SX-200® DIGITAL
PRIVATE AUTOMATIC BRANCH EXCHANGE (PABX)

CONTROL SHEET - VOLUME 3 (PN 9108-092-003-NA)
ENGINEERING, MAINTENANCE and TROUBLESHOOTING
CONTENTS - THIS VOLUME

Section Number	Title	Issue
MITL9108-093-003	Volume 3 Index	2
MITL9108-093-180	Engineering Information	2
MITL9108-093-350	Troubleshooting	2
MITL9108-093-351	RS-232 Maintenance Terminal	2
MITL9108-093-353	Maintenance Information	2

CONTENTS - OTHER VOLUMES

Volume 1 GENERAL DESCRIPTION (PN 9108-092-001-NA)

Section Number	Title	Issue
MITL9108-093-001	Volume 1 Index	2
MITL9108-093-000	Documentation Index	2
MITL9108-093-100	General Description	2
MITL9108-093-105	Features Description	2
MITL9108-093-150	Ordering Information	2
MITL9108-093-220	Automatic Route Selection (ARS) and Toll Control	2
MITL9108-093-221	Station Message Detail Recording (SMDR)	1
MITL9108-093-223	Abbreviated Dialing	2
MITL9108-093-230	Tenanting	2
MITL9108-093-450	Traffic Measurement	2

CONTENTS - OTHER VOLUMES

Volume 2 INSTALLATION AND CUSTOMER DATA ENTRY (PN 9108-092-002-NA)

Section Number	Title	Issue
MITL9108-093-002	Volume 2 Index	2
MITL9108-093-200	Installation	2
MITL9108-093-206	Installation Forms	2
MITL9108-093-210	Customer Data Entry	2
MITL9108-093-320	System Test Procedures	2

Volume 4 PERIPHERALS INFORMATION (PN 9108-092-004-NA)

Section Number	Title	Issue
MITL9108-093-004	Volume 4 Index	2
MITL9108-093-060	Bay Power Supply Description	2
MITL9108-093-106	SUPERSET 3™ Set Information	2
MITL9108-093-107	SUPERSET 4™ Set Information	2
MITL9108-093-125	Circuit Card Descriptions	2
MITL9108-093-315	Attendant Console Description	2

SX-200® DIGITAL
PRIVATE AUTOMATIC BRANCH EXCHANGE (PABX)
ENGINEERING INFORMATION

CONTENTS PAGE

CONTENTS (CONT'D) PAGE

CONTENTS (CONT'D) PAGE

LIST OF ILLUSTRATIONS

LIST OF TABLES

1. GENERAL

Introduction

1.01 This Section provides engineering information for the SX-200® DIGITAL PABX, with either Generic 1000 or Generic 1001 software.

Reason for Reissue

1.02 This Section has been reissued to detail Engineering Information for the SX-200® DIGITAL PABX, in 336-Port and 480-Port configurations.

2. SYSTEM OVERVIEW

General

2.01 The SX-200® DIGITAL PABX is an advanced electronic Private Automatic Branch Exchange employing digitally controlled solid-state, space and time division switching with stored-program control.

2.02 The maximum possible combination of trunks and lines which can be accommodated is illustrated in Figures 2-1 and 2-2. Figure 2-3 shows the SX-200® DIGITAL PABX as the focal point of an automated office, where apart from providing a comprehensive range of PBX functions, it acts as a sophisticated interface and switching system for a wide range of equipment.

2.03 The PABX is electrically compatible with most existing telephones, Private Branch Exchange (PBX) and Central Office (CO) equipment, and provides:

- The use of a flexible numbering plan.
- The simultaneous use of DTMF and rotary dial (RD) stations.
- Extensive selection of standard and optional features.
- Freedom from scheduled maintenance.
- Automatic diagnostics.
- Optional uninterruptable power supply (UPS).
- The use of SUPERSET 3™ and SUPERSET·4™ electronic telephone sets.

Maintenance

2.04 Modular design and functional packaging of the equipment permits rapid location and replacement of defective components. Circuit malfunctions are detected by diagnostic routines automatically initiated by the MCC. Diagnostic routines, detailed in Section MITL9108-093-353-NA, General Maintenance Information, and Section MITL9108-093-350-NA, Troubleshooting, direct service personnel to the defective circuit card or assembly, and identify the required field-replaceable unit. Diagnostic routines and maintenance procedures do not interfere with users unaffected by the malfunction.

2.05 System expansion is achieved by the addition of plug-in line and trunk printed circuit cards. Lines are added in increments of 12 or eight, SUPERSET® sets are added in increments of eight or six, CO trunks in increments of six or four, and Tie trunks in increments of two or one.

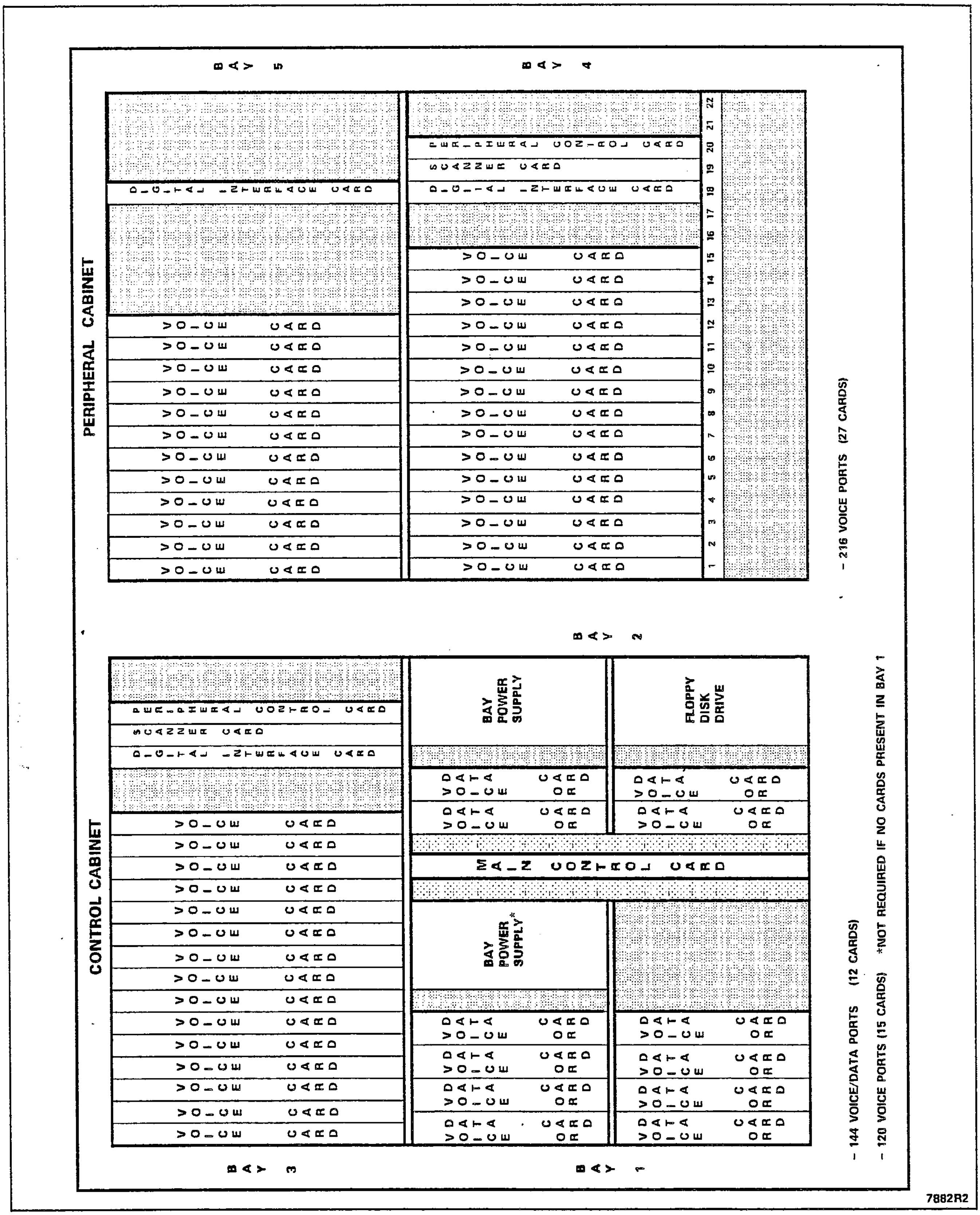


Figure 2-1 SX-200® DIGITAL PABX Bay and Slot Assigment - 480 Port Configuration

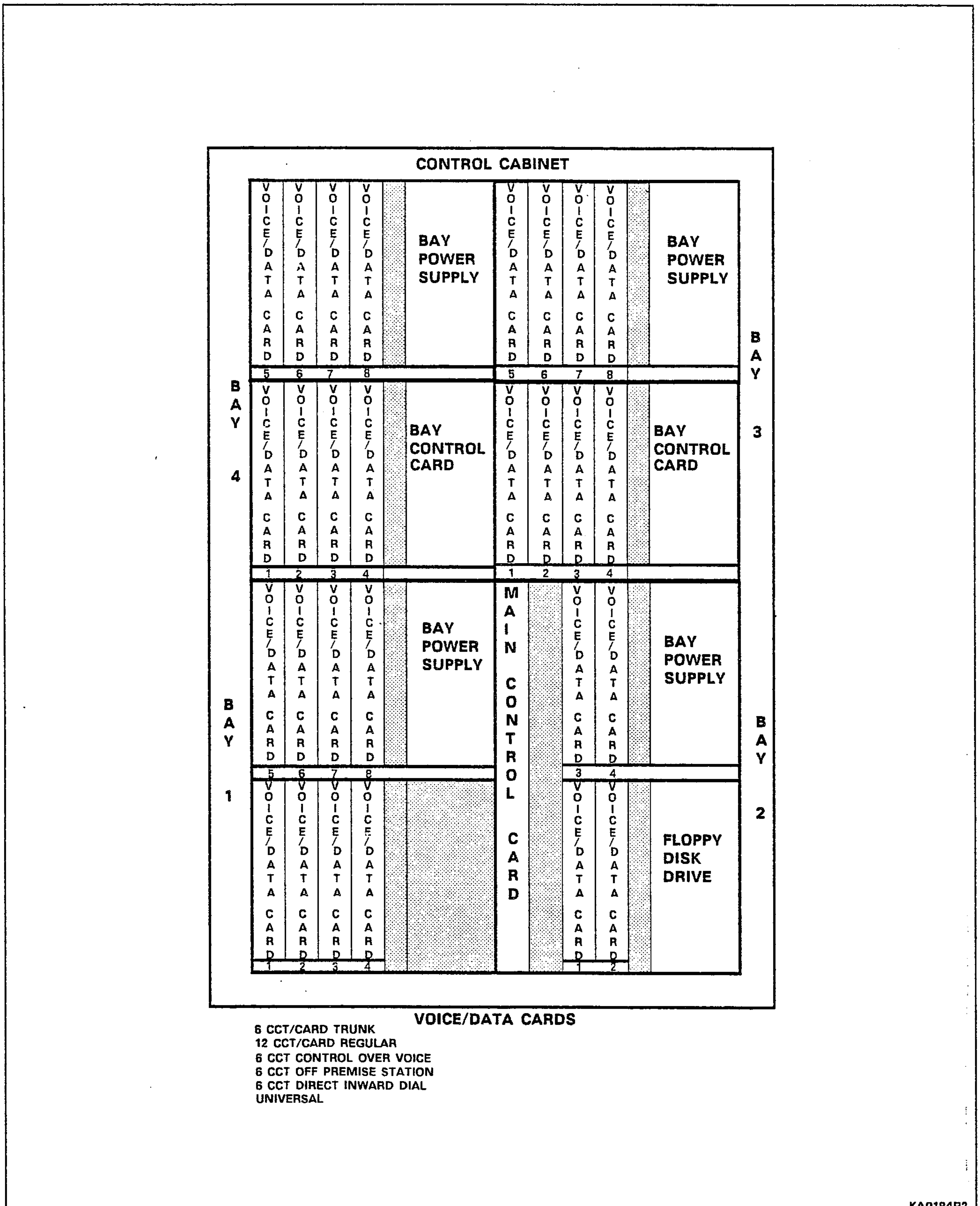


Figure 2-2 SX-200® DIGITAL PABX Bay and Slot Assignment - 336 Port Configuration

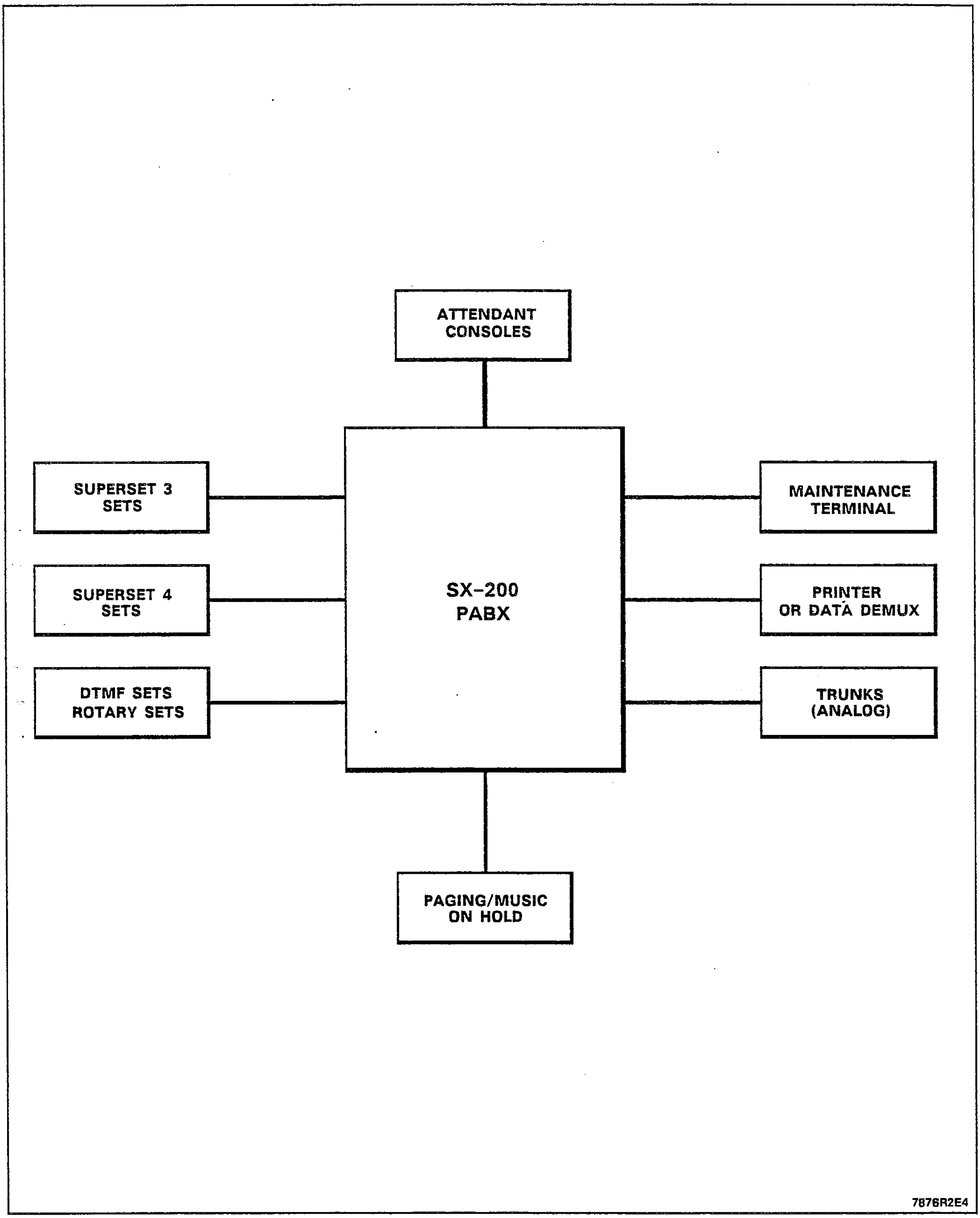


Figure 2-3 SX-200® DIGITAL PABX Peripherals

3. PHYSICAL DESCRIPTION

General

3.01 Each equipment cabinet (refer to Figures 3-1 through 3-4), is of metal construction and has the following dimensions: height 965 mm (38 in.), width 600 mm (23.5 in.) and depth 700 mm (27.5 in.). A fully equipped system weighs approximately 400 kg (900 lb).

3.02 All connections from the cross-connecting terminals to the equipment cabinets are made using connectorized cables. Connections between the cross-connecting terminals and external equipment are made in accordance with accepted practice.

3.03 As an option, the SX-200® DIGITAL PABX may be fitted with a customer-supplied uninterruptible telephone standby power supply (UPS). The reserve power should maintain system operation for approximately 2 hours in the event of a primary power failure. Each cabinet in a multi-cabinet system must be fitted with one dedicated UPS. Refer to the manufacturer's instructions for information on installation and maintenance.

Control Equipment Cabinet

3.04 The door on the front of the SX-200® DIGITAL control equipment cabinet, Figure 3-1, provides access to the system maintenance panel, two digital equipment bays, one analog equipment bay and the Main Control (MC) card. The rear doors provide access to the backplanes, equipment interface connectors, and the rear door power supply. Connection to an optional peripheral equipment cabinet is made through the cable ducts located at the bottom of either of the cabinet side panels.

Universal Equipment Cabinet

3.05 The Universal cabinet is similar to the existing Control cabinet. The major differences are: its maintenance panel is located immediately above the digital Control shelf, its Floppy Disk Drive plugs directly into the backplane, it can have a digital Peripheral shelf, and its Main Control Card directly controls up to three 6-circuit Power Fail Transfer cards. The SX-200® DIGITAL PABX in the Universal cabinet can be expanded by installing either a 120-port shelf or a 192-port shelf above the maintenance panel. The SX-200® DIGITAL PABX 480-port configuration Control cabinet (Figure 3-2) is created by installing a 120-port shelf (Bay 3) above the Control shelf (Generics 1000 and 1001). An optional 216-port Peripheral cabinet (Bays 4 and 5) may be connected to the PABX. The SX-200® DIGITAL PABX 336-port configuration Control cabinet (Figure 3-3) is created by installing one 192-port digital shelf (Bays 3 and 4) above the Control shelf (Generic 1001). Bays 3 and 4 are each similar to Bay 1.

Peripheral Equipment Cabinet

3.06 The door on the front of the SX-200® peripheral equipment cabinet (Figure 3-4) provides access to the peripheral maintenance panel, and two analog equipment bays. The rear doors provide access to the backplanes, equipment interface connectors and the rear door power supply. Connection to the control equipment cabinet is made through the cable ducts located at the bottom of either of the cabinet side panels.

Maintenance Panels

3.07 The control maintenance panel provides access to the system through the RS-232 maintenance ports and the test line connectors. Only one of the maintenance ports (LOCAL or REMOTE) may be used at one time. The test line connector permit the use of either RJ-11 or "banana plug" type connectors. Also housed on the control maintenance panel are the Power Fail Transfer (PFT) control switches and the power on/off switch and LED indicator for Bay 3.

3.08 The Universal Control cabinet maintenance panel contains a local RS-232 maintenance terminal port, test line connectors (RJ-11 or banana plug), Power Fail Transfer switch, and a modular console connector. The remote maintenance terminal port connector is located at the lower rear of the cabinet near the cable entry.

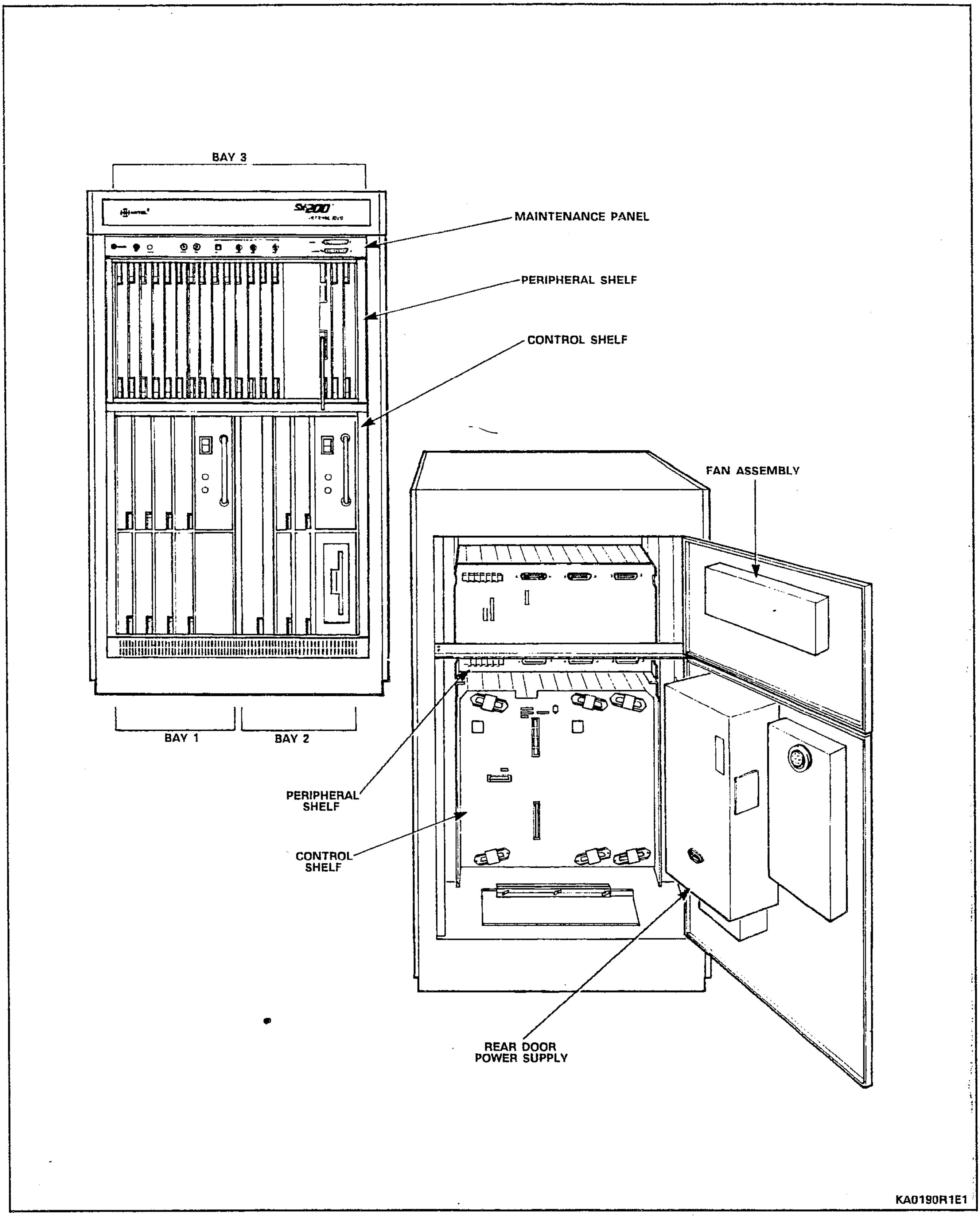


Figure 3-1 Control Cabinet

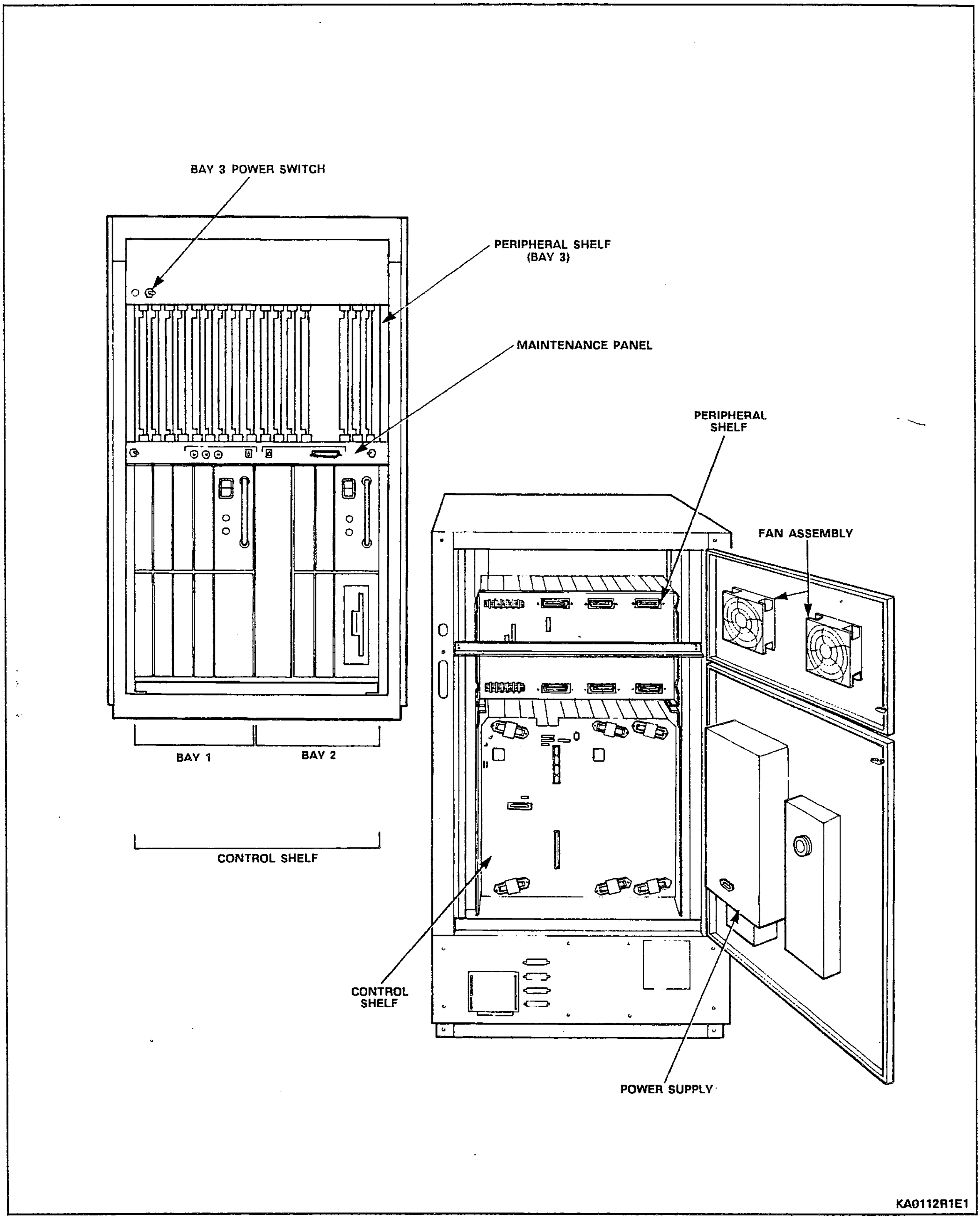


Figure 3-2 Universal Cabinet with Peripheral Bay

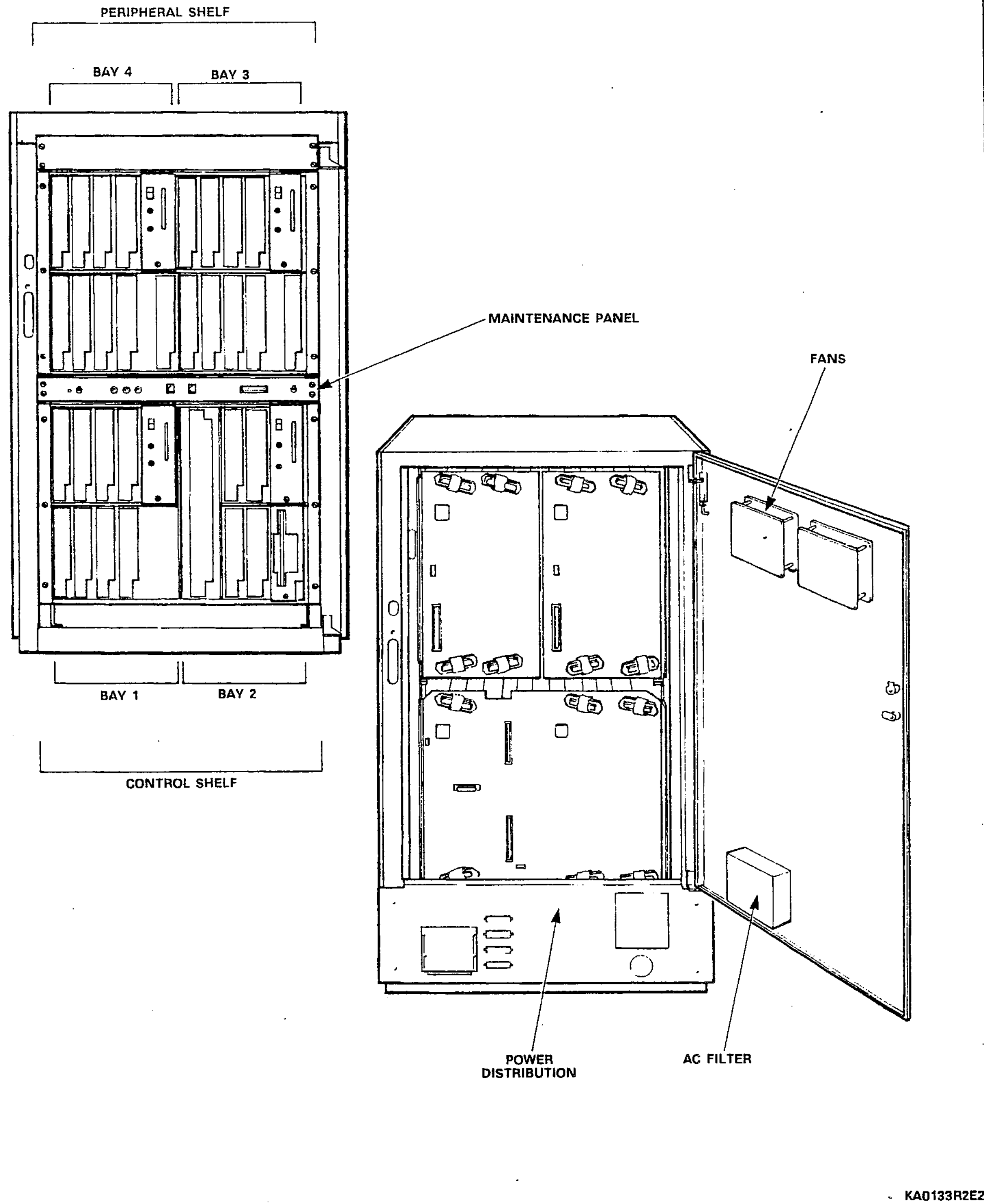


Figure 3-3 Universal Cabinet with Digital Peripheral Bays

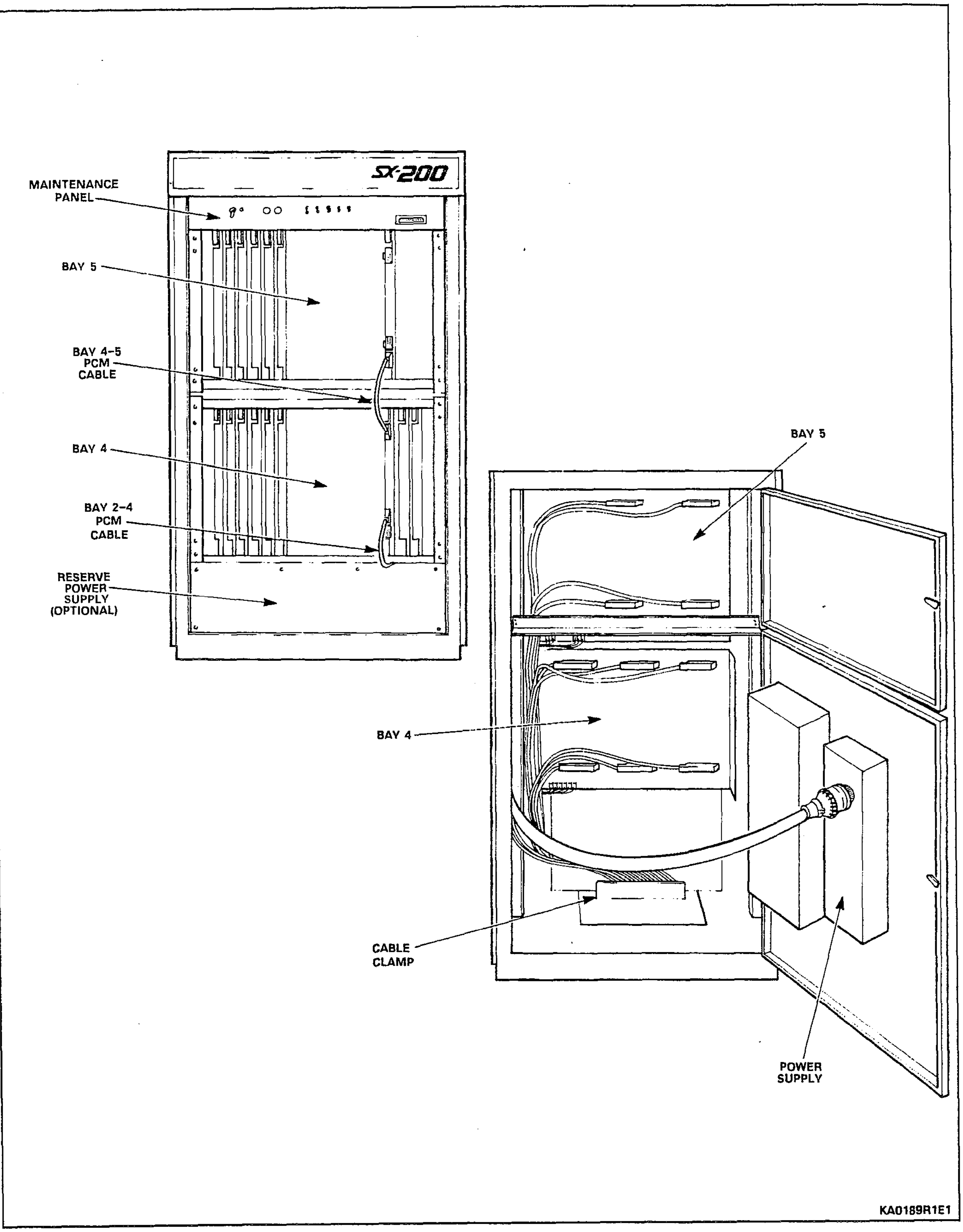


Figure 3-4 Peripheral Cabinet

Power Supplies

3.09 The power supplies for the digital bays are card-mounted and slide into the card shelf from the front. The power supplies for the analog peripheral bays (one for Bay 3, and one for Bays 4 and 5) mount directly on the cabinet back door (weight: 31.8 kg (70 lb)).

