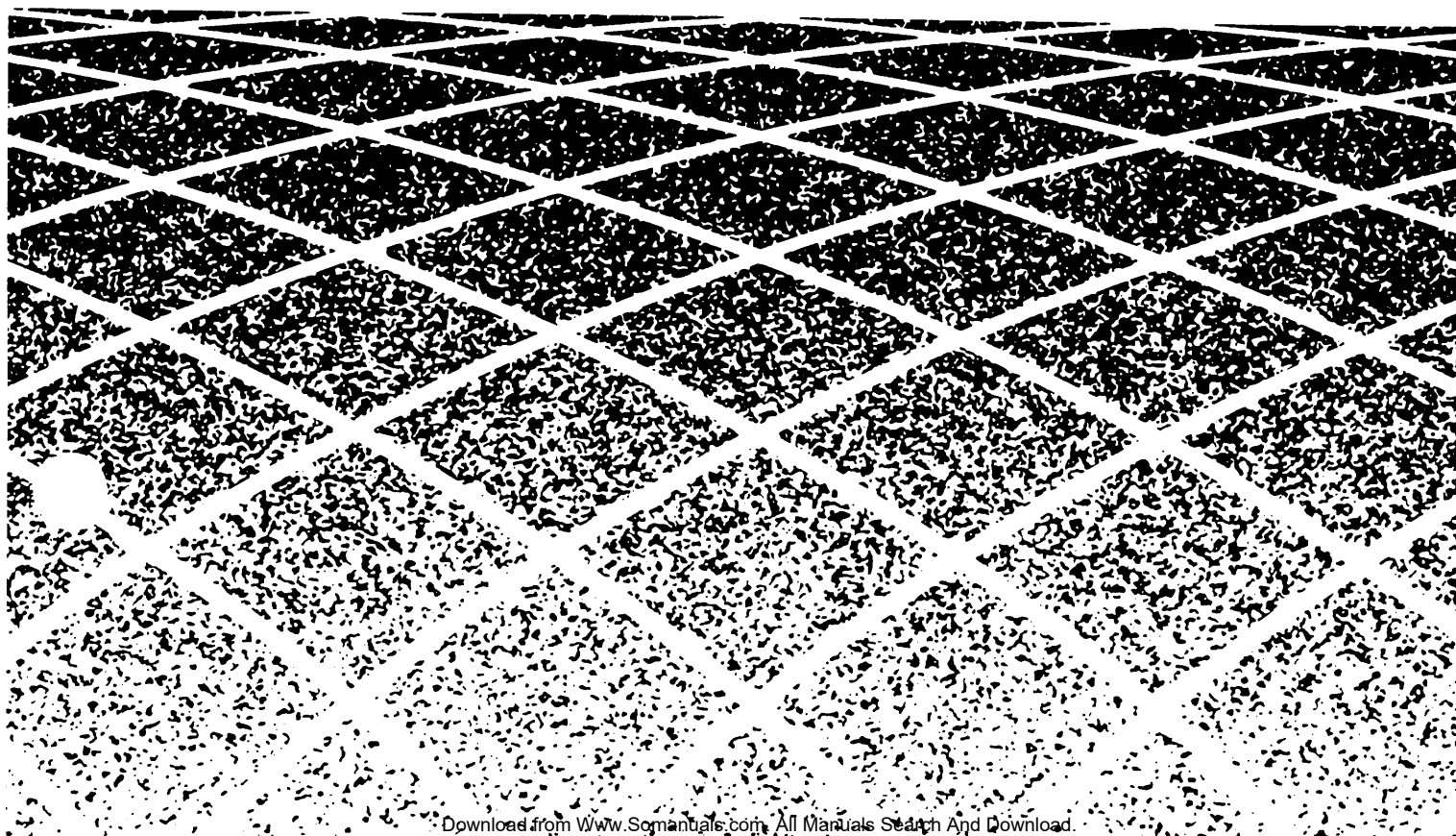




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Issue 1
October 1992

MERLIN LEGEND™ Communications System Release 2.0

Installation Section



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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 les limites applicable aux appareils numériques de la class A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

Trademarks

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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 (511A) 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

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 les limites applicable aux appareils numériques de la class A prescrites dans le reglement sur le brouillage radioélectrique edicté par le ministère des Communications du Canada.

FCC Notification and Repair Information

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

- **Means of Connection.** Connection of this equipment to the telephone network shall be through a standard network interface jack: USOC RJ11C, RJ14C, 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 AS.2.
 - 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 le matériel homologué. Cette étiquette certifie que le matériel est conforme à certaines normes de protection, d'exploitation et de sécurité des réseaux de télécommunications. Le Ministère n'assure toutefois pas que le matériel fonctionnera à la satisfaction de l'utilisateur.

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

L'abonné ne doit pas oublier qu'il est possible que la conformité aux conditions énoncées ci-dessus n'empêchent pas la dégradation du service dans certaines situations. Actuellement, les entreprises de télécommunication ne permettent pas que l'on raccorde leur matériel à des jacks d'abonné, sauf dans les cas précis prévus par les tarifs particuliers de ces entreprises.

Les réparations de matériel homologué doivent être effectuées par un centre d'entretien canadien autorisé désigné par le fournisseur. La compagnie de télécommunications peut demander à l'utilisateur de débrancher un appareil à la suite de réparations ou de modifications effectuées par l'utilisateur ou à cause de mauvais fonctionnement.

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


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

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

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


**MERLIN LEGEND D.O.C.
Location Label Placement**

**Ministère des Communications
du Canada emplacement de
l'étiquette**




MERLIN LEGEND

Model 511A Control Unit



MADE IN U.S.A.



TELEPHONE
EQUIPMENT

LR 54200

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

Complies with Part 68, FCC Rules. See the System Reference Manual for proper FCC Classification.
 FCC Reg. Nos. MF: AS593M-72682-MF-E
 KE: AS593M-72914-KE-E
 PF: AS5USA-65646-PF-E
 REN: 1.5A

WARNING: If equipment is used for out-of-building applications, approved secondary protectors are required. See Installation Manual.

AVERTISSEMENT: Si l'équipement est utilisé pour des applications extérieures, l'installation d'un protecteur secondaire est requise. Voir le manuel d'installation.

CANADA

DR ID

Use only AT&T manufactured MERLIN LEGEND circuit modules, carrier assemblies, and power units, as specified in the Installation Manual, in this product. There are no user serviceable parts inside. Contact your authorized agent for service and repair.

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

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

Use only AT&T manufactured MERLIN LEGEND circuit modules, carrier assemblies, and power units, as specified in the Installation Manual, in this product. There are no user serviceable parts inside. Contact your authorized agent for service and repair.

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

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

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.

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 *Installation* guide contains information on installing and upgrading the MERLIN LEGEND™ Communications System.

Intended Audience

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

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 Communications System family of documentation. These documents are listed by their abbreviated titles. For example, *MERLIN LEGEND, Release 2.0 Communications System Installation* is referred to as *installation*.

To order these books, call the Customer Information Center (CIC). Check the inside front cover for the telephone number.

NOTE:

For any application that runs on the 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.

<u>Document No.</u>	<u>Title</u>
	System Documents
555-620-114	<i>System Overview</i>
555-620-110	<i>Feature Reference</i>
555-620-115	<i>Equipment and Operations Reference</i>
555-620-116	<i>Pocket Reference</i>
555-620-111	<i>System Programming</i>
555-620-112	<i>System Planning</i>
555-620-113	<i>System Planning Forms</i>
	Telephone User Support
555-620-122	<i>MLX-10D™, MLX-28D™, and MLX-20L™ Display Telephones User's Guide</i>
555-620-123	<i>MLX-10D, MLX-28D, and MLX-20L Display Telephones Quick Reference</i>
555-620-150	<i>MLX-10D Telephone Tray Cards (6 cards)</i>
555-620-152	<i>MLX-28D and MLX-20L Telephone Tray Cards (5 cards)</i>
555-620-124	<i>MLX-10™ Non-Display Telephone User's Guide</i>
555-620-125	<i>MLX-10 Non-Display Telephone Quick Reference</i>
555-620-151	<i>MLX-10 (non-display) Telephone Tray Cards (6 cards)</i>

Document No.	Title
555-620-120	<i>Analog Multiline Telephones User's Guide</i>
555-620-121	<i>Analog Multiline Telephones Quick Reference</i>
555-620-128	<i>MLC-5 Cordless Telephone Quick Reference</i>
555-620-126	<i>Single-Line Telephones User's Guide</i>
555-620-127	<i>Single-Line Telephones Quick Reference</i>
	System Operator Support
555-620-134	<i>MLX Direct-Line Consoles Operator's Guide</i>
555-620-135	<i>MLX Direct-Line Consoles Quick Reference</i>
555-620-132	<i>Analog Direct-Line Consoles Operator's Guide</i>
555-620-133	<i>Analog Direct-Line Consoles Quick Reference</i>
555-620-136	<i>MLX Queued Call Console Operator's Guide</i>
555-620-137	<i>MLX Queued Call Console Quick Reference</i>
	Miscellaneous User Support
555-620-130	<i>Calling Group Supervisor's Guide</i>
555-620-131	<i>Calling Group Supervisor's Quick Reference</i>
555-620-129	<i>Data User's Guide</i>
	Documentation for Qualified Technicians
555-620-140	<i>Installation, Programming, & Maintenance (IP&M) Binder</i> (consists of 555-620-141, 555-620-142, 555-620-143, and 555-620-144)
555-620-141	<i>Installation</i>
555-620-142	<i>System Programming & Maintenance (SPM)</i>
555-620-143	<i>Maintenance and Troubleshooting</i>
555-620-144	<i>Programming Summary</i>

How to Comment on This Document

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

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

A. Sherwood
AT&T
99 Jefferson Road
Room 2A25
Parsippany, NJ 07054

Introduction to Installation

1

Installation of the MERLIN LEGEND Communications System, involves the following:

- installing the control unit
- installing the telephones
- connecting the system wiring
- installing optional equipment

Optional equipment, such as a data module, printer, and various adjuncts may be connected to the control unit. This chapter provides an overview of the entire installation process, which varies from customer to customer.

Overview of the Installation Process

The following is a comprehensive list of everything that the system could include. When installing your customer's system, try to adhere to this order as much as possible.

1. Install the control unit (required).
See Chapter 2.
2. Connect power accessories to the control unit (optional).
See Chapter 2.
3. Install the telephones (required) and adjuncts (optional).
See Chapter 3.
4. Connect the telephones to the control unit (required).
See Chapter 3.
5. Connect the control unit to the network interface (required).
See Chapter 4.
6. Connect the channel service unit to the 100D module on the control unit (required only with the 100D module).
See Chapter 4.
7. Connect the printer and PC to the control unit (optional).
See Chapter 5.
8. Connect data equipment to the control unit (optional).
See Chapter 6.
9. Initialize and test the system (required).
See Chapter 7.
10. Install the control unit housing (required).
See Chapter 7.
11. Install applications (optional).
See Chapter 8.

Tools and Equipment

A list of required tools and equipment is provided just before each procedure throughout this guide.

System Forms

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

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

Using the System Forms

Not all of the system forms are necessary for each system.

The following sections list the forms according to the following categories:

- Installing the control unit
- Installing telephones and adjuncts
- Connecting the network interface
- Connecting data equipment
- Programming the system

Installing the Control Unit

- Form 1, System Planning (the Control Unit Diagram on the back)
- Form 3c, Incoming Trunks—Tie

Some of the procedures in Chapter 2 refer to the Control Unit Diagram, which is the second side of Form 1, System Planning.

If you are installing a 400EM module in the control unit, you need Form 3c, Incoming Trunks—Tie to determine the switch settings prior to installing the module in the control unit.

Installing Telephones and Adjuncts

The following forms indicate the telephones and adjuncts that are to be installed, as described in Chapter 3.

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

Connecting the Network Interface

The following forms indicate the trunks that are to be connected to the control unit. Information regarding the channel service unit is indicated as well. This information is needed to perform the procedures in Chapter 4.

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

Connecting Data Equipment

The following forms indicate the data equipment needed to setup data stations and modem pools, as described in Chapter 6:

- Data Form 1a, Modem Pool—Analog to Digital
- Data Form 1b, Modem Pool—Digital to Analog
- Data Form 2a, Analog Data Station
- Data Form 2b, Digital Data Station
- Data Form 3, Data Hunt Groups

Programming the System

If you have a system programming diskette that was created using SPM, you do not need to program the system. Use that diskette to restore the system as described in Chapter 7. If you did not receive this diskette and it is your responsibility to program the system, see the *System Programming* guide for instructions. Each programming procedure indicates the appropriate form.

Upgrading the Communications System

If you are upgrading to Release 2.0 from Release 1.0, 1.1, or from the MERLIN® II Communications System, see Chapter 7 for the upgrade procedure.

NOTE:

You cannot upgrade the system software from the MERLIN II Communications System. You can upgrade only the hardware.

Installing the Control Unit

2

If you have not read Chapter 1, do so before continuing with any instructions in this chapter.

Overview

Installing the control unit involves the following, which this chapter describes in detail:

1. Installing the backboard
2. Meeting the power and grounding requirements
3. Checking the total unit load
4. Installing the basic carrier
5. Installing any expansion carriers specified for the system
6. Installing the power supply
7. Installing the processor
8. Installing the trunk/station modules

These are referred to as *modules* throughout this guide.

9. Connecting the control unit to AC power
10. Powering up the system
11. Powering down the system

Be sure to follow these procedures in the order specified.

Preparation

The control unit must be installed on a backboard, which may already be installed. If so, skip to the section, "Power and Grounding."

If backboard installation is your responsibility, follow the procedures in this section.

Environment

The placement of the control unit requires careful consideration. Make sure you install the backboard in an area that meets all of the environmental requirements listed in Table 2-1.

Table 2-1. Environmental Requirements

Operating Temperatures	40° - 104°F (4° - 40°C) Optimum temperature: 60°F (15.6°C)
Humidity	20%-80%
Airborne Contamination	Do not expose the control unit to moisture, corrosive gases, dust, chemicals, spray paint, or similar material.
Ventilation	Allow at least 1 inch (2.54 cm) on the right and left sides of the control unit and 12 inches (31 cm) above and below to prevent overheating. Do not place the control unit near extreme heat (for example: furnaces, heaters, attics, or direct sunlight).
Electrical Fields	Do not expose the control unit to devices that generate electrical currents causing interference (such as arc welders or motors).
Heat Dissipation	Basic carrier: 500 BTU/hr Basic carrier with one expansion carrier: 1000 BTU/hr Basic carrier with two expansion carriers: 1500 BTU/hr



WARNING:

Do not install the control unit outdoors.

Electrical Noise/Radio-Frequency Interference (RFI)

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

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

Field strengths below 1.0 volt per meter are unlikely to cause interference. The field strength produced by radio transmitters can be estimated by dividing the square root of the emitted power in kilowatts by the distance from the antenna in kilometers. This yields the approximate field strength in volts per meter and is relatively accurate for distances greater than about half a wavelength (492 ft, or 150 m, for a frequency of 1000 Hz). See the Customer Support Information in the beginning of this guide for FCC Part 15 radio frequency regulations.

Control Unit Requirements

■ Dimensions

- Basic carrier: 14" W x 23" H x 12" D
- Basic carrier and one expansion carrier:
25" W x 23" H x 12" D
- Basic carrier and two expansion carriers:
37" W x 23" H x 12" D

■ Location

- Within 5 ft (152 cm) of AC power outlet that is not switch-controlled
- Within 25 ft (762 cm) of the network interface—or use an off-premises range extender (OPRE)
- Within 1000 cable feet (305 m) of telephones— or use an OPRE (for basic telephones)

Backboard Requirements

The backboard should be wide enough to accommodate additional carriers if system growth is anticipated. In addition to the basic carrier, two expansion carriers can be added.

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

- **Dimensions**

- with SYSTIMAX wiring: 7' W x 4' H x 3/4" D
- without SYSTIMAX wiring: 6' W x 3' H x 3/4" D

- **Material**

- 3/4" plywood
- Check with local building code enforcement agency to see if fire-retardant material is required.
- Make sure that the material meets local building code requirements.

Installing the Backboard

When you are certain that the backboard and its location meet the requirements indicated in this section, attach the backboard to the wall, allowing enough room on either side of the control unit for necessary wiring fields and future addition of expansion carriers.

Use the following mounting hardware:

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

NOTE:

The combined pullout force of the backboard should be at least 650 pounds (295 kilograms).

Power and Grounding

Proper power and grounding are essential for correct and safe functioning of the system.

Use this section to verify that all power and grounding requirements are met.

⚠ CAUTION:

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

- The load center of appropriate current rating must be equipped with circuit breaker(s) labeled 120 VAC, 15 amps.
- Each breaker must protect one dedicated quad AC outlet or two dedicated duplex AC outlets.
- All AC outlets must be connected to the same load center and must have the ground wire connected to the single-point ground bar on the first AC outlet (see Figure 2-1).
- One outlet must have an attached ground bar connected by a #6 AWG copper wire to an approved ground. This ground bar is the system's single-point ground (see Figure 2-1).

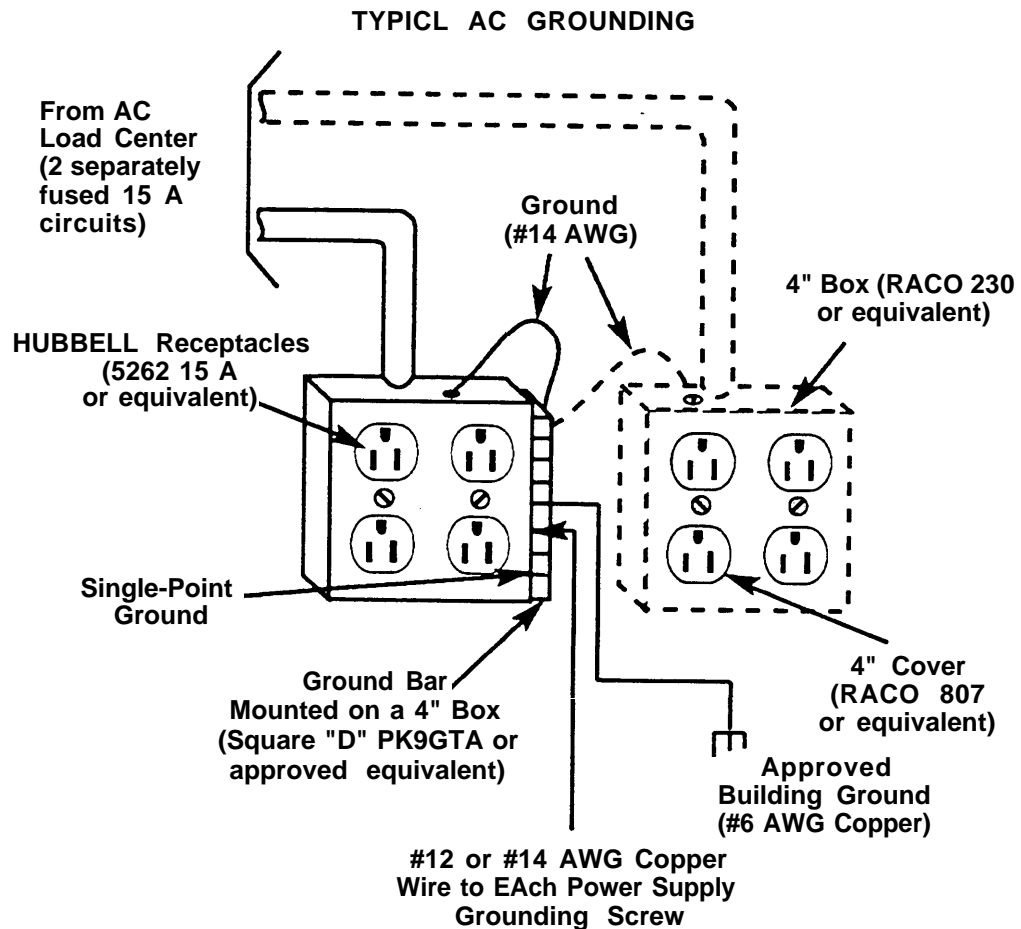


Figure 2-1. AC Grounding Requirements

- Each carrier requires one outlet receptacle.
- Additional AC outlets may be required for auxiliary equipment.
- If a printer or a PC is to be installed with the system, it must be plugged into the same AC branch as the power supply of the basic carrier.

If the printer or PC is 50 ft (15 m) or more from the control unit or is plugged into a different AC circuit, asynchronous data units (ADUs) must be installed as well. Complete installation instructions are provided in Chapter 5.

- The AC power requirements indicated in the next section, “AC Outlet Tests” must be met.



CAUTION:

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

AC Outlet Tests

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

Table 2-2. AC Power Requirements

Parameter	Value	Unit
Nominal voltage	117	VAC
Voltage range	110-125	VAC
Frequency	60±5%	Hz
Maximum current	3 per power supply	amps
Power consumption	225 per power supply	watts

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

- open ground
- hot and neutral reversed
- open hot
- open neutral
- hot and ground reversed



WARNING:

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

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

1. Plug the circuit tester -into the outlet to be tested.
If the circuit is properly grounded, the yellow and white lights on the tester turn on.
2. Unplug the circuit tester.

Using a Volt-Ohm Milliammeter (VOM)

1. Set the VOM to the scale on which you can read 130 VAC.
2. Measure the AC outlet voltages (see Figure 2-2).

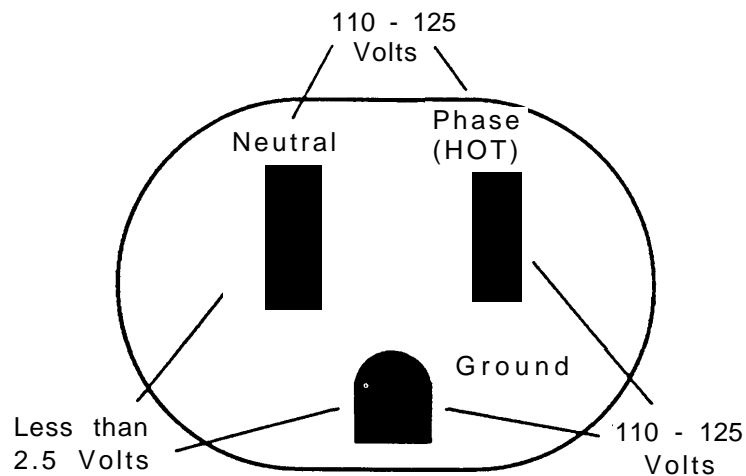


Figure 2-2. Measuring the AC Outlet Voltages

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



WARNING:

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

Grounding Requirements

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

- lightning
- power surges
- power crosses on central office trunks
- electrostatic discharge (ESD)

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

- The control unit, the central office trunk protector, and the AC power service panel should be as close to each other as possible.
- Because equipment can be located throughout a building, the National Electrical Code requires that the ground point for the central office trunk protector be bonded to the AC power ground as shown in Figure 2-3.
- The AC outlet and the single-point ground bar must be properly grounded as shown earlier in Figure 2-1.
- Each power supply in the control unit must be connected to the single-point ground bar by a #12 AWG or a #14 AWG solid copper wire. Figures 2-1 and 2-3 show this connection.

This wire run should be as short as possible, preferably within 5 ft (152 cm), not to exceed 10 ft (305 cm). This procedure is described later in this chapter under “Providing the Proper Grounding.”

- The AC outlet must be connected to the 147A protector with #12 AWG or a #14 AWG solid copper wire.

Installing the Control Unit

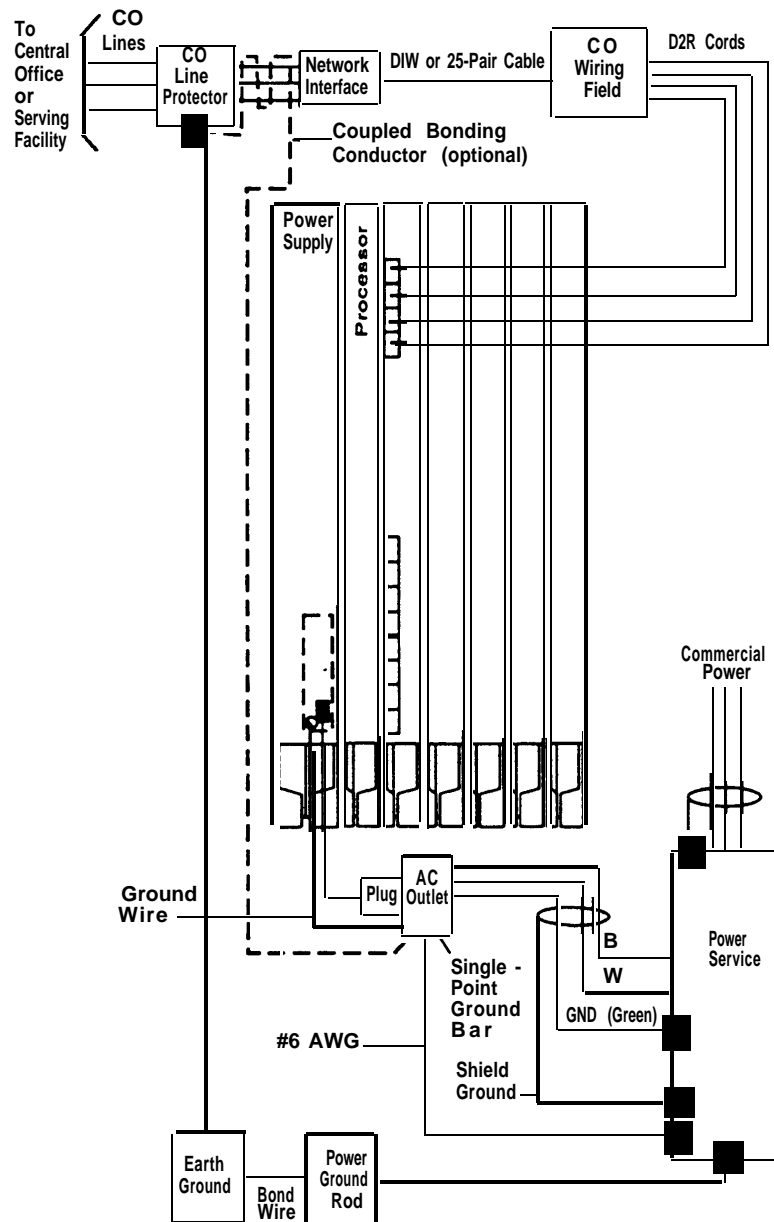


Figure 2-3. Central Office and AC Grounds



WARNING:

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

Approved Grounds

The following is a list of approved grounds, starting with the most preferred:

- building steel
- acceptable water pipe—must be a metal, underground water pipe at least ½-inch (30.4 cm) in diameter, and in direct contact with the earth for at least 10 ft (3 m).

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

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

- other local metal underground systems or structures—local underground structures such as tanks and piping systems
- rod and pipe electrodes—a 5/8 -inch (1.6-cm) solid rod or ¾-inch (1.9-cm) conduit or pipe electrode driven to a minimum depth of 8 ft (244 cm)
- plate electrode—a minimum of 2 square ft (61 square cm) of metallic surface exposed to the exterior soil

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



WARNING:

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

Central Office Trunk Protection

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

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



CAUTION:

Check these requirements with a simple, visual inspection; if you cannot verify that the central office grounding requirements are met, contact the central office. Do not connect the central office trunks until you are certain that these requirements are met.

Heavy Lightning Protection

For most surges, adequate protection is provided by meeting the requirements listed in the previous section, "Grounding Requirements."

Additional protection is required when the customer is located in a heavy lightning area:

Connect a 147A protector to the system to limit surges from the AC lines and central office trunks.

One 147A protector provides protection for four central office trunks.

- Connect a 146A protector to the 147A to provide protection for another four trunks.

You can connect as many as three 146A protectors to a 147A, which allows a maximum of 16 central office trunks on one 147A protector.

- For more than 16 trunks, add another 147A protector and continue adding 146As as needed.

See Table 2-3 for various configurations.

See Figure 2-4 for a typical 147A protector installation.

Table 2-3. Heavy Lightning Protection

If you have this number of central office trunks . . .	Connect these protectors
1-4	147A
5-8	147A and a 146A
9-12	147A and two 146As
13-16	147A and three 146As
17-20	Two 147As and three 146As See the note below.
21-24	Two 147As and four 146As See the note below.

NOTE:

When you use the additional 147A, you can connect the 146As in any combination, up to a maximum of three 146As per 147A. For example, if you have only enough wall space for two 146As and a 147A, put two 146As with the first 147A, and then put the third 146A with the additional 147A.

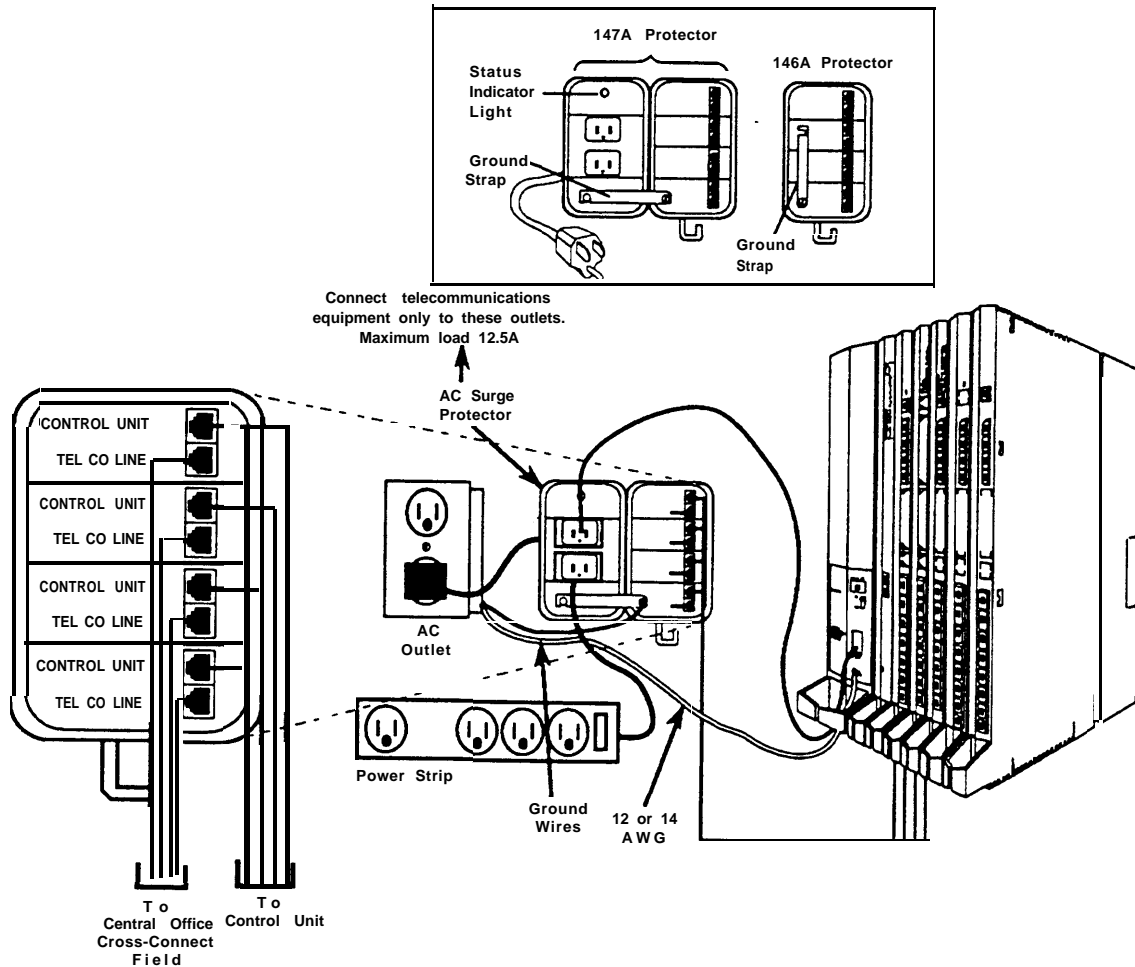


Figure 2-4. Installing 146A and 147A Protectors

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

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 in the unit load calculation.

- 800 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 800 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 391A1) generally supports six modules of any type in a Hybrid/PBX system— without requiring an auxiliary power unit.

If, however, both of the following conditions are true, the unit loads on a carrier can exceed the 54-unit maximum, and therefore require auxiliary power:

- all six carrier slots are occupied by MLX telephone or analog multiline telephone modules

- the carrier has a total of more than 45 MLX-20L telephones or 34-button analog multiline telephones installed

Unit Loads for Key or Behind Switch Mode

In a Key or Behind Switch system with four or fewer modules, no calculation is needed. The power supply (model 391A1) generally supports four modules of any type 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.



CAUTION:

Running the system with more than 54 unit loads per carrier may not appear to do harm. However, this can cause the system to malfunction, thereby creating “no trouble found” situations, such as malfunctioning LEDs on multiline telephones, or power unit failure.

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 later in this chapter, as the fourth step under “Installing the Processor.”

Installing the Basic Carrier

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

NOTE:

If you are upgrading a system, the basic carrier (and possibly one or two expansion carriers) is already installed. Do not remove any of these carriers; skip to the next section, "Upgrading the Control Unit."

Following the instructions given below, mount the basic carrier onto the plywood, leaving 5 inches (12.7 cm) of plywood to the left. This allows easy access to the installation and removal of the system cover, while allowing enough room for system expansion (up to a total of three carriers and 5 inches (12.7 cm) of plywood to the right of the third carrier).

1. Mark the screw hole locations on the backboard using the basic carrier as a guide. See Figure 2-5.

Make sure the carrier is level before marking the holes.

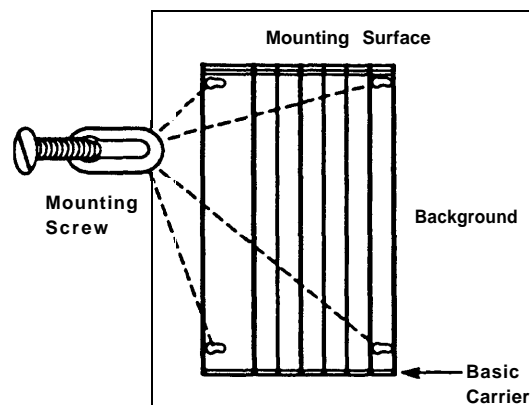


Figure 2-5. Marking the Basic Carrier Screw Holes

2. Remove the carrier from the backboard and drill a pilot hole in the center of each of the four screw-hole marks.
3. Anchor the screws approximately halfway into the backboard.
4. Place the housing clips around the molding for the screws on the back of the carrier. See Figure 2-6.

NOTE:

Install all four housing clips if the system has only one carrier.

If an expansion carrier is to be added, install the housing clips only on the left side of the basic carrier.

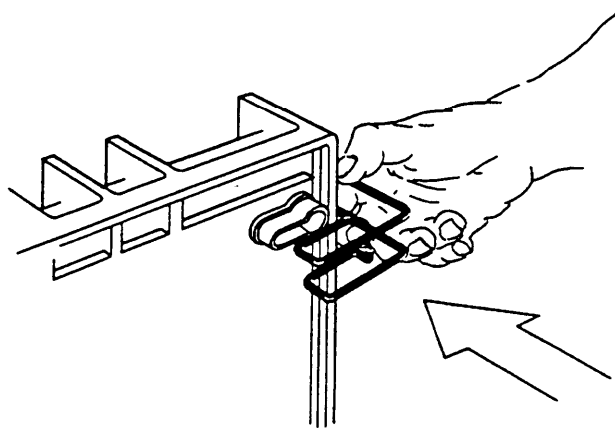


Figure 2-6. Installing the Housing Clips on the Carrier

5. Position the carrier on the screws and slide the carrier to the left.
6. Check to see that the carrier is level and that the housing clips extend as far as possible from the sides of the carrier.
7. Tighten the screws.

Upgrading the Control Unit

When upgrading, do the following:

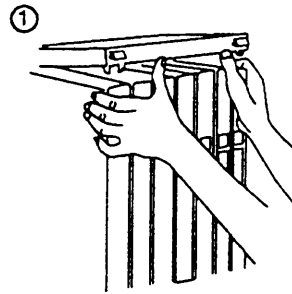
1. Remove the control unit housing:
 - a. Disconnect AC power from each auxiliary power unit at the wall outlet.
 - b. Disconnect AC power from each carrier by disconnecting the power cord at the wall outlet.
 - c. If the existing control unit is a MERLIN II Communications System, remove the housing as follows. See Figure 2-7.
 - i. 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 2-7.
 - ii. Remove the top from each carrier. in the system by pushing it straight up from the front.
 - iii. Discard the MERLIN II Communications System housing.
 - d. If the existing control unit is a MERLIN LEGEND Communications System, remove the housing as follows. See Figure 2-7.
 - i. From both sides of the control unit, pry the clips from the housing, using a screwdriver if difficult to reach.
 - ii. 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.

- iii. Do not discard the housing, unless new housing is provided. You will reassemble the housing when installation of the entire system is complete, as described in Chapter 7.

MERLIN II
Communications System



MERLIN LEGEND
Communications System

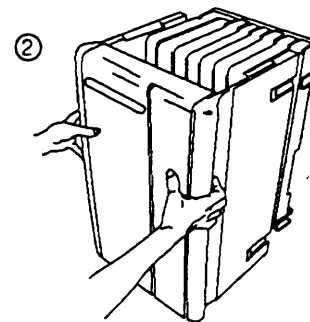
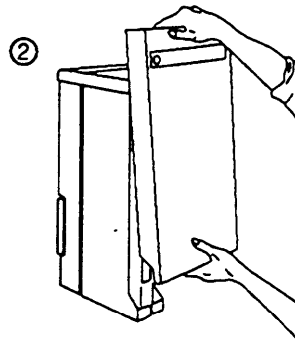
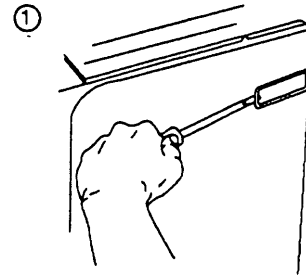


Figure 2-7. Removing the Control Unit Housing

2. Do not remove any of the existing carriers.
3. Power down the system as described later in this chapter, under "Powering Down the System."

4. See the Control Unit Diagram on Form 1, System Planning.

If you will be adding an expansion carrier, remove the rightmost module from the control unit and put it aside.



CAUTION:

If you remove the cords from the module, make sure they are labeled first.

5. If housing clips are already installed on the existing control unit, remove them:
 - a. Remove the rightmost module from the control unit. See “Removing a Module” later in this chapter for instructions.
 - b. Using a flat-blade screwdriver, unscrew the upper-right corner of the carrier only far enough to free the clip.
 - c. Pull the top-right corner of the carrier toward you while grasping the housing clip and pushing it away from you (to free it from the carrier).

When the clip is free enough to clear the screw molding on the back of the carrier, slide the clip out and discard it.

- d. Compare the Control Unit Diagram with the existing control unit.

If you will be installing an additional expansion carrier in this upgrade, do not replace the clip on the right side until the last expansion carrier is installed. If no more carriers are to be installed, replace the clip now, making sure the clip is as far to the right as possible.
- e. Secure the screw, and then repeat Steps b, c, and d for the lower-right corner of the carrier.

6. Remove the power supply as follows:
 - a. Press upon the tab at the bottom rear of the power supply.
 - b. While the tab is unlocked, pull the power supply towards you, and then lift it straight up.



WARNING:

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

7. Remove the clips from the left side of the control unit in the same way; however, make sure you replace the clips before securing the screws again.
8. If not already installed, install the new clips on the left side of the control unit:
 - a. Using a flat-blade screwdriver, unscrew the upper-left corner of the carrier only enough to slide a new clip behind the screw molding on the back of the carrier.
 - b. With the clip in place, secure the screw, making sure the clip is as far to the left as possible.
 - c. Repeat Steps a and b for the lower-left corner.
9. Reinstall the power supply by hooking it onto the rod at the top of the carrier, and then swinging it down into place.
10. Push the power supply firmly until you hear it lock.
11. To install any expansion carriers, see the next section, "Installing Expansion Carriers."
12. To install or replace any modules, see "Installing the Modules," later in this chapter.

Installing Expansion Carriers

If one or more expansion carriers is indicated for the system, follow this procedure to mount each one (see Figure 2-8).

1. If you are adding an expansion carrier to an existing system, see the previous section before continuing.
2. Locate the breakaway plastic tab on the right side of the previously mounted carrier. Using a flat-blade screwdriver, gently pry the tab open to expose the card extenders and connectors on the carriers.

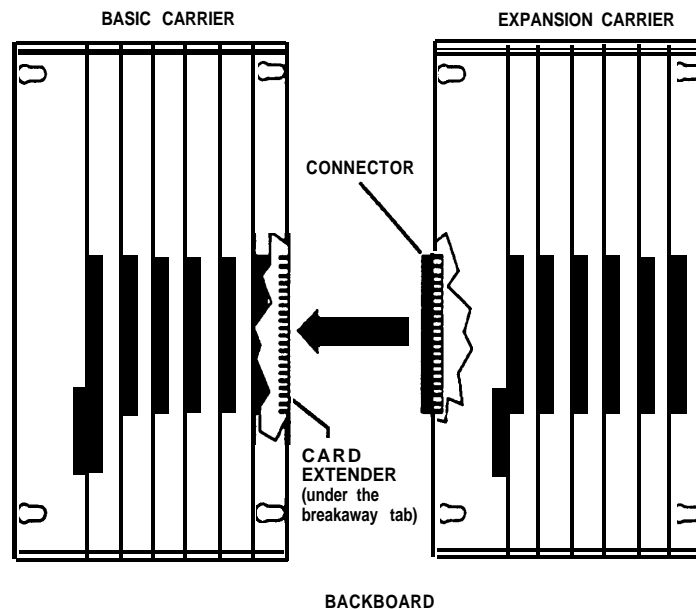


Figure 2-8. Connecting the Carriers

3. Align the connector of the expansion carrier with the card extender on the previously mounted carrier and slide the connector onto the extender.
4. Mark the screw hole locations on the backboard using the expansion carrier as a guide. Make sure the carrier is level before marking the holes.

5. Disconnect the expansion carrier connector from the previously mounted carrier and put the expansion carrier aside.
6. Drill a pilot hole in the center of each of the four screw-hole marks.
7. Anchor the screws approximately halfway into the backboard.
8. If this is the last carrier in the system, place the control unit housing clips around the right-hand molding for the screws on the back of the carrier.
If not, skip this step.
9. Position the expansion carrier on the screws and slide it to the left, thereby reconnecting the expansion carrier card extender to the previous carrier's connector.
10. Make sure the connection is secure.
11. Check to see that the carrier is level and that the housing clips extend as far as possible from the right side of the carrier.
12. Tighten the screws.

Installing the Power Supply



WARNING:

- *Do not attach any cables or power cords to the power supply until it is installed in the carrier.*
- *Do not power up the control unit until all of the modules and power equipment are installed.*

Once they are installed, follow the procedures under “Powering Up the System” later in this chapter. Failure to comply with these procedures can result in shock hazard or damage to the equipment.

- *If a ring generator is specified in the system forms (Control Unit Diagram), install it in the power supply before putting the power supply in the carrier. The detailed procedure is provided in the section “Step 2a: Installing a Ring Generator,” later in this chapter.*
- *For expansion carriers only, a copper shield must be installed on the power supply before installing it in the carrier. The detailed procedure is provided in the section, see “Step 3: Installing a Copper Shield.”*
- *To prevent damage from electrostatic discharge (ESD), avoid touching leads, connectors, pins, and other components. Use a properly grounded wrist strap.*
- *Remove the protective cover from the gold-finger connector (on the back of the power supply) before inserting it into the carrier.*

Installing the power supply can involve as many as four steps, depending on the system configuration. The following procedure includes steps that require detailed explanation. The detailed procedures for those steps immediately follow this high-level procedure.

1. Make sure all power to the control unit is turned off.

See “Step 1: Turn Off the Power.”

2. Install a ring generator in the power supply if an 012 basic telephone or 008 OPT module is connected to the same carrier. See “Step 2a: Installing a Ring Generator.”

NOTE:

Place all 012 modules and 008 OPT modules in one carrier whenever possible.

3. Add a copper-foil shield to any power supply that is to be installed in an expansion carrier. See “Step 3: Installing a Copper Shield.”
4. Install the power supply in the leftmost slot of each carrier. See “Step 4: Installing the Power Supply into the Carrier.”

Step 1: Turn off the Power

- a. Make sure that *each power supply* is turned off.
- b. Make sure all power cords and auxiliary units are disconnected.

Step 2a: Installing a Ring Generator

If a ring generator (the 129B frequency generator) is indicated on the Control Unit Diagram it must be installed in the power supply before installing the power supply into the carrier.

NOTE:

- This procedure is part of a larger procedure for installing the power supply. If you have not already read the beginning of this section, “Installing the Power Supply,” do so before continuing.
- If you are replacing a ring generator, skip to the next section, “Step 2b: Replacing a Ring Generator.”



WARNING:

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

Follow these steps to install a ring generator (see Figure 2-9 throughout this procedure):

- a. Make sure each power supply is turned off, including the module in the control unit and any auxiliary power units.
- b. 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.

- c. Remove the power supply from the carrier.
- d. Place the power supply on its left side and remove the five screws.

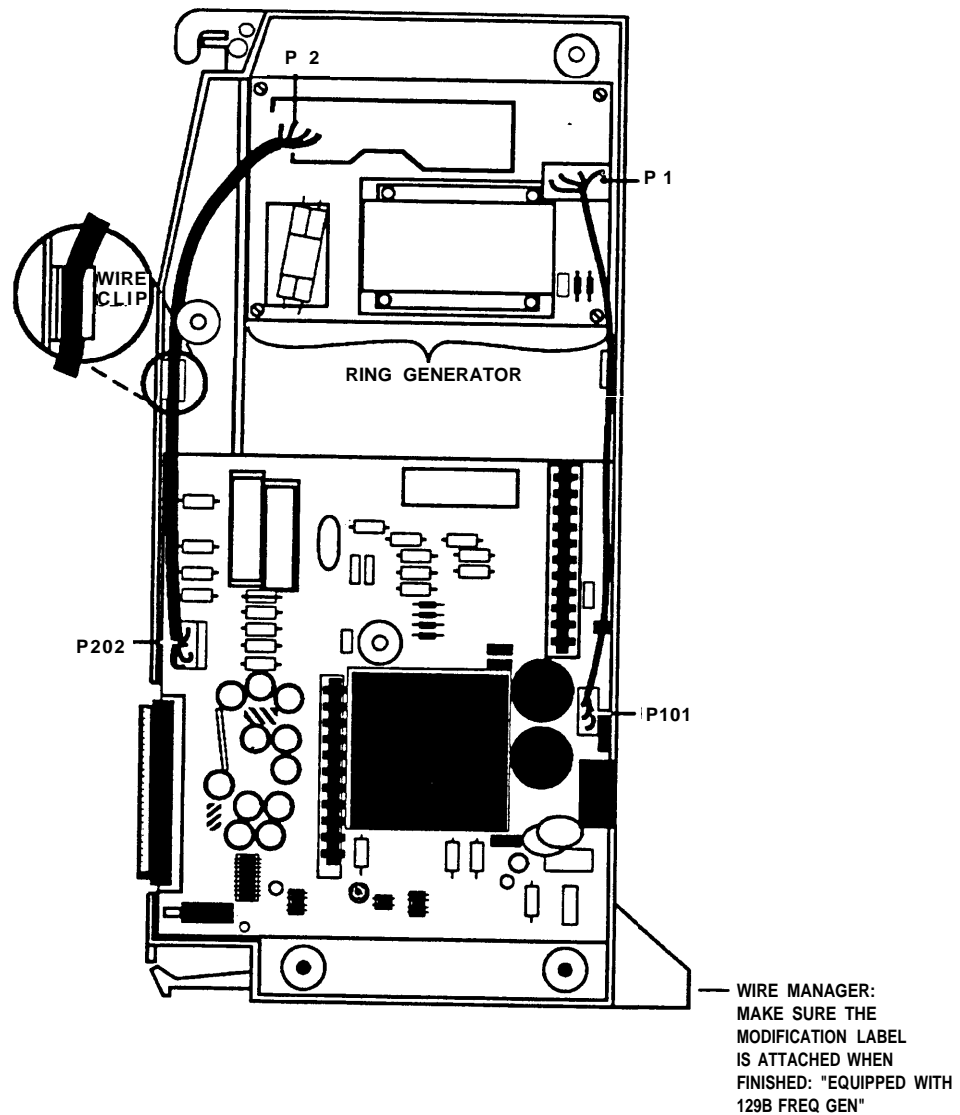


Figure 2-9. Installing a Ring Generator in the Power Supply

- e. Carefully turn the module over on its right side and then remove the top of the power supply housing.
- f. Position the ring generator as shown in Figure 2-9 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.

- g. Secure the ring generator using the four screws, one in each corner.
- h. Connect one end of the 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 cable connectors, is "keyed" so that you cannot attach it to the header if it is turned the wrong way.

- i. 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 do not cross each other.

- j. Connect one end of the 4-pin cable to the header labeled P202 on the power supply circuit board.
- k. Connect the other end of the cable to the header labeled P2 on the ring generator.
- l. Use the clips provided with the ring generator to attach the cables to the inside edge of the plastic housing.
- m. 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.

- n. Carefully, taking time to make sure the on/off faceplate stays aligned, turn the module over and replace the five screws on the housing.
- o. Fasten the modification label *Equipped with 129B Freq Gen* to the wire manager (on the front of the power supply as shown in Figure 2-9).

Step 2b: Replacing a 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 2-10 throughout this procedure):

- a. Make sure each power supply is turned off, including the module in the control unit and any auxiliary power units.
- b. 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.

- c. Remove the power supply from the carrier.
- d. Place the power supply on its left side and remove the five screws.
- e. Carefully turn the module over on its right side and then remove the top of the power supply housing.

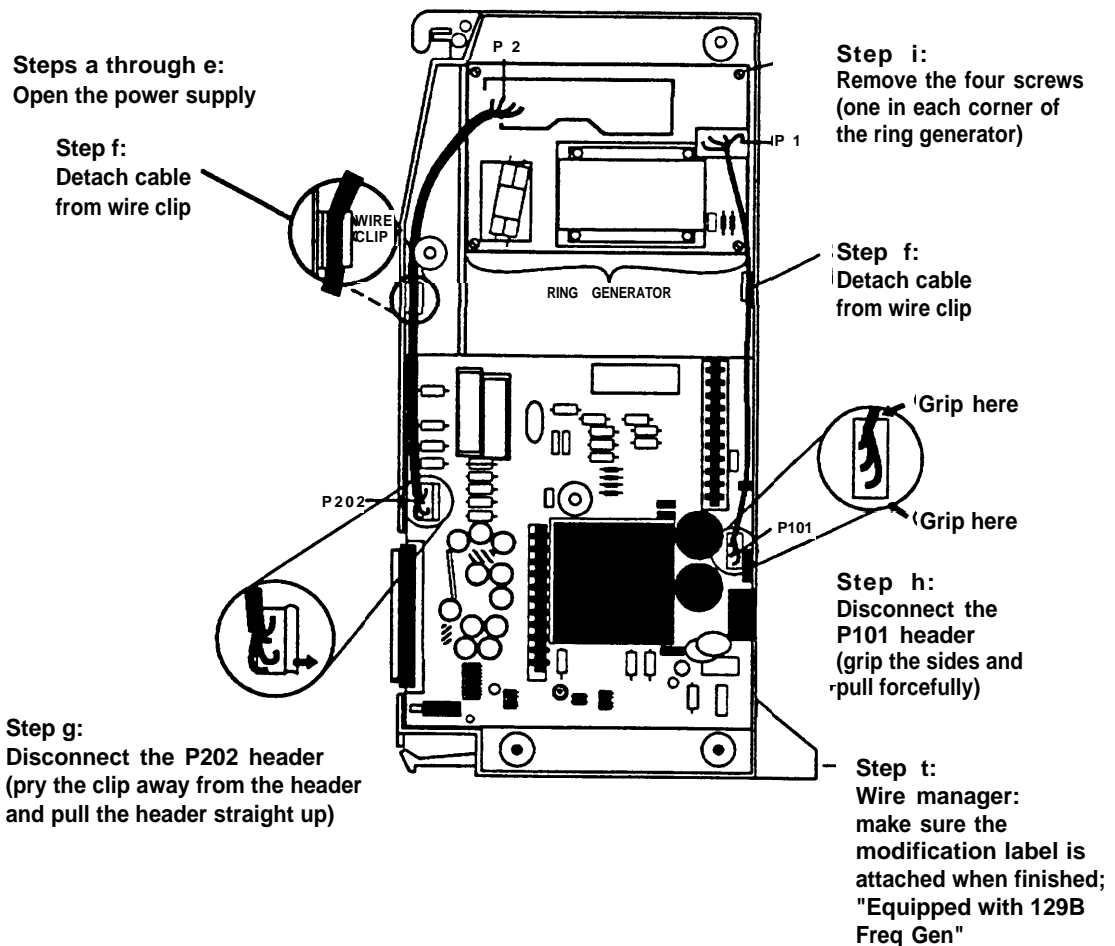


Figure 2-10. Replacing a Ring Generator

- f. Detach the cables from the inside edge of the plastic housing by removing them from the clips.

- g. Disconnect the 4-pin cable from the header labeled P202 on the left side of the power supply circuit board.

As shown in Figure 2-10, you may need to pry back the clip to free the cable.

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

As shown in Figure 2-10, you need to grip this cable firmly and pull forcefully.

- i. Remove the four screws from the ring generator as shown in Figure 2-10.

- j. Remove the ring generator.

- k. Position the replacement ring generator as shown in Figure 2-10 and align the screw holes.

Make sure the P1 header on the ring generator is on the same side of the power supply housing as the P101 header on the circuit board.

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

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

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

- n. 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.

- o. Connect one end of the new 4-pin cable to the header labeled P202 on the power supply circuit board.
- p. Connect the other end of the cable to the header labeled P2 on the ring generator.
- q. Attach the cables to the clips on the inside edge of the plastic housing.
- r. 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.

- s. Carefully, taking time to make sure the on/off faceplate stays aligned, turn the module over and replace the five screws.
- t. Verify that the modification label `Equipped with 129B Freq Gen` is adhered to the wire manager (on the front of the power supply shown in Figure 2-10).
If not, adhere the label supplied with the new ring generator.
- u. 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.
- v. Reconnect the cords to the power supply and then the auxiliary power units (if any were connected before).
- w. Connect the cord(s) to AC power when ready to power up the system.

