COMDIAL

DXP Plus

Digital Communications System

System Hardware Instructions

The publications included in this binder reflect software releases through 2.A.

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Printed in U.S.A.

GCA47-099.01
7/95

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NOTICE

This symbol, when encountered on the equipment cabinet or on other installed hardware, means

CAUTION—refer to the system manual

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Getting Started

Use this information in this section as a path for Installing the DXP *Plus* digital communications system.

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Getting Started With The DXP Plus Digital Communications System

1.0 Understanding The System Hardware

The DXP *Plus* digital communications system is a high-featured, versatile system. It is capable of providing communications needs for a broad range of user applications. To employ this versatility and capability to the fullest advantage, follow a step-by-step approach for understanding and installing the system.

Turn to *Section 2*, and open the General Description manual. Carefully and thoroughly read this publication to gain an overview understanding of the 480 *Plus*. Once you understand the make-up of the DXP *Plus*, you are ready to begin system installation.

2.0 Installing The System

Turn to *Section 3* for installation instructions for the system components. You must refer to these instructions when you perform the system installation. However, before you begin an installation, read and understand the considerations detailed in the next several paragraphs.

The DXP *Plus* system includes a main common equipment cabinet and can also include up to two expansion common equipment cabinets. These cabinets house a power supply and the individual circuit boards that provide the system's operating structure. Every installation includes a power supply and certain standard basic board requirements; however, the remaining board requirements vary with the individual installation sites. Because of this fact, you need a site survey to help you plan your installation. You or your system planner must go on-site, confer with the site manager, and document the hardware configuration needs for the site.

While you are on site, locate the physical area where you will install the common equipment cabinets, and ensure that the area provides AC power in the proper configuration.

NOTE: The main common equipment cabinet and battery back-up assembly charger requires a dedicated 117 volt, 15 AMP AC circuit. If you plan to later install expansion cabinets, you must supply two 117 VAC, 15 AMP dedicated electrical outlets. Each dedicated circuit must be protected by its own circuit breaker. These circuit breakers must be ganged together so that if one breaker trips open, the other breaker will also trip open.
When equipped with the optional switchable power supply and optional switchable battery back-up assembly, the DXP Plus will operate from 240 volts AC supplied in the same manner as specified in the preceding paragraph..

Once you know what system components the installation requires, you are better prepared to perform the installation in a timely and efficient manner.

Comdial installation specialists ***strongly suggest*** that you temporarily install the components and test the system operation at your facility before you take it to the permanent installation site. When you do this, you ensure that the equipment is operational, and if it is not operational, you give yourself an opportunity to correct any problems that exist.

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3.0 Troubleshooting The System

Turn to the publications contained in *Section 4* for information that you can use when you are troubleshooting a system failure or analyzing system components.

4.0 Updating Your System Knowledge

From time-to-time, Comdial Engineers will enhance the DXP *Plus* system software or add to the system's hardware capability. The technical publications personnel document these changes on Technical Advisory Bulletins that they make available to you in several ways:

- you may turn to *Section 5* and find the TABs that are currently available,
- you may call the Technical Services facsimile (FAX) line at 1–800–266–3425 Extension 500 and obtain additional copies,
- you may call the bulletin board at 804–978–2583 and down-load the TAB information.

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ANSI-RAB

Comdial's Quality Management System Is Certified To The ISO 9001 Standard.

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Charlottesville, VA 22906-7266

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General Description

Use this information in this section to gain a general understanding of the DXP *Plus* digital communications system.

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COMDIAL DXP Plus

Digital Communications System

General System Description

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Contents

1 Introducing The DXP Plus

1.1 Using This Publication

What this book does

This DXP Plus General Description provides an overview of the system and its features. The system's general specifications are detailed in full in Section 5, Knowing The General Specifications. Section 6, Understanding The Features, details all of the available features.

Where to find what you need

The General Description contains six sections. Use the following list as a guide to finding what you need in this book.

- **Section One,** ***Introducing The DXP Plus,*** gives you a general overview of the system and its capabilities.
- **Section Two,** ***Understanding The Telephone Features,*** lists the telephone models that function on the DXP *Plus*. This chapter also lists the major features of the telephones, and it gives you diagrams and dimensions of each telephone model.
- **Section Three,** ***Previewing The Hardware,*** details all of the hardware for the DXP *Plus*. Use this chapter to find definitions of the printed-wire-boards. Along with general definitions, section three gives the product code numbers and the installation locations for each board.
- **Section Four,** ***Connecting The System,*** describes some basic installation instructions. You will find information on line and station connections in section four.
- **Section Five,** ***Knowing The Specifications,*** lists all of the product codes and specifications for the DXP *Plus*.
- **Section Six,** ***Understanding The Features,*** defines all of the system's features.

1.2 Understanding The DXP Plus

Station and line capacity

The DXP *Plus* system is a 480-port, three-cabinet, digital communications system consisting of one main cabinet and two expansion cabinets. With analog, loop-start, DID, or multipurpose line boards, the maximum configuration is 0 lines and 480 stations, or 232 lines and 8 stations. By using T1 boards, however, you can enhance the system's capacity to a maximum of 560 ports, with a 240 line and 320 station maximum configuration.

How the system works

The Comdial DXP *Plus* digital communications system provides cost-effective voice and data communications using the latest PCM-TDM (pulse code modulated/time division multiplexing) digital switching technology. The DXP *Plus* switching architecture provides a non-blocking switching array that gives all ports simultaneous access through the system. The digital technology allows simultaneous voice and data transmission using 2B+D signaling (CCITT specification for basic access data transfer rate for ISDN on a single twisted pair) when data terminals become available. The design is a fully modular, ISDN (integrated services digital communications network) system with 1024 usable time slots and the flexibility for upgrade and expansion as needed. The DXP *Plus* digital communications system supports the current Comdial line of DigiTech, *Impact*, and ExecuTech telephones.

2 Telephone Features

2.1 Using The Comdial Telephones

The DXP *Plus* system supports many of Comdial's proprietary telephones as well as industry-standard telephones. The following list details the various telephone models.

- **DigiTech Telephones**
  - » 7700S — LCD Speakerphone
  - » 7701X — Multiline Telephone
  - » 7714X — Multiline Telephone
  - » 7714S — Multiline Speakerphone
  - » DD32X — 32-Button DSS/BLF

- ***Impact* Telephones**
  - » 8024S — 24 Line LCD Speakerphone
  - » 8124S — 24 Line Speakerphone
  - » 8012S — 12 Line LCD Speakerphone
  - » 8112S — 12 Line Speakerphone
  - » 8112N — Multiline Proprietary Telephone
  - » IB64X — DSS/BLF Console
  - » 8101N — Single line Proprietary Telephone

- **ExecuTech Telephones**
  - » 6620E — 23-Line Monitor Telephone
  - » 6620T — 23-Line Speakerphone
  - » 6614E — 22-Line Monitor Telephone
  - » 6600E — 17-Line LCD Speakerphone
  - » 6700S — 12-Line LCD Speakerphone
  - » 6701X — Single Line Proprietary Telephone
  - » 6706X — 6-Line Monitor Telephone
  - 6714S — 14-Line Speakerphone
  - 6714X — 14-Line Monitor Telephone
  - 6614T — 22-Line Speakerphone
  - DB70 — 70-Button DSS/BLF
  - DB32S — 32-Button DSS/BLF
  - EX32X — 32-Button DSS/BLF

2.2 Understanding The Telephone Features

The DXP *Plus* supports the following telephone features on both analog and digital proprietary telephones. Some of these features are system-wide and others are specific to individual stations.

Alphanumeric Display

— Displays time, day and date

— Keeps you apprised of the status of your telephone

— Provides programming prompts

Auxiliary Jack (used only with *Impact* and DigiTech LCD speakerphone)

— Allows you to use your telephone privately and handsfree with headset

— Allows you to plug in a tape recorder

— Allows you to plug in a loud ringer

— Helps improve operation of high-volume business applications by adding a paging speaker

Button Query

— Allows you to see the function of a programmed button on your LCD screen

Hold Button

— Places a line on hold

— Stores pauses in number sequences while programming

— Allows you to scroll through multiple held calls on display

Interactive Buttons

— Provide quick and easy access to system and call processing features

— Provide straightforward button programming without dialing codes (the interactive buttons themselves, however, are not programmable)

Intercom Button

— Selects an intercom line

— Initiates many of the features of the telephone

Message Waiting Light

— Tells you that there is a message for you

Mute Button

— Keeps the person on the line or speakerphone from hearing your conversation

Programmable Buttons

— Allow you to program your telephone for automatic dialing functions

— Allow you to program your telephone for Direct Station Selection (DSS)

— Show which lines and intercoms are either in use or on hold

— Allow you to store frequently used feature codes at unused buttons

Ringer Volume Control

— Lets you vary ringer volume

Shift Button

— Allows you to program and access preprogrammed feature codes or secondary speed dial numbers (each programmable button can accommodate two feature codes or speed dial numbers)

Speaker Button

— Turns your speaker on or off

— Disconnects a call when your handset is on-hook

— Ends or cancels programming

Status Lights

— Shows status of line when next to line button

— Shows status of station when next to DSS button

— Shows status of feature when next to programmable button

TAP Button

— Recalls dial tone, or activates host system features (must be programmed for either feature)

— Retrieves held calls (last call held is first call retrieved)

Transfer/Conference Button

— Transfers calls

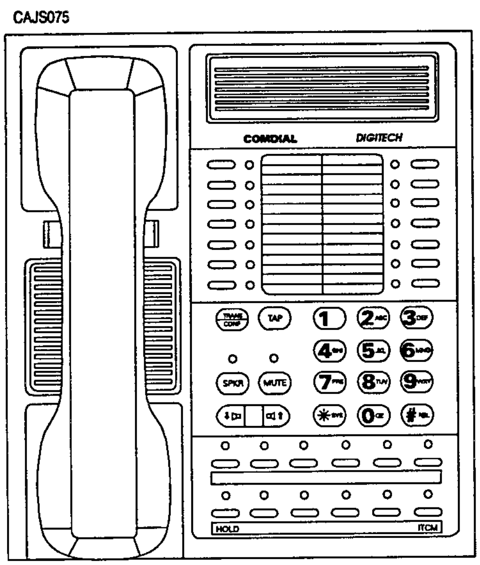
— Sets up conference calls

Volume Control

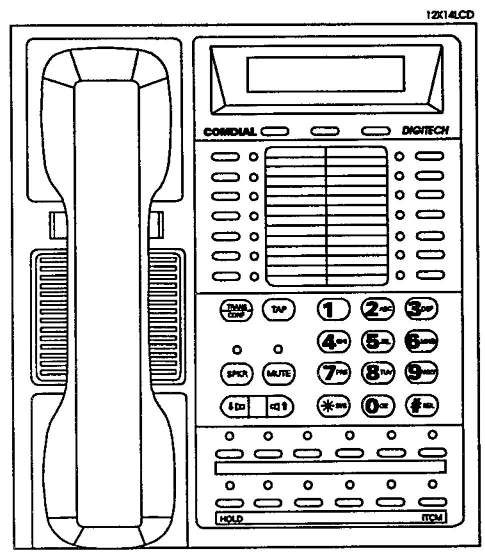
— Regulates the volume of the speaker and the handset

2.3 Using DigiTech Telephones

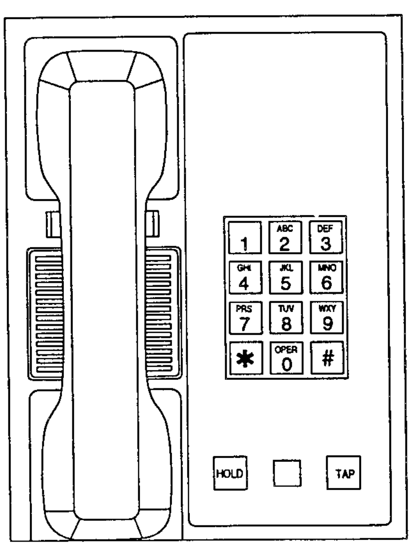
The DXP *Plus* accepts all of the currently produced DigiTech telephones. Figure 1 details all of the DigiTech telephones that operate on the DXP *Plus*. Figure 2 shows the dimensions of the DigiTech Multiline telephone.



7714X, 7114S



7700S



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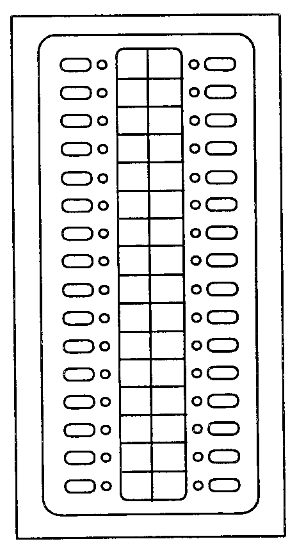

DD32X

Figure 1: DigiTech Station Configurations

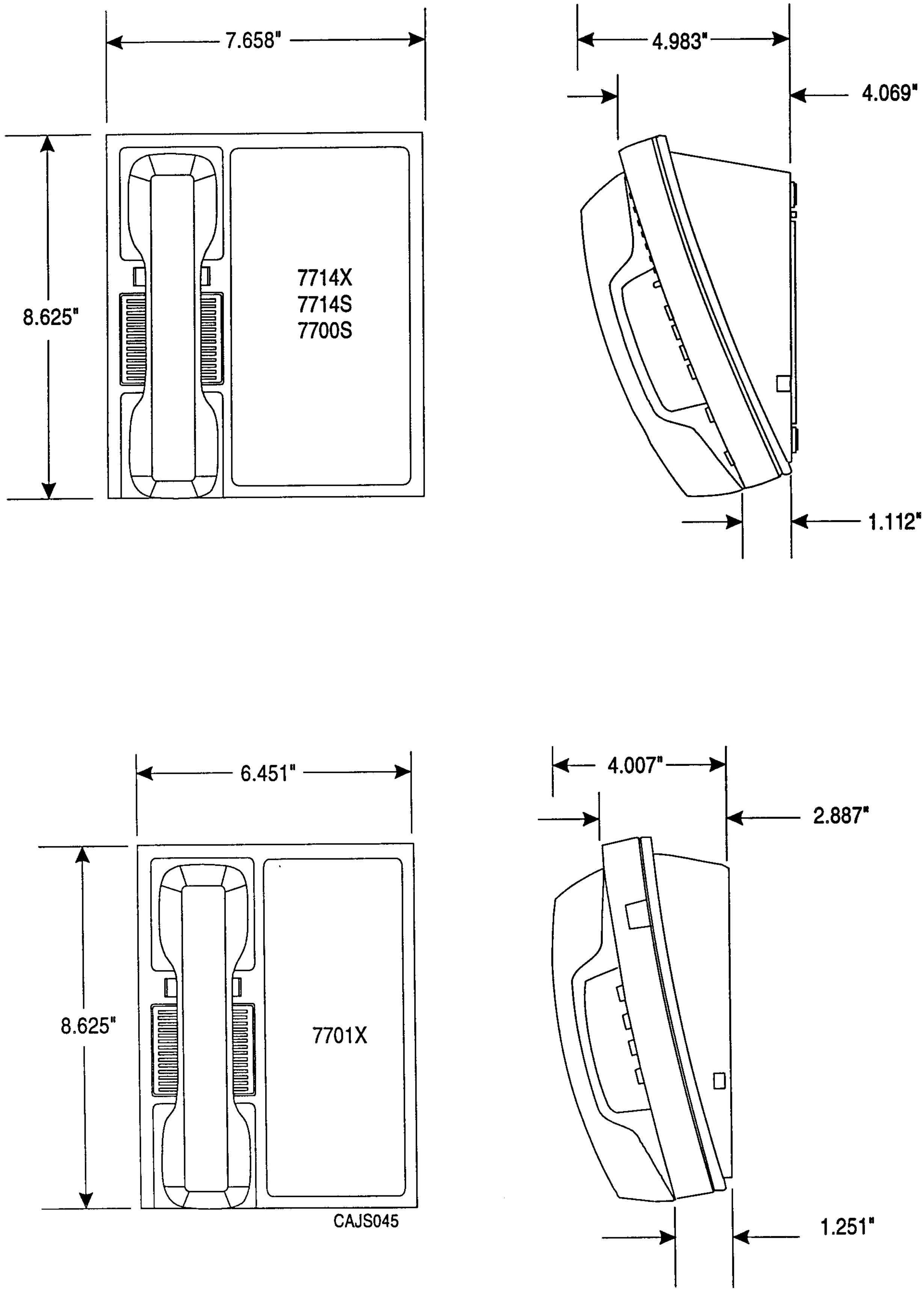

Figure 2:DigiTech Station Outline Dimensions

2.4 Using Impact Telephones

The DXP *Plus* accepts all of the currently produced *Impact* telephones. Figure 3 details all of the *Impact* telephones that operate on the DXP *Plus*. Figure 4 shows the dimensions of the *Impact* Multiline telephone.

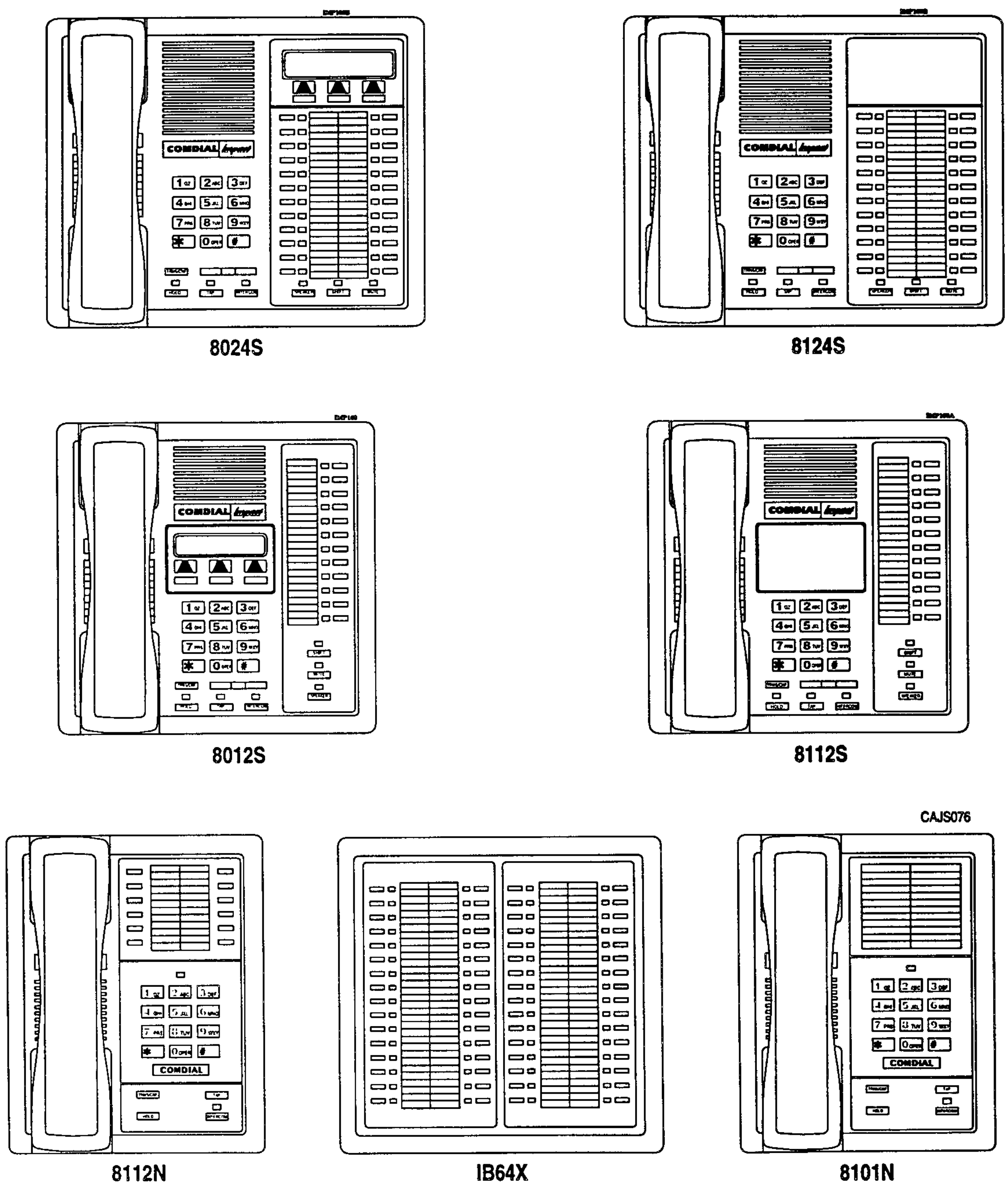

Figure 3: Impact Station Configurations

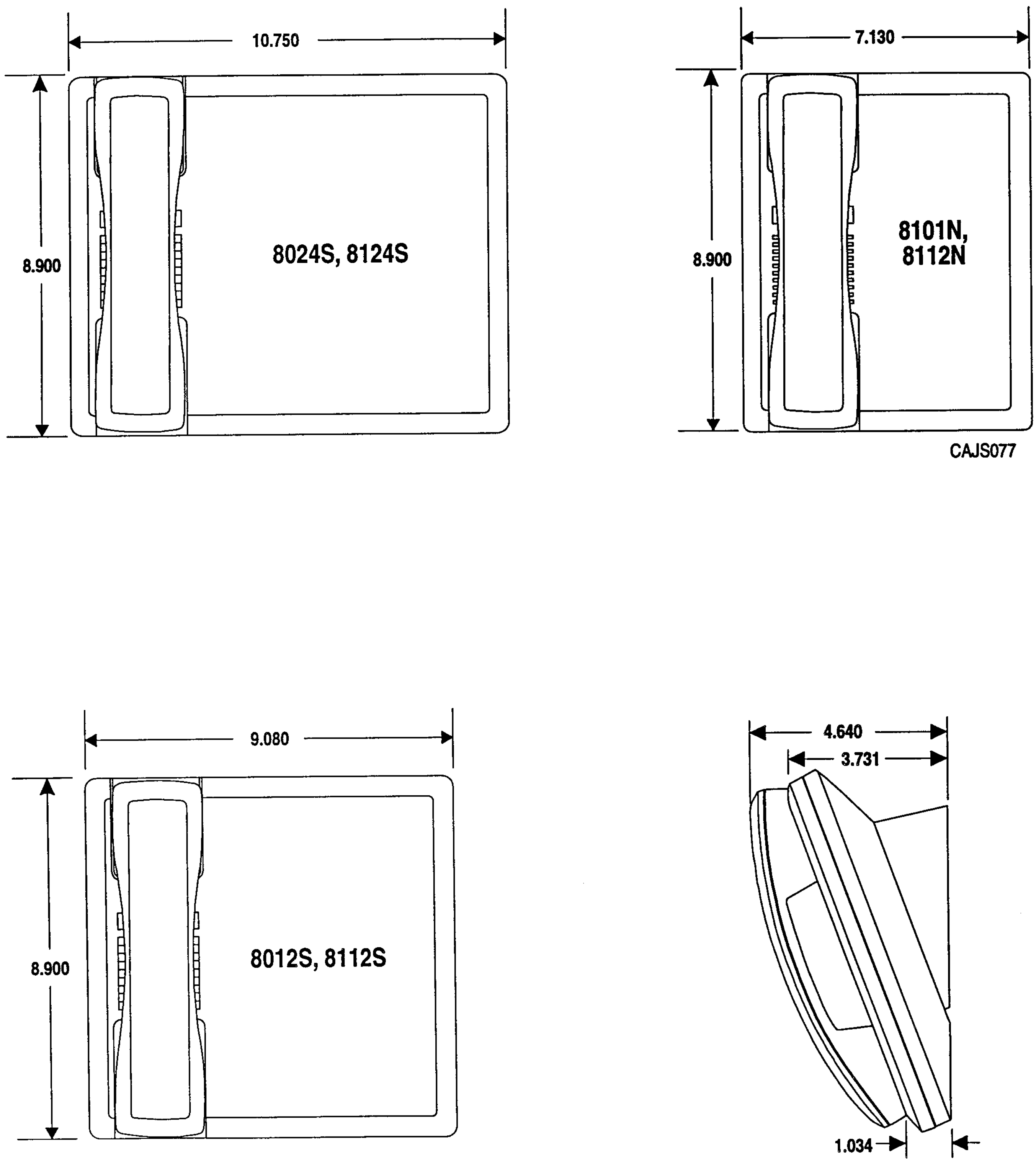

Figure 4: ***Impact*** **Station Outline Dimensions**

2.5 Using ExecuTech Telephones

The DXP *Plus* accepts all of the currently produced ExecuTech telephones. Figure 5 details all of the ExecuTech telephones that operate on the DXP *Plus*. Figure 6 shows the dimensions of the ExecuTech Multiline telephone.

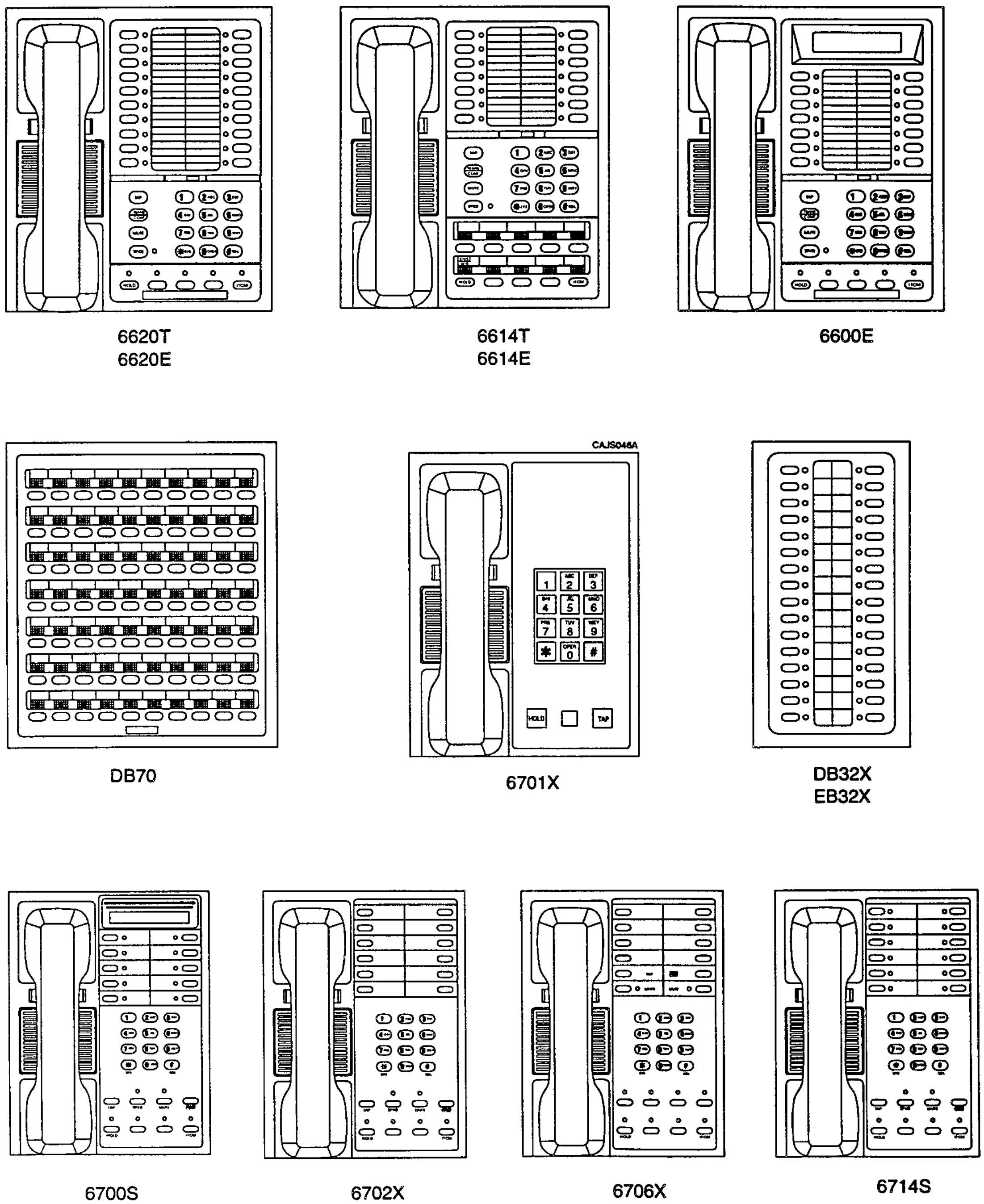

Figure 5: ExecuTech Station Configurations

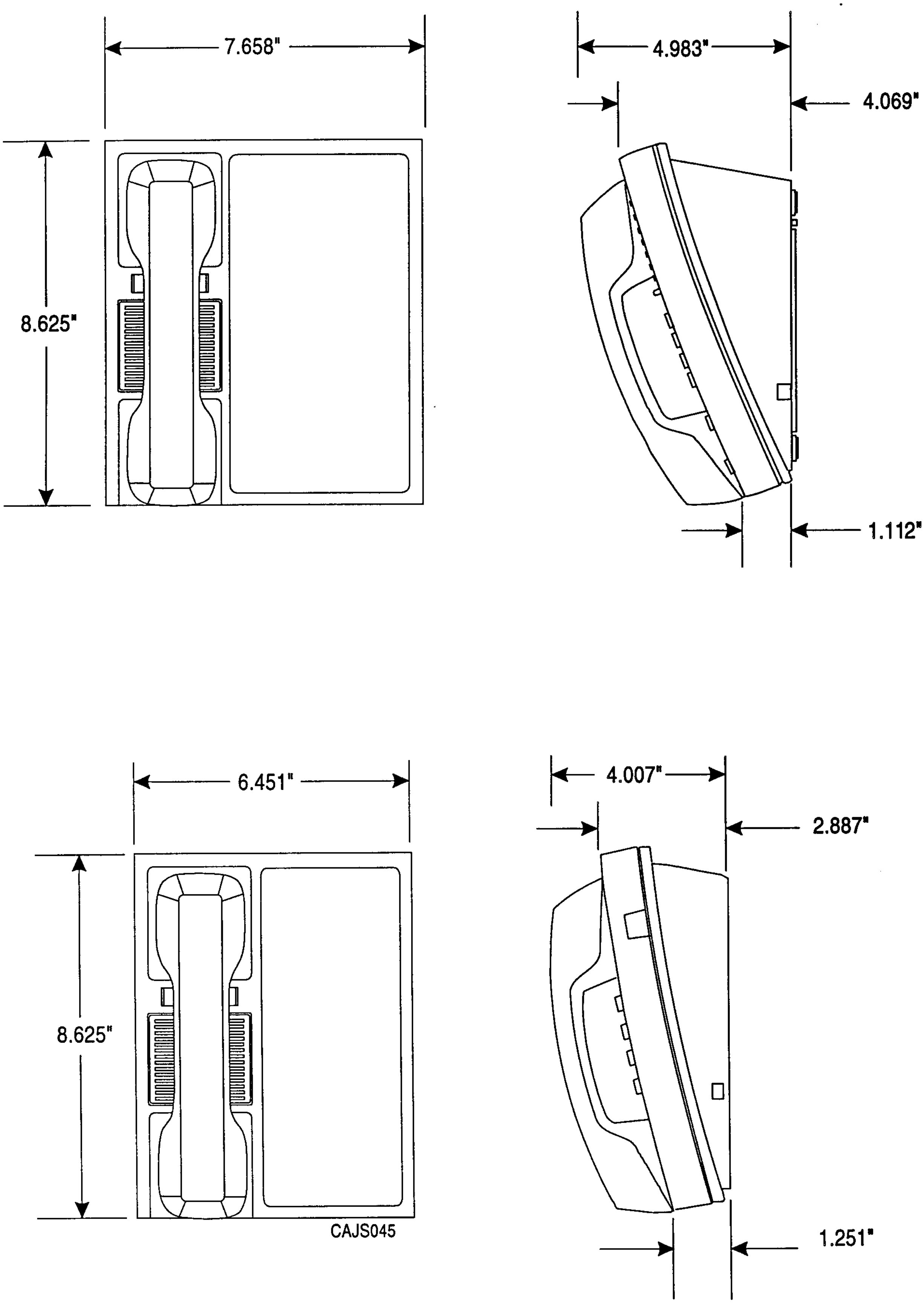

Figure 6: ExecuTech Station Outline Dimensions

3 Reviewing The Hardware

3.1 Understanding The Printed-Wire Boards

The basic system consists of a main cabinet, which accepts 14 printed-wire boards, and two expansion cabinets; the upper expansion cabinet accepts twelve printed-wire boards, and the lower cabinet accepts eleven (see Figure 7). Some of the printed-wire boards also hold smaller circuit cards that mount directly to the boards (See section 3.5 for card information) The line boards are listed in section 3.3; station boards are located in section 3.4. The complement of circuit boards include the following (for information on the main DXP *Plus* package, see section 3.6, *Locating The Boards*):

Auxiliary Board:

— A utility board that provides interface for a maximum of four special-purpose circuit cards. Actual make-up requirements depend upon system configuration.

Central Processing Unit (CPU) Board:

— Provides central processing and control for the system and other miscellaneous functions. The CPU board has the time switch and conference circuitry and two serial data ports, which have been dedicated for PC-based programming and a remote maintenance modem.

Conference Board:

— Provide additional conference capability. Each board provides 5 additional 3-way conferences.

Interface Boards:

— Ties the main cabinet to the expansion cabinet. Each expansion cabinet has an interface board; that connects the main cabinet with the expansion cabinets. Interface boards are included with the expansion cabinet packages.

Memory Card:

— Provides the memory storage and operating system control. The card mounts directly onto the CPU board, and it is available with two (four megabyte as a future feature) of memory. The system uses re-programmable random access memory, known as "flash memory" —not replaceable memory chips, known as EPROM.

Services Board:

— Provides an interface for music-on-hold and background music inputs; it also provides an output to an external paging amplifier. The services board includes four dry-contact relays for external control functions. You can also add up to three additional cards onto the services board for data communications, DTMF tone receiving, and T1 synchronization.

3.2 Defining The Line Boards

The DXP *Plus* accepts several different types of lines. In order to use these various lines, you must install the correct line board. The following list details all of the current DXP *Plus* line boards.

Direct Inward Dialing Line Board:

— Direct Inward Lines (DID) are incoming only and are employed to reduce the number of channels between the DXP *Plus* and the Central Office (CO). DID lines allow incoming CO calls to reach internal intercom extensions without going through the attendant station. DID operation requires a group of published directory numbers provided by the CO. The number of DID lines is limited only by the number of installed DID boards. The DID translation tables have limits that may affect DID capacities. The system supports a maximum of 400 DID lines.

Loop-Start Line Board:

— The loop-start line board provides system interface for loop start lines. Loop start lines are the most common CO line type (loop-start lines do not usually offer disconnect supervision)

Multi–Purpose Line Board:

— The multipurpose line board provides system interface for ground start lines, loop start lines, and E & M Tie lines; these are typically the three line types that the central office (CO) makes available for connection. The multipurpose line board is programmable for each line type. You can have a maximum of two Tie lines on each multipurpose line board.

T1 Line Board:

— The T1 board provides 8, 16, or 24 channels of voice transmissions over a single four wire cable using multiplexing techniques. The system accepts a maximum of ten T1 boards.

3.3 Defining The Station Boards

The DXP *Plus* accepts digital, analog, and industry standard telephones. In order to use these different types of stations, you must install the correct station board. The following list explains each station board.

Analog Station Board

— The analog station board provides support for Comdial's proprietary analog telephones (such as the various ExecuTech models). Each board supports either 8 or 16 stations. A precharge port is provided for board removal or insertion without system power-down.

Digital Station Board

— The digital station board provides support for Comdial's proprietary digital telephones (such as the Impact and DigiTech). Each board supports either 8 or 16 stations. A precharge port is provided for board removal or insertion without system power-down.

Industry Standard Telephone Board

— The industry-standard station board provides support for industry-standard telephones. Each board supports either 8 or 16 stations. A precharge port is provided for board removal or insertion without system power-down.

3.4 Defining The Option Circuit Cards

Many of the DXP *Plus* boards accept smaller circuit cards. These boards mount directly into the DXP *Plus*, while the optional circuit cards mount only onto boards. You can install these optional cards on any of the following boards: the Auxiliary Board, the Services board, and the Interface boards.

Synchronization Card

— Adjusts the T1 transmit frequency to match the frequency from the CO. The synchronization card mounts onto the Services board only.

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Communications Card:

— The optional communications card provides extra serial ports for the DXP *Plus*. The communications card contains four serial communication ports and is attached to either the Auxiliary board, the interface boards, or the Services board. You can install two communications cards onto the lower two slots of any of these boards. The system supports a maximum of 18 serial data ports.

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DTMF Tone Card

— The DTMF Tone card expands the system's industry-standard dialing capability. The system has one IST DTMF receiver located on the services board while each DTMF card provides four additional DTMF receivers.

3.5 Locating The Boards

Main Cabinet

☐ The 14-board capacity of the main cabinet breaks down as follows from left to right:

1 – interface board slot
1 – bulk storage slot *(bulk storage board is a future feature)*
1 – CPU board slot
1 – services board slot
1 – voice resource slot *(voice resource board is a future feature)*
1 – auxiliary/universal slot (for auxiliary boards, station boards, conference boards, or line boards)
8 – universal slots (for station, conference, or line boards)

Upper Expansion Cabinet

☐ The 12-board capacity of the upper expansion cabinet breaks down as follows:

1 – interface board slot
2 – auxiliary/universal slot (for auxiliary boards, station boards, conference boards, or line boards)
9 – universal slots (for station, conference, or line boards)

Lower Expansion Cabinet

☐ The 11-board capacity of the lower expansion cabinet breaks down as follows:

1 – interface board slot
2 – auxiliary/universal slot (for auxiliary boards, station boards, conference boards, or line boards)
8 – universal slots (for station, conference, or line boards)

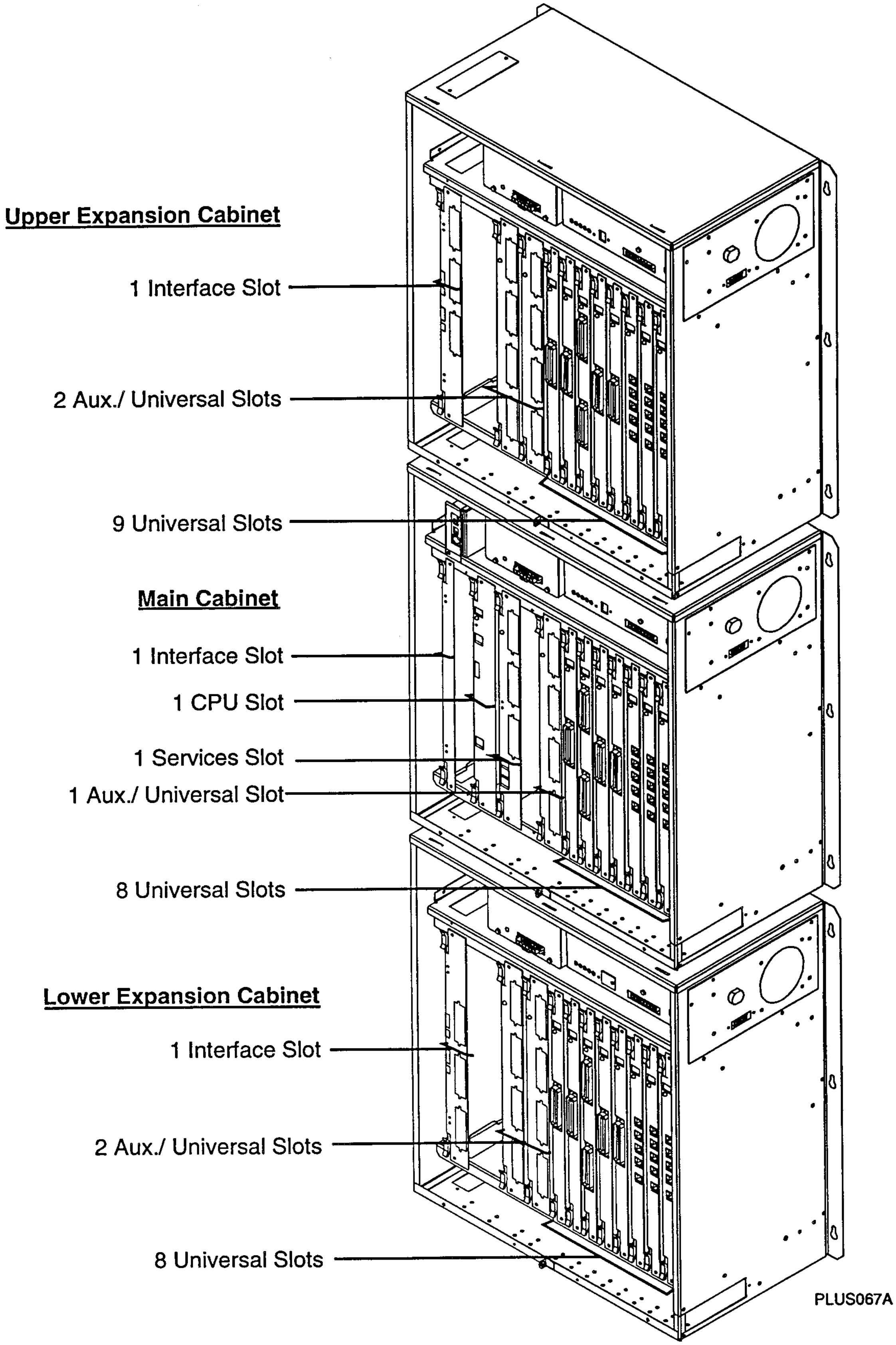


Figure 7: Board Locations

3.6 Using The Modem

The modem is a general-purpose, ✳ Hayes™ compatible, 300, 1200, and 2400 automatic baud detect serial modem. The CPU board provides a dedicated serial data port and power port for the modem. If you connect the modem to a serial data port on one of the communications cards, you will have to program the system for modem operation on that port.

✳ Hayes is a registered trademark of Hayes Microcomputer Products.

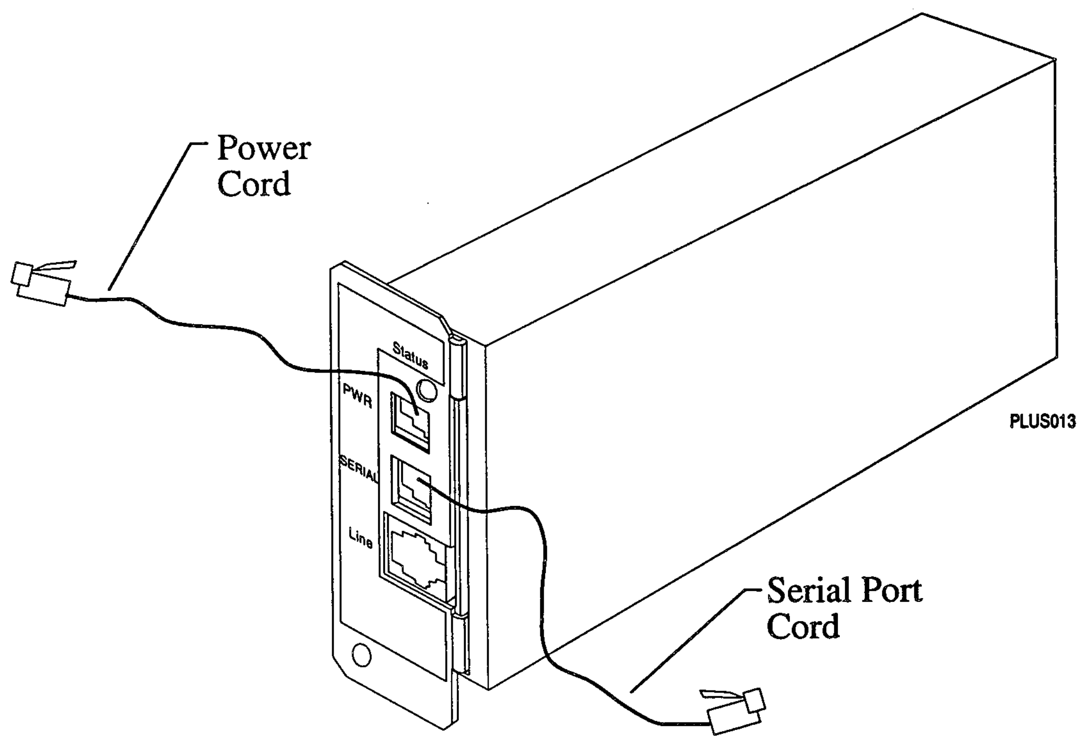


Figure 8: Modem

3.7 Using The Ring Generator

The DXP *Plus* digital communications system supports the use of industry-standard telephones (IST). To use ISTs, the system requires a ring generator assembly to supply ringing voltage and message waiting voltage to the industry-standard telephones.

Regardless of the number of installed industry-standard telephones, you will need to install one ring generator assembly in each common equipment cabinet that has IST telephones connected.

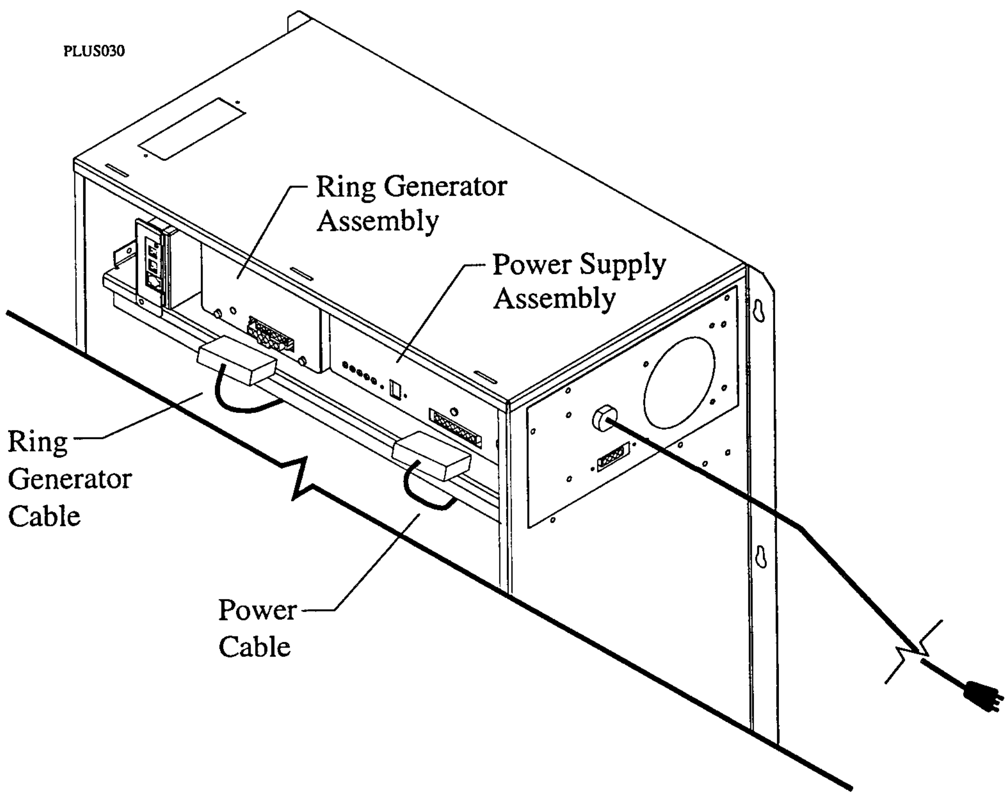


Figure 9: Ring Generator

3.8 Understanding The Board Configuration

Physical vs. Logical board location

The DXP *Plus* uses two distinctions for station and line locations: the physical location and the logical location.

The **physical location** corresponds to the order of the universal slots in the system; these physical slot locations never change. There are a possible 30 physical slot locations in the DXP *Plus* (nine slots in the main cabinet, eleven slots in the upper expansion cabinet, and ten slots in the lower expansion cabinet–*see figure 10 for physical board locations*), and no matter what board you install in the first universal slot of the main cabinet, for example, that slot is always physical slot one. The physical slot numbers begin with the first universal slot in the main cabinet and move from left to right. The first universal slot in the upper expansion cabinet is physical slot number 10, and the first universal slot in the lower cabinet is physical slot 21. Installers need to know the physical location of the boards in order to properly wire the lines and stations.

The **logical location** of a station or a line corresponds to its relationship to the other stations or lines in the system and is not dependent upon the board's location in the cabinet. Therefore, if you have installed your first station board into the fifth slot of the main cabinet, for example, the system still refers to the first station on that board as logical station one (station one always defaults with intercom 1001).

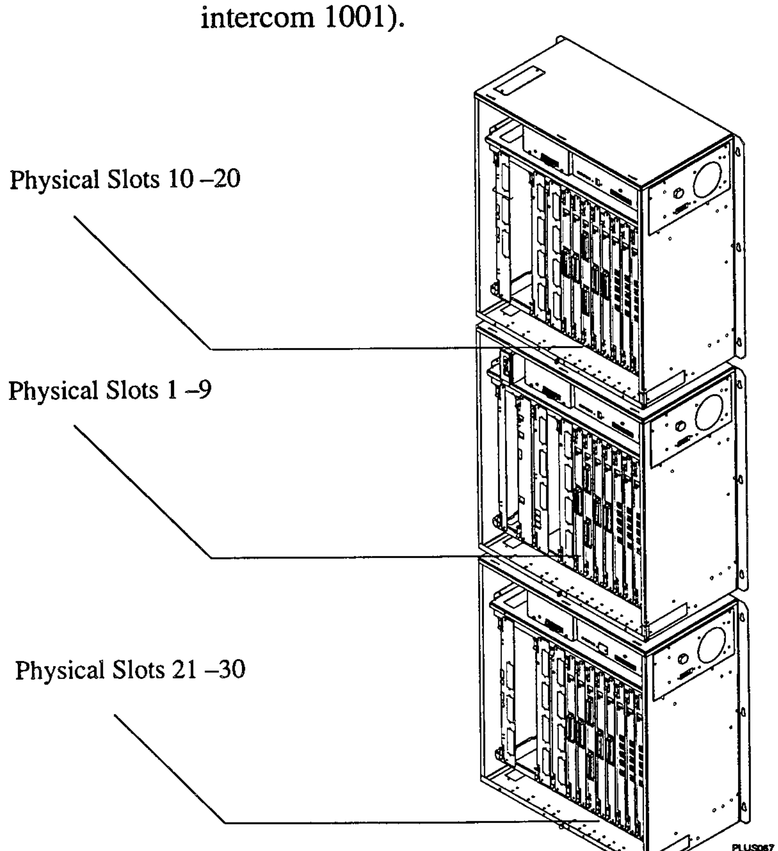


Figure 10: Physical Board Locations

How automatic configuration works

Because there are no dedicated station or line ports in the DXP *Plus,* the system uses an automatic configuration method to number the lines and stations. When you master clear the system, it automatically searches for all installed line and station boards in the main and expansion cabinets. Once the system has identified the board type and location, it automatically numbers the ports on every installed board (see the section below, "*How the system renumbers logical ports,*" for more information on renumbering).

How the system renumbers logical ports

The automatic renumbering configuration, which renumbers the *logical* ports, begins at the left-most universal slot in the main cabinet and proceeds left to right. When the system has configured all of the boards in the main cabinet, it moves to the upper expansion cabinet and continues searching from left to right. Finally, the system searches the lower expansion cabinet, again from left to right, until it has numbered all of the lines and stations. When the configuration is finished, the line and station ports are numbered logically from left to right in each cabinet throughout the system.

Adding boards without renumbering

When you install additional boards or relocate existing boards after the system is in service, the logical numbers of the stations or lines on the added board continue from the last assigned logical number. For example, if your last assigned station number was 16, the next station number will be 17, regardless of the board's physical slot.

After you remove and delete a board through programming, that board's logical ports are available for reassignment. So an added or relocated board would then take the logical port numbers from the removed board and not from the end of the logical sequence. For example, if you had 64 stations and were to remove a station board that had held logical stations 1–16, the next station board that you installed would occupy logical station ports 1–16 and not ports 64–80. If you were to remove an 8-port board and replace it with a 16-port board, the first eight ports on the new board would replace the original eight logical port numbers, and the remaining eight ports would begin with the last assigned logical port. So using our same scenario, the new 16-port board would have logical ports 1–8 and 64–72.

3.9 Mounting Considerations

When installing the DXP *Plus* digital communications system, take note of the following requirements (figure 11 shows the mounting dimensions):

NOTE: The following instructions describe how to mount the main cabinet using a backboard; however, you can mount the cabinet on a standard 23–inch equipment rack if you wish.

- Always choose a secure and dry mounting location that has plenty of ventilation. Be sure that the temperature range of the location is within 32-122 degrees F (0-50 degrees C) and that the humidity is less than 90 percent, non-condensing.

- Locate the equipment within four feet of a proper AC electrical outlet dedicated exclusively to this equipment. The outlet must be a 117 VAC 15 AMP circuit with a third-wire ground supplied to a standard electrical outlet (NEMA 5-15R)

- Locate the equipment within 25 feet of the TELCO/PBX jacks—this is an FCC requirement. A nominal distance of seven feet is ideal.

- Use a reliable earth ground—a metal cold water pipe or a metal building frame ground.

- Use a backboard of at least 3/4-inch thick plywood to mount the DXP Plus common equipment. It is a good practice to make this backboard large enough to accommodate the main cabinet, the expansion cabinet, and a battery backup assembly even though the initial installation may not require all of this equipment.

- Always bridge underlying wall studs with the backboard and drive the attaching hardware through the backboard and through the underlying wall into the wall studs. Allow space between the top and bottom of the main cabinet for later placement of an expansion cabinet above the main cabinet.

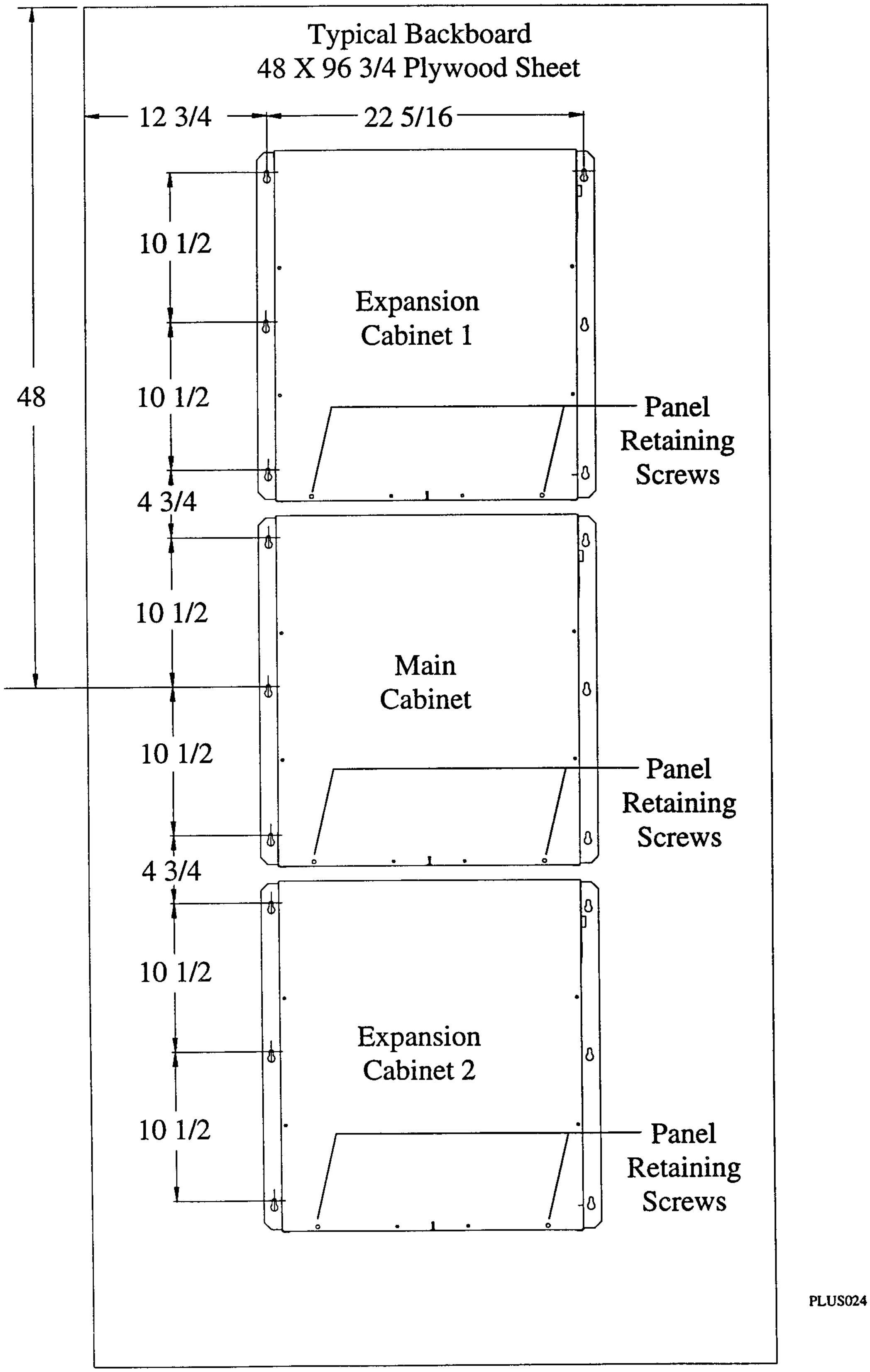


Figure 11: Mounting The Cabinets

3.10 Using The Power Supply

What the power supply does

Each cabinet in the DXP *Plus* system has its own power supply. The power supply provides + and – 5 VDC operating power for the circuit boards and – 36 VDC for all of the telephone stations. Each power supply is located in the top right corner of the respective cabinet (see figure 12 for power supply locations).

Power supply requirements

For the AC power connection, employ a dedicated 117VAC 15 AMP circuit, with a third-wire ground, supplied to a standard electrical outlet (NEMA 5-15R). Remember, this electrical outlet must be located within four feet of the common equipment cabinet. You must supply ***two*** dedicated electrical outlets, each protected by its own circuit breaker, if you plan to install expansion cabinets.

CAUTION

The dedicated AC circuit for the expansion cabinets must be different from the dedicated AC circuit that you provide for the main cabinet.

Where to connect the power supply

If you install the optional battery back-up assembly, you can use the main cabinet's electrical outlet to supply AC power to that assembly's battery charger.

To provide protection against surges and spikes that may appear on the AC line, install a plug-in power line surge protector between the AC power cord of the installed equipment and the AC outlet.

The common equipment cabinet employs a fan-cooled electronic switching power supply (ensure that the fan can always provide unobstructed air flow for cooling). During operation, power supplies of this type generate an audible sound from their switching regulators. This sound is normal and is not an indication that the power supply is operating improperly.

CAUTION

DO NOT attach or secure the line cord to the surface of the mounting location in any manner.

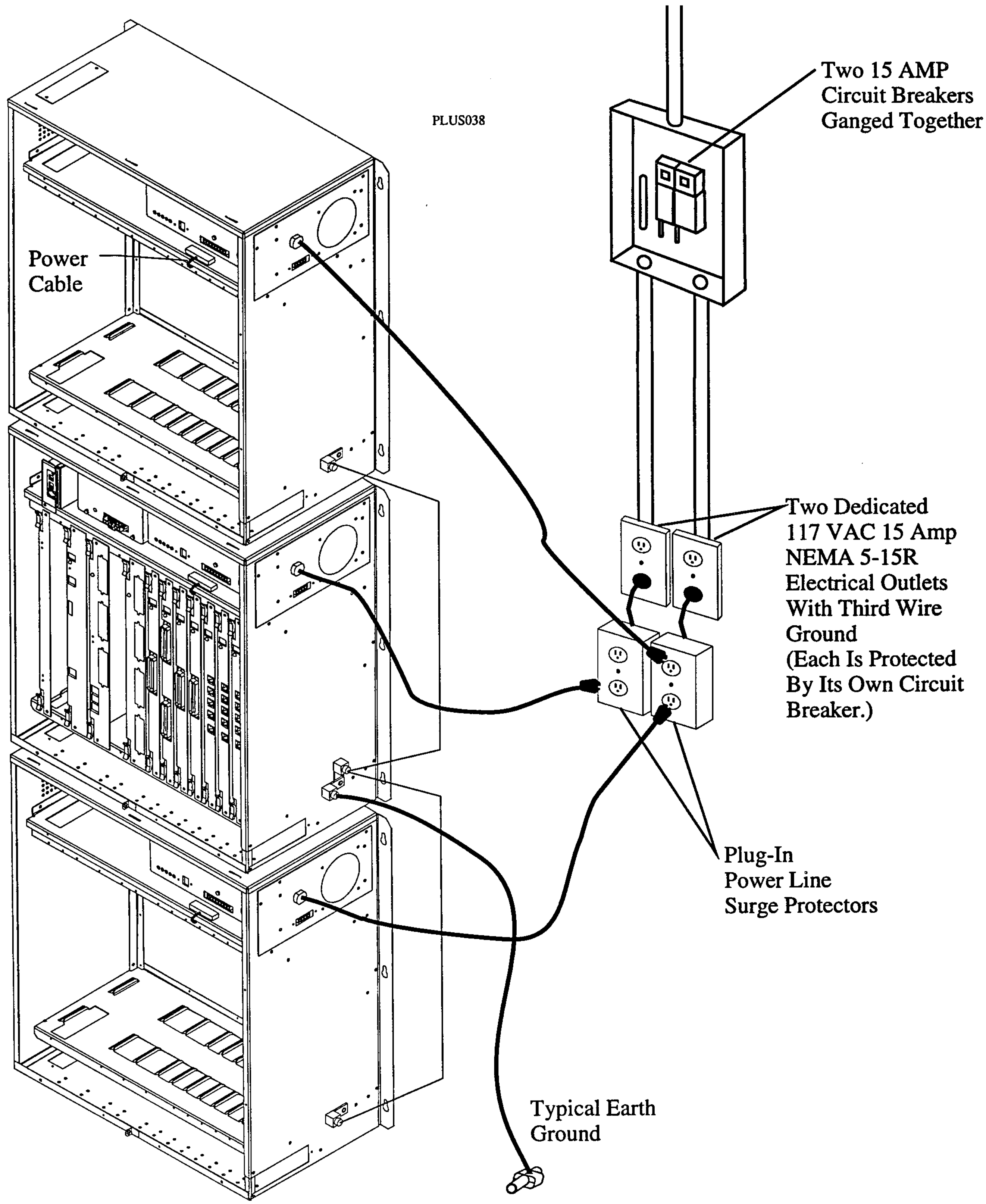


Figure 12: Power Connections

3.11 Using The Battery Backup

What the battery backup does

Should the AC power to the system be interrupted, one external battery assembly provides 1.0 hour of operation for a fully loaded system (for information on battery backup time using expansion cabinets, see the section below, *"How to calculate battery backup time"*).

During AC operation, the external battery assembly accepts re-charging current to maintain the voltage potential of its batteries at an operational level. The measured voltage the battery backup is 34.5 volts when the batteries are fully charged.

Battery backup components

You can only install one battery backup per system. The battery backup assembly includes the following items:

- Batteries: Five 6-volt, 50 ampere-hour, (Comdial product code BT000-141), charger unit and interface cables.
- Metal enclosure with wire harness, includes combination circuit breaker, on/off switch.

How to calculate backup time

Calculate the minimum battery backup time provided by a BBPLS assembly to a fully configured DXP *Plus* system using the following formula:

$$T = \frac{Ke}{1 + [(0.084)\,(N)]}$$

T = Back-up time in hours
K = 0.85 (Constant)
e = 50 (ampere-hour capacity of BBPLS)
N = Total number of stations

Example:
Assume that you have installed a DXP *Plus* with three cabinets supporting 472 telephones and containing one line board along with a BBPLS battery assembly to provide back-up power.

$$T = \frac{(.82)(50)}{1 + [(0.084)\,(472)]} = \frac{41.0}{\mathbf{40.65}} = \mathbf{1.0\ Hour}$$

NOTE: The external battery assembly requires a maximum of 10 hours to completely re-charge to full potential after it has been completely discharged and, in some cases, when initially installed.

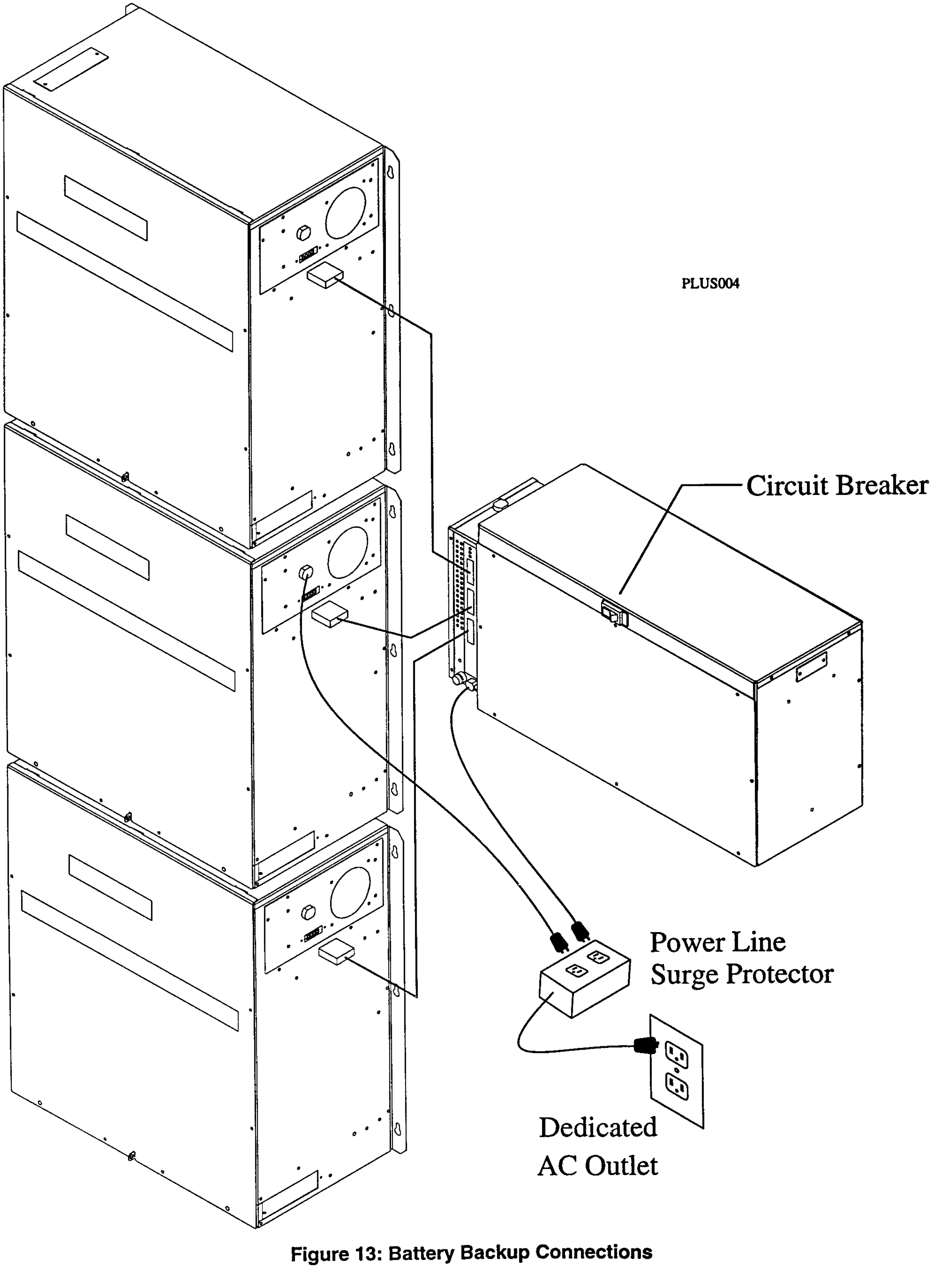


Figure 13: Battery Backup Connections

4 Connecting The System

4.1 Connecting The Lines

How to connect the lines

Line terminations to the line boards vary depending upon the line board type. Terminations for the loop start board are standard modular jack connections. Each jack on the loop-start board provides termination for two lines. Terminations for the loop start and the multipurpose boards are through a 50-pin amphenol-type connector, and the connection for the T1 board is an eight-pin modular jack. The demarcation point can be a type 66M-xx connector block or individual 6-position modular jacks. The wiring that you route between the demarcation-point and the line board termination should be #24 AWG or larger twisted-pair wiring (see figure 14 for line board connections).

How to protect the lines

Transient voltage spikes, if induced onto CO or CENTREX lines, can travel through the cable and into the common equipment. The telephone company offers basic protection against this condition, but it is usually designed to protect the central office circuits. While this CO or CENTREX service will also provide some protection to the common equipment, you should not rely upon it for total protection. To help ensure that external over-voltage surges do not damage the system, Comdial recommends that you install and properly ground gas discharge tubes, or similar primary protection devices, on all lines.

Each line board is shipped with a ferrite collar. Bundle the line cables together and snap the collar around the bundle to provide protection against radio frequency interference.

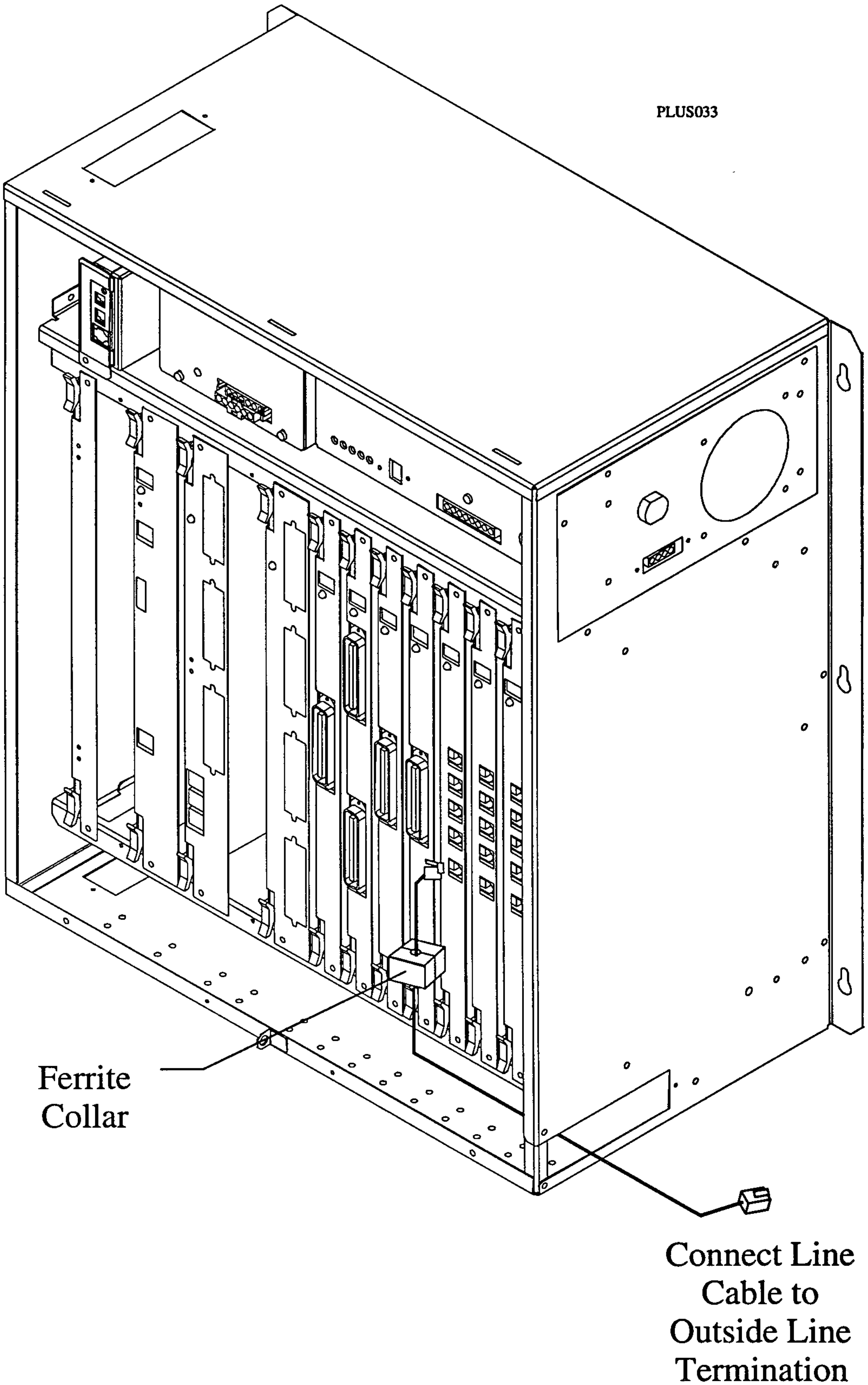


Figure 14: Typical Line Connections (loop-start board shown)

4.2 Connecting The Stations

How to connect the stations

Connections between the telephones and the station boards are typically via type 66M-xx connector blocks that are cable connected to the station boards (see figure 15).

The gauge size of the twisted-pair station wiring determines the maximum distance allowed from the common equipment to the stations.

Station Type	Wire Gauge		
	20 AWG	22 AWG	24 AWG
Digital Telephone	2500 Feet	2000 Feet	1500 Feet
Analog Multiline Telephone	2500 Feet	2000 Feet	1500 Feet
Analog Single-Line Proprietary Telephone	4000 Feet	3500 Feet	3000 Feet
Industry-Standard Telephone	4000 Feet	3500 Feet	3000 Feet

Protecting the connections

If spare conductors exist in the cables that are run between the station boards and the 66M-xx connector blocks, it is a good practice to connect them to earth ground to help prevent them from inducing radio frequency and/or AC interference into the system.

Each station interface board is shipped with an appropriate supply of ferrite collars. Snap one of these around each station cable to provide protection against radio frequency interference.

Installing a DSS / BLF console

Install a DSS/BLF Console at any station in the system as a companion to a telephone. There is no limit to the maximum number of consoles that can be installed on a system. When you install a console, you must also define the station as a console with programming.

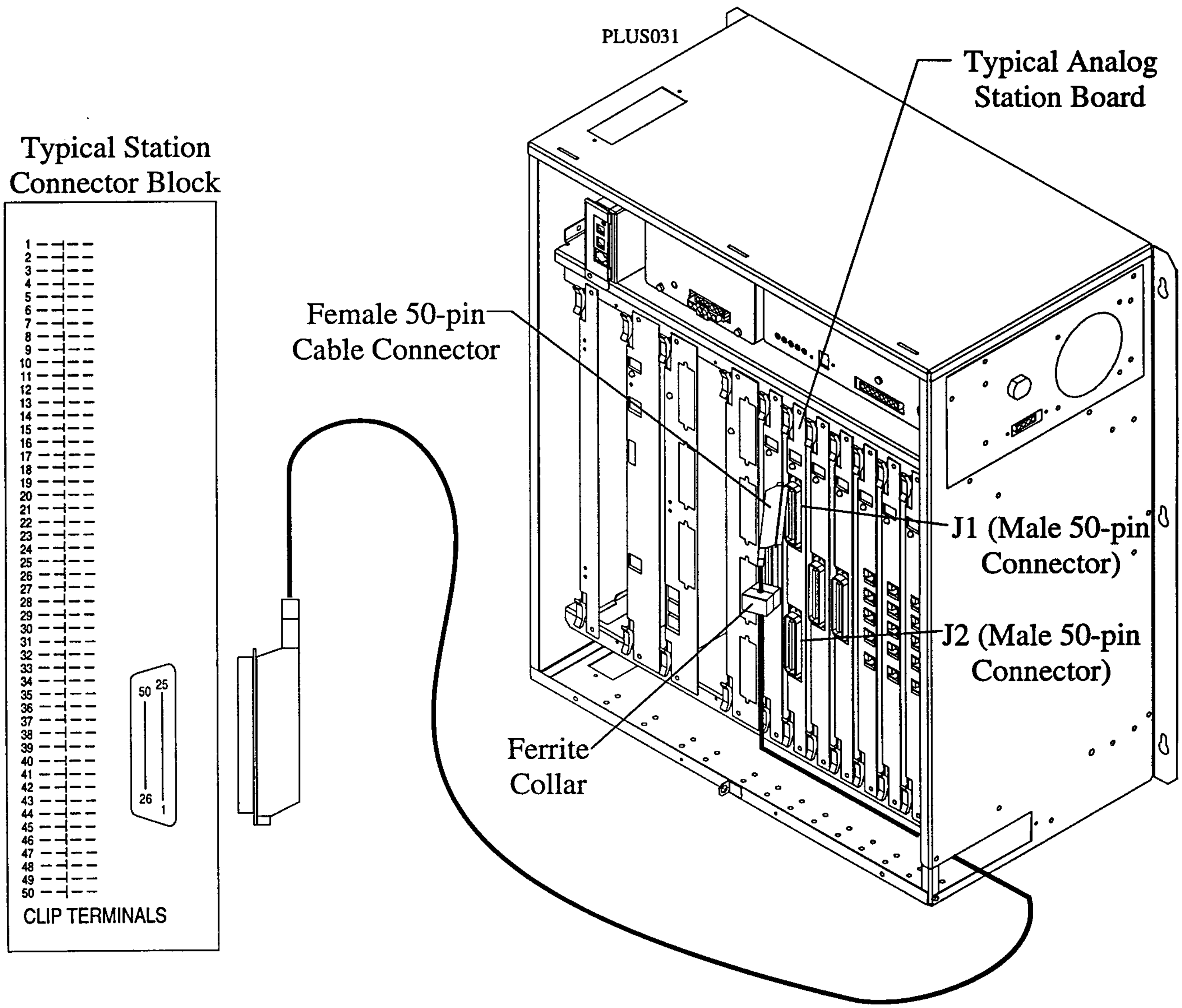


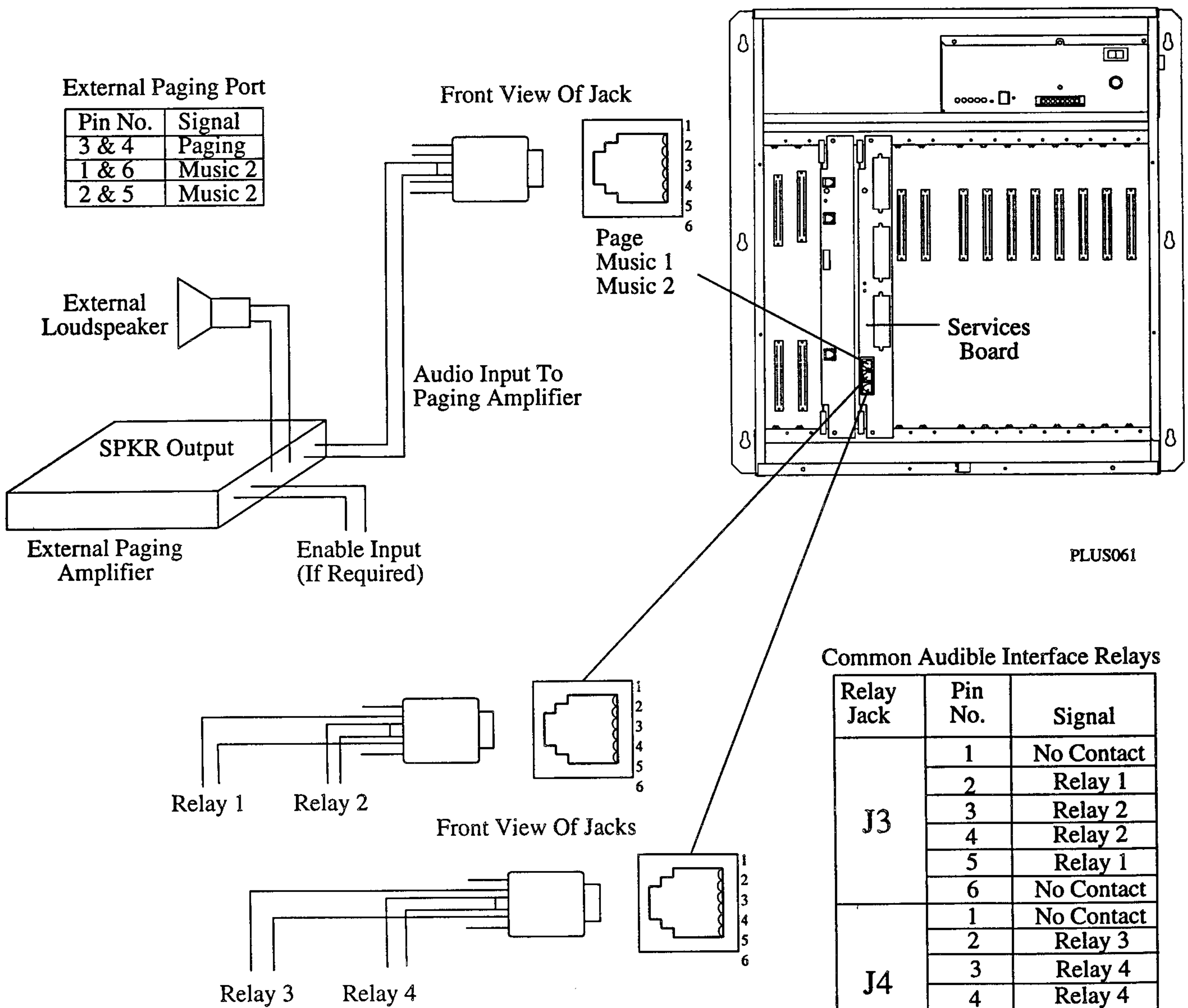
Figure 15: Station Connections

4.3 Connecting The Paging Equipment And Music Sources

The services board provides a standard 6-position modular jack for interfacing external paging equipment and external music sources to the DXP *Plus* system. This jack supplies audio output from the DXP *Plus* for paging purposes and accepts audio input from two separate audio sources. See Figure 16 for details.

External Paging Port

Pin No.	Signal
3 & 4	Paging
1 & 6	Music 2
2 & 5	Music 2



Common Audible Interface Relays

Relay Jack	Pin No.	Signal
J3	1	No Contact
	2	Relay 1
	3	Relay 2
	4	Relay 2
	5	Relay 1
	6	No Contact
J4	1	No Contact
	2	Relay 3
	3	Relay 4
	4	Relay 4
	5	Relay 3
	6	No Contact

Figure 16: Paging Equipment and Music Source Interface

4.4 Connecting A Power Failure Telephone

Each line board provides one standard 6-position modular jack that interfaces an industry-standard telephone for power failure operation to line 1 of that board (see Figure 17 for jack details).

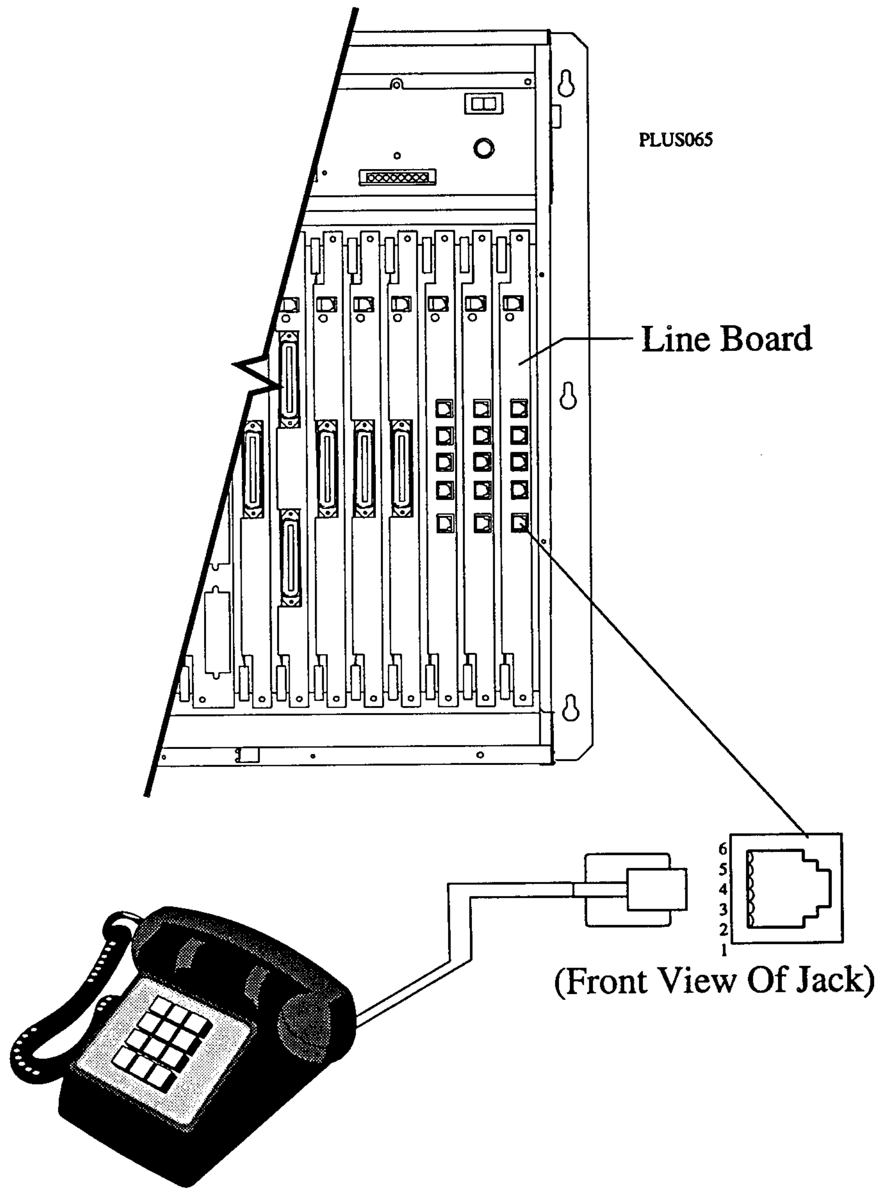
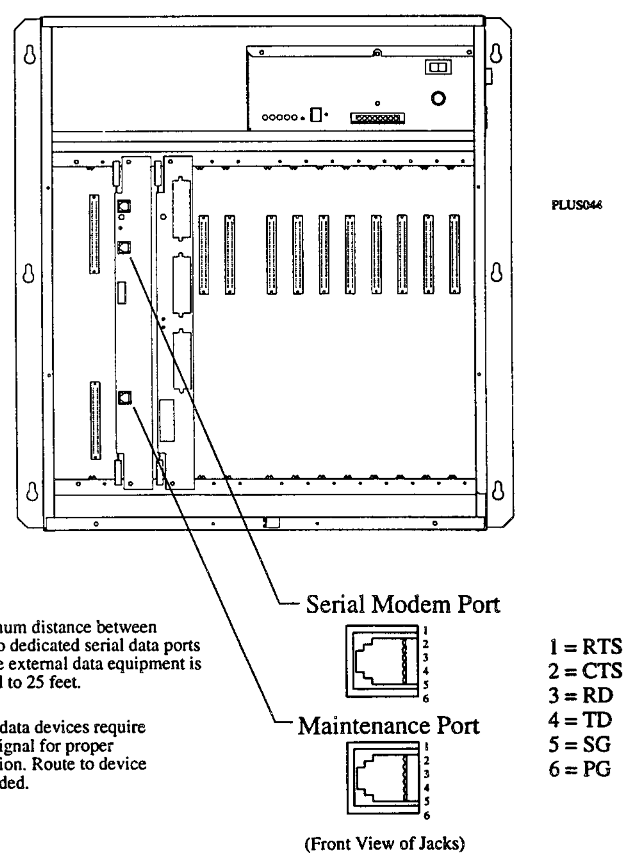


Figure 17: Line Board Power Fail Telephone Connection

4.5 Connecting The Serial Data Ports

The CPU board provides two serial data ports dedicated for PC-based programming and the remote-maintenance modem. You can add as many as 16 additional non-dedicated serial data ports by adding the communications card onto either the services board, the auxiliary board, or either of the two interface boards. Each of these boards will accept up to two communications cards onto its lower two slots. The following chart shows the locations for all of the non-dedicated serial data ports (Figure 18 shows the pin-outs for serial data ports).

Serial Data Port Designation	DXOPT–COM Location
Serial Data Ports 3–10	Lower two slots on the services board
Serial Data Ports 11–18	Lower two slots of one of the following: —The interface board in the upper expansion cabinet, —The interface board in the lower expansion cabinet, —The auxilary board in the main cabinet.
In order to use all 16 non-dedicated serial data ports you must install four communications cards.	

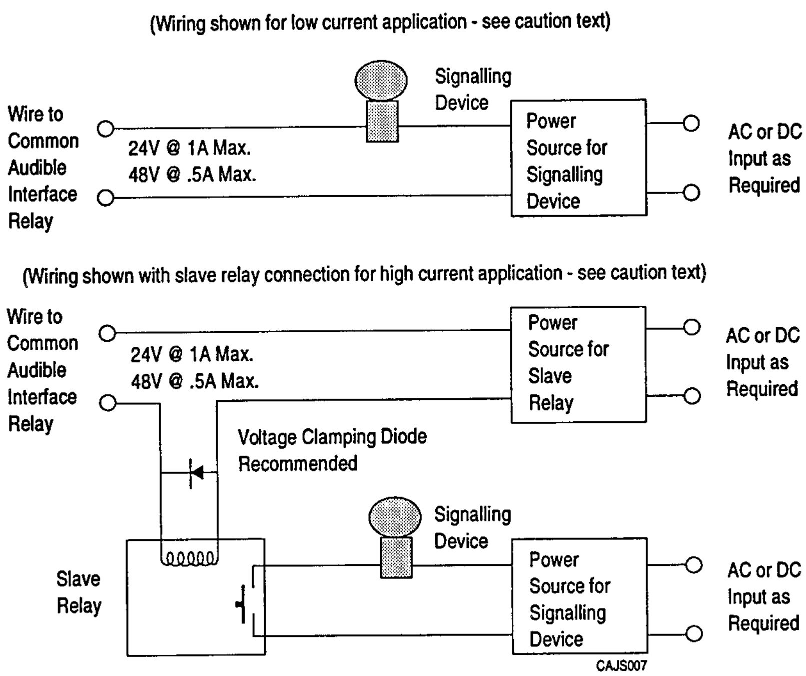


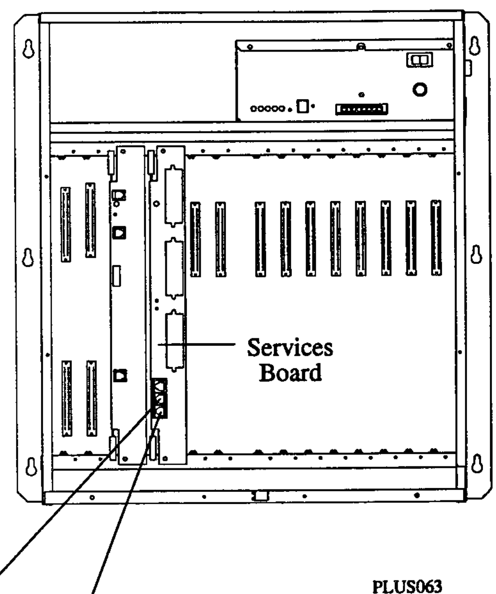
NOTES:
1. Maximum distance between the two dedicated serial data ports and the external data equipment is limited to 25 feet.
2. Some data devices require CTS signal for proper operation. Route to device as needed.

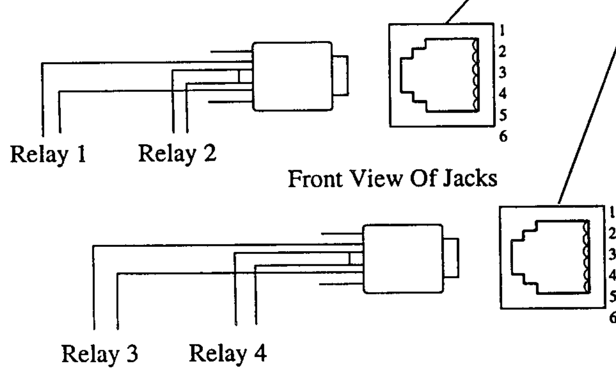
Figure 18: Serial Data Port Connections

4.6 Connecting The Slave Equipment Requiring Dry-Contact Relay Closure For Actuation

The other ports provide dry-contact relay closures that are under software control. Figure 19 illustrates the relay jack details.







Common Audible Interface Relays

Relay Jack	Pin No.	Signal
J3	1	No Contact
	2	Relay 1
	3	Relay 2
	4	Relay 2
	5	Relay 1
	6	No Contact
J4	1	No Contact
	2	Relay 3
	3	Relay 4
	4	Relay 4
	5	Relay 3
	6	No Contact

Figure 19 Slave Equipment Connections

5 Knowing The Specifications

System Capacity (Maximums):

Attendant Consoles:	
Telephone Attendant	Unlimited
Personal Computer Attendant (Total Control)	4
Conferencing: (Simultaneous - without conference circuit board)	32 total conferencing circuits Each conference party uses 2 circuits Each SOHVA or Service Observe uses 3 circuits Maximum of two 7-way conference (14 circuits) Each conference circuit board adds 5 three-way conferences
DSS/BLF Consoles:	
Assigned To Each Station	4 (Each console uses a separate station port)
Intercom:	
Conversations (Simultaneous)	Non-blocking
Paths	Non-blocking
Stations Assigned To Same Group Intercom Number	480
Simultaneous Rings On Same Group Intercom Number	480
Lines:	72 (main cabinet) 88 (expansion cabinet 1) 80 (expansion cabinet 2)
Line Groups (With unlimited members):	16
Paging:	
External Paging Ports	1 plus 4 relays
Internal/External Paging Zones or All Call	8
Station Capacity Per Zone	480
Park Orbits:	9
Power Fail Circuits:	One per line board
Ringing Capacities (Simultaneous):	
Proprietary Telephones	480
Single-line IST	32 per ring phase, max. of 96 per cabinet, total of 288

Subdued Off-Hook Voice Announce Groups:	
Receive	16
Transmit	16
SMDA Call Storage Capacity:	
with 2 megabytes of memory	Approximately 15,000 calls
with 4 megabytes of memory	Approximately 30,000 calls
Speed Dials:	
System Speed Dial	500 maximum
Station Speed Dial Numbers Per Set	10
Station Speed Dial Sets Per Station	1 at default , 1 minimum, 10 maximum
Speed Dial Sets Per System	960
Stations:	144 (main cabinet) 176 (upper expansion cabinet) 160 (lower expansion cabinet)
Station Class Of Service:	32
Toll Restriction Table Entries:	400
Traffic Capacities:	36 CCS (1 Erlang), non-blocking

Power Requirements:

Domestic AC Power Supply	87 - 130 VAC Single phase - all models 6A maximum AC current 600W 700VA
International Power Supply	87 - 130 VAC at 50/60 Hz, externally switchable, 187 - 264 VAC at 50/60 Hz 5A maximum AC current 600W 700VA (Approved to IEC 950 International Safety Standards)

Battery Back-up Reserve Powers:

1 Hour minimum for fully loaded system (main cabinet plus two expansion cabinets)

Domestic Battery Charger	Input voltage: 87–130 VAC single phase 3A maximum AC current 200W 320VA
Switchable Battery Charger	Input voltage: 87–130 VAC 50/60 Hz, or 187–264 VAC 50/60 Hz externally—switchable 3A Maximum AC current 200W 256VA

Dimensions (approximate):

Main Cabinet:

Width (inches)	23.75
Height(inches)	24.75
Depth (inches)	12.0
Weight (approximate pounds)	42 (with cabinet, board cage, and backplane) 72 (with power supply and circuit boards added)

Expansion Cabinet:	**# 1 (Upper)**	**# 2 (Lower)**
Width (inches)	23.75	23.75
Height (inches)	24.75	24.75
Depth (inches)	12.0	12.0
Weight (approximate pounds)	72 - inc. cab., board cage, backplane, power supply, and circuit boards	

Station Cable Requirements:

Type

- #24 AWG minimum
- 2-wire (1-pair) twisted, non-shielded for IST
- 2-wire (1-pair) twisted, non-shielded for proprietary digital telephones
- 4-wire (2-pair) twisted, non-shielded for proprietary analog telephones
- 6-wire (3-pair) twisted, non-shielded for proprietary analog telephones with SOHVA.

Maximum Length	With 20 AWG	With 22 AWG	With 24 AWG
Digital Telephone	2500 feet	2000 feet	1500 feet
Analog Multiline Telephone	2500 feet	2000 feet	1500 feet
Analog Single Line Proprietary Telephone	4000 feet	3500 feet	3000 feet
IST Telephone	4000 feet	3500 feet	3000 feet

Switching Principle

Digital, pulse code modulated/time division multiplexed (PCM-TDM)
Provides non-blocking switching with stored program control

Operating Environment:

Temperature	32-122 degrees F (0-50 degrees C)
Humidity	90 percent relative, non-condensing
Heat Dissipation (Fully loaded main cabinet)	1474 BTUs per hour
Heat Dissipation (Fully loaded exp. cabinet)	1474 BTUs per hour

Terminations:

Station:	Standard 50-pin male connectors for connection to external distribution field.
Line:	Standard, 6-conductor mini-jack (USOC 14C)

Serial Data Ports:

CPU Board	1 at 9600 bps, 1 at 2400 bps
Com Card on Services Board	4 at maximum of 19,200 bps
Com Card on Auxiliary Board, or Upper or Lower Interface Board	4 at maximum of 9600 bps
Format	Serial, pseudo RS-232C
Parity	None, Even, Odd (Programmable)
Data Bits	7 or 8 (programmable)
Stop Bits	1 or 2 (programmable)
Baud Rate	Programmable in class of service
Handshaking	X on - X off Hardware—CTS and RTS, None
Cable Length (serial data ports)	25 feet for dedicated serial ports on CPU board 50 feet com card on services board at 19,200 baud 500 feet com. card on auxiliary or interface boards at 9600 baud

Music Interfaces (Two Inputs):

Input Level	3 Volts peak-to-peak maximum
Input Impedance	Approximately 500 Ohms
Connector	Modular jack

PA Port:

Output Level	400 Millivolts peak-to-peak (typical speech)
Output Impedance	Approximately 500 Ohms
Connector	Modular jack

Central Office Limits:

Loop Limits	1900 Ohms maximum loop
Cable Insulation Leakage	15,000 Ohms minimum

Industry/Regulatory Standards:

FCC Certified, Part 15 (Class A)
FCC registered (fully protected)
LISTED by OSHA-accredited, nationally recognized, test laboratory
EIA RS478
Bell publication 02 guidance
Hearing aid compatible handset

Memory Retention After Power Loss:

	65 hours typical - without battery back up

FCC Registration Number:

Key System	CVWUSA-65214-KF-E
Hybrid System	CVWUSA-65213-MF-E

Ringer Equivalence Number:

	0.4B

Product Codes:

Main Cabinet	DXCBM–PLS
Expansion Cabinet	DXCBX–PLS
Power Supply	DXPSM–PLS
Power Supply (switchable)	DXPSM–PLSSPS
Interface Board (main)	DXINT–PLSMI
Interface Board (expansion)	DXINX–PLSX2, DXINX–PLSX3
Services Board	DXSRV–PLS
Central Processor Unit Board	DXCPU–PLS
Auxiliary Board	DXAUX
Conference Boards	DXCNF
DID Board	DXPCO–DD8,–DD4
T1 Board	DXPT1
Total Control PC Attendant	DXPTC–PLS
Multipurpose Line Board	DXPCO–GD4,– GD8
Communications Card	DXOPT–COM
Digital Station Board	DXDST–8
	DXDST–16
Analog Station Board	DXAST– 8
	DXAST–16
Industry Standard Station Board	DXIST–8
	DXIST–16
Line Board	DXP CO–LP4
	DXP CO–LP8
Software Card (Flash Memory)	DXPSW–PLS2
	DXPSW–PLS4 *(future feature)*
Ring Generator For IST	DXRNG–PLS
DTMF Receiver Card	DXOPT–TON
External Battery Assembly	BBPLS
External Battery Assembly (switchable)	BBPLS–SPS
PC Attendant Position	DXPTC–PLS

Product Codes–continued

Main Package (includes main cabinet, power supply, CPU board, services board, and modem)	Domestic: International:	DXBKM–PLS DXBKM–PLSS
Upper Expansion Package (includes upper cabinet, main interface board, upper interface board, and power supply)	Domestic: International:	DXBKX–PLSX2 DXBKX–PLSSX2
Lower Expansion Package (includes lower cabinet, lower interface board, and power supply)	Domestic: International:	DXBKX–PLSX3 DXBKX–PLSSX3
System Software	4 megabyte 2 megabyte	DXPSW–PLS4 DXPSW–PLS2

Ringing Cadences:

Digital Intercom Ring	150 msec. on, 75 msec. off, 4 sec. between rings
Digital Trunk Ring	450 msec. on, 75 msec. off, 4 sec. between rings
Digital Recall Ring	275 msec.—300msec. on, 4 sec. between rings
Digital Camp–on Recall Ring	150 msec. on, 75 msec. off
Analog Intercom Ring	300 msec. on, 150 msec. off, 3.5 sec. between rings
Analog Trunk Ring	900 msec on, 125 msec off, 3.5 sec. between rings
Analog Recall Ring	500 msec. on, 3.5 sec. between rings
Analog Camp–on Recall Ring	300 msec. on, 150 msec off

5.1 FCC Rules And Regulations

This electronic key system complies with Federal Communications Commission (FCC) Rules, Part 68. The FCC registration label on the DXP Plus contains the FCC registration number, the ringer equivalence number, the model number, and the serial number or production date of the system.

Notification To Telephone Company

Unless a telephone operating company provides and installs the system, the telephone operating company which provides the lines must be notified before a connection is made to them. The lines (telephone numbers) involved, the FCC registration number, and the ringer equivalence number must be provided to the telephone company. The FCC registration number and the ringer equivalence number of this equipment are provided on the label attached to the common equipment. The user/installer is required to notify the telephone company when final disconnection of this equipment from the telephone company line occurs.

Compatibility With Telephone Network

When necessary, the telephone operating company provides information on the maximum number of telephones or ringers that can be connected to one line, as well as any other applicable technical information. The telephone operating company can temporarily discontinue service and make changes which could affect the operation of this equipment. They must, however, provide adequate notice, in writing, of any future equipment changes that would make the system incompatible.

Installation Requirements

Connection of the electronic key system to the telephone lines must be through a universal service order code (USOC) outlet jack supplied by the telephone operating company. If the installation site does not have the proper outlet, ask the telephone company business office to install one. The correct outlet jack for this system is either a type RJ21X or type RJ14C.

Party Lines And Coin Lines

Local telephone company regulations may not permit connections to party lines and coin lines by anyone except the telephone operating company.

Troubleshooting

If a service problem occurs, first try to determine if the trouble is in the on-site system or in the telephone company equipment. Disconnect all equipment not owned by the telephone company.
If this corrects the problem, the faulty equipment must not be reconnected to the telephone line until the problem has been corrected. Any trouble that causes improper operation of the telephone network may require the telephone company to discontinue service to the trouble site after they notify the user of the reason.

Repair Authorization

FCC regulations do not permit repair of customer owned equipment by anyone except the manufacturer, their authorized agent, or others who might be authorized by the FCC. However, routine repairs can be made according to the maintenance instructions in this publication, provided that all FCC restrictions are obeyed.

Radio Frequency Interference

The electronic key system contains incidental radio frequency generating circuitry and, if not installed and used properly, may cause interference to radio and television reception. This equipment has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules. These limits are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference to radio and television reception; in which case the user is encouraged to take whatever measures may be required to correct the interference. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient the television or radio's receiving antenna, and/or relocate the DXP Plus, the individual telephone stations, and the radio or TV with respect to each other. If necessary, the user should consult the manufacturer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the Government Printing Office, Washington D.C. 20402. Stock No. 004-000-00345-4.

This digital apparatus does not exceed the (Class A) limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le pre'sent appareil nume'rique n'emet pes de bruits radioe'lectriques de'passant les limites applicables aux appareils nume'riques (de la class A) prescrites dans le Re'glement sur le brouillage radioe'lectrique e'dicte' par le ministe're des Communications du Canada.

Ringer Equivalence Number

The REN of each line is 0.4B. The FCC requires the installer to determine the total REN for each line, and record it at the equipment.

6 Understanding The Features

6.1 DXP Plus Features List

This list details all of the features available on the DXP *Plus*. Use it as a pre-installation check list.

- ☐ Abandoned Hold Release
- ☐ Adjunct Feature Module
- ☐ Access Denied
- ☐ Account Code Button
- ☐ Account Codes With Positive Verification
- ☐ All Call Paging
- ☐ Allow Ringer Off *(Ringer Volume Off)*
- ☐ Alpha-Numeric Calling Party and Line Display
- ☐ Alternate Attendant
- ☐ Answer Button
- ☐ Area Paging Interface
- ☐ Attendant Position
- ☐ Attendant Position, PC
- ☐ Authorization Code
- ☐ Automatic Dialing
- ☐ Automatic Hold - Intercom To Intercom/Line
- ☐ Automatic Hold - Line To Intercom
- ☐ Automatic Hold - Line To Line
- ☐ Automatic Pause Insertion
- ☐ Automatic Privacy
- ☐ Automatic Number Identification (ANI)
- ☐ Automatic Redial
- ☐ Automatic Reports
- ☐ Automatic Route Selection
- ☐ Automatic Station Relocation
- ☐ Auxiliary Equipment Interface
- ☐ Auxiliary Station Ringer Interface
- ☐ Background Music*
- ☐ Battery Backup (Chassis, Cable, and Batteries)
- ☐ Battery Backup Interface
- ☐ Block Programming
- ☐ Busy Button Inquiry
- ☐ Busy On SOHVA
- ☐ Button Query
- ☐ Call Announce Beeps
- ☐ Call Announce With Handsfree Answerback
- ☐ Call Costing and SMDA Reports
- ☐ Call Forward - All Or Personal
- ☐ Call Forward- Immediate
- ☐ Call Forward - Busy Or RNA, All Or Personal
- ☐ Call Park
- ☐ Call Park Recall
- ☐ Call Pick-Up - Directed
- ☐ Call Pick-Up - Group
- ☐ Call Pick-Up - System
- ☐ Call Transfer - Screened
- ☐ Call Transfer - Unscreened With Automatic Camp On
- ☐ Call Waiting Tone
- ☐ Caller ID
- ☐ Caller ID–RNA
- ☐ Camp-On With Automatic Call Back
- ☐ Camp-On - Call Waiting
- ☐ Camp-On - No Answer
- ☐ Clear Major Alarm Ring
- ☐ Central Message Desk
- ☐ Central Processor Switched Data Port Configuration
- ☐ Centrex Compatible
- ☐ Common Audible Ringer Interface
- ☐ Conferencing - Multiline
- ☐ Console Support
- ☐ Console-Less Operation
- ☐ Communications Card Support
- ☐ Consultation Hold
- ☐ Copy Model
- ☐ Data Base Program Storage Via PC Interface
- ☐ Data Base Programming From Main Station (Limited)
- ☐ Data Base Programming With Personal Computer And Visual Man Machine Interface (VMMI) Software
- ☐ Day One and Day Two Ringing
- ☐ Default Busy/RNA Call Forward
- ☐ Default Functional Programming
- ☐ Delayed Ringing
- ☐ Dial 0 for System Attendant
- ☐ Dial Plus Interdigit Time
- ☐ Digital Voice Announce
- ☐ Dialed Number Identification Service (DNIS)
- ☐ Digital Wireless Telephone Support
- ☐ Direct Inward Dialing (DID)
- ☐ Direct Inward System Access (DISA)
- ☐ Direct Line Access by Station
- ☐ Direct Line Group Selection
- ☐ Directed Station Hold
- ☐ Disconnect Supervision
- ☐ Discriminating Ringing
- ☐ Do Not Disturb
- ☐ Do Not Disturb Inhibit
- ☐ Do Not Disturb Override
- ☐ DSS Status Button
- ☐ Dynamic Save Button
- ☐ E&M tie Line support
- ☐ End to End DTMF Signalling
- ☐ End to End Signalling on Intercom
- ☐ End to End Signalling on Lines
- ☐ Enhanced LCD Display
- ☐ Exclusive Hold
- ☐ Executive Override
- ☐ Executive Override Block
- ☐ Extended DTMF Tones
- ☐ Existing Comdial Telephone Support
- ☐ ExecuMail Integration

- ☐ External Paging Interface
- ☐ Feature Inhibit
- ☐ Feature Renumbering
- ☐ Flexible Ringing Assignment
- ☐ Flexible Ringing Assignment Of The External Paging Port
- ☐ Flexible Station Numbering Plan
- ☐ Ground Start Lines
- ☐ Group Intercoms
- ☐ Handsfree Answer Inhibit
- ☐ Handset Volume Control
- ☐ Headset Capability
- ☐ Hold
- ☐ Hold, Exclusive
- ☐ Hold Queuing
- ☐ Hold Time Reporting
- ☐ Hot Transfer
- ☐ I Hold and I Use Indications
- ☐ Idle Line Preference
- ☐ Idle Line Priority
- ☐ Industry Standard Telephone Support
- ☐ IST Offhook Treated As Busy
- ☐ IST Message Wait Retrieval Access Code
- ☐ IST Ring Frequency
- ☐ IST Ring Patterns
- ☐ Interactive Button Support
- ☐ Intercom Call Progress Tones
- ☐ Intercom Hunt List
- ☐ Intercom Interdigit Dialing Time-out
- ☐ Intercom Time-out
- ☐ Intercom Number
- ☐ Key/Hybrid Configuration
- ☐ Last Number Redial
- ☐ Line Access Restriction
- ☐ Line Answer From Any Station
- ☐ Line Appearance, Enhanced
- ☐ Line Groups
- ☐ Line Group Access
- ☐ Line Names
- ☐ Line Queuing
- ☐ Liquid Crystal Display (LCD) Messaging
- ☐ Liquid Crystal Display (LCD) Support
- ☐ Lock Button
- ☐ Manual Exclusion
- ☐ Manual Reset
- ☐ Master Clear
- ☐ Maximum Call Duration
- ☐ Meet-Me Answer Page
- ☐ Memory Retention Without Batteries
- ☐ Message Deposit
- ☐ Message Waiting
- ☐ Mnemonic Programming
- ☐ Modem Support
- ☐ Modify Digits Table
- ☐ Multiple Attendant Positions
- ☐ Multipurpose Line Board
- ☐ Music Interface*
- ☐ Music On Hold*
- ☐ Mute
- ☐ Names (Stations And Lines)
- ☐ Night Service Automatic Switching
- ☐ Night Transfer (Of Ringing)
- ☐ Off-Premise Extension (OPX)
- ☐ On-Hook Dialing
- ☐ Operator Station
- ☐ Originating Denied
- ☐ Out Dial Delay Time
- ☐ Password Protection
- ☐ Pause Time
- ☐ PBX/Centrex/Central Office Compatible
- ☐ Personal Intercom Number
- ☐ Paging Access
- ☐ Periodic Line Tone
- ☐ Personal Intercom Number Preference
- ☐ Personalized Ringing Tone
- ☐ Pooled Line Access
- ☐ Power Failure Transfer
- ☐ Preselection Prime Line
- ☐ Printer Interface
- ☐ Privacy
- ☐ Privacy Release
- ☐ Private Lines
- ☐ Program Printout
- ☐ Programmable Button Flexibility
- ☐ Programming Port
- ☐ Pulse/Tone Switchable
- ☐ Quick Transfer
- ☐ Remote Programming and Diagnostics
- ☐ Remote Station Disable
- ☐ Release Button
- ☐ Reminder Alert
- ☐ Restrict ARS Hookflash *(Automatic Route Selection, Hookflash Restriction)*
- ☐ Restricted Dial Error Tone
- ☐ Response Messaging
- ☐ Ring Back On Busy
- ☐ Ring Back Tone
- ☐ Ring No Answer Call Forward
- ☐ Ring On Busy
- ☐ Ringing Line Preference
- ☐ Save Button Dial Storage
- ☐ Saved Number Redial
- ☐ Self Diagnostics
- ☐ Serial Data Port
- ☐ Service Observing
- ☐ Shift Button
- ☐ Silent Mode Button
- ☐ Single-Line Proprietary Telephone Support
- ☐ SMDA Reports
- ☐ SOHVA Beeps *(SOHVA Tone Bursts)*
- ☐ Speakerphone Support
- ☐ Split Button
- ☐ Square/Non-Square Configuration
- ☐ Station Hunting
- ☐ Station Class Of Service
- ☐ Station Message Detail Accounting (SMDA)
- ☐ Station Message Detail Recording (SMDR)
- ☐ Station Monitoring with DSS Call Pickup
- ☐ Station Names
- ☐ Station Speed Dial
- ☐ Subdued Off-Hook Voice Announce
- ☐ Subdued Off-Hook Voice Announce Groups
- ☐ Subdued Ringing
- ☐ Synchronized Ringing
- ☐ System Clock
- ☐ System Speed Dial
- ☐ System Status Reports
- ☐ T1 Digital Carrier Transmission Option
- ☐ Tap (Flash)/Recall
- ☐ Telephony Services Application Programming Interface (TSAPI) Support
- ☐ Through Dialing
- ☐ Tie Lines
- ☐ Time And Date
- ☐ Timed And Immediate Recall
- ☐ Toll Restriction
- ☐ Toll Restriction Pause Entries
- ☐ Tone or Voice Signalling on Internal Calls
- ☐ Transfer/Conference Button
- ☐ Transfer Ring Cadence
- ☐ Unsupervised Conference
- ☐ Voice Announce Blocking
- ☐ Voice Mail Integration Digits
- ☐ Zone Paging

** The system is equipped with two inputs for separate customer-supplied music sources.*

6.2 Defining The Features

The following section defines all of the DXP *Plus* features. Read through all of these definitions before programming the DXP *Plus* to ensure that you are programming the desired feature.

