



Installation and Maintenance Manual
Technical Manual - Volume I



DX-120 Installation and Maintenance Manual

Technical Manual - Volume I

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TABLE OF CONTENTS

SAFETY AND REGULATORY CONSIDERATIONS

SAFETY	1
Protecting Against Static Electricity	1
REGULATIONS	2
Complying with Underwriters Laboratories Regulations	2
FCC and Industry Canada (IC) Rules and Regulations	2

SECTION 1 - INTRODUCTION

USING THIS MANUAL	7
Locating Documentation	8
OVERVIEW	9
System Technology	9
Configuration	11
Key Service Unit	15
Power Supply	16
CPM (Central Processor Module)	17
408M (KSU1 Component)	18
408E (KSU II Component)	19
APM4 (Analog Port Module - 4 Circuits)	20
DPM8 (Digital Port Module - 8 Circuits)	21
DPM16 (Digital Port Module - 16 Circuits)	22
COM4 (Central Office Module - 4 Circuits)	23
MDM (Modem Module)	24
AAM (Automated Attendant Module)	25
T1 Card (T1 Module) Details	26
ISDN Card (T1/PRI Module) Details	27
DET (Digital Executive Telephone)	29
DSS (Direct Station Selection) Console	30
Specifications	31

Table of Contents (continued on next page)

*Table of Contents (continued)***SECTION 2 - INSTALLATION**

INSTALLING THE DX-120	41
Installation Overview	41
Site Planning	42
Tools and Supplies	43
Preparing the Main Distribution Frame	43
KSU Wiring	46
Typical MDF Installation	48
KSU Components	49
Adding an APM4	54
Adding a COM4	56
Adding an MDM	58
Adding an AAM	60
Adding a KSU2 Second Cabinet	61
Adding a Music Source	63
Adding an External Pager	65
Add a Loud Bell Control or Gate Control	66
Adding a DPM16 (Digital Port Module – 16 port)	68
Adding a T1 or ISDN (T1/PRI) Card	69
Connecting a Serial Cable for PC-DBA	70
Connecting a Serial Cable for SMDR	71
Power-up Initialization (Cold Start)	72

SECTION 3 - MAINTENANCE & TROUBLESHOOTING

SYSTEM MAINTENANCE	75
Cleaning the Telephones	75
TECHNICAL PROBLEM SOLUTIONS	75
Problems Not Related to System Issues	75
Diagnostic Quick Reference	76
MAINTENANCE UTILITIES	82
Loading PC-DBA software	82
CONNECTING TO THE SYSTEM	83
Cable Connection	83
Connecting PC-DBA to the DX-120 Switch	84
Establishing a Modem Connection with PC-DBA	86
ACCESSING PC-DBA MAINTENANCE	88
Maintenance Utilities (Menu Items)	89

Table of Contents (continued on next page)

Table of Contents (continued)

SECTION 4 - INSTALLATION ISSUES

TROUBLESHOOTING INSTALLATION ISSUES113

- Corrupted Database on Initial System Setup 113
- Adding Hardware to an Existing System 113
- Voice Mail Doesn't Work ("No Legal Member" Error). 114
- Invalid Entries Calling a Busy Station (Issues with Multiple Mailbox Greetings) 117
- Ensuring Optimum Call Handling Performance 118
- Ringing a Group Of Phones
 - Before Routing the Call to Auto-Attendant. 119
- Using Multiple Lines &
 - Assigning Different Auto-Attendant Greetings for Each Line 122
- Setting Up Message Delivery to a Cell Phone 125
- Using Prime CO Instead of Intercom with Modem or Fax 127
- Digits Passed Inband to the Voice Mail in an Overflow 1 Condition 129
- Digits Passed Inband to the Voice Mail in an Overflow 2 Condition 130
- Digits Passed Inband to the Voice Mail in a Re-Route Condition 131

INDEX

INDEX133

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SAFETY AND REGULATORY CONSIDERATIONS

SAFETY

Protecting Against Static Electricity



CAUTION

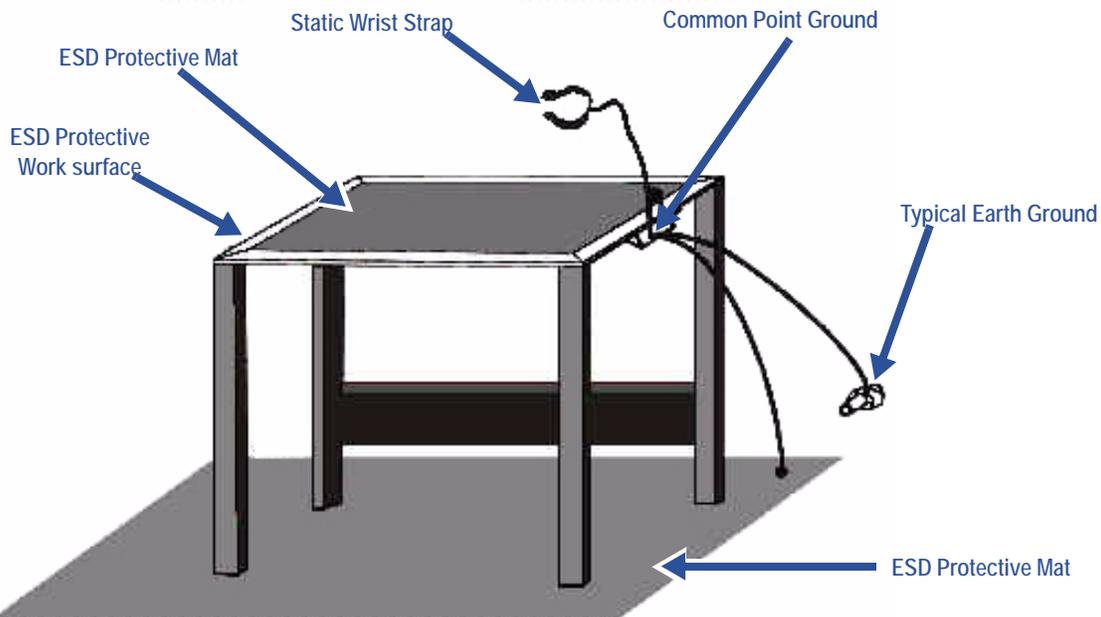
Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. Refer to Vertical publication IMI01-005, *Handling of Electrostatically Sensitive Components*, for general information. Specific handling precautions are also included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

The telephone system may include some installed circuit boards when it arrives at your site. The equipment cabinets provides universal slots that will accept either line or station boards.

When removing or installing circuit boards in the cabinets, you must **wear a static discharge wrist strap**. Be sure that the strap is touching bare skin and is connected to an AC or earth ground.

Disconnect the AC power cord from the AC outlet (or external battery back-up system if applicable) before you remove or install the circuit board. Whenever you remove a circuit board from a cabinet, immediately place the board in a static protection bag while you still have your wrist strap in place and properly grounded.

When removing circuit boards from an installation location for servicing, **always transport them to a static-safe work area in static protection bags**. If you do not already have a static-safe work area, you can create one by arranging a work area as detailed in the illustration.



REGULATIONS

Complying with Underwriters Laboratories Regulations

Per the Underwriters Laboratories regulation 1950, 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
- Avoid using a telephone (other than a cordless type) during an electrical storm—there may be a remote risk of electrical shock from lightning
- Do not use the telephone to report a gas leak in the vicinity of the leak.
- TNV wiring to outside plant leads (e.g., central office trunk wiring) must be 26 AWG gauge minimum.

FCC and Industry Canada (IC) Rules and Regulations

FCC PART 15 RF EMISSION INFORMATION

This equipment 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 the 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 and 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 receiving antenna, and/or relocate the system, the individual telephone stations, and the radio or television 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, DC, 20402. Stock No. 004-000-00345-4.

FCC Regulations (continued on next page)

*FCC Regulations (continued)***FCC PART 68 INFORMATION**

This equipment complies with Part 68 of the FCC Rules. A label, located on the exterior lower left side of the cabinet, contains the FCC Registration Number(s) and Ringer Equivalence Number (REN).

Notify the local telephone company when you connect the equipment to the network and provide the information shown in the following table:

Line Type	Service Order Code*	Facilities Interface Code	Ringer Equivalence Number*	Universal Service Order Code Connector
Loop Start	9.0F	02LS2	See Equipment Specification Sheet	RJ11
T1 Line	6.0Y	04DU9-1SN	N/A	RJ48C
ISDN (T1/PRI) Line	6.0Y	04DU9-1SN	N/A	RJ48C

**NOTE**

State tariffs do not permit ground start operation for KF registered equipment (key system operation). Ground start operation is only permitted for MF registered equipment (KTS/PBX hybrids with both manual and pooled outgoing and incoming access to the network). The system must be configured for MF operation when using ground start operation

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

Should the equipment cause harm to the telephone network, the telephone company may disconnect your service temporarily. If possible, they will notify you in advance. If advanced notice is not practical, they will notify you as soon as possible. You will be informed of your right to file a complaint with the FCC. The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the proper functioning of your equipment. If they do so, they will notify you in advance to give you an opportunity to maintain uninterrupted telephone service. In addition, the telephone company may ask that you disconnect this equipment from the network until the problem has been corrected or until you are sure that the equipment is not malfunctioning.

FCC Regulations (continued on next page)

FCC Regulations (continued)

TERMS AND DEFINITIONS

Service Order Code (SOC)

Defines type of service and system protection.



EXAMPLES

- 9.0F = analog service, full protection to the network from systems using live voice. Only registered terminal equipment can be connected to station ports.
- 6.0Y = digital service, provides total protection, including billing protection and encoded analog content.

Facilities Interface Code (FIC)

A tariff reference used by customers to order correct facilities to be provided by the telco.



EXAMPLES

- 02LS2 = analog service, 2-wire, local switched access, loop-start
- 02RV2-T = analog service, 2-wire, local switched access, reverse-battery
- 04DU9-1SN = digital service, 1.544 Mbps ANSI ESF and B8ZS without line power

Ringer Equivalence Number (REN)

Useful in determining the quantity of devices that may be connected to the telephone line and still have all of those devices ring when the telephone number is called. In most, but not all areas, the sum of the REN's of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices that you may connect to your line, you may want to contact your local telephone company to determine the maximum REN for your calling area.

Universal Service Order Code Connector (USOC Code)

Defines the FCC Part 68 approved telco provided connector, electrically and mechanically, required to interface with the customer equipment. To avoid legal, warranty, insurance, and casualty problems, do not pass anything through the network connector other than those permitted in the FCC Part 68 RJ series connectors. Definitions of connectors are as follows:



EXAMPLES

- RJ21X is a 25 line, 2-wire, T/R, 50 position connector,
- RJ48C is a single line, 4-wire, T/R, T1/R1, 1.544 Mbps, 8-position connector.

Regulations (continued on next page)

*Regulations (continued)***INDUSTRY CANADA RF EMISSION INFORMATION**

This digital device does not exceed the Class A limits for radio noise emissions from digital apparatus set out in Radio Interference Regulations of Industry Canada.

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

INDUSTRY CANADA TELCO INFORMATION

NOTICE: The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

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

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

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

**CAUTION**

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

**NOTICE**

The ringer equivalence number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to the telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the ringer equivalence numbers of all the devices does not exceed 5.

Industry Canada TELCO Information (continued on next page)

Industry Canada TELCO Information (continued)**AVIS**

L'étiquette de Industrie Canada identifie le matériel homologué. Cette étiquette certifie que le matériel est conforme à certaines normes de protection, d'exploitation et de sécurité des réseaux de télécommunications. Le Ministère n'assure toutefois pas que le matériel fonctionnera à la satisfaction de l'utilisateur. Avant d'installer ce matériel, l'utilisateur doit s'assurer qu'il est permis de le raccorder aux installations de l'entreprise locale de télécommunication.

Le matériel doit également être installé en suivant une méthode acceptée de raccordement. L'abonné ne doit pas oublier qu'il est possible que la conformité aux conditions énoncées ci-dessus n'empêche pas la dégradation du service dans certaines situations. Les réparations de matériel homologué doivent être effectuées par un centre d'entretien canadien autorisé désigné par le fournisseur.

La compagnie de télécommunications peut demander à l'utilisateur de débrancher un appareil à la suite de réparations ou de modifications effectuées par l'utilisateur ou à cause de mauvais fonctionnement. Pour sa propre protection, l'utilisateur doit s'assurer que tous les fils de mise à la terre de la source d'énergie électrique, des lignes téléphoniques et des canalisations d'eau métalliques, s'il y en a, sont raccordés ensemble. Cette précaution est particulièrement importante dans les régions rurales.

**AVERTISSEMENT**

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

**AVIS**

L'indice d'équivalence de la sonnerie (IES) assigné à chaque dispositif terminal indique le nombre maximal de terminaux qui peuvent être raccordés à une interface. La terminaison d'une interface téléphonique peut consister en une combinaison de quelques dispositifs, à la seule condition que la somme d'indices d'équivalence de la sonnerie de tous les dispositifs n'exécède pas 5.

SECTION 1 - INTRODUCTION

USING THIS MANUAL

This publication contains a technical discussion of the digital telephone system. It provides step-by-step instructions for installation. You should become familiar with this manual before you attempt to install the system. This manual provides the following information:

- Regulatory and Safety Considerations
- Description of the hardware
- An understanding of the operational characteristics of the system hardware components
- Instructions for installing the cabinet, printed circuit boards, and ancillary equipment



HINT

It is also a good idea to review the companion document for this Installation Manual: DX-120 Programming and Maintenance Manual - Technical Manual Vol II.

All of the Vertical publications are available for download from Vertical's Customer Care Center, located at <http://www.vertical.com/cc>. Should you need hard copies of these publications, contact your Vertical inside sales representative.

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Locating Documentation

Vertical technical publications are numbered according to their intended function. Various publications pertaining to the products offered by Vertical can be found at <http://vertical.com/ccs>. If you are unfamiliar with the CCC, please contact Technical Support for details about logging in.

Document Prefix	Document Type	Purpose
AG	Attendant Guide	Contains information required for programming and using a system attendant.
FLDII	Field Installation Instructions	Contains basic information as a quick reference for programming in the field (vs. remote programming)
GCA	General and Descriptive Information <i>(generally refers to Vertical documents created or edited prior to 11/06)</i>	Provides general information for the operation of features or hardware. This may include programming manuals as well as user guides.
IMI <i>or</i> IM	Installation and Maintenance Instructions	Provides instructions for Installing and Maintaining various Vertical (Comdial) products.
PRG <i>or</i> PRGM	Programming Instructions	Provides programming information required for a particular product.
PRN	Product Release Notice	Contains information about any new product that may have recently been released
QR	Quick Reference	Provides concise, abbreviated installation, programming, or operating information in a one or two page document.
SAB	Service Advisory Bulletin	Provides information to alert the field about specific service related issues.
SRN	Software Release Notice	Provide information about a new software release. These notices may be for new feature releases or maintenance.
SUPG	Supervisor's Guide	Provides information specific to supervisor's on particular systems that allow a supervisor to use and program a variety of additional features.
TAB	Technical Advisory Bulletin	Publications that are intended to offer specific technical information related to a particular product.
UG	User Guide	Provides information specific to end-users (e.g., those who use a phone at their desk vs. someone who installs and/or programs the system).

OVERVIEW

The Vertical DX-120 is a fully digital hybrid key telephone system. The DX-120 uses a mix of “loop start” central office (telephone company) line interfaces and digital lines such as T1 or ISDN (T1-PRI), along with a mix of analog and digital extension ports to provide office communications and connectivity to the Public Switched Telephone Network (PSTN).

The DX-120 delivers a vast array of office productivity features and telephone use enhancing features, including Caller Identification (requires telephone company subscription), in the standard package. Unlike most systems that support Caller ID, the DX-120 supports Caller ID to DX-120 proprietary digital extensions and to third-party, Caller ID capable analog devices (cordless telephones, etc.)

Although most features are standard, the DX-120 provides for several optional features to further enhance office communications. Built-in voice processing integration packages include:

- Automated Attendant
- Four port, Flash-based Voice Mail/Auto Attendant (expandable to 8 ports)
- Four port, Hard drive-based Voice Mail/Auto Attendant (expandable to 8 ports)

The DX-120 platform allows you to use these voice processing platforms without losing valuable system port resources.

The DX-120 is comprised of an application configured, expandable Key Service Unit (KSU) platform. There is one fully-featured Digital Executive Telephone (DET) that delivers access to all system functions. The system architecture provides an expandable interface for digital port growth and analog port growth. The basic configuration supports both device types. Analog ports might be used for plain old telephones, fax machines, modems, etc. The DX-120 is designed to meet the telecommunications needs of small-to-medium business offices.

System Technology

- The DX-120 incorporates state-of-the-art digital technology for voice switching and call processing, using Pulse Code Modulation and Time Division Multiplexing (PCM/TDM).
- The DX-120 is a non-blocking switch, with no loss or degradation of voice signals.
- The system is stored-program control and uses a ARM7 main microprocessor and peripheral devices (extensions and CO lines) in a distributed processing configuration.
- Memory consists of 640K bytes of ROM (Read Only Memory) and 384K bytes of RAM (Random Access Memory). The RAM is lithium battery protected.
- The maximum system configuration is 16 loop start, 24 digital lines, 88 extensions (80 digital and 8 analog) and 8 voice processing channels.

System Technology (continued on next page)

System Technology (continued)

AVAILABLE EQUIPMENT FOR THE DX-120

DEVICE	PART #	CHARACTERISTICS
KSU1	7201	<ul style="list-style-type: none"> 8 digital extension ports 4 analog device ports 4 CID-ready CO line ports. 2 music source inputs, can be assigned as desired to CO lines for hold music/messages 1 power failure port (CO line 1). 1 control contact (LBC, Gate, External Page Control) 1 external paging equipment interface 2 serial ports PC-DBA programming SMDR (Station Message Detailed Recording)
OPTIONAL EQUIPMENT		
KSU2	7202	<ul style="list-style-type: none"> • Used to expand the system capacity beyond KSU1 limits. • 8 digital extension ports • 4 CO line ports • 1 power failure port (CO line circuit 1).
DPM8	7220	<ul style="list-style-type: none"> • Digital Port Module - 8 circuit • Installs into KSU1 or KSU2
APM4	7230	<ul style="list-style-type: none"> • Analog Port Module - 4 circuit • Always factory-installed into KSU1; can also be connected to KSU2 via dedicated cable
COM4	7210	<ul style="list-style-type: none"> • CO line Module - 4 circuit with one power failure port on first CO line circuit • Installs into KSU1 or KSU2
MDM	7249	<ul style="list-style-type: none"> • Modem Module, for use with off-site programming. • Installs into KSU1 only.
AAM	7240	<ul style="list-style-type: none"> • Automated Attendant Module • 4 port, one menu for routing • 10 announcements for various caller greetings. Installs into KSU1 only
DPM16	7221	<ul style="list-style-type: none"> • Digital Port Module - 16 circuit • Installs into KSU1 or KSU2
T1	7290	<ul style="list-style-type: none"> • T1 Digital Trunking - 24 channels
ISDN (T1/PRI)	7285	<ul style="list-style-type: none"> • ISDN (T1/PRI) Digital Trunking - 23 channels plus D-channel
CO DX FLASH VM	7271C	<ul style="list-style-type: none"> • Flash-based, 4-port Voice Mail (Corporate Office DX) with Auto Attendant. • 1.5 hours storage and 100 mailboxes.
CO DX HD VM	7270C	<ul style="list-style-type: none"> • Hard Drive-based, 4-port Voice Mail (Corporate Office DX) with Auto Attendant and on-board modem. • 100 hours storage and 100 mailboxes.
CO DX 4-port Expansion VM	7273	<ul style="list-style-type: none"> • 4 port expansion to 7271C or 7270C.

Configuration

The Vertical DX-120 platform is comprised of one full-featured key telephone model and two modular KSUs (Key Service Units). Several modules are available for enhanced system applications and configuration expandability.

KSU1 COMPONENTS

The CPM (Central Processor Module) is installed inside of KSU1 and connected to the 408M ribbon cable J4 (also labeled "To CPM").

- The CPM contains:
 - Two serial ports
 - Two music ports
 - One control contact (external paging/LBC/gate control)
 - One external page equipment interface connection
 - Socket connectors for the KSU2 (labeled "2nd Cabinet"), MDM, and VP modules (AAM, 7271C, and 7270C)
- The standard 408M (part of 7201) contains:
 - 4 CO line ports
 - 1 power failure transfer port for the first CO line circuit
 - 8 digital ports
 - a ribbon cable (J1, also labeled "COM4") for connection to the COM4 module (PN 7210) in KSU1
 - ribbon cable sockets (J2 and J3, also labeled "To DPM8") for connection of DPM8 (PN 7220) or DPM16 (PN 7221) module
- The standard APM4 (part of 7201) contains four analog device ports (installed on ribbon cable J5, also labeled "APM4")

KSU2 COMPONENTS

The standard 408E contains:

- 4 CO line ports
- 1 power failure transfer port for the first CO line circuit
- 8 digital ports
- a ribbon cable J1, also labeled "COM4") for connection to the COM4 module (PN 7210)
- ribbon cable sockets J2 and J3, also labeled "To DPM8") for connection of DPM8 (PN 7220) or DPM16 (PN 7221) module
- a shielded cable (J4) for connection to CPM socket JP2 (also labeled "2nd Cabinet") in KSU1

Configuration (continued on next page)

*Configuration (continued)***VOICE PROCESSING MODULES**

The DX-120 provides several voice processing (or voice mail) options. The optional voice processors that you can add to the DX-120 are fixed system resources that do not require peripheral device ports (analog or digital). This significant advantage means that the DX-120 VP options can be added to any DX-120 configuration without “port loss” thus eliminating the ill effects of reducing the overall capacity of the system when the voice processor is connected. Because the DX-120 doesn’t use conventional peripheral ports to interface the VPs, we refer to the VP connectivity in terms of “channels.”

- **AAM (Automated Attendant Module):** The AAM provides four channels for automated attendant operation only. The AAM is then capable of handling four calls simultaneously. Callers answered by the AAM are greeted by one of four greetings associated with the DX-120 mode of operation (Day / Evening / Alternate / Temporary). Various other announcements are also included for caller processing, refer to the *DX-120 Technical Manual, Volume II, Programming* for further details.
- **7271C (Flash-based, four port VM with Automated Attendant):** The 7271 provides four channels for automated attendant and voice mail operation. The 7271 is equipped to support up to 100 voice mailboxes and 3.2 hours of message storage (including the various greeting announcements).
- **7270C (Hard Drive-based, four port VM with Automated Attendant):** The 7270C provides four channels for automated attendant and voice mail operation. The 7270C is equipped to support up to 2000 voice mailboxes and 150 hours of message storage (including the various greeting announcements).
- **7273 (Four port expansion card):** The 7273 is added to the 7271C or 7270C to increase the total number of voicemail ports from four (4) to eight (8).

**NOTE**

- For details on installing the 7271C and 7270C refer to the *Corporate Office DX Installation Instructions*.
- All of these voice processors are connected to the DX-120 CPM via specific interface sockets.

Configuration (continued on next page)

Configuration (continued)

CONFIGURATION TABLE

SYSTEM CONFIGURATION										
Equipment	T1 or					Digital	Analog	Digital	Analog	
	COM4	DPM8	DPM16	ISDN	APM4	Trunks	Trunks	Stations	Stations	
KSU1* 7201P-00 71201P-04 (one APM4 included as standard)							4	8	4	
		1					4	16	4	
		2					4	24	4	
		1	1				4	32	4	
	1						8	8	4	
	1	1					8	16	4	
	1	2					8	24	4	
	1	1	1				8	32	4	
			1					4	24	4
			2					4	40	4
	1		1				8	24	4	
	1		2				8	40	4	
				1			24 \ 23	4	8	4
		1		1			24 \ 23	4	16	4
		2		1			24 \ 23	4	24	4
		1	1	1			24 \ 23	4	32	4
	1			1			24 \ 23	8	8	4
	1	1		1			24 \ 23	8	16	4
	1	2		1			24 \ 23	8	24	4
	1	1	1	1			24 \ 23	8	32	4
		1	1			24 \ 23	4	24	4	
		2	1			24 \ 23	4	40	4	
1		1	1			24 \ 23	8	24	4	
1		2	1			24 \ 23	8	40	4	

**This configuration does not allow space for voicemail.*

System Configuration (continued on next page)

SYSTEM CONFIGURATION (continued)									
Equipment	T1 or				Digital	Analog	Digital	Analog	
	COM4	DPM8	DPM16	ISDN	APM4	Trunks	Trunks	Stations	Stations
KSU1* 7201P-08				1		24 \ 23	4	8	4
		1		1		24 \ 23	4	16	4
			1	1		24 \ 23	4	24	4
KSU2 7202P-00 <i>adds to KSU1 configuration (KSU2 does not come with an APM4. However, one can be added via the dedi- cated cable)</i>							4	8	
		1					4	16	
		2					4	24	
		1	1				4	32	
	1						8	8	
	1	1					8	16	
	1	2					8	24	
	1	1	1				8	32	
			1				4	24	
			2				4	40	
	1		1				8	24	
	1		2				8	40	
						1	4	8	4
		1				1	4	16	4
		2				1	4	24	4
		1	1			1	4	32	4
	1					1	8	8	4
	1	1				1	8	16	4
	1	2				1	8	24	4
	1	1	1			1	8	32	4
		1			1	4	24	4	
		2			1	4	40	4	
1		1			1	8	24	4	
1		2			1	8	40	4	
Maximum Capacity KSU1						24	8	40	4
Maximum Capacity KSU2							8	40	4
TOTAL SYSTEM CAPACITY						24	16	80	8

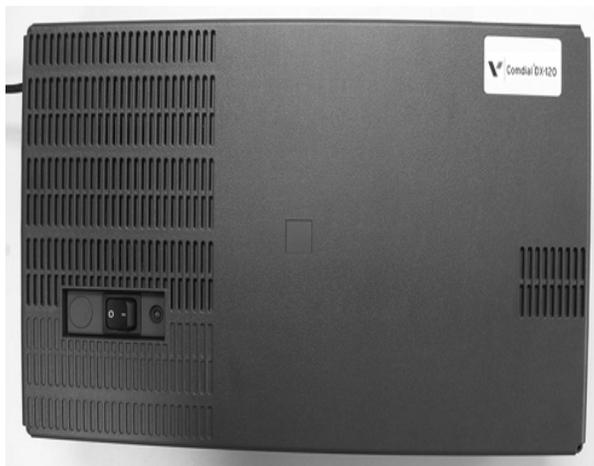
**This configuration does not allow space for voicemail.*

Key Service Unit

The DX-120 Key Service Unit (KSU) is a modular flat-pack design. Two KSU's (KSU1 and KSU2) may be equipped to achieve the total system capacity of 16 loop start, 24 digital lines, 88 extensions (80 digital and 8 analog) and 8 voice processing channels. KSU1 is factory equipped with one 408M, one APM4 and the CPM. KSU2 is factory equipped with one 408E.

Each KSU is a self-contained cabinet with internal power supply. The power supply AC transformer voltage switch can be set for either 117vac or 230vac operation. (It is factory set for 117vac operation.) The KSU is designed to be mounted on the wall and is shipped with a wall mounting template. The compact KSU weighs less than 20 pounds and is UL Listed.

DX-120 Key Service Unit (KSU)



You can remove:

- Or reposition four panels installed over various KSU openings to accommodate exterior connection requirements.
- One panel to route a serial cable through the KSU outer housing for connection of ancillary SMDR equipment.
- Another panel to route a serial (NULL Modem) cable through the KSU outer housing for direct connection of a PC for on-site PC-DBA programming.
- Or reposition the remaining KSU panel to accommodate cables entering through the outer housing for connecting station/extension cables or to the MDF.
- The panel covering the jacks on the phone boards (located under the left side of the main board).

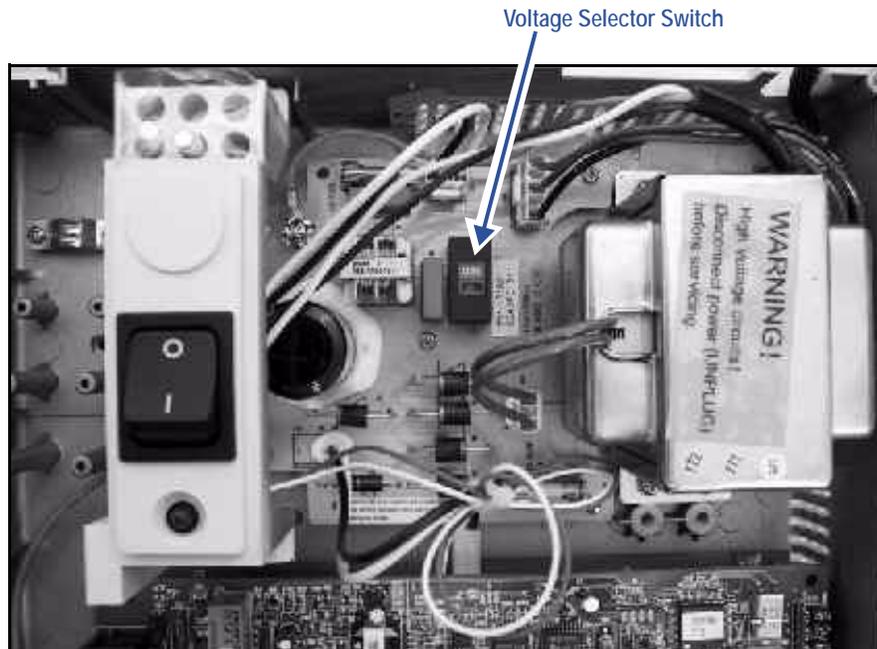


NOTE

From the exterior, with covers in place, the KSU1 and KSU2 look identical. However, KSU1 contains the CPM (system call processing).

Power Supply

The power supply circuitry of the DX-120 incorporates a linear design AC transformer with a choice of input voltage. The voltage selector switch is shipped set for 117vac applications; you can also set this switch for 230vac applications. Since the power supply is linear in design, the output voltage varies between 21.6vdc and 32vdc depending on load and stability of the input voltage. The output voltage is delivered to the 408M (in KSU1, 408E in KSU2) for voltage regulation. All system operation and logic voltages are produced at the 408M/E.



- Two fuses are equipped on the power supply board, one for AC input over-voltage protection and one for DC output over-current protection.
- A main power switch is accessible when the KSU cover is in place. In the event battery backup operation is desired the KSU power cord can be connected to a external (ancillary) UPS (Uninterrupted Power Supply).



IMPORTANT!

It is your responsibility to match the battery requirements/UPS requirement to the specific needs of the equipment owner. To determine the battery requirement needs and UPS requirement, see see "Specifications" to find the current draw and necessary Amp/Hour back up support that the battery/UPS must supply.

CPM (Central Processor Module)

The CPM module is equipped standard in KSU1. This board contains all circuitry required to control the fully equipped DX-120. The system uses the CPM to perform all digital voice switching and call processing data switching.

The CPM has one ribbon cable connector for connection to the KSU1 408M and six (6) connector sockets for connection of the system built-in modem, voice processor, and second cabinet (KSU2). Since the CPM comes installed inside of KSU1 the CPM ribbon cable is already in place and connected to the KSU1-408M J5 socket.