Step 3: Installing a Copper Shield

Each expansion carrier requires a power supply.

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

See Figure 2-11.

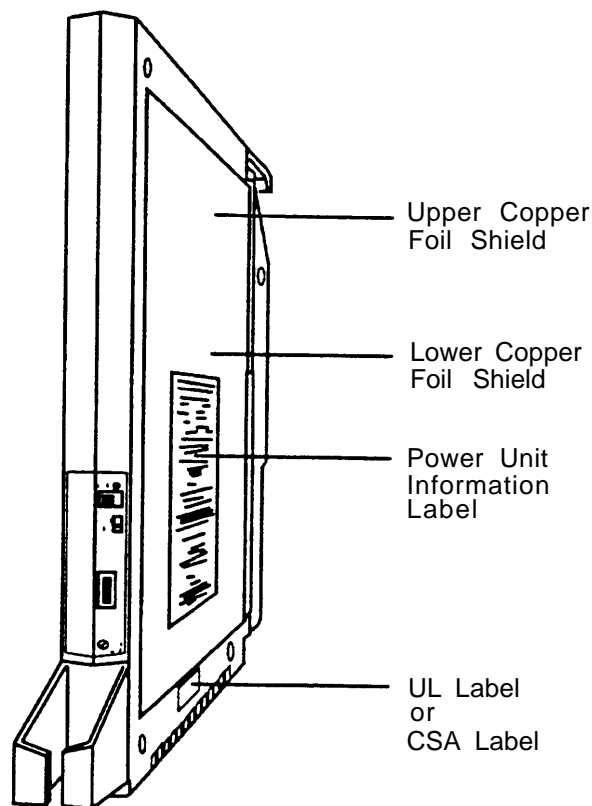


Figure 2-11. Installing a Copper Shield in the Power Supply

NOTE:

This procedure is part of a larger procedure for installing the power supply. If you have not already read the beginning of this section, "Installing the Power Supply," do so before continuing.

- a. Make sure all power is off as indicated in the beginning of this section, "Installing the Power Supply."
- b. Lay the power supply on a flat surface with the right side up (as viewed from the front edge).
- c. Wipe the module free of any dust or dirt.
- d. Peel the backing paper from the smaller copper-foil shield to expose the adhesive.

NOTE:

Check the position of the foil shield before sticking it to the side of the module. Once in place, the foil is difficult to remove.

- e. Position the foil on the upper part of the module. Work out any air bubbles as you press the foil firmly in place.
- f. Peel the backing paper from the larger copper-foil shield to expose its adhesive.
- g. Position the foil on the lower part of the module.
 - The shields should meet.
 - They should not overlap or have any space between them.
 - Tuck the foil shield tightly along the ledge (or crease) of the housing. Work out any air bubbles as you press the foil firmly in place.
- h. With the copper-foil shield in place, put the power unit information label on the lower piece of foil.
- i. Attach the UL or CSA label on the power supply below the copper-foil shield.

Step 4: Installing the Power Supply into the Carrier

- a. Lower the module hook onto the rod.
- b. Make sure the connector on the module mates properly with the connector on the carrier.
- c. Push the module into the carrier until it locks into place.



CAUTION:

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

Installing the Processor

Installing the processor requires the following steps:

1. If *both* of the following conditions are true, open the processor and modify the board as indicated in “Step 1: Modifying the Processor for Key Mode.”
 - Form 1, System Planning, indicates Key mode
 - Form 2c, System Numbering—Trunk Jacks, does not have *any* GS trunks indicated in the `Incoming Trunk Type` column

NOTE:

On initialization of a Release 1.0 system, all loop-start and ground-start trunks default to loop-start. In Releases 1.1 and 2.0, if the system is programmed for Key mode, the strap is checked on initialization. If the strap is set (Key-only operation), all trunks revert to loop-start. If the strap is not set, any programmed designation of ground-start trunks is retained.

The ground-start pool never has trunks assigned to it automatically, but must be programmed after the ground-start ports are designated. In Releases 1.1 and 2.0, ground-start trunks are assigned to the ground-start pool on initialization, except in a system strapped for Key mode operation.

2. Install the feature module in the processor as indicated in “Step 2a: Installing the Feature Module.”
3. Insert the processor into the carrier as indicated in “Step 3: Installing the Processor in the Carrier.”

**CAUTION:**

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

4. Install or replace the auxiliary power unit as described in “Step 4a: Installing the Auxiliary Power Unit” or “Step 4b: Replacing an Auxiliary Power Unit.”
5. Provide the proper grounding as described in “Step 5: Providing the Proper Grounding.”

Step 1: Modifying the Processor for Key Mode

CAUTION:

- *This procedure is part of a larger procedure for installing the processor. If you have not already read the beginning of this section, “Installing the Processor,” do so before continuing.*
- *This procedure must be performed for KF registration with the FCC.*
- *This procedure prevents the system from being programmed as a Hybrid/PBX system. Do this only if the system is programmed for Key mode and GS trunks are not indicated on Form 2c, System Numbering—Trunk Jacks.*

Otherwise, skip to the next section, “Step 2a: Installing the Feature Module.”

- a. Remove the processor from its package.
- b. Put the processor on a flat surface.
- c. If the feature module is installed, remove it as indicated later, under “Step 2b: Replacing the Feature Module.”

CAUTION:

Do not touch the HDR3 header on the processor board, which is exposed when the feature module is not installed in the processor. If the HDR3 header is removed, the system programming may be deleted and have to be restored.

See Figure 2-12.

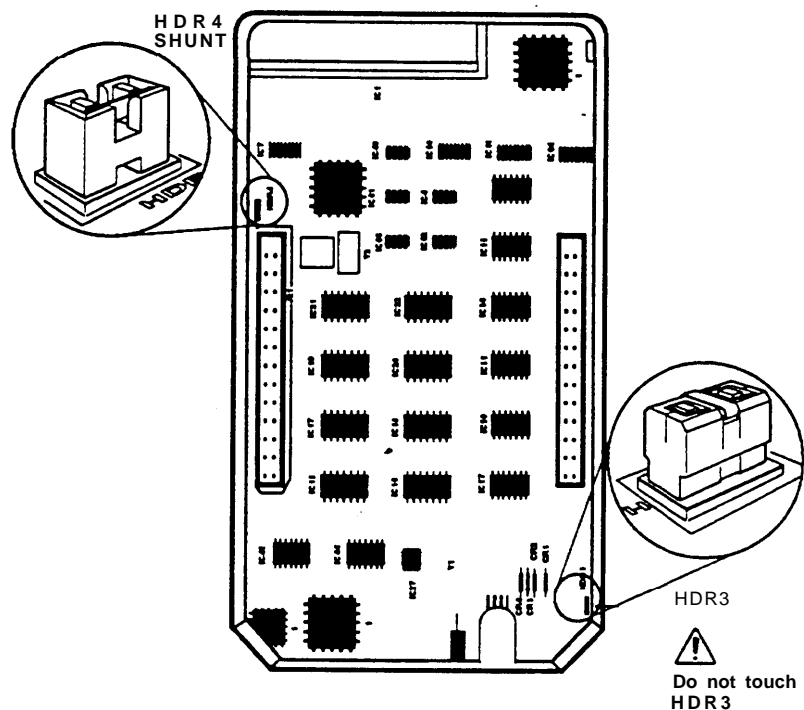


Figure 2-12. Modifying the Processor Board for Key Mode

- d. on the exposed portion of the processor board, find the header marked HDR4; it is in the upper-left area.
- e. A shunt is attached to one of the pins on the HDR4 header.
- f. Remove the shunt from the single header pin; then reinsert it so that it covers both pins on the header.
- g. Take the KF label from the Jack Numbering Labels Sheet that is packed with the feature module; fasten it to the wire manager at the base of the module.

Step 2a: Installing the Feature Module

This procedure is part of a larger procedure for installing the processor. If you have not already read the beginning of this section, "Installing the Processor," do so before continuing.

Upgrades: If you are upgrading an existing system, skip to "Step 2b: Replacing the Feature Module."

Before you install the processor in the carrier, you must install the feature module in the processor:

- a. Unpack the feature module.
- b. Fasten the round feature module label to the front of the processor housing.
- c. Put the processor on a flat surface as shown in Figure 2-13.
- d. Align the connectors on the feature module with the connectors in the processor as shown in Figure 2-13.
- e. When you are sure that the feature module is properly seated, press it firmly into place.

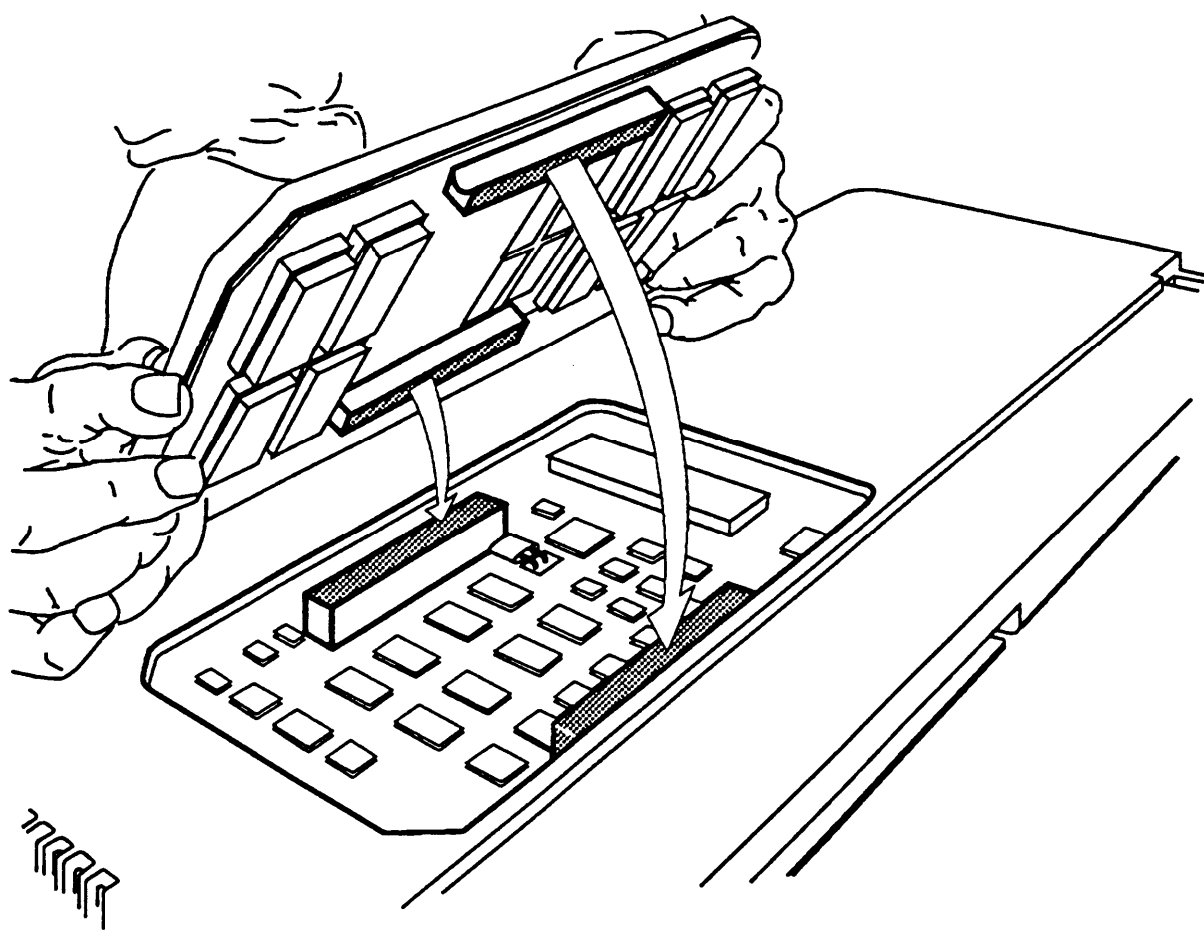


Figure 2-13. Installing the Feature Module in the Processor

Step 2b: Replacing the Feature Module

It may become necessary at some point to replace the feature module because of upgrades or malfunctions.



CAUTION:

Make sure that you have a backup of the system programming before replacing the feature module. (When the feature module is replaced, system programming is lost.) See Chapter 7 for information on the backup procedure.

Follow this procedure to replace the feature module in a fully installed system:

- a. Turn off the system (see “Powering Down the System” later in this chapter). Make sure the switch on the power supply is turned off.
- b. Remove the processor from the carrier:
 - i. Press upon the tab on the bottom-rear of the module.
 - ii. Pull the bottom of the module away from the carrier.
 - iii. Lift upward to disengage the module from the rod on the top of the carrier.
- c. Put the processor on a flat surface.
- d. Grasp *both* metal rings on the outside of the feature module and pull straight up.



CAUTION:

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

- e. Check the HDR4 header on the processor circuit board for proper mode operation (see “Step 1: Modifying the Processor for Key Mode” earlier in this chapter).
- f. Align the connectors on the new feature module with the connectors in the processor (see Figure 2-13).
- g. Firmly press the new feature module into the processor.
- h. Insert the processor back into the carrier as described in the next section, “Step 3: Installing the Processor in the Carrier.”

Step 3: Installing the Processor in the Carrier

This procedure is part of a larger procedure for installing the processor. If you have not already read the beginning of this section, “Installing the Processor,” do so before continuing.

To install the processor in the carrier, follow this procedure (see Figure 2-14).

- a. Remove the protective cover from the gold-finger connector (on the back of the processor).
- b. Lower the top of the processor onto the carrier in Slot 0 (the first slot next to the power supply).

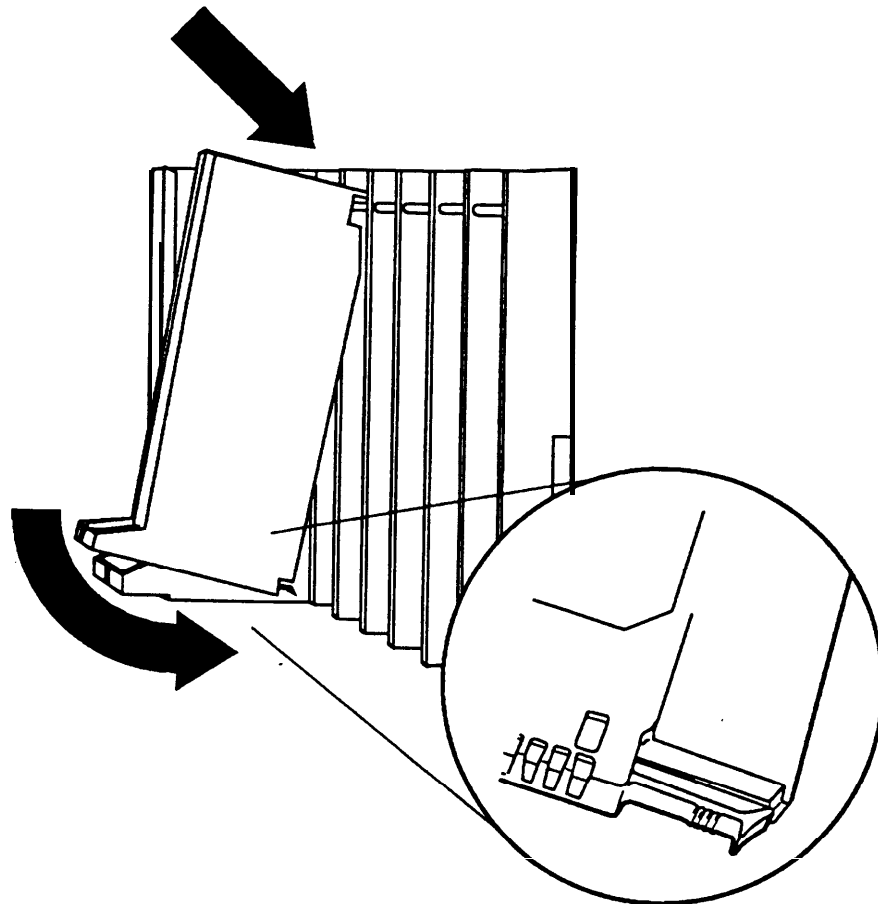


Figure 2-14. Installing the Processor into the Carrier

- c. Make sure that the connector on the module mates properly with the connector on the carrier as you swing the processor down into place.

- d. Push firmly until the processor snaps into place.

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

 **CAUTION:**

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

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

A damaged carrier or module must be replaced.

See Figure 2-14 for the bottom-rear locking tab. This tab is used on all modules.

Step 4a: Installing the Auxiliary Power Unit

The Control Unit Diagram on the back of System Form 1, System Planning, indicates whether an auxiliary power unit is required for the carrier that you are installing. (see Figure 2-15).

NOTE:

- Use the 9024 auxiliary power unit for new installations.
You can continue to use a previously installed 335A auxiliary power unit provided no new telephones or modules are added to the carrier.
- To replace an auxiliary power unit, skip to the next section, "Step 4b: Replacing an Auxiliary Power Unit."

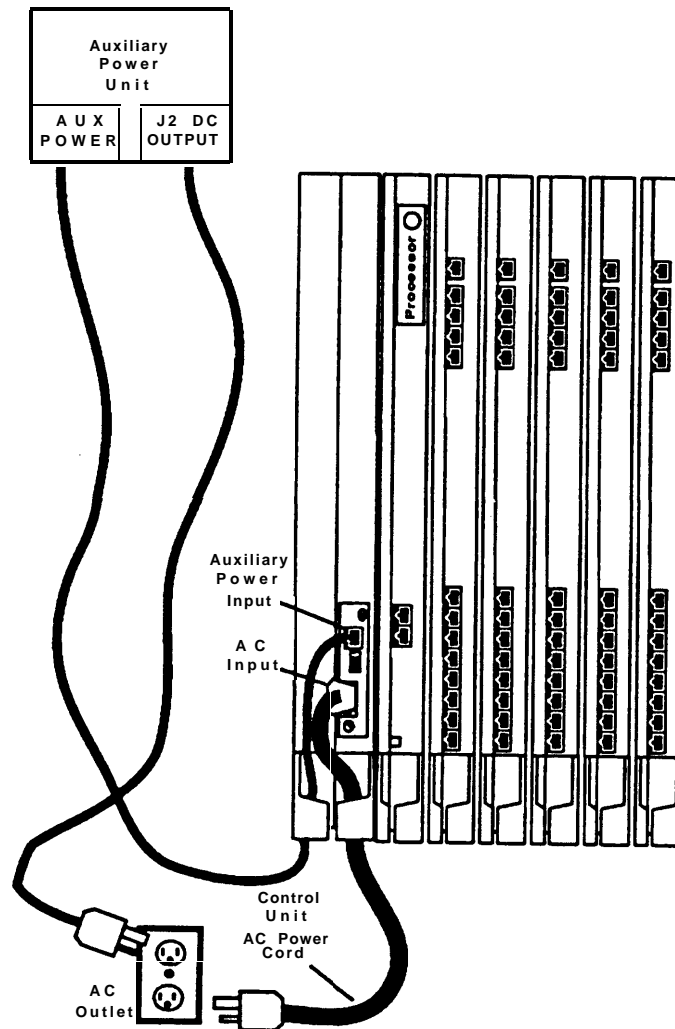


Figure 2-15. Installing an Auxiliary Power Unit

- Make sure that the switch on the power supply is turned off.
- Mount the auxiliary power unit on a surface (preferably the backboard) within 2 ft (61 cm) of the control unit.
- Connect the power unit line cord into the jack labeled **AUX POWER INPUT** on the power supply.

- d. Connect the other end of the line cord into the jack labeled J2 DC OUTPUT on the auxiliary power unit.

 **CAUTION:**

- *Do not plug the power supply or the auxiliary power unit into the AC outlet until you are ready to turn on the system, as described in “Powering Up the System” later in this chapter.*
- *If the system is backed up by an Uninterruptible Power Supply (UPS), connect the auxiliary power to the UPS.*
- *Do not attach the power cord(s) to any building surfaces.*
- *Use only the power unit line cord supplied with the auxiliary power unit. An incorrect cord will damage the power supply and may damage modules.*

Step 4b: Replacing an Auxiliary Power Unit

See Figure 2-15 throughout this procedure.

- a. Make sure that the switch on the power supply is turned off.
- b. Unplug both the power supply and the auxiliary unit from the outlet.
- c. Disconnect the cord from the jack labeled `AUX POWER INPUT` on the power supply.
- d. Remove the auxiliary power unit (with the two cords still attached).
- e. Mount the replacement auxiliary power unit in place of the old one.
- f. Connect the cord into the jack labeled `J2 DC OUTPUT` on the replacement auxiliary power unit.
- g. 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 later in this chapter under “Powering Up the System.”*
- *Do not attach the power cord(s) to any building surfaces.*

Step 5: Providing the Proper Grounding

As discussed earlier under “Power and Grounding,” the power supply on each carrier (basic and expansion) must be grounded.



WARNING:

Grounding circuit continuity is vital for safe operation. There is a risk of electric shock if the system is not properly grounded.

Follow these steps to properly ground the control unit power supplies (see Figures 2-1 and 2-3):

- a. Attach a #12 AWG or #14 AWG solid copper ground wire to the grounding screw on each power supply.
- b. Connect the other end of each ground wire to the terminals of the single-point ground bar on the AC outlet box.

Installing the Modules



CAUTION:

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

Guidelines for Installing Modules

By installing the modules as indicated on the Control Unit Diagram of Form 1, System Planning, you should meet the following guidelines:

- Do not leave empty slots between modules. The system will ignore modules installed beyond any empty slot.
- Whenever possible, place all 012 modules and 008 OPT modules in the same carrier so that the same ring generator can support them.
- Make sure you install each module in the slot assigned; if installed in the wrong slot, the system will not function properly.
- If a phantom module (a programmed empty slot) is indicated on the Control Unit Diagram, make sure the slot remains empty, and do not install any modules to the right. The system will ignore any modules installed to the right of an empty slot.

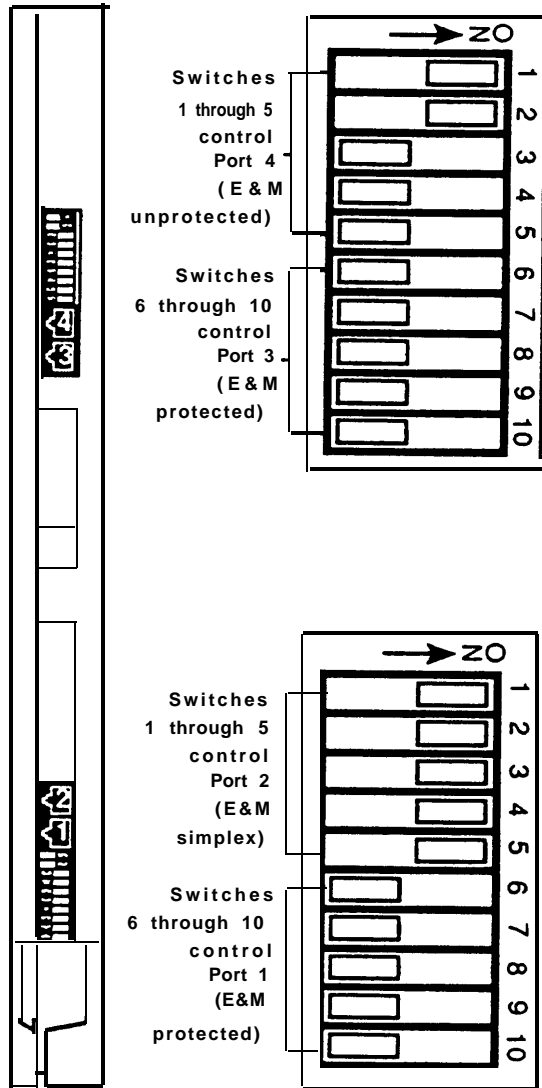


Figure 2-16. Setting the 400EM Module DIP Switches for E&M Signaling Types 1C and 5

Table 2-4. Setting the 400EM Module DIP Switches

Ports (As numbered in Figure 2-15)		DIP Switch Position	E&M Signaling Type		
			1S (Default) Unprotected - E&M Mode	1 C Protected E&M Mode	5 Simplex Mode
2	4	1	ON	OFF	NA
		2	ON	OFF	NA
		3	OFF	OFF	ON
		4	OFF	OFF	ON
		5	OFF	OFF	ON
1	3	6	ON	OFF	NA
		7	ON	OFF	NA
		8	OFF	OFF	ON
		9	OFF	OFF	ON
		10	OFF	OFF	ON

Example: If ports 1 through 4 are programmed per column 2 of Table 2-5, set the DIP switches as indicated in column 3:

Table 2-5. Sample DIP Switches for the 400EM Module

Ports	E&M Signal	Switches
1 and 2	1C	Set all switches to OFF
3 and 4	1S	Default: no action required

Procedure

See the Control Unit Diagram on the back of System Form 1, System Planning, to determine the order of modules.

Once you have installed the power supply and the processor in the basic carrier, use the remaining slots for the modules as follows:

- Basic carrier: slots 1 through 5
- First expansion carrier: slots 6 through 11
- Second expansion carrier: slots 12 through 17

Follow this procedure to install the modules, starting from Slot 1 (the first open slot next to the processor).

1. For each 400EM module trunk jack (numbered as ports 1 through 4 in Figure 2-16, check the System Planning Form 3d (Outside Trunks—Tie). If the E&M Signal column indicates 1C or 5 for a particular logical ID, set the DIP switches on the front of the 400EM module, as shown in Table 2-4 and Figure 2-14.

NOTE:

The default E&M signal, 1S, does not require any adjustments in the DIP switches.

2. Remove the protective cover from each module's gold-finger connector.
3. Lower the module onto the rod on the top of the carrier in the appropriate slot as shown in Figure 2-14.
4. Be sure that the connector on the module mates properly with the connector on the carrier.

5. Swing the module into the slot and firmly push the module into the carrier until it locks into place.



CAUTION:

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

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

A damaged carrier or module must be replaced.

6. After all modules have been installed, label all jacks with the numbered labels provided with the feature module:
 - Trunk labels: green numbers on off-white
 - Telephone labels: blue numbers on off-white

See Figure 2-17 for the locations of trunk jacks and telephone jacks on each module, and label them as described in the procedure that follows.

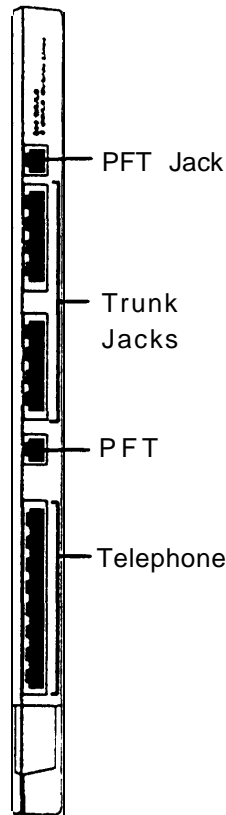


Figure 2-17. Trunk and Telephone Jacks on Each Module

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

NOTE:

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

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

 **CAUTION:**

The 008 OPT module is assigned 12 Logical IDs, and the last four numbers are not assigned to jacks. For example, if the previous module (on the left) is labeled with Logical IDs 1 through 8, label the 008 OPT jacks with Logical IDs 9 through 16. Skip numbers 17 through 20.

When you label the next module (on the right), label the first jack as Logical ID 21.

Removing a Module

Follow this procedure to remove a module:

1. Follow the procedure in the last section of this chapter, "Powering Down the System."
2. Push up firmly on the tab at the bottom rear of the module.
3. While holding up the tab, swing the bottom of the module toward you, away from the carrier.
4. Lift up the module to disengage it from the rod on the top of the carrier.

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.

For instructions on checking poorly labeled wiring, see "Checking Poorly Labeled Wiring" in Chapter 3.

3. Run a demand test by entering the test mode.
4. Remove the module as described previously, under "Removing a Module."
5. Inspect the module for visible damage.
6. Insert the new module as shown in Figure 2-14.
7. Restore the module as described in Chapter 7.
8. Plug-in the trunk and extension cords.
9. Attach a tag, error printout, and any information that will help identify any visible problems or failure symptoms.

Connecting the Control Unit to an AC Outlet

 **CAUTION:**

- *Make sure the AC outlet has been tested for proper grounding by following the procedures earlier in this chapter under “AC Outlet Tests.” The outlet should be 177-VAC, 60-Hz, 3-wire (phase, neutral, ground).*
- *To prevent someone from accidentally shutting off the power, do not connect the control unit to a switch-controlled outlet. The AC outlet should be within 5 ft (752 cm) of the control unit.*

Follow this procedure to connect the control unit to an AC outlet:

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

 **CAUTION:**

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

Powering Up the System



CAUTION:

Only when the system is completely installed, follow the procedure in this section to power up the system. Failure to comply with this procedure can result in shock hazard or damage to the equipment.

1. For each power supply and auxiliary power unit, if not already connected, connect the AC power cord to the connector marked **AC INPUT** on the power supply.
Plug the other end of the AC line cord into the AC outlet.
2. 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.
3. Turn on the power switch on the basic carrier power supply.
 - The green light on the power supply should turn on.
 - The red light on the processor should turn on for 15 to 45 seconds and then turn off.
 - All indicators on the 100D and 400EM modules (if present) should turn on and then off. They remain off when the modules are idle.
4. If any of these conditions are not met, see the *Maintenance and Troubleshooting* guide for corrective action.

Powering Down the System

During installation you may need to power down the system for troubleshooting or adding new equipment to the carrier.



CAUTION:

Follow these steps in the exact sequence.

1. Turn off the power supply on the basic carrier.
2. Turn off the power supplies on the expansion carriers.
3. Unplug any auxiliary power units.
Because the power supplies are already off, the sequence for removing auxiliary power cords is not important.
4. Unplug the system from the AC outlet.

Installing Telephones and Adjuncts

3

The control unit supports the MLX-10, MLX-10D, MLX-20L, and MLX-28D telephones as well as analog multiline and single-line telephones. When installing Multi-Function Modules (MFMs), adjuncts, and Direct Station Selectors (DSSs), follow the procedures in this chapter in the order given:

1. Install the MFMs
2. Install the adjuncts
3. Install the DSSs
4. Assemble the MLX telephones
5. Connect all telephones to the control unit

NOTE:

- To connect data equipment to the system, see Chapter 6.
- To connect the MERLIN PFC™, see Chapter 8.

Installing the Multi-Function Module

The Multi-Function Module (MFM) is an optional adapter for connecting tip/ring (T/R) or supplemental alert devices to any MLX telephone. If you are installing an MFM, do it before you install the MLX telephone.

The MFM provides a modular jack connection for the following adjuncts:

- T/R devices such as single-line telephones, fax machines, modems, credit card verification terminals, cordless telephones, and answering machines. The MLX telephone and the adjunct that is connected to the MFM are independent; they can send and receive calls at the same time. The MFM is the only T/R adapter used with the MLX telephones.
- Supplemental alerts such as bells, chimes, horns, and strobes. These alerts notify people in noisy areas of incoming calls.

The MFM is set for T/R devices or for supplemental alerts by two jumper blocks preset at the factory for T/R operation. The MFM comes with the following:

- a KS22911-L2 power supply
- a 400B or 400B2 adapter
- a D6AP cord

See Figure 3-1.

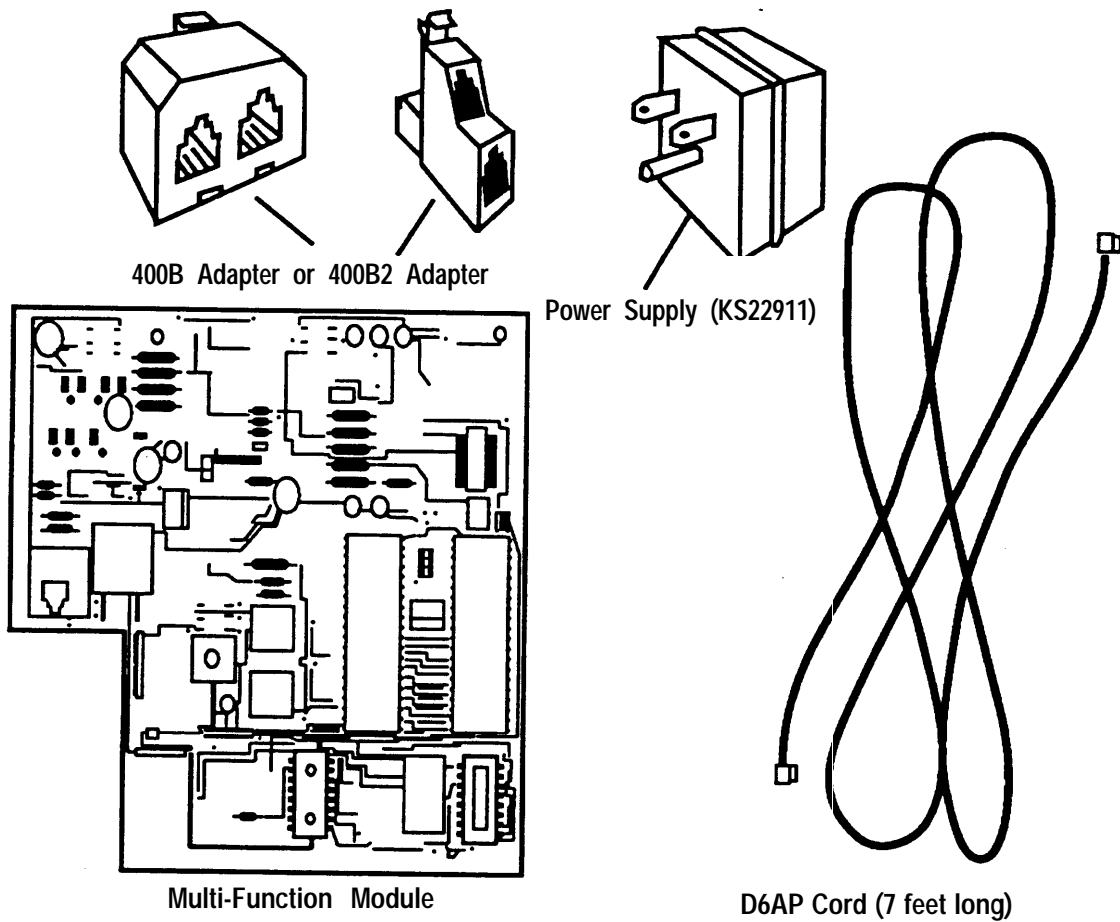


Figure 3-1. Multi-Function Module Packing List

Before installing the MFM, consider the following:

- The KS22911-L2 power supply must be connected to an electrical outlet within 50 ft (15 m) of cord length of the MLX telephone.
- If you are connecting an MFM and two DSSS to the telephone, a 329A power unit is required.
- A longer D8W telephone cord is required if the wall jack is more than 7 ft (213 cm) from the MLX telephone.

The MFM uses one of the two B-channels when it is active. This means that when an adjunct, such as a fax machine, and the MLX telephone are in use at the same time, Voice Announce to Busy is not possible. (Voice Announce to Busy is a feature that allows users to be paged on the speakerphone even if they are on a call.)

MFM Installation Procedure



WARNING:

- *ONLY a qualified technician should install, repair, or set options for an MFM.*
- *Do not touch the circuitry on the MFM. Touching the circuitry may result in component damage from electrostatic discharge.*
- *Before installing the MFM, disconnect all trunk and/or power cords attached to the MLX telephone. This is to ensure that no hazardous voltages are present during assembly. Ringing voltage from the MFM attached to the MLX telephone can cause electrical shock if adjustments are made while the cords are connected.*



RISK OF ELECTRICAL SHOCK: Follow all warnings and cautions.

Follow these steps to install and replace an MFM and change its pin settings.

1. Remove the user card tray from the bottom of the desk stand on the telephone.
2. Remove the desk stand and the module cover. See Figure 3-2:

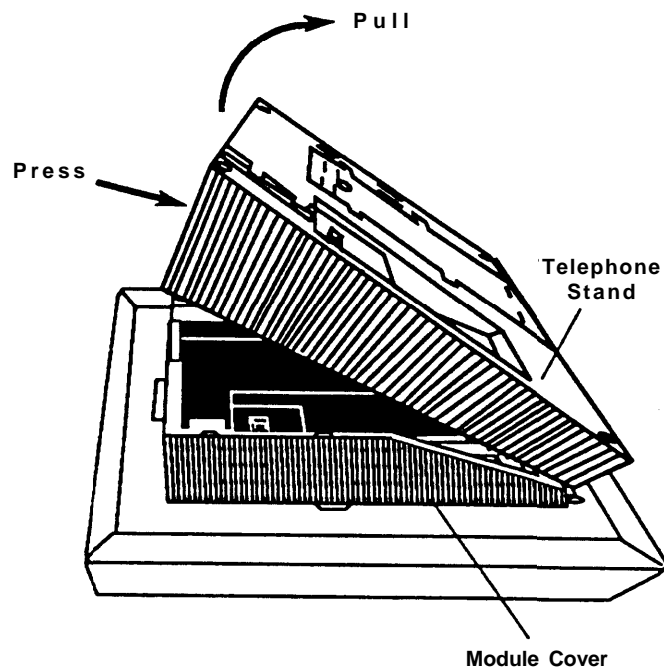


Figure 3-2. Remove Desk Stand and Module Cover

NOTE:

To install or replace an MFM in a previously wall-mounted MLX-10 or MLX-10D telephone, go to Step 2c.

- a. Place the telephone face down on a flat surface. Press on the top rear center of the stand to release the tab.
 - b. Pull the stand toward you and away from the telephone.
 - c. Use a screwdriver to remove the screw in the lower right-hand corner of the module cover.
 - d. Press the center of the right side of the module cover with one hand and lift the cover to remove it.
3. To remove an existing MFM, do the following (see Figure 3-3):
- Disconnect any cords attached to the phone, taking precautions to make sure you will reconnect them to the appropriate jacks.
 - If the telephone does not have an existing MFM, go to Step 4.
 - To reset the jumpers on an existing MFM, go to Step 5.
- a. Locate the MFM locking tabs on the top and bottom of the telephone. Spread these tabs apart to release the MFM.
 - b. Grasp the MFM by the edges and pull it toward you to free the connector pins. Do not touch the connector pins. Set the MFM aside on a clean surface.

3-6 Installing the Multi-Function Module

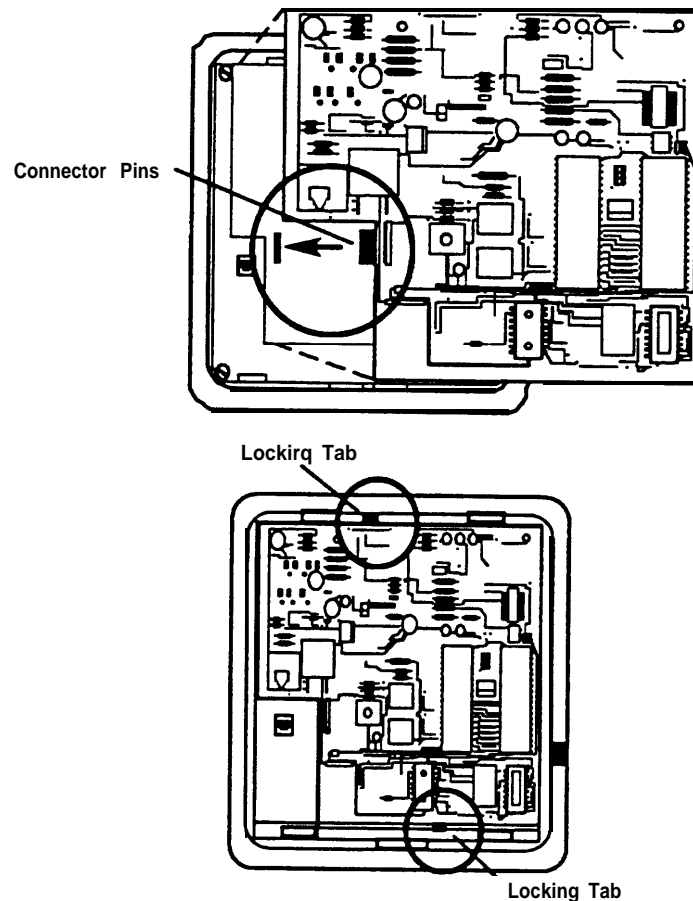


Figure 3-3. MFM Locking Tabs

4. Install a new MFM. (see Figure 3-3).
 - a. Hold the MFM circuit board by the edges with the long connector pins facing the underside of the telephone.
 - b. Taking care not to touch the connector pins, push down on the MFM board so that the connector pins are inserted into the socket in the telephone.
 - c. Press firmly to lock the tabs in place. The connector pins and tabs must be secure.

5. As needed, adjust the jumper settings for T/R operation or for a supplemental alert device (see Figure 3-4):
 - a. Pull the connectors off.
 - b. Push the connectors down over the appropriate pins.

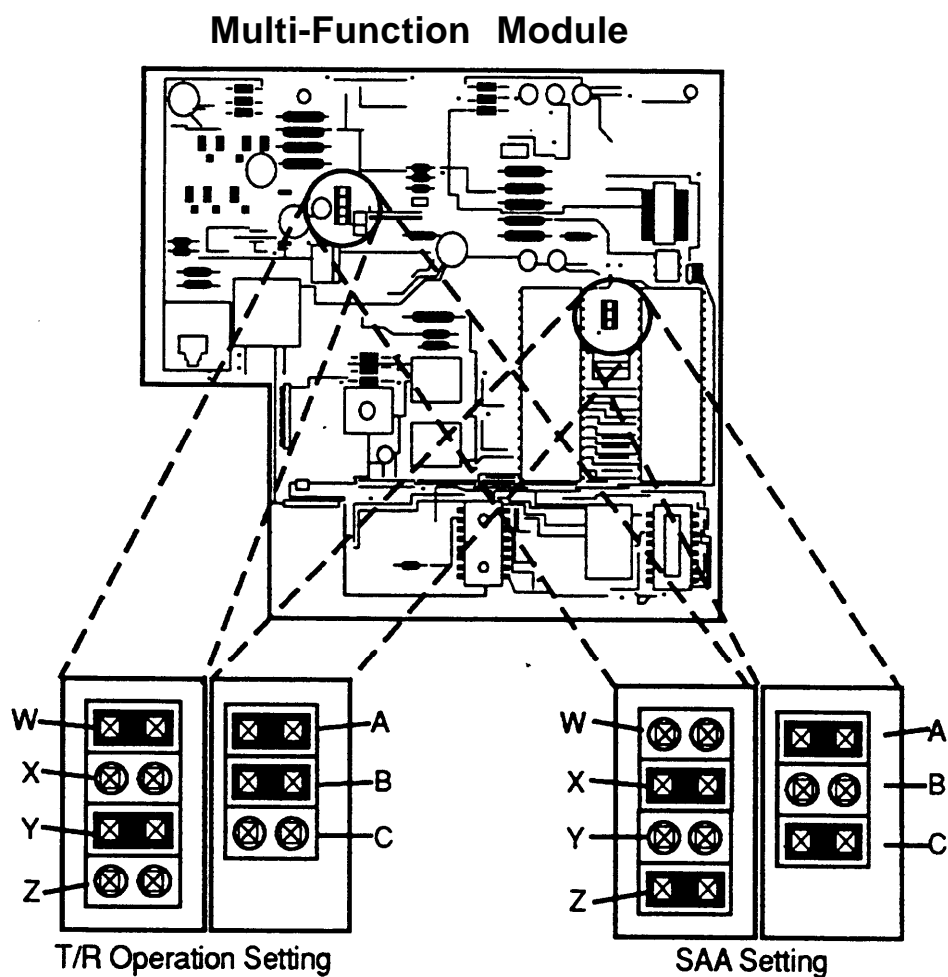


Figure 3-4. Setting the MFM Jumpers

6. Replace the module cover.
 - a. If the module cover has a square jack guard that protects the TEL/OTHER jack area, grasp and twist the guard to remove it. See Figure 3-5.

NOTE:

Save the jack guard if you are wall mounting an MLX-10 or MLX-10D telephone.

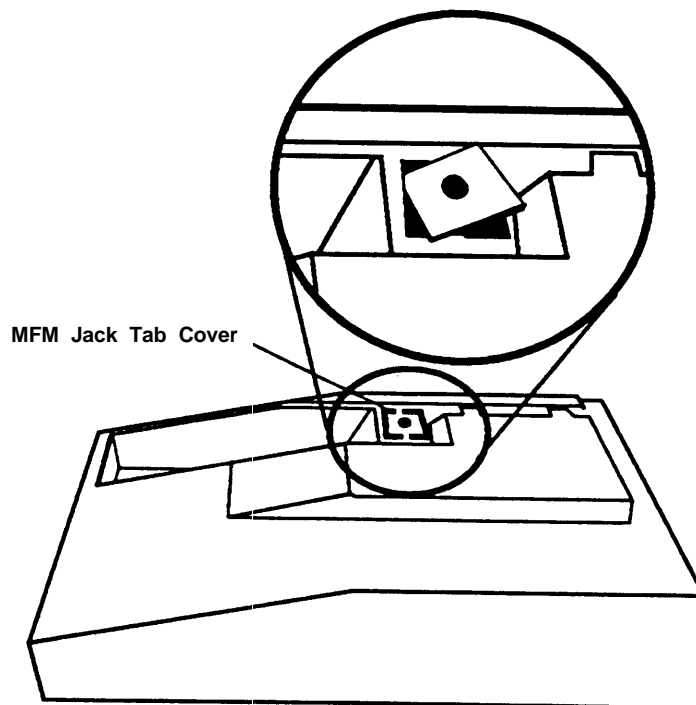


Figure 3-5. Removing the Jack Guard

- b. There are locking tabs on both sides of the module cover and a screwpost on the right side of the telephone. Place the tab in the slot on the left side of the telephone.

- c. Lower the cover to the right and press firmly to lock the tabs in place. Both tabs must be secure.
 - d. Replace and tighten the screw you removed earlier.
7. Replace the desk stand and the user card tray.

NOTE:

If you are wall mounting an MLX-10 or MLX-10D telephone, do not replace the desk stand. Go to Step 8.

- a. The desk stand has two height adjustments. Insert the tab at the bottom of the stand in either the low or high position.
 - b. Insert the tab at the top of the stand into the corresponding slot on the desk telephone. To readjust the stand, see the instructions on the bottom of the card tray.
8. Power up the telephone as follows (see Figure 3-6):
 - a. Plug the D8W cord from the telephone into the 8-conductor (large) modular jack of the 400B or 400B2 adapter.
 - b. Connect one end of the D6AP cord to the 2-conductor (small) modular jack on the 400B or 400B2 adapter, and plug the other end into the modular jack of the KS22911-L2 power supply. The total length of the cords connecting the power supply to the MLX telephone must be less than or equal to 50 ft (15 m).



CAUTION:

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

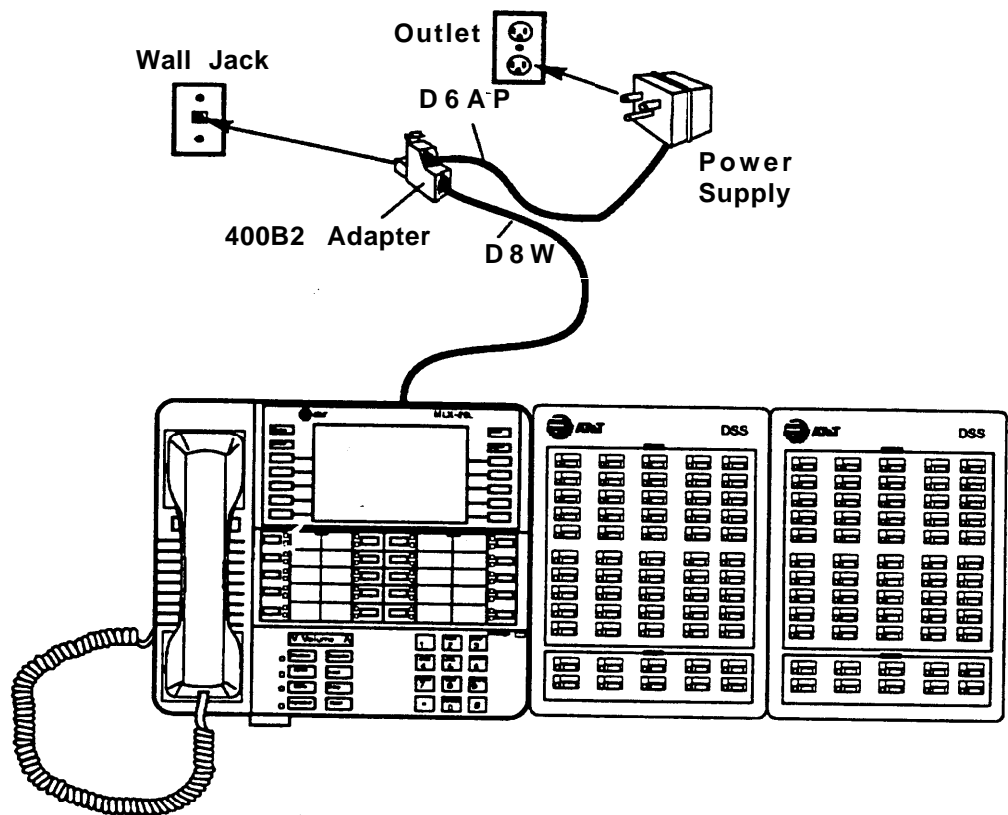


Figure 3-6. Powering up the Telephone after Installing the MFM

- c. Plug the power supply into a 117-VAC outlet that is not controlled by a wall switch.

- d. Insert the plug end of the 400B or 400B2 adapter into the wall jack.
9. Test the MFM for T/R operation by using the directions in “Test the MLX Telephones with an MFM” later in this chapter.
10. Attach any adjuncts as described in the next section.

Installing Adjuncts

The following procedure provides instructions for connecting most adjuncts to the system. For any additional information, see the subsection for the adjunct provided later in this section.

NOTE:

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

1. Connect one end of the cord packaged with the product (usually a D4BU cord) to the adjunct as explained in the documentation.
2. Depending on the information given on the system form, connect the other end of the cord as described in one of the following procedures:
 - When connecting the adjunct to an MLX telephone, insert the other end of the cord into the jack labeled `TEL/OTHER` on the back of the telephone.

- When connecting the adjunct to a single-line telephone, do the following:
 - a. Connect a 267A2 bridging adapter to the telephone.
 - b. Connect the cord from the adjunct to the bridging adapter.
 - c. Reconnect the cord from the control unit to the bridging adapter.

- When connecting the adjunct to an analog multiline telephone, do the following:
 - a. Connect a 4-pair cord to the OTHER jack on the telephone.
 - b. Connect the other end to the VT jack on a general purpose adapter (GPA).
 - c. Connect the cord from the adjunct to the TEL/EQUIP jack on the GPA.

NOTE:

See the next section, “General Purpose Adapter (GPA),” for additional information.

- When connecting the adjunct to the 012 module, connect the adjunct cord directly to the logical ID indicated on the system form.
3. When connecting adjuncts to telephones, make sure you route the adjunct and D8W telephone cords through the cord channel.
See Figure 3-7.
 4. Test the adjunct by dialing its associated extension.

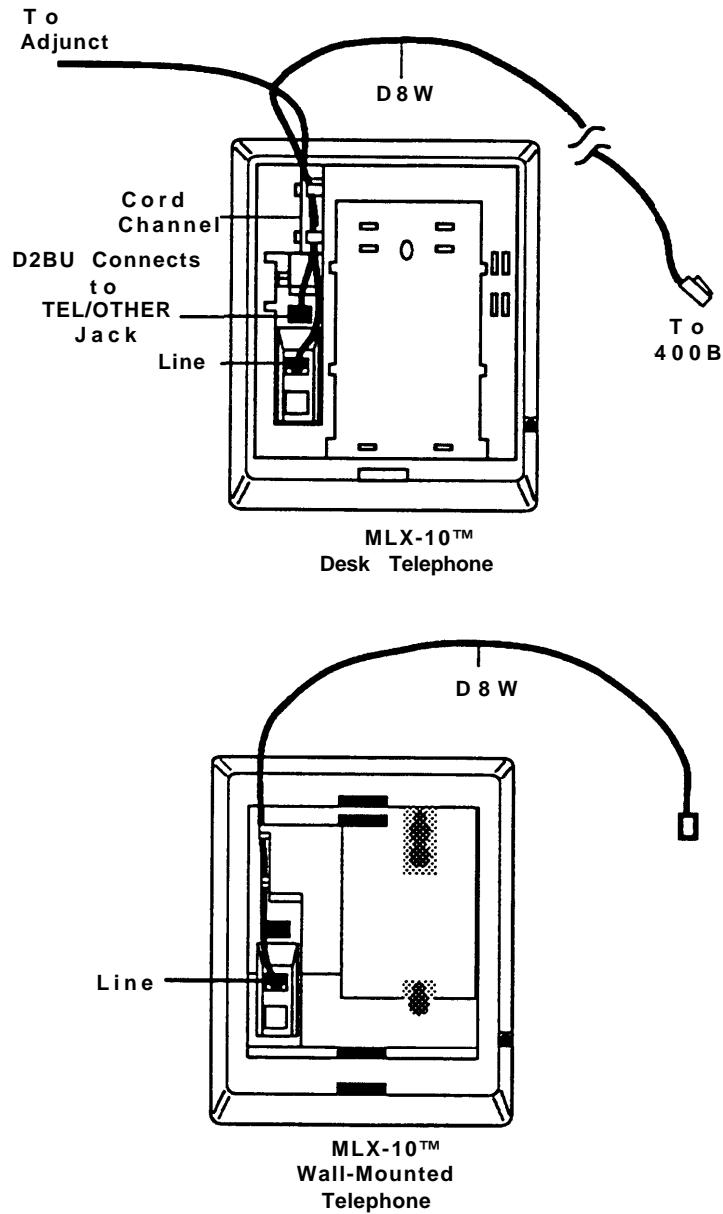


Figure 3-7. Routing the Cord(s) through the Cord Channel

General Purpose Adapter (GPA)

A GPA permits the attachment of a tip/ring (T/R) device such as a single-line telephone, modem, or answering machine to an analog multiline telephone. The device must be touch-tone, not rotary.