Printed Circuit Cards

3.10 All circuit cards (see Figures 3-5 and 3-6) within the PABX consist of a fibreglass board with printed wiring patterns on both sides. Riveted to the front of each board is a transparent faceplate which allows the LEDs mounted on the front of the boards to be easily seen. The digital bay cards have a single extractor located at the bottom of each card, while the analog bay cards have colour-coded card extractors located at the top and bottom of the faceplate. The extractors ensure that the card is seated correctly in the backplane connector; the coloured extractors identify the card position within an analog bay.

Attendant Console

3.11 The SX-200® DIGITAL Attendant Console (Figure 3-7) is enclosed in an attractive streamlined housing. Located on the left side of the console are a pair of handset/headset RJ-11 connectors, allowing simultaneous operation and supervision. The console keyboard contains two rows of seven function keys, two rows of five softkeys, and full number key pad. The console LCD display, mounted above the keyboard, displays the active state of calls in progress, current system alarm status, and other information.

3.12 A complete description of the Attendant Console is given in Section MITL9108-093-315-NA, Console Description and of its operation in the Console Operating Instructions handbook.

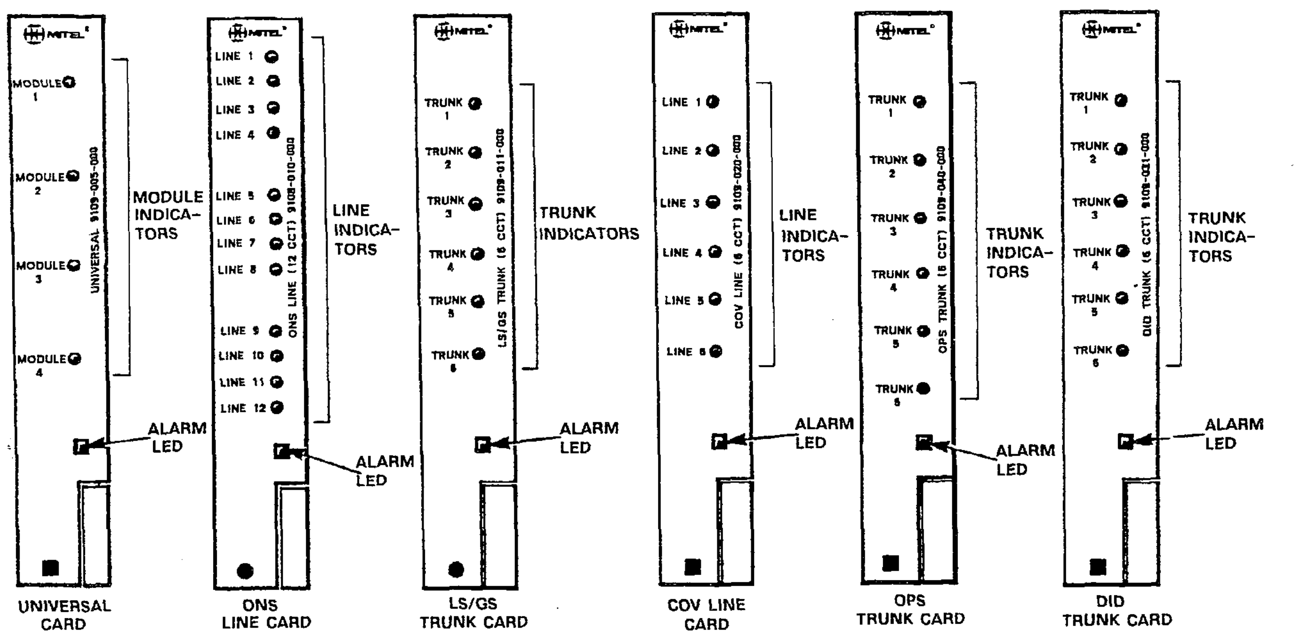


Figure 3-5 SX-200® Peripheral Cards

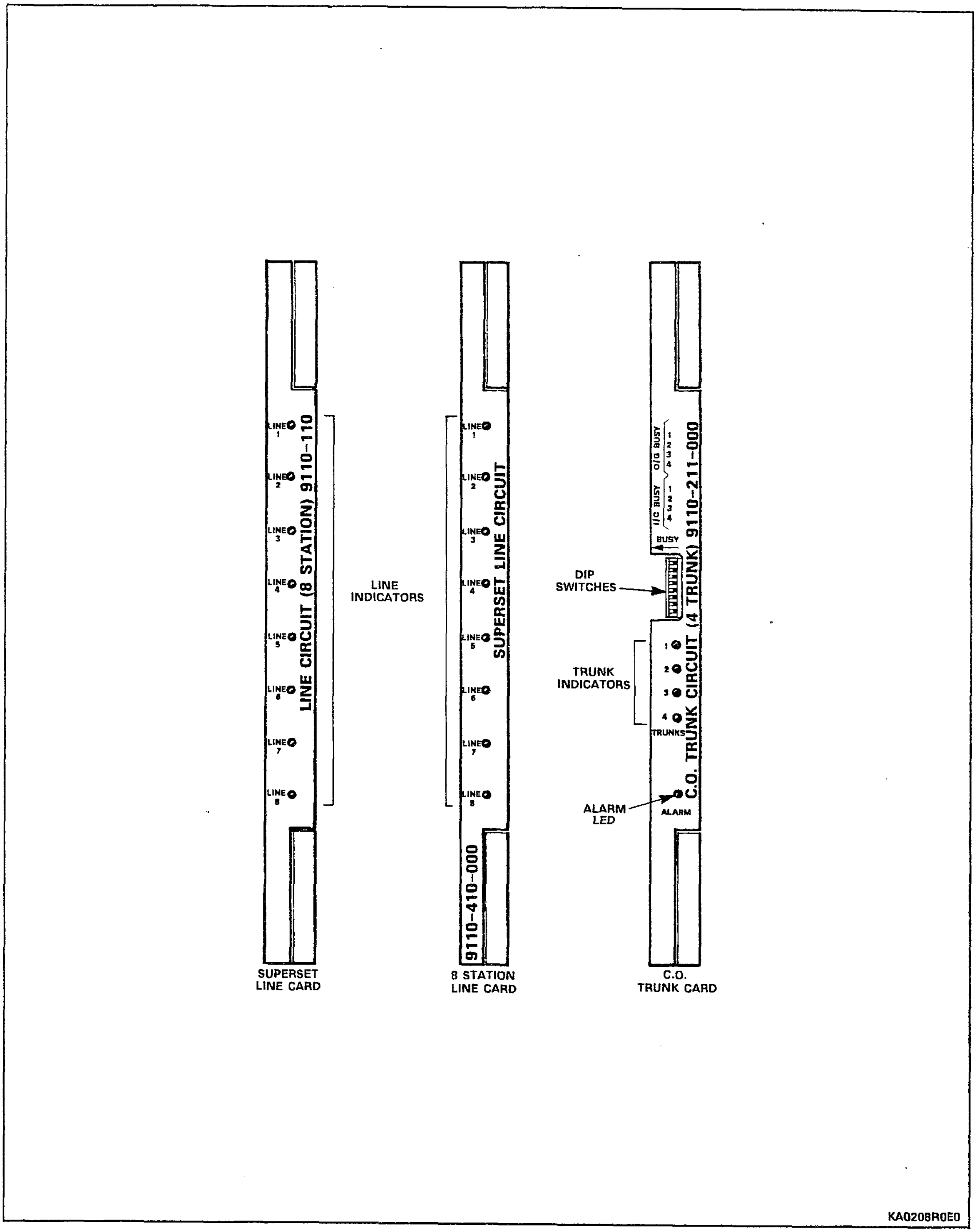
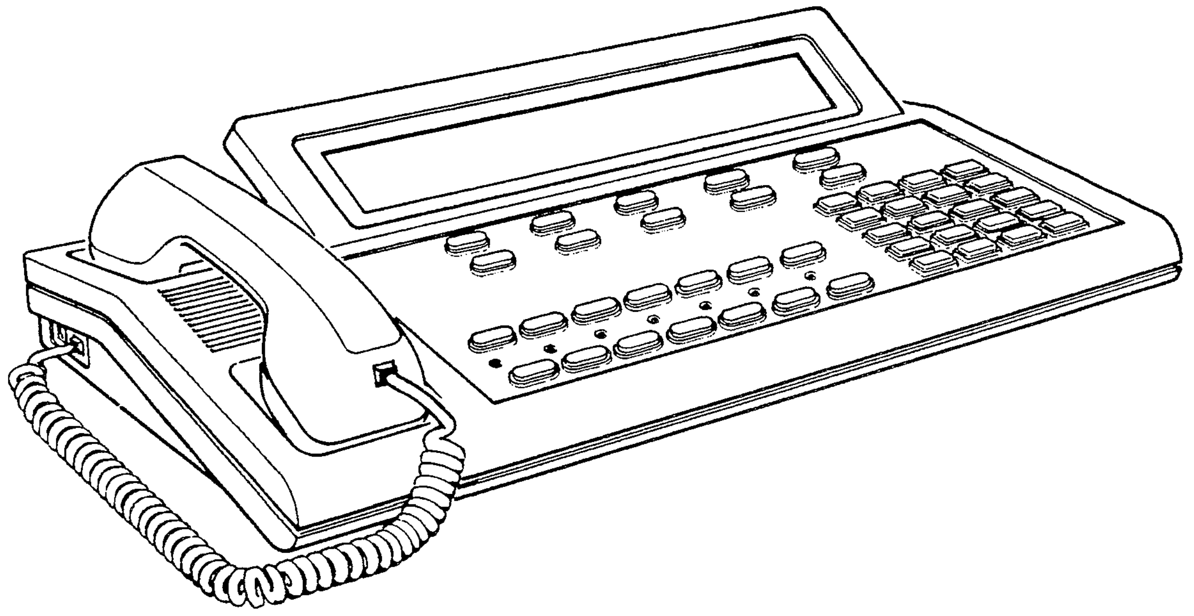


Figure 3-6 SX-200® Peripheral Cards



7101R2

Figure 3-7 SX-200® Attendant Console

4. SYSTEM CONFIGURATION

General

4.01 Figures 3-1 through 3-4 show the cabinets which contain the equipment bays and the maintenance panels. These units are described in detail in the following paragraphs.

Equipment Cabinets

4.02 The 480-port configuration has two equipment cabinets: a Control cabinet and a Peripheral cabinet. The 336-port configuration has one cabinet; the Control Cabinet. The Control cabinet contains two digital bays and an optional peripheral shelf; the 336-port configuration has two digital bays in its peripheral shelf; the 480-port configuration has one analog bay in its peripheral shelf. The Peripheral cabinet contains two optional analog equipment bays.

Digital Equipment Bays

4.03 Digital equipment bays house the voice/data line cards, LS/GS trunk cards, and universal peripheral cards. Digital bays reside only in the control equipment cabinet. Bay 1 (optional) may contain up to eight digital cards, and a bay power supply. Bay 2 (not optional) may contain up to four digital cards, a bay power supply and a floppy disk drive unit. Bays 3 and 4 (optional in 336-port configuration) are the same as Bay 1, but contain a Bay Control card in the lower right position. The peripheral cabinet is not used if digital Bay 3 is present.

Analog Equipment Bays

4.04 Analog equipment bays house the analog peripheral circuit cards, a Digital Interface card (DIC), a Peripheral Control card (PCC), and an Interrupt Scanner card. Analog equipment bays are optional, and reside in either the control equipment cabinet (Bay 3) or the peripheral equipment cabinet (Bay 4). Bay 5 requires only a DIC card and peripheral circuit cards.

Available Cards

4.05 Except for the Main Control card, each card in the Control shelf interfaces the system to 12 pairs, which can be cross-connected at the distribution frame. A brief description of each digital card type is given below:

Main Control Card (MCC) – The MCC contains the main system processor, the digital crosspoint switching network, the dynamic RAM memory, and other circuits. It controls all system operation and call processing (see Part 8 for additional information).

Bay Control Card – The Bay Control Card controls and monitors the status of lines, trunks and other circuits within the bay. It communicates with the Main Control Card. The Bay Control Card is installed in the lower rightmost slot of each active bay, except bays 1 and 2. This card must not be inserted or removed with the power on.

On-Premises Line Card (ONS) - The ONS contains 12 digital line circuits to interface with analog stations located within the same building as the DIGITAL PABX.

LS/GS Trunk Card - The CO Trunk card provides six digital interface circuits to interface between the Digital PABX and an analog CO. These trunks can be individually set to operate as Loop Start or Ground Start, via switches on the card (see Section MITL9108-093-125-NA).

COV Line Card - Provides six SUPERSET® line circuits, which serve as digital "control-over-voice" interfaces between SUPERSET® sets and the PABX.

OPS Line Card - The OPS Line Card contains six digital line circuits to interface with analog stations not in the immediate vicinity of the PABX.

DID Trunk Card - Provides six circuits which provide digital interfaces for Direct Inward Dialing to the DIGITAL PABX.

Universal Card - The Universal card can hold up to four modules for special features required by the system. Each module provides an interface between the backplane and three line pairs.

> **Console Interface Module** - Interfaces the attendant console to the PABX.
>
> **DTMF Receiver Module** - Receives and decodes DTMF dialing, providing binary digits to the PABX.
>
> **E&M Trunk Module** - Provides digital interfacing between the SX-200® DIGITAL PABX and other PBXs, analog Toll Offices, or any other analog equipment which require special signaling.
>
> **Music on Hold/Paging Module** - Provides an input for a music source, a paging output, and a control relay for an external paging amplifier.

4.06 A brief description of each analog card type and analog control card is given below; each card in a Peripheral bay interfaces the system to eight pairs:

8-Station Line Card - Provides eight circuits which serve as interfaces between the analog station and the switching circuitry in the analog bays. SUPERSET® sets may not be used with this line card.

SUPERSET® Line Card - Provides eight SUPERSET® line circuits which serve as interfaces between the SUPERSET® sets and the switching circuitry in the analog bays. Standard telephone sets may not be used with this line card.

CO Trunk Card - Provides 4 interfaces for use between the Central Office and the SX-200® DIGITAL PABX switching circuitry for either loop start or ground start CO trunks.

E&M Trunk Card - Provides 2 interfaces for use between the SX-200® DIGITAL PABX and another PBX or analog Toll Offices, or any other analog equipment which requires special signaling.

DID/Loop Tie Trunk Card - Provides 2 interfaces for Direct Inward Dialing and other dial-in lines to the SX-200® DIGITAL PABX.

Digital Interface Card (DIC) - The main function of the DIC is to interface the analog card types in the analog bays to the digital switching network.

Scanner Card - The function of the Scanner card is to sequentially scan all ports to detect signals which require processor action in the analog peripheral bays.

Peripheral Control Card (PCC) - This card controls system operation within the Peripheral bays, and is under control of the Main Control card.

Power Supplies

4.07 Digital Bays have shelf mounted power supplies which generate the system operating voltages of 12 Vdc; 5 Vdc, -5 Vdc, -12 Vdc, -28 Vdc, -48 Vdc and 90 Vac ringing voltage from a 115 Vac input (optionally 230 Vac).

4.08 Analog Bays require a rear door mounted power supplies generate the system operating voltages of 8 Vdc, -5 Vdc, -10 Vdc, -48 Vdc and 90 Vac ringing voltage from a 115 Vac power input (optionally 230 Vac). A system configuration that includes an analog Bay 3 or a second equipment cabinet will employ one rear door mounted power supply on each cabinet. A door mounted power supply is required in the Control Cabinet only if Bay 3 is installed. Refer to Part 9 of this Section for further details on the power supplies.

5. FEATURES

General

5.01 The SX-200® DIGITAL PABX offers many features, which are provided by a software package. A full description of these features appears in Section MITL9108-093-105-NA, Features Description. Certain limitations which apply to System Features are listed in Table 5-1.

TABLE 5-1
FEATURE LIMITATIONS

FEATURE LIMITATIONS	G1001	G1000
Maximum number of simultaneous calls		100
Maximum number of speech paths or channels used by any call		2
Maximum number of simultaneous consultations		5
Maximum number of simultaneous add-on (3-way) calls		6
Maximum number of simultaneous station-controlled conference calls		6
Maximum number of parties in conference at one time		5
Maximum number of calls that can simultaneously be camped on to a station, trunk group, or hunt group		100
Maximum number of simultaneous callbacks that can be enabled		100
Maximum number of simultaneous call forwards that can be enabled		400
Maximum number of simultaneous "Dial 0" calls		100
Maximum number of hunting groups		50
Maximum number of calls that can be simultaneously connected to Music On Hold		178
Maximum number of stations in a station hunting group		50
Maximum number of stations in a call pickup group		50
Maximum number of dial call pickup groups		50
Maximum number of trunks assignable to night stations		200
Maximum number of trunks in a trunk group		50
Maximum number of trunk groups		50
Maximum number of calls that can override a given extension		1
Maximum number of calls that can be simultaneously held by one attendant		8
Maximum number of calls incoming that can be separately identified at the Attendant Console		8
Maximum number of LDN's that can be identified at the Attendant Console		9
Maximum number of abbreviated dial numbers		1000
Maximum number SUPERSET® Speed Dial numbers	2212	1792
Maximum number of trunk buffers for SMDR		75
Maximum number of abbreviated dial numbers per station that may be stored		26
Maximum number of SUPERSET® sets		
336-port configuration		78
480-port configuration		158

6. SYSTEM ENVIRONMENTAL AND INSTALLATION REQUIREMENTS

General

6.01 This Part is concerned with the design parameters of the system as they are affected by environmental conditions. Electrical characteristics and performance are detailed in the subsequent parts of this Section.

6.02 The parameters in this Part are segregated into the following subparts:

- Design Data and Compatibility as detailed in 6.03 and 6.04,
- Shipping and Storage data as detailed in 6.05 and
- Installation Requirements as detailed in 6.07 to 6.10.

Design Data

6.03 The systems are designed to operate within the environmental conditions outlined in Table 6-1.

TABLE 6-1
ENVIRONMENTAL OPERATING CONDITIONS

Specification	Range
Temperature	0°C to 40 °C (32°F to 104°F) maximum. 10°C to 40°C (50°F to 104°F) for the floppy disk. 0°C to 30°C (32°F to 86°F) for the console.
Relative humidity	20% to 90% noncondensing.
Acoustic noise	The system radiates less than 45 dB SPL, "A" weighted, measured 1200 mm (47.2 in.) from the center of the cabinet.
Vibration	0.5 g (4.903 m/s) (sinusoidal) 5 to 200 Hz.
Electromagnetic Suseptibility	The system is able to function in an electric field of 50 V/m without major degradation of service.
Electrostatic Discharge	The system will continue to function with no noticeable effects after being exposed to the following electrostatic discharges on to various parts of the equipment (i.e., faceplates, switches, etc.): a) 20 kV from a 60 pF capacitor, through a 10 kilohm resistor b) 10 kV from a 100 pF capacitor, through a 500 ohm resistor.

Compatibility

6.04 The systems are compatible with:

- Single line 2500 or 500-type telephone sets or equivalent station apparatus.

- Line cards of a 1A1/2 telephone key system.
- Standard Dial Pulse and DTMF telephone sets equipped with or without message waiting lamps.
- Step-by-step, crossbar and commonly used electronic central office equipment.
- Other PABXs via Tie trunk interfaces.

Shipping and Storage

6.05 The equipment is designed to withstand shipping by truck, rail, air or sea without damage, when packaged in conventional shipping containers of the manufacturer. The range of environmental conditions that the equipment is capable of withstanding in storage is shown in Table 6-2.

Heat Dissipation

6.06 A fully configured SX-200® DIGITAL PABX will dissipate heat in the following manner (figures are approximate):

Bays 1 and 2	:	500 BTU/hr
Bay 3	:	1000 BTU/hr
Bay 4	:	1000 BTU/hr
Bay 5	:	750 BTU/hr

Installation Requirements

6.07 The installation requirements are detailed in Section MITL9108-093-200-NA, Shipping, Receiving and Installation.

Cabling and Cross-Connections

6.08 The following paragraphs detail the cabling and cross-connections required when installing the PABX.

Station and Trunk Cabling

6.09 Station and trunk cabling terminates on the building cross-connect terminal in the normal manner.

Cable Terminals

6.10 Section MITL9108-093-200-NA, Shipping, Receiving and Installation gives full details of the requirements for interconnection of cables between the building cross-connect terminal and the connector locations in the rear of the cabinet (Figures 3-1 and 3-2), including power fail transfer connections between the cabinet and the cross-connect terminal.

SUPERSET® Set Loop Lengths

6.11 The following loop lengths apply to the SUPERSET® Line Card (analog Bays 3,4,5) and the COV Line Card (Digital Bays 1,2).

Wire Gauge	SUPERSET LINE CARD	COV LINE CARD
22	840 m 2750 ft	2010 m 6600 ft
24	610 m 2000 ft	1524 m 5000 ft
26	470 m 1550 ft	1006 m 3300 ft

TABLE 6-2
STORAGE CONDITIONS

Specification	Range
Temperature range	-50°C to 71°C (-58°F to 159.8°F); 10°C to 40°C (50°F to 104°F) for the floppy disk. -20°C to 60°C (-4°F to 140°F) for the console.
Relative humidity	Up to 100 % RH at 18°C (64.4°F); 10 to 70% RH for the console
Vibration	0.5 g (4.903 m/s) (sinusoidal) 10 to 500 Hz
Shock	Up to 75 cm (30 in.) drop depending upon package
Low pressure	87 mm Hg 15,152 m (50,000 ft)
Temperature shock	-50°C to 25°C (-58°F to 75°F) in 5 minutes

7. PROGRAMMING AND CUSTOMER DATA ENTRY

General

7.01 The design and software of the SX-200® DIGITAL PABX allows maximum programming flexibility during installation or whenever a change is required. The features described in Section MITL9108-093-105-NA are enabled or disabled as required at the time of installation. Any subsequent changes to the original data may be accomplished by reprogramming from a customer's Attendant Console or Maintenance Terminal. Full details of programming procedures are outlined in Section MITL9108-093-210-NA, Customer Data Entry.

Initial Loading

7.02 Basic programming of the SX-200® DIGITAL PABX is accomplished by loading the system software from a floppy disk. The particular version of the system software determines the "generic" level, which then applies to the particular system in general. The disk is controlled by the system main processor on the Main Control Card. Upon a system reset, the processor runs PROM-based diagnostics on itself and the other system processors, and then proceeds to load the system software from the disk.

Customer Data Entry

7.03 Along with the system software, the floppy disk will contain a default customer database. This database may be customized to suit a particular site's requirements. Modification of the database may be accomplished in two ways: entering data by hand via the Attendant Console or Maintenance Terminal, or by loading via floppy disk. Refer to Sections MITL9108-093-315-NA, Attendant Console, and/or MITL9108-093-351-NA, RS-232 Maintenance Terminal. Whether the Attendant Console or Maintenance Terminal is used, the correct password must be entered to access the customer database. Some data may be entered via a standard telephone set; e.g., call forwarding. The displays and softkeys associated with the console and terminal enable existing data to be rapidly accessed and viewed, new data to be added, and data to be deleted.

8. TECHNICAL DESCRIPTION

General

8.01 The SX-200® DIGITAL Private Automatic Branch Exchange (PABX) is a microprocessor-controlled PABX which uses distributed processing and a combination of time- and space-division switching. The system uses the PCM (Pulse Code Modulation) form of time-division multiplexing as its digital conversion format. The system employs both digital peripheral cards and digitally-interfaced analog peripheral cards.

8.02 The SX-200® DIGITAL PABX system architecture is illustrated in Figures 8-1 and 8-2. The major component blocks are described in the paragraphs below.

Circuit Switch Links

8.03 The subsystems of the SX-200® DIGITAL PABX communicate over 2,048 kHz serial links. Each link is a continuously repeated data frame comprising 32 channels; each channel contains an 8-bit word which occupies an equal time slot within the frame. These links are segregated by function into circuit switch links and message links.

8.04 Circuit switch links provide paths through the system for the transfer of peripheral-related data; i.e., PCM audio, or TDM data. Each digital peripheral interface card has dedicated to it one-and-one-half circuit switch links which connect the card to the peripheral switch.

Control

8.05 The main processor, which has overall control of the system, is a 16 bit MC68000 CPU. It is supported by 1 megabyte of Dynamic Random Access Memory, which is used for the storage of system software, programmed devices, abbreviated dial digit strings, ARS digit strings, and SUPERSET® line appearances. Dynamic memory allocation is illustrated in Figures 8-3 through 8-7. The system also provides 1.24 megabytes (formatted) of disk space; this is used for the permanent storage of the system software and the customer database.

8.06 The peripheral processors in 480-port configurations, which control the analog cards in Bays 3, 4 and 5, are 8 bit MC6809 CPUs, and are supported by 32 kbytes of static RAM. Each of the analog bays contain a Digital Interface card (DIC) which interfaces the analog peripheral cards to the digital end of the system. Controlling each DIC card is one 8 bit MC6809 CPU, supported by 8 kbytes of static RAM. The Bay Control Card in digital bays 3 and 4 of the 336-port configuration has 256 kbytes of RAM and interfaces its bay to the MCC.

8.07 The Attendant Console contains a MC6809 CPU, supported by 16 kbytes of EPROM and 4 kbytes of static RAM, which controls the display, and monitors keystrokes. The Console module on the

Universal card contains one 8 bit MC68121 CPU supported by 4 kbytes of EPROM, which formats and controls the routing of data between the system PCM bus and the console.

8.08 On each analog trunk circuit card is an MC6802 CPU with up to 4k bytes of PROM that controls functions such as seizing and releasing trunk circuits.

Digital Switching

8.09 The SX-200® DIGITAL PABX uses a specially developed very large scale integrated (VLSI) circuit to implement the analog-to-digital and digital-to-analog conversion functions. The basis of this encode/decode process is the MT8960 Integrated PCM Filter/Codec (commonly known as a CODEC), which is used throughout the system to convert analog to PCM and PCM to analog. The CODEC combines a low pass filter and an analog-to-digital PCM encoder in the transmit direction (i.e., towards the SX-200® DIGITAL PABX) and a digital-to-analog decoder and low pass filter in the receive direction (i.e., towards the peripheral).

8.10 The PABX uses another specially developed VLSI circuit as its main PCM switching matrix element - the 8 link x 32 channel MT8980 Digital Time/Space Crosspoint Switch (DX Chip). The DX chip is arranged with eight incoming links and eight outgoing links; each link comprising 32 channels. Under control of the main CPU, any channel of the incoming links can be connected to any channel of the outgoing links. Thus, one DX chip is equivalent to a 65,536 (256 x 256) crosspoint array. This chip type forms the Circuit Switch and Peripheral Switch Matrices on the Main Control card, and forms part of the interface between the digital PCM links and the analog speech paths in the analog bays.

Analog Switching

8.11 The system uses an established LSI circuit to implement a space-division switching matrix in the analog bays. The basis of this space division is the 4-by-8 bit MT8804 Analog Switch Array, which is used throughout the analog bays to connect any one of the 32 analog speech paths to any one (or more) extension or trunk circuit(s).

Analog Bay Interface

8.12 The task of connecting the 32 digital PCM channels from the digital DX network to the 32 analog speech paths (junctors) in the analog bays is performed by the JIC (Junctor Interface Circuit). The JIC converts the 4-wire (separate transmit and receive) signals from the CODEC to 2-wire junctor signals.