Assuming the orientation of the KSU1 cabinet is installed on the wall; the two horizontal connector sockets in the upper right corner of the CPM are for the MDM (Modem Module). The connector socket labeled "2nd Cabinet" is for connection to the KSU2/408E if that expansion is required. The remaining two connector sockets on the CPM, one at the left side, the other at the right side are for the voice processor solution.



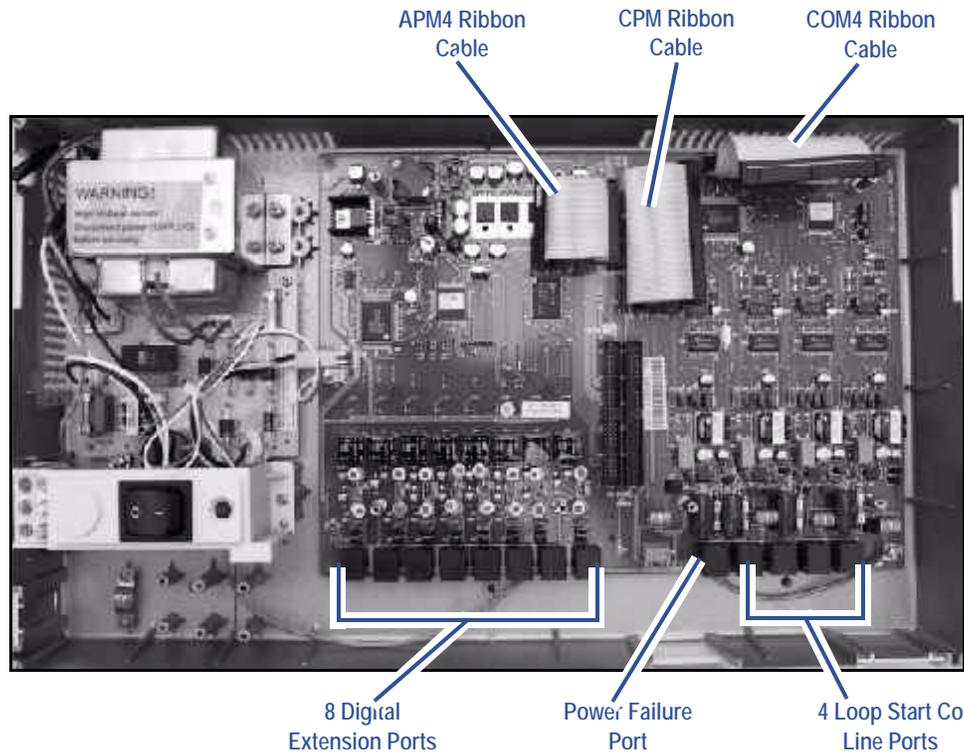
NOTE

The voice processor solution can be any of three possible choices: AAM, 7271C, or 7270C.

- The CPM also provides the following standard connectors:
 - Music Channel 1 - On Hold/Background Music Interface
 - Music Channel 2 - On Hold/Background Music Interface
 - Control Contact (Loud Bell / Door / External Page Control)
 - External Paging Equipment Interface
 - RMP Serial Port - for onsite PC-DBA system database programming
 - SMDR Serial Port - for connection to ancillary SMDR/Call Accounting equipment
 - T1 or ISDN (T1/PRI)
- The CPM has two option strap jumpers one for database start-up (JE1) and one for music channel one source (internal/external) selection (JPC1).
 - JE1 Cold Start/Normal is used to force load database default factory settings. This jumper will normally never require operation after the initial power up sequence is completed. However should the need arise to return the site database to the factory settings this jumper is used to perform a cold start.
 - JPC1 Internal/External is used to select the Music Channel 1 source. The DX-120 provides a synthesized music source for music on hold, in applications where no music source is available. The synthesized tune is repeated. JPC1 is in the "EXT" (i.e, external) position when it ships from the factory.

408M (KSU1 Component)

The 408M is the large circuit board that is packaged inside of KSU1. The 408M provides interface for up to four loop-start CO lines and 8 digital extension ports. Additionally the 408M regulates the 24 volt DC power from the source to produce all required logic voltages and operations voltages. There is also a Power Failure Port located on the 408M that is connected to the first CO line circuit. Whenever power fails, this port becomes active with dial tone from the CO line connected to the first CO line port.



KSU1 shown with cover – CPM and APM4 removed (408M exposed)

- The 408M is equipped with a heartbeat LED that indicates processing activity on the PCB. The 408M peripheral processor is operating when the heartbeat LED is flashing. The KSU1 operation LED (located next to the power switch) is tied to the 408M heartbeat LED. Therefore, when the LED next to the power switch is flashing, the 408M is active.
- The KSU1-408M has three ribbon cables:
 - located at the upper right and oriented in a horizontal position, the J1 cable is used to interface a COM4 if required to expand the system CO line capacity.
 - located at the upper center and oriented in a vertical position, the J4 cable is used to interface the DX-120 CPM.
 - located at the upper center and oriented in a vertical position, the J5 cable connects to the standard APM4 installed in KSU1.
- Each CO line circuit incorporates over-voltage protection, ring detector, loop detector, loop/pulse-dial relay, current sink circuit, coupling/isolation transformer (impedance 600:600), hybrid circuit, CODEC & filter, polarity guard circuit and radio frequency noise filter.

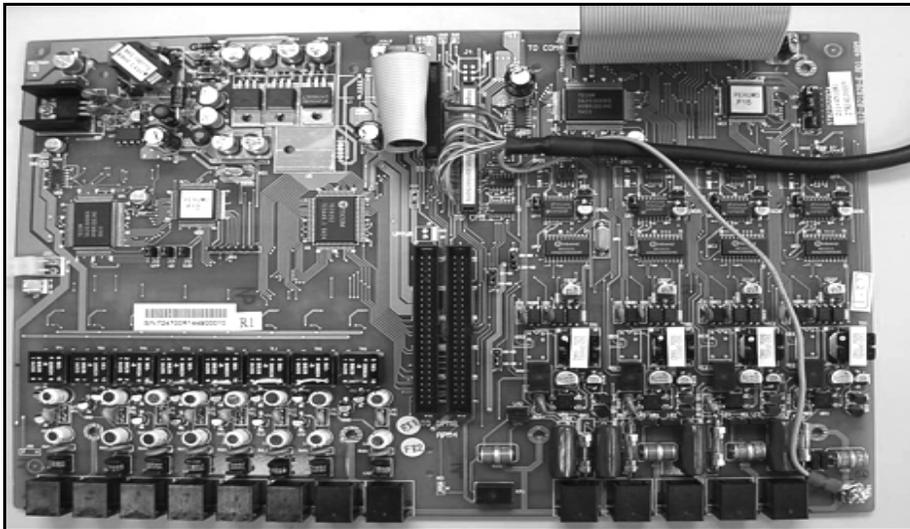
408M - KSU1 Component (continued on next page)

408M - KSU1 Component (continued)

- The fourth CO line port is equipped with CNG fax tone detection circuitry. When programmed as a "FAX" line, this circuit will automatically engage the FAX Tone detector. If FAX tone is detected, the system routes the call to the analog port designated as the destination for fax calls.
- Each digital port (connects to Digital Executive Telephones and DSS Consoles) is comprised of a proprietary octal ASIC (Application Specific Integrated Circuit) transceiver. There are three data channels in operation at each digital port via the octal transceiver. One channel is used for call processing control of digital terminal functions/operations and two channels are used for the digital voice channel requirements.
- Each digital station interface is protected against circuit wiring shorts by an over-current protection polyswitch. The digital station circuit requires only one cable pair to operate and is not polarity sensitive.
- Physical connection of digital extensions, power failure telephones, and CO lines to the 408M module is made through convenient RJ-11 connectors along the bottom edge of the module.

408E (KSU II Component)

The 408E is very similar to the 408M; however, it is unique to KSU2. The 408E provides interface for up to 4 loop-start CO lines and 8 digital extension ports. In addition, the 408E regulates the 24-volt DC power from the source to produce all required logic voltages and operations voltages. There is also a power failure port located on the 408E that is associated to the first CO line circuit. Whenever power fails this port becomes active with dial tone from the CO line connected to the first CO line port.



KSU2

- The 408E is equipped with a heartbeat LED that indicates processing activity on the PCB; the 408E peripheral processor is operating when the heartbeat LED is flashing. The KSU2 operation LED (located next to the power switch) is tied to the 408E heartbeat LED, therefore, when the LED next to the power switch is flashing, the 408E is active.
- The KSU2-408E connections are almost identical to those on the 408M (KSU1); the exception is the long shielded cable used to connect KSU2 to the CPM inside of KSU1.

**NOTE**

There is no standard APM4 installed inside of KSU2. However, one can be connected using the dedicated cable.

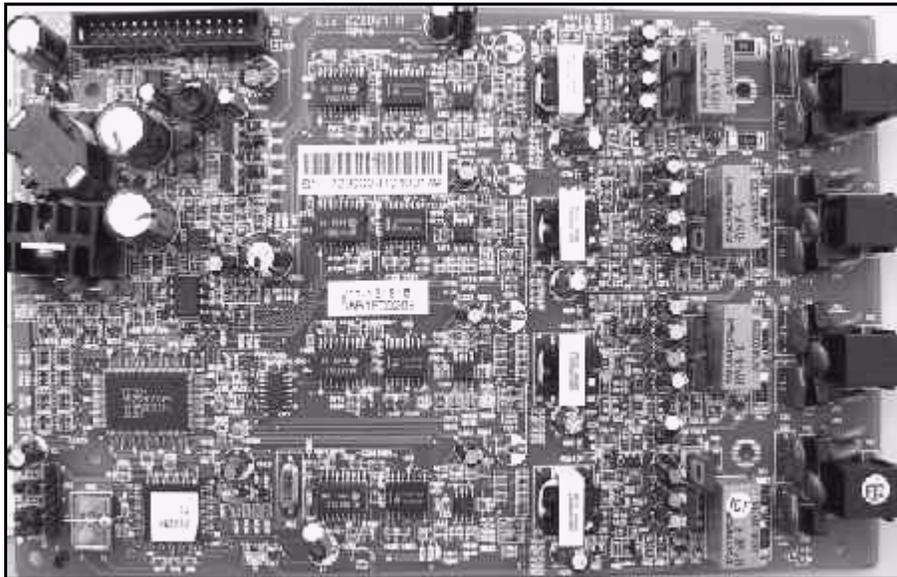
408E - KSU2 Component (continued on next page)

408E - KSU2 Component (continued)

- Each CO line circuit incorporates over-voltage protection, ring detector, loop detector, loop/pulse-dial relay, current sink circuit, coupling/isolation transformer (impedance 600:600), hybrid circuit, CODEC & filter, polarity guard circuit and Radio Frequency noise filter.
- The fourth CO line port is equipped with CNG Fax Tone Detection circuitry. When programmed as a “FAX” line, this circuit automatically engages the FAX tone detector. If FAX tone is detected, the system routes the call to the analog port designated as the destination for fax calls.
- Each digital port (connects to Digital Executive Telephones and DSS Consoles) is comprised of a proprietary octal ASIC (Application Specific Integrated Circuit) transceiver. There are three data channels in operation at each extension port via the octal transceiver: one channel is used for call processing control of digital terminal functions/operations and two channels are used for the digital voice channel requirements.
- Each digital station interface is protected against circuit wiring shorts by an over-current protection Polyswitch. The digital station circuit requires only one cable pair to operate and is not polarity sensitive.
- Physical connection of digital extension terminals, power failure telephones, and CO lines to the 408M module is made through convenient RJ-11 connectors along the bottom edge of the module.

APM4 (Analog Port Module - 4 Circuits)

The APM4 provides four separate analog device ports. This allows the DX-120 to support auxiliary office equipment such as fax machines, PC/FAX modems, and analog telephones (single line telephones). The APM4 generates -30VDC and 20-25Hz, 50V square wave ringing for operation.



APM4 (Analog Port Module - 4 Circuits)

- The APM4 is equipped with a heartbeat LED that indicates processing activity on the PCB; the APM4 peripheral processor is operating when the heartbeat LED is flashing.
- The APM4 provides DTMF receivers for each analog port. Ancillary analog devices connected to APM4 analog ports must generate DTMF signaling.

**IMPORTANT**

Pulse (rotary-dial) telephones/equipment are not supported.

APM4 - Analog Port Module (continued on next page)

APM4 - Analog Port Module (continued)

- All connections are via RJ-11 connectors along the bottom edge of the module. KSU1 is delivered with one APM4 installed on ribbon connector J5 as standard equipment.
- APM4's may be installed on 408M/E-J5 (standard in KSU1:408M-J5 or KSU2 via dedicated cable).

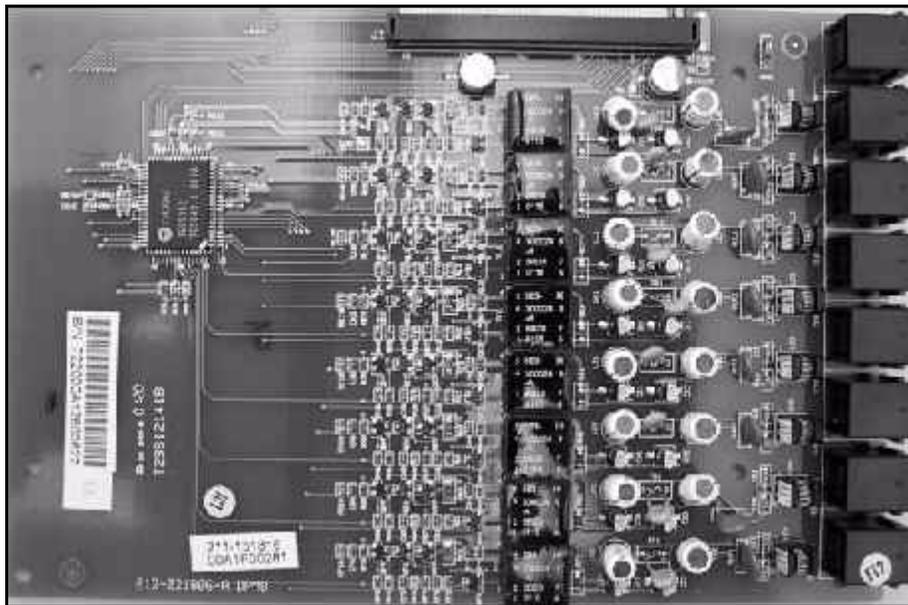


IMPORTANT

DO NOT ATTEMPT to install an APM4 on J2 or J3.

DPM8 (Digital Port Module - 8 Circuits)

The DPM8 module expands the DX-120 system capacity of digital ports DET (Digital Executive Telephones) and DSS consoles. Each digital port is comprised of a proprietary octal ASIC transceiver. There are three data channels in operation at each digital port via the octal transceiver. One channel is used for call processing control of digital terminal functions/operations and two channels are used for the digital voice channel requirements. The DPM8 is controlled directly from the 408M/E; therefore, there is no heartbeat LED located on the DPM8.

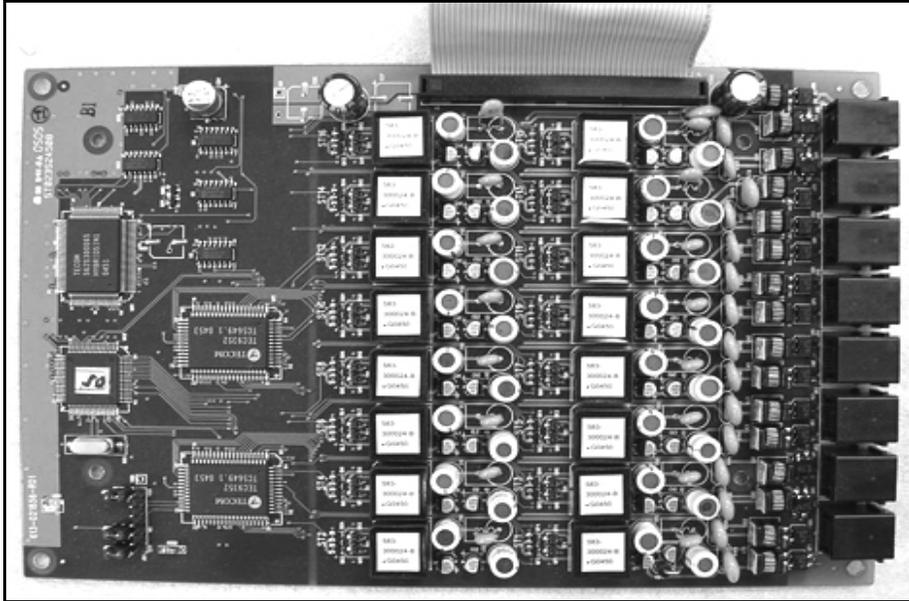


DPM8 (Digital Port Module - 8 Port)

- Each digital station interface is protected against circuit wiring shorts by an over-current protection Polyswitch. The digital station circuit requires only one cable pair to operate and is not polarity sensitive.
- Physical connection of digital port terminals (DET and DSS) to the DPM8 module is made through convenient RJ-11 connectors along the bottom edge of the module.

DPM16 (Digital Port Module - 16 Circuits)

The DPM16 module expands the DX-120 system capacity of digital ports DET (Digital Executive Telephones) and DSS consoles. Each digital port is comprised of a proprietary octal ASIC transceiver. There are three data channels in operation at each digital port via the octal transceiver. One channel is used for call processing control of digital terminal functions/operations and two channels are used for the digital voice channel requirements. The DPM16 is controlled directly from the 408M/E. Therefore, there is no heartbeat LED located on the DPM16.

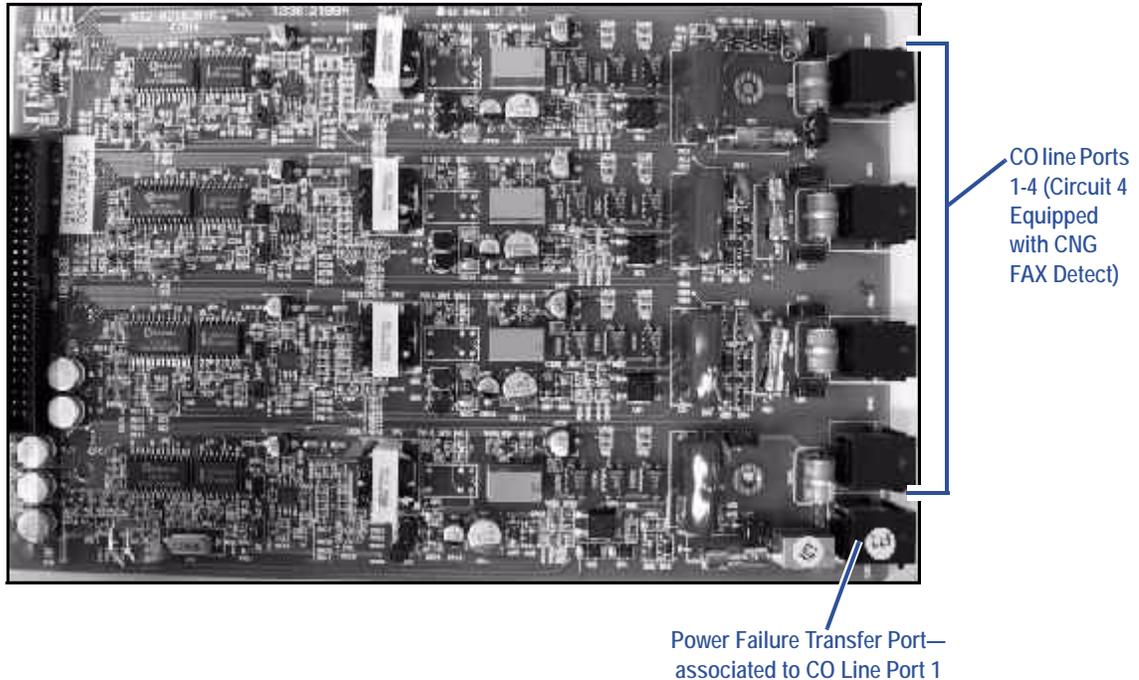


DPM16 (Digital Port Module - 16 Port)

- Each digital station interface is protected against circuit wiring shorts by an over-current protection Polyswitch. The digital station circuit requires only one cable pair to operate and is not polarity sensitive.
- Physical connection of digital port terminals (DET and DSS) to the DPM16 module is made through convenient RJ-12 connectors along the bottom edge of the module.

COM4 (Central Office Module - 4 Circuits)

The COM4 module is installed in the dedicated position via J1 of the 408M/E. The COM4 interfaces four loop-start CO lines. Since one COM4 may be installed in KSU1 and one COM4 may be installed in KSU2, you can expand the DX-120 system loop start CO line capacity to support up to 16 loop start CO lines.

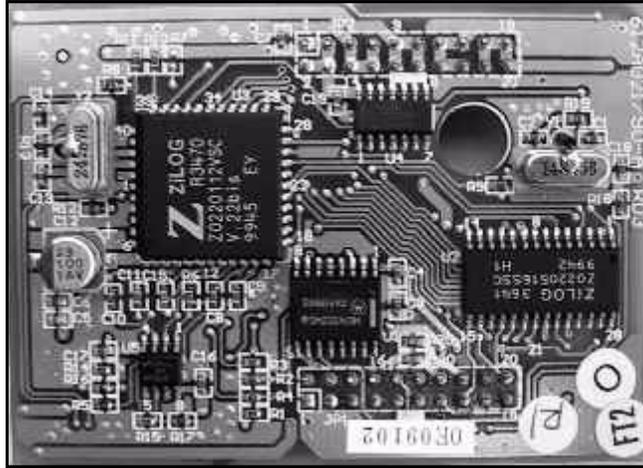


COM4 (Central Office Module - 4 Port)

- The COM4 module is shipped with four mounting stand-offs used to install the board into the KSU1 or KSU2. Five RJ11 jacks are provided along the bottom edge of the COM4 module for connection of one power failure telephone and the four CO lines.
- CO lines are terminated at the site by the telephone company at a point of interface called the Demarcation (Demarc). When ordering CO lines for the site, request termination on RJ11 type jacks. Doing so allows you to easily extend the CO lines to the COM4 RJ11 connector (one CO line per jack and connector).
- Each CO line circuit incorporates over-voltage protection, ring detector, loop detector, loop/pulse-dial relay, current sink circuit, coupling/isolation transformer (impedance 600:600), hybrid circuit, CODEC & filter, polarity guard circuit, and Radio Frequency noise filter.
- The fourth CO line port is equipped with CNG Fax Tone Detection circuitry. When programmed as a "FAX" line, this circuit will automatically engage the FAX tone detector. If FAX tone is detected, the system routes the call to the analog port designated as the destination for fax calls.

MDM (Modem Module)

The 7249 Modem Module is a self-contained integrated modem unit that is installed at J5 and J6 in the upper right corner of the CPM. The integrated MDM allows you to access the system programming and remote maintenance utilities from an off-site location (password verification is required).



MDM (Modem Module)

- When the MDM is installed, you can program the system remotely using PC-DBA.



NOTE

PC-DBA is included in the utilities CD shipped with every new system. Or, you can obtain PC-DBA at the Vertical web site, www.vertical.com.

- You can service the system, using PC-DBA and a modem in your PC, to place a call to the site where the DX-120 is installed.



NOTE

If one of the voice processing systems are installed, routing to the modem extension is automated. Otherwise, the person who answers this data call must transfer the call to extension 100. Once the modems have established the data connection, you can begin servicing the switch.

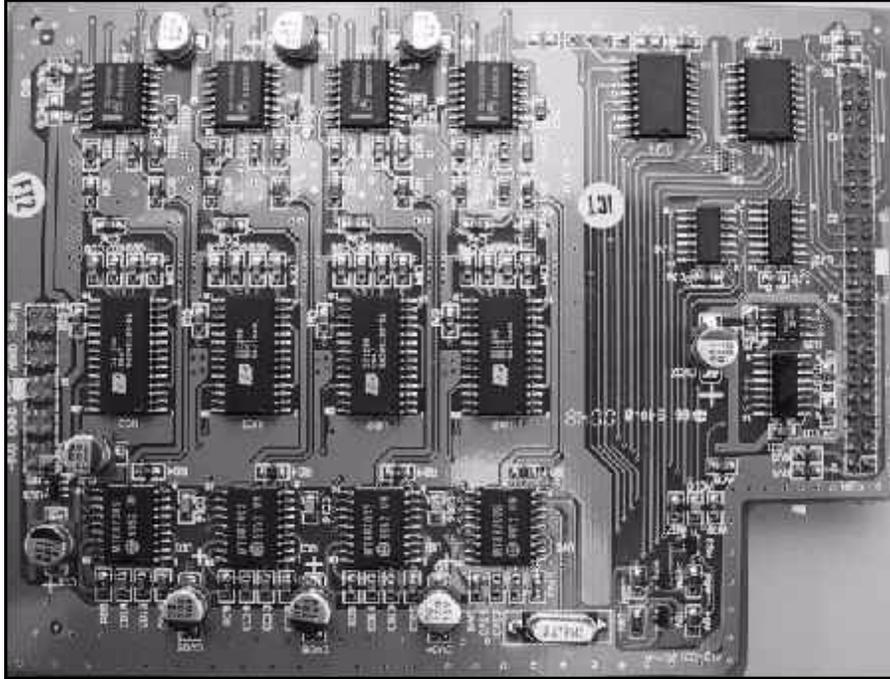


IMPORTANT

The MDM default extension number is 100. This number can be changed and therefore may be different for some DX-120 systems.

AAM (Automated Attendant Module)

- The Automated Attendant Module is a self contained integrated module that enables automatic answering of selected CO lines and a single-level menu for greeting callers and routing them to DX-120 system destinations.
- The AAM can handle all call traffic or act as a backup to the primary answering system attendant.

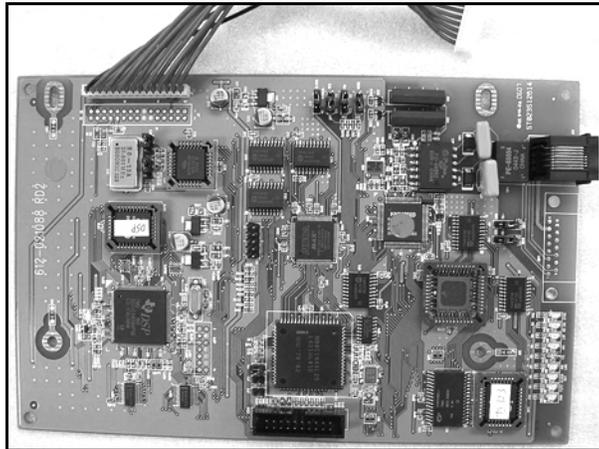


AAM (Automated Attendant Module)

- The AAM is installed at J3 and J4 of the CPM (centered above the board).
- The AAM provides 10 announcements for the various modes of system/action operation: Day Greeting, Alt Greeting, Night Greeting, Waiting Message, Invalid Message, Busy Message, No Answer Message, Goodbye Message, Inquiry Message, and Temporary Message.

T1 Card (T1 Module) Details

The T1 Card (T1 Module) allows for expansion of the DX-120 system CO line interface to a capacity maximum of 24 digital CO line ports.



T1 Module

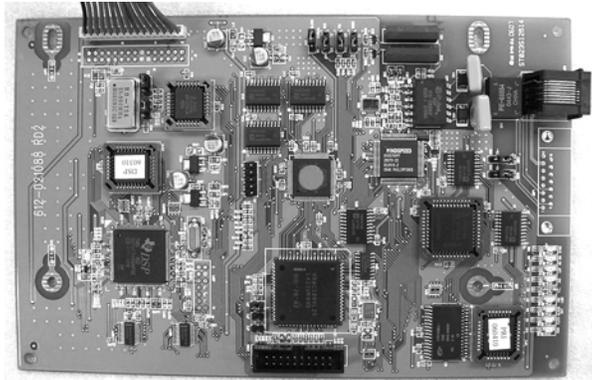
T1 Card (T1 Module) Details	
Capacity:	<ul style="list-style-type: none"> • One (1) T1(1.544Mbps, 24channels) interface
Network interface mode	<ul style="list-style-type: none"> • T1-Interface
Network connector	<ul style="list-style-type: none"> • RJ-45
LED indicator	<ul style="list-style-type: none"> • T1 Card has 9 LEDs on the PCB which indicate alarms of T1 trunk, in-use status, and synchronous clock enable status.
LED # Function	
<ul style="list-style-type: none"> • D2 Yellow Alarm Indicator 	<ul style="list-style-type: none"> • Normal=Dark • Alarm = Red lit
<ul style="list-style-type: none"> • D3 AIS Alarm Indicator 	<ul style="list-style-type: none"> • Normal =Dark • Alarm = Red lit
<ul style="list-style-type: none"> • D4 Loss of Frame Alarm Indicator 	<ul style="list-style-type: none"> • Normal = Dark • Alarm = Red lit
<ul style="list-style-type: none"> • D5 No Signal Alarm Indicator 	<ul style="list-style-type: none"> • Normal = Dark • Alarm = Red lit
<ul style="list-style-type: none"> • D6 PRI Link Channel Sync. 	<ul style="list-style-type: none"> • For T1 card = Always Dark
<ul style="list-style-type: none"> • D7 Clock Mode Indicator, 	<ul style="list-style-type: none"> • Master Mode = Dark • Slave Mode = Green lit
<ul style="list-style-type: none"> • D8 T1/E1 Indicator 	<ul style="list-style-type: none"> • T1 = Green lit • E1= Dark
<ul style="list-style-type: none"> • D9 Heart Beat 	<ul style="list-style-type: none"> • Normal = Flashing • Abnormal = Dark or Steady Green lit

T1 Card (T1 Module) Details (continued on next page)

T1 Card (T1 Module) Details (continued)	
<ul style="list-style-type: none"> • D10 Signaling Synchronization indicator 	<ul style="list-style-type: none"> • Synchronous = Green lit • Non-Synchronous = Dark
Clock source	<ul style="list-style-type: none"> • On-board crystal and can be set as master or slave to synchronize with PSTN, depending upon the networking requirement.
Backplane connector	<ul style="list-style-type: none"> • 15-pin
Backplane interface covers the following:	
<ul style="list-style-type: none"> • Power feeding 	<ul style="list-style-type: none"> • 5 VDC
<ul style="list-style-type: none"> • PCM highway 	<ul style="list-style-type: none"> • System will provide an 8KHz frame signal for T1 card's synchronization.
<ul style="list-style-type: none"> • Control data interface 	<ul style="list-style-type: none"> • Compatible with SPI (Serial Peripheral Interface) bus timing.

ISDN Card (T1/PRI Module) Details

The ISDN Card (T1/PRI Module) allows for expansion of the DX-120 system CO line interface to a capacity maximum of 23 Digital CO line ports.



ISDN Card (T1/PRI Module)

ISDN Card (T1/PRI Module) Details	
Capacity:	One (1) T1(1.544Mbps, 24channels) interface
Network interface mode	ISDN (T1/PRI) Interface
Network connector	RJ-45
LED indicator	ISDN (T1/PRI) Card has 9 LEDs on the PCB which indicate alarms of T1 trunk, in-use status, and synchronous clock enable status.