NOTE:

The GPA is intended for answer-only service. It does not have touch-tone receivers or pulse dial detectors; therefore, calls must be dialed by using the associated analog multiline telephone.

When the system forms indicate a GPA for installation of any adjunct, follow this procedure:

1. Plug one end of a 4-pair cord into the `VT` jack on the back of the GPA.
2. Plug the other end into the `OTHER` jack on the underside of the analog multiline telephone.
3. Plug the cord from the adjunct into the `TEL EQUIP` jack on the GPA.
4. Slide the switch on the back of the GPA to the setting that provides the GPA service required:
 - **Basic.** This setting is used to dial and answer calls from an analog multiline telephone or to attach a T/R adjunct such as a single-line telephone, answering machine, or fax machine. Incoming calls ring only on the analog multiline telephone. This setting also allows the user to originate and receive calls on the telephone while using a computer or modem that is attached to the GPA. This is called simultaneous voice and data.
 - **Join.** This setting is used to add a recording device or a single-line telephone to a call that is in progress on the telephone. You cannot originate or answer calls on this setting.

- **Automatic.** This setting is used in one of two ways:
 - with a device, such as an answering machine or a modem, to answer calls. An `Auto Answer+All` button is needed so that calls can be answered automatically.
 - to make and receive calls on the telephone while using a computer or modem that is attached to the GPA. This is called simultaneous voice and data.

Answering Machines

Connect the answering machine to one of the following, as described earlier in this section:

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

If the telephone is *not* built in to the answering machine, connect a 267A2 bridging adapter to the telephone using any industry-standard device that recognizes a 600-ms disconnect signal.

Answering devices that disconnect automatically, such as voice-reset disconnect timers and fixed recording timers, are also supported.

Cordless Telephones

Connect the cordless telephone to one of the following, as described earlier in this section:

- 012 module
- MLX telephone with an MFM

When connected through an MFM port, the cordless telephone places and receives calls independently of the MLX telephone.

Using a GPA with an analog multiline telephone is not recommended; the cordless telephone cannot dial out through the GPA.

Credit Card Verification Terminals

Connect the credit card verification terminal to one of the following, as described earlier in this section:

- 012 module
- MLX telephone with an MFM

When connected through an MFM port, the transaction terminal places and receives calls independently of the MLX telephone.

Using a GPA is not recommended; the credit card verification terminal cannot dial out through the GPA.

Dial Dictations

Connect the dial dictation device to one of the following, as described earlier in this section:

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

Dial dictation can also be connected by using a commercially available “trunk adapter” or UPAM with a loop-start central office trunk jack and an external power supply unit.

NOTE:

Dial dictation equipment requiring contact closure cannot be connected via the MFM. Such equipment *can* be connected via the UPAM, as it provides the required contact closure.

Fax Machines

Connect the fax machine to one of the following, as described earlier in this section:

- 012 module
- MLX telephone with an MFM

The fax machine sends and receives fax calls independently of the associated telephone. Calls are dialed with the fax machine's dialpad or from an associated single-line telephone.

Using a GPA with a multiline telephone is not recommended; the fax machine cannot auto-dial through the GPA.

Group Calling Delay Announcements

Connect the group calling delay announcement device to one of the following, as described earlier in this section:

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

An industry-standard announcement device, such as a DA-5 Digital Voice Announcer, provides Night Service information or announces to a caller that calling groups are busy.

Headsets

For MLX telephones, the headset base unit plugs into the telephone handset jack, which means that the *headset* will be used in place of the *handset*.

For analog telephones, you can connect the headset in one of the following ways:

- Connect the headset base unit directly into the handset jack (to use the *headset* in place of the *handset*).
- Connect the headset base unit to a 502C adapter, which connects to the OTHER jack on an analog multiline telephone (to allow the use of both handset and headset, as desired. The base unit provides the capability for switching back and forth.)

Four telephone headsets are now available:

- The **StarSet® Headset** has a single ear tip and is worn without a headband.
- The **Mirage® Headset** has a single disk-shaped receiver and is worn without a headband:
- The **Supra® Headset** has a single disk-shaped receiver and a headband.
- The **Supra NC® Headset** has two disk-shaped receivers and a headband.

Each headset comes with a 10-ft (305-cm) coiled cord and a Quick-Disconnect latch.

The following amplifiers operate in conjunction with the headsets described above:

- **Modular Amplifier** — connects the StarSet, Mirage, Supra, and Supra NC to any telephone equipped with a modular handset.
- **Plug Prong Amplifier** — connects the StarSet, Mirage, Supra, and Supra NC to a non-MLX telephone equipped with a headset adapter and to many automatic call distributors.

Both amplifiers have volume and mute controls.

Loudspeaker Paging Systems

A paging device is used to page co-workers and make announcements through loudspeakers.

Connect the loudspeaker paging system to an LS or GS trunk jack that is programmed for paging.

Figure 3-8, Figure 3-9, and Figure 3-10 show various configurations for single-zone paging. See Figure 3-11 and Figure 3-12 for single-zone and multizone paging configurations that include background music, Magic On Hold®, (and Talk-Back in Figure 3-12).

DTMF Signaling

External paging systems that use DTMF signaling, such as PagePac 20 with ZoneMate 39 paging systems, can be connected to an LS or GS trunk jack programmed for paging operation, including bi-directional paging (Talk-back).

Zone paging systems, such as the PagePac series, require one LS or GS jack. Any zone can be used once the paging jack is activated.

A UPAM is required to connect the system to paging equipment such as the following:

- PagePac without ZoneMate
- Paging systems requiring a contact closure, impedance-matching transformer, or both

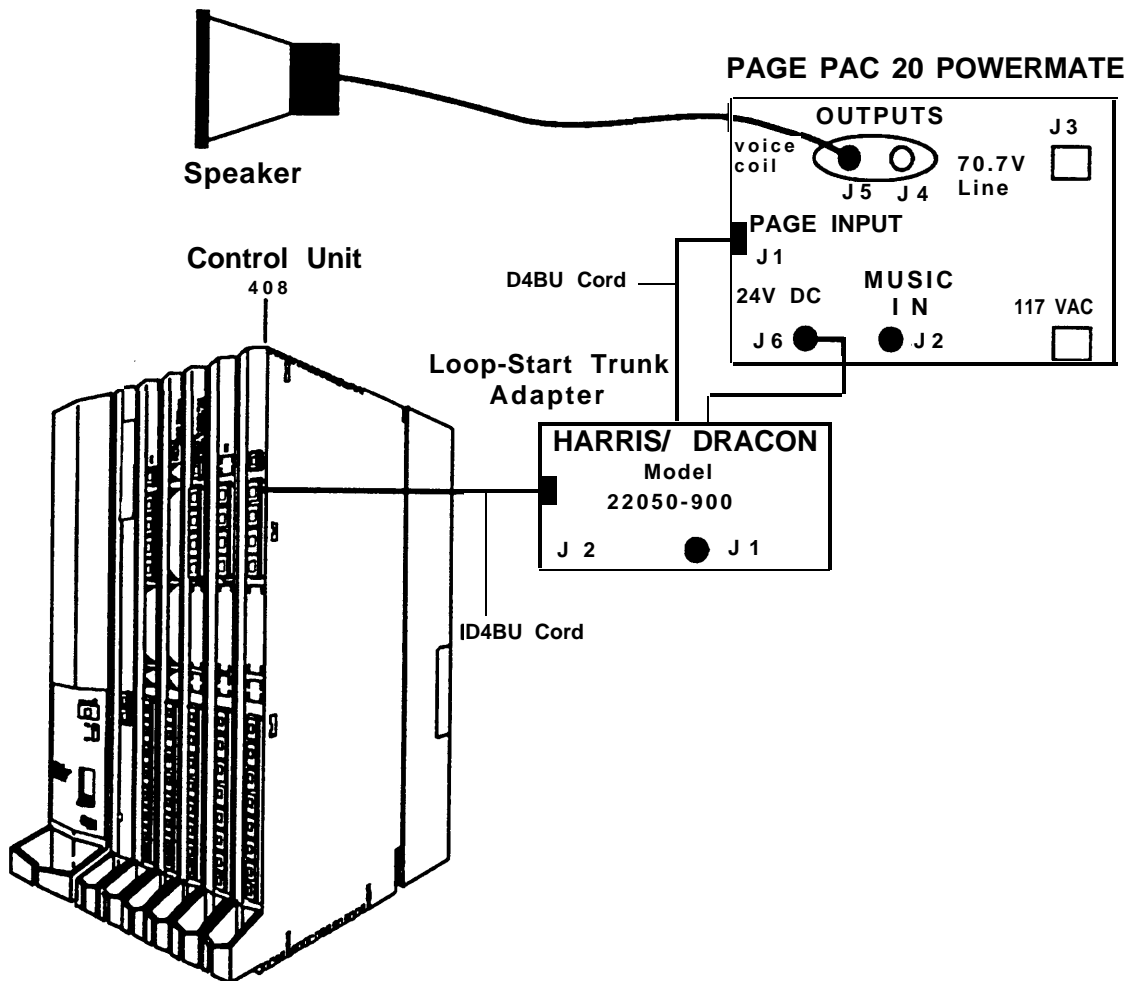
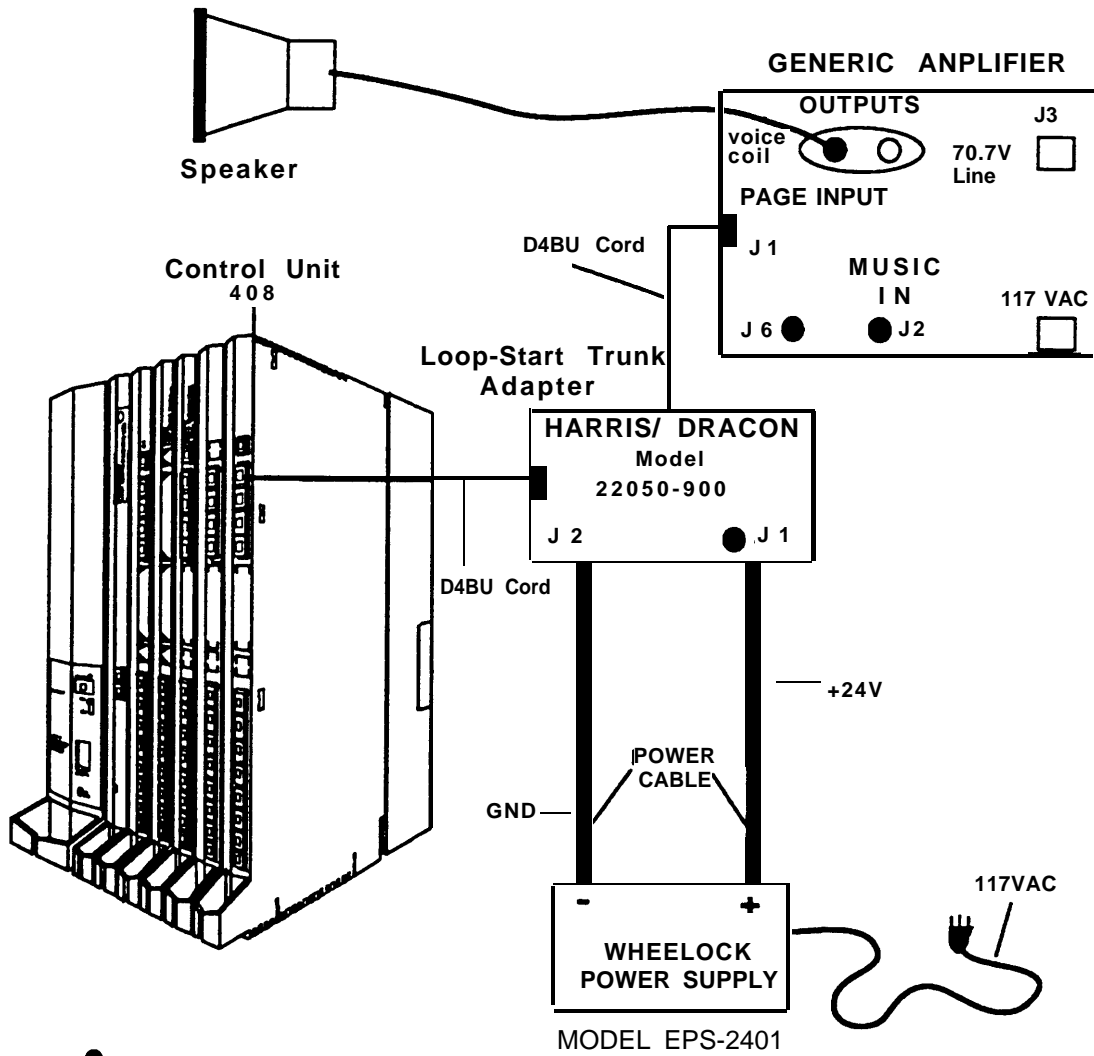
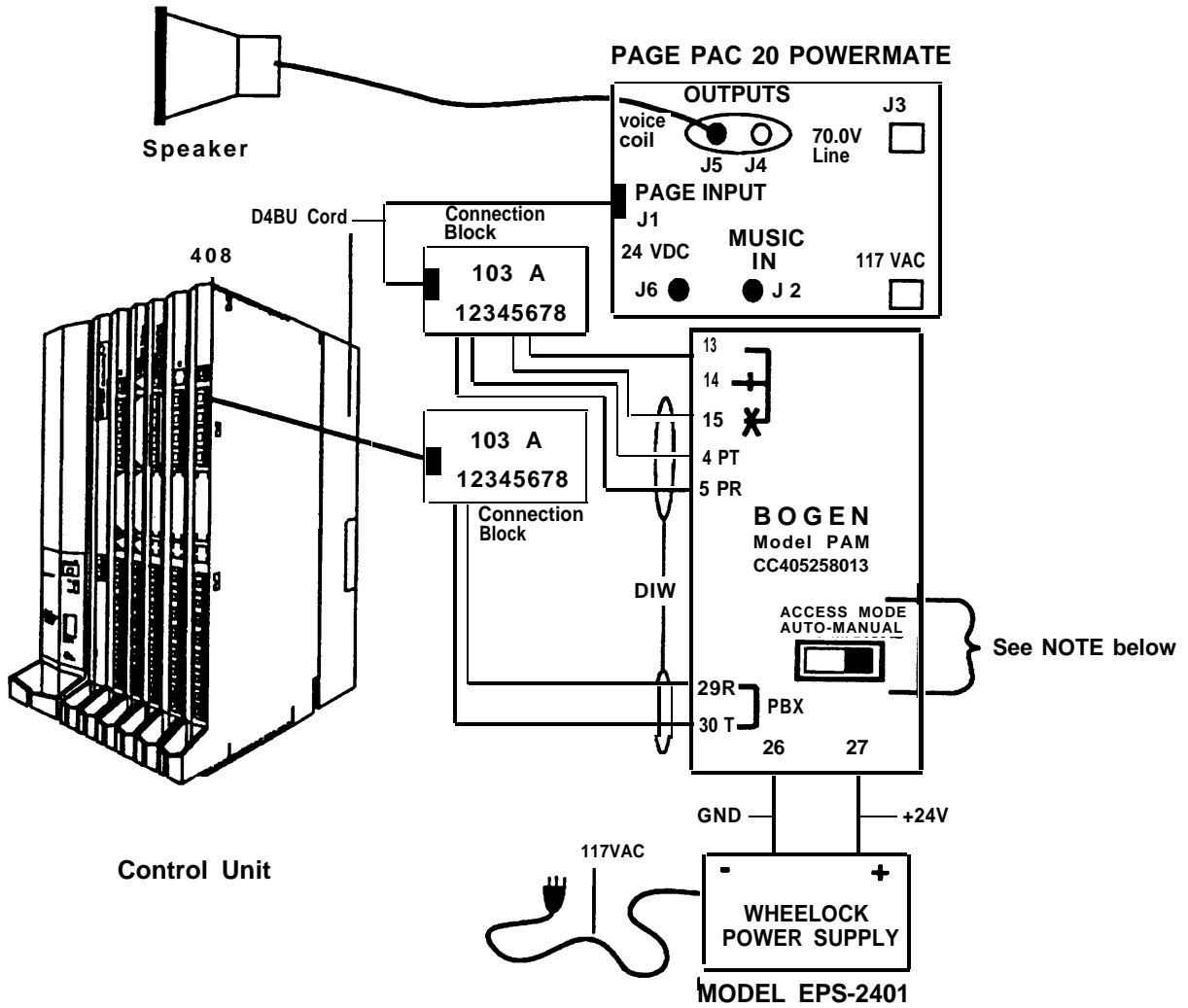


Figure 3-8. Single-Zone Paging with PagePac 20



WARNING! The black wire from the LS trunk adapter power cable must be connected to the + input of the Wheelock PS. The grey on black wire must be connected to the input.

Figure 3-9. Single-Zone Paging with Customer-Supplied Amplifier



NOTE: Set the Access Mode switch to MANUAL

Figure 3-10. Single-Zone Paging with Paging Access Module

Modems

Connect the modem to one of the following, as described earlier in this section:

- single-line telephone
- MLX telephone with an MFM

When connected to the TEL/OTHER jack on the MLX telephone, data calls made from the modem are independent of the associated MLX telephone. Data calls can be dialed from the data terminal keyboard or an associated single-line telephone.

- GPA and analog multiline telephone

See Chapter 6 for complete information connecting modems and other data equipment.

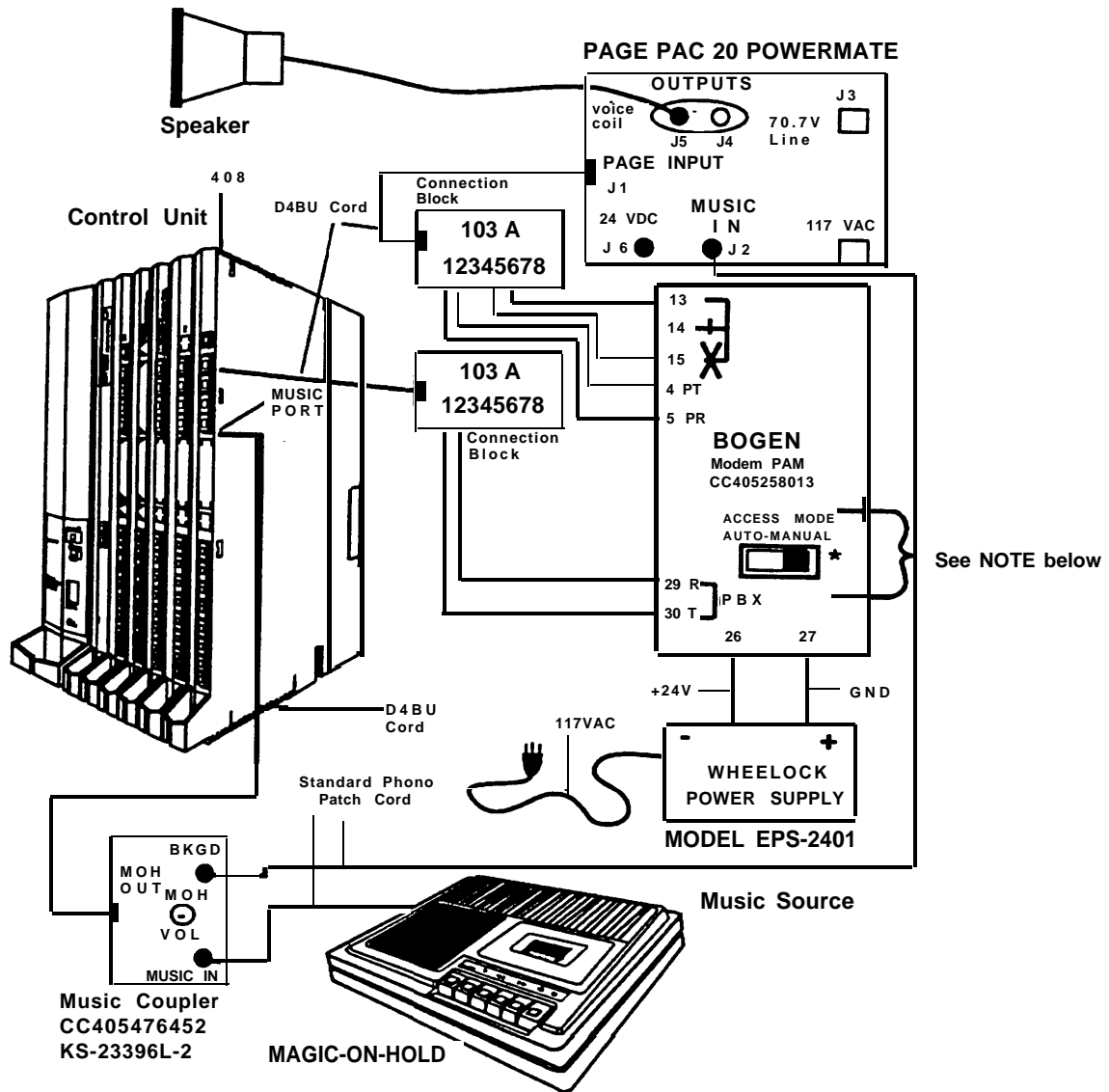
Music-on-Hold, Magic On Hold

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

- PagePac 20 equipment can be used with a loudspeaker system to provide music, and paging without a music coupler.
- If equipment is used that rebroadcasts music or other copyrighted materials, the customer may be required to obtain a copyright license from and pay license fees to a third party such as the American Society of Composers, Artists, and Producers (ASCAP) or Broadcast Music Incorporated (BMI).

To bypass the license requirement, the customer can purchase a Magic On Hold system, which does not require such a license, from an authorized dealer.

Figure 3-11 and Figure 3-12 show various configurations via single-zone and multizone paging.



NOTE: Set the Access Mode switch to MANUAL

Figure 3-11. Single-Zone Paging with Background Music and Magic On Hold

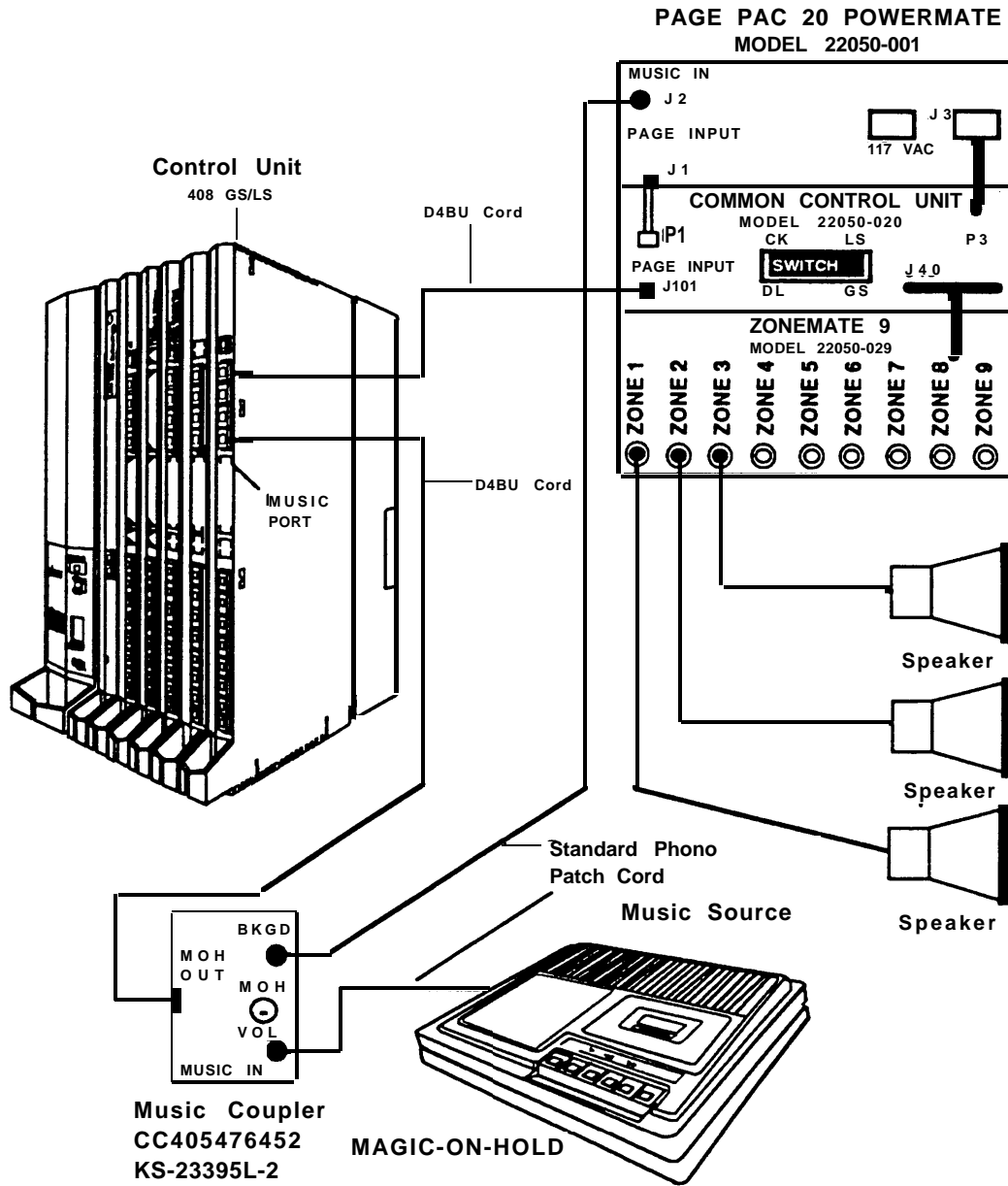


Figure 3-12. Multizone Paging with Background Music, Magic On Hold, and Talk-Back

Supplemental Alerts

Alerting devices notify people working in noisy areas of incoming, transferred, and inside calls.

Connect a supplemental alert device to one of the following, as described earlier in this section:

- single-line telephone
- MLX telephone with an MFM
- supplemental alert adapter (SAA) and analog multiline telephone

NOTE:

See the next section, "Supplemental Alert Adapter (SAA)," for installation instructions.

The MFM and SAA support devices operating on 48 VDC, Alerts operating on 20-30 Hz can be connected to an MFM or a single-line telephone jack.

Supplemental Alert Adapter (SAA)

When the system forms indicate the installation of a bell, horn, chime, or strobe with an analog multiline telephone, install the SAA as follows (see Figure 3-13).

1. Plug the telephone cord into the jack labeled `TELEPHONE` on the SAA.
2. Plug the cord from the alert device into the jack labeled `ALERTER` on the SAA.
3. Plug the cord from the telephone jack into the jack labeled `CONTROL UNIT` on the SAA.

Supplemental Alert Adapter

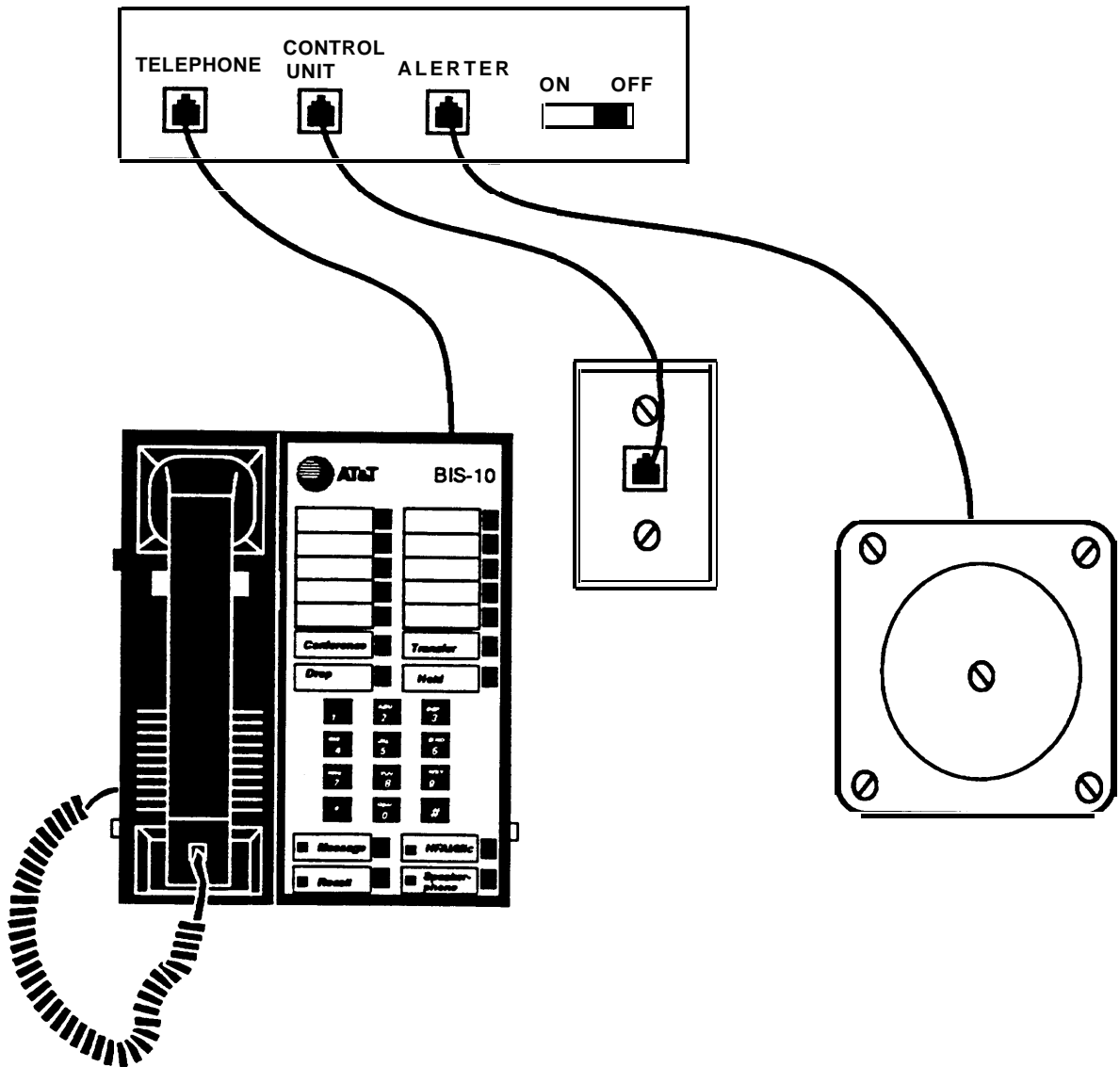


Figure 3-13. Installing the Supplemental Alert Adapter

SAA-Compatible Alert Devices

Compatible alerts include horns, bells, chimes, and strobes:

- Bell
- Horn
- Chime
- Strobe

Unsupported Telephones, Adjuncts, and Adapters

The following analog telephone adjuncts and adapters are not to be used with the system and, in some cases, will damage the device or the system if connected:

- Basic Telephone and Modem Interface (BTMI)
- Basic Telephone and Modem interface-2 (BTMI-2)
- ATR Interface (ATRI)
- MTR Interface (MTRI)
- Off-Premises Extension Unit (OPX)
- System 25 Direct Extension Selector (DXS)

Table 3-1 provides additional information on the telephones and adjuncts to be avoided.

Table 3-1. Unsupported Telephones and Adjuncts

Model	Notes
510D Personal Terminals	Digital Communications Protocol (DCP)
DCP telephones MET telephones	7400 telephones and adjuncts (asynchronous data units and multiple asynchronous data units) that use DCP and that are supported on the MERLIN II Communications System. Multibutton electronic telephones (MET) and adjuncts that are used with the Dimension PBX and Horizon systems.
Single-line telephones	with neon message-waiting light
Analog telephone adjuncts	Basic telephone modem interface (BTMI); BTMI-2; off-premises extension (OPX) unit; System 25 Direct Extension Selector (DXS); DSS attached to a 34-button Deluxe membrane

Installing the Direct Station Selector

The DSS is an optional piece of telephone equipment. One or two DSSs can be connected to an MLX-28D or MLX-20L telephone.

NOTE:

Connect the DSS(s) before you install the MLX telephones.

Before installing the DSS, consider the following:

- Auxiliary power is required under the following circumstances:
 - An MLX telephone with an MFM and two DSSs requires a 329A power unit.
 - An MLX telephone (without an MFM) has two DSSs requires a KS22911-L2 power unit.
 - An MLX telephone with one DSS and an MFM requires a KS22911-L2 power unit, 400B adapter, and the D6AP cord that is provided with the MFM.
 - If one carrier has three or more MLX telephones, each with a DSS attached, use a KS22911-L2 power unit, 400B adapter, and D6AP cord for each MLX telephone and DSS *after* the first two.
- The total length of cords between the KS22911-L2 or 329A power supply and the MLX telephone can be no more than 50 ft (15 m).
- Do not replace the 2-foot (61-cm) D8AC cord (packaged with the DSS) with a longer cord. Improper operation may result.
- Connect each KS22911-L2 power supply to an AC outlet that is not controlled by a wall-switch.

DSS Installation Procedure

NOTE:

If you are connecting two DSSs to the telephone, unpack the second DSS now.

1. Adjust the angle of the DSS. For instructions on removing the telephone stand, see Figure 3-2 earlier in this chapter.

The DSS is packed fully assembled with the desk stand in the low position. If you prefer the low position, go to Step 2. To adjust the angle of the DSS to the high position, place the DSS face down on a flat surface and follow these steps:

- a. Press on the top rear center of the stand to release the tab. Pull the stand toward you and away from the DSS.
 - b. To adjust the stand to the high position, insert the tab at the bottom of the stand into the other slot.
 - c. Lower the stand and press the tab at the top into the corresponding slot on the DSS.
2. Install the D8AC cord on the DSS. See Figure 3-14.
 - a. There are two jacks on the DSS labeled **IN** and **OUT**. Plug one end of the D8AC cord into the jack labeled **IN**.
 - b. Route the D8AC cord through the cord channel on the left side of the DSS.
 - If you are installing one DSS, go to Step 4.
 - If you are installing two DSSs, repeat Steps 1 and 2 for the second DSS; then go to Step 3.
 3. Wire the two DSSs. See Figure 3-14.
 - a. Place the two DSSs side by side and face down.

- b. Route the D8AC cord from the **IN** jack of the second DSS (DSS2) through the cord channel of the first DSS (DSS1).
- c. Plug this D8AC cord into the jack labeled **OUT** on DSS1.

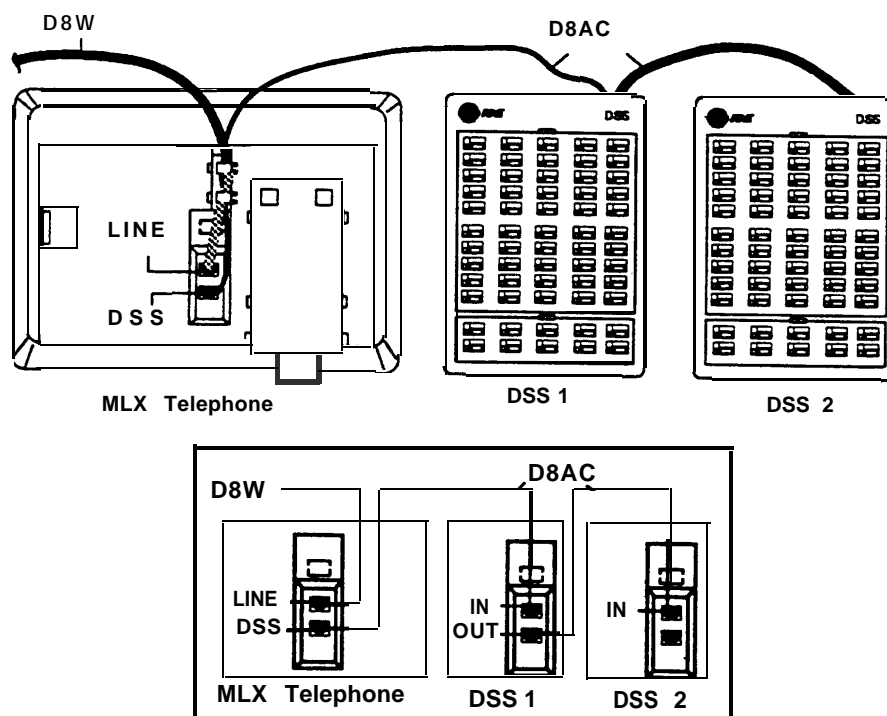


Figure 3-14. Connecting One or More DSSs

4. Wire the telephone to the DSS(s). See Figure 3-14.
 - a. With the handset removed from the telephone, place the telephone face down on a flat surface to the right of the upside-down DSS(s).
 - b. Plug the D8AC cord from the **IN** jack of the DSS1 into the jack labeled **DSS** on the telephone, and route the cord through the cord channel.

- c. Plug the D8W line cord into the jack labeled `LINE` of the MLX telephone. The D8AC and D8W cords share the cord channel on the telephone.
5. Turn the telephone and the DSS(s) face up with the telephone now to the left of the DSS(s).
6. Insert one end of the coiled H4DU handset cord into the handset and the other end into the jack on the side of the telephone.

NOTE:

- If auxiliary power is not required, go to Step 7.
 - If auxiliary power is required, go to Step 8.
7. Power up the telephone by plugging the D8W cord into the wall jack (auxiliary power is not required). Go to Step 9.
 8. Power up the telephone (auxiliary power is required). See Figure 3-6.
 - a. Plug the D8W cord from the telephone into the 8-conductor modular jack of the 400B or 400B2 adapter.
 - b. Connect one end of the D6AP cord to the 2-conductor (small) modular jack of the 400B or 400B2 adapter, and plug the other end of the D6AP cord into the modular jack of the KS22911-L2 or 329A power supply.



CAUTION:

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

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

The combined total length of the D6AP and D8W cords can be no more than 50 ft (15 m).

9. Label the DSS designation cards.
 - a. Pull the tab at the top of the large plastic cover and rotate the cover toward you.
 - b. Remove the cover and the large designation card.
 - c. Write or type the button assignments on the card. For the DSS1, use the side of the large card that is labeled 00 through 49. For the DSS2, use the side labeled 50 through 99.

The button assignments on the designation card should be by extension number, not by logical ID port number.

- d. Replace the card and the plastic cover. Make sure the coated side of the cover is facing up.
- e. Repeat these steps to remove the small plastic cover and to label the small designation card.

NOTE:

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

Assembling the MLX Telephone

If you are installing an MLX telephone, you need to assemble it prior to connecting it to the control unit. For all other telephones, skip to the next section, "Connecting the Telephones to the Control Unit."

Before installing an MLX telephone or operator console, consider the following:

- A 630B Phonemount (not included) is required to mount an MLX-10 or MLX-10D telephone to the wall.
- MLX-20L and MLX-28D telephones cannot be wall-mounted.
- To connect an adjunct, you must first have an MFM. (Adjuncts include answering machines, alerts, and fax machines.) If you are installing an MFM, do it now by using the procedure in "Install the Multi-Function Module" earlier in this chapter.

MLX Telephone Installation Procedure

1. Remove or adjust the desk stand. See Figure 3-2 earlier in this chapter.

NOTE:

- MLX-20L and MLX-28D telephones cannot be wall-mounted.
- If you have removed the stand to wall mount an MLX-10 or MLX-10D telephone, set the stand aside and go to Step 2.

MLX telephones are packed fully assembled with the desk stand in the low position. The angle of any MLX desk telephone can be adjusted to the high position. If you are wall mounting an MLX-10 or MLX-10D telephone, you must first remove the desk stand. To remove the desk stand or adjust its angle, place the telephone face down on a flat surface and follow these steps:

- a. Press on the top rear center of the stand to release the tab(s). Pull the stand toward you and away from the telephone.
- b. To adjust the stand to the high position, insert the tab(s) at the bottom of the stand into the slot(s).
- c. Lower the stand and press the tab(s) at the top into the corresponding slot(s) on the telephone.

NOTE:

The diagram on the bottom of the user card tray also shows the steps to adjust the stand.

2. Connect the line cords. See Figure 3-7 earlier in this chapter.
 - a. Plug one end of the D8W cord into the telephone jack labeled `LINE` on the underside of the telephone.
 - b. Route the D8W cord through the cord channel on the back of the telephone.
 - c. If the telephone is for desktop use, turn the desk telephone face up and plug the D8W cord into the wall jack.
3. Install the handset by inserting one end of the coiled H4DU handset cord into the handset and the other end into the jack on the side of the telephone.

4. Label the extension identification card.
 - a. Insert a straightened paper clip into the hole on the side of the plastic cover while holding your finger on the opposite edge. Use the paper clip to push and lift the cover. See Figure 3-15.

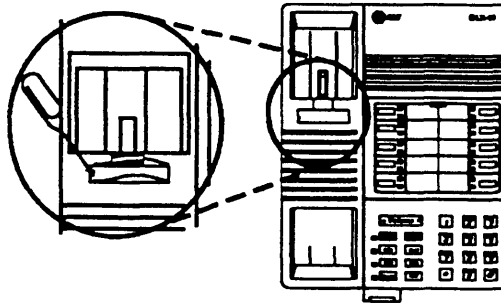


Figure 3-15. Removing the Extension Label

- b. Type or write the assigned extension number on the card. See Figure 3-16.

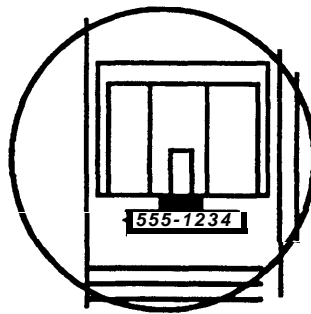


Figure 3-16. Labeling the Extension

- If you are mounting an MLX-10 or MLX-10D wall telephone, go to Step 5.
 - If you are assembling a desk telephone, go to Step 6.
5. Prepare the handset holder for wall mounting.
 - a. Remove the handset holder by pushing it up and pulling it out. See Figure 3-17.

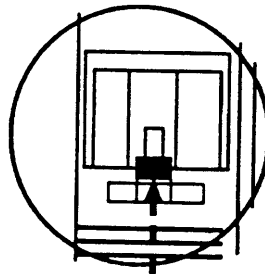


Figure 3-17. Removing the Handset Holder

- b. Rotate the handset holder 180 degrees and replace it in its slot. See Figure 3-18.

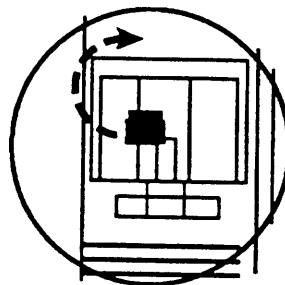


Figure 3-18. Rotating the Handset Holder

6. Replace the extension identification card and plastic cover by inserting one end into the slot and bending the cover to snap the other end into place. See Figure 3-19.
-

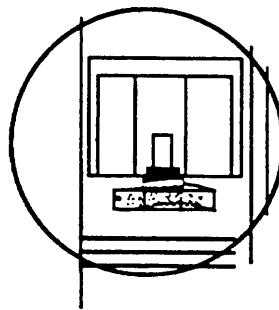


Figure 3-19. Replacing the Extension Label

- If you are mounting an MLX-10 or MLX-10D wall telephone, go to Step 7.
 - If you are assembling a desk telephone, go to Step 8.
7. Mount an MLX-10 or MLX-10D wall telephone.
 - a. Turn over the telephone and remove the jack guard from the TEL/OTHER jack area. Set the telephone aside.
 - b. Unpack the 630B Phonemount and remove the modular jack from the backplate.
 - c. Route the D8W cord (or DIW cable) through the hole in the backplate and have it exit at the top of the backplate, leaving 10 inches (25 cm) of cord to connect the telephone. See Figure 3-20.
 - d. Attach the backplate to the wall by using the instructions provided with the 630B Phonemount.

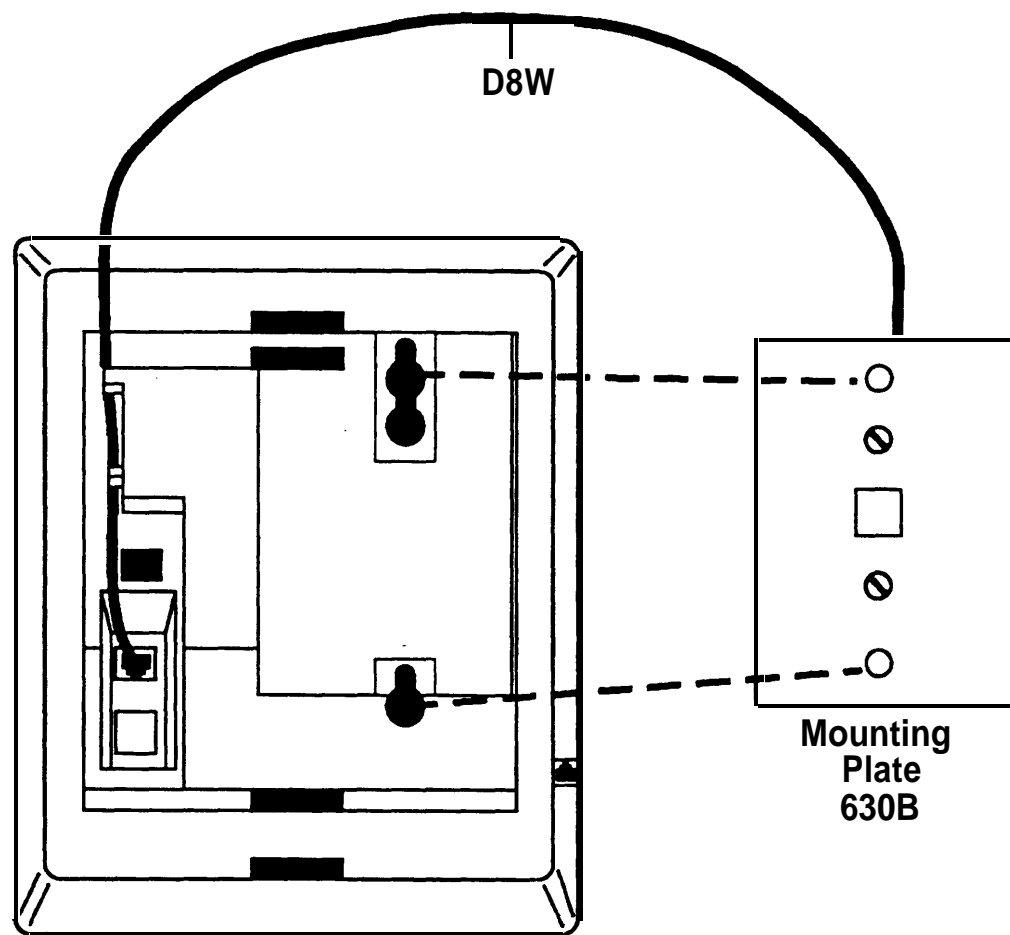


Figure 3-20. Routing the Cord through the Backplate

- e. Insert the two short screws provided with the Phonemount into the mounting plate. Be sure to thread the upper screw through the jack guard. See Figure 3-21.

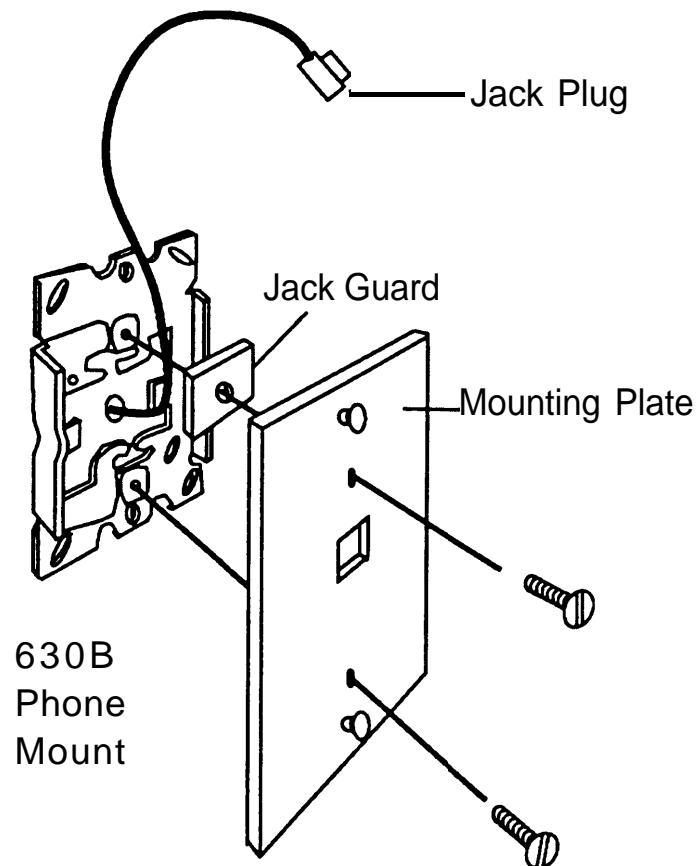


Figure 3-21. Mounting the Backplate

- f. Plug the free end of the cord into the jack labeled **LINE** on the back of the telephone. Route the cord through the cord channel above the jack. See Figure 3-7 earlier in this chapter.
- g. Position the telephone on the mounting plate studs and then slide the telephone down to lock it in place. To remove the telephone, slide it up and off.

8. Label the button assignment card.
 - a. Pull the tab at the top of the plastic cover toward you.
 - b. Type or write the button assignments on the card.
 - c. Insert the card and replace the plastic cover. Be sure the textured side of the cover is facing you.

9. Adjust the contrast on the telephone's display.
 - MLX-20L: Slide the lever on the top of the telephone.
 - MXL-10D and MLX-28D: Follow the directions in the user's guide for the appropriate MXL telephone.

Connecting the Telephones to the Control Unit

The method of connection depends on the number of telephones. For 24 telephones and under, use direct connection. When installing more than 24 telephones, a cross-connect field is recommended.

Use one of the following recommended wiring kits for building the cross-connect field:

- Interconnect Wire: A complete wiring kit containing 110 jack-panel blocks, a template, wiring troughs, D-rings, and D8W cords
- SYSTIMAX: A complete wiring kit containing 110 termination blocks with modular jacks, a 110A field-termination block, a template, wiring troughs, D-rings, and patch cords

CAUTION:

- *Take extreme care to make sure that only MLX phones are connected to MLX modules; otherwise, the mismatch could damage the ports and cause them to stop functioning.*
- *Incorrect wiring can result in users not being able to place outgoing calls. Make sure you use the proper cord. For all GS/LS modules, do the following:*
 - *Use a D2R cable from an RJ11.*
 - *Do not use the Brand-Rx Quad cable from an E66 block.*

If you cannot avoid using the Brand-Rex Quad cable, reverse the tip and ring leads at the E66 block to correct the mismatch.
- *To avoid coupling power supply noise onto system wiring, allow at least 3 inches (7 cm) of clearance between the basic carrier's power supply and any wiring or termination hardware located left of the control unit.*

If staples are used to attach the cords to walls or baseboards, check that the cords have not been pierced.

WARNING:

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

If you need to connect the telephones differently from the instructions on the system forms, record each jack and telephone change on Form 2a, System Numbering—Station Jacks. See Appendix A.

NOTE:

- If an MLX telephone or analog multiline telephone is in a different building from the control unit, *and is within 1000 ft (305 m) of the control unit*, connect the telephone to the control unit using two in-range out-of-building (IROB) protectors.
- Make sure you use an MLX-specific IROB for an MLX telephone, and an analog multiline-specific IROB for an analog multiline telephone.
- See the documentation packaged with the IROB protector for complete installation instructions.
- If the single-line or tip/ring telephone is 1000 ft (305 m) or further from the control unit, connect the telephone to the control unit using an off-premises range extender (OPRE)
See the documentation packaged with the OPRE for complete installation instructions.

Connecting up to 24 Telephones

For a system with up to 24 telephones, use direct wiring: plug in one end of a DIW cable into the telephone jack on the control unit module and connect the other end to the wall jack for the telephone.

Hardware

- DIW cables
- Unicon plug
- cable ties

See Figure 3-22.

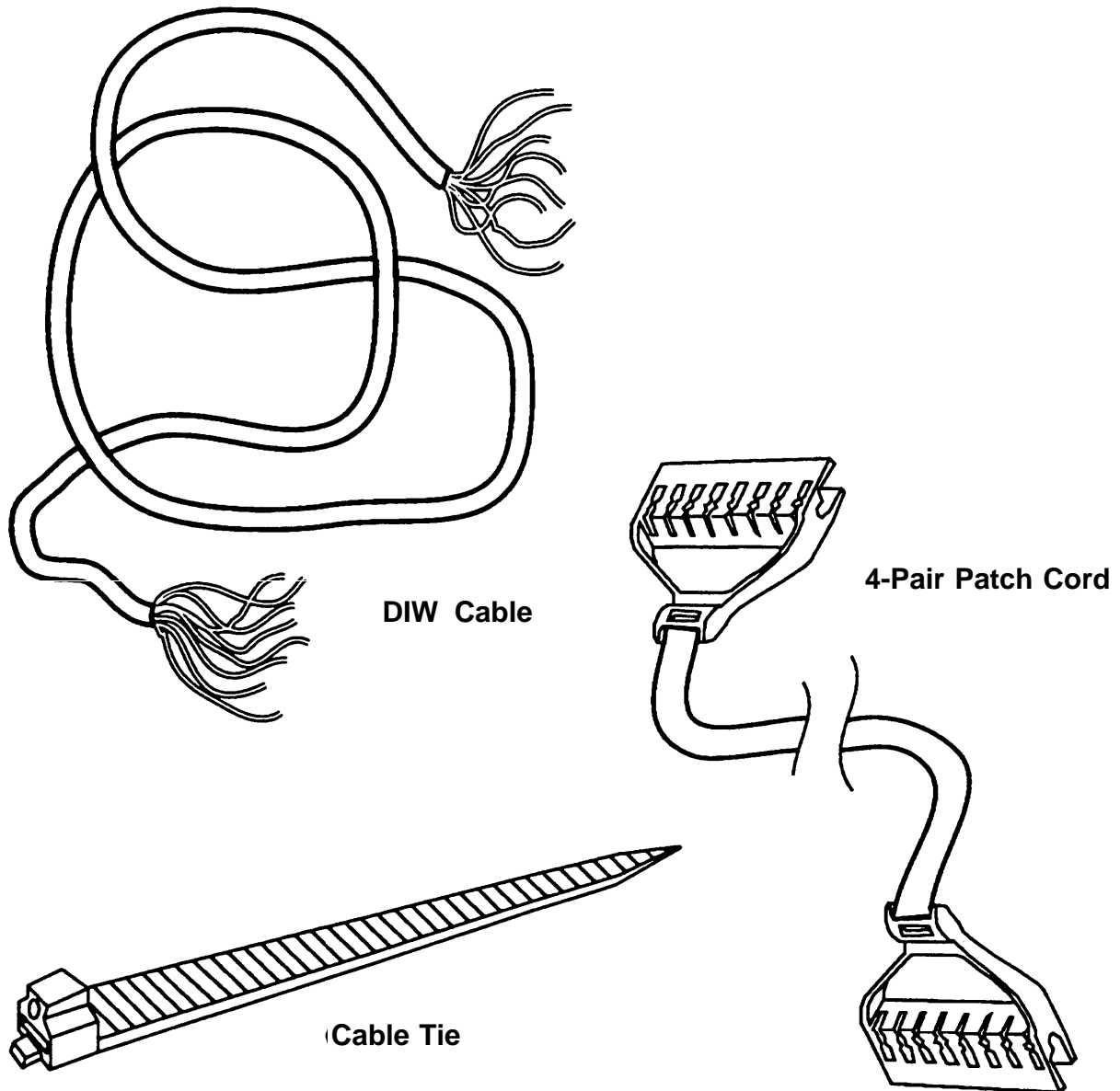


Figure 3-22. Hardware for Connecting up to 24 Telephones (also included in SYSTIMAX Hardware Kit; see also Figure 3-27)

Tools

See Figure 3-23.