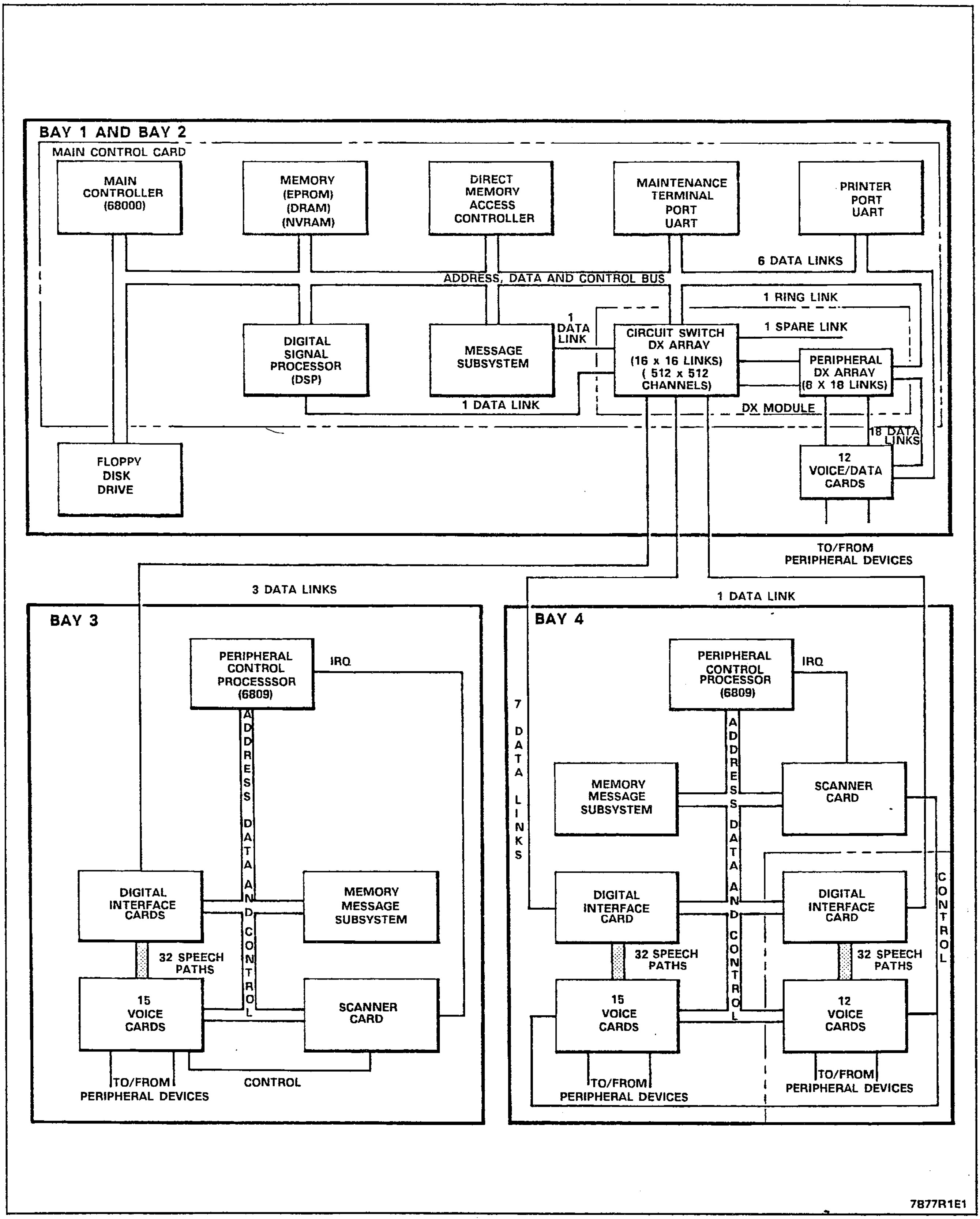


Figure 8-1 SX-200® DIGITAL PABX System Architecture (480-Port Configuration)

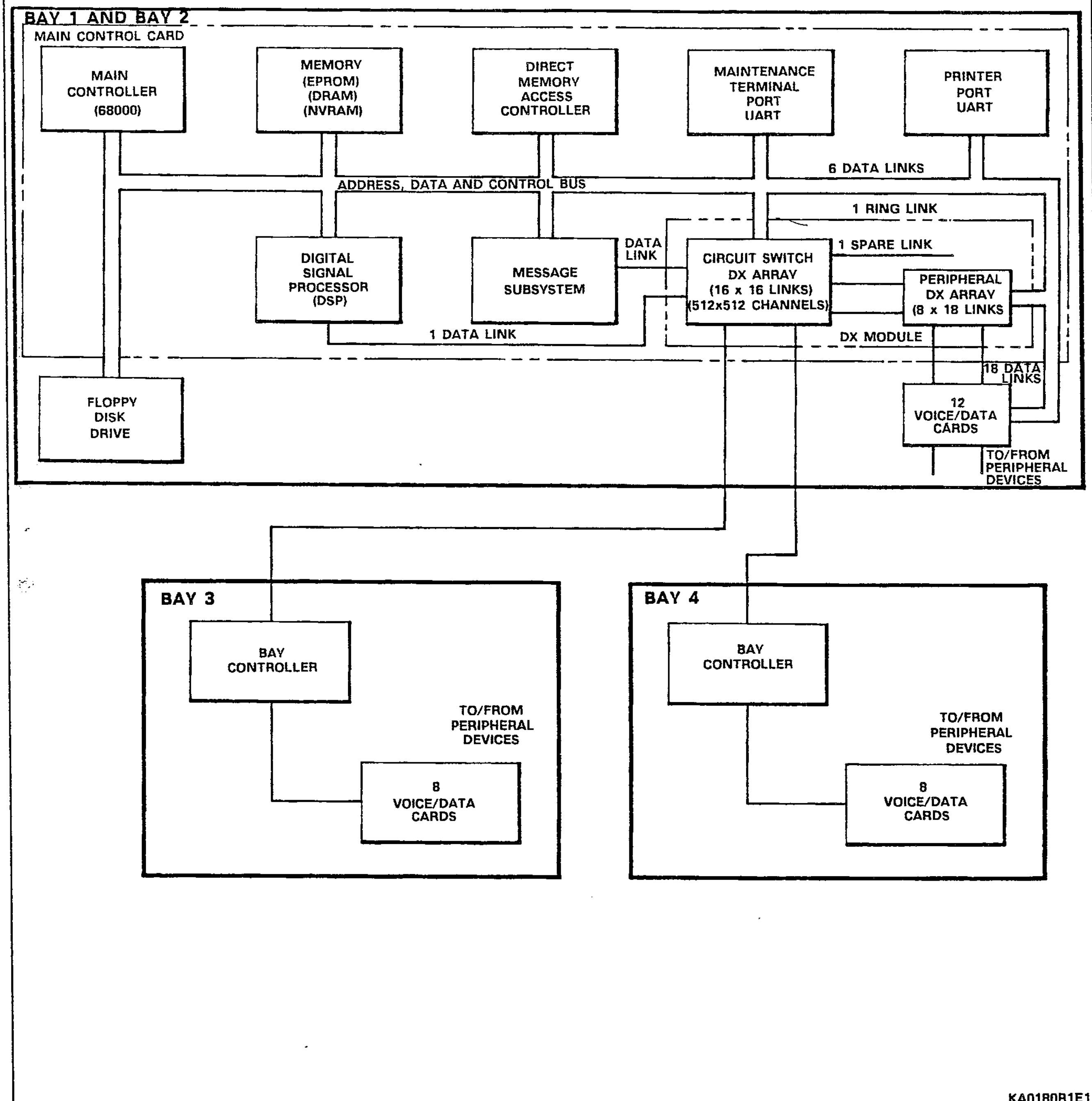


Figure 8-2 SX-200® DIGITAL PABX System Architecture (336-Port Configuration)

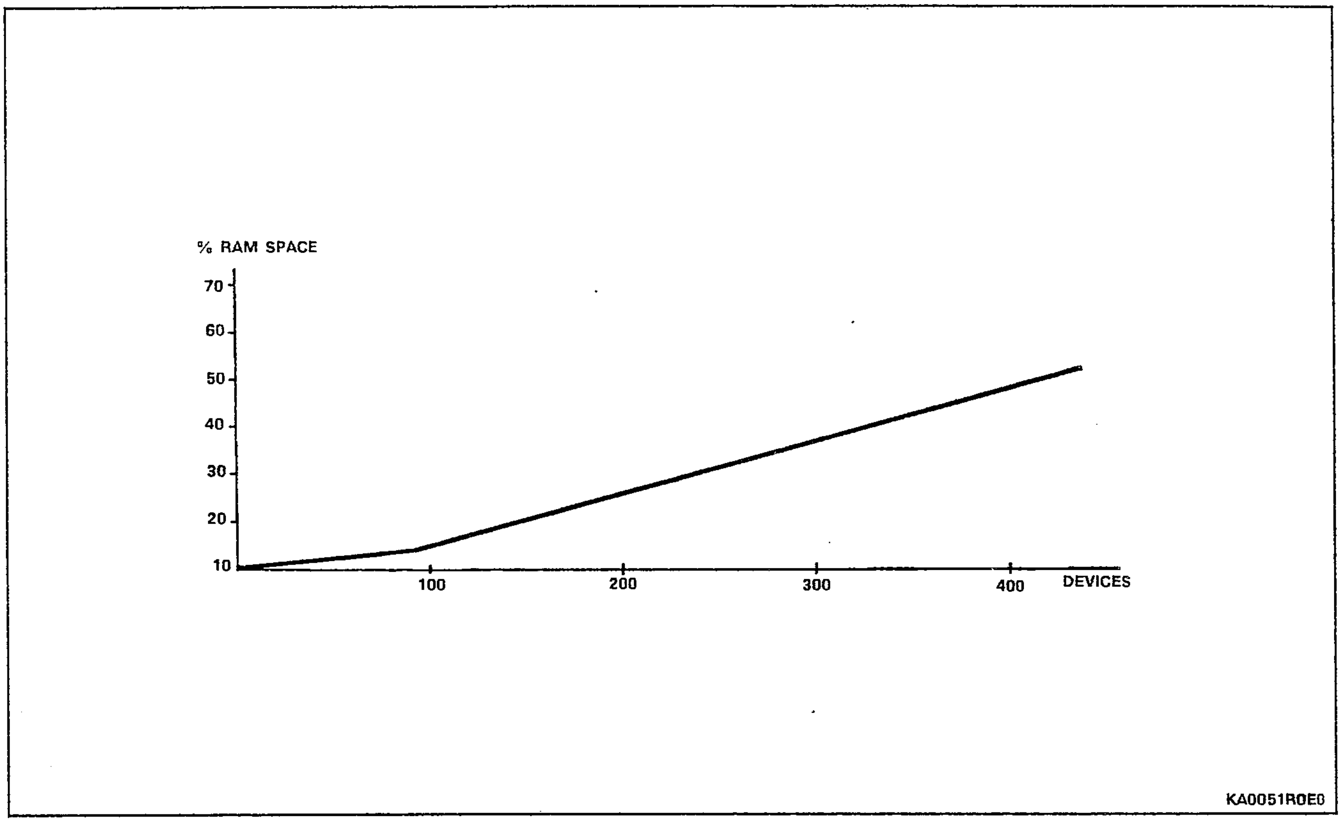


Figure 8-3 Memory Availability v.s. Number of Programmed Devices

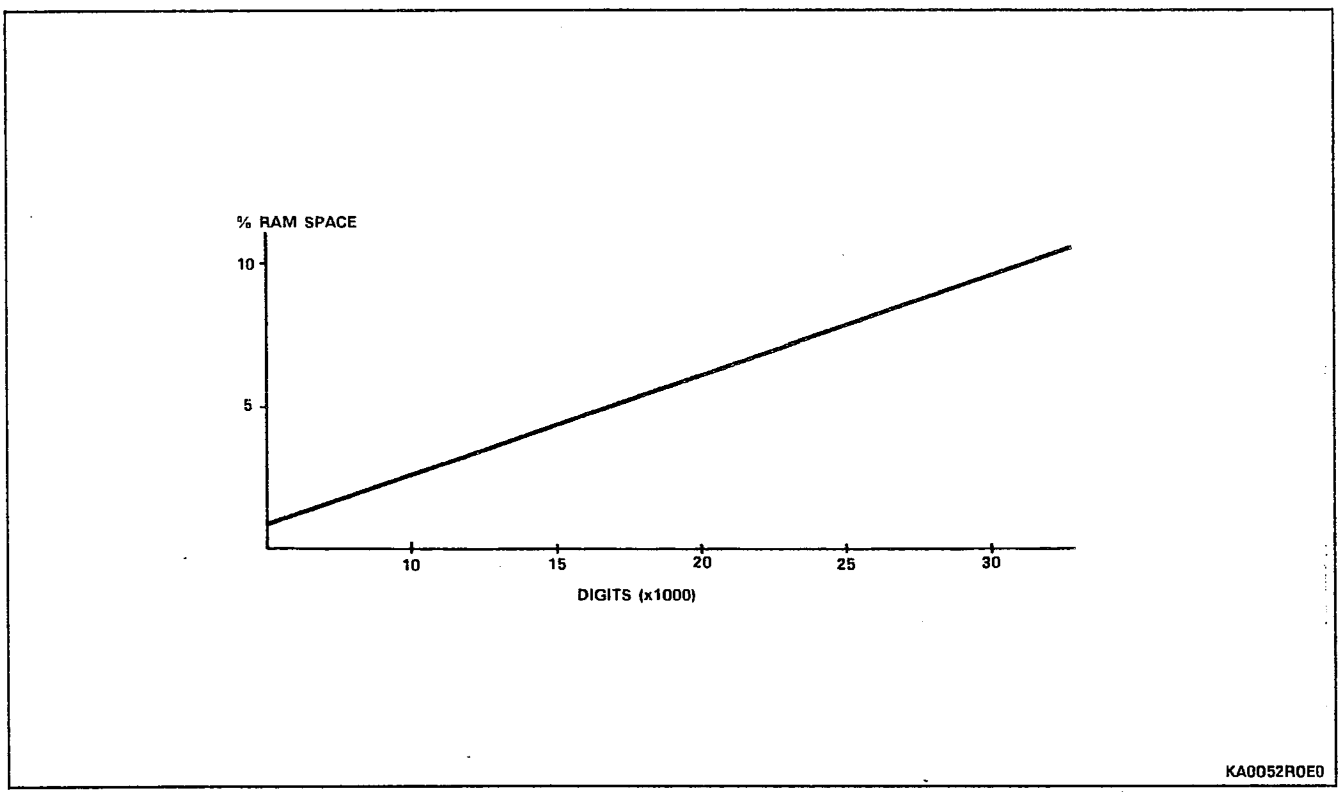


Figure 8-4 Memory Availability v.s. Number of Abbreviated Dial Digits

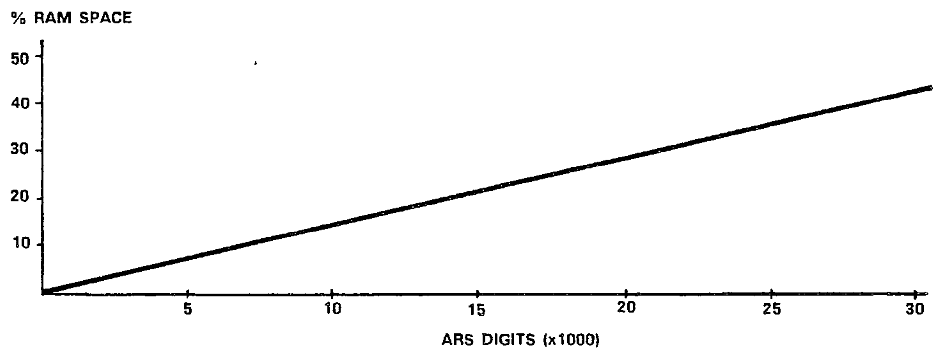


Figure 8-5 Memory Availability v.s. Number of ARS Digits

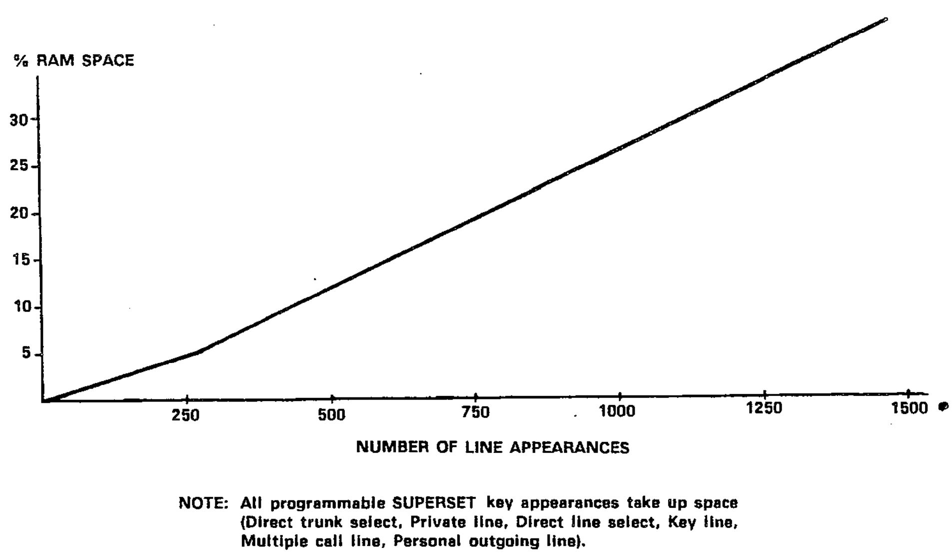


Figure 8-6 Memory Availability v.s. Number of SUPERSET® Key Appearances

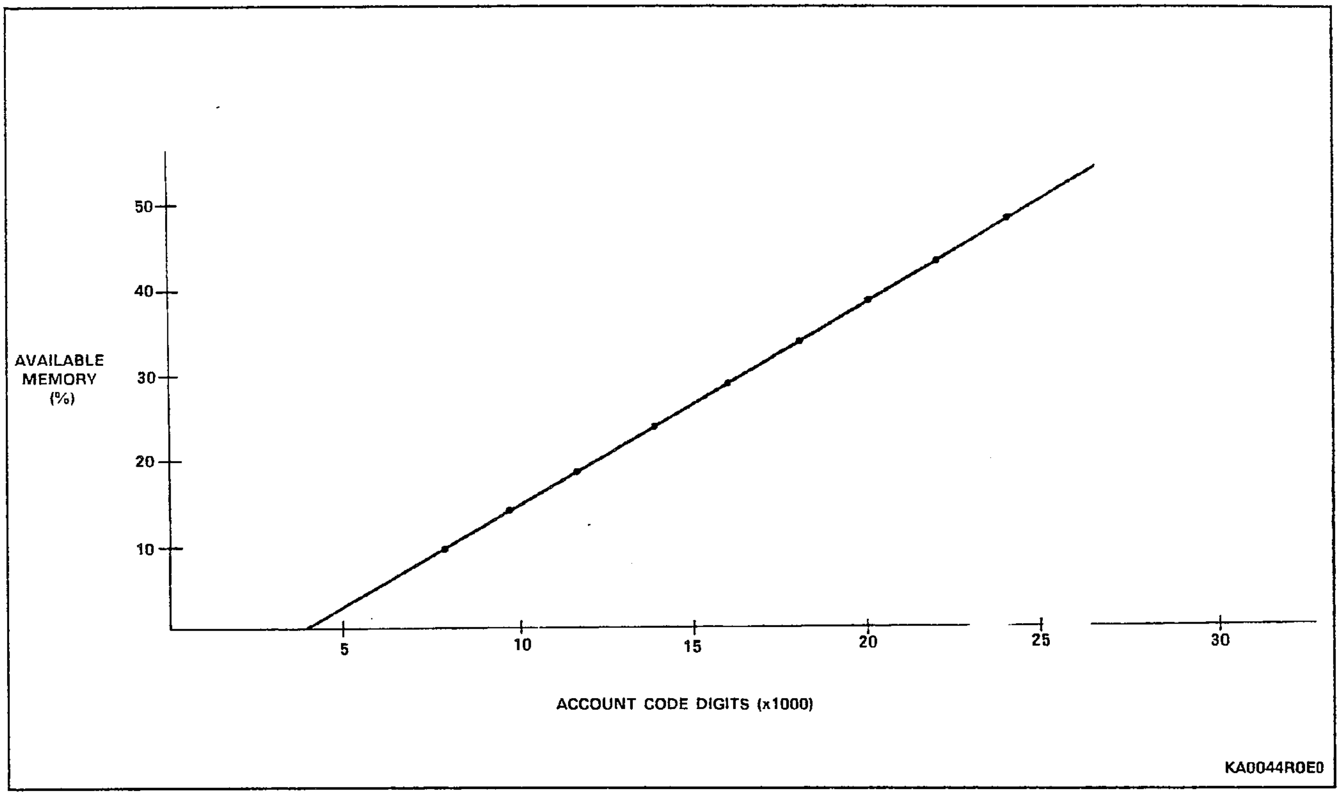


Figure 8-7 Memory Availability v.s. Number of Account Code Digits

Main Control Card

8.13 The Main Control card is the highest level in the intelligence hierarchy of the SX-200® DIGITAL PABX. It contains the following:

- 68000 CPU
- EPROM containing system power-up routines
- Dynamic RAM
- Floppy disk interface circuitry for two 5.25 inch drives
- Two communication Ports (UARTs)
- Digital Signal Processor for tone generation/detection and conferencing
- DX module containing the Circuit Switch Matrix and the Peripheral Switch
- Message interface (HDLC).

Circuit Switch

8.14 The circuit switch matrix provides a nonblocking switching matrix which, in conjunction with the peripheral switch, interconnects the digital peripherals (i.e., digital lines and digital trunks) and the links from the analog bays. The matrix comprises four DX chips arranged in tandem such that the matrix has 16 receive links and 16 transmit links. The function of each link is outlined in Table 8-1. As a nonblocking matrix, the circuit switch matrix is fully switchable; i.e., all incoming links have access to all outgoing links.

Peripheral Switch

8.15 The purpose of the peripheral switch is to concentrate the circuit switch links from up to 12 digital peripheral cards (and 18 links) on one side, down to the six links provided by the circuit switch matrix on the other side. Note that only Bays 1 and 2 are switched through the peripheral switch. The peripheral switch comprises three DX chips; one concentrates Bay 2 and two concentrate Bay 1.

Message Subsystem

8.16 The function of the message subsystem is to facilitate the transfer of control messages and program loading between the main control processor and lower node processors such as Digital Interface cards, SUPERSET® sets and consoles. This transfer of information occurs over the PCM links of the Circuit Switch Matrix (see Table 8-1). The protocol used in the message system is based on the OSI (Open Systems Interconnection) widely used HDLC (High Level Datalink Control) protocol format.

Peripheral Interface Cards

8.17 Peripheral interface cards provide an interface between the terminations of the SX-200® DIGITAL PABX (i.e., lines and trunks) and the circuit switch. The card type depends upon the type of peripheral interfaced to the system; i.e., an E&M Trunk card caters to E&M trunks only.

8.18 The number of interface circuits that each card provides varies with the type, complexity, and space requirements of the circuit. A list of peripheral interface cards and the number of circuits on each is provided in Table 8-2.

8.19 The basic operation of the digital peripheral cards in bays 1 and 2 is controlled by signals received from the peripheral switch or the Main Control card. Digital peripheral cards in Bays 3 and 4 are controlled by the Main Control card and Bay Control card. Operation of the analog peripheral cards is controlled by the Main Control card in conjunction with the Peripheral Control card and Digital Interface card in the associated cabinet. The clocks provided by the Main Control card for the digital peripheral cards and the Digital Interface cards are as follows:

(a) Frame Pulse. This signal synchronizes the start of a PCM frame which consists of a complete sequence of 32 channels. It occurs every 125 microseconds.

(b) 244 ns Clock (C244+). The positive going edge of each clock pulse is used to generate channel counting.

TABLE 8-1
SX-200® PCM CIRCUIT SWITCH LINK ASSIGNMENTS

336-Port Configuration Use	Link #	480-Port Configuration Use
HDLC message system link	0	HDLC message system link
Digital Signal Processor link	1	Digital Signal Processor link
Bay 3 voice link (lower shelf), ringing reference	2	Bay 3 voice link
Bay 3 voice link (upper shelf), message link (HDLC)	3	Bay 3 message link (HDLC)
Bay 3 voice link (shared)	4	unused
Bay 4 voice link (lower shelf), ringing reference	5	Bay 4 voice link
Bay 4 voice link (upper shelf), message link (HDLC)	6	Bays 4 & 5 message link
Bay 4 voice link (shared)	7	Bay 5 voice link
Bay 1 voice link (lower shelf)	8	Bay 1 voice link (lower shelf)
Bay 1 voice link (lower shelf)	9	Bay 1 voice link (lower shelf)
Bay 1 voice link (upper shelf)	10	Bay 1 voice link (upper shelf)
Bay 1 voice link (upper shelf)	11	Bay 1 voice link (upper shelf)
Bay 2 voice link (shared)	12	Bay 2 voice link (shared)
Bay 2 voice link (shared)	13	Bay 2 voice link (shared)
dial tone, filter, codec, Bays 1 and 2 ringing reference	14	dial tone, filter, codec, Bays 1 and 2 ringing reference
unused	15	unused

TABLE 8-2
PERIPHERAL INTERFACE CARDS

Card Name	Card Description	Bay Type	No. Circuits
ONS Line	On-premises line interface	digital	12
LS/GS Trunk	Central Office trunk interface	digital	6
COV Line Card	SUPERSET 3™/SUPERSET 4™ Set control-over-voice line interface	digital	6
OPS Line Card	Off-premises line interface	digital	6
DID Trunk Card	Direct Inward Dial trunk interface	digital	6
E&M Trunk Module	E&M Trunk interface (module on Universal card)	digital	1
8 Station Line	On-premises line interface	analog	8
SUPERSET® Line	SUPERSET 3™/SUPERSET 4™ line interface	analog	8
CO Trunk	Central Office trunk interface	analog	4
E&M Trunk	E&M Trunk interface	analog	2
DID/Tie Trunk	Direct Inward Dial/Tie trunk interface	analog	2

Speech Path Accessing - Digital

8.20 For each digital peripheral interface card, there are 1.5 PCM links allocated, connecting it to the circuit switch-matrix on the Main Control card. Under control of the Main Control card (via the message subsystem), the transmit and receive channels of an originating circuit can be connected to the receive and transmit channels of any other circuit through the circuit switch matrix. See Appendix A for further details.

Speech Path Accessing - Analog

8.21 Each speech path is directly wired to an MT8804 on each analog line and analog trunk circuit card in the system. Under control of the Peripheral Control card, any speech path may be connected to any of the circuits on the card. This is illustrated in Figure 8-8. See Appendix A for further details.

Dynamic RAM Allocation

8.22 The SX-200® DIGITAL PABX has approximately 105 kbytes of memory space available for Customer Data Entry (CDE) programming. The most taxing of this CDE programming, in terms of dynamic memory usage, is; the number of devices (lines, trunks, etc.), ARS digit strings, account codes, abbreviated dial digit strings, and SUPERSET® set key appearances. It is necessary therefore, to make trade-offs between these categories to best allocate the available RAM space. This can easily be done using the graphs in Figures 8-3 through 8-7.

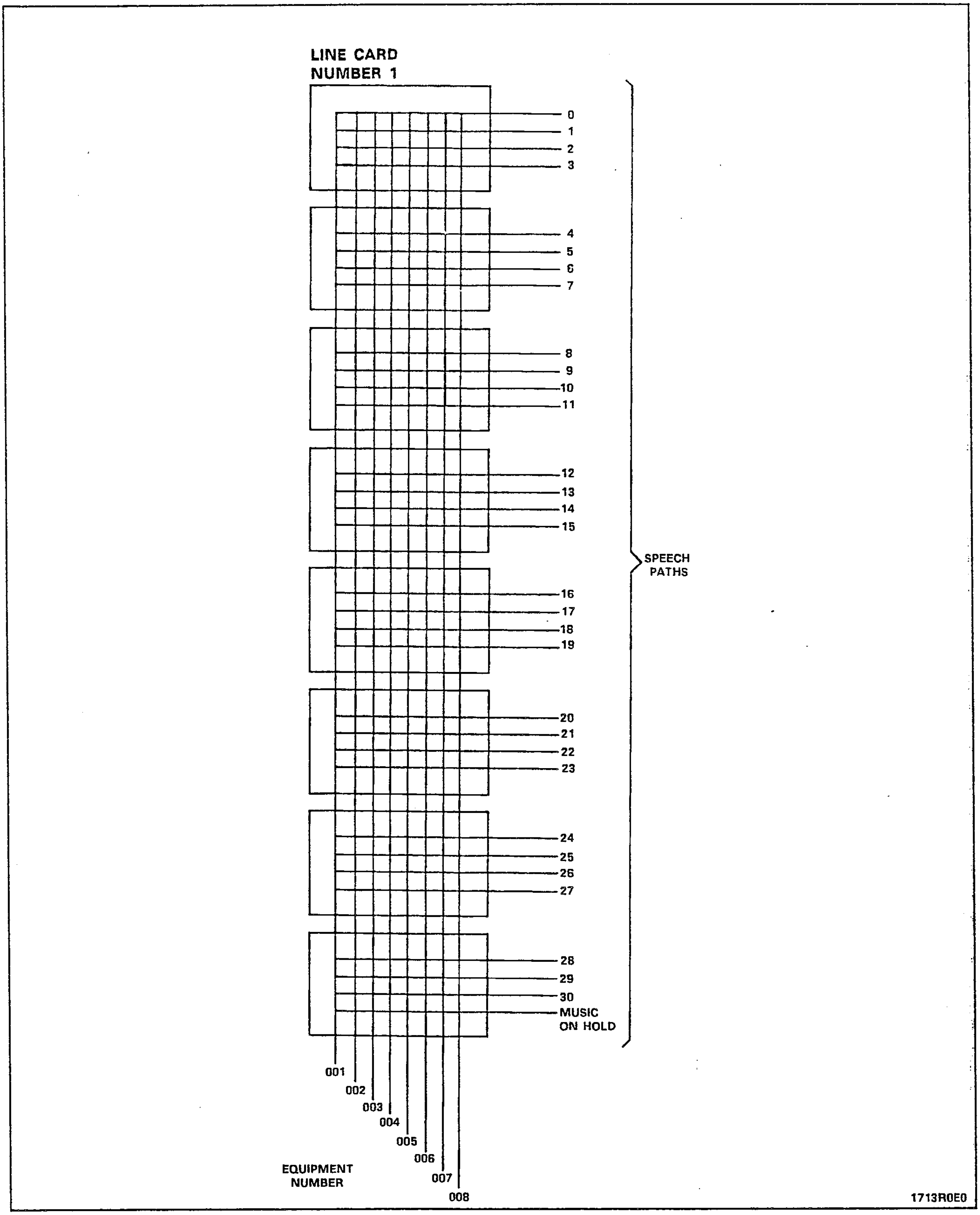


Figure 8-8 Analog Speech Paths

9. ELECTRICAL CHARACTERISTICS

General

9.01 This Part gives details of the electrical characteristics of the power supplies. A summary of the electrical power characteristics is detailed in Table 9-1.