ISDN Card (T1/PRI Module) Details (continued on next page)

ISDN Card (T1/PRI Module) Details (continued)	
LED # Function <ul style="list-style-type: none"> • D2 Yellow Alarm Indicator 	Normal=Dark Alarm = Red lit
<ul style="list-style-type: none"> • D3 AIS Alarm Indicator 	Normal =Dark Alarm = Red lit
<ul style="list-style-type: none"> • D4 Loss of Frame Alarm Indicator 	Normal = Dark Alarm = Red lit
<ul style="list-style-type: none"> • D5 No Signal Alarm Indicator 	Normal = Dark Alarm = Red lit
<ul style="list-style-type: none"> • D6 PRI Link Channel Sync. 	ISDN (T1/PRI) Working = Steady Green
<ul style="list-style-type: none"> • D7 Clock Mode Indicator, 	Master Mode = Dark Slave Mode = Green lit
<ul style="list-style-type: none"> • D8 ISDN (T1/PRI) Indicator 	ISDN (T1/PRI) = Green lit
<ul style="list-style-type: none"> • D9 Heart Beat 	Normal = Flashing Abnormal = Dark or Steady Green lit
<ul style="list-style-type: none"> • D10 Signaling Synchronization indicator 	Synchronous = Green lit Non-Synchronous = Dark
Clock source	On-board crystal and can be set as master or slave to synchronize with PSTN, depending upon the networking requirement.
Backplane connector	15-pin
Backplane interface covers the following:	
<ul style="list-style-type: none"> • Power feeding 	5 VDC
<ul style="list-style-type: none"> • PCM highway 	System will provide an 8KHz frame signal for ISDN (T1/PRI) card's synchronization.
<ul style="list-style-type: none"> • Control data interface 	Compatible with SPI (Serial Peripheral Interface) bus timing.

DET (Digital Executive Telephone)

The DX-120 has one model digital telephone called the Edge 120 Digital Executive Telephone.



Edge 120 DET - Digital Extension Telephone

- The DET provides:
 - a speakerphone for hands-free conversations
 - a two-row by sixteen column (32-character), dot-matrix, supertwist, Liquid Crystal Display (LCD)
 - three interactive buttons to enhance system feature operation.
- The supertwist LCD eliminates the need for contrast adjustment, and enhances clarity of displayed data using an angled viewing position. Since the DX-120 includes Caller ID (CID) as a standard feature, the LCD also provides every designated ringing extension with CID data for incoming CO line calls.



NOTE

CID requires a subscription from the servicing telephone company.

- The display also provides a visual reference to call progress and call duration, as well as time and date information. The display enables the user to send and receive visual advisory and callback messages. Users may select from six pre-programmed messages (i.e., "IN A MEETING," "OUT OF OFFICE"), or they may create a custom message. Callers from other DETs to an extension with a message active will receive the visual advisory message on their LCD display.
- Each digital speakerphone has 30 programmable Feature Buttons to aid the user by providing direct access to system features and resources. There are also three interactive buttons and 9 fixed function buttons.

DET - Digital Extension Telephone (continued on next page)

DET - Digital Extension Telephone (continued)

- Each DET is equipped standard with a 2.5 millimeter headset jack. Users can toggle their speakerphone operation in and out of a special “headset mode”. This mode allows the user to easily activate the headset jack via the ON/OFF button as an alternative to using the speakerphone. Thus, headset mode is easily enabled or disabled so that users can quickly select between use of the headset or speakerphone operations.



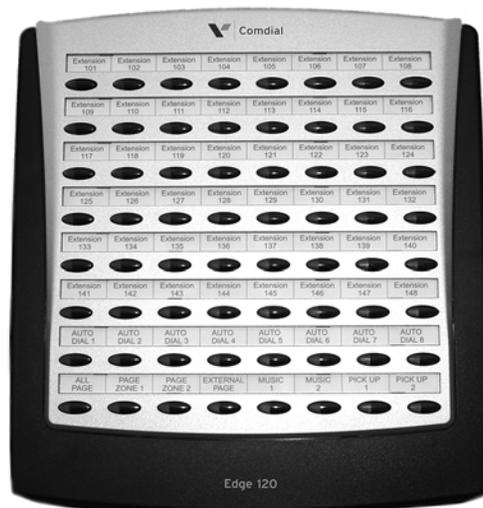
NOTE

The DET must be idle to change this setting.

- You can mount the telephone in one of three positions: low and low profile desk positions and the wall mounted position.
- Each speakerphone is also equipped with a status lamp to aid in user operations. The lamp is dual color (red / green) and indicates various modes of operation, such as messages/voice messages waiting, incoming calls - distinctive for CO and intercom, in-use indication for speakerphone mode, headset mode, etc.
- The Multiple Call Handling utility known as Call Key (Feature Code 66) provides a method for tracking the status for a “pool” of CO lines. More specifically, the Call Key reflects the status of any active Trunk calls for a specific extension (assuming there is not a Line Key programmed for that individual CO line that the Trunk call is associated with). Furthermore, users can program multiple Call Keys on their phone to allow for tracking the status and management of additional, simultaneous Trunk calls.
- There are two types of lamp indicators on the phone: General and Hold. General lamp indicators appear next buttons to provide general call status. The Hold lamp indicators provide status with regard to any calls on hold (either trunk or intercom). Refer to the Edge 120 DET User Guide for more information.

DSS (Direct Station Selection) Console

The DSS console is a digitally interfaced component of the DX-120. It connects to the system via any available digital port (408M/E, DPM8, DPM16 digital port).



DSS (Direct Station Selection) Console

DSS Console (continued on next page)

DSS Console (continued)

- The DSS has 64 programmable buttons with dual color (red / green) LEDs and may be assigned any system feature code or directory number. These buttons may be assigned for either system features operations or CO line access operations.
- You can mount the DSS console in one of three positions: low and low profile desk positions and the wall mounted position. DSS consoles are programmed to operate with an associated speakerphone.
- You can assign up to four DSS consoles per speakerphone. The maximum number of DSS consoles supported by the DX-120 is 12.
- Each equipped DSS console requires one digital port, therefore the total number (system capacity) of speakerphones possible is reduced by one for each DSS console installed.

Specifications**CURRENT DRAW**

Use this chart to calculate the Amphour requirements of the DX-120 system based upon its configuration. This information is typically used to apply UPS battery requirements.

Component	Current Draw (Amps) @ 117 VAC	Quantity	Extended Total Amps
KSU1 (7201)	0.18A	1	0.18A
KSU2 (7202)	0.17A	1 max.	
COM4 (7210)	0.02A	2 max.	
DPM8 (7220)	0.01A	4 max.	
APM4 (7230)	0.08A	3 max.	
MDM (7249)	0.01A	1 max.	
AAM (7240)	0.01A	1 max.	
7271C	0.02A	1 max.	
7270C	0.01A	1 max.	
DET (7261-00)	0.016A	80 max.	
DSS (7262-00)	0.016A	12 max.	
Station wire: per DET, DSS, and IST	0.02A every 100 ft. of 24AWG	?	
<i>Multiply the unit times the quantity installed in the subject application (site) and add the right column for the total current draw (Amps) @ 117VAC for this site.</i>			

Specifications (continued on next page)

Specifications (continued)

SYSTEM CRITERIA AND CAPACITY

System Criteria and Capacity	
Time slots	PCM - 32 time slots x 8 Highways (256 voice channels) TDM 64 Time Slots (data processing)
Customer database memory protection	300 hours via on-board lithium battery (no charging required)
Ports: CO/PBX/Centrex Lines Digital Stations Standard Single Line Telephones	16 48 16* <i>*There are 32 total possible digital extensions in this configuration.</i>
DTMF Receivers:	One dedicated per single line telephone port
DTMF Senders:	Unlimited <i>DTMF signal generation is derived from the core system tone resource. Tone combinations are available as needed.</i>
Tone Detectors: (used to monitor call progress tones; Busy Tone, Ring-back Tone, etc.)	2 (shared for advanced call processing system features; DISA, ECF, ABR. etc.)
Contacts	1 LBC can be programmed as associated to a CO line or dialed by an extension to actuate the contact
Conference circuits	8 - 4 party conference circuits
DISA circuits	Any number of CO lines may be programmed for DISA operation. (AAM required for operation.)
System Attendants	1 Attendant + 1 alternate per tenant group
Tenant Groups	3
UCD/Hunt Groups: Members per group: Group Types: Hunting Method:	24 24 UCD or Voice Announce Linear, All Ring or Distributed

System Criteria and Capacity (continued on next page)

System Criteria and Capacity (continued)	
Voice Mail Groups Members (ports) Integration Method VM message waiting VM control codes	1 per Tenant (uses 1 UCD Group per VM system) 24 Digital (ICD Voice) and In-band (for other) #96 + station number to turn VM button LED on. #*96 + station number to turn VM button LED off Disconnect Digits: 8 digits max. Subscriber Calling via Intercom: 4 digits max. Transfers to VM : 4 digits max. Busy Forward: 4 digits max. No Answer Forward: 4 digits max. Direct Call Forward: 4 digits max. CO Line Recall: 4 digits max. CO Line Ringing: 4 digits max. UCD Overflow: 4 digits max. Record Digits for Voice Recorder function: 4 max. Delete Digits: 4 digits max. Suffix for transferred calls: 2 max.
CO line loop current sensing	Interrupt programmable from 50ms to 2500ms.
Paging	8 Internal Page Extension Groups 1 External Page Port 1 Internal All Call 1 System (Internal/External) All Call
Speed Dialing	1000 total bins, dynamically allocated. 200 bins at default allocated for system-wide use. 20 bins at default allocated for extension use (extensions 101-148 only) (50 possible per extension) 16 digits maximum per bin.
Last Number Redial	16 digits per station
Save Number Redial	16 digits per station
User Saved Number (Memo Pad)	20 digits per station
Callback request per station	1
Camp On by a busy station	1
Stations Camped on to a station	1
Stations Camped on to a busy line	1
Message - Executive Notification	6 pre-programmed 1 personal per station
Message - Executive Preprogrammed	6 pre-programmed 1 personal per station

System Criteria and Capacity (continued on next page)

System Criteria and Capacity (continued)	
Message Waiting	40 simultaneous maximum per system (does not affect VM message indications)
Name in Display	1 per station, 7 characters max.
Class Of Service (COS)	8 (0-7) per Day, 8 (0-7) per Night
Toll Restriction To/From Tables	100 Tables per tenant, 10 digits per entry, Day and Evening COS assignable per entry per CO Line and Extension.
Forced Verified Account Codes	600 codes, 2-8 digits max., each assigned a COS
Unverified Account Codes	8 digits max.
Call Pick Up Groups	8 extension groups
Station Lock Password	4-8 digits per extension
CDB Programming Password	8 alphanumeric characters (“_____” eight spaces at default); default password when programming via DET “#####” (eight pound signs)
System Reminder Alarm	8 time settings per tenant group
Station Alarm	1 per station repeating or one time
Ring Schemes	8
Distinctive Ring Tones	8 per station
External Call Forward	via extension call forward settings

Specifications (continued on next page)

*Specifications (continued)***ELECTRICAL DATA**

Electrical Specifications	
AC Power source	Dedicated 117/230vac \pm 15%, 47-63Hz single phase
Power consumption	1.5A maximum @ 120vac (180 watts)
Power Supply fuse	
AC input:	2A 250v
DC output:	1A 125v
Idle Channel Noise	-74 dB
Cross Talk Attenuation	75 dB (@ 1kHz)
Ringing Sensitivity	40v RMS 25 Hz
Ringer Equivalence Number	1.5
CO Line Signaling	DTMF amplitude (-5 dB,-7 dB) +- 2 dB, @ approx. 2 Vpp Pulse Dialing ratio 60/40 @ 10 PPS
Music source / Background Music	0 dBm at 600 ohm input impedance
Contact rating (Option Module LBC)	1A @ 30VDC 0.5A @ 90VAC 30Hz 1/8th inch phono jack
External Page Port	0 dBm at 600 ohms 1/8th inch phono jack

ENVIRONMENTAL DATA

Environmental Specifications	
Operating Temperature	0° to 35° C, 32° to 95° F
Recommended Operating Temperature	70° to 78° F
Storage Temperature	32° to 104° F
Operating Relative Humidity	5% to 90% (non-condensing)
Heat Dissipation (BTU)	300

Specifications (continued on next page)

Specifications (continued)

UNIT (COMPONENT) DETAIL

UNIT SPECIFICATIONS					
Part Number	Description	Dimensions:			Weight
7200	CPM Central Processor Module	L	210 mm	8.25 in.	0.4Kg
		W	138 mm	5.5 in.	
		H	18 mm	.75 in.	
7201P/7202P	KSU1/KSU2	L	460 mm	18.4 in.	4.0Kg
		W	270 mm	10.8 in.	
		H	105 mm	4.2 in.	
7210	COM4 Central Office Module – 4 Port	L	210 mm	8.25 in.	0.3Kg
		W	138 mm	5.5 in.	
		H	18 mm	.75 in.	
7220	DPM8 Digital Port Module – 8 Port	L	210 mm	8.25 in.	0.28Kg
		W	138 mm	5.5 in.	
		H	18 mm	.75 in.	
7221	DPM16 Digital Port Module – 16 Port	L	210 mm	8.25 in.	0.4Kg
		W	138 mm	5.5 in.	
		H	18 mm	.75 in.	
7230	APM4 Analog Port Module – 4 Port.	L	210 mm	8.25 in.	1.2Kg
		W	138 mm	5.5 in.	
		H	21 mm	.0875 in.	
7240	AAM Automated Attendant Module	L	140.1 mm	5.515 in.	0.09 Kg
		W	105 mm	4.135 in.	
		H	2.22 mm	.0875 in.	
7248	408M Standard 4 CO Line x 8 Digital Extension Module	L	210 mm	8.25 in.	0.4Kg
		W	138 mm	5.5 in.	
		H	18 mm	.75 in.	
7249	MDM Modem Module	L	75.05 mm	2.955 in.	0.3Kg
		W	55.12 mm	2.170 in.	
		H	13.33 mm	0.525 in.	
7261-00	DET Digital Executive Telephone (LCD Speakerphone)	L	230 mm	9 in.	1.7Kg
		W	182 mm	7.25 in.	
		H	140 mm	5.5 in.	
7262-00	DSS Console	L	241 mm	9.5 in.	1.7Kg
		W	202 mm	8 in.	
		H	93 mm	3.75 in.	

Unit Specifications (continued on next page)

UNIT SPECIFICATIONS (continued)					
Part Number	Description	Dimensions:			Weight
7270	CO DX HD	L	210 mm	8.25 in.	0.342Kg
		W	138 mm	5.5 in.	
		H	21 mm	.0875 in.	
7271C	CO DX FLASH	L	210 mm	8.25 in.	0.233Kg
		W	138 mm	5.5 in.	
		H	21 mm	.0875 in.	
7285	ISDN (T1/PRN) Module	L	210 mm	8.25 in.	0.184Kg
		W	138 mm	5.5 in.	
		H	17.4 mm	.69 in.	
7290	T1 Module	L	210 mm	8.25 in.	0.184Kg
		W	138 mm	5.5 in.	
		H	17.4 mm	.69 in.	

WIRING DATA

Maximum Cable Length	
DET (distance measures in linear feet of cable from KSU to DET)	26 AWG - 255m (850 ft.) 24 AWG - 425m (1416 ft.) 22 AWG - 700m (1983 ft.)
Standard Single Line Telephone (distance measures in linear feet of cable from KSU to IST)	26 AWG - 195m (650 ft.) 24 AWG - 340m (1133 ft.) 22 AWG - 476m (1586 ft.)

SIGNALING (CENTRAL OFFICE-PSTN) DATA

Dialing Specifications	
DTMF Dialing Mode	
Frequency deviation:	± 1%
Rise time:	3ms
Duration of DTMF signal:	programmable 50-150ms (70ms default)
Inter-digit time:	programmable 50-150ms (70ms default)
VM Port DTMF duration:	programmable 60-150ms (120ms default)
VM Port Inter-digit time:	programmable 60-150ms (120ms default)
Pulse Dialing Mode	
Pulse dial rate:	10 pulses per second
Pulse Make/Break ratio:	60/40

Specifications (continued on next page)

Specifications (continued)

REGULATORY DATA

FCC Registration Numbers	
For systems configured for key system operation (each CO line appears on its own dedicated button).	D6XTAI-40144-KF-T
For systems configured for hybrid operation (CO lines may be accessed by dial codes and Pool/Loop buttons).	D6XTAI-40145-MF-T

SIGNALING (INTERNAL) DATA

Audible Signals		
Signal	Frequency	Cadence
CO Line Ringing:		
Scheme 0	N/A	300ms On, 400ms Off, 300ms On, 4 seconds Off
Scheme 1	N/A	1 second On, 3 seconds Off
Scheme 2	N/A	1 second On, 3 seconds Off
Scheme 3		follows ring cadence of Ring Scheme selected
Scheme 4		follows ring cadence of Ring Scheme selected
Scheme 5		follows ring cadence of Ring Scheme selected
Scheme 6		follows ring cadence of Ring Scheme selected
Scheme 7	-SLT bell-	follows ring cadence of Ring Scheme selected
Distinctive 1		follows ring cadence of Ring Scheme selected
Distinctive 2		
Distinctive 3		
Distinctive 4		
SLT		
Intercom Ringing:		
Scheme 0	N/A	1 second On, 3 seconds Off
Scheme 1	N/A	1 second On, 3 seconds Off
Scheme 2	N/A	300ms On, 400ms Off, 300ms On, 4 seconds Off
Scheme 3		follows ring cadence of Ring Scheme selected
Scheme 4		follows ring cadence of Ring Scheme selected
Scheme 5		follows ring cadence of Ring Scheme selected
Scheme 6		follows ring cadence of Ring Scheme selected
Scheme 7	-SLT bell-	follows ring cadence of Ring Scheme selected
Distinctive 1		follows ring cadence of Ring Scheme selected
Distinctive 2		
Distinctive 3		
Distinctive 4		
SLT		
Message Wait Callback		follows ring cadence of Ring Scheme selected

Specifications (continued on next page)

Specifications (continued)

MTBF (MEAN-TIME BETWEEN FAILURE) DATA

Mean-Time Between Failure Analysis System Components	
Cabinet Assembly	86.0
Power Supply Unit	170.0
CPM	2,915.7
408M	11,407.3
DPM8	3560.8
DPM16	121,654.5
COM4	6,146.5
APM4	6,860.2
MDM	761.0
AAM	2,337.3
T1	318,076.27
ISDN (T1/PRI)	257,340.64
Method: Use the figures above for each unit installed (or to be installed) and calculate the total for this system configuration. Use the total from step 1 in place of the variable "x" in the formula at the right to calculate MTBF for this system configuration.	$(1^3) \times (109) = \text{MTBF hours}$

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SECTION 2 - INSTALLATION

INSTALLING THE DX-120

Proper installation of the Vertical DX-120 is essential to assure optimum system operation. You must follow these procedures to reduce system problems resulting from improper installation and to reduce the potential of experiencing problems while bringing the DX-120 on-line.

Installation Overview

The following steps provide an overview of the installation process. Details on each of these steps are contained in the following sections of this chapter. Be sure to read the detailed instructions before installing the DX-120.

- A) Plan the installation, including the KSU1 or KSU1 and KSU2 and Main Distribution Frame (MDF) location, station locations, cable runs, and optional equipment.
- B) Assemble the correct tools and supplies: UTP telephony grade cable/wiring, miscellaneous telephony hardware, 66 blocks, modular wall jacks, etc.)
- C) Run the wiring for speakerphones, DSS consoles and analog devices (FAX machines, modems, etc.) from the MDF to each location.
 - Wiring topology is referred to as "star-wiring" configuration; no cable should loop from one telephone location to another.
- D) Run cable/wiring to any optional equipment, such as external paging equipment, loud bell signaling devices, music sources, etc.
- E) Mount the MDF backboard and attach the terminal blocks on the backboard. Use a dedicated MDF with 66 block wiring field to promote full serviceability of the system and connections using proven techniques.
 - If you route extension cables into the KSU, you have to terminate one cable pair into standard crimping modular connectors for each cable.



CAUTION

Although you can route the extension cable/wiring directly into the DX-120 KSU1/ KSU2 housing and connect directly to the appropriate interface module (408M, DPM8, DPM16, APM4, COM4, CPM), Vertical does not recommend this method since it makes it difficult to service the system.

- F) Mount the KSUs on the MDF backboard, using the mounting template provided.
- G) Ground the KSU1 (and KSU2 if applicable) to a known "good" earth ground.
- H) Install optional expansion modules (COM4, DPM8, DPM16, APM4) inside the KSU as required.
 - *APM4 is factory installed in KSU1. However, one can be installed in KSU2 via the dedicated cable.*
- I) Install optional features modules (AAM, 7270C, 7271C, or MDM) inside the KSU as required.
- J) Install the telephone instruments and any optional telephone equipment, such as headsets or single line telephones.

Site Planning

The first step in site planning is establishing suitable environmental conditions for the system.

- A) Place KSU1, and KSU2 if applicable, within 5 feet (1.5 meters) of an isolated, dedicated, 105-125VAC, 57-63Hz, 15A, single-phase commercial power source.



CAUTION

- ***This must be an isolated, dedicated AC circuit for proper operation.***
 - ***Run all three wires (power, neutral, and ground) separately from the outlet to the breaker panel, without being bonded to any other wire or circuit.***
 - ***Do not plug any other equipment into this outlet.***
 - ***To maintain the protection provided by the isolated, dedicated circuit, the length of the AC power cord limits the distance between the KSU and the outlet.***
 - ***To protect the system from lightning damage or other AC power line disturbances, install a surge protector.***
 - ***Do not use an extension cord.***
 - ***Select the KSU location to minimize cable run length. Terminal equipment connected to the system must not exceed specified limits (see see "Specifications").***
 - ***The KSU location should not be exposed to direct sunlight, high humidity, heat, dust, or strong magnetic fields (such as those generated by heavy motors, copy machines and some kitchen appliances).***
 - ***The DX-120 system must be installed in a climate controlled environment. This equipment cannot function in environments above 95 degrees Fahrenheit ambient temperature.***
- B) The MDF should consist of a 3/4-inch plywood backboard large enough to mount all hardware and equipment allowing all components ample space for adequate ventilation and servicing. Allow additional room for external apparatus, if used.
- C) For cooling purposes, ample air space (at least four inches on the top, bottom, left and right sides) must be provided for the KSU.
- D) SMDR/SMDA output devices must be placed within 50 feet (15 meters) of the KSU (limited by RS-232C standard wiring practices).
- E) The equipment should be located in a climate-controlled room adhering to the environmental specifications listed in see "Environmental Data" .



CAUTION

- ***When installing the KSU and station instruments, allow a sufficient margin for error in case of air conditioning failure, routine maintenance, plant shutdown, etc.***
- ***As a general rule, if conditions are suitable for office personnel, they are also suitable for KSU and terminal equipment operation.***
- ***A properly controlled environment will help to extend the operating life of the equipment.***

Site Planning (continued on next page)

Site Planning (continued)

- The following statements are from **UL 1459**, a product safety specification governing telephone equipment:
 - 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 non-insulated telephone wires or terminals unless the telephone line has been disconnected at the network's interface.
 - Use caution when installing or modifying telephone lines.



CAUTION

Per Underwriters Laboratories regulation 1950, TNV wiring to outside plant leads (e.g. central office trunk wiring) must be 26 AWG gauge minimum.

Tools and Supplies

Assemble the correct supplies and tools to install the Vertical DX-120.

- Use UTP (Unshielded, Twisted-Pair) three or four pair (recommended) cable to run from the MDF to all extension terminals (DETs, DSS consoles, and analog devices). DETs only need one twisted pair to operate. Additional pairs are always recommended to allow for future potential uses.
- Six conductor modular jack assemblies for all station instruments (recommended).
- Standard punch-down terminal blocks (66M1-50 type) as required.
- Four or six conductor crimping modular plug assemblies for each port interface.
- AC voltage surge/spike protector.
- Standard telephone hand tools and mounting hardware for the KSU(s), MDF backboard, punch-down terminal block(s), modular jack assemblies for CO lines, etc.

Preparing the Main Distribution Frame

The MDF is the point at which the KSU, terminal equipment, CO lines, and miscellaneous equipment connect to one another. It is extremely important that you make the connections carefully and accurately.

ASSEMBLING THE MDF

Follow these steps to assemble the MDF.

- 1) Mount a sufficiently sized, 3/4-inch plywood backboard at the proper location to use as the MDF termination and equipment mounting board.
- 2) Plan the layout of all required MDF components allowing for expansion. This may include: KSU1, KSU2, 66M1-50 termination blocks, cable fastening hardware, and miscellaneous third-party communications equipment (paging equipment, etc.).
- 3) Locate the Telco-provided CO/Centrex lines at the DEMARC (Demarcation) and extend them to the MDF location.
- 4) Locate a suitable, known-good earth ground preferably within 10 feet of the MDF and route a **#10AWG grounding wiring** from the point of grounding to the MDF for connection to the KSU.
- 5) Install all telephone cabling and route to the MDF location for termination.
- 6) Mount all equipment and termination hardware as required to interconnect terminal devices and KSU modules.

Preparing the Main Distribution Frame (continued on next page)

*Preparing the Main Distribution Frame (continued)***KSU COMPONENTS AND INSTALLATION**

- KSU1
 - one mounting template
 - standard 408M (module) equipped with eight digital extension ports, four CO line ports, and one CO line PFT (Power Failure Transfer) port
 - standard CPM
 - standard APM4
 - system installation, maintenance, and programming manuals and system installation quick reference guide.
- KSU2
 - one mounting template
 - standard expansion cabinet 408E (module) equipped with 8 digital extension ports, four CO line ports, and one CO line PFT port.

**IMPORTANT!**

Open the cartons and verify that all items are complete and undamaged. Remove all packing material and store for future use in the event that return shipment is required.

MOUNTING THE KSU

- 1) Select a suitable location for the KSU1 considering that the expansion (KSU2) may be installed at the same time or sometime in the future.
 - *KSU1 and KSU2 may be mounted such that they are side-by-side or mounted one above the other.*
- 2) Using the mounting template as a guide, mark the two mounting screws locations on the MDF backboard.
- 3) Pre-drill two screw holes and install the two, pan-head No. 10 screws (supplied) into the backboard with a regular screwdriver.
 - *The screw heads should protrude about 1/4-inch from the backboard plywood surface.*
- 4) Lift the KSU over the two screws, allowing the screws to extend into the KSU slotted mounting holes.
 - *As the KSU is allowed to rest in place on the mounting screws it will slip over the screw shanks until the top of the slot is reached.*
 - *Properly installed, the KSU power transformer (where the KSU AC power cord is located) is positioned in the upper left corner.*
 - *The power switch and power/heartbeat LED are positioned at the left side of the KSU toward the bottom.*

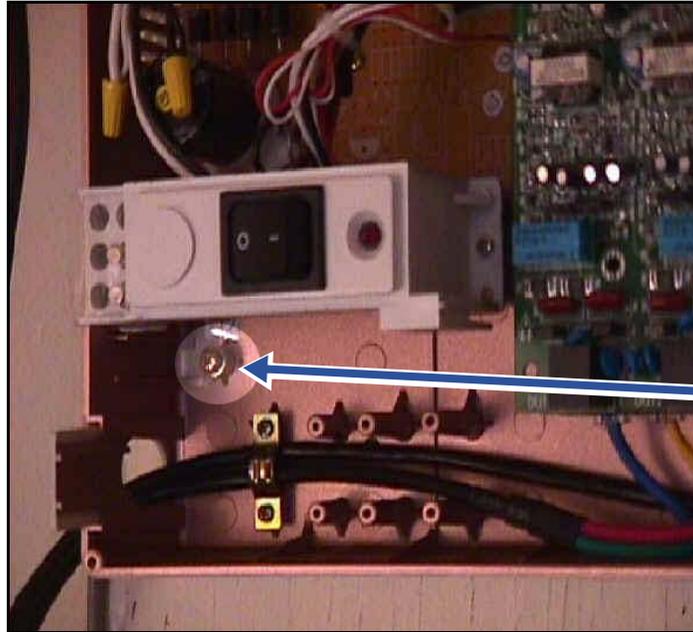
**CAUTION**

It is very important that you mount the KSU correctly to allow proper power supply heat dissipation. KSU1 and KSU2 must be wall mounted only in order to prevent the build up of heat in and around the system.

Mounting the KSU (continued on next page)

Mounting the KSU (continued)

- 5) Extend the earth ground #10 wire into the KSU opening at the lower left corner of the KSU.
- 6) Terminate the grounding wire onto the ground lug provided there.
 - *The two steps above ground the KSU.*



Ground Lug

KSU Wiring

The 408M/E, APM4, COM4, and DPM8 are equipped with RJ-11 modular jacks for each of the interfaced ports. This connection scheme allows for two methods of installation. The first method (traditional “MDF”) is recommended whenever possible to allow for maximum serviceability.



CAUTION

System power must be OFF before you plug in the station cable or while servicing port connections at the punch-down block (66M1-50). Although each port is over-current protected, unnecessary shorting should be avoided.

EXTENDING PORTS TO THE MDF

- Whenever you extend the various ports of the DX-120 to the MDF, you must extend modular-ended cables from the KSU module port to the MDF connection block. You have many choices when completing these connections; it is left to your discretion to use the most suitable industry-standard wiring practice for the particular installation.



CAUTION

Use a quality crimping tool to fasten the modular connector to the cable pair when using field-crimped modular connectors. Use of an inferior crimping tool can lead to bad connections.

- Many third-party vendor products are available to aid in this installation procedure. The following examples are readily available at communications equipment / accessories supply houses. Although this example denotes product of The Siemon Company®, you are urged to investigate the various products available and make decisions for use based on your own assessment. Vertical is not responsible for the performance of any product provided by a third-party (outside) vendor.



EXAMPLE

The examples in the following chart are 25 pair (UTP), USOC, 24 AWG cables pre-fitted with modular connectors on one end of the cable, and a male or female AMP® type connectors on the other end for termination on a specially equipped, 66-block with mating AMP® type connector.

The Siemon Company® Hydra Cable Assemblies		
Product Number	Length (feet)	Wiring Scheme - End 1
HYD-F-24U1-03	3	25-Pair, Female
HYD-F-24U1-07	7	25-Pair, Female
HYD-F-24U1-10	10	25-Pair, Female
HYD-M-24U1-03	3	25-Pair, Male
HYD-M-24U1-07	7	25-Pair, Male
HYD-M-24U1-10	10	25-Pair, Male

- When you are finished with the KSU wiring, you can individually isolate each port of the DX-120 system for independent maintenance needs. Terminate the wiring in place onto a 66M1-50 – connector block. Extend ports from this connector block to station cables using standard jumper wire.