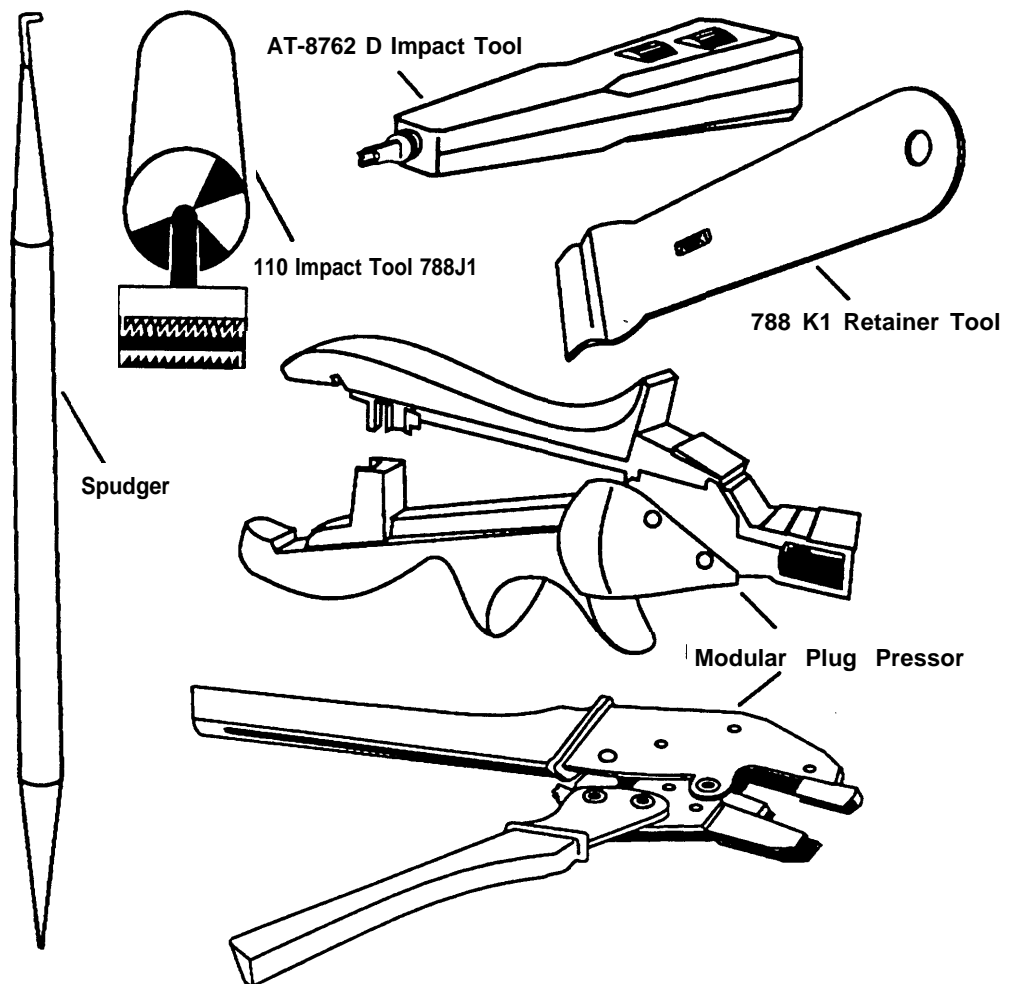


Figure 3-23. Tools for Connecting up to 24 Telephones

Telephone Installation Procedure

1. Run the DIW cable from the control unit to the telephone and cut it. Allow enough slack for routing the wire.
2. Attach a Unicon plug to the control unit end of the DIW cable by using the 4-pair plug presser.
3. Plug the DIW cable into the control unit and connect the other end to the telephone jack. See "Terminating Cable at a Telephone Outlet" later in this chapter.
4. Repeat Steps 1 through 3 for each telephone line.
5. Route the wires properly by using cable ties. Fasten wire runs vertically to the left or right of the control unit. The final horizontal wire run to the control unit must be fastened within 12 inches (30 cm) of the control unit. Allow sufficient slack to reach any port on the control unit.
6. Label the control unit module jacks, telephone jacks, and DIW cables properly. See "Label the System Wiring" later in this chapter.

Connecting More than 24 Telephones

For systems with more than 24 telephones, the two recommended methods are Interconnect Wiring and SYSTIMAX as described later in this chapter.

Interconnect Wiring

Interconnect Wiring is required when the system has more than 24 telephones and SYSTIMAX has not been ordered. The Interconnect Wiring module provides the hardware to interconnect up to 12 telephones with 110-type wiring.

For Interconnect Wiring, you must build a jack field between the control unit and the telephones by using 110AB1-100JP12 termination blocks with modular jacks and 110A1 wire troughs.

Hardware

Each kit includes the following:

- instructions and parts sheet
- 110AB1-100JP12 termination blocks with modular jacks
- 110A1 wire troughs
- D-rings
- D8W cords

Tools

- D-impact tool
- spudger
- hand tools

See Figure 3-23.

Telephone Installation Procedure (More than 24)

1. Drill two diagonally opposite holes in a suitable backboard (plywood is recommended) for each piece of hardware. Keep a 1/16-inch (1.6-mm) space between each piece of hardware.
2. Mount the wire troughs and the termination blocks. There is a wire trough above each termination block.
3. If necessary, repeat Steps 1 and 2 for a second column.
4. Mount the termination blocks and terminate the telephone cable. If the telephone cable is bottom feed, start at the top and work down. If the telephone cable is top feed, start at the bottom and work up.
 - a. Mount a termination block to the wall with appropriate fasteners.
 - b. Strip the jacket off the DIW telephone wires, exposing the conductors.

- c. Punch down the telephone wires to the termination block.
 - i. Route the telephone wires underneath the termination block and through the fanning slots.
 - ii. Insert the conductors into the designated 110 connecting blocks already on the termination block. Follow the color sequence shown in Figure 3-24.

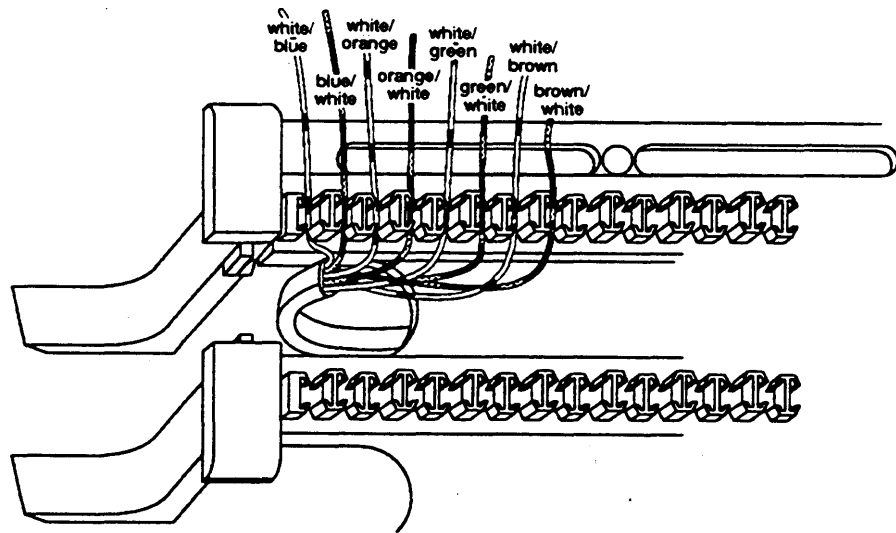


Figure 3-24. Inserting the Conductors into the Connecting Blocks

- iii. Use the D-impact tool to seat the conductors. See Figure 3-25.

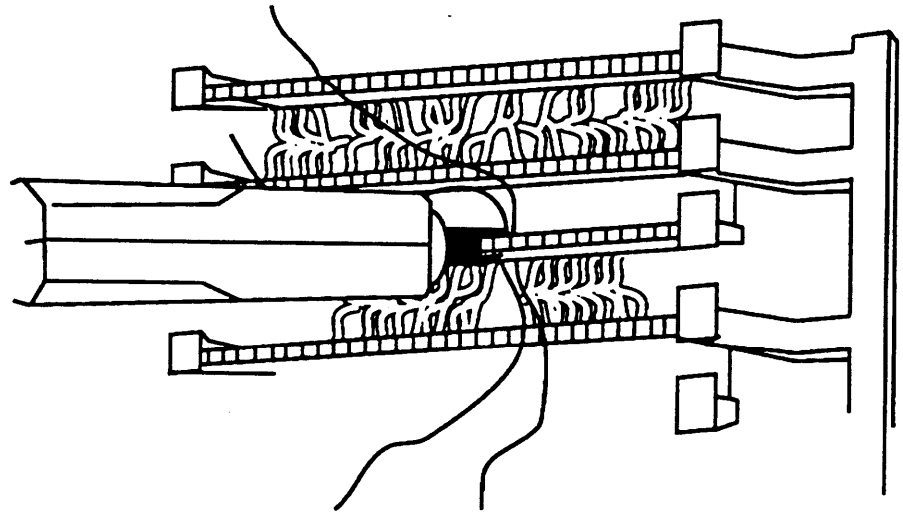


Figure 3-25. Using the D-Impact Tool to Seat the Conductors

- iv. Remove any insulation fragments with a spudger (see Figure 3-23 if you do not know which tool is the spudger).
- d. Repeat Steps a through c above for each termination block.
- 5. Mount the wire troughs.
- 6. As needed, mount the D-rings.
- 7. Label the D8W cords, termination blocks, and DIW cables properly. See “Label the System Wiring” later in this chapter.
- 8. Plug one end of a D38W cord into the telephone jack on the control unit module and the other end into the designated jack on the termination block. Do this for all telephones.

9. Route the wires through the wire troughs and D-rings. See Figure 3-26.
-

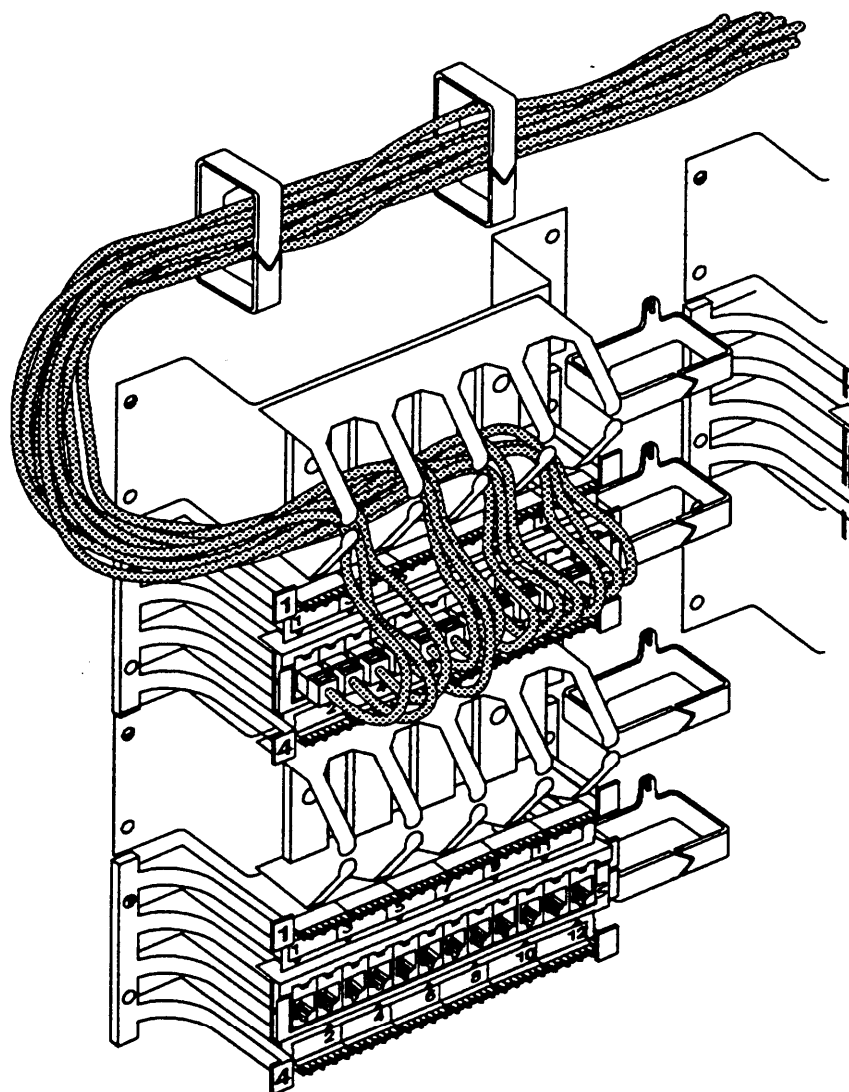


Figure 3-26. Routing the Wires through the Wire Troughs and D-Rings

SYSTIMAX

SYSTIMAX is a wiring kit that contains all the hardware needed to build a cross-connect field between the control unit and the telephone jack.



CAUTION:

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

With each kit you can build up to 24 jacks. The maximum number of telephones on the system is 144, which would require six kits.

Hardware

Each kit includes the following:

- instructions and parts sheet
- template-full scale
- two 110AB1-100JP12 termination blocks with modular jacks
- one 110AB1-100FT field-terminated block
- 110A1 wire troughs
- D-rings
- 110P8A5B patch cords (4-pair)
- D8W cords

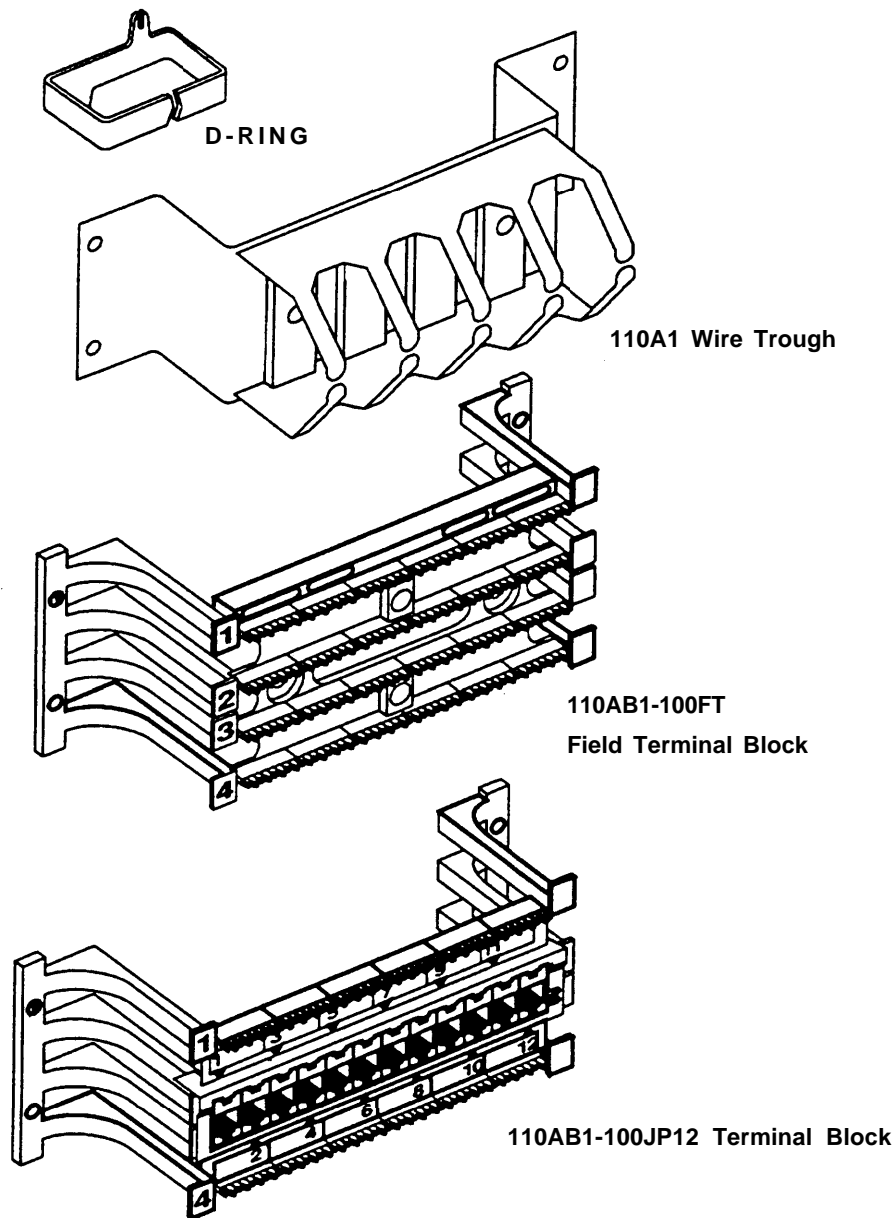


Figure 3-27. SYSTIMAX Hardware Kit (See also Figure 3-22)

3-54 Connecting the Telephones to the Control Unit

Tools

- D-impact tool
- 788J1 impact tool
- spudger
- hand tools

SYSTIMAX Wiring Procedure

1. Locate the proper wall space. The cross-connect field will usually be to the right of the control unit. Leave enough space between the control unit and the cross-connect field to allow for system growth.
2. Attach the template to the wall or backboard with a staple gun, tacks, or tape. Make sure that the upper edge of the template outline is 70 inches (177 cm) above the floor and that the template is parallel to the floor.
3. Find the placement of the hardware on the template. See Figure 3-29. The first and third columns on the template show where the termination blocks go; the middle column shows the place for the field-terminated blocks.

Keep the elements of a kit in the same-colored blocks. For example, the termination blocks of kit #1 go in the green section of column 1; the field-terminated block of kit #1 goes in the green section of column 2.

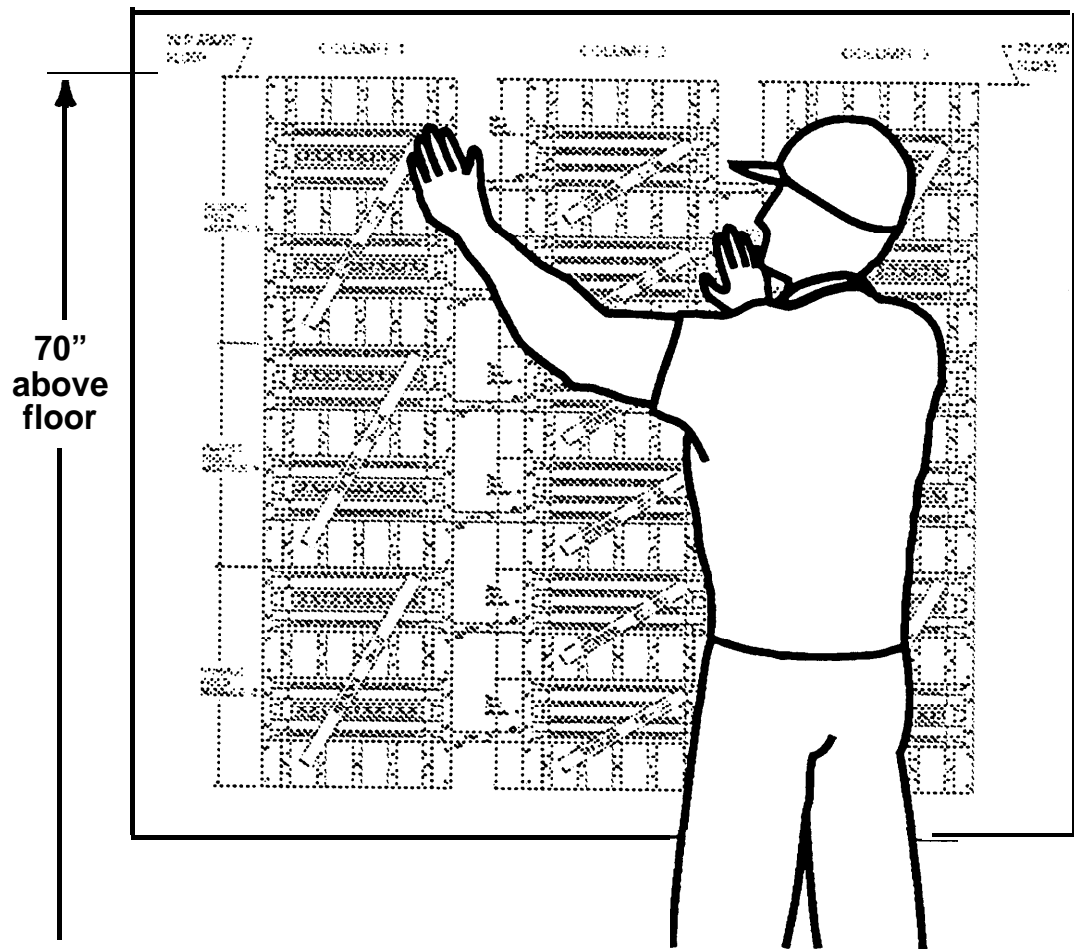


Figure 3-28. Attaching the SYSTIMAX Template to the Wall



Figure 3-29. Using the SYSTIMAX Template to Place the Hardware

4. Drill two diagonally opposite holes for each piece of hardware. You can drill right through the template. See Figure 3-30.

There is a 1/16-inch (1.6-mm) space between the outline of each piece of hardware; keep this space as you mount the hardware.

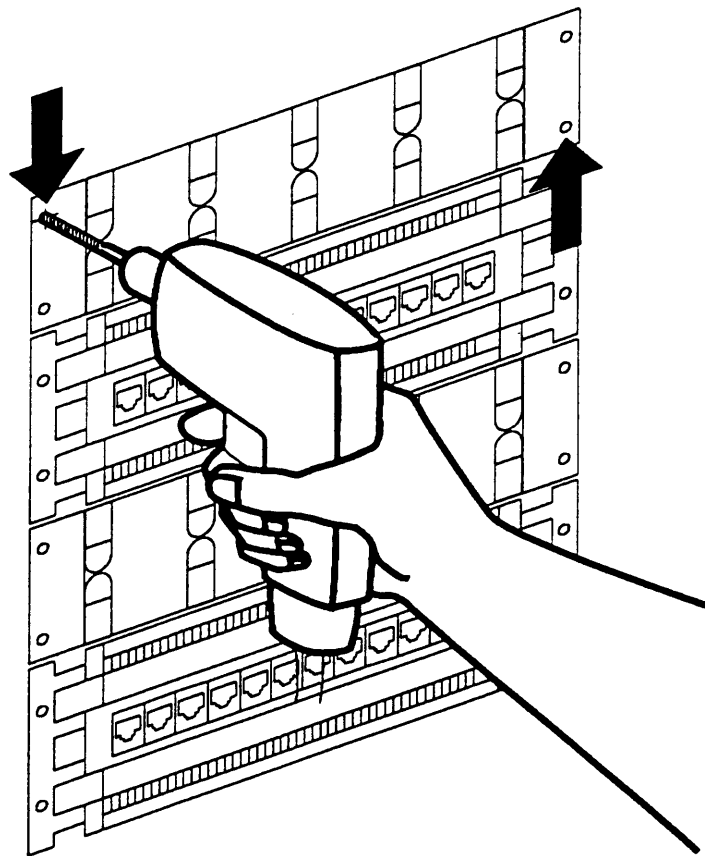


Figure 3-30. Drilling Holes for Each Piece of Hardware

5. Remove the template from the wall. Keep it in one piece so that you can check it for correct placement of hardware.
6. Mount the wire troughs and termination blocks on columns 1 and 3 as needed.

7. Mount the field-terminated blocks on column 2 and terminate the telephone cable. If the telephone cable is bottom feed, start at the top and work down. If the telephone cable is top feed, start at the bottom and work up. In either case, work on one field-terminated block at a time.
 - a. Run the telephone cable underneath the field-terminated block.
 - b. Strip 12 inches (31 cm) of jacketing off the cable, exposing the conductors.
 - c. Press the conductors into the index strip on the field-terminated block according to the color sequence shown in Figure 3-24. Make sure each pair keeps its twist up to the index strip. (Each pair is split by a raised tooth on the index strip.)
 - d. Use the 788J1 impact tool to seat and trim the conductors. See Figure 3-31.

Make sure the blade edge is positioned properly: blade up for rows 1 and 3, blade down for rows 2 and 4.
 - e. Continue seating and trimming conductors from left to right for each row.

NOTE:

The last two right-hand slots must remain vacant.

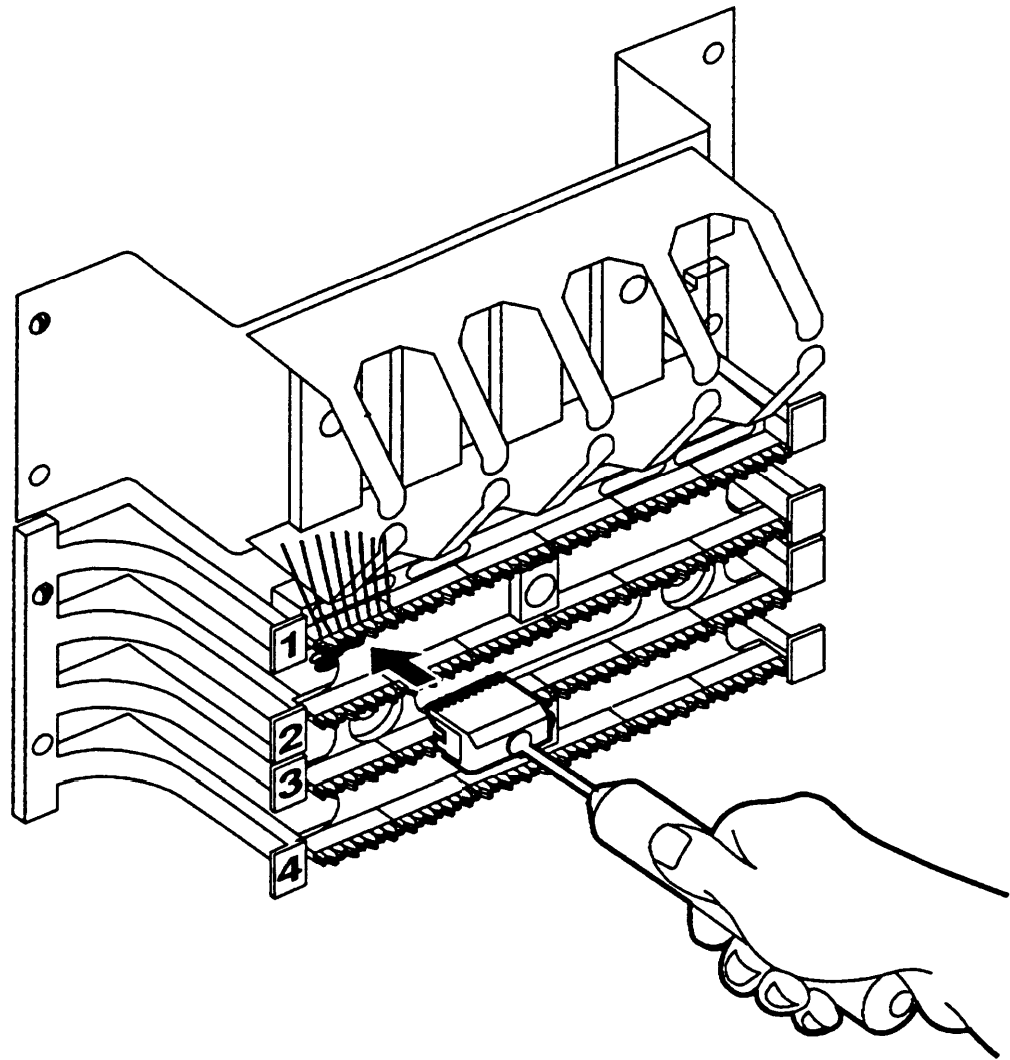


Figure 3-31. Using the 788J1 Tool to Seat and Trim the Conductors

- f. Reverse the blade edge on the 788J1 impact tool and use the tool to seat the connecting blocks on each index strip. See Figure 3-32. Make sure the slate strip on each connecting block is facing down.

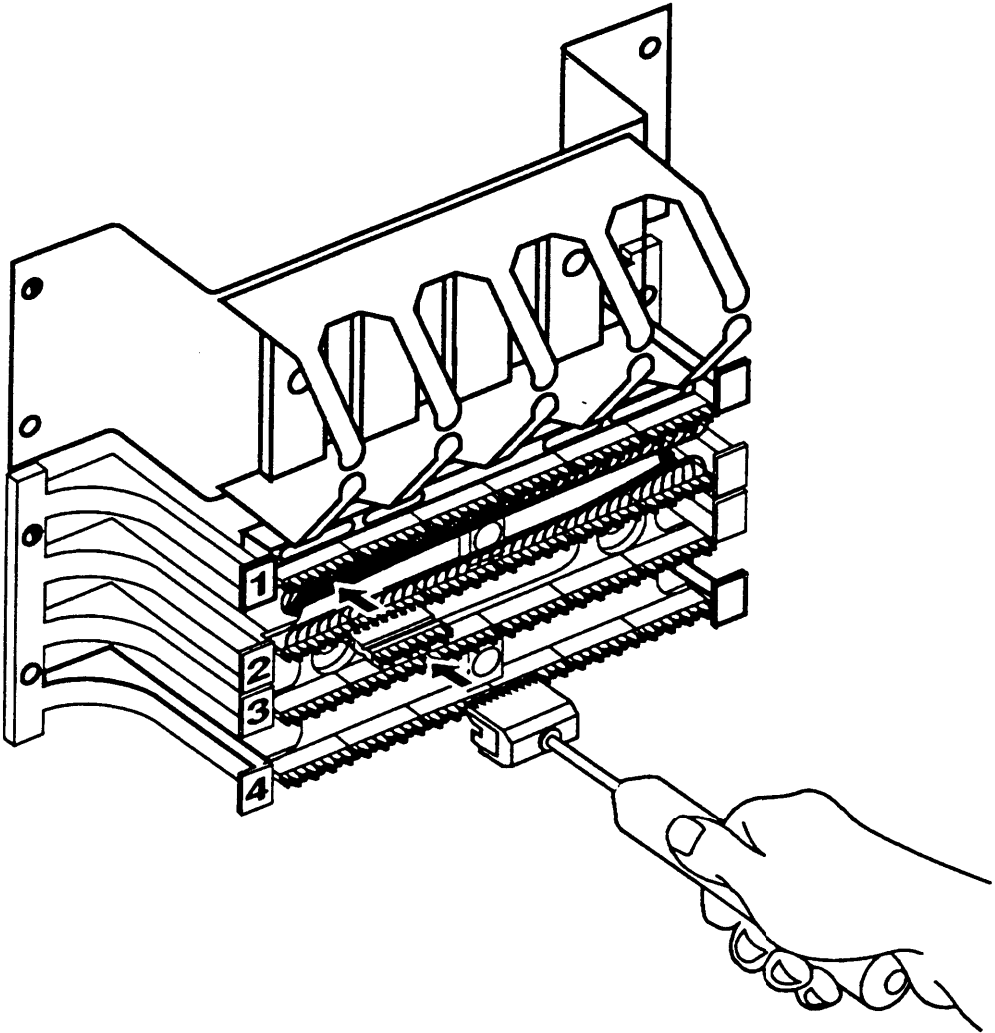


Figure 3-32. Using the Reversed Blade Edge on the 788J1 Impact Tool

8. As shown on the template, mount the wire troughs on column 2 after all the field-terminated blocks have been wired.
9. Mount the D-rings between the columns as needed to route the patch cords.
10. Plug one end of a D8W cord into the proper control unit module telephone jack and the other end into the corresponding jack on the termination block in column 1 or column 3.
11. Repeat for all the D8W cords.
12. Route the D8W cords through the wire trough above the termination block. See Figure 3-26 and Figure 3-27.

NOTE:

Each kit has extra D-rings and wire troughs. Use them as needed to route the cords.

13. Label the termination and field-terminated blocks. See “Label the System Wiring” later in this chapter). Write the appropriate information (such as extension numbers and users’ names) on the strip labels provided and snap the designation strips into place.
14. Use the 110P8A5B patch cords to connect termination blocks to field-terminated blocks. See Figure 3-33. Properly route the patch cords through the wire troughs and D-rings.

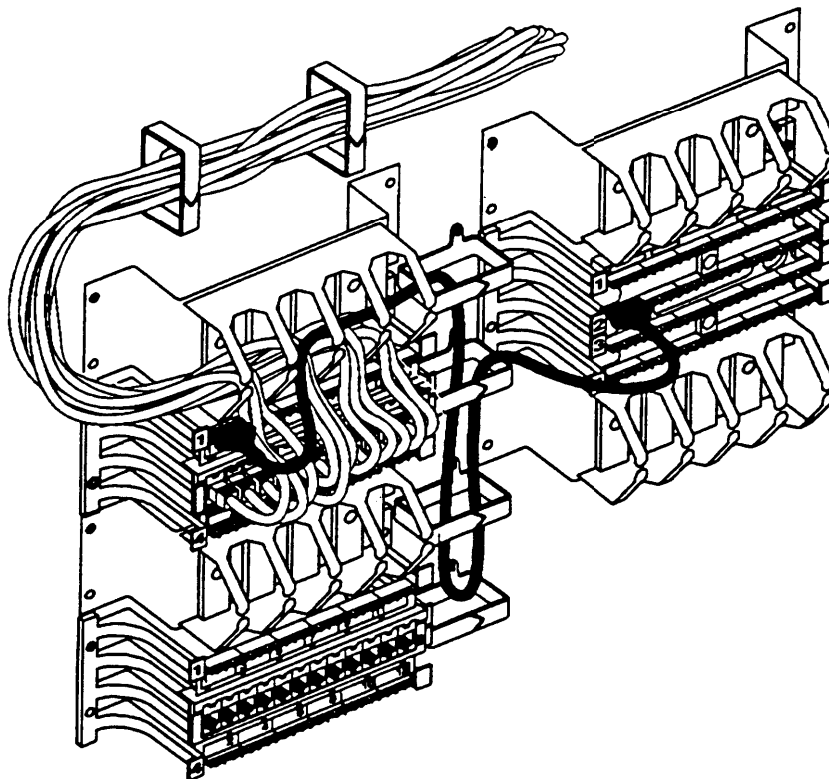


Figure 3-33. Connecting Termination Blocks to Field-Terminated Blocks

Wire a Telephone for Two Voice-Pairs

If an analog telephone requires either the Voice Announce to Busy feature or the Simultaneous Voice and Data feature, use a bridging adapter to assign two adjacent odd/even telephone jacks (01 and 02, 13 and 14, etc.) on an analog telephone module to that telephone. This provides the telephone with the two voice pairs needed to use these features. See Figure 3-34.

NOTE:

The numbers of these telephone jacks are boxed on the system forms. In Figure 3-34, the label on the bridging adapter refers to the default intercom number, not the telephone jack number.

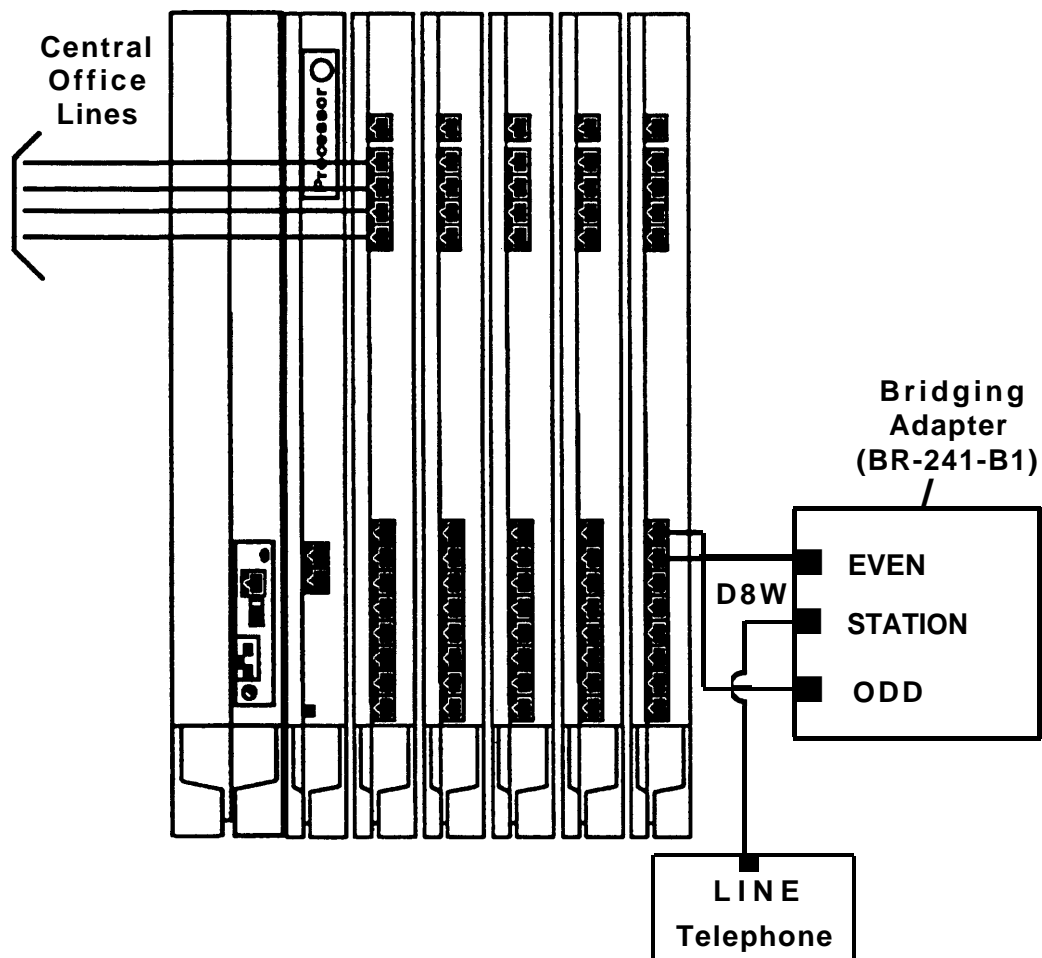


Figure 3-34. Connecting Two Voice Pairs to a Telephone Using a Bridge Adapter (BR-241-B1)

Terminate Cable at a Telephone Outlet

There are many kinds of telephone outlets, which are fundamentally all the same. Some are surface-mounted, affixed directly onto a wall surface, and others are flush-mounted, where the jacks are located inside a wall housed in a regular electrical box. On the workstation side, a cord plugs into the jack; on the closet side, the DIW cable is hard-wired to the outlet. Following is one method to use when connecting DIW cable to a surface-mounted telephone outlet. You should be able to adapt the method used to join DIW cable to flush-mounted outlets.

NOTE:

In some cases the electrical boxes will already be mounted; in others the installer must do the job. In either case, the box should be installed before the cable is terminated on the outlet.

1. Take the outlet apart by first unscrewing the screw that holds the sections together; then pull off the termination clips.
2. Pull out a few feet (approximately one meter) of slack from the wall.
3. Use diagonal pliers to strip 3 to 4 inches (8 to 12 cm) off the end of the DIW cable.
4. Thread the conductors through a hole in the base of the outlet.
5. Press the wires into appropriate slots on the outlet. See Figure 3-35.

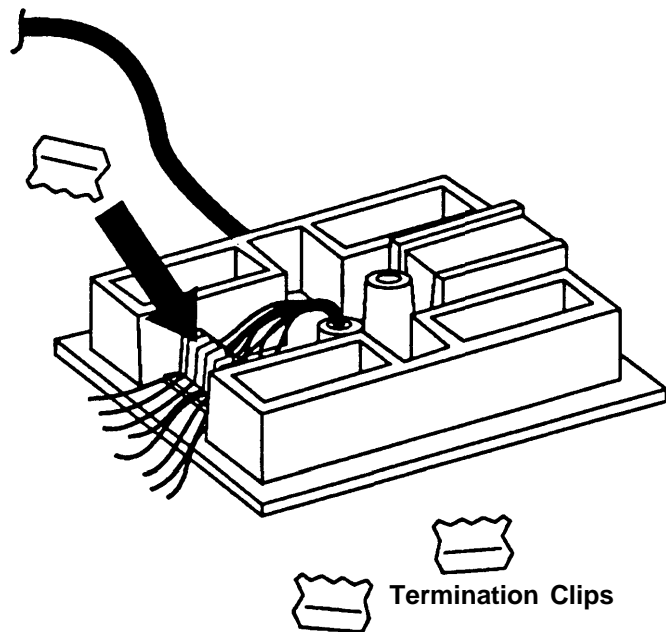


Figure 3-35. Pressing the Wires Over the Slots in the Outlet

6. Use diagonal pliers to clip off the ends of the conductors.
7. Press the clips back on over the wires.
8. Strip off the protective paper from the adhesive strips and press them onto the back of the outlet.
9. Press the outlet onto the wall.
10. For additional security, screw the outlet to the wall.
11. Screw the parts of the outlet together.

Label the System Wiring

If done correctly, labeling can provide valuable information about the location of wire or cable within the building and save hours of frustrating work. There are five types of labels used for identification:

- **Cable labels** are white adhesive-backed tabs that are stuck to the cables to identify the source and the destination of the cables before they are pulled to and terminated in satellite closets and equipment rooms. The labels come in a variety of shapes and sizes to accommodate different sizes of cable. Use a pen or a felt-tip marker to write on the surface.
- **Field labels** are adhesive-backed tabs that are applied to smooth surfaces in the equipment room and satellite closets. They identify components. Use a pen or a felt-tip marker to write on them.
- **Insert labels** are cardboard-like strips that slip inside the clear plastic designation strips located between the rows of a termination or field-terminated wiring block. They are color-coded to identify the origins of cables. Along with the color-coding scheme, alphanumeric codes on the labels help to identify the specific location of the same pair or series of pairs at the other end of the cable (see Table 3-2).
- **Jack labels** are small, white, rectangular-shaped stick-on tabs that are stuck to the cover plate or housing of telephone outlets. They identify the location of the satellite closet where the cable to that outlet is terminated and the number of the circuit.
- **Telephone cord labels** are blue labels packaged with the control unit carriers and wrap around each end of the telephone cords that leave the control unit.

Table 3-2. Insert Labels

Color	What It Identifies	Special Features
Light blue	DIW cable originating at telephone outlets in offices or other locations	The fourth pair of the DIW cable to MLX telephones is reserved for supplying power to one DSS at an operator console.
White	Various types of riser (house) or campus cable connections	
Gray	Closet letter and circuit number	Used with 25-pair tie cables that link large riser closets and smaller satellite closets or two riser/satellite closets
Green	Central office pairs	Used only on the trunk or auxiliary field in the equipment room
Purple	System-common equipment, such as a PBX or a data switch	Usually supplied with the system-common equipment

Continued on next page

Table 3-2. - Continued

Color	What It Identifies	Special Features
Yellow	Auxiliary circuits arranged in 3-pair modularity	For auxiliary circuits that are not arranged in 3-pair modularity, use blank labels. If a system has customized labels for the auxiliary system, use them.
Orange	Connections from transmission electronics equipment, such as multiplexer or concentrators	Supplied by the equipment manufacturers

Labeling 4-Pair Wire and Outlets

It does not matter whether you pull the DIW cable from the telephone to the control unit or from the control unit to the telephone. In either case, mark one end of the DIW cable with the location or destination of the other end.

The following procedure is an example of pulling from the telephone to the control unit.

1. If you do not have labeling instructions on any the system forms, assign a number to each jack on the floor.
2. Put the boxes of wire near the offices (and jacks) where they have been assigned.
3. Mark the end of each DIW cable with the number of the jack where the wire has been assigned.

4. Mark the box with the letter of the closet to which the DIW cable is pulled and with the circuit number of the wire. This is the same as the number you wrote on the wire sheath. Wire 1 becomes circuit 1; wire 2 becomes circuit 2.

5. At the boxes next to the offices, pull out enough wire to reach the wall jacks. Allow plenty of slack.

Cut the wire and mark the end of the DIW cable with the closet letter and the circuit number.

6. After you pull the wire into the office or work area and fish it through the wall opening for the wall jack, transfer the information to the faceplate of the jack itself.

You should now have the correct closet letter and circuit number of the wire on the jack.

7. When the DIW cable reaches the control unit cross-connect field, punch down the pairs in the same sequence as labeled on the sheath.
8. On the blue labels designed for the 110-type field-terminated block, add any necessary information. With pre-printed labels, you add only the floor number. With blank labels, you also have to write in the closet letter and the number from the wire sheath.

If no labeling exists, simply assign a different number to each DIW cable and write that number on both the box and the wire end.

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 cables.

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 of the telephone core 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 connection block.

8. Using the diagonal pliers or wire strippers, cutoff 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.

Remove Damaged Connecting Blocks

In some cases, a connecting block can become damaged and must be removed as follows.

1. Remove the wires or the patch cord from the connecting block.
 - With interconnect wiring, remove the telephone wires with long-nosed pliers and tag the wires with tape to identify their position.
 - With SYSTIMAX, pull off the patch cord.
2. Place a 788K1 retainer tool against the conductor pairs beneath the connecting block to be removed.
3. Grip the connecting block in the center with pliers. Move the block gently up and down and pull it out. See Figure 3-36.

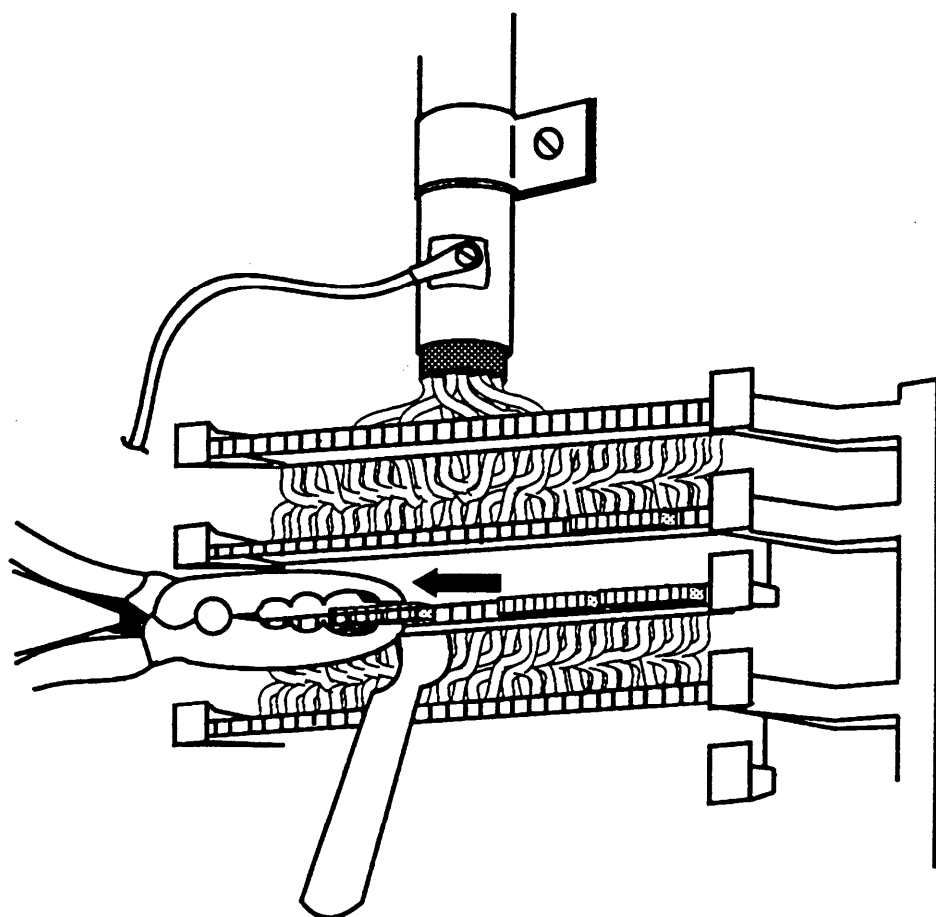


Figure 3-36. Removing the Connecting Block

4. If a conductor wire is accidentally pulled from a block, pull it with the long-nosed pliers to get some slack. Use your fingers to lay the conductor wire back in its slot in the index strip. Reseat it with the D-impact tool.
5. Seat the new connecting block by using the 788J1 impact tool. See Figure 3-31.
6. Replace the telephone wire onto the connecting block.
 - With interconnect wiring, remove the tag from the telephone wires and reseat the wires by using the D-impact tool.
 - With SYSTIMAX, attach the patch cord to the connecting block.

Connecting the Control Unit to the Network Interface

4

To connect the control unit to the network interface side, the method of connection depends on the type of network interface that is installed. While there are many ways to connect the network interface to the control unit, the methods in this chapter are preferred.

CAUTION:

- *The telephone company is responsible for providing appropriate protection for central office trunks. Do not connect the central office trunks until you are certain that they are properly protected. See the section, “Central Office Trunk Protection,” in Chapter 2 for details.*
- *To avoid coupling power supply noise onto system wiring, allow at least 3 inches (8 cm) of clearance between the basic carrier’s power supply and any wiring or termination hardware located left of the control unit.*
- *If the network interface is greater than 25 ft (7.6 m) from the control unit, connect the control unit to the network interface using an off-premises range extender (OPRE)

See the documentation packaged with the OPRE for complete installation instructions*
- *If staples are used to attach the cords to walls or baseboards, check that the cords have not been pierced.*
- *National and local building codes specify the type of cable required for telecommunication wiring. For example, indoor wiring (DIW) cable cannot be used inside or on top of air plenums or ducts, along hot pipes, or across walkways. Consult your local ordinances and regulations for proper cable selection.*

Wiring

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

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

Table 4-1. Network Interfaces

Network Interface	Description	Adapter
RJ11	Connects one outside ground-start (GS), loop-start (LS), or Direct Inward Dialing (DID) trunk to one modular jack	
RJ14	Connects two outside trunks to one modular jack (GS, LS, and DID)	2-line adapter (267C-type)
RJ21X	50-pin connector connects 25 110AB1 jack-panel block outside trunks (GS, LS, and DID)	110AB1 jack-panel block
RJ2GX	50-pin connector for up to eight tie trunks	356A eight tie trunks; 259A for one tie trunk
RJ48C/X	Connects DS1 facilities to a 4-pair jack (two active pairs)	Z601A if modular cords are used

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

NOTE:

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

You may also need to know the interface codes for network facilities. These codes are shown in Table 4-2 by trunk type and adapter type.

Table 4-2. Central Office Network Interface Codes

Trunk Type	Federal Interface Code for Trunk	Network Interface
LS central office trunk	02LS2	RJ11C, RJ14C RJ21
GS central office trunk	02GS2	RJ11C, RJ14C, RJ21
DID	02RV2-T	RJ11C, RJ14C, RJ21
OPS	0L13C	RJ11C
Tie trunk	TL31M	RJ2GX
DS1	04DU9-B 04DU9-C	RJ48C/X See note below.

NOTE:

The preferred network interface is the RJ48X. With the RJ48X interface, if no connection is provided by the customer's equipment, the T1 trunk's receive pair is looped back to the transmit pair. This simplifies troubleshooting the T1 trunk.

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

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

RJ21X Interface

The RJ21X network interface has a female 50-pin (25-pair) amphenol connector. See Figure 4-1:

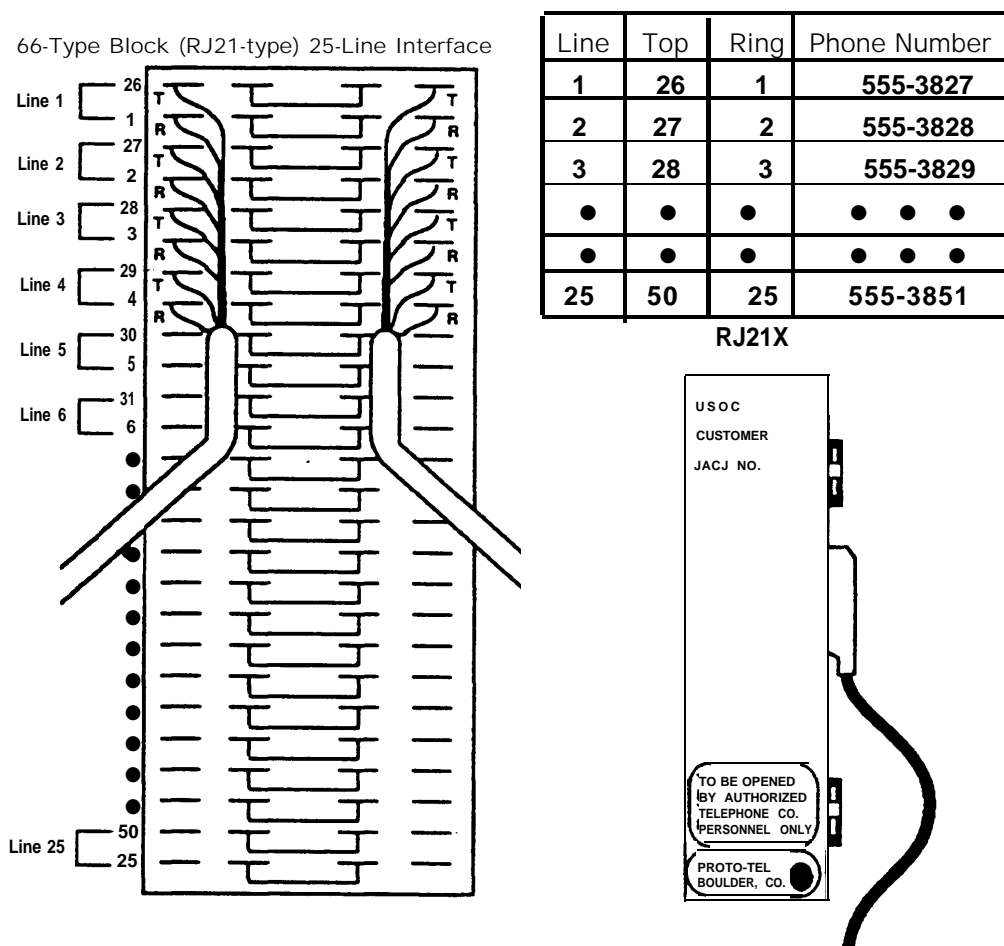


Figure 4-1. RJ21X Network Interface Connector

To connect the RJ21X interface to the control unit, you must build a wiring field between the RJ21X interface and the control unit. This field, in effect, converts the female amphenol connector to 8-wire modular jacks.

