom®
Digital WATS (wide area telecommunications service) offering for outward calling.

Megacom 800
Digital 800 service for inward calling.

MFM
Multi-Function Module

MLX-10 /MLX-10D telephone or console
A 10-button telephone offered with or without a 2-line by 24-character, menu-driven display.

MLX-20L telephone or console
A telephone with 20 programmable line or feature buttons and a 7-line by 24-character, menu-driven display.

MLX-28D telephone or console
A telephone with 28 programmable line or feature buttons and a 2-1ine by 24-character, menu-driven display.

modem pool
A pair, or group of pairs, of modems and data modules with interconnected EIA-232-D interfaces that converts digital signals to analog, or analog signals to digital, thereby allowing users with digital data stations to communicate with users who have analog telephones.

MOH
Music-on-Hold

Multi-Function Module (MFM)
An adapter that provides a tip/ring interface for the connection of optional equipment such as answering machines, external alerts, and fax machines to an MLX telephone. The optional equipment and the MLX telephone operate simultaneously and independently. The MFM is installed inside the MLX telephone.

multiplexing
A process in which a transmission channel is divided into two or more 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 (MOH)
Magic on Hold or a customer-provided music source connected to the communications system via a loop-start (LS) jack. Most MOH equipment is designed for LS operation.

Note: If you use equipment that rebroadcasts music or other copyrighted materials, you may be required to obtain a copyright license from and pay fees to a third party such as the American Society of Composers, Artists, and Producers (ASCAP) or Broadcast Music Incorporated (BMI). Or you can purchase a Magic on Hold system, which does not require such a license, from your technical support organization.

network
A 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.

off-premises telephone
A telephone located in a building other than where the control unit is located.

OPT
off-premises telephone

OPX
off-premises extension

parity
The addition of a bit to a bit string so that the total number of 1‘s is odd or even. Parity can be used to detect and correct transmission errors.

pass through
A connection from an internal modem to a programming port on the communications system.

PBX
private branch exchange

PFT
power failure transfer

personal line
A central office (CO) line that rings only at the user’s telephone.

pool
On a Hybrid/PBX system, a grouping of outside trunks that users can choose with multiple pool buttons or by dialing access codes on an SA (System Access) button on the telephone, Pools are also used by the Automatic Route Selection (ARS) feature to choose the cheapest method to route a call.

power supply
A device that directs electricity to modules and telephones on the communications system. One power supply is needed for each carrier, and an auxiliary power unit is added when necessary.

PRI
primary rate interface

Primary Rate Interface (PRI)
A standard digital interface that specifies the protocol used between two or more communications systems, PRI runs at 1.544 Mbps and, as used in North America, provides twenty-three 64-kbps Bchannels (voice or data) and one 64-kbps Dchannel (signaling). The Dchannel is the 24th channel of the interface and contains multiplexed signaling information for the other 23 channels.

protocol
A set of conventions governing the format and timing of message exchanges between devices, such as a multiline analog telephone and the communications system control unit.

riser cable
Cable that runs between floors in a multistory building and connects wire closets.

signaling
The sending of control and status information between devices to set up, maintain, or take down a connection.

simplex signaling
The transmission of signals in one direction only across a telecommunications channel.

single-line telephone
An industry-standard, touch-tone or rotary telephone that only handles one trunk and is connected to the communications system via a jack on a basic telephone module.

SMDR
Station Message Detail Recording

SMDR printer
A printer used for Station Message Detail Recording (SMDR) that is connected to the communications system via an EIA-232-D jack on the processor.

SPM
System Programming and Maintenance

Square Key
A way of configuring the communication system in Key mode so that all lines appear on all telephones.

SSN
Switched Services Network

station
The endpoint on the internal side of the communications system. A station can be a telephone with or without an adjunct or can be a data terminal with a modem (analog) or a data module (digital) attached.

station jack
An analog, digital, or tip/ring (T/R) interface on the control unit module for connecting telephones and other equipment.

switchhook flash
Operation of the telephone switchhook in which the on-hook period is in the range of 250 –500 ms.

synchronous data transmission
A method for continuous digital data stream in which the transmission of each binary bit is synchronized with a master clock.

System Programming & Maintenance (SPM)
A DOS-or UNIX-based application for programming and maintaining the communications system.

system renumbering
A process used to change the extension numbers assigned to telephones, adjuncts, calling groups, paging groups, Call Park zones, and Remote Access.

T1
A digital transmission carrier path that in North America transmits at the DS1 rate of 1.544 Mbps.

TDM
time-division multiplex

tie trunk
A private line directly connecting two communications systems.

time-division multiplexing (TDM)
A process where the transmission channel is divided.

tip/ring (T/R)
The contacts and associated conductors of a single-line telephone plug or jack.

touch-tone receiver (TTR)
A device used to decode touch-tones dialed from single-line telephones or Remote Access telephones.

T/R
See tip/ring (T/R).

uninterruptible power supply (UPS)
A device that connects to the communications system to provide 117 VAC to the equipment when the commercial power source fails.

unit load
A measure of the power load drain of a module, telephone, or adjunct.

UPAM
Universal Paging Access Module

UPS
uninterruptible power supply

VA
volt-ampere

VAC
Volts AC

voice-band channel
A transmission channel, generally the 300-3400 -Hz frequency band.

voice-only
A telephone that is set up for making and receiving voice calls but not data calls.

voice signal pair
A pair of leads on an analog multiline telephone used for the Voice Announce to Busy feature.

WATS
wide area telecommunications service

WATS (wide area telecommunications service)
A service that allows calls to certain areas for a flat-rate charge based on expected usage.

wink-start tie trunk
A 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.

ZCS
zero code suppression

zero code suppression (ZCS)
A binary coding scheme that ensures a data stream contains at least a minimum number of information bits (ones) for receiver synchronization.

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