No MDF

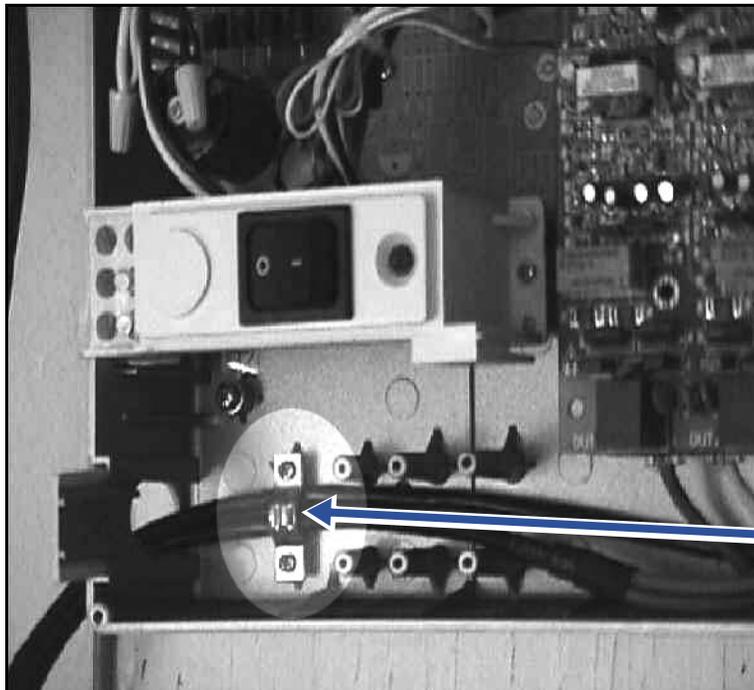


IMPORTANT!

Although this method initially appears to be convenient and more cost-effective, there is an inherent lack of serviceability. Therefore, Vertical does not recommend this method of installation.

Since the Vertical DX-120 is equipped with RJ-11 interfaces for all port connections*, it is possible to route station cables into the KSU directly without use of 66M1-50 connector blocks. Using quality modular connectors and crimping tool, connect each terminal cable directly to the port required.

Regardless of the method used, route the station / MDF cables out of the KSU through the opening at the lower left of the KSU housing. A cable restraint clamp is provided which you can use to secure cables exiting the KSU.

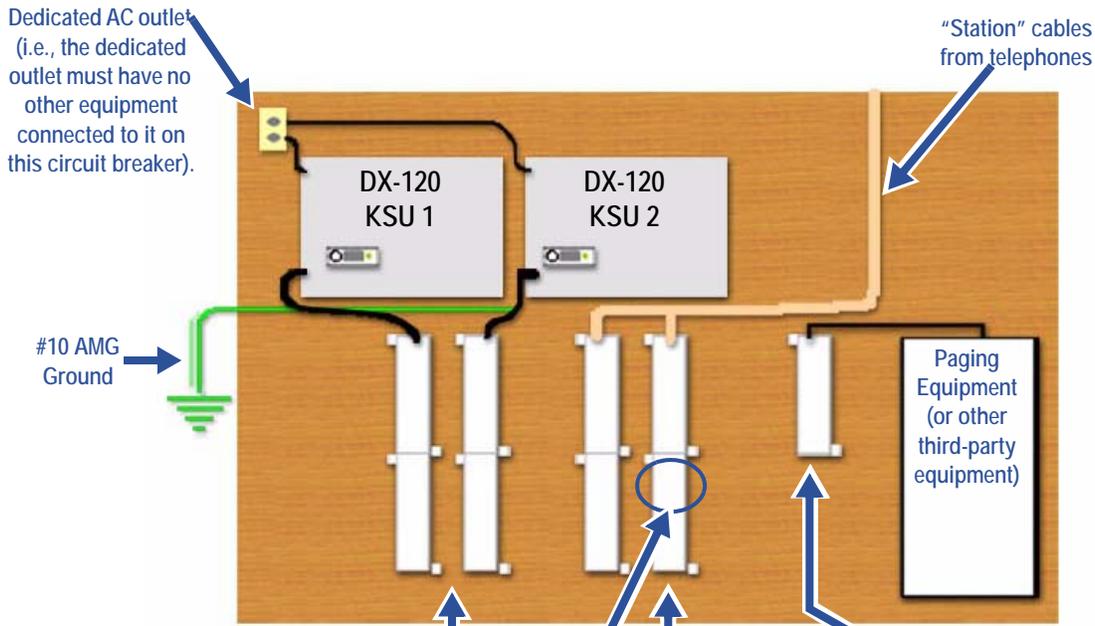


cable restraint clamp

**This does not include DPM16.*

Typical MDF Installation

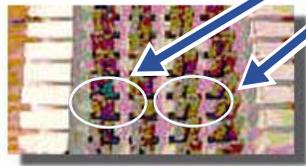
The following example install illustrates a two-cabinet installation using the MDF installation method.



66M1-50 Blocks
KSU
Termination

66M1-50 Blocks
Ancillary
Equipment
(paging, music
sources, etc.)

66M1-50 Blocks
"Station" Phone
Cable
Terminations



66M1-50

- The 66M1-50 is split into a left and right half for termination wiring.
- Each row conducts between the two left columns and the two right columns. This is the source of the term "Split 50"
- Be sure to terminate cable pairs from the KSU and from telephone locations on outer column pins (one lead only per pin).



IMPORTANT!

NEVER terminate two wires on one pin!
This is referred to as "double-punching"
and causes poor connection of wires on
the terminal.



NOTE

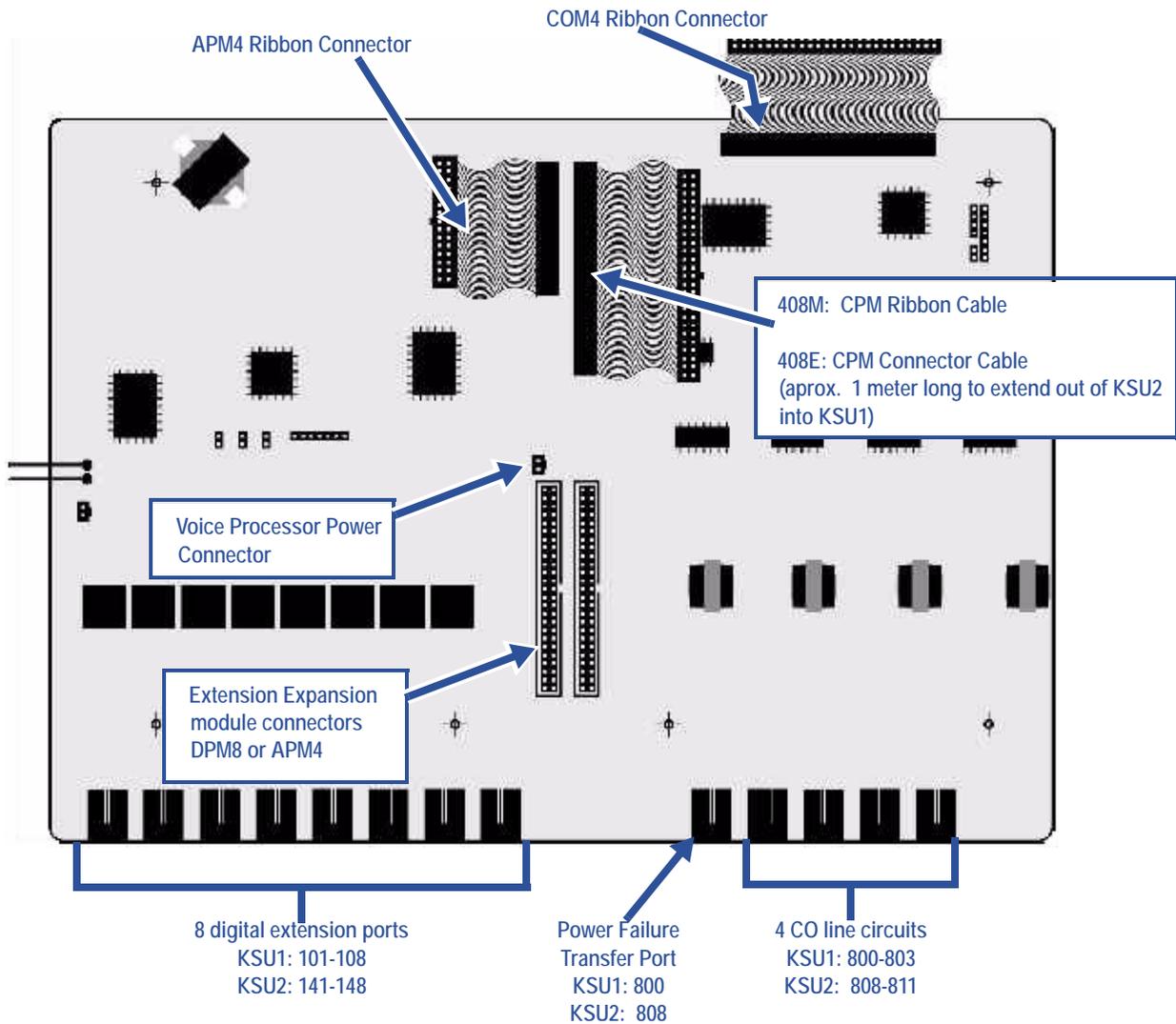
When used with "Bridging Clips", the Split
50 Block can be used to isolate trouble in
wiring.

KSU Components

KSU1 408M AND KSU2 408E

The 408M module is installed at the factory into KSU1. Although this module has the same port configuration as the 408E, they are not interchangeable. Each 408M and 408E is equipped with four CO line ports, one power failure port, and eight digital extension Ports. See the following diagram to locate the various ports provided on the 408M/E.

The 408M/E is also the interface point for the various add-on modules of the DX-120 system. All peripheral modules connect to the DX-120 via the 408M/E. See the following diagram for a reference to the various interface connectors.



KSU Components (continued on next page)

*KSU Components (continued)***REPLACING A 408M OR 408E**

Occasionally, when instructed to do so by a Vertical technical support representative, you may have to remove a 408M or 408E and replace it in the field. To do so, use the following the steps.

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.

**CAUTION**

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.

**CAUTION**

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Remove all circuit modules from the KSU cabinet.

**NOTE**

- *All modules are fastened in place using standoff hardware, therefore, be sure to reconstruct these stand off placements when you re-install the various modules.*
- *APM4 modules must be installed using 2.5 cm (nickel) standoffs.*

- 7) Install the replacement 408M/E using the 1.5cm (brass) standoffs removed from the original.
- 8) Install all other remaining modules in the order that they were removed.
 - *Be sure to connect them to the appropriate 408M/E connector.*
- 9) Reconnect CO line and station cabling connections as required.

**CAUTION**

The FCC requires that wiring of CO lines into a KSU be separated from wiring of station apparatus into a KSU. Therefore you must use separate cables for wiring stations and CO lines.

- 10) Replace the KSU cover and secure with cover screws.
- 11) Restore KSU power when all wiring is complete.

KSU Components (continued)

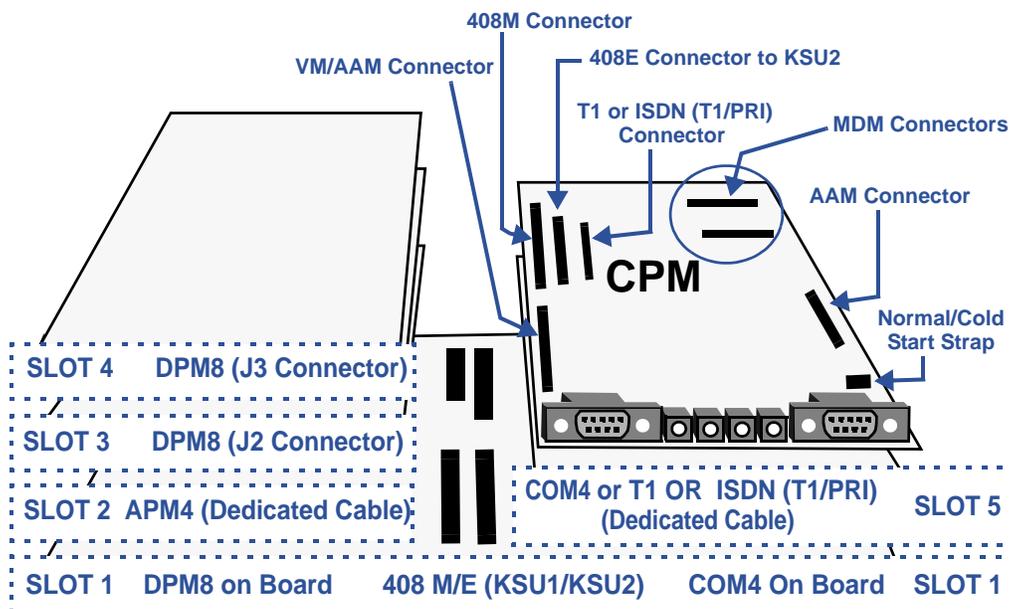
KSU ASSEMBLY – ADD-ON MODULES

- Whenever you expand the DX-120 system, you install a module into one of the KSU cabinets.
- Modules are connected to the various connectors on the 408M/E.
- Modules are mounted using standoff posts.
 - Two standoff post sizes are used in the DX-120.
 - The APM4 modules must be installed using the 2.5 cm (nickel) standoffs.
 - All other modules use the 1.5 cm (brass) standoffs.



IMPORTANT!

Proper use of standoff is imperative to assure proper system operation.



KSU Components (continued on next page)

KSU Components (continued)

ADDING A DPM8

You can add two DPM8 modules to each KSU of the DX-120 system. These modules expand the DX-120 system capacity to a maximum of 24 digital ports in each KSU, for a total of 48 total digital ports.

To install a DPM8, connection to the 408M/E via the Extension Expansion module connectors J2 and J3. These connectors have the logical system address of SLOT 2 and SLOT 3 in both cabinet 1 (KSU1-408M) and cabinet 2 (KSU2-408E).



NOTE

You can connect both APM4 and DPM8 modules to the system via these two connectors. Install the DPM8 using four 2.0 cm brass color standoffs included with the DPM8 module.

DPM8 Extension Number Matrix Per Installed Location		
KSU Connector Used	Extension Numbers in KSU1	Extension Numbers in KSU2
J2 Extension Expansion	109,110,111,112, 113,114,115,116	173, 174, 175, 176, 177, 178, 179, 180
J3 Extension Expansion	125, 126, 127, 128, 129, 130, 131, 132	189, 190, 191, 192, 193, 194, 195, 196

INSTALLING THE DPM8

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.



CAUTION

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.



CAUTION

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Remove the DPM8 module from the packaging and locate the four brass-color standoffs packaged with the module.

Installing the DPM8 (continued on next page)

Installing the DPM8 (continued)

- 7) Position the DPM8 over the left-hand side of the 408M/E and any other extension modules already installed.

**NOTE**

When installing DPM8 modules, Vertical recommends that you install them closest to the 408M/E. An APM4 module is always factory-installed in KSU1. In addition, a second APM4 can be installed in KSU2 (see page 54). Therefore, before installing the DMP8 you must move any installed APM4 module outward (toward cabinet cover) and install the add-on DPM8 first, then re-install the APM4. In the KSU extension modules are always installed on the left-hand side.

- 8) Use the four brass-color standoffs supplied with the DPM8 to secure the DPM8 in position.
- 9) Connect the DPM8 ribbon cable to the 408M Extension Expansion Module Connector closest to the DPM8.

**HINT**

Press firmly (but not forcefully) on the connector to secure a good connection.

- 10) Make connections to the eight (8) digital ports as required.

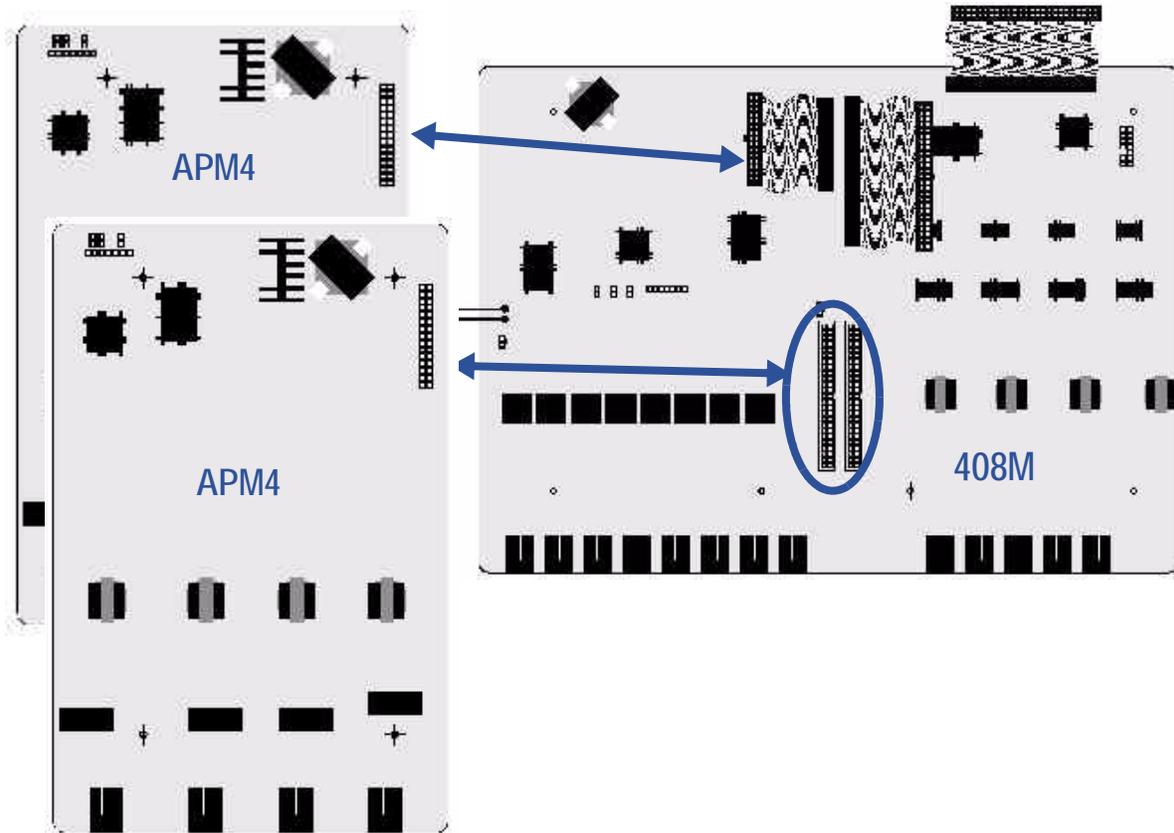
**CAUTION**

The FCC requires that wiring of CO lines into a KSU be separated from wiring of station apparatus into a KSU. Therefore you must use separate cables for wiring stations and CO lines.

- 11) Replace the KSU cover and secure with cover screws.
- 12) Restore KSU power.

Adding an APM4

One APM4 is factory-installed in KSU1. However, you can add a second APM4 to the KSU2 (via the dedicated cable). With the 2 APM4s, the DX-120 system capacity is eight analog station ports (4 in each KSU). The APM4s utilize four 2.5 cm (nickel) standoffs.



Extension Number Matrix Per Installed Location			
KSU Connector used	Extension numbers in KSU1	Extension Numbers in KSU2	Notes
APM4 Connector (SLOT 4)	149,150,151,152	153,154,155,156	KSU1 analog ports are standard

Adding an APM4 (continued on next page)

Adding an APM4 (continued)

INSTALLING THE APM4 IN KSU2

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU2 cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.

**CAUTION**

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.

**CAUTION**

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IM101-005, Handling of Electrostatically Sensitive Components.

- 6) Remove the APM4 module from the packaging and locate the four nickel-color standoffs packaged with the module.
- 7) Position the APM4 over the left-hand side of the KSU2 408M/E and any other extension modules already installed.

**NOTE**

In the KSU2, extension modules are always installed on the left-hand side.

- 8) Use the four nickel-color standoffs supplied with the APM4 to secure the APM4 in position.
- 9) Connect the dedicated APM4 ribbon cable from the 408E to the APM4 module.

**IMPORTANT!**

Do not use any other connector other than the dedicated cable as provided.

**HINT**

Press firmly (but not forcefully) on the connector to secure a good connection.

- 10) Make cable/wiring connections to the 4 analog ports as required.

**CAUTION**

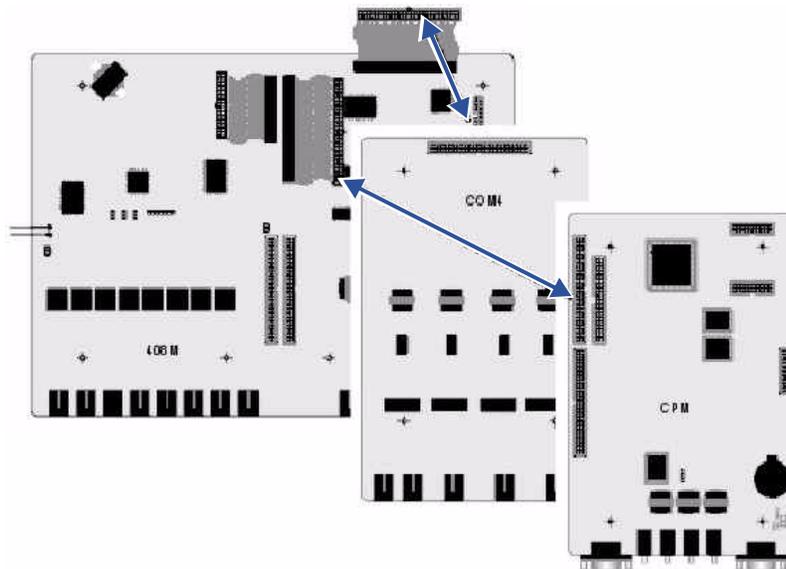
The FCC requires that wiring of CO lines into a KSU be separated from wiring of station apparatus into a KSU. Therefore you must use separate cables for wiring stations and CO lines.

- 11) Replace the KSU2 cover and secure with cover screws.
- 12) Restore power.

Adding a COM4

You can add one COM4 to KSU1 and one COM4 to the KSU2. These modules expand the DX-120 system loop start CO line interface capacity to a maximum of eight loop start CO line ports in each KSU (16 total loop start CO line ports when used in KSU 1 & 2).

- When adding a COM4 to either KSU, connect to the 408M/E via the COM4 module ribbon cable.
 - This ribbon cable has the logical system address of SLOT 5 in both cabinet 1 (KSU1-408M) and cabinet 2 (KSU2-408E).
- COM4 modules are installed using four 2.0 cm (brass) standoffs.
- Always install the COM4 module beneath the CPM module (in KSU1) by first removing the CPM, installing the COM4, and then re-installing the CPM. This is required whenever you install the In-Skin Voice Processor.



CO Line Directory Number Matrix Per Installed Location			
408M in KSU1 - SLOT 1	COM4 in KSU1 - SLOT 5	408E in KSU2 - SLOT 1	COM4 in KSU2 - SLOT 5
800, 801, 802, 803	804, 805, 806, 807	808, 809, 810, 811	812, 813, 814, 815

Adding a COM4 (continued on next page)

*Adding a COM4 (continued)***INSTALLING THE COM4**

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.

**CAUTION**

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.

**CAUTION**

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

**IMPORTANT!**

Vertical recommends installing the COM4 closest to the 408M/E. This means you must temporarily remove the CPM and then reposition the CPM above the COM4 once you have installed the COM4 (in KSU1).

For KSU2 installation skip step 6.

- 6) Remove the installed CPM by removing the four brass standoffs used to secure the board, retaining these standoffs for later use.
- 7) Remove the ribbon cable that connects the CPM to the 408M then set it aside.
- 8) Remove the COM4 module from the packaging and locate the four brass-color standoffs packaged with the module.
- 9) Position the COM4 over the 408M/E (right-hand side) where you just removed the CPM (KSU1).
- 10) Use the four brass-color standoffs supplied with the COM4 to secure the COM4 in position.
- 11) Connect the COM4 ribbon cable from the 408M/E to the COM4 connector.

**HINT**

Press firmly (but not forcefully) on the connector to secure a good connection.

Installing the COM4(continued on next page)

Installing the COM4(continued)

For KSU2 installation, skip step 12 and proceed to step 13.

- 12) Reposition the CPM over the installed COM4 and secure using the four brass-color standoffs previously removed (see [page 57](#)).
- 13) Make cable/wiring connections to the 4 CO line ports as required.

**CAUTION**

The FCC requires that wiring of CO lines into a KSU be separated from wiring of station apparatus into a KSU. Therefore you must use separate cables for wiring stations and CO lines.

- 14) Replace the KSU cover and secure with cover screws.
- 15) Restore KSU power.

Adding an MDM

You can add one MDM to KSU1. The MDM allows you to remotely access to the DX-120 database programming and maintenance functions using PC-DBA.

**NOTE**

The MDM does not provide access to the DX-120 In-Skin Voice Mail/AA.

- At default the MDM directory number is 100.
 - To establish a connection to the MDM remotely, call into the system where the MDM is installed from the remote site using PC-DBA.
 - Ask to be transferred to extension 100.
 - When you hear the modem tone, initiate any required keystrokes to link the modems.
 - Then proceed with usual PC-DBA connection routines.

**NOTE:**

If you are using In-skin voicemail or AA a manual transfer is not necessary.

- Install the MDM onto designated connectors located on the CPM.

Adding an MDM (continued on next page)

Adding an MDM (continued)

INSTALLING THE MDM

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.

**CAUTION**

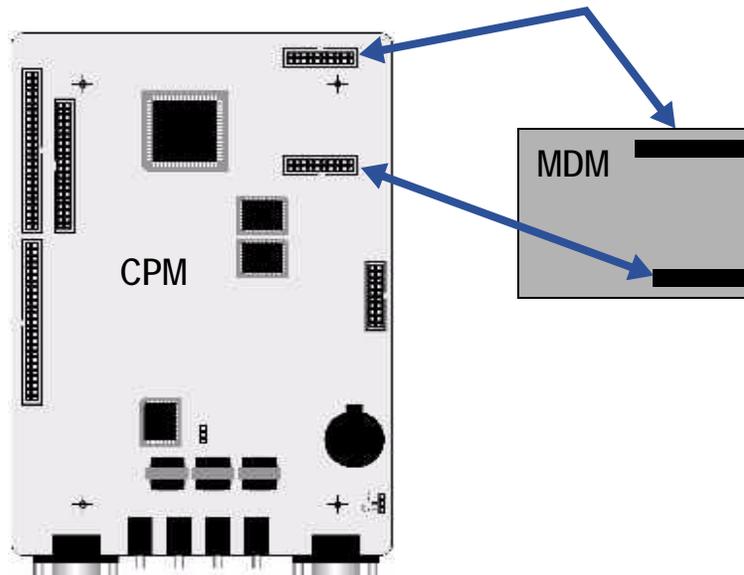
Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.

**CAUTION**

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IM101-005, Handling of Electrostatically Sensitive Components.

- 6) Locate the CPM at the right-hand side of KSU1, above the 408M (and COM4 if installed).
- 7) Position the MDM over the CPM-MDM connectors as shown below.

**HINT**

Press firmly (but not forcefully) on the MDM to secure a good connection into the CPM-MDM connectors.

- 8) Replace the KSU cover and secure with cover screws.
- 9) Restore KSU power.

Adding an AAM

You can add one AAM to the KSU1. The AA Module adds automated attendant functionality to the DX-120 system with 10 integrated announcements. **The AAM does not provide voice mail functions.**



HINT

For more information on how to program the AAM and its announcements, refer to the DX-120 Technical Manual, Volume II, Programming.

INSTALLING THE AAM

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.



CAUTION

Be sure that the strap is touching bare skin and is not isolated by clothing.

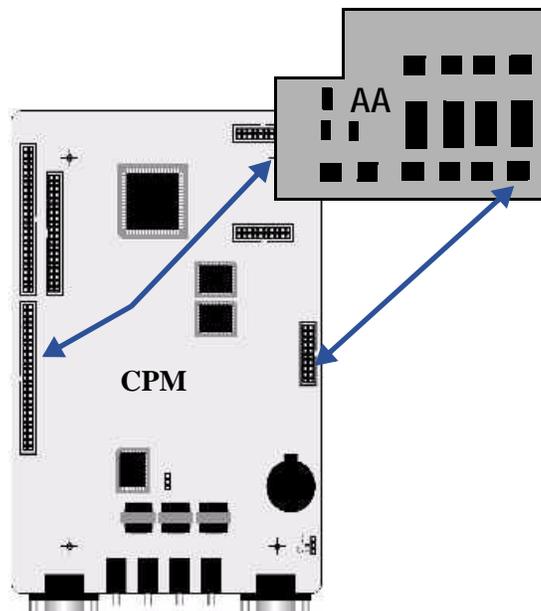
- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.



CAUTION

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Locate the CPM at the right-hand side of KSU1 above the 408M (and COM4 if installed).
- 7) Position the AAM over the CPM-AAM connectors as shown below.



HINT

Press firmly (but not forcefully) on the AAM to secure a good connection into the CPM-AAM connectors.

- 8) Replace KSU cover and secure with cover screws.
- 9) Restore KSU power.

Adding a KSU2 Second Cabinet

You can add one KSU2 to a KSU1. The KSU2 adds:

- eight digital DX-120 extension ports
- four CO line ports
- one Power Failure Transfer port
- Extension expansion connectors for two additional DPM8s or one APM4
- Dedicated ribbon cable for one APM4
- Dedicated ribbon cable for one COM4

INSTALLING THE KSU2 (CONNECTING THE KSU2 TO THE KSU1)

- 1) Be sure that the entire system is turned off.
- 2) Remove the cover from both the KSU 1 and KSU 2 (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.

**CAUTION**

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.

**CAUTION**

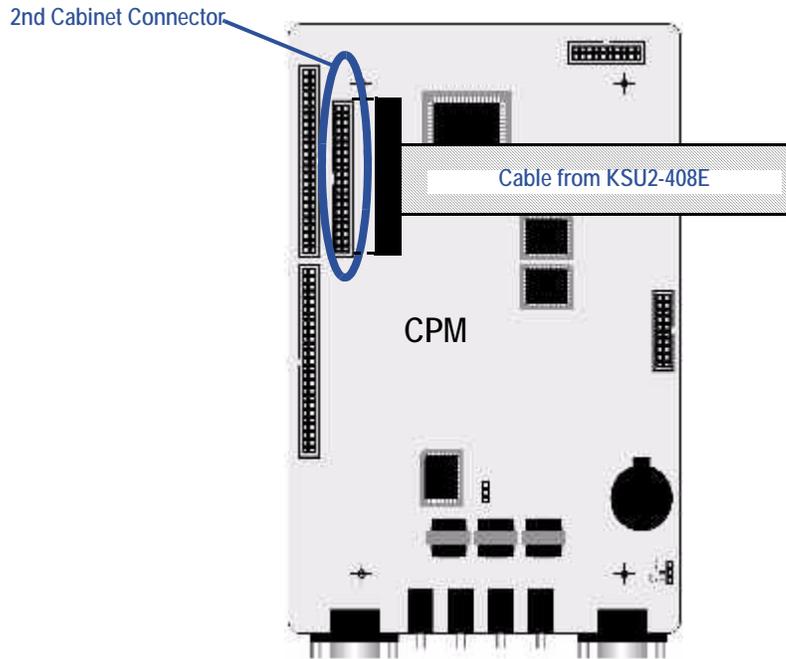
Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Locate the long cable attached to the 408E of KSU2, and route it out of the KSU2 cabinet into the KSU1 cabinet so you can connect it to the CPM.
- 7) Locate the CPM at the right-hand side of KSU1 above the 408M (and COM4 if installed).