Building the Wiring Field

Build the wiring field between the network interface and the control unit by using 110AB1-100JP12 terminal blocks with modular jacks and associated hardware.

RJ21X Wiring Field Hardware

- 10AB1-100JP12 termination blocks with modular jacks
- 110A1 wire troughs
- D-rings
- D2R cords

See Figure 4-2.

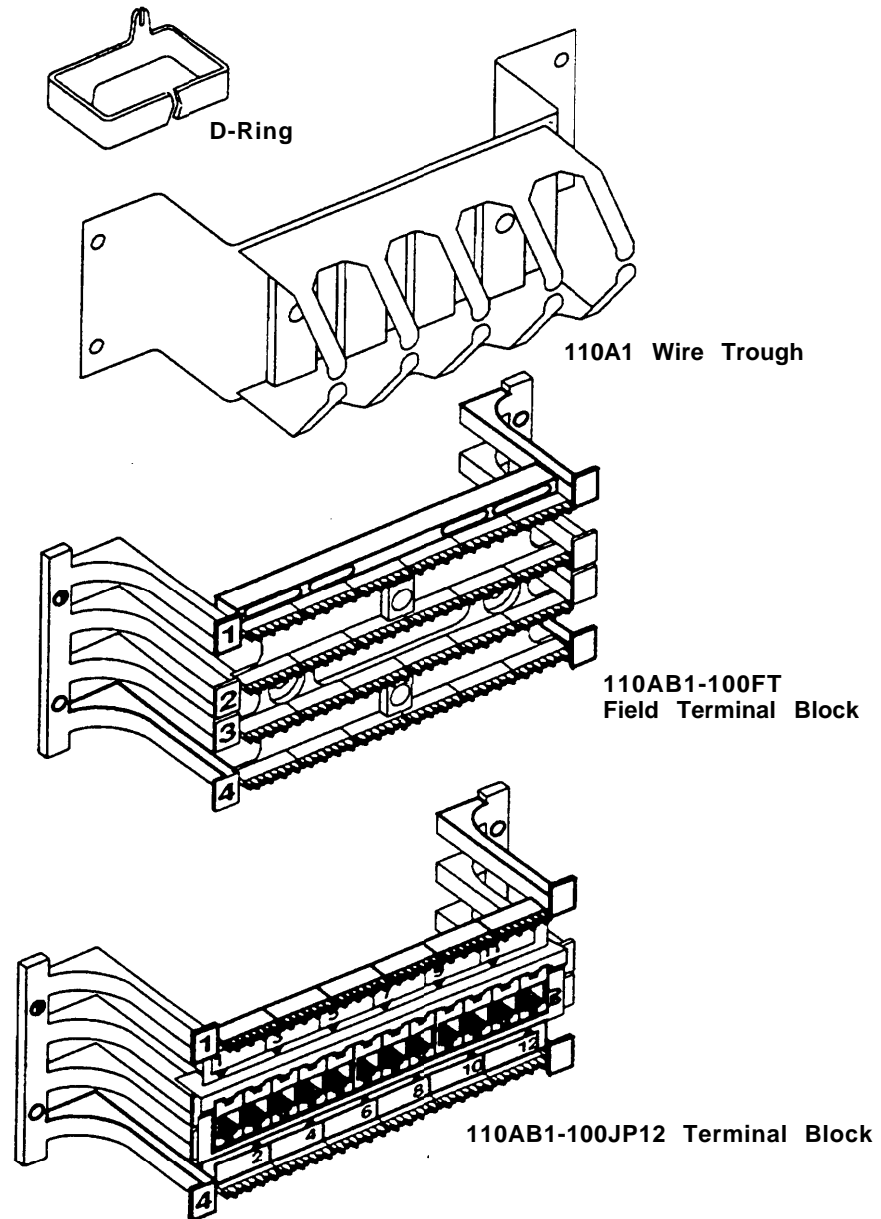


Figure 4-2. RJ21X Wiring Field Hardware

RJ21X Wiring Field Tools

- D-impact tool
- spudger
- hand tools

See Figure 4-3:

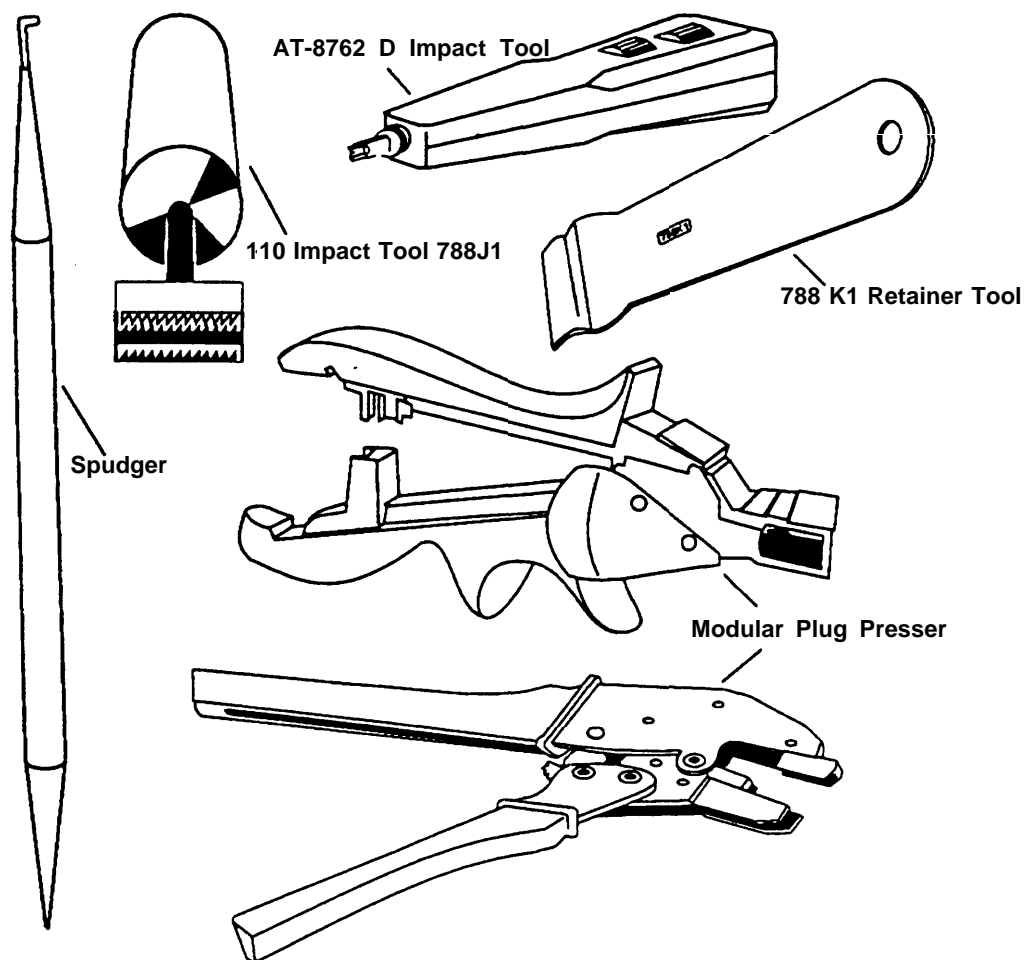


Figure 4-3. RJ21X Wiring Field Tools

RJ21X Wiring Field Procedure

Follow this procedure to connect the RJ21X network interface to the control unit:

1. Drill two diagonally opposite holes into the backboard for each piece of hardware. Keep a 1/16-inch (1.6 mm) space between each piece of hardware.

2. Mount the wire troughs and the termination blocks.

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

3. If necessary, repeat steps 1 and 2 for a second column.

4. Run the 25-pair amphenol cable on the RJ21X interface to the termination blocks.

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

5. As needed, mount the D-rings to properly dress the wires.

6. Cut off the amphenol connector on the cross-connect field side and strip the wires for each of the 25 pairs.

7. Punch down the 25-pair wires to the termination block.

- a. Route the wires through the fanning slots on the termination block.

- b. Insert the conductors into the designated 110 connecting blocks already on the termination block.

- c. Use the D-impact tool to seat the conductors (see Figure 4-4).

- d. Remove any insulation fragments with a spudger.

8. Test the central office trunks for proper connection (see "Testing Trunks" later in this chapter).

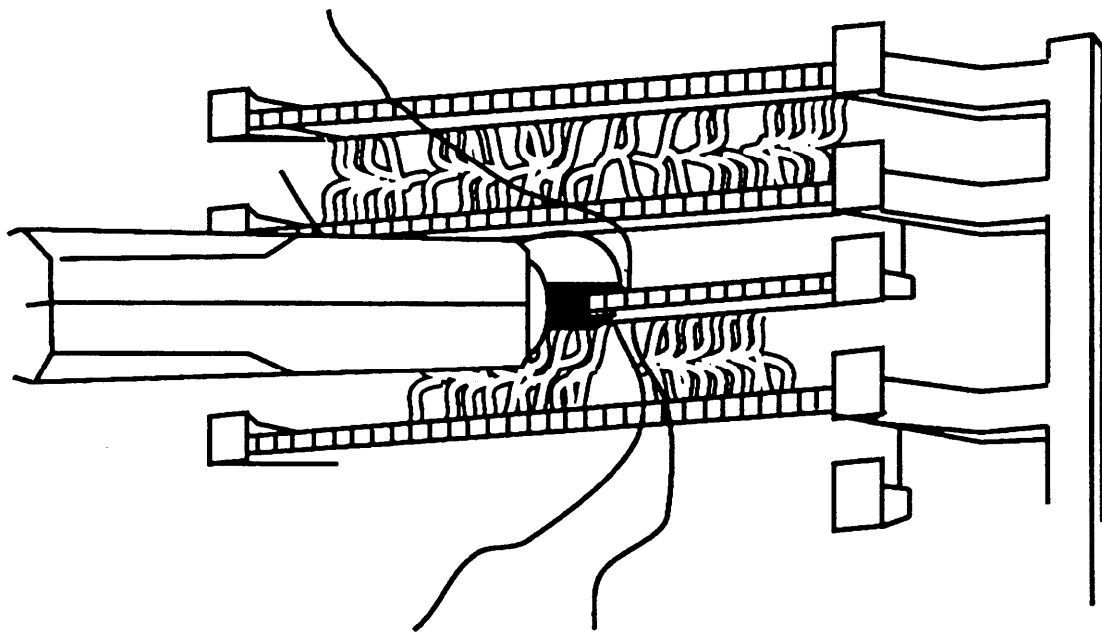


Figure 4-4. Using the D-Impact Tool to Seat the Conductors

9. Label the network interface jacks, control unit module jacks, termination blocks, and D2R cords (see “Labeling Trunks” later in this chapter).
10. For each trunk, plug one end of a D2R cord into the designated jack on the termination block and the other end into the trunk jack on the proper control unit module.

NOTE:

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

⚠ CAUTION:

Do not plug an analog multiline telephone, an MLX telephone, or anything else from the telephone side of the control unit into this wiring field; doing so will busy-out the trunk.

RJ11 and RJ14 Interfaces

The RJ11 and RJ14 interfaces are connected similarly, with the following differences:

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

Plug a 267C-type adapter into each RJ14 jack.

See Figure 4-5:

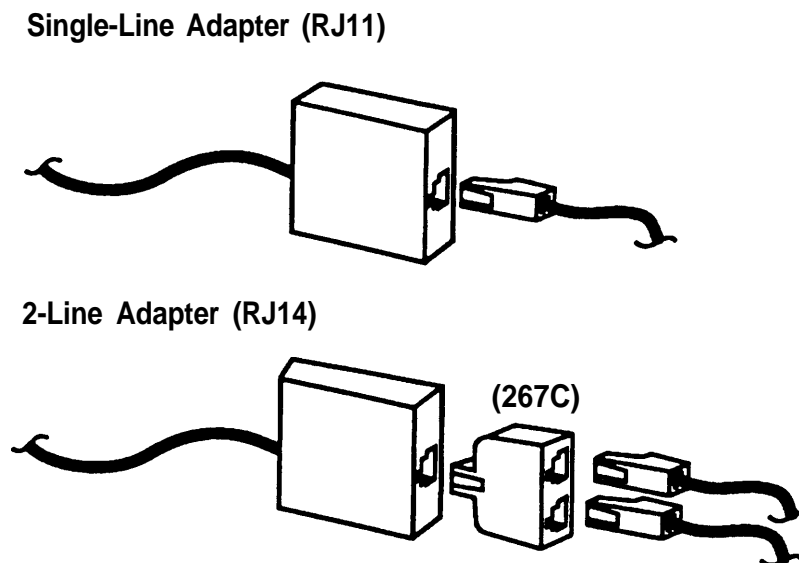


Figure 4-5. RJ11 and RJ14 Interfaces

RJ11 and RJ14 Network Interface Hardware

- D2R cords



CAUTION:

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

- *Use a D2R cable from an RJ11.*
- *Do not use the Brand-Rex Quad cable from an E66 block.*
If you cannot avoid using the Brand-Rex Quad cable, reverse the tip and ring leads at the E66 block to correct the mismatch.

RJ11 and RJ14 Network Interface Procedure

Follow this procedure to connect the RJ11 and RJ14 network interfaces to the control unit.

1. Test the central office trunks for proper connection (see “Testing Trunks” later in this chapter).
2. Label the network interface jacks, the control unit module jacks, and the D2R cords properly (see “Labeling Trunks” later in this chapter).
3. Plug one end of a D2R cord into the jack at the network interface and the other end into the appropriate trunk jack on the control unit.
4. Dress the wires properly.

RJ2GX Interface

The RJ2GX interface is a 25-pair amphenol connector that interfaces up to eight tie trunks. You construct the cross-connect field in the same way as for the RJ21X interface (see “RJ21X Interface” earlier in this chapter).

RJ21X and RJ2GX interfaces do not require separate termination blocks. If there is room on the termination block for the trunk wires, both the RJ21X and the RJ2GX can be punched down on the same 110AB1-100JP12 block. Any wires not used are left unterminated.



CAUTION:

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

RJ48C/X Interface

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

Testing Trunks

Before connecting the central office trunks to the control unit, verify that a dial is being received and that you can dial out on every trunk.



CAUTION:

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

DID trunks can be tested only through the control unit; do not test DID trunks at this time.

Test Loop-Start Trunks

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

1. Plug the telephone or the craft set into each central office trunk jack (either at the network interface or at the cross-connect field) and listen for a dial tone.
2. If you find a central office trunk that does not have a dial tone, check for a bad adapter or loose connections.
3. If adapters and wiring are in working order but you still do not hear a dial tone, notify the customer.
4. If you hear a dial tone, dial a known telephone number to verify dialing. Also, check that you have good two-way transmission after the central office completes the connection.
5. If you cannot dial out on any of the trunks, notify the customer. It is the customer's responsibility to report service outages to the local telephone company.

Test Ground-Stat Trunks

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

NOTE:

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

1. Plug the single-line telephone into each central office trunk jack (either at the network interface or at the cross-connect field).
2. Pick up the handset.
You should hear a dial tone.
3. Ground the ring lead by pushing the ground key (or button) or by grounding one side of the trunk.
4. Remove the ground from the ring lead.
5. Dial a known telephone number to verify dialing.
Also, check that you have good two-way transmission after the central office completes the connection.
6. If you find a central office trunk that does not have a dial tone, check for a bad adapter or loose connections.
7. If adapters and wiring are in working order but you still don't hear a dial tone, notify the customer.
8. If outward dialing is not possible on any of the trunks, notify the customer.

NOTE:

It is the customer's responsibility to report service outages to the local telephone company.

Labeling Trunks

You can have up to 80 central office trunk jacks on the communications system (1 to 80). Follow this procedure to label each D2R or D8W cord, network interface jack, and control unit module jack.

Procedure: Labeling Trunks

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

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

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

Installing the Channel Service Unit

The channel service unit (CSU) provides the interface between the 100D module and the DS1 facilities.

NOTE:

Before the CSU can be installed, the local telephone company must be contacted for information such as services available, equipment options, and 48-VDC power on the trunk.

Two models are available:

- ESF T1 CSU
- 551 T1 CSU

For any information on these CSUs that this chapter does not cover, see the user guide for your CSU. It is also recommended that you refer to the CSU documentation as you perform the procedures described in this section.

ESF T1 CSU

The ESF T1 CSU can connect to the DS1 network by using the D4 or extended superframe format (ESF). Also, it is the only CSU to provide the B8ZS line coding needed to transmit a 64-kbps clear channel.

Installing the ESF T1 CSU involves the following:

1. Setting the CSU DIP switches
2. Mounting the CSU in a relay rack or on a shelf as a stand-alone unit
3. Connecting the CSU to the 100D module and the network interface
4. Plugging the CSU into a 117-VAC outlet

Step 1: Setting the CSU DIP Switches

Set the CSU DIP switches as indicated on Form 3b, Incoming Trunks—DS1 Connectivity (100D Module).

The seven 8-position DIP switches on the rear panel of the CSU are set for operating features and diagnostic tests:

- SW1 sets the CSU address, which must be confirmed with the local telephone company (see Table 4-3 for the default settings).
- SW2 sets the bit-error rate (BER) alarm threshold (see Table 4-4 for the default settings).
SW3 is not used.
- SW4 sets the Errored Seconds threshold. Positions 7 and 8 can be changed to match diagnostic equipment (see Table 4-5 for the default settings).
- SW5 sets signal processing parameters according to the services required by the customer and provided by the telephone company (see Table 4-6 for the default settings).
- SW6 sets signal processing parameters according to the services required by the customer and provided by the telephone company (see Table 4-7 for the default settings).
- SW7 sets the distance from the 100D module to the CSU (see Table 4-8 for the default settings).

NOTE:

Setting SW7 or administering line compensation for the 100D module can provide for cable distances up to 655 ft (200 m). If the SW7 is set and the 100D module is administered, the maximum cable distance between the 100D module and the CSU can be up to 1310 ft (399 m).

Default Switch Settings

In the following tables, the “up” position is OFF or OPEN. The “Down” position is ON or CLOSED. To effect option changes, you must power down the CSU and then power up.

4-18 Installing the Channel Service Unit

Table 43. SW1 Default Settings

<u>Position</u>	<u>Status</u>
<u>1</u>	<u>up</u>
<u>2</u>	<u>down</u>
<u>3</u>	<u>down</u>
<u>4</u>	<u>down</u>
<u>5</u>	<u>down</u>
<u>6</u>	<u>down</u>
<u>7</u>	<u>down</u>
<u>8</u>	<u>down</u>

Table 44. SW2 Default Settings

<u>Position</u>	<u>Status</u>	<u>Effect</u>
<u>1</u>	<u>up</u>	<u>BER threshold is 10-6</u>
<u>2</u>	<u>down</u>	<u>BER threshold is 10-6</u>
<u>3</u>	<u>up</u>	<u>BER threshold is 10-6</u>
<u>4</u>	<u>up</u>	<u>BER threshold is 10-6</u>
<u>5</u>	<u>up</u>	<u>not used</u>
<u>6</u>	<u>up</u>	<u>not used</u>
<u>7</u>	<u>up</u>	<u>not used</u>
<u>8</u>	<u>up</u>	<u>Alarm LED/relay operation is momentary.</u>

Table 4-5. SW4 Default Settings

<u>Position</u>	<u>Status</u>	<u>Effect</u>
1	down	not used
2	down	not used
3	down	not used
4	down	not used
5	down	not used
6	down	not used
7	up	disable auto dial modem
8	down	TABS protocol enabled

Table 4-6. SW5 Default Settings

<u>Position</u>	<u>Status</u>	<u>Effect</u>
1	down	DTE is D4 framed.
2	down	Network is AMI.
3	down	DTE is AMI.
4	up	generate CRC-6 to DTE
5	up	generate CRC-6 to network
6	up	Part 68 Density enforcement
7	up	does not poll far-end CSU for alarms
8	up	not used

Table 4-7. SW6 Default Settings

Position	Status	Effect
1	down	send received signal to DTE or network during loopback operation
2	up	DTE B8ZS is not decoded.
3	up	Network B8ZS is not decoded.
4	down	Network ESF
5	down	default to DIP switch configuration upon power-up
6	up	not used
7	up	not used
8	down	loop network signal back (ESS loopback) to network during keep-alive

Table 4-8. SW7 Settings

Position	Status		
	0-150 ft	150-450 ft	450-655 ft
1	down	up	up
2	up	down	up
3	up	up	up
4	up	down	up
5	up	up	down
6	up	down	up
7	up	up	down
8	up	up	up

Bit-Error Rate Threshold Option

DIP switch SW2 can be set to alarm at bit-error rate (BER) threshold levels between 10-4 and 10-9 or can be disabled. Table 4-9 shows the settings for SW2 for the various thresholds.

Table 4-9. SW2 BER Options

Position	Threshold Option						
	10-4	10-5	10-6	10-7	10-8	10-9	Disable
1	up	down	up	down	up	down	down
2	up	up	down	down	up	up	up
3	up	up	up	up	down	down	up
4	up	up	up	up	up	up	down
5	not used (up)						
6	not used (up)						
7	not used (up)						
8	up = non-latching mode; down = latching mode						

Switch Settings for Framing in Hybrid/PBX Mode

The framing format for the network and for data terminal equipment can be either D4 or extended superframe (ESF). DIP switches SW5 and SW6 must be set according to the following tables to match the framing format for the network and the equipment. This applies to Hybrid/PBX mode only.

Table 4-10. Switch Settings in Hybrid/PBX Mode: Network and Equipment are ESF Framed Using AMI ZCS Line Code

Switch	Position							
	1	2	3	4	5	6	7	8
5	up	down	down	up	up	down	★	up
6	up	up	up	down	down	up	up	up

★ When this switch position is down, the near-end CSU polls the far-end CSU for alarm status.

Table 4-11. Switch Settings in Hybrid/PBX Mode: Network and Equipment are ESF Framed Using B8ZS Line Code

Switch	Position							
	1	2	3	4	5	6	7	8
5	up	up	up	down	down	down	up	up
6	up	down	down	down	down	up	up	up

Table 4-12. Switch Settings in Hybrid/PBX Mode: Network and Equipment are D4 Framed

Switch	Position							
	1	2	3	4	5	6	7	8
5	down	down	down	up	up	down	up	up
6	up	up	up	up	down	up	up	up

Set the Power Option Switch

Open the top panel of the ESF T1 CSU and set the power option switch to one of the following:

- span power (SP)
- dry loop (DL), local power
- wet loop (WL), local power

CAUTION:

Connecting an ESF T1 CSU that is provisioned for wet loop to a digital microwave, digital multiplexer, or fiber optics can damage the equipment.

Connecting an ESF T1 CSU that is provisioned for the wet loop option with span-line power present can damage the CSU.

Therefore, use the wet loop option only in private networks with user-owned facilities.

Local power is required for total unit operation no matter which method of power is selected.

Select the dry loop option in almost all cases. If span-line power is provided and the telephone company agrees, you can set the CSU for SP. However, most telephone companies do not provide span-line power for new installations.

Set the Artificial Transmit Line Option

Open the top panel of the ESF T1 CSU and set the Line Build-Out (LBO) switch to the proper option, which depends on the distance from the CSU to the first line repeater (see Table 4-14).

Table 4-13. Artificial Transmit Line Options

<u>Position</u>	<u>Option</u>	<u>Distance</u>
1	0.0 dB	0 - 1000ft
2	7.5 dB	1000 - 2000ft
3	15.0 dB	2000 — 3000 ft

NOTE:

- The required setting for the LBO switch is usually specified by the telephone company.
- The receive path contains a fixed 7.5 dB artificial line and an automatic line build-out (ALBO); circuit, which automatically compensate for signal levels in the range of 0 to -27.7 dB.

Step 2: Mounting the CSU

When you are finished setting the CSU switches, mount the CSU in a relay rack or on a shelf as a standalone unit.

Step 3: Connecting the ESF T1 CSU

Follow this procedure to connect the ESF T1 CSU to the 100D module and the DS1 network (see Figure 4-6):

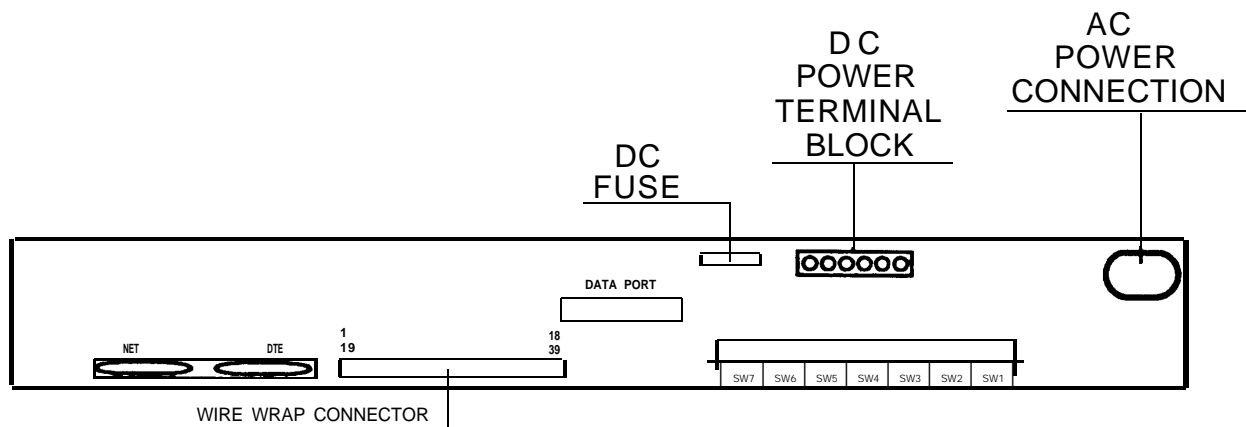


Figure 4-6. Connecting the ESF T1 CSU (Rear Panel)

- a. Connect one of the following cords to the rear panel of the CSU:
 - Connect a D8W cord directly to pins 3, 5, 21, and 23 on the wire-wrap connector (see Table 4-14 and Table 4-15).
 - Connect an M4BJ cable adapter to the 15-pin DTE female connector (see Table 4-16).

- b. Connect the other end of the cord to the 100D module.
- c. Connect the network interface cord to the CSU in one of the following ways:
 - directly to pins 8,10, 26, and 28 on the wire-wrap connector (see Table 4-15)
 - with a special cable adapter to the NET 15-pin male connector (see Table 4-17)

NOTE:

See the ESF T1 documentation for the name of this cable adapter.

Table 4-14. 100D Module Pin Assignments

<u>Pin No.</u>	<u>Designation</u>	<u>Signal</u>
1	T1	RCV (tip)
2	R1	RCV (ring)
4	R	XMT (ring)
5	T	XMT (tip)

Table 4-15. Wire-Wrap Connector Pin Assignments

Pin No.	Signal
1	shield ground
2	shield ground
3	transmit data to the DTE (ring)
5	receive data from the DTE (tip)
8	receive data from the network (tip)
10	transmit data to the network (ring)
19	shield ground
20	shield ground
21	transmit data to the DTE (tip)
23	receive data from the DTE (ring)
26	receive data from the network (ring)
28	transmit data to the network (tip)
30	external ACO input
31	audible com
32	audible N/C (with ACO)
33	audible N/O (with ACO)
34	visual com
35	visual N/C (no ACO)
36	visual N/O (no ACO)

Table 4-16. DTE 15-Pin Connector Pin Assignments

Pin No.	Signal
1	receive data from the DTE (tip)
2 or 8	shield ground
3	transmit data to the DTE (tip)
4 or 15	shield ground
9	receive data from the DTE (ring)
11	transmit data to the DTE (ring)

Table 4-17. Network 15-Pin Connector Pin Assignments

Pin No.	Signal
1	transmit data to the network (tip)
3	receive data from the network (tip)
8	shield ground
9	transmit data to the network (ring)
11	receive data from the network (ring)
15	shield ground

Step 4: Plugging the CSU into an AC Outlet

When Steps 1, 2, and 3 are finished, plug the CSU power cord into a 117-VAC outlet.

ESF T1 CSU Front Panel

The ESF T1 CSU front panel consists of LEDs, controls, and test jacks (see Figure 4-7).

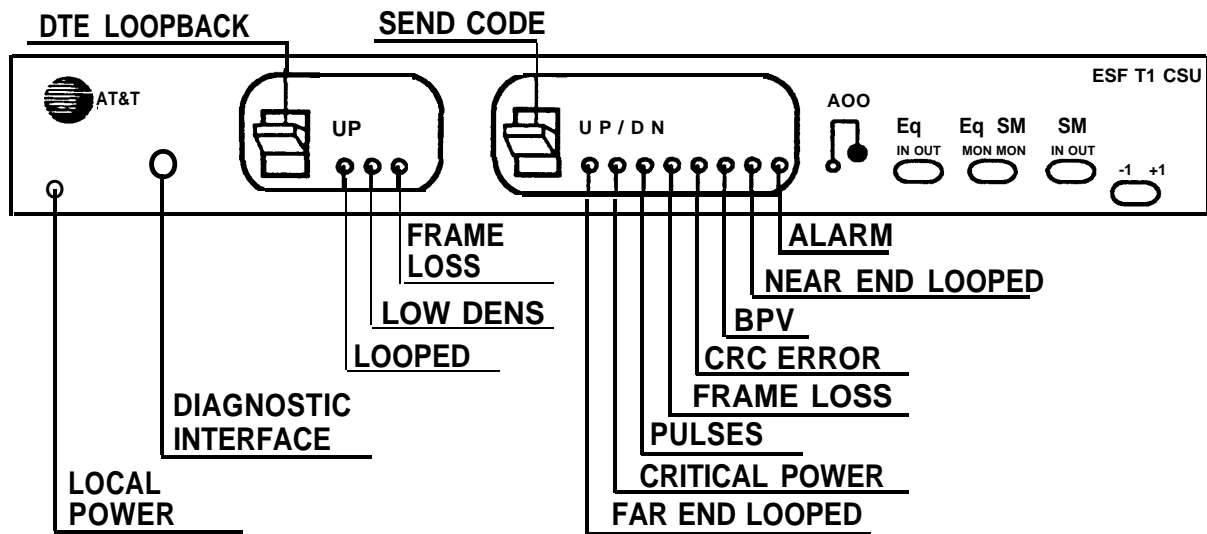


Figure 4-7. ESF T1 CSU Front Panel

Tables 4-18, 4-19, and 4-20 show the functions of these items.

Table 4-18. CSU Front Panel LEDs

LED	Color	When Lit Indicates
LOCAL POWER	Yellow	Local 117 VAC or -48 VDC is ON
Network Side:		
FAR END LOOPED	Red	Far-end CSU looped if initiated by near-end CSU.
CRITICAL PWR PULSES	Yellow	Power is on to critical circuits
FRAME LOSS	Green	Normal incoming signal from network
	Red	Loss of signal, loss of frame synch, improper frame sequence, or unframed signal
CRC ERROR	Red	CRC error detected
BPV	Red	Non-B8ZS violation detected when optioned for B8ZS; other bipolar violations detected
NEAR END LOOPED	Yellow	Loopback is activated
ALARM	Red	BER threshold exceeded (associated contacts for an audible alarm are also activated)
System Side:		
LOOPED	Yellow	Loopback activated on system side
FRAME LOSS	Red	Loss of signal, loss of frame synch, improper frame sequence, or unframed signal
LOW DENS	Red	Avg. ones density below threshold or consecutive zeroes threshold
ACO	Yellow	Lights when ACO button is pressed when ALARM LED is lit

Table 419. CSU Front-Panel Controls

Control	Function
LOOPBACK	Loops the incoming signal from the system to the system
SENDCODE	Sends loop-up or loop-down code to far-end CSU
ACO	Functions only when the ALARM LED is lit; turns on ACO LED and deactivates audible alarm; clears a arm if the alarm condition has been cleared

Table 4-20. CSU Front-Panel Test Jacks

Jack	Provides
DIAGNOSTIC	Access via 310 jack to the 4-kbps data link
EQ IN	Break-in access to transmit line to system
EQ OUT	Break-in access to receive line from system
SM IN	Break-in access in transmit path to network
SM OUT	Break-in access in receive path from network
EQ MON	Monitor access to received signal from system
SM MON	Monitor access to received signal from network
+1, -1	Test points for measuring simplex current from network to critical circuits-(if provided)

551 T1 CSU

The 551 T1 CSU performs many of the same functions as the ESF T1 CSU except for the following:

- B8ZS is not supported.
Therefore, the 64-kbps clear channel is not supported.
- Extended superframe (ESF) format is not supported.
if a network requires this format, the ESF T1 CSU must be used.

This CSU consists of the following components:

- chassis with top and rear cover
- Signal Monitor Unit (plug-in)
- Office Repeater (plug-in)
- Fault Location Filter (a factory-installed option)

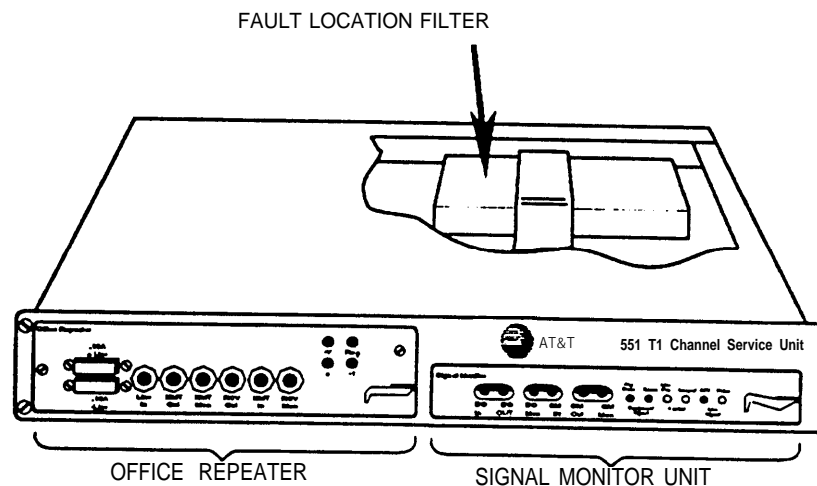


Figure 4-8. 551 T1 CSU

Installing the 551 T1 CSU involves the following:

1. Setting the CSU DIP switches
2. Mounting the CSU in a relay rack or on a shelf as a stand-alone unit
3. Connecting the CSU to the network interface
4. Inserting the signal monitor unit
5. Inserting the office repeater
6. Connecting the CSU to the 100D module
7. Plugging the CSU into an outlet

NOTE:

Before the CSU can be installed, the serving telephone company must be contacted to obtain all necessary information, such as services available, equipment options, and power on the line.

These steps are explained in detail in the sections that follow.

Step 1: Setting the CSU DIP Switches

Before placing the signal monitor unit and the office repeater in the CSU, set the CSU DIP switches according to the specifications on Form 3b, Incoming Trunks—DS1 Connectivity (100D Module).

The default settings accommodate most installations. However, some options depend upon local line conditions, for example, availability of line power and the type of service requested by the customer.

Also, proper settings for some options must be obtained from your technical support organization, the customer's authorized dealer, or the local telephone company. The local telephone company representative must be informed of the options selected.

Signal Monitor Unit Switch Settings

There are four option switches in the signal monitor unit (see Figure 4-10). These switches govern the operation of the following options:

- ONES causes the unit to transmit an ALL ONES keep-alive signal to the central office when the customer signal drops below the minimum average ones-density.
- ESS (electronic switching system) causes the CSU to loop back its receive line to its transmit line (instead of generating ALL ONES) when the customer signal fails. The loopback framing pattern prevents false alarms at an ESS or a data acquisition control system (DACS).
- ZEROES selects either 16 or 50 consecutive zeroes to be the criteria for lighting the Zeroes LED.
- ACTIVE FAULT LOCATE causes the remote loopback path to preserve bipolar violations to allow single-ended fault locating when active fault filters are used. Table 4-21 shows the switch settings for the different options.

Figure 4-21. Signal Monitor Unit Switch Settings

Option	Switch Setting
ONES	#1 — closed #2 — open
ESS	#1 — open #2 — closed
ZEROES	#3 — closed for 16-zero limit
ACTIVE FAULT LOCATE	#4 — closed

Office Repeater Switch Settings

Table 4-22 and Table 4-23 show the power mode and artificial line-option settings for the office repeater. See Figure 4-11 for the location of the option-setting screws.

Table 4-22. Office Repeater Power Mode Option Settings

Power Mode	Screw Options ★	S2	S3	S4	S5
Line power	C, E, K	n/a	n/a	AB	B
-48 V with sealing current	C, E, K	Y	OU	AA	B
-48 V without sealing current	C, G, J	Y	OUT	AA	B

★ Letters indicate those screws that are closed.

Table 4-23. Office Repeater Artificial Line Options

<u>Line Loss</u>	<u>S1</u>	<u>S5</u>
<u>0 dB</u>	<u>C</u>	<u>n/a</u>
<u>7.5 dB</u>	<u>A</u>	<u>A</u>
<u>15 dB</u>	<u>B</u>	<u>B</u>

Step 2: Mounting the CSU

After the options have been set on the signal monitor unit and the office repeater, mount the CSU shelf assembly into a relay rack, a cabinet, or as a standalone unit.

Step 3: Connecting the CSU to the Network Interface

The terminal block (TB1) on the back of the CSU is the connecting point for T1 service lines, fault wires, and loopback wires. Also, if a local power supply is used, the TB1 is the termination spot for the power supply wires.

⚠ WARNING:

Voltages as high as 260 V can occur between the transmit and receive pairs of the T1 line.

Follow this procedure to connect the T1 lines to the CSU (see Figure 4-9):

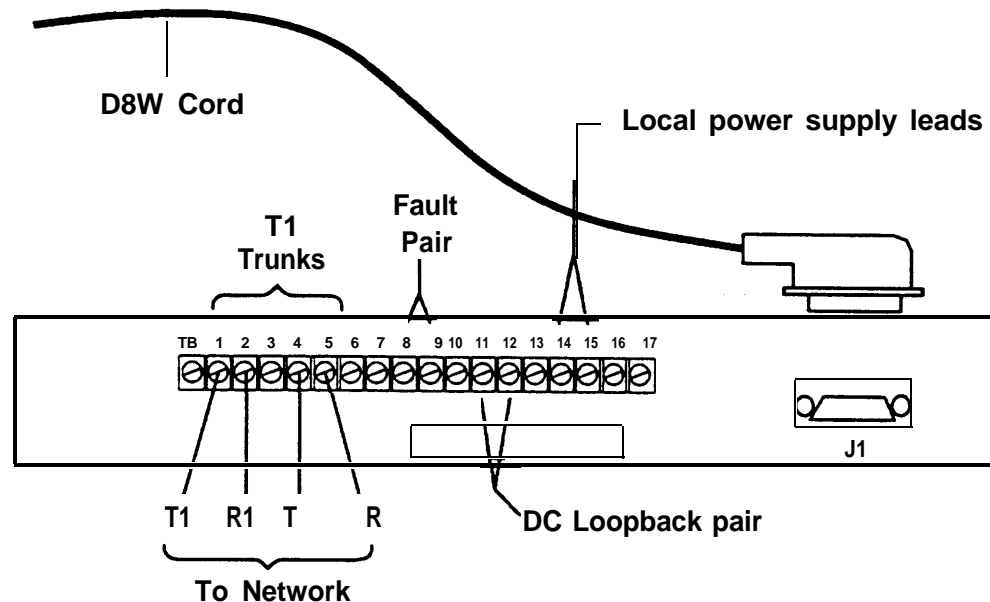


Figure 4-9. Connecting the T1 Lines to the CSU

- Connect the T1 service lines to terminals 1 through 5.
- Connect the fault pair (if provided by the local telephone company) to terminals 8 and 9.

- c. Connect the DC loopback pair (if provided by the local telephone company) to terminals 11 and 12.
- d. If the CSU is to be locally powered, connect the power supply leads to terminals 14 and 15.

Step 4: Inserting the Signal Monitor Unit

After setting the option switches, plug the signal monitor unit into the right side of the 551 T1 CSU.

The signal monitor unit has six LEDs and six bantam jacks (see Figure 4-10).

Table 4-24 and Table 4-25 show the functions of the LEDs and the test jacks on the front panel.

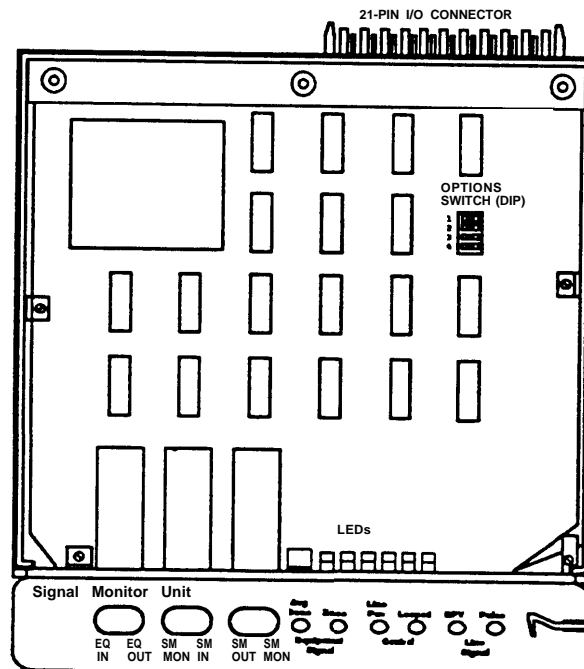


Figure 4-10. Signal Monitor Unit

Table 4-24. Signal Monitor Unit Front-Panel LEDs

Label	Color	When Lit Indicates
Avg. Dens	Red	Low average ones density
Zeroes	Red	> 50 consecutive zeroes (needed for encryption) or > 16 consecutive zeroes (option switch S4 closed)
Line Pwr	Yellow	Presence of simplex current
Looped	Yellow	Loopback function activated
BPV	Red	Bipolar violations received
Pulse	Green	Normal 1.544-Mbps pulses present

Table 4-25. Signal Monitor Unit Front-Panel Test Jacks

Jack	Provides
EQ (IN-OUT-MON)	Access to transmit input and receive output of the 100D module
SM (IN-OUT-MON)	Access to CSU transmit input and receive output

Step 5: Inserting the Office Repeater

Plug the office repeater into the left slot of the 551 T1 CSU (see Figure 4-11):

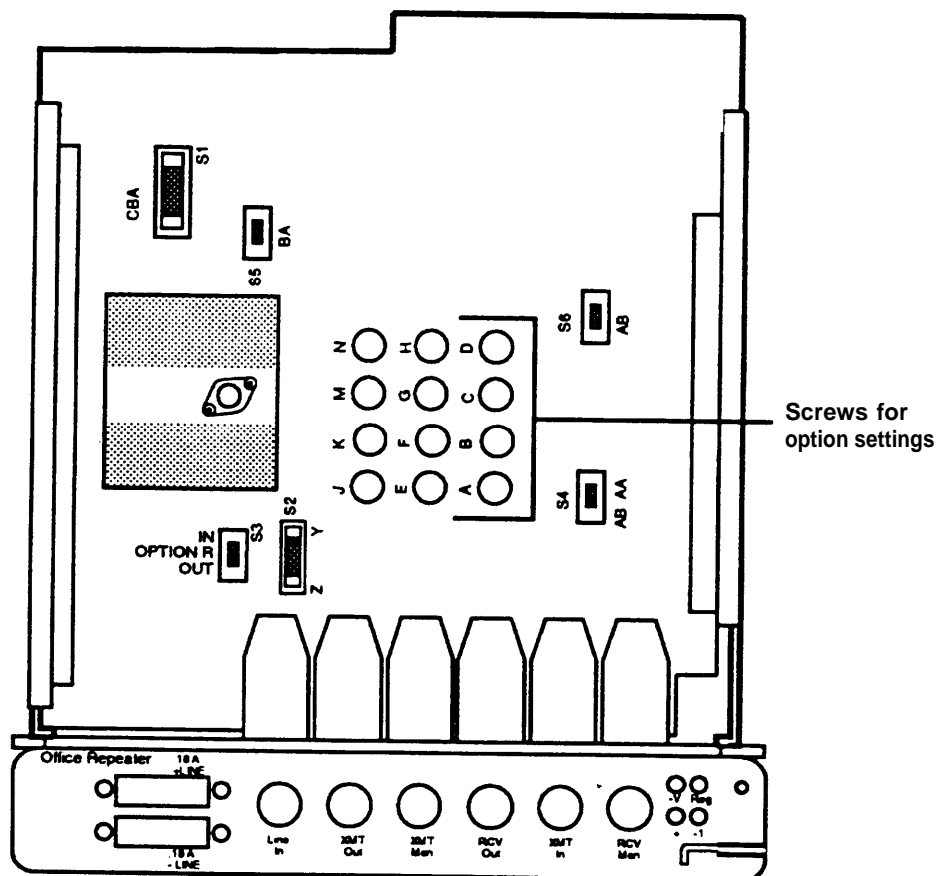


Figure 4-11. Inserting the Office Repeater into the 551 T1 CSU

The front panel has the following:

- six 310 jacks for in-line access and monitoring of the span line and the signal monitor unit card
- two GMT fuses for protection of the local powering circuitry
- four test points

The transmit path in the office repeater has an adjustable artificial line; this allows the transmit level to be adjusted to 0, 7.5, or 15 dB to meet the required -15 or -22.5 dB section loss. The receive path contains a fixed 7.5 dB artificial line and an Automatic Line Build-Out (ALBO) circuit, which automatically compensates for signal levels in the range of 0 to -27.7 db.

Step 6: Connecting the 551 T1 CSU to the 100D Module

- a. Connect the 100D module to the CSU rear panel (see Figure 4-9).

NOTE:

The maximum length of cable from the 100D module to the CSU for line compensation is 655 ft (200 m).

Table 4-26 shows the pin assignments for the rear panel connections.

Table 4-26. CSU Rear-Panel Pin Assignments

100D Module			551 T1 CSU		
PIN #	DESIG	SIGNAL	D-CONN	DESIG	SIGNAL
1	T1	RCV (tip)	3	T	XMT (tip)
2	R1	RCV (ring)	11	R	XMT (ring)
4	R	XMT (ring)	9	R1	RCV (ring)
5	T	XMT (tip)	1	T1	RCV (tip)

-
- b. Connect the network interface cord to pins 1, 2, 4, and 5 on terminal block 1 (TB1) on the rear panel of the CSU.

Table 4-27. TB1 Pin Assignments

<u>Pin No.</u>	<u>Designation</u>	<u>Signal</u>
1	T1	Transmit
2	R1	Transmit
4	T	Receive
5	R	Receive

Step 7: Plugging the CSU into an Outlet

Depending on the type of line provided by the local telephone company, the CSU can be supplied with -48 VDC power on the T1 wire pair from the network.

If the CSU is not powered from the network, a KS22911-L1 power supply is required.

Connect the power supply to the rear panel at TB1 as follows:

- positive lead to terminal 15
- -48 VDC lead to terminal 14

Once you have completed all installation procedures as described in the previous chapters, you can connect an Station Management Detail Record (SMDR) or Call Accounting Terminal (CAT) printer and a personal computer (PC), or a CAT and CAT printer, to the system.

Connecting a PC to the Control Unit

A PC with MS-DOS 3.3 or higher and SPM 2.xx or higher can be used for SMDR, system programming, and maintenance. The connection of the PC to the control unit depends on the distance between them:

- If the PC is within 50 ft (15 m) of the control unit, follow the procedure in the section, "Connecting a PC (Within 50 Feet)."
- If the PC is more than 50 ft (15 m) from the control unit, follow the procedure in the section, "Connecting a PC (50 Feet or More)."



CAUTION:

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

Connecting a PC (Within 50 Feet)

Use the hardware and procedures in this section to connect a PC to the control unit when the distance is less than 50 ft (15 m). See Figure 5-1.

Hardware

- 355AF adapter
- D8W cord
- EIA-232-D cable (optional; use only if preferred)

Procedure: Connecting the PC (Within 50 Feet)

1. For system programming or system maintenance, plug one end of a D8W cord into the SPM jack on the control unit (the lower jack).

NOTE:

For SMDR, plug the D8W cord into the SMDR jack (the upper jack) instead of the SPM jack.

2. Plug the other end of the D8W cord into a 355AF adapter.
3. If you are using the EIA-232-D cable, connect one end to the 355AF adapter and the other end to the COM1 port on the PC.

If you are not using the EIA-232-D cable, connect the 355AF adapter directly to the COM1 port on the PC.

5-2 Connecting a PC to the Control Unit

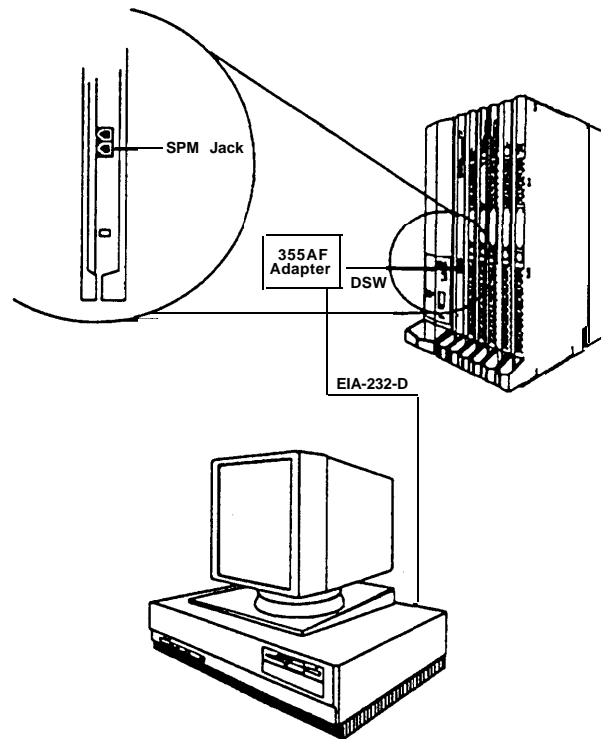


Figure 5-1. Connecting the PC (Within 50 Feet)

Connecting a PC (50 Feet or More)

Use the hardware and procedures described in this section to connect a PC to the control unit when the distance is 50ft (15 m) or more. See Figure 5-2.

NOTE:

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

Hardware

- 355AF adapter
- 400B2 power adapter
- BR1A-4P adapter, or 102 connecting block, or 103 connecting block
- Z3A2 asynchronous data unit (ADU)
- EIA crossover cable
- ADU crossover cable
- 2012D transformer
- 248B adapter
- 8-position wall jacks
- 4-pair plug-ended cable
- D8W cords
- D6AP power cord
- EIA-232-D cable

Procedure: connecting the PC (50 Feet or More)

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

5-4 Connecting a PC to the Control Unit

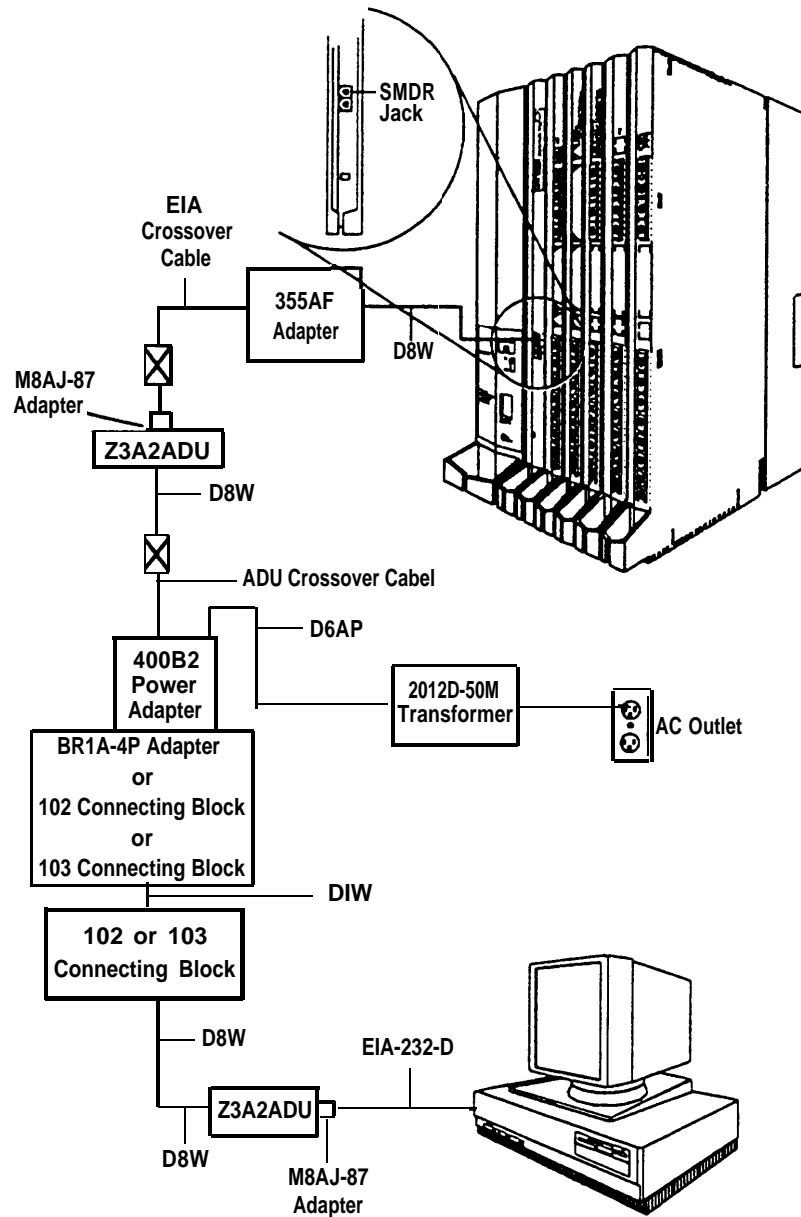


Figure 5-2. Connecting the PC (50 Feet or More)



CAUTION:

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

5. Connect one end of a D8W cord to the WALL jack on the Z3A2 ADU and the other end to an ADU crossover cable.
6. Connect the other end of the ADU crossover cable to one of the jacks on a 400B2 power adapter.
7. Connect one end of a D6AP cord to the 400B2 power adapter.
8. Connect the other end of the D6AP cord to a 2012D-50M transformer (see Figure 5-3).
9. Plug the 400B2 power adapter into a wall jack, BR1A-4P adapter, 102 connecting block, or 103 connecting block.
10. If the 400B2 is plugged into a wall jack, make sure that building wiring has been set up so that the control unit-side wall jack communicates with the PC-side wall jack.