A

Abandoned Hold Release

If a distant on-hold party hangs up, it may cause an interruption in the line current. The DXP *Plus* system then drops the line from the hold condition and returns it to service. You can program the time interval between hang-up and line-drop with choices of either 50 milliseconds or 350 milliseconds. The central office makes the arrangement for the time choice. Also refer to the discussion titled, Disconnect Supervision.

Access Denied

If you have programmed the system to do so, it can deny access to particular lines and group intercoms at certain telephones. A user cannot select a line for use if it is access denied at his or her telephone.

Account Code Button

As part of the button mapping, the system installer can assign a special button that the user may use to apply an account code to a call. Refer to the discussion titled Account Codes With Positive Verification.

Account Codes With Positive Verification

Station users can assign account codes to specific calls. The system uses the account codes to identify calls by category, or special grouping, for call accounting purposes. All calls with the same account code are reported together by the station message detail accounting (SMDA) feature. The system attendant can obtain a separate printout of calls assigned to one account without causing any other calls to print or be deleted. The programmer can arrange for the system to verify that the user entered an account code and to sound an error tone if an invalid account code is entered. If the programmer arranges it, attendants can use account codes as a basis for SMDA print-outs. He or she may program the system to prompt station users to enter account codes for incoming calls and/or out-going calls if desired. The prompt can be with or without system verification of the entry. Alternately, account code prompting can be turned off completely. Depending upon the type of call, different users are associated with the call accounting record. The following list explains to whom the call record is associated:

- On out-going calls, the user who enters the account code
- On transferred calls, the transferee
- On incoming calls, the last user active on a call.

Account codes may be from three to 16 digits in length as set by class of service programming. The system will verify all digits. Also refer to the discussion titled Account Codes With Positive Verification—forced.

Account Codes With Positive Verification—Forced

Station users can assign account codes to specific calls. The system uses the account codes to identify calls by category, or special grouping, for call accounting purposes. If the programmer programs the system to have forced account codes, *the user must enter the account code before the call can be placed.* If the system does not find a match between a user entered account code and one that the programmer has set in the system, the call will not be allowed. Remember, verification alone does not deny users' calls, only forced verification denies. The programmer can arrange for the system to verify that the user entered an account code and to sound an error tone if an invalid account code is entered. If the programmer arranges it, attendants can use account codes as a basis for SMDA print-outs. He or she may program the system to prompt station users to enter account codes for incoming calls and/or out-going calls if desired. You can program the system to recognize emergency numbers that do not require account codes.

Account Code Display And Display Time

For LCD speakerphone users, a message appears in the telephone's display prompting the user to enter an account code for incoming or outgoing calls. If the user does not require this prompt, the programmer should turn off the prompting message display.

Adjunct Feature Module Support

When the installer includes a 16-button adjunct feature module with certain model Comdial proprietary telephones, that module extends the programmable buttons of the telephone by 16 buttons and status lights. The users can program these buttons for speed dialing and direct station selection (DSS) with busy lamp field (BLF) status lights.

All-Call Paging

Refer to the discussion titled *Zone Paging.*

Allow Ringer Off (Ringer Volume Off)

On some proprietary telephones, the user selects the ringer volume level by pressing a rocker-type volume control repeatedly to select one of four different volume levels. The lowest volume setting is essentially an off condition as the telephone sounds only one low-volume ring burst when a call rings the station. Sometimes users would rather not receive even one ring burst. For these cases, installers can program the system so that it completely silences the ringer at a telephone when its user selects the lowest volume setting.

Alpha-Numeric Calling Party And Line Display

An LCD speakerphone, when receiving an inside call, displays the caller's name (up to seven characters), for example, "John L". The system uses the remaining nine characters on the display for status messages (for example, "Fwd from"). The system also displays the logical line number of the current line. Also see the discussion titled *Liquid Crystal Display Support.*

Alternate Attendant

Refer to the discussion titled *Attendant Position.*

Answer Button

When you map a telephone with this button, the user can press it to answer the call that is audibly ringing at his or her station. It is possible for more than one call to be ringing at the same time; however, only one of the first ringing calls is answered with the answer button.
Also refer to the discussion titled *Programmable Button Flexibility.*

Area Paging Interface

Refer to the discussion titled *External Paging Interface.*

Attendant Position

The attendant of a telephone system is typically the first person to answer an incoming call and usually directs incoming calls to the proper person or department within the system. In addition to call control, the attendant controls system-wide operating features such as night transfer (of ringing) and the system clock. Additionally the attendant is responsible for programming such items as system speed dial numbers and LCD messages that are available to many of the system users.

The DXP *Plus* provides two attendant positions at default (stations 1 and 2, intercom 101 and 102); however, the programmer can assign any or all stations (up to 480 total) as attendant stations if they wish. The attendant can also assign up to four DSS/BLF consoles to each attendant position where needed. In addition to the many programmer–enabled feature buttons that the system can make available at any station, the DXP *Plus* provides the attendant position with several special purpose programmer-enabled feature buttons to enhance call processing. These special purpose buttons are described below.

Alternate Button

When an attendant presses this button, all calls that are normally routed to his or her telephone now route to an alternate attendant's telephone instead.

Both Button

The "both" button provides a means for attendants to conference between themselves, a current call, and the last call that they placed on hold.

Overflow Button

When an attendant presses this button, calls that normally ring at his or her telephone also ring at an overflow attendant's telephone as well.

Queue Button

When multiple calls are ringing at an attendant station or are on hold there, the system places them in a queue. The attendant can use this button to determine how many calls are queued and awaiting service.

Serial Call Button

When a caller wishes to speak to more than one person or department, the attendant uses this button to place the caller in a serial mode of multiple transfers to every desired party. In the serial mode, the system automatically transfers the caller to another party as soon as a present party hangs up (up to three stations can be part of a serial transfer). The system places the caller in the serial mode as soon as the attendant hangs up.

Test/Busy Button

This button provides the attendant a means to test the status of specific lines. Attendants can use this button to determine whether individual lines are idle, busy, on hold, or out of service.

Also refer to the discussions titled Answer Button, Lock Button, Release Button, Split Button, and Silent Mode Button and to the discussion titled Programmable Button Flexibility.

Attendant Position, PC

The Total Control PC attendant position is a computerized attendant operating station that consists of an IBM-compatible personal computer, a proprietary interface circuit board (factory-installed in one of the computer's expansion slots), a customized keyboard that includes a handset cradle, a telephone handset, a program diskette, and all necessary cables for connecting the equipment to the DXP *Plus*. The DXP *Plus* can handle a maximum of four PC Attendants.

Among the many features that are available to the PC attendant is a feature that allows him or her to change the class of service of an individual station. This feature allows an attendant to control the calling parameters of a station (such as how much or little toll restriction to allow) at any time.

The installer can program function keys F1–F12 on the PC attendant keyboard with features that are in addition to the fixed features that these keys provide. To access the additional features, the attendant must press and hold the CONTROL key while pressing the desired function key on the keyboard.

Authorization Code

Authorization codes have a "walking class of service" option. Walking class of service provides system users the mobility to use their class of service (COS) features, prime line assignments, and exception numbers on any telephone in the system instead of being limited by what is available to the particular telephone they happen to be using. Authorization codes are associated with personal intercom numbers as is COS, prime markings, and exception numbers. Therefore, when a user enters his or her authorization code at any system telephone, the code alerts the system as to what features to make available to the user. The user can use the telephone for anything allowed by his or her personal intercom number; however, a user cannot disturb the last number redial stored there by the normal user. Once a user accesses his or her telephone features, those features remain in effect until any idle time exceeds the authorization code time-out period. A telephone user activates walking class of service by pressing ITCM and then dialing #08 followed by an authorization code. Also refer to the discussion titled *Lock Button.*

Automatic Dialing

Refer to the discussion titled *Station Speed Dial.*

Automatic Hold—Intercom To Intercom/Line

If a user selects a second intercom number during the time that he or she is already active on the first intercom number, this feature causes the first intercom number call to be automatically placed on hold. This feature allows a user to move from intercom call to intercom call without having to press the HOLD button to place any current calls on hold. The programmer must enable this feature for it to be available.

Automatic Hold—Line To Intercom

If a telephone user selects an intercom number while a line call is active, this feature causes the system to automatically place the line call on hold . This is a fixed system feature and is always available.

Automatic Hold—Line To Line

If a user selects a second line during the time that he or she is already active on a line, this feature causes the system to automatically place the first line call on hold. The feature allows a user to move from line call to line call without pressing the HOLD button. The programmer must enable this feature for it to be available.

Automatic Number Identification (ANI)

Automatic Number Identification (ANI) is a T1 service feature for both E&M and DID lines. Long distance common carriers offer ANI as a feature to dial 800 and dial 900 lines. The ANI feature provides information to an internal telephone system that identifies the telephone number of the calling party. Businesses served by a dial 800 or dial 900 service allow any available user to answer the calls and have their internal telephone system process the ANI information to identify the caller's telephone number. The common carrier supplies ANI information as DTMF digits. When the ANI feature is combined with the Dialed Number Identification Service (DNIS) feature, the common carrier also delimits the DNIS information from the ANI information with an asterisk (✱) tone so that the DXP *Plus* can process each portion properly.

Automatic Pause Insertion

When the system stores a dialed number for later redial, it automatically stores a pause whenever the user waits between digits for at least two seconds while dialing the number. The system inserts the automatic pause in the stored number sequence at the point where the manual pause in dialing occurred. The actual time length of the inserted pause is programmable.

Automatic Privacy

The programmer can make a line private or non-private. In the private mode, a station has exclusive use of the line during a call. No other station can access that line unless the original user includes it through the use of the add-on conference feature. In the non-private mode, any stations with that line appearance can gain access at the same time (sometimes known as common line pickup). Users may add up to five parties into one conversation. Also see the discussions titled: *Conferencing —Multiline and Privacy Release.*

Automatic Redial

With this feature, the system automatically redials a busy or unanswered outside call. Once the user activates automatic redial, the station selects the line, automatically dials the number, and waits for a response. (It dials and then waits 30 seconds for an answer.) If the called station does not answer, the redialing station disconnects, waits one minute, and then repeats the sequence. The station will repeat this procedure for approximately 10 minutes. The feature cycle is timed and does not have busy and ring-no-answer detection circuitry. Because of this, if the redialing user is operating handsfree when the called party answers, he or she must take the handset off-hook to prevent being cut off by the timing cycle. The station users must program an Auto Redial button at one of the designated programmable button locations on their telephones before they can use it.

Automatic Reports

This feature makes the system automatically generate selected station message detail accounting and call costing reports for printing on a daily or weekly basis. The programmer sets the time that the report is to be printed, sets the type of report to be printed, and dictates whether the call records are to be erased from the system memory after they have been printed.

Automatic Route Selection

Automatic Route Selection (ARS) allows the system to automatically select the least costly line group available to a station to route a call. The system modifies the dialed number, if needed, to match the selected line group. Additionally, ARS provides the costing information for the dialed call that is reported by the station message detail accounting feature. ARS makes routing decisions (which lines to route a call over, if and how to modify a number, and costing information) based entirely upon the programming of the system.

When the ARS feature is active, the user selects ARS by dialing 9. Because direct line selection by the user bypasses the ARS route selection feature, the programmer normally does not give stations direct line appearance when ARS is part of the system operation.

The ARS feature can operate with the toll restriction feature or independently from it; however, both features use the same entry table for programming. The programmer enables or disables automatic route selection on a system-wide basis. A defaulted system has ARS disabled.

The programmer must program a number and the proper routing information before the system can perform ARS on that number when it is dialed. The programmer generally arranges routing from the least costly routing method to the most costly routing method. The costliness of the route is determined by the line group over which the call is routed.

If a station does not have access, because of programmed restrictions, to a route that the ARS selects for it, the system denies the dialing and causes an error tone to sound at the station. If the station does have access, ARS routes calls from that station based on the routing information. If the call can not be made on the line group first selected by the routing, ARS will try the next route. Once again the route access is tested. This process is repeated, up to a maximum of six times. Each route is programmed from least to most costly. The more costly the route, the higher the access level needed to access it and the greater the chance that the station will be denied access. If ARS selects a more costly route because the least costly one is busy, a station user receives a warning tone when a call is attempted. Since this tone indicates that a more expensive line group was chosen by the system, the station user should hang up and try again later. This warning tone feature is enabled through programming.

Before automatic route selection can operate efficiently in a cost saving manner, the programmer must group similar lines together into line groups.

Each route in every route table contains costing information. The costing information includes two programmable tiers of costing and a programmable surcharge amount. Even if a call is not routed through ARS, (if the station user selects the line), the system still accesses this costing information to cost the call.

The programmer can arrange the automatic route selection feature so that it modifies the dialed number by adding or deleting digits until the number better fits the dialing needs of the selected route. Doing this results in situations such as the following example:
Assume a station user dials 12025551212 (Washington D.C. area), and further assume that the system has an FX line to the Washington D.C. area and ARS will route the call over it. ARS will delete the 1202 prefix and only dial 5551212 because the FX line does not require the prefix numbers to complete the call. Field maximum: 20 digits.

You can program the system for any one of three different dial tones that you will hear whenever you enter the ARS access code. The ARS dial tone choices are:

— Dial Tone 1 - steady intercom dial tone (dual tones of 480 Hz + 620 Hz),

— Dial Tone 2 - same as dial tone 1 only preceded by three short tones (200 ms on, 200 ms off),

— Dial Tone 3 - steady similated central office ring back tone (dual tones of 440 Hz + 480 Hz).

Restrict ARS Hookflash (Automatic Route Selection, Hookflash Restriction)

This feature enhances ARS response to hookflash action on an outside line when that action is followed by dialed digits. With the feature enabled, the system delays response to a hookswitch flash until after the ARS feature verifies as valid all subsequent dialed digits. With the feature disabled, the system sends the hookflash over the line without waiting for the ARS feature to verify the validity of subsequent dialed digits. This station class of service feature is applicable only when the ARS feature is active.

Automatic Route Selection For Speed Dials

The programmer can arrange for the system to route the system speed dial and any personal speed dial numbers that the user has programmed through the system's automatic route selection feature (ARS).

Automatic Station Relocation

The system will automatically recognize a particular station should someone relocate it to a different station port. After being installed at a new port location, a relocated station will provide the same class of service parameters and station features that it provided at its original port location. Also, the relocated station will respond to the same personal intercom number that it responded to at its original port location. A relocated station prompts the user to take action to either accept its original programming or accept the programming at the new port. If the user takes no action, the station assumes the parameters and personal intercom number that is determined by a system programming procedure. Consider these following points when you enable station relocation:

- If someone does a station relocation, the programmer must save the database programming to make the relocation permanent.
- This relocation feature only applies to digital telephones.
- Users must ensure that the vacated port remains unused until they complete a relocation.
- If someone connects a telephone to the vacated port before users complete a relocation, the relocated telephone will not retain its original programming.
- When the user accept the original programming for the new port, the vacated port assumes the programming currently assigned to the new port (that is, a parameter exchange takes place between the vacated port and the new port).
- If a DSS/BLF console was assigned to the telephone at its original location, the console assignment follows the telephone to the new location even though the console is no longer located physically near the telephone. If the user relocates the console, the system programmer must reprogram the new port for console use.

The relocation feature also applies to relocated digital telephone boards, however, the installer must ensure that the vacated port remains unused until the relocation is complete. All stations connected to the relocated circuit board show the relocation prompt.

Auxiliary Equipment Interface (Busy Lead Detection)

One line port on every loop start line board will detect current flow on the line ahead of the common equipment. When an external device, such as a modem or fax, is connected to this line and is activated, current flow over the line occurs. When the port detects the current flow, the system causes a busy indication for this line to appear at every system telephone that has its appearance. Normally, the user cannot interrupt an external device by pressing the line button or by dialing a line group code; however, if the line is programmed to be non-private, a user can interrupt the device.

Auxiliary Station Ringer Interface

The central processor unit circuit board includes four dry-contact relay actuations. They may be used for the following:

- Programmable Station Ringer Interface
- Paging Enable
- Door Relay Lock/Unlock
- Zone Night Answer

The relay contacts for the station ringer interface follows the ring pattern of a ringing line or telephone. These relay contacts close during ringing and open between rings and may be used to control an external signaling device. The relay contacts for the paging enable and door relay are closed while the activating station is off-hook and may be used to provide a path for an enabling signal where needed. Contacts on relay 1 is normally closed when idle and contacts on relays 2, 3, and 4 are normally open when idle.

Also refer to the discussions titled *Common Audible Ringer Interface, External Paging Interface, Flexible Ringing Assignments, Line Answer From Any Station, and Night Transfer (Of Ringing).*

B

Background Music (Two Selections)

If the system includes an external music source, telephone users can turn background music on and off at their stations. The system uses two dedicated audio ports to interface the music sources, one for background music through the station speakers and the other for music on hold for both lines and intercom numbers. Therefore, the background music can be different from the music provided to held calls if the system installer connects two different sources to the system. When the two different choices are available, station users can dial a code to choose either source for their background music.

Also refer to the discussions titled *Music Interface* and *Music On Hold.*

Battery Back-Up (Chassis, Cable, and Batteries)

Battery back-up assemblies that include chassis, cable, and battery are available as optional kits (through normal distribution from Comdial). The battery back-up assembly connects directly to the battery interface connector on the system main power supply.

Battery Backup Interface

Attach a Comdial-provided optional battery backup kit to the DXP *Plus* digital communications system for full uninterruptable system power in case of an AC power loss. The switching and trickle charge circuitry are in the common equipment power supply assembly, but batteries, chassis, and cable are packaged as a separate option. When the installer plugs the system into an active AC power source, the common equipment power supply will constantly charge the attached batteries with a trickle current. Built-in circuitry automatically switches to battery power when AC power is lost. With batteries at full charge, a fully loaded system (without expansion cabinets) will remain fully functional for a minimum of one hour without AC power.

If additional time is required, the backup time can be increased by adding additional batteries.

Block Programming

A programmer can assign the programmed features of a particular line or station, to other lines or stations. He or she can also assign a particular arrangement of button functions (mapped buttons) of one telephone to a quantity of other telephones. This feature eliminates the need to individually program every station class of service, line and/or button function.

Busy Button Inquiry

This feature provides the user with a means to identify both a station that is busy on a line and the line the station is busy on as well. The system presents the identified line or station information on the user's telephone display for 10 seconds after he or she requests that information. If the system installer has not given the user's telephone this feature, the system presents busy information to the display without identifying the line or station involved.

Button Mapping

Refer to the discussion titled, *Full Button Programmability Of Features, Programmable Button Flexibility, and Square / Non Square Configuration.*

Button Query

The button query feature allows users to display the function of programmable buttons on LCD telephones.

C

Call Announce With Handsfree Answerback

The internal speaker at each full–featured multiline telephone provides call-announce capability over the personal intercom number. Users can call announce between all telephone types except between an analog monitor telephone and digital telephones. When a user makes a call-announce intercom call to the personal intercom number of another telephone, the user of that telephone can make a handsfree response to the call. If the personal intercom number is forwarded or is in a hunt group, the intercom call will appear as a tone signaled intercom call at the telephone to which the calls are forwarded. A tone burst, programmable by the installer, precedes the call announce.

Call Announce Beeps (Call Announce Tone Bursts)

Installers can set the number of call announce tone bursts for each station in the system to be a value of from one to five .

Call Costing And Station Message Detail Accounting Reports

The system provides built-in, estimated costing of all calls. It also provides station message detail accounting (SMDA) reports of all calls, and it displays call costs on LCD speakerphones. Call costing, in general, provides a means of establishing costs to be applied to outside calls made from system telephones. Call costing computes charges for a call after it is completed but does not restrict dialing as toll restriction does. Call costs are based on a two-tier time rate and include a line surcharge cost. The programmer can make allowances for call set-up and minimum call duration using the answer time and dial time parameters. The system determines call costing through the use of the toll restriction and automatic route selection (ARS) features; however, these features need not be active for costing to work. Call costing is based on programmed estimates that best fit the particular area of the country the system is installed in.

Caller ID

DXP *Plus* caller ID provides relevant caller information (caller's name and number, for example) to any called LCD stations. The installer can program any C.O. line as a caller ID line. The caller ID information is also reflected in the SMDA printout. The DXP *Plus* Caller ID feature package requires the use of a CID08 unit—hardware designed to support the Bell 202 Caller ID signal transmitted by the central office. The CID08 supports up to 8 CO lines (you can install up to 8 CID08 units), for a total of 64 caller ID lines.

Caller ID RNA—Ring–No–Answer

If a station with assigned caller ID lines receives a call but does not answer, the system will automatically archive the caller ID information. The installer can program any station or group of stations to receive Caller ID RNA information. Upon reviewing a Caller ID RNA record, the user can automatically redial that number by pressing the SAVE button. When the caller ID information goes to more than one telephone, the system will also display the last station user that viewed that record, thus preventing multiple call backs. Caller ID RNA is a programmable feature.

Call Forward—All Or Personal

Station users can forward the calls that normally ring at their telephones to another telephone for answering. They can forward just their prime line and intercom calls or forward every call that rings at their station. If users forward calls while the attendant has enabled the night transfer of ringing mode, the night mode ringing assignments at their stations are forwarded. There are multiple levels of forwarding. Station A can forward to station B, then station B can forward to station C, thus making calls to station A forward all the way to station C. For each internal call received while call forward is enabled, the forwarding telephone sounds a ring reminder (short tone burst) to remind the users that their calls are being forwarded.

The programmer can assign a call forward button to individual telephones. If a telephone has a call forward button available at a programmable button location that includes an associated light, the light turns on when the user presses the button.

If a telephone has an LCD display, it will show a call forward message along with the extension number or name of the station receiving the forwarded calls.

Also see the discussions titled *Call Forward— Busy Or Ring No-Answer, Call Forward—Manual, and Default Busy Ring No-Answer Call Forward.*

Call Forward—Busy Or Ring No-Answer, All Or Personal

Station users can forward the calls that normally ring at their telephones to another telephone for answering. They can forward just their prime line and intercom calls or forward every call that rings at their telephone. Users can control whether the calls forward immediately or after a preprogrammed number of rings (this is true of busy calls as well, which ring in a subdued manner) that is set by the programmer. When the telephone is set to ring several times before forwarding, the user has a chance to end the current call before the incoming call is forwarded. Certain conditions must exist before this enhancement will allow the call to a busy station to subdue-ring before forwarding. The called station must have an idle intercom available and this intercom number must be part of the intercom hunt list that the programmer arranged for the station, or the call to a busy station will forward automatically. The number of group intercoms in a station's intercom hunt list determines the number of calls that can subdue ring on a busy station. After the system reaches that maximum number, any additional calls immediately follow the station's forwarding assignment.

When a busy station receives a call on a line for which it has an appearance, the call will forward immediately. If the station does not have a line appearance but does have an idle intercom in its hunt list, the call will subdue–ring at the idle intercom for the programmed number of rings before it forwards. When a busy station receives an intercom call or a transferred call and it has an idle intercom in its hunt list, the call will subdue ring at the idle intercom for the programmed number of rings before it forwards.

The programmer must enable the call forwarding enhancement as a separate programming choice in addition to class of service programming. Once the feature is enabled, it will enhance both the default call forward scheme and the call forward scheme that the users set up for themselves.

Also see the discussions titled *Call Forward - All Or Personal, and Default Busy Ring No-Answer Call Forward.*

Call Forward—Immediate

The installer can map a call forward button on the user's telephone that will allow the user to forward calls even if he or she is not busy. After a user determines where to forward a call and activates the call forward button, the system will immediately forward the call once the line rings.

Call Forward, Recall

If the site includes ExecuMail equipment and the programmer has arranged for the ExecuMail to provide release transfer, she or he should also arrange for the ExecuMail station to have this call forward, recall feature. Also see the discussion titled *Call Forward - Busy or Ring No-Answer, All Or Personal.*

Call Park

The system can hold nine calls in park zones (also referred to as orbits) where they are retrievable by all users in the system.

Those calls that users can park include intercom calls, outside calls, and conference calls. Users park calls in predefined zones and then retrieve them by dialing an intercom feature code or by pressing a preprogrammed call park button. Call park, when used with paging features, allows a user to direct calls to roving personnel by first parking a call in an orbit and then paging the personal to tell them which orbit holds the call. When a user retrieve a call from park orbit, the system places the call on the user selected intercom. If the station has several intercoms arranged in a hunt list, the system always chooses the intercom that the user selected.

Also see the discussion titled *Call Park Recall.*

Call Park Recall

If a call remains parked after the park recall time (as set by the programmer) has ended, the system returns the call to the parking station where it rings. If that telephone includes an LCD display, a message appears on the screen that shows the orbit number of the returning call.

Also refer to the paragraph titled *Call Park.*

Call Pick-Up Directed

A station user can dial a code and the intercom number of a ringing station to answer the call.

Call Pick-Up Group

If a call rings to any station in a preprogrammed pick-up group, and a second user in the group wishes to answer the call, the second user can dial the group pick up code to answer the call. Up to 16 different groups can exist with any number of stations in a group. The system provides group overlap by allowing stations to be in more than one group at the same time thus enabling them to pick up calls for stations in each group. The programmer places the stations in their logical answering groups.

Call Pick-Up System

If a call rings at any station in the system, certain other station users, such as the attendant station, can pick up that call. That station user must dial the appropriate pick up code to answer the call, and the station must be programmed to pick up the call. The programmer places all telephones in the same pick-up group to enable this feature.

Call Transfer—Screened

Screened call transfer allows users to first announce and then transfer both line and intercom calls from one station to another station or group in one of two ways. If both stations have access to the line or intercom number, the user makes a common line pickup transfer. If the other station does not have access to the incoming line, the user makes a transfer using the system transfer feature. The user uses the TRANS/CONF button to effect the call transfer. Also refer to the discussion titled *Call Transfer—Unscreened with Automatic Camp-On, and Hot Transfer.*

Call Transfer —Unscreened With Automatic Camp-On

Unscreened call transfer allows users to transfer both line and intercom calls from one station to another station or group without first announcing them. The unscreened transferred call appears at the other station where it will ring if that station is idle or automatically camp-on and await an answer if that station is busy. The call automatically rings back to the transferring station after a programmed recall period. There is no limit as to how many calls that can be camped onto another station. A transferred call will ring if the called intercom number is idle. If the handset is off-hook, the ringing is subdued.

Call Waiting Tone

A user can send a call waiting tone to signal to a busy station that he or she wishes that station to contact them. They do this by dialing a special code when they encounter a busy signal. The call waiting tone sounds at the busy station and reoccurs until the calling party hangs up. The frequency of the call waiting tone is preprogrammed by the programmer.

Camp-On With Automatic Call Back

After calling another station and encountering a busy signal or a ring with no answer, a user can camp on to that station, hang up, and wait to be called back by the system when that station becomes idle or when the user returns. Likewise, a user can camp-on to a busy line, hang up, and wait to be called back when it becomes idle.

When the busy station becomes idle, the system rings the originating station and starts a timer. The user of the originating station must take it off hook as soon as it rings and as soon as he or she does so, the camped-on telephone rings.

When the user of the ring no-answer station uses it for any call activity, the system detects this activity as a sign that the user has returned. As soon as that call activity is finished, the system rings the station that originated the camp-on and starts a timer. The user of the originating station must take it off hook, and as soon as he or she does so, the camped-on telephone rings.

When the busy line becomes idle, the system rings the originating station and starts a timer. The user of the originating station must take it off hook before a preprogrammed time out occurs. As soon as he or she does so, the camped-on line returns dial tone to the originating station. If the originating user does not take his or her station off– hook before the time-out period elapses, the system cancels the camp-on. If, for some reason, the system cannot ring the camped-on facility after the user takes the originating station off hook, he or she hears busy tone and may camp-on again.

Camp–On—Call Waiting

If a user makes a call to a busy telephone, he or she can send a call waiting tone to the busy telephone and wait on line for an answer. As soon as the called telephone returns to idle, it will ring with the camped on call.

Also refer to the discussion titled *Call Waiting Tone.*

Camp–On—No Answer

Refer to the discussion titled *Camp–On With Automatic Call Back.*

Clear Major Alarm Ring

Major alarm rings occur whenever a number of faults exceed a programmed threshold. You can use a telephone station to clear a major alarm ring by pressing the INTERCOM button and then dialing a feature code (default code is #09). However, the telephone station must have a class of service (COS) assigned to it that has this feature enabled. The installer or programmer enables this feature through COS programming.

Central Message Desk

The programmer can designate one station as the central message desk and arrange for it to have exclusive message waiting control. A central message desk user takes messages for other system users, controls the message waiting light at their telephones, and delivers the messages upon request.

Also refer to the discussion titled *Message Waiting.*

Central Processor Switched Data Port Configuration

The CPU board provides a dual in-line pin (DIP) switch that enhances installer convenience in setting up data communications between the DXP *Plus* and an external data device. It is possible to mismatch the data port configurations between the DXP Plus and the external device in a manner that prevents data communications from occurring. The DIP switches provide a hardware way of setting the data configuration to a known set of parameters without the need for reprogramming the system. With the switch set to ON, the DXP Plus provides the following data parameters:

Parameter	Maintenance Port	Modem Port
Baud Rate In	9600	2400
Baud Rate Out	9600	2400
Data Bits	8	8
Stop Bits	1	1
Parity Bits	None	None
Flow Control	None	None

Common Audible Ringer Interface

Relay connections that provide dry-contact closure whenever ringing occurs are available on the central processor unit circuit board. The relay closure tracks the ringing pattern of the applied ring signal and is typically used to control an external ringer device. The installer can program the particular ringing assignment that is tracked, and the ringing assignment can be any one of those that are provided by the flexible ringing assignment feature.

Also refer to the discussions titled *Auxiliary Ringer Interface, External Paging Interface, Flexible Ringing Assignments, Line Answer From Any Station, and Night Transfer (Of Ringing).*

Communications Card Support

The communications card provides serial data ports for interfacing such items as open architecture interface applications, PC attendant positions, and the SMDA data printer.

Install communications cards on the services board, the expansion cabinet interface boards, and the main cabinet's auxiliary board. Each of these boards will accept two communications cards in its lower two slots.

The DXP Plus supports a maximum of 18 serial data ports. Two of these ports are the dedicated ports provided by the CPU board while communications cards provide the remaining 16 undedicated ports.

Conferencing - Multiline

This feature allows one station to access other stations or lines at the same time resulting in a conference arrangement. Users press the TRANS/CONF button to establish conferencing. Conference transmission levels are not affected by line loading.

A station user can make conference calls that encompass up to seven (32 total conferencing circuits) parties, including the originating station, in any combination of lines and system stations. For example, a user can conference his or her telephone with three lines and one other station.

After establishing a conference between his or her station and two external parties, the user can drop out of the conference by dialing a special code. The conference between the two outside parties continues in an unsupervised condition. During unsupervised conferences, a line-to-line connection exists through the system. The programmer can set the length of time that the system allows such a connection to continue.

Console Support

The DXP *Plus* supports the operation of a DSS/BLF console. The system installer must use a station port to install each DSS/BLF console; however, the programmer can assign up to four DSS/BLF consoles to support the operation of one system station. When assigned to a station, a DSS/BLF console provides additional programmable buttons that the user can program as direct station select (DSS) buttons with associated busy lamp field (BLF) lights and as speed dial buttons (the console, however, does not support second-level speed dialing). The programmer can also assign both outside lines and intercom numbers to console buttons when necessary. The station with which the console is assigned to work does not have to be a paired station port.

Consoleless Operation

The system can operate with or without the use of an attendant console.

Consultation Hold

When the station user presses the TRANS/CONF button while on a call, the call is placed on consultation hold and dial tone is returned to the station. The user may then make another intercom or line call. After speaking with this "consulted" party, the station user may do any of the following: (1) return to the held call by selecting the line or intercom number for the held party, (2) effect a conference by pressing the TRANS/CONF button (putting the held call, the consulted party and the station user in conference), (3) hang up and effect a transfer of the held party to the consulted party. If the user encounters a busy or a ring no-answer, he or she may press the TAP button to return to the held party.

Transfer considerations:

- The system default denies line-to-line transfers.
- To make an unscreened or blind transfer, press the TRANS/CONF button, dial the desired intercom number, and hang up.

Copy Model

Refer to the discussion titled *Block Programming*.

D

Database Program Storage

Programmers can save and restore the DXP *Plus* data base using the visual man machine interface (VMMI). They will find this feature useful for retaining existing operating parameters and later reloading this database after they upgrading the system's software.

Database Programming (From Main Station)

The system administrator can use a system telephone to reprogram certain feature parameters away from the values set by the installer using the computer-based VMMI. Included among the features that the system administrator can program are the ability to assign prime line, prime group, or prime intercom to the stations, and the ability to assign day and night toll restriction exception numbers to the stations.

Database Programming

System programmers employing the visual man machine interface (VMMI) program running on a DOS-based personal computer can customize the DXP *Plus* system parameters and change the system data base. The VMMI program causes the system to down load the existing database to the PC's memory where the installer can make additions and changes to database. While the installer is reprograming the database, the system allows users to continue to use their telephones but prevents them from making changes that affect the database's structure. As the installer makes the changes to the database, the VMMI program sends these changes back to the DXP *Plus* memory.

Day One And Day Two Ringing

Refer to the discussion titled *Flexible Ringing Assignments.*

Day Restriction Level

Refer to the Discussion titled *Toll Restrictions.*

Default Busy/Ring No-Answer Call Forward

The programmer can arrange for the system to automatically forward any calls that ring at busy telephones or any calls that ring and are not answered after a preprogrammed number of rings. The programmer chooses the station to receive those calls forwarded with this feature on a station-by-station basis; he or she can also program the number of rings (0-6) the system requires until it rolls the call to the forwarding station. The system defaults to four rings, three rings for voice mail ports. Users do not select this operating feature since it is fully automatic; however, user-enabled call forwarding overrides this default busy ring no-answer call forwarding.

Also see the discussions titled *Call Forward - All Or Personal; and Call Forward-Busy Ring No-Answer, All Or Personal.*

Default Functional Programming

At initial power up of the system, the system operating features consist of a specific group of conditions (default conditions). These default conditions provide a completely operational system for normal use. A system installer can leave the system in a defaulted state or reprogram it as desired. After reprogramming, a programmer can restore default conditions to the system at any time they are needed as follows:

- When a master clear is programmed, the entire system is restored to the basic default start-up operating mode. This action erases *all* customized program settings.
- When a system default is programmed, all system parameters and timing are reset to the basic start-up settings. *Plus*, system-wide customized data such as LCD messages and system speed dial numbers are erased.
- When line default is programmed, all lines are set to the basic operating parameters. Any lines that are now programmed for rotary dial are reset as tone dial.
- When station COS default is programmed, the station operating features are set to the basic operating mode.
- When button mapping default is programmed, each button at every telephone connected to the system is reset to the basic settings for that particular model of telephone. This means that all unique button functions are erased.
- When the table defaults are programmed, all customized data that the programmer has entered in any tables such as SOHVA groups and toll restriction tables are erased. See also—*Master Clearing The System.*

Delayed Ringing

Ringing assignments are programmable. A programmer can program a station to provide delayed ringing on some lines while providing direct ringing on other lines.

Diagnostics (Limited)

The installer can use this feature to perform maintenance routines and diagnose certain system malfunctions.

Dial 0 For System Attendant

A user can signal the system attendant station (station 101 at default or any other station set by programming) by dialing the digit 0 on their personal or group intercom number.

Dial Pulse Interdigit Time

You can set the interdigit time between dial pulses when the system pulse–dials a number over a line. The DXP *Plus* defaults this time to 200 milliseconds and provides a range of timing values in 100 millisecond intervals between 100 milliseconds and one second.

Dial Pulse Rate—Make / Break Ratio

You can set the line make / break ratio for rotary dial signaling in a more flexible manner. You can program the make and break times independently in one millisecond increments to any time from one to 99 milliseconds.

Dialed Number Identification Service (DNIS)

The DNIS feature allows the DXP *Plus* to read an inband DTMF digit string sent by a common carrier. It uses this information to identify the telephone number the caller dialed and appropriately route the call. DNIS is a service that long distance carriers make available for dial 800 and dial 900 number subscribers on trunks that use E&M signalling over a T1 network. Also see the discussion titled *Automatic Number Identification (ANI).*

Digital Wireless Telephone Support

The DXP Plus supports the operation of the Scout 900MX digital wireless telephone. The Scout 900MX is a full-featured proprietary multiline telephone consisting of a wireless handset that lets the user roam about and still make and receive telephone calls.

Direct-in Lines (DIL)

The direct-in lines (DIL) feature provides a line appearance at a dedicated button on one or more multiline telephones. The programmer can assign a DIL to a proprietary single-line telephone where it provides one-way (either incoming or outgoing) or two-way operation depending upon further programming action.

Direct Inward Dialing (DID)

DID Hunting

When a DID call rings at a station that the programmer has disabled though programming action, the system routes the call through the disabled station's hunt list until it locates a group intercom for the call to ring. Should all group intercoms be busy or should no one answer the call in a programmed number of rings, the system then routes the call along the station's call forwarding arrangement. With a hunt list containing up to eight assigned group intercoms and access to each group intercom available to several system stations, many users have an opportunity to service a DID caller. Coupling this flexibility with the station's call forwarding ability, provides many chances for system users to service DID calls. A programmer could program a hunt list and a call forwarding scheme to an unassigned station and provide a designated DID termination and routing center. There would be no need to connect a telephone to the station port to use the feature in this manner. The programmer could arrange several DID termination centers to service different DID numbers. Each DID number could represent different calling categories, and ring at different blocks of system stations (see Multipurpose Line Board for more information).

Direct Line Access By Station

Through program assignment, the system gives certain stations direct access to lines. The programmer must map line buttons for use at these stations. The users then press the line buttons to select lines for use.

Direct Line Group Selection

This feature allows the programmer to put lines into line groups. A line group appears to the station user as a single button. The system supports a maximum of 16 line groups with a line group containing any number of lines; however, all lines in a group must be the same type. A multiline telephone can have a line group button for each line group. A single-line proprietary telephone is either dedicated to a specific line group, or it's user may dial a code to access a line group.

When a user presses an idle line group button or dials a line group access code, the system scans the lines in that group and picks the first available line in a reverse hunt group. The indicator associated with the line group button on multiline telephones is idle if at least one line in the group is idle.

Direct Inward System Access (DISA)

DISA is a DXP *Plus* enhancement option that allows outside callers to directly call a station and access the internal system features, including all line groups and ARS. To prevent fraudulent access and unauthorized use, the caller must use an authorization code to gain access to outside lines as well as many of the advanced telephone features. The authorization codes are from one to six digits (including pauses). You can use any of the digits zero through nine.

The system denies access, and routes a DISA call to a pre-programmed device such as a station telephone, or proprietary voice mail, under the conditions listed below:

- a caller dialing an invalid authorization code,
- a caller dialing restricted or invalid features,

Comdial has taken reasonable steps in the design of all product features, including DISA, which protect against unauthorized or fraudulent access to, or use of, a system, or which protect against unauthorized, fraudulent or unaccounted-for access to, or use of, long distance lines. However, no system is entirely invulnerable or immune from unauthorized or fraudulent access or use, or unaccounted-for access or use, and therefore Comdial disclaims any and all liability, and makes no warranty, express or implied, relating to unauthorized or fraudulent access or use, or unaccounted-for access or use.

NOTE: DISA is not recommended for use on loop start lines without disconnect supervision. While DISA will function, Comdial will not be liable for its performance under any condition where disconnect supervision is not provided.

Disconnect Supervision

When the programmer enables this feature for a line, the system detects any break in loop current anytime during a call and disconnects the line. Also refer to the discussion titled, Abandoned Hold Release.

Discriminating Ringing

The system provides two types of ringing to give an audible distinction between internal and external calls. Internal calls sound two quick bursts every four seconds and external calls sound one long burst every four seconds, except when synchronized ringing is enabled. When synchronized ringing is enabled, the central office ringing pattern is tracked on external calls. Incoming calls transferred by an attendant always ring as an external call.

Do Not Disturb (DND)

Users can set any multiline telephone to a do not disturb mode (DND) using the designated programmable button. The associated indicator turns on as an indication of active DND *Plus* an appropriate message appears in the display of LCD speakerphones. Under the DND condition, an outside call forwards to another station or to the attendant according to the call forwarding feature. An intercom number call will not ring a DND station and the system sends a fast busy signal to the caller to distinguish from a standard busy line. No paging announcements are received on the DND station. Even though a station is in the DND mode, the user can make out-going calls and access other features.

You can set any multiline telephone to a do not disturb mode using the designated programmable button. The associated indicator turns on as an indication of active DND *Plus* an appropriate message appears in the display of LCD speakerphones. Under the DND condition, an outside call forwards to another station or to the attendant according to the call forwarding feature. An intercom number call doesn't ring a DND station and the system sends a fast busy signal to the caller to distinguish the DND condition from a standard busy line. No paging announcements are received on the DND station. Even though a station is in the DND mode, you can still make outgoing calls and access other features.

You can enable or disable this feature on an industry-standard telephone by dialing the feature code (default is #01).

Do Not Disturb (DND) Inhibit

The programmer can inhibit DND on a station class of service basis.

Do Not Disturb (DND) Override

The programmer can provide stations with a Do Not Disturb (DND) override capability that will allow them to call a station that is set in the DND mode. The programmer must also enable the executive override feature for the DND override feature to function. Refer to the discussions titled: *Do Not Disturb and Executive Override.*

DSS/BLF Console Support

The DXP *Plus* system supports the use of both digital and analog proprietary DSS/BLF consoles. The installer can place a console at any station port and use database programming to identify it as a console port. The installer then uses database programming to enable the console to be a companion to a telephone that he or she has installed at any other station port. The system supports the use of up to four consoles for each telephone, and there is no limit to the maximum number of consoles that it will support.

The DSS/BLF console provides a one-button direct station selection (DSS) intercom and an associated busy lamp field (BLF) *Plus* additional autodial capability to the telephone user.

DSS Status Button

When the programmer assigns the personal intercom number of one telephone to appear at a button on another telephone, the button and its associated light provide a direct station select (DSS) busy lamp field (BLF) feature. With this feature, the user can monitor the status of the appearing station. If the programmer also assigns a DSS status button to the telephone, the user can press it to select between monitoring all of the telephone status or just its personal intercom status.

Also refer to the discussion titled *Intercom Number.*

Digital Voice Announce

The DVA is a line-powered device that provides voice prompts for auto-attendant and transfer, or you can use it to enhance the operation of DISA and Tracker. However, you *must* have DISA assigned for DVA to function. The DVA is designed to interface with a digital station port and is easy to install and program. You perform all DVA programming through the "Attendant Level" programming, though there are some DXP *Plus* programming steps as well. It isn't necessary to send DTMF or ringing signals to the unit to activate it because the DISA programming determines the DVA's actions. When you use DVA in conjunction with DISA, the DXP *Plus* automatically answers CO lines and guides callers with voice prompts.

Connect the DVA to any vacant digital station port. The DVA self-identifies to the CPU in the DXP *Plus*, so you don't have any phone-type programming to do.

The DVA accepts and stores up to four recorded messages, with a total maximum recorded time for all messages of two minutes. The system attendant or installer can divide this two-minute period as necessary among the four messages or use the entire two minutes for one message. These pre-recorded messages play during an in-process call. Single digit dialing is allowed during each of the four prompts. The system attendant or installer can store the customized messages (prompts) into the DVA device by delivering them from the attendant's station. The DVA interfaces with the DXP *Plus* through any of its unused digital telephone station ports. The maximum number of DVA units you can install is limited only by the number of DXP *Plus* station ports (480). If you install multiple DVAs, the DVA functions as an automatic attendant, and it enhances the operation of direct inward system access (DISA) by providing automated voice prompts and dialing instructions to callers. In general, the voice prompts are of the categories listed in the examples following this description.

You control the day versus night messages by programming the day 1, day 2, and night ringing begin and end times in the system parameters menu. The system goes into the night mode either manually by the attendant or automatically each day when the programmed times occur. When the system is in the night mode, the night menu message plays versus the day menu message; likewise, the night routing message plays versus the day routing message.

Message types, such as welcome greetings and recall-no-answer messages are indexed within the system by a two-digit number (example: *10* = Welcome Greeting 1, *11* = Welcome Greeting 2, and so forth).

A single-digit number appended to many of the message-type names (example: Welcome Greeting ***1***, Welcome Greeting ***2***, and so forth) is used for grouping similar types of messages together to prompt callers. For example, a company sharing the telephone system with several departments may assign all messages in group 1 to the sales department and all messages in group 3 to the customer service department. This allows DISA lines coupled with voice prompt 1 to seek welcome group 1, and DISA lines coupled with voice prompt 2 to seek welcome greeting 2, for departmental applications.

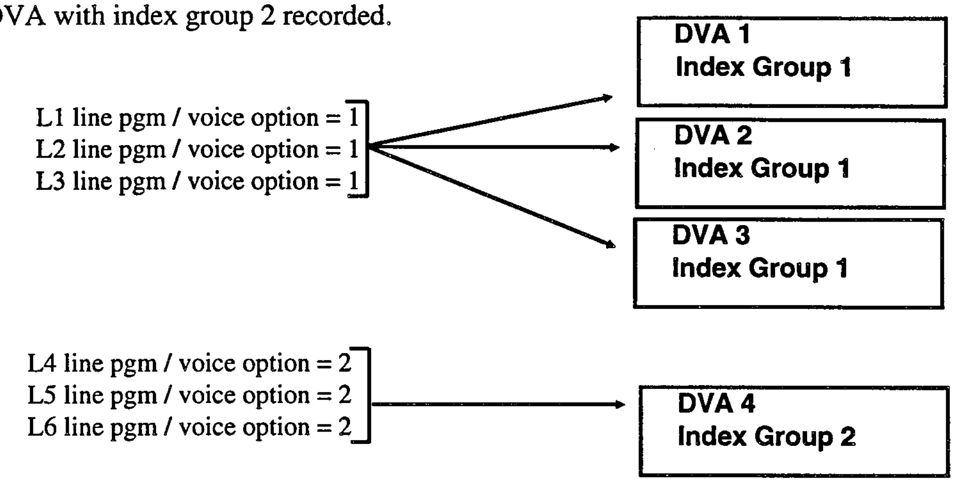
When programming DVA voice menus (example, press 1 for sales, 2 for customer service ...), you can also enter feature codes as well as intercom numbers in the Voice Digit Translation menu. For example, if you have installed the Tracker Paging System option, you can program the Tracker Pager access code (*8) into one of the single-digit translation locations. This allows callers to track the called party by pressing the appropriate single-digit button on their telephone when prompted by voice message. The caller then enters his or her call-back number and the # symbol to complete the page.

NOTE: DVA prompts are shared; for example, if you make eight different recordings, with two DVAs, they will be distributed in both units. If one DVA fails or is removed, then only the remaining messages will play.

DVA continued on next page. . .

DVA Continued . . .

Lines are associated with DVAs by "Line Pgm," DVA voice option. For example, in the diagram below, lines 1, 2, and 3 are programmed for "voice option 1" and will be answered by any DVA unit with index group 1 prompts recorded. Lines 4, 5, and 6 are programmed with voice option 2 and will be answered by the DVA with index group 2 recorded.



The following are examples of DVA voice messages.

Welcome greeting

This greeting identifies your company or business. *Example: "Welcome to Acme Company, one of our agents will be with you as soon as possible."*

Day message

This message represents the main menu prompt used during normal daytime hours.

Example 1: "If you know your party's extension, dial it now; otherwise, stay on the line—an operator will be with you shortly."

Example 2: "To reach engineering, dial 1; to reach customer service, dial 2; to reach sales, dial 3; otherwise, stay on the line—an operator will be with you shortly."

Night message

The night message is used after normal business hours have ended. Example: "Our office hours are from eight to five. Please call back tomorrow."

Recall no answer messages

Whenever a station is dialed from a DISA line and is not answering, the system plays a recall no answer message to the caller. *Example 1: "The party you have reached is unavailable at this time." Example 2: "The party you have reached is unavailable at this time. Dial 1 followed by your call-back number and pound symbol to track the called party or dial 2 to leave a voice message."*

NOTE: In example 2, the installer must install the Tracker Paging System and proprietary voice mail options.

Recall busy message

Whenever a station is dialed from a DISA line and is busy, the system plays a recall busy message to the caller. *Example: "The party you have reached is unavailable at this time—please dial another extension or dial zero for the operator."*

Hold message

This prompt is used during DISA calls and is activated when the called party is being paged with the Tracker Paging system. *Example: "The party you have reached is being paged—please hold."*

DISA authorization code message

This message prompts callers to dial their DISA authorization code. Example: "Please enter your authorization code at this time."

Feature access message

Before a caller using a DISA line can access system features, he or she must dial the proper feature code.

Example: "The following features are available. Dial *01 for system speed dial access, *8 for Tracker Pager, or hold and you will be assisted by an operator.

Drop message

This prompt is used when a DISA call cannot be completed (not enough system resources available, wrong access code dialed, or feature dialed is busy).

NOTE: The call is not routed to the attendant–the message plays, then reorders.

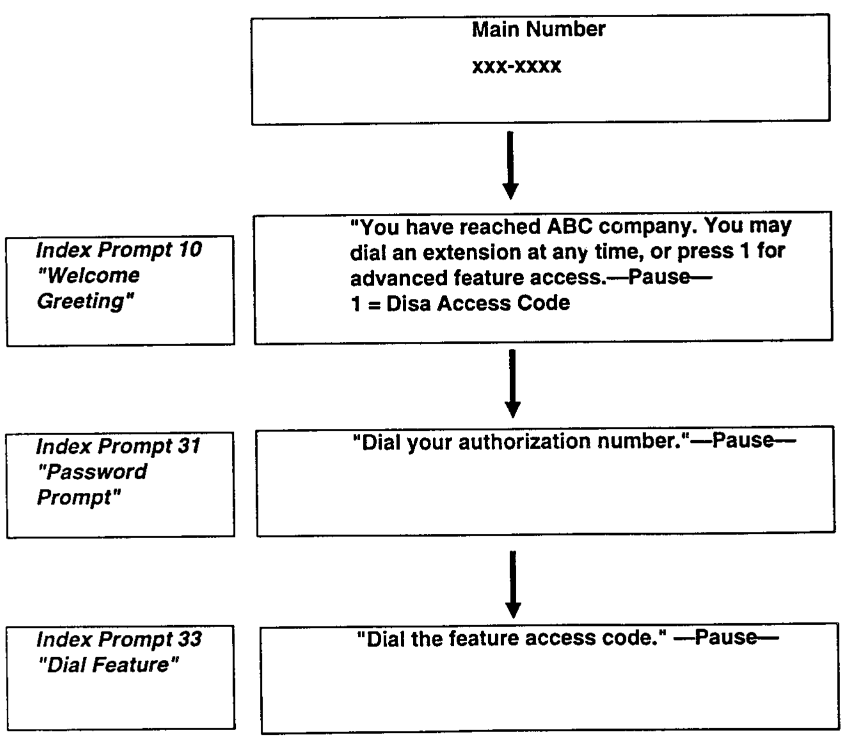
Example: "Your call cannot be completed at this time. Please try again."

DVA / DISA

You can enhance the security of DISA by using the DVA. The DXP *Plus* seizes the incoming call based on the "DISA assignment" parameters, and the DVA plays the appropriate prompts to enhance the following.

DISA access code,
Authorization code,
Feature access code.

For example:

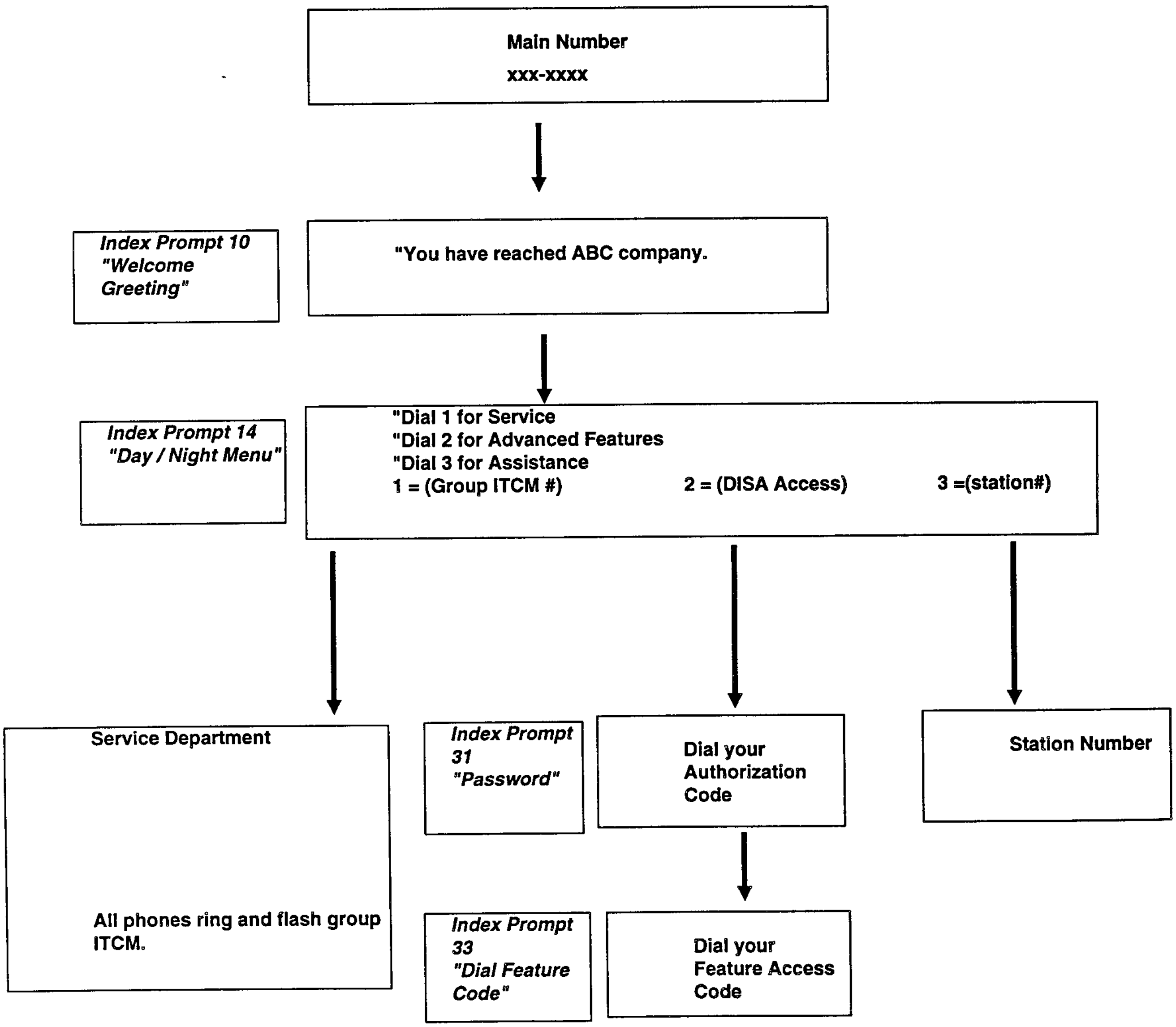


DVA/ Auto Attendant with Single Digit Menu

The DVA functions as an auto attendant, giving callers single-digit dialing options. The DXP *Plus* seizes the incoming call based upon the "DISA assignment" parameters, and the DVA plays the appropriate prompts.

Welcome Greeting
Day Main Greeting--Menu choices
Recall Busy
Recall No Answer

For example:



DVA / Tracker

The DVA gives caller's single digit dialing access to the Tracker paging system. The DXP *Plus* seizes the incoming call based upon the "DISA assignment" parameters, and the DVA plays the appropriate voice prompts.

Welcome Greeting
Day Main Greeting—Menu choices
Recall Busy
Recall No Answer

For Example:

Main Number
xxx-xxxx

Index Prompt 10 "Welcome Greeting"

"You have reached ABC company.

Index Prompt 14 "Day / Night Menu"

"If you are calling from a tone-dial telephone, you may dial the extension number at any time."

Index Prompt 22 "Recall No Answer"

"I'm sorry, that extension doesn't answer.
Dial 1 to Track;
Dial 2 to leave a message with the attendant;
Dial 3 to leave a message in the voice mail box

1 = *8 2 = Extension Number 3 = Voice Mail Port number

Index Prompt 26 "Recall Busy"

"I'm sorry, that extension doesn't answer.
Dial 1 to Track;
Dial 2 to leave a message with the attendant;
Dial 3 to leave a message in the voice mail box

1 = *8 2 = Extension Number 3 = Voice Mail Port number

Dynamic Save Button

Unprogrammed buttons at multiline telephones are available for the user to dynamically save dialed numbers. To save a number, the user presses any unprogrammed button before hanging up after he or she has dialed a number. To dial the saved number, the user presses the same button and the system automatically dials the saved number. Saving a number over a previously saved number erases the old one and stores the new one in place of it.

E

E & M Tie Line Support

Extension Hunting

When an E and M tie line call rings at a station that the programmer has disabled though programming action, the system routes the call through the disabled station's hunt list until it locates a group intercom for the call to ring. Should all group intercoms be busy or should no one answer the call in a programmed number of rings, the system then routes the call along the station's call forwarding arrangement. With a hunt list containing up to eight assigned group intercoms and access to each group intercom available to several system stations, many users have an opportunity to service an E and M tie line caller. Coupling this flexibility with the station's call forwarding ability, provides many chances for system users to service E and M tie line calls. A programmer could program a hunt list and a call forwarding scheme to an unassigned station and provide a designated E and M tie line termination and routing center. There would be no need to connect a telephone to the station port to use the feature in this manner. The programmer could arrange several E and M tie line termination centers to service different extension numbers. Each extension number could represent different calling categories, and ring at different blocks of system stations (Also see *Multipurpose Line Board Support*).

End-to-End DTMF Signaling

The system accepts DTMF tones or digital signals from proprietary telephones and sends them as DTMF tones through the public telephone network where they are received at a distant end for computer, voice mail, or other peripheral feature access.

End-to-End Signaling On Intercom

After establishing an intercom call, the system can continue to send and receive dialing signals (DTMF tones) through the intercom path. This feature can be performed from every station in the system and is used by peripherals such as a VMI–X or ATI–D–1PT accessory unit for voice mail.

End-to-End Signaling On Lines

After a user has established an outside call, the system can continue to send dialing signals (DTMF tones) through the public switched network and have them received at the distant end for inward call completion (bank by telephone, voice mail). Users can perform this conventional, on or off-hook dialing feature from every station in the system.

Enhanced Line Appearance

Refer to *Line Appearance, Enhanced*

Exclusive Hold

Refer to *Hold, Exclusive*

ExecuMail Integration

The DXP Plus supports the ExecuMail voice mail system through an appropriate interface device. The ExecuMail system provides voice mail boxes where callers can leave messages to station users when the users are not available to answer their telephones. The ExecuMail system camps incoming calls that encounter busy ports so that they can recall when a voice mail part becomes available.

Also refer to the paragraph titled *Voice Mail Integration Digits.*

Executive Override

This feature allows the user of a station, upon encountering a busy signal at another station, to dial a special code that will override the busy condition, sound a warning tone, and allow caller access to the existing conversation.

Conditions for executive override are as follows:

- Calling station has class of service that enables busy override.
- Calling station is switched to override voice path.
- Called party may respond and will be heard by calling station and outside party.
- When the calling party dials the override code, the called party receives several tone bursts.

Also refer to the feature discussion titled *Do Not Disturb.*

Executive Override Block

As a class of service feature, the programmer can block executive override at a station. When a station is blocked, a caller cannot override a busy condition and break into an on-going conversation at the called station.

Extended DTMF Tones

The installer can program the length of the DTMF tones associated with automatically or manually dialed numbers on analog telephones. This feature allows the system to access equipment such as answering machines, banking computers, voice mail equipment, that requires DTMF tones longer than the defaulted 80 msec. tone. To use the feature, the user programs the digits that require longer DTMF tones into speed dial locations or waits until the DTMF dialing time threshold exceeds the limit.

Extended DTMF Tones For ExecuMail

The programmer can set different DTMF tones for ExecuMail Stations. The system defaults the length to 80 msec., but the programmer can set other tone lengths as needed.

External Paging Interface (External Paging Port)

The external paging port, available on the services circuit board, provides an interface for external paging equipment. When the programmer assigns the external paging port to a paging zone, announcements to that zone are sent through the external paging equipment installed at the port. When the programmer assigns one of the relays that are available on the central processor unit circuit board to the paging zone, it provides a dry-contact actuation for the duration of the page to that zone. Typically, the installer wires the system so that this actuation enables the external paging equipment while the paging signal is sent through it.

The programmer can program a line port as an external paging interface for an external paging amplifier. When this feature is available, station users access the amplifier by selecting that line port. The paging line port accepts dialed DTMF tones to make a zone selection if the amplifier provides this function. When the programmer assigns a flexible ringing assignment to the external paging port, the external paging equipment responds to a ring signal and sounds the ringing over the paging loudspeaker. The programmer can assign one of the common audible ringer interface relays to track the ring signal that is supplied to this external paging port. Typically, the installer wires this relay so that its contact actuation enables the paging equipment.

Also refer to the discussions titled *Auxiliary Ringer Interface, Common Audible Ringer Interface, Flexible Ringing Assignments, Line Answer From Any Station, and Night Transfer (Of Ringing)*

F

Feature Inhibit

The programmer can disable a large array of individual features to provide a very basic telephone system when it is necessary. A basic system might be necessary at a site where a large proportion of the telephones are accessible to unauthorized users that may use them to tamper with the system, or such a system may be necessary for locations where users only need a narrow range of features to do their job.

Feature Renumbering

While the dialing codes for personal and group intercoms and for feature access are set by system default, they are flexible, and the programmer can renumber them when necessary. Feature renumbering may be necessary if personal or group intercom numbers must be in a certain block or sequence to match some site requirement (for example, numbering all telephones located on the third floor with 3nnn numbers). If a new number assignment conflicts with a defaulted dialing code, the defaulted code can be reassigned into a block of unassigned numbers set aside for that purpose.

At default, the blocks of numbers are as follows:

1001 – 1480 = personal intercom

4001 – 4480 = group intercom
5000 – 5039

6000 – 8999 = feature codes

5040 - 5999 = unassigned codes

9 = line group 1

The programmer can reassign any number between 1 and 9999 to any intercom or feature code in any combination of three- or four-digits; however, the assigned numbers must not conflict with one another. For instance, if 2111 is assigned as an intercom number, there cannot be any intercom or feature code numbered 21, 21n, or 21nn. Similarly, since 9 is defaulted as the code for line group one, there cannot be any intercom or feature code numbered 9n, 9nn, or 9nnn.

Flexible Ringing Assignments

The programmer can arrange ringing assignments for every station. He or she can arrange for this ringing to sound immediately as soon as the call appears on specified lines at a telephone (direct ringing) or after a system imposed delay (delayed ringing). Further, he or she can arrange for a telephone to ring when calls appear on specified lines during certain periods of the day or night. To program for flexible ringing, the programmer assigns lines to the direct and delayed ringing modes. He or she also divides a 24-hour period into three time blocks designated as day 1, day 2, and night mode and assigns lines to each of these categories. The programmer then assigns the direct, delayed, day 1, day 2, and night mode ringing designations to the various stations.

During the day 1 time period, calls on lines assigned to direct, delayed and day 1 categories all ring. During the day 2 time period, calls on lines assigned to direct, delayed and day 2 categories all ring. During the night time period, calls on lines assigned to delayed and night both ring.

The system also provides a manual night transfer (of ringing) feature that the attendant activates by dialing a code or pressing a preprogrammed button. While this feature is active, calls on lines assigned to delayed and night ringing both ring at the various stations; however, no other ringing occurs.

Also refer to the discussions titled *Auxiliary Ringer Interface, Common Audible Ringer Interface, External Paging Interface, Line Answer From Any Station, and Night Transfer (Of Ringing).*

Flexible Ringing Assignment Of The External Paging Interface

Refer to the discussion titled, *External Paging Interface.*

Flexible Station Numbering Plan

Refer to the discussions titled *Feature Renumbering* and *Intercom Number.*

Full Button Programmability Of Features

The programmer, and often the telephone users themselves, can make frequently dialed feature codes available at programmable buttons by storing the specific access codes necessary for dialing the features. They can store every feature access code, except those requiring TRANS/CONF button action, in a continuous string including button actuations and keypad digits up to a maximum of 16 digits per programmable button.

Also refer to the discussion titled *Programmable Button Flexibility.*

G

Group Intercoms

Refer to the discussion titled *Feature Renumbering* and *Intercom Number.*

Ground Start Line Support

Refer to the discussion titled *Multipurpose Line Board Support.*

H

Handsfree Answer Inhibit

The MUTE button on a multiline telephone will block all handsfree answerback response. This arrangement prevents a station user from monitoring another station site using the monitoring ability of the voice announce feature. When a user presses the MUTE button at his or her telephone, all handsfree answerback is disabled thus inhibiting any off-site monitoring. The mute light will remain on to indicate that this feature is active on digital telephones. On analog telephones, the monitor light will flash. Also refer to the discussion titled *Mute.*

Handset Volume Level (On Impact Telephones)

The installer can program the handset volume feature on Impact telephones to offer the station user more choices when selecting the handset volume level locally from his or her telephone. Normally, users have up to 8 volume levels that they can select. However, this programmed feature increases the user's handset volume choices to 13.

Headset Compatibility

Some proprietary multiline telephones are equipped with a headset jack. The programmer can enable a station port to allow headset operation with these telephone models. The programmer assigns, or in some cases the user can program, a programmable button at the telephone that the user can press to enable/disable headset port operation.

Hold

This feature allows a user to temporarily disconnect from a current call yet retain it so that it can be retrieved. When users place a call on hold, they are free to use their telephones for other calls or features and then return to the held call. At a multiline telephone, the user can put a call on hold manually, by pressing a HOLD button, or automatically (if programmed), by pressing another line button. Further, when a user presses the TRANS/CONF button to transfer a call, the system places the call on hold. The user can place a call on hold in either an exclusive or non-exclusive manner. Exclusive hold prevents a user at another telephone from retrieving a call held on a shared line. Non-exclusive hold allows any telephone that has line appearance of the held call to pick it up. The transfer hold is an exclusive hold condition. When a user answer a call on a group intercom and places it on hold, the system keeps this call on hold on the group intercom. This means that the user who placed the call on hold or any other user with access to that group intercom can pick up the held call.

The programmer must program each multiline telephone for manual or automatic and exclusive or non-exclusive hold. When he or she enables automatic hold at a telephone, it does not prevent users from using manual hold.

Also refer to the various discussions headed *Automatic Hold...* .

Directed Station Hold

This feature allows station users to pick up the last call a user placed on hold at another station. This feature does not allow users to pick up exclusive hold calls or calls that are in the process of being transferred. Also, the feature does not allow users to send a directed call hold to a station where its user is scanning the currently held calls. In addition, this feature allows users to place a call on hold at another station and have this call appear to be the one that has been on hold there for the longest time. Features such as hold recall apply to the station that sent the directed call hold and not to the station that received the directed call hold.

Hold, Exclusive

Exclusive hold prohibits a user from retrieving a held call at any station other than the one where it was placed on hold. The exclusive hold condition also links the held call to the timed hold recall timeout feature. After timeout, audible and visual signaling occurs and the exclusive hold condition reverts to a normal hold condition. The programmer enables or disables exclusive hold as a class of service feature.

Hold Queuing

The hold queuing feature allows a station user to put multiple lines on hold. The LCD speakerphone user can scroll through this queue of held calls by repeatedly pressing the HOLD button. The numbers or names of the held lines are shown on the LCD display. When the desired line appears on the display, the user presses TAP to retrieve it.

Hold Time Reporting

A programmer can arrange for the SMDR/SMDA parameters to convey either the cost of calls that the stations make or the amount of time that lines have been on hold at the stations. This time includes the actual hold time as well as the time waiting for transfers and conferences to be completed.

Hot Transfer

A hot screened call transfer allows users to first announce and then transfer both line and intercom calls from one telephone to another in a special manner. Once users have announced that they are transferring a call to another telephone, they can then take action to make the transferred call appear at the other station as if that user has already answered it. If the recipient of a hot transferred call is using a speakerphone, he or she merely begins the conversation with the distant party. If the recipient of the hot transfer is using a monitor telephone, he or she must lift the handset to reply to the distant party.

Also refer to the discussion titled *Call Transfer - Screened.*

I

I Hold And I Use Indications

The light associated with a line button provides a visual indication of the status of that line. When a user has a line in-use or on-hold at his or her telephone, the light indication provided is of a different flash rate than the indication provided at the other telephones in the system.

Idle Line Preference

With idle line preference, a telephone automatically connects to an assigned outside line that is idle and arranged foı this feature. Connection occurs as soon as the user lifts the telephone handset. He or she does not have to press a line button.

The programmer assigns idle line preference to a station class of service and then assigns that class of service to a particular telephone. He or she also assigns the lines that are associated with the feature and the priority that these lines are to be available. If the programmer enables this feature and the prime line automatic feature together, the user gets his or her prime line upon going off-hook or an idle line if the prime line is in use.

Also refer to the discussion titled *Idle Line Priority.*

Idle Line Priority

When a programmer arranges for a telephone to have idle line preference he or she also specifies the order in which the idle lines are given to the station. Also refer to the discussion titled *Idle Line Preference.*

Industry Standard Telephone Support

The DXP Plus supports industry standard (IST) telephones.

Distinctive Ringing

An industry–standard telephone can sound one ring cadence for intercom calls and another for for outside calls. You must select the ringing style in station class of service programming.

DTMF Receiver–Time-out

You can program the amount of time that the system waits to receive a DTMF tone on an industry–standard telephone. The DTMF receiver–timeout feature applies to the time between a user's lifting the handset and pressing a dialpad digit.

Do Not Disturb (DND)

You can dial a feature code (#01 by default) from your industry standard telephone and put the telephone into a do not disturb (DND) condition. While in this condition, an outside call forwards to another station or to the attendant according to the call forwarding feature. An intercom call will not ring the DND station and the system sends a fast busy signal to the caller to distinguish the DND from a standard busy line.

Flash Time

The flash time is the timed length of the signal delivered when a user presses the hookflash (or TAP) button. The installer can program both the minimum and maximum times that define the IST flash.

Hold Confirmation

Hold confirmation allows the industry–standard telephone users to have positive tone feedback while on hold.

Offhook Treated As Busy

When an industry-standard telephone user takes the telephone's handset off hook, the IST station appears busy to the system. This feature prevents the system from ringing an IST station while the station is idle and off hook making it unable to sound audible ringing.

Message Wait Retrieval Access Code

This feature allows IST station users to respond to a message waiting condition without using the central message desk. They do this by dialing a special intercom feature code that lets them respond directly to a waiting message.

Ring Frequency

The system programmer can set a ring frequency of 25 Hz for international applications or set a ring frequency of 21 Hz for domestic applications. He or she must choose a setting that matches the frequency of the installed ring generator.

Ring Patterns

Installer can program the ringing pattern for either IST ring mode one or IST ring mode two. Mode one causes a two-second ring phase while mode two causes a shorter one second ring phase. For this feature to function properly, the industry-standard telephone interface board must contain firmware revision 2C

Ringing on Busy

When an industry–standard telephone is busy on a call and another call comes to that telephone, the system sounds three quick tone bursts to the telephone's handset receiver. You must program the ringing on busy feature.

Industry-Standard Telephone Support continued on next page . . .

Industry-Standard Telephone Support continued . . .

Ringing Time-out

You can program the number of times that the system sends a ring signal to an industry–standard telephone on a system wide basis.

Ringing Patterns

The ringing pattern can be changed. Additionally, firmware revision 2C or higher must be installed on the DXIST (industry-standard interface) board. A ringing pattern (mode 2) with pulse durations half the normal ones (mode 1) can be programmed. This results in shorter ring phases of one-second duration.

Ringing Per Phase

Installers can bridge two ISTs at a single station port but the telephones share the same intercom number. When installers do this, it reduces the number of ISTs that can ring simultaneously from 96 per cabinet to 48 per cabinet. Bridged ISTs require programming action to match the systems ringing requirements to the installation parameters.

Ringing Time-out

You can program the number of times that the system sends a ring signal to an industry-standard telephone on a system-wide basis.

Subdued Off-Hook Voice Announce (SOHVA)

Users can perform a SOHVA from any telephone to an industry-standard telephone if the installer has programmed the IST in the SOHVA tables according to the SOHVA feature. Users can SOHVA the IST whenever it is busy on a line or the intercom. The IST user can not respond to a SOHVA call and his or her outside party will hear the SOHVA caller's voice.

Station Lock

This feature allows you to lock any local industry standard telephone (IST) being used with a DXP system. You enable this feature by dialing the feature code (default is #04) followed by your authorization code. You disable this feature by dialing only your authorization code after hearing the "enter your authorization code" fast tone. Your authorization code is programmed into the system by the installer. Also refer to the discussion titled Authorization Codes.

When this feature is enabled, access to lines and features on your telephone are denied to other users until you unlock or disable this feature.

Interactive Button Support

The system supports three interactive buttons on LCD speakerphones. These buttons and their associated expanded display messages provide quick easy access to system features and straight-forward button programming without the need for dialing codes.

Intercom Hunt List

You can place personal intercom and group intercom numbers in a hunt list. When a user makes a call to a busy hunt list number, the system searches the list for an idle number to ring. The system allows you to place up to eight intercom numbers in a hunt list, either all group intercom numbers or one personal and seven group numbers. Refer to *Intercom Number—Intercom Hunt List.*

Intercom Number

The DXP *Plus* system provides intercom support in several ways as described in the following paragraphs. The system provides 480 personal intercom slots and 520 group intercom slots for a total of 1000 available intercom slots.

Personal Intercom Number

The system assigns a unique personal intercom number to every station, and the user of that station has exclusive use of that intercom number for making calls. However, telephone users can answer personal intercom calls that ring at another telephone or pick up non-exclusive calls that are on hold there. At default, the personal intercom appears on a telephone at the intercom button, but it can appear at any button that the programmer maps for that purpose. Personal intercoms can hunt to other personal or to group intercoms, depending upon programming.

Group Intercom Number

Group intercom numbers are those that are shared for use by several stations. Any time someone calls a group intercom number, *all* stations assigned to the number will ring. The programmer, through station programming methods, enables a station's ability to answer and originate calls on a group intercom number. He or she also maps the buttons on a telephone at which the group intercom numbers are to appear. The lights associated with these buttons show activity status of the group intercom numbers. In addition to normal intercom activity, a group intercom can show the appearance of a line that normally does not appear at the telephone (such as one carrying a transferred call). Group intercom numbers can appear in intercom hunt lists; however, a particular group intercom number can appear in only one hunt list at a time.

When a user selects a group intercom and dials a line group code to select a line or dials a code to retrieve a call from a park orbit, the system places the subsequent line appearance on the group intercom that the user preselected. the line appearance remains at that group intercom until the user finishes his or her call, parks it, or transfers it to another telephone.

Station Monitoring

The programmer can make the personal intercom number of one telephone appear at a button on other telephones in the system. Users at those telephones can use the light associated with this button to monitor the idle/busy status of that telephone and press the button to make a call to the idle monitored telephone.

The degree of monitoring that users can do is determined by whether the station monitoring feature that is assigned to the telephone is on or off. The type of monitoring that they can do is determined by whether their telephones have a status button that they can use to choose one type of monitoring in place of another.

When the station monitoring feature is off, the status light shows the state of the monitored telephone. If the user's telephone has a status button, he or she can press it to show the busy/idle state of just the personal intercom number of the monitored telephone.

When the station monitoring feature is on, the status light shows activity status (idle, ringing, busy, and hold) of the monitored telephone.

The programmer must map a telephone button for each personal intercom that is to appear and, if desired, map a status button for the user to switch between the types of monitoring. Also, she or he must enable station monitoring as a class of service feature and assign that class of service to those telephones where monitoring is required.

Intercom Hunt List

The programmer can group up to eight intercom numbers together at an individual telephone to form an intercom hunt list. The eight numbers can include one personal intercom number and seven group intercom numbers or eight group intercom numbers.

When someone calls a telephone and it is busy, the call will go to the first idle number in that telephone's hunt list and then ring every telephone that has access to that number. An outside line call to a busy telephone will always go to the hunt list; however, an intercom call will not. To make an intercom call route to the hunt list, the programmer must include the personal intercom number of that telephone in the hunt list. The system will not allow you to assign a group intercom number to more than one hunt list at a time.

When a user has set his or her telephone to forward just prime line and personal intercom calls, those calls will forward while any other calls to that telephone will go to the hunt list. When a user has set his or her telephone to forward all calls, then all calls forward and none go to the hunt list.

Also refer to the discussion titled *Feature Renumbering.*

Intercom Time-out

Should the user select the intercom for use and then perform no dialing or other action, the intercom will timeout after 10 seconds (at default) and return the telephone to an idle state.

Intercom Call Progress Tones

Internal call progress is marked by the following special tones: Dial tone sounds steady; ring back tone sounds one second on and three seconds off; tone signaled internal call sounds a two-tone burst every four seconds at a called station and returns to the caller as ring back; voice signaled internal call sounds a single tone burst at a called station and returns to the caller as two tone bursts; busy tone sounds one-half second on and one-half second off at the calling station, and do not disturb tone sounds a fast busy tone when the called station is in the do not disturb mode. (The system only supplies OPX ports with the regular busy tone since fast busy tones could interfere with the operation of some accessories that can be connected to these ports).

Intercom Inter-Digit Dialing

A timer begins timing out after the dialing of each number during intercom number dialing. It also begins a timeout whenever the station user accesses the intercom number path and does not dial any digits. When the timer times out, the system returns the station to an idle state.

K

Key/Hybrid Configuration

Either key system or hybrid configuration is available with the DXP *Plus* digital communications system. Whenever the programmer assigns outside lines into line groups and gives individual stations access to those line groups, the system automatically places itself into the hybrid configuration mode. The installer does not have to make any physical adjustment to the equipment to achieve the hybrid configuration mode. The Federal Communications Commission rules and regulations, Part 68, designate a fully protected hybrid configuration as an MF equipment type category and a key system configuration as a KF equipment type category. The installer must report the appropriate category registration number to the telephone company. Operationally, the hybrid configuration enables a PBX feature that may incur a higher monthly tariff to the telephone company.

L

Last Number Redial

The system provides each station with a last number redial feature. This feature saves 16 digits of the last outside number dialed at the station. A newly dialed number always replaces a previously dialed number. When the user presses the last number redial button, the system will choose a line and redial the saved number. The system will choose the last line used and redial the number. If the last line used is busy or is unavailable, the system will choose the prime line. If they both are unavailable, the system will choose any line assigned to idle line preference. If this is busy or unavailable, no further system action is taken; you must hang up and retry later when a line is available.

Line Access Restriction

Refer to the discussion titled *Access Denied.*

Line Answer From Any Station (TAFAS)

The programmer can assign one or more of the four relays, which are located on the central processor board, to track the ring signal on any or all lines that he or she assigns to them. The programmer can arrange for the tracked ringing to be during the direct, delayed, day 1, day 2, or night ringing modes. Typically, the installer wires a relay so that its contact actuation causes an external bell or other device to sound. Station users can hear an external ringer and dial a code. When they do this, the system allows their stations to answer any line that the installer has assigned to that external ringer through the relay programming. Since each site installation can be unique, the installer must explain to the users which dialing code answers which external ringer.

Also refer to the discussions titled *Auxiliary Ringer Interface, Common Audible Ringer Interface, External Paging Interface, Flexible Ringing Assignments, and Night Transfer (Of Ringing)*

Line Appearance, Enhanced

When a telephone user selects a group intercom and dials a line group code to select a line or to retrieve a call from a park orbit, the system places the subsequent line appearance on the group intercom that the user preselected. The line appearance remains at that group intercom until the user finishes his or her call, parks that call, or transfers it to another telephone.

Line Groups

The programmer can assemble and program outside lines together in up to 16 different line groups. Users can access each group by dialing a different access code or by pressing a line group button. The programmer can use this feature to reserve certain lines for certain clusters of stations for a tenant-service arrangement.

Line Group Access

The programmer can assign certain line groups to certain stations for call origination purposes. Stations may also be denied access to certain line groups.

Line Queuing

When several telephones share a line and that line is busy, a user can dial a code and hang up to wait for the line to become idle. When the line becomes idle, the user's telephone will ring.

Liquid Crystal Display Support

The system supports the use of LCD speakerphones having a liquid crystal display (LCD). The LCD speakerphone display may shows many useful messages that guide station users through many calling situations.

Enhanced LCD Display

The installer can program the system to enhance the display of an LCD-equipped telephone so that it shows both the name of the calling station and its personal intercom number.

Liquid Crystal Display Messaging

A user can set standard and system supplied custom display messages by dialing a specific code at any telephone. When a user places a call from an LCD speakerphone, the preset LCD message from the called station will flash on the caller's LCD. When a user sets a message, the intercom number light at his or her telephone flashes to indicate that the feature is active. The attendant programs these messages form his or her position (30 messages are available).

Lock Button

When the installer maps a telephone with this button, a user can press the button and dial an authorization code to deny other users access to lines and features at his or her telephone.
Also refer to the discussion titled *Authorization Codes.*

M

Manual Exclusion

Refer to the discussion titled *Privacy Release.*

Manual Reset

The system provides a button on the central processor unit circuit board for manually resetting the software. When someone presses this button, it causes the system to reset all lights, features, line states and station states.

Master Clearing The System

When master clearing the system, the installer can set the parameters to one of three settings.

Mode 1—"Key-Like Mode"

At default, assigns line appearances for every multiline telephone but does not assign group intercoms in any station hunt list.

Mode 2—"PBX-Like Mode"

At default, assigns no line appearances but does default two unique group intercom appearances for every multiline telephone in the hunt list.

Mode 3—"All-clear"

This option defaults the system with no button mapping, group intercom access, or extension numbers for stations.

Maximum Call Duration

This feature automatically cuts off calls on certain lines after a preprogrammed time. The system will not cut off calls made to an emergency number. The system sounds a warning tone at the busy station 10 seconds before it disconnects the call. The warning tone consists of one 800 ms burst followed by eight 100 ms bursts.

Meet—Me Answer Page

Any station user can dial a code in response to an all-call or zone page and be connected to the paging party in a private conversation.

Memory Retention Without Batteries

The database programming is electronically protected during AC power failures by an internal electronic component sometimes known as a "supercap". The stored data will remain in memory for a minimum of 30 hours provided that the system has been powered continuously for approximately 30 minutes prior to the power failure or disconnection. The system clock will continue to run for at least 30 minutes after an AC power failure or disconnection.

Message Deposit

This messaging feature allows station users to call an LCD speakerphone and arrange for a message to be left on its display. The message is for the called party to read if he or she is unable to answer the caller.

Message Waiting

A special feature access code allows a station user to control the message waiting (MW) light at other stations in the system. When the message waiting light is turned on at a station, the user can automatically call the station that turned it on. Stations that include an LCD display show the source of the message.

The programmer can program one station as the central message desk and arrange it for exclusive message waiting control. The central message desk user can control message waiting lights and deliver messages to and from all other stations in the system. The programmer can also provide a programmable button for placing and retrieving message waiting calls. Single line telephones only utilize central message desk signaling. A station can have as many 8 message waiting lights stacked at one time.

Mnemonic Programming

Refer to the discussion titled *Programmable Button Flexibility*.

Modem Support

The system supports the operation of the DXMDM serial data modem. The DXMDM is a general-purpose, 300, 1200, and 2400 automatic baud detect, serial data modem that receives its operating power and configuration programming from the DXP *Plus* system. The CPU board provides a dedicated serial data port for DXMDM modem use. If your installer connects the modem to a serial data port that is supplied by a communications card, he or she will need to program the system for modem operation on this port. Regardless of where the modem is connected, the system arranges for that port to automatically match the baud rate and serial data parameters of the modem.

The system also suports the operation of a customer-supplied modem connected to a serial data port that is supplied by a communications card.. This customer-supplied modem must be self-powered and must provide its own terminal ready and auto answer capability.

Modify Digits Table

Refer to the discussion titled Automatic Route Selection.

Multiple Attendant Positions

The system supports the operation of an attendant position at more than one station port.
Also refer to the discussion titled *Attendant Position.*

Multipurpose Line Board

The multipurpose line board provides system interface for ground start lines, loop start lines, and E & M Tie lines; these are typically the three line types that the central office (CO) makes available for connection. The multipurpose line board is programmable for each line type. You can have a maximum of two Tie lines on each multipurpose line board.

Music Interface

The services circuit board provides a modular jack where the installer can connect customer-provided music sources. Two different sources can be used so that the music supplied to parties while they are on hold is different than that supplied internally for background music. Also refer to the discussions titled *Background Music and Music On Hold.*

Music On Hold (MOH)

When an installer connects a customer-supplied music source to the system and the programmer enables the feature, music is provided to outside lines and intercom calls while they are on hold. Music on hold can be turned on or off system-wide by attendant action. Also see discussions titled *Music Interface and Background Music.* You can program each line for either music on hold source.

Mute

Each multiline telephone has a MUTE button that, when pressed by the user, will mute the handset transmitter (or internal microphone on speakerphones) to prevent the user's voice from being heard by the distant party. The mute light flashes to indicate a muted condition. Users can respond to a SOHVA by pressing the MUTE button and speaking to the SOHVA sender and releasing the button when they have finished their response. The button provides push-on/push-off operation on speakerphones. Also refer to the discussion titled *Handsfree Answer Inhibit and Subdued Off-Hook Voice Announce.*

N

Names (Station And Lines)

The programmer can name every station and line connected to the system for identification and programming purposes. On an LCD speakerphone, the name of called and calling stations appear in the display. When a user selects a line for use or when it is ringing on a call, the line name appears in the LCD speakerphone display.

Night Service Automatic Switching

The programmer can arrange the system to automatically enter and exit the night transfer (of ringing) mode of operation on a timed basis.

Also refer to the discussion titled *Night Transfer (Of Ringing).*

Night Ringing

The attendant can manually place the system in the night ringing mode by dialing a code or pressing a preprogrammed button. This mode overrides the direct, day 1, and day 2 automatic ringing modes. While this feature is active, calls on lines assigned to delayed and night ringing both ring at the various stations. No other ringing occurs unless the programmer has arranged for a loud ringing bell or other external ringing device to sound when calls appear on those assigned lines during the night ringing mode. These calls may be answered at any telephone in the system if the user dials the proper code.

When the attendant station includes a preprogrammed night transfer (of ringing) button, its associated light conveys the following system ringing status: day 1 ringing = steady on, day 2 ringing = wink with off time, night ringing = continuous wink, and manual night transfer (of ringing) = flutter.

Also refer to the discussions titled *Auxiliary Ringer Interface, Common Audible Ringer Interface, External Paging Interface, Flexible Ringing Assignments, and Line Answer From Any Station.*

Also refer to the discussions titled *Flexible Ringing Assignments* and *Line Answer From Any Station.*

O

Off-Premise Extension (OPX)

Installers can locate any industry-standard telephone away from the main premises served by the system. To enable this feature, they must use a proprietary interface device between the telephone and the DXP *Plus* system and make the necessary programming entries.

On-Hook Dialing

Multiline speakerphones and monitor telephones provide manual and/or automatic dialing while it's handset is on-hook. An internal loudspeaker monitors call progress for completion (the user must take the handset off-hook to provide the voice link on non-speakerphone monitor stations).

Operator Station

The system programmer designate the station that you want to ring when system users dial the operator. Usually this station is an attendant position station; however, the operator station can be any station in the system. In other words, the operator station does not have to be an attendant position station if you do not want it to be one. Plus, the programmer can change the code that users dial to call the operator from a default of 0 to the dialing code of your choice.

Originating Denied

The programmer can deny users the ability to originate calls on certain lines or intercom numbers at certain stations. Originating denied does not prevent a user from answering a ringing line, retrieving a held call or receiving a transferred call.

Out-Dial Delay Time

With speed dialing, it is sometimes necessary for the system to wait a short time after selecting a line and before dialing the number. This wait period gives the telephone company switching equipment time to prepare to receive the dialed number. This feature provides a programmable wait time to match various types of telephone company switching equipment.

P

Paging Access

This feature allows station users to dial-up customer provided loudspeaker paging equipment and page over externally placed loudspeakers and determines what paging zones, if any, a station can page over.

Password Protection

No one can enter a programming mode to reprogram the system without first entering a password. The system provides two different entry levels for programming and allows for a different password for each entry. While the passwords are the same at default, a programmer can change them as needed to provide security against unauthorized program entries. The two programming entry levels are the installer level and the administrator level. Programmers can enter the installer level, using the installer password, to perform all programming functions including major changes such as master clearing or defaulting , feature renumbering, and diagnostics. They can enter the administrator level, using the administrator password, to perform most programming functions except those major changes just mentioned. When the system is initially installed and programmed, or at any later time as needed, the installer programmer can make the two passwords different to limit subsequent access to either programming level to certain special or authorized people.

The system also provides two entry levels for main station database programming and provides a different feature code for each entry. These feature codes default to certain values, but a programmer can change them as needed to provide security against unauthorized program entries. These two different programming entry levels are the system manager and the attendant levels. On-site system managers use the system manager feature code to make many program changes in the system, line, station, and station class of service parameters. Attendants use the attendant feature code to make routine changes in the day-to-day operating parameters of the system such as revamping LCD messages, adding system speed dial numbers, and setting the system clock.

The installer programmer can change the passwords and the feature codes from the default values to custom ones whenever a change is needed. Also, the system manager can change the feature codes at any time he or she chooses. When they change these passwords and feature codes, they should keep a record of the new ones since the default words and codes will no longer provide entry to the programming.

Pause Time

During speed dialing, it is sometimes necessary for the system to delay the sending of dialed digits to give telephone company switching equipment time to prepare to receive them. This feature allows users to store pauses as part of the stored number at the points in the numbering sequence where delays are required.

PBX/CENTREX/Central Office Compatible

System features and programmable buttons support the requirements of most PBXs, Central Offices, and CENTREX systems. Users can make numbers, #, *, programmable pauses, and flash signals a part of every stored number for access to host system feature codes.

PC Attendant

Refer to Attendant Position, PC.

Periodic Line Tone

This feature provides periodic warning tones to station users while they are busy on certain lines. The warning tone consists of one 500 ms burst, a 100 ms off period, and one100 ms burst. The tone reminds the users to keep their conversations short on these lines. The system programmer can enable this feature for a class of service of telephones and then specify the applicable lines. Further, he or she can select how often the tone sounds.

Personal Intercom Number

Refer to the discussion titled *Intercom Number.*

Personal Intercom Number Preference

When a telephone goes off-hook, the system automatically connects it to the personal intercom number assigned to the station.

Personalized Ringing Tone

This feature allows a station user with certain model telephones to choose one of several different ring tones to aid in distinguishing one ringing station from another.

Pooled Line Access

Refer to the discussion titled *Line Group Access.*

Power Failure Transfer

A power failure line connection is available on each line interface board for connecting industry-standard telephones such as a Comdial ATC or Max*Plus* model. The system automatically connects these power-fail telephones directly to certain lines whenever there is an AC power failure. During a power failure, users can originate and receive calls on a power-fail station. The power-fail stations automatically disconnect as soon as power is restored.

Preselection

This feature provides an override to the automatic line preference. If a station user presses a line button on his or her telephone before lifting the handset, the station will go off hook on the selected line.

Prime Line

With this feature, a station automatically selects a line, line group, or intercom number for use when the user takes it off hook. The feature can be over-ridden if the user preselects another line, line group, or intercom number before lifting the handset. If the prime line is ringing, it is automatically answered when the user lifts the handset—this feature can be used along with ringing line preference functions. Also see—*Ringing Line Preference.*

Printer Interface

The system makes a wide variety of printout records available through a serial data port provided by a communications card. The programmer can direct these printouts to the SMDR/SMDA data printer or to the screen of the programming PC. Also refer to the discussions titled *Communications Card Support* and *Serial Data Port.*

Privacy

Refer to the discussion titled *Automatic Privacy.*

Privacy Release

The programmer can assign a privacy button to a telephone. If a line has privacy release programmed for it, a user can press the privacy button to change it into a non-private one.

Private Lines

Lines may appear at one station port or at selected station ports for call origination and reception yet may not appear at other stations.

See the discussion titled *Direct In Lines.*

Program Printout

The system supports an RS-232 compatible, asynchronous serial data printer to the system. When a data printer is connected to a serial port, the programmer can command it to provide a printout of all or selected database data, and the system administrator or attendant can command it to print selected data.

Programmable Button Flexibility

The programmable buttons accommodate any combination of line appearances, features, speed dial numbers and other intercom numbers. A shift operation permits the station user to program speed dial numbers on the second level. Through the button mapping programming procedure, the programmer can assign functions and features to each button on every system station using a list of mnemonics (shorthand titles for functions and features that the system software understands).

A button may be programmed as one of four things:

1. Feature button (including line group access)
2. Line direct appearance button
3. Intercom number button (DSS/ BLF)
4. Speed dial button - If shift is used, a second level of autodial storage is available.

Also refer to the discussions titled *Button Mapping, Square / Non Square Configuration, and Full Button Programmability Of Features.*

Programming Port

Refer to the discussion titled *Database Programming (From The Main Station).*

Pulse/Tone Switchable

If the installation site is in an area that supplies rotary (pulse) dialing lines from the central office instead of, or in addition to, tone (DTMF) dialing lines, the programmer can match the dialing mode of the line port to that of the line. If a rotary dial line is matched, further programming action matches the system with the pulses-per-second rotary dial signaling of the line. The system defaults the line ports to match tone dialing lines.

On those occasions when a user needs to send DTMF tones after making a call on a rotary line (to generate banking-by-telephone codes for instance), he or she can dial a # to convert the dialing mode to tone for the duration of the present call. The system changes it back to pulse when that call is completed.

Q

Quick Transfer

The quick transfer feature allows users to perform an automatic screened or unscreened transfer of an incoming line call without pressing their telephone's TRANS/CNF button. The transfer occurs automatically as soon as the user who answers the call dials the intercom number or access code for the transfer location. The system begins the call transfer process as soon as the user dials a digit on his or her dial pad, and effects the transfer as soon as the user hangs up or presses his or her telephone's RELEASE button. When installers activate this feature, it greatly reduces the keystrokes that users must take to transfer calls over a tie line.

R

Recall

Refer to the discussion titled *Timed Recall.*

Recall/Flash (TAP)

Refer to the discussion titled TAP *(Flash)/Recall.*

Relays

Refer to the discussion titled *Auxiliary Ringer Interface.*

Release Button

When a telephone is mapped with this button and a user presses it, the system discontinues the current active operation and returns the station to an idle state. When used along with an answer button, the release button provides rapid call handling.
Also refer to the discussions titled *Database Program Storage and Password Protection.*

Reminder Alert

A user can set up to two reminder alerts to sound at his or her telephone. The alert sounds at the station as four short tone bursts, which continue until the user responds to the alert by pressing CLEAR. This feature only works on digital stations that have interactive buttons.

Remote Programming And Diagnostics

Programmers can program the DXP *Plus* system from a personal computer (PC) running the visual man machine interface (VMMI) program. The PC can be connected directly to the maintenance port on the services board or connected by modem through the public telephone network. For remote programming to take place, an installer must connect the DXP *Plus*' modem between the maintenance port on the services board and an outside telephone line and connect a customer-supplied modem between the PC and an outside telephone line. In addition to database programming, installers with the proper password entry can perform maintenance routines and diagnose system malfunctions to the board level.

Remote Station Disable

This feature allows users at stations with the proper class of service to dial a code and remotely disable or enable another station. Normally, the installer should give this capability to the system attendant but could assign it to any class of service that is appropriate.

Response Messaging

Users can set messages to be received and displayed by calling LCD speakerphones. These messages give information on the status of the called telephone. The system attendant usually programs customized messages for use by the other telephone users, although the defaulted system does provide several general purpose messages for use.

Telephone users can program a response message button on their telephones if they wish. This response message button lets them make a non-verbal response to subdued off-hook voice announce calls or intercom calls using the attendant-prepared response messages.

Restricted Dialing Error Tone

When you dial a toll-restricted number from your telephone, you will hear an intercom error tone frequency with a continuous pattern of 250 ms on and 250 ms off. With earlier software, no audible error indication is given.

If you have a LCD speakerphone, the message *EXT or Code* is displayed. The message *Dialing Denied* is displayed instead.

Ring No-Answer (RNA) Call Forward

Refer to the discussion titled *Default Busy/Ring No-Answer.*

Ring Back On Busy

With this feature disabled, when someone calls another telephone and the calling party is busy on an outside line, the caller hears a ring back tone—not a busy tone. In this case, when the caller is using a non-display telephone he or she has no means of knowing the busy status of the called party. (LCD speakerphones can display called party status— for details on this display feature, see the paragraph titled *Allow Busy Display).* Installers can take programming action on a individual station basis that allows callers to hear a busy tone instead of a ring back tone when they call a party who is busy on an outside line.

Ring Back Tone

By default, when callers call an intercom party, they receive an intercom ring back tone to tell them that the called intercom station is ringing. Also, when they call over the CO line, they receive a CO-style ring back tone to tell them that the distant CO telephone is ringing. Some system users find intercom ring back tone confusing. When installers encounter this situation, they can take this programming action to assign CO-style ring back tone to intercom calls on a system-wide basis.

Ring On Busy

If a user is on a speakerphone call (on certain model telephones) and a second call comes in to that station, a quick subdued tone burst sounds. If the user does not wish to hear this tone burst, the programmer can eliminate any ringing. For industry standard telephones, the system will send three short tone bursts through the handset.

Ringing Line Preference

When this feature is active at a station, a ringing line is automatically connected to a station when the user takes the handset off hook or presses the speaker button. No manual line selection is required.

S

Save Button Dial Storage

A user can dial digits and save them while on a call, which is useful should the distant party tell the user of a number to call and the user wishes to save that number for later redial.

Saved Number Redial

Refer to the paragraph titled Dynamic Save Button.

Screened Call Transfer

Refer to the feature discussion titled, *Call Transfer - Screened.*

Self Diagnostics

Each station can execute a self test when so enabled. This test verifies processor, indicator, and tone function.

Serial Data Port

The DXP *Plus* provides two serial data ports on the cpu board and dedicates them to PC-based programming and the remote maintenance modem. The installer can add up to 16 additional serial data ports to the system for interfacing such items as open architecture interface applications, PC attendant positions, and the SMDA data printer. He or she adds these serial data ports by installing communications cards on the services board, the expansion cabinet interface board, and the main cabinet's auxiliary board. Each of these boards accepts two communications cards in its lower two slots.

The DXP *Plus* supports a maximum of 18 serial data ports. Serial data ports 1 and 2 are the dedicated ports provided by the cpu board while communications cards provide the remaining 16 undedicated ports (serial data ports 3–18).

The maximum available serial data baud rate is dependent upon the location of the communications card. For cards located on the services board, the maximum baud rate is 19200 baud. For cards located on the auxiliary board or on the interface boards, the maximum baud rate is 9600 baud. There are some limitations involved. If a device is transmitting / receiving from the DXP *Plus* at a high rate, engineering sources recommend the use of a communications protocol (RTS / CTS or XON / XOFF) to prevent buffer overrun and data loss.

The maximum cable distance between a serial data device and a serial data port varies with the port's system location. The dedicated ports on the services board are limited to 25 feet of cable. The undedicated serial ports on the services board are limited to 500 feet of cable when operated at the 19200 baud rate. The undedicated serial ports on the auxiliary and interface boards are limited to 50 feet when operated at the 9600 baud rate.

Service Observing

Service observing is programmable as a station class of service feature. It allows users to enter an in-progress call in an unannounced muted mode, to monitor the conversation. No warning tones sound when users make the call entry. This feature is useful in allowing a supervisor to monitor the performance of an employee during a phone conversation with a client. In order for a station to use the service observing feature, that station must have the initiate observe feature allowed and the telephone being observed must be programmed as observable while service observing is activated. The station that is being observed can continue to answer or originate multiple calls without disrupting the observing station.

Shift Button

The programmer can button map a certain station to have a SHIFT button. If a telephone includes a SHIFT button, the user can press it to reach a second level of speed dial storage.

Also see the paragraph titled *Station Speed Dial.*

Silent Mode Button

When a telephone is mapped with this button, the user can press it to turn off the ringer at his or her station for the duration of the current ringing call. Ringer operation is restored when a new call rings at the station.
Also refer to the discussion titled *Programmable Button Flexibility.*

Single-Line Proprietary Telephone Support

The system supports a proprietary single-line telephone. The single-line telephone provides basic intercom service coupled with the ability to access outside lines and system features through special access codes. The programmer identifies the station port for single-line telephone use.

SMDA Reports

The system will automatically provide an SMDA report whenever the costed call storage reaches 95 percent of capacity. The programmer can arrange the system to print the reports automatically at a specific time in the order that they are specified. The attendant can view the number of free records or delete all stored records. Deleting all stored records insures that the system is storing only the latest SMDA reports and provides a known starting point for record storage. Also, the installer can use the programming terminal to view the number of free records and delete all the stored records. Any call records created between the time the report printout was started and completed will not be printed or deleted. If the reports are not deleted after they are printed, a later command to delete records will delete all records at that point and not just the ones that were printed in the previously generated reports. The programmer can arrange for the system to always delete the records after they have been printed. The attendant can request particular reports at any time they are required.

If the programmer arranges the system to use account codes, they can be used to identify calls by category or by any other desired grouping so that costing by that category or grouping can be reported.

There are four different Station Message Detail Accounting reports.

- Detailed report sorted by stations
- Detailed report sorted by account codes
- Line summary report
- A general output of all records

SMDA Reports—Call Costing / Hold Time

The programmer can also choose between call costing reports and hold time display reports. The hold time display feature reports the accumulated time a line has been on hold; call costing reports the estimated cost of the call.

Speakerphone Support

The optional speakerphone provides handsfree operation of all features.

Speed Dial Sets

Refer to the discussions titled *System Speed Dials* and *Station Speed Dials.*

Split Button

When a telephone is mapped with this feature, the user can press the button to switch between the last call (intercom, outside line, or conference) that they placed on hold and their current active call.
Also refer to the discussion titled *Programmable Button Flexibility.*

Square/Non-Square Configuration (Button Mapping)

Refer to the discussion titled *Programmable Button Flexibility*, and *Full Button Programmability of Features.*

Station By Station Privacy

See the discussion titled *Automatic Privacy.*

Station Call Transfer

Refer to the discussions titled *Call Transfer - Unscreened, Call Transfer - Screened.*

Station Camp-On, Callback

Refer to the discussion titled *Camp-On With Automatic Callback*

Station Class Of Service

The programmer can enable or disable a group of features and parameters to provide a particular class of service (COS). The system permits the arrangement of up to 32 different classes of service. After programming the COS features, the programmer then programs individual stations to exhibit one of these different classes of service. He or she usually chooses certain COS features to match a particular group of users and then programs the stations assigned to these users to exhibit that COS.

Station Hunting

Station hunting is available to systems with a **software revision of 3.A and later**. Station hunting provides a means of routing both intercom and outside calls through an installer-determined grouping of stations. This call routing continues to a designated overflow location in case of no answer or if all stations in the hunt group are busy. Station hunting works equally well with intercom, standard central office (CO) lines, direct inward dialing (DID/DNIS) lines, direct inward system access (DISA) lines, and E&M tie lines.

For station hunting purposes, stations are considered busy under the following conditions:

- when they are currently connected with a call (internal or external),
- when they have an incoming call currently ringing,
- when they have a call on hold, in DND, call forwarded, out of service or being intercepted by an OAI application.

The installer can enable default call forwarding for a hunt group station. This feature allows the system to forward the non-hunt group routed calls that a station receives. Calls routed to a station by the station hunting feature ignore the default call forwarding settings. The installer can assign all types and any number of lines to ring at a hunt group. He or she can assign the lines as direct, delayed, day 1, day 2 or night ringing lines.

Hunt Group Attributes

Pilot Extension: This is the extension number that callers dial to call or route calls to this hunt group. The pilot extension number is similar to a personal intercom number, or extension number, and follows the same numbering plan restrictions. When station hunting is used with DID/DNIS, the pilot extension is the extension number assigned in the DID/DNIS translation table. When station hunting is used with DISA, the pilot extension can be the extension number assigned to the singls digit translation for the digital voice announce (DVA) message associated with the DISA line.

Name: The hunt group's name is the seven character alphanumeric name of this group that is used for LCD display and reference.

Full Name: The hunt group's full name is the 20 alphanumeric character name of the group that is used by OAI applications. (Future development will support OAI access and control of station hunting.)

Direct Ring Lines: The list of lines that directly ring at this hunt group when the system is not in the night mode of operation. This list can contain any lines in the system.

Delayed Ring Lines: The list of lines that delay ring on this hunt group. This list can contain any lines in the system.

Day 1, Day 2, Night Ring Lines: The lists of lines that can ring this hunt group during these programmed times. These lists can contain any lines in the system.

Member Stations: The list of stations that are members of this hunt group. This list can contain all stations in the system but is limited to personal intercom numbers only.

Overflow Destination: The overflow destination is a station intercom number, a group intercom number, a voice mail number, or another hunt group pilot extension where the system routes unserviced hunt group calls.

Queue Ringing Calls: With the queue ringing calls feature disabled and if all stations in the hunt group are busy, the sytem immediately routes hunt group calls to the overflow destination. With the queue ringing calls enabled, in the case of no answer or if all stations in the hunt group are busy, hunt group calls wait in a queue to be answered until an overflow timer times out then route to the overflow destination.

Types Of Hunting

Terminal Hunting: Terminal station hunting always delivers a call to the first idle station programmed in the hunt group. If the station does not answer within a programmed amount of time (programmed as the Call Advance Timer), the system delivers the call to the next sequential idle station programmed in the hunt group. The system makes no attempt to balance the distribution of incoming calls as this is a linear search through the programmed list. The search starts at the beginning of the list for each incoming call.

Distributed Hunting: Distributed station hunting delivers a call to the next idle station in the hunt group after the station that received the previous call. If that station does not answer within the programmed call advance time, the system delivers the call to the next sequential idle station programmed in the hunt group. This hunting method is a linear search through the programmed list; however, the search starts wherever it left off after the previous call.