Installing the KSU2 (continued on next page)

Installing the KSU2 (continued)

8) Position the KSU2 connection cable over the CPM-“2nd Cabinet Connector” as shown below.



HINT

Press firmly (but not forcefully) on the KSU2-Cable connector to secure a good connection into the CPM-2nd Cabinet Connector.

- 9) Replace the KSU cover and secure with cover screws.
- 10) Restore KSU power by powering both KSU cabinets at the same time.
- 11) Flip both cabinet power switches to the “ON” position **simultaneously**.

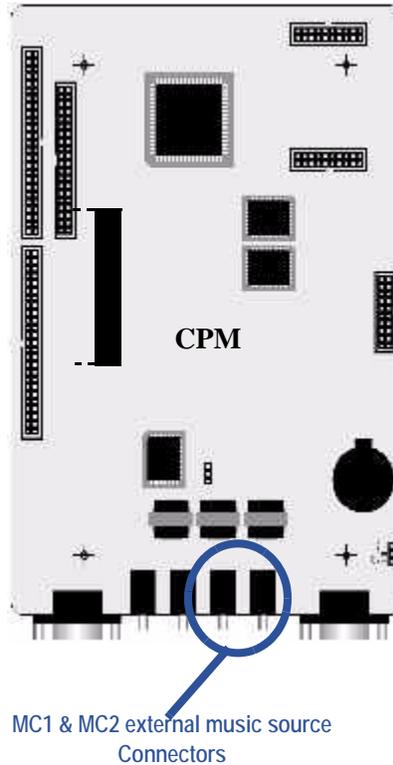


CAUTION

You must turn on both cabinets at the same time. Failure to do so can result in damage to the KSU1 and potentially the KSU2.

Adding a Music Source

You can connect two sources of music to the CPM for use with the Music On Hold and Background Music features.



HINT

A third option is to use an internal musical tune or tone can be used for callers on hold. When this option is used, the MC1 connector is not used.

SELECTING INTERNAL MUSIC TUNE FOR MUSIC CHANNEL MC1

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU 1 cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.



CAUTION

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.



CAUTION

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Locate the CPM and "MUSIC" option strap.
- 7) Move the "MUSIC" option strap (JPC1) from the "EXT" (factory position) to the "INT" position.

Adding a Music Source (continued on next page)

*Adding a Music Source (continued)***INSTALLING EXTERNAL MUSIC SOURCE TO MC1/MC2/BOTH**

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU 1 cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.

**CAUTION**

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.

**CAUTION**

6. Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Locate the CPM and the "MUSIC" option strap.
- 7) Make sure that the "MUSIC" option strap is in the "EXT" position. (Required for external source to operate on MC1.)
- 8) Locate CPM the "MC1" and "MC2" connector jacks on the CPM.
- 9) Connect the output of the external music source to the appropriate MC1 or 2 connector

**HINT**

- *At default MC1 is used for Music On Hold.*
- *This is easily accomplished using a prefabricated mini-plug to mini-plug cable available at Radio Shack.*



- 10) Adjust the music volume level at the external music source.

**HINT**

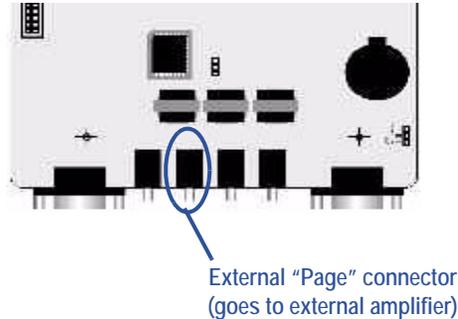
When adjusting the music for Music On Hold:

- *Place a call into the system on one of the CO Lines so that the external music source is heard by the calling party (you).*
- *Adjust the volume level of the external music source until a desirable level is reached.*
- *Background Music is then adjusted at the telephone using the instrument volume control.*

Adding an External Pager

One port is provided at the CPM of the DX-120 system for use with external paging system apparatus.

- When DX-120 users dial the external pager code (“777” at default) or dial the Tenant Group All Page code (“400” at default), voice announcements can be made over the external paging equipment.



- The DX-120 External Page port does not provide any amplification. Interface at the amplifier should be matched to approximately 600 ohms for the best performance.

EXTERNAL PAGER INSTALLATION PROCEDURE

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU 1 cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.



CAUTION

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.



CAUTION

7. Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Locate the CPM and “PAGE” connector jack on the CPM.
- 7) Using an eighth-inch mini plug, connect the DX-120 Page port to the external amplifier input.
- 8) Adjust the voice volume level at the external paging amplifier.



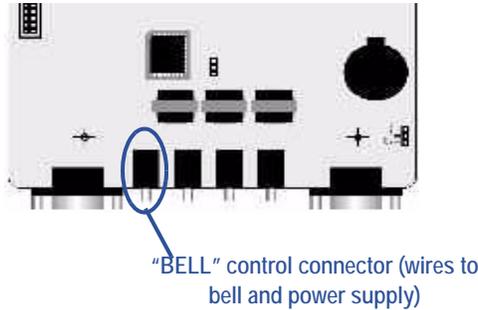
HINT

When adjusting the volume level:

- Dial access to the External Pager port at any DX-120 telephone (“777”).
- Adjust the volume control associated to the amplifier input selected for this purpose.

Add a Loud Bell Control or Gate Control

One “dry-connection” is provided at the CPM of the DX-120 system for use with external ringing devices or door opening apparatus. The DX-120 can be programmed to activate the dry contact whenever certain CO lines ring or whenever the LBC code is dialed to actuate a door opener.



INSTALLING A LOUD BELL

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU 1 cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.



CAUTION

Be sure that the strap is touching bare skin and is not isolated by clothing.

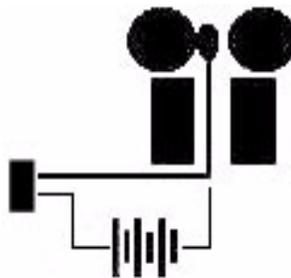
- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.



CAUTION

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Locate the CPM and “BELL” connector jack on the CPM.
- 7) Wire the DX-120 BELL contact in series with an external 24vdc power supply and 24vdc bell or ringing device.



CAUTION

Use only 24v or less voltage supply and Direct Current (dc).

- 8) Program LBC operation for CO line ringing according to CO line group assignments.



HINT

For more information refer to the DX-120 Technical Manual, Volume II, Programming.

Add a Loud Bell or Gate Control (continued on next page)

*Add a Loud Bell or Gate Control (continued)***INSTALLING A GATE OR DOOR CONTROL**

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU 1 cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.

**CAUTION**

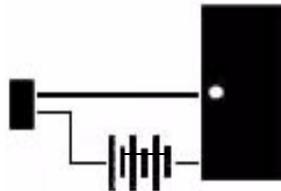
Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.

**CAUTION**

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Locate the CPM and “BELL” connector jack on the CPM.



- 7) Wire the DX-120 BELL contact in series with an external 24vdc power supply and 24vdc door opening device.

**CAUTION**

Use only 24v or less voltage supply and Direct Current (dc).

- 8) Program LBC operation for External Page operation.
- 9) Dial the External Page code to activate the gate/door.

**HINT**

- *The External Page code can be programmed onto an available Flexible Feature Button.*
- *For more information refer to the DX-120 Technical Manual, Volume II, Programming.*

Adding a DPM16 (Digital Port Module – 16 port)

- Two DPM16 (Digital Port Module, 16-port - i.e., 16 digital phones) modules can be added to each KSU of the DX-120 system.
- These modules expand the DX-120 system extension capacity to a maximum of 40 digital ports in each KSU (80 total digital ports).
- DPM16's are installed by connection to the 408M via the Extension Expansion module connectors ("J2" and "J3.")
- The DPM16 board has eight RJ-12 jacks.
- Each RJ-12 jack has four wires so you plug two phones into each jack.
- You cannot do a Off-Hook Voice Announce (OHVA) to a phone that is plugged into the DPM16. However, you can do a OHVA from a phone that is plugged into a DPM16 board.

INSTALLING A DPM16

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.



CAUTION

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.



CAUTION

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Remove the DPM16 module from the packaging and locate the four brass-color standoffs packaged with the module.
- 7) Position the DPM16 over the left-hand side of the 408M/E and any other extension modules already installed.



NOTE

When installing DPM16 modules, Vertical recommends that you install them closest to the 408M/E. An APM4 module is always factory-installed in KSU1. In addition, a second APM4 can be installed in KSU2 (see page 54). Therefore, before installing the DPM16 you must move any installed APM4 module outward (toward cabinet cover) and install the add-on DPM16 first, then re-install the APM4. In the KSU extension modules are always installed on the left-hand side.

- 8) Use the four brass-color standoffs supplied with the DPM16 to secure the DPM16 in position.
- 9) Connect the DPM16 ribbon cable to the 408M Extension Expansion Module Connector closest to the DPM16.



HINT

Press firmly (but not forcefully) on the connector to secure a good connection.

Installing a DPM16 (continued on next page)

Installing a DPM16 (continued on next page)

- 10) Make connections to the sixteen (16) digital ports as required.

**CAUTION**

The FCC requires that wiring of CO lines into a KSU be separated from wiring of station apparatus into a KSU. Therefore you must use separate cables for wiring stations and CO lines.

- 11) Replace the KSU cover and secure with cover screws.
- 12) Restore KSU power.

Adding a T1 or ISDN (T1/PRI) Card

- One T1 (T1 Module) or ISDN (T1/PRI Module) card can be added to KSU1.
- The module expands the DX-120 system CO Line interface capacity to a maximum of 24 CO Line ports in system.
- The T1 or ISDN (T1/PRI) CARD is installed onto a designated connector located on the CPM2.

INSTALLING A T1 OR ISDN (T1/PRI) CARD

**NOTE**

In the description below, for better readability the term T1 is used to describe both a T1 or ISDN (T1/PRI) Card.

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.

**CAUTION**

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.

**CAUTION**

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Remove the T1 Card module from the packaging and locate the four brass-color standoffs packaged with the module.
- 7) Remove the installed CPM by removing the four brass standoffs used to secure the board, retaining these standoffs for later use.
- 8) Position the T1 Card over the right-hand side of the 408M/E (and the COM4 module if it is installed).

**NOTE**

When installing a T1 Card module, Vertical recommends that you install it directly below the CPM card.

Installing T1 or ISDN (T1/PRI) Card (continued on next page)

Installing T1 or ISDN (T1/PRI) Card (continued)

- 9) Use the four brass-color standoffs supplied with the T1 Card to secure the T1 in position.
- 10) Reposition the CPM over the installed COM4 and secure using the four brass-color standoffs previously removed (see step 7).
- 11) Connect the T1 Card ribbon cable to the J7 connector or the CPM card..

**HINT**

Press firmly (but not forcefully) on the connector to secure a good connection.

- 12) Make all cable/wiring connections as required.

**CAUTION**

The FCC requires that wiring of CO lines into a KSU be separated from wiring of station apparatus into a KSU. Therefore you must use separate cables for wiring stations and CO lines.

- 13) Replace the KSU cover and secure with cover screws.
- 14) Restore KSU power.

Connecting a Serial Cable for PC-DBA

- You can connect PC-DBA to the to DX-120 system to set up all user database programmable features and system operations.
 - This connection is rarely permanent and is typically performed only during routine systems database updates and changes by a qualified technician.
 - Connection of the PC to the DX-120 is accomplished through the serial data port on the CPM labeled "PCDBA."
 - Connection is simplified by means of a straight-through, 9-pin, female to male, serial cable. (Use Radio Shack model 26-117B for good results.)
 - Connection to the PC is made via an available 9-pin serial port connector that is designated as COM1 or COM2 in the PC configuration.
- Once the cable is linked between the PC and the DX-120 CPM PCDBA port, you can use PC-DBA to program the DX-120 system and to back up your customer's database.

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU 1 cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.

**CAUTION**

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.

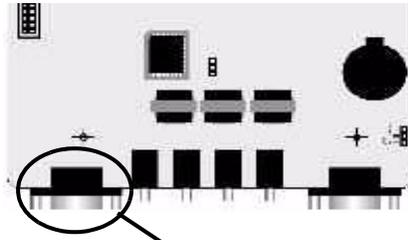
**CAUTION**

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

Installing T1 or ISDN (T1/PRI) Card (continued on next page)

Installing T1 or ISDN (T1/PRI) Card (continued)

- 6) Locate the CPM and "PCDBA" serial port on the CPM.



"PCDBA" serial port connector
(straight-through, 9-pin, male-to-female cable required)

- 7) Connect the male end of the 9-pin serial cable into this PCDBA port.
8) Connect the other end (female) of the 9-pin serial cable to the PC serial port to be used with PC-DBA.

**HINT**

For more information about how to program the DX-120 using PC-DBA, refer to the DX-120 Technical Manual, Volume II, Programming.

Connecting a Serial Cable for SMDR

- SMDR (Station Message Detail Recording) can be output from the DX-120 system for use with serial printers of collection in call accounting devices.
 - Connection of the SMDR device to the DX-120 is accomplished through the serial data port on the CPM labeled "SMDR."
 - Connection to serial printers may require customization of the serial cable used to make the connection.
- Whenever a call accounting system (third-party device) is deployed, connection is often no more complicated than using a straight-through, 9-pin, female to male, serial cable.

**NOTE**

Use Radio Shack model 26-117B for good results.

- Connection to the PC/call accounting system is made via an available 9-pin serial port connector that is designated as COM1 or COM2 in the PC configuration.
- Once the cable is linked between the collection device and the DX-120 CPM-SMDR port, the collection device must be programmed for compatible link protocol (baud rate). At default the SMDR port baud rate is set at 9600 bps.

SMDR 9-pin Serial Cable Pin Designations								
1	2	3	4	5	6	7	8	9
DCD	RXD	TXD	DTR	GND	DSR	RTS	CTS	RI

- 1) Be sure that the entire system is turned off.
- 2) Remove the KSU 1 cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.

**CAUTION**

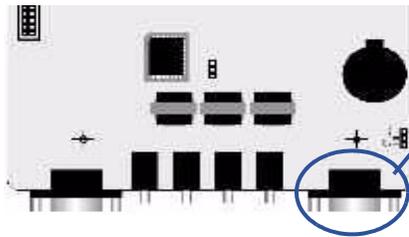
Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.

**CAUTION**

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

- 6) Locate the CPM and “SMDR” serial port on the CPM.



“SMDR” serial port connector (straight-through)

- 7) Connect the male end of the 9-pin serial cable into this SMDR port.
- 8) Connect the other end (female) of the 9-pin serial cable to the PC/collection device serial port.
- 9) Replace the KSU cover.

Power-up Initialization (Cold Start)

**IMPORTANT!**

- *The installation of the DX-120 is complete only when initialization is performed at the time of startup. This process is required for proper operation of the system.*
- *Occasionally it may be required to perform this initialization process after the original installation, but this is rare.*
- Initialization causes the operational customer database to be established and organized for system operation and future updating.
- Once initialization has been completed the default database contents are loaded into operational memory: the system is ready to run on this database configuration.
- Customized changes may be made to this database according to the allowable program settings for the various features.

**CAUTION**

If you are performing a cold start on a system with an existing customized database, be sure to back up that database prior to beginning the cold start procedure. The cold start procedure forces the default database into the DX-120 switch, overwriting any existing database residing on that switch. For more details on backing up databases, see the DX-120 Technical Manual, Volume II, Programming.

Power-up Initialization - Cold Start (continued on next page)

*Power-up Initialization - Cold Start (continued)***INITIALIZING THE DX-120****IMPORTANT!**

If you have previously plugged in the power cords and/or turned on the power supplies, turn OFF the power supply to the DX-120 KSUs and un-plug the DX-120 AC power cords on KSU1 and KSU2.

- 1) Be sure that the entire system is turned off and unplugged.
- 2) Remove the KSU 1 cover (four screws at each corner).
- 3) Install a static discharge wrist strap on your bare wrist, and adjust it for a snug fit.

**CAUTION**

Be sure that the strap is touching bare skin and is not isolated by clothing.

- 4) Connect the wrist strap cord between the wrist strap and an AC or earth ground.
- 5) Connect a static discharge wrist strap to a suitable earth ground.

**CAUTION**

Circuit boards are susceptible to damage caused by electrostatic discharge. You must keep this in mind as you handle the circuit boards. For additional information, see Vertical publication IM101-005, Handling of Electrostatically Sensitive Components.

- 6) Locate the CPM and “NORMAL/COLD START” option strap (in bottom right corner) of the installed CPM (JPE1).

Initializing the DX-120 (continued on next page)

Initializing the DX-120 (continued)

- 7) Move this strap to the "COLD START" position and allow it to remain in this position for 30 seconds.

**NOTE**

New systems are shipped with this strap in the "COLD START" position, so if you are installing a new system you can skip this step.

**CAUTION**

This procedure overwrites all customized customer programming. If you want to maintain customized programming, be sure to back up the custom database prior to performing the cold start. For more information refer to the DX-120 Technical Manual, Volume II, Programming.

- 8) Move the strap to the "NORMAL" position.

**CAUTION**

Vertical ships the DX-120 with the option strap in the COLD START position to preserve the battery while the system is in transit. However, you **MUST** move this strap to NORMAL for the DX-120 to begin normal operation. The system specifically monitors the position of this strap and shuts down operation if it remains in the COLD START position.

- 9) Install all optional expansion modules inside the KSU as required.

- Optional expansion modules include: COM4, DPM8, DPM16, APM4, VM, AAM, T1, ISDN (T1/PRI).

- 10) Plug the AC power cords into a dedicated, non-switching UPS.

**CAUTION**

- **Only a qualified telephony technician should perform this procedure since hazardous voltages are present inside the KSU cabinets.**
- **DO NOT TOUCH exposed terminals or fuse connections at or around the power supply and fuse area while the system is powered and the KSU cabinet cover is removed!**

- 11) Turn on the power supply to the DX-120 KSUs by simultaneously moving the ON/OFF switch to the ON position on KSU1 and KSU2 (if two cabinets are installed)

- 12) Watch the LED on the CPM (at the left side of the module) to make sure it begins to flash on and off.
- The LED located at the ON/OFF button of the KSU follows the operation of the LED on the 408M. Both of these LEDs indicate the operation of the peripheral processors on the 408M, and should be flashing in unison.

- The LED on the APM4 will also begin to flash indicating that its peripheral processor is running.
- As the main CPU comes on-line it will detect the Cold Start status of a specially blocked memory address. Once this is detected, the system forces default data into operational memory.
- While the system is detecting and force-loading data, it flashes the CPM LED at various fast rates, then stabilizes the LED again at a consistent rhythmic rate.
- When the LED reaches this consistent rate, the system has finished initiation and is operational. The default data is loaded and ready, and the telephones should be functional. In this status, all CO lines will ring at extension 101, all extensions may take and place calls, and all systems features are operational per their default configuration.

- 13) Begin customizing the database to meet your customer's specific site needs.

**HINT**

For additional information, see Vertical publication IMI01-005, Handling of Electrostatically Sensitive Components.

SECTION 3 - MAINTENANCE & TROUBLESHOOTING

SYSTEM MAINTENANCE

Maintaining the Vertical DX-120 digital telephone system is a combination of customer database changes, facilities and apparatus moves, adds and changes. These requirements are accomplished by practicing the techniques, illustrations and step-by-step instructions listed in the previous sections of this manual.

Cleaning the Telephones

When properly installed, the Vertical DX-120 is relatively maintenance-free. However, as with most things, from time to time the digital telephone instruments may become dirty or dusty and require cleaning. We recommend the following be considered:

- Use a clean, dry cotton (or other soft, absorbent) cloth to wipe the instrument clean.
- Do NOT use cleaning chemicals
 - The use of chemicals to clean the telephone plastics is NOT recommended since some chemicals can cause permanent damage to the telephone finish.
 - If deep soiling conditions exist, many specialized telephone cleaning solutions will provide satisfactory results.
 - When trying any cleaner for the first time, apply the cleaner to a small sample area on the underside of the instrument. If the expected results are achieved, proceed with cleaning the remainder of the telephone.

TECHNICAL PROBLEM SOLUTIONS

The system trouble shooting procedures are a logical approach to fault identification, analysis, and correction. The DX-120 may generate symptoms of problems that actually occur outside of the office environment.

Problems Not Related to System Issues

The following is a list of that may be common situations that are NOT the result of a system component or software failure.

- system restarts (from temporary AC power interruption)
- fading (from the long distance carrier)
- dropped calls (caused by internal users randomly pressing holding CO line buttons)

Technical Problem Solutions (continued on next page)

Technical Problem Solutions (continued)

Diagnostic Quick Reference

This section attempts to provide you with some quick, and reliable, tools to diagnose service-related problem reports. For installation-related problems, see “Troubleshooting Installation ISSUES”.

Diagnostic Quick Reference Chart			
Symptom(s)	Diagnostic Aid	Cause(s)	Action
No system operation. No LED or LCD operation Digital Executive Telephones. No dial tone at IST's.	CPU Heartbeat LED Dark	No AC input	1) Check commercial AC outlet. 2) Verify that both ends of AC cord are plugged in.
		Power Switch	Switch the KSU AC power switch to the “ON” position.
		AC Fuse	1) Switch KSU power to the OFF position and remove cover (four screws). 2) Locate the system power supply in the upper left corner of the KSU interior and inspect the AC fuse for continuity (DVM required).
		DC Fuse	1) Switch KSU power to the OFF position and remove cover (four screws). 2) Locate the system power supply in the upper left corner of the KSU interior and inspect the DC fuse for continuity (DVM required).
No system operation.	CPU Heartbeat LED Dark or Lit steady	Memory strap in “Cold Start” position	<i>If the memory strap is in the “Cold Start” position:</i> Initialize the system as described in “Power-up Initialization (Cold Start)” on page 72.
		Power Switch	Switch the KSU AC power switch on the “ON” position.
		AC Fuse	1) Switch KSU power to the OFF position and remove cover (four screws). 2) Locate the system power supply in the upper left corner of the KSU interior and inspect the AC fuse for continuity (DVM required).
		DC Fuse	1) Switch KSU power to the OFF position and remove cover (four screws). 2) Locate the system power supply in the upper left corner of the KSU interior and inspect the AC fuse for continuity (DVM required).

No system operation (continued on next page)

Diagnostic Quick Reference Chart (continued)			
Symptom(s)	Diagnostic Aid	Cause(s)	Action
<i>No system operation (continued)</i>			
		SPI Bus Error	<ol style="list-style-type: none"> 1) Switch KSU power to the OFF position. 2) Remove cover (four screws). 3) Locate each expansion module. 4) Verify the ribbon cable connection is accurate and secure. 5) Check for improper aligning of module connectors. 6) Detach all station cabling and retest. 7) Check all socketed IC's for good "seated" connections. 8) Unplug one module at a time and retest until failed component is found. 9) Perform Initialization and Power Up sequence.  <p>NOTE: <i>This is an emergency action since the unique customer database will be erased and the system will reboot with default database programming.</i></p> <ol style="list-style-type: none"> 10) If this does not clear the trouble, replace KSU1 and initialize it as described in "Power-up Initialization (Cold Start)" on page 72.
Telephone/ Terminal apparatus not working	CPU Heartbeat LED flashing and 408M/408E/DPM8 module Heartbeat flashing but one or more digital telephones are not functioning.	Shorted station cabling.	<ol style="list-style-type: none"> 1) At the KSU, power the system down. 2) Remove the power cord from the AC outlet. 3) Remove the KSU cover (four screws). 4) Disconnect all station wiring on the affected 408M, 408E, DPM8, or DPM16 and connect one known-good DET directly to one of the interface ports. 5) Replace the KSU cover and retest with this phone. <p><i>Follow the above procedures to test each interface port as needed. If any port is found faulty or not working, replace the module. Otherwise, replace the wiring/cabling.</i></p>
		Faulty Telephone	<p>If the above test yields all working ports and no cabling errors</p> <ul style="list-style-type: none"> • Test each connected telephone one at a time until the faulty telephone is discovered. • Replace the faulty telephone(s).
 <p>NOTE: <i>Digital telephones use only one twisted cable pair for power, data control and voice communications. There are no fuses for station interface protection. Instead, a current sensing Polly-switch limits excessive current going to each terminal connection. If a station cable pair is shorted or a telephone's DC power supply is damaged, the Polly-switch will temporarily open to protect the KSU Module circuitry.</i></p>			

Diagnostic Quick Reference Chart (continued on next page)

Diagnostic Quick Reference Chart (continued)			
Symptom(s)	Diagnostic Aid	Cause(s)	Action
Digital telephone erratic operation: • Erratic LED/LCD operation • Faint data noise in the background during conversations	Digital Volt/Ohm Meter	Cable distance is too long for gauge of wire/cable used.	If a digital telephone is not receiving clear 2B+D signaling from the KSU, test as follows: With station cable cross-connect (jumper) wire removed and telephone unplugged: Place a short circuit across the inside wiring cable pair at the user end (jack) of the cable. With a DVM: Measure the short circuit resistance one way. The short-circuited cable pair ohm reading should not exceed 34 ohms.
		Non-standard telephone cable being used.	Each digital telephone should operate on one dedicated, unshielded, twisted pair cable to avoid data noise and interference between adjacent cable pairs.
		Multiple digital extensions being fed from one common cable or on the same cable pair.	
Other party cannot hear you (handset)	Another digital telephone	Component failure	1) Lift handset. 2) Dial another digital extension. 3) Confirm connection of audio. If audio is one-way only 4) Replace handset and repeat steps 1-3. If problem persists... 5) Replace handset cord and repeat steps 1-3. If the problem persists... 6) Replace the telephone.

Diagnostic Quick Reference Chart (continued on next page)

Diagnostic Quick Reference Chart (continued)			
Symptom(s)	Diagnostic Aid	Cause(s)	Action
Cannot hear other connected party	Another digital telephone	Component failure	1) Lift handset If the intercom dial tone is not heard over the handset: 2) Hang up (put the handset in the cradle). 3) Press the SPK button. If dial tone is heard over the loudspeaker: 4) Replace handset and repeat the first test. If there is still no dial tone heard through the handset: 5) Replace the handset cord and retest. Still no dial tone heard: 6) Replace the telephone. <p style="text-align: center;">AND/OR</p> If dial tone is not heard over the loudspeaker (ON/OFF button test): 7) Replace the telephone.
 NOTE: The above test requires you to set the feature "Auto Select" for intercom operation ("ICM").			
Other party can't hear you while using the speakerphone.	Another digital telephone	Connection / component failure	1) Press the SPK button. 2) Listen for dial tone over the loudspeaker. 3) Call a working extension.  NOTE The called extension should use the handset for this test. 4) Verify two-way connection. If the called extension cannot hear your voice: 5) Verify that MUTE is not enabled (i.e., status lamp flashing red). 6) Lift the handset and verify two-way connection using handset. If verified as a speakerphone problem: 7) Replace the telephone.

Diagnostic Quick Reference Chart (continued on next page)

Diagnostic Quick Reference Chart (continued)			
Symptom(s)	Diagnostic Aid	Cause(s)	Action
No sound heard over loudspeaker in speakerphone mode.	Another digital telephone	Connection / component failure	1) Press the <i>SPK</i> button. 2) Listen for dial tone over the loudspeaker. 3) Call a working extension.  NOTE <i>The called extension should use the handset for this test.</i> 4) Verify two-way connection. If the called extension cannot hear your voice: 5) Verify that MUTE is not enabled (i.e., status lamp flashing red). 6) Lift the handset and verify two-way connection using handset. If verified as a speakerphone problem: 7) Replace the telephone.
Static and / or noise can be heard during a conversation	Process of elimination. Industry standard technician testing tools (lineman's test set, etc.)	Another extension	If only static is heard when connected to a specific extension during an intercom call: Examine that extension.
		Station cabling/MDF wiring	If static exists on all calls: 1) Check station cabling/wiring and all MDF connections. 2) Correct any problems.
		Extension apparatus	If noise persists: 1) Change-out swappable components (handset, handset cord). If noise continues: 2) Try a known good extension connected to this station cable.

Static and / or noise can be heard during a conversation (continued on next page)

Diagnostic Quick Reference Chart (continued)			
Symptom(s)	Diagnostic Aid	Cause(s)	Action
<i>Static and / or noise can be heard during a conversation (continued)</i>			
		Telco problem	<p>If static/noise is heard on CO lines only:</p> <ol style="list-style-type: none"> 1) Determine if other extensions also hear the noise/static. <p>If other extensions also hear the noise/static:</p> <ol style="list-style-type: none"> 2) Determine if other CO lines affected (ie.e., either several or only a few). 3) Disconnect CO line at interface point and connect Lineman's test set to the same point of connection <i>ahead</i> of the system. <p>If noise/static persists:</p> <ol style="list-style-type: none"> 4) Contact the local servicing telephone company and request repair. <p>If noise/static can be isolated to the DX-120 equipment:</p> <ol style="list-style-type: none"> 5) Verify which CO line ports are affected (which CO ports seem to have noise/static). 6) Replace interface modules as required.
Programming lost or changed.	Digital Executive Telephone display.	Intended programming change.	Check with system administrator for incidental changes made.
		PC-DBA programming changes Send All operation.	When using PC-DBA to make customer database changes you must take special precaution not to overwrite existing data with residual PC-DBA working directory values. When using PC-DBA to update any database, it is highly recommended to perform the function <i>Receive All</i> prior to making any specific database changes to assure that the working directory database matches the database in use at the customer site.
		Bad Memory battery	If power fluctuations occur and the memory battery backup battery is low or bad, the customer database is susceptible to being defaulted (factory settings loaded) whenever a power interruption occurs. If this occurs change the standard (photo-cell type) lithium battery.

MAINTENANCE UTILITIES

The DX-120 includes a versatile maintenance utility that you access through PC-DBA. A technician with PC skills can easily use the maintenance function to obtain various data and information about the DX-120 and all connected components. The DX-120 system allows you to administer system database parameters via an IBM® Compatible, Personal Computer.

- The use of a PC has distinct advantages over programming the system via the digital telephone, including:
 - Specific database archiving (via save function)
 - Remote programming
 - Outboard programming
- The PC program that interfaces with the DX-120 system is PC-DBA (PC-Database Administration). PC-DBA is a windows based program and requires the following resources in the PC environment:
 - PC running Windows 98, 2000, ME, or XP
 - RAM: 64 MB or greater
 - Processor Speed: 350 MHz or greater
 - Free Hard Disk Space: 4 GB or greater



NOTE

PC-DBA is included in the utilities CD shipped with every new system. You can obtain PC-DBA at the www.vertical.com/ccc.



IMPORTANT!

Use of this DX-120 utility requires a well-rounded understanding of the PC Windows environment. The creator and/or supplier of PC-DBA cannot support users who are unfamiliar with these basic requirements. If any of these issues concern you, please consult with a qualified technician who is well-versed in PC operation.