If the 400B2 is plugged into a BR1A-4P adapter, 102 connecting block, or 103 connecting block, use 4-pair plug-ended cable to connect the BR1A-4P adapter (or connecting block) to the PC-side wall jack.

11. On the PC side, plug one end of a D8W cord into the wall jack and the other end into the WALL jack on the Z3A2 ADU.
12. Plug one end of a D8W cord into the wall jack and the other end into the WALL jack on the Z3A2 ADU.
13. Connect one end of an EIA-232-D cable to the 25-pin male connector on the Z3A2 ADU and the other end to the COM1 port on the PC.
14. Plug the 2012D-50M transformer into a wall outlet.

5-6 Connecting a PC to the Control Unit

Connecting a CAT to the Control Unit

The CAT is a stand-alone unit that connects to the SMDR jack of the control unit and provides cost-accounting information. The CAT links the control unit to the CAT Printer. The connection of the CAT to the control unit depends on the distance and whether the CAT and control unit share the same AC outlet.

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

- If the CAT is grounded to the same AC outlet as the control unit and the CAT unit is within 14 ft (4.27 m) and the printer is within 50 ft (15 m) of the control unit, skip to the section, “Connecting a CAT and Printer on the Same AC Outlet.”
- If the CAT is either not grounded to the same AC outlet as the control unit or more than 14 ft (4.27 m) from the control unit, skip to the section, “Connecting a CAT and Printer on a Different AC Outlet.”



CAUTION:

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

Connecting a Printer to the Control Unit

A printer can be connected to the SMDR jack on the control unit.

The following printers are supported:

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

NOTE:

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

Printer connection varies depending on the printer model, whether the printer is grounded on the same AC outlet as the control unit, and whether the printer is within 50 ft (15 m) of the control unit. All methods are explained in this chapter:

- If the printer is an AT&T CAT serial printer used with a CAT and is grounded to the same AC outlet as the control unit and within 50 ft (15 m) of the control unit, skip to the section, "Connecting a CAT and Printer on the Same AC Outlet."
- If the printer is an AT&T CAT serial printer used with a CAT and is either not grounded to the same AC outlet as the control unit or more than 50 ft (15 m) from the control unit, skip to the section, "Connecting a CAT and Printer on a Different AC Outlet."
- If the SMDR or CAT printer is within 50 ft (15 m) of the control unit and is connected to the same 117-VAC branch as the control unit, skip to the section, "Connecting a Printer (Within 50 Feet)"
- If the SMDR or CAT printer is more than 50 ft (15 m) from the control unit and is not connected to the same 117-VAC branch as the control unit, skip to the section, "Connecting a Printer (50 Feet or More)."

5-8 Connecting a Printer to the Control Unit



CAUTION:

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

Connecting a CAT and Printer on the Same AC Outlet

If the printer is an AT&T CAT serial printer and is plugged into the same AC outlet as the control unit and CAT, and the CAT is less than 14 ft (4.27 m) and the printer is less than 50 ft (15 m) from the control unit, use the hardware and procedures in this section.

Hardware

- Z200A EMI filter
- D8W cord
- 355A Adapter

Procedure: Connecting a CAT and Printer on the Same AC Outlet

1. Plug the short end of the Z200A EMI cord into the SMDR jack on the control unit (the upper jack).
2. Plug the other end of the Z200A EMI cord into the SMDR jack on the back of the CAT.
3. Plug one end of a D8W cord into the PRINTER modular jack on the back of the CAT.
4. Plug the other end of the D8W cord into a 355A adapter.
5. Slide the 355A adapter into the serial port on the back of the printer.
6. Set the printer options for use with the SMDR feature. See the section, "Setting Printer Options," for the appropriate printer setting for the printer.

Connecting a CAT and Printer on a Different AC Outlet

If the printer is an AT&T CAT serial printer and is either not grounded to the same AC outlet as the control unit or CAT, or is more than 50 ft (15 m) from the control unit, follow the procedures in this section.

NOTE:

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

Hardware

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

Procedure: Connecting a CAT Printer on a Different AC Outlet

1. Plug the short end of the Z200A EMI cord into the SMDR jack on the control unit (the upper jack).
2. Plug the other end of the Z200A EMI cord into a 355AF adapter.
3. Connect the female connector on the 355AF to one end of the M7U null modem cable.
4. Connect the other end of the M7U null modem cable to the 25-pin female connector on a Z3A4 ADU.
5. Plug one end of a D8W cord into the WALL jack on the Z3A4 ADU.
6. Plug the other end of the D8W cord into a modular jack on the D8AM modular crossover cable.
7. Plug the other end of the D8AM modular crossover cable into the top jack on the 400B2 power adapter.
8. Plug the 400B2 power adapter into the control unit-side wall jack. Make sure that building wiring has been set up so that the control unit-side wall jack communicates with the printer-side wall jack.

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

NOTE:

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

10. Plug the other end of the D6AP cord into the lower jack on the 400B2 power adapter.
11. Plug the 2012D-50M (or 2012D) transformer into a wall outlet near the control unit.
12. At the printer location, plug one end of a D6AP cord into a 2012D-50M transformer, or follow the instructions given in the note above.
13. Plug the other end of the D6AP cord into the lower jack on a 400B2 power adapter.
14. Plug the 400B2 power adapter into the wall jack.
15. Plug the 2012D-50M (or 2012D) transformer into a wall outlet near the printer.
16. Plug one end of another D8W cord into the top jack on the second 400B2 power adapter.
17. Plug the other end of the D8W cord into the WALL jack on the Z3A2 ADU.
18. Connect the 25-pin male connector on the Z3A2 ADU to the 25-pin female connector on a second 355AF adapter.
19. Plug one end of a third D8W cord into the second 355AF adapter.
20. Plug the other end of this D8W cord into the SMDR jack on the back of the CAT.

21. Plug one end of a fourth D8W cord into the `PRINTER` jack on the back of the CAT.
 22. Plug the other end of this D8W cord into a third 355A adapter.
 23. Slide this 355A adapter into the serial port on the back of the printer.
 24. Set the printer options for use with the SMDR feature. See the section, "Setting Printer Options," for the appropriate printer setting for the printer.
-

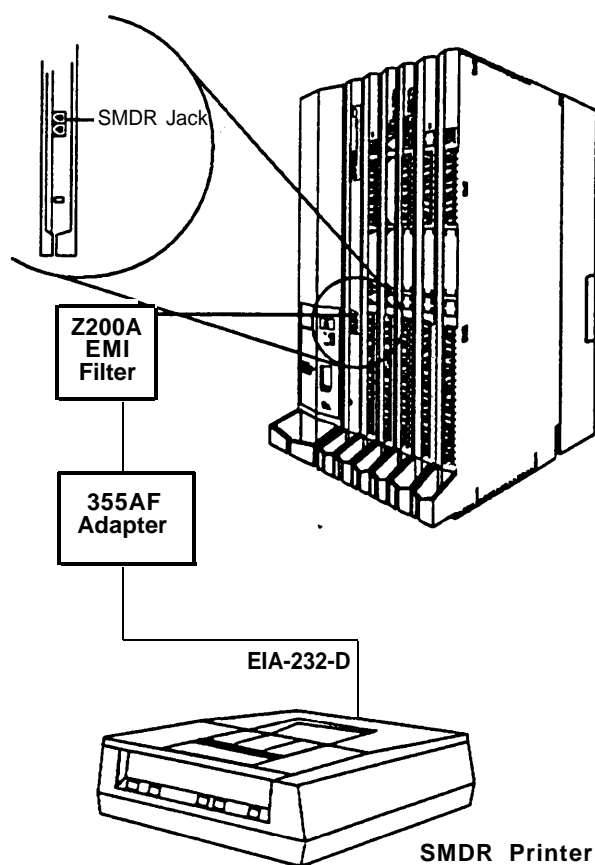


Figure 5-3. Connecting the Printer (Within 50 Feet)

Connecting a Printer (Within 50 Feet)

If the printer is within 50 ft (15 m) of the control unit and is connected to the same 117-VAC branch as the control unit, use the hardware and procedures in this section.

Hardware

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

Procedure: Connecting the Printer (Within 50 Feet)

1. Plug the short end of the Z200A EMI cord into the SMDR jack on the control unit (the upper jack).
See Figure 5-3 for the entire procedure.
2. Plug the other end of the Z200A EMI cord into the adapter (355AF or 355A).
3. Connect the female connector on the adapter to the 25-pin male connector on the printer's interface cable, or into the parallel or serial port (depending on the printer type) on the printer.
4. Set the printer options for use with the SMDR feature. See the section, "Setting Printer Options," for the appropriate printer setting for the printer.

Connecting a Printer (50 Feet or More)

Use the hardware and procedure described in this section to connect a printer to the control unit if the following conditions apply:

- the printer is not a CAT printer connected to a CAT
- the printer is 50 ft (15 m) or more from the control unit
- the printer is not grounded to the same AC outlet as the control unit
- the printer is not grounded to an outlet that is on the same 117-VAC branch as the control unit and that is 50 ft (15 m) or less from the control unit

NOTE:

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

Hardware

- Z200A EMI filter
- adapter for the interface cable connector
 - 355A for the male connector
 - 355AF for the female connector

- 400B2 power adapter
- Z3A2 ADU
- BR1A-4P adapter, or 102 connecting block, or 103 connecting block
- 8-position wall jacks
- EIA crossover cable
- ADU crossover cable
- 2012D transformer
- 248B adapter
- D8W cords
- D6AP power cord
- EIA-232-D cable
- 4-pair plug-ended cable

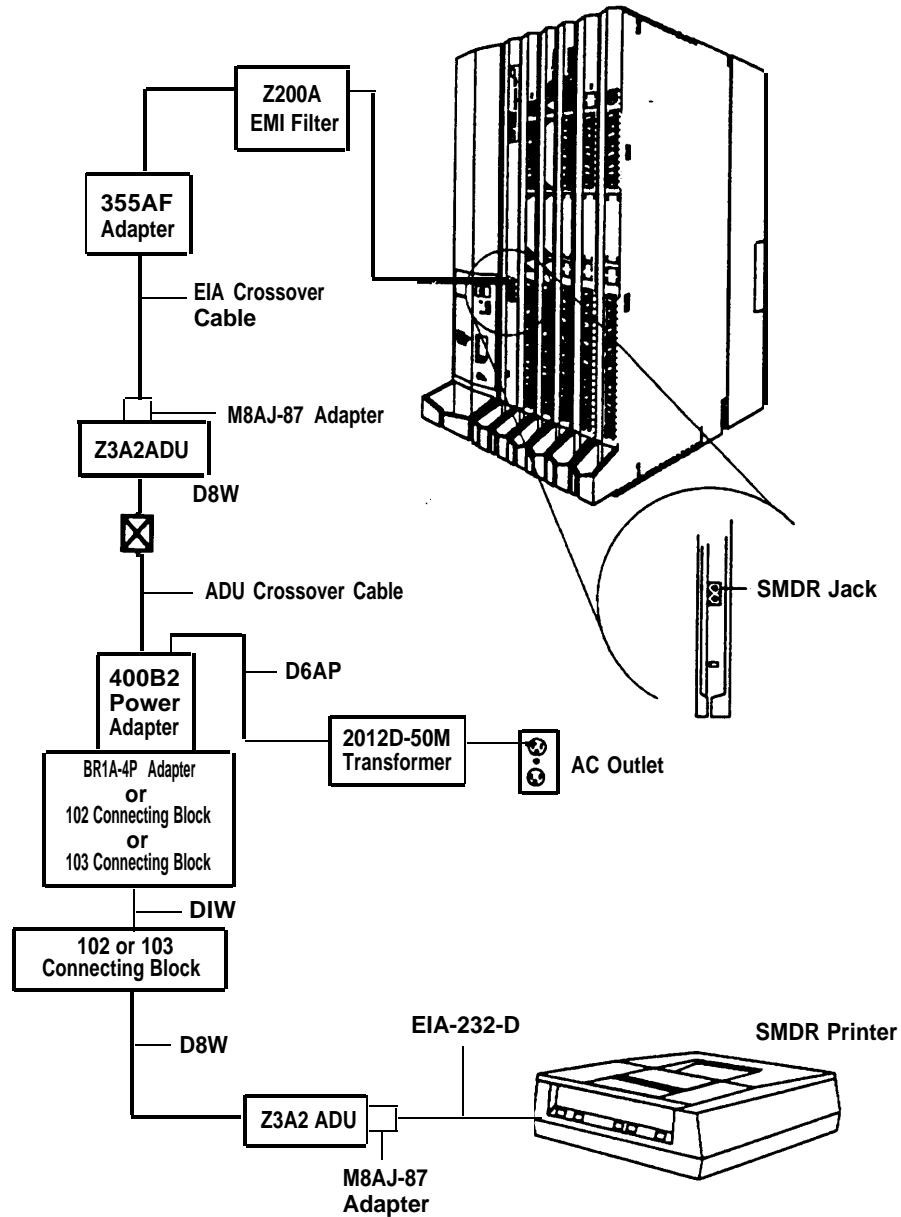


Figure 5-4. Connecting the Printer (50 Feet or More)

Procedure: Connecting the Printer (50 Feet or More)

1. Plug the short end of the Z200A EMI cord into the SMDR jack on the control unit (the upper jack).
See Figure 5-4 for the entire procedure.
2. Plug the other end of the Z200A EMI cord into a 355AF adapter.
3. Connect the female connector on the 355AF adapter to one end of the EIA crossover cable.
4. Connect the other end of the EIA cable to the 25-pin male connector of the Z3A2 ADU.



CAUTION:

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

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

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

NOTE:

If you are working with a 248B adapter and 2012D transformer instead of a 2012D-50M transformer, plug the D6AP cord into the jack on the 248B adapter, and then connect the spade-tip wires on the 248B adapter to the screws on a 20120 transformer (see Figure 5-5).

10. Plug the 400B2 adapter into a wall jack, BR1A-4P adapter, 102 connecting block, or 103 connecting block.
11. If the 400B2 is plugged into a wall jack, make sure that building wiring has been set up so that the control unit-side wall jack communicates with the printer-side wall jack.

If the 400B2 is plugged into a BR1A-4P adapter, 102 connecting block, or 103 connecting block, use 4-pair plug-ended cable to connect the BR1A-4P adapter (or connecting block) to the printer-side wall jack.
12. On the printer side, plug one end of a D8W cord into the wall jack and the other end into the `WALL` jack on the Z3A2 ADU.
13. Connect one end of an EIA-232-D cable to the 25-pin male connector on the Z3A2 ADU and the other end to the parallel or serial port (depending on the printer type) of the printer.
14. Plug the 2012D-50M (or 2012D) transformer into a wall outlet.
15. Set the printer options for use with the SMDR feature. See the section, "Setting Printer Options," for the appropriate printer setting for the printer.

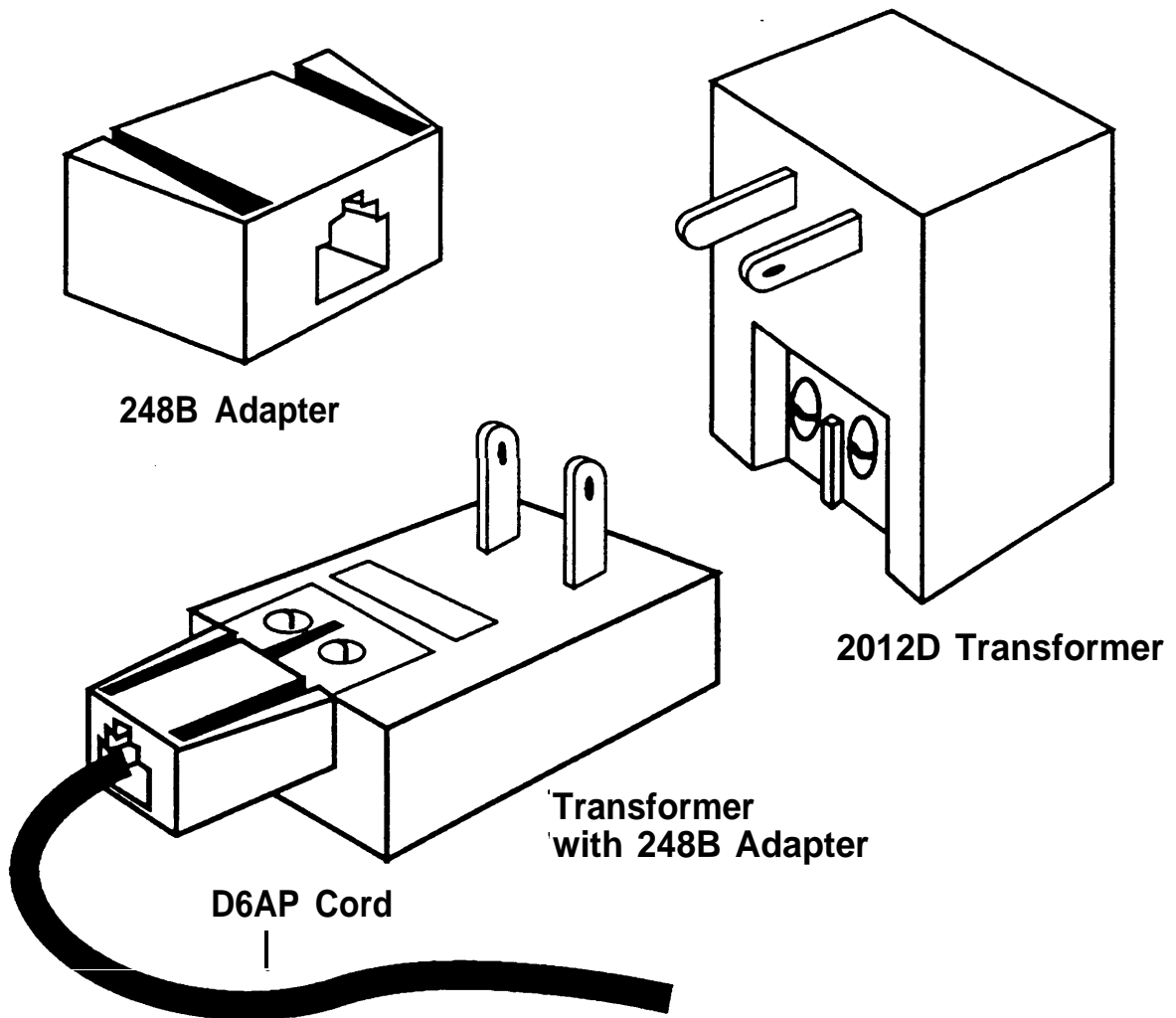


Figure 5-5. Connecting the 248B Adapter and the 2012D Transformer

Setting Printer Options and DIP Switches

Use the information in this section to determine the correct printer setting for the printer.

- For the AT&T 572 printer, set the options on the printer according to Table 5-1. (See the user's guide supplied with the printer for further information.)
- For the AT&T 475/476 printer, set the DIP switches on the printer according to Table 5-2. (See the user's guide supplied with the printer for further information.)
- For the AT&T CAT printer, set the DIP switches on the printer according to Table 5-3. (See the user's guide supplied with the printer for further information.)
- For the AT&T Applications printer, set the DIP switches on the printer according to Table 5-4. (See the user's guide supplied with the printer for further information.)

Table 5-1. AT&T 572 Printer Options

<u>No.</u>	<u>Function</u>	<u>Menu</u>	<u>Status</u>
01	FORM LENGTH	09	11
02	LPI	01	6
03	CPI	01	10
04	LQ or NLQ	01	LQ
05	BUZZER	01	ON
06	FONT	01	BUILT-"IN"
07	RESOLUTION	01	144
11	BUFFER	02	N-"LINE"
13	PW ON MODE	01	ON-"LINE"
14	DIRECTION	01	BI-DIR. 1
15	BUFFER FULL	02	LF + CR

Continued on next page

Table 5-1. - Continued

<u>No.</u>	<u>Function</u>	<u>Menu</u>	<u>Status</u>
16	P.E.	01	ACTIVE
17	AUTO CR	01	CR + LF
18	ZERO	01	0
22	AUTO LF	01	CR ONLY
31	1" SKIP	01	OFF
32	CHAR. SET (GO,GL)	02	USA
33	CHAR. SET (G1 ,GR)	01	U K
34	CHAR. SET (G2)	03	GE
35	CHAR. SET (G3)	0	"LINE" DRAWING
81	OFF-"LINE" STATE	01	ALL RECEIVE
82	DSR	02	OFF
83	RTS TIMING	01	RTS
84	CD	02	OFF
85	CTS	02	OFF
91	OVER RUN	02	256
92	DATA BIT	02	8
93	PROTOCOL	03	XON/XOFF ★
94	STOP BIT	01	2
95	PARITY	01	NON
96	B P S	04	1200

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

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

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

NOTE:

Open = off, Closed = on

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

<u>Switch 1</u>	<u>Switch 2</u>	<u>Control Switch</u>
DIP 1-On	DIP 1-On	DIP 1-Off
DIP 2-On	DIP 2-On	DIP 2-Off
DIP 3-On	DIP 3-Off	DIP 3-Off
DIP 4-On	DIP 4-Off	DIP 4-Off
DIP 5-On	DIP 5-On	DIP 5-On
DIP 6-On	DIP 6-On	DIP 6-Off
DIP 7-On	DIP 7-On	DIP 7-On
DIP 8-On	DIP 8-Off	DIP 8-Off

NOTE:

Off = open, On = closed

AT&T Applications Printer DIP Switch Settings

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

Connecting Data Equipment

6

This chapter explains how to set up data stations and modem pools. A data station is a data terminal that sends and receives data (and voice if the station includes a telephone). If the system includes both analog and digital data stations that need to communicate with each other, a modem pool is required. See Figure 6-1.

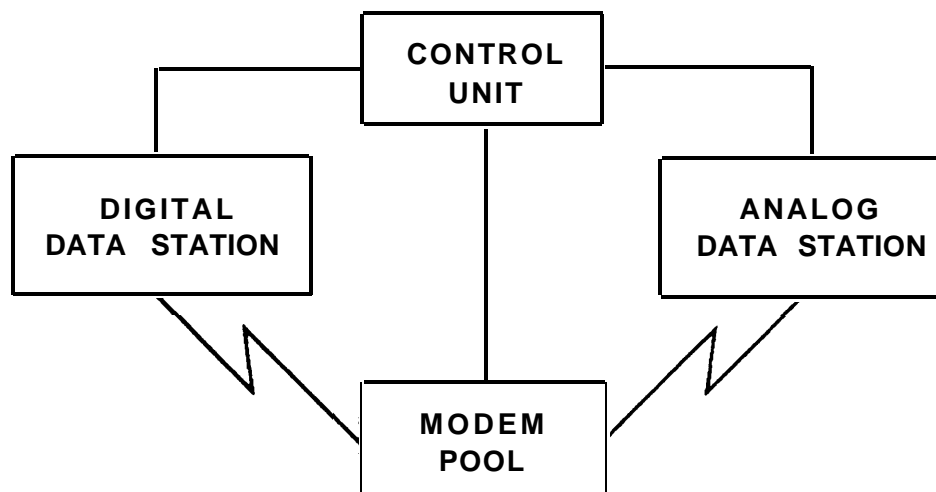


Figure 6-1. Data Stations and a Modem Pool

Data Stations

A data station is a combination of equipment, possibly including a telephone, PC, printer, or fax machine. If the data station sends and receives *analog data*, it requires a modem to convert the signal from digital to analog or from analog to digital. If, however, the data station sends and receives *digital data*, it requires a data module instead of a modem.

Analog Data Stations

An analog data station uses a modem to convert digital signals so that it can send and receive analog signals. This allows the customer to have data communication without requiring PRI trunks.

Depending on the customer's needs, the system supports the following analog stations:

- Analog data and analog voice
(analog data terminal and analog multiline telephone)
- Analog data only

NOTE:

If the modem has a phone jack, a telephone can be connected; however, simultaneous voice and data is not permitted.

- Analog data and digital voice
(analog data terminal and MLX telephone)

NOTE:

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

See Form 2a, System Numbering—Station Jacks for your customer's specifications.

Detailed instructions for setting up analog data stations are in the section, "Data Station Equipment Configurations."

Digital Data Stations

Depending on the customer's needs, the system supports the following types of digital stations:

- Digital data and digital voice (digital data terminal and MLX telephone)
- Digital data only (simultaneous voice and data is not permitted)

NOTE:

- PRI trunks are required to send and receive data to and from digital data stations that are external to the system.
- See Table 6-1 for a detailed comparison of data station configurations.
- A video conferencing data station is an example of a synchronous digital data station. See "Video Conferencing Data Stations" later in this chapter for detailed instructions.

See Form 2a, System Numbering—Station Jacks and Form 2b, System Numbering—Digital Adjuncts for your customer's specifications.

Detailed instructions for setting up digital data stations are in the next section, "Data Station Equipment Configurations."

Data Station Equipment Configurations

Table 6-1 shows the equipment configuration for each type of data station.

Table 6-1. Data Station Configurations

Type of Data Station	Module and Jack Type	Telephone (for voice)	GPA or MFM	Modem or Data Module	Data Terminal Equipment
Analog data and analog voice	2 adjacent station jacks on an ATL module: 408, 408 GS/LS, or 008	analog multiline telephone (and a BR-241-B1 bridging adapter)	G PA	modem	terminal, PC, LAN workstation, or local host
Analog data only	1 station jack on an 008 OPT or 012 module	none	none	modem	terminal, PC, LAN workstation, or local host
Analog data and digital voice	1 station jack on an 008 MLX or 408 GS/LS-MLX module	any MLX telephone	MFM	modem	terminal, PC, LAN workstation, or local host
Digital data and digital voice	1 station jack on an 008 MLX or 408 GS/LS-MLX module	any MLX telephone	none	data module	terminal, PC, LAN workstation, local host, or video codec (see note after table)
Digital data only	1 station jack on an 008 MLX or 408 GS/LS-MLX module	none	none	data module (and a 440A4 terminating resistor adapter)	terminal, PC, LAN workstation, local host, or video codec (see note after table)

See the note on the next page for important information.

NOTE:

- The first data station type (analog data and analog voice) requires a bridging adapter to connect the telephone to the two adjacent ATL station jacks.
- The last data station type (digital data only) requires a terminating resistor adapter to connect the data module to the MLX station jack.
- See “Video Conferencing Data Stations” for the type of information indicated in Table 6-1.
- The maximum cord length from the data module to the telephone is 80 ft (24 m).
- Do not connect two data modules on one line.

Analog Data and Analog Voice Stations

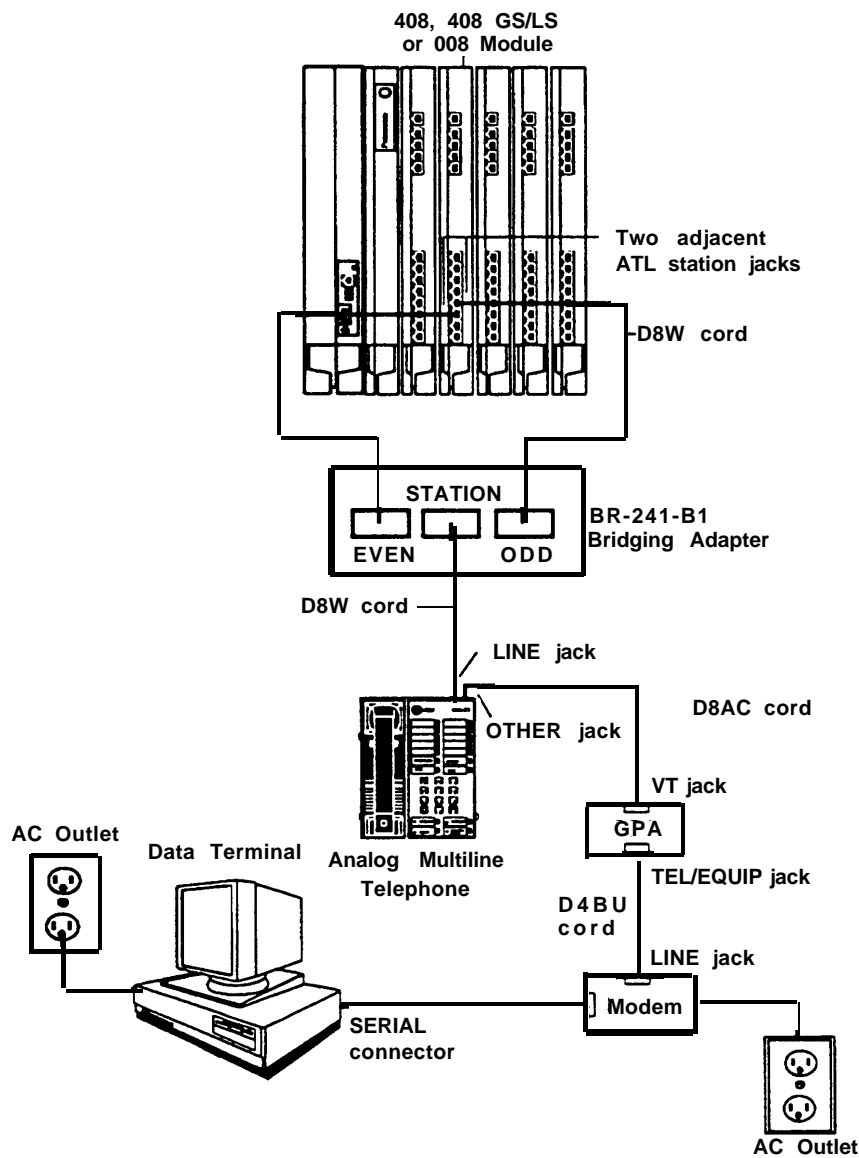


Figure 6-2. Analog Data and Analog Voice Equipment Configuration

1. Connect the data terminal to the modem:
 - a. Using an EIA-232-D cable, connect the SERIAL connector on the data terminal to the modem.

NOTE:

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

2. Make sure that the modem option settings for speed and parity are compatible with those of the data terminal. If you are not sure, see the customer's system administrator or the documentation packaged with the modem and data terminal.
3. Connect the modem to the GPA:
 - a. Connect one end of a D4BU cord to the TEL/EQUIP jack on the GPA.
 - b. Connect the other end to the modem as indicated in the modem's documentation (usually the LINE jack).
4. Connect the GPA to the analog multiline telephone:
 - a. Plug one end of a D8AC cord into the VT jack on the back of the GPA.
 - b. Plug the other end into the OTHER jack on the underside of the telephone.
 - c. Slide the switch on the back of the GPA to Automatic or Basic.

The `Automatic` setting can be used in one of two ways:

- to answer calls
an `Auto Answer+All` button is needed so that calls can be answered automatically
- to make and receive calls on the telephone while using the modem (simultaneous voice and data)

The `Basic` setting can be used in one of two ways:

- for originating (not sending) calls
- to originate telephone calls while using the modem (simultaneous voice and data)

5. Using a D8W cord, connect the `STATION` jack on the BR-241-B1 bridging adapter to the `LINE` jack on the analog multiline telephone.
6. Using two D8W cords, connect the `EVEN` and `ODD` jacks on the BR-241-B1 bridging adapter to the station jacks indicated on Form 2a, System Numbering—Station Jacks.

NOTE:

Connect the `EVEN` jack on the bridging adapter to the station jack that is associated with the even-numbered extension, not the logical ID.

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

Analog Data-Only Stations

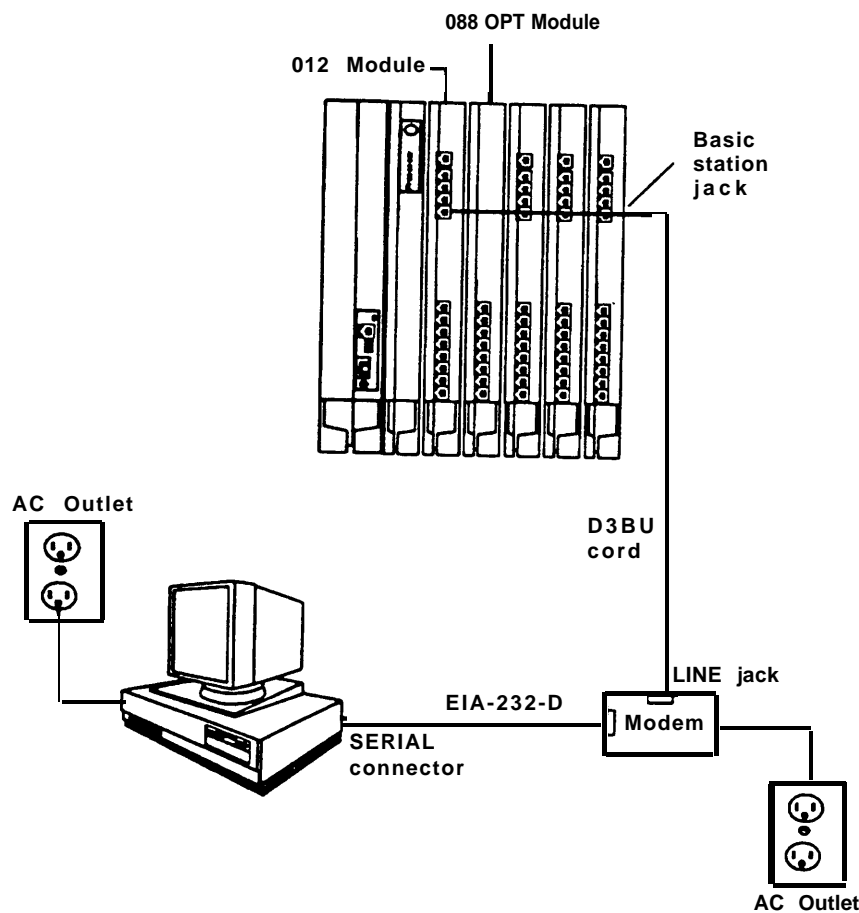


Figure 6-3. Analog Data Only Equipment Configuration

1. Connect the data terminal to the modem:
 - a. Using an EIA-232-D cable, connect the SERIAL connector on the data terminal to the modem.

NOTE:

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

2. Make sure that the modem option settings for speed and parity are compatible with those of the data terminal. If you are not sure, see the customer's system administrator or the documentation packaged with the modem and data terminal.
3. Connect the modem to the control unit:
 - a. Connect one end of a D4BU cord to the modem according to the modem's documentation (usually the `LINE` jack).
 - b. Connect the other end to the appropriate basic station jack on the 012 or 008 OPT module. See Form 2a, System Numbering—Station Jacks for the appropriate module and station jack.
4. Connect all power cords to an AC outlet that is not controlled by a wall switch.

Analog Data and Digital Voice Stations

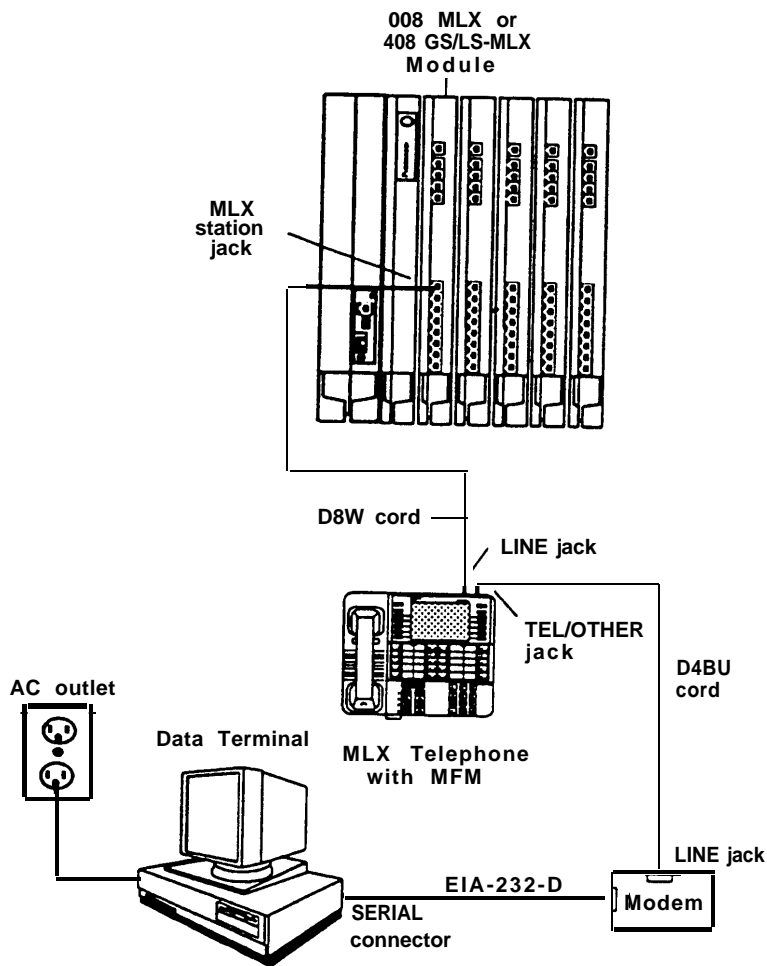


Figure 6-4. Analog Data and Digital Voice Equipment Configuration

1. Connect the data terminal to the modem:
 - a. Using an EIA-232-D cable, connect the `SERIAL` connector on the data terminal to the modem.

NOTE:
For any data terminal that has both `COM1` and `COM2` connectors, make sure you use the one designated for data transmission. See the customer's system administrator if you are not sure.
2. Make sure that the modem option settings for speed and parity are compatible with those of the data terminal. If you are not sure, see the customer's system administrator or the documentation packaged with the modem and data terminal.
3. Connect the modem to the MFM in the MLX telephone:
 - a. Connect one end of a D4BU cord to the modem as described in the modem's documentation.
 - b. Connect the other end to the `TEL/OTHER` jack underneath the MLX telephone (assuming that the MFM is already installed; if not, see "Installing the Multi-Function Module" in Chapter 3).
 - c. Be sure to route the D4BU cord through the telephone's cord channel.
4. Connect the MLX telephone to the control unit:
 - a. Connect one end of a D4BU cord to the `LINE` jack underneath the MLX telephone.
 - b. Connect the other end to the appropriate MLX station jack. See Form 2a, System Numbering—Station Jacks for the appropriate module and station jack.
5. Connect all power cords to an AC outlet that is not controlled by a wall switch.

Digital Data and Digital Voice Stations

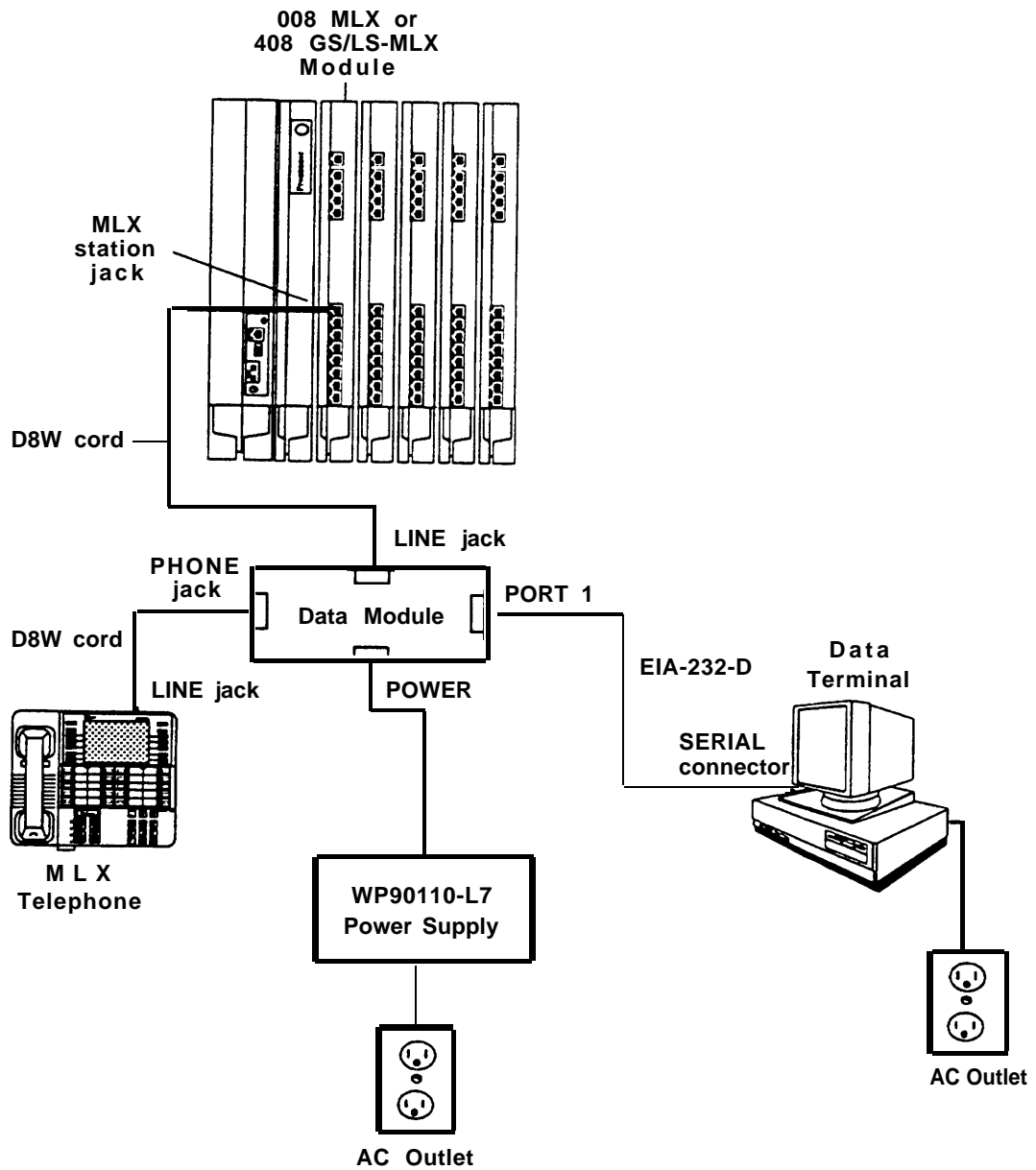


Figure 6-5. Digital Data and Digital Voice Equipment Configuration

NOTE:

- The configuration shown in Figure 6-5 is for *asynchronous* digital data transmission. For information on setting up *synchronous* digital data stations, see “Video Conferencing Data Stations” later in this chapter.
- The maximum cord length from the data module to the telephone is 80 ft (24 m).

1. Connect the data terminal to the data module:
 - a. Connect an EIA-232-D cable to the SERIAL connector on the data terminal.

NOTE:

For any data terminal that has both COM1 and COM2 connectors, make sure you use the one designated for data transmission. See the customer’s system administrator if you are not sure.

- b. Make sure that the data module option settings for parity and speed are compatible with those settings of the data terminal. (Speed is synchronized automatically when the factory default settings remain unchanged.)

If you are not sure about the data terminal option settings, see the customer’s system administrator or the documentation packaged with the data module and data terminal.
 - c. Connect the other end to PORT 1 on the data module.
2. Plug the WP90110-L7 power supply cord into the connector labeled POWER on the data module.

3. Connect the data module to the MLX telephone:
 - a. Connect one end of a D8W cord to the `PHONE` jack on the data module.
 - b. Connect the other end to the `LINE` jack on the MLX telephone.
4. Connect the data module to the control unit:
 - a. Connect one end of a D8W cord to the `LINE` jack on the data module.
 - b. Connect the other end to the appropriate MLX station jack. See Form 2a, System Numbering—Station Jacks for the appropriate module and station jack.
5. Connect all power cords to an AC outlet that is not controlled by a wall switch.

Digital Data-Only Stations

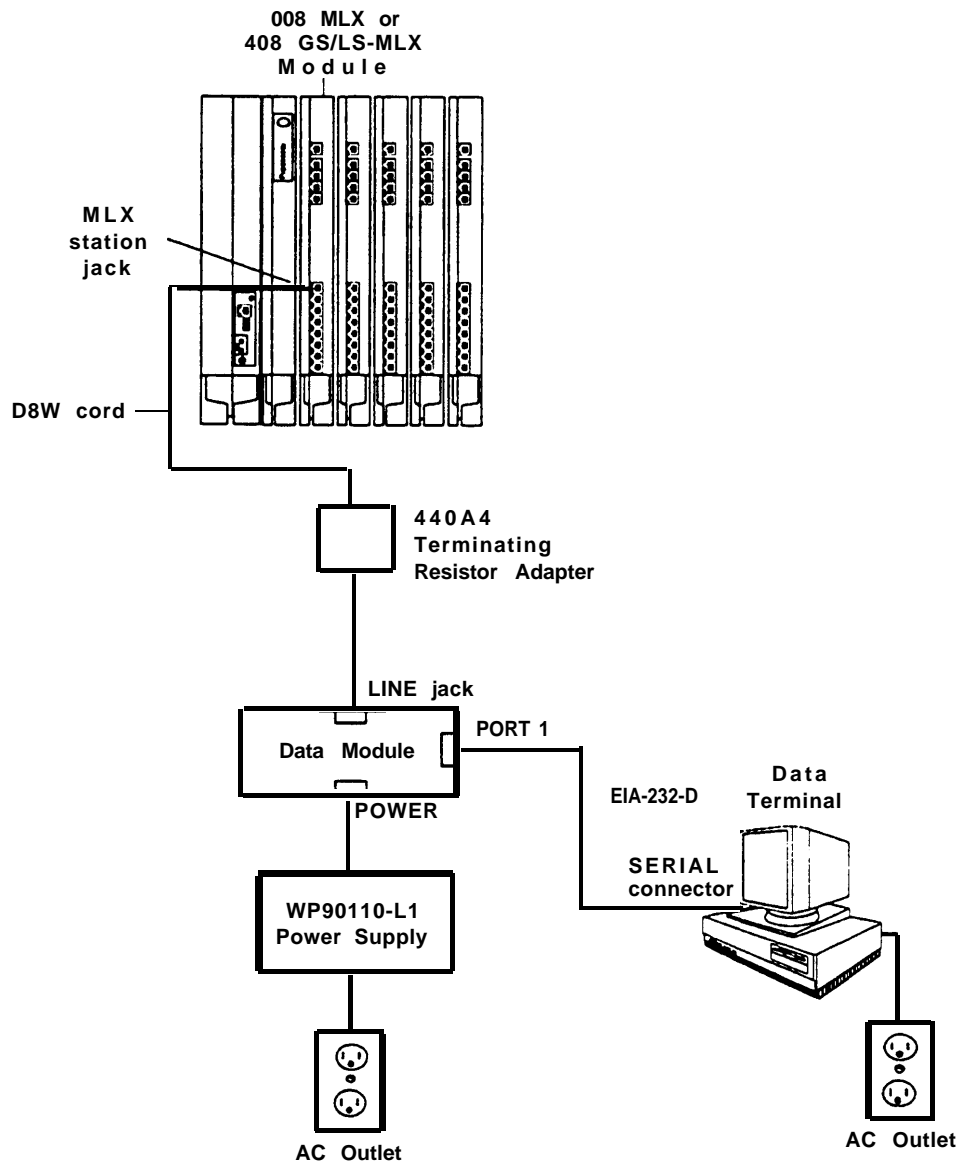


Figure 6-6. Digital Data-Only Equipment Configuration

1. Connect the data terminal to the data module:

- a. Connect an EIA-232-D cable to the `SERIAL` connector on the data terminal.

NOTE:

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

- b. Make sure that the data module option settings for parity and speed are compatible with those settings of the data terminal, (Speed is synchronized automatically when the factory default settings remain unchanged.)

If you are not sure about the data terminal option settings, see the customer's system administrator or the documentation packaged with the data module and data terminal.

- c. Connect the other end to `PORT 1` on the data module,

2. Plug the WP90110-L7 power supply cord into the `POWER` connector on the data module.

3. Connect the data module to the control unit using a 440A4 terminating resistor adapter:

- a. Connect the 440A4 terminating resistor adapter to the `PHONE` jack on the data module, using a D8W cord.
- b. Connect the other end of the adapter to the appropriate MLX station jack, using another D8W cord. See Form 2b, System Numbering—Digital Adjuncts for the appropriate module and station jack.

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

Video Conferencing Data Stations

This section is an example of how to use the 7500B data module with a *multipurpose enhancement board* for synchronous data communication, which allows data transmission at the speed of 56 or 64 kbps.

High-Speed Synchronous Enhancement Board

For instructions on using a high-speed synchronous enhancement board or any information on setting up the 7500B data module that this chapter does not include, see the documentation packaged with the 7500B data module.

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

Hardware Requirements

- 008 MLX or 408 GS/LS-MLX module in the control unit
- ESF T1 CSU

NOTE:

If any other type of CSU is used, your customer support organization cannot support installation and maintenance.

- Two Shore Microsystems SM-100 EIA-232/V.35 converters (or equivalent)

- Two 7500B data modules
- Two 7500B data module feature package 2 upgrades (user's manuals included)
- Two multipurpose enhancements boards

By installing a multipurpose enhancement board in each 7500B data module, you can provide synchronous communication and RS-366 ACU interface.

- Two WP90110-L7 power supplies (one per standalone data module)
- Two 440A4 terminating resisting adapters
- 277A multiple mounting (mounting for multiple 7500B units)
- Cables:
 - Two male/male EIA-232-D cables, 8 ft (24 m), to connect the **PORT 1** jacks on the data modules to the EIA-232/V.35 converters
 - Two male/male V.35 DB-37 cables, 8 ft (24 m), to connect the V.35 communication ports on the video codec to the EIA-232/V.35 converters
 - Two male/male RS-366 DB-25 cables, 8 ft (24 m), to connect the RS-366 dialing port of the video codec to **PORT 2** on the data module

Video Conferencing Connections

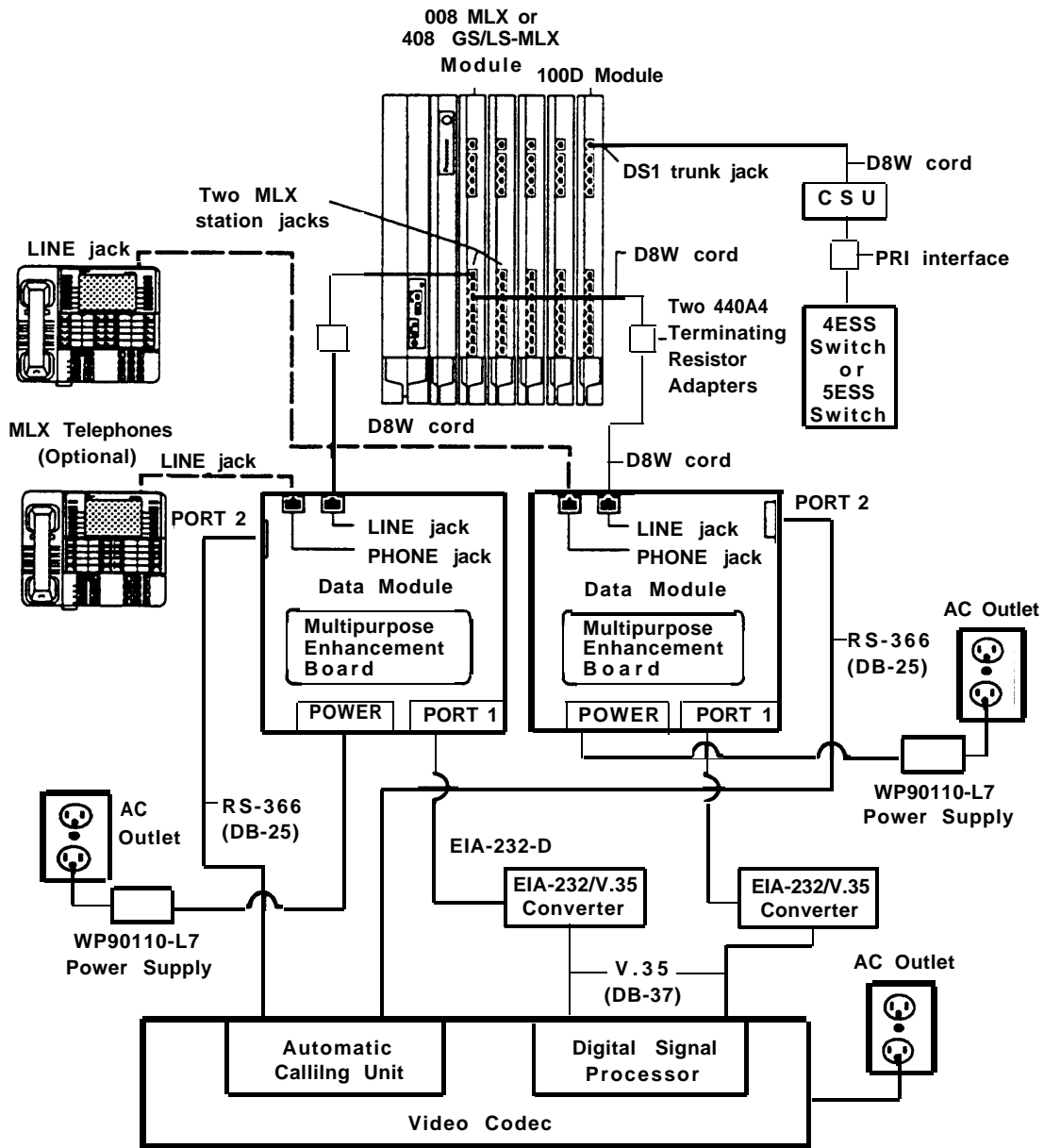


Figure 6-7. Video Conferencing Connections

NOTE:

If you will be connecting MLX telephones, omit both 440A4 terminating resistors, and note that the maximum cord length from the data module to the telephone is 80 ft (24 m).