Longest Idle Station Hunting: Longest idle station hunting delivers a call to the station that has been idle for the longest period of time since completing the last call that was routed to it by the station hunting feature. In the case of stations with equal idle times (such as at system startup), the system picks the first of the grouped stations with equal idle times. If that station does not answer within the call advance time, the system delivers the call to the station with the next longest idle period.

Ring All Station Hunting: Ring all station hunting is not a true hunting method. This method delivers a call to all idle stations simultaneously. This is a good method to use when the site requires that all calls be answered as quickly as possible.

None (No Hunting): This selection disables hunting for the group. It allows a hunt group to be completely programmed yet disabled. Any intercom calls to this group will receive busy and line ringing ignores any programming within this group.

Station Hunting Timers

Call Advance Timer: This is the time interval that a station within a hunt group rings unanswered before the system routes the call to the next station in the group. This timer is programmable from 10 seconds though 5 minutes.

Overflow Timer: This is the maximum time interval that an unanswered call hunts within a group before the system routes it to the designated overflow station for the group. This timer is programmable from 30 seconds through 15 minutes.

Recall Timer: This is the maximum time interval that an unanswered transferred call hunts within a group before recalling to the source of the transfer. This timer is programmable from 30 seconds through 15 minutes.

Station Hunting Operation

When a system station user makes an intercom call to the hunt group pilot extension, the system rings the first available station within the hunt group (based on the group's selected hunting method). This ringing appears on the station's personal intercom. The system ignores all call announce settings as all intercom calls into a hunt group are treated as voice announce block calls. If the station does not answer the call within the programmed call advance time limit, the system rings the next station of the group. If no station answers within the programmed overflow time, the call rings the designated overflow destination.

When a line rings at a hunt group, it rings at the first available station within the group (based on the group's selected hunting method). As the ringing line appears at the station, it follows the DXP *Plus* conventions for line appearances. If the station does not answer the call within the programmed call advance time limit, the system rings the next member station. If no station answers within the programmed overflow time, the system sends the call to the designated overflow destination.

The DXP *Plus* supports a maximum of 64 hunt groups. Each hunt group can include the maximum number of stations that the system can support; however, due to system memory limitations, all hunt groups can not contain all stations simultaneously. Since the system makes a total of 32 Kbytes of memory available for station hunt groups, you can use the following formula to determine possible station hunt group capacities.

[32768 Kbytes] – [(Stations per group) x (2) + (220 bytes of memory)] = memory remaining for next hunt group

Station Message Detail Recording (SMDR)

Station message detail recording provides a record of the incoming and outgoing calls handled by the system on selected lines. This record provides information for accounting and traffic analysis studies. When enabled, SMDR is invoked automatically. The SMDR feature generates a call record for printing as soon as it is collected by the system. The call record is presented as ASCII data in an eighty-column format to an RS-232 data port located on the central processor unit circuit board. SMDR requires customer-provided equipment such as a printer or other compatible data recording device.

Also see the discussion titled *Call Costing and SMDA Reports.*

Station Monitoring With DSS Call Pick Up

Refer to the discussion titled *Intercom Number.*

Station Name

The installer can assign a display name and a full name to a station. A display name is composed of a maximum of seven characters and shows in the display of an LCD speakerphone as a identification aid. A full name is composed of a maximum of 20 characters and shows in some voice mail and open architecture interface applications. The installer can compose a valid name from any alpha-numeric character; however, the first character of a display name must be an alphabetic character.

Station Speed Dial

Station speed dialing is a feature that lets the user dial lengthy numbers using one or two buttons, store frequently used feature dialing codes, and store intercom extension numbers of frequently called telephones. The user can store speed dial numbers at any unused programmable button, or if the programmer assigns a shift button to a telephone, or one exists as a fixed feature button, the user can store a speed dial number at a second level under any programmable button.

Speed dial buttons can store up to 16 digits, *Plus* trunk or intercom number selection. Stored digits include 0-9, ∗ and #. A pause is stored at any point where the HOLD button is pressed, and a hookflash is stored at any point where the TAP button is pressed. Also refer to the discussion titled *Automatic Pause Insertion.*

There are two levels of storage on speed dial buttons. To access the second level, the user must press the programmed SHIFT button. The shift mode is then active for five seconds after the SHIFT button is pressed. If a SHIFT button is not available, the user has access to only one level of speed dial storage.

A speed dial set is a group of 10 speed dial locations. The DXP *Plus* system allocates one speed dial set to each telephone as a default but can allocate up to 10 sets to a telephone if a programmer makes it so. When a DSS/BLF Console is operated as a companion to a telephone, the programmer must allocate it's speed dial sets at the companion telephone to be shared with the console. The total system speed dial allocation that is available is 960 sets or 9600 individual speed dial locations.

Station Transfer Recall

Refer to the discussion titled *Timed Recall.*

Subdued Off-Hook Voice Announce (SOHVA)

With the subdued off-hook voice announce (SOHVA) feature, a subdued announcement can be made from one station to another station that is off-hook and busy on a call. When a user is operating a telephone in a handsfree mode, it cannot receive a SOHVA. The telephone must be a model that includes SOHVA capability. With SOHVA, the announcement is delivered and responded to in a subdued manner that prevents the distant party from hearing either the announcement or the response. A tone alert precedes the announcement and is delivered to the handset receiver of the telephone ahead of the announcement. The installer can program the number of tones that the system delivers. The announcing callers also receive a tone to alert them that they are making a SOHVA call. Users can response to the announcement in a verbal or non-verbal manner. They affect a verbal response by pressing and holding the MUTE button or appropriate interactive button and speaking into the handset. They effect non-verbal response by pressing a pre-programmed button to send a message to be shown on the display of the announcing station (if it is an LCD speakerphone). The announcing station is automatically disconnected after the response message is displayed. Stations that have the voice announce blocking feature turned on cannot receive a SOHVA call. Also refer to the discussion titled *Call Announce with Handsfree Answerback* and *Response Messaging*.

SOHVA installations for analog telephones requires two paired station ports. In addition to the wiring connections associated with the installation, the installer must take certain programming actions. He or she must mark the telephone type for the odd-numbered station port to support the connected telephone, and mark the telephone type for the even-numbered station port undefined.

Busy On SOHVA

A default, a system returns a ring back tone to users who make SOHVA calls to busy stations; however, the system programmer can arrange for telephone users to receive a busy signal instead of the ring back tone. This feature lets non-LCD telephone users know that a called station is busy.

SOHVA Beeps (SOHVA Tone Bursts)

Installers can choose the number of tone bursts that each telephone user hears preceding a SOHVA message to be a value of from one to six.

Subdued Off-Hook Voice Announce Groups

The SOHVA calling groups control the pattern that station ports receive and/or originate SOHVA calls to one another. The programmer first creates SOHVA groups and then assigns individual stations to each group.

Subdued Ringing

When a station is busy on a call and another call comes to the same station, the ringing of the second call will automatically be subdued to a lower volume.

Synchronized Ringing

When the programmer enables synchronized ringing, the central office ringing pattern is tracked on external calls that ring within the DXP *Plus* system.

Also refer to the discussion titled *Discriminating Ringing*.

System Clock

The system clock provides time and date information for display on LCD speakerphones and on SMDR/SMDA printouts. The clock also provides the time for the user–set alert feature.

System Speed Dial

System speed dialing provides system users with a repertory of up to 500 numbers that they can dial from any telephone in the system. The programmer or the attendant is responsible for storing the system speed dial numbers. These numbers can be up to 32 digits long and can include line number selection, the dial pad digits 0-9, ∗, and #, *Plus* pauses and hookflash signals.

The programmer or attendant can divide the unused or available system speed dial numbers into up to 50 different groups with 10 numbers in each group and then assign different speed dial groups to each station class of service (total of 500).

The program can choose a line a line group that the system will automatically select for speed dialing. Alternately, the programmer or attendant can choose the intercom to be automatically selected for speed dialing. This enhancement allows an intercom selection and feature codes to be stored together as speed dial numbers for true one-button access to features (for example; store INTERCOM ∗11 and INTERCOM #1 at two locations for system wide availability to music on and music off). This enhancement will not accept ∗#0∗ or ∗#746∗ as programming entries and it ignores any entered pauses or hookflashes.

System Status And T1 Status Log Viewing

When enabled, this feature permits the system to notify certain designated stations when a system error condition occurs by lighting the system status button. You can view the status log directly from an LCD speakerphone. If the T1 option is installed, you can also view the T1 status log from an LCD speakerphone in the same manner.

Your LCD speakerphone must have a pre-programmed system status button to enter the status log viewing mode. The status button is programmed using the button mapping procedure in the Programming Instructions. The LCD status log viewing feature allows you to view the log only. The installer must use programming to clear the log.

To enter the log viewing mode, you press the system status button (the system status button flashes red if any log entries exist). The LCD indicates "SYSTEM" and "T1" (if the T1 option is installed). Select the log you want to view by pressing the related interactive button. If you are using a telephone that is not equipped with interactive buttons, you can use dial pad buttons 1, 2, and 3 that perform the same functions as the interactive buttons. See the following chart.

Interactive Button Location	Displayed Function	Equivalent Dial Pad Button
Left	SYSTEM,	1
Left	REV	1
Center	FWD	2
Right,	T1	3
Right,	INFO	3

After selecting the log you want to view, you can view the time and date of the current log entry by pressing the INFO interactive button (or dial pad button 3 when appropriate). You can scroll through the selected log to view all of the entries by pressing the REV and FWD interactive buttons (or dial pad buttons 1 and 2 when appropriate).

The number of entries in the log is displayed whenever you press the # button.

You exit the log viewing mode either by pressing the SPEAKER button, pressing the hookswitch, or waiting for the 15-second timeout.

T

T1 Digital Carrier Transmission Option

This feature allows up to 24 channels of voice and/or data transmissions over a single four-wire cable using multiplexing techniques in superframe (SF) or extended superframe (ESF) format. For convenience, a customer service unit (CSU) is built into the T1 option board to terminate the T1 channels, provide protection from transient voltages, and respond to loopback requests from the central office. This eliminates the need to install a CSU external to the DXP.

Up to four T1 boards can be installed if the expansion cabinet has been added to the main cabinet – two boards in each cabinet. The DXOPT-SYN card on the DXAUX board must be installed whenever one or more T1 boards is installed, and the DXP is receiving its timing signals from an external source. In installations where the local DXP is supplying the clock signal for the far system, no DXOPT-SYN card is required in the local DXP.

You can assign a system status button to a station and enable the system to report T1 transmission errors via the T1 status log. Depending on how you program the system, the T1 status log either prints out on an optional printer or is displayed on an optional video display terminal (VDT). You can also view the T1 status log from an LCD speakerphone by programming a system status button.

Also, you can program the system to alert the system attendant whenever a major alarm alerting condition occurs by activating an external, customer-supplied audible or visual alarm. The external alarm connects to one of the relay jacks (J3 or J4) on the front of the DXCPU board. Make sure the alarming device complies with system voltage and power requirements. You determine when a major alarm alerting condition should occur by programming threshold values and corresponding time periods for each type of alarm caused by a transmission error. Whenever the threshold value is reached within the programmed time period, the selected relay on the DXCPU board is activated by the board's circuits, which in turn, activates the external alarm. The system attendant can turn the alarm off from any specified station by dialing a feature code.

Transmit Or Receive Gain

Line transmit or receive gain adjusts the audio levels for both the transmit and receive circuits in the individual T1 channels when using the T1 option. The available selections are very low (-6 dB), low (-3 dB), normal (0 dB), high (+3 dB) and very high (+6 dB). The default setting is "Normal (0 dB)."

Adjusting the receive level changes the strength of the incoming signal while adjusting the transmit level changes the signal strength being received at the far end.

CAUTION

If you use line transmit or receive gain on non-T1 lines, it can severely affect speakerphone performance.

TAP (Flash)/Recall

When host system custom calling features are available via a hook-flash signal while on line, the TAP button functions as a hook-flash button and generates a flash signal when the user presses it. When custom calling signals are not available, the TAP button functions as a positive disconnect and recalls dial tone when the user presses it. These features are mutually exclusive. The programmer sets the desired function for the system by programming action. With single–line proprietary telephones, the Tap function works for internal transferring only. An access code is required to activate custom calling features

Telephony Services Application Programming Interface (TSAPI) Support

The DXP Plus provides support for TSAPI applications. These applications are Novell Telephony Services* applications developed by third-party software vendors. TSAPI applications run independently of the DXP Plus yet use its digital communications capability. The DXP *Plus'* Enterprise open architecture interface (OAI) data port provides the hardware interface for the personal computer (PC) that runs the TSAPI software program. Depending upon the TSAPI application and its functions, there may or may not be a need to reprogram the DXP *Plus'* database feature parameters.

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Through Dialing

An installer can connect external telephony equipment to the DXP 480 *Plus* through a proprietary interface device or through an IST port. When the programmer enables the through dialing feature, DTMF tones that the external device generates pass through the interface equipment, the DXP Plus system, and any line connection. Also see the paragraph titled *Off Premise Extension.*

Time And Date

The time designation will accept either a 12- or 24-hour format. Time and date appear on the LCD speakerphone and the SMDA/SMDR record printout.

Timed And Immediate Recall

If a telephone user places a call on hold and fails to pick it back up within a preprogrammed time, the call rings the user's telephone again. While only the telephone that put the call on hold rings, all other telephones that share call appearance will flash the light for the held call at a hold recall rate.

Recall to an originating station also occurs from unanswered parked calls, transferred calls, and calls that are camped-on. *Plus*, unanswered calls (ring no-answer calls) recall to the attendant or other preprogrammed designation after exceeding a preprogrammed timeout period.

Any transfer attempt that fails will cause the held call to recall immediately. Examples of failed transfer attempts are calling any of the following:

- non-existent extension
- partial extension number
- invalid extension number

A calling party continues to hear music on hold (if provided) throughout the recall sequence.

Toll Restriction

With the toll restriction feature, the system allows or denies outgoing line calls to selected users over selected lines. Toll restriction meets different dialing needs by allowing users to dial numbers that they are required to dial yet restrict them from dialing numbers they are not allowed to dial. Toll restriction can be used together with the automatic route selection and call costing features if desired, or used separately as a stand alone feature or not used at all.

The programmer assigns toll restriction to stations based on system requirements. Telephones that are not assigned this feature are free to dial any number their users choose to dial. *Plus*, a toll restricted station can dial any telephone number that it is not restricted from dialing. If a station is restricted from dialing a certain telephone number on a certain line, it can, if programming permits, dial that number on another line that is not restricted. Further programming action specifies whether or not toll restriction applies to system speed dial numbers. The programmer can also differentiate between day toll restrictions and toll restrictions that only take effect in night mode. A defaulted system imposes no toll restriction on any station.

The toll restriction feature first compares a dialed number to a matching assigned restricted number up to the last digit in the assigned number. At that point it considers it a match and applies other toll restriction tests whether the station user keeps dialing or not. If all toll restriction tests are met, the station is not normally allowed to dial the number. There are 32 exception number test matches assigned to the station. Exception numbers allow stations to dial numbers that they are not normally allowed to dial by their toll restriction.

Toll Restriction Pause Entries

When this feature is activated by installers, they can enter a pause at the end of a restricted number's digit string to indicate that dialing is complete. They do this by typing a P or p after they type the digit string. The pause entry distinguishes this restricted number as unique. They can enter the same digits without the pause but instead followed by additional digits as another unique number. They can assign different routing and toll restriction parameters to each of these entries. There are several applications for this feature. One application is in international dialing where different toll restriction parameters apply depending upon whether the caller dialed 0 or 011. In this case, installers can enter 0 **pause** to access local lines and 01 to access international lines. Another application is with tie line calling where a remote extension is the same digits as an office or area code that installers need to enter in the restriction table. By entering nnn **pause** for tie line access and nnn@ for CO line access, the system can route the call over the proper line. A third application is brought forth with the advent of the new North American Numbering Plan (NANP). With NANP, an area code may be the same digits as a local office code. Installers can enter nnn@@@@ **pause** for local line access and nnn@@@@@@@ for long distance line access (the @ is a match anything character). In any application, the system resets its pause timer after receiving each caller dialed digit. If the timer expires before the caller dials another digit, the system routes the call based on the digits preceding the **pause**. If, instead, the system detects more digits instead of a **pause**, it routes the call based on the entire digit string.

Tone On Hold

This feature gives you an alternative to providing music or no music for callers who are placed on hold.

When you program this feature into the DXP system, both internal and external callers hear a pattern of short tone bursts while they are on hold. The patterns consist of two 1/10-second tone bursts separated by 1/10-second. These tone patterns repeat every five seconds.

The installer enables this feature and assigns it to particular trunks through line programming or stations through class of service programming using the PC. The system manager can also select this feature from the applicable class of service from a programming station for intercom calls placed on hold. The choices when programming this feature are: music from source one, music from source 2, tone on hold, or nothing.

Tone Or Voice Signaling On Internal Calls

Intercom number calls can be tone signaled or voice signaled as desired. Programming determines which signaling method the system uses as the primary method when an intercom number call is made. Users can choose the alternate method at the station by pressing the intercom key. Intercom number call progress is marked by special tone signals.

Tracker Paging System

The Tracker Paging System interfaces a DXP system with individual Tracker pagers. The Tracker Paging System informs users through their Tracker pagers that they have a call waiting for them. The Tracker base station connects to any of the DXP system's serial ports or to the PC Attendant position. The DXP can accept up to four Tracker base stations supporting up to 600 Tracker pagers. Many different types of Tracker pagers are supported—from those with numeric displays to those that display a pre-programmed message up to 32 alphanumeric characters long.

Creating Messages From The PC Attendant

Up to eight default messages can be programmed and delivered from the PC Attendant position only (see the *Digital Communications System PC Attendant's Console User's Guide*, GCA 70-230 for instructions). The PC attendant can be in either the *local* or the *system* mode of operation.

RNA Or Busy Tracking

If the called station fails to answer or is busy, the caller can activate the Tracker Paging System by pressing the TRACK button on his or her telephone. The TRACK button is one of the telephone's interactive buttons. On telephones not equipped with interactive buttons, the caller activates the Tracker Paging System by dialing the Tracker access code (defaults to * 8). When the call is accepted, the caller will hear a confirmation tone, or if it is not accepted, a busy tone.

Direct Tracking

The caller can also do direct paging by pressing the TRACK programmed button or by dialing the Tracker access code (defaults to * 8). The telephone prompts the caller with its display to enter the assigned extension number for the pager along with the display message "Enter Ext:"

Transfer Tracking

If the system attendant attempts to transfer a call to an extension that does not answer (or is busy) and then activates the Tracker pager assigned to that extension, the incoming call is placed on a page orbit. Once the system places the call on a page orbit, the user's Tracker pager displays the orbit number so that he or she can retrieve the call by dialing the number of the orbit containing the call. If the user does not retrieve the call within the pre-programmed timeout, the call returns to the attendant. The Tracker Paging System on DXP supports up to 100 page orbits.

Using Voice Mail With Tracking

When a caller reaches an extension with an assigned Tracker pager, and that extension is covered by proprietary voice mail, the system may prompt the caller to either select the assigned Tracker pager or leave a message. If the caller selects the Tracker pager, the system places the call in a page orbit, and displays that page orbit number on the user's Tracker pager. The user retrieves the call by dialing the number of the page orbit containing the call. After a pre-programmed timeout, the call is returned to the proprietary voice mail where the caller can leave a message.

Accessing The Tracker Pager From DISA

The Tracker Paging System is accessible from DISA by using the DVA voice messages.

Programming Options

There are three levels of programming associated with Tracker operation.

• One level, the DXP system level, is done by the installer or system programmer using a PC. This installs Tracker operating parameters and pager-to-intercom assignments that can only be changed at this programming level. Transfer/Conference Button

Each multiline telephone and proprietary multiline telephone provides a fixed button that gives quick, easy transferring and conferencing of calls.

• Another level is done by the PC attendant, if installed. The PC attendant operates in one of two modes–*local* or *system*. In the *local* mode, the attendant can assign pagers to intercoms and select pager types. This programming is transparent to the DXP system and does not alter any Tracker programming done at the DXP system level. When using the *system* mode of operation, all Tracker operating parameters and pager-to-intercom assignments, as viewed on the PC screen, are as programmed into the DXP system by the installer or system programmer.

• Finally, the system manager can select a Tracker base station and enable or disable the Tracker Paging system from a programming station.

Transfer Recall

Refer to the discussion titled *Timed Recall.*

Transfer Ring Cadence

A telephone user can select the ringing cadence that announces a transferred line call. They have two choices as follows: one cadence provides a 2 sec. on—4 sec. off tone, the other cadence provides a 0.5 sec on—5.5 sec. off tone. The programmer can choose either cadence as the default setting.

U

Unscreened Call Transfer

Refer to the discussion titled, Call Transfer - Unscreened With Automatic Camp-On.

Unsupervised Conference

Refer to the discussion titled Conferencing - Multiline.

V

Voice Mail Integration Digits

Installers can choose the DTMF digits that the DXP *Plus* sends to a voice mail system. A voice mail system uses these DTMF digits to determine system and station status so that it can properly process a call. Installers must be versed in the voice mail's requirements before they can assign DTMF integration digits in the DXP *Plus*. The system defaults the voice mail parameters to match the Comdial voice mail system. Certain applications in countries with dialing plans different than the United States may require different integration digits. The default digits are shown in the following list and discussed below:

Follow Extension ID = 2	Intercom/Answer Confirmation = 1
Busy = 2	Do Not Disturb = 3
Incoming Intercom Answer = 9	Disconnect = A

Follow Extension ID – When the voice mail system receives a forwarded call from a ring no-answer (RNA) or busy station, the DXP *Plus* sends to the voice mail system the extension number of the forwarded call followed by this DTMF digit (n). The DXP *Plus* sends this digit within 500 ms of the time the voice mail system answers the call. For example, if extension 101 is forwarded to voice mail and voice mail answers a forward RNA or busy forwarded call, the DXP *Plus* sends 101n to the voice mail system within 500 ms of the answer time.

Intercom/Answer Confirmation – The DXP *Plus* sends this DTMF digit to the voice mail system to confirm that an intercom path (without dial tone) is available for the voice mail system's call transfer or dialing use. The DXP *Plus* sends this digit within 500 ms of the time it detects the voice mail system's off-hook or hookflash condition. The DXP *Plus* also immediately sends this digit to the voice mail system when a station answers a voice mail transferred call. This action can alert the voice mail system to disconnect and leave the parties connected.

Busy – If the voice mail system transfers a call to a station that is busy on a call, the DXP *Plus* sends this DTMF digit to the voice system. When the voice mail system receives this digit, it can abandon the transfer, reconnect to the call, and offer the caller whatever options the the voice mail system has available in its programming. If the DXP *Plus* auto attendant transfer on busy feature is active, the DXP *Plus* will not send the DTMF digit to the voice mail system thus allowing the system to transfer a second call to the station.

DND – If the voice mail system transfers a call to a station that is in the do not disturb (DND) mode, the DXP *Plus* sends this DTMF digit to the voice system. Receiving this digit allows the voice mail system to distinguish between a busy and a DND condition and offer the caller the appropriate choices.

Incoming Intercom Answer – The DXP *Plus* sends this DTMF digit to the voice mail system when a station user makes an intercom call to the voice mail system. This action allows the voice mail system to distinguish between internal and external calls and offer the caller appropriate prompts and dialing options.

Disconnect – When an outside line or intercom party hangs up, the DXP *Plus* sends this DTMF digit to the voice mail system to command an immediate disconnect. For outside calls, the central office (CO) must provide disconnect supervision to the DXP *Plus* and the installer must program the DXP *Plus* line for abandon hold release and disconnect supervision. At default, the DXP *Plus* sends the DTMF tone for the *A* character as the disconnect digit. Since a caller cannot dial an *A* from a telephone. This feature eliminates callers from causing an accidental disconnect by dialing this digit on their telephone's dial pad.

Voice Announce Blocking

This feature allows the user of multiline telephones to block voice announced intercom calls by dialing a special code or by pressing a programmed button.

Z

Zone Paging

This feature arranges for stations to transmit and/or receive voice announcements to and from a particular group of stations or to all stations. This feature also arranges for all-call and zone paging to an external paging device. The programmer can assign stations to particular paging zones, up to eight zones, to permit station users to make announcements to one particular site, or he or she can assign all stations to the same zone to permit users to announce all areas at once.

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LIMITED WARRANTY

Comdial Corporation (Comdial) warrants that under normal operating conditions, this Equipment (except for fuses, lamps, and other consumables) will be free from defects in material and workmanship for a period of twenty-four (24) months from the manufacturing date stamped on the Equipment. Comdial's sole obligation under this warranty or under any other legal obligation with respect to the Equipment is to repair or replace, at its option, the Equipment if it is deemed defective by Comdial during the warranty period free of charge with new or refurbished equipment or parts, at Comdial's option, when the Equipment is returned to Comdial, freight or postage prepaid, during the warranty period. This warranty does not apply if, in the sole judgement of Comdial, the Equipment has been installed or used in combination or in assembly with products not supplied by Comdial and which are not compatible or inferior quality, design or performance, or the Equipment has been otherwise misused, abused, accidentally damaged, or damaged or malfunctions or fails to function as a result of acts of God such as fire, flood, or lightning or other incidence of excessive or insuffıcent voltage or failure to follow instructions. Repair or alteration of this Equipment other than as specifically authorized by Comdial or its authorized repair agent is prohibited and will void this warranty. This warranty does not cover costs associated with installation, removal, or reinstallation of the Equipment. Comdial does not warrant that the Equipment is compatible with all telephone or switching systems. THIS WARRANTY IS EXCLUSIVE, BEING IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. WITHOUT EXPANDING UPON THE FOREGOING WARRANTY, THE MAXIMUM LIABILITY OF COMDIAL UNDER ANY WARRANTY, STATUTORY, EXPRESS OR IMPLIED, IS LIMITED TO THE PURCHASE PRICE OF THE EQUIPMENT. COMDIAL SHALL HAVE NO RESPONSIBILITY FOR DAMAGE TO PROPERTY OR ANY OTHER LOSS OR INJURY, INCLUDING CONSEQUENTIAL AND/OR INCIDENTAL DAMAGES, RESULTING FROM THE POSSESSION, OPERATION OR USE OF THE EQUIPMENT, ALL SUCH CLAIMS BEING HEREBY EXPRESSLY WAIVED. THE PURCHASER'S EXCLUSIVE WARRANTY AND REMEDY SHALL BE ONLY AS STATED HEREIN.

This warranty gives you specific legal rights and you may also have other rights which may vary from state to state. Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations may not apply to you.

If the Magnuson-Moss Act should be held to apply to the sale of the Equipment by a court of competent jurisdiction, the implied warranty of fitness for a particular purpose shall extend for one year from the date of manufacture.

No Comdial dealer nor any other person or entity other than Comdial may extend or modify this warranty, and no such modification or extension shall be effective unless it is in writing.

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The information contained herein does not purport to cover all details or variations in equipment or to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes contact, Comdial, Inside Sales Department, P.O. Box 7266, Charlottesville, Virginia 22906.

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COMDIAL

Installation

This section contains installation details for both the main cabinet and the expansion cabinet of the DXP *Plus* digital communications system.

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COMDIAL

Installing The DXP Plus Main Common Equipment Cabinet

1.0 Installing The Common Equipment Cabinet

1.1 Considering The Mounting Parameters

- Choose a suitable location.

  ✔ A suitable location is within four feet of a proper electrical outlet. (The main cabinet and two expansion cabinets requires two dedicated 117VAC 15 AMP circuits, with a third-wire ground, supplied to standard NEMA 5-15R electrical outlets. Each outlet must be supplied from the opposite phase of the AC power line.

  ✔ A suitable location provides a distance between the common equipment and the TELCO/PBX jacks of 25 feet or less as per FCC requirements. (Good engineering practices recommend a nominal distance of 7 feet.)

  ✔ A suitable location allows enough room between the top and bottom of the main cabinet and the ceiling or floor of the equipment room for placement of one expansion cabinet above and one expansion cabinet below the main cabinet.

  ✔ A suitable location is secure and dry and has adequate ventilation. The temperature range of a suitable location is within 32–122 degrees F (0-50 degrees C), and the relative humidity is less than 90 percent non-condensing .

1.2 Inventorying The Tools And Hardware

- Round-head wood screws (typically $^1/_4$ x 1–inch for mounting equipment cabinet to backboard)
- Round-head wood screws (typically $^1/_4$ x 1 $^1/_2$–inch for mounting backboard to wall studs; longer screws are necessary if fasteners must also pass through a dry-wall covering)
- Cross recessed screwdriver (phillips-head type)—to match front panel shipping screws
- Flat blade screwdriver—to match front panel retaining screws
- Electric drill—if prepared holes are required
- Connecting tool—for fastening wires to a type–66 connector block.
- Crimping tool—for 623-type modular plugs
- Static discharge wrist strap and conductive floor mat

1.3 Complying With Underwriters Laboratories Regulations

Per The Underwriters Laboratories regulation 1459, 2nd edition, be aware of the following precautions when installing telephone equipment that is to be directly connected to the telephone company network:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

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1.4 Mounting The Common Equipment Cabinet

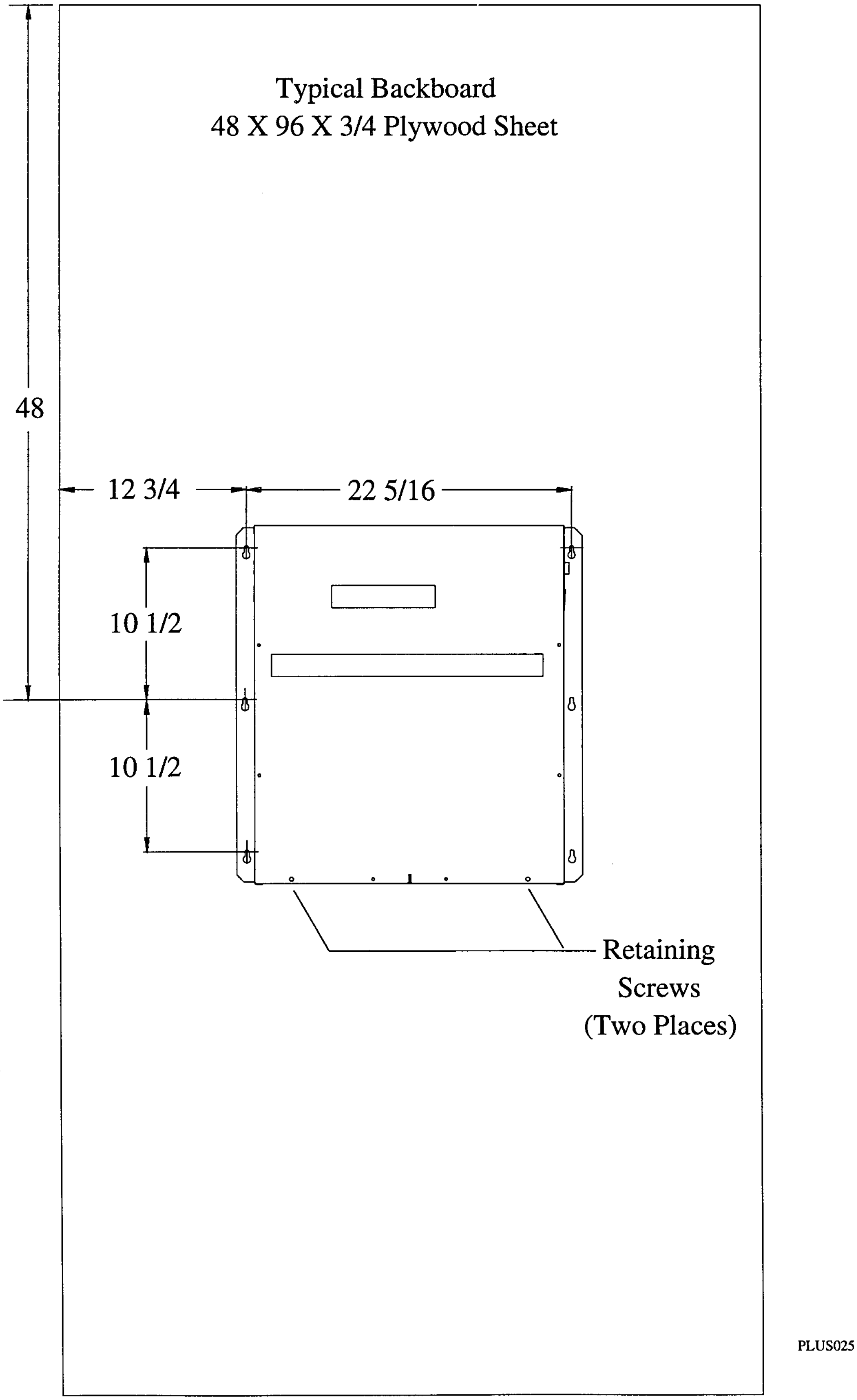
1. Unpack and carefully inspect all equipment for shipping damage. Notify the shipper immediately of any damages found. Verify that the packages contain all parts and accessories needed for proper installation and operation.

NOTE: The following instructions describe how to mount the main cabinet using a backboard; however, you can mount the cabinet on a standard 23–inch equipment rack if you wish.

2. Choose a place at the mounting location where the backboard will bridge underlying wall studs, and securely attach a suitable backboard to the mounting surface. (Suitable backboards are available commercially or you can construct one out of 3/4-inch plywood.) You must drive the hardware that secures the backboard to the mounting surface into the underlying wall studs instead of just into the wall material alone.
3. Refer to the illustration for the locating dimensions required for the mounting screws, and mark their locations on the backboard. You must attach the main common equipment cabinet vertically to the backboard.
4. Drill holes in the backboard of a proper size to accommodate the hardware being used.
5. Insert the two top screws into the backboard and tighten them to within approximately 1/8-inch of the surface.
6. Hang the cabinet on the top screws using the top mounting holes in the rear mounting flange of the cabinet. Note that these holes are elongated with an enlargement at one end. This feature allows the cabinet to slide down on the screws to secure the mounting when the cabinet is hung on them.
7. Use the openings for the middle and lower set of mounting screws as a guide, and mark the location for the remaining screws.
8. Lift the cabinet from the top screws and set it aside while preparing the holes for the remaining screws.
9. Rehang the cabinet as discussed in step 6.
10. Insert the middle and lower screws into the backboard and tighten them to within approximately 1/8-inch of the surface.

Shipping screws attach the front panel to the main cabinet. These screws are in addition to the two retaining screws located at the lower corners of the panel. Remove and store the shipping screws. You will not need them to re-attach the panel to the cabinet after you have installed the power supply assembly, circuit boards, and wiring; however, you will need them to secure the panel in place if you should later transport the cabinet to a new location.

After you remove the screws, pivot the front panel upward until you can unhook the panel hangers from the slots in the cabinet top. To re-attach the front panel, pivot it upward so that you can hook the panel hangers into the slots at the top of the cabinet, and then pivot the panel down in place. Install the two retaining screws at the bottom right-hand and left-hand corners of the panel to secure it to the cabinet.



Mounting The Common Equipment Cabinet

1.5 Understanding System Grounding Requirements

Transient voltage spikes, if induced onto CO or CENTREX lines, can travel through the cable and into the common equipment. The telephone company offers basic protection against this condition but it is usually designed to protect the central office circuits. While it will also provide some protection to the common equipment, you should not rely upon it for total protection. To help ensure that external over-voltage surges do not damage the system, you should install and properly ground primary protection devices, such as gas discharge tubes or similar devices, on all lines. While the line boards have internal secondary surge protection on all line ports, in order for this protection to be effective, you **MUST** connect the common equipment cabinet to a reliable, effective earth ground.

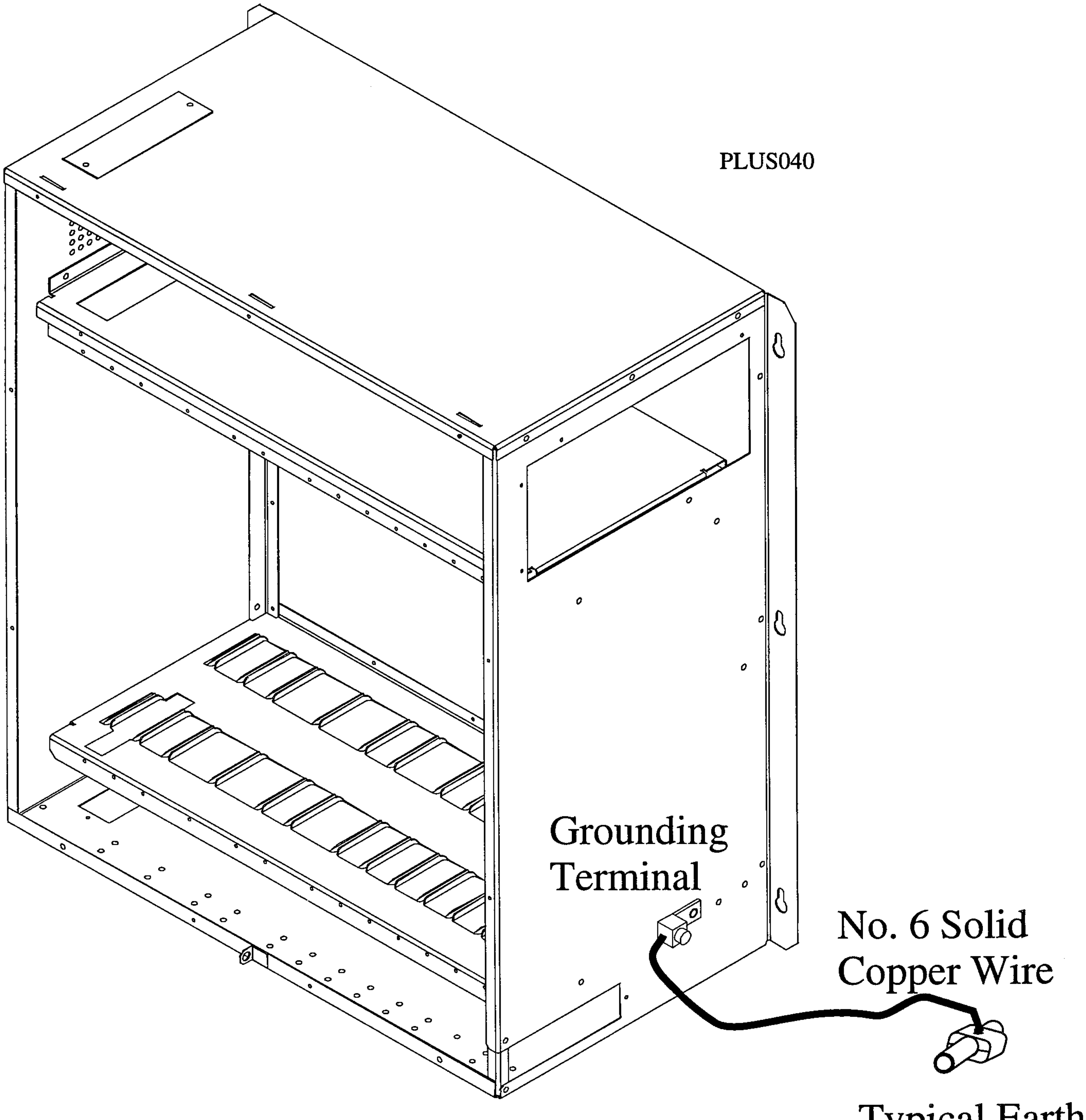
Proper DXP grounding is necessary for trouble-free operation and personnel safety. The DXP *Plus* has the following three types of grounds:

- Service Ground—a neutral power line wire that is connected to the ground bus in the premises' AC power panel,
- System Ground—a non-current carrying power line wire that is connected to the ground bus in the premises' AC power panel,
- Frame Ground—a low impedance conductor that places the common equipment cabinet at reference ground potential. The frame ground provides the greatest safety by limiting electrical potential between non-current carrying parts of the system. The common equipment cabinet provides a ground stud on its cabinet for access to its frame ground.

Effective grounding requires that you connect the frame ground to a good earth ground. A good earth ground is one such as the ground bus in the premises' AC power panel or a public metallic cold water pipe at a point immediately at its entrance to the premises and ahead of any meters, pumps, or insulating sections that have been added for vibration reduction. Avoid using the premises' structural steel frame as it may not be at earth ground potential. Make the ground connection with #6 or larger insulated, solid copper grounding wire. **Keep the ground wire separate from the three-wire AC line cord, do not splice it, and keep it as short as possible.**

The impedance of the wiring between the DXP and the earth ground must not exceed 0.25 ohms and the impedance between the earth ground and the power company's reference standard ground must not exceed 5 ohms. Use an acceptable low impedance measuring device to measure the impedance of these paths. The #6 or larger wire size will minimize the wiring impedance; however, if the impedance between earth ground and the power company's standard reference ground exceeds 5 ohms, contact the local power company. The ground path must always be of sufficient current-carrying capacity to prevent a build up of voltages that may result in circuit noise, hazard to personnel, or equipment damage.

Be sure that all of the ground connections are visible for inspection and maintenance. Tag all of the ground connections with a sign that reads: *Do Not Remove Or Disconnect.*



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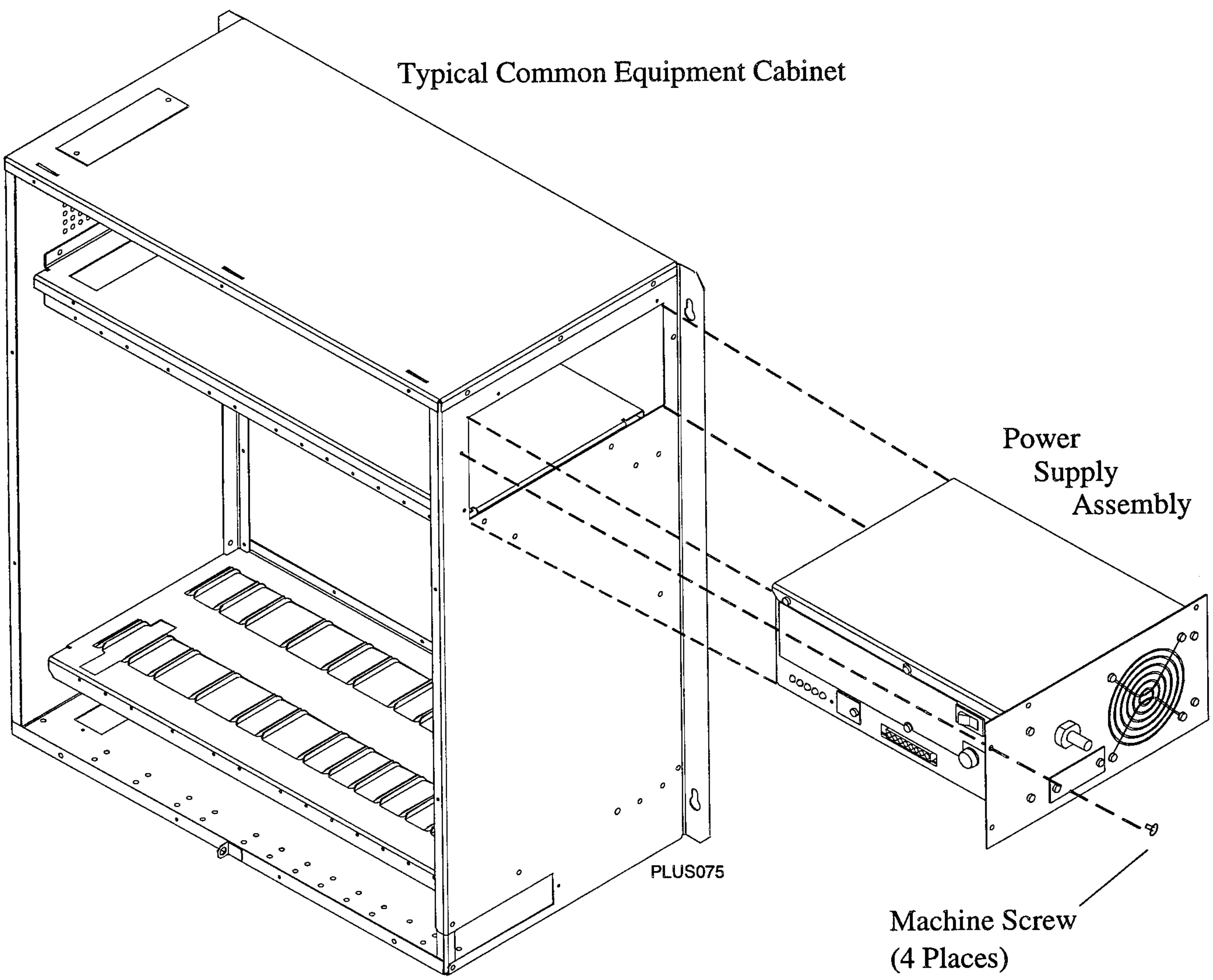
Grounding The System

2.0 Installing The Power Supply

NOTE: The common equipment cabinet employs an electronic switching power supply. During operation, power supplies of this type generate an audible sound from their switching regulators. This sound is normal and is not an indication that the power supply is operating improperly.

Install the power supply assembly in the common equipment cabinet per the following discussion and illustration.

1. Be sure to ground the common equipment cabinet per the instructions in the previous paragraph before installing the power supply assembly.
2. Remove the power supply assembly from the carton. Be sure to save the small bag containing the mounting hardware.
3. Slide the power supply assembly into the opening at the top right side of the common equipment main cabinet until the assembly's front panel contacts the side of the cabinet.
4. Locate the power cable routed from the backplane and connect it to the power supply's connector.
5. Remove the #6 thread-forming screws from the hardware bag and secure the assembly to the cabinet.
6. The supplied power supply assembly accessories include a ferrite collar. Snap this collar around the AC power cord to provide protection against radio frequency interference.



Installing The Power Supply

2.1 Making The AC Power Connection

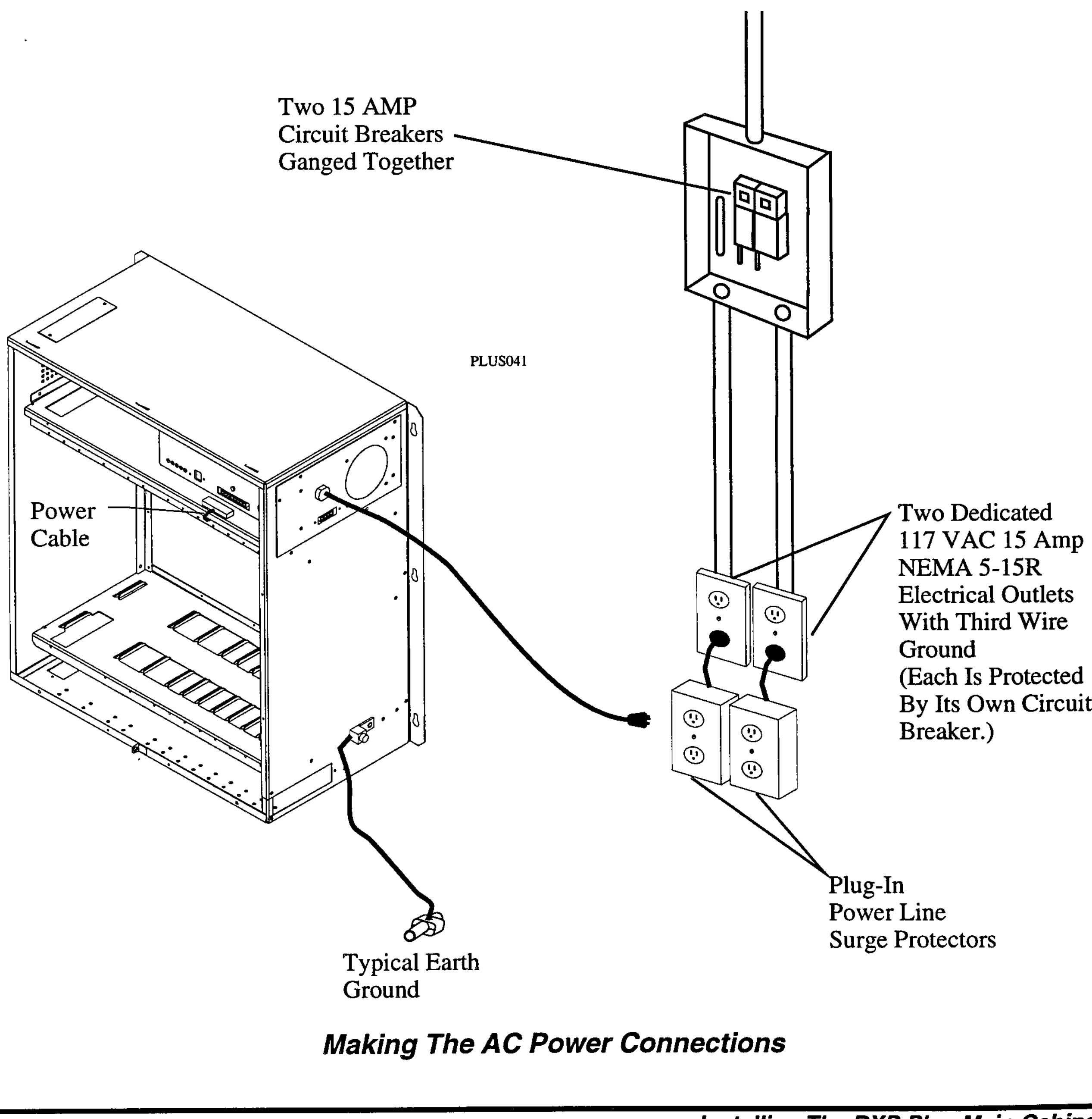
- For the main cabinet's AC power connection, employ a dedicated 117 VAC 15 AMP circuit, with a third-wire ground, supplied to a standard electrical outlet (NEMA 5-15R). Remember, this electrical outlet must be located within four feet of the common equipment cabinet. Remember also, you must supply two dedicated electrical outlets if you plan to later install expansion cabinets.

NOTE: *If you install the optional battery back-up assembly, you can use this same outlet to supply AC power to that assembly's battery charger.*

- To provide protection against surges and spikes that may appear on the AC line, install a plug-in power line surge protector between the AC power cord of the installed equipment and the AC outlet..

CAUTION

DO NOT attach or secure the line cord to the surface of the mounting location in any manner.



Making The AC Power Connections

2.2 Measuring The Power Supply Voltages

If you need to measure power supply voltages, you can do so at the DC voltage connector. Measure the power under the following conditions:

- AC line cord connected to the AC outlet,
- DC power cable disconnected from power supply's DC voltage connector,
- AC power switch turned on.

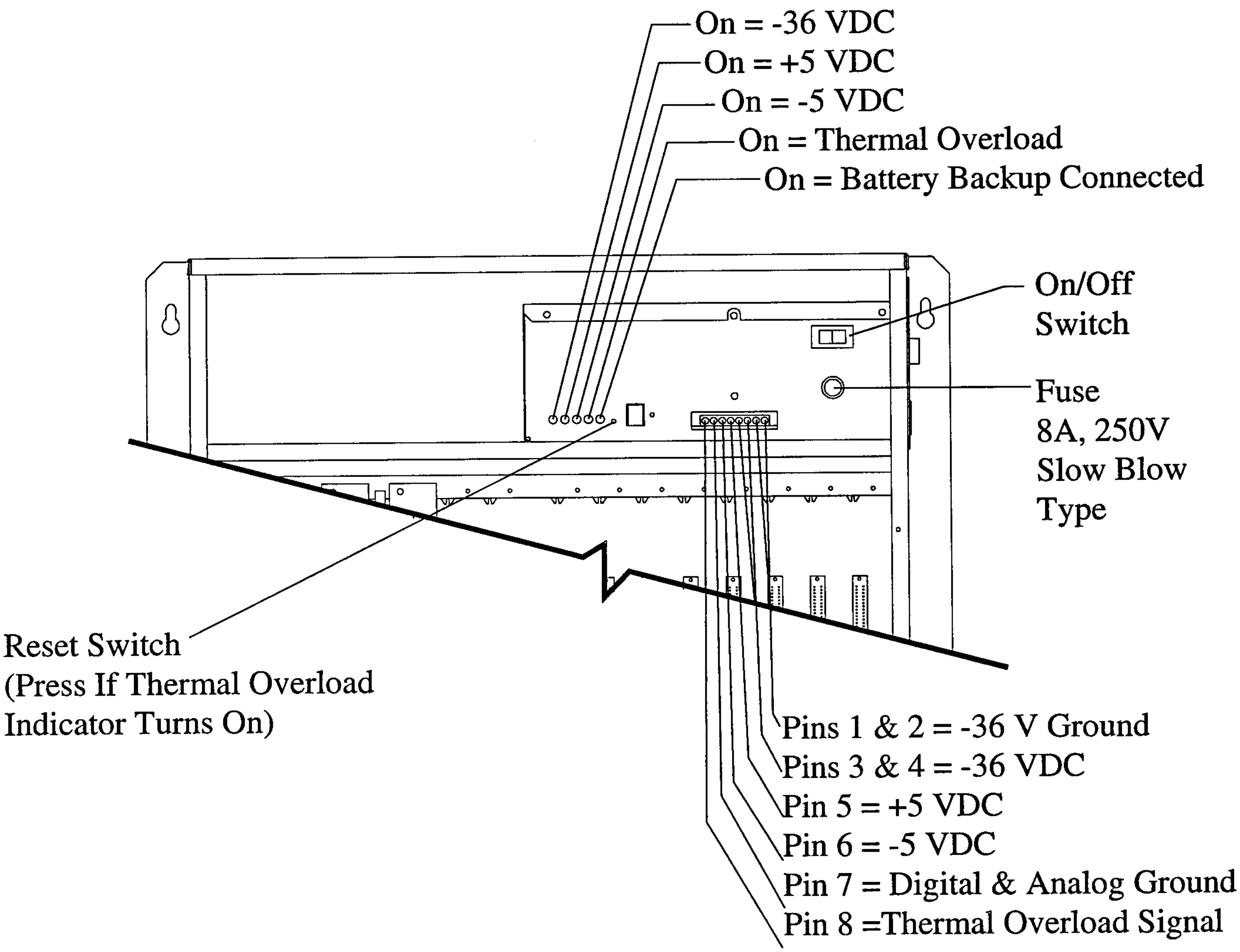
Measurement details are shown in the illustration.

CAUTION

Once you have measured the power supply voltages, turn off the AC power switch and disconnect the AC line cord from the AC outlet. Leave the AC power disconnected until you have installed the circuit boards in the main cabinet.

2.3 Identifying The Fuse

The power supply fuse is a *slow-blow* type rated at 8 AMPS and 250 VOLTS. A replacement fuse must have the same rating.



Power Supply Measurements		
Measure Between Terminals		Measured Values
+ Voltmeter Lead	- Voltmeter Lead	
Pin 1	Pin 3	- 36 VDC +/- 1.0V
Pin 5	Pin 7	+ 5 VDC +/- .3 V
Pin 6	Pin 7	- 5 VDC +/- .3 V
Pin 8	Pin 7	0 volts = normal operation + 5 V nominal = thermal overload condition (press Reset switch)

Measuring The Power Supply Voltages

3.0 Installing Circuit Boards In The Main Cabinet

CAUTION

Circuit boards for the DXP Plus system are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, *Handling Of Electrostatically Sensitive Components, for general information. Specific handling precautions are also included in this installation instruction.*

Each circuit board is supplied in a static protection bag. Do not open a static protection bag prior to board installation time.

The board slots are keyed so that only those boards that will operate from a particular slot will plug into that slot.

The main cabinet provides unique slots for the CPU board, the services board, and the interface board for the main cabinet). The remaining board slots are universal and will accept auxiliary boards, line boards, or station boards .

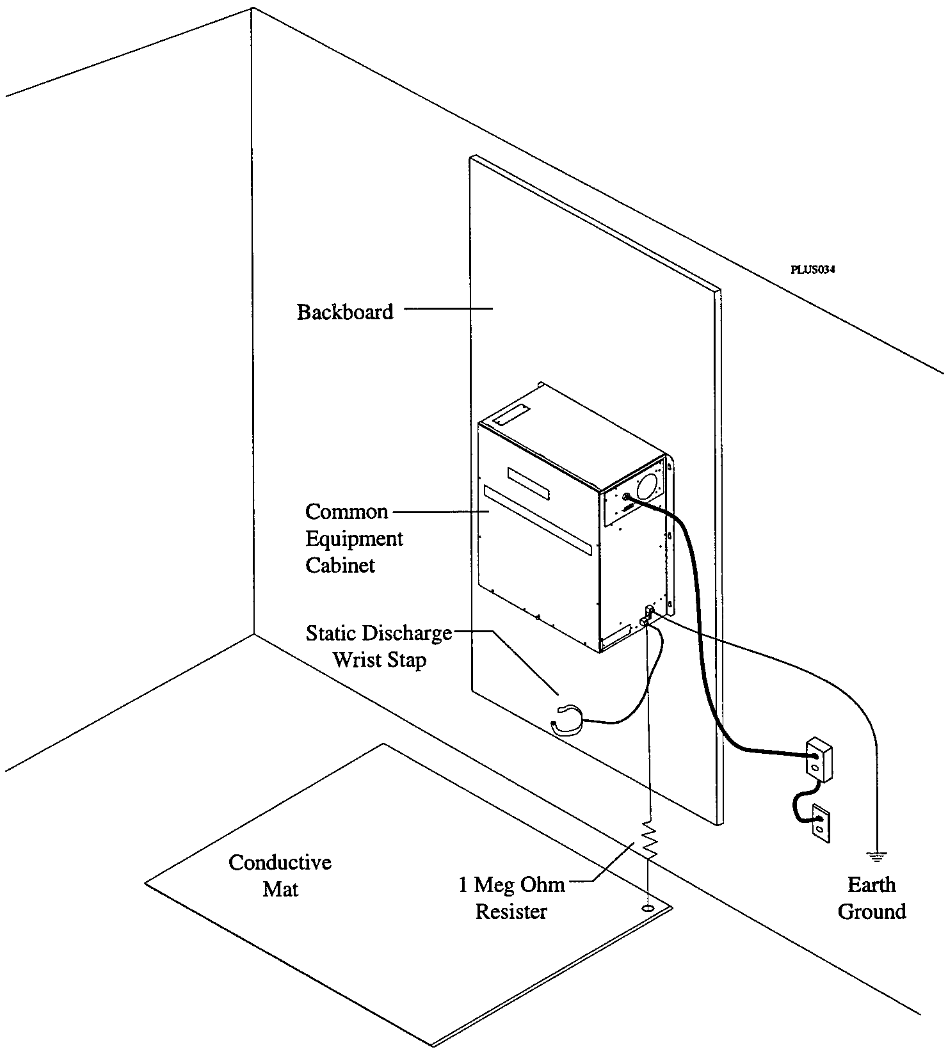
This publication provides installation instructions for the CPU and services boards. Since you will install line and station boards as well as auxiliary boards and other optional circuit boards on an as needed basis, each of these boards include its own installation instruction for your reference.

3.1 Creating A Static Safe Work Area

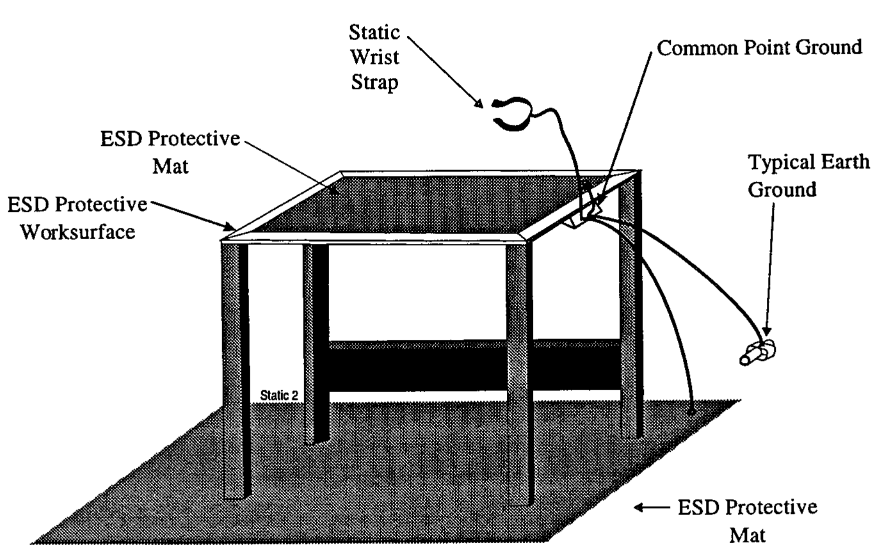
When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



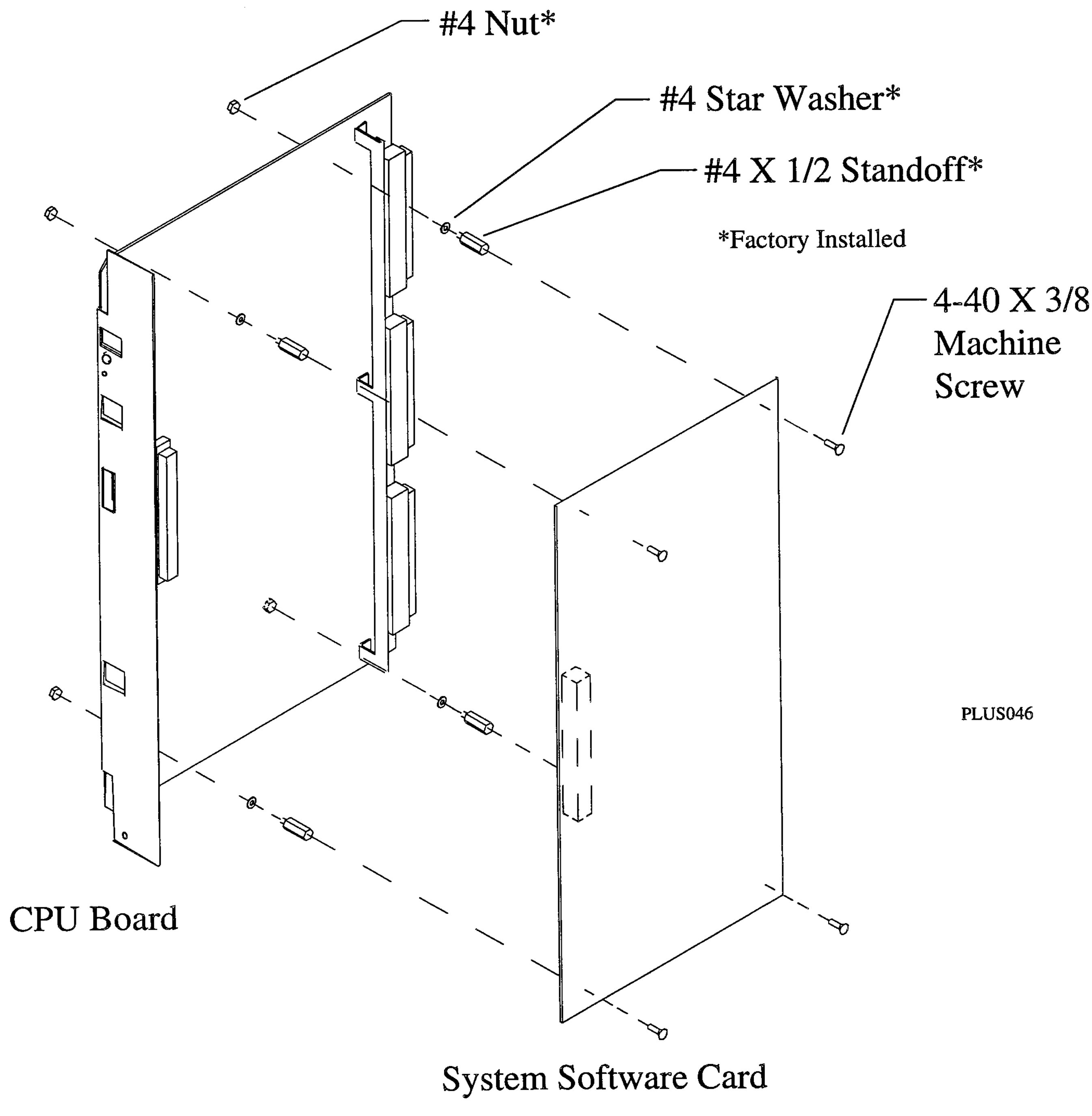
Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

3.2 Installing The System Software And CPU Board

1. Place the static protection bags that contain the CPU board and the system software card on the static safe work area.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground.
3. Remove the CPU board and system software card from their static protection bags, orient them as shown in the illustration, and attach them with the supplied hardware.



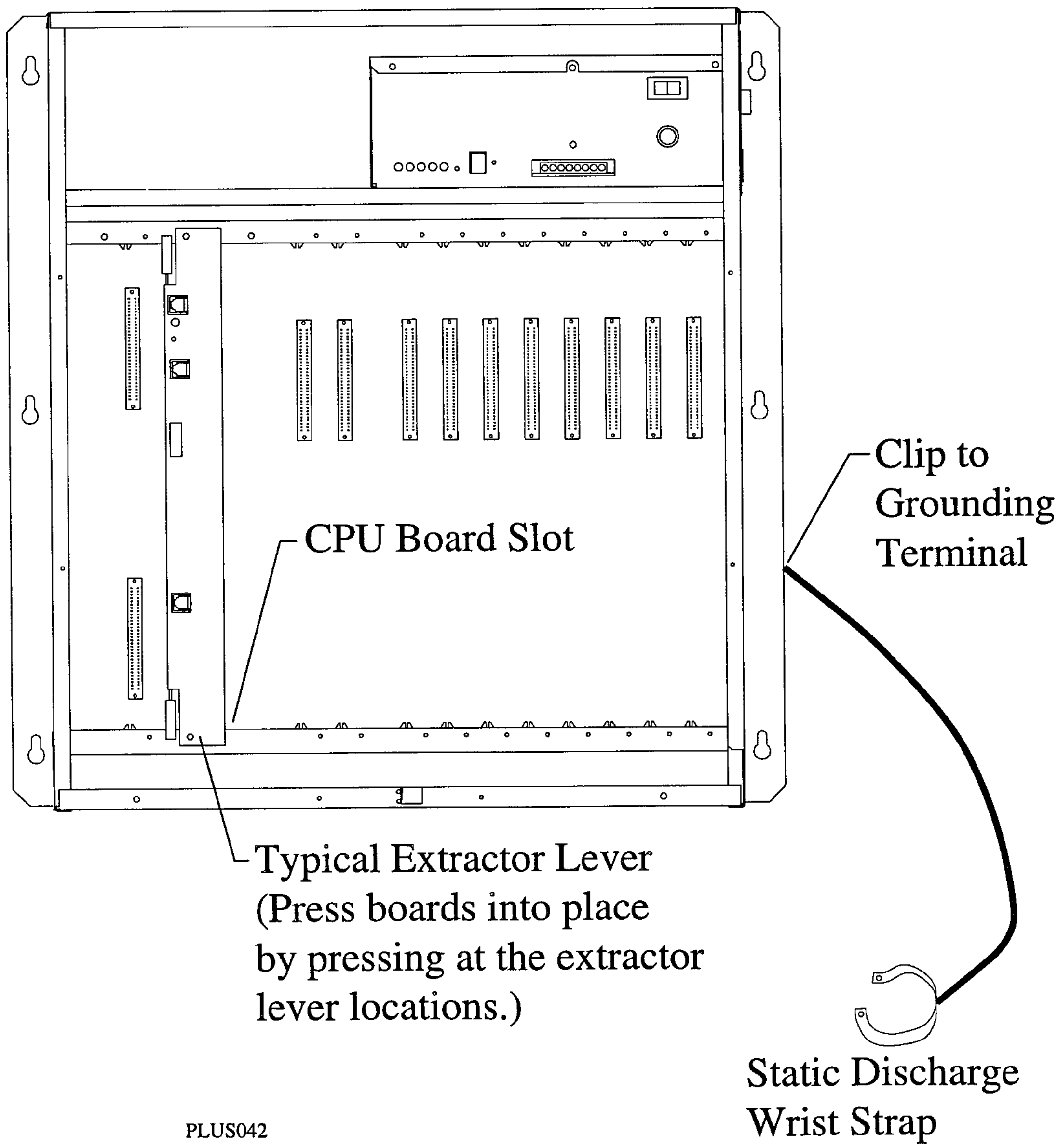
Assembling The Software Board To The CPU Board

4. If the common equipment cabinet is not at the static safe work area, place the assembled CPU board and software card into a static protection bag and transport the board assembly to the cabinet.
5. Be sure that the AC power cord is not connected to an AC outlet and that the cable from the optional battery back-up assembly is not connected to the main cabinet power supply.
6. Locate the proper board slot. Remember, the CPU board plugs into a unique slot.
7. With your static discharge wrist strap properly grounded, remove the board and card assembly from the static protection bag. Orient it with the top and bottom guides in the main cabinet board cage, and press it in firmly until the board edge connector properly mates with the backplane connector.

CAUTION

When pressing the board and card assembly into place, press it only at the extractor lever locations. If you apply pressure at other locations, you may damage the board assembly.

8. Make a final inspection to ensure that the board and card assembly is in the correct slot, oriented correctly and mated properly; then install and tighten the supplied screws to secure it to the board cage.



Installing The Assembled Software And CPU Board

3.3 Installing The Services Boards In The Equipment Cabinet

1. Be sure that the AC power cord is not connected to an AC outlet and that the cable from the optional battery back-up assembly is not connected to the main cabinet power supply.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground

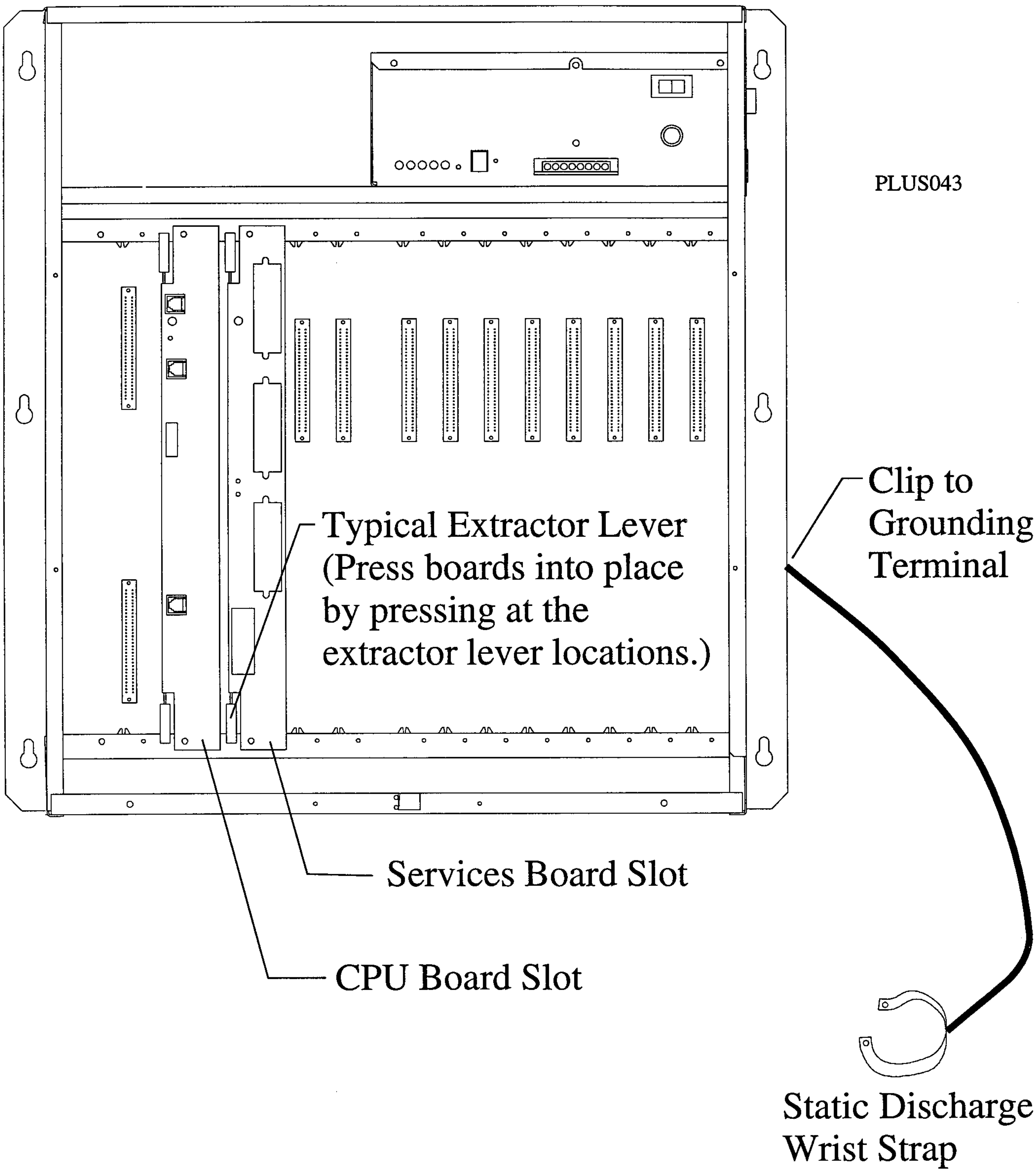
NOTE: With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.

3. When you are ready to install the circuit board, remove it from its static protection bag.
4. Locate the proper board slot. Remember, the service board plugs into into a unique slot.
5. Orient the circuit board with its top and bottom guides in main cabinet board cage. and press the board firmly until its board edge connection properly mates with the connector on cabinet's backplane.

CAUTION

When pressing circuit boards into place, press them only at the extractor lever locations. If you apply pressure at other locations you may damage the board assembly.

6. Repeat steps 3 and 4 until all circuit boards are installed.
7. Make a final inspection to ensure that all circuit boards are, oriented correctly and mated properly.
8. Install and tighten the supplied screws to secure the circuit boards to the board cage.



Viewing The Circuit Board Installation

4.0 Connecting Data Devices

The system provides two short-run serial data ports on the CPU board. The system designates these modular jacks as **Modem** and **Maintenance.** These two serial data ports are dedicated to the personal computer (PC) that you will use to load the programmed data base and to the remote servicing and programming modem that you will use to remotely load the programmed data base and troubleshoot the system. Since these serial data ports are short-run, you must keep the cabled distance between the data device and the data port to 25 feet or less.

NOTE: *If you connect a modem other than the DXMDM, you must interface that modem through a comunications card that you have installed on the services board or an auxiliary board.*

CAUTION

When you are not using a PC for programming purposes, you should disconnect it from the maintenance port. It is possible for the idle connected PC to induce electrical interference that may affect system performance.

Remember, **a data cable must be no longer than 25 feet in length**. When preparing a data cable for connection to a data device, refer to the manufacturer's manual for the equipment being interfaced and make the following wiring connections:

- Wire the common equipment RD (data from device to common equipment) connection to the device TD (transmit data) connection.
- Wire the common equipment TD (data to device from common equipment) connection to the device RD (receive data) connection.
- Wire the common equipment SG (signal ground) connection to the device SG (signal ground) connection.
- If required for proper operation, wire the common equipment CTS (clear-to-send status from device to common equipment) connection to the device RTS (request-to-send) connection.

NOTE: *The common equipment requires a positive voltage, with respect to signal ground, in order to send data.*

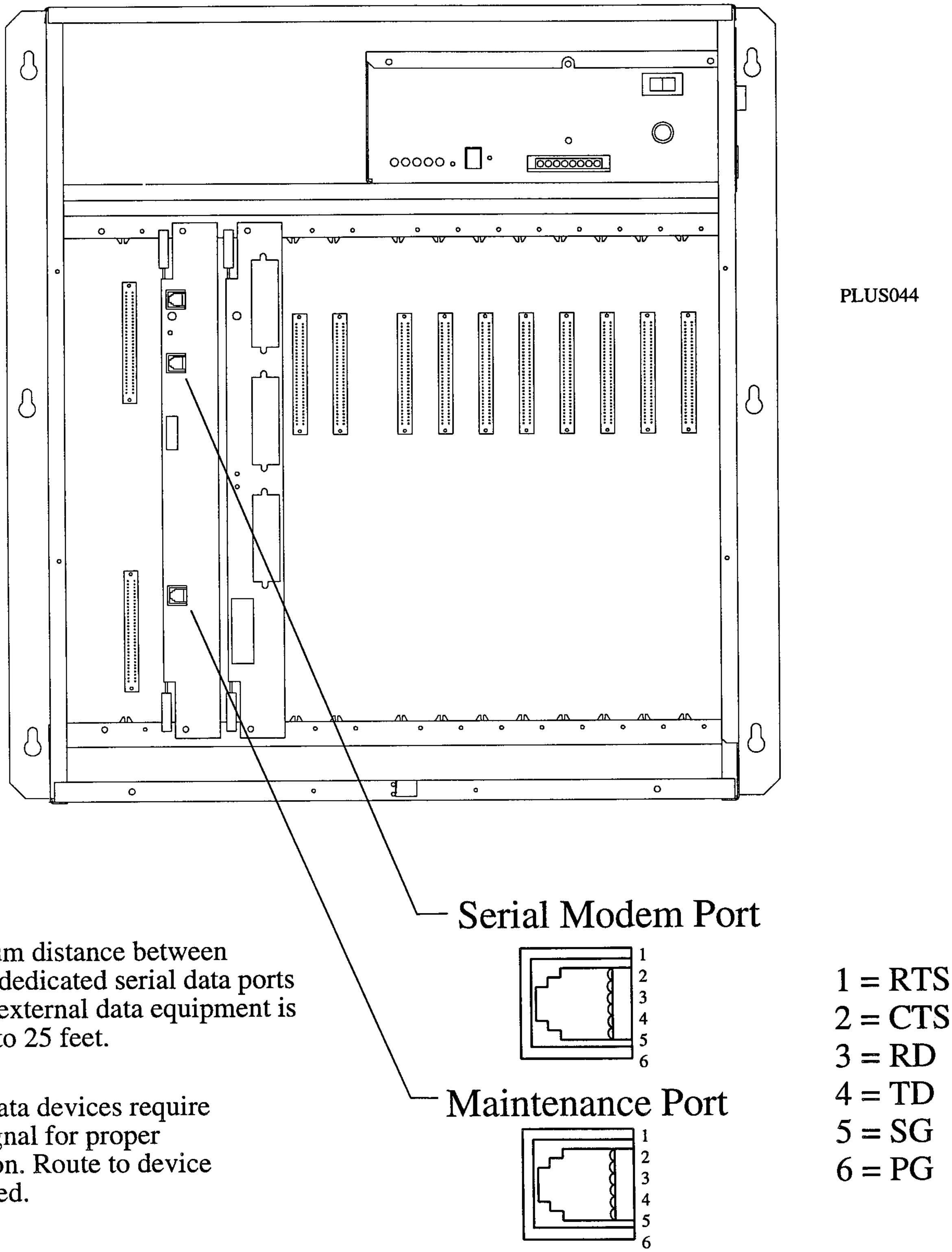
- If the cable has spare wires, be sure to ground them so that they will not act as antennas and induce interference into the system. Further, if there is a source of RF power nearby (such as a radio transmitter), use shielded cable and ground the shield at both ends.

The default data format is shown in the following chart. Configure the data device that you connect to the maintenance port to match the charted information.

Port Type	Baud Rate	Data Bit	Stop Bit	Parity Bit
Maintenance Port	**9600**	**8**	**1**	**0**
Modem Port	**2400**	**8**	**1**	**0**

CAUTION

As an added precaution against induced interference, route the data cable as far away from any fluorescent lighting as you can reach, and make every effort to route the data cable perpendicular to other wiring.



NOTES:

1. Maximum distance between the two dedicated serial data ports and the external data equipment is limited to 25 feet.

2. Some data devices require CTS signal for proper operation. Route to device as needed.

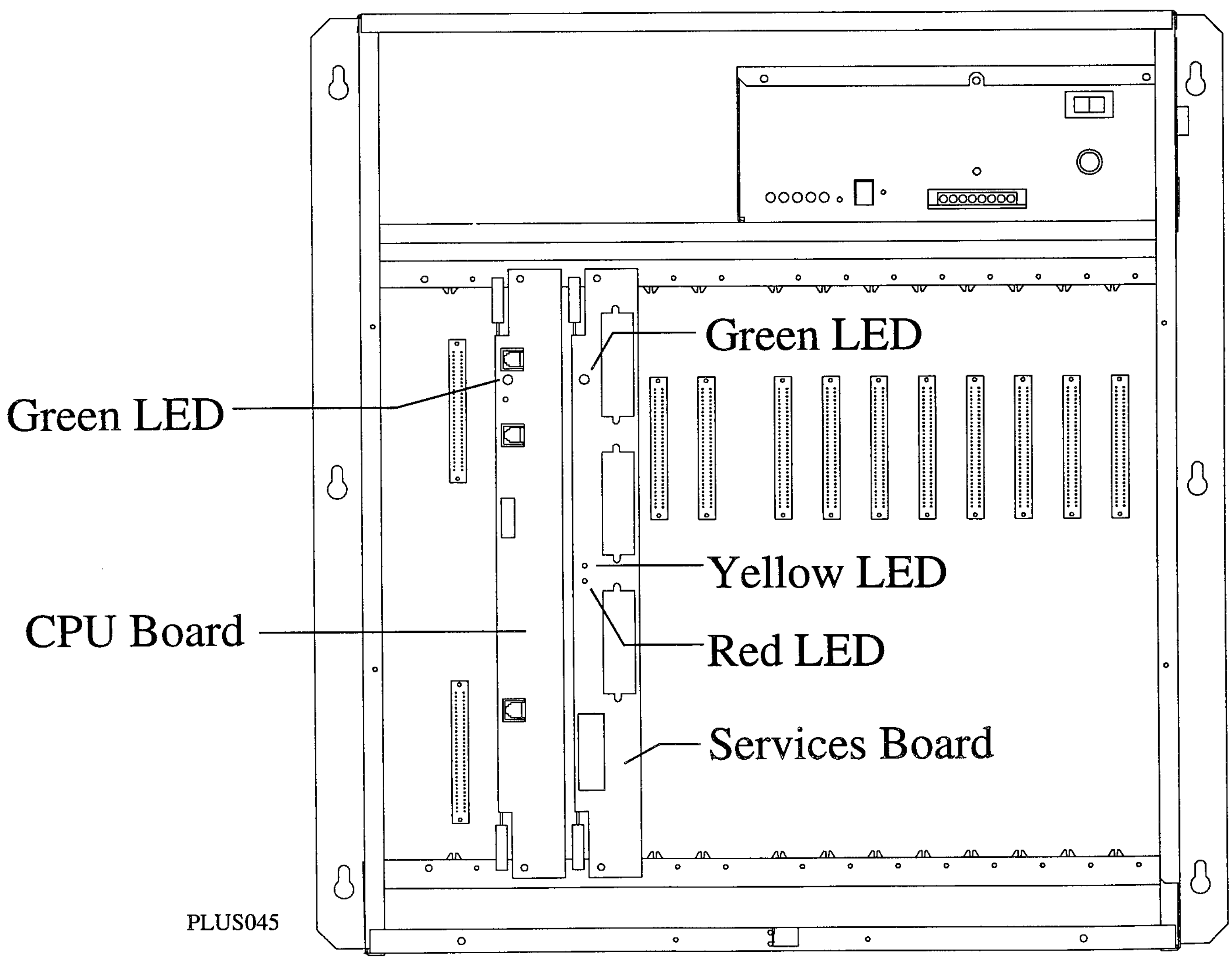
Detailing Typical Data Device Connections

5.0 Viewing The Circuit Board Status Indicators

Once you have installed the CPU board and services board in the main cabinet, turn on the AC power and observe the board's status lights.

The status light on the front of the circuit boards shows the following conditions:

Circuit Board	Status Light Condition
CPU Board	Steady On = Normal Operation Steady Off = System Malfunction
Services Board	Green Steady On = Normal Operation Green Steady Off = System Malfunction Yellow Off, Red Off = Normal Operation Yellow On, Red Off = Main Cabinet Using Battery Back Up Operation Yellow Off, Red On = Main Cabinet Out Of Service



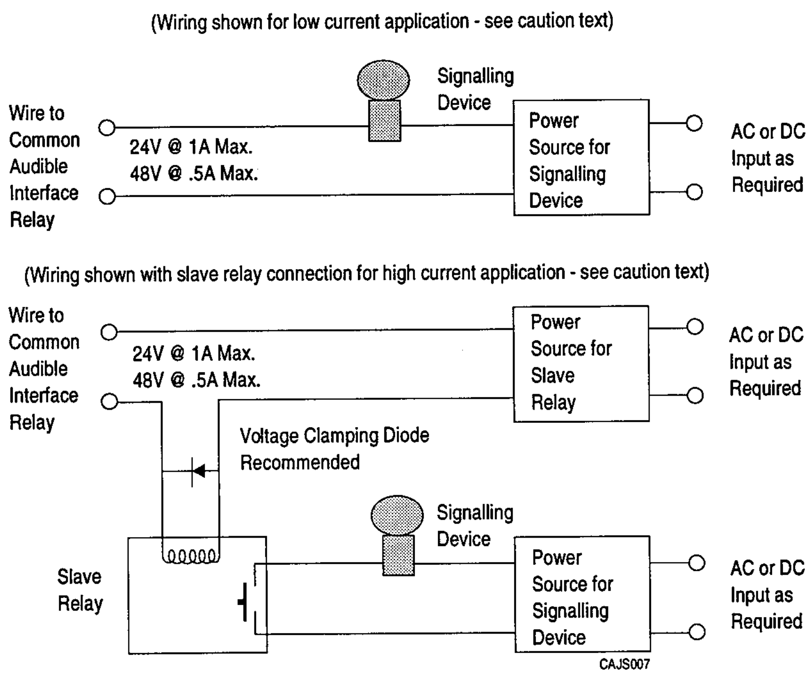
Locating The Status Lights

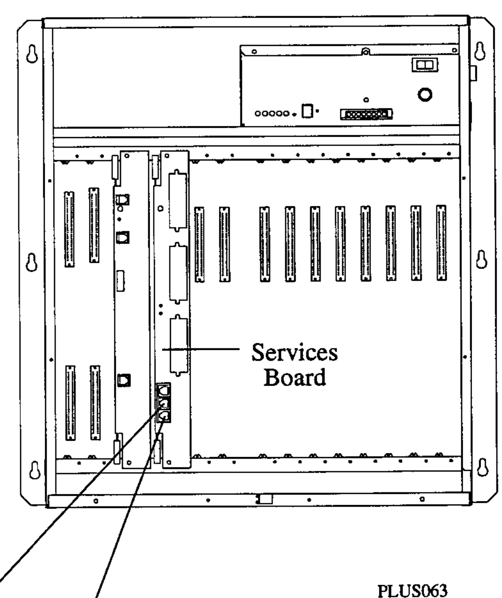
6.0 Configuring The Common Audible Ringing Interface

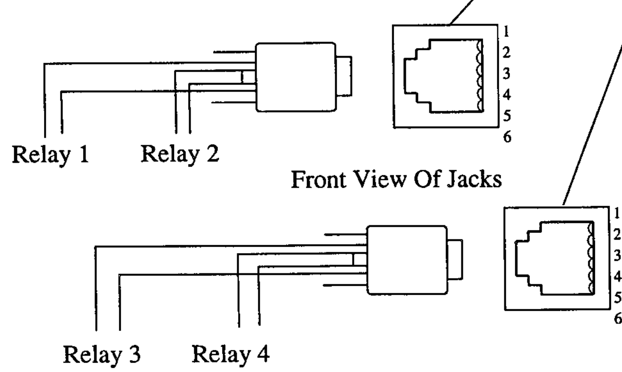
The services board provides relay actuation dry-contact terminals that you can use for controlling external ringing equipment. These relays are under programming control. You can program them to provide dry-contact actuations that track the ringing pattern of any of the programmed flexible ringing assignment ringing patterns.

CAUTION

Do not exceed a 1 amp at 24 volts (0.5 amp at 48 volts) load on these control terminals. If the load requirements exceed this limit, connect the load through an external slave relay. DO NOT CONNECT THESE CONTROL TERMINALS DIRECTLY TO THE 120VAC LINE.







Common Audible Interface Relays

Relay Jack	Pin No.	Signal
J3	1	No Contact
	2	Relay 1
	3	Relay 2
	4	Relay 2
	5	Relay 1
	6	No Contact
J4	1	No Contact
	2	Relay 3
	3	Relay 4
	4	Relay 4
	5	Relay 3
	6	No Contact

Detailing Typical Common Audible Interface Wiring

7.0 Configuring The External Paging Interface

A special transformer-isolated external paging port, located on the services board, provides system interface for an external paging amplifier. Connect a customer-supplied paging amplifier to the PAGE jack as shown in illustration.

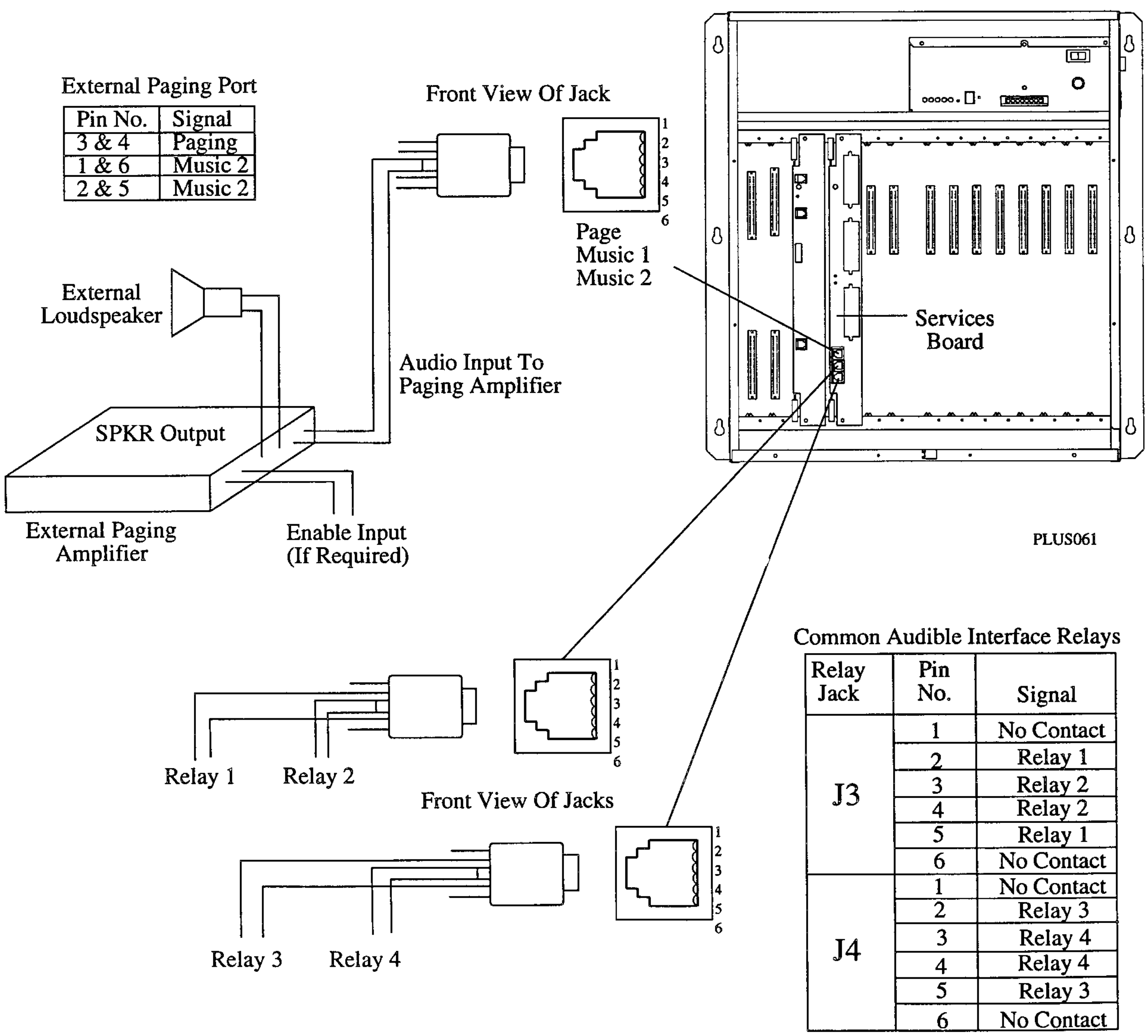
Remember, the Services board provides relay actuation dry-contact terminals that you can use for controlling the external paging amplifier. Of course, you must make the necessary wiring arrangements to match the control that you want to occur.

Once you have made the necessary wiring connections, you may either:

- program any of the relays to provide dry-contact actuation that will turn on the paging amplifier for as long as the paging port is active,
- or program any of the relays to use their dry-contact actuations to track line ringing signals sent from the paging port. (This is useful for turning the amplifier on and off to sound these ringing signals.)

CAUTION

Do not exceed a 1 amp at 24 volts (0.5 amp at 48 volts) load on these control terminals. If the load requirements exceed this limit, connect the load through an external slave relay. DO NOT CONNECT THESE CONTROL TERMINALS DIRECTLY TO THE 120VAC LINE.



External Paging Port

Pin No.	Signal
3 & 4	Paging
1 & 6	Music 2
2 & 5	Music 2

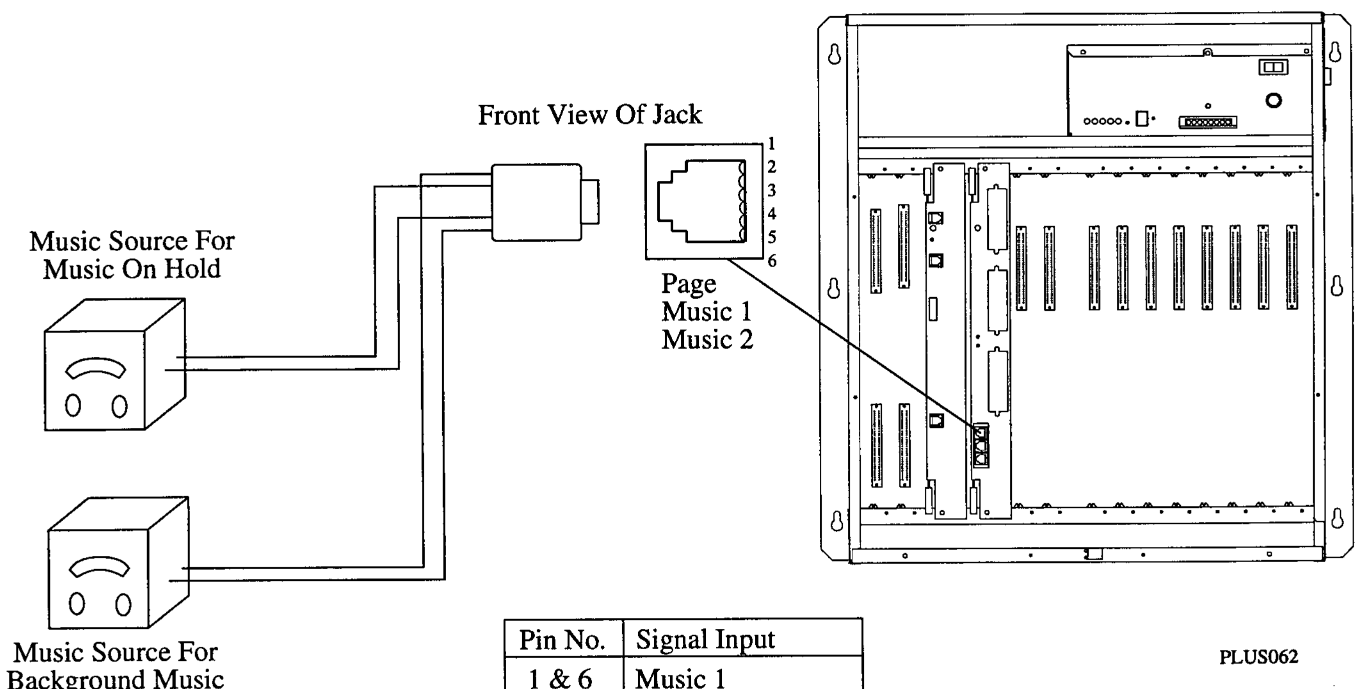
Common Audible Interface Relays

Relay Jack	Pin No.	Signal
J3	1	No Contact
	2	Relay 1
	3	Relay 2
	4	Relay 2
	5	Relay 1
	6	No Contact
J4	1	No Contact
	2	Relay 3
	3	Relay 4
	4	Relay 4
	5	Relay 3
	6	No Contact

Making A Typical External Paging Connection

8.0 Installing An External Audio Source

If music or other audio information is to be part of the system, connect a customer-provided audio source to the common equipment music interface jack provided on the services board. These jacks are labeled MUSIC1 and MUSIC2. You can provide different audio sources, one for outside parties while on hold and another for internal background music, if desired. The input impedance of the music interface is approximately 500 ohms. Use the volume control on the audio source(s) to adjust the audio level of the music source(s) as required.



Pin No.	Signal Input
1 & 6	Music 1
2 & 5	Music 2

Installing An External Audio Source

9.0 Understanding FCC Rules And Regulations

This DXP *Plus* digital communications system complies with Federal Communications Commission (FCC) Rules, Part 68. The FCC registration label on the equipment cabinet contains the FCC registration number, the ringer equivalence number, the model number, and the serial number or production date of the system.

Notification To Telephone Company

Unless a telephone operating company provides and installs the system, the telephone operating company which provides the lines must be notified before a connection is made to them. The lines (telephone numbers) involved, the FCC registration number, and the ringer equivalence number must be provided to the telephone company. The FCC registration number and the ringer equivalence number of this equipment are provided on the label attached to the common equipment. The user/installer is required to notify the telephone company when final disconnection of this equipment from the telephone company line occurs.

Compatibility With Telephone Network

When necessary, the telephone operating company provides information on the maximum number of telephones or ringers that can be connected to one line, as well as any other applicable technical information. The telephone operating company can temporarily discontinue service and make changes which could affect the operation of this equipment. They must, however, provide adequate notice, in writing, of any future equipment changes that would make the system incompatible.

Installation Requirements

Connection of the DXP *Plus* system to the telephone lines must be through a universal service order code (USOC) outlet jack supplied by the telephone operating company. If the installation site does not have the proper outlet, ask the telephone company business office to install one. The correct outlet jack for this system is either a type RJ21X or type RJ14C.

Party Lines And Coin Lines

Local telephone company regulations may not permit connections to party lines and coin lines by anyone except the telephone operating company.

Troubleshooting

If a service problem occurs, first try to determine if the trouble is in the on-site system or in the telephone company equipment. Disconnect all equipment not owned by the telephone company. If this corrects the problem, the faulty equipment must not be reconnected to the telephone line until the problem has been corrected. Any trouble that causes improper operation of the telephone network may require the telephone company to discontinue service to the trouble site after they notify the user of the reason.

Repair Authorization

FCC regulations do not permit repair of customer owned equipment by anyone except the manufacturer, their authorized agent, or others who might be authorized by the FCC. However, routine repairs can be made according to the maintenance instructions in this publication, provided that all FCC restrictions are obeyed.

Radio Frequency Interference

The DXP *Plus* system contains incidental radio frequency generating circuitry and, if not installed and used properly, may cause interference to radio and television reception. This equipment has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules. These limits are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference to radio and television reception; in which case the user is encouraged to take whatever measures may be required to correct the interference. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient the television or radio's receiving antenna, and/or relocate the DXP, the individual telephone stations, and the radio or TV with respect to each other. If necessary, the user should consult the manufacturer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the Government Printing Office, Washington D.C. 20402. Stock No. 004-000-00345-4.

This equipment has been tested and found to comply with the limits of 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.

This digital apparatus does not exceed the (Class A) limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le pre'sent appareil nume'rique n'emet pes de bruits radioe'lectriques de'passant les limites applicables aux appareils nume'riques (de la class A) prescrites dans le Re'glement sur le brouillage radioe'lectrique e'dicte' par le ministe're des Communications du Canada.

CAUTION

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Ringer Equivalence Number

The REN of each line is 0.4B. The FCC requires the installer to determine the total REN for each line, and record it at the equipment.

COMDIAL

Charlottesville, VA 22906-7266

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COMDIAL

Installing The DXP Plus Expansion Common Equipment Cabinet

1.0 Installing The Expansion Common Equipment Cabinet

1.1 Considering The Mounting Parameters

Mount the first expansion cabinet above the main common equipment cabinet and mount the second expansion cabinet below the main common equipment cabinet.

Insure that the expansion cabinet is within four feet of it own dedicated 117VAC, 15 AMP electrical outlet. (The expansion cabinet requires its own dedicated 117VAC 15 AMP circuit, with a third-wire ground, supplied to a standard NEMA 5-15R electrical outlet and supplied from the opposite phase of the AC power line that supplies power to the main cabinet.)

CAUTION

This dedicated AC circuit must different from the dedicated AC circuit that you provide for the main cabinet. For best results wire the expansion cabinet's dedicated AC circuit from a power phase that is opposite from the one that supplies the main cabinet's AC circuit.

1.2 Inventorying The Tools And Hardware

- Round head wood screws (typically 1/4 x 1–inch)—for mounting expansion equipment cabinet to backboard)
- Cross recessed screwdriver (phillips-head type)—to match front panel shipping screws
- Flat blade screwdriver—to match front panel retaining screws
- Electric drill—if prepared holes are required
- Connecting tool—for fastening wires to a type-66 connector block.
- Crimping tool—for 623-type modular plugs
- Static discharge wrist strap and conductive floor mat

1.3 Complying With Underwriters Laboratories Regulations

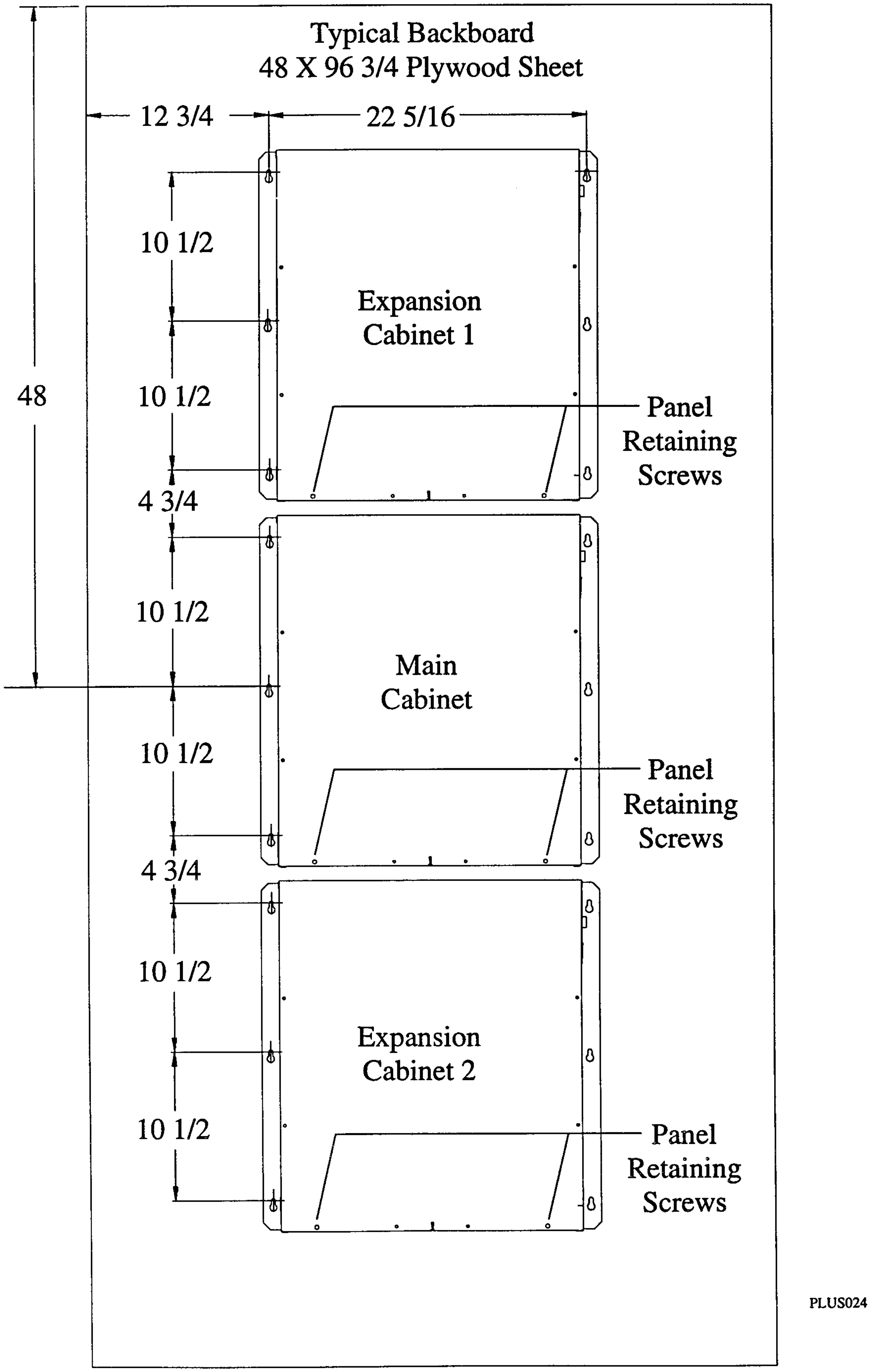
Per The Underwriters Laboratories regulation 1459, 2nd edition, be aware of the following precautions when installing telephone equipment that is to be directly connected to the telephone company network:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Printed in U.S.A.
IMI66-106.02
6/95

1.4 Mounting The Expansion Common Equipment Cabinet

1. Unpack and carefully inspect all equipment for shipping damage. Notify the shipper immediately of any damages found. Verify that the packages contain all parts and accessories needed for proper installation and operation.
2. Expansion cabinet one mounts above the main cabinet and expansion cabinet two mounts below the main cabinet. After you determine where you will mount the expansion cabinet, remove the plates covering the appropriate interface cable access holes on the main and expansion cabinets. As you face the front of the cabinets, these plates are located near the left front of the cabinet's top and bottom.
3. The illustration shows the locating dimensions required for the expansion cabinet's mounting screws. Mark the hardware locations on the backboard either above or below the main common equipment cabinet depending upon where you intend to mount the cabinet. (You must mount the cabinet vertically on the backboard.)
4. Drill holes in the backboard of a proper size to accommodate the hardware being used.
5. Insert the two top screws into the backboard and tighten them to within approximately 1/8-inch of the surface.
6. Hang the cabinet on the top screws using the top mounting holes in the rear mounting flange of the cabinet. Note that these holes are elongated with an enlargement at one end. This feature allows the cabinet to slide down on the screws to secure the mounting when the cabinet is hung on them.
7. Use the openings for the middle and lower set of mounting screws as a guide, and mark the location for the remaining screws.
8. Lift the cabinet from the top screws and set it aside while preparing the holes for the remaining screws.
9. Rehang the cabinet as discussed in step 6.
10. Insert the middle and lower screws into the backboard and tighten them to within approximately 1/8-inch of the surface.
11. Shipping screws attach the front panel to the main cabinet. These screws are in addition to the two retaining screws located at the lower corners of the panel. Remove and store the shipping screws. You will not need them to re-attach the panel to the cabinet after you have installed the power supply assembly, circuit boards, and wiring; however, you will need them to secure the panel in place if you should later transport the cabinet to a new location.
12. After you remove the shipping and retaining screws, pivot the front panel upward until you can unhook the panel hangers from the slots in the cabinet top. To re-attach the front panel, pivot it upward so that you can hook the panel hangers into the slots at the top of the cabinet, and then pivot the panel down in place. Install the two retaining screws at the bottom right-hand and left-hand corners of the panel to secure it to the cabinet.



Mounting The Common Equipment Cabinet

1.5 Understanding System Grounding Requirements

Transient voltage spikes, if induced onto CO or CENTREX lines, can travel through the cable and into the common equipment. The telephone company offers basic protection against this condition but it is usually designed to protect the central office circuits. While it will also provide some protection to the common equipment, you should not rely upon it for total protection. To help ensure that external over-voltage surges do not damage the system, you should install and properly ground primary protection devices, such as gas discharge tubes or similar devices, on all lines. While the line boards have internal secondary surge protection on all line ports, in order for this protection to be effective, you **MUST** connect the common equipment cabinet to a reliable, effective earth ground.