TABLE 9-1
ELECTRICAL POWER CHARACTERISTICS

Characteristic	Details
Door-Mounted AC Power Supply	
Input voltage	120 Vac -20% to +10%
Frequency	44 Hz to 64 Hz
Holdover Time	Momentary interruptions in commercial power - up to 250 ms duration
Input Current	4.0 Amps maximum at 120 Vac
Talk Battery Noise	Does not exceed 28 dBrnC
Shelf-Mounted AC Power Supply	
Input Voltage	102 Vac to 135 Vac
Frequency	47 Hz to 63 Hz
Holdover Time	Minimum of: 40 ms at 120 Vac, 20 ms at 102 Vac, delivering full rated load
Input Current	Maximum of: 2.0 Amps at 120 Vac 1.1 Amps at 240 Vac

TABLE 9-2
BAY POWER SUPPLY TEST POINT VOLTAGES

Voltage	Range
+5 Vdc	+4.925 to +5.075
+12 Vdc	+10.8 to +13.2
-12 Vdc	-13.2 to -10.8
-5 Vdc	-5.5 to -4.5
-28 Vdc	-30.8 to -23.8
-48 Vdc	-53.76 to -40.8
90 Vac	63.0 to 99.0

TABLE 9-3
REAR DOOR POWER SUPPLY TEST POINT VOLTAGES

Voltage	Range		
+8 Vdc	+7.6	to	+8.4
0 Vdc	–		–
−5 Vdc	−5.3	to	−4.7
−10 Vdc	−10.5	to	−9.5
−48 Vdc	−52.0	to	−45.0
GND or 0 Vdc	–		–
90 Vac	85.0	to	95.0

10. SIGNALING AND SUPERVISION

General

10.01 This Part outlines the signaling and supervision parameters of the SX-200® DIGITAL PABX.

10.02 The standard range of tones are available from the SX-200® DIGITAL PABX's Digital Signal Processor:

(a) 12 DTMF sets of tones. Those in common use are listed in Table 10-1.

(b) A set of tones, listed in Table 12-4, which form part of the North American Audible Tone Plan.

(c) One ringing tone of 20 Hz.

10.03 The SX-200® DIGITAL PABX is capable of accepting and repeating signals from telephone sets which have the parameters shown in Table 10-1, Dial Pulse Reception Limits and Table 10-2, DTMF Tone Parameters.

10.04 Where any of the frequencies shown in Table 12-4 are present at the system input, any other single frequency (200 - 3400 Hz) should be a minimum of 40 dB below the signal frequency. DTMF pulses are registered in the presence of precise dial tone at a level of -10 dBm.

10.05 The SX-200® DIGITAL PABX gives the following output signal conditions:

- Dial Pulse Conditions:

Pulse Rate	: 9 to 11 pps
Break Interval	: 58% to 62%
Interdigit Time	: 800 ms.

- DTMF Dialing Conditions:

Frequency Deviation	: ±1%
Tone Duration	: greater than 40 ms
Interdigit Time	: greater than 40 ms
level, low group	: greater than -10 dBm
level, high group	: greater than - 8 dBm
level, DTMF signal	: less than +2 dBm
level, third	: greater than 40 dB
Frequency	: below DTMF signal
Twist	: less than 4 dB.

Note: For information on DTMF levels, refer to Part 12F of this Section.

TABLE 10-1
DIAL PULSE RECEPTION LIMITS

Parameter	Min	Max
ONS Line:		
Pulse Rate	8 pps	12 pps
Break Duration	58%	64%
Interdigit Time	300 ms	15 s
8 Station Line:		
Pulse Rate	8 pps	12 pps
Break Duration	50%	80%
Interdigit Time	300 ms	15 s
OPS Line:		
Pulse Rate	8 pps	12 pps
Break Duration	42%	84%
Interdigit Time	300 ms	15 s

TABLE 10-2
DTMF TONE PARAMETERS

Low Frequency (Hz)	High Frequency (Hz)		
	1209	1336	1477
697	1	2	3
770	4	5	6
852	7	8	9
941	*	0	#

Frequency deviation : ±1.5 %
Signal interval (2 frequency) : 40 ms (min)
Per frequency, minimum level : −17 dBm on line circuit

Twist, maximum (at −10 dBm): +4 to −8 dB
(high frequency relative to low frequency)

11. TRANSMISSION

General

11.01 The following descriptions detail some of the transmission characteristics which apply to the SX-200® DIGITAL PABX. The terms used for the different types of peripheral interfaces are explained in Table 11-1.

TABLE 11-1
INTERFACE REFERENCES

Circuit Ref	Description	Card Type (Part No.)
ONS	An industry-standard telephone set may be connected to the SX-200® DIGITAL PABX by means of one of the following card types:	
ONS(D)	* ONS Line card	9109-010
ONS(A)	* 8 Station Line card	9110-011
OPSS	An industry-standard telephone set located off premises may be connected to the SX-200® DIGITAL PABX via this card type:	
	* OPS Line card	9109-020
OPSL	An industry-standard telephone set located outside the range of the ONS circuit (over 2 kilometers) may be connected to the SX-200® DIGITAL PABX via this card type:	
	* OPS Line card	9109-020
ACO	An Analog CO (ACO) trunk can be connected to the SX-200® DIGITAL PABX by means of one of the following types of trunk interface cards:	
ACO(D)	* LS/GS Trunk card	9109-011
ACO(A)	* CO Trunk card	9110-211
ACO(A)	* DID/Tie Trunk card	9110-031
ACO(D)	* DID Trunk card	9109-031
ATO	An Analog Toll Office (ATO) trunk may be connected to the SX-200® DIGITAL PABX by means of one of the following trunk interface cards:	
ATO(D)	* LS/GS Trunk card	9109-011
ATO(A)	* CO Trunk card	9110-211
ATO(A)	* E&M Trunk card	9110-013
ATO(D)	* E&M Trunk module	9109-013
ATT	An Analog Tie Trunk (ATT) can be connected between the SX-200® DIGITAL PABX and another PBX, over a 2- or 4-wire analog trunk by means of one of the following trunk cards:	
ATT(A)	* E&M Trunk card	9110-013
ATT(D)	* E&M Trunk module	9109-013
ATT(A)	* DID/Tie Trunk card	9110-031
ATT(D)	* DID Trunk card	9109-031
SATT	This designation refers to a "satellite" tie trunk which connects a Main PBX to a Satellite PBX. The type of trunk cards used to interface are the same as those for the ATT interface described above	

Frequency Response

11.02 The frequency response relative to 1004 Hz at 0 dBm for different types of interconnections is shown in Table 11-2.

Overload - Digitally Switched Analog Card Types

11.03 The overload levels shown in Table 11-3 define the maximum signal levels which may be applied to an analog interface before clipping occurs. The Input Overload (IOL) defines the maximum analog input signal level which can be applied to a digital interface circuit before clipping of the encoded PCM word occurs. The Output Overload (OOL) defines the maximum analog output signal which can be produced at the output of an interface by the application of a 3 dBm0 digital signal to the input.

Overload - Locally Switched Analog Card Types

11.04 The change in attenuation when the level of a 1004 Hz signal is increased from -9 to +7 dBm shall not exceed 0.4 dB.

TABLE 11-2
FREQUENCY RESPONSE

Interconnection	Frequency (Hz)	Variation in Attenuation w/r to 1004 Hz (dB) minimum	maximum
Line to Line	60	-20.0	--
	200	0	-5.0
Line to 2-W Analog Trunk	300	0.5	-1.0
	3000	0.5	-1.0
2-W Analog Trunk to 2-W	3200	0.5	-1.5
Analog Trunk	3400	0	-3.0
Line to 4-W Analog Trunk	60	-20.0	--
	200	0	-4.0
2-W Analog Trunk to	300	0.4	-0.65
4-W Analog Trunk	3000	0.4	-0.65
	3200	0.4	-1.5
	3400	0	-3.0
4-W Analog Trunk to	60	-16.0	--
4-W Analog Trunk	200	0	-3.0
	300	0.3	-0.3
	3000	0.3	-0.3
	3200	0.3	-1.5
	3400	0	-3.0

TABLE 11-3
OVERLOAD LEVELS - DIGITALLY SWITCHED ANALOG CARD TYPES

Interface Type	Connecting Circuit	Overload Point (dB) IOL	OOL
ONS(A)	any circuit	6.0	0
ACO(A)	ONS(D)	0	6.0
ACO(A)	any trunk	3.0	3.0

Quantization Distortion

11.05 The quantization distortion of a connection is a measure of the signal to distortion ratio as the input signal is varied. Note that this parameter does not apply to the analog card types. For 95% of connections the signal to distortion ratio will exceed the limits shown in Table 11-4.

TABLE 11-4
SIGNAL TO DISTORTION RATIO

1004 Hz Input Level (dBm0)	Signal/Distortion Ratio (dB) 95% of all connections
0 to -30	33
-40	27
-45	22

Intermodulation Distortion

11.06 Intermodulation (harmonic) distortion is measured using two pairs of equal level tones (851/863 Hz and 1372/1388 Hz), at a total composite input power of −13.0 dBm0. Table 11-5 shows the second and third order products for the different types of connections. 95% of the connections in each category shall exceed the stated limits.

TABLE 11-5
INTERMODULATION REQUIREMENTS (4.8 Kb/s)

Connection Type	Second Order Product (dB)	Third Order Product (dB)
Line to Line	40	43
Line to Trunk	45	53
Trunk to Trunk	45	53

Return Loss

11.07 The ERL and SFRL return losses for different types of interconnection or idle states are shown in Table 11-6.

TABLE 11-6
RETURN LOSS CHARACTERISTICS

Connection Type	Terminal Balance		Through Balance		Transhybrid Loss		Non-Talking
	ERL (dB)	SFRL (dB)	ERL (dB)	SFRL (dB)	200 - 3400 Hz	SRL 500 - 2500 Hz	(dB)
Line to Line	18	12					
Line to 4-W Trunk	24	14					
4-W Trunk to Line	24	14					
Line to 2-W Trunk	18	12					
2-W Trunk to Line	18	12					
4-W Trunk to 2-W Trunk	28	14					
2-W Trunk to 4-W Trunk	28	14					
4-W Trunk to 4-W Trunk			27	20			
ONS(D) Line					17	19	
2-W Trunk					18	21	
Loop Start LS/GS Trunk (2-W)							6
Ground Start LS/GS Trunk (2-W)							2
Line to Line *	20	14					
Trunk to Trunk *	24	14	27	20			10
Line to Trunk *							5

* denotes analog card type

Crosstalk

11.08 The crosstalk attenuation, or coupling loss, between any two transmission paths, at any frequency between 200 and 3200 Hz is greater than 75 dB for 95% of all connections.

Echo Path Delay

11.09 The round trip echo path delay with a frequency of 1500 Hz does not exceed the stated values for the following types of interconnection:

- Line to Line: 3.0 ms
- Line to Trunk: 3.0 ms
- Trunk to Trunk: 3.0 ms.

Envelope Delay Distortion

11.10 Table 11-7 details the maximum envelope delay distortion for the digital card types. These objectives are met by 95% of all connections. For the analog card types, the envelope delay distortion is less than 200 microseconds between 400 and 3200 Hz, for all connections.

TABLE 11-7
ENVELOPE DELAY DISTORTION

Connection Type	Frequency Band (Hz)	Envelope Delay Distortion (microseconds)
Line to Line	1000 - 3000	less than 280
	400 - 3200	less than 560
Line to Trunk	1000 - 3000	less than 140
	400 - 3200	less than 280
Trunk to Trunk	1000 - 3000	less than 140
	400 - 3200	less than 280

Longitudinal Balance

11.11 All connections meet the longitudinal balance requirements outlined in Table 11-8. Note that these apply to OFF-HOOK circuits only.

TABLE 11-8
LONGITUDINAL METALLIC BALANCE

Frequency	Longitudinal Metallic Balance (dB)	
(Hz)	Minimum	Average
200	58	63
500	58	63
1000	58	63
3000	53	58

System Impedences

11.12 System impedences are as follows:

- Station - 9109-010 : 600 ohms I/P impedence
  600 ohms DC loop resistance
  - 9110-110 : 600 ohms I/P impedence
  1200 ohms DC loop resistance.
- LS/GS Trunk Loop: 600 ohms I/P impedence, 1600 ohms loop range.
- LS/GS Trunk T/R to ground Resistance:
  - greater than 30 Kohms (ground start)
  - greater than 10 Mohms (loop start) - both in the IDLE state
- Analog type lines: 600 ohms AC input impedence, nominal
- Analog type trunks: 600/900 ohms AC input impedence, nominal

Idle Channel Noise – C Message

11.13 The idle channel C message noise will not exceed the following values for any type of interconnection:

- Average: 16 dBrnC
- 95% of all interconnections: 20 dBrnC

Idle Channel Noise – 3 kHz Flat

11.14 The idle channel noise for 3 kHz flat noise requirements do not exceed the following values for any type of interconnection:

- 95% of all interconnections: 39 dBrn0
- 50% of all interconnections: 35 dBrn0

12. LOSS AND LEVEL PLAN

General

12.01 This Part describes the loss and level plan for North American applications of the SX-200® DIGITAL PABX.

12.02 A large number of interconnections are possible with the SX-200® DIGITAL PABX, ranging from interconnections between on-premises (ONS) line circuits, to the interconnection of remotely located satellite PBXs with the SX-200® DIGITAL PABX. The principles of the loss and level plans are described in Part A, their application to the SX-200® DIGITAL PABX is detailed in Part B, and the arrangements for setting the transmission levels are detailed in Part C.

North American Loss and Level Plans

12.03 The purpose of a transmission loss and level plan is to provide an acceptable transmission grade of service to all subscribers in the telephone network. At present, two loss plans exist for the public switched network in North America. They are the VIA NET LOSS (VNL) plan and the SWITCHED DIGITAL NETWORK (SDN) plan.

VNL Plan

12.04 The VNL plan consists of two parts: a fixed loss portion and a variable loss portion; they are as follows:

(a) **Fixed Portion.** A minimum fixed amount of loss is introduced into all Toll connections. This loss is equal to 5 dB and is split equally between the two end trunks connected to the Toll network.

(b) **Variable Portion.** In addition to the fixed portion, a variable loss is introduced into all trunks involved in a connection. This loss, known as VNL, is proportional to the trunk length and its propagation delay. The loss ranges from a minimum of 0.5 dB to a maximum of 3.0 dB, and covers trunk lengths from 0 to about 2900 km (0 to 1800 miles). Trunks in excess of this length employ echo suppressors and are designed to zero loss.

12.05 The loss objectives for Toll connections using the VNL plan range from a minimum of 5.5 dB to a maximum of 8.0 dB between end-to-end CO offices (CL5 to CL5). This is illustrated in Figure 12-1.

SDN Loss Plan

12.06 The Switched Digital Network (SDN) loss plan was developed to meet the needs of the evolving digital public switched network. This plan does not assign losses to intermediate links in a connection. Under the plan, the local area public network (local CO to local CO) is operated at zero loss. This feature eliminates the need to introduce digital padding on intermediate digital trunk links and maintains data transparency throughout the network.

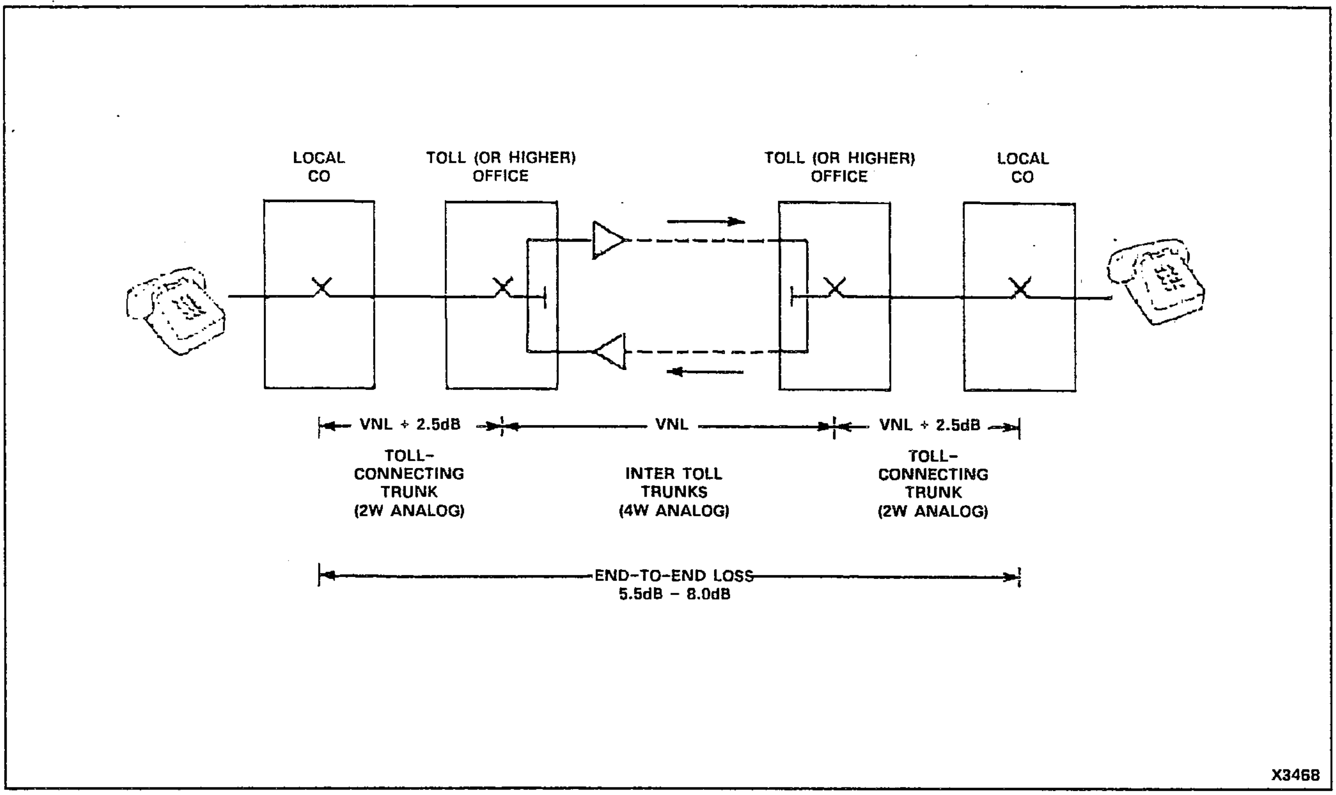


Figure 12-1 Local to Local Central Offices VNL Objectives

12.07 Control of echo and noise with this plan is achieved by inserting fixed amounts of loss at the end points where the conversion to analog takes place. A compromise value of 6 dB was selected for line-to-line connections over the Toll network. This loss is inserted in the receive (RX) direction of transmission (D-A) under software control. This is illustrated in Figure 12-2.

SX-200® DIGITAL PABX Loss And Level Plan

12.08 To illustrate the loss and level plan used for the SX-200® DIGITAL PABX, reference is made to the layout illustrated in Figure 12-3. This layout is not intended to be a typical network, but is drawn to show the different types of trunk and line interfaces which the SX-200® DIGITAL PABX will accommodate. The terms used for the different types of peripheral interfaces are explained in Table 11-1.

12.09 To implement the required loss objectives (Table 12-1) of the plan, combinations of software selectable analog and digital transmission pads are provided. All analog padding is provided by Mitel 8960 series combined Codec/Filter integrated circuits, over a 7 dB range in 1 dB increments. Padding is provided in both the Transmit (TX) and Receive (RX) directions (see Part C).

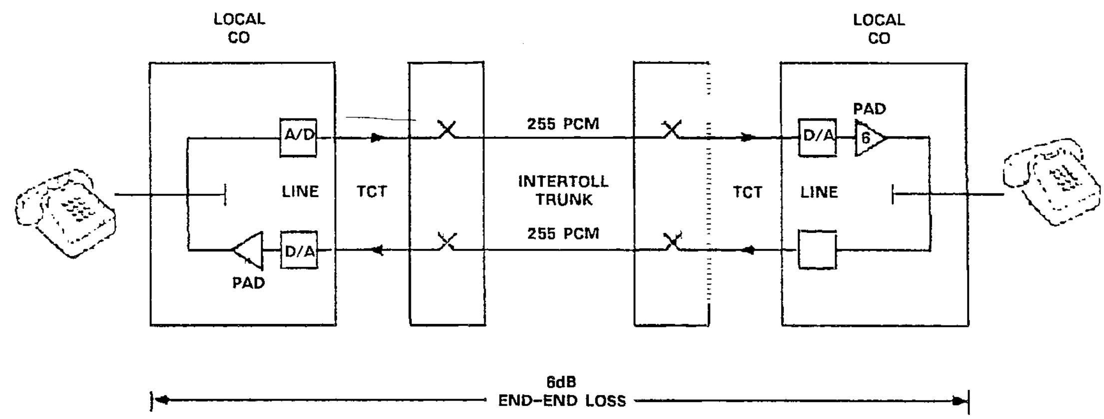


Figure 12-2 Local to Local Central Offices Fixed Loss Plan Objectives

Satellite PBX

12.10 A satellite PBX (shown in Figure 12-3) is defined as a PBX which has no direct connection to the serving central office for incomming traffic. It has no directory number, and receives all incoming calls through the main PBX over satellite trunks. The satellite PBX is usually in the same local area as its main PBX.

Analog Transmission Pad Arrangements - Digital Interfaces

12.11 The analog transmit pad (A/D) setting defines the input level required to produce a 0 dBm0 digital signal, as well as the overload point of the interface (approximately 3 dB above the 0 dBm0 signal level). The Tx pad comprises a fixed portion and a variable portion. The fixed portion is incorporated into the analog interface to the codec/filter. The variable portion (0 to 7 dB) is incorporated into the codec/filter.

12.12 The analog receive pad (D/A) defines the output level produced by a digital milliwatt input signal. The Rx pad comprises a fixed portion which is part of the analog interface to the codec/filter, and a variable portion (0 to −7 dB) which is incorporated into the codec/filter. This pad arrangement is illustrated in Figure 12-4.

Analog Transmission Pad Arrangements - Analog Interfaces

12.13 The transmit pads for the analog type cards consist of a variable or fixed portion on the card itself, a fixed portion on the Digital Interface card, and a variable portion in the codec/filter. The variable transmit pad on the analog ONS line card may be set to either -6.0 dB or -10.7 dB. The fixed transmit pad on the analog trunk cards is set to -6.0 dB. The fixed portion on the Digital Interface card is set to 1.8 dB while the variable portion in the codec/filter can be set to anything between 0 dB and 7 dB, in 1 dB steps. The input signal level and overload level are defined by the sum of the fixed and variable pads described in the Digital Interfaces paragraphs.

12.14 The receive pads for the analog type cards consist of a fixed portion on the analog card itself, a fixed portion on the Digital Interface card, and a variable portion in the codec/filter. The fixed portions are set to 5.7 dB and -1.9 dB respectively, while the variable portion can be set from 0 to -7 dB in 1 dB steps. The output signal level and overload level are defined by the sum of the fixed and variable pads as described in the Digital Interfaces paragraphs. This pad arrangement is illustrated in Figure 12-5.

Local Switching Loss Plan

12.15 To maximize the traffic performance of the SX-200® DIGITAL PABX, connections between analog interface circuits which are in the same analog equipment bay may be made by connecting both interfaces to the same analog speech path (junctor), without passing through the digital switching network in the digital bays. This type of connection is known as a "locally switched connection". The port-to-port losses for locally switched connections are shown in Table 12-2.

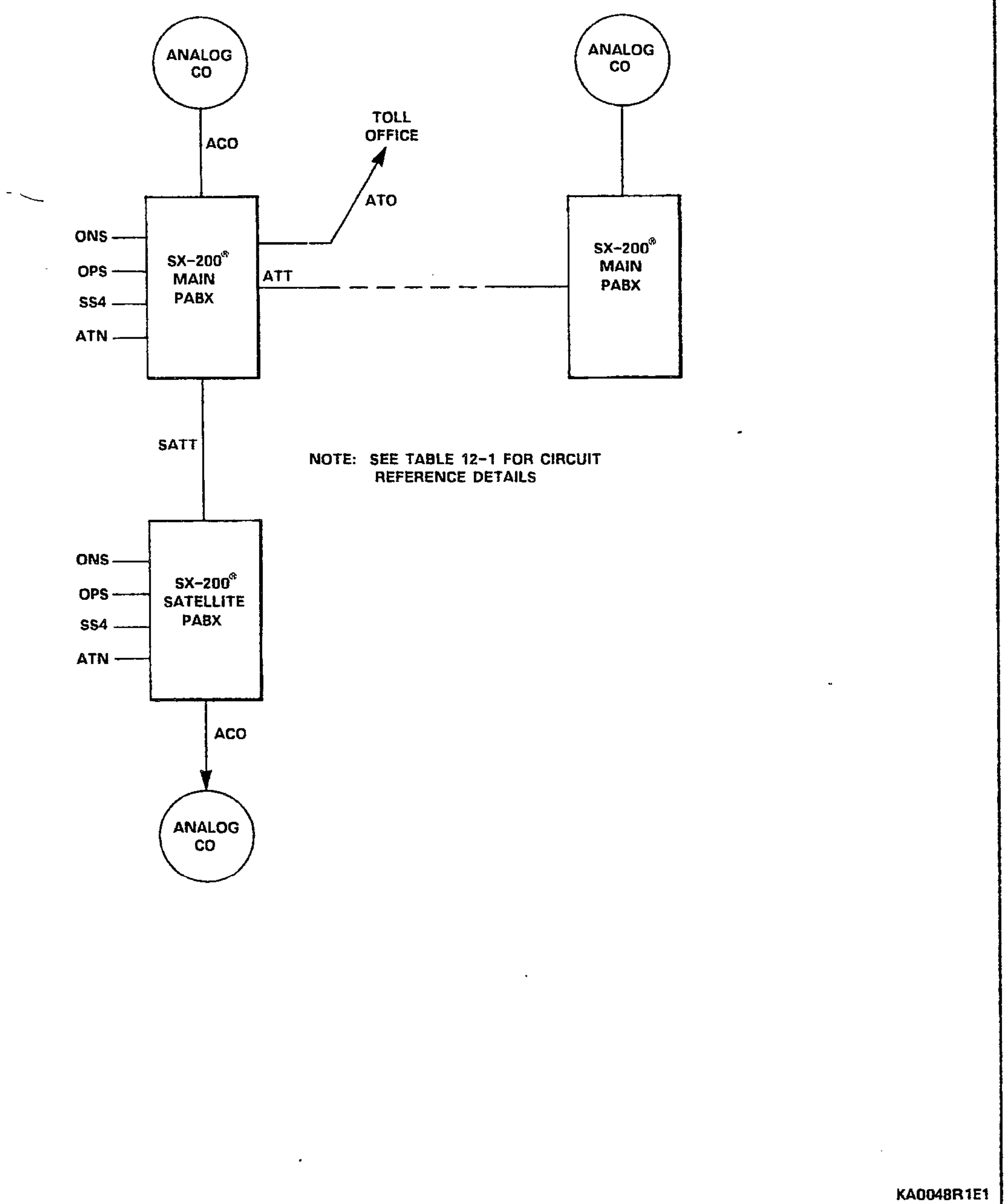


Figure 12-3 Types of Trunk and Line Interfaces

TABLE 12-1
SX-200® DIGITAL PABX LOSS PLAN

Originating Circuit	Connecting Circuit	Loss (dB) Tx Direction	Loss (dB) Rx Direction
ONS(D)	ONS(D)	-6.0	-6.0
	ONS(A)	-5.2	-5.2
	OPSS	-6.0	-6.0
	OPSL	-3.0	-3.0
	ACO(D)	0	0
	ACO(A)	-0.2	-0.2
	ATT(A)	-3.2	-3.2
	ATT(D)	-3.0	-3.0
	ATO(A)	-6.2	-6.2
	ATO(D)	-6.0	-6.0
	sATT	-3.0	-3.0
ONS(A)	ONS(D)	-6.0	-6.0
	ONS(A)	-5.4	-5.4
	OPSS	-5.2	-5.2
	OPSL	-3.2	-3.2
	ACO(D)	-0.2	-0.2
	ACO(A)	-0.4	-0.4
	ATT(A)	-3.4	-3.4
	ATT(D)	-3.2	-3.2
	ATO(A)	-6.4	-6.4
	ATO(D)	-6.2	-6.2
	sATT	-3.2	-3.2
OPSS	ONS(D)	-6.0	-6.0
	ONS(A)	-5.2	-5.2
	OPSS	-6.0	-6.0
	OPSL	-3.0	-3.0
	ACO(D)	0	0
	ACO(A)	-0.2	-0.2
	ATT(A)	-3.2	-3.2
	ATT(D)	-3.0	-3.0
	ATO(D)	-6.0	-6.0
	ATO(A)	-6.2	-6.2
	sATT	-3.0	-3.0
OPSL	ONS(D)	-3.0	-3.0
	ONS(A)	-3.2	-3.2
	OPSL	0	0
	OPSS	-3.0	-3.0
	ACO(D)	0	0
	ACO(A)	-0.2	-0.2
	ATT(A)	-2.2	-2.2
	ATT(D)	-2.0	-2.0
	ATO(D)	-3.0	-3.0
	ATO(A)	-3.2	-3.2
	sATT	-2.0	-2.0

TABLE 12-1 (CONT'D)
SX-200® DIGITAL PABX LOSS PLAN

Originating Circuit	Connecting Circuit	Loss (dB) Tx Direction	Loss (dB) Rx Direction
ACO(D)	ONS(D)	0	0
	ONS(A)	-0.2	-0.2
	OPSS	0	0
	OPSL	0	0
	ACO(D)	0	0
	ACO(A)	-0.2	-0.2
	ATT(A)	-2.2	-2.2
	ATT(D)	-2.0	-2.0
	ATO(A)	-3.2	-3.2
	ATO(D)	-3.0	-3.0
	sATT	0	0
ACO(A)	ONS(D)	-0.2	-0.2
	ONS(A)	-0.4	-0.4
	OPSS	-0.2	-0.2
	OPSL	-0.2	-0.2
	ACO(D)	-0.2	-0.2
	ACO(A)	-0.4	-0.4
	ATT(A)	-2.4	-2.4
	ATT(D)	-2.2	-2.2
	ATO(A)	-3.4	-3.4
	ATO(D)	-3.2	-3.2
	sATT	-0.2	-0.2
ATT(A)	ONS(D)	-3.2	-3.2
	ONS(A)	-3.4	-3.4
	OPSS	-3.2	-3.2
	OPSL	-2.2	-2.2
	ACO(D)	-2.2	-2.2
	ACO(A)	-2.4	-2.4
	ATT(A)	-0.4	-0.4
	ATT(D)	-0.2	-0.2
	ATO(A)	-0.4	-0.4
	ATO(D)	-0.2	-0.2
	sATT	-0.2	-0.2
ATT(D)	ONS(D)	-3.0	-3.0
	ONS(A)	-3.2	-3.2
	OPSS	-3.0	-3.0
	OPSL	-2.0	-2.0
	ATT(D)	0	0
	ATT(A)	-0.2	-0.2
	sATT	0	0
	ACO(D)	-2.0	-2.0
	ACO(A)	-2.2	-2.2
	ATO(D)	0	0
	ATO(A)	-0.2	-0.2