1. For each data module, plug one end of a D8W cord into the `LINE` jack on the data module.
2. Connect the other end of each D8W cord as follows:
 - a. If Data Form 2b, Digital Data Station indicates that an MLX telephone is to be installed, connect these D8W cords to the MLX station jacks indicated on Data Form 2b.
 - b. If Data Form 2b does not indicate that an MLX telephone is to be installed, connect these D8W cords to each 440A4 terminating resistor.

Using two more D8W cords, connect each terminating resistor to the MLX station jacks indicated on the Data Form.
3. Plug each WP90110-L7 power supply cord into the connectors labeled `POWER` on the data modules.

NOTE:

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

4. If indicated on the Data Form, connect MLX telephones to the data modules:
 - a. Connect a D8W cord into the `LINE` jack on each MLX telephone.
 - b. Connect the other end of each D8W cord into the `PHONE` jack on each data module.

5. Connect each data module to the video conferencing data station:
 - a. Using the DB25 cords, connect the `PORT 2` jacks on each data module to the dialing ports in the video codec's automatic calling unit. See the documentation packaged with the video codec for details.
 - b. Using the EIA-232-D cables, connect the `PORT 1` jacks on each data module to the EIA/V.35 converters.
 - c. Using the DB-37 cords, connect the EIA/V.35 converters to the video codec's V.35 communication ports. See the documentation packaged with the video codec for details.
6. If not already done, connect the CSU to the control unit and the foreign exchange switch (the 4ESS switch or the 5ESS switch) as described in Chapter 4 under "Installing the Channel Service Unit."
7. Connect each WP90110-L7 power supply to the `POWER` connectors on the data modules.
8. Plug the power supplies, CSU, video conferencing equipment, and control unit into the AC outlets when ready to power up the entire system.

Data Module and CSU Settings

Depending on which speed the customer is running, both of the data modules and the CSU need to be configured as indicated in Table 6-2 and the section that follows, "CSU DIP Switch Settings."

Table 6-2. Data Module Settings

Data Module Settings	56 Kbps	64 Kbps
Auto-dial	off	off
Busy out	off	off
Datarest	on	off
DTR	follow	follow
Duplex	full	full
Mode	cs	cs
Speed	56,000	64,000

CSU DIP Switch Settings. If the customer's system is running at 56 kbps, set the CSU line coding DIP switch to AMI. See Chapter 4 for details.

Modem Pools

A call between an analog data station and a digital data station is possible only if the system includes a modem pool to convert the signals back and forth between analog and digital. A modem pool consists of one or more modem-and-data module pairs; two pairs are shown in Figure 6-8.

Modem pools are set up as analog-to-digital or digital-to-analog:

- **Digital-to-Analog:** This type of modem pool is used when a call to an analog data station is originated from a digital station.
- **Analog-to-Digital:** This type of modem pool is used when a call to a digital data station is originated from an analog data station.

The physical connections for both digital-to-analog and analog-to-digital pairs are the same. It is the option settings on the modem and data module and the system programming (done in SPM) that distinguish one type of modem pool from another.

NOTE:

Since an MLX telephone is not part of the configuration, you must use a 440A4 terminating resistor to connect the data module to the MLX station jack in every modem pool configuration.

Data Hunt Groups

In a digital-to-analog modem pool, the data modules are assigned to a data hunt group, which is an extension that is dedicated to a modem pool. When a call reaches the dialed data hunt group, the call is directed to the first idle data module in the pool.

Similarly, in an analog-to-digital modem pool, the modems are assigned to a data hunt group.

Inside and Outside Data Calls

To setup modem pools that handle calls both within the system and outside, you will use a basic station jack on an 012 or 008 OPT module to connect each modem to the control unit. Each data module connects to an MLX station jack on an 008 MLX or 408 GS/LS-MLX module. See Figure 6-8 and follow the detailed procedures in this section.

Outside Data Calls Only

To setup modem pools that handle only the calls that are transmitted over outside trunks, you will use an MLX station jack on an 008 MLX or a 408 GS/LS-MLX module to connect each data module to the control unit. The modems connect directly to the network interface, not the control unit.

See Figure 6-8 and follow the detailed procedures in this section.

Modem Pool Hardware Requirements

- Modem (one per data module)

Most modems can be connected to the system. If a modem is used in a modem pool, use a 2224G modem. The modem option settings in this section are specifically for this modem.

- 7500B data module (one per modem)
- WP90110-L7 power supply (one per standalone data module) or a 277A multiple mounting power supply

NOTE:

You can configure the 7500B as a standalone data module using a WP90110-L7 power supply or set up a multiple-mount arrangement using a 277A multiple mounting power supply. The 277A provides a common power supply for up to eight data modules. Both the power unit and the data mounting require a 115 VAC power outlet. Neither is provided with the data module and both must be ordered separately.

See the 7500B data module documentation for instructions on installing the 277A for a multiple-mount arrangement.

- D8W cords (two per modem-and-data module pair)
- D4BU cords (one per modem-and-data module pair)
- EIA-232-D cables (one per modem-and-data module pair)
- 440A4 terminating resistor (one per data module)

See Figure 6-8 and the next section, "Setting Up a Modem Pool," for detailed procedures.

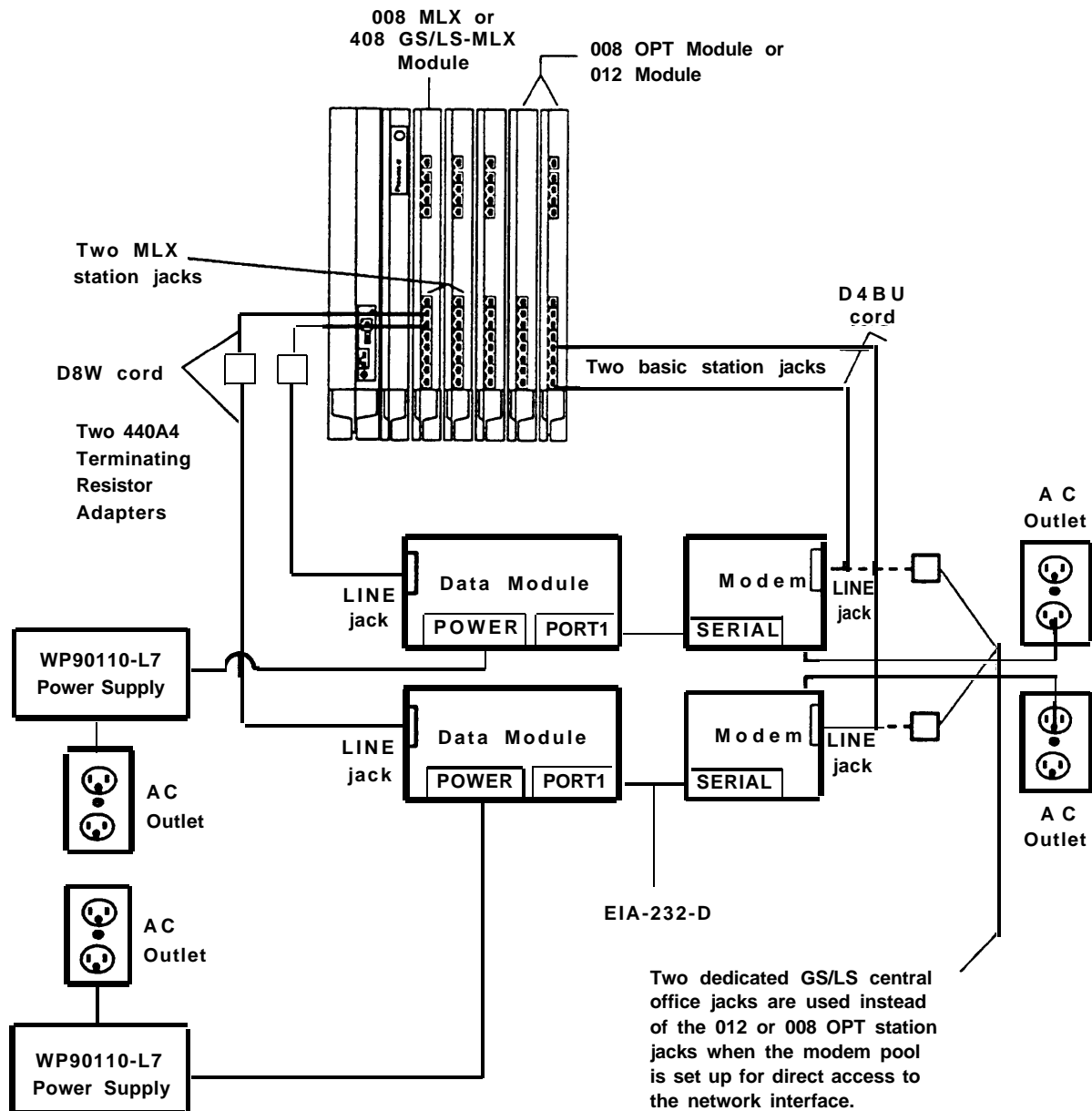


Figure 6-8. Modem Pool Configurations

Setting Up a Modem Pool

This section provides one procedure, which applies to all types of modem pools. Depending on the type of modem pool that you are installing, some steps vary. These differences are noted throughout the procedure.

1. Connect each data module to an MLX station jack as indicated on Form 2b, System Numbering—Digital Adjuncts:
 - a. Connect a D8W cord to the MLX jack and connect the other end to the 440A4 terminating adapter.
 - b. Connect the terminating adapter to the `LINE` jack on the data module using another D8W cord.
2. Connect each data module to a modem:
 - a. Connect one end of an EIA-232-D cable to `PORT 1` on the data module.
 - b. Connect the other end to the `SERIAL` connector on the modem.
3. Plug the WP90110-L7 power supply cord into the connector labeled `POWER` on the data module.

NOTE:

If using the 277A multi-mount arrangement, see the 7500B data module documentation for instructions on connecting the power; however, do not connect anything to an AC outlet until you finish setting up the entire modem pool.

4. If the modem pool is to be connected directly to the network interface, skip this step.

Connect the modem to the Logical ID as indicated on the appropriate modem pool data form:

- a. Connect one end of a D4BU cord to the `LINE` jack on the modem.
 - b. Connect the other end to the appropriate logical ID on the 008 OPT or 012 module.
 - c. Skip Step 5.
5. If the modem pool is to be connected directly to the network interface, connect the modem to the outside trunk jack as indicated on the appropriate modem pool data form:
 - a. Connect one end of a D4BU cord to the `LINE` jack on the modem.
 - b. Connect the other end to the appropriate `GS/LS` outside trunk.
 6. Set the options on the modem(s) and data module(s) as described in the next section, "Option Settings."
 7. Plug the power cords of the WP90110-L7 power supply and modem into an AC outlet that is not controlled by a wall switch.

NOTE:

If you are using the multi-mount arrangement, connect the power supplies to AC as indicated in the 7500B data module documentation.

Option Settings

Hardware and software options must be set on the modems and data modules that are to be used in a modem pool. The option settings differ, depending on whether the modem pool is digital-to-analog or analog-to-digital.

If the modem or data module is rack-mounted, you may have to supply or remove power to a single modem or data module.

The option settings for the data module and modem are indicated for each type of modem pool in the sections that follow.

See the user manuals provided with the modem and data module for any additional information.

Digital-to-Analog 7500B Settings

Use the following procedure to prepare the 7500B data module for operation in a digital-to-analog modem pool:

1. Use the instructions provided in the 7500B data module documentation to set the DCE/DTE flip board to the `DTE` position.
2. Use the front panel controls on the 7500B to set the options. See Table 6-3. See the 7500B data module documentation for detailed information.

Table 6-3. 7500B Option Settings for Digital-to-Analog Modem Pool

Position Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Display	L	1	:	3	3	3	0	0	0	b	0	0	1	0	1	1
Display	L	2	:	0	1	1	1	0	0	0	3	1	0	0	0	0

b = blank, L = Line #

Digital-to-Analog Modem Option Settings

The following procedure is one method to prepare the 2224G modem for a digital-to-analog modem pool. The procedure is only a recommended method and may be different if you are using another type of modem.

The option settings in this section also apply to outgoing digital-to-analog modem pools.

1. Connect a data terminal such as a PC to the modem (in place of the data module) and then plug the modem and data terminal into an AC outlet.
2. Use the instructions provided with the modem to set all bit-switches to their default positions; except set switch 1, bit 2 to the right.
3. Save all bit-switch settings by unplugging the modem from the wall outlet and then plugging it back in.
4. Set the data terminal speed to match the modem's default speed.
5. Set the default software options by typing `od` and pressing **[Enter]**.
6. Set all bit-switches according to Table 6-4, except switch 1, bit 2. Set switch 1, bit 2 to the right.
7. Unplug the modem from the wall outlet; then plug it back in.

8. Set switch 1, bit 2 to the left.

This stores the switch settings in the modem's memory,

The modem option settings should now be set as shown in Table 6-4.

Table 6-4. Modem Option Settings for Modem Pools

Switch	Bit Number							
	1	2	3	4	5	6	7	8
1	L	L	L	R	R	R	L	L
2	L	R	L	L	L	L	L	L
3	D	D	D	D	U	U	D	D
4	D	D	D	D	D	U	D	D
5	U	D	U	U	U	D	D	D
7	on	on						

L = left, R = right, U = up, D = down

9. Enter command mode, set the options, and save the options into protected memory to prevent loss of settings in case of a power failure:

- a. Type **AT** and press **[ENTER]** to enter the local mode.

- b. Type **AT&D2** and press **[ENTER]**.

Option set: A data call will be dropped when the data module turns off the DTR signal, loses power, or when the connection between the data module and the modem is dropped.

- c. Type **AT&C1** and press **[ENTER]**.

Option set: The data carrier detect (CD) signal is set to follow, meaning that this signal turns off when a data call is no longer in progress.

- d. Type `ATS0=1` and press [ENTER] .
Option set: Auto Answer (incoming data calls will be answered automatically).
- e. Type `ATQ0` and press [ENTER] .
Option set: Enable result codes (factory setting).
- f. Type `AT&W` and press [ENTER] .
Writes the options to protected memory.

10. Reconnect the data module in place of the terminal (undo Step 1).

Analog-to-Digital 7500B Option Settings

Use the following procedure to prepare the 7500B data module for an analog-to-digital modem pool:

1. Use the instructions provided in the 7500B user manual to set the DCE/DTE flip board to the DTE position.
2. Use the front panel controls on the 7500B data module to set the options. See Table 6-5. See the 7500B data module user's manual for detailed information.

Table 6-5. 7500B Option Settings for Analog-to-Digital Modem Pool

Position No.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Display	L	1	:	3	3	3	0	1	0	b	0	0	1	0	1	0
Display	L	2	:	0	1	1	1	0	0	0	3	1	0	0	0	0

b = blank, L = Line #

Analog-to-Digital Modem Option Settings

The following procedure is one method to prepare the 2224G modem for operation in an analog-to-digital modem pool. This procedure is only a recommended method and may be different if you are using another type of modem.

1. Connect a data terminal such as a PC to the modem (in place of the data module) and then plug the modem and data terminal into an AC outlet.
2. Use the instructions provided with the modem to set switch 1, bit 2 to the right.

Set all other bit-switches to their default positions.

3. Save all bit-switch settings by unplugging the modem from the wall outlet and then plugging it back in.
4. Set the data terminal speed to match the modem's default speed.
5. Set the default software options:

Type `od` and press **[ENTER]**.

6. Set all bit-switches according to Table 6-4, except switch 1, bit 2.
Set switch 1, bit 2 to the right.
7. Unplug the modem from the wall outlet and then plug it back in.
8. Set switch 1, bit 2 to the left.

This stores the switch settings in the modem's memory.

The modem option settings should now be set as shown in Table 6-4.

9. Enter command mode, set the options, and save the options into protected memory to prevent loss of settings in case of a power failure:
 - a. Type **AT** and press **[ENTER]** to enter the local mode.
 - b. Type **AT&D2** and press **[ENTER]** .
Option set: A data call will be dropped when the data module turns off the DTR signal, loses power, or when the connection between the data module and the modem is dropped.
 - c. Type **AT&C1** and press **[ENTER]** .
Option set: The data carrier detect (CD) signal is set to follow, meaning that this signal turns off when a data call is no longer in progress.
 - d. Type **ATS0=1** and press **[ENTER]** .
Option set: Auto Answer (incoming data calls will be answered automatically).
 - e. Type **ATQ1** and press **[ENTER]** .
Option set: Disable result codes.
 - f. Type **AT&W** and press **[ENTER]** .
Writes the options to protected memory.
10. Reconnect the data module in place of the terminal (undo Step 1).

Initializing and Testing the System

7

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

Initializing the System

Use one of the following methods to initialize a Release 2.0 system:

- Restore from a 2.0 system programming diskette.
- Upgrade from Release 1.0 or 1.1 to 2.0 as described in this chapter.
- Follow the system programming forms and use the procedures from one of the programming guides listed in the next section, "Programming Guides."

NOTE:

Make sure that you perform a System Erase immediately before restoring from a diskette or programming the system on **initial** installation. Failure to perform the System Erase could result in inappropriate programming.

Programming Guides

- *Programming Summary* for quick-reference procedures
Document Number 555-620-144
- *System Programming* for detailed procedures
Document Number 555-620-111
- *System Programming and Maintenance (SPM)* for detailed SPM procedures
Document Number 555-620-142

Restoring from the System Programming Diskette

If you received the Release 2.0 system programming diskette, follow the procedure in this section to initialize the system.

1. Perform a System Erase:

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

See the *Maintenance and Troubleshooting* guide for additional information on System Erase.

2. Use the system programming diskette to perform the Restore procedure from the PC via SPM.

See the *System Programming and Maintenance (SPM)* guide for instructions.

NOTE:

The system must be restored from the system programming diskette (or a backup diskette) whenever a frigid start (System Erase) occurs.

Upgrading the Communications System



WARNING:

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

Before You Begin

Before you begin the Upgrade procedure, you need the following:

- To upgrade from Release 1.0 to Release 1.1:
 - SPM Version 1.16 (Version 2.xx or higher can also be used)
 - The version number of the SPM software currently installed (if any)
 - Release 1.1 feature module
 - DOS-formatted diskette

- To upgrade to Release 2.0:
 - SPM Version 2.xx or higher
 - The version number of the SPM software currently installed (if any)
 - Release 2.0 feature module
 - DOS-formatted diskette

See Tables 7-1 and 7-2 for compatibility of software and procedures from one release to another.

Table 7-1. Compatibility of SPM Versions during Upgrade

	Upgrade to 1.1			Upgrade to 2.0		
	Backup	Convert	Restore	Backup	Convert	Restore
SPM	1.13 1.16 2.xx	n/a	1.16 2.xx	2.xx	2.xx	2.xx
Feature Module	1.0	n/a	1.1	1.0 1.1	n/a	2.0

Table 7-2. Programming Compatibility

SPM Version	Program Backup on	Restore on		
		1.0	1.1	2.0
1.13	1.0	yes	no	no
1.16	1.0	yes	yes	no
2.xx	1.0	yes	yes	yes *
1.16	1.1	no	yes	no
2.xx	1.1	no	yes	yes *
2.xx	2.0	no	no	yes

* The backup file must be converted before it is restored.

Upgrade Procedure

This section provides a high-level procedure to make the following upgrades:

- from Release 1.0 to Release 1.1
- from Release 1.0 to Release 2.0
- from Release 1.1 to Release 2.0

The procedure varies slightly, depending on the release *from which* and *to which* you are upgrading.

For detailed information, you will be directed to the *System Programming* guide or the *Maintenance and Troubleshooting* guide where necessary.

NOTE:

System programming for the MERLIN II Communications System cannot be upgraded; it must be completely reprogrammed. To upgrade from a MERLIN II Communications System to Release 2.0, see the section, "Upgrading from the MERLIN II Communications System" later in this chapter.

1. Install SPM.

To upgrade your communications system to Release 1.1, you will need to install (or, on a UNIX system PC, upgrade to) Version 1.16 of SPM.

To upgrade your communications system to Release 2.0, you will need to install (or upgrade to) Version 2.xx or higher of SPM.

2. Back up your system programming.

This step provides a file containing system programming information.

To upgrade to Release 1.1, you can use any version of SPM (1.16 is recommended).

To upgrade to Release 2.0, you must use Version 2.xx or higher of SPM.

3. Change the feature module:
 - a . Turn off the AC power switches on the control unit in the following order:
 - Basic carrier
 - Expansion carrier 1, if present
 - Expansion carrier 2, if present
 - b . Unplug the interface cords from the SPM and SMDR printer ports on the processor module.
 - c . Remove the processor module from Slot 0.
 - d . Remove the feature module from the processor module and replace it with a Release 1.1 or 2.0 feature module.
 - e . Reinstall the processor module in Slot 0.
 - f . Plug the interface cords into the SPM and SMDR printer ports on the processor module.
 - g . Turn on AC power to the control unit in the following order:
 - Expansion carrier 2, if present
 - Expansion carrier 1, if present
 - Basic carrier

4. Perform a frigid start.

This step ensures that all system programming is returned to default values.

To upgrade to Release 1.1, Use the System Erase function on the SPM Maintenance menu (Maintenance → Slot → 00 → Demand Test → System Erase).

*To upgrade to Release 2.0, use the System Erase function: Maintenance → Slot → 00 → Demand Test → System Erase (Line 5, left button) **twice** → Yes*

See the *Maintenance and Troubleshooting* guide for additional information on System Erase.

5. Convert the backup file (**only when upgrading to Release 2.0**).
This procedure converts the backup file created in Step 2 to the Release 2.0 format.
6. Restore the system programming,
The system is forced idle and cannot be used during this procedure. Complete instructions can be found in the section entitled "Restore."
To upgrade to Release 1.1, Use Version 1.16 or 2.xx or higher of SPM and restore the backup file you created in Step 2.
To upgrade to Release 2.0, Use Version 2.xx or higher of SPM and restore the file you converted in Step 5.
7. Program new features, if necessary.
See the *System Programming* guide for detailed procedures on programming.

Upgrading from the MERLIN II Communications System

To upgrade to Release 2.0 from the MERLIN II Communications System, do the following:

1. Install SPM.
To upgrade your communications system to Release 1.1, you will need to install (or, on a UNIX system PC, upgrade to) Version 1.16 of SPM
To upgrade your communications system to Release 2.0, you will need to install (or upgrade to) Version 2.xx or higher of SPM.
2. Remove the control unit housing.
See Chapter 2 for instructions, if necessary.
3. Replace old modules and add new modules as indicated on the Control Unit Diagram of Form 1, System Planning.
See Chapter 2 for instructions, if necessary.

4. Replace the feature module:
 - a. Turn off the AC power switches on the control unit in the following order:
 - Basic carrier
 - Expansion carrier 1, if present
 - Expansion carrier 2, if present
 - b. Unplug the interface cords from the SPM and SMDR printer ports on the processor module.
 - c. Remove the processor module from Slot 0.
 - d. Remove the feature module from the processor module and replace it with a Release 1.1 or 2.0 feature module.
 - e. Reinstall the processor module in Slot 0.
 - f. Plug the interface cords into the SPM and SMDR printer ports on the processor module.
 - g. Turn on AC power to the control unit in the following order:
 - Expansion carrier 2, if present
 - Expansion carrier 1, if present
 - Basic carrier

See Chapter 2 for any additional details.

5. Perform a frigid start:

This step ensures that all system programming is returned to default values.

To upgrade to Release 1.1, Use the System Erase function on the SPM Maintenance menu (Maintenance → Slot → 00 → Demand Test → System Erase).

*To upgrade to Release 2.0, use the System Erase function: Maintenance → Slot → 00 → Demand Test → System Erase (Line 5, left button) **twice** → Yes*

See the *Maintenance and Troubleshooting* guide for additional information on System Erase.

6. Restore from a Release 2.0 system programming diskette as described earlier in this chapter under “Restoring from the System Programming Diskette.”

7. Program new features, if necessary.

See the *System Programming* guide for detailed procedures on programming.

8. Replace the control unit housing when finished upgrading.

See Chapter 2 for any additional instructions.

Setting the Time and Date

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

Quick-Reference Procedure

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

See one of the programming guides for any additional instructions.

Testing the System

Once the system has been installed and initialized, it is ready for system acceptance testing. Perform the basic functionality tests in this section to test the trunks, telephones, and features.

Troubleshooting Failed Tests

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

Testing the MLX Telephones

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

If you hang up during any of these procedures, you are automatically taken out of the test mode.

Follow these steps to test the basic features of an MLX telephone:

1. Pick up the handset of the telephone being tested and push an Intercom button (**ICOM**) in Key or Behind Switch mode or a System Access button (**SA**) in Hybrid/PBX mode. After receiving a dial tone, dial *** 00** to activate the test mode.

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

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

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

3. Press the same line button repeatedly to toggle between the green and red LEDs.

4. To test a fixed-feature button with one LED, press the button.

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

NOTE:

- If **Mute** is pressed before **Speaker**, the **Mute** LED cannot be turned off; it will wink.
 - The **Mute** and **Speaker** LEDs remain steady during test mode.
 - The pressing of the **Mute** button is processed within the telephone.
 - When the telephone test is originated from **Speaker** button, every second press of the **Mute** causes the **Mute** LED to flash off momentarily.
 - Also, both the **Mute** and **Speaker** LEDs may occasionally remain on after disconnecting with **Speaker**.
 - Press the fixed-feature buttons repeatedly to toggle the LEDs on and off.
5. To test the red Message light, press a fixed-feature button without an LED (such as **Transfer**, **Conf**, or **Drop**) or any dialpad button.
The **Message** light should turn off.
 6. Hang up the handset to leave test mode.

Testing the MLX Telephones with a Display

While the MLX telephone with a display is in the test mode, follow these steps to test the display buttons:

1. Press the labeled display buttons (**Home**, **Menu**, **Inspct**, and **More**).

The display should spell out these button labels.

2. Press the unlabeled display buttons.

The display should indicate `Display Button n` where n is 1 through 4.

Testing the MLX Telephones with an MFM

Test a MLX telephone with an MFM installed and configured for a T/R adapter, Follow these steps to check the proper channel operation and the MFM circuitry for the TTR, the ring generator, and the message light:

1. Connect a known working 2500-type single-line telephone with a message light to the MFM adapter. The 2500 telephone must also have a mechanical ringer.
2. Pick up the handset on the 2500 telephone and dial *** 09** after receiving the dial tone.

You should receive another dial tone.

3. Press any button to deactivate the test tone.
4. Dial **123456789 * 0#** and press the switchhook quickly.

You should receive a confirmation tone.

5. Hang up.

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

6. Turn off the message light by dialing the appropriate code number.

Testing the Telephones for Intercom Dial Tone

Follow these steps to test for intercom dial tone:

1. Press **ICOM** or **SA** (depending on the mode of operation). The red LED next to this button should go on.

2. Press **Speaker**.

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

3. Press **Speaker** or **SA** again to disconnect the Intercom.

The green LEDs next to **ICOM** or **SA** and **Speaker** should turn off, and the dial tone should stop.

The red LED remains on in some cases.

Testing the Telephones for Outside Line Dial Tone

Follow these steps to test for an outside line dial tone:

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

The red LED next to this button should turn on.

2. Pick up the handset or press **Speaker**.

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

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

Testing the Analog Multiline and Single-Line Telephones

Follow these steps to test the basic functioning of analog telephones:

1. If you are testing a multiline telephone, press **ICOM** or **SA**.
2. Pick up the handset and wait for the dial tone.
3. Dial the extension number of another working telephone.
You should hear ringback at the calling telephone and ringing at the called telephone.
4. At the called telephone, have someone pick up the handset; verify that you have good two-way communication.
5. At both telephones, hang up.
6. If you are testing a multiline telephone, press an outside line button or **SA**.
 - a. Pick up the handset and wait for the dial tone.
 - b. If you pressed **SA**, dial the dial-out code.
 - c. Dial the destination telephone.

NOTE:

For Hybrid/PBX mode, make sure that the destination telephone has a personal line or is a direct-line console operator.

You should hear ringback at the calling telephone and ringing at the answering telephone.

- d. Have someone pick up the handset at the answering telephone; verify that you have good two-way communication.
 - e. At both telephones, hang up.
7. If the station is toll restricted, place a toll call.
You should hear a reorder tone.

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

Follow these steps to test the GS and LS outgoing and incoming trunks at a telephone:

1. Dial **★ 03** followed by the trunk ID number (01 — 80).

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

NOTE:

Dialing **★ 03** on a single-line telephone works only if telephone has a touch-tone dialpad and the trunk accepts touch-tone dialing.

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

Testing the DID Trunks

Follow these steps to test the DID trunks:

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

Testing the Tie Trunks

Before making the following tie-trunk tests, make sure that the tie trunks for the system are connected and properly programmed, and have someone at the far end ready to place and receive calls throughout these testing procedures.

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

- automatic-start two-way (both incoming and outgoing)
- automatic-start incoming only
- automatic-start outgoing only
- dial-repeating two-way (both incoming and outgoing)
- dial-repeating incoming only
- dial-repeating outgoing only

Testing Two-Way Automatic-Start Tie Trunks

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

NOTE:

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

Testing Incoming Automatic-Start Tie Trunks

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

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

Your telephone should ring, and the LEDs next to the tie-trunk button should respond as follows:

- red LED should turn on
- green LED should flash

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

The green LED should change from flashing to on.

3. At your telephone and the distant telephone, hang up.

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

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

Testing Outgoing Automatic-Start Tie Trunks

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

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

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

2. Pick up the handset.

NOTE:

In Hybrid/PBX systems with pooled tie trunks, press **SA** and dial the pool dial-out code.

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

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

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

4. Repeat this procedure for each outgoing and two-way automatic-start tie trunk.

Testing Two-Way Dial-Repeating Tie Trunks

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

Testing Incoming Dial-Repeating Tie Trunks

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

1. Have the person at the far end place a dial-repeating call to your telephone by dialing the proper tie-trunk number.
Your telephone rings, and the green LED next to **ICOM** (or **SA** for Hybrid/PBX systems) flashes.
2. Pick up the handset.
The red LED next to the ringing button turns on, and the green LED changes from flashing to on.
3. Verify that you have good two-way communication and hang up.
The green LED should turn off, the red LED will turn off, and another red LED may turn on.
4. Repeat Steps 1 through 3 for each incoming or two-way dial-repeating tie trunk.

Testing Outgoing Dial-Repeating Tie Trunks

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

1. At any telephone that has access to a dial-repeating tie trunk, press the first tie-trunk button.
The red LED next to the pressed tie-trunk button turns on.
2. Pick up the handset.
The green LED next to the selected button turns on.

NOTE:

In Hybrid/PBX systems with pooled tie trunks, press **SA** and dial the pool dial-out code.

3. Dial the tie-trunk number of the station where someone is waiting for your call. You hear ringing.
4. When the person answers, verify that you have good two-way communication and hang up.

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

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

Testing Selected System Features

The procedures in this section, listed below, test selected system features:

- Automatic Route Selection (ARS), which is for Hybrid/PBX mode only.

Use the same test for Idle Line Preference code, which is a similar feature that is used in Key mode only.

Use the same test for Station Message Detail Recording (SMDR) as explained in the test procedure.

- Group Calling

Use the same test for the Listed Directory Number (the QCC queue), which is for Hybrid/PBX only.

Use the same test for Group Page.

- System Speed Dial

- Coverage

If any feature is not working properly, check the system programming. You can run these tests most easily from an MLX telephone or an analog multiline telephone.

ARS and SMDR Tests

If ARS patterns have been translated, you can test the routing by placing toll calls and checking the trunk indicated on the SMDR printout.

NOTE:

Make sure that you make each toll call for at least 40 seconds, or less, depending on the minimum SMDR recording time. Otherwise, SMDR will not recognize it as a call. To determine the minimum SMDR recording time, check with the customer's system administrator.

Follow these steps to verify ARS patterns:

1. In Hybrid/PBX mode, determine which toll numbers to call by examining the system administrator's ARS patterns.
2. At any multiline telephone, pick up the handset, dial the ARS access code, and dial one of the toll numbers. Make sure that the call is completed before hanging up.
3. Repeat Step 2 for any additional toll numbers.
4. At the SMDR printer, verify that the call was placed over the correct trunk group and check the number of seconds before the call is reported on the SMDR printout, If there are errors, check the system programming.

Group Calling Test

Follow these steps to test the Group Calling feature:

1. Make sure that each group member is logged into the group by having each member dial #44.
2. At any telephone, pickup the handset and dial the trunk that is programmed to ring for a calling group.
3. At the ringing telephone, have someone pickup the handset verify that you have good two-way communication.
4. Repeat Steps 2 and 3 for each calling group.
5. Make additional calls to check each member of each calling group.
6. At any telephone, pick up the handset and dial the group extension number.
7. Test the calling group delay announcement (if provided):
 - a. Make the whole group busy or log out all members of the group (by having each member dial # * 44).
 - b. Repeat Steps 2 and 3 for each calling group.
8. At the ringing telephone, have someone pick up the handset and verify that you have good two-way communication.

System Speed Dial Test

Follow these steps to test System Speed Dial:

1. Determine which numbers have been translated for System Speed Dial. (Get the list of translated numbers from the system manager.)
2. From the test telephone, pick up the handset and dial a System Speed Dial code.

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

Coverage Test

Follow this basic testing procedure to verify that coverage is in effect:

1. Have someone call the covered telephone.
2. Count the number of rings that occur at the covered telephone before the covering telephone starts ringing. This should be the same as the programmed number of rings.
3. Pickup the handset at the covering telephone and verify that you have good two-way communication.
4. Hang up at the covering telephone.
5. Check both individual and group coverage.

Testing the Operator Console

Testing the operator console, whether it is analog or digital, is the same as testing an MLX telephone, except for testing the console's unique feature buttons. Follow these steps to test the operator console:

1. Pick up the handset of the telephone being tested and push **ICOM** (Key or Behind Switch mode) or **SA** (Hybrid/PBX mode). After receiving the intercom dial tone, dial **★ 00** to activate the test mode.
You should hear a steady test tone over the handset and a ring burst over the speaker. The telephone's red and green LEDs should be on.
2. To test the line buttons, press any line button with two LEDs.
The diagnostic tone should stop, and the LEDs for that button should turn off.
3. Press the same line button repeatedly to toggle the green and red LEDs on and off.

4. To test a fixed-feature button with one LED, press the button.

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

NOTE:

- If **Mute** is pressed before **Speaker**, the **Mute** LED cannot be turned off; it will wink.
- The **Mute** and **Speaker** LEDs remain steady during test mode.
- The pressing of the **Mute** button is processed within the telephone.
- When the telephone test is originated from **Speaker**, every second press of the **Mute** button causes the **Mute** LED to flash off momentarily.

Also, both the **Mute** and **Speaker** LEDs may occasionally remain on after disconnecting with **Speaker**.

- Press the fixed-feature buttons repeatedly to toggle the LEDs on and off.

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

The **Message** light should turn off.

6. Verify that all features are working properly.
7. If any features are not working properly, verify the system programming.

Testing the DSS

At each Direct Station Selector (DSS), check that all lights are operational. Using the DSS, call a telephone in the system. Test that the page buttons on the DSS work properly.

Testing the Night Service

Follow these steps to test the Night Service feature on the system operator console:

1. At the system operator console, press the Night Service button. If the Night Service with Outward Restriction option is programmed, you will need to enter the assigned password after pressing the Night Service button.

The Night Service LED turns on.

NOTE:

Night Service on a DLC can also be activated by pressing **Feature** and dialing 39.

2. Pick up the handset and press a button for any outside trunk.
3. Dial the number of an operator console that is programmed to receive Night Service coverage.
4. Verify that the telephones assigned to the Night Service group are ringing.
5. Have someone pick up the handset at a telephone in the Night Service group; verify that you have good two-way communication.
6. At both telephones, hang up.
7. Repeat Steps 2 through 5 for each operator console that is programmed to receive Night Service coverage.

8. Test telephones that have been programmed for Night Service with Outward Restriction.
 - a. Pickup a handset on a restricted telephone and verify that outside calls are not allowed.
 - b. Using the password, make an outside call.
 - i. Hang up the handset.
 - ii. Press the **Recall** button and dial the password.

NOTE:
On an MLX telephone without a programmed **Recall** button, press **Feature** and dial **775** and the password before picking up the handset.

 - iii. Pick up the handset and make an outside call.
 - iv. Verify that you have good two-way communication and hang up.
9. At the operator console, press the Night Service button again and verify that the Night Service LED turns off.

Testing the Dictation System Access

Place a call to verify that the dictation system access equipment can be accessed. If dictation equipment has not been installed, this feature cannot be tested.

1. At the test telephone, pickup the handset.
2. Dial the access code and the number associated with the dictation equipment.

3. Verify that the ready tone is being transmitted.
4. Test the transmission in both directions:
Make a recording and play it back.
5. Hang up.

Testing the Paging Interface

NOTE:

If you are testing ZoneMate 9 paging equipment (used with PagePac 20), get an acknowledge tone. Then dial the zone code and make an announcement.

Follow these steps to test the paging interface:

1. Pick up the handset at the test telephone and dial the access code or extension number for a particular zone.
You may hear a confirmation tone.
2. Make an announcement into the handset.
You should hear the announcement from the loudspeaker(s).
3. Hang up.
4. Repeat Steps 1 through 3 for all paging zones provided.

Testing Music-on-Hold

Follow these steps to verify that music is provided to outside callers placed on hold. Inside callers do not receive Music-on-Hold (MOH).

1. Pick up the handset at the test telephone. Dial the central office trunk access code and the system's listed directory number, or if you are using the DID trunk, dial any station.
2. At the called station, answer the incoming call.

3. At the called station, press **Hold**.
The line button's green LED should flash,
4. Verify that music is heard at the calling telephone.
5. Hang up.

NOTE:

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

Testing the PFT Jacks

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

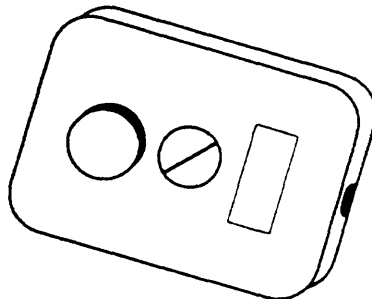


Figure 7-1. Ground-Start Button

Follow these steps to test the PFT jacks:

1. Plug a touch-tone or rotary dial telephone into a PFT jack.
2. Note the outside line number assigned to the lowest-position trunk jack on the module and be sure that the outside trunk is connected to the system.
3. Turn off power to the control unit, first at the power supply module on the basic carrier and then at the power supply module on each expansion carrier.
4. If the telephone is connected to a GS trunk, push the GS button attached to the telephone.
5. Pick Up the handset on the touch-tone or rotary dial telephone. You should hear a dial tone.
6. If the telephone is connected to a GS trunk, again push the GS button attached to the telephone.
7. Dial an outside number where you know someone will answer the call.
8. After the call is answered and you have verified that you have good two-way communication, tell the person the telephone number assigned to the outside-line jack bridged by the PFT jack to which you are connected.
9. Have that person call the number after you hang up. Your phone should ring after the other person completes dialing the number.
10. Answer the phone and verify that you have good two-way communication before disconnecting.

NOTE:

Test all PFT jacks (by repeating Steps 1 through 10 for each jack) before going to step 11.

11. Turn the power back on, first at each expansion carrier and then at the basic carrier.

Testing the Touch-Tone Receivers

The 400 and 400 GS/LS modules each have four touch-tone receivers (TTRs). The 008 OPT, 800 DID module, and 012 basic telephone modules each provide two TTRs.

Follow these steps to test the TTRs:

1. At a touch-tone single-line telephone connected to a 012 or 008 OPT module, pick up the handset. Dial **★ 04** and the 2-digit number (starting with 01) of the TTR to be tested.

You should hear a busy tone if the receiver is in use or a reorder tone if you misdialed or addressed a receiver not in your system (for example, you dialed **07** and your system has only a 012 module and one 400 module for a total of six TTRs).

In either case, try again.

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

2. Dial the following: **123456789 ★ 0#**

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

3. Repeat the test for each TTR.

Installing the Control Unit Housing

Once you complete system acceptance testing successfully and are confident that the system is completely installed, install the control unit housing.

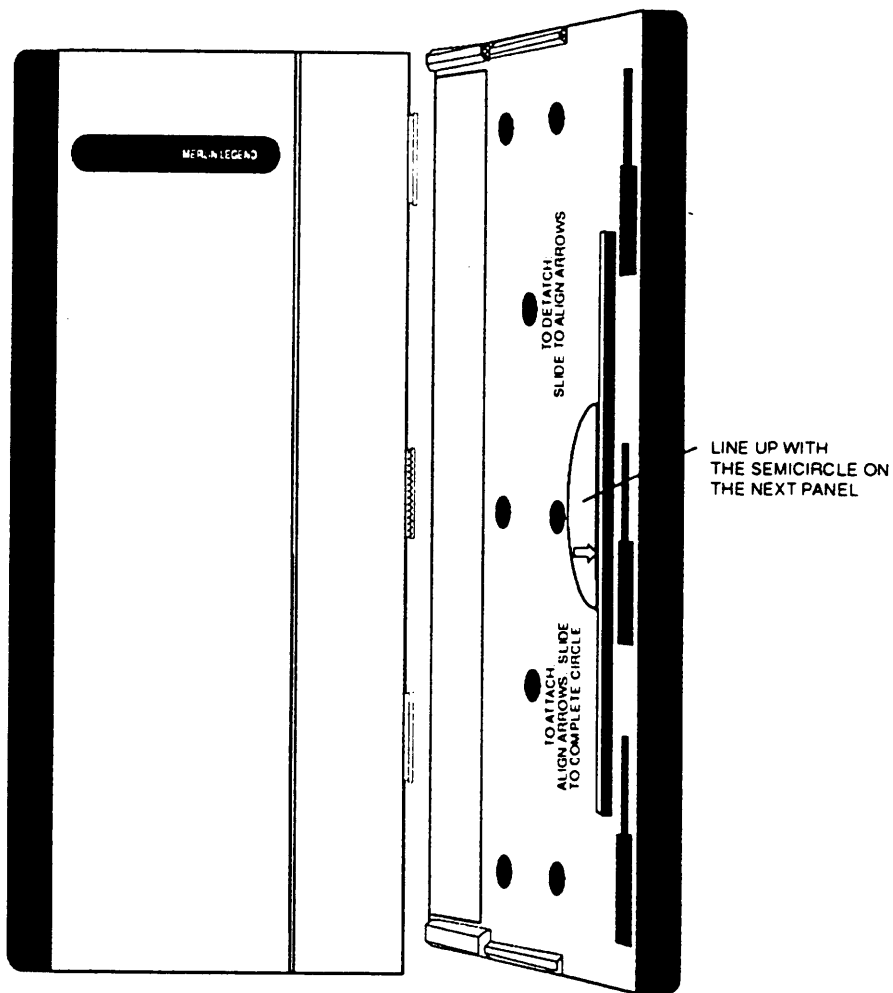


Figure 7-2. Installing the Control Unit Housing

NOTE:

If you are upgrading from the MERLIN II Communications System, see “Upgrading from the MERLIN II Communications System” earlier in this chapter.

1. Lay the front panel(s) face down.
2. 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 (as shown in Figure 7-2).
3. Connect the side panels to the front panel(s) similarly.
4. Pick up the whole housing and place it on the control unit.

NOTE:

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

- a. Line up the wire clips that are attached to the carrier with the recesses on the outside of the side panels.

NOTE:

If the wire clips are not already attached to both sides of the control unit, see “Installing the Housing Clips” in Chapter 2.

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

This chapter provides installation instructions and documentation references for the applications that are supported on this system. The following software and hardware can be installed on the system. See the documentation packaged with each application for detailed installation instructions.

- stand-alone products
 - Call Accounting Terminal (CAT)
 - CAT — Business (CAT/B)
 - CAT — Hospitality (CAT/H)
 - MERLIN PFC Telephone
 - MERLIN Attendant™ for the MERLIN LEGEND Communications System
 - MERLIN MAIL™ Voice Messaging System for the MERLIN LEGEND Communications System
 - CONVERSANT® Intro
- DOS-based products
 - Call Accounting System (CAS) for the MERLIN LEGEND Communications System

- CAS Plus V3 — Business
- CAS/H LEGEND — Hospitality
- Call Management System (CMS) for the MERLIN LEGEND Communications System
- InnManager™ Guest Management System
- System Programming and Maintenance (SPM) for the MERLIN LEGEND Communications System —DOS
- UNIX-based products
 - Integrated Solution III (IS-III)
 - AUDIX Voice Power™— IS-III
 - Call Accounting System (CAS)— IS-III
 - System Programming and Maintenance (SPM)— IS-III
 - CONVERSANT Intro
 - Fax Attendant— IS-III

Voice Messaging Systems and TTRs

The following applications are voice messaging systems (VMSs):

- MERLIN MAIL Voice Messaging System
- MERLIN Attendant
- AUDIX Voice Power— IS-III
- Automated Document Delivery System (ADDS)

Considerations

Applications that use mode codes must be connected to integrated VMI ports. Applications (such as MERLIN Attendant) that do not use mode codes connect to generic VMI ports. The tip/ring ports on 012 basic telephone modules are programmed to be either “generic VMI” or “integrated VMI.”

A VMS requires a certain number of touch-tone receivers (TTRs), depending on the number of VMS ports (see Table 8-1). TTRs are supplied by the following modules: 008 OPT, 012, 400, and 400 GS/LS/TTR. However, the VMS applications are not supported on the 008 OPT module.

Table 8-1. TTRs Required by VMS

No. of VMS ports	No. of TTRs Required	No. of 012 Modules	No. of 400 or 400 GS/LS/TTR Modules
1	1	1	0
2	1	1	0
3	2	1	0
4	2	1	0
6	3	1 or 2	0 1
8	4	1 or 2	0 1
12	6	2 or 3	0 1

Automated Document Delivery System

The Automated Document Delivery System (ADDS) is a computer-based system for faxing documents. ADDS stores the documents in a database and automatically faxes them on request 24 hours a day.

Using a touch-tone telephone, a caller accesses the system and is guided by prompts through the process of selecting a document and indicating the fax number to which the information is to be sent. The caller then receives the requested information in minutes by fax transmission.

For additional information, see the “ADDS Documentation” section later in this chapter.

Considerations and Constraints

- Using one line for fax transmission limits ADDS to approximately 100 calls per day. Businesses anticipating more than 100 calls per day may need more than one system to handle the call volume efficiently.
- ADDS should be used in a two-line configuration to maximize performance and minimize busy signals.
- ADDS can be used behind an Automated Attendant.
- ADDS does not function using a BBMI, GPA, or a tip/ring adapter.

Hardware Requirements

- To set up ADDS, a business must have the following:
 - Automated Document Delivery System Unit
 - a touch-tone telephone
 - a Group 3 fax machine with an integrated handset

- To request and receive information, a caller must have a touch-tone telephone and a Group 3 fax machine.
- For backup of stored data, one of the following is required:
 - AT&T 705 MT Multi-tasking Terminal
 - AT&T 6386/SX WGS (or compatible) with ProComm Plus software

Installation Procedure

See the “ADDS Documentation” section later in this chapter for installation instructions.

ADDS Documentation

- *AT&T Automated Document Delivery System (ADDS) Administrator's Guide* (Document Number 999-500-413)

Call Accounting System

The Call Accounting System (CAS) for the MERLIN LEGEND Communications System is ideal for medium- and large-sized companies that want to manage telephone usage and control costs by tracking calls placed from and received by the system.

NOTE:

CAS is also available as part of the UNIX-based Integrated Solution II (IS-II) and Integrated Solution III (IS-III) software application.

CAS runs on an approved DOS-based PC. Two versions of this product are offered: CAS— Hospitality(CAS/H) for hotels and health care facilities and CAS Plus— Business (CAS Plus) for other types of businesses.

Considerations

- Only one CAS can be connected to the system.
- CAS operates on an approved PC operating with MS-DOS®, version 3.3 or later. The PC must be dedicated to CAS.

Hardware and Software Requirements

A typical CAS system consists of the following equipment:

- An approved DOS-based PC with the following configuration:
 - 640K RAM
 - Hard disk drive with at least 3 Mbytes of available space for the application software
 - parallel printer output
 - serial SMDR input
- One of the following parallel printers:
 - AT&T Call Accounting System Printer - 80 column
 - AT&T Applications Printer -132 column
- D8W cord and 355AF adapter connecting the SMDR port on the communications system to the COM1 serial port on the PC
- MS-DOS Operating System, disk version 3.3 or later
- CAS software (CAS/H, CAS Plus)

Installation Procedure

For detailed installation instructions, see the “CAS Documentation” section later in this chapter for the appropriate document title.

Highlights of these instructions are as follows:

1. Connect the hardware as described in Chapter 5 under “Connecting a PC to the Control Unit.”
2. Complete the worksheets. Make sure that the four CAS worksheets show all information you need on telephone lines and extensions, calling patterns and processing options, and departments and personnel.
3. Install the software. Load and test MS-DOS and CAS, version 3.3 or later.
4. Enter the worksheet information. Use the planning worksheets to administer the software to meet the needs of the customer.

CAS Documentation

- *Call Accounting System Plus V3—Installation*
- *Call Accounting System Plus V3—Administration and Operation*

Call Accounting Terminal

The Call Accounting Terminal (CAT) Plus is a stand-alone application that provides accurate and flexible call accounting at a low cost. Two versions of this product are offered, CAT Plus—Hospitality for hotels and health care facilities and CAT Plus—Business for other types of businesses.

Considerations

- Only one CAT can be connected to the system.
- A serial printer such as the CAT printer must be used.

Hardware Requirements

- Call Accounting Terminal—CAT Plus
- Serial printer (AT&T CAT Printer is recommended) connected via a Z200A EMI Cable to the PRINTER jack of the CAT
- D8W cord and 355AF adapter connecting the SMDR port on the communications system to the SMDR jack of the CAT

Installation Procedure

For detailed installation procedures, see the “CAT Documentation” section later in this chapter for the appropriate document title.

Highlights of these instructions are as follows:

1. Before attaching the CAT to the control unit and the printer, set the ten CAT switches to establish the speed or baud rate for the CAT and its associated printer.
2. Connect the control unit, CAT, printer, and power supply as shown in Figure 8-1.

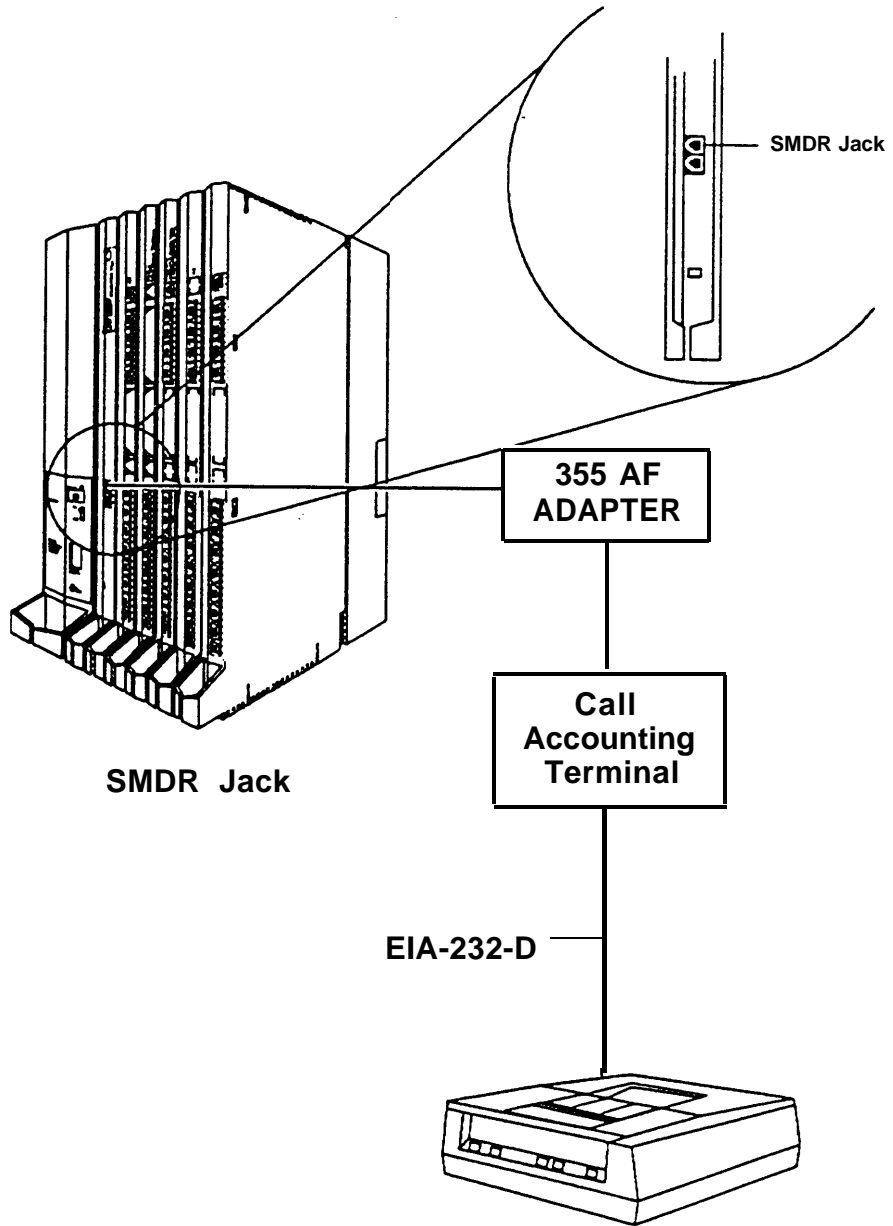


Figure 8-1. Connecting the CAT

The CAT Plus must be placed within the distances noted below:

- control unit
 - 14 ft (4.27 m)—direct connection
 - 1000 ft (305 m)—using building wiring
- serial printer—50 ft (15 m)
- power supply—grounded walloutlet—4ft (122 cm)

NOTE:

Do not use an outlet that is controlled by a wall switch.