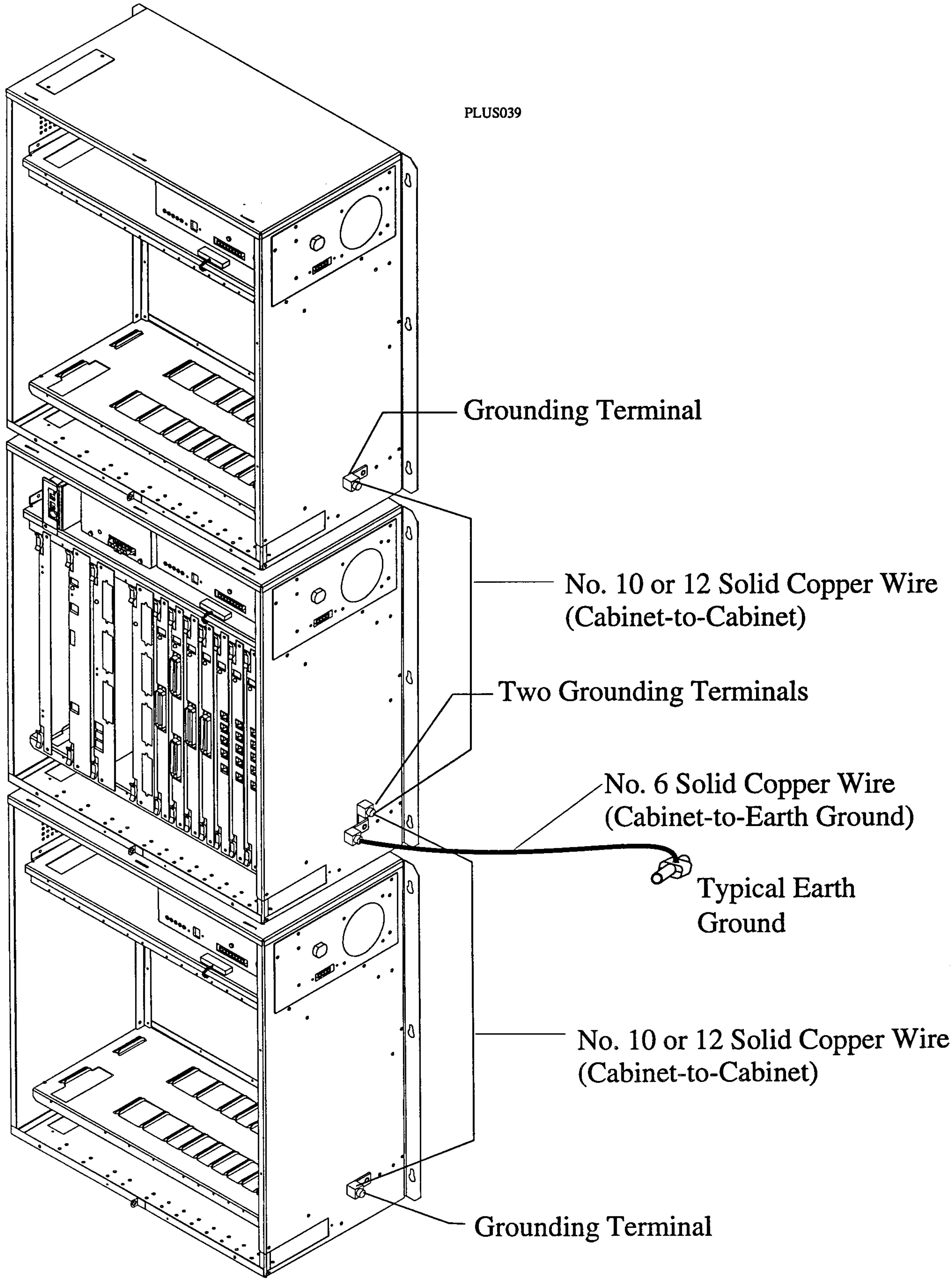
Proper DXP grounding is necessary for trouble-free operation and personnel safety. The DXP *Plus* has the following three types of grounds:

- Service Ground—a neutral power line wire that is connected to the ground bus in the premises' AC power panel,
- System Ground—a non-current carrying power line wire that is connected to the ground bus in the premises' AC power panel,
- Frame Ground—a low impedance conductor that places the common equipment cabinet at reference ground potential. The frame ground provides the greatest safety by limiting electrical potential between non-current carrying parts of the system. The common equipment cabinet provides a ground stud on its cabinet for access to its frame ground.

Effective grounding requires that you connect the frame ground to a good earth ground. A good earth ground is one such as the ground bus in the premises' AC power panel or a public metallic cold water pipe at a point immediately at its entrance to the premises and ahead of any meters, pumps, or insulating sections that have been added for vibration reduction. Avoid using the premises' structural steel frame as it may not be at earth ground potential. Use #10–12 or larger insulated solid copper grounding wire to connect the frame ground of the expansion cabinet (available through the ground stud on the expansion cabinet's side) to the frame ground of the main common equipment cabinet. Use #6 or larger insulated solid copper grounding wire to make the ground connection from the main cabinet's frame ground to earth ground. **Keep this ground wire separate from the three-wire AC line cord, do not splice it, and keep it as short as possible.**

The impedance of the wiring between the DXP and the earth ground must not exceed 0.25 ohms and the impedance between the earth ground and the power company's reference standard ground must not exceed 5 ohms. Use an acceptable low impedance measuring device to measure the impedance of these paths. The #6 or larger wire size will minimize the wiring impedance; however, if the impedance between earth ground and the power company's standard reference ground exceeds 5 ohms, contact the local power company. The ground path must always be of sufficient current-carrying capacity to prevent a build up of voltages that may result in circuit noise, hazard to personnel, or equipment damage.

Be sure that all of the ground connections are visible for inspection and maintenance. Tag all of the ground connections with a sign that reads: *Do Not Remove Or Disconnect.*



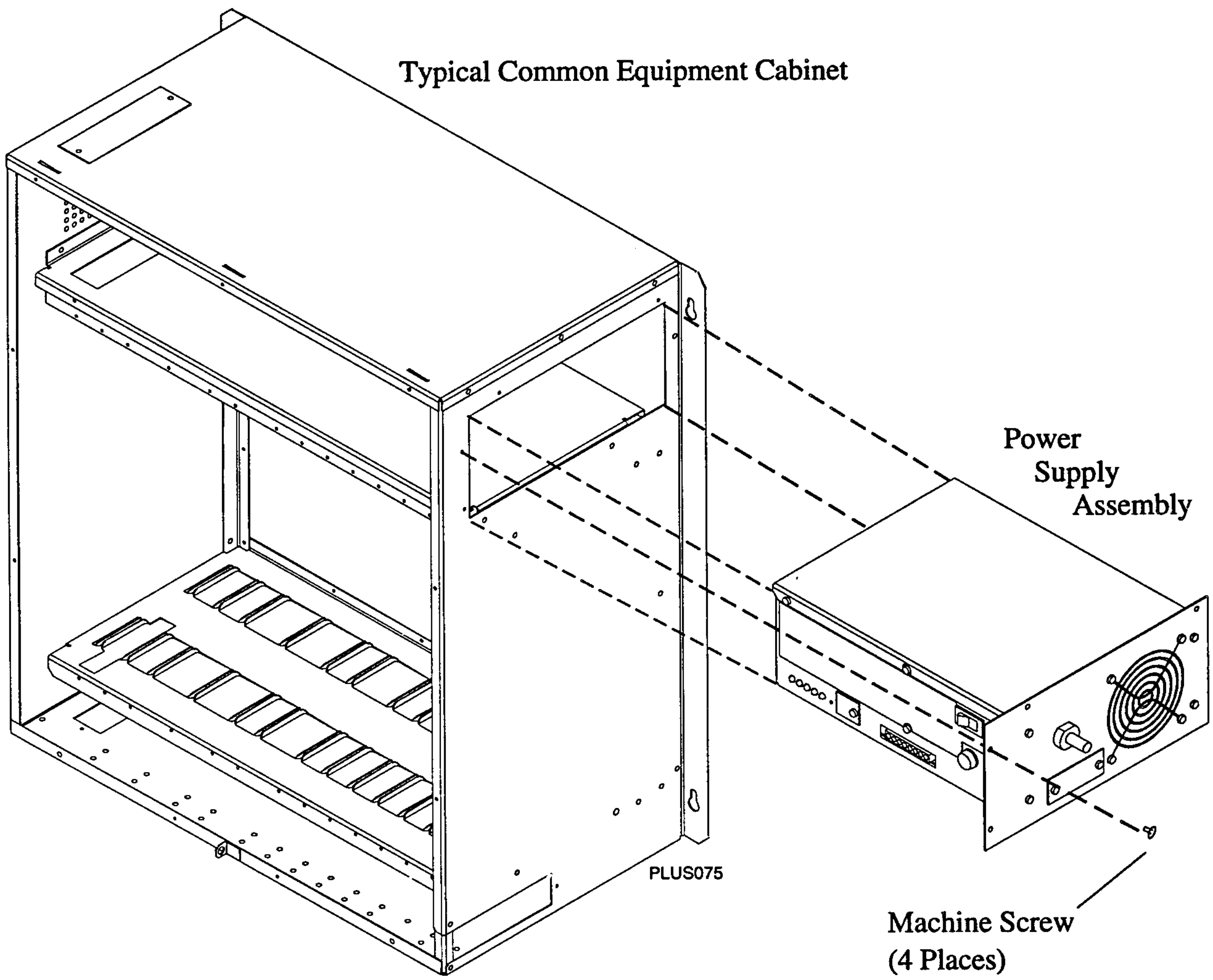
Grounding The Expansion Cabinets

2.0 Installing The Power Supply

NOTE: The common equipment cabinet employs an electronic switching power supply. During operation, power supplies of this type generate an audible sound from their switching regulators. This sound is normal and is not an indication that the power supply is operating improperly.

Install the power supply assembly in the expansion cabinet per the following discussion and illustration.

1. Be sure to ground the common equipment cabinet per the instructions in the previous paragraph before installing the power supply assembly.
2. Remove the power supply assembly from the carton. Be sure to save the small bag containing the mounting hardware.
3. Slide the power supply assembly into the opening at the top right side of the common equipment main cabinet until the assembly's front panel contacts the side of the cabinet.
4. Locate the power cable routed from the backplane and connect it to the power suppy connector.
5. Remove the #6 thread-forming screws from the hardware bag and secure the power supply assembly to the expansion cabinet.
6. The supplied power supply accessories include a ferrite collar. Snap this collar around the AC power cord to provide protection against radio frequency interference.



Installing The Power Supply Assembly

2.1 Making The AC Power Connection

- For the expansion cabinet's AC power connection, employ a dedicated 117VAC 15 AMP circuit, with a third-wire ground, supplied to a standard electrical outlet (NEMA 5-15R) for the AC power connection. Remember, this electrical outlet must be located within four feet of the common equipment expansion cabinet. Remember also, this dedicated electrical outlet is in addition to the one that you provide for the main cabinet's AC power needs.

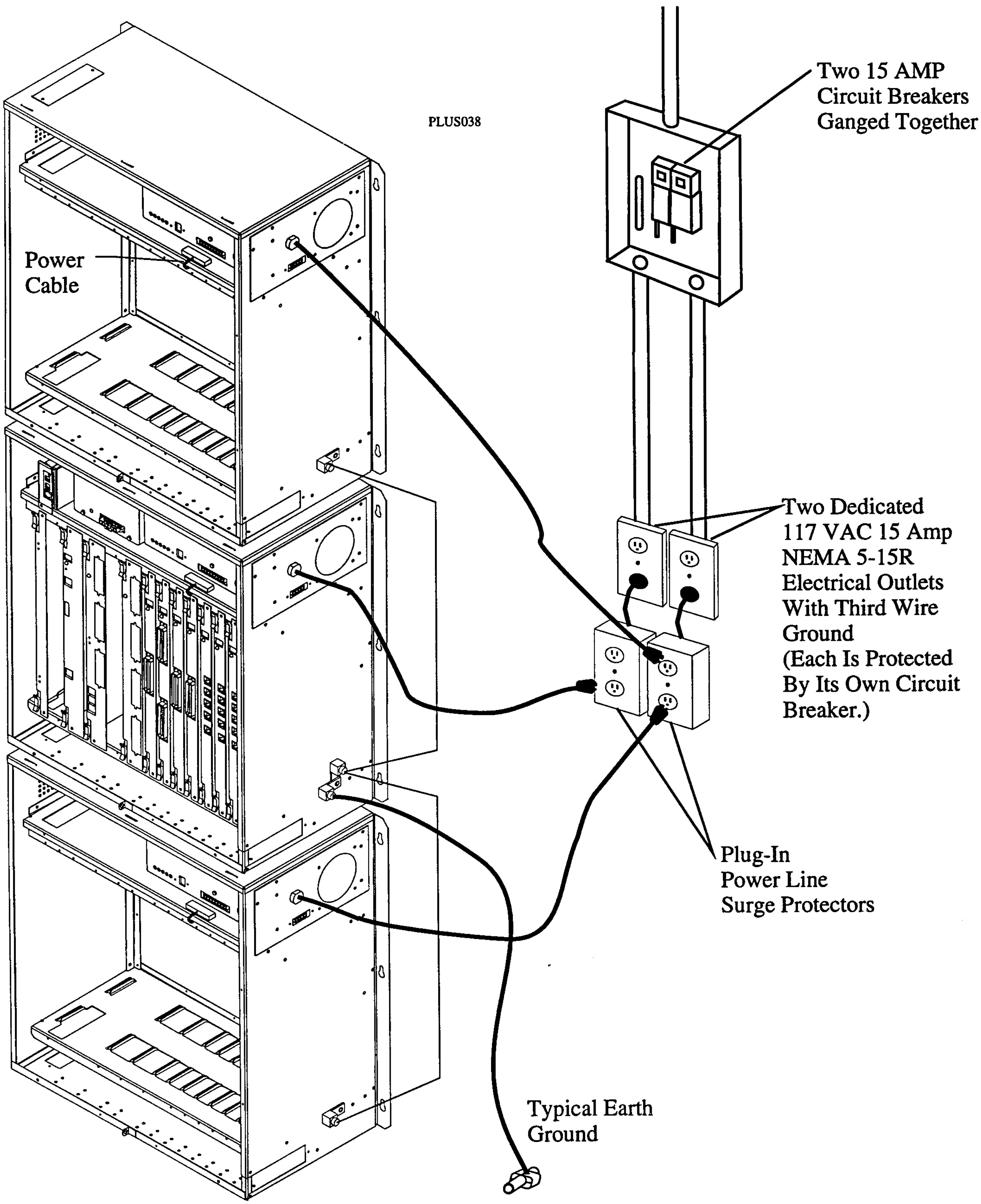
CAUTION

This dedicated AC circuit must different from the dedicated AC circuit that you provide for the main cabinet. For best results wire the expansion cabinet's dedicated AC circuit from a power phase that is opposite from the one that supplies the main cabinet's AC circuit. Connecting too much electrical equipment to one power phase may overload that power phase and cause a drop in the supplied AC voltage.

- Install a plug-in power line surge protector between the equipment's AC power cord and the AC outlet to provide protection against surges and spikes that may appear on the AC line.

CAUTION

DO NOT attach or secure the line cord to the surface of the mounting location in any manner.



Making the AC Power Connections

2.2 Measuring The Power Supply Voltages

If you need to measure power supply voltages, you can do so at the voltage connector. Measure the power under the following conditions:

- AC line cord connected to the AC outlet,
- DC power cable disconnected from power supply's DC voltage connector,
- AC power switch turned on.

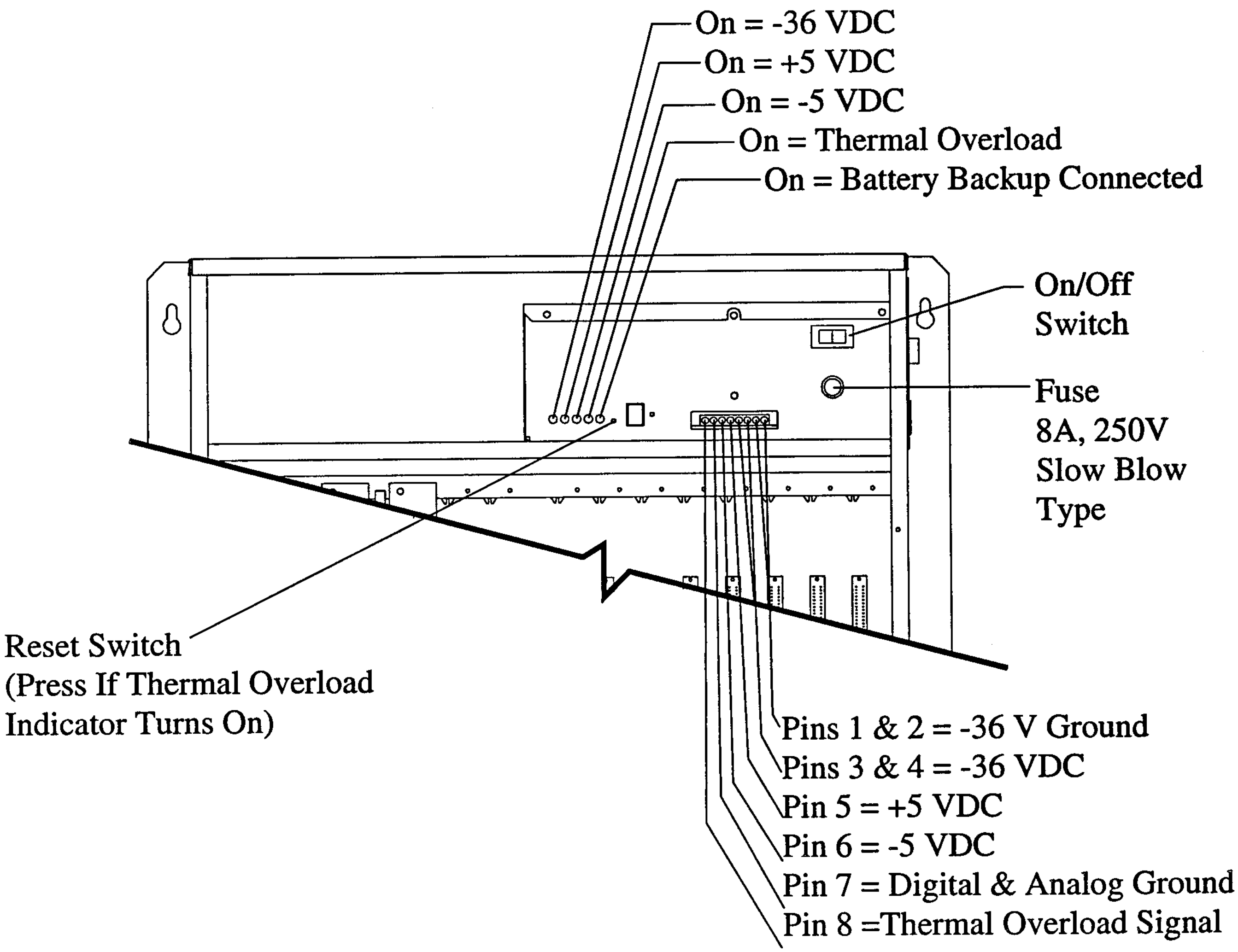
Measurement details are shown in the illustration.

CAUTION

Once you have measured the power supply voltages, turn off the AC power switch and disconnect the AC line cord from the AC outlet. Leave the AC power disconnected until you have installed the circuit boards in the main cabinet.

2.3 Identifying The Fuse

The power supply fuse is a *slow-blow* type rated at 8 AMPS and 250 VOLTS. A replacement fuse must have the same rating.



Power Supply Measurements		
Measure Between Terminals		Measured Values
+ Voltmeter Lead	- Voltmeter Lead	
Pin 1	Pin 3	- 36 VDC +/- 1.0V
Pin 5	Pin 7	+ 5 VDC +/- .3 V
Pin 6	Pin 7	- 5 VDC +/- .3 V
Pin 8	Pin 7	0 volts = normal operation + 5 V nominal = thermal overload condition (press Reset switch)

Measuring The Power Supply Voltages

3.0 Installing Circuit Boards In The Expansion Cabinet

CAUTION

Circuit boards for the DXP Plus system are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, Handling Of Electrostatically Sensitive Components, *for general information. Specific handling precautions are also included in this installation instruction.*

Each circuit board is supplied in a static protection bag. Do not open a static protection bag prior to board installation time.

The board slots are keyed so that only those boards that will operate from a particular slot will plug into that slot.

The expansion cabinet provides a unique slot for the interface board and universal slots for the auxiliary boards line boards, or station boards.

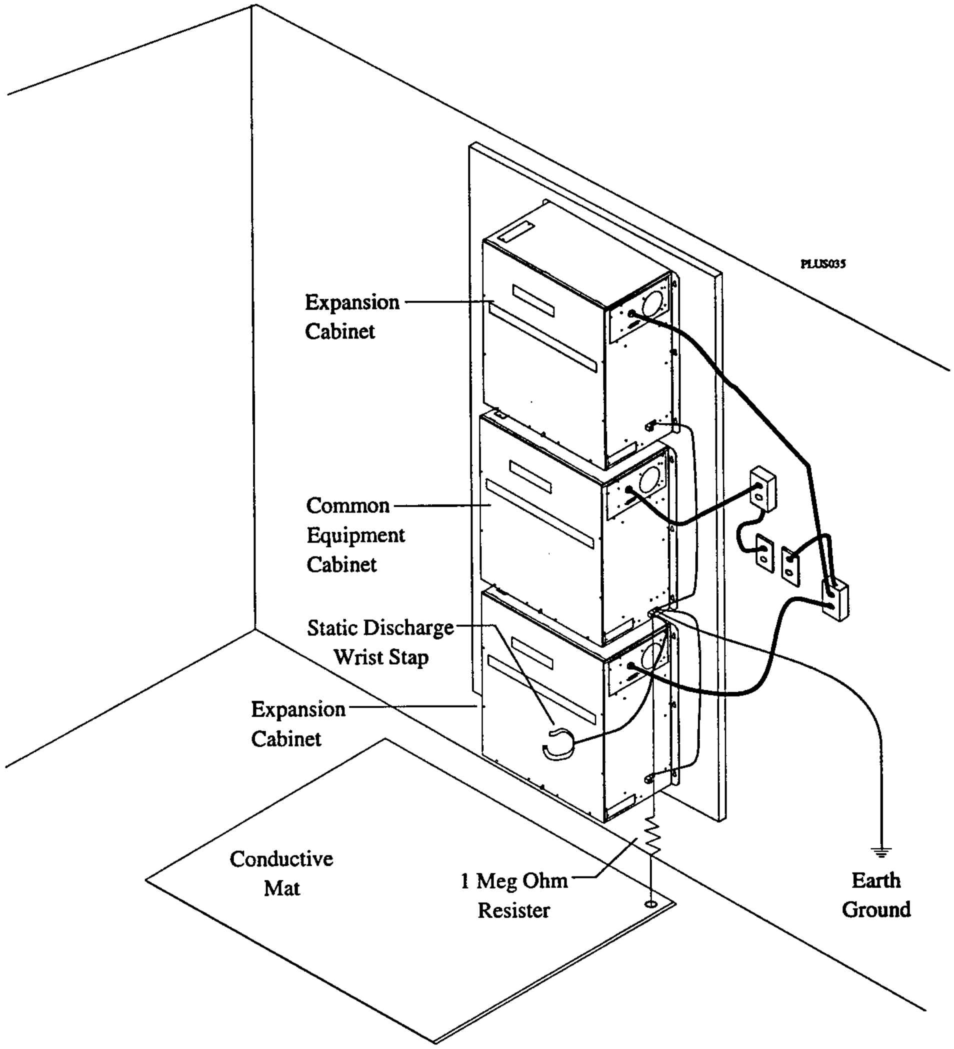
This publication provides installation instructions for the interface board. Since you will install line and station boards as well as auxiliary boards and other optional circuit boards on an as needed basis, each of these boards include its own installation instruction for your reference.

3.1 Creating A Static Safe Work Area

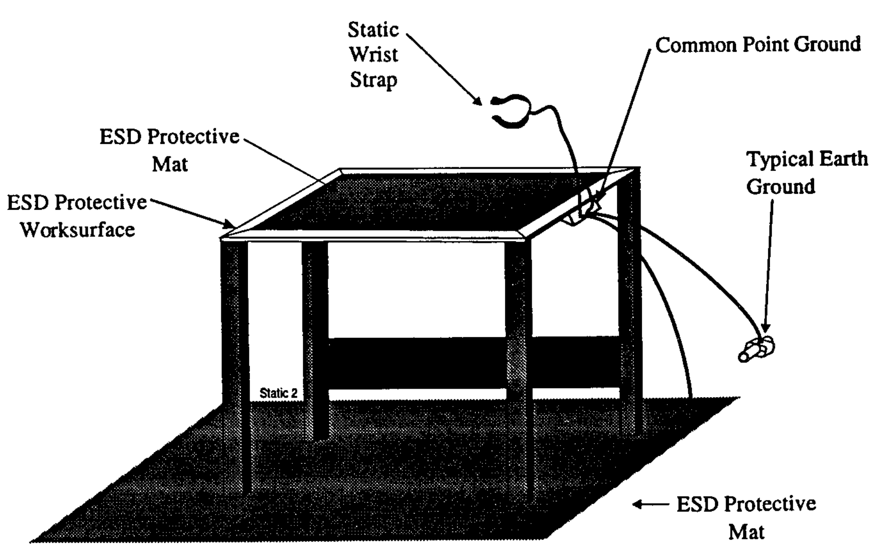
When servicing the main or expansion common equipment cabinets at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing a common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

3.2 Installing The Interface Boards

When you add an expansion cabinet to the main common equipment cabinet, you must install interface boards in both cabinets and route the accompanying cables through the cable access holes in the cabinets. You must install the nnnnn–M1 interface board in the main cabinet, the nnnn–X2 interface board in the upper expansion cabinet, and the nnnn–X3 interface board in the lower expansion cabinet.

1. Be sure that the AC power cord is not connected to an AC outlet and that the cable from the optional battery back-up assembly is not connected to the main cabinet power supply.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground

NOTE: With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.

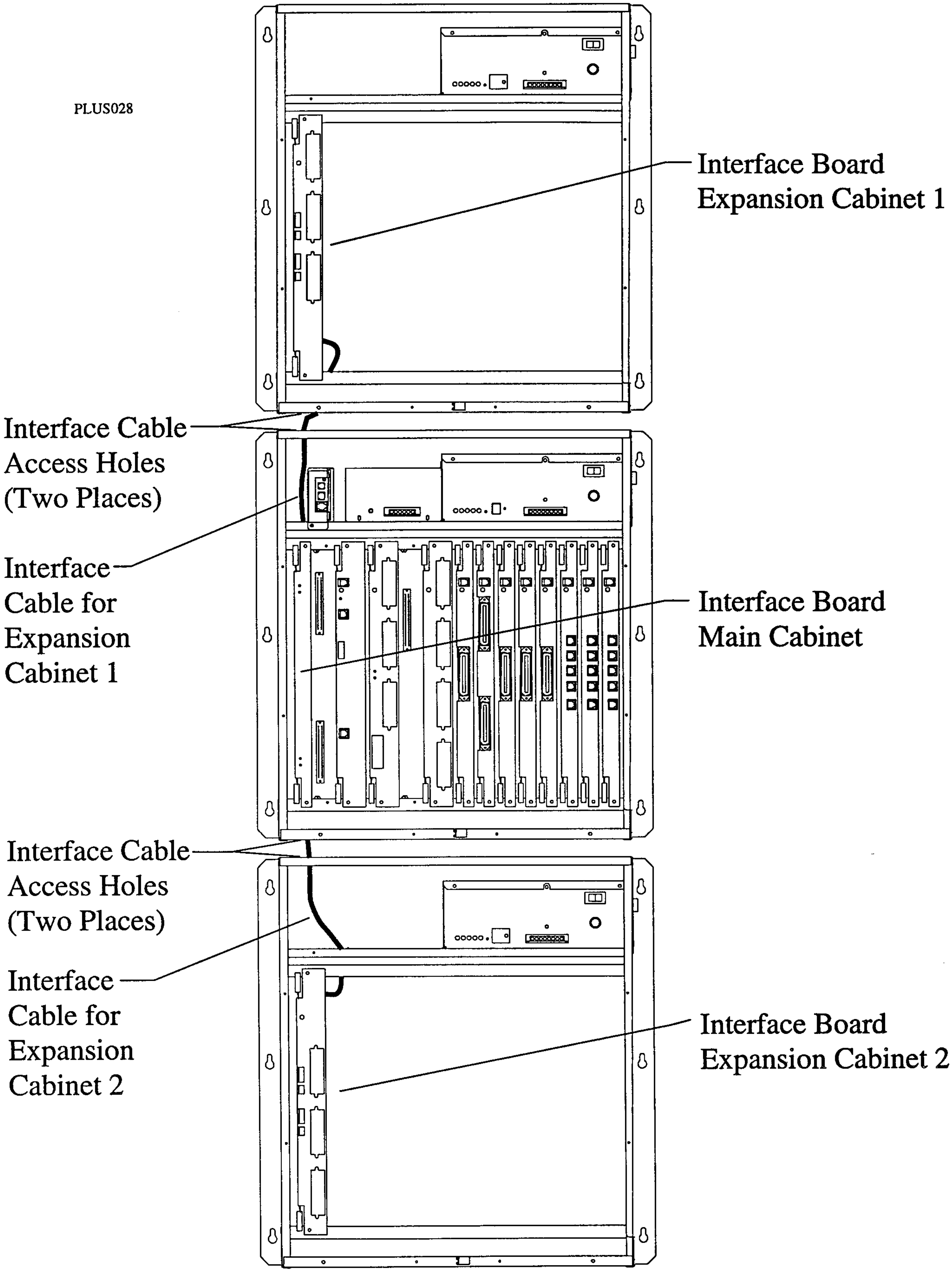
3. When you are ready to install the circuit board, remove it from its static protection bag.
4. Locate the proper board slot. Remember, the interface boards all plug into unique slots in their respective cabinets.
5. Orient the circuit board with its top and bottom guides in main cabinet board cage. and press the board firmly until its board edge connection properly mates with the connector on cabinet's backplane.

CAUTION

When pressing circuit boards into place, press them only at the extractor lever locations. If you apply pressure at other locations you may damage the board assembly.

6. Repeat steps 3 and 4 until all circuit boards are installed.
7. Route the interface cables between the main and expansion cabinets. Be sure to thread the cables through the access holes in the cabinets.
8. Make a final inspection to ensure that all circuit boards are, oriented correctly and mated properly.
9. Install and tighten the supplied screws to secure the circuit boards to the board cage.
10. Place the system in operation and inspect the status lights for proper operation.

Interface Board	Status Light Condition
Upper Expansion Cabinet	Green Winking On = normal operation Green Steady On = option board in operation
Lower Expansion Cabinet	Green Winking On = normal operation Green Steady On = option board in operation
Main Cabinet	Green Winking On = normal operation Top Yellow Off, Top Red Off = normal operation Top Yellow On, Top Red Off = upper cabinet on battery power Top Yellow Off, Top Red On = upper cabinet out of service Bottom Yellow Off, Bottom Red Off = normal operation Bottom Yellow On, Bottom Red Off = lower cabinet on battery power Bottom Yellow Off, Bottom Red On = lower cabinet out of service



Viewing The Interface Board Installation

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COMDIAL

Installing The Loop Start Line Board In The DXP Plus Digital Communications System

1.0 Introducing The Loop Start Line Board

1.1 Defining Loop Start

The line board signals for the host system to complete a line connection by sending a supervisory signal to the host system. Typically this signal is the hookflash that occurs when a user takes a telephone off hook on the line. The line board transmits this signal to the host system by placing a resistance across the line's tip and ring leads to complete a current loop. When the host system senses this resistance, it sends dial tone over the line thus giving line service to the system.

1.2 Inventorying The Loop Start Line Boards

There are two versions of the loop start line board. One version interfaces four central office lines and the other version interfaces eight central office lines.

1.3 Complying With Underwriters Laboratories Regulations

Per The Underwriters Laboratories regulation 1459, 2nd edition, be aware of the following precautions when installing telephone equipment that is to be directly connected to the telephone company network:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch un-insulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Printed in U.S.A.

IMI89-172.01
7/95

2.0 Installing Circuit Boards In The Equipment Cabinet

CAUTION

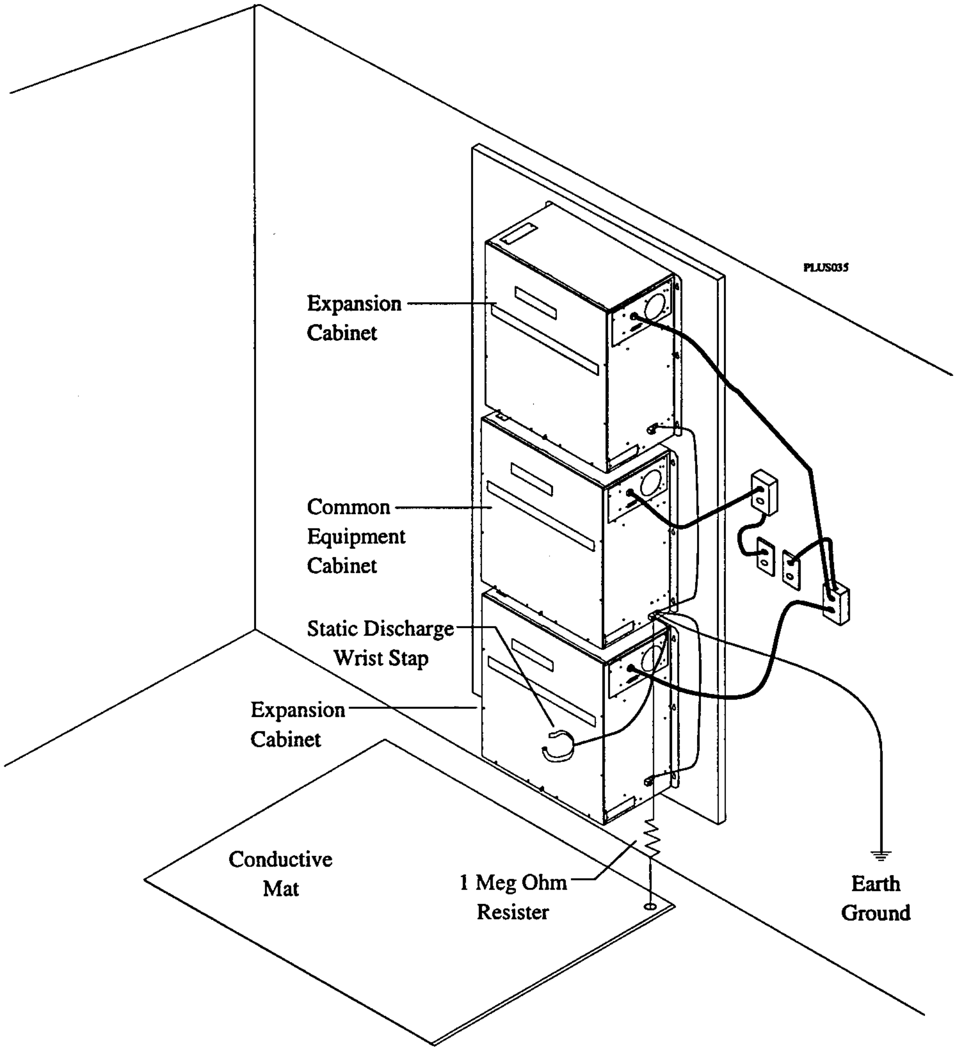
Circuit boards are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, Handling Of Electrostatically Sensitive Components, for general information. Specific handling precautions are also included in this installation instruction.

2.1 Creating A Static Safe Work Area

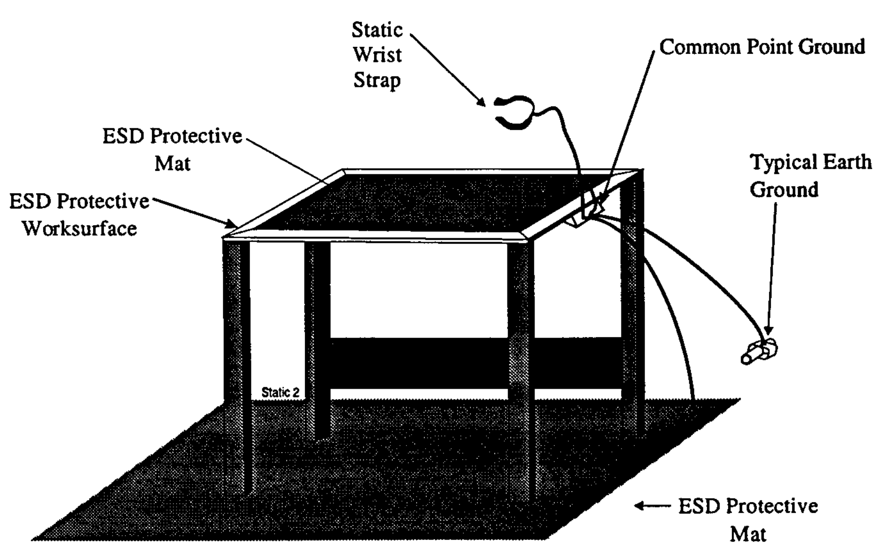
When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

2.2 Installing Loop Start Line Boards

1. Normally you should disconnect the AC power cord from the AC outlet and disconnect the optional battery back-up assembly from the main cabinet power supply; however, when necessary, you can install a line board in an operating system. If you must do this, connect one end of a standard telephone handset coil cord to the precharge port on the power supply. During step 5, you will connect the other end of this coil cord to the precharge jack on the line board.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground

NOTE: With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.

3. Each circuit board is supplied in a static protection bag for safe keeping. When you are ready to install the circuit board, remove it from its static protection bag.
4. Locate the proper board slot.
   - On DXP *Plus* systems the loop start line boards connect to any universal slot.

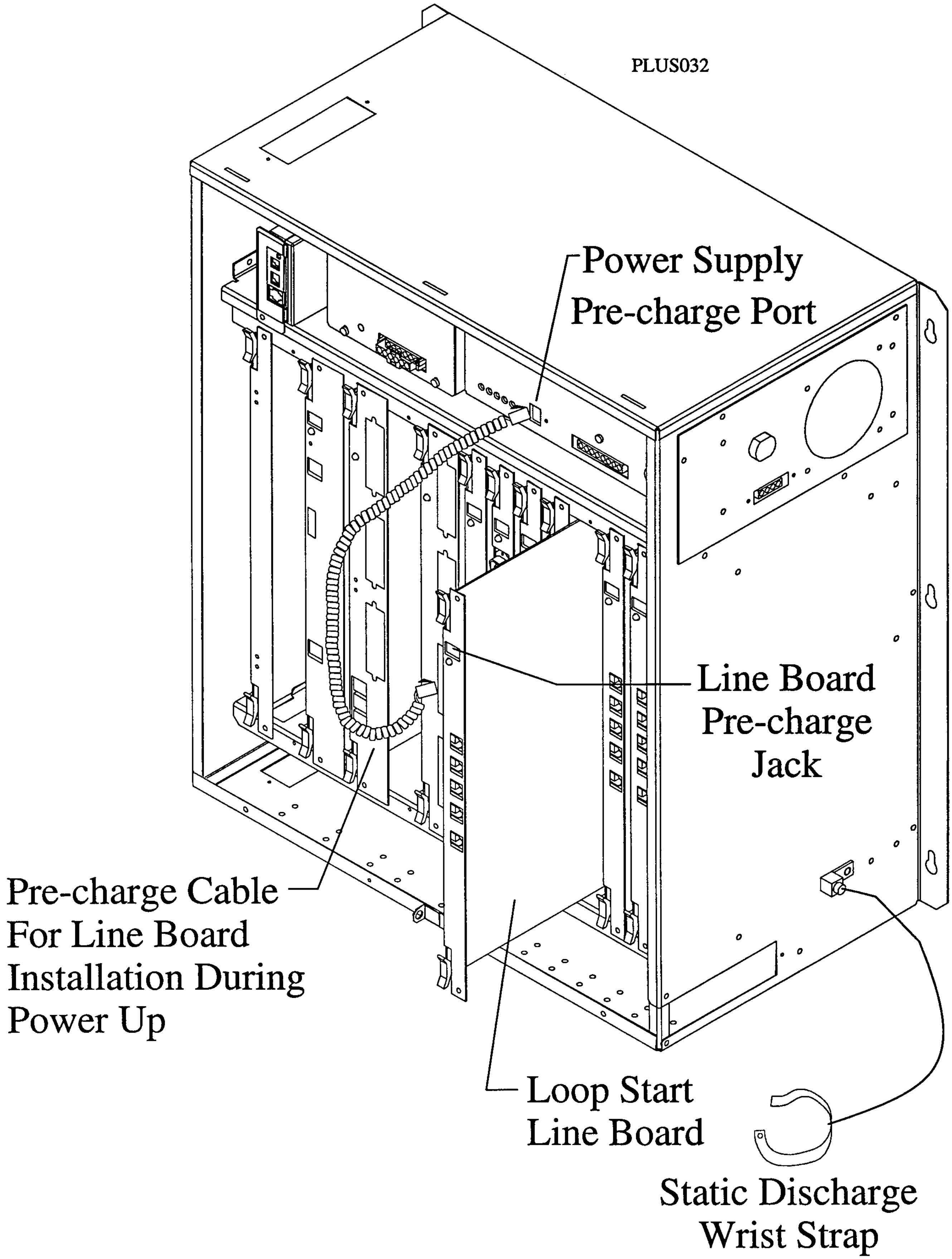
NOTE: On DXP Plus systems, do not install a line board at the right-most board slot in the second (or lower) expansion cabinet. The system reserves this slot for internal use.

5. If you are installing the line board in an operating system, connect the free end of the precharge cord that you installed in step 1 to the precharge jack on the line board.
6. Orient the circuit board with its top and bottom guides in main cabinet board cage. and press the board firmly until its board edge connection properly mates with the connector on cabinet's backplane.

CAUTION

When pressing circuit boards into place, press them only at the extractor lever locations. If you apply pressure at other locations you may damage the board assembly.

7. Repeat steps 3 and 4 until all circuit boards are installed.
8. Make a final inspection to ensure that all circuit boards are, oriented correctly and mated properly.
9. Install and tighten the supplied screws to secure the circuit boards to the board cage.
10. Each line board includes a ferrite collar. Bundle the line cables together and snap the ferrite collar around the cable bundle to provide protection against radio frequency interference.



Viewing A Typical Line Board Installation

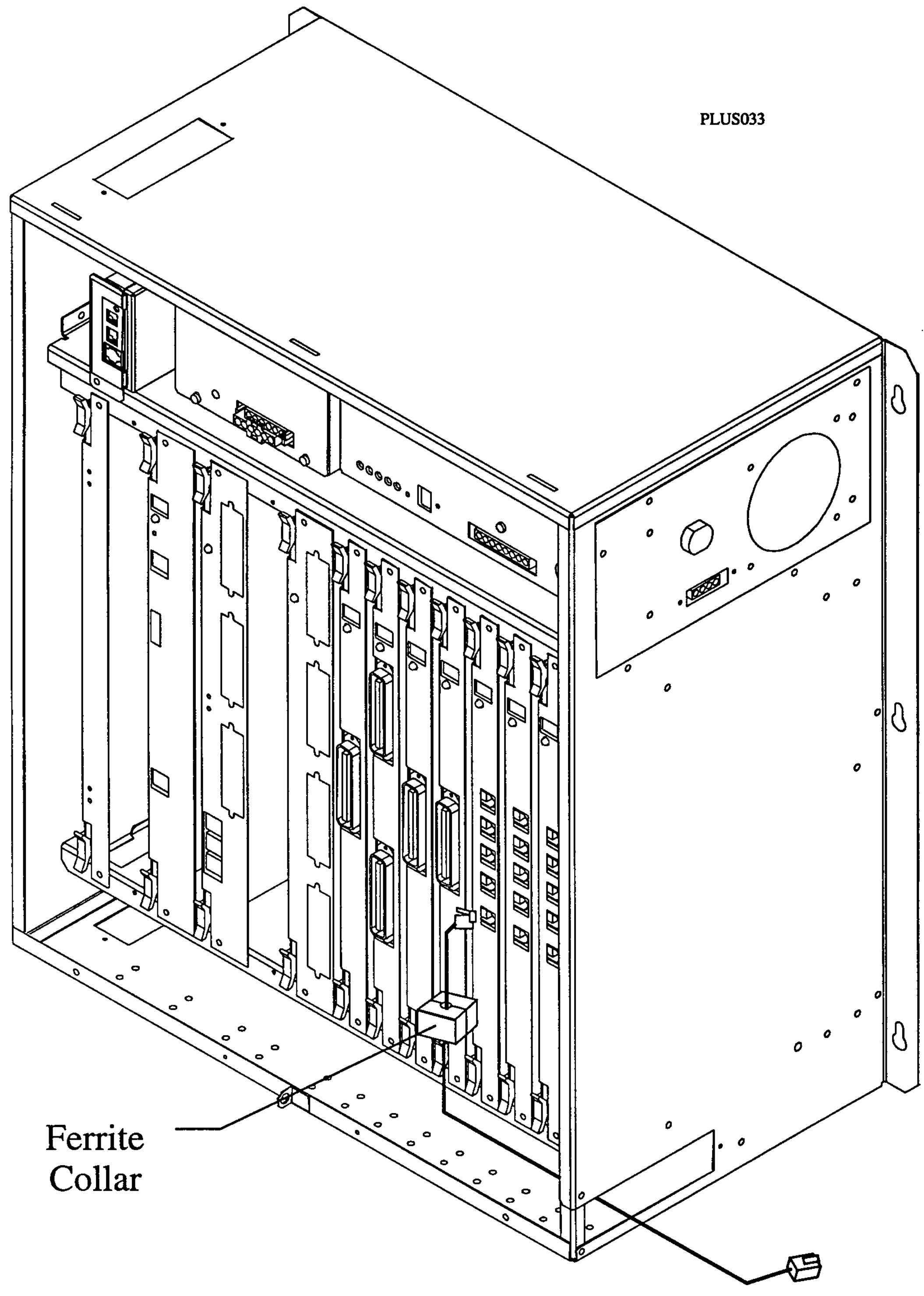
3.0 Connecting The Telephone Lines

The line terminations on the line board are standard modular plug/jack connections. Each modular jack provides termination for two lines. The line outside termination can be a type 66M-xx connector block or individual 6-position modular jacks. The wiring that is routed between the outside termination and the common equipment circuit board termination should be twisted-pair wiring.

Remember, each line board is shipped with a ferrite collar. Bundle the line cables together and snap the collar around the bundle to provide protection against radio frequency interference.

Detailing The Line Board Connections

Line Jack	Pin Number	Connection	Telephone Number
1	1	No Connection	
	2	Line 8 Tip	
	3	Line 7 Tip	
	4	Line 7 Ring	
	5	Line 8 Ring	
	6	No Connection	
2	1	No Connection	
	2	Line 6 Tip	
	3	Line 5 Tip	
	4	Line 5 Ring	
	5	Line 6 Ring	
	6	No Connection	
3	1	No Connection	
	2	Line 4 Tip	
	3	Line 3 Tip	
	4	Line 3 Ring	
	5	Line 4 Ring	
	6	No Connection	
4	1	Auxiliary (Line 2) Tip	
	2	Line 2 Tip	
	3	Line 1 Tip	
	4	Line 1 Ring	
	5	Line 2 Ring	
	6	Auxiliary (Line 2) Ring	
5	1	No Connection	
	2	No Connection	
	3	Power Fail (Line 1) Ring	
	4	Power Fail (Line 1) Tip	
	5	No Connection	
	6	No Connection	



Viewing A Typical Line Connection

3.1 Understanding The DXP Plus Logical Numbering

Because there are no dedicated station or line ports in the DXP *Plus*, the system uses an automatic configuration method to logically number its stations and lines. Automatic configuration occurs after you perform a master clear on the system.

How automatic configuration works
With automatic configuration, the system does a search for all installed station and line boards in the main and expansion cabinets, and assigns a logical number for each provided station and line encountered during the search. The search begins in the main cabinet at the left-most universal slot and proceeds left to right. The search then moves to the upper expansion cabinet where it searches left-most slot to right-most slot. The search finally moves to the lower expansion cabinet where it again searches left-most slot to right-most slot. When automatic configuration is finished, the system has logically numbered all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system.

How logical number and physical location relate to one another
The logical number of a station or line corresponds to its relationship to other stations or lines in the system but is not dependent upon the board's placement in the cabinet. The physical location of a station or line corresponds to the order of the system's board slots. The main cabinet contains slots 1–9, the upper expansion cabinet contains slots 10–20, and the lower expansion cabinet contains slots 21–30. Therefore, even if the first encountered station board is located in slot five of the main cabinet, the system still assigns logical number one to the first station provided by that board. During installation, you can skip slots. For example, you can install eight-line, loop start, line boards in only slots one and 30 if you wish. In this case, slot one yields logical line numbers 1–8 and slot 30 yields logical line numbers 9–17.

Where you can place circuit boards
Each installed board requires timing circuits equal to its capacity. For example, a 16–station board requires 16 timing circuits, an eight–line loop start line board requires eight circuits, and a fully configured T1 trunk board requires 24 timing circuits. In the DXP *Plus,* each universal slot provides 32 timing circuits. Because of this timing circuit provision of each slot, you can place any station or line board at any slot location with no restrictions.

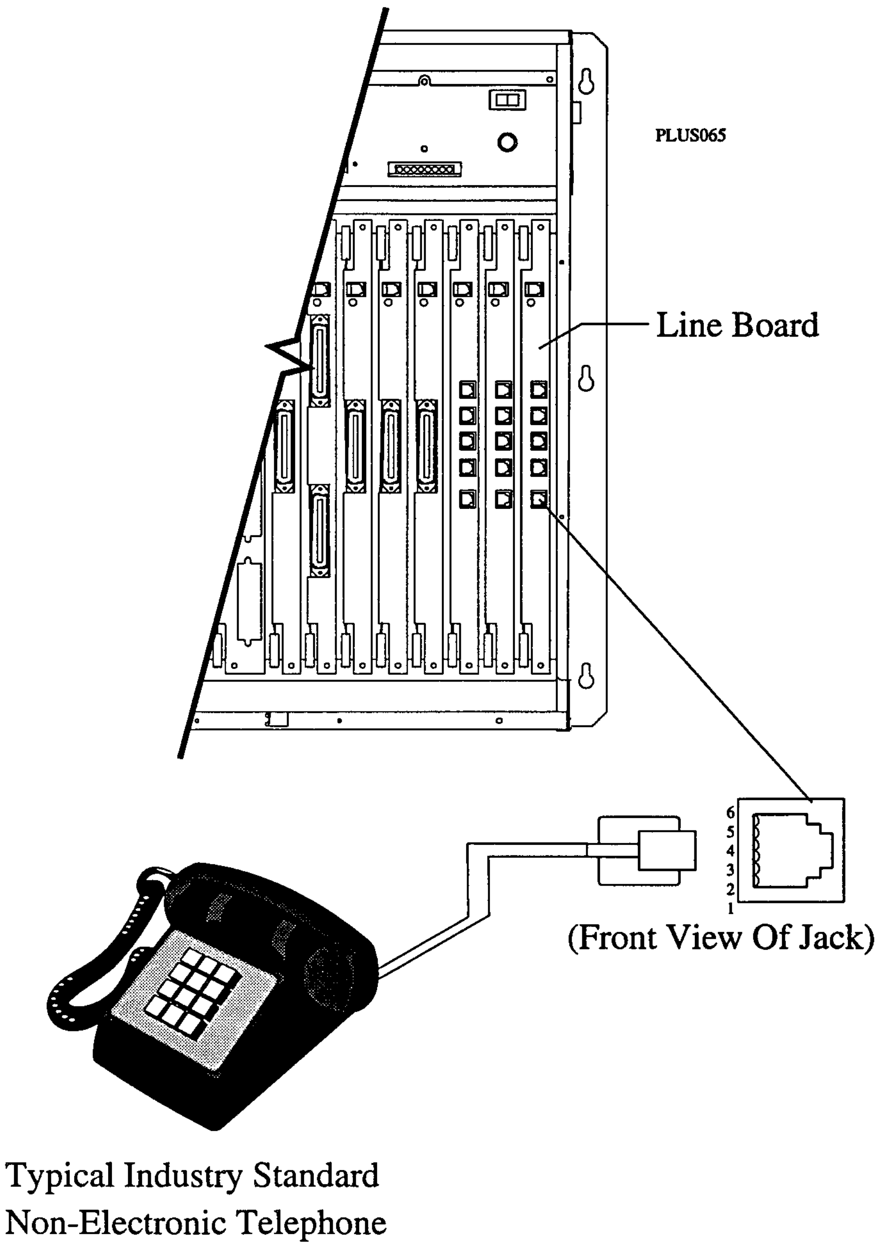
Adding boards without renumbering
If you install or relocate a station or line board, this board does not operate until you take appropriate programming action. If you use an available open slot for adding or relocating a board, that board's stations or lines assume logical numbers in sequence after the system's last assigned logical station or line number. For example, if the system's last logical station number is 24, the logical numbers of the newly installed board's stations begin at logical number 25.

After you remove a board and delete it through programming, that board's logical numbers are available for reassignment. This means that you can remove a board, add or move another board, take the appropriate programming action, and have the stations or lines of the added or relocated board assume the logical numbers made available by the removed board. For example, if the system's last logical number is 64 and you remove the board providing stations with logical numbers 1–16 and delete it through programming, the stations on an added board assume logical numbers beginning with 1 instead of 65. However, if you remove and program delete an eight-station board and add a 16-station board, the first eight stations stations on the added board assume logical numbers 1–8 and the last eight stations assume logical numbers 65–72.

Remember, should you master clear the system, the automatic configuration feature logically numbers all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system. This action renumbers those station and lines provided by boards that you have added or relocated since you last performed the system master clear.

4.0 Making A Power Failure Station Connection

Every loop start line board provides a tip and ring pair connected to line 1 as an emergency power failure circuit. This power fail circuit is active during a commercial AC power failure if an external battery assembly is not installed to provide battery back-up power to the system. Connect an industry standard, single-line telephone to the power failure jack and use it to provide basic communications capability until the AC power to the system is restored. The bottom jack on the line board provides the power failure connection.

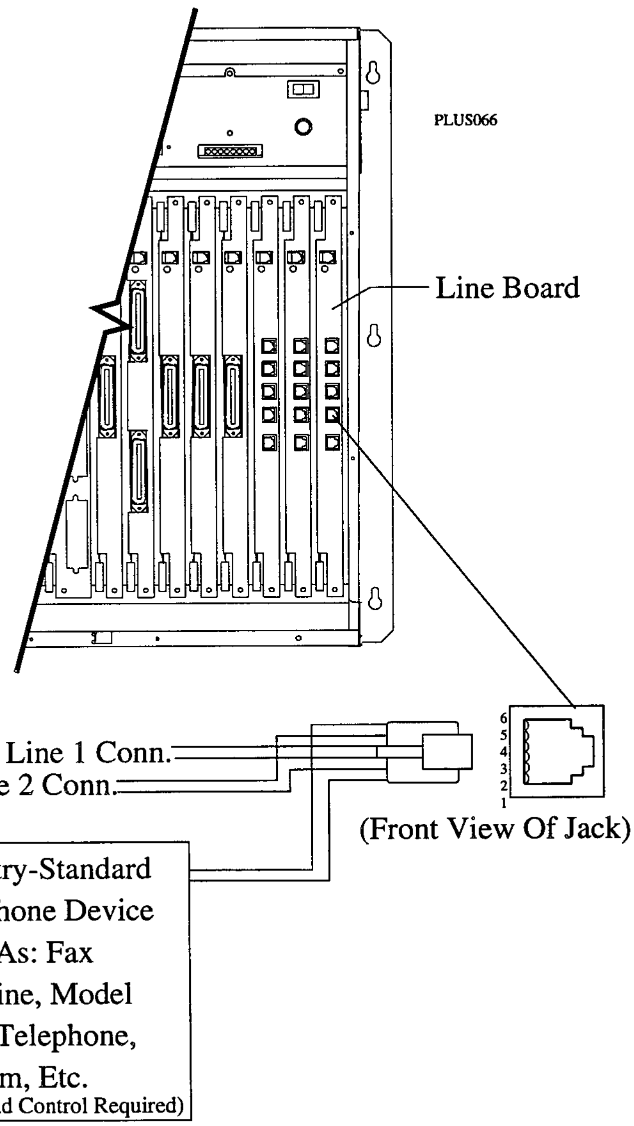


Making A Power Failure Station Connection

5.0 Making An Auxiliary Equipment Interface Connection (Busy Lead Detection)

When needed, connect an industry standard non-electronic telephone device such as a FAX machine, an industry-standard telephone, or a data device, such as a modem, on a line ahead of the common equipment. The system will detect an off-hook condition in the connected device and turn on the status light for the line at the system telephones to indicate that the line is busy.

Each line board makes one auxiliary equipment connection available for use. This connection is at pins 1 and 6 of the lines 1,2 jack and is associated with line 2 of that line board.



Making A Typical Auxiliary Interface Connection

COMDIAL

Installing The Analog Station Board In The DXP Plus Digital Communications System

1.0 Introducing The Analog Station Boards

The analog station board supports the operation of the ExecuTech model 66nnn and 67nnn analog multiline telephones.

1.1 Inventorying The Analog Station Boards

There are two models of station boards available for use.

- Eight-station model supports eight ExecuTech multiline and single line proprietary analog telephones
- 16-station model supports 16 ExecuTech multiline and single line proprietary analog telephones

1.2 Complying With Underwriters Laboratories Regulations

Per The Underwriters Laboratories regulation 1459, 2nd edition, be aware of the following precautions when installing telephone equipment that is to be directly connected to the telephone company network:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

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IMI89-173.01
7/95

2.0 Installing Circuit Boards

CAUTION

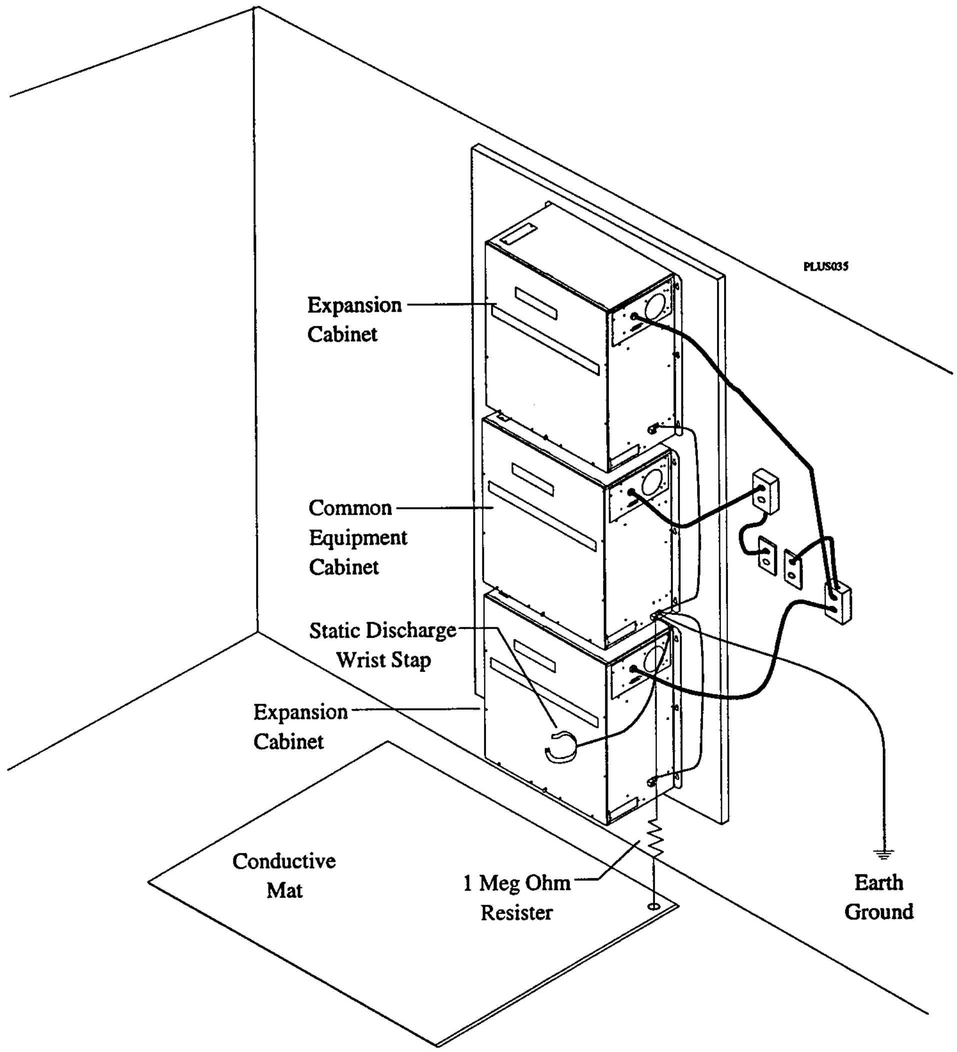
Circuit boards are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, Handling Of Electrostatically Sensitive Components, for general information. Specific handling precautions are also included in this installation instruction.

2.1 Creating A Static Safe Work Area

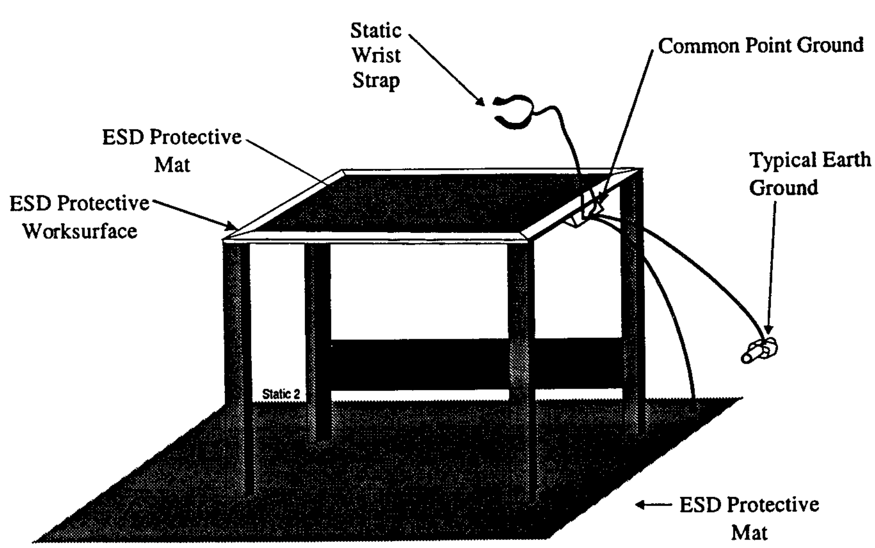
When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

2.2 Installing Station Boards In The Equipment Cabinet

1. Normally you should first disconnect the optional battery back-up assembly from the main cabinet power supply and then disconnect the AC power cord from the AC outlet; however, when necessary, you can install a station board in an operating system. If you must do this, connect one end of a standard telephone handset coil cord to the precharge port on the power supply. During step 5, you will connect the other end of this coil cord to the precharge jack on the station board.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground

NOTE: With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.

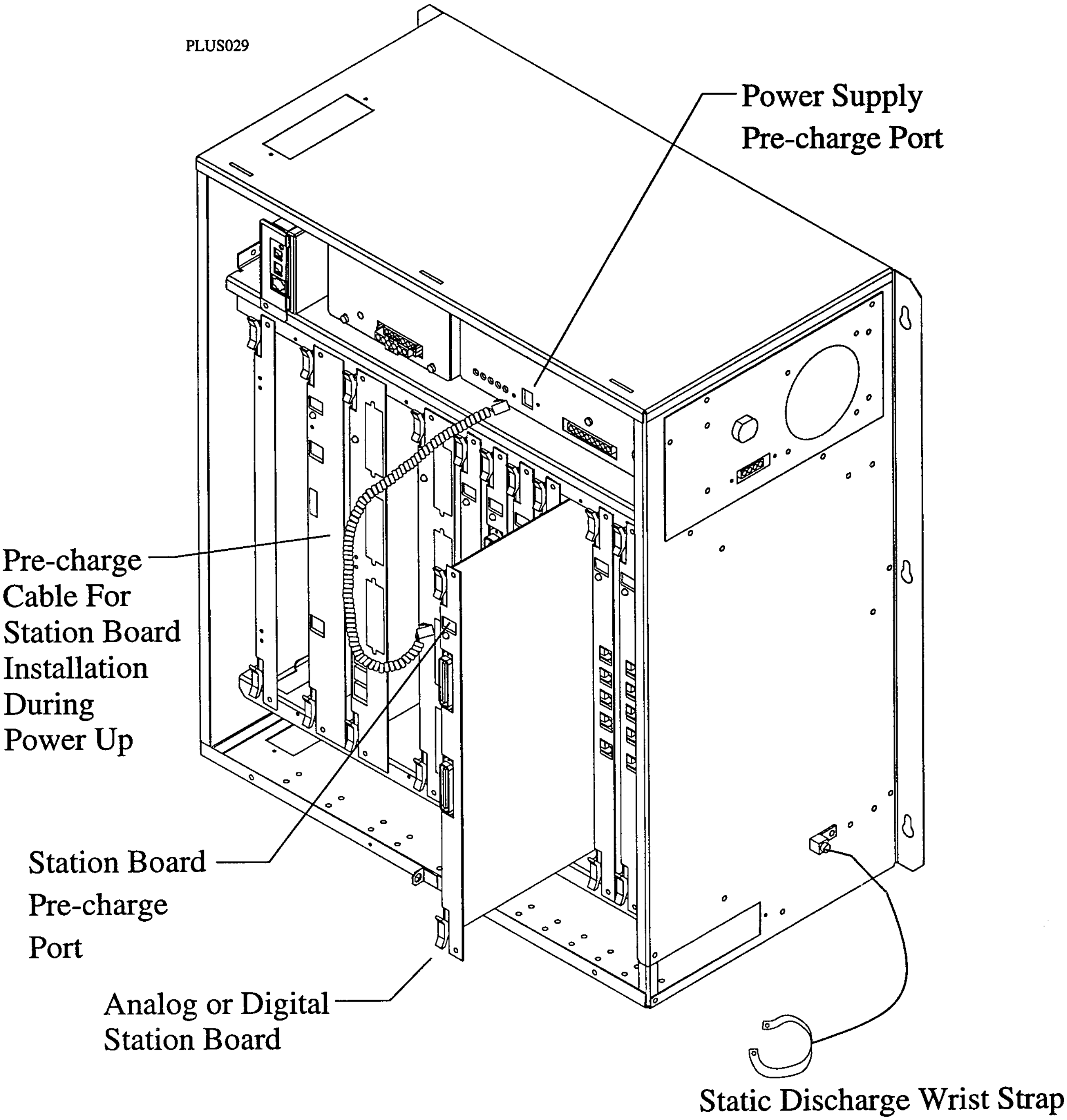
3. Each station board is supplied in a static protection bag for safe keeping. When you are ready to install the circuit board, remove it from its static protection bag.
4. Locate the proper board slot.
   - On DXP *Plus* systems the station boards connect to any universal slot.

NOTE: On DXP Plus systems, do not install a station board at the right-most board slot in the second (or lower) expansion cabinet. The system reserves this slot for internal use.

5. If you are installing the station board in an operating system, connect the free end of the precharge cord that you installed in step 1 to the precharge jack on the station board.
6. Orient the station board with its top and bottom guides in main cabinet board cage. and press the board firmly until its board edge connection properly mates with the connector on cabinet's backplane. If you connected a handset cord between the pre-charge port on the power supply and the jack on the circuit board, disconnect the cord after installing the board.

   CAUTION

   When pressing circuit boards into place, press them only at the extractor lever locations. If you apply pressure at other locations you may damage the board assembly.
7. Repeat steps 3 and 4 until all circuit boards are installed.
8. Make a final inspection to ensure that all circuit boards are, oriented correctly and mated properly.
9. Install and tighten the supplied screws to secure the circuit boards to the board cage.
10. Each station board includes a ferrite collar. Snap the ferrite collar around the cable station to provide protection against radio frequency interference.



Viewing A Typical Station Board Installation

3.0 Connecting The Stations

Connections between the telephone stations and the common equipment station boards are typically via type 66M-xx connector blocks that are cable connected to 50-pin male connectors on the station boards.

The American Wire Gauge (AWG) size of the station wiring determines the maximum distance allowed from the common equipment to the stations. The following chart details this relationship.

Station Type	Wire Gauge		
	20 AWG	22 AWG	24 AWG
Analog Multiline Telephone	2500 Feet	2000 Feet	1500 Feet
Analog Single-Line Proprietary Telephone	4000 Feet	3500 Feet	3000 Feet

If spare conductors exist in the cables that you run between the station boards and the 66M-xx connector blocks, it is a good practice to connect the spare conductors to earth ground. Doing this may help prevent the spare connectors from inducing radio frequency and/or AC interference into the system.

Remember, you should snap a ferrite collar around each station cable to provide protection against radio frequency interference.

CAUTION

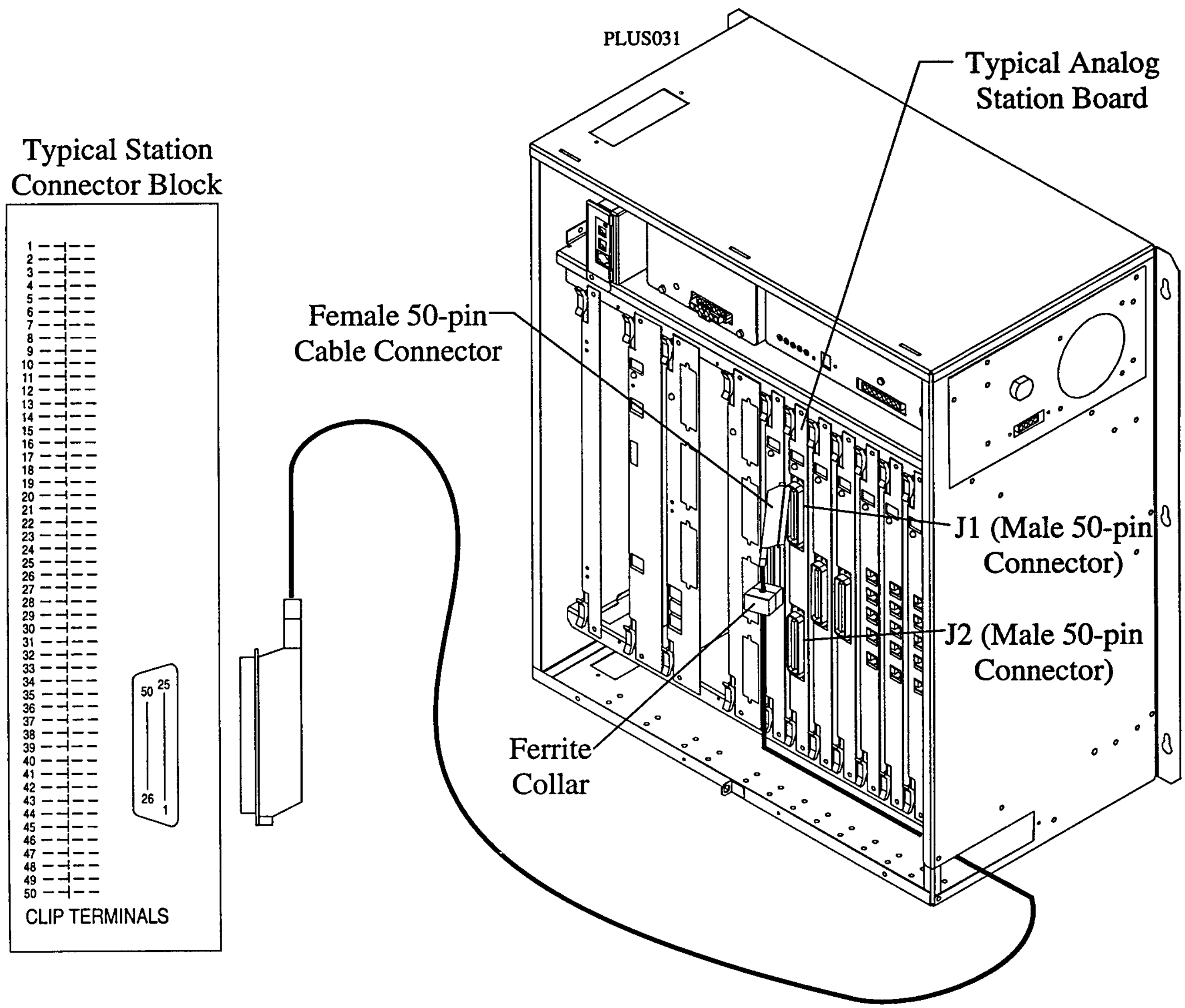
The polarity between the individual wires in a particular voice or data pair is not critical; however, do not connect the voice circuits to the data circuits.

3.1 Installing DSS/BLF Consoles

Install a DSS/BLF Console at any station port in the system as a companion to a system telephone.

- The DXP *Plus* systems support a maximum of four consoles for each telephone and there is no limit to the maximum number of consoles that you can install on a system. Typically, the console capacity is equal to one-half of the total station capacity of the system.
- The installed distance limit between the station board and the console is the same as that allowed for an analog or digital telephone.

When you install a DSS/BLF console, you must program define the station port as a console port.



Viewing A Typical Station Connection

3.2 Detailing The Station Connections

3.2.1 Detailing Analog Station Board J1 Connections

25-Pair Connections For J1				Station Pair Connections		Station Identification	
Wire Color	Pair	Pin No.	Clip Term.	Pair Identification	Wire Color	Station	Location (note the site position in this column)
White-Blue	1	26	1	Voice Path	Green	1	
Blue-White		1	2		Red		
White-Orange	2	27	3	Data Path	Yellow		
Orange-White		2	4		Black		
White-Green	3	28	5	Voice Path	Green	2	
Green-White		3	6		Red		
White-Brown	4	29	7	Data Path	Yellow		
Brown-White		4	8		Black		
White-Slate	5	30	9	Voice Path	Green	3	
Slate-White		5	10		Red		
Red-Blue	6	31	11	Data Path	Yellow		
Blue-Red		6	12		Black		
Red-Orange	7	32	13	Voice Path	Green	4	
Orange-Red		7	14		Red		
Red-Green	8	33	15	Data Path	Yellow		
Green-Red		8	16		Black		
Red-Brown	9	34	17	Voice Path	Green	5	
Brown-Red		9	18		Red		
Red-Slate	10	35	19	Data Path	Yellow		
Slate-Red		10	20		Black		
Black-Blue	11	36	21	Voice Path	Green	6	
Blue-Black		11	22		Red		
Black-Orange	12	37	23	Data Path	Yellow		
Orange-Black		12	24		Black		
Black-Green	13	38	25	Voice Path	Green	7	
Green-Black		13	26		Red		
Black-Brown	14	39	27	Data Path	Yellow		
Brown-Black		14	28		Black		
Black-Slate	15	40	29	Voice Path	Red	8	
Slate-Black		15	30		Green		
Yellow-Blue	16	41	31	Data Path	Yellow		
Blue-Yellow		16	32		Black		
Yellow-Orange	17	42	33	The analog station board does not provide station connections on J1 connector pairs 17–25. Remember, you should connect all unused conductors in your house cable to earth ground.			
Orange-Yellow		17	34				
Yellow-Green	18	43	35				
Green-Yellow		18	36				
Yellow-Brown	19	44	37				
Brown-Yellow		19	38				
Yellow-Slate	20	45	39				
Slate-Yellow		20	40				
Violet-Blue	21	46	41				
Blue-Violet		21	42				
Violet-Orange	22	47	43				
Orange-Violet		22	44				
Violet-Green	23	48	45				
Green-Violet		23	46				
Violet-Brown	24	49	47				
Brown-Violet		24	48				
Violet-Slate	25	50	49				
Slate-Violet		25	50				

3.2.2 Detailing Analog Station Board J2 Connections

25-Pair Connections For J2				Station Pair Connections		Station Identification	
Wire Color	Pair	Pin No.	Clip Term.	Pair Identification	Wire Color	Station	Location (note the site position in this column)
White-Blue	1	26	1	Voice Path	Green	9	
Blue-White		1	2		Red		
White-Orange	2	27	3	Data Path	Yellow		
Orange-White		2	4		Black		
White-Green	3	28	5	Voice Path	Green	10	
Green-White		3	6		Red		
White-Brown	4	29	7	Data Path	Yellow		
Brown-White		4	8		Black		
White-Slate	5	30	9	Voice Path	Green	11	
Slate-White		5	10		Red		
Red-Blue	6	31	11	Data Path	Yellow		
Blue-Red		6	12		Black		
Red-Orange	7	32	13	Voice Path	Green	12	
Orange-Red		7	14		Red		
Red-Green	8	33	15	Data Path	Yellow		
Green-Red		8	16		Black		
Red-Brown	9	34	17	Voice Path	Green	13	
Brown-Red		9	18		Red		
Red-Slate	10	35	19	Data Path	Yellow		
Slate-Red		10	20		Black		
Black-Blue	11	36	21	Voice Path	Green	14	
Blue-Black		11	22		Red		
Black-Orange	12	37	23	Data Path	Yellow		
Orange-Black		12	24		Black		
Black-Green	13	38	25	Voice Path	Green	15	
Green-Black		13	26		Red		
Black-Brown	14	39	27	Data Path	Yellow		
Brown-Black		14	28		Black		
Black-Slate	15	40	29	Voice Path	Red	16	
Slate-Black		15	30		Green		
Yellow-Blue	16	41	31	Data Path	Yellow		
Blue-Yellow		16	32		Black		
Yellow-Orange	17	42	33	The analog station board does not provide station connections on J2 connector pairs 17–25. Remember, you should connect all unused conductors in your house cable to earth ground.			
Orange-Yellow		17	34				
Yellow-Green	18	43	35				
Green-Yellow		18	36				
Yellow-Brown	19	44	37				
Brown-Yellow		19	38				
Yellow-Slate	20	45	39				
Slate-Yellow		20	40				
Violet-Blue	21	46	41				
Blue-Violet		21	42				
Violet-Orange	22	47	43				
Orange-Violet		22	44				
Violet-Green	23	48	45				
Green-Violet		23	46				
Violet-Brown	24	49	47				
Brown-Violet		24	48				
Violet-Slate	25	50	49				
Slate-Violet		25	50				

3.3 Detailing Station Call Announce Parameters

The DXP *Plus* systems place no limits (other that the distance constraints stated previously) on telephone placement and arrangement within the system; however, when placing telephones that require call announcing capability, consider the parameters detailed in this call announce matrix table.

Call Announce Matrix

Receive Call Announcements

Originate Call Announcements	Digital Speaker	Digital Monitor	Digital Single Line	Analog Speaker	Analog Monitor	Analog Single Line	PC Atten.	Scout 900MX	Industry Standard
Digital Speaker	YES	YES	NO	YES	NO	NO	NO	NO	NO
Digital Monitor	YES	YES	NO	YES	NO	NO	NO	NO	NO
Digital Single Line	YES	YES	NO	YES	NO	NO	NO	NO	NO
Analog Speaker	YES	YES	NO	YES	YES	NO	NO	NO	NO
Analog Monitor	YES	YES	NO	YES	YES	NO	NO	NO	NO
Analog Single Line	YES	YES	NO	YES	NO	NO	NO	NO	NO
PC Atten.	YES	YES	NO	YES	NO	NO	NO	NO	NO
Scout 900MX	YES	YES	NO	YES	NO	NO	NO	NO	NO
Industry Standar	YES	YES	NO	YES	NO	NO	NO	NO	NO

3.4 Understanding The DXP Plus Logical Numbering

Because there are no dedicated station or line ports in the DXP *Plus*, the system uses an automatic configuration method to logically number its stations and lines. Automatic configuration occurs after you perform a master clear on the system.

How automatic configuration works

With automatic configuration, the system does a search for all installed station and line boards in the main and expansion cabinets, and assigns a logical number for each provided station and line encountered during the search. The search begins in the main cabinet at the left-most universal slot and proceeds left to right. The search then moves to the upper expansion cabinet where it searches left-most slot to right-most slot. The search finally moves to the lower expansion cabinet where it again searches left-most slot to right-most slot. When automatic configuration is finished, the system has logically numbered all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system.

How logical number and physical location relate to one another

The logical number of a station or line corresponds to its relationship to other stations or lines in the system but is not dependent upon the board's placement in the cabinet. The physical location of a station or line corresponds to the order of the system's board slots. The main cabinet contains slots 1–9, the upper expansion cabinet contains slots 10–20, and the lower expansion cabinet contains slots 21–30. Therefore, even if the first encountered station board is located in slot five of the main cabinet, the system still assigns logical number one to the first station provided by that board. During installation, you can skip slots. For example, you can install eight-line, loop start, line boards in only slots one and 30 if you wish. In this case, slot one yields logical line numbers 1–8 and slot 30 yields logical line numbers 9–17.

Where you can place circuit boards

Each installed board requires timing circuits equal to its capacity. For example, a 16–station board requires 16 timing circuits, an eight–line loop start line board requires eight circuits, and a fully configured T1 trunk board requires 24 timing circuits. In the DXP *plus,* each universal slot provides 32 timing circuits. Because of this timing circuit provision of each slot, you can place any station or line board at any slot location with no restrictions.

Adding boards without renumbering

If you install or relocate a station or line board, this board does not operate until you take appropriate programming action. If you use an available open slot for adding or relocating a board, that board's stations or lines assume logical numbers in sequence after the system's last assigned logical station or line number. For example, if the system's last logical station number is 24, the logical numbers of the newly installed board's stations begin at logical number 25.

After you remove a board and delete it through programming, that board's logical numbers are available for reassignment. This means that you can remove a board, add or move another board, take the appropriate programming action, and have the stations or lines of the added or relocated board assume the logical numbers made available by the removed board. For example, if the system's last logical number is 64 and you remove the board providing stations with logical numbers 1–16 and delete it through programming, the stations on an added board assume logical numbers beginning with 1 instead of 65. However, if you remove and program delete an eight-station board and add a 16-station board, the first eight stations stations on the added board assume logical numbers 1–8 and the last eight stations assume logical numbers 65–72.

Remember, should you master clear the system, the automatic configuration feature logically numbers all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system. This action renumbers those station and lines provided by boards that you have added or relocated since you last performed the system master clear.

3.4.1 Understanding Station Pairing

Station ports are paired ODD/EVEN, beginning with the lowest directory number 101/102, 103/104, etc., for data and for overload protection. The odd port is the positive voltage (+) port and the even port is the negative voltage (-) port.

4.0 Installing Subdued Off-Hook Voice Announce Wiring For Analog Stations

An analog multiline telephone has subdued off-hook voice announce (SOHVA) capability built into it. This telephone contains a 6-position, 3-pair station jack for SOHVA connection.

To enable SOHVA as a system feature for analog stations,

✔ you must use 6-wire, twisted-pair house cable to connect two data-paired station ports to a 625A2-6 station jack,

✔ you must connect the SOHVA-capable analog multiline telephone to the 625A2-6 station jack using a 6-wire line cord,

✔ you must take programming action to configure the station ports to support SOHVA operation.

Make the installation per the following procedure:

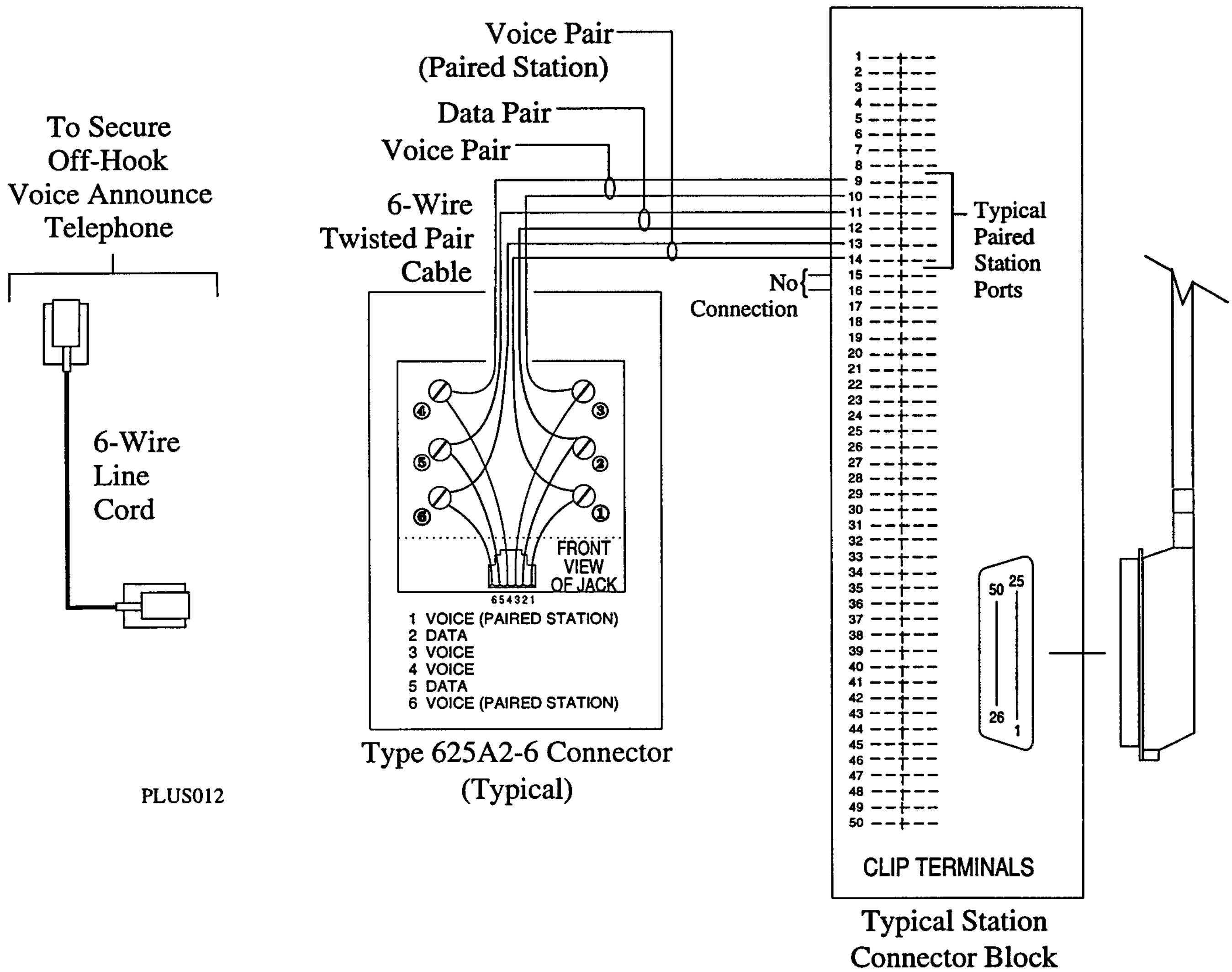
1. Identify two data-paired ports on an analog station connector block (identify an odd-numbered port and its even-numbered counterpart such as ports 103 and 104).
2. Use 6-wire, twisted-pair house cable and make the following connections:

   (a) connect pins 3 and 4 (the inside pair) of a 625A2-6 station jack to the voice pair of the odd-numbered station port.

   (b) connect pins 2 and 5 (the outside pair) of the 625A2-6 station jack to the data pair of the odd-numbered station port,

   (c) connect pins 1 and 6 of the 625A2-6 station jack to the voice pair of the even-numbered stration port,

   (d) leave the data pair of the even-numbered station port vacant.
3. Using the *Telephone Types* programming selection from the stations programming menu, program the odd-numbered station port to support the type of telephone that you will install there. Program the even-numbered station port as UNDEFINED.



Making Subdued Off-Hook Voice Announce Connections For Analog Multiline Telephones

5.0 Testing The Analog Station Installation

5.1 Making A Resistance Check

Make the following resistance measurements at the station connector blocks under the following conditions.

- AC power cord disconnected from electrical outlet.
- External battery back-up assembly disconnected.
- Common equipment connected to station connector blocks.
- Stations wired and wiring punched down on blocks.
- Bridging clips removed from blocks to isolate stations from common equipment.

1. Measure the resistance of each installed station and wiring from the station side of the connector blocks. Resistance values will vary with cable length and station type but should be within the limits shown in the chart below.
2. Measure the resistance of the common equipment and cables from the common equipment side of the station connector blocks. Resistance values should be within the limits shown in the chart below.

Making Resistance Measurements				
Measured Pair	**Resistance In Ohms**			
	Multiline Telephone	**Single Line Telephone**	**DSS/BLF Console**	**Common Equipment**
Voice Pair	**40–150**	**40–150**	**0.3–100**	**40–50**
Data Pair	**0.3–100**	**0.3–100**	**0.3–100**	**1–2**

5.2 Making A Voltage Check

Make the following voltage measurements at the station connector blocks under the following conditions:

- Bridging clips installed
- AC power connected to the common equipment

Measure the voltage across one voice line and one data line and then across the other voice line and the other data line for each even and odd station. The measured voltage must be within the limits shown in the chart below.

Making Voltage Measurements			
Station Under Test	**66M-xx Block Connection**	**Meter Lead Polarity**	**Measured Voltage**
Odd Station	**Voice 1**	**+**	**+ 34 +/- 3 VDC**
	Data 3	**-**	
	Voice 2	**+**	**+ 34 +/- 3 VDC**
	Data 4	**-**	
Even Station	**Voice 5**	**+**	**- 34 +/- 3 VDC**
	Data 7	**-**	
	Voice 6	**+**	**- 34 +/- # VDC**
	Data 8	**-**	
Varriant readings can indicate a possible wiring, station, or common equipment problem.			

5.3 Causing An Analog Station To Self Test

You can cause analog multiline stations to self test for proper operation per the following instructions:

1. Disconnect line cord at station base.

NOTE: The adjacent odd or even station will be disabled during the time that the station line cord is being disconnected or reconnected.

2. Press and hold **MUTE** and reconnect line cord to station connector. Station will automatically perform self test routine.
3. Release **MUTE** as soon as test begins. Sequence of test is as follows:
   - (a.) Indicators will light in sequence
   (b.) Indicators will then turn off at the same time
   (c.) Ringer will sound—be sure to set station ringer volume to medium or high setting
4. Replace any station that does not pass the self test.

5.4 Causing A DSS/BLF Console To Self Test

You can cause the DSS/BLF Consoles to self test for proper operation as follows:

1. Disconnect console line cord plug from line.
2. Press and hold console button **C10** while reconnecting line cord plug to line.

NOTE: The companion station will be disabled during the time that the console is being disconnected and reconnected.

3. Release console button **C10,** and note that BLF indicators will each turn on in sequence beginning with station 10 indicator. Indicators will then turn off and console will become operational.

5.5 Understanding The Failure Indications

If erratic light indications or ring signals occur at a paired station, an open data pair at either station may be the fault. A station with an open data line may work properly on a short loop but fail on a long loop.

Stations are paired for overload current protection. If a fault occurs that causes more than 300 milliamps of current to be drawn, the overload paired stations are disabled by circuit action. Disconnect the disabled stations and reconnect them one at a time to isolate the faulty one.

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Installing The Digital Station Board In The DXP Plus Digital Communications System

1.0 Introducing The Digital Station Boards

The digital station board supports the operation of both the DigiTech and Impact digital multiline telephones.

1.1 Inventorying The Digital Station Boards

There are two models of station boards available for use.

- Eight-station model supports eight DigiTech or Impact multiline and single line proprietary digital telephones
- 16-station model supports 16 DigiTech or Impact multiline and single line proprietary digital telephones

1.2 Complying With Underwriters Laboratories Regulations

Per The Underwriters Laboratories regulation 1459, 2nd edition, be aware of the following precautions when installing telephone equipment that is to be directly connected to the telephone company network:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Printed in U.S.A.

IMI89-174.01
7/95

2.0 Installing Circuit Boards

CAUTION

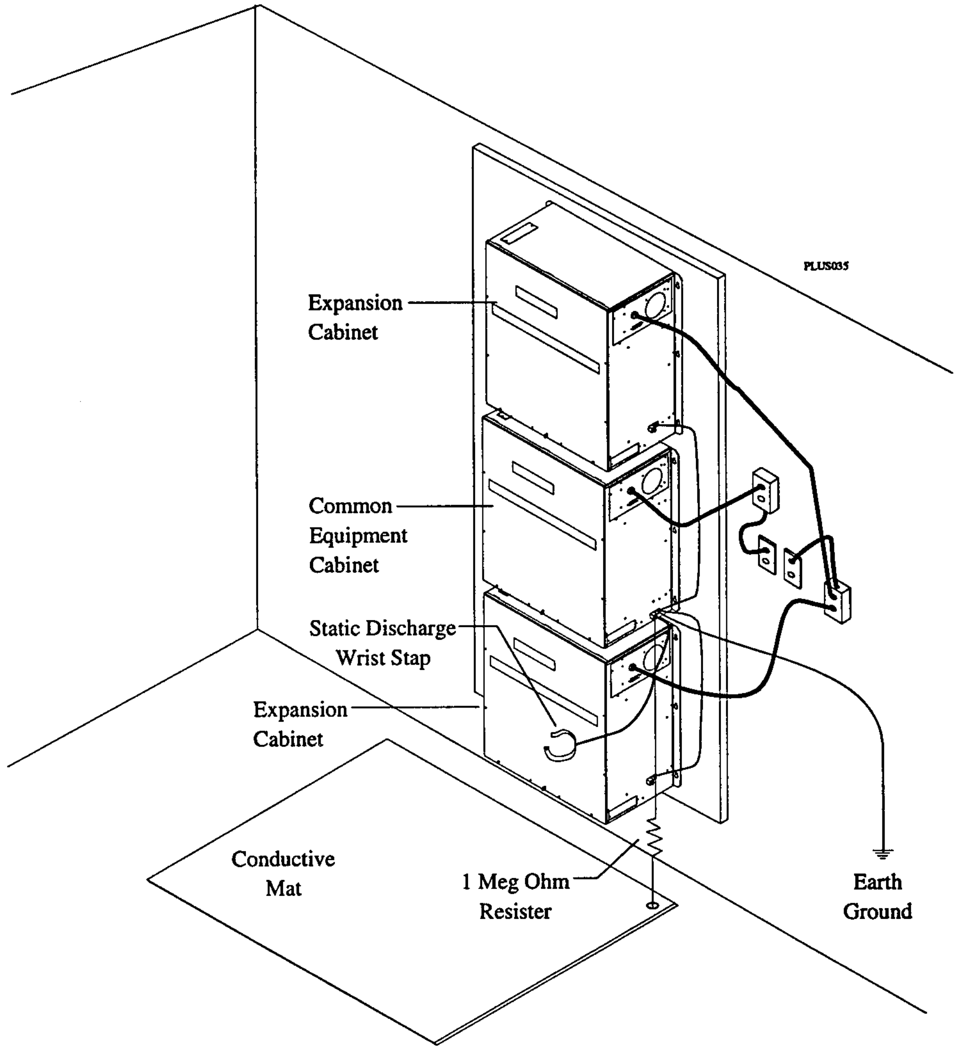
Circuit boards are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, Handling Of Electrostatically Sensitive Components, for general information. Specific handling precautions are also included in this installation instruction.

2.1 Creating A Static Safe Work Area

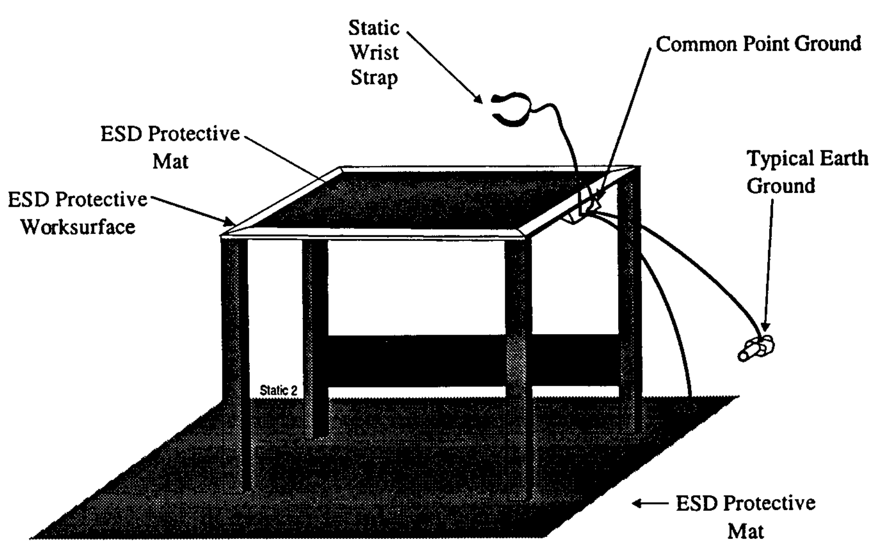
When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

2.2 Installing Station Boards In The Equipment Cabinet

1. Normally you should disconnect the AC power cord from the AC outlet and disconnect the optional battery back-up assembly from the main cabinet power supply; however, when necessary, you can install a station board in an operating system. If you must do this, connect one end of a standard telephone handset coil cord to the precharge port on the power supply. During step 5, you will connect the other end of this coil cord to the precharge jack on the station board.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground

NOTE: With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.

3. Each station board is supplied in a static protection bag for safe keeping. When you are ready to install the circuit board, remove it from its static protection bag.
4. Locate the proper board slot.
   - On DXP *Plus* systems the station boards connect to any universal slot.

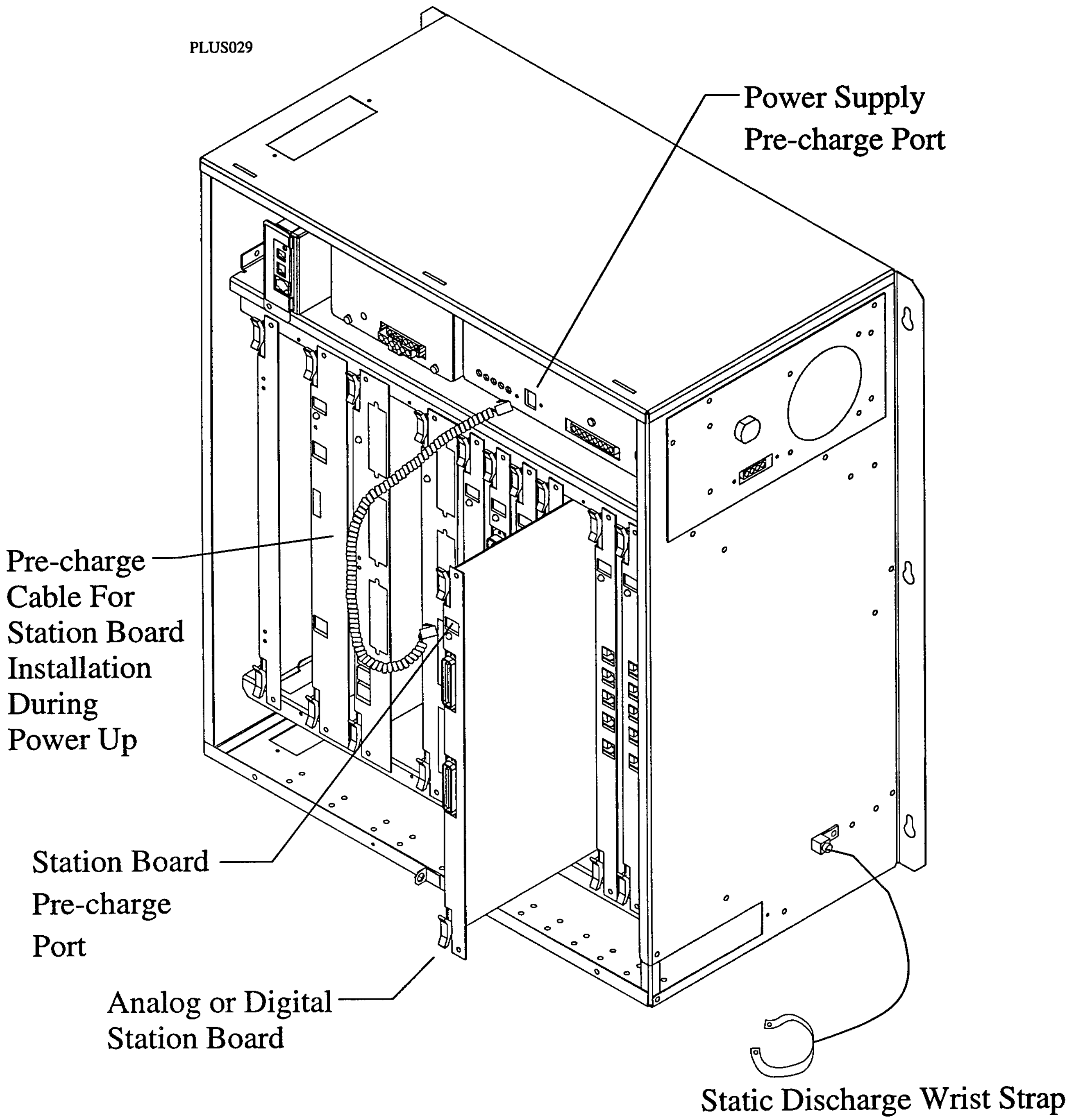
NOTE: On DXP Plus systems, do not install a station board at the right-most board slot in the second (or lower) expansion cabinet. The system reserves this slot for internal use.

5. If you are installing the station board in an operating system, connect the free end of the precharge cord that you installed in step 1 to the precharge jack on the station board.
6. Orient the station board with its top and bottom guides in main cabinet board cage. and press the board firmly until its board edge connection properly mates with the connector on cabinet's backplane.

CAUTION

When pressing circuit boards into place, press them only at the extractor lever locations. If you apply pressure at other locations you may damage the board assembly.

7. Repeat steps 3 and 4 until all circuit boards are installed.
8. Make a final inspection to ensure that all circuit boards are, oriented correctly and mated properly.
9. Install and tighten the supplied screws to secure the circuit boards to the board cage.
10. Each station board includes a ferrite collar. Snap the ferrite collar around the cable station to provide protection against radio frequency interference.



Viewing A Typical Station Board Installation

3.0 Connecting The Stations

Connections between the telephone stations and the common equipment station boards are typically via type 66M-xx connector blocks that are cable connected to 50-pin male connectors on the station boards.

The American Wire Gauge (AWG) size of the station wiring determines the maximum distance allowed from the common equipment to the stations. The following chart details this relationship.

Station Type	Wire Gauge		
	20 AWG	22 AWG	24 AWG
Digital Telephone	2500 Feet	2000 Feet	1500 Feet

If spare conductors exist in the cables that you run between the station boards and the 66M-xx connector blocks, it is a good practice to connect the spare conductors to earth ground. Doing this may help prevent the spare connectors from inducing radio frequency and/or AC interference into the system.

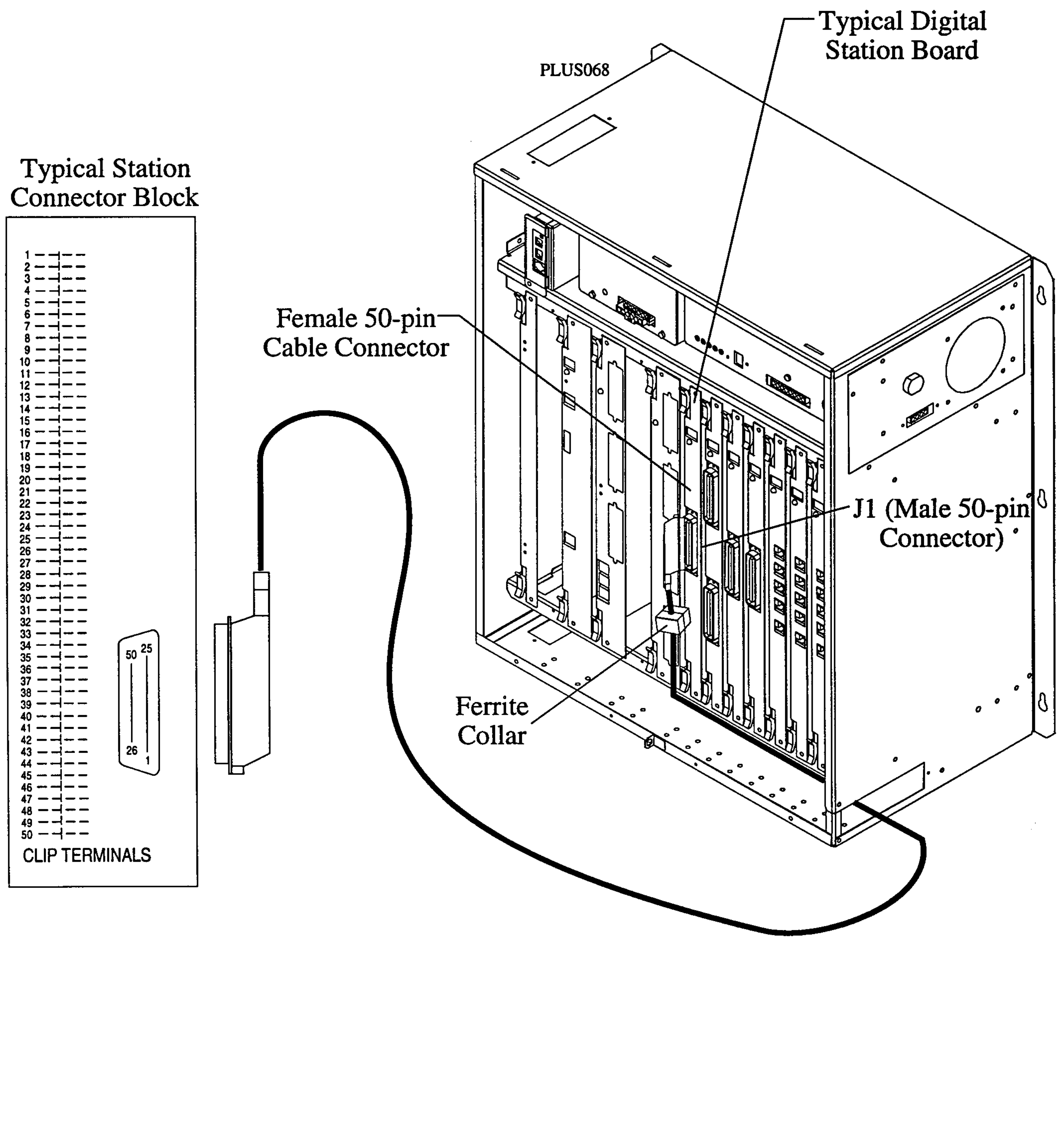
Remember, you should snap a ferrite collar around each station cable to provide protection against radio frequency interference.

3.1 Installing DSS/BLF Consoles

Install a DSS/BLF Console at any station port in the system as a companion to a system telephone.

- The DXP *Plus* systems support a maximum of four consoles for each telephone and there is no limit to the maximum number of consoles that you can install on a system. Typically, the console capacity is equal to one-half of the total station capacity of the system.
- The installed distance limit between the station board and the console is the same as that allowed for an analog or digital telephone.

When you install a DSS/BLF console, you must program define the station port as a console port.



Viewing A Typical Station Connection

3.2 Detailing The Station Connections

3.2.1 Detailing Digital Station Board Connections

25-Pair Connections				Station Pair Connections		Station Identification	
Wire Color	Pair	Pin No.	Clip Term.	Pair Identification	Wire Color	Station	Location (note the site position in this column)
White-Blue	1	26	1	Signal Path	Green	1	
Blue-White		1	2		Red		
White-Orange	2	27	3	Signal Path	Yellow	2	
Orange-White		2	4		Black		
White-Green	3	28	5	Signal Path	Green	3	
Green-White		3	6		Red		
White-Brown	4	29	7	Signal Path	Yellow	4	
Brown-White		4	8		Black		
White-Slate	5	30	9	Signal Path	Green	5	
Slate-White		5	10		Red		
Red-Blue	6	31	11	Signal Path	Yellow	6	
Blue-Red		6	12		Black		
Red-Orange	7	32	13	Signal Path	Green	7	
Orange-Red		7	14		Red		
Red-Green	8	33	15	Signal Path	Yellow	8	
Green-Red		8	16		Black		
Red-Brown	9	34	17	Signal Path	Green	9	
Brown-Red		9	18		Red		
Red-Slate	10	35	19	Signal Path	Yellow	10	
Slate-Red		10	20		Black		
Black-Blue	11	36	21	Signal Path	Green	11	
Blue-Black		11	22		Red		
Black-Orange	12	37	23	Signal Path	Yellow	12	
Orange-Black		12	24		Black		
Black-Green	13	38	25	Signal Path	Green	13	
Green-Black		13	26		Red		
Black-Brown	14	39	27	Signal Path	Yellow	14	
Brown-Black		14	28		Black		
Black-Slate	15	40	29	Signal Path	Red	15	
Slate-Black		15	30		Green		
Yellow-Blue	16	41	31	Signal Path	Yellow	16	
Blue-Yellow		16	32		Black		
Yellow-Orange	17	42	33				
Orange-Yellow		17	34				
Yellow-Green	18	43	35				
Green-Yellow		18	36				
Yellow-Brown	19	44	37				
Brown-Yellow		19	38				
Yellow-Slate	20	45	39	The digital station board does not provide station connections on connector pairs 17–25. Remember, you should connect all unused conductors in your house cable to earth ground.			
Slate-Yellow		20	40				
Violet-Blue	21	46	41				
Blue-Violet		21	42				
Violet-Orange	22	47	43				
Orange-Violet		22	44				
Violet-Green	23	48	45				
Green-Violet		23	46				
Violet-Brown	24	49	47				
Brown-Violet		24	48				
Violet-Slate	25	50	49				
Slate-Violet		25	50				

3.3 Understanding The DXP Plus Logical Numbering

Because there are no dedicated station or line ports in the DXP *Plus*, the system uses an automatic configuration method to logically number its stations and lines. Automatic configuration occurs after you perform a master clear on the system.

How automatic configuration works

With automatic configuration, the system does a search for all installed station and line boards in the main and expansion cabinets, and assigns a logical number for each provided station and line encountered during the search. The search begins in the main cabinet at the left-most universal slot and proceeds left to right. The search then moves to the upper expansion cabinet where it searches left-most slot to right-most slot. The search finally moves to the lower expansion cabinet where it again searches left-most slot to right-most slot. When automatic configuration is finished, the system has logically numbered all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system.

How logical number and physical location relate to one another

The logical number of a station or line corresponds to its relationship to other stations or lines in the system but is not dependent upon the board's placement in the cabinet. The physical location of a station or line corresponds to the order of the system's board slots. The main cabinet contains slots 1–9, the upper expansion cabinet contains slots 10–20, and the lower expansion cabinet contains slots 21–30. Therefore, even if the first encountered station board is located in slot five of the main cabinet, the system still assigns logical number one to the first station provided by that board. During installation, you can skip slots. For example, you can install eight-line, loop start, line boards in only slots one and 30 if you wish. In this case, slot one yields logical line numbers 1–8 and slot 30 yields logical line numbers 9–17.

Where you can place circuit boards

Each installed board requires timing circuits equal to its capacity. For example, a 16–station board requires 16 timing circuits, an eight–line loop start line board requires eight circuits, and a fully configured T1 trunk board requires 24 timing circuits. In the DXP *Plus,* each universal slot provides 32 timing circuits. Because of this timing circuit provision of each slot, you can place any station or line board at any slot location with no restrictions.