Loading PC-DBA software

When PC-DBA is retrieved from Vertical's web site, it is downloaded in a self-extracting executable file. Take the following actions to install the software on your PC.

- 1) Download the PC-DBA executable file from either the CD provided or from the CCC (go to www.vertical.com/ccc).



HINT

The executable's file name will be a format similar to the following:
`DX120_PCDBA_A3310160322136.exe`.

- 2) Double click on the executable file to start the Install Shield Wizard.
- 3) Follow the on-screen instructions.
 - When the installation is complete, an icon is placed on your Desktop.
- 4) Click on the new icon to launch PC-DBA.

CONNECTING TO THE SYSTEM

All operations in *PC-DBA – Maintenance* require that your PC be connected to the DX-120 switch. You can do this in any of three ways:

- a direct connection to the KSU1 – CPM – PC-DBA port
- using the optional system modem (PN 7249)
- using the built-in modem of the in-skin hard drive voicemail module with pass-through communications enabled.

Once you establish a data communications link, you can connect to the system by pressing the F5 key or go to Control>Connect. to display the Connect window. This connect operation links PC-DBA to the DX-120 processor for data exchange.

Cable Connection

Connect to the DX-120 system on site via the PC serial port (COM port). Use a straight-through, 9-pin to 9-pin, Male/Female cable from the PC serial port to the DX-120 CPM – PC-DBA port. Once you make this connection, you can connect to the DX-120 system processor for the various Maintenance operations.

**HINT**

For more information on cable connections with PC-DBA, please refer to See “Connecting a Serial Cable for PC-DBA” on page 70..

PASS-THROUGH COMMUNICATIONS WITH CORPORATE OFFICE DX

Pass-through Communications is a feature associated with the Corporate Office DX 7270C hard drive voice mail board. This feature allows you to communicate with the DX-120 or the in-skin hard drive voice mail system through a single modem number.

**HINT**

Refer to the Corporate Office DX Installation Manual for more information.

Connecting PC-DBA to the DX-120 Switch

In order to use any of the Maintenance options available in PC-DBA, you must first connect it with the DX-120 switch. There are two methods that allow you to make this connection:

- **Local Connection (on-site)**
- **Remote Connection (via modem)**

ESTABLISHING A LOCAL CONNECTION WITH PC-DBA

If you are on site, you can easily connect PC-DBA to the local system using this method.

From the mainscreen of PC-DBA:

- 1) Go to Control ► Connect to display the Password screen.



- 2) Enter the appropriate password



HINT

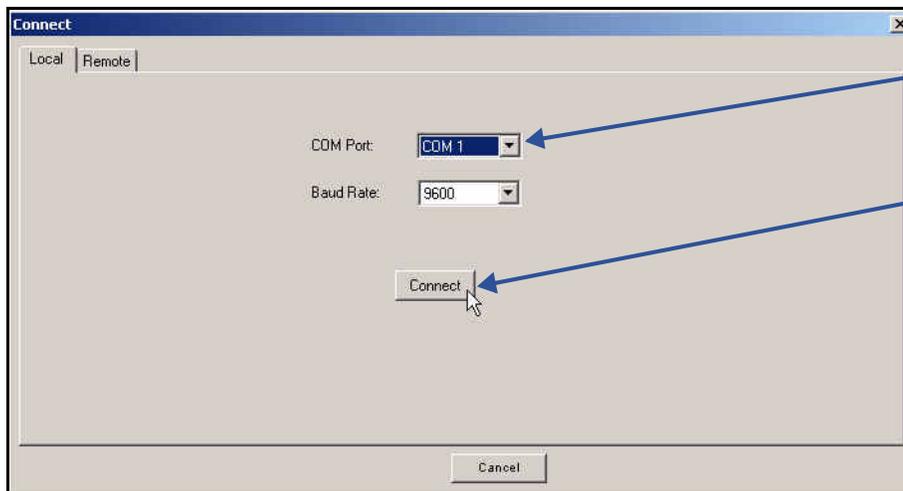
The default password is eight pound signs (i.e., #####).



NOTE

If you enter the password incorrectly, a message will be displayed to let you know and will ask you to try again.

- 3) Click OK to display the Local connection window.



Select the appropriate COM Port and Baud Rate.

Click Connect to initiate the connection.

- 4) Select the appropriate Com Port.
- 5) Select the appropriate Baud rate.

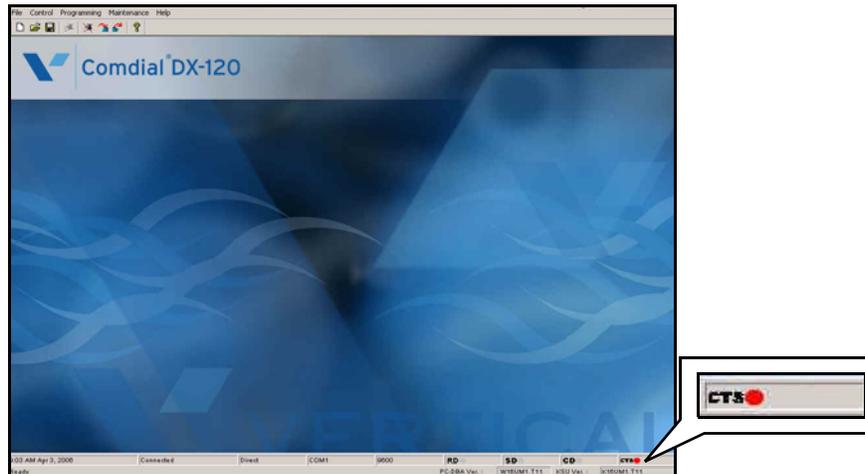
Establishing a Local Connection with PC-DBA (continued on next page)

Establishing a Local Connection with PC-DBA (continued)

6) Click Connect to initiate the connection.

**HINT**

When the system is connected a red dot will appear in the lower left corner of the screen next to the CTS indicator.



7) Program the switch as needed.

**HINT**

- See “Accessing PC-DBA Maintenance” on page 88 as well the DX-120 Programming Manual for more information about using PC-DBA.
- There is also an online help system in PC-DBA that can provide you with the information you need to program and maintain the DX-120.

Establishing a Modem Connection with PC-DBA

If the system is not equipped with an automated attendant or a voice mail in auto attendant mode, make sure the attendant is aware that a modem connection will be taking place. Use of the automated attendant can greatly assist the modem connection process since you can enter the modem extension remotely.

From the mainscreen of PC-DBA:

- 1) Go to Control▶Connect to display the Password screen.



- 2) Enter the appropriate password



HINT

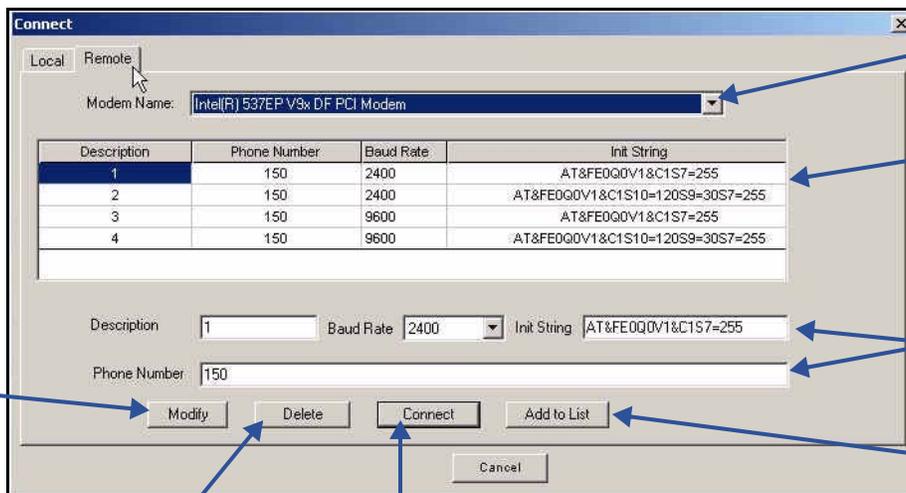
The default password is eight pound signs (i.e., #####).



NOTE

If you enter the password incorrectly, a message will be displayed to let you know and will ask you to try again.

- 3) Click OK to display the Local connection window.
- 4) Click the Remote tab to display the Remote connection window.



Select the appropriate modem name.

Select an existing control string for connection, modification, or deletion.
See NOTE below.

Enter new control string information as needed.

Click here to add any new control string information to the table/list.

Click here to save changes made to the selected control string.

Click here to delete the selected control string.

Click here connect using the selected information.

- 5) Select the appropriate modem name.

Establishing a Modem Connection with PC-DBA (continued on next page)

Establishing a Modem Connection with PC-DBA (continued)

6) Select the appropriate control string

OR

Enter a new control string.

**NOTE**

- To **add a new control string**: Enter a new control string, then click *Add to List* to save the new information.
- To **change an existing control string**: Click on the string to be edited, make the change, then click *Modify* to save the change.
- To **delete an existing control string**: Click on the string to be deleted, then click *Delete*.

7) Click *Connect* to initiate the connection using the currently selected modem name and control string.

**NOTE:**

- If nothing happens, it is likely that the modem is not being addressed by PC-DBA. Select the COM (serial port) that is connected to the PC modem. Enter the telephone number at the site location. Then press **Enter**.
- If modem connection at this site requires a human to transfer the modem call to the DX-120 modem (ext 100), you must have a standard telephone connected to the same circuit as the modem so that you can verbally request the answering person to transfer the call.
- Once a modem connection has been accomplished, you can perform an *F5-Connect*. *F5-Connect* is required to link PC-DBA to the DX-120 CPM processor.
- Refer to the *HINT* under step 6 on [page 85](#) regarding the CTS indicator that appears once connection has been established.

ACCESSING PC-DBA MAINTENANCE

The ability access the PC-DBA Maintenance Utilities requires the following two tasks:

- Download of the PC-DBA software onto a PC
- Successful and current connection between PC-DBA and the DX-120 processor

From the main PC-DBA Screen:

- 1) Go to Maintenance to display a list of features.



- 2) Click on any of the options in this menu to access the corresponding feature (for more information about using each feature refer to the pages shown below for each).



HINT

- Some items on this menu have submenus. Please refer to the main item for more information on the submenus.
- For reference and when diagnosing any issues that may come up, the KSU version number appears in the bottom right corner of the main screen of PC-DBA.



Maintenance Utilities (Menu Items)

- Configuration (see below)
- Diagnosis
- Status
- SW/HW Revision
- Event
- Logon Data
- Remote Control
- T1 Maintenance



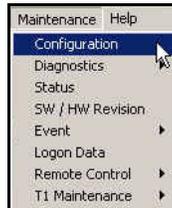
IMPORTANT!

- Remember, in order to access these utilities, there must be an active connection between PC-DBA and the DX-120 switch (see See “Connecting PC-DBA to the DX-120 Switch” on page 84.)
- Refer to the HINT under step 6 on [page 85](#) regarding the CTS indicator that appears once connection has been established.

CONFIGURATION

When you select *Configuration*, the DX-120 processor sends the current hardware configuration to PC-DBA for viewing. For each board viewed, the board type is displayed so that the hardware can be readily identified.

From the main PC-DBA Screen (during connection between the system and the switch - see page 84):



- 1) Go to Maintenance ► Configuration to display the Configuration screen.
 - A message will appear to let you know that the configuration information is being transferred from the switch and being received by PC-DBA.

Configuration receiving

A message will appear to let you know the information is being received/transferred.

This screen will appear after the transfer is completed.

Configuration:Board Status		
BOARD	TYPE	STATUS
COMMON CTRL BOARD	CPM BOARD	CONNECT
OPTION BOARD	OPEN	OPEN
MODEM BOARD	OPEN	OPEN
CABINET1		
CABINET2		

- 2) Click on any button on this screen to display configuration details about the corresponding board.

Configuration (continued on next page)

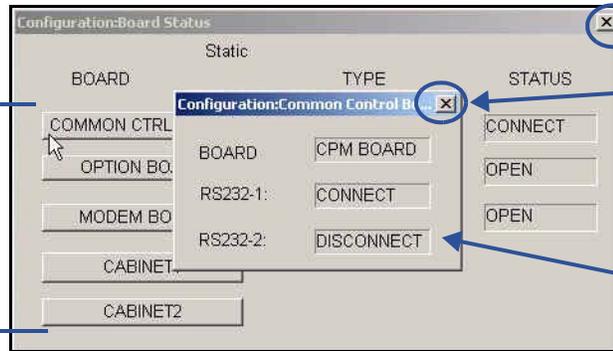
Configuration (continued)

3)

EXAMPLE



Click any of the buttons to display configuration information for each of the corresponding boards.



Click the X at the top right of each screen to close them.

Each time you click a button, configuration information for the corresponding board appears in a second window like this one.

4) Click the X in the top right corner of each window to close it.

DIAGNOSTICS

- The Diagnostics submenu allows you to do any of the following:
 - **Run a Self Test for:**
 - The System (*with an option to wait for a report*)
 - Board(s)
 - Port(s)
 - **Run a Report on a Self Test already performed on the system**
- The Diagnostics function can be invoked to force a diagnostic test operation.
- The system performs this test automatically at the time it boots up (initial installation) and whenever programmed to do so.
- By default, the factory settings for the system Self-Test Time is set to "NULL" (never performed). (For programming details, refer to the *DX-120 Technical Manual, Volume II, Programming.*)
- The Diagnostic Self-Test can be invoked automatically via programming settings or manually.
- When the Diagnostic Self-Test is invoked, the DX-120 performs a list of software and hardware checks to assure proper operation of the hardware installed.
- Diagnostic Test activity has the lowest priority in CPU processing tasks, therefore, the time required to complete this testing operation could vary from one test to the next. When an automatic test or manual test of the entire system is invoked, the testing time can take approximately 30 minutes.
- Manual diagnostics testing can be invoked for the entire system or for one module or module port. To do a manual test, perform the following steps.

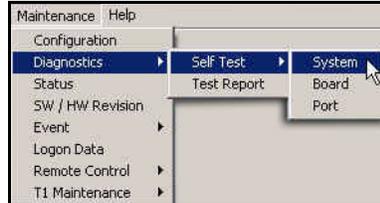
Diagnostics (continued on next page)

Diagnostics (continued)

SELF TESTING THE SYSTEM

From the main PC-DBA Screen (during connection between the system and the switch - see page 84):

- 1) Go to Maintenance ► Diagnostics ► Self test to display the the Self Test submenu.



- 2) Select System to display a screen asking you to decide if you want to:

- **Wait for Results**

This option allows you to run the test without getting results (you can run the report at any time afterward using the “Test Report” option - see “Run the Self Test Report Only” on page 95).



IMPORTANT!

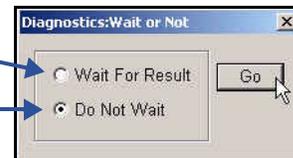
When invoking the test for the entire system, Vertical recommends that you not select the “Wait for Result” option as this option takes several minutes to complete. It also prevents you from using any other PC-DBA functions.

- **No, Don’t Wait (recommended option)**

This option allows you to run the test “behind the scenes” while still performing other PC-DBA tasks. This choice is recommended over the “Wait for Results” option as it allows you to continue working while the test is being executed.

If you choose this option, you will not be able to perform any other PC-DBA tasks until the test is completed.

This option allows you to run the test in the background so that you can still work in PC-DBA. You can then use the Test report option from the Diagnostics menu to obtain a specific report at a later time.



- 3) Select which option you want to use (e.g., Wait or Don’t Wait).

- 4) Click Go to run the self test of the system.

- If you selected “Wait for Results” the test may take several minutes or more to complete. Once the test is completed, a screen will appear which allows you to select the specific test report you want to view (see step 2 on [page 95](#))
- If you select “Do Not Wait”, the test will run while you continued to perform tasks within PC-DBA. When the time is convenient, you can check for test results at a later time (see [“Run the Self Test Report Only”](#) below).
- To run self tests specifically for boards/modules and ports, see below.

Diagnostics (continued on next page)

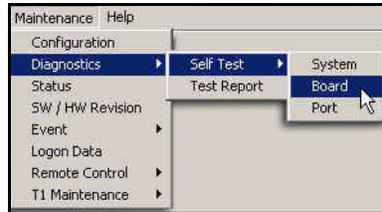
Diagnostics (continued)

SELF TEST BOARDS

You can run a self test and obtain report results for each the boards on your system. This test will let you know which boards are installed and working.

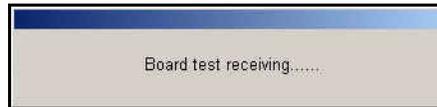
Unlike the system self test, you will get the results immediately following the test. Depending upon the size of your system, this test could take several seconds to a few minutes. Once the test is complete, you can select which results you want to view.

- 1) Go to Maintenance ► Diagnostics ► Self test to display the the Self Test submenu.

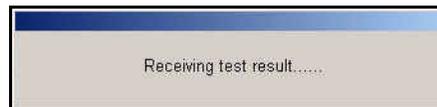


- 2) Select Board to have the system begin checking/testing the boards associated with your system.

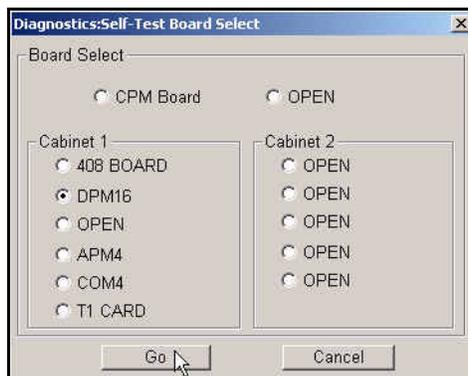
- First, a message will appear to let you know that the boards are being tested:



- A message will then appear to let you know that the report is being received for the board test.



- The Board Select screen will appear.

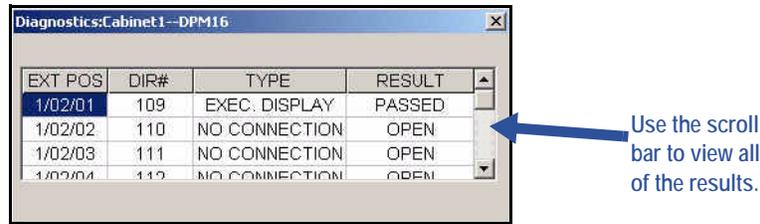


- 3) Select the board for which you want to review the self-test results.

Self Test Boards (continued on next page)

Self Test Boards (continued)

- 4) Click Go to display the results for the specified board.
 - You can review results for each board one at a time.



- 5) Use the scroll bar on the right of the window to review all of the results.
- 6) Click  in the upper right corner of the window to close it and return to the Board Select screen.
- 7) Select another board for which you want to review self-test results.

OR

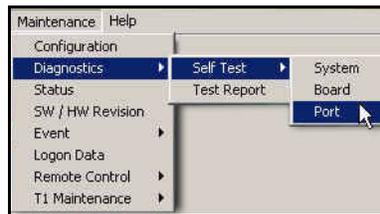
Click Cancel to close the Self-test feature.

SELF TEST PORTS

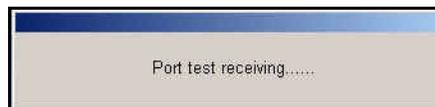
You can run a self test and obtain report results for any port on your system. This test will let you know which ports are available and working.

Unlike the system self test, you will get the results immediately following the test. Depending upon the size of your system, this test could take several seconds to a few minutes. Once the test is complete, you can select which results you want to view.

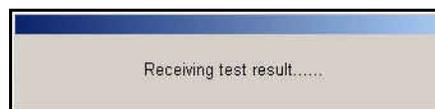
- 1) Go to Maintenance ► Diagnostics ► Self test to display the the Self Test submenu.



- 2) Select Port to have the system begin checking/testing the ports associated with your system.
 - First, a message will appear to let you know that the ports are being tested:



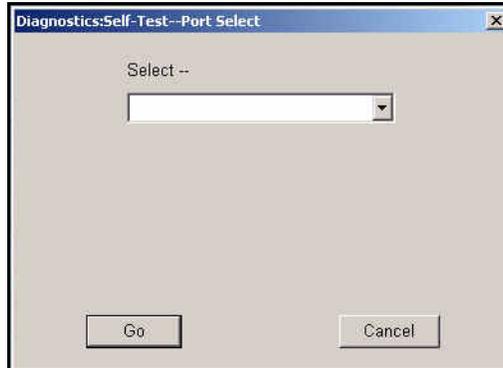
- A message will then appear to let you know that the report is being received for the port test.



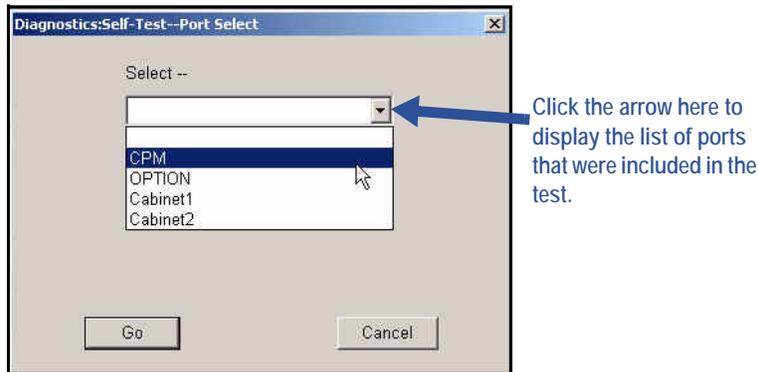
Self Test Ports (continued on next page)

Self Test Ports (continued)

- The port Select screen will appear.



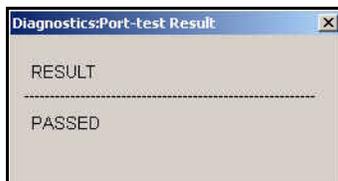
- 3) Click the arrow at the right of the field to display a list of the ports that were included in the test.



HINT

Depending upon the selection you make in step 3, a second field may appear requiring you to make your selection even more specific. Make the selection as appropriate and go to step 4.

- 4) Click Go to display the results for the specified port.
 - You can review results for each port one at a time.



- 5) Click  in the upper right corner of the window to close it and return to the Port Select screen.
- 6) Select another port for which you want to review self-test results.

OR

Click Cancel to close the Self-test feature.

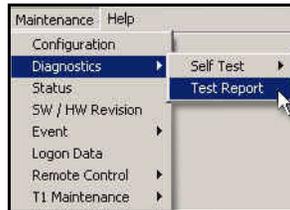
Diagnostics (continued on next page)

Diagnostics (continued)

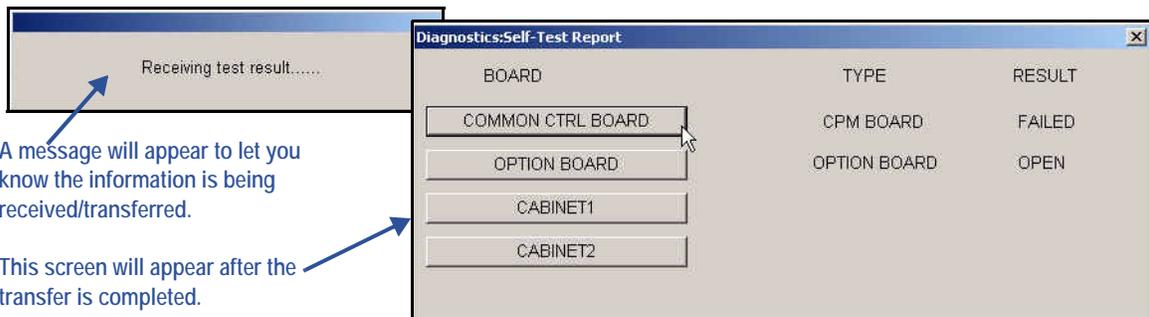
RUN THE SELF TEST REPORT ONLY

If you ran a Self Test, but did not want to wait for results, or simply need to review the results of the last tests run, you can use this option.

From the main PC-DBA Screen (during connection between the system and the switch - see page 84):



- 1) Go to Maintenance▶Diagnostics▶Test Report to display the main Test Results screen.
 - A message will appear to let you know that the test results are being transferred from the switch and being received by PC-DBA.

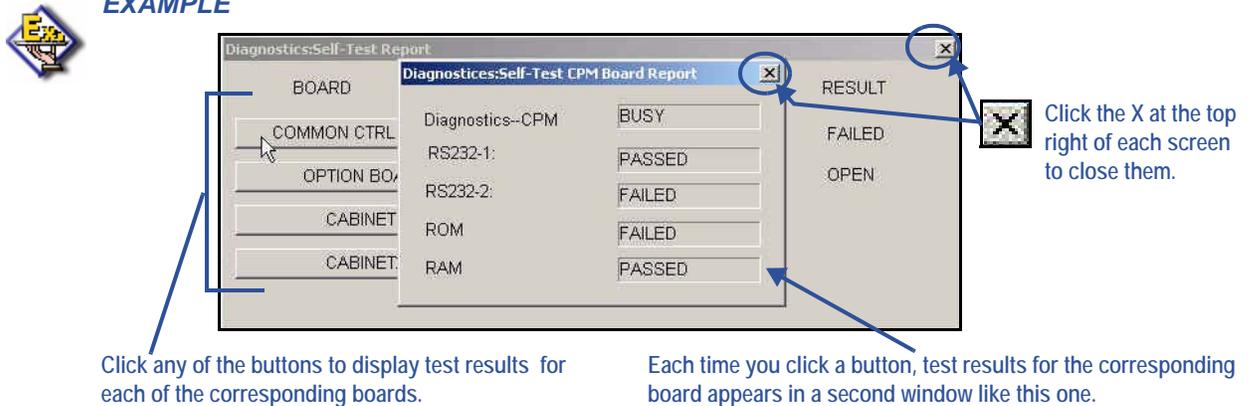


A message will appear to let you know the information is being received/transferred.

This screen will appear after the transfer is completed.

- 2) Click on the specific board for which you want to review test results.

EXAMPLE



Click any of the buttons to display test results for each of the corresponding boards.

Each time you click a button, test results for the corresponding board appears in a second window like this one.

Click the X at the top right of each screen to close them.

- 3) Click the X in the top right corner of each window to close it.

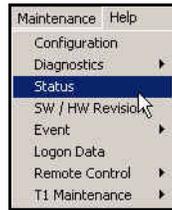
Maintenance Utilities (continued)

Maintenance Utilities (continued)

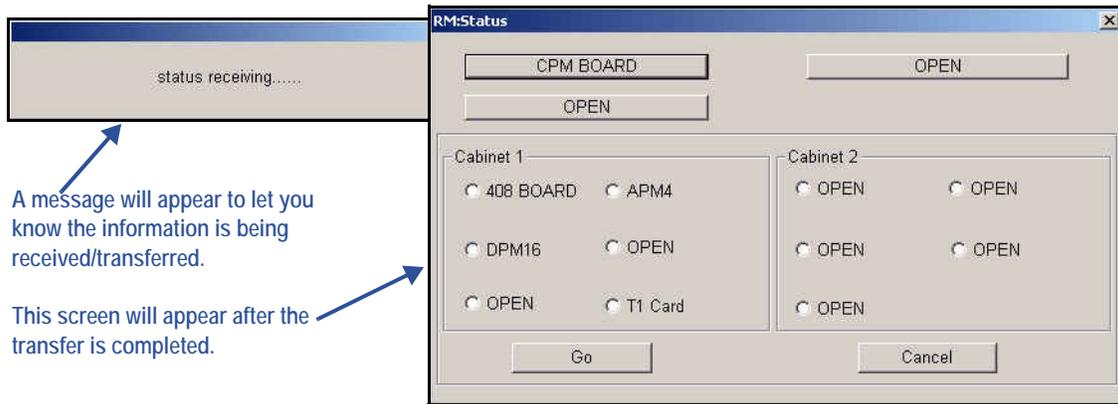
STATUS

You can use the Status function to view a specific DX-120 system resource status (e.g., *On the Status - OPTION BOARD screen the connect status can be either IDLE (ready for call) or BUSY (port in use).*

From the main PC-DBA Screen (during connection between the system and the switch - see page 84):



- 1) Go to Maintenance ► Status to display the Status screen.
 - A message will appear to let you know that status information being transferred from the switch and being received by PC-DBA.



A message will appear to let you know the information is being received/transferred.

This screen will appear after the transfer is completed.

Status (continued on next page)

Status (continued)

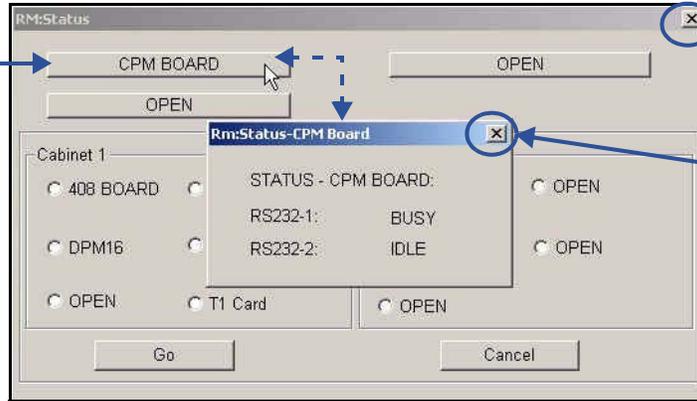
To Get the Status of the CPM Board

- 2) Click the CPM Board button to display the status of the RS232 ports (then skip to step 5 on [page 98](#)).
 - See [“STATUS REFERENCE CHART” on page 98](#) for statuses and their definition.

EXAMPLE



Click here to display the RS232 port status on the CPM board.



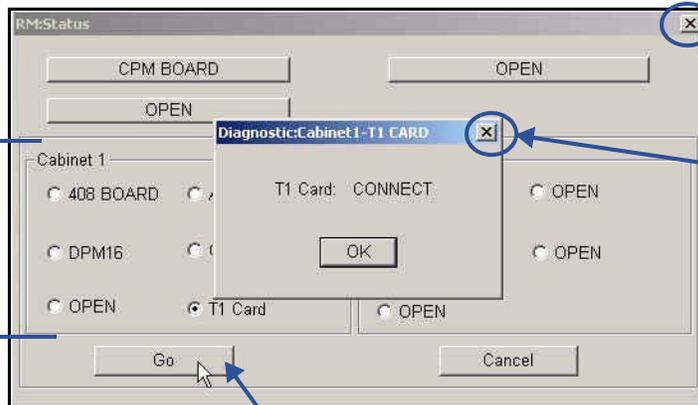
Click the X at the top right of each screen to close them.

AND/OR

To Get the Status of Another Board

- 2) Click on the name of the board (in Cabinet 1 or 2) for which you want to view the status.
- 3) Click Go to display the status of the specified board (then skip to step 5 on [page 98](#)).
 - See [“STATUS REFERENCE CHART” on page 98](#) for statuses and their definition.
 - If you click on one of the “Open” options, it will confirm that there is no connection made for that slot. If you want to find out which slots are open in general, see [“To Find Out Which Slots are Open”](#) below.

EXAMPLE



Click the X at the top right of each screen to close them.

Select the board for which you want to review the status.

Click here to review the status for a selected board.