3. Test the CAT Plus, following the instructions provided in the documentation packaged with the application.

CAT Documentation

Customer information booklets:

- *Call Accounting Terminal—CAT Plus V3 for Business Installation and Use*
- *Call Accounting Terminal—CAT Plus V3 for Hospitality Installation and Use*

Call Management System

The Call Management System (CMS) for the MERLIN LEGEND Communications System is a DOS-based software application that simulates the actions of a system operator by answering calls and distributing them to individual telephones.

For additional information, see the "CMS Documentation" section later in this chapter.

Considerations

- The CMS cannot be connected to a system that is in Behind Switch mode.
- Up to two CMSs can be installed on a system to handle a second set of lines if a business requires more than 28 lines or employs more than 28 agents.
- CMS operates on an approved PC with MS-DOS, version 3.3. The PC must be dedicated to CMS.
- The CMS supervisor's console is any Direct-Line Console.
- CMS agents can have any MLX telephone or any analog multiline telephone that can be used with the system.
 - CMS agent telephones must be connected to the first 58 telephone jacks on the control unit. (CMS allows only a two-digit method to specify an extension number; jacks 59 to 144 are designated by four digits.)
 - Because CMS is compatible only with 2-digit dialing, do not use flex-numbering on any telephone associated with CMS.

- The two CMS interface card ports on the PC must be connected to two analog multiline telephone jacks on the same analog multiline telephone module; these jacks must be operator positions. If two operator position jacks are not available on the same module, another analog multiline telephone module must be installed in the control unit to provide these jacks.
- CMS trunks can be loop-start, ground-start, T1 emulated ground-start, or primary rate interface (PRI).
- Up to four CMS external alerts can be used for agents and supervisors. For example, an alert sounds if the number of calls waiting to be answered nears a programmed threshold.
- A MERLIN Attendant can be used to direct callers to the appropriate CMS group.
- To play music for waiting callers, you must attach a Music-on-Hold (MOH) product to the system that is compatible with an MOH coupler.

NOTE:

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

Hardware and Software Requirements

- an approved PC with 640K RAM, 3.5-inch floppy disk drive, and 20 Mbyte hard disk drive.
- an approved monochrome or color monitor
- CMS interface card with two 14-ft (4.27-m), 4-pair modular plug telephone cords and one 14-ft (4.27-m) DIN connector cord for connection to DA-5 Digital Voice Announcer
- CMS software
- DA-5 Digital Voice Announcer for CMS
- parallel printer
- parallel printer cable to connect the printer to the PC
- supervisor console—MERLIN II System Display Console
- agent telephones—any MLX or analog multiline telephones supported by the communications system
- two analog multiline modules (008 or 408); one to connect the two PC ports to the operator positions, and one to connect the CMS supervisor console
- MS-DOS Operating System, disk version 3.3

Installation Procedure

For a list of optional hardware that can be used with CMS, and for detailed installation procedures, see the “CMS Documentation” section below for the appropriate document title.

CMS comes with a hardware installation checklist and information on installing the CMS software, creating an agent directory, programming lines and groups, and testing and managing calls. The control unit permits the connection of two CMS applications, and each application can have one PC.

CMS Documentation

- *Call Management System (CMS) for the MERLIN LEGEND™ Communications System Installation and System Programming Guide*
- *Call Management System for MERLIN LEGEND™ Communications System User's Quick Reference*
- *Call Management System for MERLIN LEGEND™ Communications System Supervisor's Guide*
- *Call Management System for MERLIN LEGEND™ Communications System Planning Guide and Forms*

CONVERSANT Intro

CONVERSANT Intro is an entry-level voice response system that enables the user to run integrated voice response (IVR) applications.

CONVERSANT intro can automatically answer and route calls and execute telephone transactions. CONVERSANT Intro consists of the hardware and software that supports transaction processing, data retrieval, and data entry using a touch-tone telephone connected to a public telephone network.

Considerations

- CONVERSANT Intro supports a maximum of 24 channels of analog ports, or up to 6 IVP4 boards. In a co-resident environment, such as CONVERSANT Intro and AUDIX Voice Power, the system supports a maximum of 16 channels. The number of channels assigned to AUDIX Voice Power can never exceed 12.

Hardware Requirements

The platform for CONVERSANT Intro is the Master Controller III (Tower). The Master Controller III is a desktop 20 MHz, 486-SX PC with six available EISA bus slots (with the tape drive installed). It has 8 MB of RAM.

- 500 MB fixed disk drive
- 250-MB tape drive
- 3.5-inch floppy disk drive
- two serial ports and one parallel port are integrated on the main board with connectors on the back panel of the system unit. A diskette drive controller and fixed disk drive interface also are integrated on the main board.
- A Video Graphics Array (VGA) video display controller and a tape drive controller are provided on separate add-in boards.
- AT&T UNIX System V version 3.2.2. It includes a system unit, a monitor, and a keyboard.

Installation Procedure

See the section “CONVERSANT Intro Documentation” later in this chapter for installation instructions.

CONVERSANT Intro Documentation

- *CONVERSANT Intro Application Support Software Installation Guide*
- *CONVERSANT Intro Application Support Software User's Guide*

InnManager Guest Management System

The InnManager Guest Management System is a stand-alone, DOS-based, integrated property management application combining all real time front-desk operations and record keeping. Suitable for hotels with up to 100 extensions, InnManager allows functions such as reservations, inventory, maintenance, check-ins and check-outs, call accounting, billing, and audits to be performed.

For additional information, see the “InnManager Documentation” section later in this chapter.

Considerations

- InnManager operates on an approved AT&T PC operating with DOS version 3.3. The PC must be dedicated to the InnManager, although specific applications such a spread-sheet or word-processor may co-reside on the PC and be used to supplement InnManager.
- Only one InnManager can be connected directly to the system. Additional InnManager terminals can be networked to the “host” InnManager PC.

Hardware Requirements

A typical InnManager system consists of the following equipment:

- An approved AT&T DOS-based PC with the following configuration:
 - 640K RAM
 - 40MB hard drive
 - parallel printer output (AT&T Master Controller-II is recommended)
 - serial SMDR input

- 80 or 132 column printer (AT&T Call Accounting System Printer or AT&T Applications Printers are recommended)
- D8W cord and 355AF adapter connecting the SMDR port on the communications system to the COM1 serial port on the PC
- Remote Maintenance Device (modem), 25-wire serial cable and 9-25 pin adapter for remote maintenance
- MS-DOS Version 3.3
- InnManager Guest Management System software

Installation Procedure

See the “InnManager Documentation” section later in this chapter for installation instructions.

InnManager Documentation

- *InnManager Guest Management System Installation Instructions*
- *InnManager Guest Management System Release 3.02 User's Guide*

Integrated Solution III

Integrated Solution II (IS-III) is a complete package of UNIX-based voice processing and call analysis software that helps to manage telephone usage and costs. IS-III offers a single interface and can include any of the following software:

- Call Accounting (CAS)
- AUDIX Voice Power—IS-III R 2.1.1
- System Programming and Maintenance (SPM)—IS-III Release 2.xx or higher
- FAX Attendant (FA)

The number of incoming lines and subscribers programmed for AUDIX Voice Power and the number of busy-hour calls determine how many voice channels are required for the user's system (see Table 8-2).

Table 8-2. Voice Channels Required

No. of Channels Required	Lines	Subscribers	Busy-Hour Calls
2	1 to 6	1 to 20	1 to 20
4	7 to 18	21 to 60	21 to 60
6	19 to 24	61 to 80	61 to 80
8	25 to 42	81 to 200	81 to 200
12	Over 42	201 to 300	201 to 300

Considerations

- IS-III uses UNIX System V, Release 3.2.2.
- For AUDIX Voice Power, the loop-start ports should be programmed for reliable far-end disconnect.
- For AUDIX Voice Power, the first four logical IDs on an 008 OPT module cannot be used to physically connect telephone equipment; however, the extension numbers of these logical IDs may be used for “Phantom extensions.”
- If IS-III includes AUDIX Voice Power, (or Fax Attendant) when users receive voice-mail (or fax-mail) messages, the message LEDs on their telephones turn on, if a mailbox (or fax mailbox) has been assigned to each of those telephones.
- The system may need more touch-tone receivers in the following cases:
 - Single-line telephone users do not get dial tone
 - AUDIX Voice Power fails to transfer calls
 - Calls fail to ring or calls go to coverage prematurely
 - Message Waiting lights fail to light
- CAS—IS-III uses the call information provided by the system’s built-in SMDR feature to process calls.
- SPM—IS-III reports can be printed out or can be written to a disk (hard or floppy).
- SPM—IS-III reports should not be printed while the system is handling more than 100 calls per hour.
- Only the CAS-IS-III and the SPM—IS-III applications can be connected to a system operating in Behind Switch mode.

Hardware Requirements

The Master Controller II+ (Desktop) and the Master Controller III (Tower) are the PC platforms for IS III.

The Master Controller II+ is a desktop 20 Mhz, 386-SX PC with three available AT bus slots (with the tape drive installed). It has 8 Mbyte of RAM memory, either 100 Mbyte or 200 MB hard disk drive, 3.5 inch floppy drive, and 125 Mbyte streaming tape drive.

The Master Controller III is a tower 20 Mhz 486-SX PC with six available EISA bus slots (with the tape drive installed). It has 8 Mbyte of RAM memory, either 200 or 500 Mbyte hard disk drive, and 250 Mbyte streaming tape drive.

- A 355AF adapter for connecting the Master Controller to the serial port on the control unit if they are within 50 ft (15 m) of each other and are on the same AC branch circuit
- ADUs for connecting the Master Controller to the serial port on the control unit, if they are not within 50 ft (15 m) of each other and/or are not on the same AC branch circuit
- Any additional hardware required by the individual applications included in IS-III, including the cables and adapters for connecting the applications to the system
- IVP4 boards or IVP6 cards for AUDIX Voice Power and FAX Attendant
- 012 basic telephone module to provide the tip/ring interface for AUDIX Voice Power
- TR114 boards for FAX Attendant

Installation Procedure

For detailed installation instructions, see the “IS-III Documentation” section later in this chapter for the appropriate document title.

Highlights of these instructions are as follows:

1. Set up the equipment and identify the hardware for IS-III.
2. Connect the hardware as shown in the instructions.
3. Install the software. Test the IS-III application.

If a voice application is installed you will need two 125-Mbyte tape cartridges for system backup.

IS-III Documentation

Integrated Solution III Installation and Maintenance Guide

MERLIN Attendant

The MERLIN Attendant is a stand-alone application that provides operator-like services through the use of prerecorded messages and electronic switching.

Considerations

- The MERLIN Attendant cannot be connected to a system that operates in the Behind Switch mode.
- The MERLIN Attendant cannot be connected to a system that has an AUDIX application or a Voice Mail system installed.
- A maximum of four Attendants can be connected to the system.
- All lines to MERLIN Attendant should be programmed for reliable far-end disconnect.

- The system may need more touch-tone receivers in the following cases:
 - Single-line telephone users do not get dial tone
 - MERLIN Attendant fails to transfer calls
 - Calls fail to ring or calls go to coverage-prematurely
- When the Attendant is set up for both daytime and after-hours operation, the time on each Attendant's clock must match the MERLIN LEGEND Communications system clock so the end of the business day is recognized.

Hardware Requirements

- 012 basic telephone module

NOTE:

You can use up to four ports on an 012 basic telephone module for MERLIN Attendants.

When using four ports, you can use up to two additional ports for single-line telephones, another additional port for a fax machine, and one more additional port for a remote maintenance device, such as a modem.

When using one, two, or three ports, you can use up to three additional ports for single-line telephones, another additional port for a fax machine, and one more additional port for a remote maintenance device, such as a modem.

- MERLIN Attendant unit and cords
- Some AC power strips may be needed since the Attendant is powered by wall-mounted transformers (10 VAC).
- Powering and grounding procedures must follow those established for T/R telephones that require auxiliary power.

Installation Procedure

See the documentation indicated below for installation procedures.

MERLIN Attendant Documentation

MERLIN Attendant Installer's Guide

MERLIN MAIL Voice Messaging System

The MERLIN MAIL Voice Messaging System provides the following integrated call management services:

- Automated Attendant
- Call Answer
- Voice-Mail

The number of incoming trunks and subscribers programmed for Automated Attendant service and the number of busy-hour calls determine how many MERLIN MAIL Voice Messaging System ports are required for the user's system (see Table 8-3).

Table 8-3. MERLIN MAIL Ports Required

Number of Ports Required	2	4
Incoming Trunks	1 to 6	7 to 18
Number of Subscribers or Busy-Hour Calls	1 to 20	21 to 60

NOTE:

MERLIN MAIL is available only as a 2-port or 4-port system.

Considerations

- The MERLIN MAIL Voice Messaging System cannot be connected to a system in Behind Switch mode.
- The MERLIN MAIL Voice Messaging System is available in 2-port and 4-port configurations. Both models have four hours of message storage capacity.
- You can use two or four ports on an 012 basic telephone module with the MERLIN MAIL Voice Messaging System.

When using two ports, you can use up to three additional ports for single-line telephones, another additional port for a fax machine, and one more additional port for a remote maintenance device, such as a modem.

When using four ports, you can use up to two additional ports for single-line telephones, another additional port for a fax machine, and one more additional port for a remote maintenance device, such as a modem.

- When mailbox users receive voice-mail messages, the message LEDs on their telephones are turned on, provided that a physical station set has been assigned to that mailbox.

- The trunks that are to be answered by MERLIN MAIL should be programmed for reliable far-end disconnect.
- Callers who dial from rotary telephones cannot use the features of the MERLIN MAIL Voice Messaging System.
- The system may need more touch-tone receivers in the following cases:
 - Single-line telephone users do not get dial tone
 - MERLIN MAIL fails to transfer calls
 - Calls fail to ring or calls go to coverage prematurely
 - Message Waiting lights fail to light
- The MERLIN MAIL Voice Messaging System and the MERLIN Attendant should not be used on the same system.
- Programming of the MERLIN MAIL Voice Messaging System is done via a touch-tone interface.

The MERLIN MAIL Voice Messaging System has an EIA-232-D serial port and an external modem to support remote diagnostics.
- The first four logical IDs on an 008 OPT module cannot be used to physically connect telephone equipment; however, the extension numbers of these logical IDs may be used for “Phantom extensions.”

Hardware Requirements

- MERLIN MAIL Voice Messaging System unit and power cords
- remote maintenance device (with a wall-mount transformer)
- modem cable with a 9-pin connector at one end and a 25-pin connector at the other end to connect the remote maintenance device to the serial port on the MERLIN MAIL Voice Messaging System unit
- D4BU modular cords (two for a 2-port system or four for a 4-port system, plus one for the remote maintenance device)
- 012 basic telephone module

NOTE:

- Additional touch-tone receivers (TTRs) may be needed for the 012 module to handle a large number of voice connections.
- MERLIN MAIL Voice Messaging System connects to two or four 012 basic telephone module jacks on the control unit.
- The MERLIN MAIL Voice Messaging System unit can be desk- or wall-mounted and should be placed in an area with low humidity and proper ventilation.
- Follow the power and ground procedures for T/R telephones that require auxiliary power.

Installation Procedure

See the documentation indicated below for installation procedures.

MERLIN MAIL VMS Documentation

*MERLIN MAIL Voice Messaging System for the MERLIN LEGEND™
Communications System Installation, System Programming, and Maintenance*

MERLIN PFC

The MERLIN PFC (Phone-Fax-Copier) Telephone is a BIS-34D 34-button display telephone with a built-in fax and personal copier that provides the convenience of a fax machine and personal copier in one compact unit. The MERLIN PFC telephone allows the user to make and receive intercom and outside calls using the built-in speakerphone, and send and receive faxes or make quick copies while using the telephone.

Considerations

- The fax machine component of the MERLIN PFC telephone does *not* transmit date, time, and fax number.
- In Behind Switch mode, a dedicated fax line for incoming fax calls is also required; in Hybrid/PBX or Key mode, the system can have either a dedicated fax line or direct inward dialing (DID).
- The MERLIN PFC telephone cannot be installed outside of building.
- All button assignments except the one for the fax line must be removed from the fax station.
- The Voice Announcement feature should be removed from the fax station.
- If the dedicated fax line is shared *for outgoing calls only*, the Ringing Option must be administered to No Ring at any station except the MERLIN PFC fax station.
- The MERLIN PFC telephone may operate in either Hybrid/PBX Mode or in Key Mode. The following lists differences in operation between the two modes.

Hybrid/PBX and Key Modes

- The dedicated fax line for incoming fax calls from the central office must be connected to a line port on the control unit, and the line cannot be assigned to any pool.
- If DID is used, a DID number must be assigned to the fax station.
- If a dedicated private line is used, assign a fax line to the voice station.
- No lines or line pools can be administered to the fax station.
- The dedicated fax line should be administered to Immediate Ring and any other lines to No Ring at the fax station.

Behind Switch Mode

- The dedicated fax line can be administered only to the MERLIN PFC fax station.
- The dedicated fax line cannot be assigned to a pool.
- The dedicated fax line should be assigned as a secondary line at the voice station.

Hardware Requirements

- The MERLIN PFC telephone requires two analog (ATL) ports: one for the voice line and one for the fax line.
- The telephone wiring between the system controller or control unit and the MERLIN PFC telephone must be installed in the same building.

PFC Documentation

- *MERLIN PFC™ Telephone Phone-Fax-Copier Installation and Maintenance Guide*

System Programming and Maintenance (SPM)

System Programming and Maintenance (SPM) for the MERLIN LEGEND Communications System is a DOS-based software application that allows the use of a PC for programming and maintaining the system. SPM performs the same functions as an MLX-20L telephone used as a system programming console and has some additional features, such as the ability to back up and restore files and print reports. The PC display shows the same button and screen layout as an MLX-20L telephone.

Considerations

- SPM operates with DOS, version 3.3 or later.
- Unless the system is being backed up or restored, a remote user takes priority over a local user. If the local user is programming when a remote user connects to the system, the system sends a message to the local user that a remote connection has been made and disconnects the local user.
- The PC with SPM connects to the EIA-232-D jack on the processor of the control unit. The EIA-232-D baud rate is 1200/2400 bps with auto-baud adjust.
- A printer connected to the PC with SPM can be used to print system programming reports. Or reports can be sent to the printer that is connected to the SMDR port on the control unit.
- SMDR information may be lost while system programming reports are printed via the SMDR port.
- A UNIX-based version of System Programming and Maintenance is available as part of Integrated Solution III, as discussed earlier in this chapter.

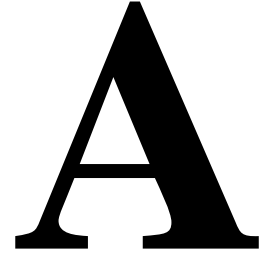
Hardware Requirements

- an approved PC or other DOS compatible PC with the following:
 - at least 512K of RAM
 - a double-sided floppy diskette drive (either 5.25-inch or 3.5-inch)
 - a serial port assigned to COM1 or COM2. The serial port can use either a DB-9 or DB-25 connector. If a DB-9 connector is used, a 9-pin to 25-pin adapter is also required. The 9-pin side must be female.
- video monitor (monochrome or color)
- D8W cord and 355AF Adapter if PC is within 50 ft (15 m) of the control unit. Distances of greater than 50 ft (15 m) require back-to-back ADUs.

Installation Procedure

See the *System Programming & Maintenance (SPM)* guide for installation instructions.

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 3-Digit Set Up Space

Mod. Type	Log. ID	Jack Type			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™
		A	D*	B										
	1					1 0	100	7100						
	2					1 1	101	7101						
	3					1 2	102	7102						
	4					1 3	103	7103						
	5					1 4	104	7104						
	6					1 5	105	7105						
	7					1 6	106	7106						
	8					1 7	107	7107						
	9					1 8	108	7108						
	10					1 9	109	7109						
	11					2 0	110	7110						
	12					2 1	1 1	7111						
	13					2 2	112	7112						
	14					2 3	113	7113						
	15					2 4	114	7114						
	16					2 5	115	7115						
	17					2 6	116	7116						
	18					2 7	117	7117						
	19					2 8	118	7118						
	20					2 9	119	7119						
	21					3 0	120	7120						
	22					3 1	121	7121						
	23					3 2	122	7122						
	24					3 3	123	7123						

Shaded lines indicate possible operator positions.

** Use Form 2b for sdjuncts 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 2c, System Numbering— Trunk Jacks

Form 2c, System Numbering — Trunk Jacks

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

Maintenance Alarm, Trunk No. _____

Loudspeaker Page, Trunk No(s). _____

Loop-Start Reliable Disconnect*

No Yes

Module Type and Slot No.	Log. I D	Jack Type (LS,GS, DID, Tie, ets.)	Trunk No.	Pool Dial-Out Code††	Re-number To	Incoming Trunk Type (Main No., Personal Line, WATS, FX, ets.)	Telephone Number or Equipment	Label	Outmode Signaling			Toll Type Prefix Req'd for LD		Hold Disc. Interval		QCC Queue Priority Level‡ (? ◆)	QCC Operator to Receive Calls‡ (No ◆)	Function
									T	F	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 (min), 891 (dial-in tie), 892 (automatic-in tie).

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

Form 2d, System Numbering— Special Renumbers

Form 24 System Numbering — Special Renumbers

Pools* (Form 2c) Description	Factory Set Number	Renumber t o	Group Calling (Form 6e) Group ID Label	Factory-Set Number	Renumber t o
	7 0			7 7 0	
	8 9 0			7 7 1	
	8 9 1			7 7 2	
	8 9 2			7 7 3	
	8 9 3			7 7 4	
	8 9 4			7 7 5	
	8 9 5			7 7 6	
	8 9 6			7 7 7	
	8 9 7			7 7 8	
	8 9 8			7 7 9	
	8 9 9			7 8 0	
				7 8 1	
				7 8 2	
				7 8 3	
				7 8 4	
				7 8 5	
				7 8 6	
				7 8 7	
				7 8 8	
				7 8 9	
				7 9 0	
				7 9 1	
				7 9 2 0	
				7 9 2 1	
				7 9 2 2	
				7 9 2 3	
				7 9 2 4**	
				7 9 2 5**	
				7 9 2 6**	
				7 9 2 7**	
				7 9 2 8**	
				7 9 2 9**	
Group Paging (Form 6c) Group ID	Factory-Set Number	Renumber t o			
	7 9 3				
	7 9 4				
	7 9 5				
	7 9 6				
	7 9 7				
	7 9 8				
	7 9 9				
Call Park (Form 6a)	Factory Set Number	Renumber t o			
	8 8 1				
	8 8 2				
	8 8 3				
	8 8 4				
	8 8 5				
	8 8 6				
	8 8 7				
	8 8 8				
Remote Access Code (Form 3a)	Factory-Set Number	Renumber t o			
	8 8 9				
Listed Directory Number* (QCC Queue)	Factory-Set Number	Renumber t o			
	8 0 0				

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

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

Unit Load Calculation Worksheet

B

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

NOTE:

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

Unit Load Worksheet

1. Number of modules in carrier (excluding power supply and processor): _____
- If fewer than 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 No
analog multiline telephone jacks?
- If no, auxiliary power is not required.
 - If yes, continue to Step 4.

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

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

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

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

- Total of MLX-20L, MLX-28D, and 34-button
analog telephones
- If 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.

Unit Load Calculation Worksheet

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.

Unit Load Calculation Worksheet

6. Calculate the actual carrier unit load.

Equipment	Qty	Unit Load		= Total
		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-10D		.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	
<i>Continued</i>				

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

Unit Load Calculation Worksheet

Equipment	Qty	Unit Load		= Total
		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 six system operator positions, each with one DSS powered from the control unit.
- If the total actual unit load is less than or equal to 54, auxiliary power is not required.
 - If the total actual unit load is greater than 54, continue to Step 7.

7. Try to exchange modules between carriers to reduce the unit loads to 54. (Remember that the 100D, 400, 400 GS/LS/TTR, 800, 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.

Unit Load Calculation Worksheet

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-10D			.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
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
<i>Continued</i>					

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

Unit Load Calculation Worksheet

Equipment	Qty	Unit Load		= Total
		Hybris/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 MXL-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.

Ordering Codes

C

This appendix contains all the codes that you will need to order any piece of equipment that the system supports.

Ordering Codes

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Control Unit			
MERLIN LEGEND Control Unit	6140-CU2		
Basic carrier and housing	106388614	403E	
Power Supply module	105743801	391A1	
Processor	106215155	517A27	
Feature Module	106874738	517G25	
MERLIN LEGEND Control Unit w/408 ATL	6140-CA2		
Basic carrier and housing		106388614	403E
Power supply module		105743801	391A1
Processor		106215155	517A27
Feature module		106074738	517G25
408 GS/LS		106064678	517A26
MERLIN LEGEND Control Unit w/408 MLX	6140-CD2		
Basic carrier and housing		106388614	403E
Power supply module		105743801	391A1
Processor		106215155	517A27
Feature module		106874736	517G25
408 GS/LS-MLX		106698590	517A29
MERLIN LEGEND Control Unit w/12 x 24 MLX	6140-242		
Basic carrier and housing		106388614	403E
Power supply module		105743801	391A1
Processor		106215155	517A27
Feature module		106874738	517G25
408 GS/LS-MLX (qty.3)		106698590	517A29
<hr/>			
Expansion Unit	61490		
Expansion carrier and housing		106388630	403F
Power supply module		105743001	391A1
Expansion Unit Cover	N/A	106388259	17A
<hr/>			

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
R1/R1.1 Upgrade to R2	6141-102A	10687473	517G25
Upgrade from Merlin II (Basic)	6140-UD2A		
Cover		106388234	16A
Processor		106215155	517A27
008 MLX		105628010	517A21
Feature module		106064660	517A25
MLX-20L telephone (choose one):			
Black		106743420	7713D01B-003
White		106743438	7713D01B-264
Expansion cover (zero, one, or two)		106388259	17A
Upgrade from Merlin II (w/MLX module)	6140-U2LA		
Cover		106388234	16A
Processor		106215155	517A27
Feature module		106874738	517G25
Expansion cover (zero, one, or two)		106388259	17A
Trunk and Station Modules			
008 MLX	61486	105628010	517A21
008 OPT	61489	106387525	517A28
012 (T/R)	61487	106553779	517E13
100D (DS1)	61491	105461550	517B15
400EM (tie trunk)	61492	105311401	517A14
400 GS/LS/TTR	61483	105628044	517018
408 GS/LS	61481	106064678	517A26
408 GS/LS-MLX	61493	106698590	517A29
800 DID	61488	105628077	517B20
800 GS/LS	61484	105627996	517A19
Vintage Trunk and Station Modules			
400 (with TTRs)	61379	105408892	517B12
408 LS	61482	105512495	517C1
008 (ATL)	61485	105351092	517B3
800 LS	61384	105351100	517B4

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Telephones			
MLX Telephones			
MLX-10			
English (black)	3156-02B	106743024	7712D01B-003
English (white)	3156-02W	106743032	7712D01B-0264
French (black)	3156-F2I	106633886	7712D01A(29)-003
French (white)	3156-F2I	106633894	7712D01A(29)-264
Spanish (black)	3156-S2I	106613508	7712D01A(22)-003
Spanish (white)	3156-S2I	106613516	7712D01A(22)-264
MLX-10D			
English (black)	3156-03B	106743040	7712D02B-003
English (white)	3156-03W	106743057	7712D02B-264
French (black)	3156-F3I	106633928	7712D02A(29)-003
French (white)	3156-F3I	106633936	7712D02A(29)-264
Spanish (black)	3156-S3I	106613524	7712D02A(22)-003
Spanish (white)	3156-S3I	106613532	7712D02A(22)-264
MLX-20L			
English (black)	3156-05B	106743420	7713D01B-003
English (white)	3156-04W	106743438	7713D01B-264
French (black)	3156-F5I	106634421	7713D01A(29)-003
French (white)	3156-F5I	106634439	7713D01A(29)-264
Spanish (black)	3156-S5I	106613557	7713D01A(22)-003
Spanish (white)	3156-S5I	106613573	7713D01A(22)-264
MLX-28D			
English (black)	3156-04B	106743503	7713D02B-003
English (white)	3156-04W	106743511	7713D02B-264
French (black)	3156-F4I	106634470	7713D02A(29)-003
French (white)	3156-F4I	106634488	7713D02A(29)-264
Spanish (black)	3156-S4I	106613599	7713D02A(22)-003
Spanish (white)	3156-S4I	106613607	7713D02A(22)-264
Analog Multiline Telephones (black)			
MLC-5	3168-MLC	105515332	7312HO1 A-003
BIS-10	3165-10B	105161061	7313HO1A-003
BIS-22	3166-22B	105188809	7314HO1A-003
BIS-22D	3166-DSB	105630420	7315HO1B-003
BIS-34	3167-34D	105167027	7317HO1A-003
BIS-34D	3167-DSB	105630529	7317HO1B-003
MERLIN PFC (ATL)	3169-PF2	106681562	
PFC paper	31690	106673361	

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Telephone (continued)			
Vintage Analog Multiline Telephones (black)			
5-Button	3160-111	105217426	Z7302H01D-003
10-Button	3161-172	105217509	Z7303H01D-003
10-Button HFAI	3161-161	105371942	Z7309H01C-003
34-Button	3162-412	103842050	Z7305H01B-003
34-Button Deluxe	3162-417	105217715	Z7305H02B-003
34-Button BIS	3162-BIS	103981965	Z7305H03D-003
34-Button BIS/DIS	3162-DIS	103981981	Z7305H04C-003
Single-Line Telephones			
8110 Analog Voice	3193-001		
Black		106272321	8110A01A-003 811
White		106272339	8110A01A-264 811
8102 Analog Voice	3192-001		
Black		106272305	8102A01A-003 810
White		106272313	8102A01A-264 810
7102	3185-MWR		
Black		105335285	7102A01A-003
Misty cream		105330419	7102A01A-215
2500 YMGK	3178-NHL		
(message waiting, recall, touch-tone, desk)			
Black		105480578	2500YMGK-003
Misty cream		105480560	2500YMGK-215
2500 MMGK	3101-ETR		
(recall, touch-tone, desk)			
Black		105414130	2500MMGK-003
Misty cream		105414122	2500MMGK-215
2500 MMGJ	3101-EBD		
(touch-tone, desk)			
Black		105414155	2500MMGJ-003
Misty cream		105414148	2500MMGJ-215
2554 MMGJ	3101-EBW		
(touch-tone, wall)			
Black		105480081	2554MMGJ-003
Misty cream		105480032	2554MMGJ-215
500 MM	3100-ORD		
(rotary, desk)			
Black		103870234	500MM-03
Ivory		103870226	500MM-50
Beige		103870267	500MM-60

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Telephones (continued)			
Single-Line Telephones (continued)			
554 BMPA	3100-ORW		
(rotary, wall)			
Black		103823498	554BMPA-3
Ivory		103823506	554BMPA-50
Beige		103823555	554BMPA-60
Cordless Telephones			
Model 5320	3103-CLS	105543516	CS6300U11A-229
Consoles			
MERLIN II	61392	105229744	7318H01A-003
System Display Console			
DSS			
English (black)	3156-DCB	105685481	604A1-003
English (white)	3156-DCW	105685499	604A1-264
Spanish (black)	3156-SDI	106613672	604A1(22)-003
Spanish (white)	3156-SDI	106613680	604A1(22)-264
Applications			
SPM Version 2.0 — DOS	61495	106906092	
SPM Version 2.0 — UNIX System	61496	N/A	
Call Accounting System (CAS)			
CAS Plus V3 Bundle w/80-col.			
Parallel Printer	1201-NP1		
CAS Plus V3 Bundle w/132-col.			
Parallel Printer	1201-WP1		
CAS Plus V3 Software	1201-DR1	406362244	
Rate Table*	12010	406158444	
CAS Plus upgrade	12009	406158394	
UNIX CAS (LEGEND)	1201-U12	406478537	
CAS/H			
CAS/H LEGEND 100S	1201-H10	405799255	
CAS/H LEGEND 200S	1201-H20	405788289	
CAS/H Rate Table*	12050	405788420	

* Consult AT&T or an authorized dealer for other area-specific information.

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Applications (continued)			
Call Accounting Terminal (CAT)			
CAT BASIC/B	3600-010		
CAT Terminal		406669762	
Printer		406637306	
CAT Basic Rate Table*	36014	406669739	
(Update Chip)			
CAT/B 150S	3600-023	406478800	
CAT/H 150S	3600-024	406478818	
CAT/B Rate Table* (update)	36023	406478792	
CAT/H Rate Table* (update)	36024	406478784	
Call Management System (CMS)			
5¼" floppy disk	1207-100		
3½" floppy disk		106496540	
Board		106496532	
CONVERSANT INTRO Application	8301-100	106198815	
CONVERSANT INTRO Application	4201-100		
Casual User	4201-101		
Conversant Intro Application			
Casual Dev. & Data	4201-102		
inn Manager w/Base Software			
Site Specific Software	7051-INN	406670984	
20 station	70501	406670992	
40 station	70502	406671008	
60 station	70503	406671016	
80 station	70504	406671024	
100 station	70505	406671032	
355AF Adapter, Receptacle	2709-A25	105012645	355AF
355A Adapter, Plug	2750-A24	105012637	355A
14' Cord	2725-07N	103687802	D8W-87 14FT

* Consult AT&T or an authorized dealer for other area-specific information.

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Applications (continued)			
MERLIN LEGEND Integrated Solution III			
Controllers			
100 MB MC-II + Processor	4200-503		
4 x 100 MB MC-II + Processor		406506329	
4MB Memory Upgrade		106219553	
COLOR MONITOR		406504571	
KEYBOARD		406504563	
9 to 25 PIN ADAPTER		406139394	
CARTRIDGE TAPES (qty.2)		106220866	
200 MB MC-II + Processor	4200-503		
4 x 200 MB MC-II + Processor		406506337	
4MB Memory Upgrade		106219533	
COLOR MONITOR		406504571	
KEYBOARD		406504563	
9 to 25 PIN ADAPTER		406139394	
CARTRIDGE TAPES (qty.2)		106220866	
200 MB MC-III + Processor	4200-912		
8 x 200 MB MC-III + Processor		406700930	
COLOR MONITOR		406504571	
KEYBOARD		406504563	
9 to 25 PIN ADAPTER		406708503	
2 x 250 MB CART. TAPES		406760009	
500 MB MC-III + Processor	4200-936		
8 x 500 MB MC-III + Processor		406700914	
COLOR MONITOR		406504571	
KEYBOARD		406504563	
9 to 25 PIN ADAPTER		406708503	
2 x 250 MB CART. TAPES		406760009	
SOFTWARE APPLICATIONS			
MERLIN LEGEND IS-III		106894942	
LEGEND IS-III PLATFORM SOFTWARE			
UNIX SPM 2.0			
LEGEND IS-III System Manager's			
Guide			
LEGEND IS-III I+M Guide			
LEGEND IS-III Tape			

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Applications (continued)			
MERLIN LEGEND R2 AVP. 2.1.1		106876311	
IVPSS 2.0			
AVP 2.1.1			
AVP/FA MLR2 Switch Integ. SW			
MERLIN LEGEND Integ. AVP/FA Admin.			
MERLIN LEGEND AVP User's Guide (50)			
MERLIN LEGEND AVP System Manager's Guide			
MERLIN LEGEND AVP/FA Planning Guide			
MERLIN LEGEND FAX Attendant		106876220	
FAX ATTENDANT 2.1.1 CO-RESIDENT Base PKG.			
AVP/FA MLR2 Switch Integ. SW			
FAX ATTENDANT User's Guide (50)			
MERLIN LEGEND AVP/FA Planning Guide Reference Sheet			
OTHER (Voice Boards)			
IVP4 Board LEGEND	8306-100	106248651	
IVP6 Board LEGEND	N/A	106856271	
IS-III Bundles			
100 MB MC-II + 4 x 4 AVP	6146-100		
100 MB MC-II + Processor	4200-503		
IVP4 Board	8306-100	106248651	
UNIX 3.2.2	N/A	106529548	
CART. TAPE UTILITIES	N/A	106632938	
MERLIN LEGEND IS-III	N/A	106894942	
LEGEND R2 AVP 2.1.1	N/A	106876311	
200 MB MC-II + 4 x 12 AVP	6146-200		
200 MB MC-II + Processor	4200-503		
IVP4 Board	8306-100	106248651	
UNIX 3.2.2	N/A	106529548	
CART. TAPE UTILITIES	N/A	106632938	
MERLIN LEGEND IS-III	N/A	106894942	
LEGEND R2 AVP 2.1.1	N/A	106876311	
200 MB MC-III + 8 x 12 AVP	6146-012		
200 MB MC-III + Processor	4200-912		
IVP4 Board (qty.2)	8306-100	106248651	
UNIX 3.2.2	N/A	106529548	
CART. TAPE UTILITIES	N/A	106632938	
MERLIN LEGEND IS-III	N/A	106894942	
LEGEND R2 AVP 2.1.1	N/A	106876311	

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Applications (continued)			
500 MB MC-III + 8 x 36 AVP	6146-036		
500 MB MC-III + Processor	4200-936		
IVP4 Board (qty.2)	8306-100	106246651	
UNIX 3.2.2	N / A	106529548	
CART. TAPE UTILITIES	N / A	106632938	
MERLIN LEGEND IS-III	N / A	106894942	
LEGEND R2 AVP 2.1.1	N / A	106876311	
100 MB MC-II + 4 x 4 AVP, CAS	6146-101		
100 MB MC-II + Processor	4200-503		
IVP4 Board	8306-100	106248651	
UNIX 3.2.2	N / A	106529548	
CART. TAPE UTILITIES	N / A	106632938	
MERLIN LEGEND IS-III	N / A	106894942	
LEGEND R2 AVP 2.1.1	N / A	106876311	
CAS—IS-III	1201-U12	406478537	
200 MB MC-II + 4 x 12 AVP, CAS	6146-201		
200 MB MC-II + Processor	4200-503		
IVP4 Board	8306-100	106248651	
UNIX 3.2.2	N / A	106529548	
CART. TAPE UTILITIES	N / A	106632938	
MERLIN LEGEND IS-III	N / A	106894942	
LEGEND R2 AVP 2.1.1	N / A	106876311	
CAS—IS-III	1201-U12	406478537	
200 MB MC-III + 8 x 12 AVP, CAS	6146-112		
200 MB MC-III + Processor	4200-912		
IVP4 Board (qty.2)	8306-100	106248651	
UNIX 3.2.2	N / A	106529548	
CART. TAPE UTILITIES	N / A	106632938	
MERLIN LEGEND IS-III	N / A	106894942	
LEGEND R2 AVP 2.1.1	N / A	106876311	
CAS—IS-III	1201-U12	406478537	
500 MB MC-III + 8 x 36 AVP, CAS	6146-136		
500 MB MC-III + Processor	4200-936		
IVP4 Board (qty.2)	8306-100	106248651	
UNIX 3.2.2	N / A	10652998	
CART. TAPE UTILITIES	N / A	106632938	
MERLIN LEGEND IS-III	N / A	106894942	
LEGEND R2 AVP 2.1.1	N / A	106876311	
CAS—IS-III	1201-U12	406478537	

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Applications (continued)			
200 MB MC-III+8x 12 AVP, 4x1000 FAX	6146-212		
200 MB MC-III + Processor	4200-912		
IVP4 Board (qty.2)	8306-100	106248651	
UNIX 3.2.2	N/A	106529548	
CART. TAPE UTILITIES	N/A	106632938	
MERLIN LEGEND IS-III	N/A	106894942	
LEGEND R2 AVP 2.1.1	N/A	106876311	
LEGEND FAX ATTENDANT		106876220	
500 MB MC-III+8x36 AVP, 4x3000 FAX	6146-236		
500 MB MC-III + Processor	4200-936		
IVP4 Board (qty.2)	8306-100	106248651	
UNIX 3.2.2	N/A	106529546	
CART. TAPE UTILITIES	N/A	106632938	
MERLIN LEGEND IS-III	N/A	106894942	
LEGEND R2 AVP 2.1.1	N/A	106876311	
LEGEND FAX ATTENDANT		106876220	
200 MB MC-III+8x12 AVP, CAS, 4x1000 FAX	6146-312		
500 MB MC-III + Processor	4200-936		
IVP4 Board (qty.2)	8306-100	106248651	
UNIX 3.2.2	N/A	106529548	
CART. TAPE UTILITIES	N/A	106632938	
MERLIN LEGEND IS-III	N/A	106894942	
LEGEND R2 AVP 2.1.1	N/A	106876311	
LEGEND FAX ATTENDANT		106876220	
CAS—IS-III	1201-U12	406478537	
500 MB MC-III+8x36 AVP, CAS, 4x3000 FAX	6146-336		
500 MB MC-III + Processor	4200936		
IVP4 Board (qty.2)	8306-100	106248651	
UNIX 3.2.2	N/A	106529548	
CART. TAPE UTILITIES	N/A	106632938	
MERLIN LEGEND IS-III	N/A	106894942	
LEGEND R2 AVP 2.1.1	N/A	106876311	
LEGEND FAX ATTENDANT		106876220	
CAS—IS-III	1201-U12	406478537	
MERLIN Attendant	6125-ATT		
Hardware		406406090	
Documentation		106431265	

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Applications (continued)			
MERLIN MAIL™ Voice Messaging System for the MERLIN LEGEND Communications System			
Two-port	6107-005		
MERLIN MAIL unit		406824532	
Remote maintenance device		406466193	
Four-port	6107-006		
MERLIN MAIL unit		406824540	
Remote maintenance device		406466193	
Two-port line card (R2) (upgrade from two to four)	6107-007	406824524	
System Adjuncts and Adapters			
Auxiliary Power Unit 9024	61416	406467142	9024
Channel service units (CSUs)			
ESF T1	2152-ESF	405616293	305010171-001
Cable (8 mod, wire wrp)	21555	406012609	513861312-50 50 FT
Cable (8 mod, 15-pin sub)	21554	406012591	513823015-50 50 FT
Stand-alone wall mount	21545	405970104	380-100213-001
Stand-alone wall bracket		405616277	380-100542-001
551 T1 L1	2152-15T	403768179	305-10097-001
Power unit	21530		
Unit		403242639	KS22911LI
Cord		103895660	DW4A-SE 10FT IP
Stand-alone wall mount	21545	405970104	380-100213-001
Stand-alone wall bracket		405616277	380-100542-001
Optional Equipment			
Peripheral Interface	62515	105179303	KIT PRTS-D181558
Async. Data Unit, Receptacle	2169-004	103964185	Z3A4
Async. Data Unit, Plug	2169-001	103963963	Z3A1
Aux Power (2 required)	21691	N/A	
Transformer		102600517	
Adapter (248B)		102802113	
Cord		102937620	
Adapter (400B)		103848859	

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
System Adjuncts and Adapters (continued)			
Electrostatic discharge (ESD) suppression kits			
D-181574	N/A	105179329	D181574
D-181589	N/A	105201891	D181589
D-181590	N/A	105201909	D181590
D-181591	N/A	105201917	0181591
D-181593	N/A	105201933	D181593
EMI filter		103965208	Z200A
In-Range Out-of-Building-343B (IROB) unit — analog multiline*	32918	406721738	343B
IROB unit — MLX*	32919	106417447	505A ASSY 0A WD
Fuse block 505A for IROB (8 fuse blocks per box)		406610337	
7500B Data Module	2164-BDM	105657654	Z750B-L1
Stand-alone power supply	21625	405509852	WP90110 L7
Multiple mounting	21626	105441166	277A
7500A upgrade kit	21627	105688501	0182208
Digital Magic On Hold® player (replaces analog unit)	3128-020	406659326	PAKG DMOH1 DIG L
Digital Announcement Unit	3119-001	406747774	ATTTDAU
Modem 2224G	2224-CEO	105659965	2224C-L1 D/2
Music Coupler	61398	406143925	ASSY-K23395 L3
PagePac® 6	5323-006	405701277	22052-006 PG PC
PagePac 6 Plus	5323-008	405701608	22052-000 PG PC6
PagePac 20 PowerMate™	5323-005	403308026	ADP06
Trunk Adapter	53518	405223298	22050-900
PagePac6 Portsaver	53519	405703026	220520020

* Any multiline off-premises telephone must have an appropriate IROB protector at the control unit location and at the off-premises location.

Ordering Codes (continued)

Component	PEC	Comcode	App. Code
System Adjuncts and Adapters (continued)			
AT&T Door Phone Speaker	53240	406269860	
PagePac 20 Talkmate	53501	403307994	PE53501 AT
PagePac 50	5322-051	403305444	5322-051 VC PG
PagePac 200	5322-201	403305469	5322-201 VC PG
PagePac VS	5322-700	403307192	5322-7003500 VC PG
200 WATT AMPLICENTER	52120	403305493	52120 AT
50 WATT AMPLICENTER	52150	403305501	52150 AT 50W
Ring generator unit	61388	105213201	129B RING GEN
SMDR Printers			
Parallel Printer (80-column)	4200-570	406637314	
Parallel Printer (132-column)	4200-571	406712067	
CAT Printer (serial)	4200-572	406716464	
Uninterruptible Power Supply (UPS)			
500 VA (15 min)	2403-050	105610141	515005C111
Reserve (1 hr)	24035	105610174	0053150
Universal Paging			
Access Module (UPAM)	58500	405891698	KIT-UPAM
TAM-B	N/A	405899972	0181900
PRS-48	N/A	405742735	0181900
WMT-1A	N/A	405891680	D181900
ZoneMate™ 9			
Dialer unit	53505	404057911	DIAL UNIT-9ZONE
Control unit		405024134	CNTL 22050-020
ZoneMate 39			
Dialer unit	53506	404057929	39 ZONE SELECT
Control unit		405024134	CNTL-22050-020C
External Alerts			
Loud external ringer	31016A	103117016	RINGER-L1AMP-49
E1CM-type	31019A		
Gray		102872934	RINGER-E1CM-49
Ivory		102917952	RINGER-E1CM-50
E1CM ringer and parts	61211		D-181233
290A adapter		102992252	290A ADPTR
Ringer		102872934	E1CM-49
Mounting plate		102988466	1049A
Cord		103938494	CORD-D4CH-87-25

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
System Adjuncts and Adapters (continued)			
Supplemental Alerts			
Alert Bell	5580-002	406293720	TB591-1
Network Interface Alert Bell	61211	102872934	RINGER-E1CM-49
Alert Horn	5580-021	406207217	THET4-1
Alert Strobe	5580441	403319197	AT-WHL LK
Alert Chime	5580-030	405136060	CHBT2-1
Telephone Adjuncts and Adapters			
General Purpose Adapter (GPA) (analog)	2301-GPA	103977997	Z1C
Multi-Function Module (digital)	3156-MFM	105746474	540A1
Supplemental Alert Adapter (SAA)	2301-SSA	105031199	ADPTR-856A
MLX-10 and MLX-10D protective cover	N/A	406648469	N/A
MLX Telephone Power	31757		
48V Power Supply		405331711	KS22911L2
Modular Power Cord		102937620	D6AP-87
400B2 Adapter		104152558	400B2
Analog Multiline Telephone Power	62510	105105514	D181522
48V Power supply		405331711	KS22911L2
Modular Power Cord		102937620	D6AP-87
Z400F Adapter		103942857	Z400F
Single-line telephones			
Program, Pause, and Auto Dial button conceal kit for 8100 series telephones	31931	106248370	Kit-D182363 Analog
4A Speakerphone	3120-02W		4 A
Power unit		102139938	PWR UNIT-85B1
Block connector		102434925	BLK CON-82B-49
Adapter for single-line telephone		102813888	ADPTR-223C
Adapter for multiline telephone		102949013	ADPTR-223D 1P
Transmitter (black)		103971891	TRMR-680AF-03
Transmitter (ivory)		103971909	TRMR-680AF-50
Loudspeakers			
Black		103873873	LSPK-108AA-03
Ivory		103873881	LSPK-108AA-50
Green		103873899	LSPK-108AA-51
Beige		103873907	LSPK-108AA-60
White		103873964	LSPK-108AA-58

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Telephone Adjuncts and Adapters (continued)			
Single-line telephones (continued)			
S201 Speakerphone	3152-007A	103786786	D8W-87 7FT
Black		106192651	MOD-S201AP-003
Misty cream		106192693	MOD-S201AP-215
CS201 Conference Speakerphone	3131-004A	103786786	D8W-87 7FT
Black		106270325	MOD-CS201A-003
Misty cream		106270333	MOD-CS201A-215
S202A Speakerphone	3152-008		
Black		105721088	TEL-S202A-003
Misty cream		105721096	TEL-S202A-215
S203A Speakerphone	3131-008		
Black		106058340	MOD-S203A-003
Misty cream		106508365	MOD-S203A-215
Message Waiting Indicator	31032	103966396	Z34A
Hands Free Unit (HFU)	3163-HFU	103814356	MOD-S102A
Headsets and Adapters			
StarSet® Headset	3122-030	406445627	KS23822L3
Mirage® Headset	3122-050	406445783	KS23822L4
Supra® Headset	3122-040	406445791	KS23822L5
Supra NC® Headset	3122-060	406741900	KS23822L12
Headset Adapter	3164-HFA	105752042	ADPTR-502C-003
500A Headset Adapter	3152-001	106690043	Adapter EL-500A-265
		405331711	Pwr Sup-KS22911L2
		102479904	Cord-D4BU-29 Std 7FT
		104152558	Adaptr-40082
Modular Amplifier	3122-020	406445619	KS23822L2
Plug Prong Amplifier	3122-010	406445601	KS23822L1
MLX Telephones Miscellaneous Add-Ons and Replacement Parts			
Handsets and Cords			
Handset (black)	N/A	106050065	K2S1-003
Handset (white)	N/A	106053408	K2S1-264
Handset, amplified hearing	31052		
Black		105581896	K6S2-003
White		106248248	K6S2-264
Misty cream		105581904	K6S2-215

Ordering Codes (continued)

Component	PEC	Comcode	App. Code
MLX Telephones Miscellaneous (continued)			
Handsets and Cords (continued)			
Handset cord, 9' (2.74 m), black	N/A	105635429	H4DU-003 9FT
Handset cord, 9' (2.74 m), white	N/A	105701809	H4DU-264 9'BULK
Handset cord, 12' (3.66 m), black	N/A	102401445	H4DU-3 12FT IP
Handset cord, 12' (3.66 m), white	N/A	102402609	H4DU-264 12'IP
Handset cord, 25' (7.62 m), black	N/A	105523866	H4DU-3 25'
DSS line cord, 2' (61 cm)	N/A	106187545	CORD D8AC-87
Desk Stands and User Trays			
Stand (large, black)	N/A	846320851	STAND-LARGE BL
Stand (large, white)	N/A	846320844	STAND-LARGE WH
Stand (small, black)	N/A	846320810	STAND-SMALL BL
Stand (small, white)	N/A	846320802	STAND-SMALL WH
User tray (black)	N/A	846320240	USER TRAY DWR B
User tray (white)	N/A	846320232	USER TRAY DWR W
Designation (Button Assignment) Cards and Covers			
Card*—MLX- 10, MLX- 10D	N/A	846865939	
Card*—MLX-20L	N/A	846865947	
Card*—MLX-28D	N/A	846865954	
Card set†—DSS	N/A	106448756	KIT-D182464
Card covers†—DSS (black)	N/A	106448731	KIT-D182462 PRT
Card covers†—DSS (white)	N/A	106448749	KIT-D182463 PRT
Card set‡—QCC	N/A	106561673	KIT-D182562 PRT
Card covers§— MLX-10, MLX-10D, MLX-20L	N/A	106448681	KIT-D182457 PRT
Card covers§—MLX-28D	N/A	106448699	KIT-D182458 PRT
Analog Multiline Telephones Miscellaneous Add-Ons and Replacement Parts			
Desk Stands and Wall Mounts			
Adjustable desk stand, 10-button	32002	103746855	11A
Adjustable desk stand, 34-button	32003	103746863	11C

* 10½ sheets per package.

† Includes both top and bottom cards or covers

‡ 8 cards per kit (four sets)

§ 4 per package

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Analog Multiline Telephones Miscellaneous Add-Ons and Replacement Parts (continued)			
Desk Stands and Wall Mounts (continued)			
Fixed desk stand, 5- & 10-button	32004	103746848	10A
Desk stand/wall mount 14A, BIS-10	N/A	103804290	14A-003
Desk stand/wall mount 14B, BIS-22	N/A	103964458	214B-003
Desk stand/wall mount 14C, BIS-34	N/A	103979837	14C-003
Fixed desk stand and wall mount, 5-button Kit of parts	32000	103804290	14A D-181230
Wall mount, 10-button Kit of parts	32001	103747846	201A D-181230
Wall mount, 34-button Kit of parts	32006	103747853	203A D-181230
Faceplates			
BIS-10	N/A	105203186	KIT PRTS-D-181582
BIS-22	N/A	105336986	KIT PRTS-D-181786
BIS-22D	N/A	105690762	KIT PRTS-D-182210
BIS-34 and BIS-34D	N/A	105203194	KIT PRTS-D-181583
Button Label Sheets			
BIS-10	N/A	105336978	KIT PRTS-D-181765
BIS-22	N/A	105336960	KIT PRTS-D-181784
BIS-22D	N/A	105690770	KIT PRTS-D-182211
BIS-34 and BIS-34D	N/A	105336956	KIT PRTS-D-181783
Display console (FM1) (includes one faceplate)	N/A	105299754	KIT PRTS-D-181727
Display console (FM2 & R3) (includes one faceplate)	N/A	105486252	KIT PRTS-D-182041
Single-Line Telephones Miscellaneous Add-Ons			
Ground-Start Button	31021	405792839	Key-KS23566L1

Ordering Codes (continued)

<u>Component</u>	<u>PEC</u>	<u>Comcode</u>	<u>App. Code</u>
Miscellaneous Parts			
Interconnect Wiring Kit			
110AB1-100JP12	N/A	104409396	
110A1 trough	N/A	104407960	
D-Rings	N/A	842139248	
D8W cords	N/A	103786802	
Parts list	N/A	N/A	
SYSTIMAX	3103-MER	106393671	
MERLIN Wiring Kit			
110A1 trough (5)	N/A	104407960	
110AB1-100JP12 modular block (2)	N/A	104409960	
110AB1-100 FT punch down block (1)	N/A	103823845	
D-Rings (6)	N/A	842139248	
patch cords 12 cords, 4-pair, 5' (1.5 m)	N/A	846619989	
D8W cords 24 cords, 14' (4.3 m)	N/A	103786802	
Template	N/A	846613933	
Instruction sheet	N/A	846613941	
Parts List	N/A	846623924	

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