Adding boards without renumbering

If you install or relocate a station or line board, this board does not operate until you take appropriate programming action. If you use an available open slot for adding or relocating a board, that board's stations or lines assume logical numbers in sequence after the system's last assigned logical station or line number. For example, if the system's last logical station number is 24, the logical numbers of the newly installed board's stations begin at logical number 25.

After you remove a board and delete it through programming, that board's logical numbers are available for reassignment. This means that you can remove a board, add or move another board, take the appropriate programming action, and have the stations or lines of the added or relocated board assume the logical numbers made available by the removed board. For example, if the system's last logical number is 64 and you remove the board providing stations with logical numbers 1–16 and delete it through programming, the stations on an added board assume logical numbers beginning with 1 instead of 65. However, if you remove and program delete an eight-station board and add a 16-station board, the first eight stations stations on the added board assume logical numbers 1–8 and the last eight stations assume logical numbers 65–72.

Remember, should you master clear the system, the automatic configuration feature logically numbers all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system. This action renumbers those station and lines provided by boards that you have added or relocated since you last performed the system master clear.

3.3.1 Understanding Station Pairing

Station ports are paired ODD/EVEN, beginning with the lowest directory number 101/102, 103/104, etc., for data and for overload protection. The odd port is the positive voltage (+) port and the even port is the negative voltage (-) port.

3.4 Detailing Station Call Announce Parameters

The DXP *Plus* systems place no limits (other that the distance constraints stated previously) on telephone placement and arrangement within the system; however, when placing telephones that require call announcing capability, consider the parameters detailed in the call announce matrix table.

Call Announce Matrix

Receive Call Announcements

Originate Call Announcements	Digital Speaker	Digital Monitor	Digital Single Line	Analog Speaker	Analog Monitor	Analog Single Line	PC Atten.	Scout 900MX	Industry Standard
Digital Speaker	YES	YES	NO	YES	NO	NO	NO	NO	NO
Digital Monitor	YES	YES	NO	YES	NO	NO	NO	NO	NO
Digital Single Line	YES	YES	NO	YES	NO	NO	NO	NO	NO
Analog Speaker	YES	YES	NO	YES	YES	NO	NO	NO	NO
Analog Monitor	YES	YES	NO	YES	YES	NO	NO	NO	NO
Analog Single Line	YES	YES	NO	YES	NO	NO	NO	NO	NO
PC Atten.	YES	YES	NO	YES	NO	NO	NO	NO	NO
Scout 900MX	YES	YES	NO	YES	NO	NO	NO	NO	NO
Industry Standard	YES	YES	NO	YES	NO	NO	NO	NO	NO

4.0 Testing The Digital Station Installation

4.1 Making A Resistance Check

Measure the resistance at the station connector blocks under the following conditions.

- AC power cord disconnected from electrical outlet.
- Common equipment connected to station connector blocks.
- Stations wired and wiring punched down on blocks.
- Bridging clips removed from blocks to isolate stations from common equipment.

Measure the resistance of each installed station and wiring from the station side of the connector blocks. Resistance values will vary with cable length and station type but should be within the following limits:

✔ Greater than 700 Kohms

Measure the resistance of the common equipment and cables from the common equipment side of the station connector blocks. The resistance value should be within the following limits.

✔ 40–50 Ohms

4.2 Making A Voltage Check

Make the following voltage measurements at the station connector blocks under the following conditions:

- Bridging clips installed
- AC power connected to the common equipment

Measure the voltage across the signal pair. The measured voltage must be within the following limits:

✔ 28–36 VDC

4.3 Causing A Digital Station To Self Test

The multiline stations can be self tested for proper operation per the following instructions:

1. Disconnect line cord at station base.
2. Press and hold **MUTE** and reconnect line cord to station connector. Station will automatically perform self test routine.
3. Release **MUTE** as soon as test begins. Sequence of test is as follows:
   - (a.) Indicators will light in sequence
   - (b.) Ringer will sound - be sure volume is set to low or high
   - (c.) Indicators and ringer will then turn off at the same time
4. Replace any station that does not pass the self test.

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Installing An Industry-Standard Telephone Station Board In The DXP Plus Digital Communications System

1.0 Understanding Industry-Standard Telephone Support

The DXP *Plus* digital communications system supports the use of on-premise industry-standard telephones (IST) through IST station interface boards. IST installations require a ring generator assembly—one required for the main common equipment cabinet and another one in each expansion common equipment cabinet. Plus, IST installations may require a dual tone multiple frequency (DTMF) receiver card if additional DTMF receivers are required beyond the one provided by the services board.

1.1 Detailing The Necessary Equipment

Regardless of the number of industry-standard telephones that you plan to install, you will need to install the following equipment:

- at least one IST station interface board,
- one ring generator assembly for each equipment cabinet that will contain IST station interface boards,
- at least one line interface circuit board

The DXP *Plus* services board provides on-board DTMF receiver circuitry capable of supporting simultaneous dialing of one industry-standard telephone at a time. This provision is adequate if your site requires only a few industry-standard telephones; however, if you intend to support a population of industry-standard telephones that will generate a large volume of outgoing call traffic, you may need to install one or more DTMF receiver cards to provide additional DTMF receivers for the telephones. Each receiver card allows four ISTs to dial simultaneously. The number of cards that you need to install in the system depends upon how active the ISTs will be at the site. See *section 1.2* for complete details.

If you do need to add receiver cards, you have three choices as to where to install them.

1. The **best and recommended choice** is to add one receiver card to top position on the main cabinet's services board.

NOTE: You can add two additional receiver cards to the lower two positions on the services board; however, you must take specific programming action to enable their use (the name of this program option is: Services DTMF Highway*). If you add these two cards and take this program option, you can add only one card to the interface board in the lower expansion cabinet (discussed in step 2 below).*

2. The **second best choice** is to add up to three receiver cards to each expansion cabinet interface board if one or both is available. Remember, add only one card to the lower cabinet's interface board if you have added or will add two additional receiver cards to the lower two positions on the services board and take programming action to enable their use

3. The third choice is to add an auxiliary board to the system and install up to four DTMF receiver cards on it. This is the **least desirable choice** because it requires you to occupy a board slot that you could otherwise use for line or station boards.

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7/95

1.2 Determining The Board Configuration That You Will Need

Use the following specifications to determine the maximum number of station boards and DTMF receiver cards that you may need.

- Each eight-station circuit board supports up to eight telephones. (It will actually support 16 telephones—two telephones at each port sharing a common intercom number.)
  - You can bridge up to two industry-standard telephones at one station port as long as you do not exceed a combined ringer equivalence number, or REN, of 2.0. (Remember, with two telephones at the same port, they share a common intercom number.)
- Each 16-station circuit board supports up to 16 telephones. (It will actually support 32 telephones—two telephones at each port sharing a common intercom number)
  - You can bridge up to two industry-standard telephones at one station port as long as you do not exceed a combined ringer equivalence number, or REN, of 2.0. (Remember, with two telephones at the same port, they share a common intercom number.)
- Each receiver card allows four industry-standard telephones to dial simultaneously. (The number of cards that you need to install in the system will depend upon how active the industry-standard telephones will be at the site.)
  - You can install one receiver card in the top position on the services board. The services board always provides on-board DTMF receiver circuitry capable of supporting simultaneous dialing of one industry-standard telephone. With the addition of a receiver card, the services board supports simultaneous dialing of five industry-standard telephones. You can add two additional receiver cards to the lower two positions on the services board; however, you must take specific programming action to enable their use (this program feature name is: *Services DTMF Highway*). With these additional two cards, the services board supports simultaneous dialing of 13 industry-standard telephones.
  - You can install three receiver cards on the expansion cabinet interface boards. With three receiver cards installed, each expansion cabinet's interface board supports simultaneous dialing of 12 industry-standard telephones.

CAUTION

If you add two additional receiver cards to the lower two positions on the services board, you can add only one receiver card to the lower expansion cabinet's interface board..

  - You can install four receiver cards on a auxiliary board. With four receiver cards installed, an auxiliary board supports simultaneous dialing of 16 industry-standard telephones (Remember, while you can install up to five auxiliary boards in the system, each auxiliary board that you use occupies a slot where you could install a station or line board.)

Based upon the above specifications, a fully-equipped DXP *Plus* system with a minimum of one line board and no auxiliary boards will provide the following industry-standard telephone support:

- main cabinet (reserving one slot for a line board) supports **128 telephones** (eight 16-station boards times 16 station ports per board—256 telephones with two telephones per station port sharing the same extension number),
- upper expansion cabinet supports **176 telephones** (eleven 16-station boards times 16 station ports per board—352 telephones with two telephones per station port sharing the same extension number),
- lower expansion cabinet supports **160 telephones** (ten 16-station boards times 16 station ports per board—320 telephones with two telephones per station port sharing the same extension number).

These individual totals add together to provide a system support total of **464 telephones** (The total is 928 telephones with two telephones per station port sharing the same intercom number.)

You can configure the system so that a **maximum of 29 of these telephones can dial simultaneously.**

- services board circuitry that supports one telephone plus one receiver card that supports four telephones provides support for five simultaneously dialing telephones
- upper expansion cabinet interface board with three receiver cards supports 12 simultaneously dialing telephones
- lower expansion cabinet interface board with three receiver cards supports 12 simultaneously dialing telephones

If you add the maximum of five auxiliary boards and install four receiver cards on each board, you can **increase the simultaneous dialing capacity to 109 telephones** but you **reduce the maximum telephone capacity to 384.** (The total is 788 telephones with two telephones per station port sharing the same extension number.)

1.2.1 Calculating Your Receiver Card Needs

You can use the following formula to determine how many receiver cards that you must install in your system.

$$\frac{\text{(Simultaneous Dialing Telephones) - (1 Telephone Supported By Services Board)}}{\text{(4 Telephones Per Card)}} = \text{Receiver Cards}$$

As an example, the system maximum is as follows: (110 - 1) ÷ 4 = 27 cards

If you are not sure how many telephones will dial at the same time in your system, you can use the following typical system averages and formula to arrive at an usable estimate.

A typical telephone system, experiences the following call traffic percentages. Your system may be similar.

- Light Call Traffic = up to 15 percent of the telephones dial simultaneously
- Moderate Call Traffic = up to 20 percent of the telephones dial simultaneously
- Heavy Call Traffic = up to 30 percent of the telephones dial simultaneously

(Percent Of Simultaneous Dialing) x (Installed IST Telephones) = (Simultaneous Dialing Telephones)

An an example the system maximum is as follows: .286 x 384 = 110 telephones

1.3 Complying With Underwriters Laboratories Regulations

Per The Underwriters Laboratories regulation 1459, 2nd edition, be aware of the following precautions when installing telephone equipment that is to be directly connected to the telephone company network:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

2.0 Installing Circuit Boards

CAUTION

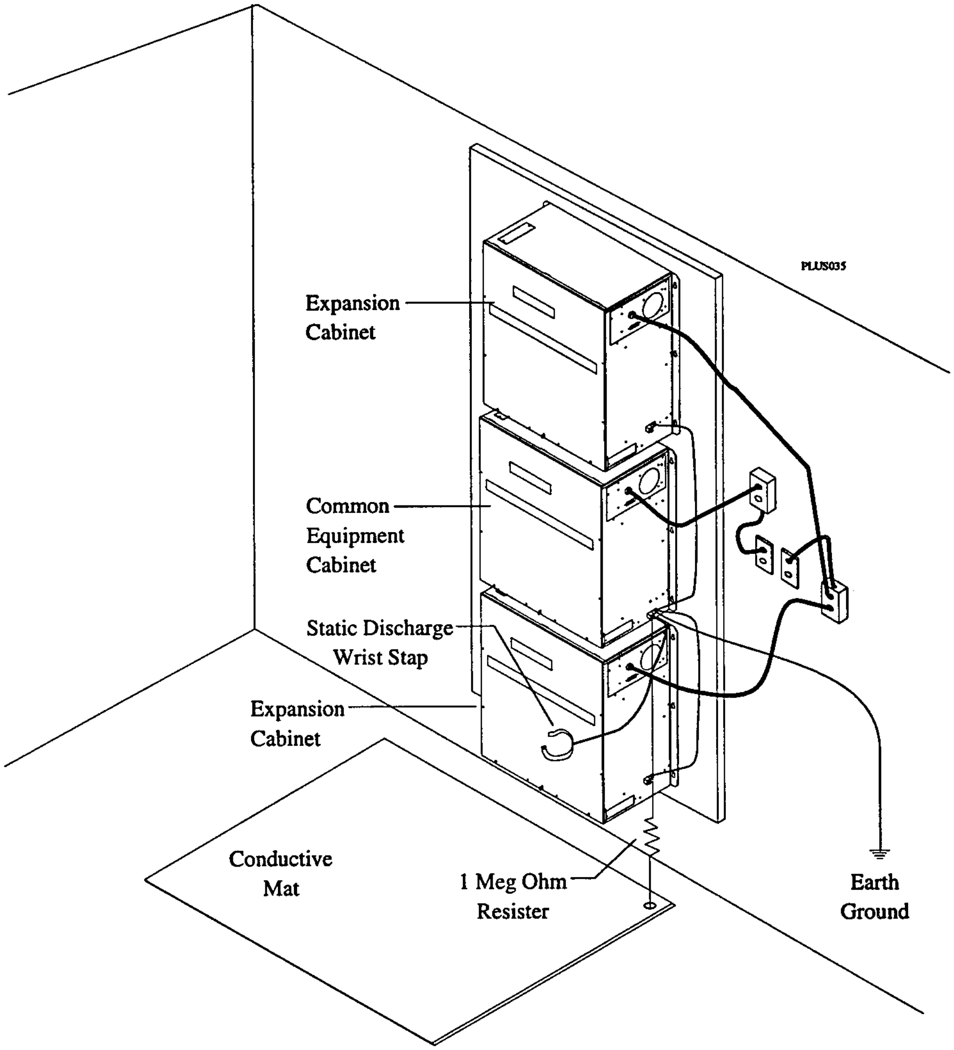
Circuit boards are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, Handling Of Electrostatically Sensitive Components, *for general information. Specific handling precautions are also included in this installation instruction.*

2.1 Creating A Static Safe Work Area

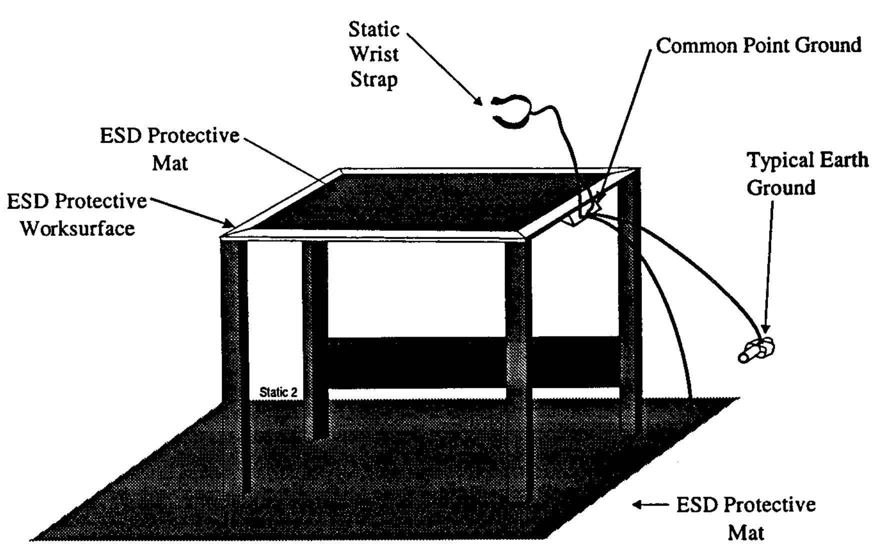
When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

2.2 Installing IST Station Boards In The Equipment Cabinet

1. Normally you should first disconnect the optional battery back-up equipment from the power supply and then disconnect the AC power cord from the AC outlet; however, when necessary, you can install a station board in an operating system. If you must do this, connect one end of a standard telephone handset coil cord to the precharge port on the power supply. During step 5, you will connect the other end of this coil cord to the precharge jack on the station board.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground

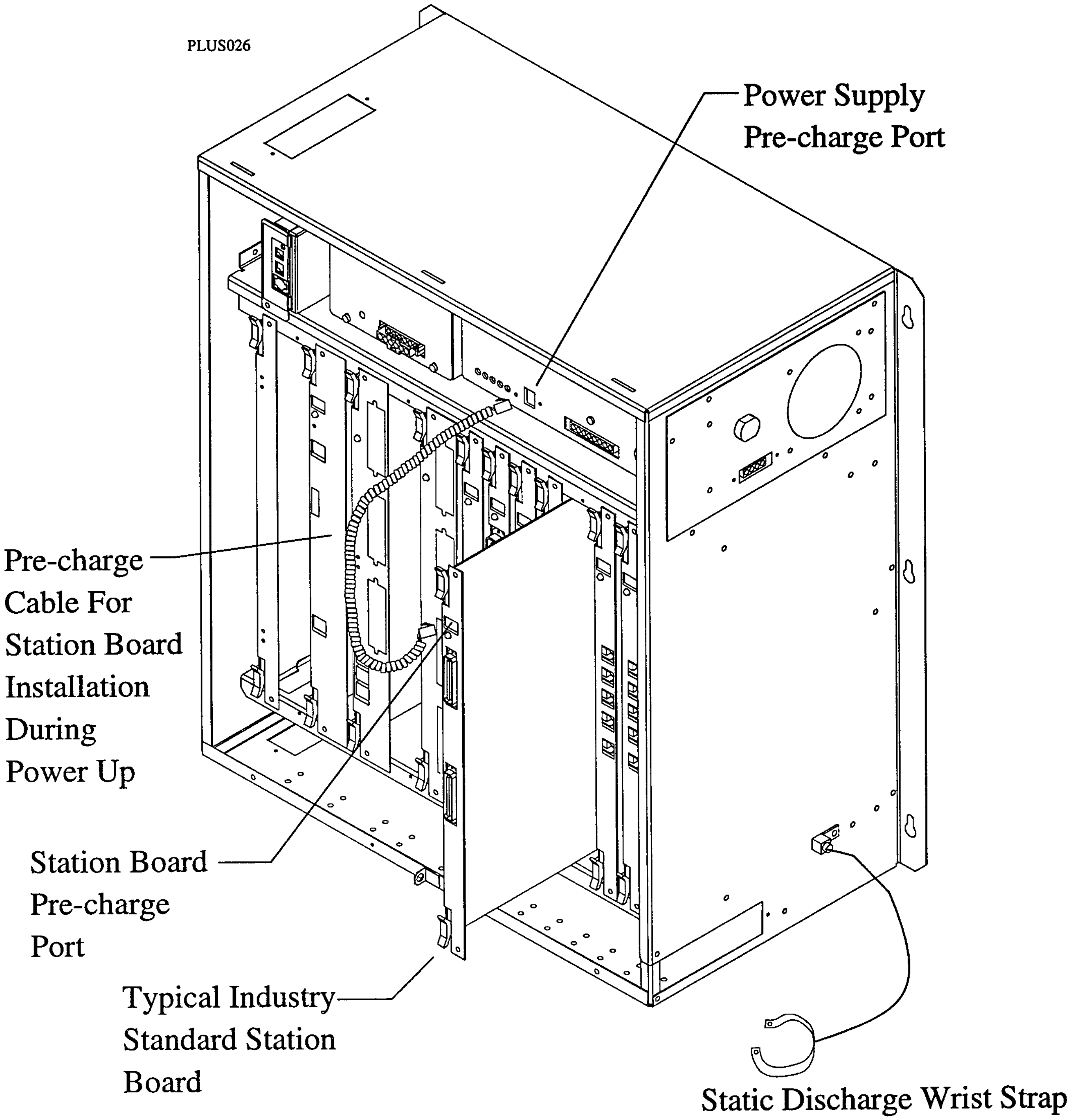
NOTE: With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.

3. Loosen the retaining hardware and lift the front panel away from the common equipment cabinet.
4. Each station board is supplied in a static protection bag for safe keeping. When you are ready to install the circuit board, remove it from its static protection bag.
5. Locate the proper board slot. On DXP *Plus* systems, the station boards connect to any universal slot; however, do not install a station board at the right-most board slot in the second (or lower) expansion cabinet. The system reserves the software timing associated with this slot for internal use.
6. If you are installing the station board in an operating system, connect the free end of the precharge cord that you installed in step 1 to the precharge jack on the station board.
7. Orient the station board with its top and bottom guides in main cabinet board cage. and press the board firmly until its board edge connection properly mates with the connector on cabinet's backplane. If you connected a handset cord between the pre-charge port on the power supply and the jack on the circuit board, disconnect the cord after installing the board.

CAUTION

When pressing circuit boards into place, press them only at the extractor lever locations. If you apply pressure at other locations you may damage the board assembly.

8. Repeat steps 3 and 4 until all circuit boards are installed.
9. Make a final inspection to ensure that all circuit boards are, oriented correctly and mated properly.
10. Install and tighten the supplied screws to secure the circuit boards to the board cage.
11. Each station board includes a ferrite collar. Snap the ferrite collar around the cable station to provide protection against radio frequency interference.
12. If your installation requires additional DTMF receivers, add receiver cards by following the instructions included with the card.
13. If the cabinet where you installed the IST station boards does not now include a ring generator assembly, install a ring generator assembly by following the instructions included with the assembly.
14. Plug the AC line cord into the AC outlet, reconnect any battery back up equipment, and turn on the switch on the power supply.
15. Replace the front panel on the common equipment cabinet.



Viewing A Typical Station Board Installation

3.0 Connecting The Stations

Connections between the telephone stations and the common equipment station boards are typically via type 66M-xx connector blocks that are cable connected to 50-pin male connectors on the station boards.

The maximum distance allowed from the common equipment to the industry-standard telephone varies with the gauge of wire that you use to make the connection. Refer to the following chart for complete details.

Station Type	Wire Gauge		
	20 AWG	22 AWG	24 AWG
Industry-Standard Telephones	**4000 Feet**	**3500 Feet**	**3000 Feet**

The maximum distances stated above are dependent upon the following conditions:

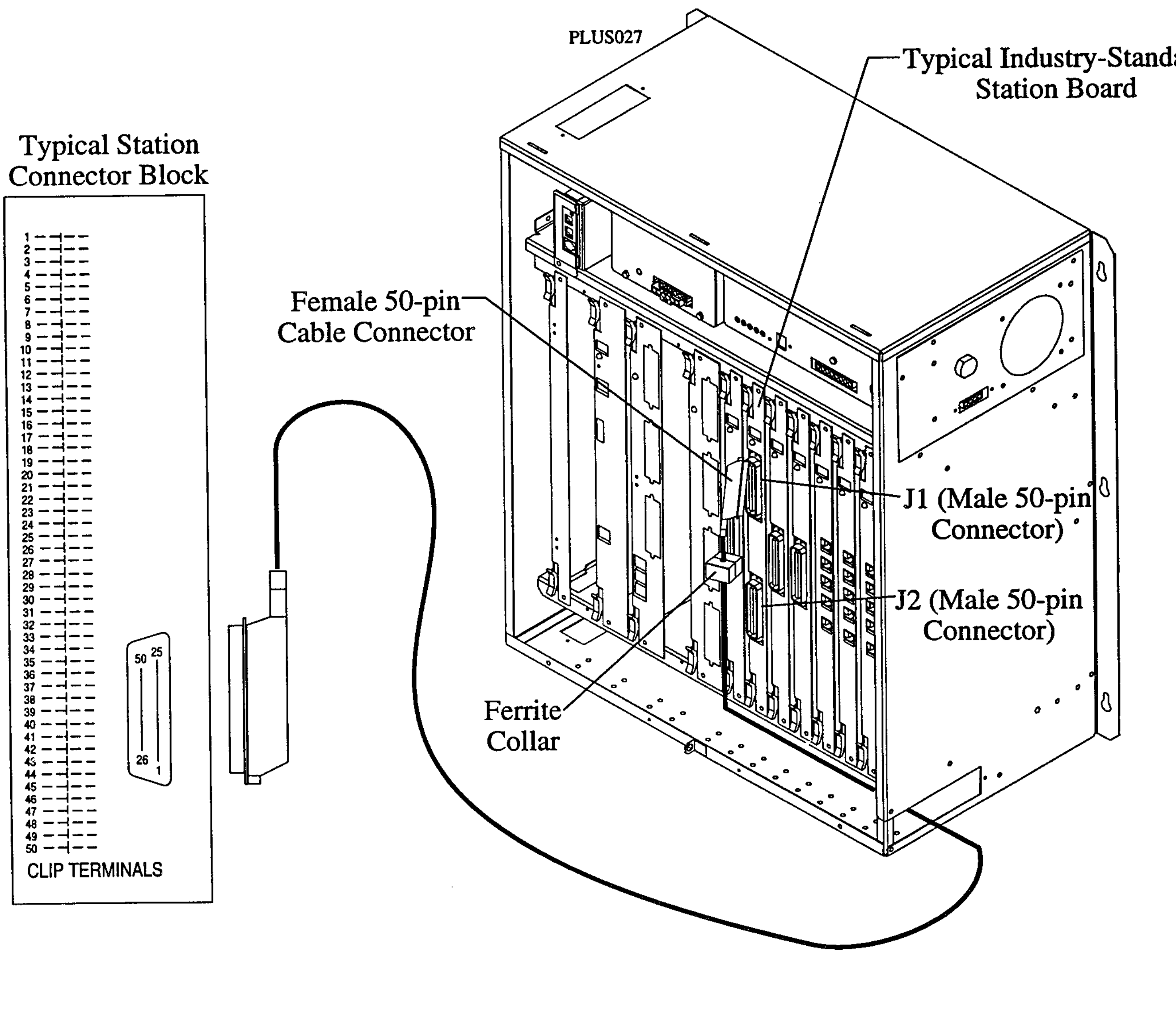
- resistance of industry-standard telephone (per EIA specs) cannot exceed 300 ohms maximum,
- DC load resistance of the wiring between the common equipment and the industry-standard telephone *Plus* the DC resistance of telephone itself can not exceed 460 ohms maximum.

If spare conductors exist in the cables that you run between the station boards and the 66M-xx connector blocks, it is a good practice to connect the spare conductors to earth ground. Doing this may help prevent the spare connectors from inducing radio frequency and/or AC interference into the system.

Remember, you should snap a ferrite collar around each station cable to provide protection against radio frequency interference.

CAUTION

The polarity between the individual wires in a particular voice pair is not critical.



Connecting Telephones To The IST Station Board

3.2 Detailing The Station Connections For J1

25-Pair Connections For J1			Station Pair Connections For J1			Station Identification	
Wire Color	Pair	Pin No.	Clip Term.	Pair Identification	Wire Color	Station	Location (note the site position in this column)
White-Blue	1	26	1	Tip Lead	Green	1	
Blue-White		1	2	Ring Lead	Red		
White-Orange	2	27	3	No Connection			
Orange-White		2	4				
White-Green	3	28	5				
Green-White		3	6				
White-Brown	4	29	7	Tip Lead	Green	2	
Brown-White		4	8	Ring Lead	Red		
White-Slate	5	30	9	No Connection			
Slate-White		5	10				
Red-Blue	6	31	11				
Blue-Red		6	12				
Red-Orange	7	32	13	Tip Lead	Green	3	
Orange-Red		7	14	Ring Lead	Red		
Red-Green	8	33	15	No Connection			
Green-Red		8	16				
Red-Brown	9	34	17				
Brown-Red		9	18				
Red-Slate	10	35	19	Tip Lead	Green	4	
Slate-Red		10	20	Ring Lead	Red		
Black-Blue	11	36	21	No Connection			
Blue-Black		11	22				
Black-Orange	12	37	23				
Orange-Black		12	24				
Black-Green	13	38	25	Tip Lead	Green	5	
Green-Black		13	26	Ring Lead	Red		
Black-Brown	14	39	27	No Connection			
Brown-Black		14	28				
Black-Slate	15	40	29				
Slate-Black		15	30				
Yellow-Blue	16	41	31	Tip Lead	Green	6	
Blue-Yellow		16	32	Ring Lead	Red		
Yellow-Orange	17	42	33	No Connection			
Orange-Yellow		17	34				
Yellow-Green	18	43	35				
Green-Yellow		18	36				
Yellow-Brown	19	44	37	Tip Lead	Green	7	
Brown-Yellow		19	38	Ring Lead	Red		
Yellow-Slate	20	45	39	No Connection			
Slate-Yellow		20	40				
Violet-Blue	21	46	41				
Blue-Violet		21	42				
Violet-Orange	22	47	43	Tip Lead	Green	8	
Orange-Violet		22	44	Red Lead	Red		
Violet-Green	23	48	45	No Connection			
Green-Violet		23	46				
Violet-Brown	24	49	47				
Brown-Violet		24	48				
Violet-Slate	25	50	49				
Slate-Violet		25	50				

3.3 Detailing The Station Connections For J2

25-Pair Connections For J2				Station Pair Connections For J2		Station Identification	
Wire Color	Pair	Pin No.	Clip Term.	Pair Identification	Wire Color	Station	Location (note the site position in this column)
White-Blue	1	26	1	Tip Lead	Green	9	
Blue-White		1	2	Ring Lead	Red		
White-Orange	2	27	3	No Connection			
Orange-White		2	4				
White-Green	3	28	5				
Green-White		3	6				
White-Brown	4	29	7	Tip Lead	Green	10	
Brown-White		4	8	Ring Lead	Red		
White-Slate	5	30	9	No Connection			
Slate-White		5	10				
Red-Blue	6	31	11				
Blue-Red		6	12				
Red-Orange	7	32	13	Tip Lead	Green	11	
Orange-Red		7	14	Ring Lead	Red		
Red-Green	8	33	15	No Connection			
Green-Red		8	16				
Red-Brown	9	34	17				
Brown-Red		9	18				
Red-Slate	10	35	19	Tip Lead	Green	12	
Slate-Red		10	20	Ring Lead	Red		
Black-Blue	11	36	21	No Connection			
Blue-Black		11	22				
Black-Orange	12	37	23				
Orange-Black		12	24				
Black-Green	13	38	25	Tip Lead	Green	13	
Green-Black		13	26	Ring Lead	Red		
Black-Brown	14	39	27	No Connection			
Brown-Black		14	28				
Black-Slate	15	40	29				
Slate-Black		15	30				
Yellow-Blue	16	41	31	Tip Lead	Green	14	
Blue-Yellow		16	32	Ring Lead	Red		
Yellow-Orange	17	42	33	No Connection			
Orange-Yellow		17	34				
Yellow-Green	18	43	35				
Green-Yellow		18	36				
Yellow-Brown	19	44	37	Tip Lead	Green	15	
Brown-Yellow		19	38	Ring Lead	Red		
Yellow-Slate	20	45	39	No Connection			
Slate-Yellow		20	40				
Violet-Blue	21	46	41				
Blue-Violet		21	42				
Violet-Orange	22	47	43	Tip Lead	Green	16	
Orange-Violet		22	44	Red Lead	Red		
Violet-Green	23	48	45	No connection			
Green-Violet		23	46				
Violet-Brown	24	49	47				
Brown-Violet		24	48				
Violet-Slate	25	50	49				
Slate-Violet		25	50				

3.4 Understanding The DXP Plus Logical Numbering

Because there are no dedicated station or line ports in the DXP *Plus*, the system uses an automatic configuration method to logically number its stations and lines. Automatic configuration occurs after you perform a master clear on the system.

How automatic configuration works

With automatic configuration, the system does a search for all installed station and line boards in the main and expansion cabinets, and assigns a logical number for each provided station and line encountered during the search. The search begins in the main cabinet at the left-most universal slot and proceeds left to right. The search then moves to the upper expansion cabinet where it searches left-most slot to right-most slot. The search finally moves to the lower expansion cabinet where it again searches left-most slot to right-most slot. When automatic configuration is finished, the system has logically numbered all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system.

How logical number and physical location relate to one another

The logical number of a station or line corresponds to its relationship to other stations or lines in the system but is not dependent upon the board's placement in the cabinet. The physical location of a station or line corresponds to the order of the system's board slots. The main cabinet contains slots 1–9, the upper expansion cabinet contains slots 10–20, and the lower expansion cabinet contains slots 21–30. Therefore, even if the first encountered station board is located in slot five of the main cabinet, the system still assigns logical number one to the first station provided by that board. During installation, you can skip slots. For example, you can install eight-line, loop start, line boards in only slots one and 30 if you wish. In this case, slot one yields logical line numbers 1–8 and slot 30 yields logical line numbers 9–17.

Where you can place circuit boards

Each installed board requires timing circuits equal to its capacity. For example, a 16–station board requires 16 timing circuits, an eight–line loop start line board requires eight circuits, and a fully configured T1 trunk board requires 24 timing circuits. In the DXP *Plus,* each universal slot provides 32 timing circuits. Because of this timing circuit provision of each slot, you can place any station or line board at any slot location with no restrictions.

Adding boards without renumbering

If you install or relocate a station or line board, this board does not operate until you take appropriate programming action. If you use an available open slot for adding or relocating a board, that board's stations or lines assume logical numbers in sequence after the system's last assigned logical station or line number. For example, if the system's last logical station number is 24, the logical numbers of the newly installed board's stations begin at logical number 25.

After you remove a board and delete it through programming, that board's logical numbers are available for reassignment. This means that you can remove a board, add or move another board, take the appropriate programming action, and have the stations or lines of the added or relocated board assume the logical numbers made available by the removed board. For example, if the system's last logical number is 64 and you remove the board providing stations with logical numbers 1–16 and delete it through programming, the stations on an added board assume logical numbers beginning with 1 instead of 65. However, if you remove and program delete an eight-station board and add a 16-station board, the first eight stations stations on the added board assume logical numbers 1–8 and the last eight stations assume logical numbers 65–72.

Remember, should you master clear the system, the automatic configuration feature logically numbers all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system. This action renumbers those station and lines provided by boards that you have added or relocated since you last performed the system master clear.

4.0 Checking Out The Installation And Isolating Failures

Check the telephone installation for proper operation by performing the following voltage measurements.

4.1 Voltage Check

Make the following voltage measurements at the station connector blocks under the following conditions:

- Common equipment connected to station connector blocks.
- Stations wired and wiring punched down on blocks.
- Bridging clips installed
- AC power connected to the common equipment

Measure the DC voltage across the Tip and Ring leads for each installed telephone with a DC voltmeter. Then, call the industry-standard telephone to stimulate the ring generator assembly and measure the AC ringing voltage across the Tip and Ring leads for each installed telephone with an AC voltmeter.

The measured voltages must be within the limits shown in the chart below. If your measured readings are different from these charted values, it could indicate a possible wiring error or a station or common equipment problem.

66M-xx Connector	Meter Lead Polarity	Measured DC Volts	Measured AC Ring Voltage
Tip Lead	+	+ 36 ± 3 VDC	70 ± 5 VAC
Ring Lead	-		

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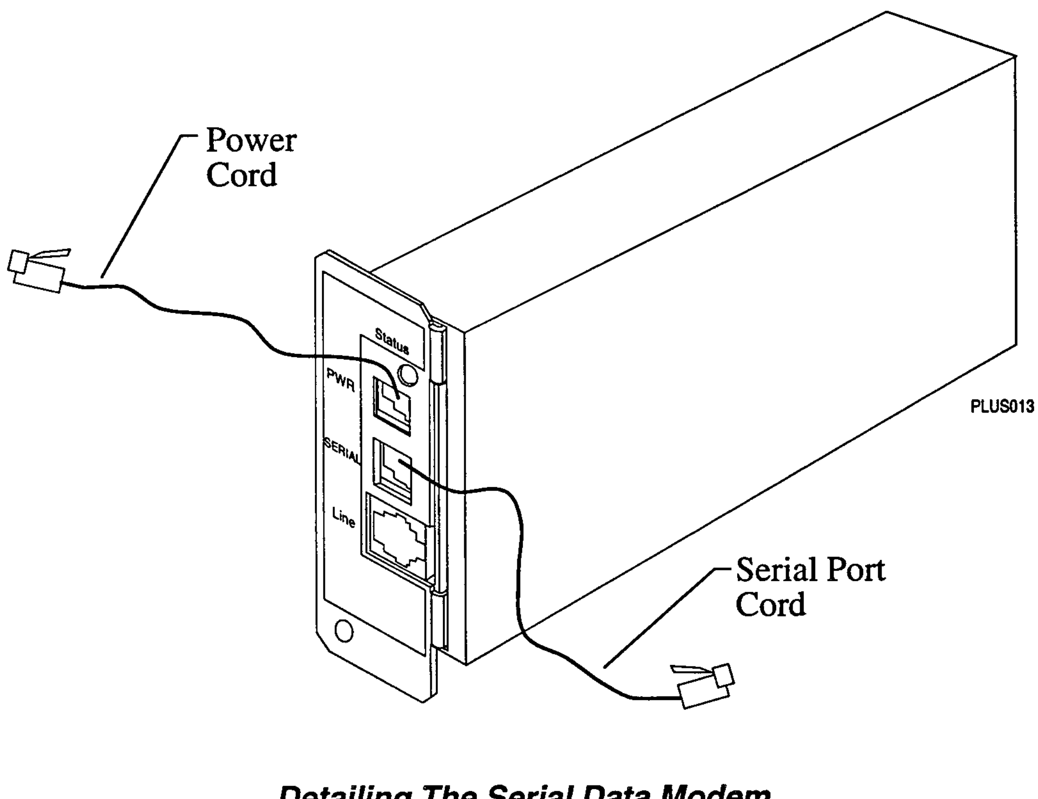
Installing The Serial Data Modem In The DXP Plus Digital Communications System

1.1 Understanding The Modem

The serial data modem allows remote servicing and programming of the DXP *Plus* digital communications system. The DXMDM is a general-purpose, Hayes*-compatible, serial data modem that receives its operating power and configuration programming from the DXP *Plus*. The modem's operating parameters appear in the following chart.

** Hayes is a registered trademark of Hayes Microcomputer Products*

BPS Out	BPS In	Data Bits	Stop Bits	Parity	Flow Control
2400	2400	8	1	None	None



Detailing The Serial Data Modem

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IMI89-185.01
7/95

1.2 Installing The DXMDM Modem

The following procedure explains how to install the serial data modem. Figure 1 illustrates the relative position of the modem and the location of its connections. The modem fits on the left side of the equipment shelf.

1. Locate DIP switch SW7 on the services board, and set it to its OFF position.
2. Insert the modem as illustrated in Figure 1.
3. Attach the modem to the equipment shelf with a single screw through the mounting-screw hole on the modem's front plate.
4. Connect the PWR cable from the modem to the jack labeled *Modem Power* on the CPU board. The modem's STAT light should come on.

NOTE: The serial data modem comes from the factory with the PWR and serial port cables already installed. They are purposefully difficult to remove; however, you can disconnect the cables for replacement if necessary. To do so, reach into the opening and press the tab down to release the connector while you pull the cable out from the jack.

5. Connect the serial port cable from the modem to the jack labeled *Modem Com* (serial data port) on the CPU board. This is the default port for the modem. When you use this connection, you will not need to take any programming action. Alternately, you can connect the modem to one of the serial data ports provided by the communications card installed on the auxiliary board (if one is installed on your system). If you use a a serial data port other than the default port, you must assign it for modem operation using the database programming procedure.
6. Connect a telephone line into the modem's line jack.
7. Set DIP switch SW7 to its ON position to ensure continuous modem operation. This step is necessary because the serial data modem depends upon the DXP *Plus* for both its power and configuration. With switch SW7 set ON, the system automatically matches the baud rate and serial data parameters of the modem regardless of which port you choose for modem connection.

CAUTION

If you disconnect the modem PWR cord from the DXP Plus, you must reset the modem after you reconnect the PWR cord. Set switch SW7 to OFF, wait five seconds, and then return it to ON to reset the modem. (You can also reset the modem from the programming station. To do so, enter the system-manager programming mode and then dial **18#***).*

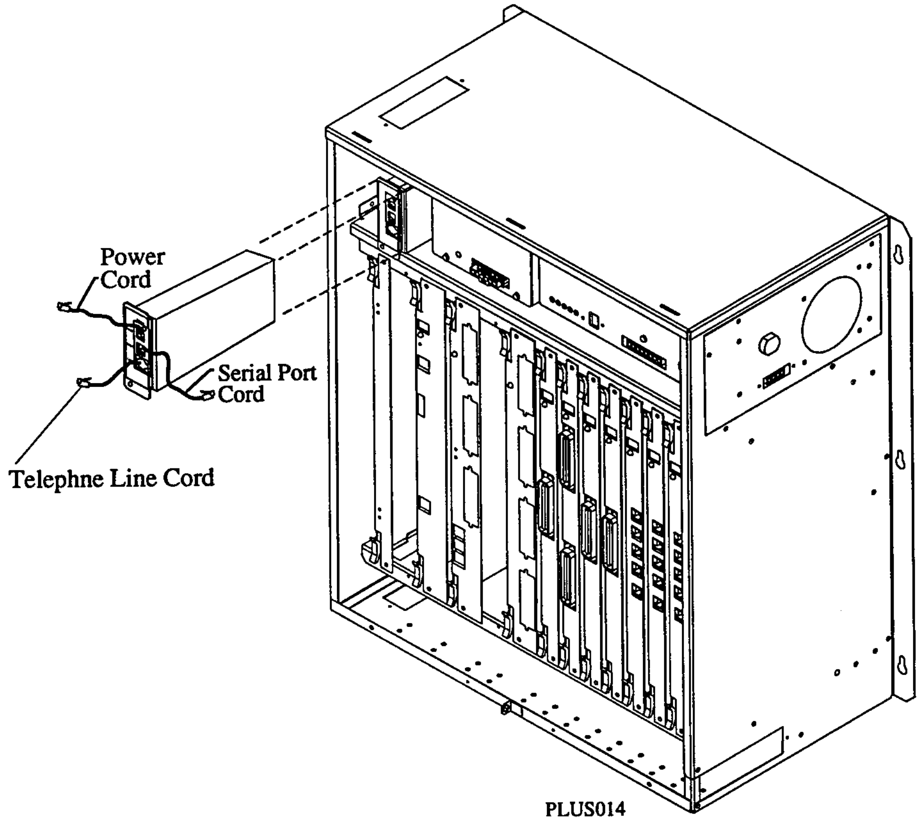

Figure 1. Installing The Modem In The Main Cabinet

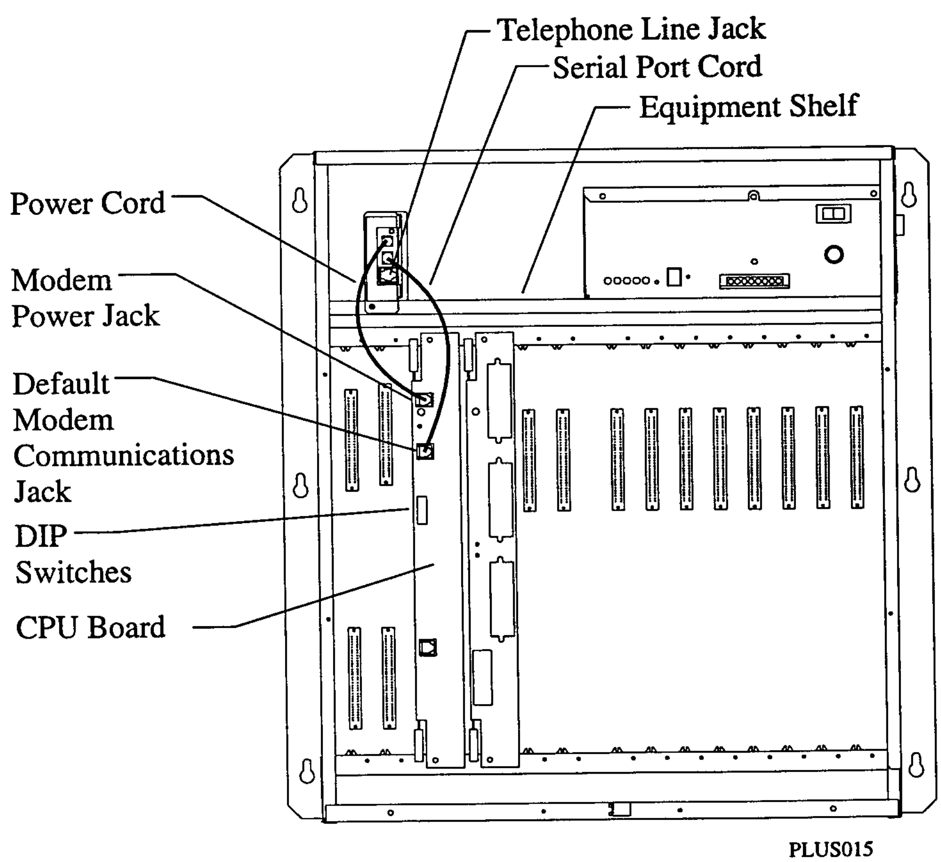

Figure 2. Viewing Modem Position And Connection Locations

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Installing A Dual Tone Multiple Frequency (DTMF) Receiver Card In The DXP Plus Digital Communications System

1.0 Introducing The DTMF Receiver Card

The DXP *Plus* digital communications system supports the use of on-premise industry-standard telephones.

To support the DTMF dialing of industry standard telephones, the DXP *Plus* services board provides on-board DTMF receiver circuitry. This circuitry supports dialing of one industry-standard telephone at a time. This provision is adequate, if your site requires only a few industry-standard telephones; however. if you intend to support a population of industry-standard telephones that will generate a large volume of outgoing call traffic, you must install one or more DTMF receiver cards to provide additional DTMF receivers for the telephones. Each DXOPT–TON card allows four industry-standard telephones to dial simultaneously. The number of cards that you need to install in the system depends upon how active the industry-standard telephones will be at the site. See *Section 1.1* for details.

If you do need to add receiver cards, you have three choices as to where to install them.

1. The **best and recommended choice** is to add one receiver card to top position on the main cabinet's services board.

NOTE: You can add two additional receiver cards to the lower two positions on the services board; however, you must take specific programming action to enable their use (the name of this program option is: Services DTMF Highway*). If you add these two cards and take this program option, you can only add one card to the lower expansion cabinet's interface board (discussed in step 2 below).*

2. The **second best choice** is to add up to three receiver cards to each expansion cabinet's interface board if one or both is available. Remember, add only one card to the lower expansion cabinet's interface board if you have added or will add two additional receiver cards to the lower two positions on the services board and take programming action to enable their use

3. The third choice is to add an auxiliary board to the system and install up to four DTMF receiver cards on it. This is the **least desirable choice** because it requires you to occupy a board slot that you could otherwise use for line or station boards.

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IMI89-186.01
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1.2 Determining The Board Configuration That You Will Need

Use the following specifications to determine the maximum number of station boards and DTMF receiver cards that you may need.

- Each eight-station board supports up to eight telephones. (It will actually support 16 telephones—two telephones at each port sharing a common intercom number.)
  - Up to two industry-standard telephones can be bridged at one station port as long as you do not exceed a combined ringer equivalence number, or REN, of 2.0. (Remember, with two telephones at the same port, they share a common intercom number.)
- Each 16-station board supports up to 16 telephones. (It will actually support 32 telephones—two telephones at each port sharing a common intercom number)
  - Up to two industry-standard telephones can be bridged at one station port as long as you do not exceed a combined ringer equivalence number, or REN, of 2.0. (Remember, with two telephones at the same port, they share a common intercom number.)
- Each receiver card allows four industry-standard telephones to dial simultaneously. (The number of cards that you need to install in the system will depend upon how active the industry-standard telephones will be at the site.)
  - You can install one receiver card in the top position on the services board. The services board always provides on-board DTMF receiver circuitry capable of supporting simultaneous dialing of one industry-standard telephone. With the addition of a receiver card, the services board supports simultaneous dialing of five industry-standard telephones. You can add two additional receiver cards to the lower two positions on the services board; however, you must take specific programming action to enable their use (this program feature name is: *Services DTMF Highway*). With these additional two cards, the services board supports simultaneous dialing of 13 industry-standard telephones.
  - You can install three receiver cards on the upper and lower expansion cabinet interface boards. With three receiver cards installed, each interface board supports simultaneous dialing of 12 industry-standard telephones.

CAUTION

If you add two additional receiver cards to the lower two positions on the services board, you can add only one receiver card to the lower expansion cabinet's interface board..

  - You can install four receiver cards on an auxiliary board. With four receiver cards installed, an auxiliary board supports simultaneous dialing of 16 industry-standard telephones (Remember, while you can install up to five auxiliary boards in the system, each auxiliary board that you use occupies a slot where you could install a station or line board.)

Based upon the above specifications, a fully-equipped DXP *Plus* system with a minimum of **one line board** and **no auxiliary boards** will provide the following industry-standard telephone support:

- main cabinet (reserving one slot for a line board) supports **128 telephones** (eight 16-station boards times 16 station ports per board—256 telephones with two telephones per station port sharing the same extension number),
- upper expansion cabinet supports **176 telephones** (eleven 16-station boards times 16 station ports per board—352 telephones with two telephones per station port sharing the same extension number),
- lower expansion cabinet supports **160 telephones** (ten 16-station boards times 16 station ports per board—320 telephones with two telephones per station port sharing the same extension number).

These individual totals add together to provide a system support total of **464 telephones** (The total is 928 telephones with two telephones per station port sharing the same intercom number.)

You can configure the system so that a **maximum of 29 of these telephones can dial simultaneously.**

- services board circuitry that supports one telephone plus one receiver card that supports four telephones provides support for six simultaneously dialing telephones
- upper expansion cabinet interface board with three receiver cards supports 12 simultaneously dialing telephones
- lower expansion cabinet interface board with three receiver cards supports 12 simultaneously dialing telephones

If you add the maximum of five auxiliary boards and install four receiver cards on each board, you can **increase the simultaneous dialing capacity to 109 telephones** but you **reduce the maximum telephone capacity to 384.** (The total is 788 telephones with two telephones per station port sharing the same extension number.)

1.2.1 Calculating Your Receiver Card Needs

You can use the following formula to determine how many receiver cards that you must install in your system.

$$\frac{\text{(Simultaneous Dialing Telephones) - (1 Telephone Supported By Services Board)}}{\text{(4 Telephones Per Card)}} = \text{Receiver Cards}$$

As an example, the system maximum is as follows: (110 - 1) ÷ 4 = 27 cards

If you are not sure how many telephones will dial at the same time in your system, you can use the following typical system averages and formula to arrive at a usable estimate.

A typical telephone system, experiences the following call traffic percentages. Your system may be similar.

- Light Call Traffic = up to 15 percent of the telephones dial simultaneously
- Moderate Call Traffic = up to 20 percent of the telephones dial simultaneously
- Heavy Call Traffic = up to 30 percent of the telephones dial simultaneously

(Percent Of Simultaneous Dialing) x (Installed Telephones) = (Simultaneous Dialing Telephones)

For example, the formula for the system's maximum values is as follows: .286 x 384 = 110 telephones

1.3 Complying With Underwriters Laboratories Regulations

Per The Underwriters Laboratories regulation 1459, 2nd edition, be aware of the following precautions when installing telephone equipment that is to be directly connected to the telephone company network:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

2.0 Installing Circuit Boards

CAUTION

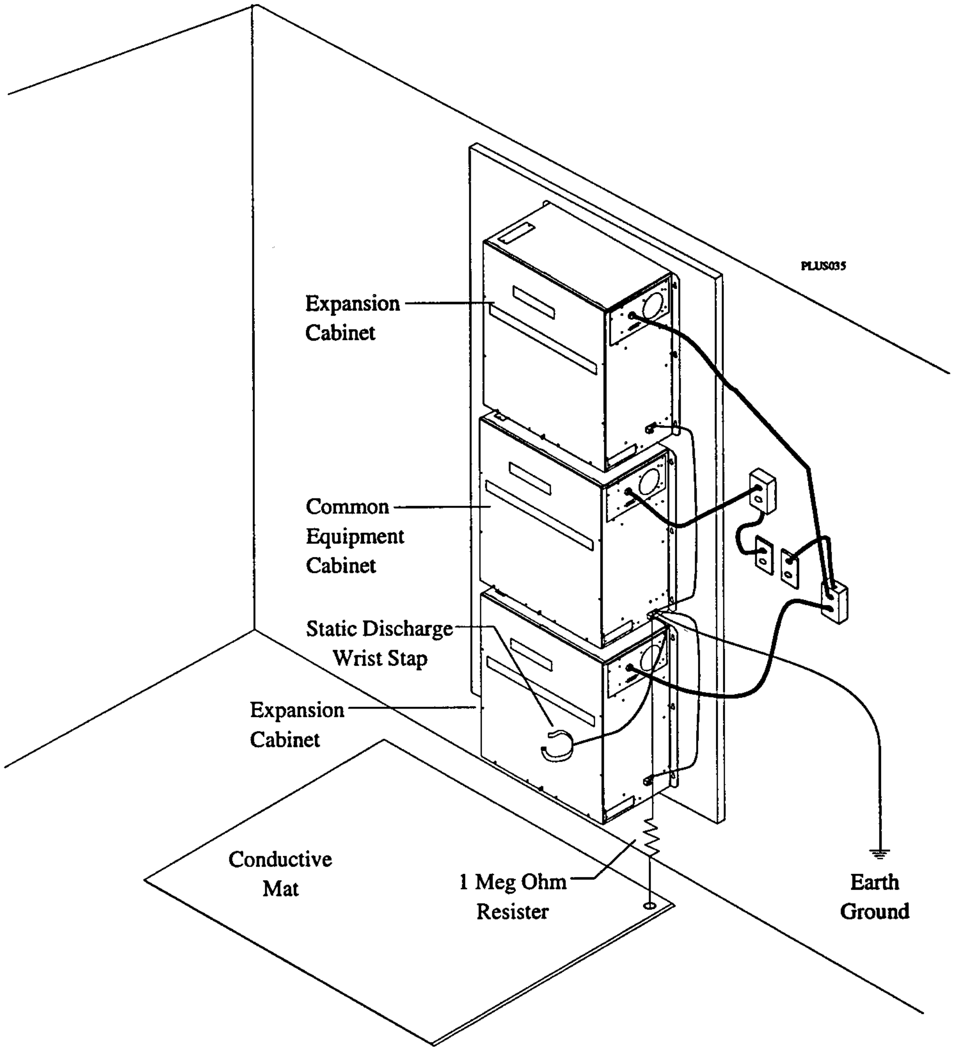
Circuit boards are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, Handling Of Electrostatically Sensitive Components, *for general information. Specific handling precautions are also included in this installation instruction.*

2.1 Creating A Static Safe Work Area

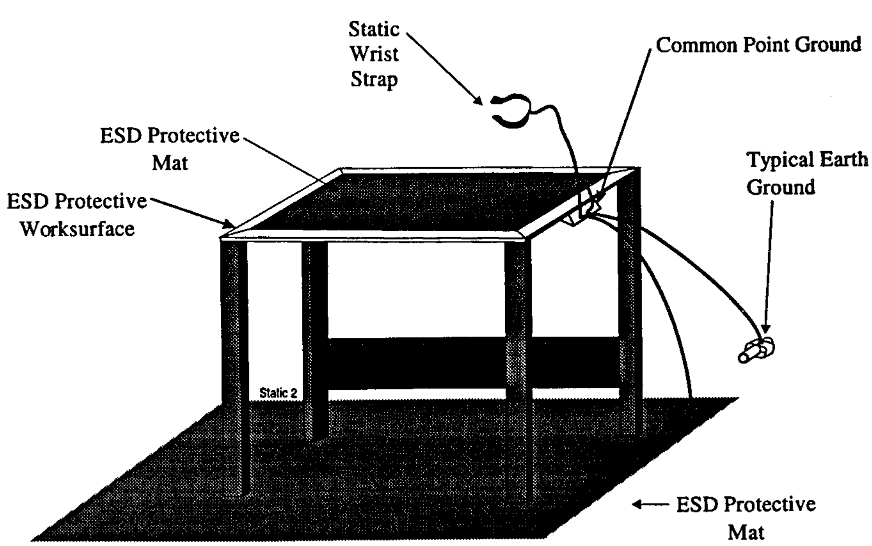
When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

3.0 Installing The Receiver Card

You can install one receiver card in the top position on the services board. You can add two additional receiver cards to the lower two positions on the services board; however, you must take specific programming action to enable their use (this program feature name is: *Services DTMF Highway*). You can install three receiver cards on the upper and lower expansion cabinet interface boards.

CAUTION

If you add two additional receiver cards to the lower two positions on the services board, you can add only one receiver cards to the lower expansion cabinet interface board.

1. Be sure you are standing on the conductive mat that you have placed in front of the cabinet area and grounded to a good earth ground. (The third wire ground of the AC power line is an acceptable grounding point if the AC wall jack is properly grounded.) The grounded conductive mat provides a safe static electric discharge path.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground.

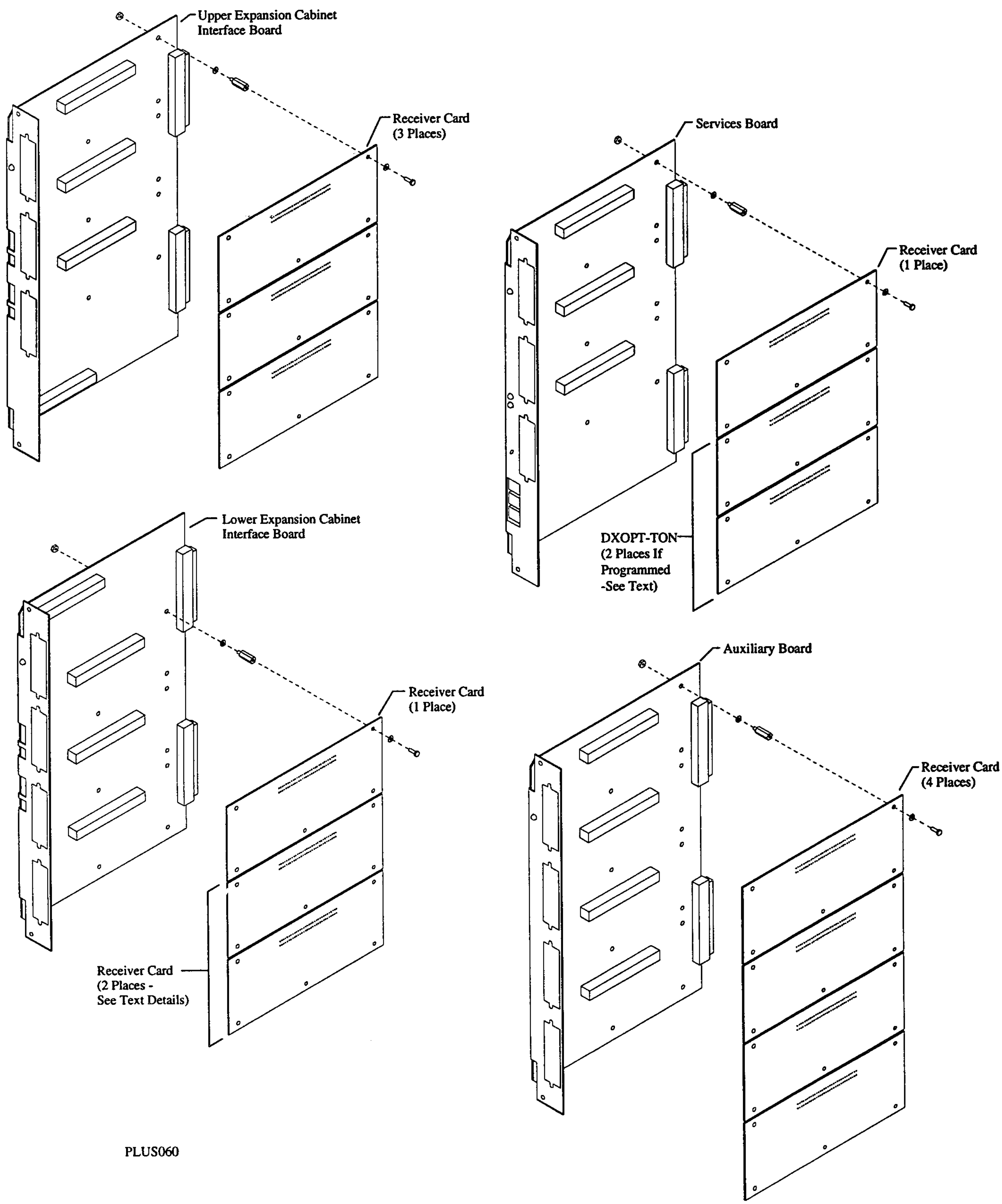
NOTE: *With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.*

3. Turn off the power to the system and disconnect the optional battery back up equipment.
4. Loosen the retaining hardware, and lift the front panel away from the common equipment cabinet.
5. Loosen the retaining hardware and remove the services board from the cabinet, place it in a static protection bag, and transport the board to the static-safe work area. Do the same for the interface board if you plan to add a receiver card to it. Further, if the common equipment cabinet contains an auxiliary board and you plan to add the receiver card to it, follow the same procedure.
6. At the static safe work area, with your wrist strap in place, remove the circuit boards and receiver cards from their static protection bags.
7. Referring to the illustrations on the next page, orient the host circuit board and the receiver card, and attach them with the supplied hardware.
8. Place the host circuit board and the newly installed receiver card into a static protection bag and transport them back to the common equipment cabinet.
9. With your static strap on your wrist, remove the board assembly from the static protection bag and install the board in its designated board slot.

CAUTION

When pressing circuit boards into place, press them only at the extractor lever locations.
If you apply pressure at other locations you may damage the board assembly.

9. Make a final inspection to ensure that the board assembly is oriented correctly and mated properly.
10. Install and tighten the supplied screws to secure the circuit board assembly to the board cage.
10. Plug the AC line cord into the AC outlet, reconnect any battery back up equipment, and turn on the switch on the power supply.
11. Replace the front panel on the common equipment cabinet.



Connecting The Receiver Card To Its Host Circuit Board

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Installing The Ring Generator Assembly In The DXP Plus Digital Communications System

1.0 Introducing The Ring Generator Assembly Installation

The DXP *Plus* digital communications system supports the use of on-premise industry-standard telephones. To do this, it requires a ring generator assembly to supply ringing voltage to the industry-standard telephones to signal incoming calls.

Regardless of the number of installed industry-standard telephones, you will need to install one ring generator for the main cabinet and one ring generator for each expansion cabinet if the site includes expansion cabinets.

1.1 Complying With Underwriters Laboratories Regulations

Per The Underwriters Laboratories regulation 1459, 2nd edition, be aware of the following precautions when installing telephone equipment that is to be directly connected to the telephone company network:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

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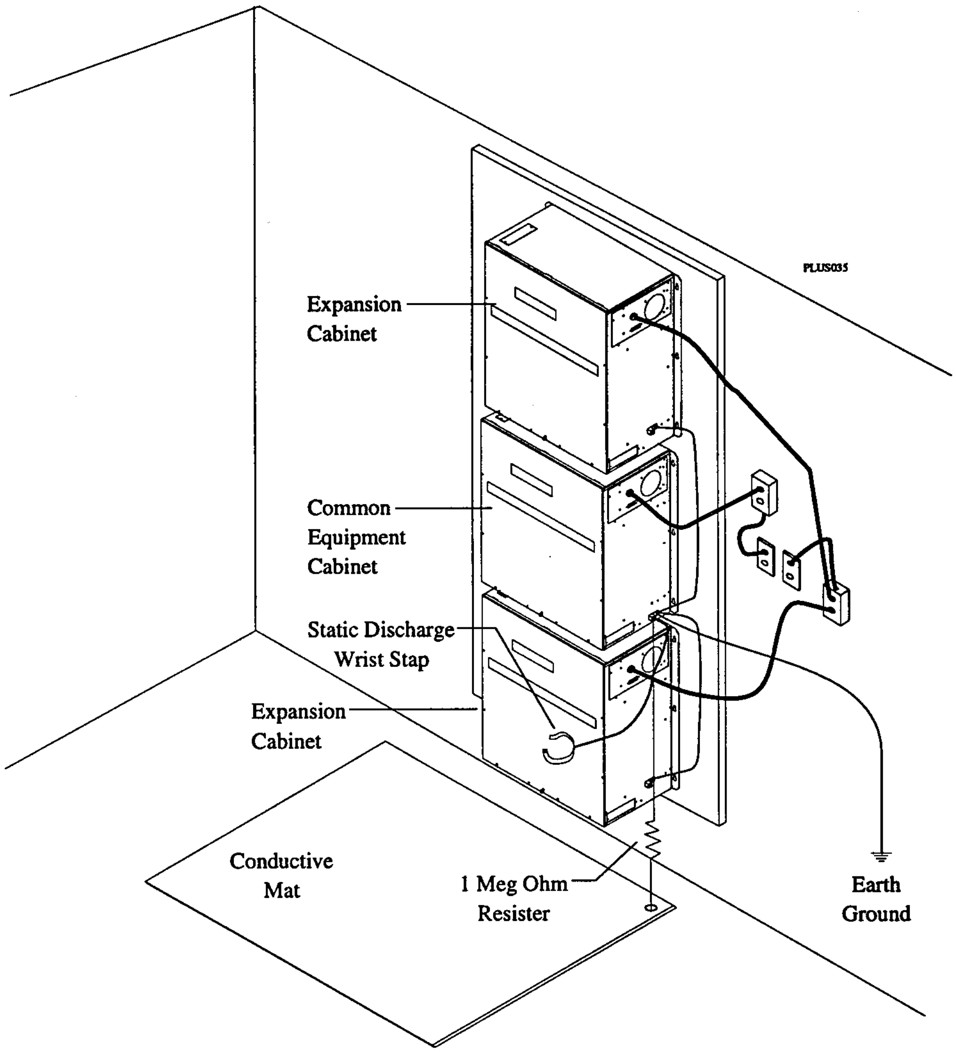
2.0 Creating A Static Safe Work Area

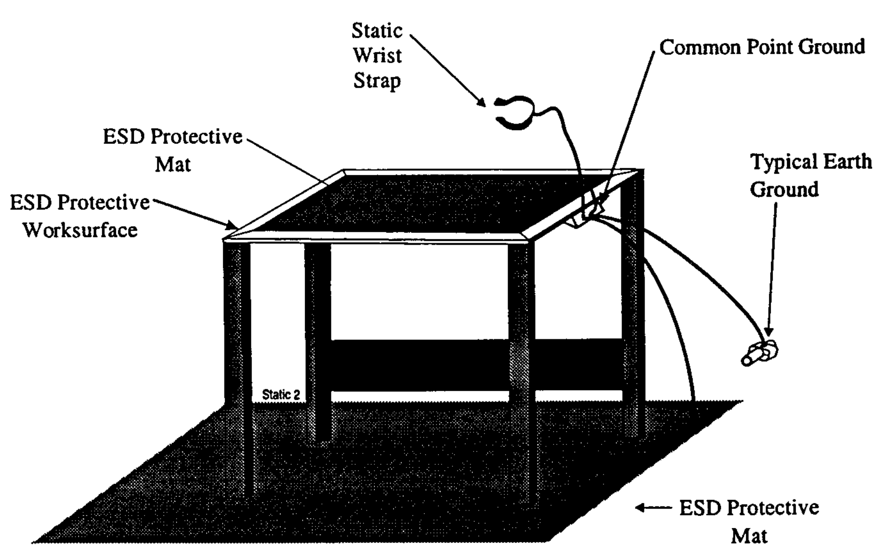
When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

3.0 Installing The Ring Generator Assembly

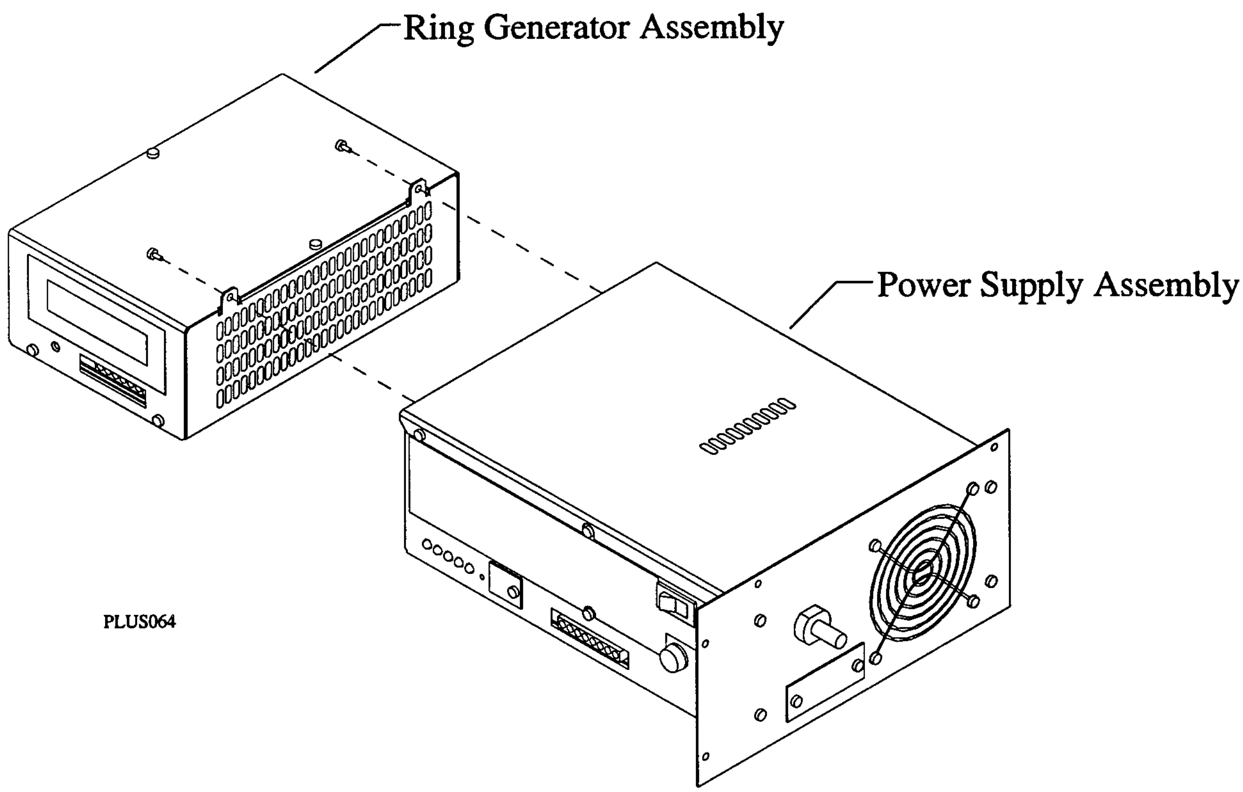
You can install the ring generator assembly in the main and expansion cabinets per the following steps.

1. Turn off the power to the system, unplug the AC line cord from the AC outlet, and disconnect the optional battery back up equipment.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground

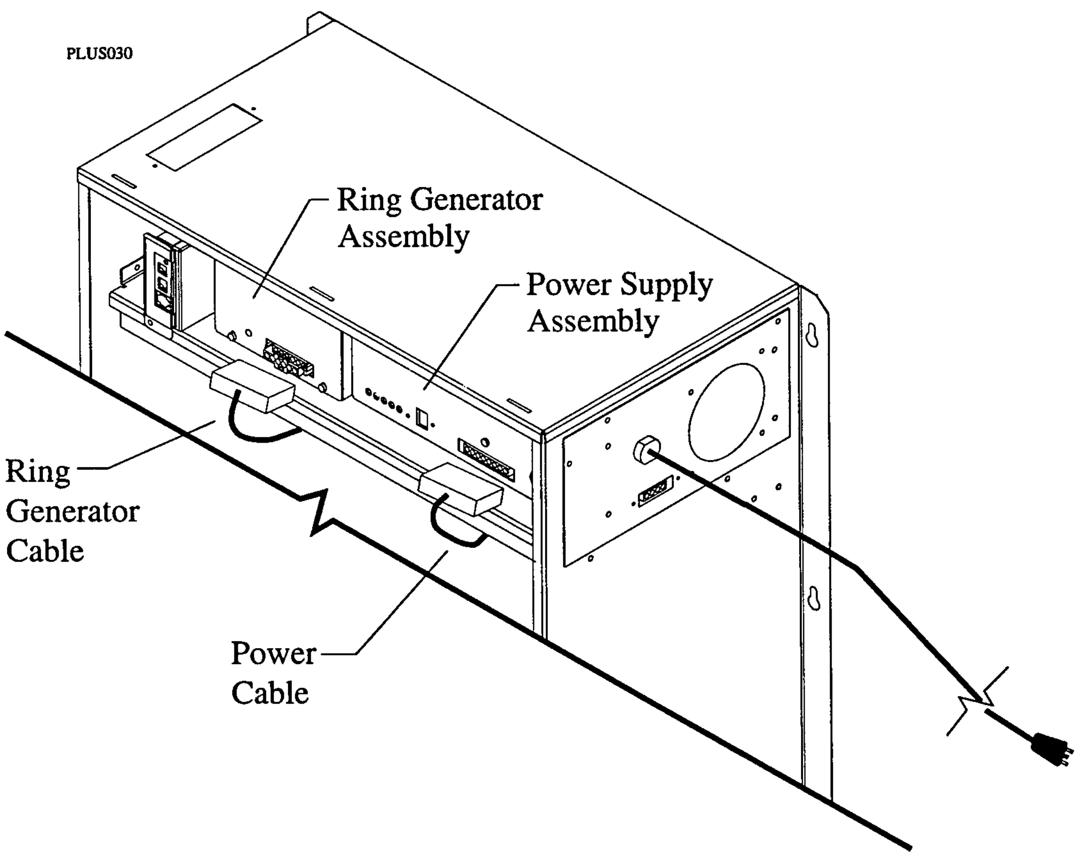
NOTE: With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.

3 Loosen the retaining hardware and lift the front panel away from the common equipment cabinet.

4. Loosen the retaining screws and remove the power supply assembly from the common equipment cabinet.
5. Connect the ring generator assembly to the side panel of the power supply chassis, and secure it with the supplied hardware.
6. Slide the attached assemblies into the opening at the top right side of the common equipment main cabinet until the assembly's front panel contacts the side of the cabinet.
7. Locate the power cable routed from the backplane, and connect it to the power supply.
8. Locate the ring generator cable routed from the backplane, and connect it to the ring generator.
9. Fasten the assembly to the common equipment cabinet with the hardware you removed in step 2.
10. Plug the AC line cord into the AC outlet, reconnect any battery back up equipment and turn on the switch on the power supply.
11. Replace the front panel on the common equipment cabinet.



Attaching The Ring Generator To The Power Supply



Installing The Ring Generator And Power Supply

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Installing The Conference Board In The DXP Plus Digital Communications System

1.0 Introducing The Conferencing Board

The software timing for the DXP *Plus* systems, dedicates 32 time slots for conferencing operations. Different types of conferencing actions require different quantities of time slots as detailed in the following list:

- SOHVA = 3 time slots,
- Service Observing = 3 time slots,
- Executive Override = 6 time slots,
- Three-Way Conference = 6 time slots,
- Four-Way Conference = 8 time slots,
- Five-Way Conference = 10 time slots,
- Six-Way Conference = 12 time slots,
- Seven-Way Conference = 14 time slots.

The maximum conference combinations that the system allows at any one time are as follows:

- three five-way or one five-way *Plus* 2 SOHVA,
- one four-way *Plus* two three-way,
- five three-way or four three-way *Plus* one SOHVA,
- four four-way,
- two six-way,
- two seven-way

The optional conference board adds the capability for five additional three-way conferences. These are three-way conferences consisting of three stations or two stations and one line. These additional three-way conferences do not provide additional SOHVA or service observe capability.

When you install the conference board, the system uses its capacity of three-way conferences before using the main system resources for additional conferencing.

1.2 Complying With Underwriters Laboratories Regulations

Per The Underwriters Laboratories regulation 1459, 2nd edition, be aware of the following precautions when installing telephone equipment that is to be directly connected to the telephone company network:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

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IMI89-188.01
7/95

2.0 Installing Circuit Boards

CAUTION

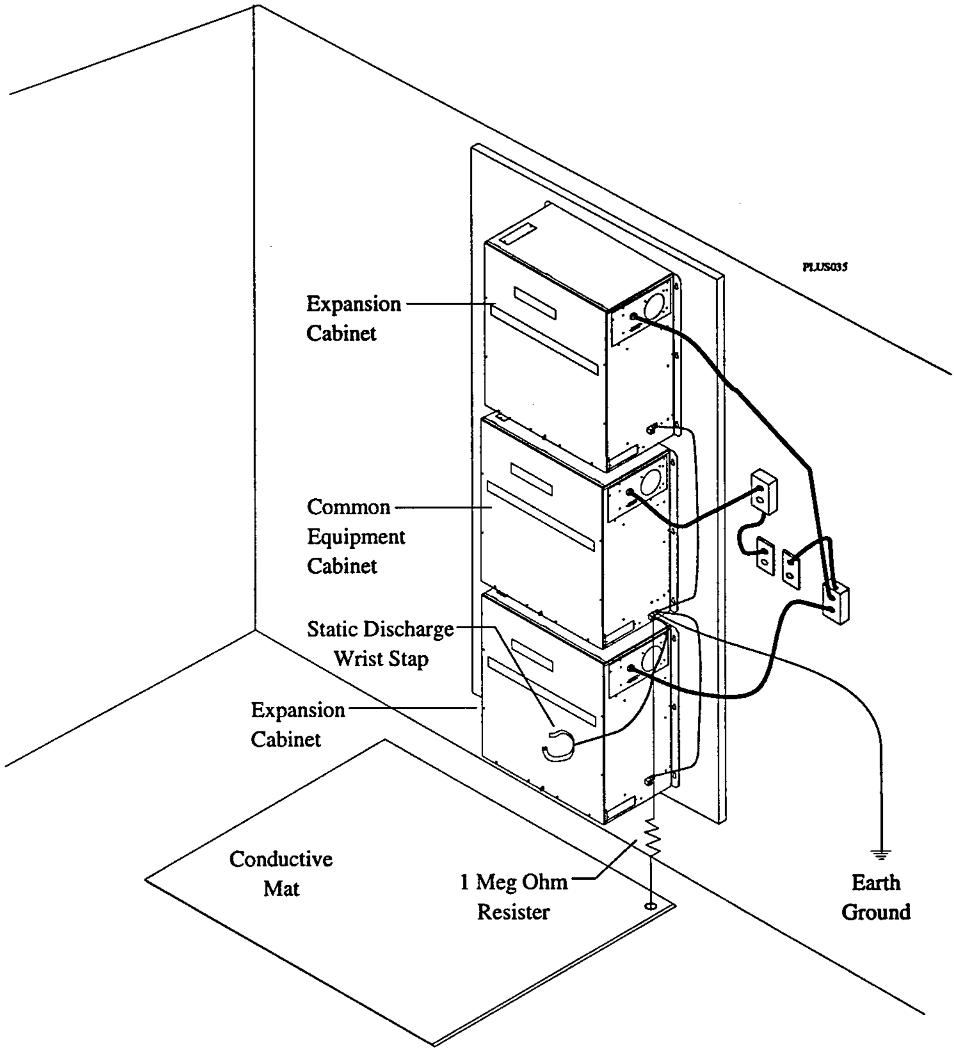
Circuit boards are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, Handling Of Electrostatically Sensitive Components, for general information. Specific handling precautions are also included in this installation instruction.

2.1 Creating A Static Safe Work Area

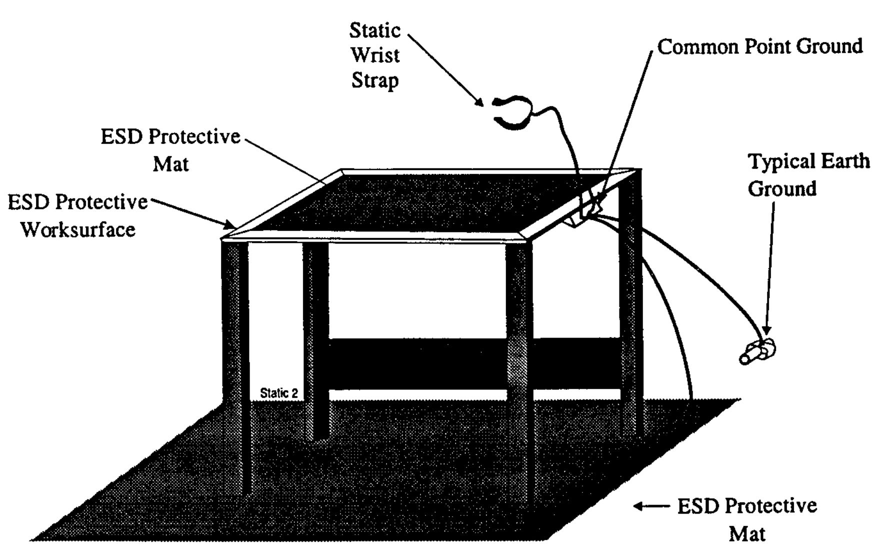
When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

2.2 Installing Conference Boards In The Equipment Cabinet

Install one or more conference boards (as needed) in any unused universal board slots.

1. Normally you should disconnect the AC power cord from the AC outlet and disconnect the optional battery back-up assembly from the main cabinet power supply; however, when necessary, you can install a DXCNF board in an operating system. If you must do this, connect one end of a standard telephone handset coil cord to the precharge port on the power supply. During step 6, you will connect the other end of this coil cord to the precharge jack on the station board.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground

NOTE: With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.

3. Loosen the retaining hardware, and lift the front panel away from the common equipment.
4. Each conference board is supplied in a static protection bag for safe keeping. When you are ready to install the circuit board, remove it from its static protection bag.
5. Locate an unused board slot for conference board installation.

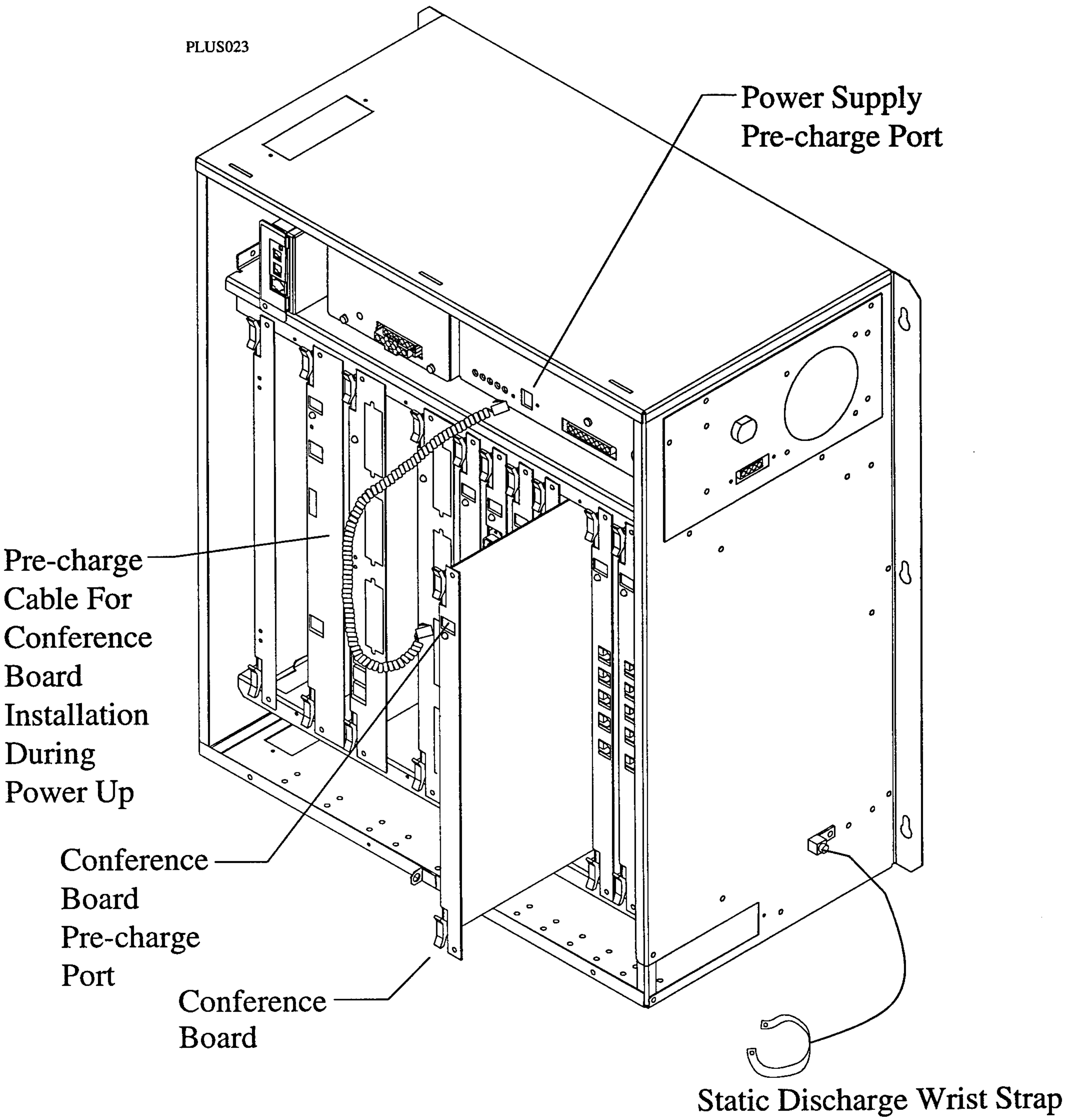
NOTE: On DXP Plus systems, do not install a conference board at the right-most board slot in the second (or lower) expansion cabinet. The system reserves this slot for internal use.

6. If you are installing the conference board in an operating system, connect the free end of the precharge cord that you installed in step 1 to the precharge jack on the station board.
7. Orient the conference board with its top and bottom guides in the cabinet's board cage. and press the board firmly until its board edge connection properly mates with the connector on cabinet's backplane.

CAUTION

When pressing circuit boards into place, press them only at the extractor lever locations. If you apply pressure at other locations you may damage the board assembly.

8. Repeat steps 4–7 until all circuit boards are installed.
9. Make a final inspection to ensure that the conference board is oriented correctly and mated properly.
10. Install and tighten the supplied screws to secure the conference board to the board cage.
11. Plug the AC line cord into the AC outlet, reconnect any battery back up equipment, and turn on the switch on the power supply.
12. Replace the front panel on the common equipment cabinet.



Viewing A Typical Conference Board Installation

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Installing The External Battery Assembly On The DXP Plus Digital Communications System

1.0 Introducing The External Battery Assembly

The external battery assembly is for use with the DXP *Plus* digital communications system. Unpack and carefully inspect all equipment for shipping damage. Notify the shipper immediately of any damages found. Verify that the packages contain all parts and accessories needed for proper installation and operation. The assembly includes the following items:

- Batteries: Five 6-volt, 50 ampere-hour, (Comdial product code BT000-141), charger unit and interface cables.
- Metal enclosure with wire harness, includes combination circuit breaker, on/off switch

Should the AC power to the system be interrupted, one external battery assembly provides the following minimum power capability:

- 1.0 hour of operation for a fully loaded system.

$$T = \frac{Ke}{1 + [(0.084)(N)]}$$

Calculate the minimum battery backup time provided by an external battery assembly to a fully configured DXP *Plus* system using the following formula:

$$T = \frac{(.85)(50)}{1 + [(0.084)(472)]} = \frac{41.0}{40.65} = 1.0 \text{ Hour}$$

T = Back-up time in hours
K = 0.82 (Constant)
e = 50 (ampere-hour capacity of battery assembly)
N = Total number of stations

Example:
Assume that you have installed a DXP *Plus* with three cabinets supporting 472 telephones and containing one line board along with a battery assembly to provide back-up power.

During AC operation, the battery assembly accepts re-charging current to maintain the voltage potential of its batteries at an operational level.

NOTE: The external battery assembly requires approximately 10 hours to completely re-charge to full potential after it has been completely discharged and, in some cases, when initially installed.

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IMI89–189.01
7/95

2.0 Understanding System Grounding Requirements

Transient voltage spikes, if induced onto CO or CENTREX lines, can travel through the cable and into the common equipment. The telephone company offers basic protection against this condition but it is usually designed to protect the central office circuits. While it will also provide some protection to the common equipment, you should not rely upon it for total protection. To help ensure that external over-voltage surges do not damage the system, you should install and properly ground primary protection devices, such as gas discharge tubes or similar primary protection devices, on all lines. While the line boards have internal secondary surge protection on all line ports, in order for this protection to be effective, you **MUST** connect the common equipment cabinet to a reliable, effective earth ground.

Proper grounding is necessary for trouble-free operation and personnel safety. The DXP *Plus* has the following three types of grounds:

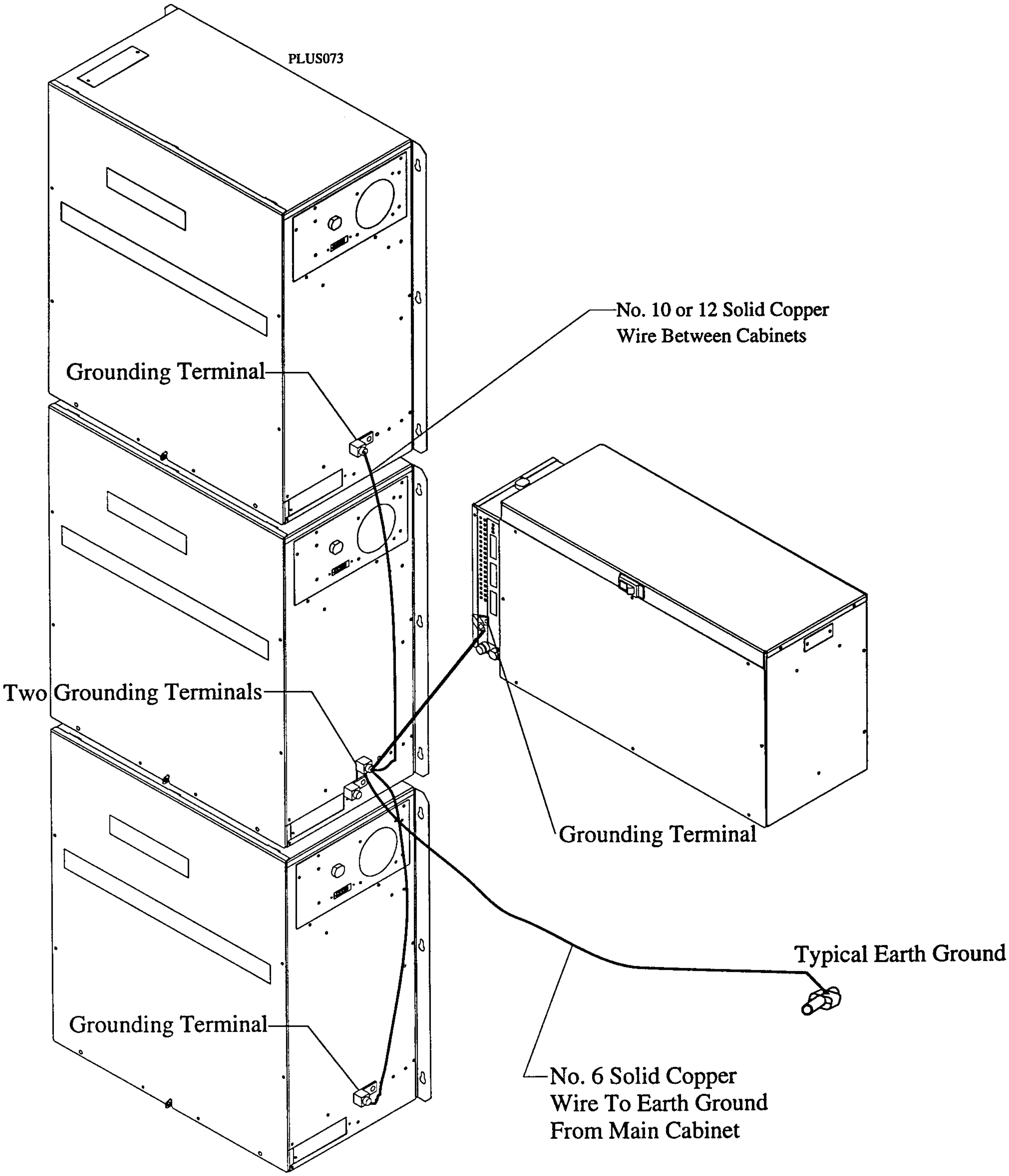
- Service Ground —a neutral power line wire that is connected to the ground bus in the premises' AC power panel,
- System Ground—a non-current carrying power line wire that is connected to the ground bus in the premises' AC power panel,
- Frame Ground—a low impedence conductor that places the common equipment cabinet at reference ground potential. The frame ground provides the greatest safety by limiting electrical potential between non-current carrying parts of the system. The common equipment cabinet provides a ground stud on its cabinet for access to its frame ground.

The entire system is effectively earth-grounded when you permanently connect the common equipment cabinet, all expansion cabinets, and the battery back-up assembly to earth or to some conducting body which serves in place of earth. The ground path must be of sufficient current-carrying capacity to prevent a build up of voltages which may result in circuit noise, hazard to personnel, or equipment damage.

An acceptable earth ground is one such as the service ground for the AC power or a public metallic cold water pipe at a point immediately at its entrance to the premises and ahead of any meters, pumps, or insulating sections that have been added for vibration reduction. Avoid using the premises' structural steel frame as it may not be at earth ground potential. Use #10–12 or larger insulated solid copper grounding wire to connect the frame ground of the battery assembly cabinet (available through the ground stud on the cabinet's side) to the frame ground of the main common equipment cabinet. Use #6 or larger insulated solid copper grounding wire to make the ground connection from the main cabinet's frame ground to earth ground. **Keep this ground wire separate from the three-wire AC line cord, do not splice it, and keep it as short as possible.**

The impedence of the wiring between the common equipment cabinet frame ground and the earth ground must not exceed 0.25 ohms and the impedence between the earth ground and the power company's reference standard ground must not exceed 5 ohms. Use an acceptable low impedence measuring device to measure the impedence of these paths. The #6 or larger wire size will minimize the wiring impedence; however, if the impedence between earth ground and the power company's standard reference ground exceeds 5 ohms, contact the local power company. The ground path must always be of sufficient current-carrying capacity to prevent a build up of voltages that may result in circuit noise, hazard to personnel, or equipment damage.

Be sure that all of the ground connections are visible for inspection and maintenance. Tag all of the ground connections with a sign that reads: *Do Not Remove or Disconnect.*



Grounding The System

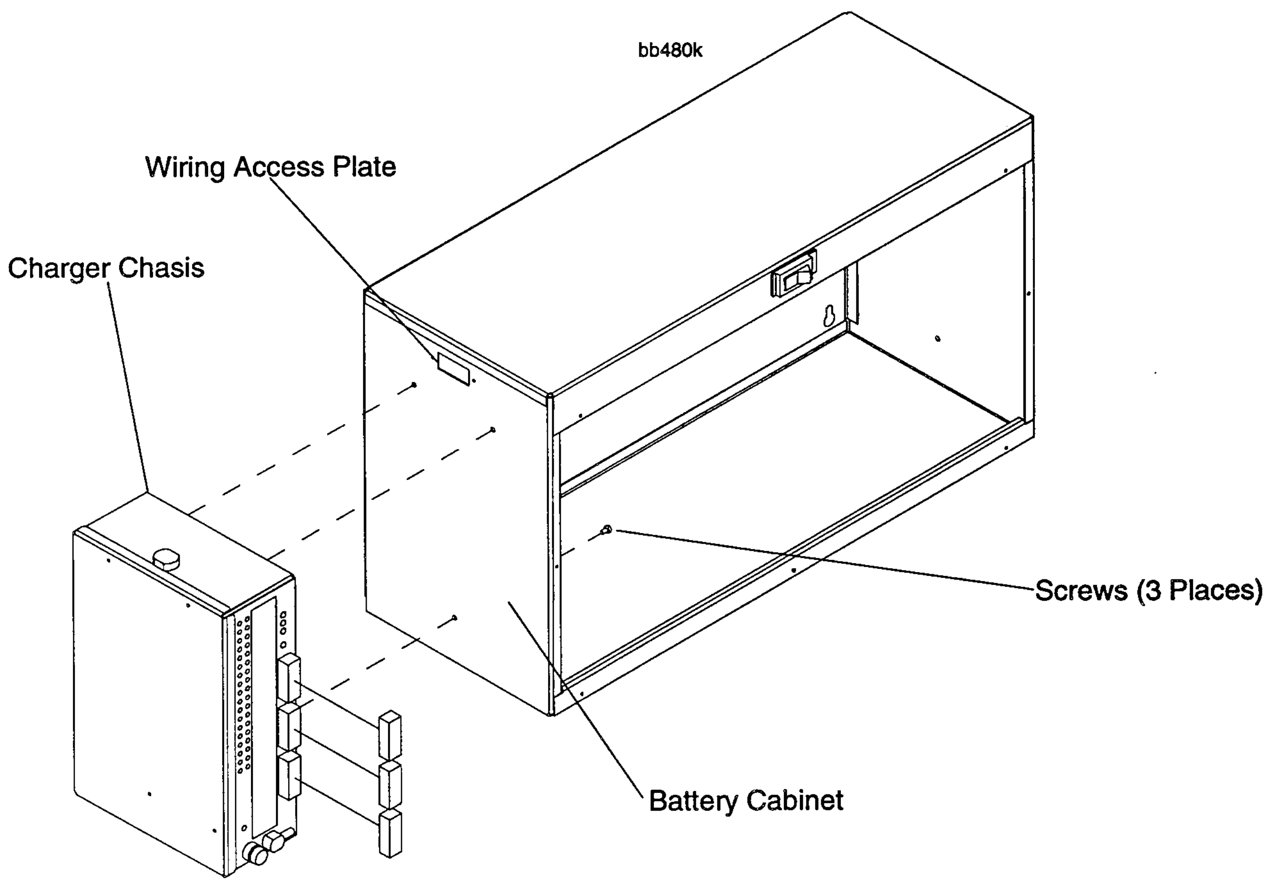
3.0 Mounting The Charger Chassis

You must mount the charger chassis to the battery cabinet; however, the particular position that you chose for this mounting depends upon the method that you plan to mount the cabinet at the DXP *Plus* site.

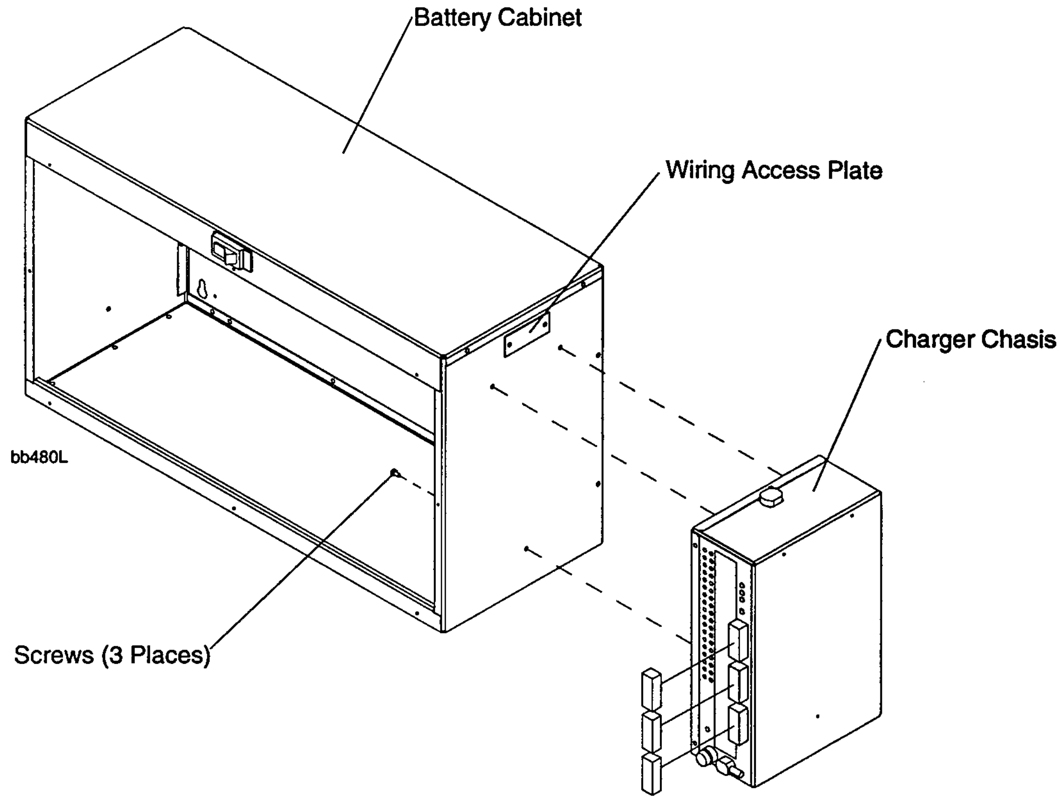
- If you plan to mount the battery cabinet on a backboard at the side of the common equipment cabinets, you must attach the charger, with its cables pointing toward you, to the left end of the battery cabinet as you face the cabinet's battery opening.
- If you plan to mount the battery cabinet below the main common equipment cabinet on the same backboard (single common equipment cabinet installations), you must attach the charger, with its cables pointing toward you, to the right end of the battery cabinet as you face the cabinet's battery opening.
- If you plan to mount the battery cabinet on the back side of a standard 23–inch double equipment rack with the common equipment cabinets mounted to the front side of the rack, you must attach the charger, with its cables pointing away from you, to the to the left end of the battery cabinet as you face the cabinet's battery opening.

To mount the charger chassis,

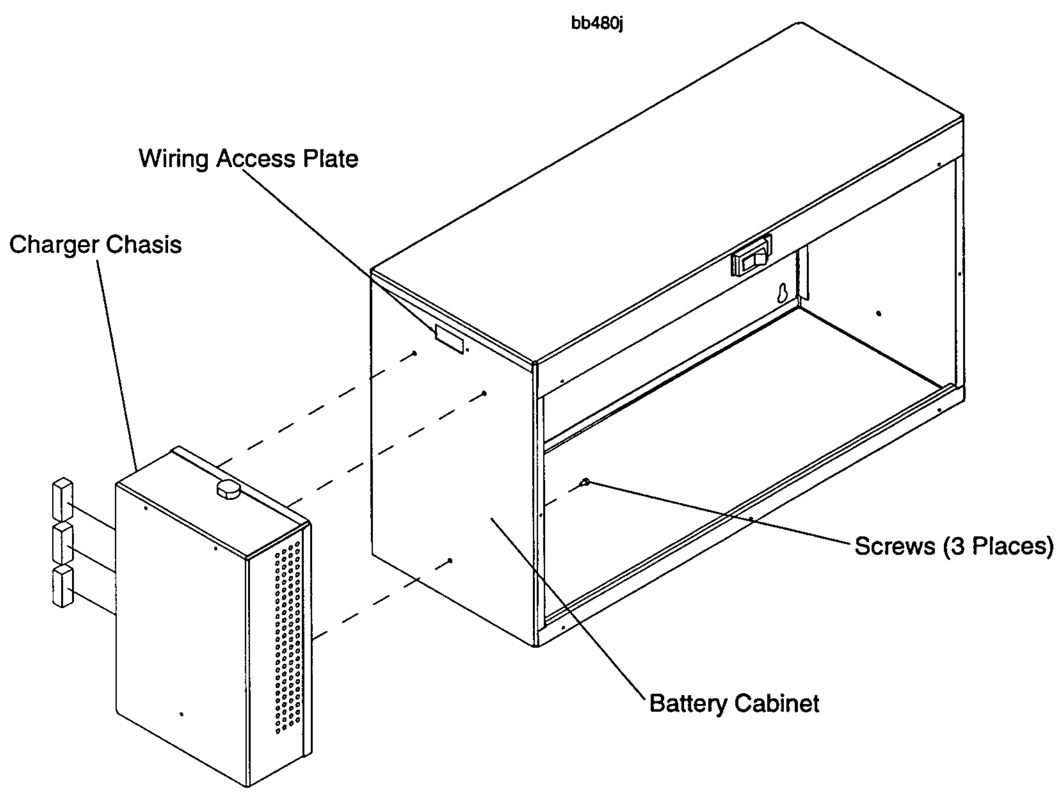
1. Choose the method of battery cabinet mounting, and orient the charger so that it is facing properly for the mounting scheme.
2. Remove the front panel from the empty battery cabinet, and save the retaining hardware.
3. Remove the wiring access plate from the end of the battery cabinet.
4. Route the black battery connection wires through the wiring access hole.
5. Attach the charger chassis to the battery cabinet with the three supplied screws.



Mounting The Charger For Separate Backboard Installations



Mounting The Charger For Below Main Cabinet Installations



Mounting the Charger For Double Rack Installations

4.0 Mounting The Battery Cabinet

CAUTION

The complete external battery assembly is heavy. The charger chassis, empty battery cabinet, and wiring weigh approximately 25 pounds and all the batteries together weigh approximately 130 pounds for a combined assembly hanging weight of approximately 155 pounds.

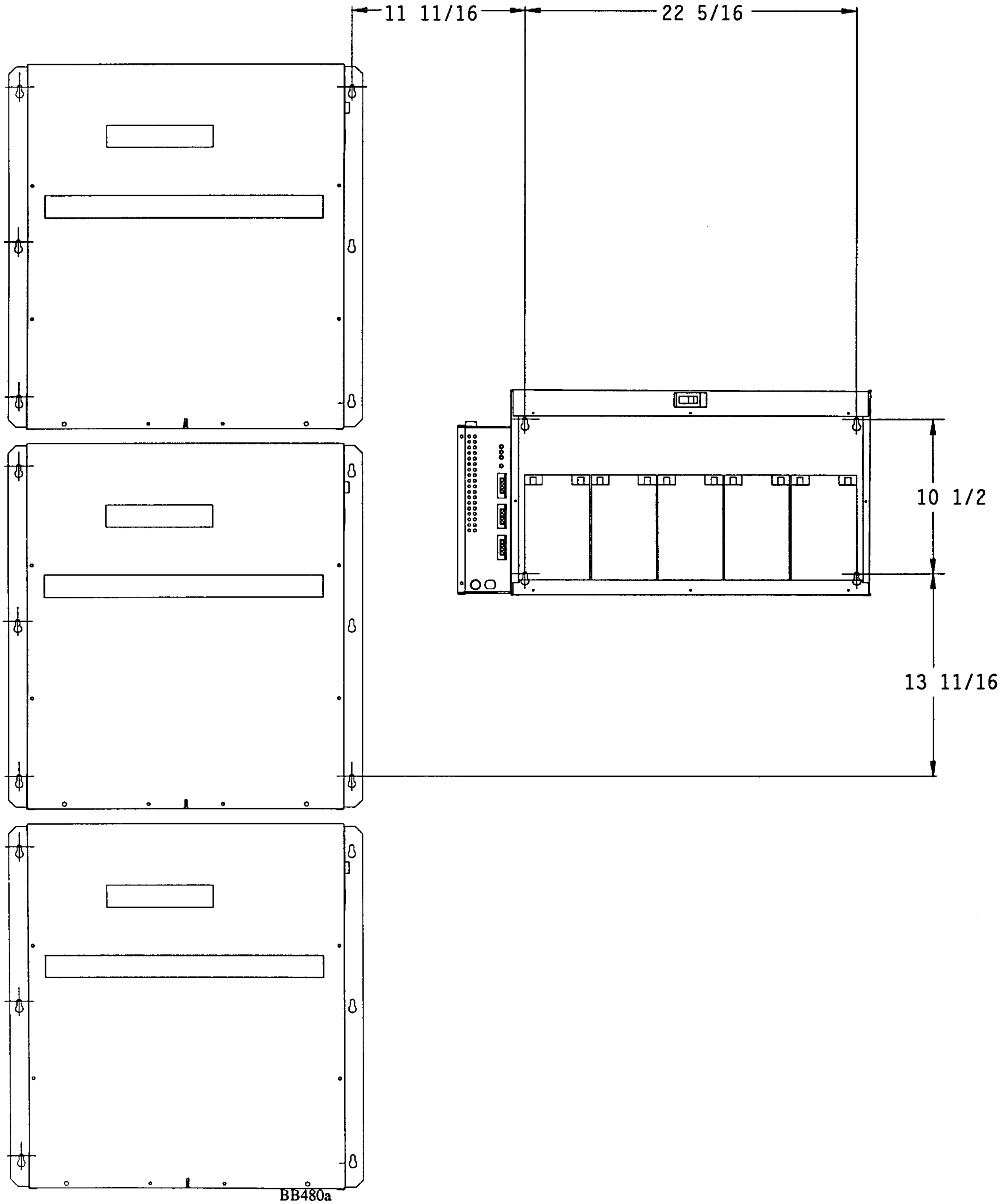
You can mount the battery cabinet at several different locations.

- You can mount the battery cabinet on a separate backboard located to the right of the common equipment cabinet location. Locate the battery cabinet as detailed in the illustration on the facing page.
- At sites that employ only a main equipment cabinet, you can mount the battery cabinet directly below the main common equipment cabinet on the same backboard.
- You can mount the battery cabinet in the middle of a standard 23–inch equipment rack if you wish. This can be a companion rack set next to the one where you have mounted the DXP *Plus* cabinets. Alternately, you can use a self-supporting, two-sided rack with the DXP *Plus* cabinets mounted on one side and the battery cabinet mounted on the other side directly behind and slightly above the main common equipment.

Remember from the *Section 2.0* discussion, you must attach the charger chassis to the battery cabinet in a orientation that supports the cabinet mounting.

NOTE: The following instructions describe how to mount the battery cabinet using a backboard.