AND/OR

(continued on next page)

*Status (continued)***To Find Out Which Slots are Open**

- 4) Click Open for either Cabinet 1 or 2 to see which slots in the specified cabinet are available (or that have no hardware recognized).
- See table below for possible statuses and their definition.

STATUS REFERENCE CHART	
STATUS	DEFINITION
<i>no status (blank)</i>	Nothing recognized.
IDLE	Equipped and ready
FAIL	Equipped, but errors present (no loop current) Extension lost data communications
OPEN	No hardware recognized (slot is available)
BUSY	In use
CONNECTED	
NO CONNECTION!	Not in use (i.e., no hardware recognized in that slot)

- 5) Click the **X** in the top right corner of each window to close it.

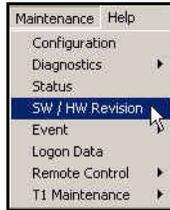
Maintenance Utilities (continued on next page)

Maintenance Utilities (continued)

SW/HW REVISION

You can use the SW/HW Revision to view the current version of software and firmware of the boards installed in the DX-120. The Hardware Revision (HW Revision) is a label only field that allows the user of PC-DBA to record the revision of hardware installed at the site. This information is stored in the Database Save operation of PC-DBA.

From the main PC-DBA Screen (during connection between the system and the switch - see page 84):



1) Go to Maintenance ► SW/HW Revision to display the Revision screen.

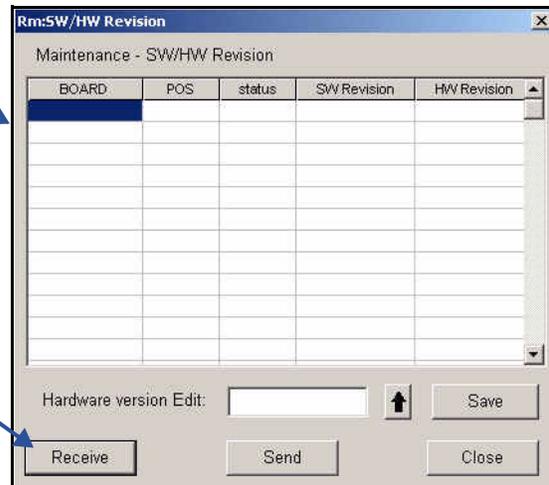


IMPORTANT!

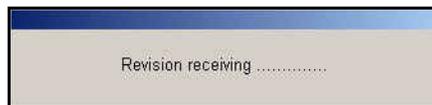
The first time you use this option, the window will be displayed with no information. If this happens, click Receive to transfer the information from the switch to PC-DBA.

The first time you use this feature, the window will appear with no revision information.

Click here to obtain all available revision information.



- A message will appear to let you know that status information being transferred from the switch and being received by PC-DBA.



SW/HW Revision (continued on next page)

SW/HW Revision (continued)

**IMPORTANT!**

- Once you receive the information into the PC-DBA, then click Save, the information will appear any time you open this screen. However, you will need to perform a SEND to update any revisions that may have been made.

BOARD	POS	status	SW Revision	HW Revision
CPM BOARD		Connect	K16UM1.T11	NULL
OPEN		Open	NULL	NULL
MDM CARD		Connect	NULL	NULL
DPM8 BOARD	1/01	Connect	PEHUM0.F15	NULL
DPM16 BOARD	1/02	Connect	PDDEE0.F04	NULL
OPEN	1/03	Open	NULL	NULL
APM4 BOARD	1/04	Connect	PEHUM0.F15	NULL
OPEN	2/01	Open	NULL	NULL
OPEN	2/02	Open	NULL	NULL
OPEN	2/03	Open	NULL	NULL
OPEN	2/04	Open	NULL	NULL
COM BOARD	1/1&5	Connect	PEHUM0.F15	NULL

Hardware version Edit:

- 2) Edit information as needed.
- 3) Click Save to store the new information.
- 4) Click Send to send the new information back to the switch.
 - The next time you use this feature, the last saved information will be displayed.

EVENT

- You can invoke event tracking to record actions the system processes, for the purposes of debugging the system. This operation is rarely required and usually used following a request by the customer service department to do so. The output data is presented to the SMDR serial port.

**NOTE**

The data must be collected in a dedicated collection PC using special Event Tracking software, or a terminal emulation software that writes to a text file, for later deciphering at customer service.

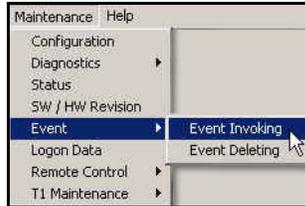
- Event tracking can be started and stopped by a specified system operation, or set to continue until manually discontinued.

Event (continued on next page)

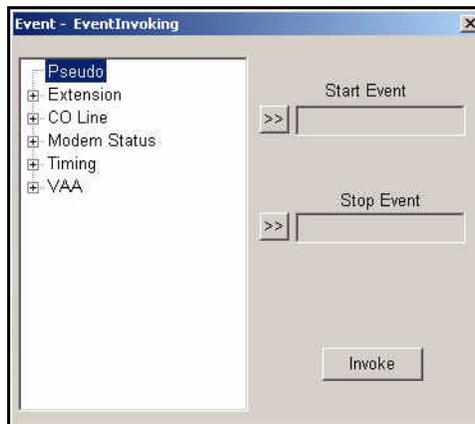
Event (continued)

EVENT INVOKING (SETTING THE SYSTEM FOR SPECIFIC EVENT TRACKING)

From the main PC-DBA Screen (during connection between the system and the switch - see page 84):



1) Go to Maintenance ► Event ► Event Invoking to display the Event screen.



IMPORTANT!

If at this point you get a “DOUBLE INVOKING!” message, it means that event invoking has already been submitted. If you want to change the event tracking, then you will need to delete what currently exists and reset it - see “Event Deleting” on page 104.



Event Invoking (continued on next page)

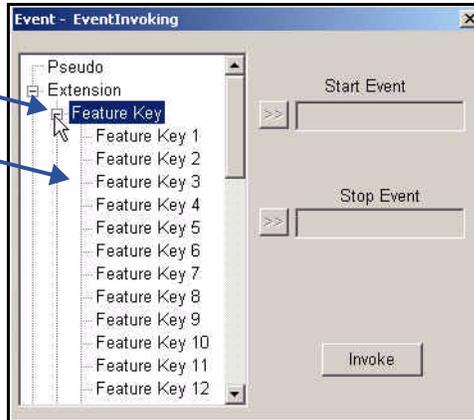
Event Invoking (continued)

- 2) Click on the + next to one of the operations to expand the list.

EXAMPLE



Click a plus sign (+)
to expand the list.



- 3) Select one of the available system operations that will cause event data output to begin.



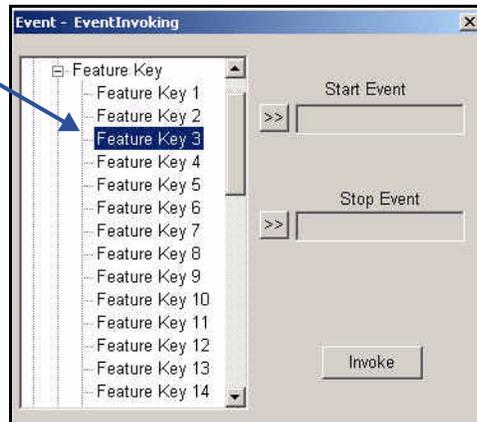
IMPORTANT!

Do not select "Pseudo" to begin event tracking. This operation is a non-occurring event intended for use with "End Event" when the event output should not end by a system operation.

EXAMPLE



Select a starting event.



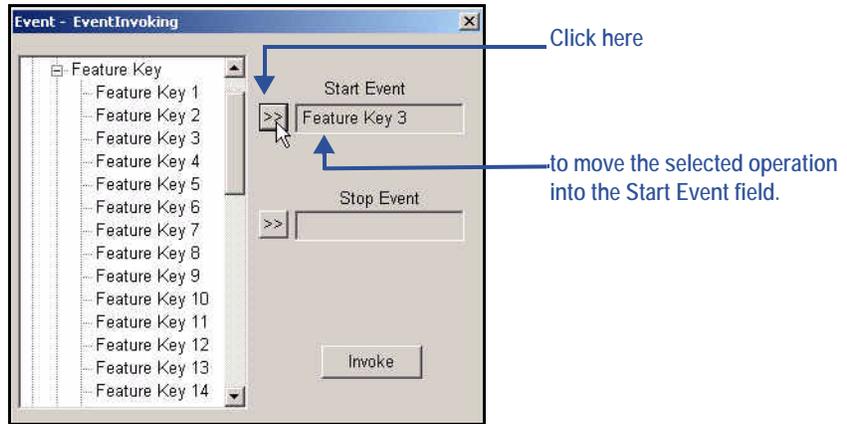
- 4) Click >> to move the selected operation to the Start Event field.

Event Invoking (continued on next page)

Event Invoking (continued)



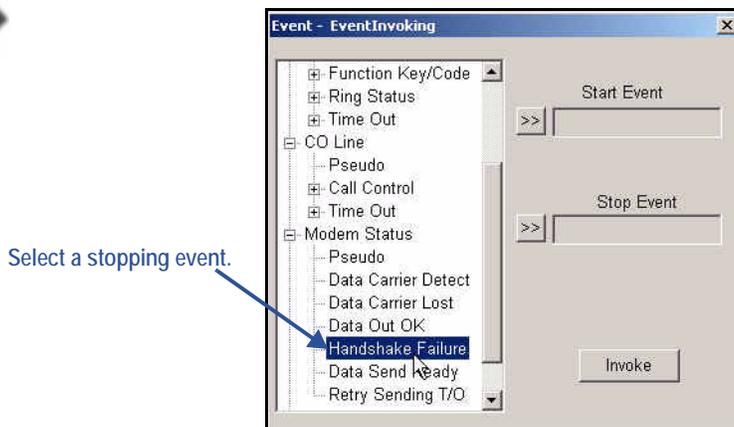
EXAMPLE



5) Select one of the available system operations that will cause event data output to end (stop).



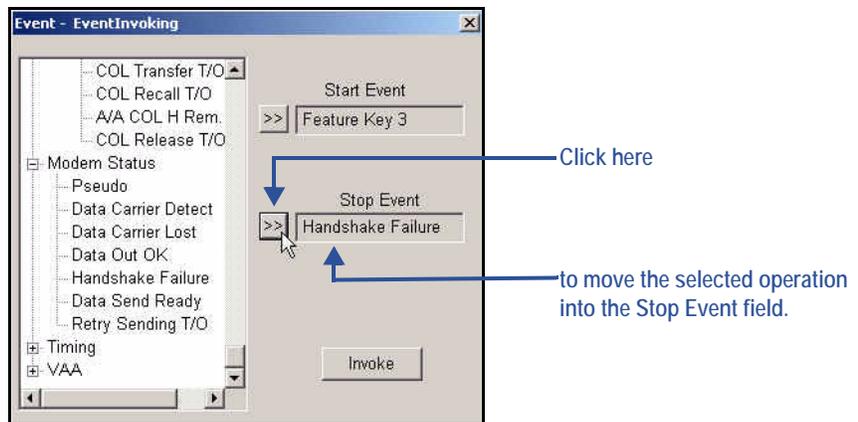
EXAMPLE



6) Click >> to move the selected operation to the Stop Event field.



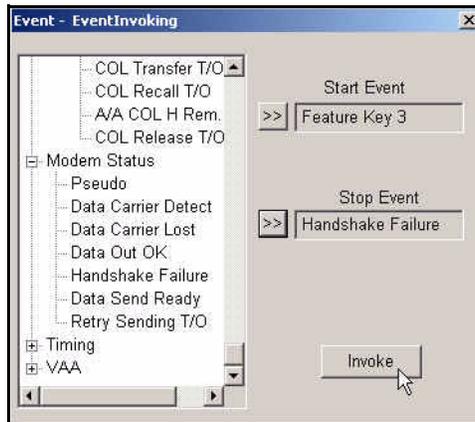
EXAMPLE



Event Invoking (continued on next page)

Event Invoking (continued)

7) Click on Invoke to set the designated event tracking.



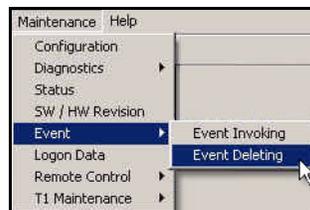
- A message will appear to let you know the settings are being invoked.



EVENT DELETING

Once you invoke a set of Event Tracking criteria, you will need to delete those before setting new ones.

From the main PC-DBA Screen (during connection between the system and the switch - see page 84):



1) Go to Maintenance▶Event▶Event Deleting to delete any event tracking settings.

- If event tracking settings exist, the following message will be displayed to let you know they are now deleted.



- If no event tracking settings exist, the following message will appear to let you know that no setting exist and you can continue with setting them - see "Event Invoking (Setting the System for Specific Event Tracking)" on page 101.

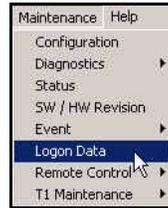


Maintenance Utilities (continued on next page)

*Maintenance Utilities (continued)***LOGON DATA**

Logon Data is used to view the last date and time that the PC-DBA session began.

From the main PC-DBA Screen (*during connection between the system and the switch - see page 84*):



- 1) Go to Maintenance ► Logon Data to review the date and time of the beginning of the last PC-DBA session.

**EXAMPLE**

- 2) Click OK to close the window.

REMOTE CONTROL

Remote Control allows the PC-DBA user to invoked system critical operations. This operation allows the user to:

- Restart the system (Warm Start)
- Restart the system and re-load default data (Cold Start)
- View and alter system memory contents (for the purposes of diagnostics).
- Block system resources for the purposes of maintenance operations (Block Control)

DIRECTORY MEMORY MAPPING

Use Directory Memory Mapping when instructed to do so by a Vertical technical support representative.

**CAUTION**

The Engineering Maintenance Tools should only be used by trained personnel. Attempts to access these tools without knowledge of their use, can cause call processing and system malfunctions or resets. All risks are assumed by the user.

Remote Control (continued on next page)

Remote Control (continued)

SOFTWARE WARM START

Use Software Warm Start to cause the system to restart operations.



CAUTION

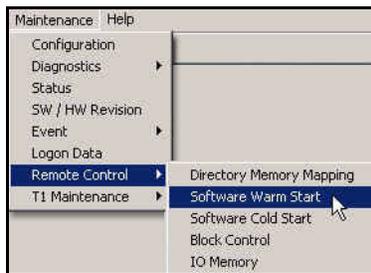
USE THIS FEATURE WITH CARE! This operation requires confirmation since all calls in progress will be disconnected.



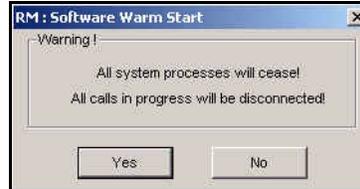
NOTE

Once you run this operation, connection between the switch and PC-DBA will be lost. Therefore, you will have to re-connect to the switch.

From the main PC-DBA Screen (during connection between the system and the switch - see page 84):



- 1) Go to Maintenance ► Remote Control ► Software Warm Start to display a prompt warning you about what will happen if you continue with this process. (i.e., all system process will be discontinued and any calls in progress will be disconnected).



- 2) Click Yes to execute the Warm Start.
 - The following message will appear to confirm that a warm start was successfully completed.



OR

Click No to cancel the Warm Start and close the warning prompt.

- 3) Click OK to close the window.

Remote Control (continued on next page)

*Remote Control (continued)***SOFTWARE COLD START**

Use Software COLD Start to cause the system to restart operations and reload default customer database data.

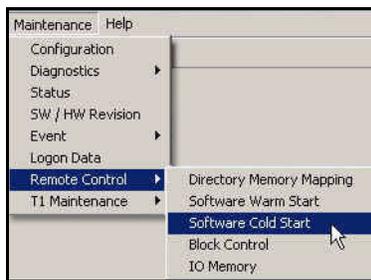
**CAUTION**

USE THIS FEATURE WITH CARE! This operation requires confirmation since all calls in progress will be disconnected and the current database will be erased!

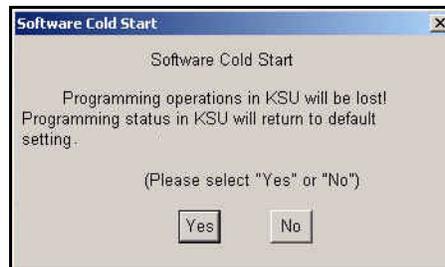
**NOTE**

Once you run this operation, connection between the switch and PC-DBA will be lost. Therefore, you will have to re-connect to the switch.

From the main PC-DBA Screen (during connection between the system and the switch - see page 84):



- 1) Go to Maintenance ► Remote Control ► Software Cold Start to display a prompt warning you about what will happen if you continue with this process (i.e. programming operations will be lost, then returned to default settings).



- 2) Click Yes to execute the Cold Start.
 - The following message will appear to confirm that a cold start was successfully completed.

**OR**

Click No to cancel the Cold Start and close the warning prompt.

- 3) Click OK to close the window.

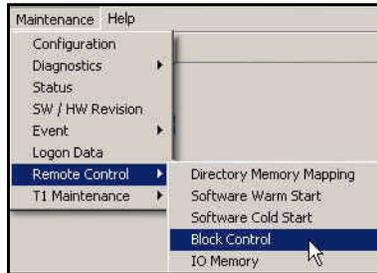
Maintenance Utilities (continued on next page)

Maintenance Utilities (continued)

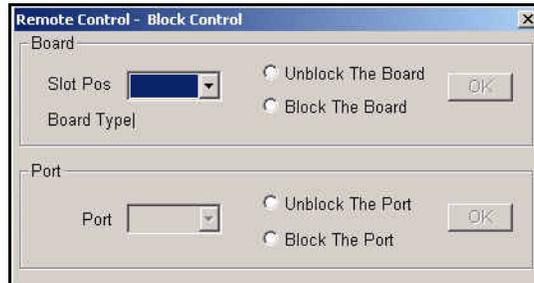
BLOCK CONTROL

You can use Block Control to restrict access to certain system resources for the purposes of trouble-shooting, e.g. you might block a CO line from use in order to test the circuit while avoiding user access to the CO line circuit. To use Block Control, you must know the cabinet number, board/module number and port number.

From the main PC-DBA Screen (during connection between the system and the switch - see page 84):



- 1) Go to Maintenance ► Remote Control ► Block Control to display the Block Control screen.



- 2) Select the number of the board you want to block (or unblock).



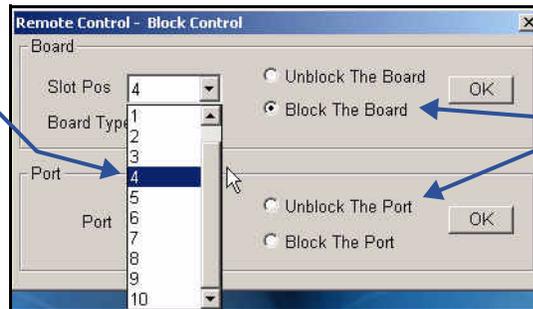
IMPORTANT

When a board or port is blocked, it must be unblocked to regain access to the resource.



EXAMPLE

Block Control can be used to block access to a board or a port. The specific board/module and/or port number must be known.



When a board or port is blocked, it must be Unblocked to regain access to the resource.

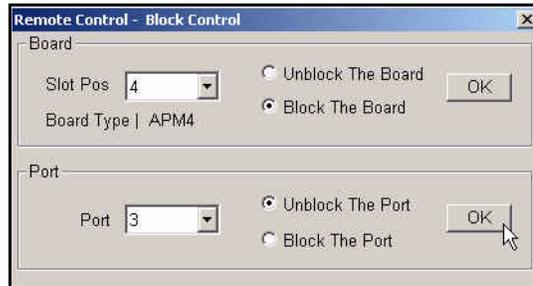
- 3) Choose whether you want to block or unblock the selected board.

AND/OR

Block Control (continued on next page)

Block Control (continued)

- 4) Select the number of the port you want to block (or unblock - see IMPORTANT note under step 2).
- 5) Choose whether you want to block or unblock the selected port.
- 6) Click OK to block (or unblock) the selected item (i.e., board or port).

**EXAMPLE**

- A message similar to the one below will appear when a block or unblock is successful.



- A message similar to the one below will appear if a block or unblock has failed (e.g., because the board is not connected, etc.).



- 7) Click OK to close the window.

I/O MEMORY MAPPING

Use I/O Memory Mapping when instructed to do so by a Vertical technical support representative. This operation is used to view system input/output port values.

**CAUTION**

The Engineering Maintenance Tools should only be used by trained personnel. Attempts to access these tools without knowledge of their use, can cause call processing and system malfunctions or resets. All risks are assumed by the user.

Maintenance Utilities (continued on next page)

*Maintenance Utilities (continued)***T1 MAINTENANCE**

The DX-120 provides an easy and efficient way to track and report errors that may occur during its operation. There are three tools that allow for tracking and clearing of errors:

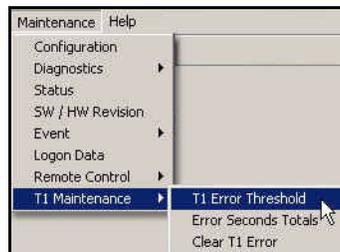
- **T1 Error Threshold**
- **Error Seconds Total**
- **Clear T1 Error**

T1 ERROR THRESHOLD

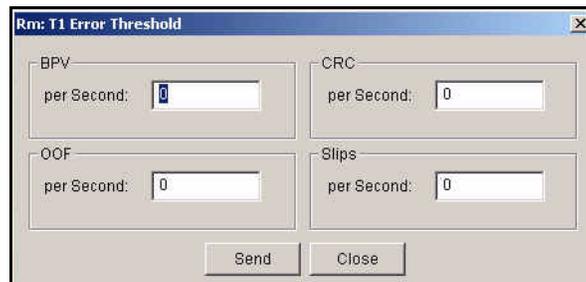
You can set the number of errors (for each error type) per second that you will allow to occur before registering an error in the total count. The default setting for each error type is -0-. (zero)

**NOTE**

It is recommended that you leave the threshold settings as is (i.e., keep the default settings). However, if there is no need to track the errors, you can set the count higher so they don't register at all.



- 1) Go to Maintenance ► T1 Maintenance ► Error Threshold to display the Error Threshold screen.



- 2) Enter the number of totals to be tracked before a total is registered.
- 3) Click Send to complete the setting:



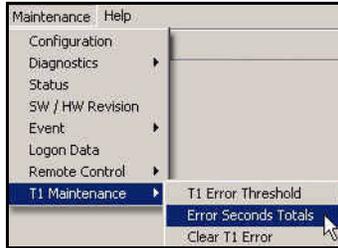
- 4) Use the Error Seconds Total to review error results at any time (see below).

T1 Maintenance (continued on next page)

T1 Maintenance (continued)

T1 ERROR SECONDS TOTALS

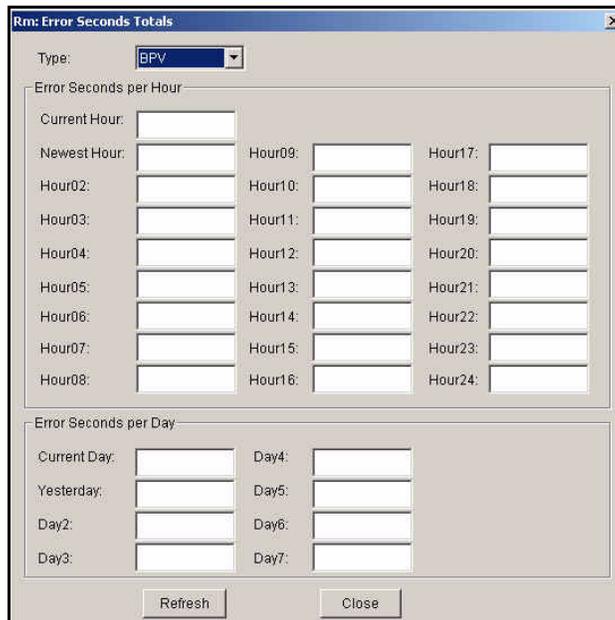
Use this feature to review any errors registered as per the Error Threshold set (see “T1 Error Threshold” on page 110).



- 1) Go to Maintenance ► T1 Maintenance ► Error Seconds Total to have the system check for registered errors.



- Once the errors have been checked has been completed, the following screen will appear to display any errors found.



- 2) Evaluate the errors and determine a course of action, if applicable.



IMPORTANT!

Contact Vertical Technical Support for assistance with understanding and correcting errors.

- 3) Click Refresh to get a real time listing of errors (registered since you previously ran the report.

OR

Click Close to close the Error Seconds Totals feature.

T1 Maintenance (continued on next page)

*T1 Maintenance (continued)***T1 CLEAR ERROR**

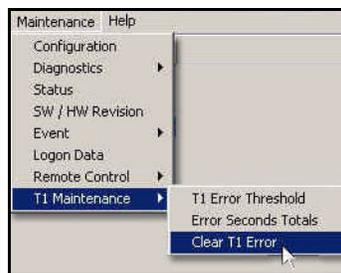
This tool allows you to clear any errors (i.e., for Hour Count only) that have been registered as described in “T1 Error Threshold” on page 110 and “T1 Error Seconds Totals” on page 111. After using the Clear T1 Error tool, the contents (errors) will automatically be sent to the KSU. The KSU will then clear the T1 Error Count for the specified error.

**NOTE**

You can clear specific errors or ALL errors. The default for this screen is for ALL options to be checked.

**IMPORTANT!**

Contact Vertical Technical Support for assistance with understanding and clearing errors.



- 1) Go to Maintenance ► T1 Maintenance ► Clear Errors to display the Clear Error screen.



- 2) Select any or all of the errors you want to clear.
 - *The default is to clear ALL registered errors.*
- 3) Click Clear T1 Error to clear the selected errors.



- 4) Click OK to close the Send succeed window.

SECTION 4 - INSTALLATION ISSUES

TROUBLESHOOTING INSTALLATION ISSUES

This chapter outlines the most common installation problems for the DX-120, and provides a corrective action addressing each issue.

Corrupted Database on Initial System Setup

SOLUTION: DX-120 POWER-UP INITIALIZATION

You must successfully initialize the DX-120 system during start up procedures for the system to operate properly.



NOTE

The installation of the DX-120 is complete only when you perform this critical initialization/cold start operation - see [“Power-up Initialization \(Cold Start\)” on page 72](#).

- You must also initialize/cold start the DX-120 system after adding any new hardware in KSU1 or KSU2. If you are adding new hardware, go to see “Adding Hardware to an Existing System” .
- When you initialize the DX-120, the system establishes and organizes an operational customer database—the system uses this database organization for future system updates.
- When the system completes the initialization process, it loads the default database contents into memory; the system is then ready to run with this database configuration.
- You can later make custom changes to the database using appropriate program settings for the various features.



HINT

- For details about the initialization process, see [“Power-up Initialization \(Cold Start\)” on page 72](#).
- If you have previously entered programming information into the DX-120 database, perform the procedure in [“Adding Hardware to an Existing System” on page 113](#).

Adding Hardware to an Existing System

SOLUTION: FOLLOW THE STEPS REQUIRED WHEN ADDING HARDWARE TO AN EXISTING SYSTEM.

When you add any optional expansion/circuit modules, COM4, DPM8, DPM16, APM4, T1, ISDN (T1/PRI), In-Skin Voicemail, AAM or Modem, to either KSU1 or KSU2, you must follow certain procedures to ensure the DX-120 configures itself properly with the newly added equipment. These procedures include performing a cold start/ initialization.



CAUTION

If your customer’s DX-120 switch uses a customized database, be sure to take these measures first to back up that database.



NOTE

If you program using the DET instead of PC-DBA, you cannot save the custom database; you will have to re-program the custom settings after performing the cold start. For further details on DX-120 programming options, see the DX-120 Technical Manual, Volume II, Programming.

Adding Hardware to an Existing System (continued on next page)

Adding Hardware to an Existing System (continued)

Adding New Hardware

- 1) Connect and login to PC-DBA.
 - See [“Accessing PC-DBA Maintenance” on page 88](#) for more information about connecting to and accessing PC-DBA).
- 2) Press F3 to perform a Receive All.

**IMPORTANT!**

Do not go on to the next step until the Receive All process is completed.

- 3) Press F7 to log out of PC-DBA.
- 4) Turn OFF the power supply to the DX-120 KSUs (i.e., move the ON/OFF switch to the OFF position).
- 5) Un-plug the DX-120 AC power cords on KSU1 and KSU2.
- 6) Begin the cold start initialization (see [“Power-up Initialization \(Cold Start\)” on page 72](#)).

Once initialization is completed:

- The default data will be loaded and ready and the telephones will be functional.
- All CO lines will ring at extension 101
- All extensions may take and place calls
- All systems features are operational per the default configuration.

**NOTE**

If you are programming using the telephone, you will have to customize the database again manually.

**IMPORTANT!**

If you are using a laptop to program the system, then log in to the PC-DBA. Press F4 and click OK to perform a Send All. The system reloads the custom database you previously saved (i.e., writing over the default database created during the cold start).

Voice Mail Doesn't Work (“No Legal Member” Error)

SOLUTION: FOLLOW THE STEPS REQUIRED WHEN INITIALIZING THE SYSTEM.

The “No Legal Member” error indicates that the DX-120 has not been properly initialized.

- You must properly initialize the system:
 - When you first install it
 - Every time you add a piece of hardware to the system (a new board, etc.).

**HINT**

If you do not have an existing database, perform a cold start initialization. Follow the procedure described under [“Power-up Initialization \(Cold Start\)” on page 72](#).

Voice Mail Doesn't Work - No Legal Member” Error (continued on next page)

Voice Mail Doesn't Work - "No Legal Member" Error (continued)

- If you have an existing database, and you have PC-DBA loaded onto a laptop, you can:
 - save the customized database
 - perform a cold start initialization (which loads a default database, writing over your custom database), and then
 - reload the saved database over the default database.

**HINT**

Follow the procedure described under ["Adding Hardware to an Existing System"](#) on page 113.

- If you have an existing database, and do not have access to PC-DBA, you must use the telephone to program the system

**HINT**

For details on DX-120 programming options, see the DX-120 Technical Manual, Volume II, Programming. When you take the system down and re-initialize it, you will have to re-program your database afterwards.

What to Do if a Normal Cold Start/Restart Is Not Possible

If circumstances on the customer site keep you from performing a cold restart, perform the following steps using the telephone.

- 1) Dial into the programming mode and enter 01-XXX-21 (where XXX represents the extension's port type).
 - The voice mail ports are in range 157-164.
- 2) Press *save*.
- 3) Press *chg* until the port type "VM" displays for this extension.
- 4) Press *HOLD* to return to the previous menu level.

OR

Press the Up or Down Volume arrows to return to the current database Item.

- 5) Return to the Selection screen.

Checking the UCD Group Numbers

- 6) Enter 06-01-XX-03-01 (where XX represents the UCD group number: e.g., 24).
- 7) Press *save* to advance to member #1 of the new UCD Group selected.
- 8) Press *chg*.
- 9) Enter the extension number of the digital channel you want to program into this member.
 - At default the digital channels of DX-120 Voicemail are 157, 158, 159, 160, 161, 162, 163, 164.)
- 10) Press *save*.
- 11) Press *next*.