TABLE 12-1 (CONT'D)
SX-200® DIGITAL PABX LOSS PLAN

Originating Circuit	Connecting Circuit	Loss (dB) Tx Direction	Loss (dB) Rx Direction
ATO(A)	ONS(D)	-6.2	-6.2
	ONS(A)	-6.4	-6.4
	OPSS	-6.2	-6.2
	OPSL	-3.2	-3.2
	ACO(D)	-3.2	-3.2
	ACO(A)	-3.4	-3.4
	ATT(A)	-0.4	-0.4
	ATT(D)	-0.2	-0.2
	ATO(A)	-0.4	-0.4
	ATO(D)	-0.2	-0.2
	sATT	-3.2	-3.2
ATO(D)	ONS(D)	-6.0	-6.0
	ONS(A)	-6.2	-6.2
	OPSS	-6.0	-6.0
	OPSL	-3.0	-3.0
	ACO(D)	-3.0	-3.0
	ACO(A)	-3.2	-3.2
	ATT(A)	-0.2	-0.2
	ATT(D)	0	0
	ATO(A)	-0.2	-0.2
	ATO(D)	0	0
	sATT	-3.0	-3.0
sATT	ONS(D)	-3.0	-3.0
	ONS(A)	-3.2	-3.2
	OPSS	-3.0	-3.0
	OPSL	-2.0	-2.0
	ACO(D)	0	0
	ACO(A)	-0.2	-0.2
	ATT(A)	-0.2	-0.2
	ATT(D)	0	0
	ATO(A)	-3.2	-3.2
	ATO(D)	-3.0	-3.0
	sATT	0	0

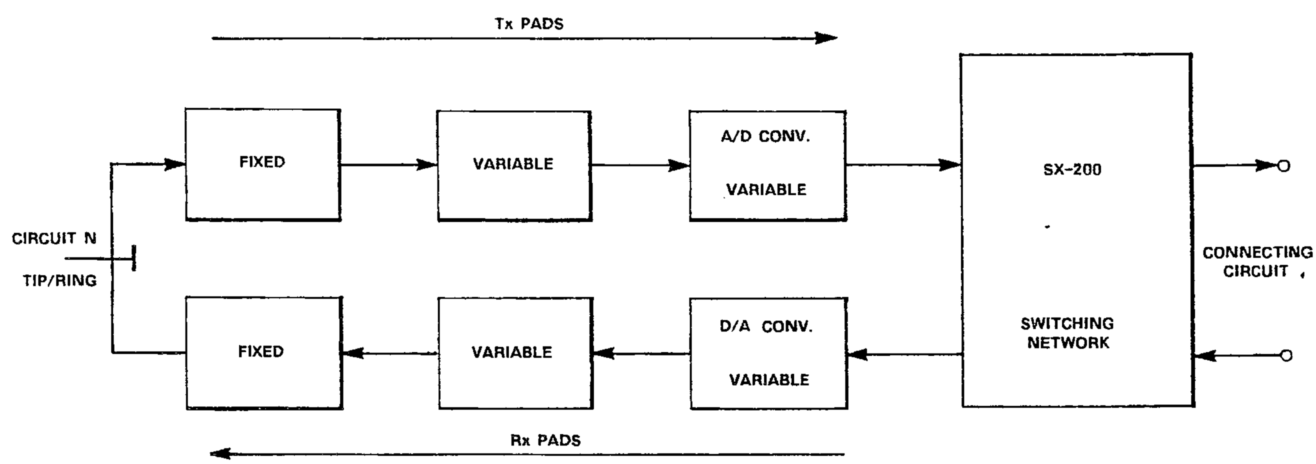


Figure 12-4 Analog Pad Arrangements - Configuration A

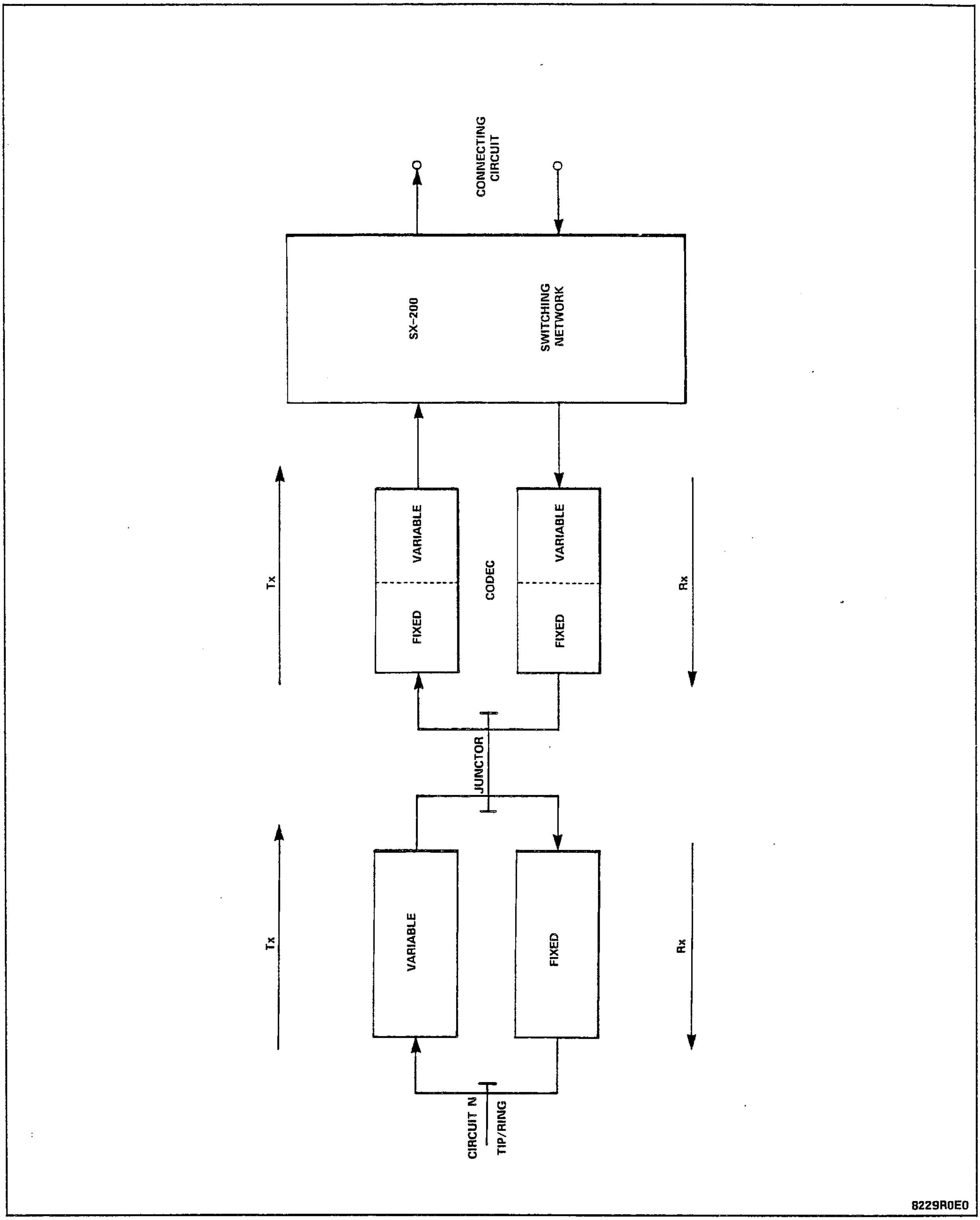


Figure 12–5 Analog Pad Arrangements – Configuration B

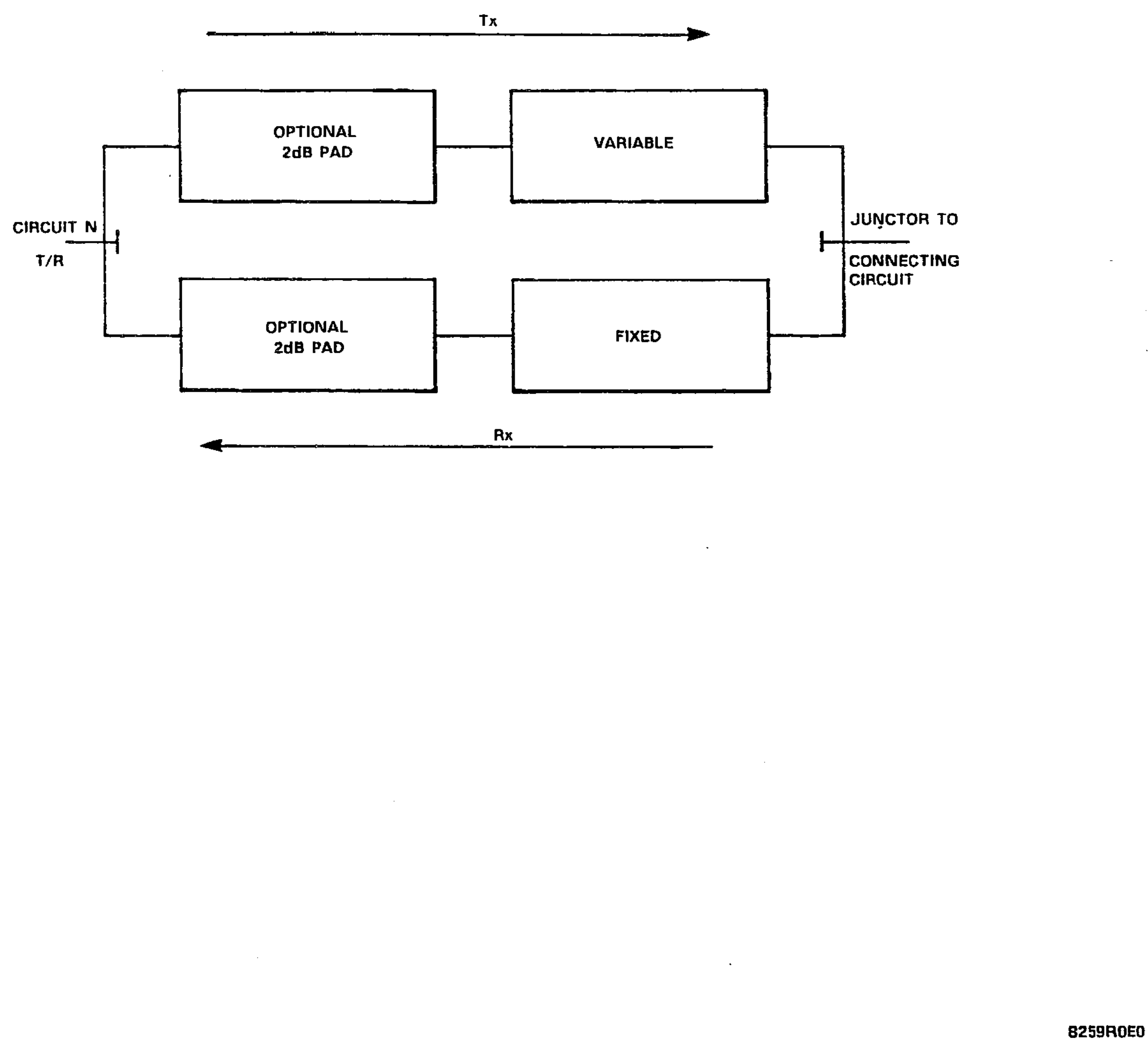


Figure 12-6 Local Switching Analog Pad Arrangements

TABLE 12-2
SX-200® DIGITAL PABX LOCAL SWITCHING LOSS PLAN

Originating Circuit	Connecting Circuit	Loss (dB) Tx Direction	Loss (dB) Rx Direction
ONS(A)	ONS(A) ACO(A) ATT(A) ATO)A)	-5.0 -0.3 -2.3 *	-5.0 -0.3 -2.3 *
ACO(A)	ONS(A) ACO(A) ATT(A) ATO(A)	-0.3 -0.3 -2.3 *	-0.3 -0.3 -2.3 *
ATT(A)	ONS(A) ACO(A) ATT(A) ATO(A)	-2.3 -2.3 -0.3 *	-2.3 -2.3 -0.3 *

* The ATO trunk cannot be locally switched. The ATO trunk can be implemented with an analog CO trunk interface, but it does not have the 2 dB pad required to meet part of the loss plan for local switching.

12.16 All analog interfaces may be represented by the block diagram Figure 12-6 when they are locally switched.

Conferencing Loss Plan

12.17 Any SX-200® DIGITAL PABX will have at least one 18 port conference circuit (Digital Signal Processor). The conferencing circuit, on a frame-by-frame basis, compares the level of all conferees and sends the loudest signal to all other parties in the conference. The party which is the loudest receives audio from the second loudest party. The conference loss plan is outlined in Table 12-3.

Tone Levels

12.18 All of the tones used by the SX-200® DIGITAL PABX are provided by the Digital Signal Processor on the Main Control card. The system provides eight tone channels, each of which can generate either a dual or single frequency tone. One channel is used to generate a signal which controls the frequency and amplitude of the ringing generator output. Three channels are used for DTMF tone generation, and the remaining four are used to generate the system call progress tones.

TABLE 12-3
CONFERENCING LOSS PLAN

Originating Circuit	Connecting Circuit	Loss (dB) Tx Direction	Loss (dB) Rx Direction
	ONS(D)	-6.0	-6.0
ONS(D)	ONS(A)	-6.2	-6.2
	OPSS	-6.0	-6.0
	OPSL	-3.0	-3.0
	ACO(D)	-4.0	-4.0
	ACO(A)	-3.2	-3.2
	ATT(A)	-5.2	-5.2
	ATT(D)	-5.0	-5.0
	ATO(A)	-6.2	-6.2
	ATO(D)	-6.0	-6.0
	sATT	-3.0	-3.0
	ONS(D)	-6.2	-6.2
ONS(A)	ONS(A)	-6.4	-6.4
	OPSS	-6.2	-6.2
	OPSL	-3.2	-3.2
	ACO(D)	-4.2	-4.2
	ACO(A)	-3.4	-3.4
	ATT(A)	-5.4	-5.4
	ATT(D)	-5.2	-5.2
	ATO(A)	-6.4	-6.4
	ATO(D)	-6.2	-6.2
	sATT	-3.2	-3.2
	ONS(D)	-6.0	-6.0
OPSS	ONS(D)	-6.0	-6.0
	ONS(A)	-6.2	-6.2
	OPSS	-6.0	-6.0
	OPSL	-3.0	-3.0
	ACO(D)	-4.0	-4.0
	ACO(A)	-3.2	-3.2
	ATT(A)	-5.2	-5.2
	ATT(D)	-5.0	-5.0
	ATO(D)	-6.0	-6.0
	ATO(A)	-6.2	-6.2
	sATT	-3.0	-3.0
	ONS(D)	-3.0	-3.0
OPSL	ONS(A)	-3.2	-3.2
	OPSL	0	0
	OPSS	-3.0	-3.0
	ACO(D)	-1.0	-1.0
	ACO(A)	-0.2	-0.2
	ATT(A)	-2.2	-2.2
	ATT(D)	-2.0	-2.0
	ATO(D)	-3.0	-3.0
	ATO(A)	-3.2	-3.2
	sATT	0	0

TABLE 12-3 (CONT'D)
CONFERENCING LOSS PLAN

Originating Circuit	Connecting Circuit	Loss (dB) Tx Direction	Loss (dB) Rx Direction
ACO(D)	ONS(D)	-4.0	-4.0
	ONS(A)	-4.2	-4.2
	OPSS	-4.0	-4.0
	OPSL	-1.0	-1.0
	ACO(D)	-2.0	-2.0
	ACO(A)	-1.2	-1.2
	ATT(A)	-3.2	-3.2
	ATT(D)	-2.2	-2.2
	ATO(A)	-4.2	-4.2
	ATO(D)	-4.0	-4.0
	sATT	-1.0	-1.0
ACO(A)	ONS(D)	-3.2	-3.2
	ONS(A)	-3.4	-3.4
	OPSS	-3.2	-3.2
	OPSL	-0.2	-0.2
	ACO(D)	-1.2	-1.2
	ACO(A)	-0.4	-0.4
	ATT(A)	-2.4	-2.4
	ATT(D)	-2.2	-2.2
	ATO(A)	-3.4	-3.4
	ATO(D)	-3.2	-3.2
	sATT	-0.2	-0.2
ATT(A)	ONS(D)	-5.2	-5.2
	ONS(A)	-5.4	-5.4
	OPSS	-5.2	-5.2
	OPSL	-2.2	-2.2
	ACO(D)	-3.2	-3.2
	ACO(A)	-2.4	-2.4
	ATT(A)	-4.4	-4.4
	ATT(D)	-5.2	-5.2
	ATO(A)	-5.4	-5.4
	ATO(D)	-5.2	-5.2
	sATT	-2.2	-2.2
ATT(D)	ONS(D)	-5.0	-5.0
	ONS(A)	-5.2	-5.2
	OPSS	-5.0	-5.0
	OPSL	-2.0	-2.0
	ATT(D)	-4.0	-4.0
	ATT(A)	-4.2	-4.2
	sATT	-2.0	-2.0
	ACO(D)	-3.0	-3.0
	ACO(A)	-2.2	-2.2
	ATO(D)	-5.0	-5.0
	ATO(A)	-5.2	-5.2

TABLE 12-3 (CONT'D)
CONFERENCING LOSS PLAN

Originating Circuit	Connecting Circuit	Loss (dB) Tx Direction	Loss (dB) Rx Direction
ATO(A)	ONS(D)	-6.2	-6.2
	ONS(A)	-6.4	-6.4
	OPSS	-6.2	-6.2
	OPSL	-3.2	-3.2
	ACO(D)	-4.2	-4.2
	ACO(A)	-3.4	-3.4
	ATT(A)	-5.4	-5.4
	ATT(D)	-5.2	-5.2
	ATO(A)	-6.4	-6.4
	ATO(D)	-6.2	-6.2
	sATT	-3.2	-3.2
ATO(D)	ONS(D)	-6.0	-6.0
	ONS(A)	-6.2	-6.2
	OPSS	-6.0	-6.0
	OPSL	-3.0	-3.0
	ACO(D)	-4.0	-4.0
	ACO(A)	-3.2	-3.2
	ATT(A)	-5.2	-5.2
	ATT(D)	-5.0	-5.0
	ATO(A)	-6.2	-6.2
	ATO(D)	-6.0	-6.0
	sATT	-3.0	-3.0
sATT	ONS(D)	-3.0	-3.0
	ONS(A)	-3.2	-3.2
	OPSS	-3.0	-3.0
	OPSL	0	0
	ACO(D)	-1.0	-1.0
	ACO(A)	-0.2	-0.2
	ATT(A)	-2.2	-2.2
	ATT(D)	-3.0	-3.0
	ATO(A)	-3.2	-3.2
	ATO(D)	-3.0	-3.0
	sATT	0	0

12.19 Most call progress and DTMF tones require that the receive gain pad in the line or trunk circuit interface codec be set to a specific value for the duration of the tone. The exception is the camp-on/override tone, which does not require any adjustment of the pads. The call progress tones are described in Table 12-4. The interface settings for the call progress tones are outlined in Table 12-5. The DTMF levels and interface settings are outlined in Tables 12-6 and 12-7 respectively.

TABLE 12-4
SX-200® NORTH AMERICAN CALL PROGRESS TONES

TONE	Frequency (Hz)	Combined Level (dBm into 600 ohms) Line Interface	Trunk Interface	Cadence (seconds)
Dial tone	350/440	-13.75 ±0.75	-13.75 ±0.75	continuous
Transfer dial tone	350/440	-13.75 ±0.75	-13.75 ±0.75	3 x (0.1 s on, 0.1 s off), followed by continuous
Reorder	480/620	-24.0 ±1.5	-18.0 ±1.5	0.25 s on, 0.25 s on
Busy	480/620	-24.0 ±1.5	-18.0 ±1.5	0.5 s on, 0.5 s off
Ringback	440/480	-19.0 ±1.5	-13.0 ±1.5	1 s on, 3 s off
Special ringback	440/480	-19.0 ±1.5	-13.0 ±1.5	0.4 s on, 0.2 s off, 0.4 s on, 3 s off.
Camp-on	440	-17.0 to -20.0	-14.0 to -20.0	on 0.2 s
Executive override	440	-17.0 to -20.0	-14.0 to -20.0	0.8 s on, (6 s off, 0.2 s on) repeated.
Special busy	440	-17.0 to -20.0	-14.0 to -20.0	0.5 s on, 0.5 s off

TABLE 12-5
CALL PROGRESS TONE INTERFACE LEVELS

TONE	Interface	Interface Level (dBm)
Dial Tone	ONS(D)	-13.75
	ONS(A)	-13.95
	OPSS	-13.75
	OPSL	-13.75
	ACO(D)	-13.75
	ACO(A)	-13.95
	ATT(A)	-13.95
	ATT(D)	-13.75
	ATO(A)	-13.95
	ATO(D)	-13.75
	sATT	-13.75
Reorder/ Busy	ONS(D)	-24.0
	ONS(A)	-23.2
	OPSS	-24.0
	OPSL	-24.0
	ACO(D)	-18.0
	ACO(A)	-18.2
	ATT(A)	-18.2
	ATT(D)	-18.0
	ATO(A)	-18.2
	ATO(D)	-18.0
	sATT	-18.0
Ringback	ONS(D)	-19.0
	ONS(A)	-18.2
	OPSS	-19.0
	OPSL	-19.0
	ACO(D)	-13.0
	ACO(A)	-13.2
	ATT(A)	-13.2
	ATT(D)	-13.0
	ATO(A)	-13.2
	ATO(D)	-13.0
	sATT	-13.0
Camp-on / Executive Override	ONS(D)	-20.0
	ONS(A)	-19.2 to -20.2
	OPSS	-20.0
	OPSL	-17.0 to -19.0
	ACO(D)	-14.0 to -20.0
	ACO(A)	-14.2 to -20.2
	ATT(A)	-17.2 to -20.2
	ATT(D)	-17.0 to -20.0
	ATO(A)	-17.2 to -20.2
	ATO(D)	-17.0 to -20.0
	sATT	-17.0 to -19.0

TABLE 12-6
DTMF LEVELS - TRUNK INTERFACE INTO 600 OHMS

Nominal level - single frequency	:	-4.0 dBm
Nominal level - frequency pair	:	-1.0 dBm
Nominal twist	:	0.0 dBm

TABLE 12-7
DTMF TONE INTERFACE LEVELS

Interface	Interface Level (dBm)
ONS(D)	n/a
ONS(A)	n/a
OPSS	n/a
OPSL	n/a
ACO(D)	-1.0
ACO(A)	-1.2
ATT(A)	-1.2
ATT(D)	-1.0
ATO(A)	-1.2
ATO(D)	-1.0
sATT	-1.0

13. TRAFFIC CONSIDERATIONS

General

13.01 This Part specifies the SX-200® DIGITAL PABX traffic characteristics. Information includes:

- Busy Hour Call Attempt (BHCA)
- System Traffic Capacity
- Grade of Service
- Receiver Provisioning
- Trunk Distribution.

Traffic specifications shown here assume a typical fully configured system as shown in Table 13-1, unless otherwise stated.

TABLE 13-1
TYPICAL CONFIGURED SYSTEM QUANTITIES

Category	480-Port Configuration
Lines	350
Trunks	54
Cabinets	2
Peripheral Bays:	
Digital -	2
Analog -	3

Busy Hour Call Attempt (BHCA)

13.02 The BHCA should not exceed the limits specified in Table 13-2.

TABLE 13-2
BUSY HOUR CALL ATTEMPTS

Busy Hour Call Attempts	System (Maximum)	Peripheral Bay (Maximum)
per Second	0.395	0.104
per Hour	1423	376

Traffic Capacity

13.03 The SX-200® DIGITAL PABX traffic capacity is outlined in Table 13-3.

TABLE 13-3
SX-200® DIGITAL PABX TRAFFIC CAPACITY
(Both Way Traffic)

System/Port	Calls/Hour	Erlang	CCS
per Port	5.59	0.19	6.83
System	1956.50	66.50	2390.5

Grade of Service

13.04 The SX-200® DIGITAL PABX Grade of Service (GOS) (in terms of blocking) is outlined in Table 13-4.

TABLE 13-4
SX-200® DIGITAL PABX GRADE OF SERVICE (GOS)

Link/Resource Blocking	Blocking Probability
Link Blocking:	
Peripheral to Network	< 0.1%
Network to Network	0.0%
Resource Blocking	
Software	< 0.01%
DTMF Receivers, Trunks	provisioning dependent

Receiver Provisioning

13.05 The number of receivers required to be installed in the PABX is dependent on various factors, such as the number of lines and trunks installed, the amount of traffic flow estimated for the system and the desired grade of service. In order to arrive at the quantity of receivers required the following assumptions were made:

- Average receiver holding time for intercom.call is 6 seconds
- Average receiver holding time for a trunk call is 17.4 seconds
- Holding time for receivers is exponential
- Call originations are Poisson
- Call holding times are exponential
- Receivers are provisioned in multiples of 4.

13.06 For a given load (heavy, medium and light traffic), the minimum number of required receivers was determined for the following grades of service (ABSBH):

- ABSBH = 98.5 - 98.5 % of all receiver requests serviced within 3 seconds.

- ABSBH = 99.5 - 99.5 % of all receiver requests serviced within 3 seconds.

13.07 The following calculations are used to generate Tables 13-5 through 13-7:

Receiver Holding Time (h) = 6 x (% intercom traffic) + 17.4 x (% trunk traffic) Seconds

Receiver Traffic (A) =

$$\frac{\text{(Originating Calls per hour) x (Receiver holding time (sec))}}{3600} \text{ Erlangs}$$

Multiple of holding time (t) $= \dfrac{3\ (s)}{h\ (s)}$

Probability of of delay
greater than t (P(>t)) = 1 - ABSBH/100

Using Erlang C formula delay curves, knowing t, A, P(>t), the minimum number of receivers can be obtained.

Trunk Distribution

13.08 Since the digital bays are non-blocking, while the analog bays are blocking, as many trunks as possible should be distributed in the digital bays. Analog type trunks should be evenly distributed throughout the analog bays. For example, a fully configured system in a heavy traffic environment might have four to five trunk cards in each of the anlog bays.

TABLE 13-5
HEAVY TRAFFIC

No. of Lines	CCS/ Line	Total CCS	In CCS	Out CCS	Intra CCS	In Calls	Out Calls	Intra Calls	Orig Calls	In Trks	Out Trks	2Way Trks	Receivers Required for ABSBH = 98.5%	Receivers Required for ABSBH = 99.5%
60	5.94	356	150	140	67	85	103	77	180	11	9	16	4	4
80	5.77	462	190	178	93	108	132	106	238	12	11	19	4	8
100	5.67	567	230	216	120	131	160	136	296	14	13	228	8	8
120	5.60	672	269	254	149	153	189	167	356	16	14	25	8	8
140	5.55	777	308	292	177	174	216	198	414	17	15	28	8	8
160	5.51	882	346	329	207	196	244	229	473	19	17	30	8	8
180	5.48	986	384	365	237	217	272	261	533	20	18	33	8	8
200	5.46	1092	422	402	267	238	299	292	591	21	20	36	8	8
220	5.44	1197	460	439	298	258	327	324	651	23	21	38	8	8
240	5.43	1303	497	476	330	279	355	356	711	24	22	41	8	8
260	5.41	1407	534	511	362	299	382	388	770	25	23	43	8	8
280	5.40	1512	570	547	394	319	409	420	829	27	25	46	8	8
300	5.39	1617	607	583	426	338	436	542	888	28	26	48	8	12
320	5.38	1722	643	619	459	357	463	483	946	29	27	51	8	12
340	5.38	1829	680	655	493	376	491	516	1007	31	28	53	12	12
360	5.37	1933	716	691	526	395	518	547	1065	32	30	55	12	12

TABLE 13-6
MEDIUM TRAFFIC

No. of Lines	CCS/ Line	Total CCS	In CCS	Out CCS	Intra CCS	In Calls	Out Calls	Intra Calls	Orig Calls	In Trks	Out Trks	2Way Trks	Receivers Required for ABSBH = 98.5%	Receivers Required for ABSBH = 99.5%
60	3.23	194	81	76	37	46	56	42	98	7	6	11	4	4
80	3.14	251	103	97	51	59	72	58	130	8	8	13	4	4
100	3.09	309	125	118	66	71	87	74	161	9	8	14	4	4
120	3.05	366	147	138	81	83	103	91	194	10	9	16	4	4
140	3.02	423	168	159	96	95	118	108	126	11	10	18	4	4
160	3.00	480	188	179	113	107	133	125	258	12	11	19	4	8
180	2.99	538	210	199	129	118	148	142	290	13	12	21	4	8
200	2.98	596	230	220	146	130	163	160	323	14	13	22	8	8
220	2.97	653	251	240	163	141	178	177	355	15	13	24	8	8
240	2.96	710	271	259	180	152	193	194	387	16	14	25	8	8
260	2.95	767	291	279	197	163	208	212	220	16	15	27	8	8
280	2.94	823	311	298	214	174	223	229	452	17	16	28	8	8
300	2.94	882	331	318	233	185	238	246	484	18	16	30	8	8
320	2.93	938	350	337	250	195	252	263	512	19	17	31	8	8
340	2.93	996	371	357	269	205	267	281	548	19	18	32	8	8
360	2.93	1055	391	377	287	215	283	298	581	20	19	34	8	8
380	2.92	1110	409	395	305	225	297	315	612	21	19	35	8	8
400	2.92	1168	429	415	324	235	312	332	644	22	20	36	8	8

TABLE 13-7
LIGHT TRAFFIC

No. of Lines	CCS/ Line	Total CCS	In CCS	Out CCS	Intra CCS	In Calls	Out Calls	Intra Calls	Orig Calls	In Trks	Out Trks	2Way Trks	Receivers Required for ABSBH = 98.5%	Receivers Required for ABSBH = 99.5%
60	1.41	85	36	33	16	20	24	18	42	5	4	7	4	4
80	1.41	113	46	44	23	26	32	26	58	6	5	8	4	4
100	1.41	141	57	54	30	33	40	34	74	6	5	9	4	4
120	1.41	169	68	64	37	38	47	42	89	7	6	10	4	4
140	1.41	197	78	74	45	44	55	50	105	7	6	11	4	4
160	1.41	226	89	84	53	50	62	59	121	8	7	12	4	4
180	1.41	254	99	94	61	56	70	67	137	8	7	12	4	4
200	1.41	282	109	104	69	61	77	75	152	9	8	13	4	4
220	1.41	310	119	114	77	67	85	84	169	9	8	14	4	4
240	1.41	338	129	123	86	72	92	93	185	10	9	15	4	4
260	1.41	367	139	133	94	78	99	101	200	10	9	16	4	4
280	1.41	395	149	143	103	83	107	110	217	10	10	16	4	4
300	1.41	423	159	153	112	89	114	118	232	11	10	17	4	4
320	1.41	451	169	162	120	94	121	127	248	11	10	18	4	8
340	1.41	479	178	172	129	99	129	135	264	12	11	19	4	8
360	1.41	508	188	181	138	104	136	144	280	12	11	19	4	8
380	1.41	536	198	191	147	109	143	152	295	13	11	20	8	8
400	1.41	564	207	200	156	114	150	160	310	13	12	21	8	8

APPENDIX A
CALL PROCESSING INFORMATION

A1.01 – Digital Bay to Digital Bay (within bays 1 and 2)

1. The Main Control Card (MCC) scans for on-hook/off-hook change of state.
2. An extension goes off-hook in Bay 1.
3. The MCC detects the off-hook during its line card scan.
4. MCC checks for the COS of the extension to determine if the call is allowed.
5. The MCC checks for and idle receiver.
6. The MCC connects the DTMF receiver to the line circuit through the DX matrix on a PCM channel.
7. The MCC connects the same channel to the Digital Signal Processor (DSP) to provide dial tone.
8. The MCC monitors the circuit for rotary pulses.
9. The DTMF receiver detects any DTMF tones and sends a message to the MCC indicating the value of the dialed digits.
10. On receipt of the first digit, the MCC removes the DSP from the assigned channel.
11. The MCC monitors the digits dialed and checks the idle/busy condition of the destination.
12. If the destination is idle, the MCC connects the DSP to the originator and ringback is supplied.
13. The MCC sends the originator a cadence message to provide interruption of the ringback tone.
14. The MCC sends ringing to the Bay Power Supply from the DSP via a DX link.
15. The Bay Power Supply amplifies and routes the ringing to the destination.
16. The MCC sends a message to the destination to turn ringing on.
17. When the destination answers, the MCC detects the off-hook change of state.