1. Add a second backboard to the right of the backboard that supports the DXP *Plus* common equipment cabinet. Be sure that this backboard bridges the studs that support the underlying wall material. Securely attach the backboard to the mounting surface. (Suitable backboards are available commercially or you can construct one out of 3/4-inch plywood.) You must drive the hardware that secures the backboard to the mounting surface into the underlying wall studs instead of just into the wall material alone.
2. Refer to the illustration for the locating dimensions required for the mounting screws, and mark their locations on the backboard. You must attach the battery cabinet vertically to the backboard.
3. Drill holes in the backboard of a proper size to accommodate the hardware being used.
4. Insert the two top screws into the backboard and tighten them to within approximately 1/8–inch of the surface.
5. Hang the cabinet on the top screws using the top mounting holes in the rear mounting flange of the cabinet. Note that these holes are elongated with an enlargement at one end. This feature allows the cabinet to slide down on the screws to secure the mounting when the cabinet is hung on them.
6. Use the openings for the middle and lower set of mounting screws as a guide, and mark the location for the remaining screws.
7. Lift the cabinet from the top screws and set it aside while preparing the holes for the remaining screws.
8. Rehang the cabinet as discussed in step 6.
9. Insert the lower screws into the backboard and tighten them to within approximately 1/8-inch of the surface.

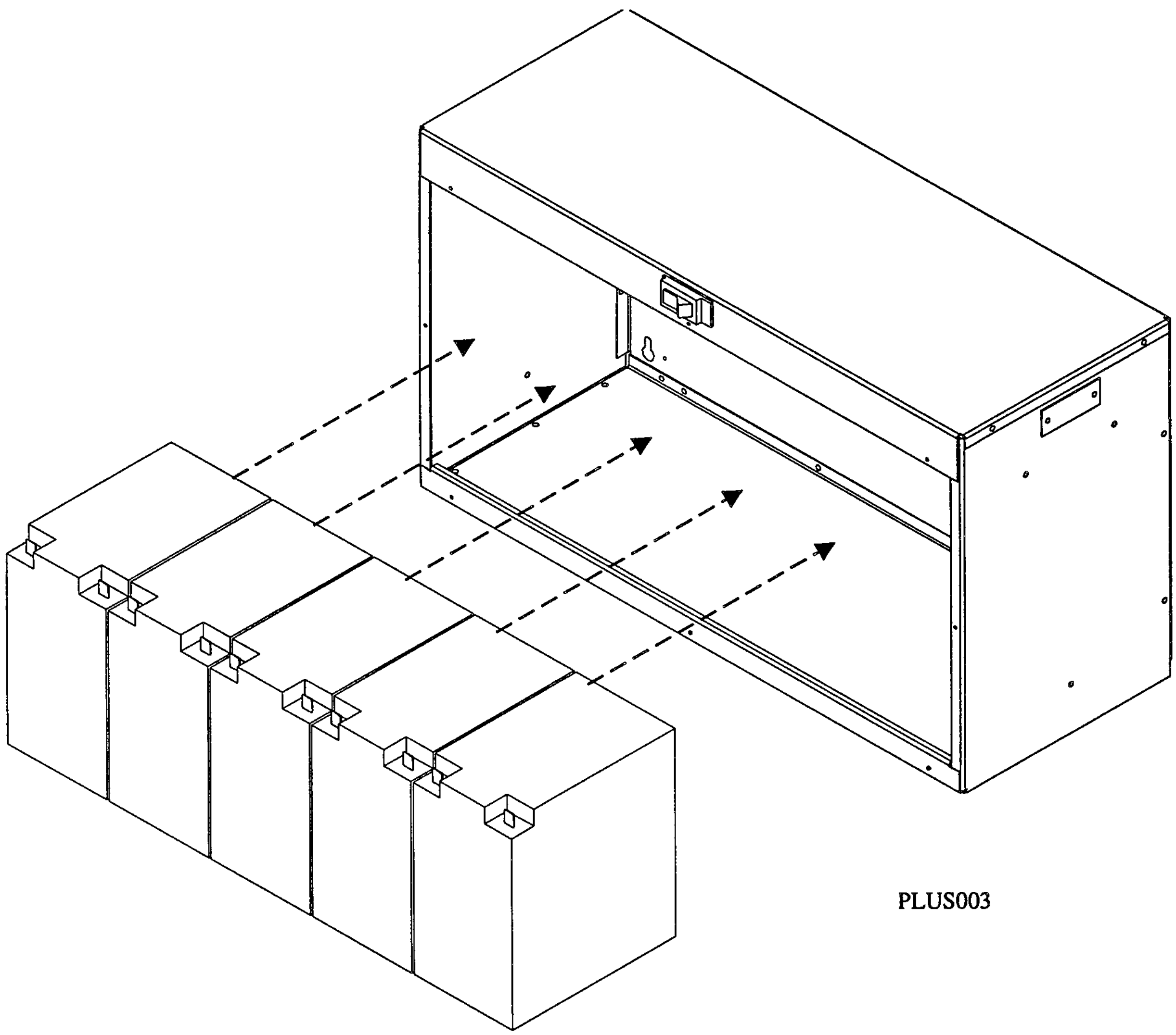


Mounting The External Battery Assembly

5.0 Assembling and Wiring The Batteries In The Cabinet

5.1 Installing The Batteries

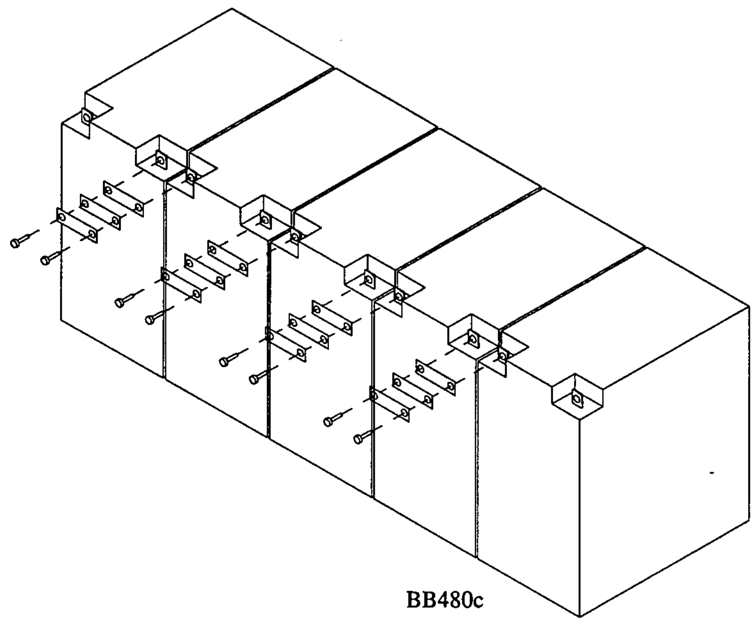
Install the batteries in the cabinet with their terminals facing the cabinet opening. The batteries set in place, and you do not need to anchor them to the cabinet.



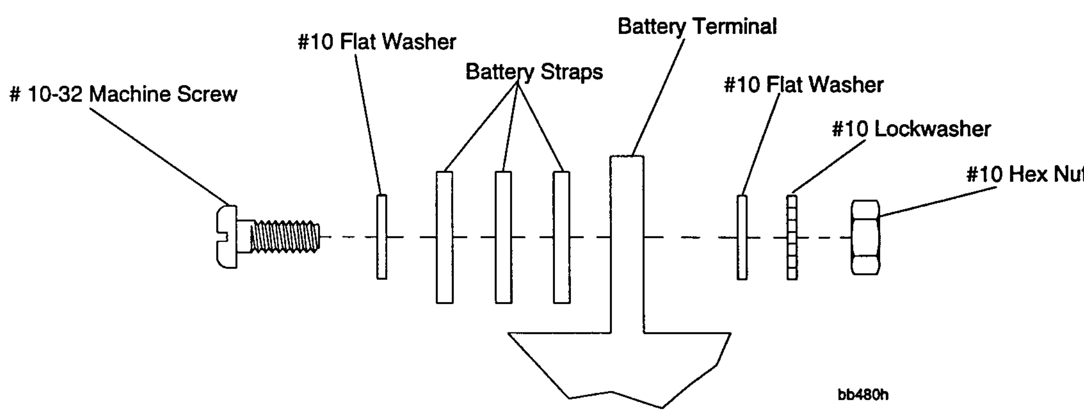
Installing The Batteries

5.2 Strapping The Batteries

You must strap the batteries together using the supplied strapping bars and hardware. Use three strapping bars at each strapping location, and install the hardware as shown in the illustration.



Strapping The Batteries



Attaching The Strapping Hardware

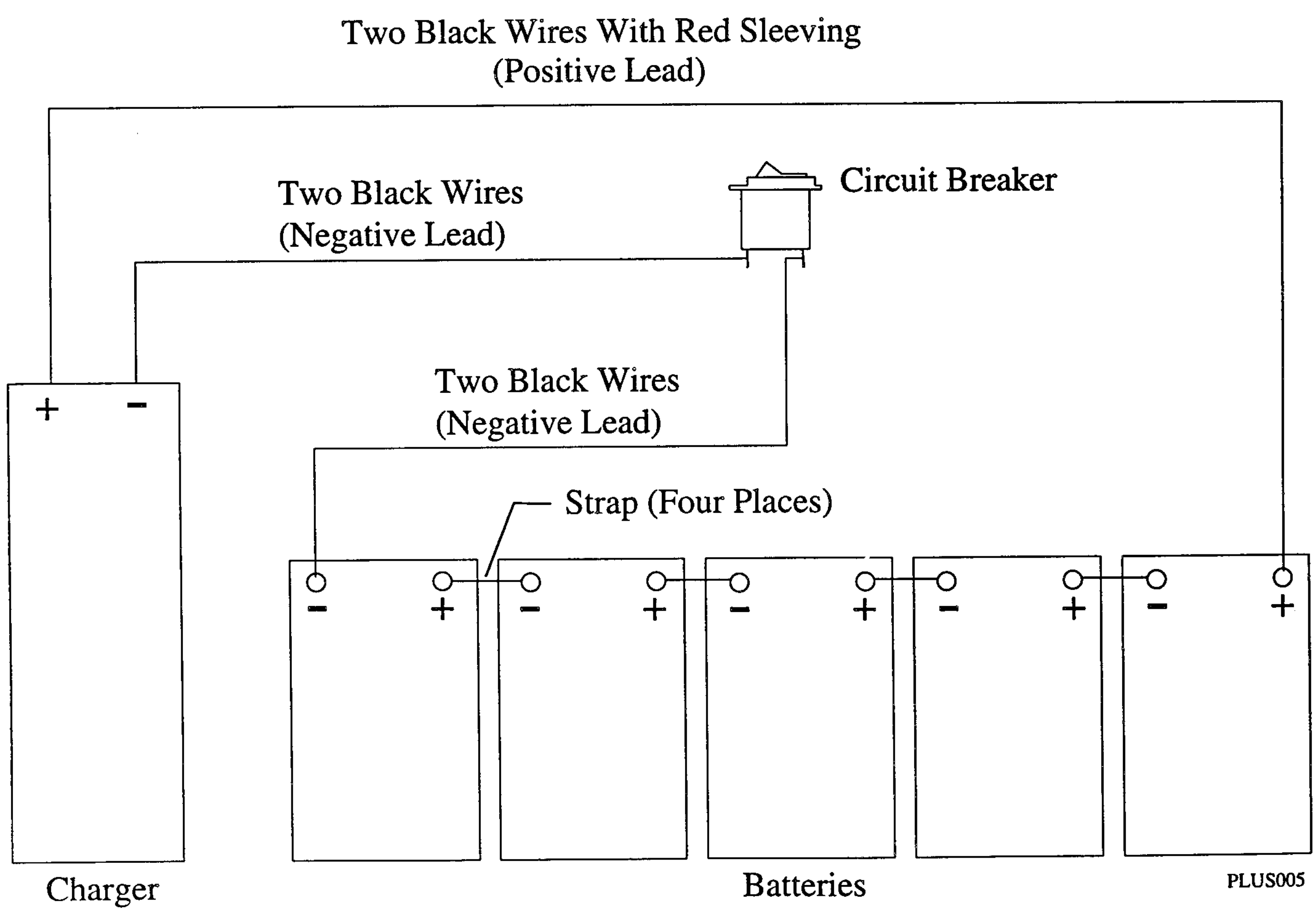
3.3 Wiring The Batteries

The charger has a pair of negative wires and a pair of positive wires (designated by red sleeving near one end of the wires). This two-wire arrangement divides the current carrying load between the two wires of each pair. The cabinet's assembly package includes two individual black wires that you use to wire the circuit breaker to the batteries. Again, two wires divide the current carrying load between both wires.

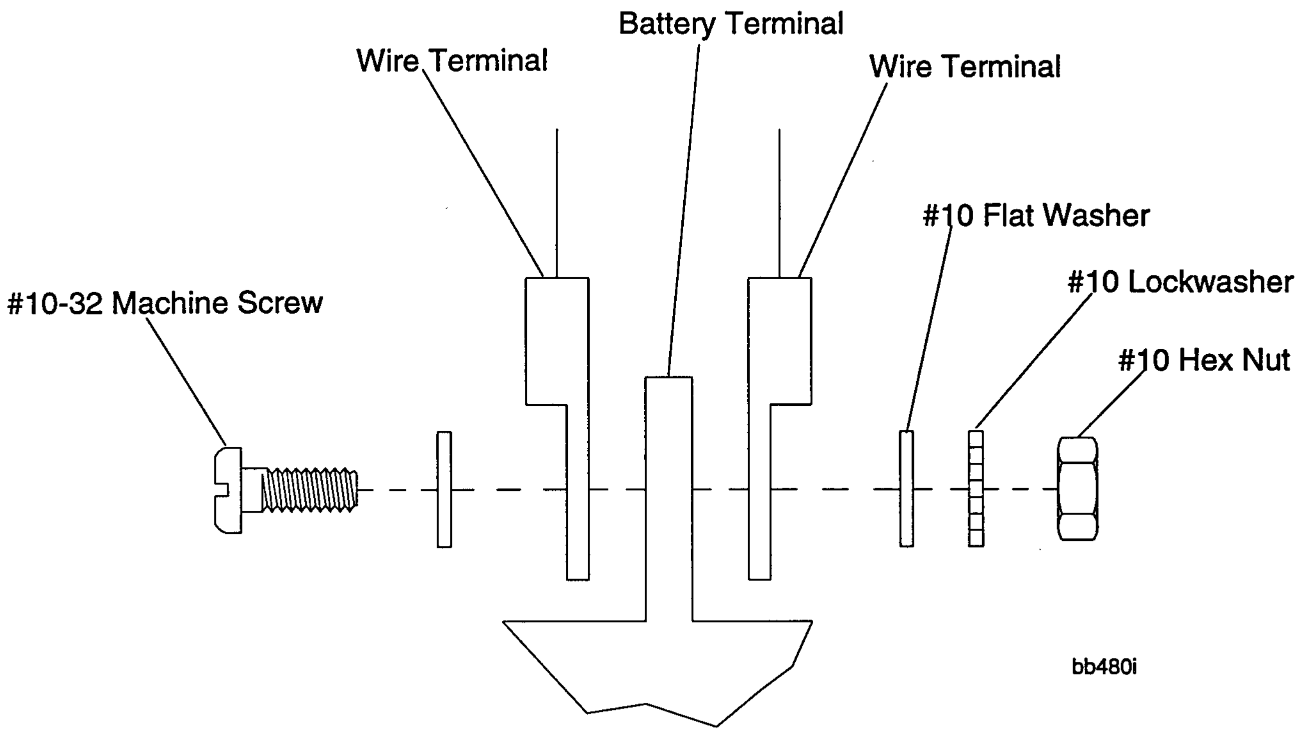
The negative wires from the charger are terminated with smaller size terminals than the those that terminate the charger's positive wires. Connect the smaller (negative) terminals to the circuit breaker and the larger (positive) terminals to the positive battery post. The individual wires that you use to connect the circuit breaker to the battery post are also terminated with a large terminal on one end and a small terminal on the other. Connect the smaller terminals to the circuit breaker and the larger terminals to the negative battery post.

Wire the batteries as shown in the schematic. Use the supplied hardware to connect the wires to the batteries per method shown in the detailed drawing.

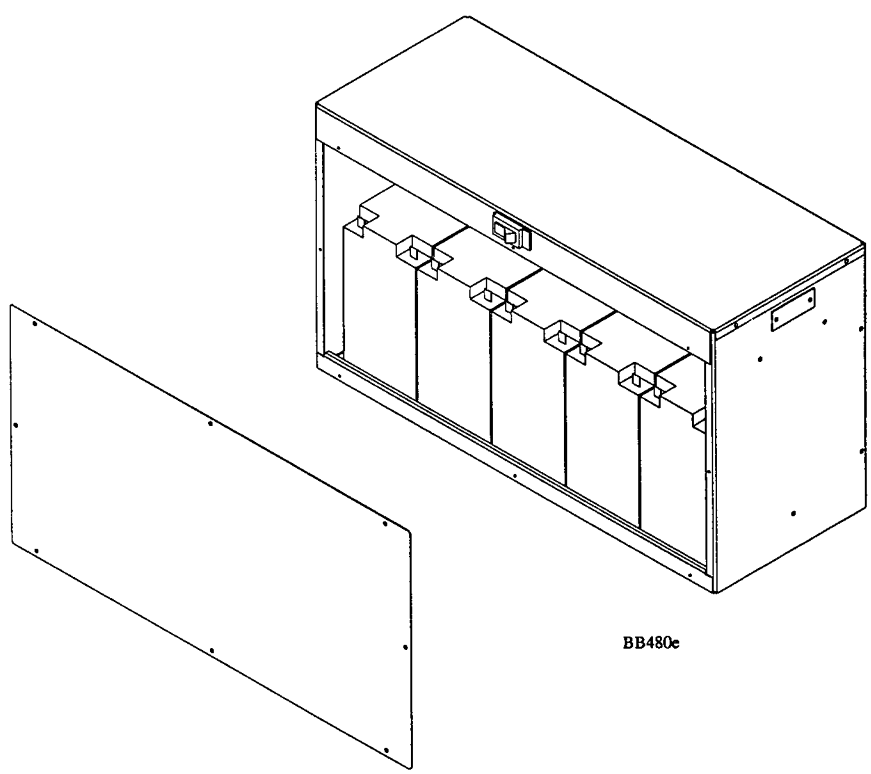
Once you have wired the batteries, attach the front cover to the cabinet with the supplied hardware.



Connecting The Wire Harness



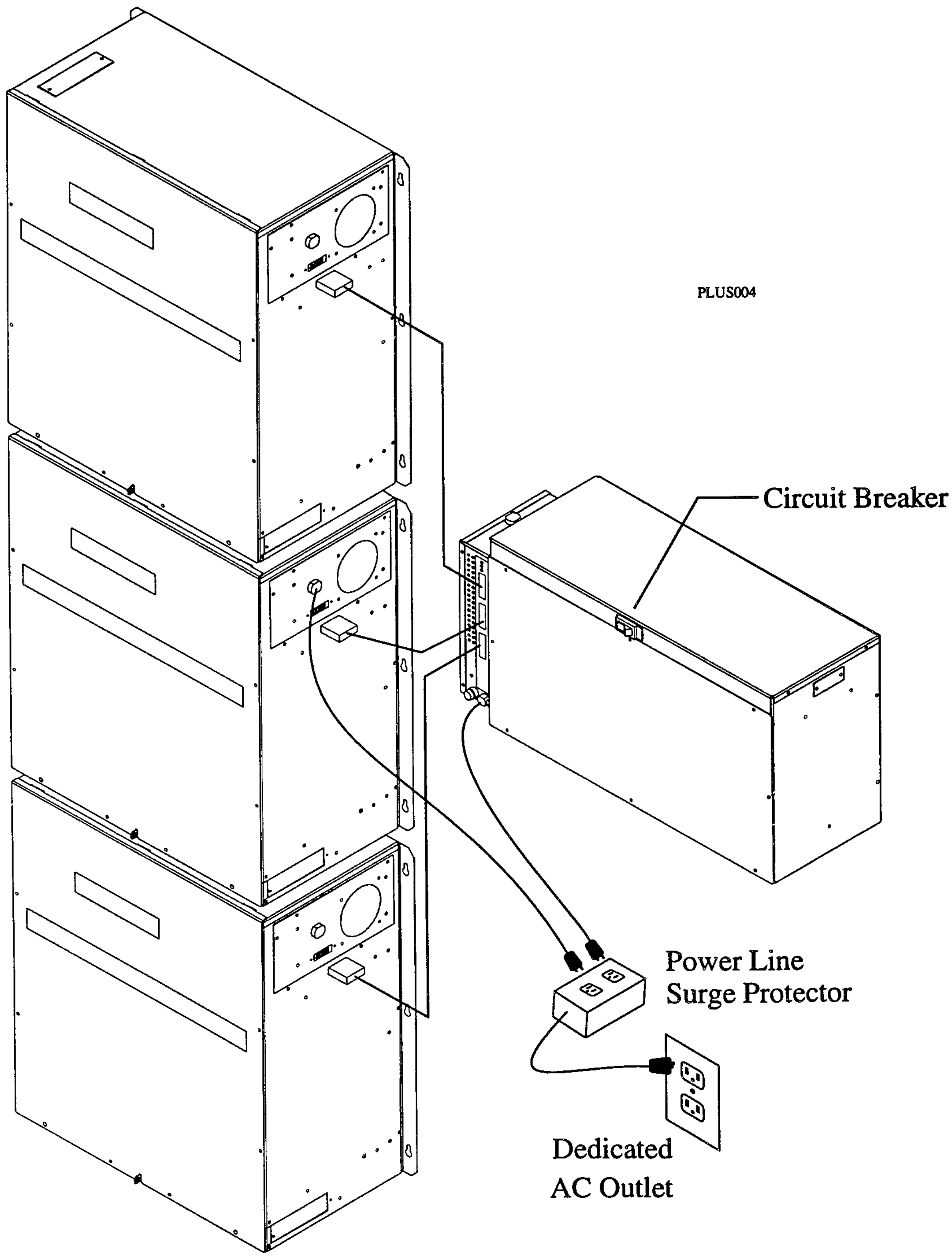
Attaching The Wiring Hardware



Installing The Front Cover

4.0 Connecting The Battery Assembly To The System

1. Connect the AC power and turn on the power supply switch in both DXP *Plus* main and expansion cabinets.
2. Connect a battery back-up cable between the battery assembly and the power supplies in the DXP *Plus* main and expansion cabinets.
3. The battery assembly includes a charger that maintains the batteries at full charge. Once you have installed the battery assembly, connect its AC power cord to **the same AC outlet surge protector that powers the DXP *Plus* main common equipment cabinet.**



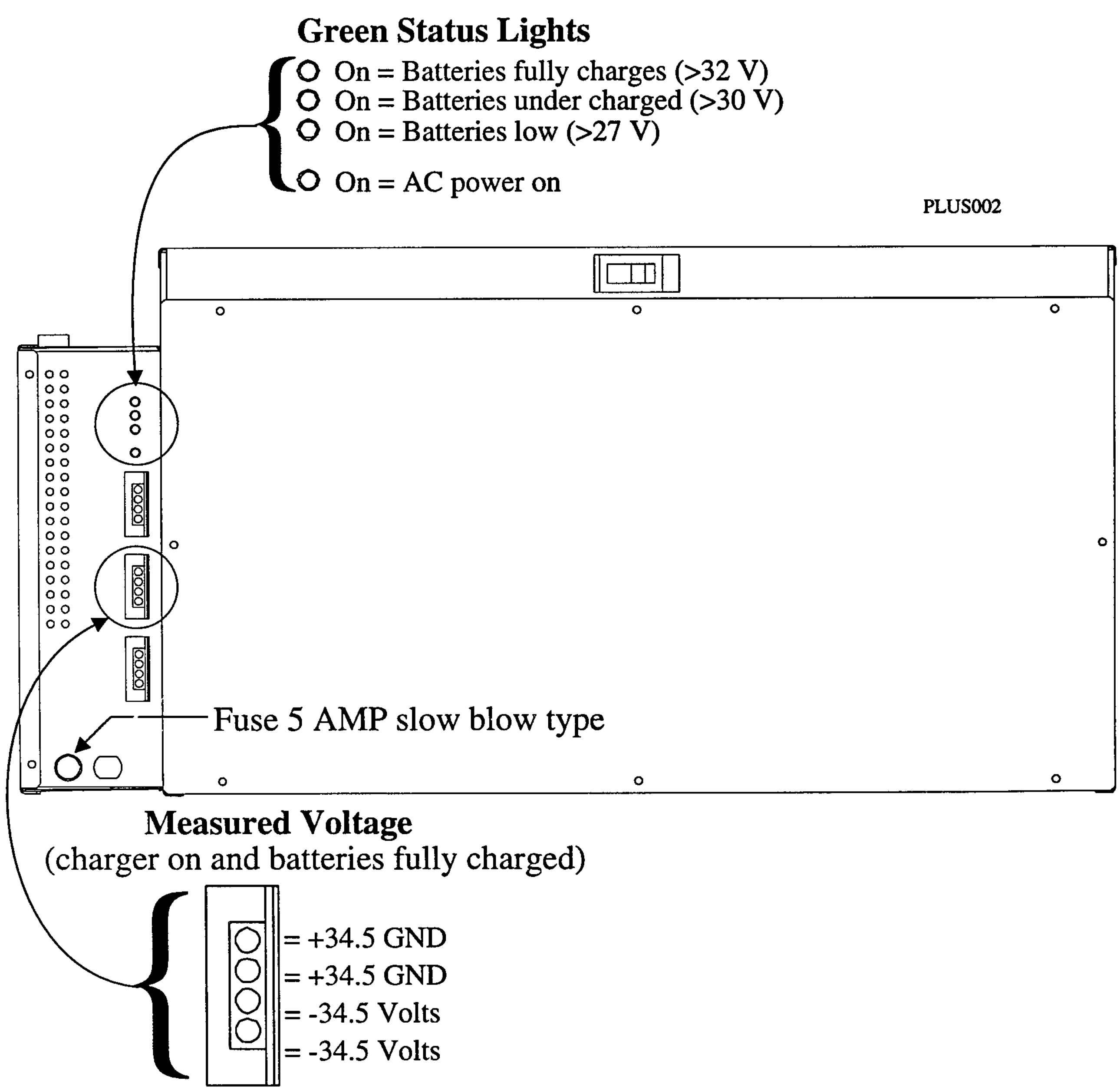
Connecting The Battery Back Up Assembly To The System

5.0 Verifying The Battery Voltage

Every three months, use an accurate voltmeter to measure the no-load voltage of the external battery assembly. The measured voltage range should be within 27–34.5 volts when the batteries are at full charge.

If the no-load voltage is lower than 27 volts, measure the charging voltage supplied by the common equipment cabinet. The measured charging voltage must be 35 volts maximum.

If the charging voltage is low or if the voltage of a freshly-charged battery assembly is no greater than 30 volts, contact your technical service representative.



Verifying The Battery Voltages

6.0 Special Cautionary Battery Information

- Do not dispose of batteries in a fire as the cells may explode. Check with the local codes for possible disposal instructions.
- Do not open or mutilate the batteries. Released electrolyte is corrosive and may cause damage to the eyes or skin. It may be toxic if swallowed.
- Exercise care in handling batteries in order not to short the battery with conducting materials such as rings, bracelets, and keys. The battery may over-heat and cause burns.
- Charge the batteries provided with or identified for use with the DXP *Plus* digital communications system only in accordance with the instructions and limitations specified in this publication.
- Observe proper polarity orientation when installing the batteries.
- Do not mix old and new batteries in the external battery assembly.
- Do not mix batteries of different sizes or from different manufacturers in this product.

NOTICE

This symbol, when encountered on the equipment cabinet or on other installed hardware, means: CAUTION—refer to the instruction manual.

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Installing The DXOPT–COM Communications Card In The DXP Plus Digital Communications System

1.0 Understanding The Communications Card

The communications card provides serial data ports for interfacing such items as open architecture interface applications, PC attendant positions, and the SMDA data printer.

NOTE: The serial data ports located on the CPU board are dedicated to PC-based programming and the remote maintenance modem.

You can install communications cards on the services board, the expansion cabinet interface boards, and the main cabinet's auxiliary board. Each of these boards will accept two communications cards in its lower two slots.

The DXP *Plus* supports a maximum of 18 serial data ports. Two of these ports are the dedicated ports provided by the CPU board while communications cards provide the remaining 16 undedicated ports. The system designates serial data ports 3–18 to specific locations as detailed in the following chart.

Serial Data Port Designation*	DXOPT–COM Location
Serial data ports 3–10	Lower two slots on the services board
Serial data ports 11–18	Lower two slots on **one of the three** following locations: — the upper expansion cabinet interface board — the lower expansion cabinet interface board — the auxiliary board installed in the main cabinet. You must take programming action to match the data port number with the installation location that you choose for the communications card.
* The full compliment of 16 undedicated serial data ports requires four installed communications cards.	

1.1 Communications Card Connections

The interface connector between the external device and the communications card is a standard modular jack, and each serial data communications port supports various baud rates, data bits, stop bits, parity, and flow control. You can program these various options using data base programming.

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IMI89-190.01
7/95

2.0 Installing Circuit Boards

CAUTION

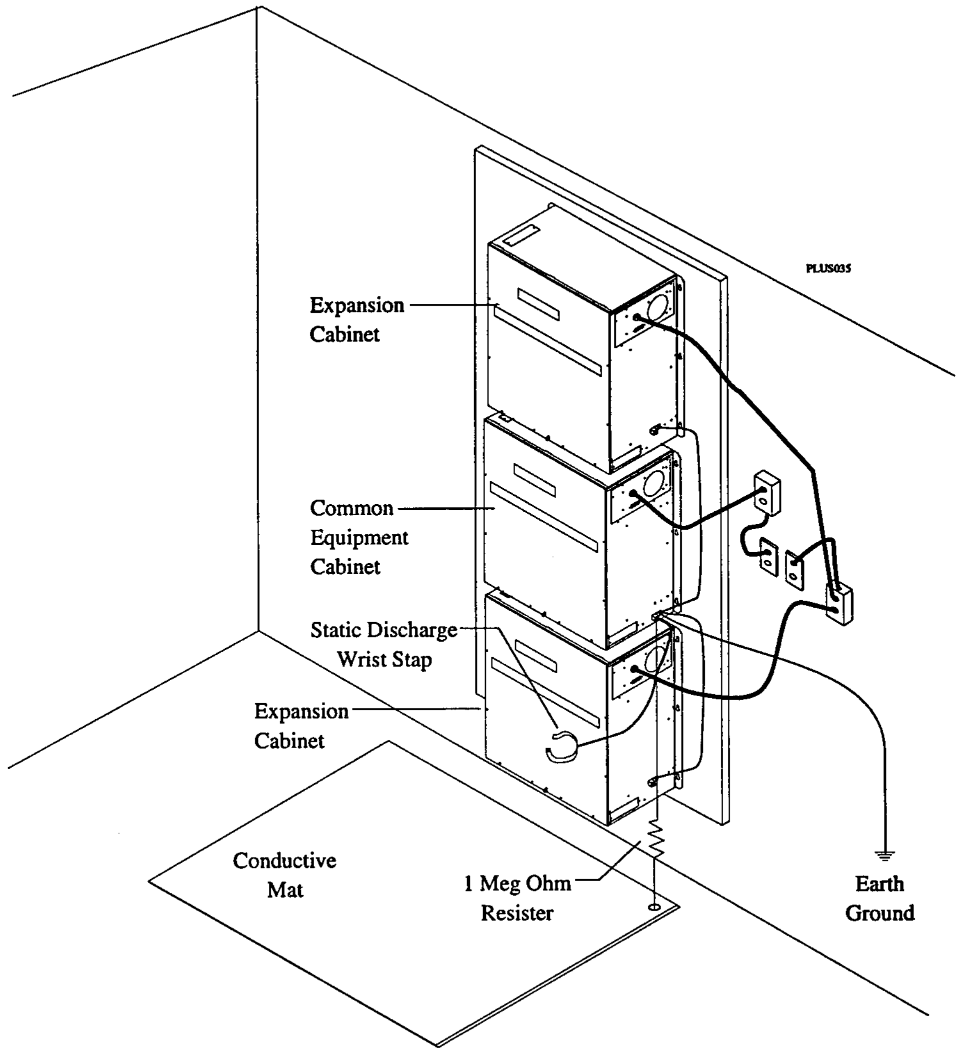
Circuit boards are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, Handling Of Electrostatically Sensitive Components, for general information. Specific handling precautions are also included in this installation instruction.

2.1 Creating A Static Safe Work Area

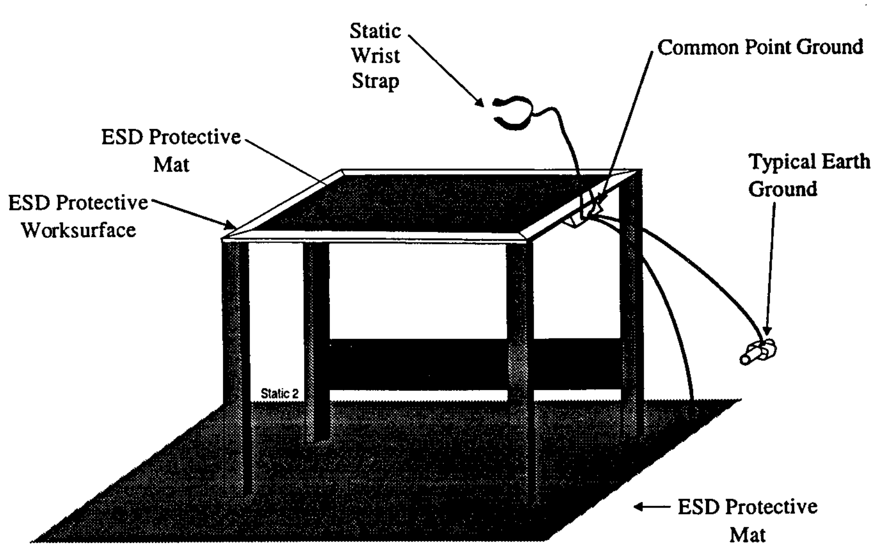
When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

3.0 Installing The DXOPT-COM Card

You can install up to four communications cards to attain a maximum of 16 serial data ports. You can install these cards in the lower two slots of the services board, the expansion cabinet interface boards, and the main cabinet's auxiliary board.

- The **best, and recommended, choice** is to add communications cards to the services board.
- The **second best choice** is to add communications cards to either or both expansion cabinet's interface boards if one or both are available.
- The **third choice** is to add an auxiliary board to the system and install communications cards on it. **This is the least desirable choice** because it requires you to occupy a board slot that you could otherwise use for line or station boards.

1. Be sure you are standing on the conductive mat that you have placed in front of the cabinet area and grounded to a good earth ground. (The third wire ground of the AC power line is an acceptable grounding point if the AC wall jack is properly grounded.) The grounded conductive mat provides a safe static electric discharge path.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground

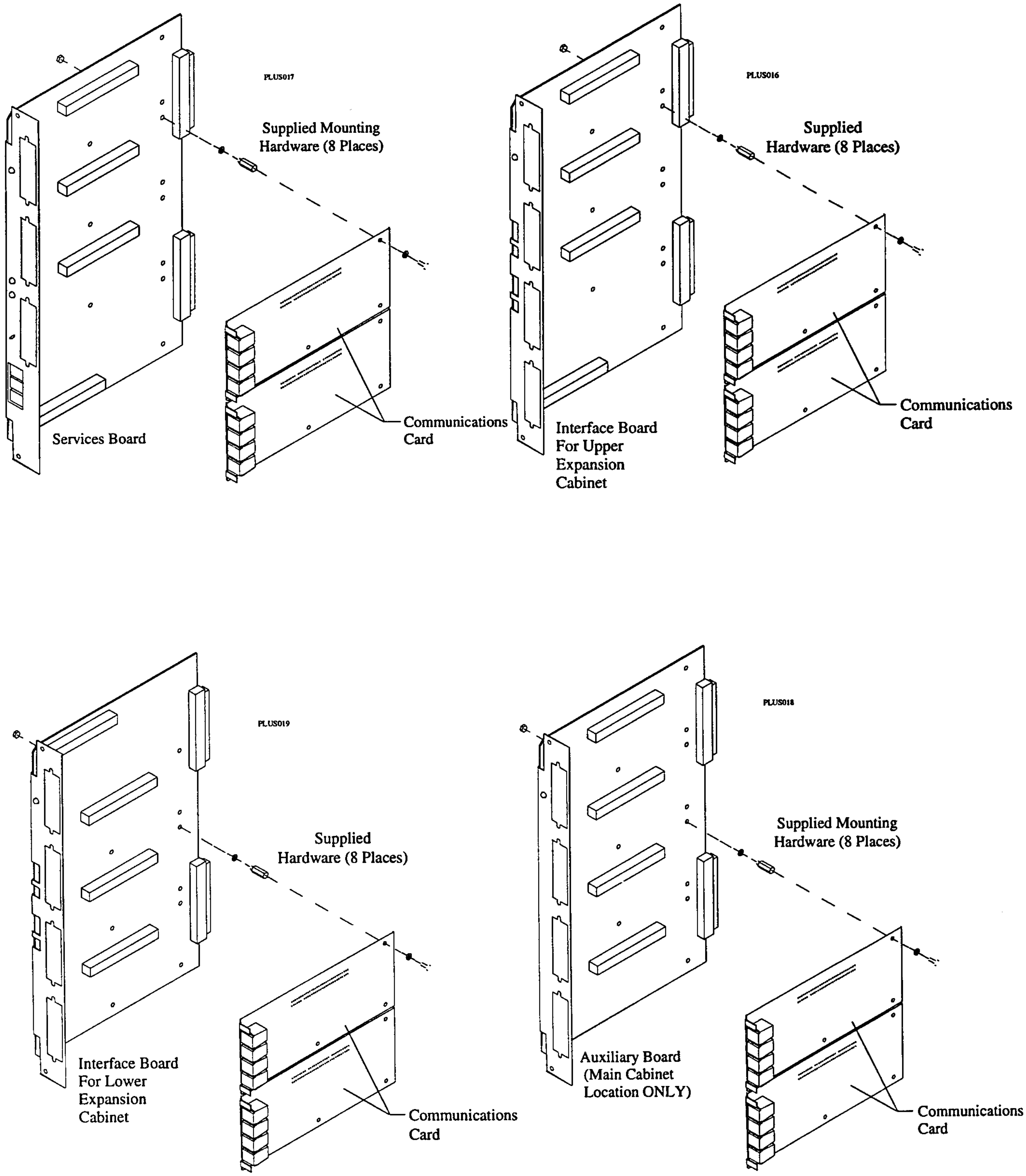
NOTE: *With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.*

3. Disconnect the AC power cord from the AC outlet and disconnect the optional battery back-up assembly from the cabinet power supplies.
4. Loosen the retaining hardware and remove the host circuit board, or boards, from the equipment cabinet, place it in a static protection bag, and transport the board to the static-safe work area.
5. At the static safe work area, with your wrist strap in place, remove the host circuit boards and the communications cards from their respective static protection bags.
6. Referring to the illustrations on the next page, orient the host circuit board and the communications card, and attach them with the supplied hardware.
7. Place the host circuit board and its newly installed communications card into a static protection bag and transport this assembly back to the common equipment cabinet.
8. With your static strap on your wrist, remove the board assembly from the static protection bag and install the board in its designated board slot.

CAUTION

When pressing circuit boards into place, press them only at the extractor lever locations. If you apply pressure at other locations you may damage the board assembly.

9. Make a final inspection to ensure that the board assembly is oriented correctly and mated properly.
10. Install and tighten the supplied screws to secure the circuit board assembly to the board cage.
11. Plug the AC line cord into the AC outlet, reconnect any battery back up equipment and switch on the power supply.
12. Replace the front panel on the common equipment cabinet.



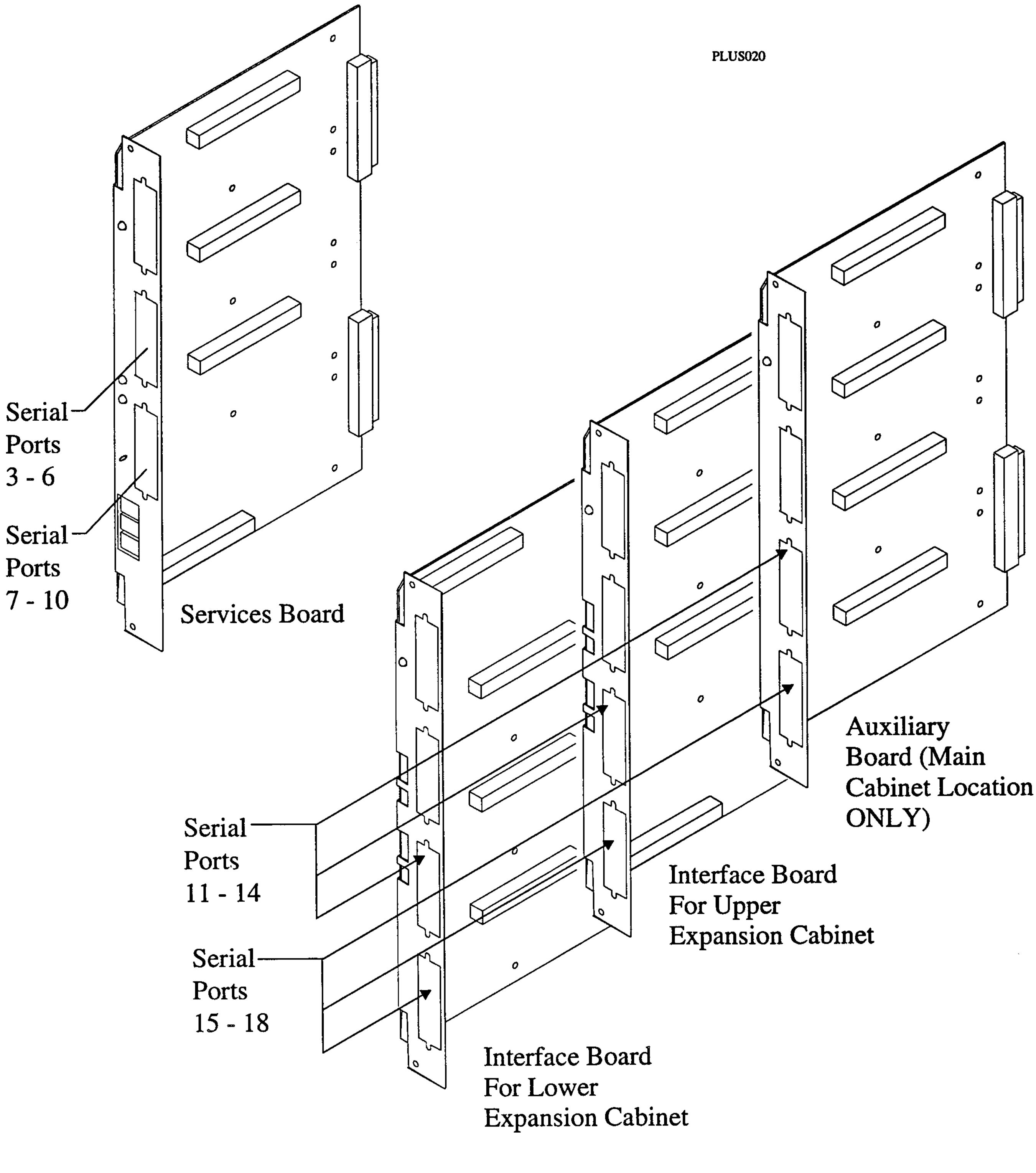
Installing The Communications Card

4.0 Identifying The Communications Card's Serial Data Port Connections

Each communications card provides four serial data ports. Each serial data port is a standard 6-conductor modular jack that serves as the interface connection between an external data device and the DXP Plus system.

The system designates serial data ports 3–18 to specific locations and, you must take programming action to match the data port number with the installation location that you choose for the communications card.

Serial Data Port Designation	DXOPT–COM Location
Serial data ports 3–10	Lower two slots on the services board
Serial data ports 11–18	Lower two slots on : upper expansion cabinet interface board –or– lower expansion cabinet interface board –or– the auxiliary board installed in the main cabinet.



Identifying The Serial Data Port Locations

5.0 Connecting Data Devices

5.1 Selecting The Baud Rate

Each serial data communications port supports various baud rates, data bits, stop bits, parity, and flow control. You can program these various options using the data base programming; however, the maximum baud rate that you can assign to a serial data port varies depending upon whether you locate the communications card. Also, if a device is transmitting/receiving data from the DXP *Plus* at a high rate, engineering sources recommend that you use a communications protoclo (such as RTS/CTS or XON/XOFF) to prevent buffer overrun and data loss.

Serial Data Port	DXOPT–COM Location	Maximum Baud Rate
Serial data ports 3–10	Lower two slots on the services board	19,200 Baud
Serial data ports 11–18	Lower two slots on: the upper expansion cabinet interface board, –or– the lower expansion cabinet interface board, –or– the auxiliary board installed in the main cabinet.	9600 Baud

The maximum distance from a serial data port that you can confidently locate a data device is dependent upon the baud rate at which you operate the serial data port.

- When operating the port at 9600 baud, your data cable run must be no longer than 500 feet.
- When operating the port at 19,200 baud, your data cable run must be no longer than 50 feet.

4.1 Making the Data Connections

Each serial data port is a standard 6–conductor modular jack that serves as the interface between an external data device and the DXP *Plus* system.

When preparing a data cable for connection to a data device, refer to the manufacturer's manual for the equipment being interfaced, and make the wiring connections detailed in the following list:

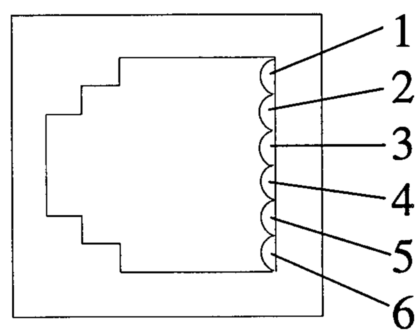
- Wire the common equipment RD (data from device to common equipment) connection to the device TD (transmit data) connection.
- Wire the common equipment TD (data to device from common equipment) connection to the device RD (receive data) connection.
- Wire the common equipment SG (signal ground) connection to the device SG (signal ground) connection.
- If required for proper operation, wire the common equipment CTS (clear-to-send status from device to common equipment) connection to the device RTS (request-to-send) connection.

NOTE: The common equipment requires a positive voltage, with respect to signal ground, in order to send data.

If the cable has spare wires, be sure to ground them so that they will not act as antennas and induce interference into the system. Further, if there is a source of RF power nearby (such as a radio transmitter), use shielded cable and ground the shield at both ends.

CAUTION

As an added precaution against induced interference, route the data cable as far away from any fluorescent lighting as you can reach, and make every effort to route the data cable perpendicular to other wiring.



PLUS50

Pin 1 = (RTS) Request To Send
Pin 2 = (CTS) Clear To Send
Pin 3 = (RD) Receive Data
Pin 4 = (TD) Transmit Data
Pin 5 = (SG) Signal Ground
Pin 6 = (GND) Chasis Ground

Identifying The Serial Data Connections

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Installing The Direct Inward Dialing (DID) Line Board In The DXP Plus Digital Communications System

1.0 Understanding The DID Line Board

1.1 Describing Direct Inward Dialing Parameters

Direct inward dial (DID) lines are incoming only and are employed to reduce the number of channels between the DXP *Plus* and the Central Office (CO). The number of DID lines that the system accepts is limited only by the number of installed DID boards that you can install in the system.

Direct inward dialing allows incoming CO calls to reach internal intercom extensions by direct dialing. No attendant assistance is necessary. Since DID lines are incoming only, their direct appearance is limited to attendant stations where busy indication may be useful.

DID operation requires a group of published directory numbers (400 maximum) provided by the CO. These directory numbers are incoming only and the DXP *Plus* translates them to the appropriate personal or group intercom number for ringing. The lines will accept outgoing DTMF digits while the call is active to support personal identification number dialing and similar user purposes.

The DXP *Plus* handles DID calls in the same manner that it handles regular intercom calls and will forward them via a hunt list or a call forwarding scheme. An unanswered DID call that receives no answer will either continue to ring or route to a programmed ring no-answer (RNA) destination. If there is no forwarding or the RNA routing destination is available, the system provides no routing.

Users can place DID calls on hold; however, if they press TAP, the system will generate an internal hookflash signal instead of one that the CO will recognize.

The system returns a ring back signal to DID calls made to a station in the do not disturb (DND) mode of operation.

When a DID line is disabled, the system returns an off-hook indication to the CO. This prevents the CO from placing calls on a disabled line.

The synchronized ringing feature does not have any affect on DID calls, and the Caller ID feature is not available on DID lines.

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IMI89-191.01
7/95

1.2 Understanding DID Operation

The DID line is a reverse battery, loop start, two-wire voice circuit. (The term reverse battery means that it is the DXP *Plus* and not the CO that provides tip and ring supervisory battery for the loop.) The PBX supervision battery, tone address, supervisory tones, and voice signals are transmitted across the voice pair. The line interface at the DXP *Plus* provides loop current detection, loop pulse digit collection, DTMF receivers, and a polarity reversal circuit.

In the idle state, the loop is open at the CO end, with on-hook battery polarity maintained on the circuit by the DXP *Plus*. The CO requests service from the DXP *Plus* by applying a resistive termination across the line tip and ring leads. The DXP *Plus* recognizes current flow in the loop as a CO connection and prepares for the incoming call. The CO does not send ringing since the DXP *Plus* generates it internally and sends it to the stations.

After the DXP *Plus* receives all of the address digits, it will translate the digits based on the appropriate DID block translation table and attempt to place the call to the desired station. To assure that the caller will always hear ring back prior to the call being answered (for example, when answered by voice mail), the system delays the station ringing until it applies ring back tone.

During station ringing, the called station will sound a distinctive ringing based on the ring code in the translation table. If the translation table has a name for this CO digit string, the LCD of the called stations will display that name. Otherwise, the DID block name will display followed by a portion of the CO digit string. If there is neither CO digit string name nor DID block name programmed, the station LCD will display just the CO digit string.

If an incoming call is addressed to either an unassigned or an uninstalled station, the DXP *Plus* will route the call to the DID block alternate extension. If the DID Block alternate extension is unavailable, it routes the call to the Dial 0 attendant. If the Dial 0 attendant is either unprogrammed or uninstalled, the DXP *Plus* will return reorder tone to the caller.

The system returns several different call progress signals to the CO in the interval after it receives address signalling and before it answers. It does this within 1.5 seconds after completion of address signalling.

Line Busy Tone: This tone indicates called station is busy or already being alerted by another call.

Reorder Tone: This tone indicates that the call cannot be completed due to:
blocking or lack of equipment,
an incomplete (partial dial) address is received.

Audible Ringing Tone: This tone indicates that the station is being alerted or that a recorded announcement will follow. The ring back will precede the actual alerting of the station to assure that the caller always hears some portion of the ring back tone.

When a called station answers, the DXP *Plus* sends answer supervision to the CO by applying reverse polarity to the line. This polarity reversal is maintained until either the station goes on-hook or the CO opens the loop. The DXP *Plus* establishes a communication path between the line and station when it detects station answer.

The CO signals a line disconnect condition to the DXP *Plus* by opening the loop. When the DXP *Plus* detects the CO disconnect, it returns the line to idle polarity and changes the line from busy to idle.

The DXP *Plus* signals a line disconnect condition to the CO by returning the supervision battery polarity to the on-hook state. Wink and delay start lines maintain the busy status until the DXP *Plus* detects CO release. After disconnect, the DXP *Plus* returns to the idle state and is ready to process the next call.

With the Wink Start line, the DXP *Plus* acknowledges that is ready to receive addressing digits from the CO by giving a momentary reversal of polarity after it has successfully allocated the resources.

With the Delay Start line, the DXP *Plus* reverses polarity upon notification from the CO of the pending incoming call, then acknowledges that is ready to receive addressing digits by returning the polarity back to the idle state after it has successfully allocated the resources.

With the Immediate Start line, there is no acknowledgment from the DXP *Plus* that it is ready. It is best to only use this method if the system is set for pulse (rotary) dialing on the line.

2.0 Installing Circuit Boards In The Equipment Cabinet

CAUTION

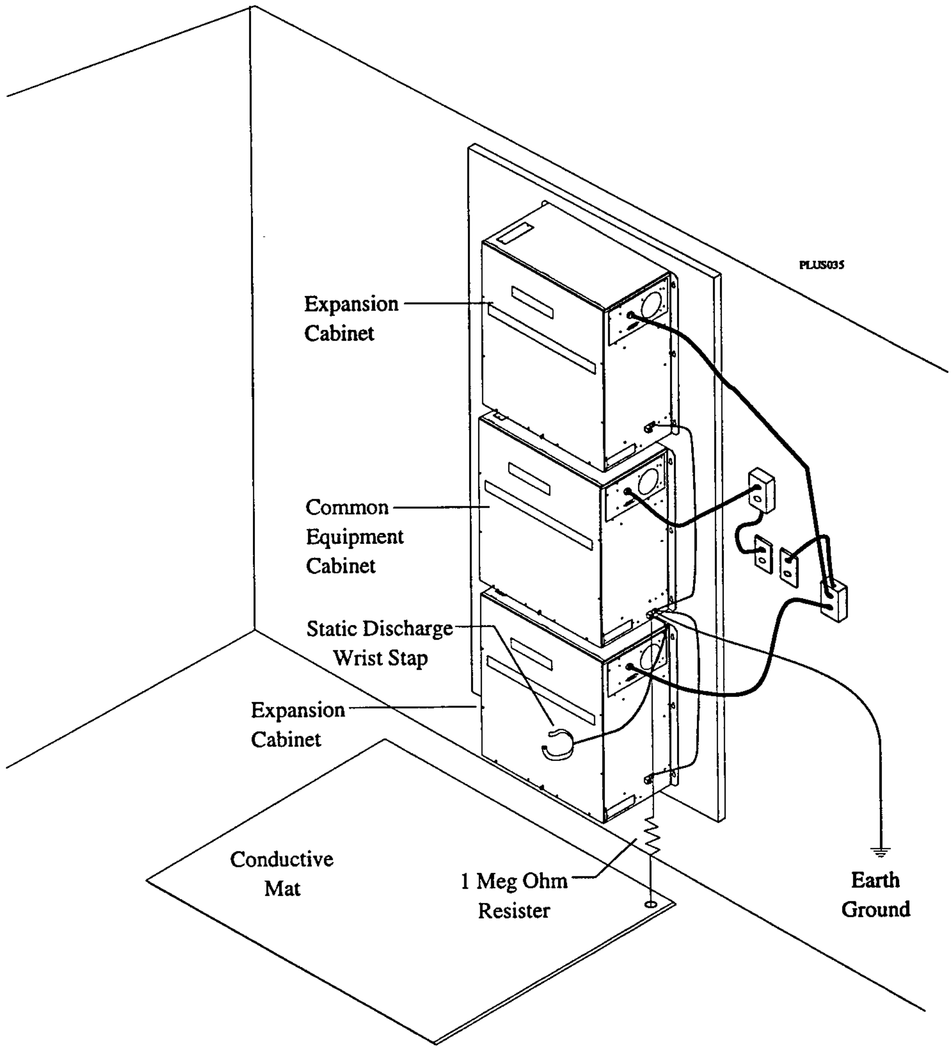
Circuit boards are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, Handling Of Electrostatically Sensitive Components, for general information. Specific handling precautions are also included in this installation instruction.

2.1 Creating A Static Safe Work Area

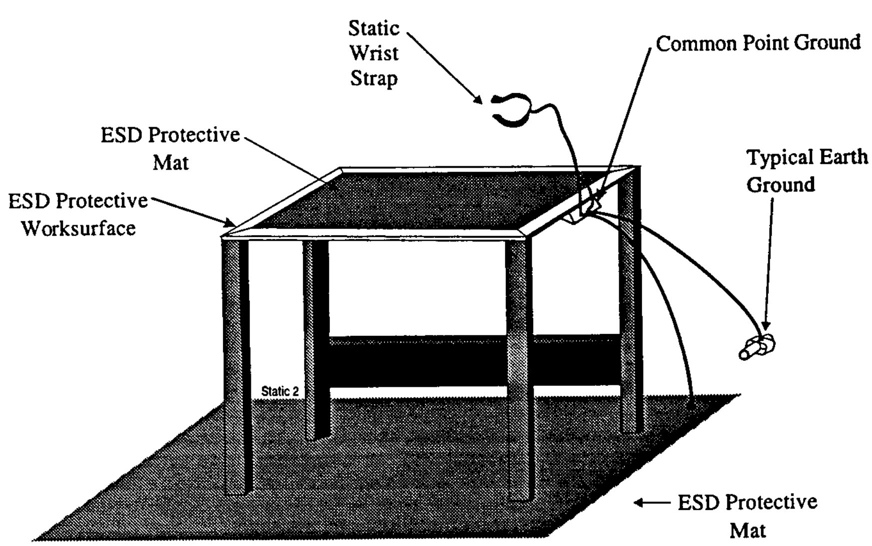
When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

2.2 Installing DID Line Boards

1. Normally you should first disconnect the optional battery back-up assembly from the main cabinet power supply and then disconnect the AC power cord from the AC outlet; however, when necessary, you can install a DID line board in an operating system. If you must do this, connect one end of a standard telephone handset coil cord to the precharge port on the power supply. During step 6, you will connect the other end of this coil cord to the precharge jack on the line board.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground
3. Loosen the retaining hardware and lift the front panel away from the common equipment cabinet.

NOTE: With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.

4. Each DID line board is supplied in a static protection bag for safe keeping. When you are ready to install the board, remove it from its static protection bag.
5. Locate the proper board slot.
   - On DXP *Plus* systems the DID line boards connect to any universal slot.

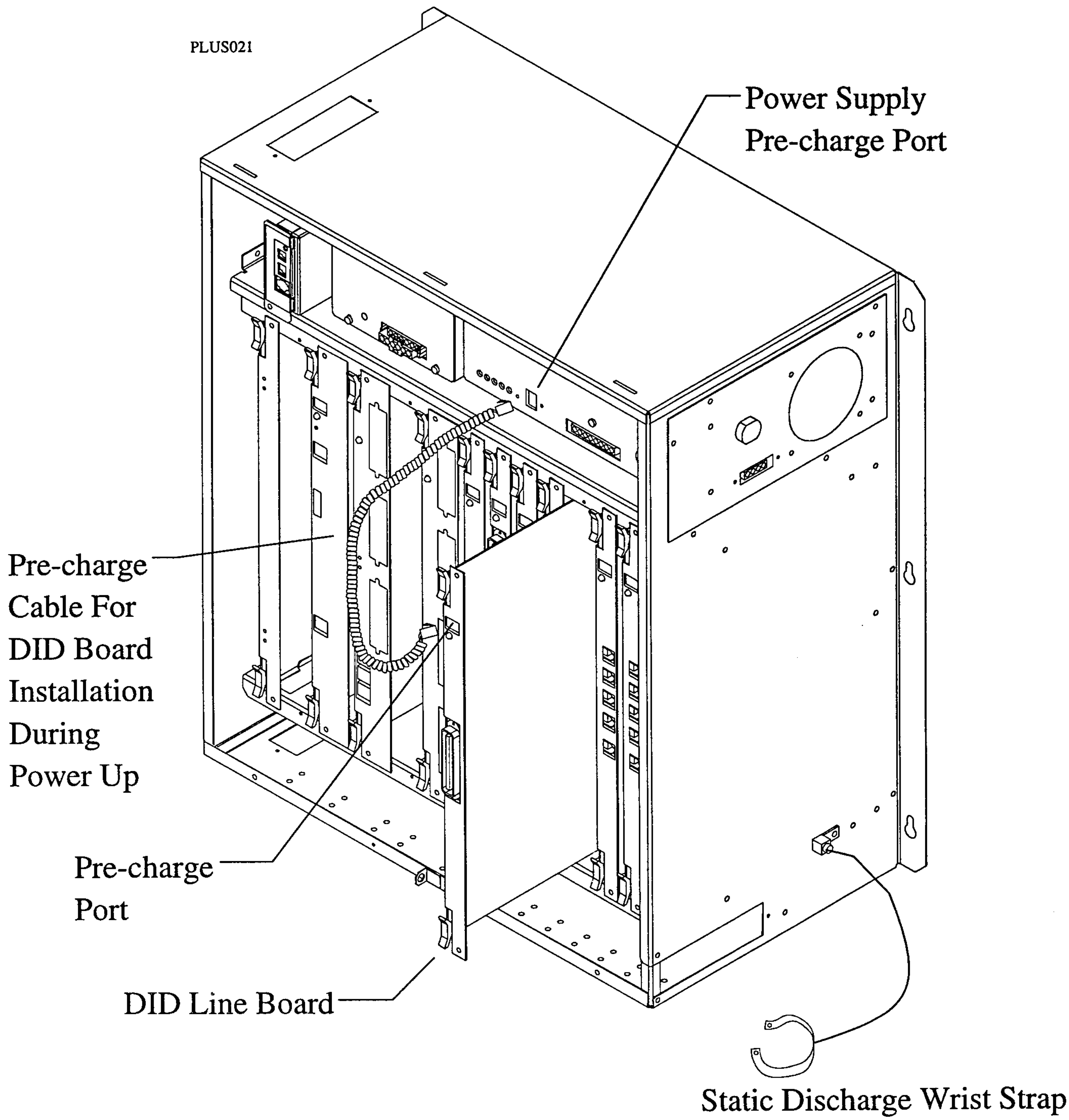
NOTE: On DXP Plus systems, do not install a DID line board at the right-most board slot in the second (or lower) expansion cabinet. The system reserves this slot for internal use.

6. If you are installing the line board in an operating system, connect the free end of the precharge cord that you installed in step 1 to the precharge jack on the line board.
7. Orient the DID line board with its top and bottom guides in main cabinet board cage. and press the board firmly until its board edge connection properly mates with the connector on cabinet's backplane. If you connected handset cord between pre-charge port on DXP *Plus* power supply and jack on DID line board (as directed in step 6), disconnect it after installing board.

CAUTION

When pressing circuit boards into place, press them only at the extractor lever locations. If you apply pressure at other locations you may damage the board assembly.

8. Repeat steps 3 and 4 until all DID line boards are installed.
9. Make a final inspection to ensure that all boards are, oriented correctly and mated properly.
10. Install and tighten the supplied screws to secure the circuit boards to the board cage. **Do not neglect this step! It is important because it helps in providing a protective ground condition for the board.**



Installing The DID Line Board

3.0 Connecting The DID Lines

The FCC specified jack configuration for DID line connection to the switched network is a universal service order code (USOC) **RJ21X** type and the facility interface code for DID is **02RV2-T.** This specified connection is typically a type 66M-nn connector block.

CAUTION

When connecting the lines for DID applications, be sure that you do not reverse the tip and ring leads.

A 50-pin connector on the DID line board provides its line terminations. You can cable connect the DID board to the CO line termination with a prepared cable that matches the termination requirements. Snap the supplied ferrite collar around the cable to provide protection against radio frequency interference.

Before you connect the CO-supplied DID lines to the board, program the system for DID operation, and test the DID line ports per the steps shown below.

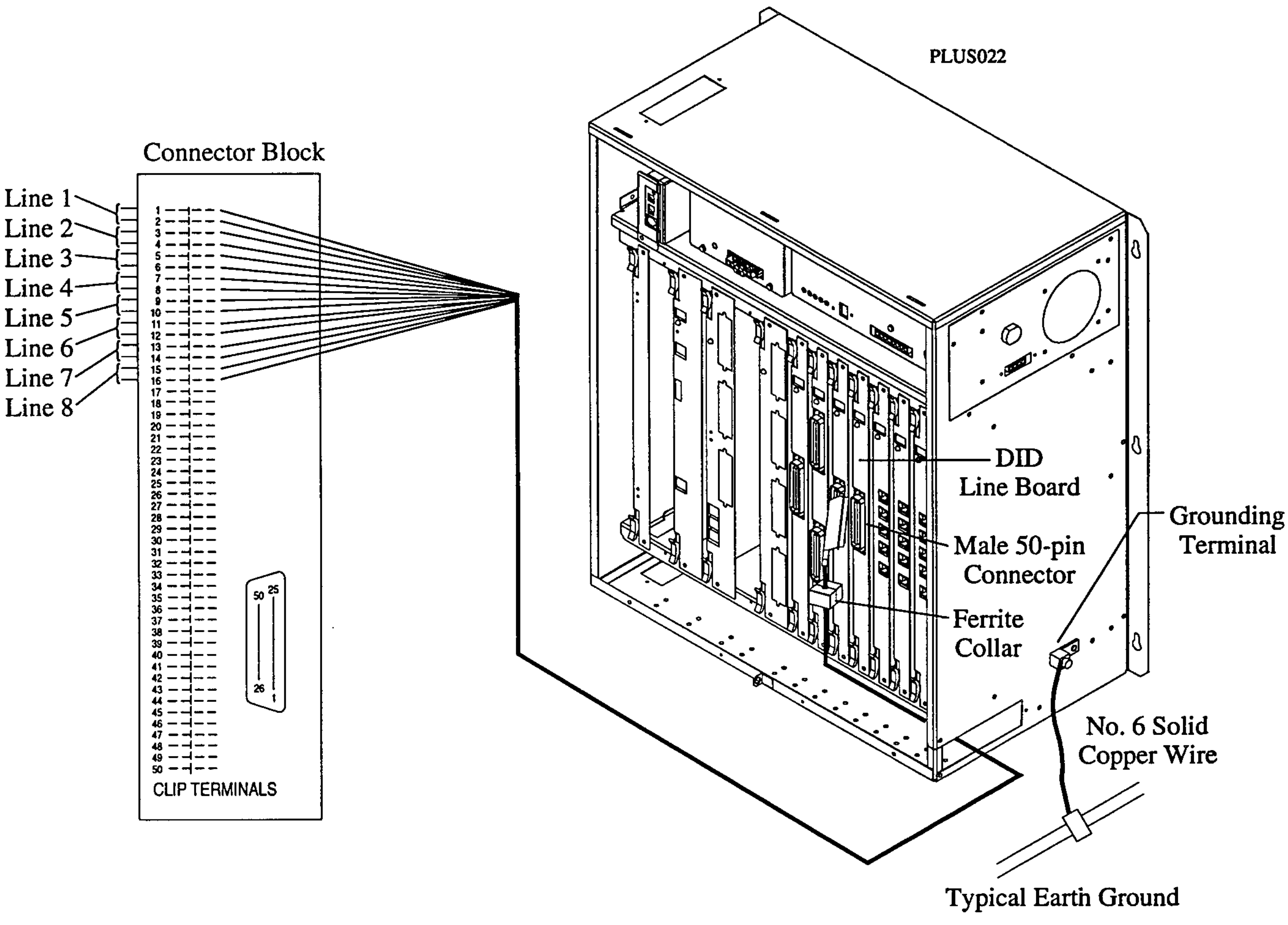
1. Replace the front panel on the common equipment cabinet.
2. Plug the AC line cord into the AC outlet, reconnect any battery back up equipment and turn on the switch on the power supply.
3. Using the data base programming procedure, program the system for DID line operation.
4. Connect a buttset or an industry-standard telephone (IST) to a line port on the DID line board.
5. Take the buttset or ISToff-hook, and listen for relay click on both wink start and delay start lines.
6. Dial a CO digit string to determine if you can make a call. Have someone answer your call to determine if you have a complete talk path. If you can complete a call, this verifies that you have programmed the system correctly.
7. Repeat step 6 as desired for other CO digit strings and repeat steps 4 through 7 at all line ports on the DID line board.
8. Connect the CO-supplied DID lines to the DID board.
9. Note the DID board's status light, and compare status with the following details:

   Rapid Flash = Malfunctioning on-board processor,

   Off with repeated 5 second blink on = Normal operation with all idle lines,

   On with repeated 5 second blink off = Normal operation with at least one busy line, (If a line is active but the LED is showing off with repeated 5 second blink on, check the wiring for poor connections),

   Three Rapid Flashes On Followed By 2.5 seconds Off = One or more lines out of service



NOTE: Wiring for the 8 line board is shown. Wiring for the 4 line board uses only pairs 1 through 4.

Viewing Typical DID Line Connections

3.1 Understanding The DXP Plus Logical Numbering

Because there are no dedicated station or line ports in the DXP *Plus*, the system uses an automatic configuration method to logically number its stations and lines. Automatic configuration occurs after you perform a master clear on the system.

How automatic configuration works

With automatic configuration, the system does a search for all installed station and line boards in the main and expansion cabinets, and assigns a logical number for each provided station and line encountered during the search. The search begins in the main cabinet at the left-most universal slot and proceeds left to right. The search then moves to the upper expansion cabinet where it searches left-most slot to right-most slot. The search finally moves to the lower expansion cabinet where it again searches left-most slot to right-most slot. When automatic configuration is finished, the system has logically numbered all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system.

How logical number and physical location relate to one another

The logical number of a station or line corresponds to its relationship to other stations or lines in the system but is not dependent upon the board's placement in the cabinet. The physical location of a station or line corresponds to the order of the system's board slots. The main cabinet contains slots 1–9, the upper expansion cabinet contains slots 10–20, and the lower expansion cabinet contains slots 21–30. Therefore, even if the first encountered station board is located in slot five of the main cabinet, the system still assigns logical number one to the first station provided by that board. During installation, you can skip slots. For example, you can install eight-line, loop start, line boards in only slots one and 30 if you wish. In this case, slot one yields logical line numbers 1–8 and slot 30 yields logical line numbers 9–17.

Where you can place circuit boards

Each installed board requires timing circuits equal to its capacity. For example, a 16–station board requires 16 timing circuits, an eight–line loop start line board requires eight circuits, and a fully configured T1 trunk board requires 24 timing circuits. In the DXP *Plus,* each universal slot provides 32 timing circuits. Because of this timing circuit provision of each slot, you can place any station or line board at any slot location with no restrictions.

Adding boards without renumbering

If you install or relocate a station or line board, this board does not operate until you take appropriate programming action. If you use an available open slot for adding or relocating a board, that board's stations or lines assume logical numbers in sequence after the system's last assigned logical station or line number. For example, if the system's last logical station number is 24, the logical numbers of the newly installed board's stations begin at logical number 25.

After you remove a board and delete it through programming, that board's logical numbers are available for reassignment. This means that you can remove a board, add or move another board, take the appropriate programming action, and have the stations or lines of the added or relocated board assume the logical numbers made available by the removed board. For example, if the system's last logical number is 64 and you remove the board providing stations with logical numbers 1–16 and delete it through programming, the stations on an added board assume logical numbers beginning with 1 instead of 65. However, if you remove and program delete an eight-station board and add a 16-station board, the first eight stations stations on the added board assume logical numbers 1–8 and the last eight stations assume logical numbers 65–72.

Remember, should you master clear the system, the automatic configuration feature logically numbers all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system. This action renumbers those station and lines provided by boards that you have added or relocated since you last performed the system master clear.

3.2 Understanding The DID Line Connections

25-Pair Connections			Wire-Pair Connections			CO Line Number
Wire Color	Pair	Pin No.	Clip Term.	Wire Name	Line Number	
White-Blue	1	26	1	Tip	1	
Blue-White		1	2	Ring		
White-Orange	2	27	3	Tip	2	
Orange-White		2	4	Ring		
White-Green	3	28	5	Tip	3	
Green-White		3	6	Ring		
White-Brown	4	29	7	Tip	4	
Brown-White		4	8	Ring		
White-Slate	5	30	9	Tip	5	
Slate-White		5	10	Ring		
Red-Blue	6	31	11	Tip	6	
Blue-Red		6	12	Ring		
Red-Orange	7	32	13	Tip	7	
Orange-Red		7	14	Ring		
Red-Green	8	33	15	Tip		
Green-Red		8	16	Ring		
Red-Brown	9	34	17			
Brown-Red		9	18			
Red-Slate	10	35	19			
Slate-Red		10	20			
Black-Blue	11	36	21			
Blue-Black		11	22			
Black-Orange	12	37	23			
Orange-Black		12	24			
Black-Green	13	38	25			
Green-Black		13	26			
Black-Brown	14	39	27			
Brown-Black		14	28			
Black-Slate	15	40	29			
Slate-Black		15	30			
Yellow-Blue	16	41	31			
Blue-Yellow		16	32			
Yellow-Orange	17	42	33			
Orange-Yellow		17	34			
Yellow-Green	18	43	35			
Green-Yellow		18	36			
Yellow-Brown	19	44	37			
Brown-Yellow		19	38			
Yellow-Slate	20	45	39			
Slate-Yellow		20	40			
Violet-Blue	21	46	41			
Blue-Violet		21	42			
Violet-Orange	22	47	43			
Orange-Violet		22	44			
Violet-Green	23	48	45			
Green-Violet		23	46			
Violet-Brown	24	49	47			
Brown-Violet		24	48			
Violet-Slate	25	50	49			
Slate-Violet		25	50			

NOTE: Wiring for the 8 line board is shown. Wiring for the 4 line board uses only pairs 1 through 4.

4.0 Understanding The Federal Communications Requirements Concerning DID Lines

The Federal Communications Commission (FCC) requires that you inform the central office (CO) that the DXP *Plus* is configured as an MF (multipurpose) registered device if you connect it to ground start DID lines. Also, FCC rules, part 68, require customer premise equipment (CPE) to return answer supervision signalling to the CO for DID calls. **Allowing the DXP *Plus* to be operated in a manner that does not provide answer supervision is a violation of these rules.** In compliance to this ruling, the DXP *Plus* system returns DID answer supervision no later than 500 milliseconds after the incoming call is serviced. The regulations require that the system return this answer supervision whenever the following DID call conditions exist:

- call answered by the called station,
- call answered by the attendant,
- call routed to a recorded announcement that can be administered by a system user,

Exceptions to the requirement are when:

- a call is not answered,
- a busy tone is received,
- a reorder tone is received.

4.1 Understanding Installer/User Information Regarding FCC Rules And Regulations

This DXP *Plus* digital communications system complies with Federal Communications Commission (FCC) Rules, Part 68. The FCC registration label on the KSU contains the FCC registration number, the ringer equivalence number, the model number, and the serial number or production date of the system.

Notification To Telephone Company

Unless a telephone operating company provides and installs the system, the telephone operating company which provides the lines must be notified before a connection is made to them. The lines (telephone numbers) involved, the FCC registration number, and the ringer equivalence number must be provided to the telephone company. The FCC registration number and the ringer equivalence number of this equipment are provided on the label attached to the common equipment. The user/installer is required to notify the telephone company when final disconnection of this equipment from the telephone company line occurs.

Compatibility With Telephone Network

When necessary, the telephone operating company provides information on the maximum number of telephones or ringers that can be connected to one line, as well as any other applicable technical information. The telephone operating company can temporarily discontinue service and make changes which could affect the operation of this equipment. They must, however, provide adequate notice, in writing, of any future equipment changes that would make the system incompatible.

Installation Requirements

Connection of the electronic key system to the telephone lines must be through a universal service order code (USOC) outlet jack supplied by the telephone operating company. If the installation site does not have the proper outlet, ask the telephone company business office to install one. The correct outlet jack for this is a type RJ21X.

Party Lines And Coin Lines

Local telephone company regulations may not permit connections to party lines and coin lines by anyone except the telephone operating company.

Troubleshooting

If a service problem occurs, first try to determine if the trouble is in the on-site system or in the telephone company equipment. Disconnect all equipment not owned by the telephone company.
If this corrects the problem, the faulty equipment must not be reconnected to the telephone line until the problem has been corrected. Any trouble that causes improper operation of the telephone network may require the telephone company to discontinue service to the trouble site after they notify the user of the reason.

Repair Authorization

FCC regulations do not permit repair of customer owned equipment by anyone except the manufacturer, their authorized agent, or others who might be authorized by the FCC. However, routine repairs can be made according to the maintenance instructions in this publication, provided that all FCC restrictions are obeyed.

Radio Frequency Interference

The electronic key system contains incidental radio frequency generating circuitry and, if not installed and used properly, may cause interference to radio and television reception. This equipment has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules. These limits are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference to radio and television reception; in which case the user is encouraged to take whatever measures may be required to correct the interference. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient the television or radio's receiving antenna, and/or relocate the KSU, the individual telephone stations, and the radio or TV with respect to each other. If necessary, the user should consult the manufacturer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the Government Printing Office, Washington D.C. 20402. Stock No. 004-000-00345-4.

This digital apparatus does not exceed the (Class A) limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pes de bruits radioélectriques dépassant les limites applicables aux appareils numériques (de la class A) prescrites dans le Réglement sur le brouillage radioélectrique édicté par le ministére des Communications du Canada.

Ringer Equivalence Number

The REN of each line is 0.4B. The FCC requires the installer to determine the total REN for each line, and record it at the equipment.

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Installing The Multipurpose Line Board In The DXP Plus Digital Communications System

1.0 Understanding The Multipurpose Line Board

The Multipurpose line board for the DXP *Plus* digital communications system provides system interface for ground start lines, loop start lines, and E&M (tie) lines. These are typically the three different line types that the central office (CO) makes available for connection to the public switched network. The multipurpose line board is fully programmable for each type of line.

1.1 Detailing The Line Types

Loop Start Lines: With this line type, the DXP *Plus* bridges a resistance across the tip and ring leads to signal the CO to establish a communications link for an outgoing call. The CO detects the resulting current flow and supplies dial tone to the DXP *Plus*. The CO signals an incoming call to the DXP *Plus* by placing an alternating voltage (ring signal) on the tip lead for the DXP *Plus* to sense. The DXP *Plus* then generates ringing to the DXP *Plus* station being called. When a station answers the ringing, the circuit is completed as it was for outgoing calls. Loop start lines can not provide any sure means of determining when a distant party hangs up his or her telephone. For a system that experiences moderate incoming and outgoing call volume and does not cost calls, loop start lines provide an economical choice for connecting the DXP *Plus* to the central office (CO) equipment. When you use line 1 for the power-fail mode, you must program that line to be a loop-start line unless the industry-standard telephone that you use as a power-fail station is a ground-start device.

Ground Start Lines: With this line type, the DXP *Plus* momentarily grounds the ring lead to signal the CO to establish a communications link for an outgoing call. When the CO detects this, it acknowledges by momentarily grounding the tip lead. The DXP *Plus* responds by removing its ground connection and bridging itself across the tip and ring leads. The CO then removes its ground connection and returns dial tone to the DXP *Plus*.

For an incoming call, the CO grounds the tip lead and places an alternating voltage on the ring lead for the DXP *Plus* to sense. The DXP *Plus* detects ring-lead ground and then causes its ring generator to generate ringing to the station being called. When a station answers the ringing, the circuit is completed as it is for outgoing calls. Because ground start lines are controlled at both ends, they are capable of release supervision that provides a sure means of determining when a distant party hangs up his or her telephone. This is very important in applications where calls are costed. Also, since the signalling protocol indicates which end requested the line, it helps prevent call collisions and glare and thus is useful in applications where there is a high volume of incoming and outgoing calls occurring on the same lines. Ground start lines are standard protocol for remote networking and are useful for connecting the DXP *Plus* to private branch exchange (PBX) equipment. For ground start lines to be dependable, you must ensure that you have connected the DXP *Plus* to a low resistance telephone company ground.

NOTE: The Federal Communications Commission (FCC) requires that you inform the central office that the DXP Plus is configured as an MF (multipurpose) registered device if you connect it to ground start lines.

E&M Tie Lines: The tie line connections (also known as tie trunk access) are special circuits that allow, on a dial-up or continuous connection (hot line) basis, the DXP *Plus* to communicate with remotely located equipment such as: another DXP *Plus*, a PBX, or to other common carrier (OCC) equipment for long distance calls. Tie lines can be a part of a private or leased network and can be metallic, carrier current, T1, or microwave.

Printed in U.S.A.

IMI89-192.01

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1.2 Detailing E&M Signalling Methods

The multipurpose line board provides two wires for a tip and ring voice circuit and two wires (the E and M line) to provide control signalling between the systems. When a local DXP *Plus* puts a request for service from the remote equipment on the M lead, the remote equipment detects this request on its E lead. As an option it can also respond by putting an alerting signal on its M lead.

NOTE: Intercom feature codes of one DXP Plus are not available to callers from the other DXP Plus nor can those callers access a line through the distant DXP Plus using line group access codes.

The DXP *Plus* supports two different types of E and M lines. The *E and M Direct* type is for direct connection between two telephone systems and is also known as a metallic connection. The *E and M Carrier* type is for tie lines that run through a central office (CO) interface; however, some COs also provide a metallic connection interface.

If you plan to use tone dial configured E and M lines with the multipurpose line board, you may need to install one or more DTMF receiver cards to the DXP *Plus*. Typically, you will need one DTMF receiver for every six lines. In high traffic situations, you may need additional DTMF receivers. For information on DTMF receiver card installation, see IMI89–186, *Installing A DTMF Receiver In The DXP Plus Digital Communications System.*

NOTE: The DTMF receiver cards that you add for this purpose are in addition to any you may add to the system to support industry-standard telephone station boards

You can program the system to respond to three different standard-protocol types of E and M signalling. They are known as: immediate signalling, wink signalling, and delayed signalling and are defined in the following paragraphs.

Immediate Signalling: With this signalling method, the called DXP *Plus* answers as soon as the calling DXP *Plus* initiates the call. There is no delay between calling and answering. This signalling method is usually used if the line is programmed for hot line operation or is programmed for pulse dialing.

Wink Signalling: With this signalling method, the called DXP *Plus* places a momentary signal reversal (wink) on its M lead to alert the calling DXP *Plus* system that it is ready to receive information. The calling DXP *Plus* controls the status of the M lead and watches for a return signal from the called DXP *Plus* on the E lead. A wink occurs when the called DXP *Plus* is ready to receive dialed digits from the calling DXP *Plus*. Dialing can begin only after the wink is complete. After the wink occurs, the called DXP *Plus* (if it is programmed for dialing) returns dial tone to the calling DXP *Plus* as an indication it is ready to receive digits. This signalling method is the preferred protocol for use between two DXP *Plus* systems.

Delayed Signalling: With delay dial signalling, the called DXP *Plus* immediately responds to the calling DXP *Plus* by sending an off-hook signal on its M lead. It holds this off-hook condition until it is ready to receive digits and then returns its M lead to on-hook. After the signal exchange occurs, the called DXP *Plus* (if it is programmed for dialing) returns dial tone to the calling DXP *Plus* as an indication it is ready to receive digits. This signalling method is an alternate to wink start signalling that also provides equipment readiness signals. This method is most useful if the DXP *Plus* is connected to another manufacturer's PBX with incompatible wink timing parameters.

In addition to the standard-protocol signalling, you can program the system to respond to two types of non-standard tie line signalling protocols. They are known as: hot line and intercom dialing and are defined in the following paragraphs.

Hot Line: You can program the system for hot-line operation so that as soon as a user accesses the tie line, the station or stations at the distant system that have access to the personal or group intercom assigned to the hot line will ring.

Intercom Dialing: Alternately, you can program the system for intercom dialing mode so that as soon as users access the tie line they will hear dial tone. Upon hearing dial tone, they can dial either a personal or group intercom number at the distant system.

2.0 Installing Circuit Boards In The Equipment Cabinet

CAUTION

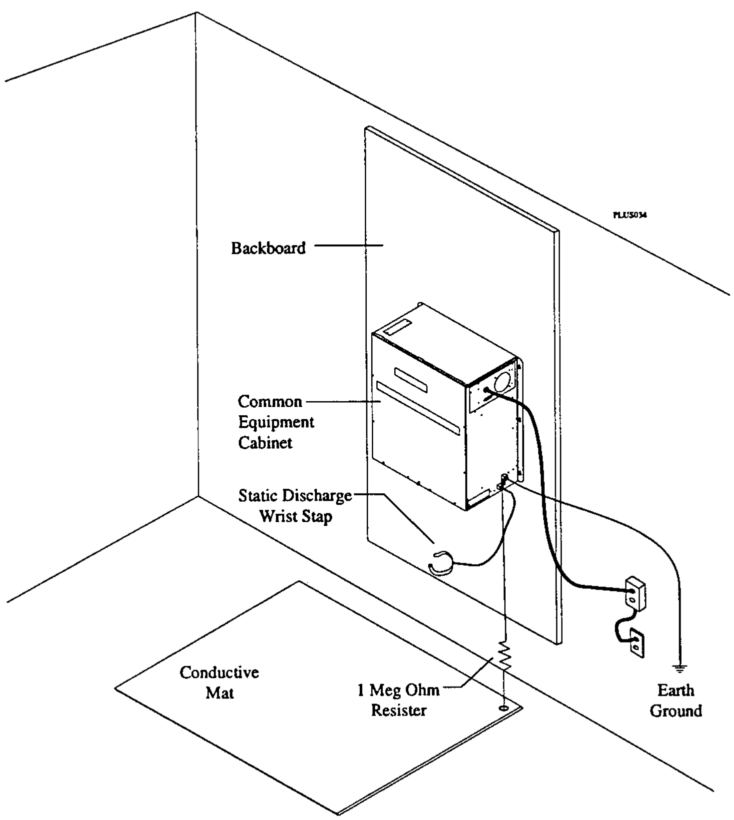
Circuit boards are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, Handling Of Electrostatically Sensitive Components, *for general information. Specific handling precautions are also included in this installation instruction.*

2.1 Creating A Static Safe Work Area

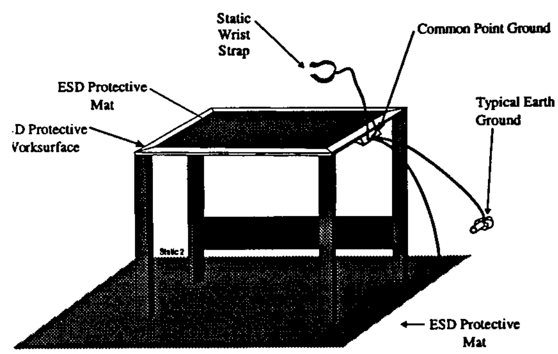
When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.



Providing Static Protection At The Cabinet Mounting Location



Creating A Static Safe Work Area

2.2 Installing Multipurpose Line Boards

1. Normally you should disconnect the AC power cord from the AC outlet and disconnect the optional battery back-up assembly from the main cabinet power supply; however, when necessary, you can install a multipurpose line board in an operating system. If you must do this, connect one end of a standard telephone handset coil cord to the precharge port on the power supply. During step 6, you will connect the other end of this coil cord to the precharge jack on the line board.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground
3. Loosen the retaining hardware and lift the front panel away from the common equipment cabinet.

NOTE: With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.

4. Each multipurpose line board is supplied in a static protection bag for safe keeping. When you are ready to install the board, remove it from its static protection bag.
5. Locate the proper board slot.
   - On DXP *Plus* systems the multipurpose line boards connect to any universal slot.

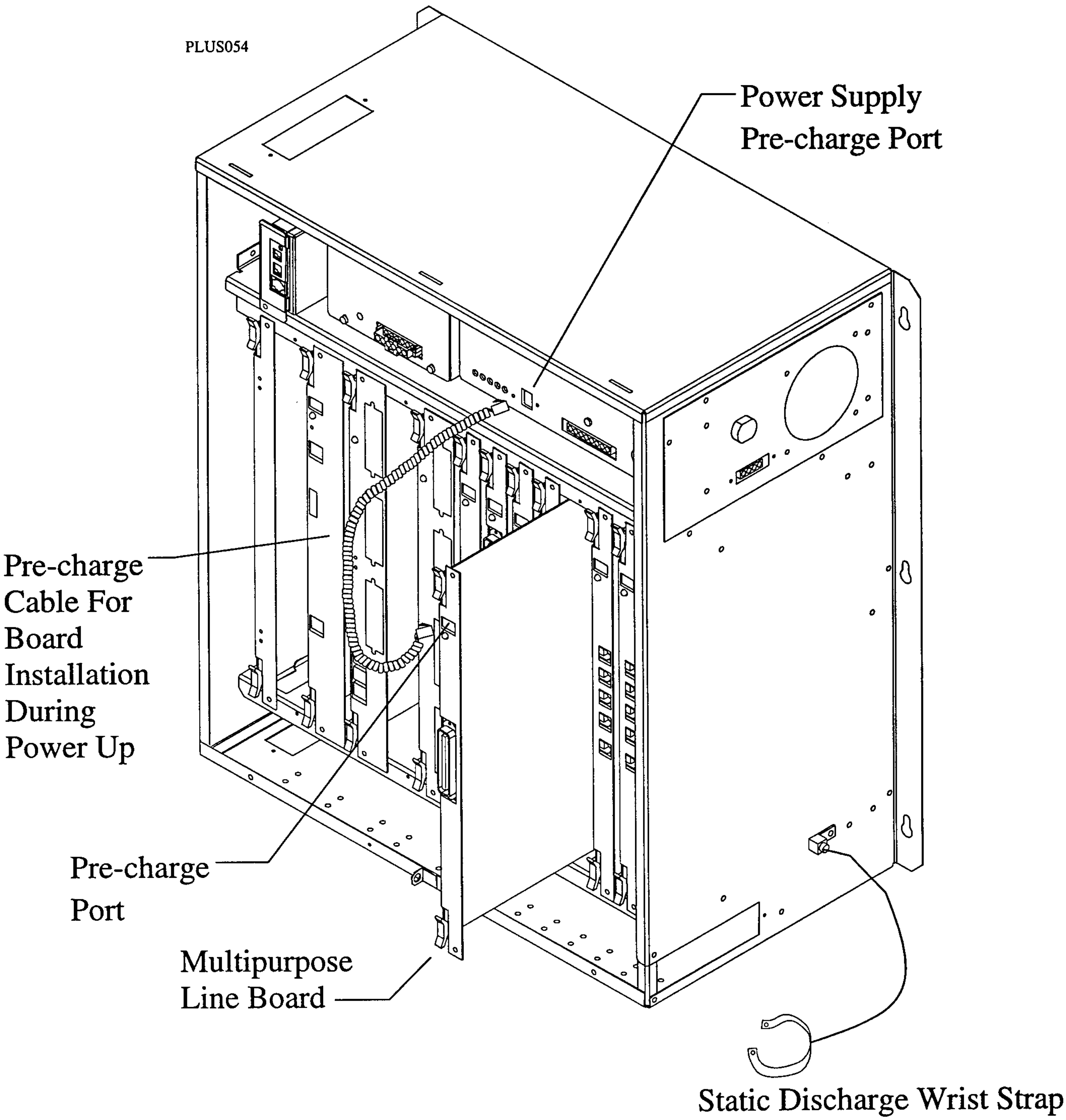
NOTE: On DXP Plus systems, do not install a multipurpose line board at the right-most board slot in the second (or lower) expansion cabinet. The system reserves this slot for internal use.

6. If you are installing the line board in an operating system, connect the free end of the precharge cord that you installed in step 1 to the precharge jack on the line board.
7. Orient the multipurpose line board with its top and bottom guides in main cabinet board cage. and press the board firmly until its board edge connection properly mates with the connector on cabinet's backplane. If you connected handset cord between pre-charge port on DXP *Plus* power supply and jack on multipurpose line board (as directed in step 6), disconnect it after installing board.

   CAUTION

   When pressing circuit boards into place, press them only at the extractor lever locations. If you apply pressure at other locations you may damage the board assembly.

8. Repeat steps 3 and 4 until all multipurpose line boards are installed.
9. Make a final inspection to ensure that all boards are, oriented correctly and mated properly.
10. Install and tighten the supplied screws to secure the circuit boards to the board cage. **Do not neglect this step! It is important because it helps in providing a protective ground condition for the board and ensures proper functioning of E and M and ground-start lines.**



Installing The Multipurpose Line Board

3.0 Connecting The Multipurpose Lines

The FCC specified jack configuration for the multipurpose board line connections to the switched network is the (USOC) **RJ2EX** type and the facility interface code is **TL11M.** This specified connection is typically a type 66M-nn connector block.

CAUTION

When connecting the lines for multipurpose applications, be sure that you do not reverse the tip and ring leads.

A 50-pin connector on the multipurpose line board provides its line terminations. You can cable connect the multipurpose board to the CO line termination with a prepared cable that matches the termination requirements. Snap the supplied ferrite collar around the cable to provide protection against radio frequency interference.

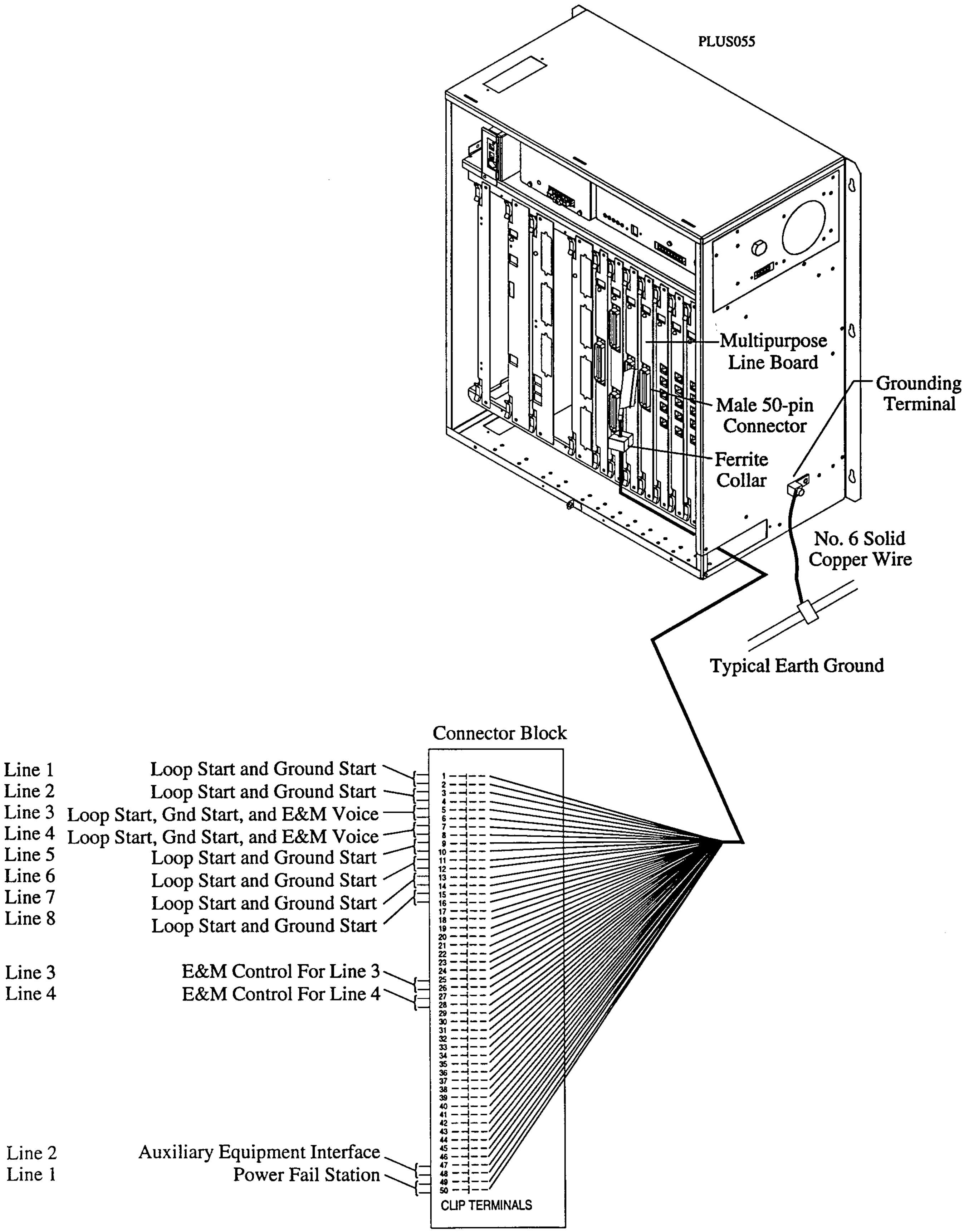
Before you connect the CO-supplied multipurpose lines to the board, program the system for proper operation.

1. Replace the front panel on the common equipment cabinet.
2. Plug the AC line cord into the AC outlet, reconnect any battery back up equipment and turn on the switch on the power supply.
3. Connect the CO-supplied lines to the multipurpose board. The system will test each circuit for loop current after you connect the lines to the board. If the multipurpose line board does not detect loop current for a line (in either loop or ground start applications), it will ignore this line and show an idle condition on its status light. If this happens, you must check the line connections for proper wiring.
4. Note the multipurpose board's status light, and compare status with the following details:
   Rapid Flash = Malfunctioning on-board processor,
   Off with repeated 5 second blink on = Normal operation with all idle lines,
   On with repeated 5 second blink off = Normal operation with at least one busy line, (If a line is active but the LED is showing off with repeated 5 second blink on, check the wiring for poor connections),
   Three Rapid Flashes On Followed By 2.5 seconds Off = One or more lines out of service

3.1 Installing E&M Lines

When you install E&M tie lines to connect the DXP *Plus* to a remote telephone system, you must follow the particular wiring arrangement detailed in the following chart. From the chart, notice that line 3 of one system connects to line 4 of the other system and that the E lead of one line connects to the M lead of the other line.

Local DXP Plus	Remote DXP Plus
Line 3 Tip	Line 4 Tip
Line 3 Ring	Line 4 Ring
Line 3 E	Line 4 M
Line 3 M	Line 4 E
Line 4 Tip	Line 3 Tip
Line 4 Ring	Line 3 Ring
Line 4 E	Line 3 M
Line 4 M	Line 3 E



Viewing Typical Multipurpose Line Connections

3.1 Understanding The DXP Plus Logical Numbering

Because there are no dedicated station or line ports in the DXP *Plus*, the system uses an automatic configuration method to logically number its stations and lines. Automatic configuration occurs after you perform a master clear on the system.

How automatic configuration works

With automatic configuration, the system does a search for all installed station and line boards in the main and expansion cabinets, and assigns a logical number for each provided station and line encountered during the search. The search begins in the main cabinet at the left-most universal slot and proceeds left to right. The search then moves to the upper expansion cabinet where it searches left-most slot to right-most slot. The search finally moves to the lower expansion cabinet where it again searches left-most slot to right-most slot. When automatic configuration is finished, the system has logically numbered all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system.

How logical number and physical location relate to one another

The logical number of a station or line corresponds to its relationship to other stations or lines in the system but is not dependent upon the board's placement in the cabinet. The physical location of a station or line corresponds to the order of the system's board slots. The main cabinet contains slots 1–9, the upper expansion cabinet contains slots 10–20, and the lower expansion cabinet contains slots 21–30. Therefore, even if the first encountered station board is located in slot five of the main cabinet, the system still assigns logical number one to the first station provided by that board. During installation, you can skip slots. For example, you can install eight-line, loop start, line boards in only slots one and 30 if you wish. In this case, slot one yields logical line numbers 1–8 and slot 30 yields logical line numbers 9–17.

Where you can place circuit boards

Each installed board requires timing circuits equal to its capacity. For example, a 16–station board requires 16 timing circuits, an eight–line loop start line board requires eight circuits, and a fully configured T1 trunk board requires 24 timing circuits. In the DXP *Plus,* each universal slot provides 32 timing circuits. Because of this timing circuit provision of each slot, you can place any station or line board at any slot location with no restrictions.

Adding boards without renumbering

If you install or relocate a station or line board, this board does not operate until you take appropriate programming action. If you use an available open slot for adding or relocating a board, that board's stations or lines assume logical numbers in sequence after the system's last assigned logical station or line number. For example, if the system's last logical station number is 24, the logical numbers of the newly installed board's stations begin at logical number 25.

After you remove a board and delete it through programming, that board's logical numbers are available for reassignment. This means that you can remove a board, add or move another board, take the appropriate programming action, and have the stations or lines of the added or relocated board assume the logical numbers made available by the removed board. For example, if the system's last logical number is 64 and you remove the board providing stations with logical numbers 1–16 and delete it through programming, the stations on an added board assume logical numbers beginning with 1 instead of 65. However, if you remove and program delete an eight-station board and add a 16-station board, the first eight stations stations on the added board assume logical numbers 1–8 and the last eight stations assume logical numbers 65–72.

Remember, should you master clear the system, the automatic configuration feature logically numbers all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system. This action renumbers those station and lines provided by boards that you have added or relocated since you last performed the system master clear.

3.2 Understanding The Multipurpose Line Connections

25-Pair Connections			Wire-Pair Connections			Line Type
Wire Color	Pair	Pin No.	Clip Term.	Wire Name	Line Number	
White-Blue	1	26	1	Tip	1	Loop Start and Ground Start
Blue-White		1	2	Ring		
White-Orange	2	27	3	Tip	2	Loop Start and Ground Start
Orange-White		2	4	Ring		
White-Green	3	28	5	Tip	3	Loop Start, Ground Start, and E&M Voice
Green-White		3	6	Ring		
White-Brown	4	29	7	Tip	4	Loop Start, Ground Start, and E&M Voice
Brown-White		4	8	Ring		
White-Slate	5	30	9	Tip	5	Loop Start and Ground Start
Slate-White		5	10	Ring		
Red-Blue	6	31	11	Tip	6	Loop Start and Ground Start
Blue-Red		6	12	Ring		
Red-Orange	7	32	13	Tip	7	Loop Start and Ground Start
Orange-Red		7	14	Ring		
Red-Green	8	33	15	Tip	8	Loop Start and Ground Start
Green-Red		8	16	Ring		
Red-Brown	9	34	17			
Brown-Red		9	18			
Red-Slate	10	35	19			
Slate-Red		10	20			
Black-Blue	11	36	21			
Blue-Black		11	22			
Black-Orange	12	37	23			
Orange-Black		12	24			
Black-Green	13	38	25	M	3	E&M Control for Line 3
Green-Black		13	26	E		
Black-Brown	14	39	27	M	4	E&M Control for Line 4
Brown-Black		14	28	E		
Black-Slate	15	40	29			
Slate-Black		15	30			
Yellow-Blue	16	41	31			
Blue-Yellow		16	32			
Yellow-Orange	17	42	33			
Orange-Yellow		17	34			
Yellow-Green	18	43	35			
Green-Yellow		18	36			
Yellow-Brown	19	44	37			
Brown-Yellow		19	38			
Yellow-Slate	20	45	39			
Slate-Yellow		20	40			
Violet-Blue	21	46	41			
Blue-Violet		21	42			
Violet-Orange	22	47	43			
Orange-Violet		22	44			
Violet-Green	23	48	45			
Green-Violet		23	46			
Violet-Brown	24	49	47	Tip	2	Auxiliary Equipment Interface (Busy Lead Detect)
Brown-Violet		24	48	Ring		
Violet-Slate	25	50	49	Tip	1	Power Fail Station
Slate-Violet		25	50	Ring		

4.0 Understanding Installer/User Information Regarding FCC Rules And Regulations

This DXP *Plus* digital communications system complies with Federal Communications Commission (FCC) Rules, Part 68. The FCC registration label on the KSU contains the FCC registration number, the ringer equivalence number, the model number, and the serial number or production date of the system.

Notification To Telephone Company

Unless a telephone operating company provides and installs the system, the telephone operating company which provides the lines must be notified before a connection is made to them. The lines (telephone numbers) involved, the FCC registration number, and the ringer equivalence number must be provided to the telephone company. The FCC registration number and the ringer equivalence number of this equipment are provided on the label attached to the common equipment. The user/installer is required to notify the telephone company when final disconnection of this equipment from the telephone company line occurs.

Compatibility With Telephone Network

When necessary, the telephone operating company provides information on the maximum number of telephones or ringers that can be connected to one line, as well as any other applicable technical information. The telephone operating company can temporarily discontinue service and make changes which could affect the operation of this equipment. They must, however, provide adequate notice, in writing, of any future equipment changes that would make the system incompatible.

Installation Requirements

Connection of the electronic key system to the telephone lines must be through a universal service order code (USOC) outlet jack supplied by the telephone operating company. If the installation site does not have the proper outlet, ask the telephone company business office to install one. The correct outlet jack for this is a type RJ21X.

Party Lines And Coin Lines

Local telephone company regulations may not permit connections to party lines and coin lines by anyone except the telephone operating company.

Troubleshooting

If a service problem occurs, first try to determine if the trouble is in the on-site system or in the telephone company equipment. Disconnect all equipment not owned by the telephone company.
If this corrects the problem, the faulty equipment must not be reconnected to the telephone line until the problem has been corrected. Any trouble that causes improper operation of the telephone network may require the telephone company to discontinue service to the trouble site after they notify the user of the reason.

Repair Authorization

FCC regulations do not permit repair of customer owned equipment by anyone except the manufacturer, their authorized agent, or others who might be authorized by the FCC. However, routine repairs can be made according to the maintenance instructions in this publication, provided that all FCC restrictions are obeyed.

Radio Frequency Interference

The electronic key system contains incidental radio frequency generating circuitry and, if not installed and used properly, may cause interference to radio and television reception. This equipment has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules. These limits are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference to radio and television reception; in which case the user is encouraged to take whatever measures may be required to correct the interference. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient the television or radio's receiving antenna, and/or relocate the KSU, the individual telephone stations, and the radio or TV with respect to each other. If necessary, the user should consult the manufacturer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the Government Printing Office, Washington D.C. 20402. Stock No. 004-000-00345-4.

This digital apparatus does not exceed the (Class A) limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pes de bruits radioélectriques dépassant les limites applicables aux appareils numériques (de la class A) prescrites dans le Réglement sur le brouillage radioélectrique édicté par le ministére des Communications du Canada.

Ringer Equivalence Number

The REN of each line is 0.4B. The FCC requires the installer to determine the total REN for each line, and record it at the equipment.

COMDIAL
Charlottesville, VA 22906-7266

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Installing The DXPT1 Digital Carrier Transmission Option In The DXP Plus Digital Communications System

1.0 Introducing The DXPT1 Option

The digital carrier transmission option (DXPT1) gives the DXP *Plus* digital communications system the capability to handle up to 24 channels of voice and/or data transmissions over a single four-wire cable using multiplexing techniques in superframe (SF) or extended superframe (ESF) format. The DXPT1 board includes a customer service unit (CSU) to eliminate the need for a CSU external to the DXP *Plus*.

Since the DXP *Plus* supports a maximum of 240 lines, and each DXPT1 board handles up to 24 channels, you can install up to 10 DXPT1 boards in the DXP *Plus* system. You can install these 10 boards in any available universal board slot in the main or expansion cabinets. Of course, any other line boards that you install, such as loop start, DID or multipurpose, reduce the number of lines available for T1 service and thus reduces the number of DXPT1 boards that you can install.

Whenever you install one or more DXPT1 boards, and the DXP *Plus* is receiving its timing signals from an external source, you must install one synchronization card (DXOPT–SYN) on the services board. When you connect the system to central office (CO) lines, you must include a synchronization card, and the DXP *Plus* must be controlled by CO signalling. In installations where the DXP *Plus* supplies the clock signal for the distant system, there is no requirement for DXOPT–SYN cards.

If you plan to use tone dial configured DID or E&M lines with the T1 digital carrier transmission option, you will need to install one or more DTMF receiver cards to the DXP *Plus*. Typically, you will need one DTMF receiver for every six lines. This ratio indicates that you need to add one DTMF receiver card for each DXPT1 board that is configured for 24 DID or E&M lines. In high traffic situations, you may need additional DTMF receiver cards. For information on DTMF receiver card installation, see IMI89–186, *Installing A DTMF Receiver In The DXP Plus Digital Communications System.*

NOTE: The DTMF receiver cards that you add for this purpose are in addition to any you may add to the system to support industry-standard telephone station boards

If you are unfamiliar with the terms and component names associated with the T1 digital carrier transmission option, refer to glossary of terms presented in *Section 8* located at the end of this publication.

CAUTION

For operation with the DXP Plus, the T1 board must be Revision B or higher. If the T1 board that you are installing is a lower revision, contact Comdial Technical Services (1–800–366–8224) for advice before you proceed with the installation..

Printed in U.S.A.

IMI89-193.01

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1.1 Understanding The DXPT1 Board

Through time division multiplexing, the DXPT1 board greatly increases the efficiency and economy of the DXP *Plus* system by providing up to 24 channels on two twisted metallic pairs. This multiplexing technique allows two-way voice or data communications at 1.544 Mbps (million bits per second) with either a central office (CO), public branch exchange (PBX), or another digital communications system (DXP *Plus*). The DXPT1 board includes a built-in customer service unit (CSU) but there is no restriction on adding an external CSU.

When you connect two DXP *Plus* systems together using E&M protocol through the T1 lines, designate one DXP *Plus* as the master and the other one as the slave. In this application, only the slave DXP *Plus* system requires a DXOPT–SYN card.

When the T1 option is installed, the DXP *Plus* supports the following signaling protocols per channel.

- Loop Start (subscriber end only)
- Ground Start (subscriber end only)
- E&M two- or four-wire tie lines
- DID (direct inward dial)

Loop Start and Ground Start will support synchronized ring, hook flash, and pause. Dialing can be DTMF (tone) or dial pulse. For E&M and DID tone operation, check the number of DTMF receiver cards needed in the system

E&M and DID will support wink start, delay dial, and immediate dial (dial pulse only). Dialing can be tone or dial pulse.

1.2 Understanding The DXOPT-SYN Synchronization Card

The DXOPT–SYN card uses a reference timing frequency of 8 KHz that it derives from the 1.544 MHz frequency supplied to the DXPT1 board by the central office (CO) or other external source. By referencing this 8 KHz with 8 KHz timing derived internally, the master 16.384 MHz voltage-controlled oscillator (VCO) can be synchronized. The T1 transmit clock (1.544 MHz) is derived from the 16.384 MHz frequency on the DXPT1 board. If the 1.544 MHz received frequency is incorrect (not within a 200 Hz tolerance), the system may loose synchronization with the CO or other external source. The DXOPT–SYN card reports this condition by turning on the appropriate alarms on the DXPT1 board and DXOPT–SYN card. A loss of clock synchronization causes frame slips that result in data communications errors.

The DXOPT–SYN card allows two timing references (primary and secondary) to be selected. You can select either automatic or manual (for maintenance mode). In the automatic mode, a loss of primary timing causes the system to switch to the secondary timing reference. If both the primary and secondary timing references are lost, the VCO oscillator on the DXOPT–SYN card is defaulted to the fixed 16.384 MHz oscillator on the services board. This results in the loss of T1 clock synchronization.