Repeat steps 8 through 10 to program all voice mail channels as members of this UCD group.

What to Do if a Normal Cold Start/Restart Is Not Possible (continued on next page)

What to Do if a Normal Cold Start/Restart Is Not Possible (continued)

12) Press *HOLD* to return to the previous menu level.

OR

Press the Up or Down Volume arrows to return to the database Item

13) Return to the Selection screen.

Checking the UCD Assignment for the Voice Mail Hunt Group

14) Enter 06-02-(1~3)-01.

- *The range of numbers in the middle of this command represent the tenant group number (usually 1).*

15) Press *save* to display the Voice Mail Table for Tenant 1 – Hunt Group.

16) Press *chg* until the UCD group you want to use as the VM hunt group displays (i.e., new UCD Group selected and programmed with digital channel members.)

17) Press *next* to continue programming the various call handling digits (Prefix/Suffix).

18) Press *HOLD* to return to the previous menu level.

OR

Press Up or Down Volume arrows to return to the DB Item

19) Exit programming.

20) Test to see if these changes have corrected the problem.



IMPORTANT!

If the procedure described above does not resolve the problem with voicemail, you MUST re-initialize the system. See ["Adding Hardware to an Existing System"](#) on page 113.

Invalid Entries Calling a Busy Station (Issues with Multiple Mailbox Greetings)

SOLUTION: THE FOLLOWING ITEMS SHOULD BE APPLIED TO ALL DX-120 (PC8 IN-SKIN) VOICE MAIL SYSTEMS; BUILD 8.5.9 AND EARLIER.

1) Add the new TRANS.TXT file – 8.5.9.



NOTE

- R41 does not support multiple mailbox greetings (all users should use greeting 0).
- All characters must be entered as shown for proper programming. Commands in bold indicate changes to previously documented material, and are not to be entered as bold.
- All of these changes have been incorporated in build 8.5.10.1 and later.

```
;Direct call (internal)
alb1czdx=x*,*,#
;Direct call (external)
alb2czdx=
;Transfer from operator (internal)
a2b1czdx=x*,*,1,1
;Transfer from operator (external)
a2b2czdx=x*,*
;Busy call forward
*a3byczdx=x*,*
a3byczdx=x*,*
;No answer call forward
a4byczdx=x*,*
;Direct call forward
a5byczdx=x*,*
;Record
a6byczdx=x*,*,1,1:n
;Individual greeting for trunk 1-8
a7byczd800=
a7byczd801=
a7byczd802=
a7byczd803=
a7byczd804=
a7byczd805=
a7byczd806=
a7byczd807=;Recall (from Hold / No ans)
a8byczdx=x*,*
;UCD re-route for UCD groups 1-5
a9byd13=3301
a9byd23=3302
a9byd33=3303
a9byd34=3304
a9byd05=3305
```

(continued on next page)

(continued)

```

;UCD overflow 1 for UCD groups 1-5
a9byd1=3101
a9byd2=3102
a9byd3=3103
a9byd4=3104
a9byd5=3105
;UCD overflow 2 for UCD groups 1-5
a9byd91=3201
a9byd01=3202
a9byd*1=3203
a9byd#1=3204
a9byda1=3205
;UCD overflow for all other groups
a9bydx=

```

- 2) Remove Mail Box 157.
 - *This is a voice mail port and cannot be used as a mail box.*
- 3) Remove Custom 16384 from voice mail – it adds an asterisk (*) to the end of transfers.
 - *This causes problems with analog phones (phone rings once but are dead air when answered).*
- 4) Change the System Technical “Seconds of non silence” from 5 to 99.
 - *Hang-ups occur when a user is leaving a message if this parameter is set too low.*
- 5) Set Routing boxes 3301-3305, 3101-3105, 3201-3205 to hang up if no digit is dialed.
 - *The UCD overflow feature will not work if routing boxes are not set this way.*

Ensuring Optimum Call Handling Performance

SOLUTION: APPLY THE FOLLOWING SETTINGS TO ALL DX-120 KSUS.

CALL HANDLING TIMING	
Xfer_I Recall	60sec
Xfer_B Recall	60sec
Hold Recall SLT	5min
Hold Recall DEKT	5min
VM DIALING RATIO	
Tone Time	60ms
Int_Dgt Time	60ms

Ringling a Group Of Phones Before Routing the Call to Auto-Attendant

SOLUTION: IMPLEMENT DELAYED RINGING TO VOICE MAIL, AUTO ATTENDANT



NOTE

UCD groups 1- 5 (410-414) are used for the DX-120's built in UCD functionality with the In-skin Voice mail system.

Implementing Delayed Ringing

- 1) Set up a UCD group.



HINT

Refer to the DX-120 Technical Manual, Volume II, Programming for details about setting up UCD Groups via the Programming►Extensions menu option.

- 2) Use Hunt group 6 through 23 (415-432) when using the inskin voice mail.



EXAMPLE

This example will ring Hunt Group 6 (Directory # 415) three times and then re-route to the Voice Mail Auto Attendant.

RP: Extension Application - UCD: Parameters			
Hunt Group:	6.415		
Attribute:	UCD	Overflow 1 Timer:	10 Sec. (0-255)
Tenant Group:	1	Overflow 1 Dest.:	
Name:	UCD 6	Overflow 2 Timer:	0 Sec. (0-255)
Members:	0	Overflow 2 Dest.:	
Hunting Method:	All Ring	Overflow Count:	1 (1-128)
No Answer Timer:	10 Sec.	Re-Route Dest.:	24.433
<input type="button" value="Update"/> <input type="button" value="Initialize(F8)"/> <input type="button" value="Close"/> <input type="button" value="Help"/>			

Implementing Delayed Ringing (continued on next page)

*Implementing Delayed Ringing (continued)****Set up the CO line Answering Position.***

- 3) Make the specified UCD Group the only Destination for Day / Eve.
- 4) Set Pre-CFW NoAns to NULL.

Extension Alarm Play Time:	30	▼	Sec.
FAX Ring Time:	10	▼	Sec.
Hold Abandon:	600	▼	ms
Hold Reminder:	30	▼	Sec.
Meet Me Conference Talk Time:	0	▼	Min.
Pause Time:	2.0	▼	Sec.
PBX Flash:	0.6	▼	Sec.
Predefined Forward Time:	10	▼	Sec.
	10		
	12		
	14		
	16		
Dialing Ratio:			

Implementing Delayed Ringing (continued on next page)

*Implementing Delayed Ringing (continued)***INSKIN VOICE MAIL**

- If you use UCD groups 6 through 23, you do not have to modify TRANS.TXT unless you want a specific routing box or mailbox to answer.
- If you use UCD group 1 through 5, you must modify the TRANS.TXT to route the integration to the proper Routing Box/greeting desired.

**EXAMPLE****PC8:**

- UCD Group 1 (410) will re-route to Voice mail with the string; **a9b2d13**. The line in the TRANS.TXT currently reads:

```
a9byd13=3301
```

- Modify this line to read:

```
a9byd13=9
```

- Make sure the initial routing box destination for digit 9 is the routing box's extension number.
- UCD group 6 (415) will re-route to VM with the String; **a9b2d63**. This digit string will get a success on the rule:

```
a9bydz=
```

- The above will follow the voice mail's Line Information screen to answer the call based on Day, Lunch or Night. So, if you need the voice mail to answer with a different greeting, (i.e., routing box 805) you must add a line to the TRANS.TXT above the following rule:

```
a9byd63=805
```

```
a9bydz=
```

EXTERNAL VOICE MAIL: DEBUT-SMALL OFFICE LITE**EXAMPLE**

UCD group 1 (410) will re-route to voice mail and receive the digit string: **348** requiring a rule to be added **3X=9** or **348=805**

**NOTE**

This method can be used for Auto Attendant options when customers, for example, want to press 4 for technical support, ring a group of phones, and then route back to Voice mail and play a specific greeting.

Using Multiple Lines & Assigning Different Auto-Attendant Greetings for Each Line

SOLUTION: CO LINE ROUTING

Both of the following examples will use:

- Trunks 1-2 for Company A
- Trunks 3-5 for Company B
- Trunks 6-8 for Company C.



EXAMPLE

- **Example 1 - Voice Mail Answers Incoming CO Lines Immediately**

1) Set the Day and or Eve answering positions to directory 433 (Voice Mail Hunt Group).

When the DX-120 forwards a call to Voice Mail hunt group 24 (dir 433) the following in-band digits are sent to voice mail.

a7byezd800 for line 1	a7byezd801 for line 2
a7byezd802 for line 3	a7byezd803 for line 4
a7byezd804 for line 5	a7byezd805 for line 6
a7byezd806 for line 7	a7byezd807 for line 8

CO Line Routing - Example (continued on next page)

CO Line Routing - Example (continued)



EXAMPLE (continued)

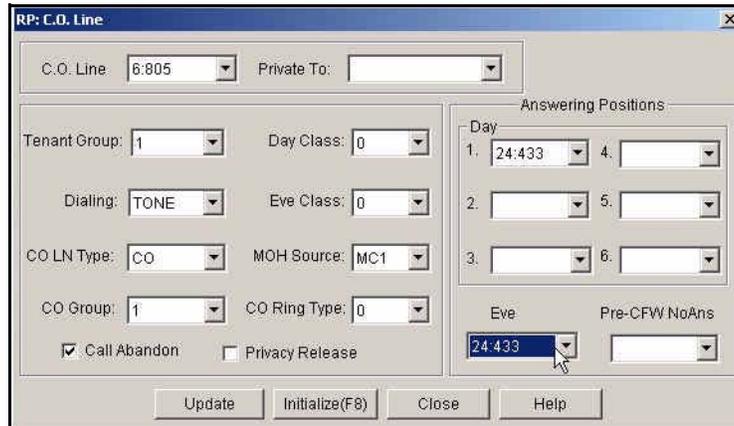
- 2) Assuming that:
- Company A will be using Routing Box 800 to answer incoming calls;
 - Company B will use Routing Box 810, and
 - Company C will use Routing Box 820.

Add the following lines to the top of the TRANS.TXT file.

```
a7byczd800 = 800
a7byczd801 = 800
a7byczd802 = 810
a7byczd803 = 810
a7byczd804 = 810
a7byczd805 = 820
a7byczd806 = 820
a7byczd807 = 820
```

• Example 2 - Incoming CO lines ring a UCD group first then re-route to Voice Mail if no one answers

- 1) Set the Day answering positions to their respective UCD group numbers.
- CO Lines 1& 2 will be answered by UCD group 415
 - CO Lines 3, 4, & 5 will be answered by UCD group 416
 - CO Lines 6, 7, & 8 will be answered by UCD group 417



The following UCD group 6 (dir 415) will ring all phones approximately three to four rings, then re-route to Voice Mail with the following in-band digits.

```
a9b2d63
```

CO Line Routing - Example (continued on next page)

CO Line Routing - Example (continued)



EXAMPLE (continued)

The following line is needed at the top of the TRANS.TXT file.
a9b2d63 = 800

The following UCD group 7 (dir 416) will ring all phones approximately three to four rings, then re-route to Voice Mail with the following in-band digits.
a9b2d73

The following line is needed at the top of the TRANS.TXT (C:\VM\TRANS.TXT) file.
a9b2d73 = 810

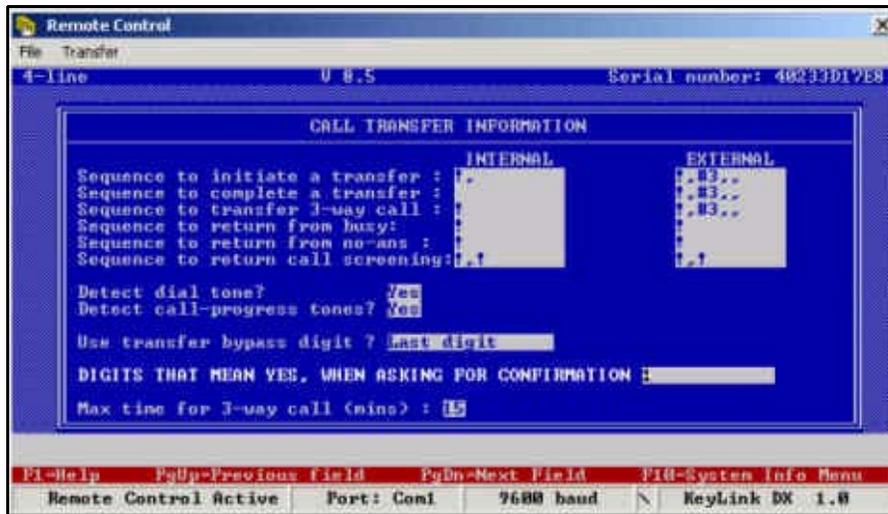
The following UCD group 8 (dir 417) will ring all phones approximately three to four rings then Re-Route to Voice Mail with the following in-band digits a9b2d83. The following line is needed at the top of the TRANS.TXT file.

a9b2d83 = 820

Setting Up Message Delivery to a Cell Phone

SOLUTION: USE REMOTE.EXE* FOR EXTERNAL TRANSFERS WITH VOICE MAIL

- If the system has In-Skin or analog voice mail, and uses Centrex transfer on the same CO line: go to the Call Transfer Information screen in voicemail, then enter the following values in the External column.
 - Sequence to initiate a transfer: !,#3,,
 - Sequence to complete a transfer: !,#3,,
 - Sequence to transfer a 3-way call: !,#3,,



- If the system has 3-way call transfer or analog voice mail 3-way call transfer, and uses one voice mail port with two CO lines, go to the Call Handling screen in PC-DBA: enter the following values in the External column.
 - Sequence to initiate a transfer: !,9,
 - Sequence to complete a transfer: !,3,/
 - Sequence to transfer a 3-way call: !,3,

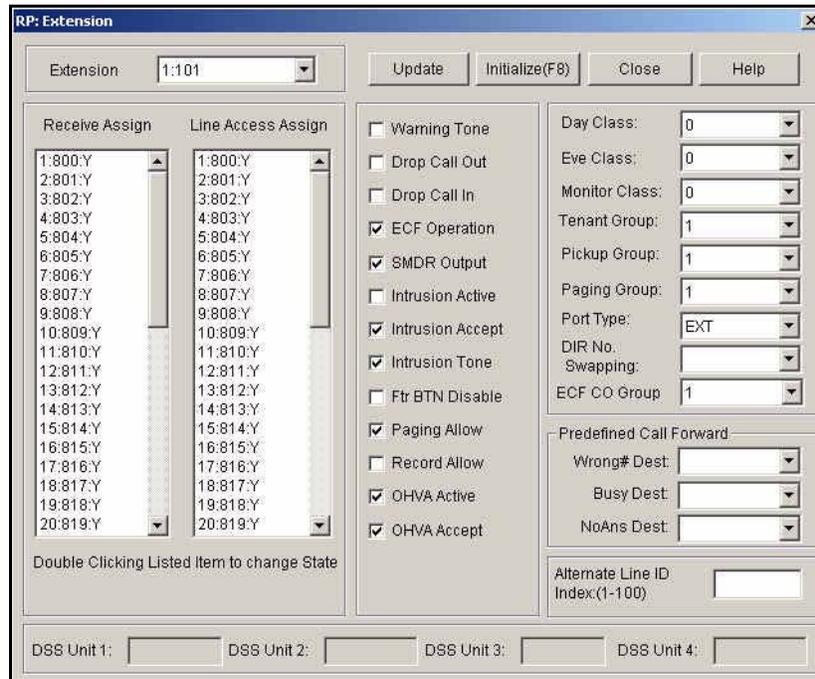


**Remote.exe is designed and maintained as DOS (only) based program.*

External Transfers with Voice Mail (continued on next page)

External Transfers with Voice Mail (continued)

- You must enable ECF.
 - Go to the DX-120 Extension screen:
 - Click on check box of the ECF Operation field to place a checkmark there (i.e., to enable the feature).


**NOTE**

If you are using the phone to program, and enter 01-XXX-18 (where XXX represents the station number). So, to program station 102 you would enter 01-102-18, to program station 123 you would enter 01-123-18, etc.

Using Prime CO Instead of Intercom with Modem or Fax

SOLUTION: ANALOG PRIME LINE—SETTING UP A PRIME LINE FOR A FAX CONNECTED TO AN ANALOG PORT USING CO LINE 4.

Place Line 4 (803) into CO Group2 (740)

From the Fax Machine

- 1) Remove the receiver from the hook.
- 2) Dial 740 (be sure you are accessing line 4).
- 3) Dial a valid number.



NOTE

You must dial out on that line /(line group) before programming the hot line (dial 800 for line 1, 801 for line 2, 802 for line 3 etc....).

- 4) Program a System Speed dial bin with a pause.
 - To do this, you can use PCDBA (see below) or program using the phone (see next page).

Use PCDBA to Program the System Speed Dial Bin with a Pause

- 5) Go to the DX-120 PC-DBA System Resource SPD. No. Programming Tenant 1 screen in PCDBA.
- 6) Choose a system speed dial bin (DIR#s 500-699), and insert a P for pause in its SPD. No. field.

The screenshot shows two windows from the PCDBA software. The top window is titled "RP: Resource -SPD. No. Assignment And Programming". It has a "System SPD" section with a "Tenant" dropdown set to "1" and a "Number of SPD. (for Tenants)" dropdown set to "200". Below this is a table with columns "No.", "DIR#", "SPD. No.", and "CO Group". The table contains four rows: (1, 500, P, 1), (2, 501, , 1), (3, 502, , 1), and (4, 503, , 1). Below the table are input fields for "No." (1), "DIR#" (500), "SPD. No." (P), and "CO Group" (1). The bottom window is titled "Extension SPD" and has an "Extension:" dropdown set to "1:101" and a "Number of SPD. (for Extension)" dropdown set to "20". It has a similar table with columns "No.", "DIR#", "SPD. No.", and "CO Group". The table contains four rows: (1, 470, , 1), (2, 471, , 1), (3, 472, , 1), and (4, 473, , 1). Below the table are input fields for "No." (1), "DIR#" (470), "SPD. No." (), and "CO Group" (1). At the bottom of the windows are buttons for "Update", "Initialize(F8)", "Close", and "Help".

OR

Place Line 4 (803) into CO Group2 (740) from the Fax Machine (continued on next page)

Place Line 4 (803) into CO Group2 (740) from the Fax Machine (continued)

Use the Telephone

6) Dial into the programming mode and enter the following commands.

- *FEATURE # **
- *Enter the password. The default is #####.*
- *Show*
- *04-09-1 [Tenant 1]*
- *Save*
- *500~699 [System Speed dial bin number]*
- *Show*
- *Chg*
- *Feature 7 0*
- *Save*

From the Fax Machine

7) Remove the receiver from the hook.

8) Program the fax extension as a hot line to that system speed dial bin number.

9) Dial (# 9 * 500 0).

- *A confirmation tone is heard.*



NOTE

- *Every time the fax machine goes off hook, line 4 will be accessed.*
- *To cancel do a hook flash and dial # * 9 *.*

Digits Passed Inband to the Voice Mail in an Overflow 1 Condition

SOLUTION: UCD OVERFLOW 1 INTEGRATION TO VOICE MAIL

The following table shows what the switch passes inband to the Voice Mail during an Overflow 1 condition.

Overflow from UCD groups / In band Strings / Digits Received			
Hunt Group #	UCD#	In-Skin	Associated VM Routing Box
1	410	a9byd1	3101
2	411	a9byd2	3102
3	412	a9byd3	3103
4	413	a9byd4	3104
5	414	a9byd5	3105
6	415	a9byd6	
7	416	a9byd7	
8	417	a9byd8	
9	418	a9byd9	
10	419	a9byd0	
11	420	a9byd*	
12	421	a9byd#	
13	422	a9byda	
14	423	a9bydb	
15	424	a9bydc	
16	425	a9bydd1	
17	426	a9byd11	
18	427	a9byd21	
19	428	a9byd31	
20	429	a9byd41	
21	430	a9byd51	
22	431	a9byd61	
23	432	a9byd71	
24	433	a9byd81	Voice Mail UCD

Digits Passed Inband to the Voice Mail in an Overflow 2 Condition

SOLUTION: UCD OVERFLOW 2 INTEGRATION TO VOICE MAIL

The following table shows what the switch passes inband to the Voice Mail during an Overflow 2 condition.

OVERFLOW FROM UCD GROUPS / IN BAND STRINGS / DIGITS RECEIVED			
Hunt Group #	UCD #	In-Skin	Associated VM Routing Box
1	410	a9byd91	3201
2	411	a9byd01	3202
3	412	a9byd*1	3203
4	413	a9byd#1	3204
5	414	a9byda1	3205
6	415	a9bydb1	
7	416	a9bydc1	
8	417	a9bydd2	
9	418	a9byd12	
10	419	a9byd22	
11	420	a9byd32	
12	421	a9byd42	
13	422	a9byd52	
14	423	a9byd62	
15	424	a9byd72	
16	425	a9byd82	
17	426	a9byd92	
18	427	a9byd02	
19	428	a9byd*2	
20	429	a9byd#2	
21	430	a9byda2	
22	431	a9bydb2	
23	432	a9bydc2	
24	433	a9bydd3	Voice Mail UCD

Digits Passed Inband to the Voice Mail in a Re-Route Condition

SOLUTION: UCD RE-ROUTE INTEGRATION TO VOICE MAIL

The following table shows what the switch passes inband to the Voice Mail during a re-route condition.

TRANSFERRING TO UCD GROUPS / IN BAND STRINGS / DIGITS RECEIVED			
Hunt Group #	UCD #	In-Skin	External Voice Mail
1	410	a9b2d13	348
2	411	a9b2d23	349
3	412	a9b2d33	350
4	413	a9b2d43	351
5	414	a9b2d53	352
6	415	a9b2d63	353
7	416	a9b2d73	354
8	417	a9b2d83	355
9	418	a9b2d93	356
10	419	a9b2d03	357
11	420	a9byd*3	358
12	421	a9byd#3	359
13	422	a9byda3	360
14	423	a9bydb3	361
15	424	a9bydc3	362
16	425	a9bydd4	363
17	426	a9b2d14	364
18	427	a9b2d24	365
19	428	a9b2d34	366
20	429	a9b2d44	367
21	430	a9b2d54	368
22	431	a9b2d64	369
23	432	a9b2d74	370
24	433	N/A	Voice Mail UCD

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INDEX

Numerics

408E 19
408M 11, 18

A

AAM 10, 25, 60
 adding 60
 installation 60
 installing 60
AAM (Automated Attendant Module) 25
AC transformer 16
Accessing PC-DBA maintenance 88
Adding
 AAM 60
 APM4 54
 bell 66
 COM4 56
 digital port module 68
 door control 67
 DPM16 68
 DPM8 52
 external pager 65
 gate control 66, 67
 hardware to an existing system 113
 KSU2 Second Cabinet 61
 KSU2 second cabinet 61
 MDM 58
 music source 63
 new hardware 114
 pager 65
 PRI 69
 second cabinet 61
 T1 69
Add-on modules, KSU assembly 51
APM4 10, 20, 54
 adding 54
 installing 55
Assembling
 KSU 51
 MDF 43
Automated attendant 12, 25

B

Battery requirements 16
Bell
 adding 66
 installing 66
Block control 108
Boards, self test 92

C

Cable 83
 connect serial 70, 71
 connection 83
 ribbon 18
Call handling performance, optimum 118
Capacity, system 32
Card
 adding PRI 69
 adding T1 69
 installing PRI 69
 installing T1 69
 T1 26
Cell phone message delivery 125
Central office module 23
Central processor module 17
Channel, music 63, 64
CID 29
Cleaning telephones 75
Clear T1 error 112
CO
 communication 83
 DX FLASH 10
 DX HD 10
 lines 13
Cold start 72, 107
COM4 10, 22, 23, 56, 57
 adding 56
 installation 56, 57
 installing 57
Communication
 pass-through 83
 with CO DX 83
Component
 detail 36
 KSU 44, 49
Configuration 11, 89
 table 13
Connection
 cable 83
 local 84
 modem 86
 PC-DBA to switch 84
 remote 84, 86
 serial cable 70, 71
Console, DSS 30
Control
 block 108
 door 67
 gate 66, 67
 remote 105
Corrupted database 113
CPM (Central Processor Module) 17
 ribbon 18
Current draw 31

D

Data
 electrical 35
 environmental 35
 logon 105
 MTBF 39
 regulatory 38
 signaling 37, 38
 wiring 37

Database corruption 113

Delayed ringing 119

Deleting events 104

DET (Digital Executive Telephone) 29

Diagnostic quick reference 76

Diagnostics 90
 status 96

Digital executive telephone 29

Digital port module 21, 22
 adding 68, 69

Digits Passed Inband 129~131

Direct station selection 30

Directory memory mapping 105

Door control 67

DPM16
 adding 68
 installing 68, 69

DPM8 10, 21, 22, 52
 adding 52
 installing 52
 DPM16 10, 11, 22, 39
 installing 16 68, 69

Draw current 31

DSS (Direct Station Selection Terminal) 30

E

Electrical data 35

Ensuring Optimum Call Handling Performance 118

Environmental data 35

Error
 clear T1 112
 T1 seconds 111
 T1 threshold 110

Establishing a Modem Connection 86

Event 100
 deleting 104
 invoking 101

Extending ports to MDF 46

External pager 65

External Voice Mail 121

F

Facilities Interface Code 4

FCC 38

G

Gate control
 adding 66, 67
 installation 66

H

HD 10

Hardware
 adding to an existing system 113
 revision 99

I

I/O Memory Mapping 109

Initialize 73
 cold start 72
 power-up 72

Inskin voicemail 119, 121

installation 41
 AAM 60
 add-on modules 51
 APM4 55
 bell 66
 COM4 56, 57
 digital port module 68, 69
 DPM16 68, 69
 DPM8 52, 68
 environmental conditions 42
 external pager 65
 gate control 66
 KSU 44, 51
 KSU2 61
 loud bell control 66
 Main Distribution Frame 43
 MDF 48
 MDF wiring 46
 MDM 58, 59
 music source 63
 outline 41
 overview 41
 pager 65
 PRI 69
 site planning 42
 T1 69
 tools and supplies 43
 troubleshooting 113

Installing the DX-80 41

Invalid Entries Calling a Busy Station 117

Invoking event 101

Issues with Multiple Mailbox Greetings 117

K

Key Service Unit 15
Key service unit 15
KSU 10, 11, 13, 15, 18, 49
 408M 49
 add-on module 51
 assembly 51
 components 44, 49, 50, 51, 52
 configuration 15
 installation 44
 mounting 44
 wiring 46
KSU2 10, 11, 14
 408E 49
 components 11
 installation 61

L

Loading PC-DBA software 82
Local connection 84
Logon data 105
Loud bell control installation 66

M

Mailbox greetings, multiple 117
Main distribution frame planning 43
Maintenance 75
 accessing 88
 diagnostics 90
 event 100
 event deletion 104
 event invoking 101
 logon data 105
 remote control 105
 SW/HW revision 99
 system 75
 T1 110
 utilities 82, 88, 89, 91, 92, 93, 99, 105, 108, 110
Mapping memory 105, 109
Maximum configuration 14
MC1 63
MC2 64
MDF
 assembly 43
 extending ports 46
 installation 43, 48
 no 47
 preparation 43, 44
 typical installation 48
MDM (Modem Module) 10, 24, 58
 adding 58
 installation 58
 installing 59
Meantime between failure 39
Memory mapping 105
 I/O 109

Modem
 adding 58
 connection to PC-DBA 86
 installation 58
 installing 59
 module 24
Module
 adding DPM16 68
 adding T1 69
 analog port 20
 automated attendant 25
 central office 23
 digital port 21, 22
 installing DPM16 68, 69
 installing T1 69
 KSU add-on 51
 PRI 69
 self test boards 92
 T1 26
Mounting KSU 44, 45
MTBF (mean-time between failure) data 39
Multiple
 lines 122
 mailbox greetings 117
Music
 adding source 63
 channel1 17
 channel2 17
 channel MC1 63, 64
 channel MC2 64
 selecting 63, 64
Music source 63

N

No
 legal member 114
 MDF 47
Numbers registration 38

O

Operating temperature 35
Optional equipment 10
Overflow1 129
Overflow2 130
Overview 9

P

Pager
 adding 65
 installing 65
 Paging system installation 65
 Pass-through 83
 PC8-Inskin 121
 PC-DBA
 connecting serial cable 70
 connecting to switch 84
 loading 82
 local connection 84
 modem connection 86
 remote connection 86
 Performance, call handling 118
 Planning site 42
 Polyswitch 19
 Ports
 extending to MDF 46
 self test 93
 Power supply 16
 Power-up 72
 initialization (cold start) 72
 Preparing main distribution frame 43, 44
 PRI, installing 69
 Prime CO 127
 Problems not related to system issues 75

Q

Quick reference, diagnostic 76

R

Registration numbers 38
 Regulatory data 38
 Remote
 connection 84, 86
 control 105
 Replacing
 408E 50
 408M 50
 Re-route 131
 Revision, HW/SW 99
 Ringer Equivalence Number 4
 Ringing
 delayed 119
 group of phones before routing to AAM 119

S

Second cabinet 61
 adding 61
 Selecting
 external music 64
 internal music 63
 music 63, 64
 Self test 90
 boards 92
 modules 92
 ports 93
 system 91
 Serial cable, connecting 70, 71
 Service order code 3
 Setting up message delivery to a cell phone 125
 Signaling
 central office-PSTN data 37
 internal data 38
 Site planning 42
 SMDR 15
 connecting serial cable 71
 Software
 adding to existing system 113
 cold start 107
 loading 82
 revision 99
 warm start 106
 Solutions 75
 Source, music 63
 Specifications 31
 current draw 31
 electrical data 35
 environmental data 35
 mtbf (mean-time between failure) data 39
 signaling (internal) data 38
 system criteria and capacity 32
 wiring data 37
 Start
 cold 107
 warm 106
 Static electricity 1
 Status 96
 Storage temperature 35
 Supplies needed for installation 43
 SW/HW Revision 99
 Switch, remote connection 84
 System
 capacity 32
 characteristics 10
 communication 83
 configuration 13
 criteria and capacity 32
 installation 41
 maintenance 75
 self test 91
 technology 9
 System data
 electrical 35
 environmental 35

I

T1
 adding 69
 capacity 26
 card 26
 clear error 112
 error seconds totals 111
 error threshold 110
 installing 69
 maintenance 110
 module 26
Technical problems 75
Telephones, cleaning 75
Temperature
 operating 35
 storage 35
Test
 boards 92
 modules 92
 ports 93
 system 91
Threshold, T1 error 110
Tools and supplies 43
Totals, T1 error seconds 111
Troubleshooting 75, 113

U

Unit (component) detail 36
User maintenance 75
USOC Code 4
Utilities 88, 89, 91, 92, 93, 99, 105, 108, 110
 maintenance 82, 89, 95, 96

V

Voice processing modules 12
Voicemail 119
 external 121
 inskin 121
 small office lite 121
 troubleshooting 114

W

Warm start 106
Wiring data 37

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