18. Ringing is removed from the destination.

19. Ringback is removed from the originator.

20. A channel is connected between the originator and the destination.

21. The MCC scans for on-hook/off-hook changes of state.

22. When an on-hook is detected, the MCC removes the channel, and the call is terminated.

A1.02 – Analog Bay (Rotary) to Analog Bay

1. The Scanner card scans the line circuits for on-hook/off-hook changes of state.

2. An extension goes off-hook in Bay 3.

3. The Scanner detects an off-hook during the line card scan.

4. The Scanner sends an IRQ to the Peripheral Control Card (PCC).

5. The PCC determines the originator, generates a message and passes it to the Digital Interface Card (DIC).

6. The DIC formats and sends a message to the MCC.

7. The MCC checks the originator's COS to determine if the call is allowed.

8. The MCC checks for an idle DTMF receiver.

9. The MCC sends a message to the PCC to connect a junctor to the originator.

10. The MCC assigns a channel of the link to the junctor, and conects the DTMF receiver to the channel through the DX matrix.

11. The MCC connects the same channel to the DSP to provide dial tone.

12. The PCC monitors the circuit for rotary pulses.

13. The DTMF receiver detects any DTMF tones and sends a message to the MCC indicating the value of the tones.

14. On receipt of the first digit, the MCC removes the DSP from the assigned channel.

15. The MCC monitors the digits dialed and checks the idle/busy condition of the destination.

16. If the destination is idle, the MCC connects the DSP to the originator and ringback tone is supplied.

17. The MCC sends a cadence message to the PCC of the originator to provide interruption of the ringback tone.

18. The MCC sends a message to the PCC to ring the destination.

19. When the destination answers, the Scanner detects the off-hook.

20. The Scanner sends an IRQ to the PCC.

21. The PCC stops ringing and sends a message to the MCC indicating that the destination is off-hook.

22. Ringback is removed from the originator.

23. Since both parties are in Bay 3, the MCC sends a message to the PCC to provide a connection between the originator and the destination using a speech path. (There are no PCM channels used in this connection).

24. The Scanner scans for on-hook/off-hook changes of state.

25. When an on-hook is detected, the PCC sends a message to the MCC indicating that the extension(s) have gone on-hook; the call is terminated.

SX-200® DIGITAL
PRIVATE AUTOMATIC BRANCH EXCHANGE (PABX)
TROUBLESHOOTING

CONTENTS PAGE

CONTENTS CONT'D PAGE

LIST OF ILLUSTRATIONS

LIST OF CHARTS

LIST OF CHARTS (CONT'D)

LIST OF TABLES

FOR EMERGENCY

TROUBLESHOOTING

GO TO

CHART 2-2

ON PAGE 2-4

I M P O R T A N T   N O T I C E

A. CORRECT SYSTEM GROUNDING IS CRITICAL. GROUNDING INSTRUCTIONS CONTAINED IN SECTION MITL9108-093-200-NA, SHIPPING, RECEIVING AND INSTALLATION MUST BE ADHERED TO WITHOUT EXCEPTION. NOTE THAT THE SYSTEM MAY FUNCTION ERRATICALLY, OR NOT AT ALL WITHOUT PROPER GROUNDING.

B. THE FOLLOWING POINTS SHOULD BE CAREFULLY NOTED AND THE INSTRUCTIONS THEREIN STRICTLY OBSERVED :

- Handle circuit cards by the edges only, and ensure that a ground strap is used. Card damage may otherwise result.
- Before replacing a card, remove the original card, check for bent or damaged connectors, inspect the backplane, and reseat the original card.
- If a problem has been cured through the replacement of a card, temporarily reinsert the original card to verify that the fault is located therein.
- Always provide the maximum amount of relevant data on the card repair tag accompanying a faulty card (see Appendix F) – never return a card without a repair tag.
- Ensure that a system fault record is always up-to-date, and kept on site.

1. GENERAL

Introduction

1.01 This Section is intended to provide maintenance personnel with a comprehensive guide to the detection, analysis and correction of malfunctions of the SX-200® DIGITAL PABX with Generic 1000 or Generic 1001 software. The scope of this Section the covers the main switching machine, the central office interface, stations and special sets, and AC power (including grounding). The Section comprises troubleshooting procedures, which are used to isolate and correct malfunctions, together with additional supporting information.

1.02 Before troubleshooting is attempted, the maintenance user should become very familiar with the SX-200® maintenance system. A complete description of the maintenance system is provided in Section MITL9108-093-353-NA. Further details concerning the maintenance of the SX-200® DIGITAL PABX with Generic 1000 or Generic 1001 software may be found in the MITEL Sections listed in Table 1-1.

Reason for Issue

1.03 New procedures have been added to cover new hardware.

TABLE 1-1
SX-200® DIGITAL PABX MITEL PRACTICES

MITL9108-093-100-NA	General Description
MITL9108-093-105-NA	Features Description
MITL9108-093-180-NA	Engineering Information
MITL9108-093-200-NA	Shipping, Receiving and Installation
MITL9108-093-210-NA	Customer Data Entry
MITL9108-093-351-NA	RS-232 Maintenance Terminal
MITL9108-093-353-NA	General Maintenance Information

2. PRIMARY TROUBLESHOOTING PROCEDURES

General

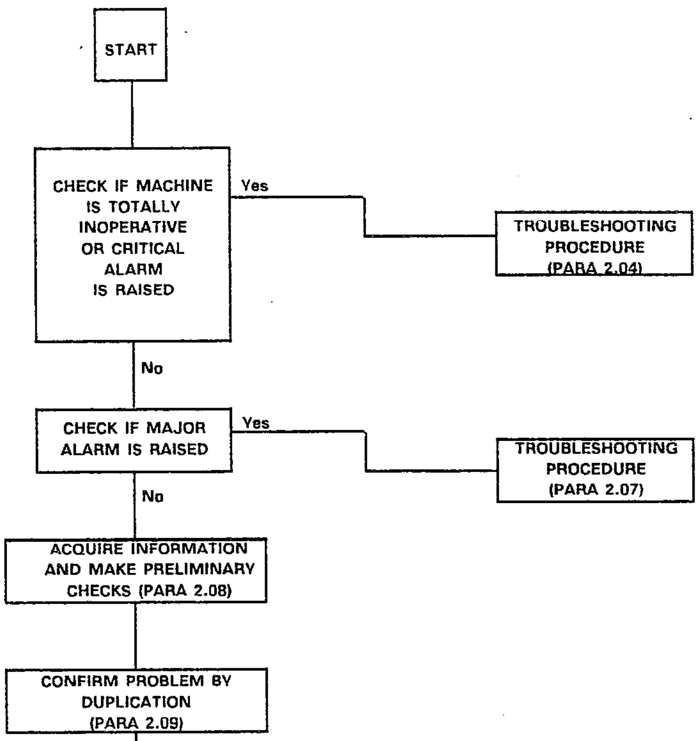
2.01 Troubleshooting a malfunction in any complex electronic system is accomplished in a series of logical steps. This Section assumes the following basic steps in the troubleshooting of a malfunction:

- GATHERING of information
- CLARIFICATION of the problem
- CONFIRMATION of the problem
- ISOLATION of the problem
- CORRECTION
- DOCUMENTATION.

2.02 Chart 2-1 provides the basic primary troubleshooting flowchart for the SX-200® DIGITAL PABX system. This chart acts as a starting point for the troubleshooting process, and directs the troubleshooter to the appropriate detailed troubleshooting procedure.

2.03 The troubleshooter, when investigating a problem, should continually verify each step in the isolation process so as to ensure that the system, and the symptoms of the malfunction are clearly understood. This will ensure that the malfunction is accuratly categorized so that appropriate diagnostics, where applicable, may be invoked.

CHART 2-1 FLOWCHART - PRIMARY TROUBLESHOOTING PROCEDURES



CATEGORIZE PROBLEM INTO ONE OF THE FOLLOWING PROCEDURE GROUPS:

Title	Para.	Page
Lines	3.01	3-1
Trunks	3.05	3-13
Universal Card	3.08	3-28
DTMF Receiver	3.09	3-30
Console Module	3.10	3-34
MOH/Pager Module	3.11	3-34
Analog Junctors	3.12	3-38
Attendant Console	3.13	3-42
SUPERSET® Sets	3.14,3.15	3-46,3-50
Main Control Card	4.01	4-1
Bay Control Card	4.06	4-2
Analog Bay Control Cards	4.11	4-7
Floppy Disk Subsystem	4.16	4-11
Power Subsystem	4.19	4-14
UPS	4.20	4-18
Maintenance/CDE Terminal	4.21	4-20
Printer	4.22	4-22
Cabinet Cooling System	4.23	4-24
Power Fail Transfer System	4.24	4-26

PROCEDURE 1 - MACHINE TOTALLY INOPERATIVE

General

2.04 When any switching machine is totally inoperative the prime requirement is the restoration of service to the system, or the part that has been affected. Chart 2-2 shows how to achieve this in the shortest possible time. Once service has been restored, the other procedures (see Chart 2-1) may be used to determine the cause of the failure.

2.05 Note that if power fail transfer has occurred, or it is necessary to invoke power fail transfer, toggle the POWER FAIL TRANSFER switches on the maintenance panel(s) to prevent lines and trunks from transferring back to the switch before it has been returned to operational status.

CHART 2-2
EMERGENCY TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Check if the green ACTIVE LED on the Main Control Card front panel is flashing.	Yes: • Go to step 9. No : • Go to step 2.	
2	Press the SYSTEM RESET pushbutton on the front panel of the Main Control card.	• If the Main Control card 7-segment displays are blank, go to step 3; otherwise go to step 11.	
3	Check if the POWER ON LED on the Bay 2 power supply is on (ensure the switch is in the ON position).	Yes: • Go to step 4. No : • Go to step 8.	
4	Turn the Bay 2 power supply off, reseat the Main Control card, and turn the power on again. Anything on 7-segment displays?	Yes: • Go to step 11. No : • Go to step 5.	
5	Turn the Bay 2 power supply off, unplug the Main Control Card, and verify that the flea clips are properly connected (particularly clips W4 and W8).	• Reseat the Main Control Card; turn the power back on. • If the problem persists, go to step 6.	see Fig 2-1
6	Check power rails and continuity on the Bay 2 backplane.	• Verify that the required voltage signals actually are present at the Main Control card edge connectors. • Once verified go to step 7.	see Fig 2-2
7	Power down Bay 2, remove Main Control card, and check if EPROM IC is securely installed.	Yes: • Possible EPROM problem (check revision label) - replace Main Control card. No: • Install EPROM properly and go back to step 2.	see Fig 2-3
8	Check if AC cord is firmly connected to the rear of the Bay 2 power supply.	No : • If loose, plug in securely; go back to step 2. Yes: • Check all other AC connections through the AC distribution frame, to the AC source. • If no cabling problems are found, refer to the Bay Power Supply troubleshooting procedures in Paragraph 4.19.	
9	Attempt a call - is Call Processing running?	Yes: • Stop. Continue to monitor system. No : • Press the SYSTEM RESET pushbutton on the Main Control card front panel, and go to step 10.	
10	Power down Bay 2, unplug Main Control card and verify that flea clip W6 is properly attached.	Yes: • Plug Main Control card back in, power the bay up, and go to step 11. No : • Connect it properly, and go back to step 2.	see Fig 2-1

CHART 2-2 (Cont'd)
EMERGENCY TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
11	Check for the following error codes on the Main Control card 7-segment displays:		
12	0	• Power down Bay 2, remove Main Control card, check flea clip W3 - re-install or replace as required; go back to step 2. • If problem persists, replace Main Control card.	see Fig 2-1
13	E 0	• Power down Bay 2, remove Main Control card, inspect installation of DRAM and DX modules. • If improperly installed, install correctly, and go back to step 2. • If properly installed, problem likely with either DRAM or DX modules - replace Main Control card.	see Fig 2-3
14	E 1 E 3 E 4 or E 5	• Power down Bay 2, replace Main Control card.	
15	E 2	• Power down Bay 2, remove Main Control card, inspect installation of EPROM IC. • If improperly installed, install correctly, and go back to step 2. • If properly installed, problem likely with EPROM IC - replace Main Control card.	see Fig 2-3
16	E 6 E 7 E 8 or E 9	• Power down Bay 2, remove Main Control card, inspect installation of DRAM module. • If improperly installed, install correctly, and go back to step 2. • If properly installed, problem likely with DRAM module - replace Main Control card.	see Fig 2-3
17	E b.	• Go to step 20.	
18	Sequence: 2 8 9 b E b	• Power down the Main Control card, and check the installation of the Decryption module. • If it is installed incorrectly, install it correctly. • If installed correctly, likely problem with Decryption module; replace Main Control card.	see Note 1
19	- ANY OTHER ERROR CODE -	• Go back to step 2. • If this persists, go to step 26.	see Note 2

CHART 2-2 (Cont'd)
EMERGENCY TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
20	Ensure that the disk drive is connected to both the power source and the data bus at the backplane.	Yes: • Go to step 21. No : • Make corrections as required, then go back to step 2.	see Fig 2-2
21	Check that the diskette is installed properly, and that the lock latch is closed.	• If problem persists, go to step 22.	
22	Remove the diskette, and check for physical damage.	• Replace diskette if damaged. • If not damaged, attempt to reset system again. • If problem persists, go to step 23.	
23	Replace the diskette.	• If problem persists, go to step 24.	
24	Ensure that the bottom switch in S3 is in the ON position (up, with respect to the board).	Yes: • Go to step 25. No : • Put switch into ON position, go to step 2.	see Fig 2-1
25	Replace the disk drive.	• If problem persists, go to step 26.	
26	Replace the Main Control card.	• If problem persists, contact MITEL Field Service.	

Notes: 1. In this case, the normal test progression will take place, software will be loaded from disk, but will not be started; rather, the system resets. This cycle will continue until the problem is corrected.

2. A normal running system may show other error codes on the 7-segment displays during normal operation; however, during a system reset, only those error codes shown in steps 12 through 18 are possible. Other error codes may be:
   a) Disk error codes - see paragraph 4.16.
   b) Faulty card error codes - where the top 7-segment display indicates the Bay number and the bottom 7-segment display indicates the slot number.

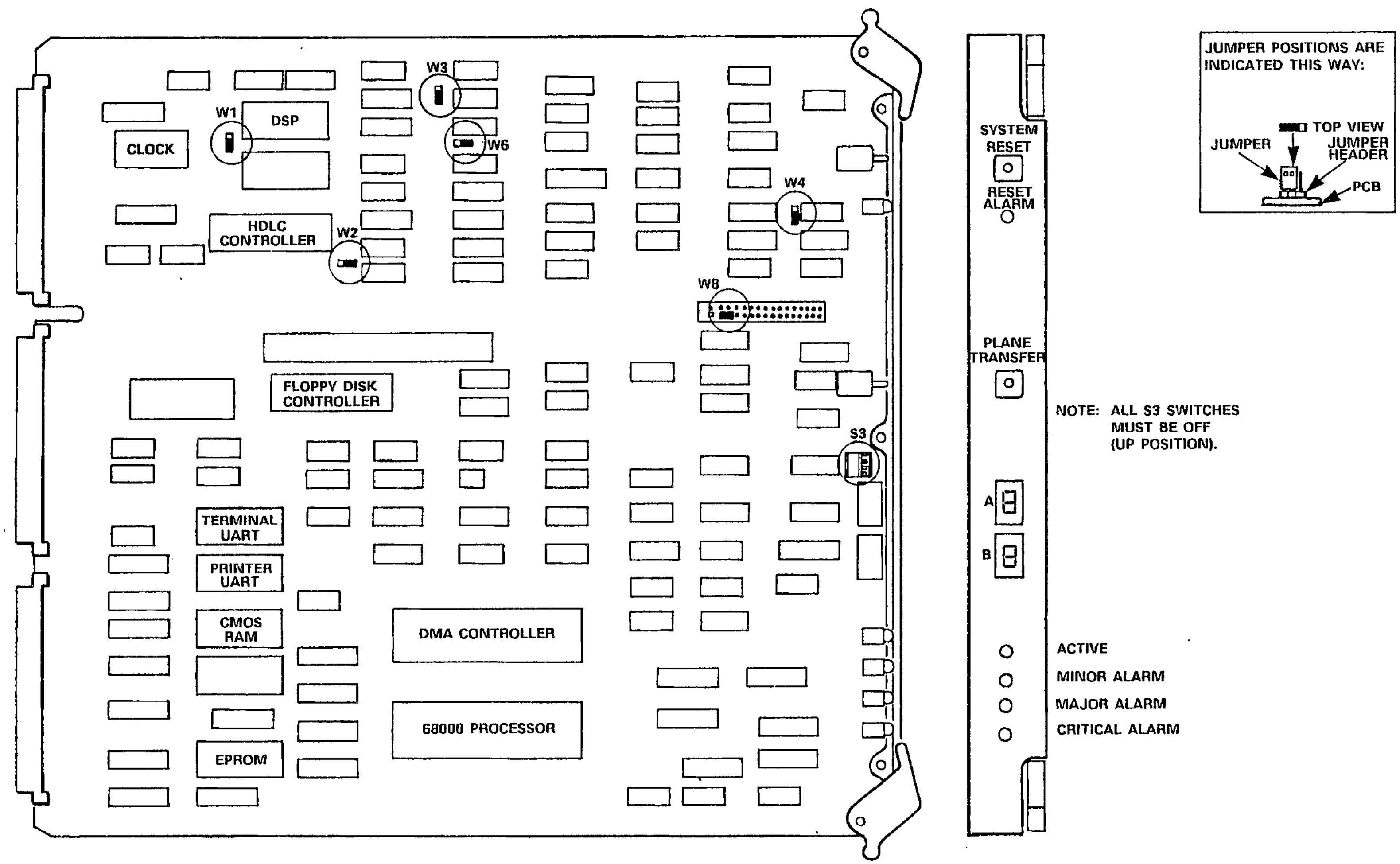


Figure 2-1 Main Control Card Flea Clip and Device Locations

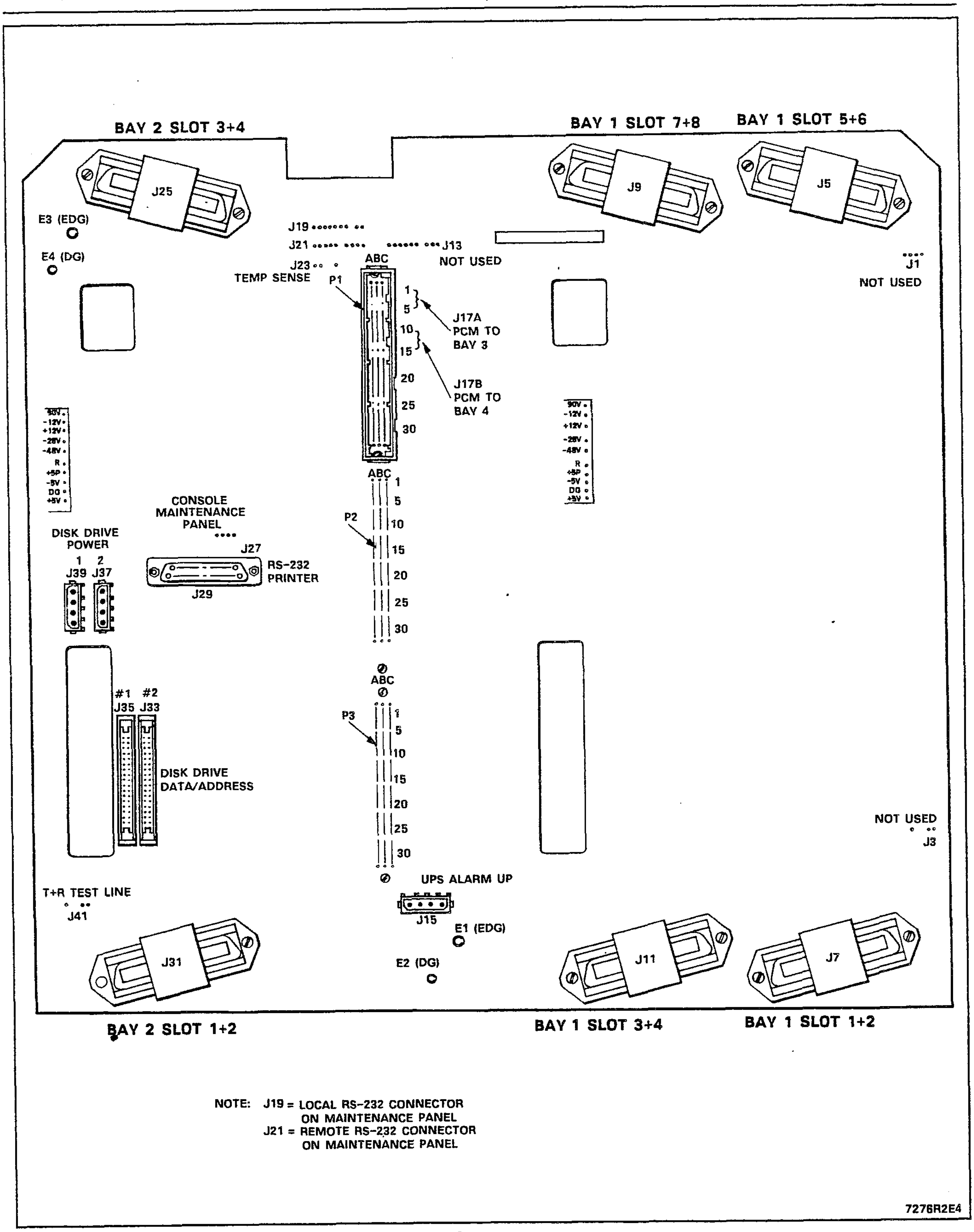


Figure 2-2 SX-200® DIGITAL PABX Backplane

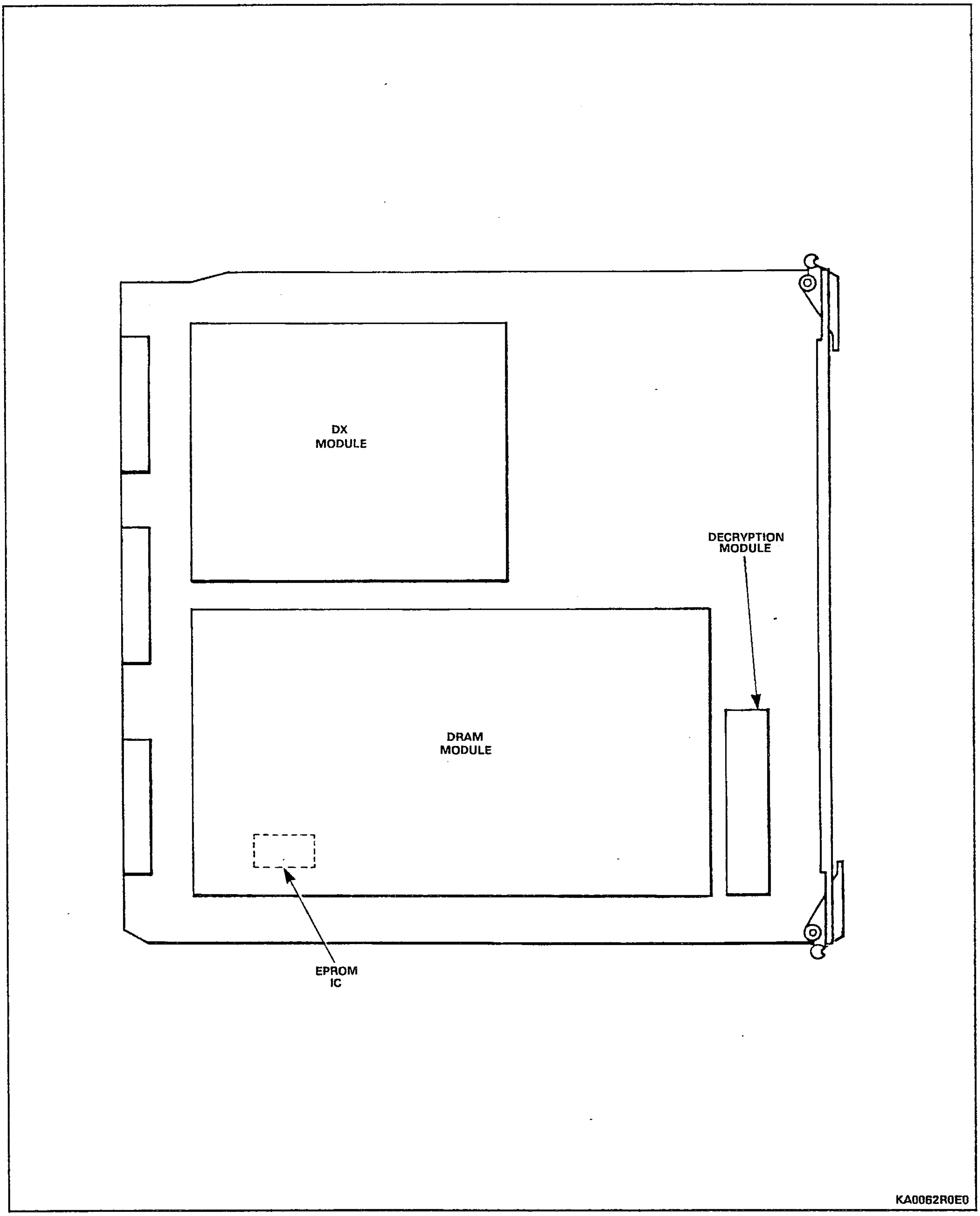


Figure 2-3 Main Control Card Module Locations

PROCEDURE 2 – CRITICAL ALARM

General

2.06 The raising of a critical alarm indicates a fault of actual or potentially catastrophic magnitude has occurred. Such an alarm is usually accompanied by activation of the automatic power fail transfer operation in a bay, bays, or throughout the entire system. Chart 2-3 shows the steps to be taken in analyzing a fault resulting in the raising of a critical system alarm. Refer to Section MITL9108-093-353-NA, General Maintenance Information for details on alarms.

CHART 2-3
CRITICAL ALARM TROUBLESHOOTING PROCEDURES - SYSTEM

Step	Action	Description / Follow-up	Remarks
1	Check if system has gone into power fail transfer mode - examine maintenance log.	Yes: • Go to step 2. No : • Force the system into power fail transfer mode via the maintenance panel switches, and leave it in this condition until the system is repaired.	see Note 1
2	Check if the Main Control card appears to be functioning correctly - check visual displays on Main Control card front panel.	Yes: • Go to step 3. No : • Refer to Emergency Troubleshooting Procedures (Chart 2-2).	see Note 3
3	If there are analog cards in the system, check if they seem to be functioning correctly - check visual displays on control card front panels.	Yes: • Go to step 4. No : • Refer to Peripheral Control Card troubleshooting procedures.	see Note 3
4	Check maintenance log history for indications of trouble before the critical alarm; any such indications?	Yes: • Refer to the appropriate troubleshooting No : • Go to step 5.	see Note 2
5	Identify the fault(s) which caused the critical alarm condition.	• Use the SHOW ALARMS command. • If maintenance cannot be accessed, refer to the Emergency Troubleshooting Procedures (Chart 2-2). • Go to step 6.	see Note 2
6	Refer to the appropriate troubleshooting procedures as indicated by the alarm report.	• If this leads nowhere, go to step 7.	
7	Check maintenance log for possible cause(s).	• If this uncovers a clue, refer to the appropriate troubleshooting procedures; otherwise go to step 8.	see Note 2
8	Check if the bays have power.	Yes: • Go to step 9. No : • Refer to the power supply troubleshooting procedures.	
9	Exercise call processing to test stability.	• Make station-to-station calls, station-to-trunk calls, etc. • If critical alarm persists to this point, go to step 10.	see Note 4
10	Refer to the Power Fail Transfer card troubleshooting procedures.	• If the PFT cards appear functional, go to step 11.	
11	Refer to the Main Control card troubleshooting procedures.		

Notes:
1. Refer to Section MITL9108-093-353-NA, General Maintenance Information for details on the power fail transfer switches.
2. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for information on procedures.
3. Refer to Section MITL9108-093-353-NA, General Maintenance Information for details on control card status indicators.
4. Avoid using stations or trunks under Power Fail Transfer (PFT) control.

PROCEDURE 3 – MAJOR ALARM

General

2.07 A major alarm is raised when a serious degradation of service occurs. The major alarm is activated when a preprogrammed percentage of ports fail, or when any common control card fails. Refer to Section MITL9108-093-353-NA, General Maintenance Information for further details on alarms. Chart 2-4 outlines the troubleshooting procedures for both system-related major alarms and bay-related major alarms.

CHART 2-4
MAJOR ALARM TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Identify the fault(s) which caused the major alarm condition.	• Use the SHOW ALARMS command. • If maintenance cannot be accessed, refer to the Main Control card troubleshooting procedures. • Go to step 2.	see Note 1
2	Refer to the appropriate troubleshooting procedures as indicated by the alarm report.	• If this leads nowhere, go to step 3.	
3	Check maintenance log for possible cause(s).	• If this uncovers a clue, refer to the appropriate troubleshooting procedures. • If this is a system major alarm, or a digital bay major alarm, go to step 4. • Otherwise go to step 6.	
4	Check if the affected bay(s) have power.	Yes: • Go to step 5. No : • Refer to the bay power supply troubleshooting procedures.	
5	Check if the Main Control card appears to be functioning correctly.	Yes: • Go to step 8. No : • Refer to the Main Control card troubleshooting procedures.	see Note 2
6	Check if the affected bay(s) have power.	Yes: • Go to step 7. No : • Refer to the rear-door power supply troubleshooting procedures.	
7	If there are analog cards in the system, check if they appear to be functioning correctly.	Yes: • Go to step 8. No : • Refer to Peripheral Control Card troubleshooting procedures.	see Note 2
8	Check connections at the backplane (see Fig. 2-2).	• Secure connections / replace cable as required. • Go to step 9.	see Note 3
9	Check maintenance log history for indications of trouble before the major alarm; any such indications?	Yes: • Refer to the appropriate troubleshooting procedures. No : • Go to step 10.	
10	Check if any other observable cause exists for the alarm.	Yes: • Refer to the appropriate troubleshooting procedures. No : • Alarm may have been caused by a transient condition; record details and monitor the system's progress.	