2.0 Installing Circuit Boards In The Equipment Cabinet

CAUTION

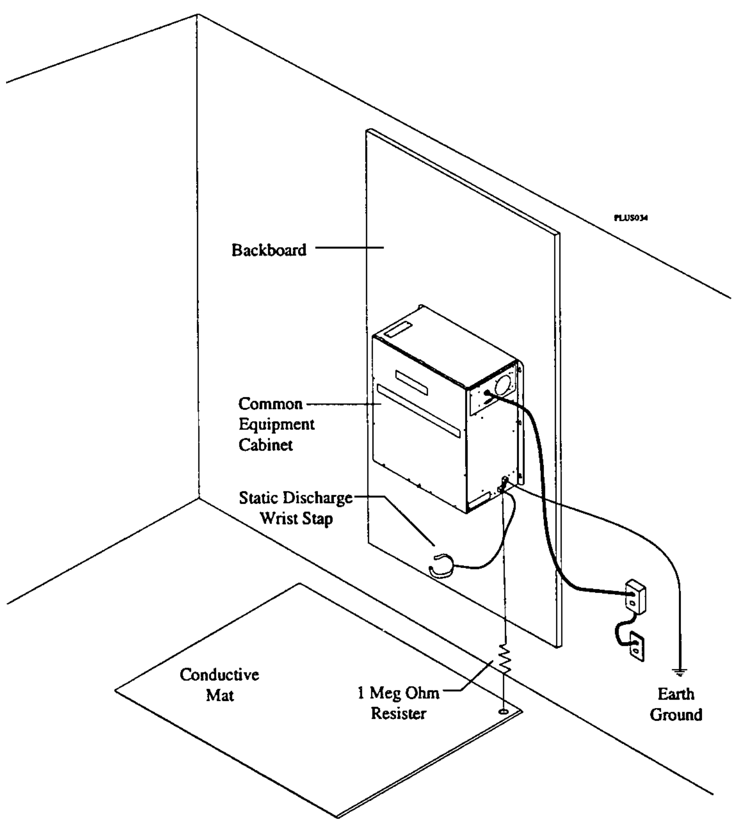
Circuit boards are susceptible to damage caused by electrostatic discharge, and you must keep this fact in mind as you handle the circuit boards. Refer to the Comdial publication IMI01-005, Handling Of Electrostatically Sensitive Components, *for general information. Specific handling precautions are also included in this installation instruction.*

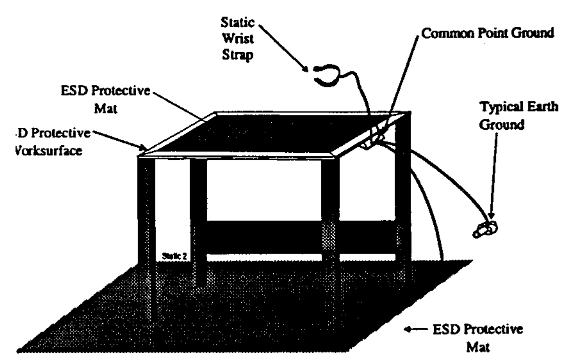
2.1 Creating A Static Safe Work Area

When servicing the common equipment cabinet at the installation location, it is a good practice to place a conductive mat in front of the cabinet area and ground the mat to a good earth ground. (The third wire ground of the AC power line is also an acceptable grounding point.) The grounded conductive mat provides a safe static electric discharge path.

When removing the common equipment cabinet from the installation location for servicing, it is a good practice to prepare a static-safe work area on which to place the cabinet.

You should supply yourself with a static discharge wrist strap, and wear it every time you handle electronic circuit boards either at the cabinet mounting location or at your work area.





Creating A Static Safe Work Area

Providing Static Protection At The Cabinet Mounting Location

3.0 Configuring The DXPT1 Board

Before you install the DXPT1 board, determine if you must meet special system requirements such as fractional service (8 or 16 channel operation). If you do have special system requirements, use the dual in-line pin (DIP) switches provided on the board to re-configure the DXPT1 board.

The DXPT1 board contains 28 DIP switches (three 8-position modules and one 4-position module). Rectangular cutouts in the front-edge panel provide access to these switches.

The eight DIP switches nearest the bottom of the panel are accompanied by eight green LED indicators.

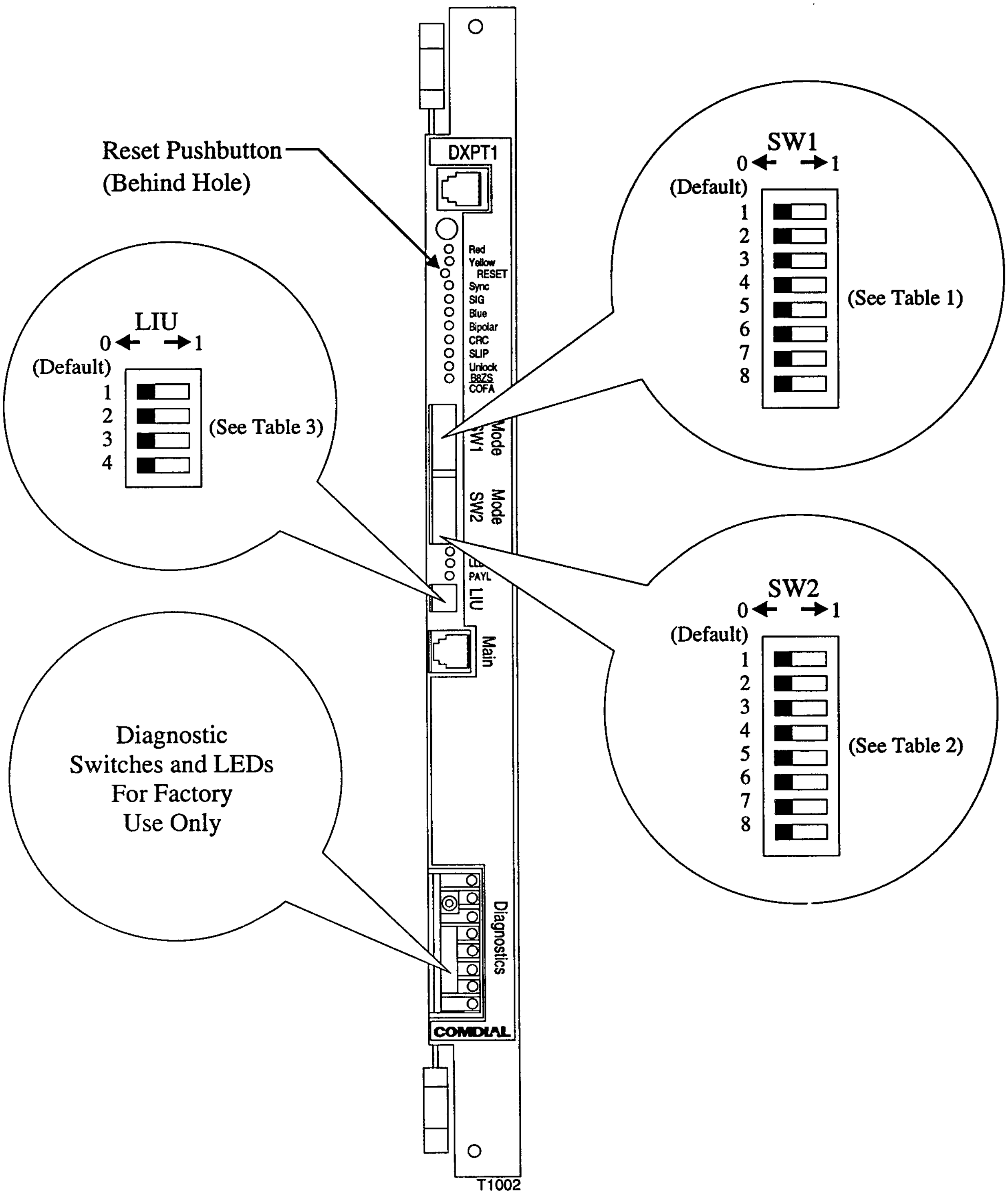
NOTE: These eight switches and their associated indicators are for factory diagnostic purposes only.

The remaining 20 DIP switches labeled SW1, SW2. and LIU are for configuring the DXPT1 board to meet specific operating requirements. See Figure 2. The default setting for all of these switches is 0 (on the left as you face the front edge of the board). This is the standard superframe (SF) configuration for most customer applications. However, special customer needs may require that you reset one or more of these switches using the procedure given below.

1. Obtain a static discharge wrist strap (supplied with the main DXP cabinet) and attach it to one of your wrists. Make sure to adjust the strap for a snug fit against your skin; do not apply the strap over any of your clothing.
2. Connect one end of the wrist strap-cord to the wrist strap and the other end to earth ground.

NOTE: With the DXP cabinet in the installed position, the ground lug on the right side of the cabinet is normally a good grounding point since this lug should have a heavy ground wire connected between it and a good earth ground.

3. Remove the DXPT1 board from its static protection bag and set it on a static-safe work area.
4. Using a ball-point pen or similar object, move the DIP switches from left (0 position) to right (1 position) as needed. All DIP switches are facing left for typical applications. See Tables 1, 2, and 3 for descriptions of the DIP switches.



Locating The DIP Switches

3.1 Understanding The T1 Options (SW1–1 Through SW1–8)

The following T1 operating modes are described to help you understand the many options that you can select with DIP switches SW1–1 through SW1–8 on the DXPT1 board.

3.1.1 T1 General Operation

T1 is the digital two-way transmission of telecommunications over a single high-speed circuit. Up to 24 separate voice or data transmissions form digital pulses that are transferred at the rate of 1.544 million bits per second (Mb/s) over the T1 trunk. At the receiving end, the digital pulses are decoded into 24 separate circuits.

Pulse characteristics such as repetition rate, pulse width, pulse amplitude, and average ones density ((ratio of one (1) bits to zero (0) bits)) are as specified by digital signal level 1 (DS-1) described in American National Standards Institute Specification, ANSI T1.403-1989.

3.1.2 Framing Modes

Digital data is handled most efficiently when it is organized into frames. A frame of digital information consists of 193 bits (24 channels x one eight-bit word + one framing or control bit). The framing bit is used for frame identification when multiple frames are used.

The frame repetition rate is eight thousand frames per second (8 Kf/s).

This option uses either of two framing formats—superframe (SF) and extended superframe (ESF).

The superframe format contains 12 frames. In the 6th and 12th frames, the voice information in the eighth (least significant) bit positions is overwritten with signaling information. This signaling method is called robbed-bit signaling. The robbed bits in the 6th and 12th frames are designated signaling bit A and B respectively.

The extended superframe format extends the framing boundaries to include 24 frames . The ESF format provides improved maintenance capability over the SF format. In this format, 24 framing bits (or 8 Kb/s) are available to provide the following:

- framing synchronization (2 Kb/s)
- facility data link (FDL) (4 Kb/s)
- CRC-6 error check (2 Kb/s)

The robbed bits from the 6th, 12th, 18th, and 24th frames are used for signaling. Therefore, two additional signaling paths are available—signaling bits C and D (future).

3.1.3 Signaling Type

Channel associated signaling (CAS) is a signaling method employing robbed bits. The signals using the robbed bits are related to the same channel as the one carrying the information. CAS is currently the only signaling-type option available for this equipment.

3.1.4 Yellow Alarm

A yellow alarm is a signal transmitted by a digital communications system when that system has lost synchronization to the incoming signal. Communications can be restored if a a yellow alarm lasts less than four seconds. After four seconds, a red alarm (out-of-service) is issued and all calls are set to on-hook. When the system is using the superframe format, the transmitted yellow alarm signal contains binary zeros (0s) in the second bit positions of all 24 channels. This is the default setting for DIP switch SW1–4.

The 12th frame method (used in Japan) forces the framing bit for the 12th channel to a binary one (1). This is detected by the receiving system as a yellow alarm.

In the extended superframe format, the system that has lost synchronization to the incoming signal will transmit a 16-bit pattern consisting of eight one (1) bits followed by eight zero (0) bits over the facility data link (FDL) to represent a yellow alarm.

3.1.5 Zero Suppression

There are two ways to avoid system timing problems when eight or more successive zero (0) bits are transmitted. One method is B7 suppression and the other is bipolar 8-zero substitution (B8ZS). For pulse modulated voice (PCM), eight consecutive zero (0) bits should never occur.

B7 suppression is a technique that forces a one (1) bit in the 7th bit position when all of the bits in a binary word are zero (0). The resulting distortion in a voice circuit is negligible. However, this technique could induce errors if it was used in digital data transmissions.

Digital information transmitted over T1 trunks is bipolar; that is, the binary ones (1s) pulses (marks) alternate between a positive and a negative voltage level. The bipolar 8-zero substitution (B8ZS) method substitutes four bits in bit positions four, five, seven, and eight when eight zero (0) bits occur in a binary word. The substituted bits are inserted in a unique pattern that causes a bipolar error. The B8ZS binary words containing the deliberate bipolar errors are detected at the receiving terminal where the errant bipolar pulses are removed and substituted with all zero (0) bits. Because the received binary words are returned to their original bit patterns (all binary zero bits), a clear channel is provided for error-free digital data transmission. Both ends of the communications link must be configured to use B8ZS. (B8ZS is a feature designed for future requirements.)

3.1.6 Fractional T1

Fractional T1 is when you use only a portion of a T1 trunk, as needed. On the DXP *Plus* you must set DIP switches SW1–7 and SW1–8 for 24 channel operation. This setting allows the system to pass error information end-to-end when operating fractional T1 with the ESF format.

Setting The SW1 DIP Switches

Switch Number	Switch Position	Function
1 (top)	0 (default) 1	FRAME MODE superframe mode (SF) extended superframe mode (ESF)
2	0 (default) 1	SIGNALING TYPE channel associated signaling (CAS) reserved
3	0 (default) 1	RESERVED FOR FUTURE USE reserved reserved
4	0 (default) 1	YELLOW ALARM TYPE bit 2 of all channels method 12 frame method (Japanese)
5,6	0, 0 (default) 0,1 1,0 1,1	ZERO SUPPRESSION B7 suppression B8ZS suppression (digital data) no suppression no suppression
7,8	0,0 default)	CHANNEL CAPACITY 24 channel capacity

NOTE: SW1–1 through SW1–8 switches are read only when you apply power to the board or do a manual reset. With power on, manually reset the board by inserting a slender object, such as a straightened-out paper clip, into the small hole located between the Yellow and Syn LEDs on the front-edge panel. You can also reset the board remotely from a video display terminal or personal computer. A reset causes a T1 service disruption.

3.2 Understanding The T1 Options (SW2–1 Through SW2–8 And LIU–1 Through LIU–4)

The following T1 operating modes are described to help you understand the many options that you can select with DIP switches SW2–1 through SW2–8 and LIU–1 through LIU–4 on the DXPT1 board. DIP switches designated LIU are associated with the DXPT1 board's line interface unit.

3.2.1 Loopback

Loopback is the maintenance routine used to verify the receive function (local or remote) and to isolate system problems. When using the superframe format, the customer interface (CI) loopback option from the network, if provided, can be activated from the network via in-band signaling (per ANSI T1.403, 1989, SECTION 8.3.1.1). Framed code words activate and deactivate loopback routines when the option is enabled with DIP switch SW2–1. The default setting is off, but many central offices will support SF loopback. *See your central office representative to ensure that you are complying with their requirements.*

You access remote and payload loopback operation via the facility data link when using the extended superframe format.

You can manually make three different types of loopback requests depending on the option you select using DIP switches SW2–7 and SW2–8. These are: local, remote, and payload loopback. When using payload loopback (ESF format only), all channel bits maintain bit-sequence integrity but the framing bit is re-established.

3.2.2 Customer Service Unit (CSU) Identification Bit

You can set the message-oriented (C/R) bit transmitted over the ESF data link by DIP switch SW2-2 to be a zero (0) bit or a one (1) bit. The C/R bit is used to identify the T1 signal origin as being either from customer premise equipment (CPE) or carrier equipment such as a CSU.

Set C/R to be a zero (0) bit for customer premise equipment (CPE) or when using an external CSU (default).

Set C/R to be a one (1) bit if the network requires the T1 internal CSU to be classified as carrier equipment.

3.2.3 Cyclic Redundancy Check (CRC-6)

This is a method for checking the accuracy of data transmissions when using the ESF format. This method uses a polynomial algorithm based on the content of a superframe of data. When CRC-6 checking is enabled via DIP switch SW2–4, an alarm will be activated whenever a CRC code (checksum) is received over the ESF data link that does not match the locally calculated code (checksum).

3.2.4 Yellow Alarm During ANSI Messages On The Facility Data Link

When using the ESF format, the facility data link is available for reporting transmission performance information once a second. Normally, these transmissions are inhibited by yellow alarms. However, you can set DIP switch SW2-5 to allow these transmissions during yellow alarms.

3.2.5 Green B8ZS/COFA LED Definition

The green LED on the DXPT1 board's edge-panel labeled "B8ZS/COFA" indicates either that B8ZS code words are being received or that a change of frame alignment (COFA) occurred during the last synchronization by the external T1 source or carrier equipment. You can determine which condition you want reported by how you set DIP switch SW2–6. The default setting is for "COFA" reporting.

3.2.6 Receive Sensitivity

The equalizer gain logic (EGL) determines how sensitive the receive circuits are to the incoming signals. You set the level for -26 dB or -36 dB by using DIP switch LIU-1. (Normally, the -26 dB level setting is the better choice.)

3.2.7 Transmit Level Attenuation

You can manually set the transmit level for a particular value (0, -7.5, -15, or -22.5 dB) or select the automatic feature that sets the transmit level automatically depending on the receive signal. A weak receive signal causes a strong transmit signal and vice versa. Use DIP switch LIU–2 to select either the manual or the automatic setting. If you select the manual setting, set the desired value with DIP switches LIU–3 and LIU–4. Normally, 0 dB is used when connecting to a network interface box.

Setting The SW2 DIP Switches

Switch Number	Switch Position	Function
1 (top)	 0 (default) 1	superframe NETWORK IN-BAND loopback disabled enabled
2	 0 (default) 1	CSU ID (C/R) BIT (ESF MODE) C/R bit = 0 designates customer premise equipment (CPE) C/R bit = 1 designates carrier equipment
3	 0 (default) 1	RESERVED FOR FUTURE USE reserved reserved
4	 0 (default) 1	CRC (CYCLIC REDUNDANCY CHECK) FOR ESF MODE disabled enabled
5	 0 (default) 1	FDL YELLOW ALARM DURING ANSI MESSAGES disabled enabled
6	 0 (default) 1	B8ZS/COFA LED DEFINITION COFA (change of frame alignment) B8ZS detect
7,8	 0,0 (default) 0,1 1,0 1,1	MANUAL loopback REQUEST no loopback local loopback request remote loopback request payload loopback request (ESF only)

NOTE: *When changing DIP switch SW2–2 or SW2–5, you must reset the board before the switch is read. With power on, manually reset the board by inserting a slender object, such as a straightened-out paper clip, into the small hole located between the Yellow and Syn LEDs on the front-edge panel. You can also reset the board remotely from a video display terminal or personal computer. A reset causes a T1 service disruption.*

Setting The LIU DIP Switches

Switch Number	Switch Position	Function
1 (top)	 0 (default) 1	RECEIVE SIGNAL SENSITIVITY -26 dB -36 dB
2	 0 (default) 1	TRANSMIT LEVEL MODE Automatic (level set by receive signal) Manual (level set by switches 3 and 4 below)
3,4	 0,0 (default) 0,1 1,0 1,1	TRANSMIT LEVEL ATTENUATION (LIU-2 must be "1") 0 dB -7.5 dB -15 dB -22.5 dB

4.0 Installing The DXPT1 Board

1. Normally you should disconnect the AC power cord from the AC outlet and disconnect the optional battery back-up assembly from the main cabinet power supply; however, when necessary, you can install a DID line board in an operating system. If you must do this, connect one end of a standard telephone handset coil cord to the precharge port on the power supply. During step 6, you will connect the other end of this coil cord to the precharge jack on the line board.
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground
3. Loosen the retaining hardware and lift the front panel away from the common equipment cabinet.

NOTE: *With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.*

4. Each DXPT1 line board is supplied in a static protection bag for safe keeping. When you are ready to install the board, remove it from its static protection bag.
5. Locate the proper board slot.
   - On DXP *Plus* systems the DXPT1 line boards connect to any universal slot.

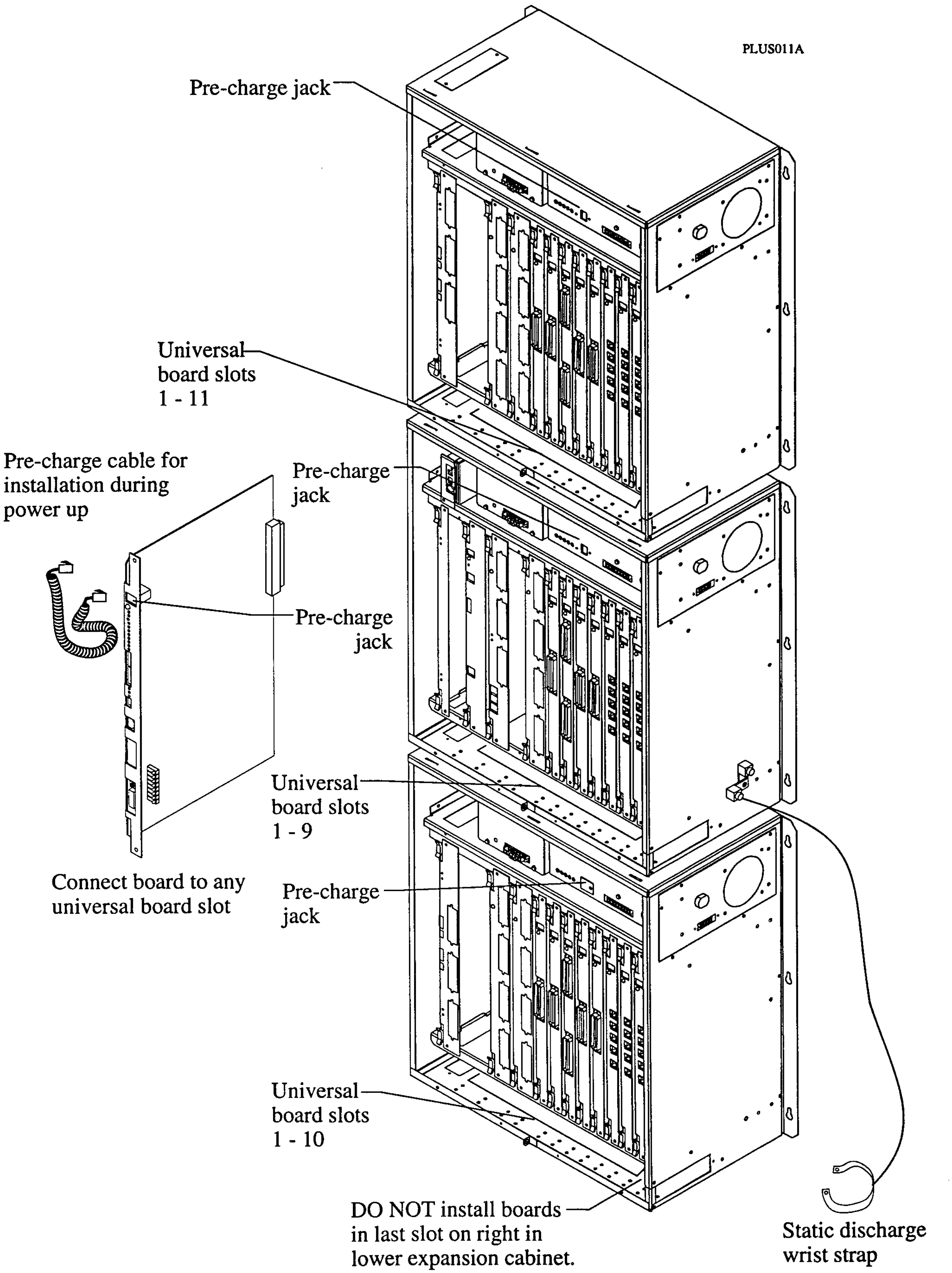
NOTE: On DXP Plus systems, do not install a DXPT1 line board at the right-most board slot in the second (or lower) expansion cabinet. The system reserves this slot for internal use.

6. If you are installing the DXPT1 line board in an operating system, connect the free end of the precharge cord that you installed in step 1 to the precharge jack on the line board.
7. Orient the DXPT1 line board with its top and bottom guides in main cabinet board cage, and press the board firmly until its board edge connection properly mates with the connector on cabinet's backplane. If you connected a handset cord between the pre-charge port on DXP *Plus* power supply and the jack on DXPT1 line board (as directed in step 6), disconnect it after installing board.

CAUTION

When pressing circuit boards into place, press them only at the extractor lever locations.
If you apply pressure at other locations you may damage the board assembly.

8. Repeat steps 3 and 4 until all DXPT1 line boards are installed.
9. Make a final inspection to ensure that all boards are, oriented correctly and mated properly.
10. Install and tighten the supplied screws to secure the circuit boards to the board cage. **Do not neglect this step! It is important because it helps in providing a protective ground condition for the board thus ensuring RFI (radio frequency interference) and lightning protection.**



Installing The DXPT1 Board

4.1 Connecting The T1 Trunk

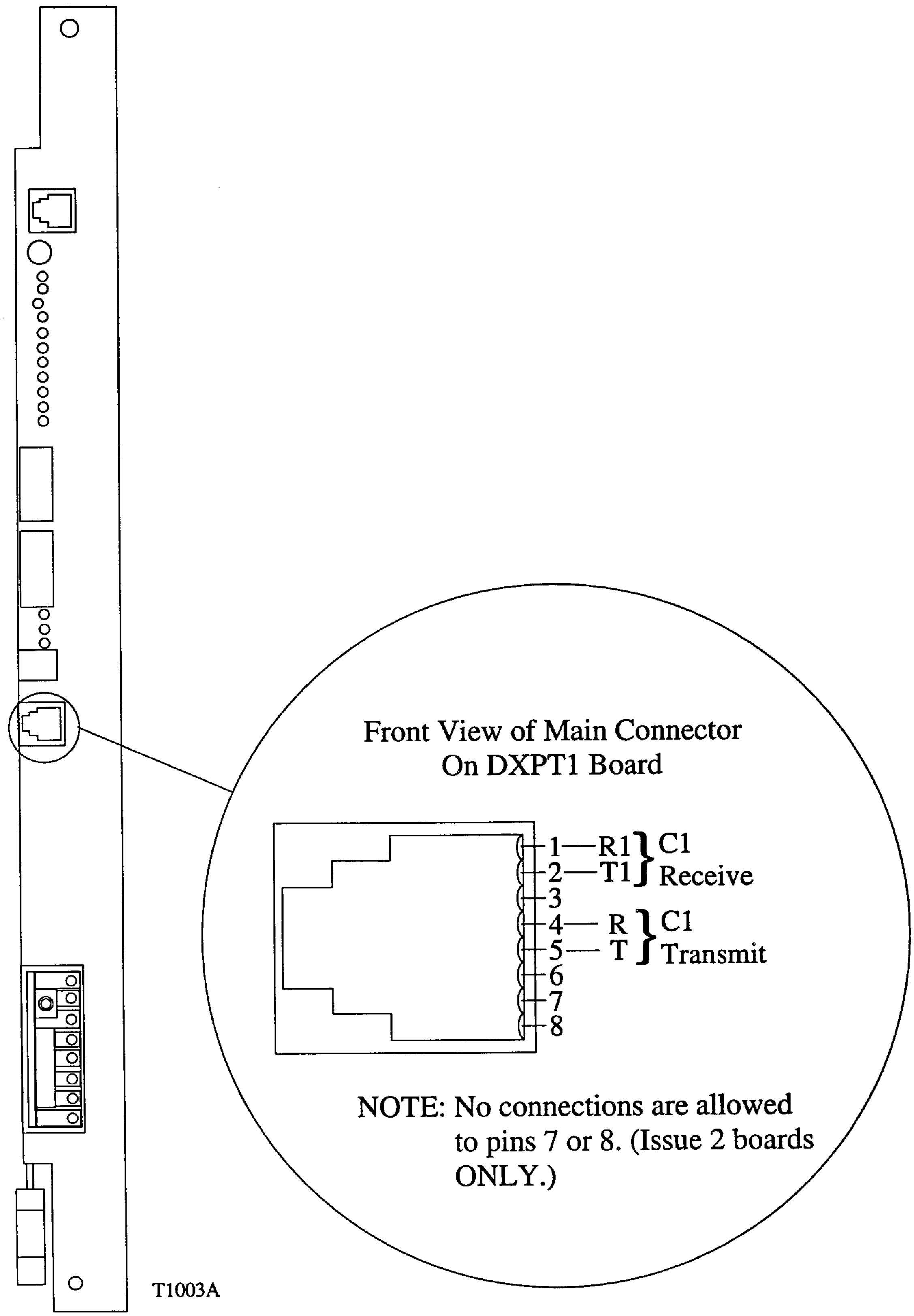
Terminate the end of the T1 trunk with a miniature 8-pin modular plug, and plug it into the main jack on the front edge of the DXPT1 board.

The DXPT1 board contains a built-in CSU that protects the DXP *Plus* from voltage surges, provides transmission drive up to 6,000 feet, and performs diagnostic tests for the network. Therefore, a customer-supplied CSU is not necessary unless your customer requires this addition.

If a direct connection to a repeater is within a few hundred feet, the transmit signal from the DXPT1 board may overdrive the repeater. Repeaters normally operate best with -7.5 to -23 dB input signals. Arrange LIU switches 2, 3, and 4 to set the transmit signal level (0 dB is default).

IMPORTANT CAUTION

To help ensure that external over-voltage surges do not damage the system, Comdial engineers suggest that you install a properly-grounded gas discharge tube or a similar primary protection device on the T1 trunk where it enters the building. If the site includes a network interface box, verify that there is standard lightning protection installed externally to the box on its network side. Primary protection where the cable enters the building is necessary to prevent a fire hazard inside the building.



Connecting The TI Trunk To The DXPT1 Circuit Board

4.2 Detailing The T1 Cable Requirements

Normally, the DXPT1 board connection to a central office is via a network interface box (smart jack). The box is usually small with an 8-pin modular telephone jack for connecting to the customer premise T1 equipment (DXPT1). For short lengths of approximately 200 feet or less, use a standard telephone cable with an 8-pin modular plug for connection to the DXPT1. Make straight-through connections for pins 1, 2, 4, and 5 when using these plugs on both ends of the cable. (Do not connect Pins 7 and 8.)

When spanning distances greater than 200 feet, use a low-capacitance cable (data-grade cable) having two twisted, solid-conductor wire pairs with shielding. The type of cable with metal shielding covering each twisted pair provides the best immunity from electrical interference. Only connect the shielding to earth ground at one end of the cable—*do not ground the shielding at the other end of the cable.*

When connecting the local DXP *Plus* directly to another DXP *Plus* system, be sure to connect the transmit pair (pins 4 and 5) of the local system to the receive pair (pins 1 and 2) of the distant system. Likewise, connect the receive pair (pins 1 and 2) of the local system to the transmit pair (pins 4 and 5) of the distant system.

4.3 Understanding The DXP Plus Logical Numbering

Because there are no dedicated station or line ports in the DXP *Plus*, the system uses an automatic configuration method to logically number its stations and lines. Automatic configuration occurs after you perform a master clear on the system.

How automatic configuration works

With automatic configuration, the system does a search for all installed station and line boards in the main and expansion cabinets, and assigns a logical number for each provided station and line encountered during the search. The search begins in the main cabinet at the left-most universal slot and proceeds left to right. The search then moves to the upper expansion cabinet where it searches left-most slot to right-most slot. The search finally moves to the lower expansion cabinet where it again searches left-most slot to right-most slot. When automatic configuration is finished, the system has logically numbered all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system.

How logical number and physical location relate to one another

The logical number of a station or line corresponds to its relationship to other stations or lines in the system but is not dependent upon the board's placement in the cabinet. The physical location of a station or line corresponds to the order of the system's board slots. The main cabinet contains slots 1–9, the upper expansion cabinet contains slots 10–20, and the lower expansion cabinet contains slots 21–30. Therefore, even if the first encountered station board is located in slot five of the main cabinet, the system still assigns logical number one to the first station provided by that board. During installation, you can skip slots. For example, you can install eight-line, loop start, line boards in only slots one and 30 if you wish. In this case, slot one yields logical line numbers 1–8 and slot 30 yields logical line numbers 9–17.

Where you can place circuit boards

Each installed board requires timing circuits equal to its capacity. For example, a 16–station board requires 16 timing circuits, an eight–line loop start line board requires eight circuits, and a fully configured T1 trunk board requires 24 timing circuits. In the DXP *Plus,* each universal slot provides 32 timing circuits. Because of this timing circuit provision of each slot, you can place any station or line board at any slot location with no restrictions.

Adding boards without renumbering

If you install or relocate a station or line board, this board does not operate until you take appropriate programming action. If you use an available open slot for adding or relocating a board, that board's stations or lines assume logical numbers in sequence after the system's last assigned logical station or line number. For example, if the system's last logical station number is 24, the logical numbers of the newly installed board's stations begin at logical number 25.

After you remove a board and delete it through programming, that board's logical numbers are available for reassignment. This means that you can remove a board, add or move another board, take the appropriate programming action, and have the stations or lines of the added or relocated board assume the logical numbers made available by the removed board. For example, if the system's last logical number is 64 and you remove the board providing stations with logical numbers 1–16 and delete it through programming, the stations on an added board assume logical numbers beginning with 1 instead of 65. However, if you remove and program delete an eight-station board and add a 16-station board, the first eight stations stations on the added board assume logical numbers 1–8 and the last eight stations assume logical numbers 65–72.

Remember, should you master clear the system, the automatic configuration feature logically numbers all station and line ports in ascending order from the left-most slot to right-most slot throughout the entire system. This action renumbers those station and lines provided by boards that you have added or relocated since you last performed the system master clear.

5.0 Installing The Syncronization Card On The Services Board

Whenever you install one or more DXPT1 boards, and the DXP *Plus* is receiving its timing signals from an external source, you must install one synchronization card (DXOPT–SYN) on the services board using the following procedure.

NOTE: *Whenever you install one or more DXPT1 boards, and the DXP Plus is receiving its timing signals from an external source, you must install one synchronization card (DXOPT–SYN) on the services board. When you connect the system to central office (CO) lines, you must include a synchronization card, and the DXP Plus must be controlled by CO signalling. In installations where the DXP Plus supplies the clock signal for the distant system, there is no requirement for DXOPT–SYN cards and you do not need to perform this procedure.*

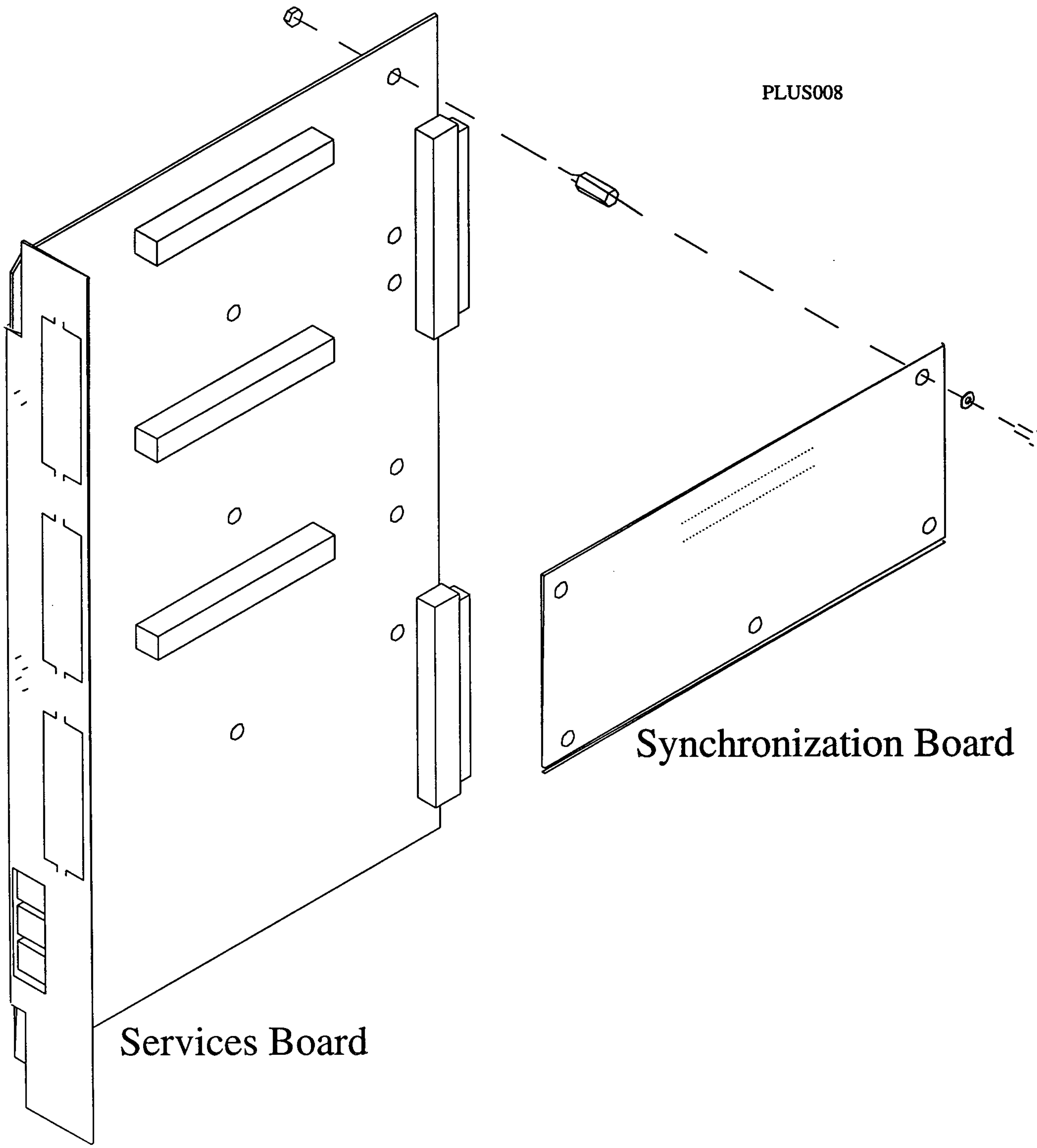
1. Switch off the DXP *Plus* power supply, disconnect the AC power cord from the AC outlet and disconnect the optional battery back-up assembly from the main cabinet power supply
2. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground
3. Loosen the retaining hardware and lift the front panel away from the common equipment cabinet.

NOTE: *With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.*

CAUTION

Do not remove or install the services board while the DXP Plus is powered-on or severe system problems may occur.

4. Locate the services board, loosen the retaining screws, remove it from the main cabinet, place it in a static protection bag, and transport it to the static-safe work area.
5. At the static-safe work area, with your wrist strap in place, remove the services board and the DXOPT–SYN card (if used) from their static protection bags.
6. Refer to the illustration, and install the DXOPT–SYN card at the top position on the services board with the supplied hardware. (Actually, you can use any of the three positions; however, other non-related option cards require installation in the lower positions so it is best to leave these positions open for those other uses.).
7. Use the method detailed in *Section 5.1* to set the strapping switches on the services board. If you wish, refer to step 8 for details, and transport the board assembly to the cabinet installation site before you set the strapping switches.
8. Place the services board with the newly installed DXOPT–SYN card into a static protection bag and transport the assembly back to the main cabinet.



Installing The Synchronization Card On The Services Board

5.1 Configuring The Services and Interface Boards

The DXP *Plus* extracts clocking information from the central office (CO) that supplies the T1 lines, and routes this information to the DXOPT–SYN sync card. The sync card uses this clocking information to derive the synchronizing signal for the DXPT1 board's transmit clock signal. Therefore, the DXPT1 board's transmit clock is slaved to the CO supplying the T1 lines. If there is only one CO supplier, that source is the primary clock source; however, if there are two different suppliers of T1 lines, use the more reliable T1 supplier as the primary source and the other T1 supplier as the secondary source.

You must designate one DXPT1 board as the primary board. Choose this board from among those boards that interface the T1 lines supplied by the primary CO supplier. Designate the primary board by placing straps on the DXSRV–480 services board and by setting DIP switches on the expansion cabinet interface boards.

If you system has only one CO supplier, you do not need to designate a secondary board; however, if the system has a second CO supplier of T1 lines, you must designate one DXPT1 board as the secondary board. Choose this board from among those boards that interface the T1 lines supplied by the second CO supplier. Designate the secondary board by placing straps on the services board or by setting DIP switches on the expansion cabinet interface boards.

If you designate primary and secondary boards to the system even though there is only one CO clock source, the DXOPT–SYN card functions as though it is receiving two clock signals and lights both ***PRI*** and ***SEC*** LEDs on the front edge of the card.

5.1.1 Summerizing the Strapping

DXPT1 Cabinet Location	Services Board Strap PRIMARY or SECONDARY*	Expansion Cabinet Interface Board Switch Setting SWA or SWB**
Main -UNV1	A	
Main–UNV2	B	
Main–UNV3	C	
Main–UNV4	D	
Main–UNV5	E	
Main–UNV6	F	
Main–UNV7	G	
Main–UNV8	H	
Main–UNV9	I	
Upper Expansion–UNV1	J or K	1
Upper Expansion–UNV2	J or K	2
Upper Expansion–UNV3	J or K	3
Upper Expansion–UNV4	J or K	4
Upper Expansion–UNV5	J or K	5
Upper Expansion–UNV6	J or K	6
Upper Expansion–UNV7	J or K	7
Upper Expansion–UNV8	J or K	8
Upper Expansion–UNV9	J or K	9
Upper Expansion–UNV10	J or K	10
Upper Expansion–UNV11	J or K	11
Lower Expansion–UNV1	L or M	1
Lower Expansion UNV2	L or M	2
Lower Expansion UNV3	L or M	3
Lower Expansion UNV4	L or M	4
Lower Expansion UNV5	L or M	5
Lower Expansion UNV6	L or M	6
Lower Expansion UNV7	L or M	7
Lower Expansion UNV8	L or M	8
Lower Expansion UNV9	L or M	9
Lower Expansion UNV10	L or M	10

* Strap PRIMARY block for primary DXPT1 and/or strap SECONDARY block for secondary DXPT1.
** Switches A and B do not designate primary or secondary—they designate the first and second DXPT1 boards installed in an expansion cabinet.

5.1.2 Setting The Strapping

Configure the services and interface boards by performing the steps in the following process.

1. Install your static discharge wrist strap on your bare wrist; adjust it for a snug fit. Be sure that the strap is touching bare skin and is not isolated by clothing. Connect the wrist strap cord between the wrist strap and an AC or earth ground

NOTE: With the common equipment in the installed position, the ground lug on the side of the cabinet is an appropriate grounding point since it should have a heavy ground wire connected between it and a good earth ground.

2. Remove the services board assembly from the static protection bag.
3. Identify the main cabinet board slots where you will install the DXPT1 boards, and the primary and secondary (if available) CO line supplier. With this knowledge, designate one DXPT1 board as primary and another DXPT1 board as secondary by placing straps on the services board.

   (a) **If you install one DXPT1 board in the main cabinet**, you must strap one pin-pair (A–I) on the services board's PRIMARY strap block. This strap designates the main cabinet slot where you installed the DXPT1 board.

   Example: If you install a DXPT1 board in universal slot two in the main cabinet, you must strap pin-pair B on the PRIMARY strap block .

   (b) **If you install two or more DXPT1 boards in the main cabinet**, you must designate one board as the primary board and another as the secondary board. After you have made these designations, you must strap one pin-pair (A–I) on the services board's PRIMARY strap block and one pin-pair (A–I) on its SECONDARY strap block to designate the main cabinet slots where you have installed the primary and secondary boards.This action designates the primary clock source for the DXOPT–SYN card.

   Example: If you install two DXPT1 boards in universal slots two and three in the main cabinet and you designate these boards primary and secondary respectively, you must strap pin-pair B on the PRIMARY strap block and strap pin-pair C on the SECONDARY strap block.

4. Identify the expansion cabinet slots where you will install the DXPT1 boards and the primary and secondary (if available) CO line supplier. With this knowledge, designate one DXPT1 board as primary and another DXPT1 board as secondary by placing straps on the services board and setting DIP switches on the expansion cabinet interface board.

   (a) **If you install one DXPT1 board in an expansion cabinet**, you must strap one pin-pair (J–M) on the services board's PRIMARY strap block. This strap designates the expansion cabinet where you have installed the board. You must also close a DIP switch in switch bank A on the expansion cabinet's interface board to designate the expansion cabinet slot where you installed the DXPT1 board.

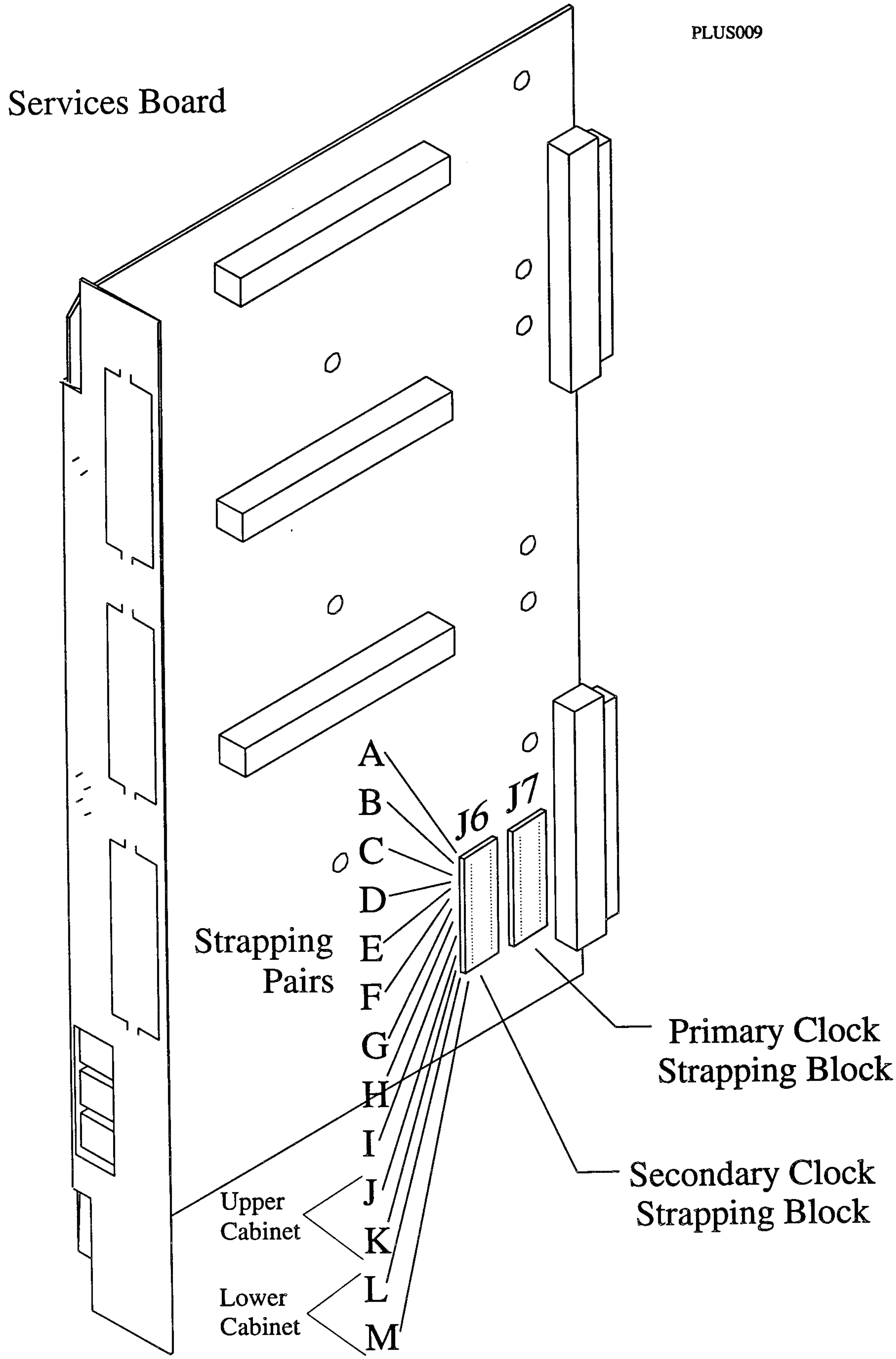
   Example: If you install the DXPT1 board in universal slot 2 of the upper expansion cabinet, strap pin-pair J on the PRIMARY strap block, and close SWA–2 on the upper expansion cabinet's interface board.

   (b) **If you install two or more DXPT1 boards in an expansion cabinet**, you must designate one board as the primary board and another as the secondary board. After you have made these designations, you must strap one pin-pair (J–M) on the services board's PRIMARY strap block and one pin-pair (J–M) on its SECONDARY strap block to designate the expansion cabinet where you have installed the primary and secondary boards. You must also close a DIP switch on switch bank A and another on switch bank B on the expansion cabinet's interface board to designate the expansion cabinet slots where you installed the primary and secondary DXPT1 boards. Do this same procedure if you use both expansion cabinets.

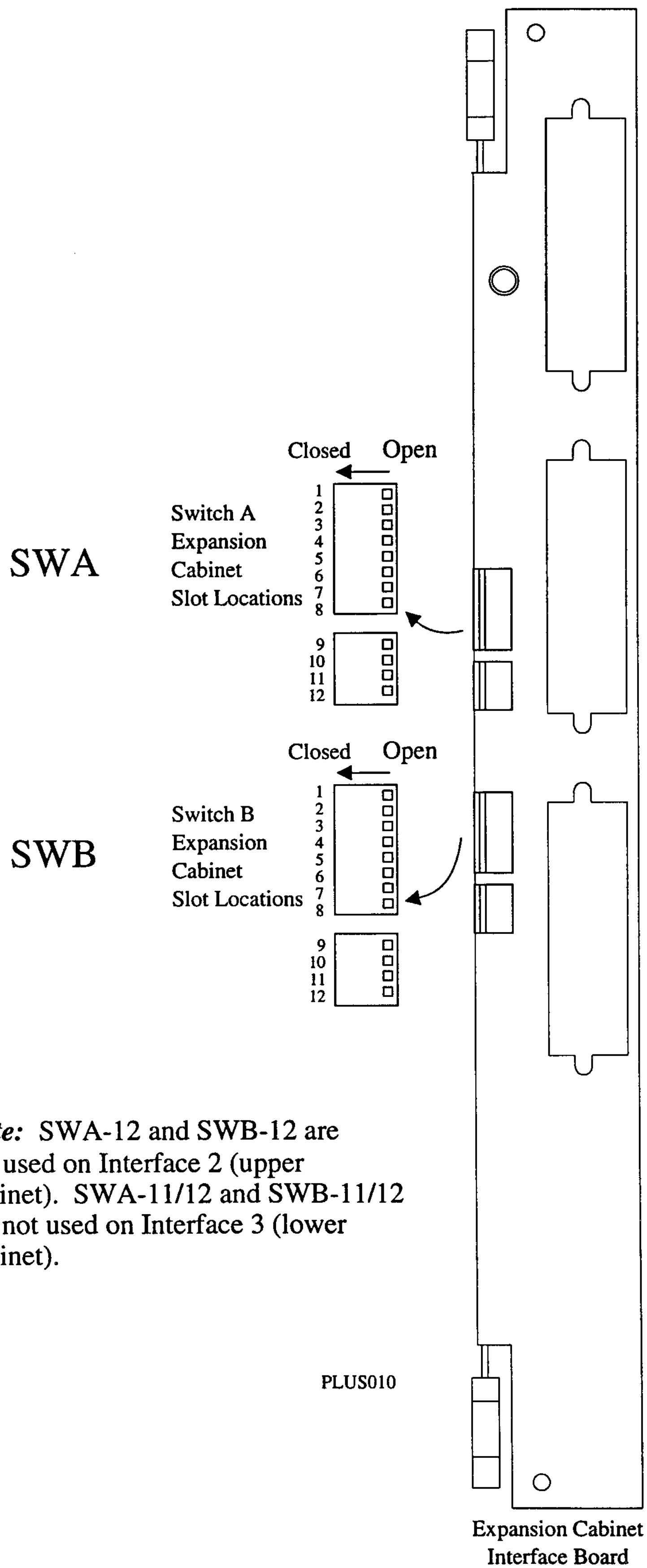
   Example: If you install two DXPT1 boards in universal slots two and three in the upper expansion cabinet and you designate these boards primary and secondary respectively, you must strap pin-pair J on the PRIMARY strap block and strap pin-pair K on the SECONDARY strap block. You also must close SWA–2 and SWB–3 on the upper expansion cabinet's interface board.

5. If the system requires **DXPT1 boards in both main and expansion cabinets**, identify the cabinet slots where you will install the DXPT1 boards and the primary and secondary (if available) CO line supplier. With this knowledge, designate any one DXPT1 board as primary and any other DXPT1 board as secondary by placing straps on the services board and setting DIP switches on the expansion cabinet interface board.
   You must either strap one pin-pair (A–M) on the services board's PRIMARY strap block or strap one pin-pair (A–M) on its SECONDARY strap block. The DXPT1 board designation of primary or secondary and the cabinet you use for its installation determines which services board pin-pair you use. You must also close a DIP switch (SWA or SWB, 1–11) on the appropriate expansion cabinet's interface board to designate the expansion cabinet slot where you installed the opposite DXPT1 board.

   Example: If you designate the DXPT1 board that you install in universal slot 2 of the main cabinet as the primary board, strap pin-pair B on the services board PRIMARY strap block. If you designate the DXPT1 board that you install in universal slot 2 in the upper expansion slot as the secondary board, strap pin-pair J on the services board SECONDARY strap block, and close SWA–2 on the upper expansion cabinet's interface board.



Locating The Services Board Strapping Blocks



SWA and SWB switches not in use must be in "off" (open) position!

Note: SWA-12 and SWB-12 are not used on Interface 2 (upper cabinet). SWA-11/12 and SWB-11/12 are not used on Interface 3 (lower cabinet).

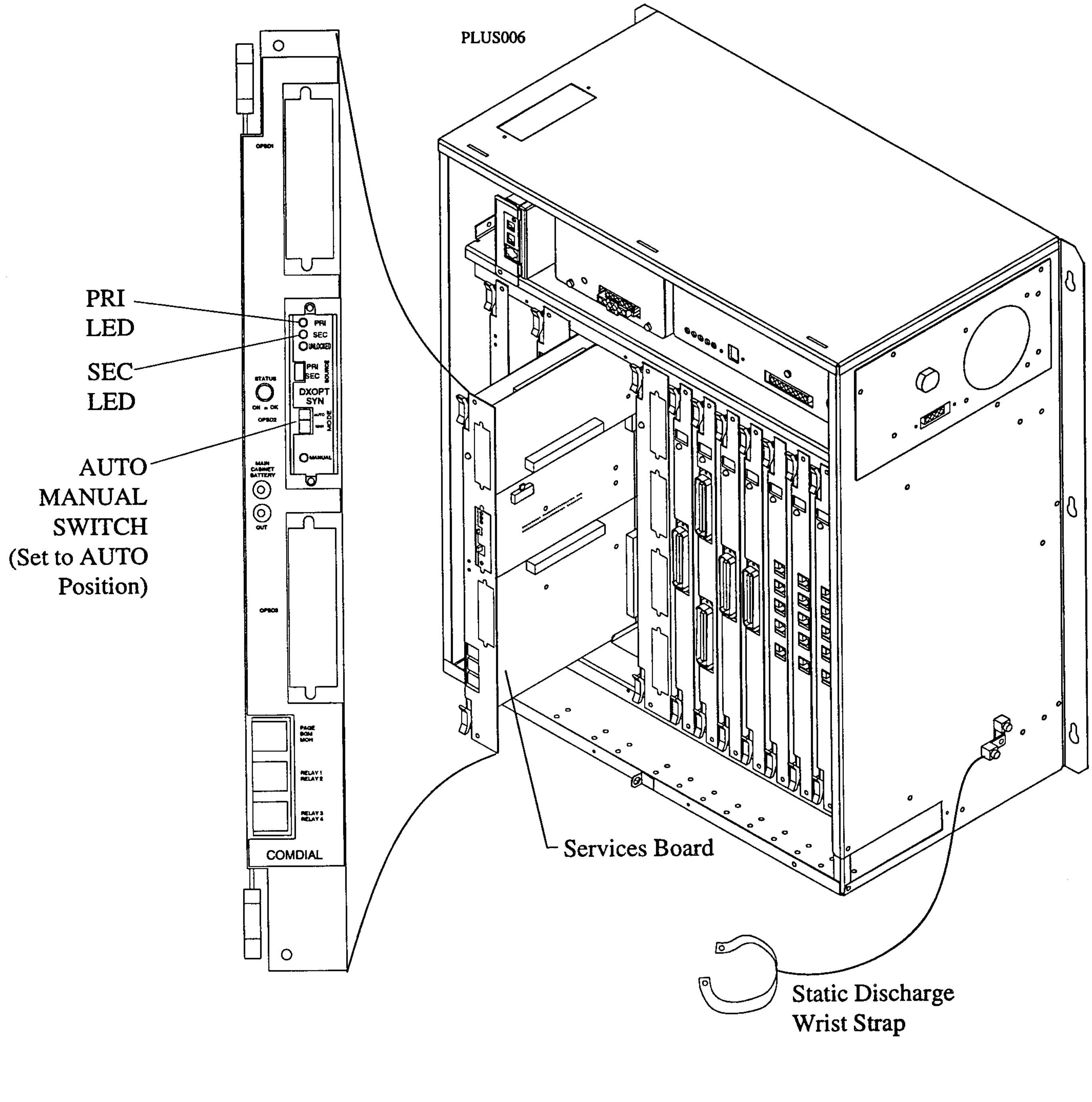
Locating The Interface Board DIP Switches

5.2 Installing The Services Board Assembly

1. With your static discharge wrist strap still properly installed, install the services board in the main cabinet.
2. If the installation includes a DXOPT–SYN card, make sure the lower (larger) slide switch on the front edge of the card is in the up **AUTO** position. Leave the upper (smaller) switch in either position as it has no effect when the automatic mode is selected.
3. Orient the services board assembly with its top and bottom guides in main cabinet board cage, and press the board firmly until its board edge connection properly mates with the connector on cabinet's backplane.

   CAUTION

   When pressing circuit boards into place, press them only at the extractor lever locations. If you apply pressure at other locations you may damage the board assembly.
4. Make a final inspection to ensure that the board assembly is oriented correctly and mated properly.
5. Install and tighten the supplied screws to secure the board assembly to the board cage.
6. If applicable, plug the power cable from the optional external battery assembly into the DXP power supply.
7. Connect the AC power cord to the AC wall outlet and turn the power switch on. If no alarms are on (red LEDs), and at least one of the green **PRI** or **SEC** LEDs is lit, replace the cabinet's front panel; otherwise, troubleshoot the installation for errors.



Installing The Services Board Assembly

6.0 Understanding The T1 Alarms And Indicators

Most of the T1 alarms and indicators (LEDs) are located on the front-edge panel of the DXPT1 board, while several are located on the front edge of the DXOPT-SYN card. The following sections discuss the alarms and indicators.

NOTE: Red /Yellow LEDs, when lit, indicate errors or non-standard configuration for normal operation.

Red Alarm (red LED)	When this LED indicator is lit, the system cannot establish communications with the network.
Yellow Alarm (yellow LED)	The yellow alarm is lit whenever the far end has lost synchronization to its incoming signal. In the superframe format, a transmitted yellow alarm has a zero (0) bit in the second bit position of every eighth-bit. In the extended superframe format, a transmitted yellow alarm consists of repeating 16-bit patterns containing eight binary one (1) bits followed by eight binary zero (0) bits on the facility data link.
Sync Alarm (red LED)	This LED (labeled *SYNC LOSS*), when lit, indicates that the frame bit in the received data cannot be found.
Signal Alarm (red LED)	The signal alarm (labeled *SIG LOSS*) turns on to indicate that the DXP has lost its incoming signal.
Blue Alarm (red LED)	When this alarm indicator is lit, the alarm indication signal (AIS) consisting of all one (1) bits is being received to indicate that the far end has lost its received signal. The purpose of this signal is to maintain the system clocks during a link failure.
Bipolar Alarm (red LED)	The system converts the digital bitstream in T1 communications to a bipolar format through a process called alternate mark inversion (AMI). The voltage polarity of the ones pulses (marks) alternates between *Plus* and minus with a zero (space) represented by no pulse. A bipolar violation occurs whenever two successive pulses are of the same polarity. This alarm LED indicates a bipolar violation (BPV) has occurred. It is important to note that BPV errors are not passed through regeneration points.
Cyclic Redundancy Check (red LED)	When using the ESF format, the cyclic redundancy check (CRC) indicator lights whenever there is a discrepancy in the check sum received for an incoming frame from the originating system and the locally calculated check sum. This discrepancy indicates a data error in the received frame. The CRC is enabled by DIP switch SW2-4.
Slip (red LED)	This indicator is turned on whenever a frame slip is detected. This is caused by the transmit clock not being synchronized with the receive clock.
Unlock (red LED)	The transmit frequency (1.544 Mhz) is not locked with the receive clock when this indicator is lit.

B8ZS)/COFA (green LED)

This is a dual-purpose indicator. Depending on how you set DIP switch SW2-6, this indicator reports either a change of frame alignment (COFA) at re-synchronization time (default setting) or bipolar 8-zero substitution (B8ZS) code words detected in the received data.

RLB, LLB, and PAYL (red LEDs)

Whenever a loopback routine is active, either the remote loopback (RLB), local loopback (LLB), or payback loopback (PAYL) mode (selected by DIP switches SW2-7 and SW2-8) is indicated by the appropriate LED being lit.

PRI and SEC (green LEDs)

The *PRI* and *SEC* LEDs on the DXOPT-SYN card light to indicate where the receive clock reference is originating from—the primary or secondary DXPT1 board location. When two or more DXPT1 boards are installed, you make the primary and secondary assignments via jumpers on the the DXAUX board. If only one DXPT1 board is installed, you can set the jumpers so that both LEDs will light.

UNLOCKED (red LED)

When lit, the Unlocked LED indicates either the DXOPT-SYN card is defective or the receive frequency is out of tolerance (1.544 Mhz ± 200 Hz).

MANUAL (red LED)

This LED, when lit, indicates that the manual mode has been selected via the *AUTO/MANUAL* mode switch on the DXOPT-SYN card. When you select the manual mode (normally for maintenance/troubleshooting), you can select either the primary or secondary timing reference by setting the *PRI/SEC* switch on the DXOPT-SYN card. For normal operation, select the automatic mode. Do not manually force the clock reference to primary or secondary if the appropriate green LED is not lit. This will cause the VCO oscillator to default to its minimum or maximum tolerance, and the T1 board(s) may not frequency-lock.

6.1 Viewing The DXPT1 Board Alarms And Indicators

LED*	LABEL	ERROR OR STATUS CONDITION WHEN LED IS LIT
●	(Status)	Rapid flash = defective board Steady on = board in wrong slot or board constraints violated Off with repeated five second blink on = normal operation (T1 trunk idle) On with repeated five second blink off = normal operation (T1 trunk busy)
●	Red	Communications with network cannot be established (out-of-service)
⊙	Yellow	Disruption in remote T1 service
●	Sync	Loss of sync with the incoming signal
●	SIG	Loss of incoming signal
●	Blue	Alarm indication signal (AIS) being received (indicates loss of signal at far end)
●	Bipolar	Bipolar violation detected
●	CRC	Cyclic redundancy check error in incoming frame if SW2-4 is enabled (ESF only)
●	SLIP	Frame slip detected
●	Unlock	Transmit frequency (1.544 MHz) not locked with receive clock
O	B8ZS/COFA	B8ZS/COFA (B8ZS zero suppress mode/change of frame alignment) per SW2-6
●	RLB	Remote loopback active
●	LLB	Local loopback active
●	PAYL	Payload loopback active
O		Diagnostics codes (for factory test only)
O		Diagnostics codes (for factory test only)
O		Diagnostics codes (for factory test only)
O		Diagnostics codes (for factory test only)
O		Diagnostics codes (for factory test only)
O		Diagnostics codes (for factory test only)
O		Diagnostics codes (for factory test only)
O		Diagnostics codes (for factory test only)

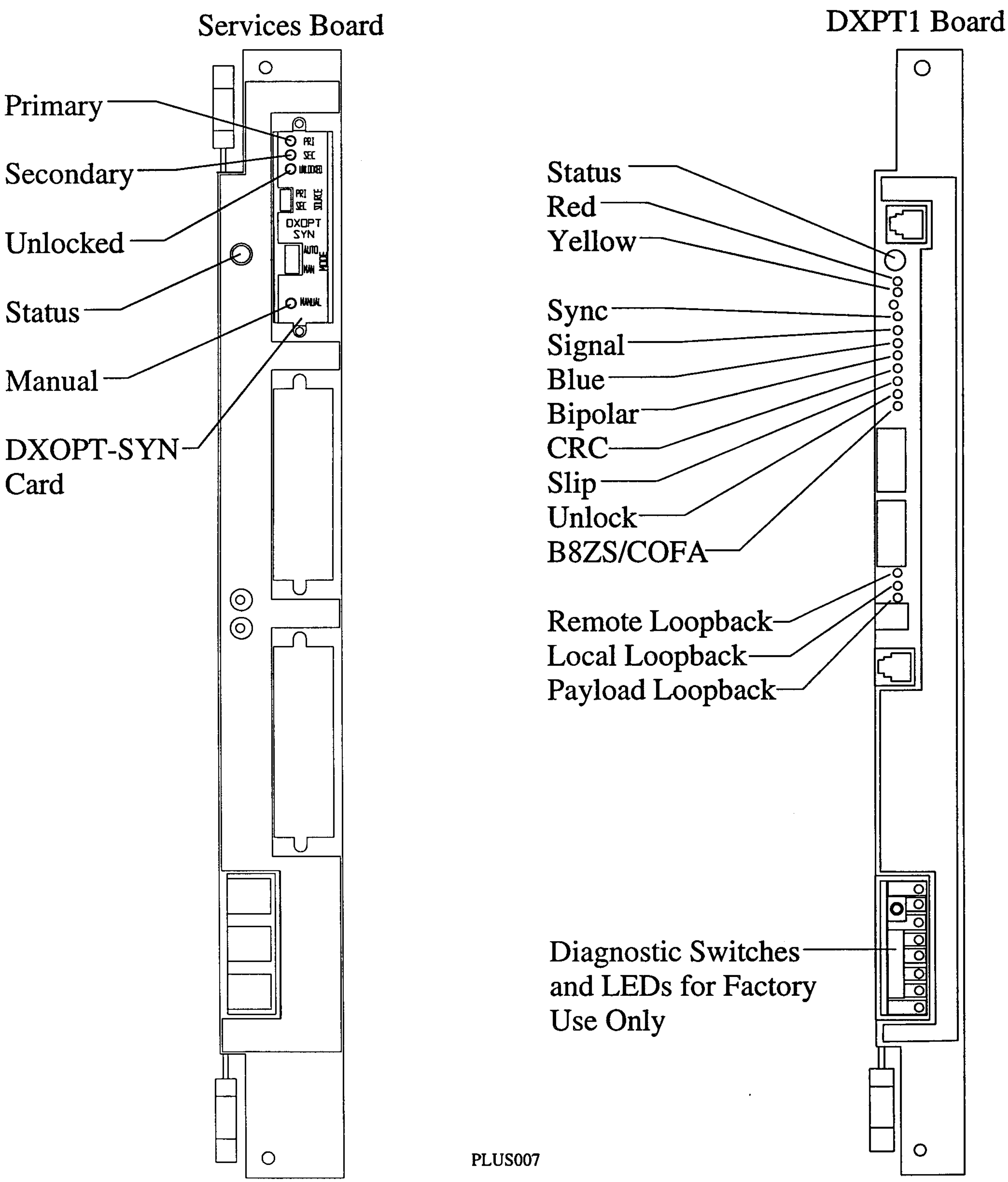
6.2 Viewing DXOPT-SYN Synchronization Card Alarms And Indicators

LED*	LABEL	ERROR OR STATUS CONDITION WHEN LED IS LIT
O	PRI	Timing reference is present from the DXPT1 primary board
O	SEC	Timing reference is present from the DXPT1 secondary board
●	UNLOCKED	Trouble (defective DXOPT-SYN card or receive frequency out of tolerance (1.544 MHz ± 200 Hz))
●	MANUAL	The manual mode is active for selecting the DXPT1 reference

NOTE: *Red /Yellow LEDs, when lit, indicate errors or non-standard configuration for normal operation. Green LEDs indicate a normal condition.*

**LED color legend*

● = Red ⊙ = Yellow O = Green



Viewing DXPT1 And DXOPT–SYN Alarms And Indicators

7.0 Understanding Installer/User Information Regarding FCC Rules and Regulations

This electronic key system complies with Federal Communications Commission (FCC) Rules, Part 68. The FCC registration label on the DXP *Plus* contains the FCC registration number, the ringer equivalence number, the model number, and the serial number or production date of the system.

7.1 Notification To Telephone Company

Unless a telephone operating company provides and installs the system, the telephone operating company which provides the lines must be notified before a connection is made to them. The lines (telephone numbers) involved, the FCC registration number, and the ringer equivalence number must be provided to the telephone company. The FCC registration number and the ringer equivalence number of this equipment are provided on the label attached to the common equipment. The user/installer is required to notify the telephone company when final disconnection of this equipment from the telephone company line occurs.

7.2 Compatibility With Telephone Network

When necessary, the telephone operating company provides information on the maximum number of telephones or ringers that can be connected to one line, as well as any other applicable technical information. The telephone operating company can temporarily discontinue service and make changes which could affect the operation of this equipment. They must, however, provide adequate notice, in writing, of any future equipment changes that would make the system incompatible.

7.3 Installation Requirements

Connection of the electronic key system to the telephone lines must be through a universal service order code (USOC) outlet jack supplied by the telephone operating company. If the installation site does not have the proper outlet, ask the telephone company business office to install one. The correct outlet jack for this system is either a type RJ21X or type RJ14C.

7.4 Party Lines And Coin Lines

Local telephone company regulations may not permit connections to party lines and coin lines by anyone except the telephone operating company.

7.5 Troubleshooting

If a service problem occurs, first try to determine if the trouble is in the on-site system or in the telephone company equipment. Disconnect all equipment not owned by the telephone company.
If this corrects the problem, the faulty equipment must not be reconnected to the telephone line until the problem has been corrected. Any trouble that causes improper operation of the telephone network may require the telephone company to discontinue service to the trouble site after they notify the user of the reason.

7.6 Repair Authorization

FCC regulations do not permit repair of customer owned equipment by anyone except the manufacturer, their authorized agent, or others who might be authorized by the FCC. However, routine repairs can be made according to the maintenance instructions in this publication, provided that all FCC restrictions are obeyed.

7.7 Radio Frequency Interference

The electronic key system contains incidental radio frequency generating circuitry and, if not installed and used properly, may cause interference to radio and television reception. This equipment has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules. These limits are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference to radio and television reception; in which case the user is encouraged to take whatever measures may be required to correct the interference. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient the television or radio's receiving antenna, and/or relocate the DXP, the individual telephone stations, and the radio or TV with respect to each other. If necessary, the user should consult the manufacturer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the Government Printing Office, Washington D.C. 20402. Stock No. 004-000-00345-4.

This equipment has been tested and found to comply with the limits of 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.

This digital apparatus does not exceed the (Class A) limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le pre'sent appareil nume'rique n'emet pes de bruits radioe'lectriques de'passant les limites applicables aux appareils nume'riques (de la class A) prescrites dans le Re'glement sur le brouillage radioe'lectrique e'dicte' par le ministe're des Communications du Canada.

CAUTION

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

7.0 Knowing The Specifications

DXP Capacity	10 T1 boards
Modes	Superframe, extended superframe
Framing	D4
Channels Allocated	8, 16, or 24
Industry Standards	ANSI T1.403-1989 AT&T PUB 62411
Maximum Output	2.4V to 3.6V base to peak, short circuit protection to 120 mA, rms
Line Rate	1.544 Mbps
Line Code	
Type	Bipolar AMI
Zero Suppression	B7 or B8ZS selectable
Receive Sensitivity	-26 dB or -36 dB selectable
Impedance	100 Ohms
DXP Loss Insertion	
Transmit	-6 dB (selectable to 0 and -3 dB per channel)
Receive	0 dB
T1 Connector	RJ48C, miniature 8-position, shielded (per ANSI T1-403, 1989)
T1 Cable	Up to 6,000 feet between DXPs, 22 AWG, twisted-pair, no external components
CSU Function	Built-in; CPE or CARRIER selectable (ESF)
Transmit Attenuation	
Manual	0, -7.5, -15, or -22.5 dB selectable
Automatic	Default
Input Jitter Tolerance	138 UI @ 1 Hz; 0.4 UI @ 10 KHz—100 KHz (0 dB line); corner frequency = 6 Hz (attenuates 20 dB per decade above corner)
Surge Protection	1 AMP fuse and transient protection for metallic >6 volts P-P; Longitudinal (tip—ring and chassis ground) protection 1500 volts minimum.
Elastic Store	Two frames, no frame loss when slipping
Compliance	FCC Part 68/Doc FCC Part 15 UL-1489/CSA (safety):
Yellow Alarm Type	
Superframe Mode	Bit 2 zero in all channels or Japanese 12th frame method, selectable
Extended Superframe Mode	Alternating bytes = all zeros and all ones; (prohibiting ANSI FDL messaging during yellow alarms is selectable)
Signaling	
Signaling Protocols	Loop Start (subscriber end) Ground Start (subscriber end) E & M Direct Inward Dial (DID)
Dialing	DTMF or Dial Pulse
Protocol Type (DID, E&M)	Wink, Delay-Dial, and Immediate Start (dial pulse only for immediate start)
DID Type Restriction	Limited to four of five types when mixing tone/dial pulse/wink/delay dial/immediate start)
Clocking	
Synchronization	Slave mode from DXOPT-SYN card on Auxiliary board
Min. RX Freq. Capture	1.544 MHz ± 200 Hz, T1 board; 16.384 MHz ± 2048 Hz, Sync card
TX Master Mode Freq.	1.544 MHz ± 75 Hz
Loopback Modes	
Superframe Mode	Local or remote loopback, manual Network loopback inband command; set 00001 5sec, reset 001 5 sec.
Extended Superframe Mode	Local, remote, payload loopback (manual) FDL ANSI network remote loopback FDL ANSI network payload loopback
LED Alarms/Errors	Status Red Alarm Yellow Alarm Blue Alarm Loss of receive synchronization Loss of signal Bipolar error(s) CRC errors (ESF) Slip errors Phase Lock error

8.0 Defining The T1 Terms

Bipolar
A bipolar signal is composed of alternating pulses that both represent a digital logic 1. The positive pulse is a (+) and the negative pulse is a (-). Zero volts represents a space, or digital logic 0.

Bipolar Violation (or error)
A bipolar error is a digital logic 1 (or mark) that has the same polarity as its predecessor.

NOTE: Every time the system regenerates the signal stream, it corrects any bipolar errors; therefore, it prevents end-to-end error checking from using bipolar errors.

B8ZS (Binary Eight Zero Substitution)
This is a technique to send an all-zero channel without violating the ones-density requirement (a single one in each channel and no more than 15 zeros in a row). Voice transmission will not allow an all zero channel. The system accomplishes B8ZS suppression by inserting a special bipolar error that is interpreted, not as an error, but an all zero channel. The B8ZS feature replaces the all-zero channel two different ways. The feature replaces the all-zero channel with the sequence 000 + - 0 - + if the preceding pulse was a +, and the feature replaces the all-zero channel with the sequence 000 - + 0 + - if the preceding pulse was -. The + represents a positive pulse, the - represents a negative pulse, and 0 represents no pulse. Set the B8ZS feature with switches SW1–5 and SW1–6.

CAS (Channel Associated Signalling)
The Channel Associated Signalling is the only inbound signalling method currently supported by the DXPT1 board.

COFA (Change of Frame Alignment)
When switch SW2-6 is off, the green LED on the DXPT1 indicates whether the network source or the network span caused the last frame synchronization. (This indication disregards the first re-sync at cold start or a system reset —cold start and reset causes the network source to re-sync.) A COFA occurs if the network source does a re-sync. The COFA is a diagnostic tool that identifies the source of the loss of frame synchronization.

CPE/Carrier Equipment
The DXPT1 is normally classified as Customer Premise Equipment (CPE). If you use SW2–2 to configure the DXPT1 board to use the internal CSU while in the ESF mode, the network may require that the system be classified as Carrier Equipment (CE). The information packet that the DXPT1 board sends to the network contains a facility data link (FDL) maintenance message that has a bit in it that provides this identification.

CRC (Cyclic Redundancy Check)
A method of checking errors from the transmission source to the destination. For T1 operation, CRC caculates a checksum depending on the data in a frame. The system uses CRC in ESF mode exclusively. (You must enable CRC with DIP switch SW2-4).

Delay Dial E&M, DID Protocol Type
Once seized by a calling system, the system being called makes A=1 and B=1 until it is ready to receive digits. When it is ready to receive digits, it makes A=0 and B=0. The system uses a delay dial protocol when wink protocol timing is not compatible to the network.

Dial Pulse – T1
Dial pulse is a method of sending address digits (numbers) using A and B bits logic bits instead of sending DTMF tones. Some carriers may not support dial-pulse signalling. While the method is slower when compared with tones, it requires no DTMF receivers.

Direct Inward Dial (DID) T1 Trunk
DID is a protocol for inbound calls where the network sends the extension number during the beginning of the call. The system supports the 0 through 7 inbound digits. The network does not translate the digits to a valid extension—the system's DID translation tables perform this action.

DS-0 (Digital Signal-Level Zero)
Digital Signal-Level Zero is a single 64Kbit channel inside a T1 span.

E & M T1 Trunk
E&M is a signalling protocol that supports both inbound and outbound digits. Inbound digits from the network are already translated to a 3–digit or 4–digit valid extension. E & M is symmetrical from both ends and ignores the subscriber/office classification of other trunks. Use this signalling protocol for interconnecting two DXP *Plus* systems.

Extended Superframe Mode (ESF)
Extended Superframe Mode consists of 24 frames. The frame bit uses only 6 frames leaving 18 bits for other purposes. These spare 18 bits provide 6 bits for CRC information and 12 bits for a facility data link. The facility data link is for maintenance information (as defined by the ANSI T1.403 specification). Like the superframe mode, the 64–Kbit user channels have 24 frames available for use.

Ground Start T1 Trunks
Ground start is a call signalling protocol that monitors only outbound digits and supports disconnect supervision. Ground start protocol supports only the subscriber end of the communications link

FDL (Facility Data Link)
The Facility Data Link is a 4–Kbit communication link from the network to the DXPT1 board only when the board is operating in the ESF mode. The system sends preemptive messages (for example, yellow alarm and loopback), if needed, and sends error packets to the network once a second. The packets contain alarm history in accordance with the ANSI T1.403 specification.

Fractional T1
Fractional T1 is a T1 span where the user uses less than 24 channels. The DXPT1 board allocates eight or 16 channels to a fractional T1 but does not reallocate unused channels in the eight, 16, or 24 mode to other resources. A fractional T1 in ESF mode will nullify the CRC and other error checking capability since the network shares channels.

Immediate Start Protocol State
Once a calling system seizes a called system, the calling system sends address digits to the called system without requiring an acknowledgement. Inbound immediate start protocol does not support tone dial. Dial-pulse is adequate however. Immediate start protocol is applicable to DID and E&M tie lines.

Inband Signalling
A signalling method where the system sends overhead signalling along with channel traffic.

ISDN (Integrated Services Digital Network) Primary Rate (also called PRI)
Currently not offered by the DXPT1 board.

Loopback Local
An operation method that loops the DXPT1 board's transmit output and receive input paths. The loopback terminates all traffic and halts call processing. While in this idle condition, the system continues to transmit the T1 transmit stream to the network but it will not answer incoming calls. If the remote T1 equipment is the clock source (primary or secondary) for the DXOPT-SYN card, the remote equipment terminates the reference signal because the network receive circuit is open in local loopback. You initiate local loopback by setting the appropriate SW1 switches. The main purpose of local loopback is to verify the DXPT1 board's ability to synchronize properly. Loopback local operation is applicable to superframe adn extended superframe modes.

Loopback Payload

The loopback payload feature is an ESF-only method of loopback which loops the network receive input path to the remote T1 equipment's transmit output path. This loopback method does not loop the first bit of each frame to allow the DXPT1 board's facility data link to continue to transmit maintenance information. You can use switches SW2–7 and SW2–8 to manually initiate the payload loopback or you can allow the network to send an FDL message to initiate or restore the payload loopback. The DXPT1 board goes out-of-service during the loopback time.

Loopback Remote

The loopback remote feature loops the network receive input path to the remote T1 equipment's transmit output path. The remote loopback feature terminates all traffic and halt any call processing. You can use the SW2 switches to manually initiate remote loopback or you can allow the network to remotely initiate the condition. In superframe mode with SW2–1 set to on, the network can send a special in-band pattern (00010001000100010001.... min 5 seconds) to cause the DXPT1 board to automatically enter the remote loopback mode. The network can disable the loopback by sending a different in-band pattern (001001001001001001001.... min 5 seconds). In ESF mode, the DXPT1 board's facility data link, or maintenance channel, can enable and disable remote loopback automatically or you can set SW2–7 on and SW2–8 off to manually enable remote loopback or set both switches off to manually disable the feature. Loopback remote operation is applicable to superframd and extended superframe modes.

LIU Line Interface Unit

The line interface unit is the interface between the T1 copper wires and the DXPT1 board's framing circuitry. The LIU is responsible for separating the 1.544MHZ receive clock from the incoming stream and converting bipolar Alternate Mark Inversion (AMI) to 5–volt digital logic. The LIU also supports the automatic line build-out that regulates the transmit level according to the receive strength (LIU-2 switch).

Loop Start T1 Trunk

Loop Start T1 Trunk is a network protocol that monitors outbound digits to the DXPT1 board. This protocol does not support disconnect supervision. Loop start protocol supports the subscriber end of the communications path but does not support the office (network) end.

Primary Clock Reference

The straps on the DXAUX board designate the primary clock reference. Primary clock reference is the first choice reference clock used to synchronize the DXP *Plus* to the incoming span. If the system looses synchronization, it uses its secondary clock reference. If the secondary clock reference is not available, the DXOPT-SYN card's variable clock oscillator (VCO) switches to the fixed oscillator on the DXSRV (services) board. When it does this, slips occur.

Repeater

A repeater is a amplifying device that central office technicians place at approximately one mile intervals along a T1 circuit to boost the T1 signal. The T1 specifications allow a maximum of 50 repeaters along a communications path.

Slip

This term describes the condition that exists when the transmit 1.544 MHz clock is different from the receive 1.544 MHz clock. When the system collects or looses a frame of information due to the span frequencies being different, the system generates a slip error. Slip does not affect voice transmissions and may not affect modem traffic; however slip does effect digital data traffic. The DXPT1 board does not currently support digital data traffic. Also, at times a central office takes a T1 span out of service if too many slips occur—one or two a day is permissible (the carrier supplier will furnish you with an an exact number if you request that information from them).

Smart-Jack (Network Interface Box)

A smart jack is a demarcation box provided by the central office. A smart jack provides isolation and increased signal drive (up to one mile) and can respond to loopback commands for diagnostic purposes. The central office usually provides an 8–pin modular jack for T1 equipment connection. Pin 1 of the modular jack goes to pin 1 of the DXPT1 modular jack, and so on. Only pins 1 and 2 (DXPT1 receive), 4 and 5 (DXPT1 transmit) require connecting.

Superframe Mode (SF)

The standard T1 mode consists of 12 frames per superframe cycle. The first frame bit remains constant and rotates through a 12-bit pattern. By identifying the frame pattern, the system can select the sixth and twelfth frame for the AB bit signalling inband method. T1 parameters allow for 24 64–Kbit user channels.

Suppression

Suppression is a means to prevent more than 15 zeros in a row and not less than 1 pulse (mark) per channel. The DXPT1 board supports two suppression methods. These are the B7 method and the B8ZS method (selected by SW1–5 and SW1–6). The B7 method inserts a logic 1 in the seventh bit position of a channel if all bits are zeros. The B8ZS method inserts a bipolar violation that will be identified and stripped at the receiving end (selected by switches SW1–5, and SW1–6). Voice coding should not allow an all zero channel.

Unlock Alarm

On a normally operating DXPT1 board, the unlock alarm LED is always off. If this LED is on, it indicates that the phase lock loop creating the transmit 1.544 MHz frequency is defective. For this indicator to be meaningful, the DXOPT-SYN card must be synchronized (no red LEDs on). If the DXOPT-SYN card is not synchronized, you must correct that situation.

Wink E&M, DID Protocol State

This effect is a quick response by a called system (A=1, B=1) to a calling system that seized the line. The response indicates that the called system is ready to receive address digits.

Yellow Alarm

The yellow alarm indicates that the network has lost its incoming frame synchronization. The DXPT1 board signalling is inactive for approximately three to four seconds during this alarm time, and the system halts all call processing. If the system clears the received yellow alarm within the time limit, the DXPT1 board's inactive state terminates and call processing continues.

The system sends a yellow alarm to the network if it loses incoming frame synchronization or if the DXPT1 loses communications to the CPU board. Received and transmitted yellow alarms can not exist at the same time. If such a situation occurs, the system inhibits the transmitted alarm.

ZBTSI (Zero Byte Time Slot Interchange)

Zero Byte Time Slot Interchange is a complex technique to insure that the T1 transmission meets the pulse density requirement. This ZBTSI technique is unpopular in the telephone industy, and the DXPT1 board does not support the feature.

COMDIAL

Installing The Switchable Power Supply In The DXP Plus Common Equipment Cabinet

1.0 Introducing The Switchable Power Supply

This publication discusses the installation of the switchable IEC 950 approved 120/230 volt power supply assembly for the DXP Plus main and expansion common equipment cabinets. The voltage ranges of this power supply assembly is as follows:

- 90–129 VAC at 50/60 Hz
- 200–254 VAC at 50 Hz

The power supply assembly is packed separately from the common equipment cabinet; therefore, you should unpack and carefully inspect it for shipping damage and notify the shipper of any damages you find. Also, verify that the package contains all parts and accessories needed for proper installation and operation.

Refer to IMI66–105, *Installation Instructions DXP Plus Main Cabinet Assembly* for complete installation instructions of the main DXP *plus* cabinet and to IMI66–106, *Installation Instructions DXP Plus Expansion Cabinet Assembly* for complete installation instructions of the DXP *plus* expansion cabinet.

The power supply assembly is protected with a 6.3A, 250V slow-blow fuse. A replacement fuse must have the same rating.

NOTE: Both the switchable power supply assembly employ electronic switching circuitry in their design. During operation, power supplies of this type generate an audible sound from their switching regulators. This sound is normal and is not an indication that the power supply is operating improperly.

Printed in U.S.A.

IMI89-196.01
7/95

2.0 Understanding System Grounding Requirements

Transient voltage spikes, if induced onto CO or CENTREX lines, can travel through the cable and into the common equipment. The telephone company offers basic protection against this condition but it is usually designed to protect the central office circuits. While it will also provide some protection to the common equipment, you should not rely upon it for total protection. To help ensure that external over-voltage surges do not damage the system, you should install and properly ground primary protection devices, such as gas discharge tubes or similar devices, on all lines. While the line boards have internal secondary surge protection on all line ports, in order for this protection to be effective, you **MUST** connect the common equipment cabinet to a reliable, effective earth ground.

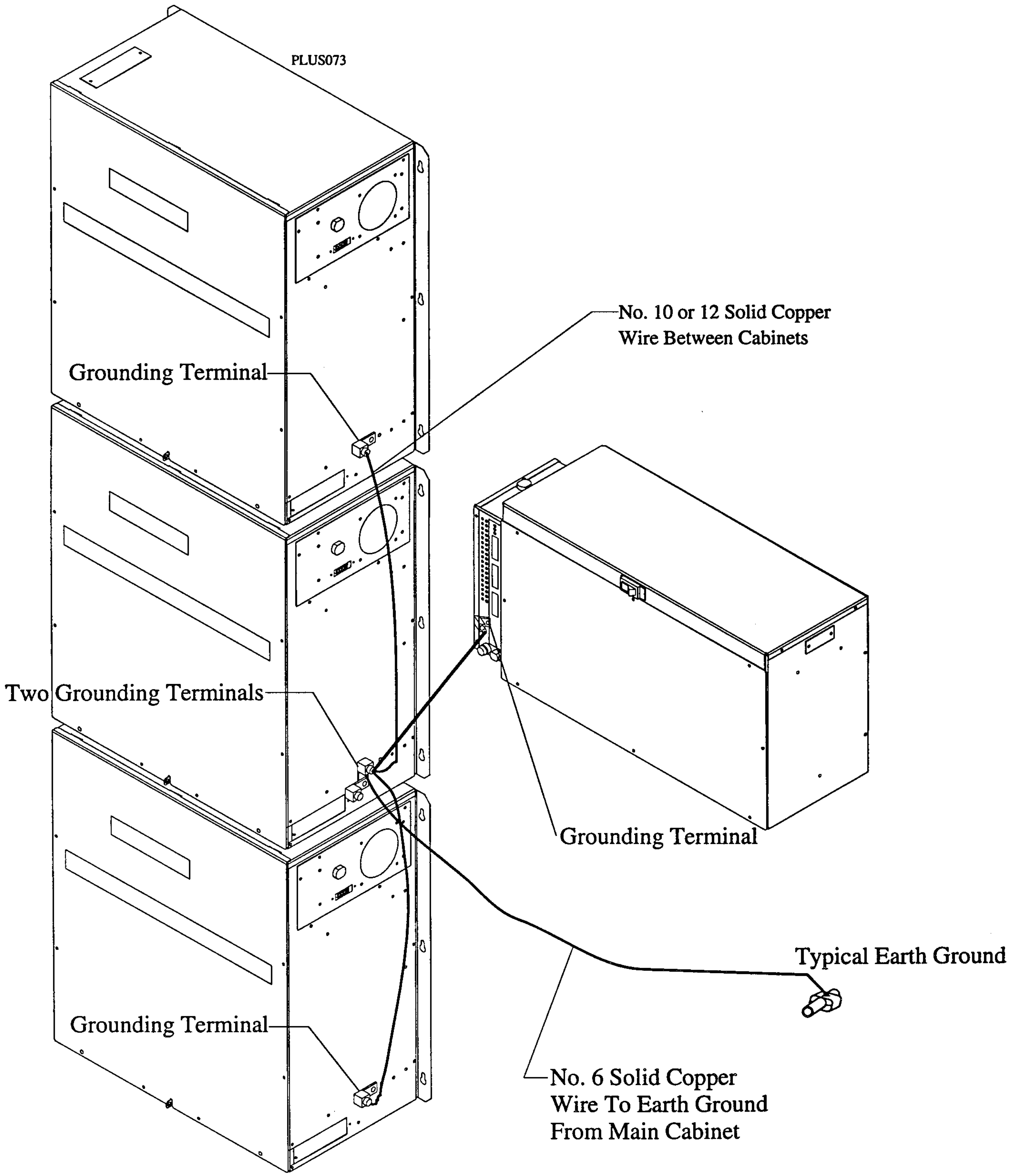
Proper DXP grounding is necessary for trouble-free operation and personnel safety. The DXP *Plus* has the following three types of grounds:

- Service Ground—a neutral power line wire that is connected to the ground bus in the premises' AC power panel,
- System Ground—a non-current carrying power line wire that is connected to the ground bus in the premises' AC power panel,
- Frame Ground—a low impedance conductor that places the common equipment cabinet at reference ground potential. The frame ground provides the greatest safety by limiting electrical potential between non-current carrying parts of the system. The common equipment cabinet provides a ground stud on its cabinet for access to its frame ground.

Effective grounding requires that you connect the frame ground to a good earth ground. A good earth ground is one such as the ground bus in the premises' AC power panel or a public metallic cold water pipe at a point immediately at its entrance to the premises and ahead of any meters, pumps, or insulating sections that have been added for vibration reduction. Avoid using the premises' structural steel frame as it may not be at earth ground potential. Use #10–12 or larger insulated solid copper grounding wire to connect the frame ground of the expansion cabinet (available through the ground stud on the expansion cabinet's side) to the frame ground of the main common equipment cabinet. Use #6 or larger insulated solid copper grounding wire to make the ground connection from the main cabinet's frame ground to earth ground. **Keep this ground wire separate from the three-wire AC line cord, do not splice it, and keep it as short as possible.**

The impedance of the wiring between the DXP *Plus* and the earth ground must not exceed 0.25 ohms and the impedance between the earth ground and the power company's reference standard ground must not exceed 5 ohms. Use an acceptable low impedance measuring device to measure the impedance of these paths. The #6 or larger wire size will minimize the wiring impedance; however, if the impedance between earth ground and the power company's standard reference ground exceeds 5 ohms, contact the local power company. The ground path must always be of sufficient current-carrying capacity to prevent a build up of voltages that may result in circuit noise, hazard to personnel, or equipment damage.

Be sure that all of the ground connections are visible for inspection and maintenance. Tag all of the ground connections with a sign that reads: *Do Not Remove Or Disconnect.*



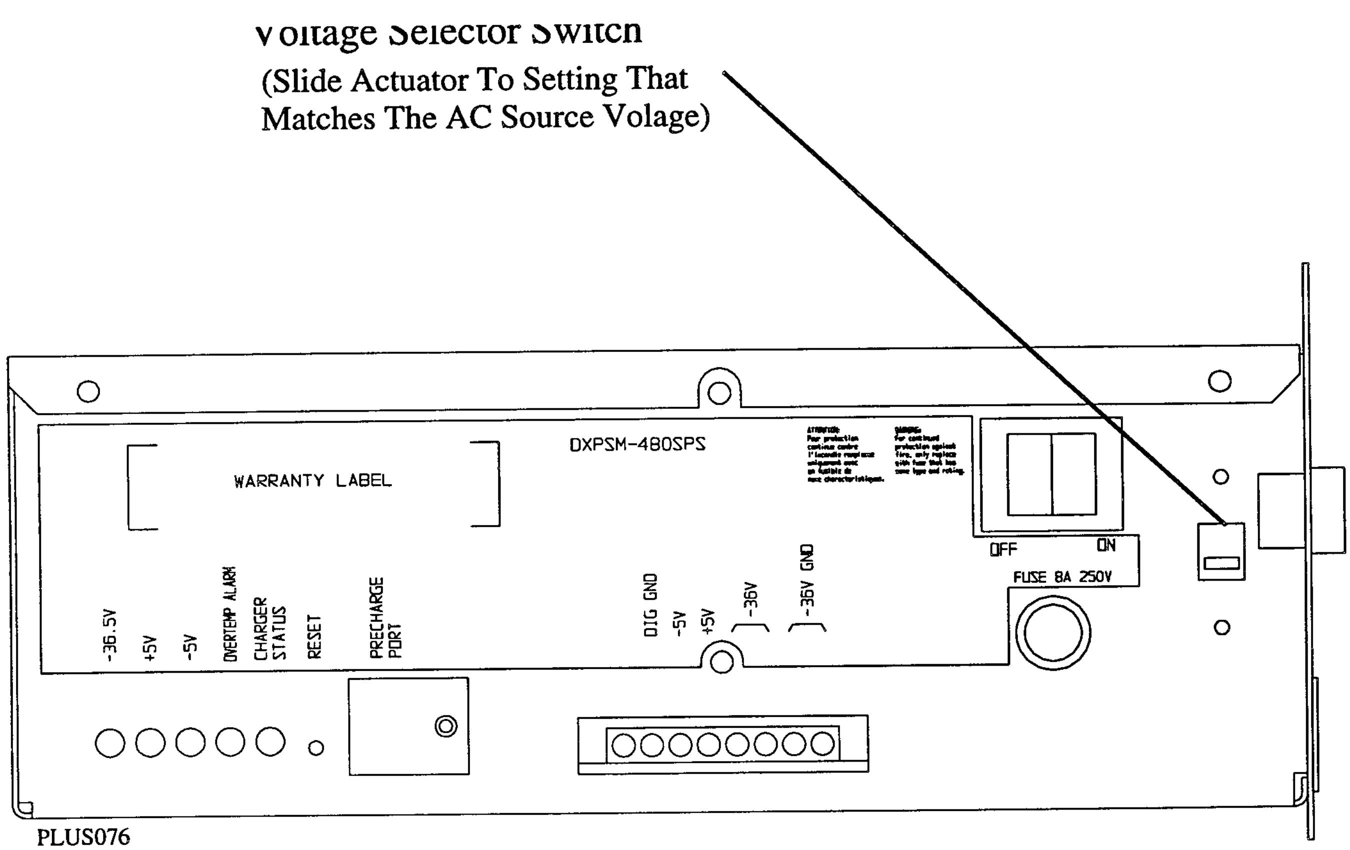
Grounding The System

3.0 Matching The Source Voltage

The factory ships the *switchable* power supply set for 230 VAC operation. If you plan to operate the power supply from a 120 VAC source, you must set the voltage selection switch for that input. The switch is located at the upper right edge of the power supply assembly. Slide the switch actuator to the setting that matches the AC source voltage available at the installation site.

CAUTION

Be sure that you set the power supply for the proper source voltage. An improper setting can result in equipment damage.



Matching The Source Voltage

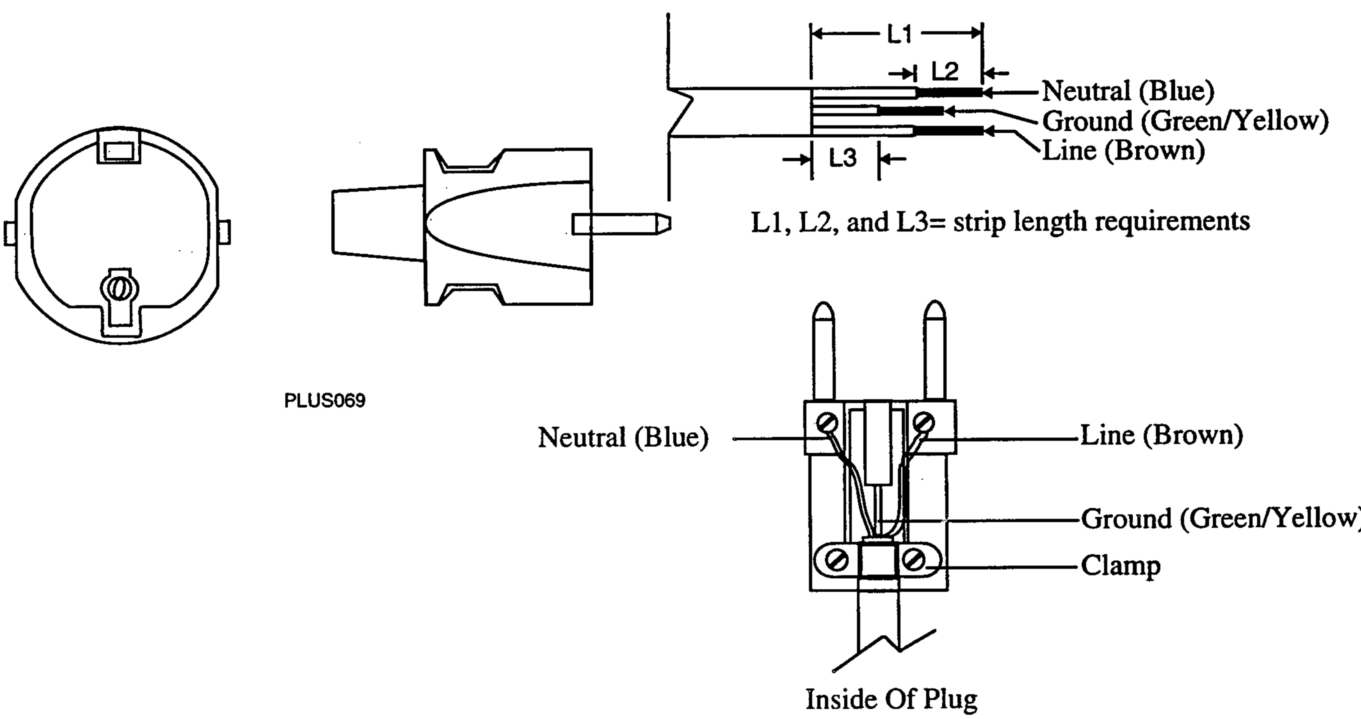
4.0 Installing The AC Power Plug

The line cord is terminated with a typical continental European plug matching the CEE 7/7 standard. If this plug does not meet the site needs, you can install a plug of the proper type for your installation.

To install a line cord plug,

- familiarize yourself with the requirements for the plug that you plan to install on the unterminated line cord (the illustration shows a typical continental European plug matching the CEE 7 standard),
- strip off the insulation from the line cord wires according to the requirements for your plug,
- open the plug and slide its outer shell onto the line cord,
- connect the ground, neutral, and line wires according to the requirements for your plug,
- if your plug includes a clamp, tighten it on the line cord,
- reassemble the plug,

Test the installation for open and short circuits using an ohm meter.



Standard Wire Color		
Power Source	Wire Color	
	Europe	USA
Line	Brown	Black

Installing A Typical Continental European AC Power Plug

5.0 Installing The Power Supply

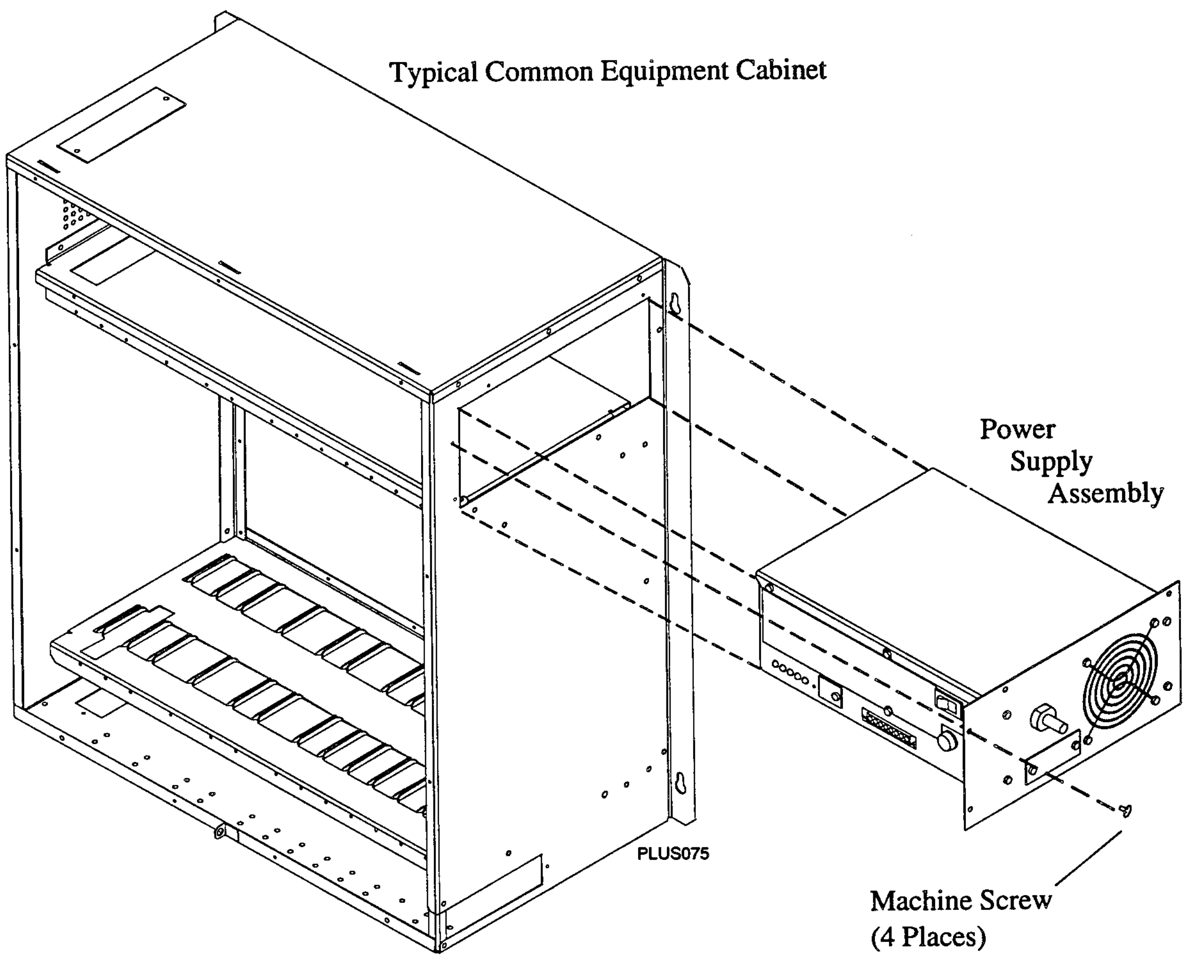
NOTE: The common equipment cabinet employs an electronic switching power supply. During operation, power supplies of this type generate an audible sound from their switching regulators. This sound is normal and is not an indication that the power supply is operating improperly.

Install the power supply assembly in the common equipment cabinet per the following discussion and illustration.

1. Be sure to ground the common equipment cabinet per the instructions in the previous paragraph before installing the power supply assembly.
2. Remove the power supply assembly from the carton. Be sure to save the small bag containing the mounting hardware.
3. Slide the power supply into the opening at the top right side of the common equipment main cabinet until the assembly's front panel contacts the side of the cabinet.
4. Locate the power cable routed from the backplane and connect it to the power supply's mating connector.
5. Remove the four #6 thread-forming screws from the hardware bag and secure the power supply assembly to the equipment cabinet.

CAUTION

The power supply is fan cooled. If air flow to the fan is blocked or the fan is out of service for any reason, the power supply can overheat. If the power supply overheats, the ***Thermal Overload*** *indicator lights, and the 36 VDC output voltage shuts off.*



Installing The Power Supply

6.0 Making The AC Power Connection

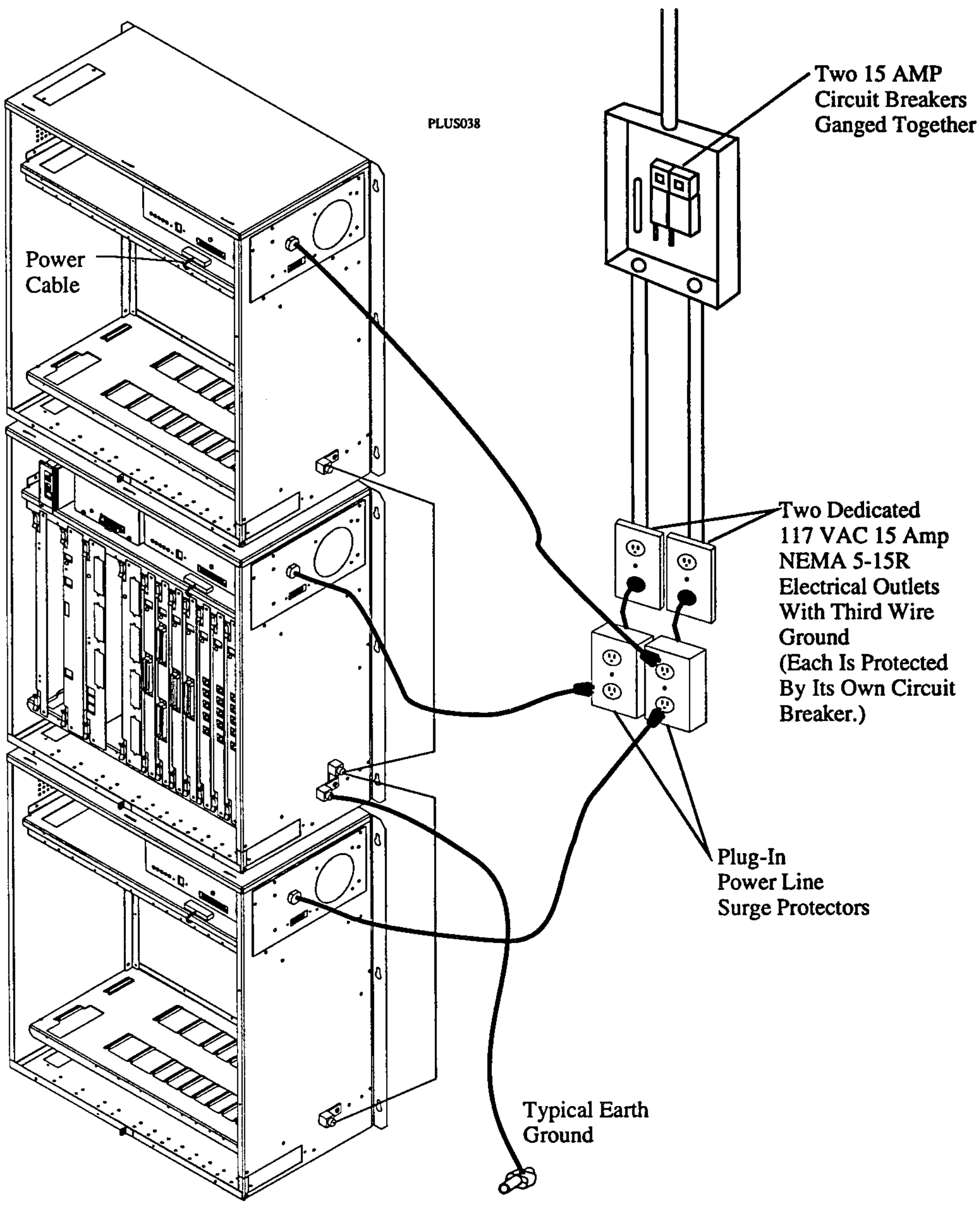
- For the main cabinet's AC power connection, employ a dedicated 15 AMP circuit, with a third-wire ground and supplied to a standard electrical outlet. Remember, this electrical outlet must be located within four feet of the common equipment cabinet. Remember also, you may need to supply two 15 AMP dedicated electrical outlets, each protected by its own circuit breaker, if you plan to later install expansion cabinets.

NOTE: If you install the optional battery back-up assembly, you can use this same outlet to supply AC power to that assembly's battery charger.

- To provide protection against surges and spikes that may appear on the AC line, install a plug-in power line surge protector between the AC power cord of the installed equipment and the AC outlet..

CAUTION

DO NOT attach or secure the line cord to the surface of the mounting location in any manner.



Making The AC Connection

7.0 Measuring The Power Supply Voltages

If you need to measure power supply voltages, you can do so at the DC voltage connector. Measure the power under the following conditions:

- AC line cord connected to the AC outlet,
- DC power cable disconnected from power supply's DC voltage connector,
- AC power switch turned on.

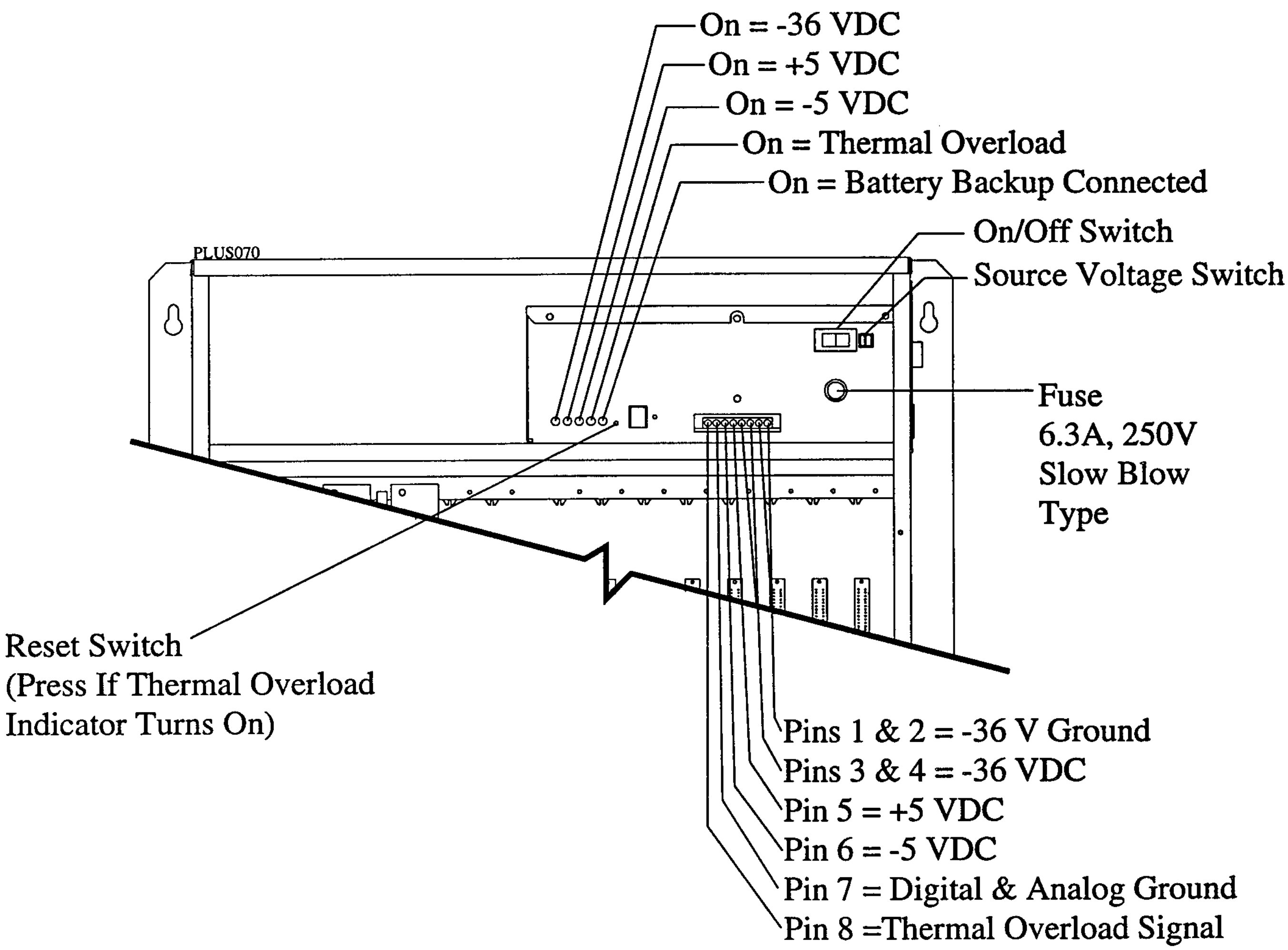
Measurement details are shown in the illustration.

CAUTION

For new installations, once you have measured the power supply voltages, turn off the AC power switch and disconnect the AC line cord from the outlet. Leave the AC power disconnected until you have installed the circuit boards in the equipment cabinet.

8.0 Identifying The Fuse

The power supply fuse is a *slow-blow* type rated at 6.3 AMPS and 250 VOLTS. A replacement fuse must have the same rating.



Power Supply Measurements

Measure Between Terminals: + Voltmeter Lead	Measure Between Terminals: - Voltmeter Lead	Measured Values
Pin 1	Pin 3	- 36 VDC +1.0V / -0V
Pin 5	Pin 7	+ 5 VDC +/-3 V
Pin 6	Pin 7	- 5 VDC +/-3 V
Pin 8	Pin 7	0 volts = normal operation + 5 V nominal = thermal overload (press reset switch)

Measuring The Power Supply Voltages

COMDIAL

Charlottesville, VA 22906-7266

CERTIFIED
ISO 9001

Accredited by the Dutch Council for Certification for certification and registration activities.

Comdial's Quality Management System Is Certified To The ISO 9001 Standard.

Installing The Switchable External Battery Assembly On The DXP Plus Digital Communications System

1.0 Introducing The External Battery Assembly

The external battery assembly is for use with the DXP *Plus* digital communications system. Unpack and carefully inspect all equipment for shipping damage. Notify the shipper immediately of any damages found. Verify that the packages contain all parts and accessories needed for proper installation and operation. The assembly includes the following items:

- Batteries: Five 6-volt, 50 ampere-hour, (Comdial product code BT000-141), charger unit and interface cables.
- Metal enclosure with wire harness, includes combination circuit breaker, on/off switch

Should the AC power to the system be interrupted, one BB480 external battery assembly provides the following minimum power capability:

- 1.0 hour of operation for a fully loaded system.

$$T = \frac{Ke}{1 + [(0.084)(N)]}$$

Calculate the minimum battery backup time provided by a battery assembly to a fully configured DXP *Plus* system using the following formula:

$$T = \frac{(.85)(50)}{1 + [(0.084)(472)]} = \frac{41.0}{40.65} = 1.0 \text{ Hour}$$

T = Back-up time in hours
K = 0.82 (Constant)
e = 50 (ampere-hour capacity of battery assembly)
N = Total number of stations

Example:
Assume that you have installed a DXP *Plus* with three cabinets supporting 472 telephones and containing one line board along with a battery assembly to provide back-up power.

During AC operation, the battery assembly accepts re-charging current to maintain the voltage potential of its batteries at an operational level.

NOTE: The BB480 external battery assembly requires approximately 10 hours to completely re-charge to full potential after it has been completely discharged and, in some cases, when initially installed.

Printed in U.S.A.
IMI89–197.01
7/95

2.0 Understanding System Grounding Requirements

Transient voltage spikes, if induced onto CO or CENTREX lines, can travel through the cable and into the common equipment. The telephone company offers basic protection against this condition but it is usually designed to protect the central office circuits. While it will also provide some protection to the common equipment, you should not rely upon it for total protection. To help ensure that external over-voltage surges do not damage the system, you should install and properly ground primary protection devices, such as gas discharge tubes or similar primary protection devices, on all lines. While the line boards have internal secondary surge protection on all line ports, in order for this protection to be effective, you **MUST** connect the common equipment cabinet to a reliable, effective earth ground.

Proper grounding is necessary for trouble-free operation and personnel safety. The DXP *Plus* has the following three types of grounds:

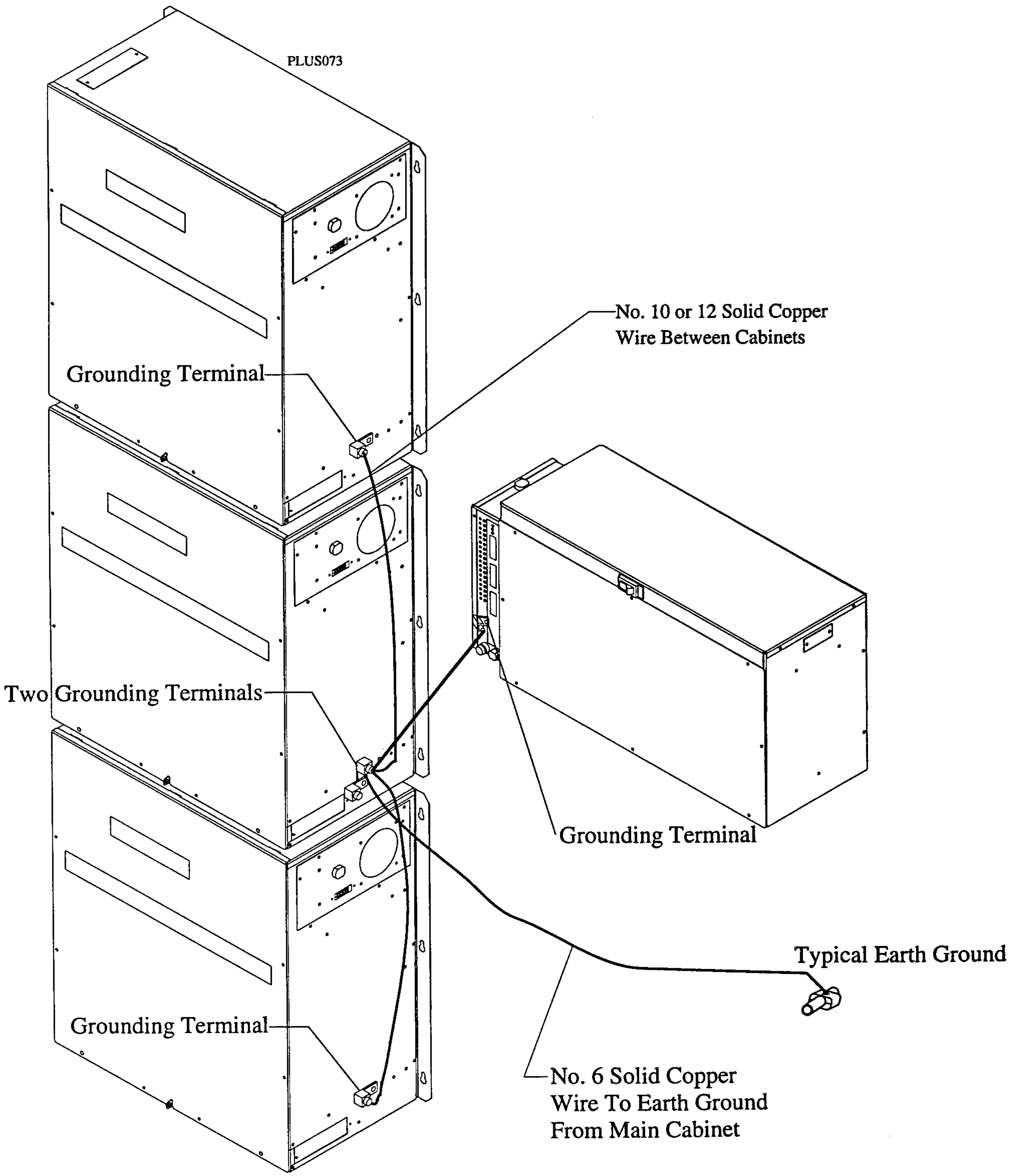
- Service Ground —a neutral power line wire that is connected to the ground bus in the premises' AC power panel,
- System Ground—a non-current carrying power line wire that is connected to the ground bus in the premises' AC power panel,
- Frame Ground—a low impedence conductor that places the common equipment cabinet at reference ground potential. The frame ground provides the greatest safety by limiting electrical potential between non-current carrying parts of the system. The common equipment cabinet provides a ground stud on its cabinet for access to its frame ground.

The entire system is effectively earth-grounded when you permanently connect the common equipment cabinet, all expansion cabinets, and the battery back-up assembly to earth or to some conducting body which serves in place of earth. The ground path must be of sufficient current-carrying capacity to prevent a build up of voltages which may result in circuit noise, hazard to personnel, or equipment damage.

An acceptable earth ground is one such as the service ground for the AC power or a public metallic cold water pipe at a point immediately at its entrance to the premises and ahead of any meters, pumps, or insulating sections that have been added for vibration reduction. Avoid using the premises' structural steel frame as it may not be at earth ground potential. Use #10–12 or larger insulated solid copper grounding wire to connect the frame ground of the battery assembly cabinet (available through the ground stud on the cabinet's side) to the frame ground of the main common equipment cabinet. Use #6 or larger insulated solid copper grounding wire to make the ground connection from the main cabinet's frame ground to earth ground. **Keep this ground wire separate from the three-wire AC line cord, do not splice it, and keep it as short as possible.**

The impedence of the wiring between the common equipment cabinet frame ground and the earth ground must not exceed 0.25 ohms and the impedence between the earth ground and the power company's reference standard ground must not exceed 5 ohms. Use an acceptable low impedence measuring device to measure the impedence of these paths. The #6 or larger wire size will minimize the wiring impedence; however, if the impedence between earth ground and the power company's standard reference ground exceeds 5 ohms, contact the local power company. The ground path must always be of sufficient current-carrying capacity to prevent a build up of voltages that may result in circuit noise, hazard to personnel, or equipment damage.

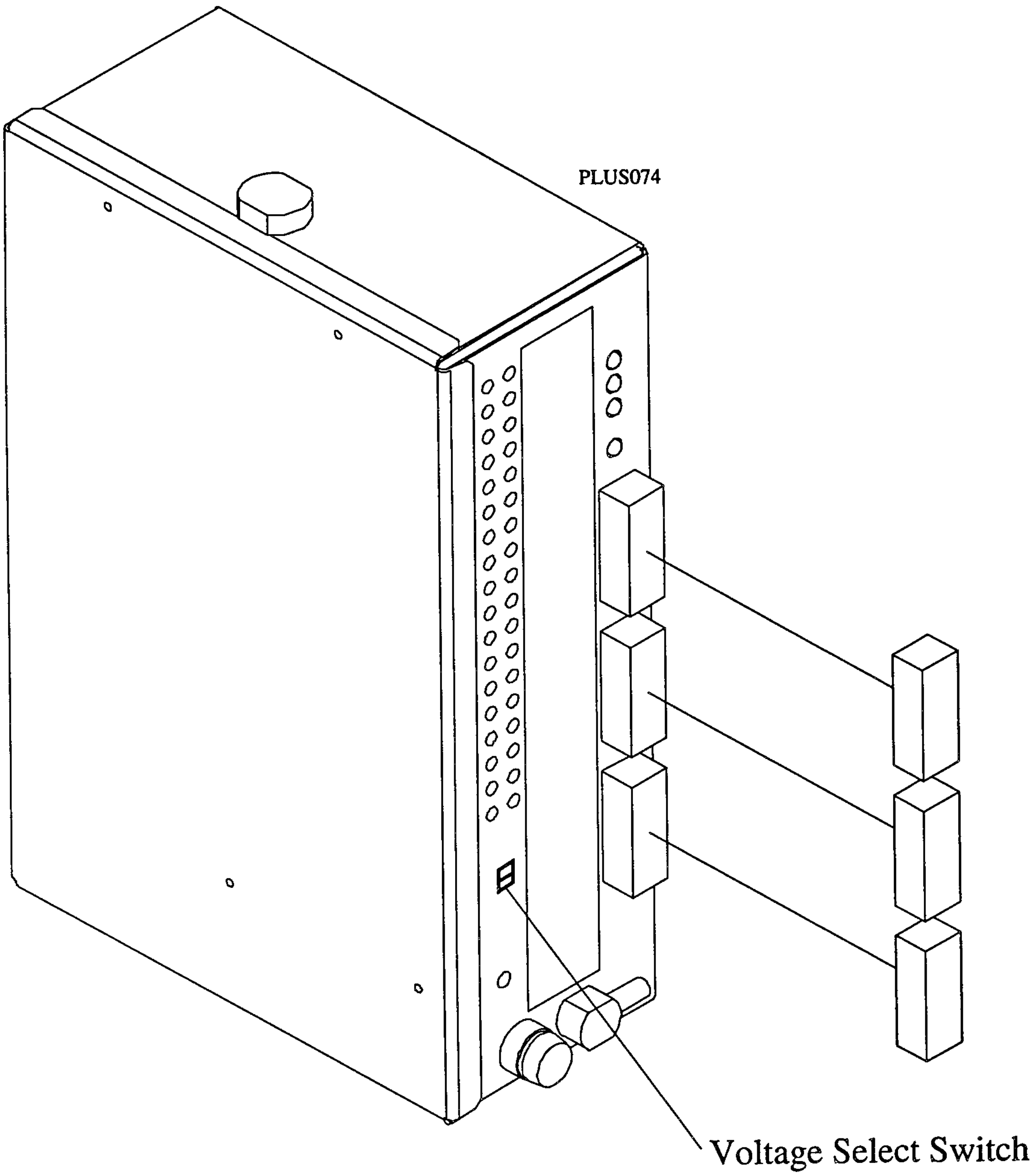
Be sure that all of the ground connections are visible for inspection and maintenance. Tag all of the ground connections with a sign that reads: *Do Not Remove or Disconnect.*



Grounding The System

3.0 Matching The Source Voltage

The factory ships the switchable battery back up charger assembly set for 230 VAC operation. If you plan to operate the charger from a 120 VAC source, you must set the voltage selection switch for that input. The switch is located at the lower left edge of the charger chassis. Slide the switch actuator to the setting that matches the AC source voltage available at the installation site.



Matching The Source Voltage

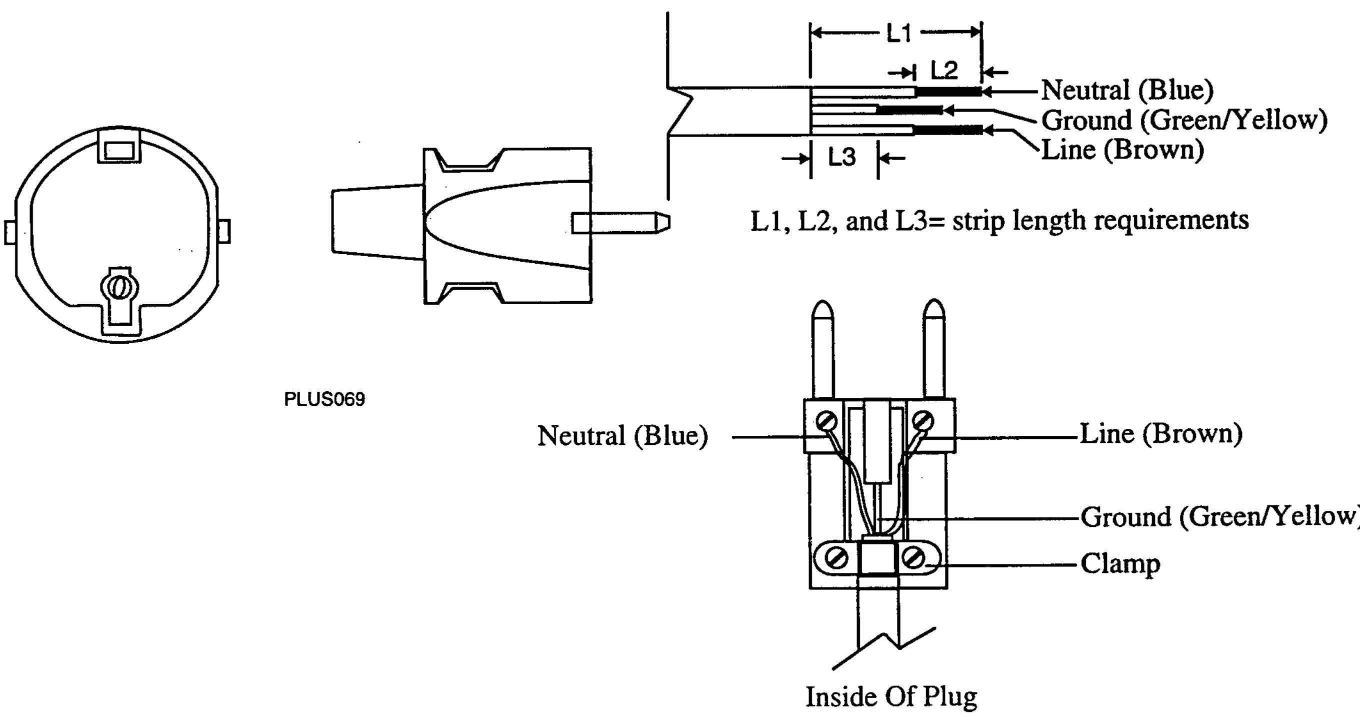
4.0 Installing The AC Power Plug

The charger assembly's line cord is terminated with a typical continental European plug matching the CEE 7/7 standard. If this plug does not meet the site needs, you can install a plug of the proper type for your installation.

To install a line cord plug,

- familiarize yourself with the requirements for the plug that you plan to install on the unterminated line cord (the illustration shows a typical continental European plug matching the CEE 7 standard),
- strip off the insulation from the line cord wires according to the requirements for your plug,
- open the plug and slide its outer shell onto the line cord,
- connect the ground, neutral, and line wires according to the requirements for your plug,
- if your plug includes a clamp, tighten it on the line cord,
- reassemble the plug,

Test the installation for open and short circuits using an ohm meter.



Standard Wire Color		
Power Source	Wire Color	
	Europe	USA
Line	Brown	Black
Ground	Green/Yellow	Yellow

Installing A Typical Continental European AC Power Plug

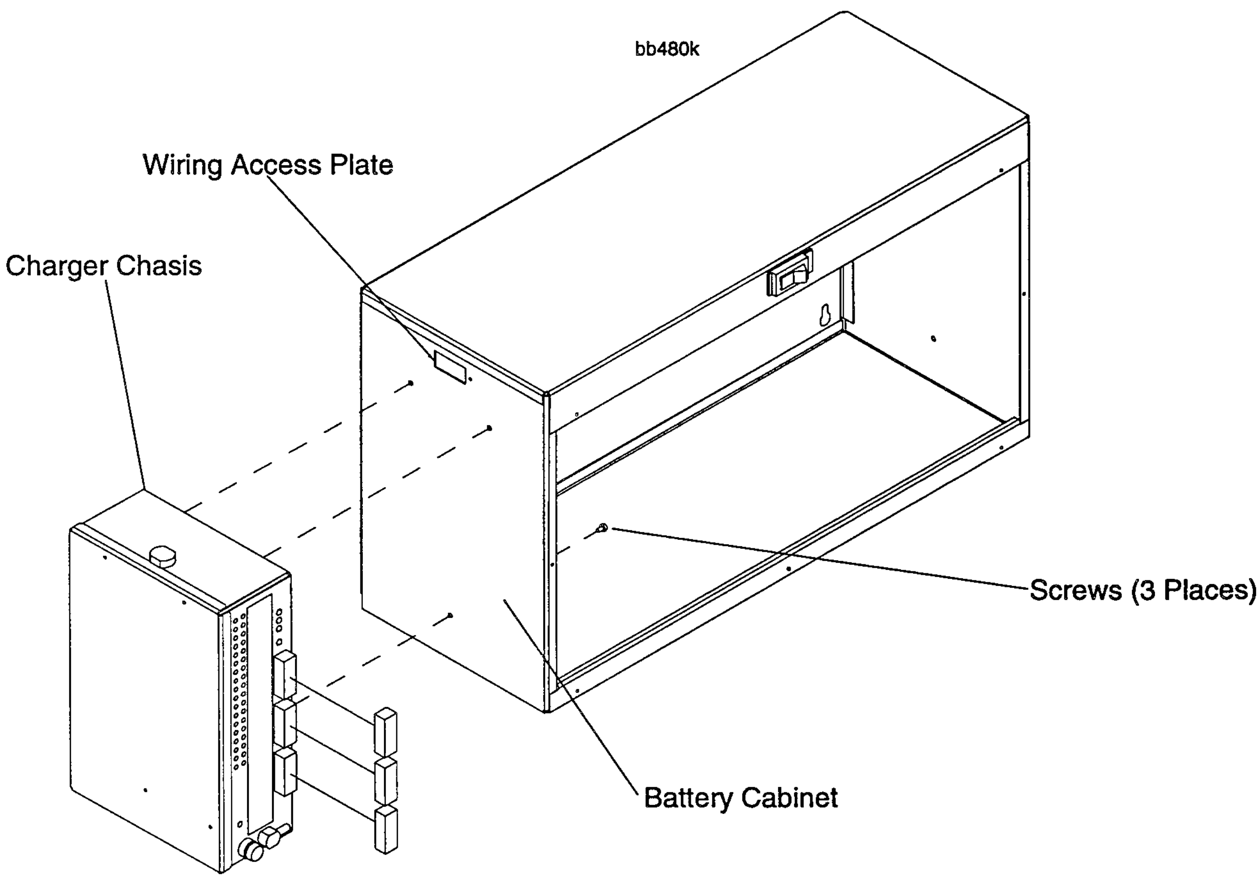
2.0 Mounting The Charger Chassis

You must mount the charger chassis to the battery cabinet; however, the particular position that you chose for this mounting depends upon the method that you plan to mount the cabinet at the DXP *Plus* site.

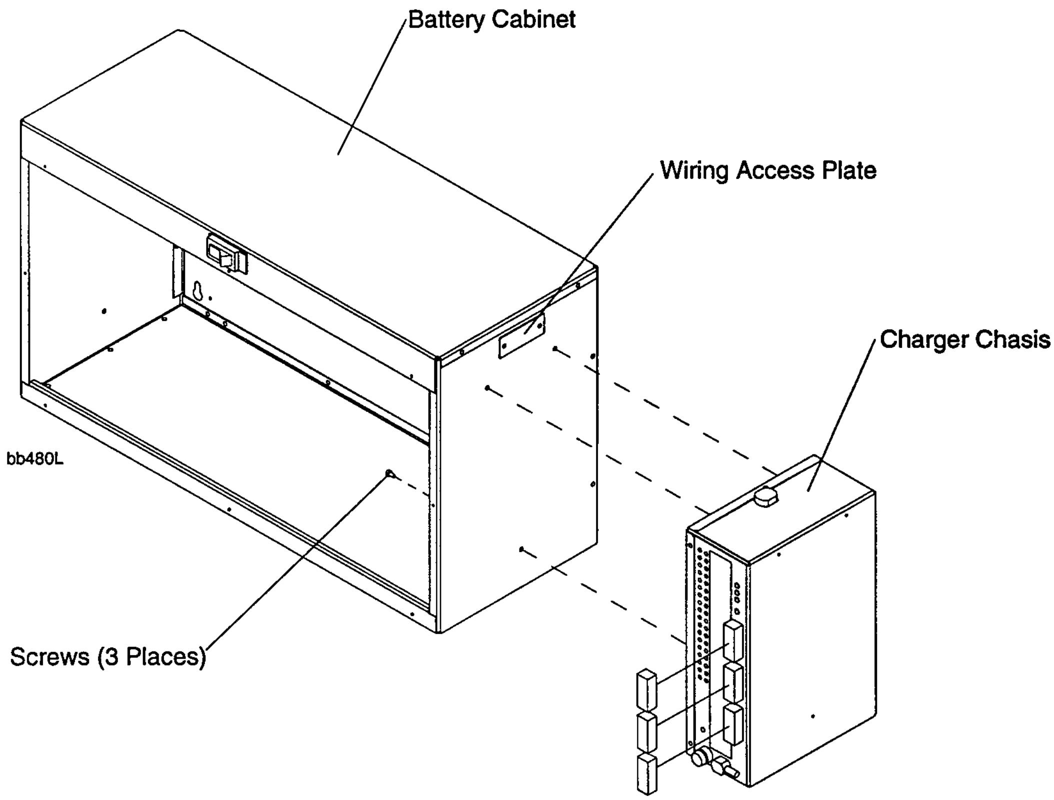
- If you plan to mount the battery cabinet on a backboard at the side of the common equipment cabinets, you must attach the charger, with its cables pointing toward you, to the left end of the battery cabinet as you face the cabinet's battery opening.
- If you plan to mount the battery cabinet below the main common equipment cabinet on the same backboard (single common equipment cabinet installations), you must attach the charger, with its cables pointing toward you, to the right end of the battery cabinet as you face the cabinet's battery opening.
- If you plan to mount the battery cabinet on the back side of a standard 23–inch double equipment rack with the common equipment cabinets mounted to the front side of the rack, you must attach the charger, with its cables pointing away from you, to the to the left end of the battery cabinet as you face the cabinet's battery opening.

To mount the charger chassis,

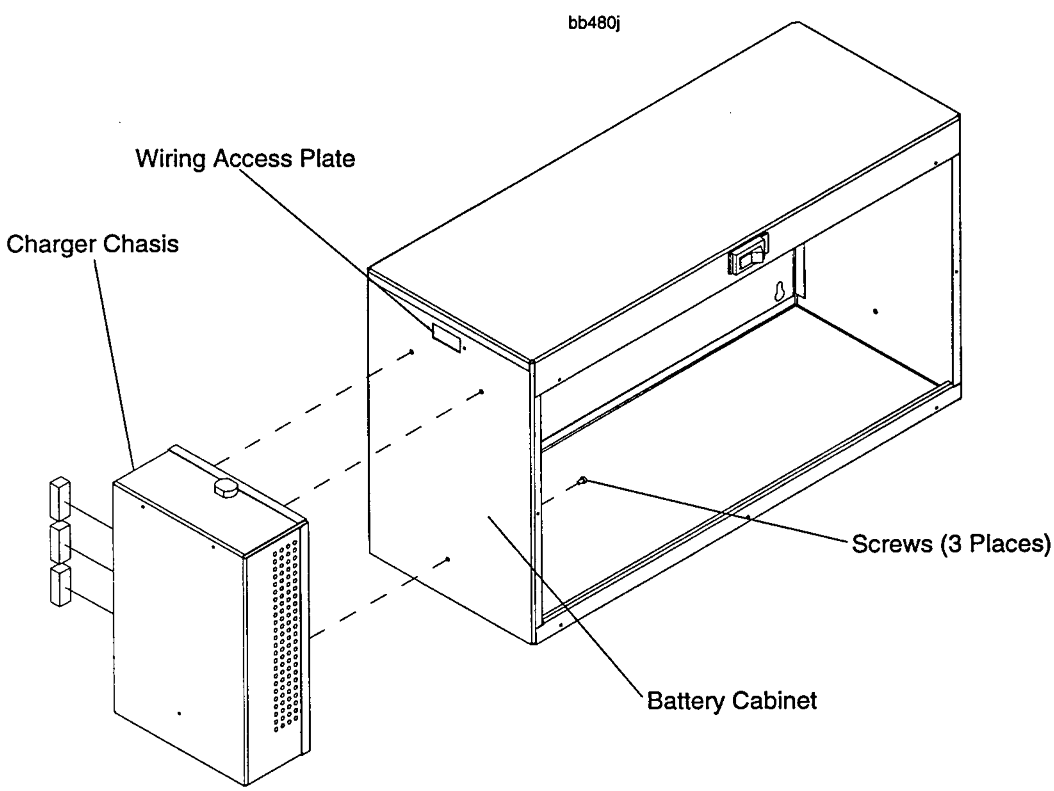
1. Choose the method of battery cabinet mounting, and orient the charger so that it is facing properly for the mounting scheme.
2. Remove the front panel from the empty battery cabinet, and save the retaining hardware.
3. Remove the wiring access plate from the end of the battery cabinet.
4. Route the black battery connection wires through the wiring access hole.
5. Attach the charger chassis to the battery cabinet with the three supplied screws.



Mounting The Charger For Separate Backboard Installations



Mounting The Charger For Below Main Cabinet Installations



Mounting the Charger For Double Rack Installations

3.0 Mounting The Battery Cabinet

CAUTION

The complete battery back up assembly is heavy. The charger chassis, empty battery cabinet, and wiring weigh approximately 25 pounds and all the batteries together weigh approximately 130 pounds for a combined assembly hanging weight of approximately 155 pounds.

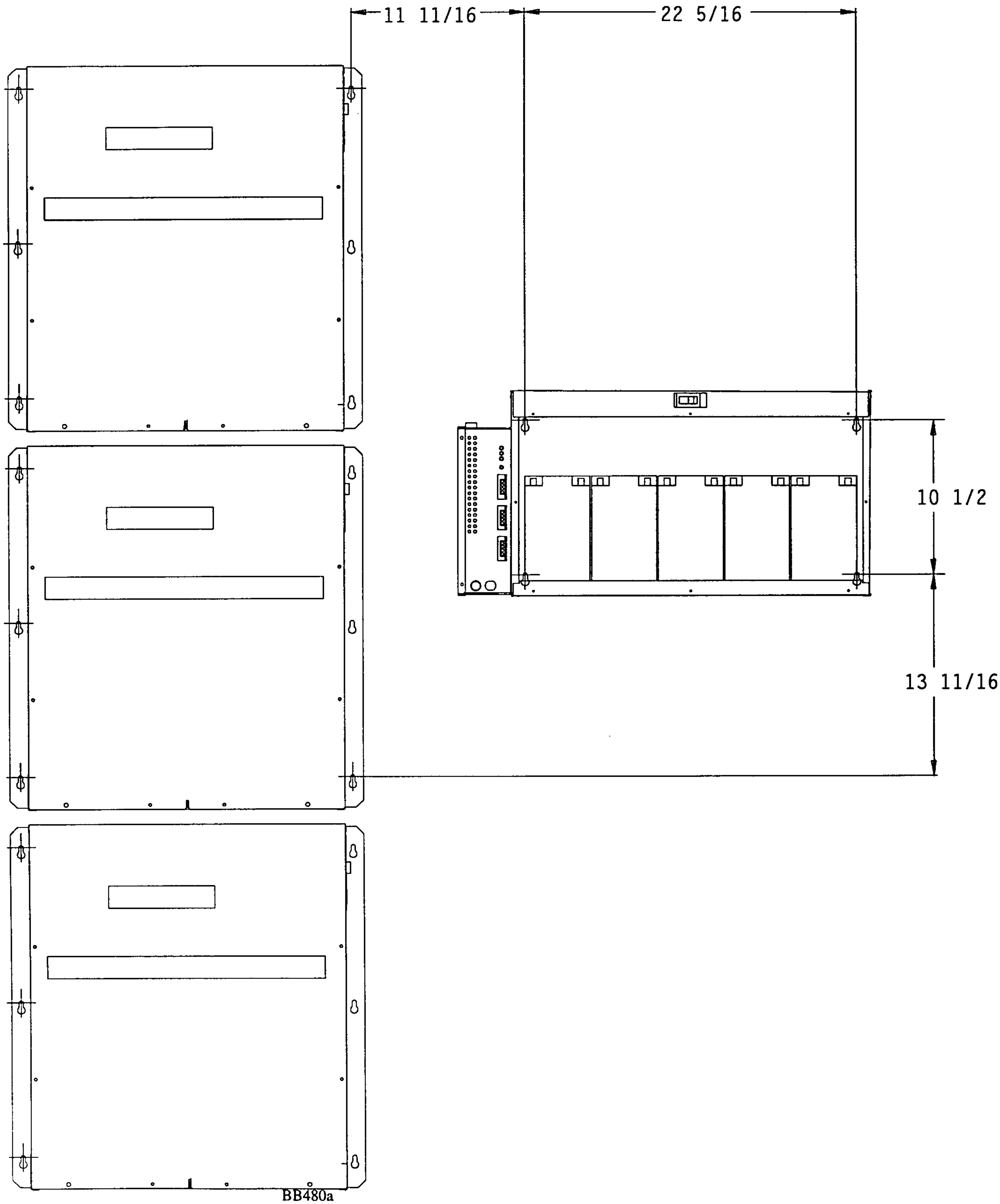
You can mount the battery cabinet at several different locations.

- You can mount the battery cabinet on a separate backboard located to the right of the common equipment cabinet location. Locate the battery cabinet as detailed in the illustration on the facing page.
- At sites that employ only a main equipment cabinet, you can mount the battery cabinet directly below the main common equipment cabinet on the same backboard.
- You can mount the battery cabinet in the middle of a standard 23–inch equipment rack if you wish. This can be a companion rack set next to the one where you have mounted the DXP *Plus* cabinets. Alternately, you can use a self-supporting, two-sided rack with the DXP *Plus* cabinets mounted on one side and the battery cabinet mounted on the other side directly behind and slightly above the main common equipment.

Remember from the *Section 2.0* discussion, you must attach the charger chassis to the battery cabinet in a orientation that supports the cabinet mounting.

NOTE: The following instructions describe how to mount the battery cabinet using a backboard.

1. Add a second backboard to the right of the backboard that supports the DXP *Plus* common equipment cabinet. Be sure that this backboard bridges the studs that support the underlying wall material. Securely attach the backboard to the mounting surface. (Suitable backboards are available commercially or you can construct one out of 3/4-inch plywood.) You must drive the hardware that secures the backboard to the mounting surface into the underlying wall studs instead of just into the wall material alone.
2. Refer to the illustration for the locating dimensions required for the mounting screws, and mark their locations on the backboard. You must attach the cabinet vertically to the backboard.
3. Drill holes in the backboard of a proper size to accommodate the hardware being used.
4. Insert the two top screws into the backboard and tighten them to within approximately 1/8–inch of the surface.
5. Hang the cabinet on the top screws using the top mounting holes in the rear mounting flange of the cabinet. Note that these holes are elongated with an enlargement at one end. This feature allows the cabinet to slide down on the screws to secure the mounting when the cabinet is hung on them.
6. Use the openings for the middle and lower set of mounting screws as a guide, and mark the location for the remaining screws.
7. Lift the cabinet from the top screws and set it aside while preparing the holes for the remaining screws.
8. Rehang the cabinet as discussed in step 6.
9. Insert the lower screws into the backboard and tighten them to within approximately 1/8-inch of the surface.

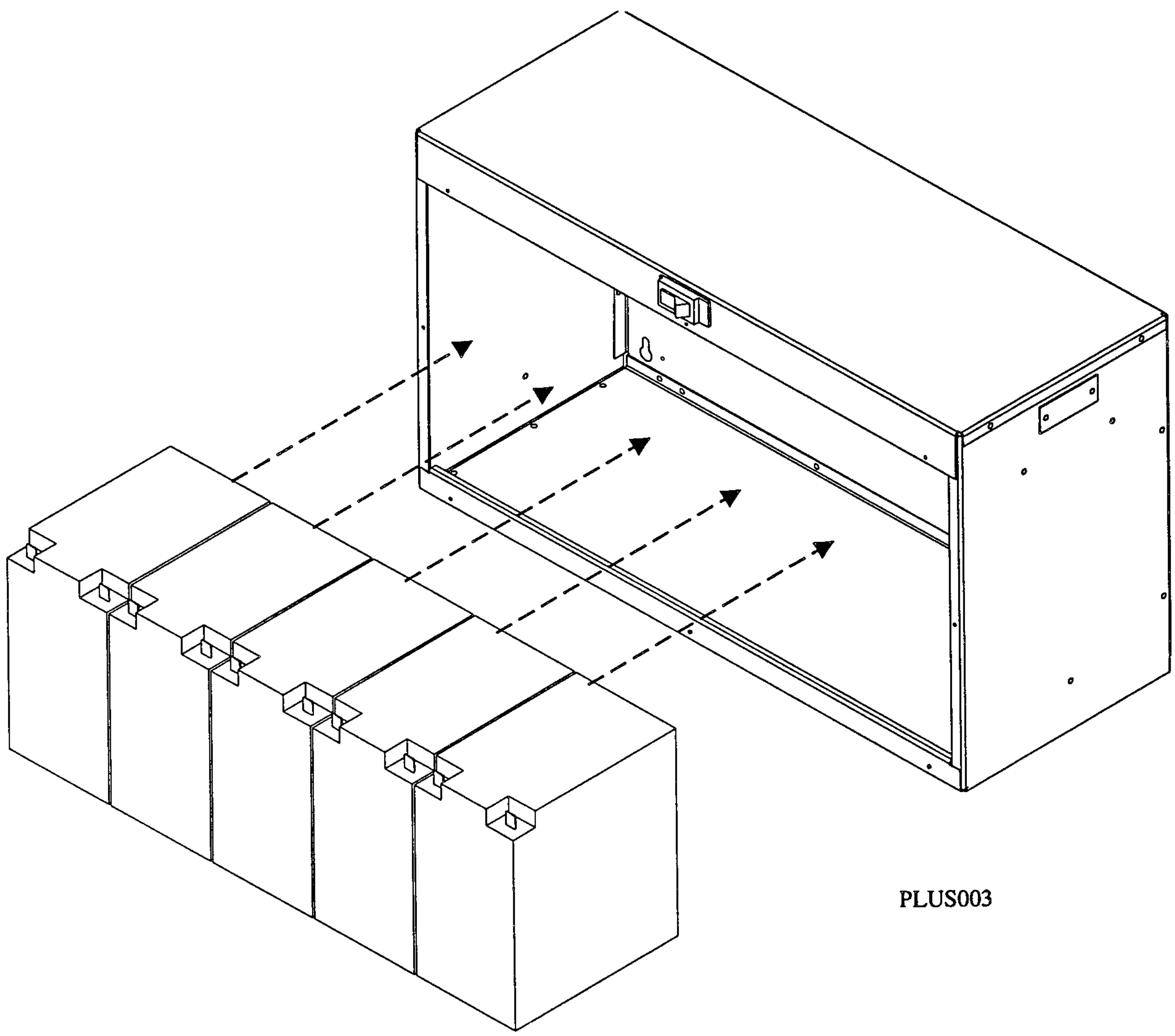


Mounting The Battery Cabinet

3.0 Assembling and Wiring The Batteries In The Cabinet

3.1 Installing The Batteries

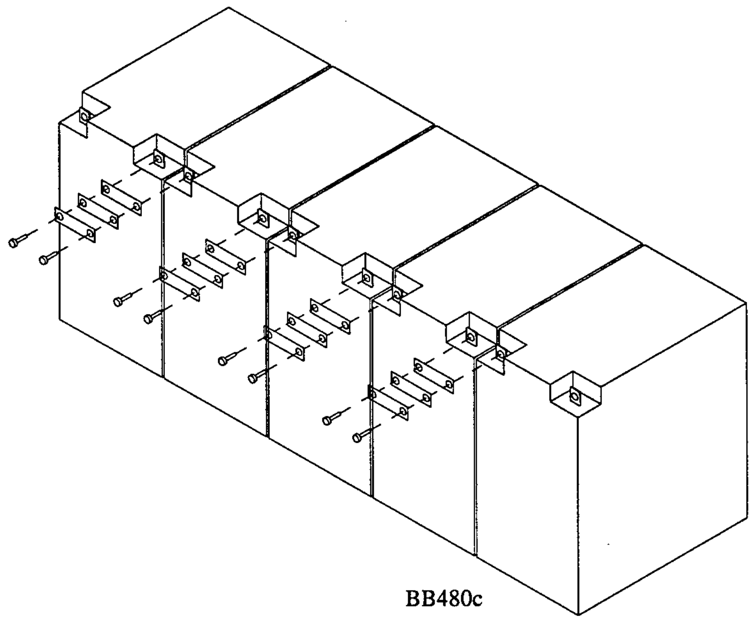
Install the batteries in the cabinet with their terminals facing the cabinet opening. The batteries set in place, and you do not need to anchor them to the cabinet.



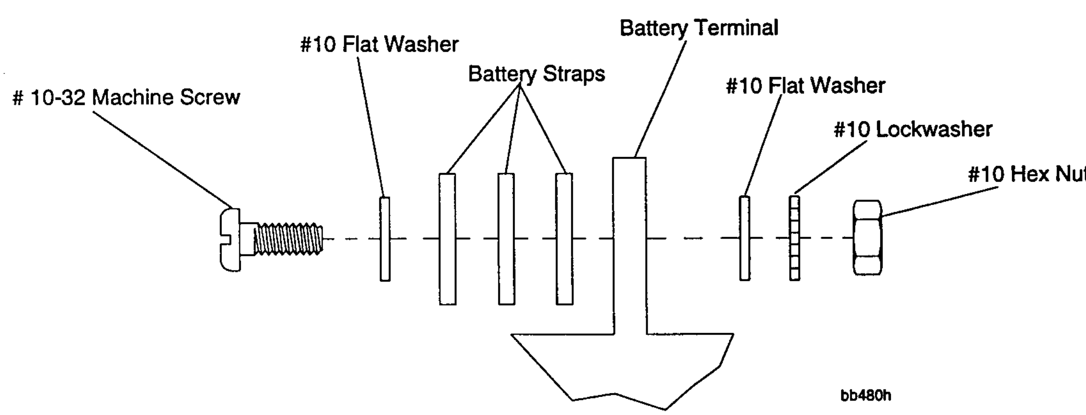
Installing The Batteries

3.2 Strapping The Batteries

You must strap the batteries together using the supplied strapping bars and hardware. Use three strapping bars at each strapping location, and install the hardware as shown in the illustration.



Strapping The Batteries



Attaching The Strapping Hardware

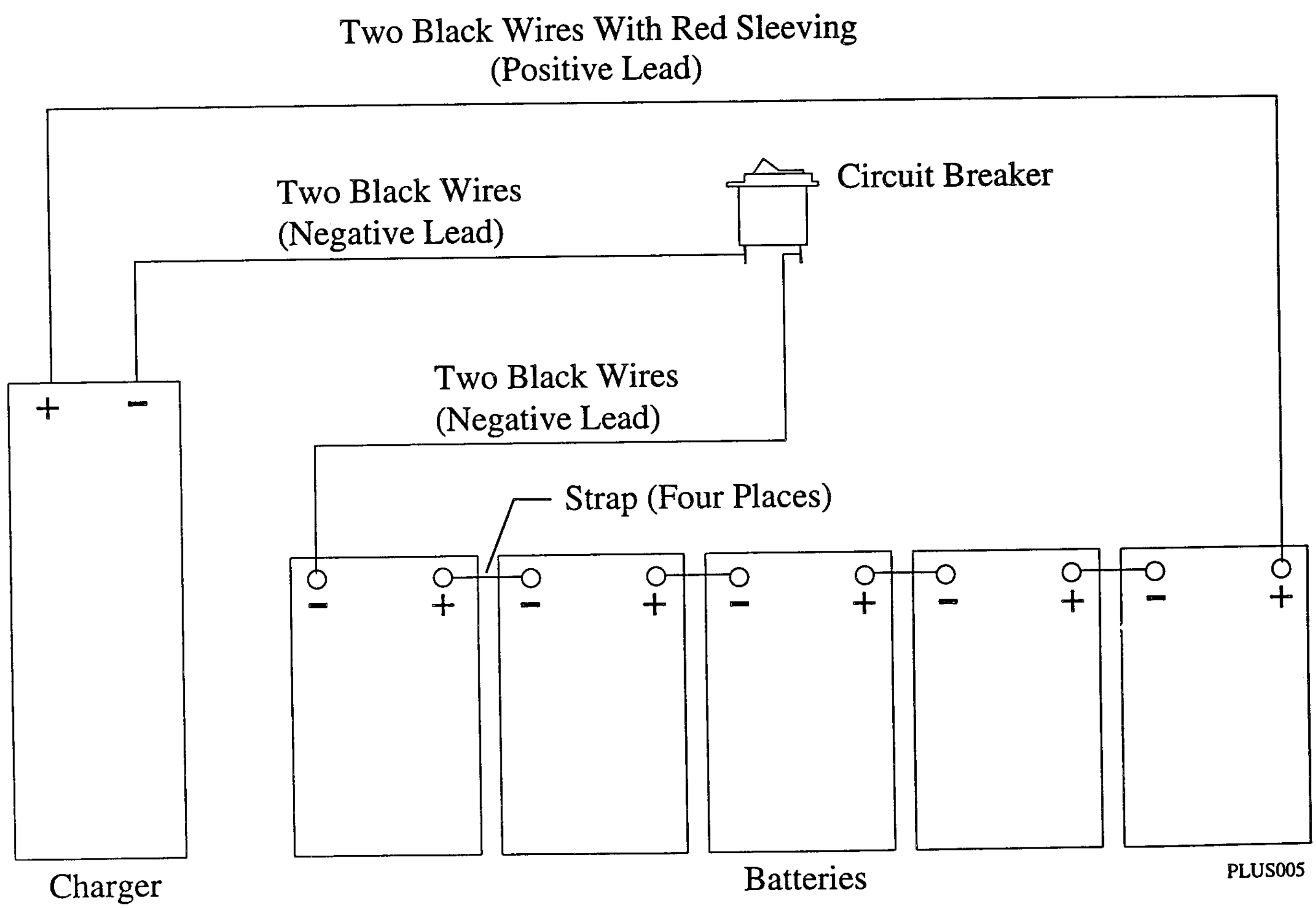
3.3 Wiring The Batteries

The charger has a pair of negative wires and a pair of positive wires(designated by red sleeving near one end of the wires). This two-wire arrangement divides the current carrying load between the two wires of each pair. The cabinet's assembly package includes two individual black wires that you use to wire the circuit breaker to the batteries. Again, two wires divide the current carrying load between both wires.

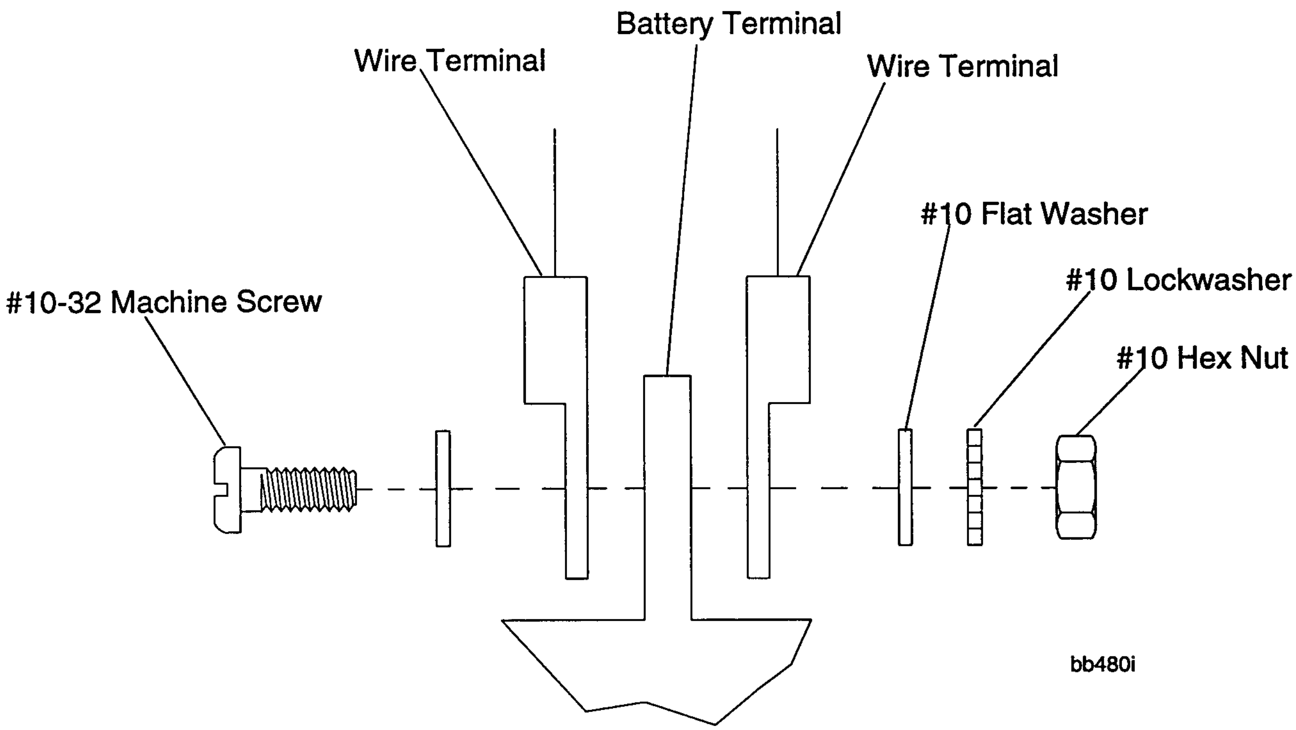
The negative wires from the charger are terminated with smaller size terminals than the those that terminate the charger's positive wires. Connect the smaller (negative) terminals to the circuit breaker and the larger (positive) terminals to the positive battery post. The individual wires that you use to connect the circuit breaker to the battery post are also terminated with a large terminal on one end and a small terminal on the other. Connect the smaller terminals to the circuit breaker and the larger terminals to the negative battery post.

Wire the batteries as shown in the schematic. Use the supplied hardware to connect the wires to the batteries per method shown in the detailed drawing.

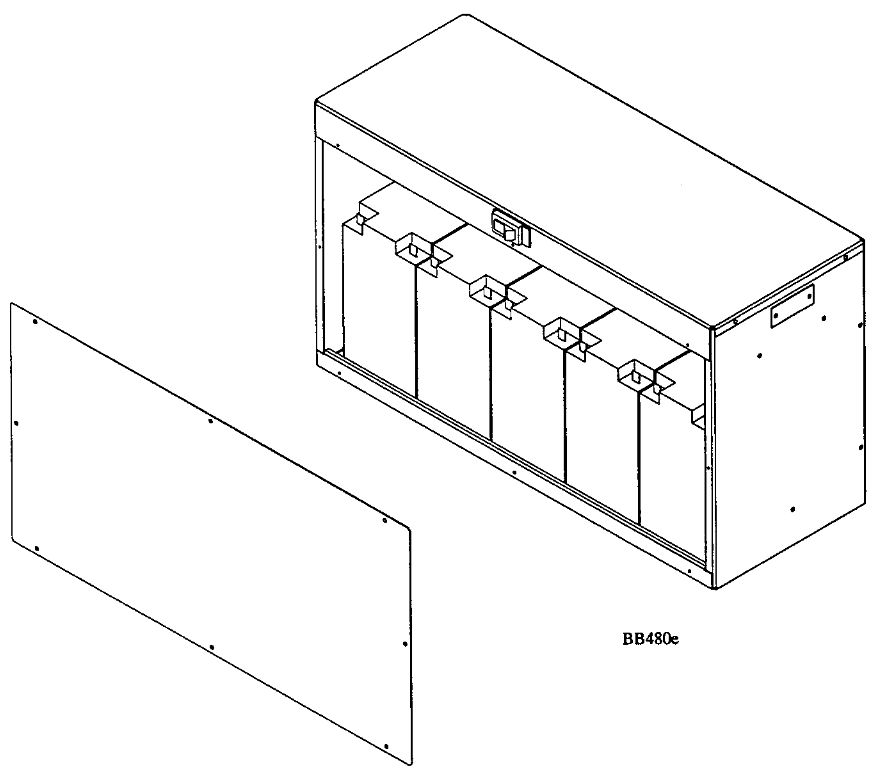
Once you have wired the batteries, attach the front cover to the cabinet with the supplied hardware.



Connecting The Wire Harness



Attaching The Wiring Hardware



Installing The Front Cover

COMDIAL

Troubleshooting

The information contained in this section will assist in isolating a failure in the DXP *Plus* digital communications system.

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Troubleshooting The DXPT1 Digital Carrier Transmission Option On The DXP Plus Digital Communications System

What This Document Contains

Referring To Other Documents

Installing The DXPT1 Digital Carrier Transmission Option, IMI89–193

Carrier-To-Customer Installation DS1 Metallic Interface, ANSI T1.403–1989

Private Branch Exchange (PBX) Switching Equipment for Voiceband Applications, 4.10 "Digital Signaling and Supervision", EIA/TIA–464A

Printed in U.S.A.

IMI89–207.01
7/95

1 Defining The T1 Terms

Bipolar

A bipolar signal is composed of alternating pulses that both represent a digital logic 1. The positive pulse is a (+) and the negative pulse is a (-). Zero volts represents a space, or digital logic 0.

Bipolar Violation (or error)

A bipolar error is a digital logic 1 (or mark) that has the same polarity as its predecessor.

NOTE: Every time the system regenerates the signal stream, it corrects any bipolar errors; therefore, it prevents end-to-end error checking from using bipolar errors.

B8ZS (Binary Eight Zero Substitution)

This is a technique to send an all-zero channel without violating the ones-density requirement (a single one in each channel and no more than 15 zeros in a row). Voice transmission will not allow an all zero channel. The system accomplishes B8ZS suppression by inserting a special bipolar error that is interpreted, not as an error, but an all zero channel. The B8ZS feature replaces the all-zero channel two different ways. The feature replaces the all-zero channel with the sequence 000 + - 0 - + if the preceding pulse was a +, and the feature replaces the all-zero channel with the sequence 000 - + 0 + - if the preceding pulse was -. The + represents a positive pulse, the - represents a negative pulse, and 0 represents no pulse. Set the B8ZS feature with switches SW1–5 and SW1–6.

CAS (Channel Associated Signalling)

The Channel Associated Signalling is the only inbound signalling method currently supported by the DXPT1 board.

COFA (Change of Frame Alignment)

When switch SW2-6 is off, the green LED on the DXPT1 indicates whether the network source or the network span caused the last frame synchronization. (This indication disregards the first re-sync at cold start or a system reset —cold start and reset causes the network source to re-sync.) A COFA occurs if the network source does a re-sync. The COFA is a diagnostic tool that identifies the source of the loss of frame synchronization.

CPE/Carrier Equipment

The DXPT1 is normally classified as Customer Premise Equipment (CPE). If you use SW2–2 to configure the DXPT1 board to use the internal CSU while in the ESF mode, the network may require that the system be classified as Carrier Equipment (CE). The information packet that the DXPT1 board sends to the network contains a facility data link (FDL) maintenance message that has a bit in it that provides this identification.

CRC (Cyclic Redundancy Check)

A method of checking errors from the transmission source to the destination. For T1 operation, CRC caculates a checksum depending on the data in a frame. The system uses CRC in ESF mode exclusively. (You must enable CRC with DIP switch SW2-4).

Delay Dial E&M, DID Protocol Type

Once seized by a calling system, the system being called makes A=1 and B=1 until it is ready to receive digits. When it is ready to receive digits, it makes A=0 and B=0. The system uses a delay dial protocol when wink protocol timing is not compatible to the network.

Dial Pulse – T1

Dial pulse is a method of sending address digits (numbers) using A and B bits logic bits instead of sending DTMF tones. Some carriers may not support dial-pulse signalling. While the method is slower when compared with tones, it requires no DTMF receivers.

Direct Inward Dial (DID) T1 Trunk

DID is a protocol for inbound calls where the network sends the extension number during the beginning of the call. The system supports the 0 through 7 inbound digits. The network does not translate the digits to a valid extension—the system's DID translation tables perform this action.

DS-0 (Digital Signal-Level Zero)

Digital Signal-Level Zero is a single 64Kbit channel inside a T1 span.

E & M T1 Trunk

E&M is a signalling protocol that supports both inbound and outbound digits. Inbound digits from the network are already translated to a 3–digit or 4–digit valid extension. E & M is symmetrical from both ends and ignores the subscriber/office classification of other trunks. Use this signalling protocol for interconnecting two DXP *Plus* systems.

Extended Superframe Mode (ESF)

Extended Superframe Mode consists of 24 frames. The frame bit uses only 6 frames leaving 18 bits for other purposes. These spare 18 bits provide 6 bits for CRC information and 12 bits for a facility data link. The facility data link is for maintenance information (as defined by the ANSI T1.403 specification). Like the superframe mode, the 64–Kbit user channels have 24 frames available for use.

Ground Start T1 Trunks

Ground start is a call signalling protocol that monitors only outbound digits and supports disconnect supervision. Ground start protocol supports only the subscriber end of the communications link

FDL (Facility Data Link)

The Facility Data Link is a 4–Kbit communication link from the network to the DXPT1 board only when the board is operating in the ESF mode. The system sends preemptive messages (for example, yellow alarm and loopback), if needed, and sends error packets to the network once a second. The packets contain alarm history in accordance with the ANSI T1.403 specification.

Fractional T1

Fractional T1 is a T1 span where the user uses less than 24 channels. The DXPT1 board allocates eight or 16 channels to a fractional T1 but does not reallocate unused channels in the eight, 16, or 24 mode to other resources. A fractional T1 in ESF mode will nullify the CRC and other error checking capability since the network shares channels.

Immediate Start Protocol State

Once a calling system seizes a called system, the calling system sends address digits to the called system without requiring an acknowledgement. Inbound immediate start protocol does not support tone dial. Dial-pulse is adequate however. Immediate start protocol is applicable to DID and E&M tie lines.

Inband Signalling

A signalling method where the system sends overhead signalling along with channel traffic.

ISDN (Integrated Services Digital Network) Primary Rate (also called PRI)

Currently not offered by the DXPT1 board.

Loopback Local

An operation method that loops the DXPT1 board's transmit output and receive input paths. The loopback terminates all traffic and halts call processing. While in this idle condition, the system continues to transmit the T1 transmit stream to the network but it will not answer incoming calls. If the remote T1 equipment is the clock source (primary or secondary) for the DXOPT-SYN card, the remote equipment terminates the reference signal because the network receive circuit is open in local loopback. You initiate local loopback by setting the appropriate SW1 switches. The main purpose of local loopback is to verify the DXPT1 board's ability to synchronize properly. Loopback local operation is applicable to superframe adn extended superframe modes.

Loopback Payload

The loopback payload feature is an ESF-only method of loopback which loops the network receive input path to the remote T1 equipment's transmit output path. This loopback method does not loop the first bit of each frame to allow the DXPT1 board's facility data link to continue to transmit maintenance information. You can use switches SW2–7 and SW2–8 to manually initiate the payload loopback or you can allow the network to send an FDL message to initiate or restore the payload loopback. The DXPT1 board goes out-of-service during the loopback time.

Loopback Remote

The loopback remote feature loops the network receive input path to the remote T1 equipment's transmit output path. The remote loopback feature terminates all traffic and halt any call processing. You can use the SW2 switches to manually initiate remote loopback or you can allow the network to remotely initiate the condition. In superframe mode with SW2–1 set to on, the network can send a special in-band pattern (00010001000100010001.... min 5 seconds) to cause the DXPT1 board to automatically enter the remote loopback mode. The network can disable the loopback by sending a different in-band pattern (001001001001001001001.... min 5 seconds). In ESF mode, the DXPT1 board's facility data link, or maintenance channel, can enable and disable remote loopback automatically or you can set SW2–7 on and SW2–8 off to manually enable remote loopback or set both switches off to manually disable the feature. Loopback remote operation is applicable to superframd and extended superframe modes.

LIU Line Interface Unit

The line interface unit is the interface between the T1 copper wires and the DXPT1 board's framing circuitry. The LIU is responsible for separating the 1.544MHZ receive clock from the incoming stream and converting bipolar Alternate Mark Inversion (AMI) to 5–volt digital logic. The LIU also supports the automatic line build-out that regulates the transmit level according to the receive strength (LIU-2 switch).

Loop Start T1 Trunk

Loop Start T1 Trunk is a network protocol that monitors outbound digits to the DXPT1 board. This protocol does not support disconnect supervision. Loop start protocol supports the subscriber end of the communications path but does not support the office (network) end.

Primary Clock Reference

The straps on the DXAUX board designate the primary clock reference. Primary clock reference is the first choice reference clock used to synchronize the DXP *Plus* to the incoming span. If the system looses synchronization, it uses its secondary clock reference. If the secondary clock reference is not available, the DXOPT-SYN card's variable clock oscillator (VCO) switches to the fixed oscillator on the DXSRV (services) board. When it does this, slips occur.

Repeater

A repeater is a amplifying device that central office technicians place at approximately one mile intervals along a T1 circuit to boost the T1 signal. The T1 specifications allow a maximum of 50 repeaters along a communications path.

Slip

This term describes the condition that exists when the transmit 1.544 MHz clock is different from the receive 1.544 MHz clock. When the system collects or looses a frame of information due to the span frequencies being different, the system generates a slip error. Slip does not affect voice transmissions and may not affect modem traffic; however slip does effect digital data traffic. The DXPT1 board does not currently support digital data traffic. Also, at times a central office takes a T1 span out of service if too many slips occur—one or two a day is permissible (the carrier supplier will furnish you with an an exact number if you request that information from them).

Smart-Jack (Network Interface Box)

A smart jack is a demarcation box provided by the central office. A smart jack provides isolation and increased signal drive (up to one mile) and can respond to loopback commands for diagnostic purposes. The central office usually provides an 8–pin modular jack for T1 equipment connection. Pin 1 of the modular jack goes to pin 1 of the DXPT1 modular jack, and so on. Only pins 1 and 2 (DXPT1 receive), 4 and 5 (DXPT1 transmit) require connecting.

Superframe Mode (SF)

The standard T1 mode consists of 12 frames per superframe cycle. The first frame bit remains constant and rotates through a 12-bit pattern. By identifying the frame pattern, the system can select the sixth and twelfth frame for the AB bit signalling inband method. T1 parameters allow for 24 64–Kbit user channels.

Suppression

Suppression is a means to prevent more than 15 zeros in a row and not less than 1 pulse (mark) per channel. The DXPT1 board supports two suppression methods. These are the B7 method and the B8ZS method (selected by SW1–5 and SW1–6). The B7 method inserts a logic 1 in the seventh bit position of a channel if all bits are zeros. The B8ZS method inserts a bipolar violation that will be identified and stripped at the receiving end (selected by switches SW1–5, and SW1–6). Voice coding should not allow an all zero channel.

Unlock Alarm

On a normally operating DXPT1 board, the unlock alarm LED is always off. If this LED is on, it indicates that the phase lock loop creating the transmit 1.544 MHz frequency is defective. For this indicator to be meaningful, the DXOPT-SYN card must be synchronized (no red LEDs on). If the DXOPT-SYN card is not synchronized, you must correct that situation.

Wink E&M, DID Protocol State

This effect is a quick response by a called system (A=1, B=1) to a calling system that seized the line. The response indicates that the called system is ready to receive address digits.

Yellow Alarm

The yellow alarm indicates that the network has lost its incoming frame synchronization. The DXPT1 board signalling is inactive for approximately three to four seconds during this alarm time, and the system halts all call processing. If the system clears the received yellow alarm within the time limit, the DXPT1 board's inactive state terminates and call processing continues.

The system sends a yellow alarm to the network if it loses incoming frame synchronization or if the DXPT1 loses communications to the CPU board. Received and transmitted yellow alarms can not exist at the same time. If such a situation occurs, the system inhibits the transmitted alarm.

ZBTSI (Zero Byte Time Slot Interchange)

Zero Byte Time Slot Interchange is a complex technique to insure that the T1 transmission meets the pulse density requirement. This ZBTSI technique is unpopular in the telephone industy, and the DXPT1 board does not support the feature.

1.1 Introducing The DXPT1

The DXPT1 is a digital interface board supporting up to 24 simultaneous calls on two pairs of wire. The advantages of T1 over single-channel systems are largely:

- Cost savings (much lower price per channel)
- Greater reliability
- Uses less copper wires
- Improved voice reproduction
- More features available

T1 is over 20 years old but the services have been upgraded during this time (for example, extended superframe).

T1 uses time division multiplexing techniques which multiplexes 24 channels in a stream. Each channel is 8 bits wide. The total is 24 channels x 8 bits = 192 bits for user information. An additional bit is added at the beginning of the stream to identify the particular frame. A frame every 125 µsec or 8000/second. 12 frames make up a superframe for standard T1. ESF mode requires 24 frames per superframe. The frame bit in superframe mode is used 100% of the time. The sequence for the frame bits is:

```
100011011100. The first bit of each frame (frame bit) repeats over and over
     |     |
     A     B Of the 12 frames, the 6th and 12th contain the "A" and "B" signalling bits respectively.
```

The signalling is inband (mixed with the channel). For the two binary bits (A and B), only four combinations are possible (00, 01, 10, 11). These bits are assigned according to the signalling protocol (for example, E&M, DID, Loop Start, and Ground Start). See section 3, "Troubleshooting The Protocol Layer."

The span speed is 1.544 MHz (193 x 8000/sec).

For extended superframe (ESF), the frame-related bits in the 24 frames are:

ESF Framing Format

```
mcm0mcm0mcm1mcm0mcm1mcm1...6 frame bits (0 or 1) on frames 4, 8, 12, 16, 20, 24 (2 Kbps)
                           12 maintenance bits (m) (4 Kbps)
                           6 CRC error checking bits (c), if enabled (2 Kbps)
```

Therefore, all of the 24 non-user bits (frame, maintenance, and error checking) use a bandwidth of 8 Kbps out of the total bandwidth of 1.544 Mbps.

The A and B signalling bits are inserted over the least significant bits (LSB) of each channel in the 6th and 12th frame respectively. *This does not change the speech encoding enough to be detected by the user.* The A and B signalling bits are repeated in the 18th and 24th frames.

1.2 Describing The Channel Service Unit (CSU)

The DXPT1 board has a CSU built into the board. This allows direct connection to the network (DS1 level). If a CSU was not built-in, the connection would be DSX-1 and would only transmit 655 feet to the nearest 66-type connector block. The CSU increases signal drive to 1 mile, provides electrical isolation (1500 volts), and provides automatic line build out (ALBO). The output is set depending on the received signal level strength. When a strong signal is received, the transmit level is -15 dB. When a weak signal is received, the transmit level is 0 dB. This ability to adjust output levels prevents over driving a line repeater in the network, if directly connected. If a customer still wants to add an external CSU, he/she may do so. Normally, the DXPT1 is connected to a central office "smart" jack. The customer's savings from using the built-in CSU can easily amount to approximately one thousand dollars, at today's prices.

NOTE: If an external CSU is added by the installer for the purposes described above, and the mode is Extended Superframe, check the SW2-2 switch for the correct ID, if in conflict.

1.3 Considering Pre-Installation Details

CAUTION

For operation with the DXP Plus, the T1 board must be Revision B or higher. If the T1 board that you are installing is a lower revision, contact Comdial Technical Services (1–800–366–8224) for advice before you proceed with the installation..

If you are the installer, you must consider the following things to ensure a proper installation.

A. Determine the T1 trunk configuration and communicate this to the central office and/or the network for coordination and assignment of service.

B. Determine whether the dial type is tone or pulse.

C. If DID or E&M protocols are going to be used, determine the number of DTMF receivers needed.

D. If the above protocols are used, coordinate the blocks of numbers assigned with the data base.

E. For DID and E & M protocols, determine the type. Wink start, delay dial, or immediate start are available. Wink start is very popular. If you choose immediate start inbound, select dial pulse over tone dial to ensure that the DXP has enough time to react.

F. AT&T will not supply dial tone unless the customer ordered this feature. However, if you enable the automatic route selection (ARS) feature, it will supply dial tone.

G. Configure an interface cable (8-conductor cable terminated with modular jacks) to connect to the DXPT1. See section 4 in *Installing The DXPT1 Digital Carrier Transmission Option,* IMI89–193 for more instructions. Pins 7 and 8 must be open at the DXP *Plus* end for DXPT1 Issue 2 while Issue 3 boards and above will not require pins 7 and 8 to be open. A smart-jack often connects pins 7 and 8 to chassis ground. If the chassis ground is connected at the smart-jack, the DXP *Plus* receive will most likely show loss of signal. (Pins 1 and 2 are shorted to 7 and 8 to allow for an inverted cable to be used.)

H. Order spare boards, if needed.

I. Make sure you have a synchronization card to install on the auxiliary board.

J. Determine the optimum DXPT1 board configuration. If a T1 board occupies a universal slot, more stations are possible than by using analog trunk boards.

K. If fractional T1 is being considered, decide whether 8-, 16-, or 24-channel mode is most beneficial.

L. Verify that primary lightning protection (such as gas discharge tubes) is provided where the T1 copper wires enter the building. This should be the case when a smart jack is installed by the central office. ***Primary protection is a must since the DXPT1 contains only secondary protection.***

M. For a DXP-to-DXP application, where no outside network exists, only one synchronization card is required. The designated "master" DXP *Plus* does not require a synchronization card.

2 Troubleshooting The Physical Layer

SW1, SW2, and the LIU switches must be set up according to the customer's requirements. See *Installing The DXPT1 Digital Carrier Transmission Option,* IMI89–193 for directions.

2.1 Selecting Functions With DIP Switches SW1-1 Through SW1-8

NOTE: SW1 switch contents will be updated only during a reset operation.

The mode, superframe or extended superframe, is critical. If set wrong, the board will not find frame sync causing the red Sync LED to light.

Yellow alarm mode (SW1-4) is always off, unless the customer is in Japan.

Suppression is defaulted to B7. If digital data is ever presented to the DXPT1 board from a drop and insert multiplexer (mux), or any other means, B8ZS will be required even though the channel is disabled in the DXP *Plus*. The digital data could be all zeros violating the ones density requirement of 1 in 8 bits in a channel. The network or mux must also have B8ZS enabled. If B8ZS is being sent in any channel the green LED above SW1 will flicker if SW2-6 is enabled. Do not set SW1-5 and SW1-6 to the "no suppression" setting unless approved by Comdial Engineering. The "no suppression" setting is for possible future needs.

SW1-7 and 8 are critical to the channel capacity required.

2.2 Selecting Functions With DIP Switches SW2-1 Through SW2-8

SW2-1 is valid only in the superframe mode. This switch must be "on" if the network is capable of initiating an inband loopback. The switch will not cause a remote loopback but it will look for the command from the network. Leaving the switch "on" does not hurt anything whether the network can perform the loopback operation or not. A reset is not required when changing the switch.

SW2-2 is programmed at reset in the ESF mode only, and it will always be "off" (default) unless the network requires the facility data link messages to be a different ID. The default is customer premise equipment. If the network requests that the messages have a carrier-type header ID, turn the switch "on" and reset the board. This will probably never need to be "on".

SW2-4 is for reporting CRC errors in the ESF mode, if the network has the ability to support the CRC feature. The default position is "off" to prevent false errors when the error checking is not supported by the network.

SW2-5 is to allow or prevent the sending of facility data link message packets in ESF mode during a preemptive yellow alarm and loopback messages. The ANSI specification allows FDL packets to be stopped during a yellow alarm and loopback, but some customers/networks want the packets to continue. Switch changes require a reset to be programmed.

SW2-6 defines the meaning of the green LED labeled "B8ZS/COFA." A reset is not required when changing this switch. When the switch is "off" (default), the LED indicates COFA detected. When the switch is "on," the LED indicates B8ZS detected. B8ZS detection is handy to verify if the network is sending B8ZS. If so, and the B8ZS suppression is not set (SW1-5, 6), the B8ZS will be seen as bipolar alarms, and recorded as such, even though they are not,

SW2-7, 8 are manual loopback requests for diagnostic reasons. Local loopback verifies the ability of the DXPT1 to sync on itself to insure frame syncing problems are not caused by the DXPT1 board. These switches are rarely used to enable remote loopback and payload loopback.

NOTE: A local loopback will disable the synchronization card reference causing an automatic switch to the next reference. If only one reference is configured, the system defaults to the DXP Plus fixed oscillator on the services board.

2.3 Selecting Functions With DIP Switches LIU-1 Through LIU-4

There are four LIU switches. The first switch will change the receive sensitivity from -26 dB to -36 dB. Changing to -36 dB for extra long loops (1 mile) is not recommended unless the DXPT1 will not maintain frame sync. In the -36 dB setting, noise could be a problem because of increased sensitivity.

The LIU-2 switch sets the transmit signal level. *The transmit signal level has nothing to do with the audio voice levels.* The default is manual "on" and the transmit level is determined by LIU-3 and 4 settings.

LIU-3 and LIU-4 are defaulted "off" which corresponds to 0 dB (strong signal).

For applications where the DXPT1 is directly connected to a nearby repeater, the automatic mode is preferred (LIU-2="off") to keep from over driving the repeater. Repeaters are very sensitive on their inputs. In auto mode, the transmit is determined by the receive level according to the following chart: LIU-3 and 4 are ignored in auto mode.

IF LEVEL RECEIVED IS	LEVEL TRANSMITTED IS
0 to -7.5 dB	-15 dB
-7.5 to -15 dB	-7.5 dB
-15 to -22.5 dB	-7.5 dB
-22.5 to -26 dB	0 dB

If in auto mode and LIU switch 3 or 4 is changed, a re-sync is required to reset the new setting. Unplugging the T1 span in and out is an easy way to cause a re-sync.

2.4 Setting Up The DXOPT-SYN Synchronization Card

Program the synchronization card by strapping the two strap blocks on the auxiliary board. A reference clock from each T1 board is presented. You can strap the board so that one T1 clock source is the primary clock reference, and another T1 source is the secondary clock reference. The secondary clock reference is then used in case the primary span fails. If only one T1 board is installed, we recommend that you strap the auxiliary board so that the one T1 source is serving as both the primary and secondary reference. Otherwise, don't strap the secondary strapping block. See section 4, *Installing The DXPT1 Digital Carrier Transmission Option,* IMI89–193. The green LEDs on the sync card verifies the presence of a reference source. If the green LEDs are off, check the straps, and make sure that the DXPT1 board is not in the local loopback mode.

If one or more of the green LEDs are lit, the sync card's red LED (Unlocked) should be off. Do not place the sync card's switch in the manual mode during normal operation. The manual mode switch is for maintenance when you want to force the use of the primary or secondary reference. The automatic mode allows automatic selection of the secondary reference in the event that the primary reference is lost. If the sync card does not synchronize, and the green LEDs are lit, the synchronization card is probably bad. The only other possibility is that the sync card detection circuit on the services board is not working, which is unlikely. If the DXPT1 board is in an expansion cabinet, be sure the interface boards are multilayer (that is, not transparent). Earlier interface boards, of the non-multilayer type, are subject to electrical noise.

3 Troubleshooting The Protocol Layer

Four protocols are supported:

- E & M
- DID
- Ground Start
- Loop Start

Ground and loop start are subscriber-end only (DXP *Plus* end) not office-end (network end).

Before starting protocol layer troubleshooting, make sure you have completed all physical layer troubleshooting to ensure that no alarms are occurring and that the DXPT1 board has no red LEDs lit except for the large status LED.

Troubleshooting the protocol layer consists of checking the A and B transmit and receive signalling bits. Depending on the protocol that is active and on which function is occurring, A and B signalling bits can be a digital one ("1") or a zero ("0"). In some cases, the level ("0" or "1") doesn't matter and could be either one (X). These levels are designated by a "0," "1," or "X" in the following tables.

When the function involves a user dialing a number with a rotary dial, the signalling bit designated by "DP" in the following tables, represents the dial pulse (make= 1 ; break = 0). For a ground start protocol, the signalling bit representing a dial pulse will be a digital one ("1") when a tone dial is used in place of a rotary dial.

NOTE: In the table below, an X is a don't care. Signalling can be a 1 or 0. DP is a dial pulse (make = 1, break = 0).

3.1 Defining The Signalling Bits For The E & M Protocol

FUNCTION	TRANSMIT		RECEIVE		EIA/TIA 464-A STANDARD
	A	B	A	B	
OUTGOING CALL					
Idle	0	0	0	X	
DXP off-hook	1	1	0	X	
Wink	1	1	1	X	Wink on
Wink	1	1	0	X	Wink off
Dial pulsing	DP	DP	0	X	
Wait for ANS	1	1	0	X	
Far end ANSW	1	1	1	X	
INCOMING CALL					
Idle	0	0	0	X	
CO goes off-hook	0	0	1	X	
DXP sends wink	1	1	1	X	
DXP after wink	0	0	1	X	
Far end DP	0	0	DP	X	Make=1, Brk=0
Far end wait FR ANS	0	0	1	X	
DXP answers call	1	1	1	X	

3.2 Defining The Signalling Bits For The Direct Inward Dial (DID) Protocol

FUNCTION	TRANSMIT		RECEIVE		EIA/TIA 464-A STANDARD
	A	B	A	B	
INCOMING CALL					
Idle	0	0	0	X	
CO goes off-hook	0	0	0	X	
DXP sends wink	1	1	1	X	
DXP after wink	0	0	1	X	
Far end DP	0	0	DP	X	Make=1, Break=0
Far end wait FR ANS	0	0	1	X	
DXP answers call	1	1	1	X	

3.3 Defining The Signalling Bits For The Ground Start Protocol

FUNCTION	TRANSMIT		RECEIVE		EIA/TIA 464-A STANDARD
	A	B	A	B	
OUTGOING CALL					
Idle	0	1	1	X	
PBX grounds ring	0	0	1	X	
PBX grounds tip	0	0	0	X	
PBX removes ring ground	0	1	0	X	
PBX loop closed	1	1	0	X	
Dial pulsing	DP	1	0	X	"1" vs DP for DTMF
Dialing CMPL	1	1	0	X	
INCOMING CALL					
Idle	0	1	1	X	
CO grounds tip	0	1	0	1	
Ringing interval	0	1	0	0	
PBX presents call	0	1	0	1	
PBX answers call	1	1	0	X	
Normal talking STAT	1	1	0	X	
DISCONNECT PBX					
Talking state	1	1	0	X	
PBX opens loop	0	1	0	X	
CO removes tip ground	0	1	0	1	Idle state
CO ABANDONS INCOM...					
Talking State	1	1	0	X	
CO removes tip ground	0	1	0	1	CO hangs up
PBX opens loop	0	1	0	1	Idle state
PBX ABANDONS BEFORE CO HAS RETURNED TIP GROUND					
PBX waiting tip ground	0	0	1	X	
PBX removes ring ground	0	1	1	X	

3.4 Defining The Signalling Bits For The Loop Start Protocol

FUNCTION	TRANSMIT		RECEIVE		EIA/TIA 464-A STANDARD
	A	B	A	B	
OUTGOING CALL					
Idle	0	1	0	1	
PBX loop closed	1	1	0	1	Waiting for dial tone
PBX pulsing	DP	1	0	1	"1" vs DP for DTMF
Dialing CMPL	1	1	0	1	
INCOMING CALL					
Idle	0	1	0	1	
CO sends ring	0	1	0	0	
Interval between ring	0	1	0	1	
PBX presents call	0	1	0	1	
PBX answers call	1	1	0	X	
Normal talking STAT	1	1	0	X	
DISCONNECT PBX					
PBX opens loop	0	1	0	X	
Idle	0	1	0	1	
CO ABANDONS INCOM...					
CO applies ring	0	1	0	0	
Interval between ring	0	1	0	1	
CO abandons	0	1	0	1	
PBX stop presenting	0	1	0	1	

4 Using The Diagnostic Function

The diagnostic function on the DXPT1 board provides a method for obtaining information about the T1 operation. You can do this either on-site or from a remote location by sending and receiving coded messages. Remote operation is described in section 4.8.

4.1 Understanding The Diagnostic Switches And Indicators

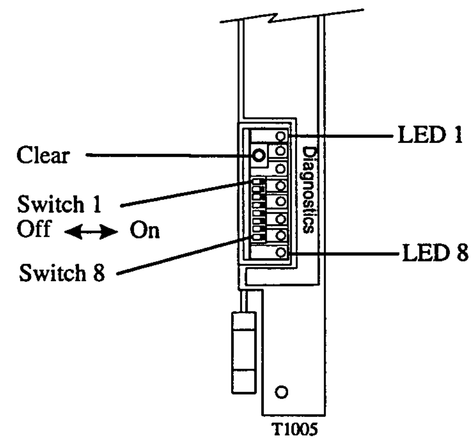
The diagnostic portion of the DXPT1 board contains eight DIP switches, eight green LEDs, and a "clear" pushbutton for clearing functions. Set the DIP switches to request certain T1 system information. When testing from a remote location, using a computer and modem, you can similate the switch settings by sending a coded message.

The system responds to your request for information by lighting certain LEDs to provide you with the requested information. If you are testing from a remote location, the system responds by sending a coded message that similates the lighted LEDs.

Use the clear pushbutton to stop any counting function (denoted by the LEDs sequencing) and reset the counter.

The diagnostic port is a monitor mode only access. You cannot cause harm to the equipment by moving the switches or pushing the clear pushbutton. Leaving any of the switches on will *not* cause any operational problems.

Since the operation is cryptic, the customer normally doesn't use the diagnostic monitor. Functions of the port are to simplify problem solving in the field



DXPT1 Diagnostic Switches And Indicators

4.1.1 Determining Channel Number

The letters ABCDE in switch positions 4 through 8 are used to designate a channel number in many of the tables used on the following pages. See the table below for the relationship between the letters ABCDE and channel numbers 1 through 24. (Example, a DIP switch setting of 10100101 requests trunk assignments on channel 6).

CHANNEL	A	B	C	D	E	CHANNEL	A	B	C	D	E	CHANNEL	A	B	C	D	E
1	OFF	OFF	OFF	OFF	OFF	9	OFF	ON	OFF	OFF	OFF	17	ON	OFF	OFF	OFF	OFF
2	OFF	OFF	OFF	OFF	ON	10	OFF	ON	OFF	OFF	ON	18	ON	OFF	OFF	OFF	ON
3	OFF	OFF	OFF	ON	OFF	11	OFF	ON	OFF	ON	OFF	19	ON	OFF	OFF	ON	OFF
4	OFF	OFF	OFF	ON	ON	12	OFF	ON	OFF	ON	ON	20	ON	OFF	OFF	ON	ON
5	OFF	OFF	ON	OFF	OFF	13	OFF	ON	ON	OFF	OFF	21	ON	OFF	ON	OFF	OFF
6	OFF	OFF	ON	OFF	ON	14	OFF	ON	ON	OFF	ON	22	ON	OFF	ON	OFF	ON
7	OFF	OFF	ON	ON	OFF	15	OFF	ON	ON	ON	OFF	23	ON	OFF	ON	ON	OFF
8	OFF	OFF	ON	ON	ON	16	OFF	ON	ON	ON	ON	24	ON	OFF	ON	ON	ON

4.2 Requesting Cold Start Information

When the DXP-T1 system is turned on, internal self-tests are run to determine the condition of the system. When you use this request, you are asking the system to provide you with the results of these tests. Upon making the cold start information request, the system verifies the following.

- operating mode is superframe (SF) or extended superframe (ESF),
- FDL daughterboard (used for ESF) is installed on the T1 board and okay or not installed (or defective),
- channel capacity currently selected is 8, 16, or 24 channels,
- static RAM is okay or has read/write errors,
- internal CPU RAM is okay or has read/write errors.

4.2.1 Setting The DIP Switches For Cold Start Information

Set the DIP switches as shown in the following table. Switch 1 is the top switch. When the switch is moved to the right, it is turned on. The hex code shown is used for remote operation only.

SWITCH SETTINGS								TYPE OF REQUEST	HEX CODE
1	2	3	4	5	6	7	8		
ON	ON	ON	OFF	OFF	OFF	OFF	ON	Provide results of all self-tests run during system start-up (cold start).	E1

4.2.2 Reading The Cold Start Information From The LEDs

The Table below shows the cold start information that is revealed by the LEDs. LED 1 is at the top.

LEDs								LED DEFINITIONS
1	2	3	4	5	6	7	8	
OFF								Not used
	OFF							SF mode
	ON							ESF mode
		OFF						Always off
			OFF					Either in SF mode or FDL board missing or bad
			ON					FDL board recognized (ESF only)
				OFF	OFF			Selected channel capacity is 24
				OFF	ON			Selected channel capacity is 8
				ON	OFF			Selected channel capacity is 16
						OFF		Static RAM has read/write errors
						ON		Static RAM is okay
							OFF	Internal CPU RAM has read/write errors
							ON	Internal CPU RAM is okay

Example: If you see the following LED light pattern, you can determine the cold start results from the above LED definitions. (For remote testing, the system would send hex code 53.)

O= LED off
●= LED on

O
● ESF mode
O
● FDL board recognized
O 24-channel
O capacity
● static RAM okay
● internal CPU RAM okay

4.3 Requesting Information On Received Signal Strength

When you use this request, you are asking the system to provide the signal strength of its received signals. Upon making the received signal strength request, the system supplies you with the following information:

- the range in dB of the received signals.

4.3.1 Setting The DIP Switches For Received Signal Strength Information

Set the DIP switches as shown in the following table. Switch 1 is the top switch. When the switch is moved to the right, it is turned on. The hex code shown is used for remote operation only.

SWITCH SETTINGS								TYPE OF REQUEST	HEX CODE
1	2	3	4	5	6	7	8	Provide the dB range of the received signal strength.	FF
ON	ON	ON	ON	ON	ON	ON	ON		

4.3.2 Reading The Received Signal Strength Information From The LEDs

The Table below shows the received signal strength information that is revealed by the LEDs. LED 1 is at the top.

LEDs								LED DEFINITIONS	HEX CODE
1	2	3	4	5	6	7	8		
LEDs 1 through 4 not used (off)				OFF	OFF	OFF	ON	-7.5 to -15 dB (medium signal)	01
				OFF	OFF	ON	ON	-15 to -22.5 dB (weak signal)	03
				OFF	ON	ON	ON	-22 dB and below (spec is to -26 dB) (very weak)	07
				ON	ON	ON	ON	0 to - 7.5 dB (strong signal)	0F

NOTE: If signal is very weak from a long span of a mile or more, and frame synchronization is not being maintained, turn DIP switch LIU-1 on.

4.4 Requesting Information On Switch Settings

You can determine how particular DIP switches on the DXPT1 board are set by using one of the following requests. Depending on which request you make, the system supplies you with the following information:

- DIP switch settings for SW1,
- DIP switch settings for SW2,
- DIP switch settings for LIU.

4.4.1 *Requesting Information On DIP Switch Settings*

Set the diagnostic DIP switches as shown in the following table. Switch 1 is the top switch. When the switch is moved to the right, it is turned on. The hex code shown is used for remote operation only.

SWITCH SETTINGS								TYPE OF REQUEST	HEX CODE
1	2	3	4	5	6	7	8		
OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	Provide the DIP switch settings for SW1	01
OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	Provide the DIP switch settings for SW1	03
OFF	OFF	OFF	OFF	OFF	ON	ON	ON	Provide the DIP switch settings for LIU	07
OFF	OFF	OFF	OFF	ON	OFF	OFF	ON	Provide the DIP switch settings for the diagnostic switches (the diagnostic LEDs simply "mirror" the switch settings; that is, LEDs 5 and 8 should be lit).	09

4.4.2 *Reading The DIP Switch Settings Information From The LEDs*

The diagnostic LEDs "mirror" the switch settings for the DIP switches requested. For example, if LED 1 is on, then switch 1 is on for the requested DIP switches. If LED 1 is off, then switch 1 is off, and so forth.

When requesting information on the LIU DIP switch settings, the system replies via LEDs 1 through 4. LEDs 5 through 8 are not used in this application.

4.5 Requesting AB Signalling

When you use this request, you are asking the system to reveal the A and B bits. Upon making the AB signalling request, the system supplies you with the following information:

- A bit transmitted to the CO,
- B bit transmitted to the CO,
- A bit received from the CO,
- B bit received from the CO.

4.5.1 Setting The DIP Switches To Request AB Signalling

Set the DIP switches as shown in the following table. Switch 1 is the top switch. When the switch is moved to the right, it is turned on. Use switches 4 through 8 (designated in the table by A through E) to select the channel you want to test (1 through 24). See the table in section 4.1.1 for the relationship between the 24 different letter groups and channel numbers. For remote operation, determine the corresponding hex code from Table 1.

SWITCH SETTINGS								TYPE OF REQUEST	HEX CODE
1	2	3	4	5	6	7	8		
OFF	OFF	ON	A	B	C	D	E	Provide AB signalling on the channel designated by ABCDE. See section 4.1.1.	see Table 1

4.5.2 Reading The AB Signalling Information From The LEDs

The Table below shows samples of the AB signalling information that is revealed by the LEDs. LEDs 5 through 8 are off. LED 1 is at the top.

LEDs								LED DEFINITIONS	HEX CODE
1	2	3	4	5	6	7	8		
ON	OFF	OFF	OFF	LEDs 5-8 are off				Transmitting A bit to central office	80
OFF	ON	OFF	OFF					Transmitting B bit to central office	40
OFF	OFF	ON	OFF					Receiving A bit from central office	20
OFF	OFF	OFF	ON					Receiving B bit from central office	10

4.6 Requesting Information On Trunk Assignments

Make this request to receive information on the trunk assignments that have been made. Upon making this request, the system provides you with the following information:

- trunk type (ground start, DID, E&M, or loop start),
- dial type (rotary or tone),
- signalling protocol (immediate, wink, delay).

4.6.1 Setting The DIP Switches For Requesting Trunk Assignment Information

Set the DIP switches as shown in the following table to request trunk assignment information. Use switches 4 through 8 (designated in the table by A through E) to select the channel you want to test (1 through 24). See the table in section 4.1.1 for the relationship between the 24 different letter groups and channel numbers. For remote operation, determine the corresponding hex code from Table 1. Switch 1 is the top switch.

SWITCH SETTINGS								TYPE OF REQUEST	HEX CODE
1	2	3	4	5	6	7	8	Provide information about trunk assignments on the channel specified by the letters ABCDE (see the table in section 4.1.1).	see Table 1
ON	OFF	ON	A	B	C	D	E		

4.6.2 Reading The Trunk Assignment Information From The LEDs

The Table below shows the trunk assignment information that is revealed by the LEDs. LED 1 is at the top.

LEDs								LED DEFINITIONS
1	2	3	4	5	6	7	8	
ON	OFF	OFF	OFF					Ground start
ON	ON	OFF	OFF					DID
OFF	ON	OFF	OFF					E&M
OFF	OFF	ON	OFF					Loop start
				ON				Tone dial
					OFF			Not used
						OFF	OFF	Wink start
						OFF	ON	Delay start
						ON	OFF	Immediate start
						ON	ON	Not used
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	No trunk assignments made

4.7 Requesting Information About Channel State

Use this request to determine the state of the channel specified in the request command. Upon making this request, the system provides you with the following information:

- channel state (idle or busy).

4.7.1 Setting The DIP Switches For Requesting Channel State Information

Set the DIP switches as shown in the following table to request the state of the channel specified in the request command. Use switches 4 through 8 (designated in the table by A through E) to select the desired channel.(1 through 24). See the table in section 4.1.1 for the relationship between the 24 different letter groups and channel numbers. For remote operation, determine the corresponding hex code from Table 1. Switch 1 is the top switch.

SWITCH SETTINGS								TYPE OF REQUEST	HEX CODE
1	2	3	4	5	6	7	8	Provide information about the state of the channel specified by the letters ABCDE (see the table in section 4.1.1).	see Table 1
ON	ON	OFF	A	B	C	D	E		

4.7.2 Reading The Channel State Information From The LEDs

The Table below shows the channel state information that is revealed by the LEDs. LED 1 is at the top.

LEDs								LED DEFINITIONS	HEX CODE
1	2	3	4	5	6	7	8		
OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	The selected channel is in the idle state.	03

4.8 Using The Hexadecimal Codes For Remote Diagnostics

You can similate the diagnostic DIP switch settings, that are usually made on-site, by sending the following code sequence via modem to the remote DXPT1 board:

tkmsg<space>(valid port number)<space>7B,(hex code)

The hexadecimal value that you use for the field code corresponds to a bit pattern that you are using to similate DIP switch settings. For example, to similate a switch setting of 11100001 (switches 1, 2, 3, and 8 on) use hex code E1 in the field position. (Switch 1 is the top switch as you look at the front edge of the DXPT1 board. The switches are "on" when you move them to the right.).

After you have interrogated the DXPT1 board by transmitting a valid diagnostic code to it, the DXPT1 responds with a hex code that similarily represents a bit pattern that you can find in Table 1. This bit pattern represents the diagnostic LEDs located adjacent to the DIP switches on the DXPT1 board. For example, let's assume you received the hex code 53 in response to a request for cold start information. Since 53 (hex) represents a bit pattern of 01010011, it follows that LEDs 2, 4, 7, and 8 are lit. (LED 1 is the top LED in the group of eight on the DXPT1 board.) See the example in section 4.2.2.

Table 1. Hexadecimal Codes Related To Bit Patterns

Bit Pattern 12345678	Hex Code	Bit Pattern 12345678	Hex Code	Bit Pattern 12345678	Hex Code	Bit Pattern 12345678	Hex Code
00000000	00	01000000	40	10000000	80	11000000	C0
00000001	01	01000001	41	10000001	81	11000001	C1
00000010	02	01000010	42	10000010	82	11000010	C2
00000011	03	01000011	43	10000011	83	11000011	C3
00000100	04	01000100	44	10000100	84	11000100	C4
00000101	05	01000101	45	10000101	85	11000101	C5
00000110	06	01000110	46	10000110	86	11000110	C6
00000111	07	01000111	47	10000111	87	11000111	C7
00001000	08	01001000	48	10001000	88	11001000	C8
00001001	09	01001001	49	10001001	89	11001001	C9
00001010	0A	01001010	4A	10001010	8A	11001010	CA
00001011	0B	01001011	4B	10001011	8B	11001011	CB
00001100	0C	01001100	4C	10001100	8C	11001100	CC
00001101	0D	01001101	4D	10001101	8D	11001101	CD
00001110	0E	01001110	4E	10001110	8E	11001110	CE
00001111	0F	01001111	4F	10001111	8F	11001111	CF
00010000	10	01010000	50	10010000	90	11010000	D0
00010001	11	01010001	51	10010001	91	11010001	D1
00010010	12	01010010	52	10010010	92	11010010	D2
00010011	13	01010011	53	10010011	93	11010011	D3
00010100	14	01010100	54	10010100	94	11010100	D4
00010101	15	01010101	55	10010101	95	11010101	D5
00010110	16	01010110	56	10010110	96	11010110	D6
00010111	17	01010111	57	10010111	97	11010111	D7
00011000	18	01011000	58	10011000	98	11011000	D8
00011001	19	01011001	59	10011001	99	11011001	D9
00011010	1A	01011010	5A	10011010	9A	11011010	DA
00011011	1B	01011011	5B	10011011	9B	11011011	DB
00011100	1C	01011100	5C	10011100	9C	11011100	DC
00011101	1D	01011101	5D	10011101	9D	11011101	DD
00011110	1E	01011110	5E	10011110	9E	11011110	DE
00011111	1F	01011111	5F	10011111	9F	11011111	DF
00100000	20	01100000	60	10100000	A0	11100000	E0
00100001	21	01100001	61	10100001	A1	11100001	E1
00100010	22	01100010	62	10100010	A2	11100010	E2
00100011	23	01100011	63	10100011	A3	11100011	E3
00100100	24	01100100	64	10100100	A4	11100100	E4
00100101	25	01100101	65	10100101	A5	11100101	E5
00100110	26	01100110	66	10100110	A6	11100110	E6
00100111	27	01100111	67	10100111	A7	11100111	E7
00101000	28	01101000	68	10101000	A8	11101000	E8
00101001	29	01101001	69	10101001	A9	11101001	E9
00101010	2A	01101010	6A	10101010	AA	11101010	EA
00101011	2B	01101011	6B	10101011	AB	11101011	EB
00101100	2C	01101100	6C	10101100	AC	11101100	EC
00101101	2D	01101101	6D	10101101	AD	11101101	ED
00101110	2E	01101110	6E	10101110	AE	11101110	EE
00101111	2F	01101111	6F	10101111	AF	11101111	EF
00110000	30	01110000	70	10110000	B0	11110000	F0
00110001	31	01110001	71	10110001	B1	11110001	F1
00110010	32	01110010	72	10110010	B2	11110010	F2
00110011	33	01110011	73	10110011	B3	11110011	F3
00110100	34	01110100	74	10110100	B4	11110100	F4
00110101	35	01110101	75	10110101	B5	11110101	F5
00110110	36	01110110	76	10110110	B6	11110110	F6
00110111	37	01110111	77	10110111	B7	11110111	F7
00111000	38	01111000	78	10111000	B8	11111000	F8
00111001	39	01111001	79	10111001	B9	11111001	F9
00111010	3A	01111010	7A	10111010	BA	11111010	FA
00111011	3B	01111011	7B	10111011	BB	11111011	FB
00111100	3C	01111100	7C	10111100	BC	11111100	FC
00111101	3D	01111101	7D	10111101	BD	11111101	FD
00111110	3E	01111110	7E	10111110	BE	11111110	FE
00111111	3F	01111111	7F	10111111	BF	11111111	FF

5 Selecting The T1 PAD Settings

The system pad settings that you select through the DXP *Plus* system programming are very important for the correct audio level to be transmitted and received and for echo suppression.

5.1 Setting T1 Transmit Level

For the older software, set to *normal* (uses low, very-low, normal, high, very-high settings). For software using Gain1, Gain2, Nominal, Loss1, Loss2, Loss3, Loss4, and Loss5, use *Nominal* setting.

5.2 Setting T1 Receive Level

For the older software, set to Very-Low. For the Loss/Gain software, set to Loss4. If echo problems occur, try Loss5.

6 Solving T1 Problems

See the following table for T1 problems you could encounter and their possible causes.

PROBLEM	POSSIBLE CAUSE
Signalling bits are not being received properly (no seize) or the network is not "seeing" the seize.	Associated multiplexer (mux) equipment may be defective if installed between the DXP and the central office (CO).
When the T1 option is installed in a DXP system, the DXP shows massive seizes on the inbound channels.	Incorrect trunk assignments. For example, ground start idle bits will cause seizes on DID and E&M trunk assignments.
The DXPT1 is seizing outward A=1 and B=1 and channel is in the idle state.	Channel not assigned and not disabled. All LEDs will be off upon making a request for trunk assignment information (see section 4.6.2).
The SIG red LED on the DXPT1 board is lit indicating no receive signal.	- If new install, cabling may be reversed. - Wiring to DXPT1 board may be defective - DXPT1 board may be defective. Verify by installing local loopback.
Bipolar alarms are indicated when T1 option is first installed.	- Only one receive wire connected. Check cable. - Noise sources or lightning.
The SLIP red LED on the DXPT1 board is lit indicating frame slips are occurring.	DXOPT-SYN card may not be locked. There should not be any red LEDs on this card lit. Verify presence of primary or secondary sources by the green LEDs lit on this card.
Echos are heard.	- Two- to four-wire hybrid conversions have been made. Cut in echo suppressors to eliminate echos on calls over 600 miles and inform the network. - Pad setting may be incorrect causing acoustical feedback (see section 5, PAD Settings). 0 dB (or -3 dB) is recommended for transmitted data and -9 dB at an industry standard telephone (IST).

A. Appendix A

Appendix A consists of two tables showing superframe and extended superframe format. The information for these tables is from the American National Standards Institute (ANSI) specification T1.403-1989.

Table 2. Superframe Format

Frame Number	F Bits: Bit Number	F Bits: Term Frame (F_1)	F Bits: Signal Frame (F_2)	Bit Use In Each Time Slot: Traffic	Bit Use In Each Time Slot: SignalTT	signalling Bit Use Options: signalling	signalling Bit Use Options: Channel
1	0	1	—	1-8	—	—	—
2	193	—	0	1-8	—	—	—
3	386	0	—	1-8	—	—	—
4	579	—	0	1-8	—	—	—
5	772	1	—	1-8	—	—	—
6	965	—	1	1-7	8	—	A
7	1158	0	—	1-8	—	—	—
8	1351	—	1	1-8	—	—	—
9	1544	1	—	1-8	—	—	—
10	1737	—	1	1-8	—	—	—
11	1930	0	—	1-8	—	—	—
12	2123	—	0	1-7	8	—	B

NOTES:

(1) Frame 1 transmitted first.

(2) Frames 6 and 12 are denoted signalling frames.

(3) Option T- Traffic (bit 8 not used for robbed-bit signalling).

Table 3. Extended Superframe Format

Frame Number	F Bits				Bit Use In Each Time Slot		Signalling Bit Use Options			
	Bit Number	FPS	DL	CRC	Traffic	Signal	T	2	4	16
1	0	—	m	—	1-8	—	—	—	—	—
2	193	—	—	C_1	1-8	—	—	—	—	—
3	386	—	m	—	1-8	—	—	—	—	—
4	579	0	—	—	1-8	—	—	—	—	—
5	772	—	m	—	1-8	—	—	—	—	—
6	965	—	—	C_2	1-7	8	—	A	A	A
7	1158	—	m	—	1-8	—	—	—	—	—
8	1351	0	—	—	1-8	—	—	—	—	—
9	1544	—	m	—	1-8	—	—	—	—	—
10	1737	—	—	C_3	1-8	—	—	—	—	—
11	1930	—	m	—	1-8	—	—	—	—	—
12	2123	1	—	—	1-7	8	—	A	B	B
13	2316	—	m	—	1-8	—	—	—	—	—
14	2509	—	—	C_4	1-8	—	—	—	—	—
15	2702	—	m	—	1-8	—	—	—	—	—
16	2895	0	—	—	1-8	—	—	—	—	—
17	3088	—	m	—	1-8	—	—	—	—	—
18	3281	—	—	C_5	1-7	8	—	A	A	C
19	3474	—	m	—	1-8	—	—	—	—	—
20	3667	1	—	—	1-8	—	—	—	—	—
21	3860	—	m	—	1-8	—	—	—	—	—
22	4053	—	—	C_6	1-8	—	—	—	—	—
23	4246	—	m	—	1-8	—	—	—	—	—
24	4439	1	—	—	1-7	8	—	A	B	D

NOTES:

(1) Frame 1 transmitted first.

(2) Frames 6, 12, 18, and 24 are denoted signalling frames.

(3) FPS = Framing Pattern Sequence (...001011...)

(4) DL = 4KBits/s Data Link (Message Bits m)

(5) CRC - CRC6 Cyclic Redundancy Check (Bits C1-C6)

(6) Option T = Traffic (Bit 8 not used for Robbed-Bit signalling)

(7) Option 2 = 2-State signalling (Channel A)

(8) Option 4 = 4-State signalling (Channels A and B)

(9) Option 16 = 16-State signalling (Channels A, B, C, and D)

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COMDIAL

Detailing Comdial's Technical Assistance

1.0 Verifying Equipment Operation

Comdial installation specialists ***strongly suggest*** that you temporarily install the equipment and test the system operation at your facility before you take it to the permanent installation site. When you do this, you ensure that the equipment is operational, and if it is not operational, you give yourself an opportunity to correct any problems that exist.

Follow the installation details closely in the accompaning manual and double check you work for mistakes. If you can not resolve the operating failure, you may need the technical assistance that Comdial makes available.

2.0 Detailing The Technical Assistance

Should you experience difficulty with installation or operation, and have made an attempt to isolate the problem using information provided in the accompaning manual, or should you encounter problems at a later date which cannot be resolved by referring to the manual, call the Comdial Technical Service staff. They can be reached at 1–800–366–8224 between the hours of 8:00 AM and 8:00 PM Eastern time, Monday through Friday.

When calling for technical assistance, you should be at the job site and have in your possession, as a minimum, an accurate volt/ohm/milliamp meter and a copy of the appropriate manual.

3.0 Explaining The Repair Service

FCC regulations do not permit repair of customer owned equipment by anyone except the manufacturer or their authorized agent. Unless specifically detailed, Comdial policy does not warrant its equipment as field repairable items.

If the equipment needs repair subsequent to the warranty period, you may return it Comdial for repair. Comdial repair personal will, at their option, either repair the defective equipment or replace it with a remanufactured unit. This repair will be done at a fixed charge. For information on this charge, call or write to the following address:

Comdial
P.O. Box 7266
Charlottesville, VA 22906–7266
Attention: Repair Department
Telephone: 1–800–877–4448

When returning equipment for repair, pack it carefully to prevent damage. The purchaser is responsible for any damages during shipment. Ship the equipment freight or postage prepaid. The shipping address is as follows:

Comdial
1180 Seminole Trail
Charlottesville, VA 22906–2829
Attention: Repair Department

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4.0 Updating Your System Knowledge

From time-to-time, Comdial Engineers will enhance equipment software or add to the hardware capability. The technical publications personnel document these changes on Technical Advisory Bulletins that they make available to you in several ways:

- you may turn to the appropriate section in your system's instruction binder and find the TABs that are currently available,
- you may call the Technical Services facsimile (FAX) line at 1–800–266–3425 Extension 500 and obtain additional copies,
- you may call the bulletin board at 804–978–2583 and down-load the TAB information.

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Technical Advisory Bulletin

This section provides a collection of technical advisory bulletins associated with the DXP Digital Communications System Dealer Package.

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TECHNICAL ADVISORY BULLETIN

Date: April 1993 Issue: TAB 105

Analog-to-Digital Common Equipment Upgrade: Considerations for ExecuMail

When Comdial common equipment is upgraded from analog to digital service (from 2000 or 22XX system to DigiTech, Impact, Americom or DXP, for example) and an ExecuMail voice processing system is connected to the analog equipment, the voice board for the ExecuMail system must be upgraded in order to ensure that DTMF recognition remains intact.

The voice board required for an ExecuMail system connected to a digital telephone system is called a DSP board and is specially configured for digital as well as analog telephone system operation. To determine whether a DSP board already exists in an ExecuMail unit:

Press **F5**.

- If a firmware version is indicated, there is at least one D41/D board in the system.
- If no firmware version is indicated, there are no D41/D boards in the system and all boards are analog.

If a firmware version is indicated:

Sign in to the system.

Press **F2**.

Select **Reports**.

Select **Previous Report**.

Enter **c** or **d:\mail\firmware.cfg** .

- The report will show how many D41/D boards are in the system. Count the number of boards installed in the system and you will be able to determine how many are D boards and how many are analog boards (all boards are recommended to be DSP boards).

The order codes for the digital voice boards are:

VMBD2-SEC Voice Board/2-Port Secondary

VMBD4-SEC Voice Board/4-Port Secondary