Notes: 1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.

2. Refer to Section MITL9108-093-353-NA, General Maintenance Information for details of control card status indicators.

3. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for location and connections of the interconnect card.

Information Gathering and Problem Clarification

2.08 Chart 2-5 provides a list of the information which may be necessary in order to adequately categorize a fault. All relevant information should be gathered and entered into a site fault record. If the fault has resulted in total or partial shutdown of the system, much of this data will be unobtainable or irrelevant. In such cases, reference should be made to PROCEDURE 1 of this document.

CHART 2-5
INFORMATION GATHERING AND CLARIFICATION

Step	Action	Description / Follow-up	Remarks
1	Talk to attendants and station users.	Obtain the following information: • frequency of occurrence • intermittent or continuous nature • area of the system in which the fault occurs • time period during which the fault occurs • number and types of users affected • ability of the attendant/user to make the fault reappear • occurrence in relation to Central Office Busy Hour	
2	Check Maintenance / Alarm indications.	• Check maintenance log for fault/alarm reports. • Note whether the system is in Day Service, Night1, or Night2 Service. • Check system LED and 7-segment display indicators for error codes.	see Note 1
3	Collect data concerning environmental conditions.	• Check if the system is located close to a heat source or a source of power radiation. • Note the temperature and humidity conditions and compare with specified operating parameters. • Check the susceptibility of the area with respect to static electricity generation. • The following can seriously affect the performance of the PABX: • power fluctuations • lightning storms • excessively high humidity • excessively high temperature • dust • radio-frequency interference	see Note 2
4	Verify system programming.	• Check the existing programming to ensure that the correct options and features have been enabled. • Verify the Class Of Service (COS) assignments, trunk descriptors, and feature access codes.	see Note 3
5	Make special checks for new installations, additions or modifications.	• Check that the procedures specified in Section MITL9108-093-200-NA have been properly implemented. • Verify that any changes have been made in accordance with the appropriate practices, and to the prescribed standards. • Check for possible conflicts if features have been added or deleted, or if other programming changes have been made.	

CHART 2-5 (Cont'd)
INFORMATION GATHERING AND CLARIFICATION

Step	Action	Description / Follow-up	Remarks
6	Make random miscellaneous checks.	• Ensure all circuit cards are properly seated. • Verify that the system fans are running. Check the cross-connect field for loose or damaged wiring, improperly seated connectors, or other signs of trouble.	
7	Check for minor alarm indications - these assist in isolating and categorizing faults	• Record relevant data and note the affected area of the system.	

Notes: 1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details on procedures.

2. Refer to Section MITL9108-093-180-NA, Engineering Information for the specified operating parameters.

3. Refer to Sections MITL9108-093-105-NA, Features Description and MITL9108-093-210-NA, Customer Data Entry.

Problem Confirmation

2.09 Many faults, particularly intermittent faults, "disappear" before the troubleshooter is able to make a positive trace. Wherever possible, attempts should be made to force the problem to recur, such that the effects may be observed and hence the cause determined. The information gathered up to this point may be used to set up conditions relating as closely as possible to those under which the fault originally manifested itself.

Useful Aids

2.10 The aids listed in Table 2-1 are useful in verifying fault conditions.

TABLE 2-1
TROUBLESHOOTING AIDS

Troubleshooting Aid	Description and Use
Maintenance Log	• Provides a record of maintenance activities and causes of alarms. The primary source of troubleshooting information. • A summary of all log messages is presented in Appendix A of this Section.
Maintenance Terminal	• Primary access to the maintenance log. • Allows testing of individual functional units, using directed diagnostics. • Provides ability to query ALARM status, along with a variety of status reports.
7-Segment Displays	• Allows system power-up testing and operation to be monitored.
Status LEDs (on peripheral cards)	• Used to determine if circuit is in use, idle, or not functioning.
System Test Line	• Allows access, through hardware connection, to specific equipment for test purposes. • Usually used in lieu of a functional maintenance terminal.
Maintenance Panels	• Provides ability to manually initiate power fail transfer.

3. PERIPHERAL EQUIPMENT TROUBLESHOOTING PROCEDURES

A. Line Cards

3.01 The procedures detailed in the following paragraphs cover the isolation and correction of station line cards and SUPERSET® line cards. Since these usually involve a degree of remoteness between the individual sets and the SX-200® DIGITAL PABX, it is recommended that an additional person should assist the troubleshooter.

ONS/Station Line Cards

3.02 The 12 circuit ONS Line card (9109-010) is installed in the digital bays, while the 8 circuit 8-Station Line card (9110-110) is installed in analog peripheral shelves, if present. Chart 3-1 lists the steps involved in the testing of these cards. Further information concerning the characteristics, parameters and operation of the ONS card is contained in Section MITL9108-093-125-NA.

CHART 3-1
ONS / 8-STATION LINE CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Verify the problem.	• Go to step 2.	
2	Disconnect the affected circuit(s) from the cross-connect field.	• Go to step 3.	
3	Use a butt-set to check if the problem persists.	Yes: • Go to step 4. No : • Problem lies outside the PBX. Check for problems with cabling and the telephone set.	
4	Log into the Maintenance Terminal.	• Must enter username and password.	See Note 1
5	Use SHOW STATUS command on the affected bay.	• Go to step 6.	
6	If required, examine the maintenance log to obtain further information. (use LOGS READ command).	• Go to step 7.	
7	Check if there appears to be problems with more than one circuit.	Yes: • Go to step 31. No : • Go to step 8.	
8	Check if the affected circuit is of type 9109-010.	Yes: • Go to step 12. No : • Go to step 9.	
9	Test all of the junctors (channels) in the affected bay.	• Use the TEST DEVICE TYPE command to test each of 31 junctors. • Go to step 10.	
10	Do any of the junctors fail?	Yes: • Go to step 11. No : • Go to step 13.	
11	Unseat the suspect card, and run the test(s) on the failed junctor(s) again. Do they now pass?	Yes: • Replace faulty card. Problem fixed. No : • Refer to Analog Junctors troubleshooting procedures.	
12	Run a directed TEST on the affected circuit; check test results returned to the terminal.	Fail: • Reseat the card and rerun the test. • If failure persists, replace the card and rerun the test. • If failure still persists, reinstall the original card, go back to step 5 and investigate further. Pass: • If programming problem is indicated, go to step 13.	see Note 2
13	Check the programming for the station; including COS, COR, and pickup groups; any programming errors?	Yes: • Correct programming errors as required. No : • Go to step 14.	see Note 3
14	Check that the associated line circuit LED lights when the set is taken off-hook.	No : • Replace the line card; if the problem persists, reinstall the original card, and go to step 32. Yes: • Go to step 15.	

CHART 3-1 (Cont'd)
ONS / 8-STATION LINE CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
15	Go off-hook, and verify that dial tone is returned.	Yes: • Go to step 21. No : • Go to step 16.	
16	Check if problem is intermittent.	Yes: • Go to step 17. No : • Go to step 19.	
17	Ensure receivers are not busied out by maintenance or due to malfunctions; (use SHOW STATUS command). Busied out?	Yes: • Return receivers to service, or refer to DTMF receiver troubleshooting procedures as required. No : • Go to step 18.	
18	Ensure sufficient receivers are provided to carry the peak traffic load. Enough receivers?	No : • Add receivers as required; if problem persists, go to step 19. Yes: • Go to step 19.	see Note 4
19	Check if Side Tone is present.	Yes: • Go to step 20. No : • Replace the line card and retest; if problem persists, go to step 32.	
20	Check if calls can be completed without dial tone.	Yes: • Problem is with control card(s). Go to step 32. No : • Replace the line card; if the problem persists, go to step 32.	
21	Dial one digit, and verify that Dial Tone is broken.	Yes: • Go to step 24. No : • Go to step 22.	
22	Check if call can be completed over Dial Tone.	Yes: • Problem is with control card(s). Go to step 32. No : • Go to step 23.	
23	Problem lies in one of the following areas: • Main Control card • Receiver module	• Check maintenance log for indications of problems in these areas. • Refer to the applicable troubleshooting procedures.	
24	Complete the dialing process and check that ringback tone is returned.	Yes: • Go to step 26. Problem in either the control card(s) or the line card. No : • Go to step 25.	
25	Replace the line card.	• If problem persists, likely problem with control card(s). Go to step 32.	
26	Set up a call to the suspect line and verify that ringing is received.	Yes: • Go to step 29. No : • Go to step 27.	
27	Verify that ringing generator output is within spec (90 VAC, 20 Hz).	• If not within spec, refer to bay power supply troubleshooting procedures; otherwise, go to step 28.	see Note 5

CHART 3-1 (Cont'd)
ONS / 8-STATION LINE CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
28	Replace line card.	• If problem persists, reinstall the original line card, and go to step 32.	
29	Answer call and verify that level and audio quality is acceptable.	Yes: • Go to step 30. No : • Replace line card and retest. • If problem persists, reinstall the original line card, and go to step 32.	
30	Flash switchhook and check if the call is dropped.	Yes: • If timing is too short, increase flash time via CDE. NOTE- Be aware of limitations of flashing while connected to a trunk. No : • Line circuit is functioning correctly - continue to monitor.	
31	Use SHOW ALARMS ALL ALL command to obtain an overall view of the problem(s).	• If there is a system CRITICAL ALARM condition, go see Note 1 of the Critical Alarm troubleshooting procedures in paragraph 2.06. • If there is a system MAJOR ALARM condition, go to the Major Alarm troubleshooting procedures in paragraph 2.07. • If there is a system MINOR ALARM condition, address each problem independently as if it were isolated – go back to step 8.	
	STEPS 32 AND ONWARD SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL - CHECK IF THIS CORRECTS THE PROBLEM. DO NOT PROCEED TO STEP 32 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
32	Check if card is of type 9109-010.	Yes: • Go to step 37. No : • Go to step 33.	
33	Power down the affected bay via the power switch on the maintenance panel/top panel.	• Go to step 34.	
34	Replace the Digital Interface card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 35. No : • Problem fixed.	
35	Replace the Peripheral Control card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 36. No : • Problem fixed.	
36	Replace the Scanner card; power up the bay. Does the fault persist?	Yes: • Possible problem with Main Control card; go to step 37. No : • Problem fixed.	
37	Power down the system, replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	

Notes to Chart 3-1:

1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.
2. This is indicated by an error message returned to the terminal.
3. Refer to Sections MITL9108-093-210-NA, Customer Data Entry and MITL9108-093-105-NA, Features Description for details of procedures.
4. Refer to Section MITL9108-093-180-NA, Engineering Information for details on receiver provisioning.
5. 90 V Ringing is labelled both on the backplane and the rear-door power supply.

OPS Line Card

3.03 OPS Lines are provided where the distance of the station from the PABX is greater than allowable for a regular ONS line, or where the station is required to be in a location removed from the PABX (up to 2 km away). Chart 3-2 contains information on the troubleshooting of this card type. Note that these procedures apply to card type 9109-040 only. Refer to the ONS line card procedures, for off-premise extensions connected to card type 9110-110. Further information concerning the characteristics, parameters and operation of the OPS line card is contained in Section MITL9108-093-125-NA.

CHART 3-2
OPS LINE CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Verify the problem.	• Go to step 2.	
2	Disconnect the affected circuit(s) from the cross-connect field.	• Go to step 3.	
3	Use a butt-set to check if the problem persists.	Yes: • Go to step 4. No : • Problem lies outside the PBX. Check for problems with cabling and the telephone set.	
4	Log into the Maintenance Terminal.	• Must enter username and password.	See Note 1
5	Use SHOW STATUS command on the affected bay.	• Go to step 6.	
6	If required, examine the maintenance log to obtain further information. (use LOGS READ command).	• Go to step 7.	
7	Check if there appears to be problems with more than one circuit.	Yes: • Go to step 28. No : • Go to step 8.	
8	Run a directed TEST on the affected circuit; check test results returned to the terminal.	Fail: • Reseat the card and rerun the test. • If failure persists, replace the card and rerun the test. • If failure still persists, reinstall the original card, go back to step 5 and investigate further. • If programming problem is indicated, go to step 9. • Otherwise, go to step 10.	see Note 2
9	Check the programming for the station; including COS, COR, and pickup groups; any programming errors?	Yes: • Correct programming errors as required. No : • Go to step 10.	see Note 3
10	Check that the associated line circuit LED lights when the set is taken off-hook.	No : • Replace the line card; if the problem persists, reinstall the original card, and go to step 28. Yes: • Go to step 11.	
11	Go off-hook, and verify that dial tone is returned.	Yes: • Go to step 17. No : • Go to step 12.	
12	Check if problem is intermittent.	Yes: • Go to step 13. No : • Go to step 15.	
13	Ensure receivers are not busied out by maintenance or due to malfunctions; (use SHOW STATUS command). Busied out?	Yes: • Return receivers to service, or refer to DTMF receiver troubleshooting procedures as required. No : • Go to step 14.	

CHART 3-2 (Cont'd)
OPS LINE CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
14	Ensure sufficient receivers are provided to carry the peak traffic load. Enough receivers?	No : • Add receivers as required; if problem persists, go to step 15. Yes: • Go to step 15.	see Note 4
15	Check if Side Tone is present.	Yes: • Go to step 16. No : • Replace the line card and retest; if problem persists, go to step 28.	
16	Check if calls can be completed without dial tone.	Yes: • Problem is with Main Control card. Go to step 28. No : • Replace the line card; if the problem persists, go to step 28.	
17	Dial one digit, and verify that Dial Tone is broken.	Yes: • Go to step 20. No : • Go to step 18.	
18	Check if call can be completed over Dial Tone.	Yes: • Problem is with Main Control card. Go to step 28. No : • Go to step 19.	
19	Problem lies in one of the following areas: • Main Control card • Receiver module	• Check maintenance log for indications of problems in these areas. • Refer to the applicable troubleshooting procedures.	
20	Complete the dialing process and check that ringback tone is returned.	Yes: • Go to step 22. No : • Problem in either the Main Control card or the line card. • Go to step 21.	
21	Replace the line card.	• If problem persists, likely problem with Main Control card. Go to step 28.	
22	Set up a call to the suspect line and verify that ringing is received.	Yes: • Go to step 25. No : • Go to step 23.	
23	Verify that ringing generator output is within spec (90 VAC, 20 Hz).	• If not within spec, refer to bay power supply troubleshooting procedures; otherwise, go to step 24.	
24	Replace line card.	• If problem persists, reinstall the original line card, and go to step 28.	
25	Answer call and verify that level and audio quality is acceptable.	Yes: • Go to step 26. • Replace line card and retest. No : • If problem persists, reinstall the original line card, and go to step 28.	

CHART 3-2 (Cont'd)
OPS LINE CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
26	Flash switchhook and check if the call is dropped.	Yes: • If timing is too short, increase flash time via CDE. NOTE- Be aware of limitations of flashing while connected to a trunk. No : • Line circuit is functioning correctly.	
27	Use SHOW ALARMS ALL ALL command to obtain an overall view of the problem(s).	• If there is a system CRITICAL ALARM condition, go see Note 1 of the Critical Alarm troubleshooting procedures in paragraph 2.06. • If there is a system MAJOR ALARM condition, go to the Major Alarm troubleshooting procedures in paragraph 2.07. • If there is a system MINOR ALARM condition, address each problem independently as if it were isolated.	
	STEP 28 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL - CHECK IF THIS CORRECTS THE PROBLEM. DO NOT DO STEP 28 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
28	Power down the system; replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	

Notes: 1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.

2. This is indicated by an error message returned to the terminal.

3. Refer to Sections MITL9108-093-210-NA, Customer Data Entry and MITL9108-093-105-NA, Features Description for details of procedures.

4. Refer to Section MITL9108-093-180-NA, Engineering Information for details on receiver provisioning.

COV/SUPERSET® Line Cards

3.04 COV and SUPERSET® Line cards connect the advanced feature SUPERSET 3™ and SUPERSET 4™ telephone sets to the SX-200® DIGITAL PABX. The COV Line card (9109-020) is installed in the digital bays and provides capacity for up to six SUPERSET® sets. The SUPERSET Line card (9110-410) is installed in analog peripheral shelves, if present, and connects up to eight SUPERSET® sets to the system. Chart 3-3 lists the steps involved in the troubleshooting of these card types. Further information concerning the characteristics, parameters and operation of the cards is contained in Sections MITL 9110-096-200-NA and MITL9108-093-125-NA.

CHART 3-3
COV / SUPERSET LINE CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Verify the problem.	• Go to step 2.	
2	Disconnect the affected circuit(s) from the cross-connect field.	• Go to step 3.	
3	Use a SUPERSET® set at the MDF to check if the problem persists.	Yes: • Go to step 4. No : • Problem lies outside the PBX. Check for problems with cabling and the telephone set. • Refer to the applicable SUPERSET® troubleshooting procedures.	
4	Log into the Maintenance Terminal.	• Must enter username and password.	See Note 1
5	Use SHOW STATUS command on the affected bay.	• Go to step 6.	
6	If required, examine the maintenance log to obtain further information. (use LOGS READ command).	• Go to step 7.	
7	Check if there appears to be problems with more than one circuit.	Yes: • Go to step 29. No : • Go to step 8.	
8	Check if the affected circuit is of type 9109-020.	Yes: • Go to step 12. No : • Go to step 9.	
9	Test all of the junctors (channels) in the affected bay.	• Use the TEST DEVICE TYPE command to test each of 31 junctors. • Go to step 10.	
10	Do any of the junctors fail?	Yes: • Go to step 11. No : • Go to step 13.	
11	Unseat the suspect card, and run the test(s) on the failed junctor(s) again. Do they now pass?	Yes: • Replace faulty card. Problem fixed. No : • Refer to Analog Junctors troubleshooting procedures.	
12	Run a directed TEST on the affected circuit; check test results returned to the terminal.	Fail: • Reseat the card and rerun the test. • If failure persists, replace the card and rerun the test. • If failure still persists, reinstall the original card, go back to step 5 and investigate further. • If programming problem is indicated, go to step 13. Pass: • Go to step 13.	see Note 2
13	Check the programming for the set; including COS, COR, and pickup groups; any programming errors?	Yes: • Correct programming errors as required. No : • Go to step 14.	see Note 3

CHART 3-3 (Cont'd)
COV / SUPERSET LINE CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
14	Check that the associated line circuit LED lights when the set is taken off-hook.	No : • Replace the line card; if the problem persists, reinstall the original card, and go to step 30. Yes: • Go to step 15.	
15	Go off-hook, and verify that dial tone is returned.	Yes: • Go to step 21. No : • Go to step 16.	
16	Check if problem is intermittent.	Yes: • Go to step 17. No : • Go to step 19.	
17	Ensure receivers are not busied out by maintenance or due to malfunctions; (use SHOW STATUS command). Busied out?	Yes: • Return receivers to service, or refer to DTMF receiver troubleshooting procedures as required. No : • Go to step 18.	
18	Ensure sufficient receivers are provided to carry the peak traffic load. Enough receivers?	No : • Add receivers as required; if problem persists, go to step 19. Yes: • Go to step 19.	see Note 4
19	Check if Side Tone is present.	Yes: • Go to step 20. No : • Replace the line card and retest; if problem persists, go to step 30.	
20	Check if calls can be completed without dial tone.	Yes: • Problem is with control card(s). Go to step 30. No : • Replace the line card; if the problem persists, go to step 30.	
21	Dial one digit, and verify that Dial Tone is broken.	Yes: • Go to step 24. No : • Go to step 22.	
22	Check if call can be completed over Dial Tone.	Yes: • Problem is with control card(s). Go to step 30. No : • Go to step 23.	
23	Problem lies in one of the following areas: • Main Control card • Receiver module	• Check maintenance log for indications of problems in these areas. • Refer to the applicable troubleshooting procedures.	
24	Complete the dialing process and check that ringback tone is returned.	Yes: • Go to step 27. • Problem in either control card(s) or the line card. No : • Go to step 25.	
25	Replace the line card.	• If problem persists, likely problem with control card(s). Go to step 30.	
26	Set up a call to the suspect line and verify that ringing is received.	Yes: • Go to step 29. No : • Go to step 27.	
27	Replace line card.	• If problem persists, reinstall the original line card, and go to step 30.	

CHART 3-3 (Cont'd)
COV / SUPERSET LINE CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
28	Answer call and verify that level and audio quality is acceptable.	Yes: • Line circuit is functioning correctly - continue to monitor. No : • Replace line card and retest. • If problem persists, reinstall the original line card, suspect the set.	
29	Use SHOW ALARMS ALL ALL command to obtain an overall view of the problem(s).	• If there is a system CRITICAL ALARM condition, go see Note 1 of the Critical Alarm troubleshooting procedures in paragraph 2.06. • If there is a system MAJOR ALARM condition, go to the Major Alarm troubleshooting procedures in paragraph 2.07. • If there is a system MINOR ALARM condition, address each problem independently as if it were isolated - go back to step 8.	
	STEP 30 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL. IF ANALOG BAYS ARE PRESENT, THESE MAY BE RESET USING THE "MASTER RESET" PUSHBUTTON ON THE SCANNER CARD. CHECK IF THE RESET SOLVES THE PROBLEM. DO NOT PROCEED TO STEP 30 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
30	Check if card is of type 9109-020.	Yes: • Go to step 35. No : • Go to step 31.	
31	Power down the affected bay via the power switch on the maintenance panel/top panel.	• Go to step 32.	
32	Replace the Digital Interface card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 33. No : • Problem fixed.	
33	Replace the Peripheral Control card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 34. No : • Problem fixed.	
34	Replace the Scanner card; power up the bay. Does the fault persist?	Yes: • Possible problem with Main Control card; go to step 35. No : • Problem fixed.	
35	Power down the system; replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	

Notes:
1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.
2. This is indicated by an error message returned to the terminal.
3. Refer to Sections MITL9108-093-210-NA, Customer Data Entry and MITL9108-093-105-NA, Features Description for details of procedures.
4. Refer to Section MITL9108-093-180-NA, Engineering Information for details on receiver provisioning.

B. Trunk Cards

3.05 The procedures detailed in the following paragraphs cover the isolation and correction of the various trunk cards. Since the many different types of trunks share much common circuitry, the troubleshooting procedures have been generalized. Supplementary procedures are provided for specific trunk types (and specialized procedures), where required. Chart 3–4 outlines the general troubleshooting procedures for trunk cards. The trunk types covered are:

- LS/GS Trunk (9109–011)
- CO Trunk (9110–011, 111, 211, 311)
- DID Trunk (9109–031)
- DID/Tie Trunk (9110–031)
- E&M Trunk (9018–013)
- E&M Trunk (9110–013).

CHART 3-4
GENERAL TRUNK CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Verify the problem.	• Go to step 2.	
2	Disconnect the affected circuit(s) from the cross-connect field.	• Go to step 3.	
3	Use a butt-set to check if the problem persists.	Yes: • Go to step 4. No : • Problem lies outside the PBX. Check for problems with cabling, Central Office, CDE programming for stations, etc.	
4	Log into the Maintenance Terminal.	• Must enter username and password.	See Note 1
5	Use SHOW STATUS command on the affected bay.	• Go to step 6.	
6	If required, examine the maintenance log to obtain further information. (use LOGS READ command).	• Go to step 7.	
7	Check if there appears to be problems with more than one circuit.	Yes: • Go to step 8. No : • Go to step 9.	
8	Check if problem is with all circuits on one card only.	Yes: • Reseat the card and check again. If problem persists, replace card. No: • Go to step 40.	
9	Check if the affected circuit is in either Bay 1 or Bay 2.	Yes: • Go to step 13. No : • Go to step 10.	
10	Test all of the junctors (channels) in the affected bay.	• Use the TEST DEVICE TYPE command to test each of 31 junctors. • Go to step 11.	
11	Do any of the junctors fail?	Yes: • Go to step 12. No : • Go to step 15.	
12	Unseat the suspect card, and run the test(s) on the failed junctor(s) again. Do they now pass?	Yes: • Replace faulty card. Problem fixed. No : • Refer to Analog Junctors troubleshooting procedures.	
13	Check if circuit is an E & M trunk module (type 9109-013).	Yes: • Go to step 23. No : • Go to step 14.	
14	Run a directed TEST on the affected circuit; check test results returned to the terminal.	Fail: • Reseat the card and rerun the test. Pass: • If failure persists, replace the card and rerun the test. • If failure still persists, reinstall the original card, go back to step 5 and investigate further. • If programming problem is indicated, go to see Note 2. • Go to step 15.	

CHART 3-4 (Cont'd)
GENERAL TRUNK CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
15	Check the programming for the trunk circuit- including COS, COR, trunk descriptors, ARS data, and trunk groups; programming errors?	Yes: • Correct programming errors as required. No : • Go to step 16.	see Note 2
16	If the circuit is in an analog bay, ensure switch settings are as specified in Section MITL9108-093-200-NA.	• Correct switch settings as required. • If no problems, go to step 17.	
17	Check if fault is intermittent.	Yes: • Go to step 18. No : • Go to step 19.	
18	Ensure that trunks are not affected by the CO Busy Hour congestion (usually occurs in late morning/early afternoon).	• If problem persists, go to step 19.	see Note 3
19	Ensure that there are no Ground offsets between the trunk circuits and the SX-200® DIGITAL PABX system.	• If there are, investigate; if not, go to step 20.	see Note 4
20	Check if problem appears to be dropped calls or phantom incoming calls.	No : • Go to step 32. Yes: • Go to step 21.	
21	Verify that the trunk programming does not recognize tip/ring reversals unless there is a special application.	• Go to step 22.	
22	Verify that the disconnect timing allows for the possibility of periodic loop disconnects during call processing through a CO.	• If problem persists, go to step 32.	see Note 5
23	Perform a directed test on the suspect circuit(s).	• Use the TEST command. • Go to step 24.	see Note 1
24	Check for test failure.	Fail: • Reseat the card and the module, then rerun the test. • If failure persists, go to step 25. Pass: • Go to step 26.	
25	Check maintenance log for indications of problems with the Universal card, other modules on the Universal card, or the Main Control card. Any such indications?	Yes: • Refer to the applicable troubleshooting procedures. No : • Go to step 26.	see Note 1
26	Use SHOW CONFIG on the card slot to identify any other modules on the Universal card. Other modules?	Yes: • Go to step 27. No : • Go back to step 15.	see Note 1
27	Perform directed tests on the other modules. Do these fail as well?	Yes: • Replace faulty module(s) - if problem persists, go to step 29. No : • Go to step 28.	see Note 6
28	Replace suspect E & M module and test.	Pass: • Problem fixed. Fail: • Possible problem with control card(s). • Go to step 41.	

CHART 3-4 (Cont'd)
GENERAL TRUNK CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
29	Is one of the modules installed a Music On Hold (MOH)/Pager module?	Yes: • Go to step 30. No : • Go to step 31.	
30	Remove the MOH/Pager module from the Universal card and retest.	Pass: • Fault was with MOH/Pager module. Problem fixed. Fail: • Go to step 31.	see Note 7
31	Replace Universal card and retest.	Pass: • Problem fixed. Fail: • Possible problem with Main Control card. • Go to step 41.	
32	If the circuit is an E & M trunk, go to the Supplementary E & M Trunk Troubleshooting Procedures (Chart 3-5).	• Otherwise go to step 33.	
33	If the circuit is a DID or Loop/Tie trunk, go to the Supplementary DID/Loop/Tie Trunk Troubleshooting Procedures (Chart 3-6).	• Otherwise, go to step 34.	
34	Check if Central Office trunk is loop start or ground start - see Appendix E for details.	• Ensure that CDE programming for the PBX trunk circuit agrees with results. If not, change programming and jumpers for type 9109-011 cards, or change switch settings for type 9110-011,-111, -211, and -311 cards. • If problem persists, go to step 35.	see Note 2 see Note 8
35	Check if busy tone is returned after dialing a trunk access code.	Yes: • Go to step 36. No : • Go to step 37.	
36	Check for two loop start trunks connected together.	Yes: • At least 1 of the trunks must have a forced release time-out period. This is switch controlled on analog trunks (see MITL9108-093-200-NA for details), and CDE controlled for digital trunks (see CDE Form 13, Trunk Circuit Descriptors - Disconnect Timer). No : • Go to step 37.	see Note 8
37	Check Tip / Ring voltages, loop currents - refer to Table 3-1.	• If any of these are incorrect, replace the card; otherwise go to step 38.	
38	Check the loop current of the circuit - refer to Appendix D.	• If this is out of tolerance, replace the card; otherwise go to step 39.	
39	Check backplane(s) for problems.	• If problem persists, possible control card problem - go to step 41.	

CHART 3-4 (Cont'd)
GENERAL TRUNK CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
40	Use SHOW ALARMS ALL ALL command to obtain an overall view of the problem(s).	• If there is a system CRITICAL ALARM condition, go to the Critical Alarm troubleshooting procedures in paragraph 2.06. • If there is a system MAJOR ALARM condition, go to the Major Alarm troubleshooting procedures in paragraph 2.07. • If there is a system MINOR ALARM condition, address each problem independently as if it were isolated – go back to step 5.	see Note 1
	STEP 41 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL. IF ANALOG BAYS ARE PRESENT, THESE MAY BE RESET USING THE "MASTER RESET" PUSHBUTTON ON THE SCANNER CARD. CHECK IF THE RESET SOLVES THE PROBLEM. DO NOT PROCEED TO STEP 41 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
41	Check if circuit is located in a digital bay.	Yes: • Go to step 46. No : • Go to step 42.	
42	Power down the affected bay via the power switch on the maintenance panel/top panel.	• Go to step 43.	
43	Replace the Digital Interface card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 44. No : • Problem fixed.	
44	Replace the Peripheral Control card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 45. No : • Problem fixed.	
45	Replace the Scanner card; power up the bay. Does the fault persist?	Yes: • Possible problem with Main Control card; go to step 46. No : • Problem fixed.	
46	Power down the system; replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	

Notes:
1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.
2. Refer to Sections MITL9108-093-105-NA, Features Description and MITL9108-093-210-NA, Customer Data Entry.
3. Refer to Section MITL9108-093-180-NA, Engineering Information for details on provisioning.
4. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details on system grounding.
5. If periodic opens in loop current are experienced during call progression through a central office, and disconnect timing has been set for a short interval, loop disconnects may cause the trunk to drop. In such cases, the timing should be increased one step at a time, until the calls are no longer dropped.

6. This step is necessary to ensure that other faulty modules are not preventing the E&M trunk module from functioning properly.
7. This step is necessary because there are no MOH/Pager module diagnostics (since the MOH is always "on-line", it cannot be taken "off-line" for testing).
8. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details on trunk card switch settings.

TABLE 3-1
TRUNK VOLTAGE AND LOOP CURRENT MEASUREMENTS

CIRCUIT	IDLE	SEIZED
E and M	Tip to gnd = 0V Ring to gnd = 0V Tip to Ring = 0V E lead = −48V M lead = 0V E to M lead = 48V I loop = 0mA	Tip to gnd = 0V Ring to gnd = 0V Tip to Ring = 0V E lead = 0V M lead = −48V E to M lead = −48V I loop = 0mA
Loop Start	Tip to gnd = 0V Ring to gnd = −48V Tip to Ring = −48V I loop = 0mA	Tip to gnd = −14V to −22V Ring to gnd = −34V to −26V Tip to Ring = −4V to −20V I loop = 10mA to 100mA
Ground Start	Tip to gnd = −48V Ring to gnd = −48V Tip to Ring = 0V I loop = 0mA	Tip to gnd = −14V to −22V Ring to gnd = −34V to −26V Tip to Ring = −4V to −20V I loop = 10mA to 100mA
DID	Tip to gnd = −2V Ring to gnd = −48V Tip to Ring = −46V I loop = 0mA	Tip to gnd = −33V to −44V Ring to gnd = −17V to −6V Tip to Ring = 16V to 38V I loop = 12mA to 30mA
Loop/Tie	Tip to gnd = −2V Ring to gnd = −48V Tip to Ring = −46V I loop = 0mA	Tip to gnd = −17V to −6V Ring to gnd = −33V to −44V Tip to Ring = −16V to −38V I loop = 12mA to 30mA

Supplementary E&M Trunk Troubleshooting Procedures

3.06 E&M Trunks are provided for the SX-200® DIGITAL PABX in two forms. The E&M Trunk module (9109-013) is installed on the Universal card in the digital bays. The module provides a single E&M circuit, which may be programmed as either 2-wire or 4-wire, as well as being conditioned via switches as Bell Standard E&M Types I or V. The E&M Trunk card (9110-013) is installed in the analog peripheral shelves (Bays 3, 4 and 5). This circuit card can also be set as either 2-wire or 4-wire via switches, but can be conditioned only as Bell Standard E&M Type 1. The Supplementary Troubleshooting Procedures for this type of trunk are provided in Chart 3-5. Further information concerning the characteristics, parameters and operation of the module is contained in Section MITL9108-093-125-NA.

CHART 3-5
SUPPLEMENTAL E&M TRUNK TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Perform General Trunk Troubleshooting Procedures in Chart 3-4.	• Go to step 2.	
2	Disconnect the affected circuit(s) from the cross-connect field.	• Go to step 3.	
3	IDLE STATE TEST- connect voltmeter between -48VDC and the M lead. Reading should be -48VDC.	• If not -48VDC, replace card; otherwise go to step 4.	see Fig 3-1
4	INCOMING TEST - seize the trunk incoming - connect butt-set to E lead and ground. Circuit LED should light when butt-set goes off-hook.	• If not, replace card/module; if fault persists, possible control problem - go to step 11. • Otherwise go to step 5.	see Fig 3-1
5	Check if incoming wink is programmed.	Yes: • Go to step 6. No : • Go to step 7.	
6	Connect voltmeter to M lead and ground. Flash of -48VDC should be seen when butt-set goes off-hook.	• If not, replace card/module; if fault persists, possible control problem - go to step 11. • Otherwise go to step 7.	see Fig 3-1
7	Connect voltmeter to M lead and ground. Complete a call to an extension - when call is completed, steady -48VDC should be seen.	• If not, replace card/module; if fault persists, possible control problem - go to step 11. • Otherwise go to step 8.	
8	OUTGOING TEST - repeat step 3.	• Go to step 9.	
9	Connect voltmeter to ground and the M lead.	• Go to step 10.	
10	Connect butt-set to the E lead and ground, and dial the access code for a trunk group. The reading should be a steady -48VDC.	• If not, replace card/module; if fault persists, possible control card problem - go to step 11. • Otherwise, circuit is functioning properly.	see Fig 3-1
	STEP 11 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL. IF ANALOG BAYS ARE PRESENT, THESE MAY BE RESET USING THE "MASTER RESET" PUSHBUTTON ON THE SCANNER CARD. CHECK IF THE RESET SOLVES THE PROBLEM. DO NOT PROCEED TO STEP 11 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
11	Check if circuit is located in Bays 1 or 2.	Yes: • Go to step 16. No : • Go to step 12.	

CHART 3-5 (Cont'd)
SUPPLEMENTAL E&M TRUNK TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
12	Power down the affected bay via the power switch on the maintenance panel/top panel.	• Go to step 13.	
13	Replace the Digital Interface card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 14. No : • Problem fixed.	
14	Replace the Peripheral Control card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 15. No : • Problem fixed.	
15	Replace the Scanner card; power up the bay. Does the fault persist?	Yes: • Possible problem with Main Control card; go to step 16. No : • Problem fixed.	
16	Power down the system; replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	

Supplementary DID Trunk Troubleshooting Procedures

3.07 The DID Trunk (9109-031) card is installed in the digital bays of the SX-200® DIGITAL PABX system. The card provides six trunk circuits. The DID/Tie Trunk (9110-031) is installed in analog peripheral shelves, if present, and provides two trunk circuits. The Supplementary Troubleshooting Procedures for these types of trunks are provided in Chart 3-6. Further information concerning the characteristics, parameters and operation of the DID Trunk card is contained in Section MITL9108-093-125-NA.

CHART 3-6
SUPPLEMENTARY DID/LOOP/TIE TRUNK TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Perform General Trunk Troubleshooting Procedures in Chart 3-4.	• Go to step 2.	
2	Disconnect the affected circuit(s) from the cross-connect field.	• Go to step 3.	
3	Connect the butt-set across the Tip and Ring of the trunk circuit - the circuit LED should light when the butt-set goes off-hook.	• If not, replace the card; if problem persists, possible control problem - go to step 9. • Otherwise, go to step 4.	see Fig 3-2
4	Check if circuit is a DID trunk.	Yes: • Go to step 5. No : • Go to step 6.	
5	Use butt-set to simulate incoming digits - connection should be made to and extension/ attendant, etc. The circuit LED should wink following digits pulsed.	• If not, ensure extension/attendant console is functional - replace suspect module/card; if fault persists, possible control problem - go to step 9. • Otherwise, go to step 7.	
6	TIE TRUNK - dialing, or going off-hook from the butt-set should connect to an extension, attendant console, night bell, hunt group, etc., depending upon the trunk's programming.	• If not, ensure connecting device is functional - replace suspect card; if fault persists, possible control problem - go to step 9. • Otherwise, go to step 7.	
7	Connect voltmeter across the Tip and Ring of the trunk circuit.	• To check wink start, or answer back supervision, go to step 8.	see Fig 3-2
8	Connect meter across Tip and Ring and check results during a simulated incoming call from the butt-set.	• When seized, meter should read -18 to -20VDC. • For a wink start, the meter should read a 180 ms positive flash, and back to -18 to -20 VDC. • For answer back supervision, deflection to +18 to +20 VDC should be read. • If these readings are not read, retry. If this persists, replace the suspect card/ module; if fault still persists, possible control problem - go to step 9.	see Fig 3-2

CHART 3-6 (Cont'd)
SUPPLEMENTARY DID/LOOP/TIE TRUNK TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
	STEP 9 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL. IF ANALOG BAYS ARE PRESENT, THESE MAY BE RESET USING THE "MASTER RESET" PUSHBUTTON ON THE SCANNER CARD. CHECK IF THE RESET SOLVES THE PROBLEM. DO NOT PROCEED TO STEP 9 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
9	Check if circuit is located in a digital bay.	Yes: • Go to step 14. No : • Go to step 10.	
10	Power down the affected bay via the power switch on the maintenance panel/top panel.	• Go to step 11.	
11	Replace the Digital Interface card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 12. No : • Problem fixed.	
12	Replace the Peripheral Control card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 13. No : • Problem fixed.	
13	Replace the Scanner card; power up the bay. Does the fault persist?	Yes: • Possible problem with Main Control card; go to step 14. No : Problem fixed.	
14	Power down the system; replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	

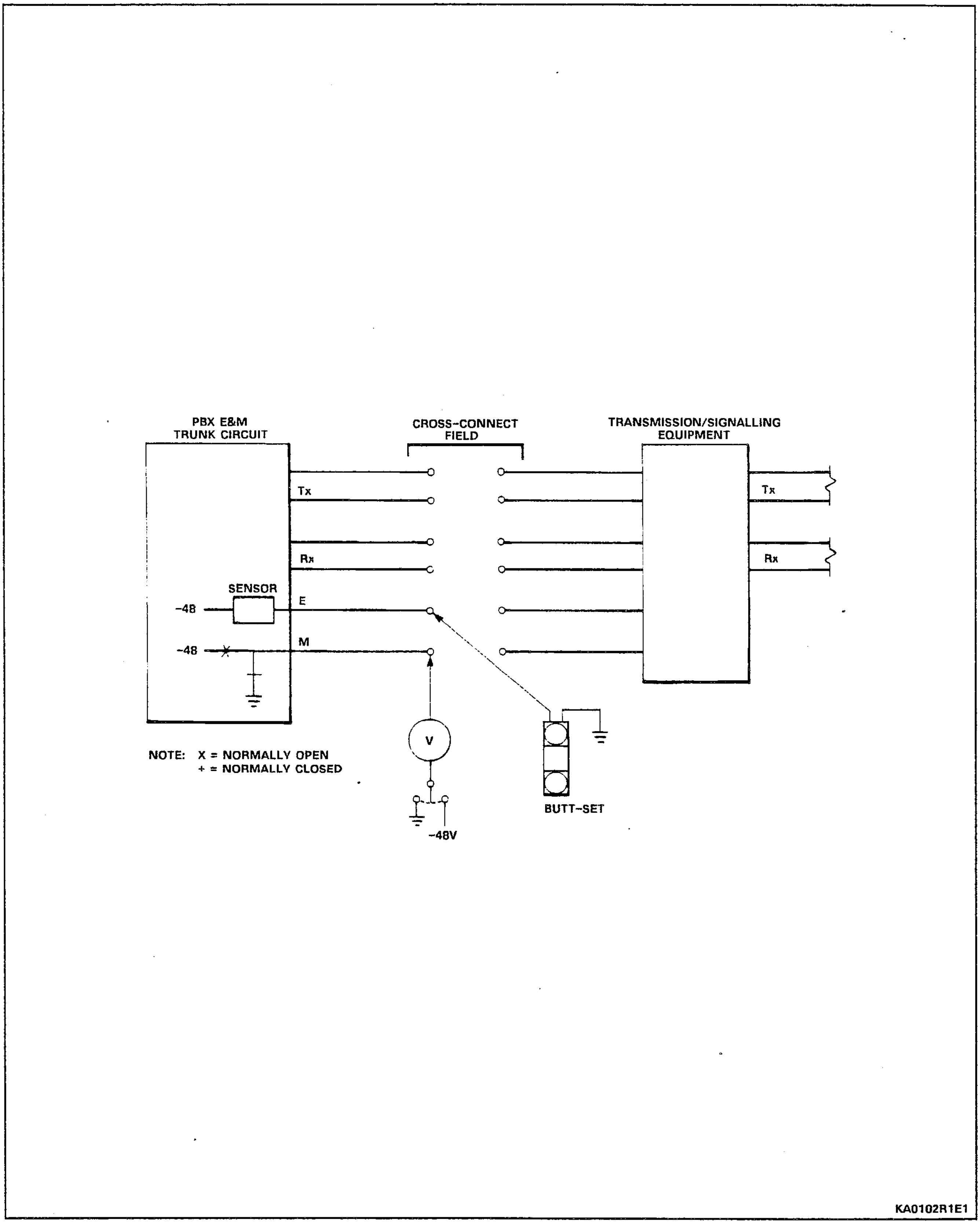


Figure 3-1 E&M Trunk Testing

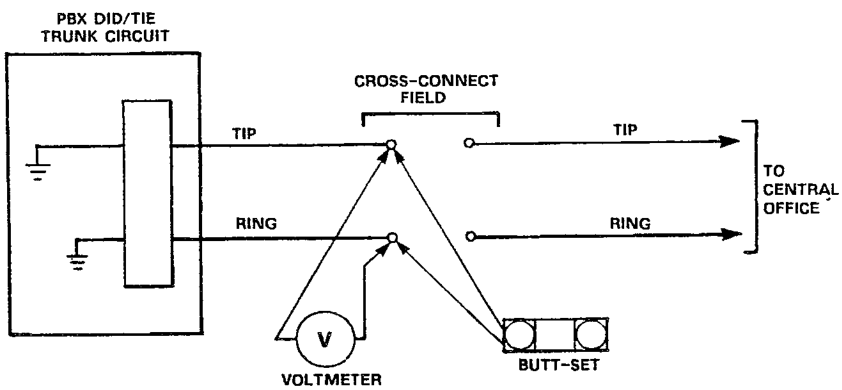


Figure 3-2 DID/Loop/Tie Trunk Testing

C. Other Peripheral Cards

Universal Card

3.08 The Universal card provides a general interface for SX-200® Digital modules. The modules are: the E&M Trunk module, the DTMF Receiver module, the Console Interface module, and the Music On Hold (MOH) module. The Universal card plugs into any high power (upper) slot of any digital bay of the PABX. Chart 3-7 shows the steps involved in the troubleshooting of this card type.

Further information on the Universal card may be found in Sections MITL9108-093-200-NA, Shipping, Receiving and Installation and MITL9108-093-125-NA, Circuit Card Descriptions.

CHART 3-7
UNIVERSAL CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Identify the affected Universal card.	• Go to step 2.	
2	Check maintenance log for indications of problems with modules, or the Attendant console. Any such indications?	Yes: • Refer to the troubleshooting procedures for the appropriate device. No : • Go to step 3.	
3	Check which module types are installed on the card; use the SHOW CONFIG command.	• Go to step 4.	
4	Check cabling to the Universal card, and all of the modules installed on it. Any cabling problems?	Yes: • Correct faulty cabling. If problem persists, go to step 5. No : • Go to step 6.	see Note 2
5	Check programming for the Universal card and all of the modules installed on it. Any programming errors?	Yes: • Correct faulty programming. If problem persists, go to step 6. No : • Go to step 6.	see Note 3
6	If there are DTMF Receiver modules on the card, test them. Otherwise, go to step 7.	Pass: • Go to step 7. Fail: • Replace faulty module and retest. If problem persists, go to step 7.	see Note 1
7	If there are E & M Trunk modules on the card, test them. Otherwise, go to step 8.	Pass: • Go to step 8. Fail: • Replace faulty module and retest. If problem persists, go to step 8.	see Note 1
8	If there are Console modules on the card, test them. Otherwise, go to step 9.	Pass: • Go to step 9. Fail: • Replace faulty module and retest. If problem persists, go to step 9.	see Note 1
9	If there is a Music On Hold (MOH) module on the card, remove it. Does problem persist?	Yes: • Go to step 10. No : • Problem fixed. Replace faulty module.	
10	Replace the faulty Universal card, and check if problem persists.	Yes: • Possible problem with Main Control card. Go to step 11. No : • Problem fixed.	
	STEP 11 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL. IF ANALOG BAYS ARE PRESENT, THESE MAY BE RESET USING THE "MASTER RESET" PUSHBUTTON ON THE SCANNER CARD. CHECK IF THE RESET SOLVES THE PROBLEM. DO NOT PROCEED TO STEP 11 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
11	Power down the system; replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	

Notes: 1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.

2. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details of cabling.

3. Refer to Sections MITL9108-093-105-NA, Features Description, and MITL9108-093-210-NA, Customer Data Entry for details.

DTMF Receiver Module (9109-016)

3.09 The DTMF Receiver module is installed on the Universal card in the digital bays of the SX-200® DIGITAL PABX system. The module provides four DTMF Receiver circuits. Also provided are two relay circuits. The troubleshooting procedures for DTMF Receivers are provided in Chart 3-8. Further information concerning the characteristics, parameters and operation of the module is contained in Section MITL9108-093-125-NA.

CHART 3-8
DTMF RECEIVER MODULE TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Check the status of the suspect circuit.	• Use the SHOW STATUS command, and check for abnormal conditions.	see Note 1
2	Check if problem is with DTMF circuit or a relay circuit.	DTMF: • Go to step 3. Relay: • Go to step 17. • If unknown, go to step 3.	
3	Perform a directed test on the suspect circuit(s).	• First busy out the receiver, then use the TEST command. If possible, avoid busying a circuit involved in a call. • Go to step 4.	see Note 1
4	Check for test failure.	Fail: • Reseat the card and the module, then rerun the test. • If failure persists, go to step 5. Pass: • Go to step 14.	
5	Check backplane continuity from Universal card to Main Control card. Problems?	Yes: • Correct as required; if problem persists, go to step 6.	
6	Check maintenance log for indications of problems with the Universal card, other modules on the Universal card, or the Main Control card. Any such indications?	Yes: • Refer to the applicable troubleshooting procedures. No : • Go to step 7.	see Note 1
7	Use SHOW CONFIG command on the card slot to identify any other modules on the Universal card. Other modules?	Yes: • Go to step 8. No : • Go to step 11.	
8	Perform directed tests on any other receiver modules, E & M trunk modules, and the console (if there is a console module installed). Do these fail as well?	Yes: • Go to step 9. No : • Go to step 11.	
9	Is one of the other modules a Music On Hold (MOH) module?	Yes: • Go to step 10. No : • Go to step 11.	see Note 2
10	Remove the MOH module, and check if problem persists. Does problem persist?	Yes: • Go to step 11. No : • Problem fixed. Replace faulty MOH module.	

CHART 3-8 (Cont'd)
DTMF RECEIVER MODULE TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
11	Replace suspect DTMF Receiver module and test.	Pass: • Problem fixed. Fail: • Go to step 12.	
12	Test the signal processor; use the TEST DEVICE TYPE DSP command.	Pass: • Go to step 13. Fail: • Problem with Signal Processor; go to step 22.	
13	Replace Universal card and retest.	Pass: • Problem fixed. Fail: • Possible problem with Main Control card. • Go to step 22.	
14	Busy out all of the DTMF Receivers in the system, except the suspect receiver.	• IMPORTANT : THIS STEP MUST BE DONE DURING A PERIOD OF LOW OR NO TRAFFIC, AS IT WILL ADVERSLY AFFECT SYSTEM PERFORMANCE. • Go to step 15.	see Note 1
15	Initiate a station-to-station call. Can the call be completed?	Yes: • Record details; return all circuits to service. Use SHOW STATUS and TEST CONTINUOUS commands, and periodically refer to the maintenance log to observe the progress of the circuit. No : • Go to step 16.	
16	Replace the suspect module.	• If problem persists, indicates possible problem with Main Control card. Go to step 22.	
17	Ensure relay is properly programmed in CDE Forms 18 and 19.	• Correct programming as required. • If problem persists, go to step 18.	see Note 3
18	Disconnect relay from the external equipment at the MDF.	• Go to step 19.	
19	Ensure external equipment is functional - short out at the MDF.	• If external equipment is activated (i.e., night bell rings) go to step 20. If not, problem with external equipment.	see Fig 3-3
20	Connect ohmmeter across relay leads at the MDF.	• An open circuit should be read. If not, verify connection at the backplane, and reseat the module. • If this persists, replace the module. • Otherwise, go to step 21.	see Fig 3-3

CHART 3-8 (Cont'd)
DTMF RECEIVER MODULE TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
21	From any station, dial the access code for the external equipment (i.e., the Night Bell access code).	• If the meter reads a short circuit, the relay is functioning properly; if not, replace the suspect module. • If problem persists, possible Main Control problem - go to step 22.	
	STEP 22 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL. IF ANALOG BAYS ARE PRESENT, THESE MAY BE RESET USING THE "MASTER RESET" PUSHBUTTON ON THE SCANNER CARD. CHECK IF THE RESET SOLVES THE PROBLEM. DO NOT PROCEED TO STEP 22 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
22	Power down the system; replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	

Notes: 1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.

2. This step is required, as it is not possible to run diagnostics on the MOH module due to its permanent "on-line" nature.

3. Refer to Sections MITL9108-093-105-NA and MITL9108-093-210-NA for information on programming.

Console Interface Module

3.10 The Console Interface module is installed on the Universal card in the digital bays of the SX-200® DIGITAL PABX system. The module provides an interface to the system for the Attendant Console. For Console Module troubleshooting procedures refer to the part on the Attendant Console.

Further information on the Console Interface module may be found in Section MITL9108-093-200-NA, Shipping, Receiving and Installation.

Music On Hold (MOH) / Pager Module

3.11 The Music On Hold (MOH) / Pager module is installed on the Universal card in the digital bays of the SX-200® DIGITAL PABX system. The module provides a music source input, a paging output, and a pair of relay contacts to control an external paging amplifier. The troubleshooting procedures for this module type are provided in Chart 3-9. Further information on the MOH/ Pager module may be found in Section MITL9108-093-200-NA, Shipping, Receiving and Installation.

CHART 3-9
MUSIC ON HOLD / PAGER MODULE TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Check the status of the suspect circuit.	• Use the SHOW STATUS command, and check for abnormal conditions.	see Note 1
2	Check maintenance log for indications of problems with other modules, or the Universal card. Any such indications?	Yes: • Refer to the appropriate troubleshooting procedures. No : • Go to step 3.	
3	Check if problem is with Music On Hold or Pager.	• If MOH, go to step 4. • If Pager, go to step 8. • If unknown, treat as problem with both.	
4	Disconnect the music source from the MOH module at the MDF.	• Go to step 5.	
5	Connect butt-set to music source pair at the MDF and go off-hook. Is music heard?	Yes: • Go to step 6. No : • Problem with music source or cabling.	see Fig 3-3
6	Reconnect music source to MOH at the MDF.	• Go to step 7.	
7	Access MOH from any station (put on hold) - is music heard?	Yes: • MOH portion is functioning correctly. No : • Go to step 12.	
8	Disconnect the PA system from the Pager at the MDF.	• Go to step 9.	
9	Connect butt-set to the PA system pair at the MDF, go off-hook and speak. Is PA system accessed?	Yes: • Go to step 10. No : • Problem with PA system or cabling.	see Fig 3-3
10	Connect butt-set to the pager pair at the MDF.	• Go to step 11.	
11	Access the pager from any station with the appropriate pager access in its COS, and speak. Is this heard on the butt-set?	Yes: • Pager portion is functioning correctly. No : • Go to step 12.	
12	Check CDE programming of the module. Check Forms 01, 18, 19 and station/trunk COS. Any programming problems?	Yes: • Correct programming errors; if problem persists, go to step 13. No : • Go to step 13.	see Note 3

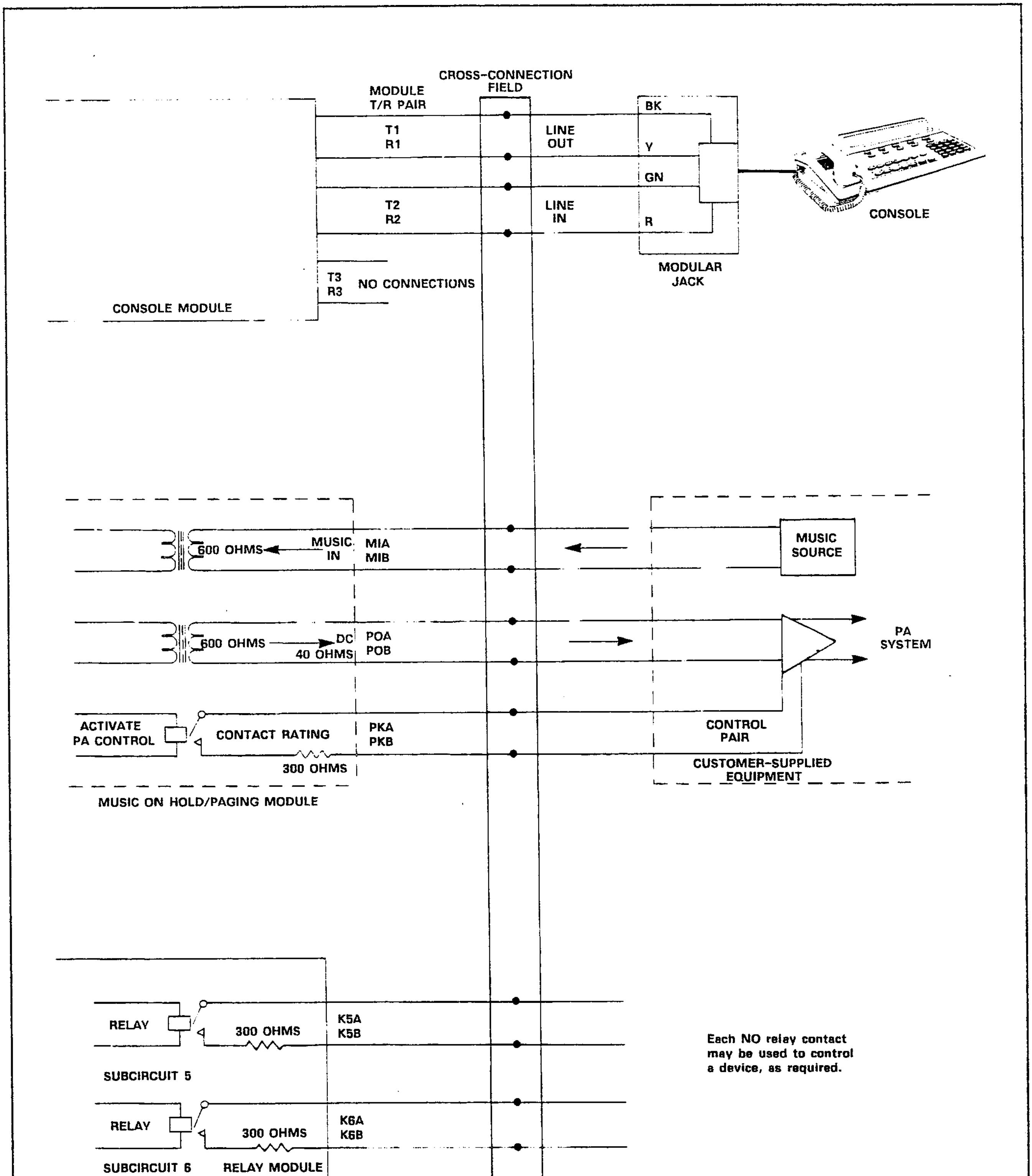
CHART 3-9 (Cont'd)
MUSIC ON HOLD / PAGER MODULE TROUBLESHOOTING PROCEDURES

<table>
<tr><th>Step</th><th>Action</th><th>Description / Follow-up</th><th>Remarks</th></tr>
<tr><td>13</td><td>Use SHOW CONFIG command on the card slot to identify any other modules on the Universal card. Other modules?</td><td>Yes: • Go to step 14.
No : • Go to step 15.</td><td></td></tr>
<tr><td>14</td><td>Perform directed tests on any consoles, E&M trunk modules, and DTMF receiver modules on the affected Universal card. Do these fail as well?</td><td>Yes: • Go to step 16.
No : • Go to step 15.</td><td></td></tr>
<tr><td>15</td><td>Replace the Music On Hold (MOH) / Pager module. Does problem persist?</td><td>Yes: • Go to step 16.
No : • Problem fixed.</td><td></td></tr>
<tr><td>16</td><td>Replace Universal card and retest.</td><td>Pass: • Problem fixed.
Fail: • If MOH module has not already been replaced, do so; if problem persists, indicates possible problem with Main Control card.
• Go to step 17.</td><td></td></tr>
<tr><td></td><td colspan="2">STEP 17 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL. IF ANALOG BAYS ARE PRESENT, THESE MAY BE RESET USING THE "MASTER RESET" PUSHBUTTON ON THE SCANNER CARD. CHECK IF THE RESET SOLVES THE PROBLEM. DO NOT PROCEED TO STEP 17 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.</td><td></td></tr>
<tr><td>17</td><td>Power down the system; replace the Main Control card. Does the fault persist?</td><td>Yes: • Refer problem to Mitel field service.
No : • Problem fixed.</td><td></td></tr>
</table>

Notes: 1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.

2. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details on cabling.

3. Refer to Sections MITL9108-093-105-NA, Features Description and MITL9108-091-210-NA, Customer Data Entry for details.



NOTE: All wiring must be done in accordance with the National Electrical Code (USA) or Canadian Electrical Code and/or local electrical inspection authorities.

Figure 3-3 Music, Paging and Relay Connections

Analog Junctors / Channels

3.12 If analog bays are present in an SX-200® system, the analog cards are connected to 32 junctors, or voice paths via analog crosspoint chips. These are located on the cards themselves, and are in turn connected to the 32 channels of the bay's digital link via the Digital Interface Card. Refer to Section MITL9108-093-180-NA, Engineering Information for further details on this interface. Chart 3-10 outlines the troubleshooting procedures for the analog junctors..

CHART 3-10
ANALOG JUNCTOR / CHANNEL TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Verify the problem.	• Go to step 2.	
2	Identify the link number.	• Check the maintenance log message, and refer to Table 3-2.	
3	Check the status of the junctors in the affected bay.	• Use SHOW STATUS command to obtain further information. • Go to step 4.	
4	Run a directed test on the suspect junctor/ channel.	Pass: • Repeat several times to verify. • Continue observation using SHOW STATUS command and maintenance log. Fail: • Go to step 5.	
	IMPORTANT : THE FOLLOWING STEPS INVOLVE THE UNPLUGGING OF SOME OR ALL OF THE CARDS IN THE AFFECTED BAY. THIS WILL ADVERSELY AFFECT SYSTEM PERFORMANCE. THIS SHOULD BE DONE ONLY DURING PERIODS OF LOW OR NO TRAFFIC.		
5	Unseat the card in Slot 1 of the affected bay, and rerun the test.	Pass: • Problem fixed. • Return the junctor to service, and replace the faulty card. Fail: • Reseat the card, and go to step 6.	
6	Repeat step 5 for all of the installed peripheral (lines and trunks) cards installed in the affected bay.	• If fault persists, go to step 7.	
7	Unseat all of the peripheral cards in the affected bay.	• Go to step 8.	
8	Rerun the test on the suspect junctor/ channel; does it now pass?	Yes: • Go to step 9. No : • Go to step 113.	
9	Reseat the card in slot 1, and rerun the test.	Pass: • Go to step 10. Fail: • Replace card and continue.	
10	Reseat the next card into its slot, and rerun the test.	Pass: • Go to step 11. Fail: • Replace card and continue.	
11	Repeat step 10 for all of the peripheral cards in the affected bay.	• Replace the cards which cause the test to fail.	

CHART 3-10 (Cont'd)
ANALOG JUNCTOR / CHANNEL TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
12	Check cabling from the digital bay backplane to the appropriate Digital Interface card.	• Correct faulty cabling/damaged cables. • Refer to Section MITL9108-093-200-NA for details on cabling. • If fault persists, go to step 13.	
13	Replace the following cards in order and rerun the test: • Digital Interface Card • Peripheral Control Card • Scanner Card.	• NOTE: The affected shelf must be powered down to replace these cards. • If fault still persists, possible problem with Main Control card - refer to Main Control card troubleshooting procedures.	

TABLE 3-2
ANALOG BAY LINK ASSIGNMENTS

LINK #	Connects to
2	Bay 3
5	Bay 4
7	Bay 5

D. Special Sets

Attendant Console

3.13 The Attendant console is a microprocessor-controlled liquid crystal display terminal which integrates access to the SX-200® DIGITAL PABX system data and telephony functions in a single device. It is adaptable to many different applications, including Maintenance and Customer Data Entry. Chart 3-11 shows the steps involved in the troubleshooting of the Attendant console.

Further information on the Attendant console may be found in Section MITL9108-093-315-NA, Console Description.

CHART 3-11
ATTENDANT CONSOLE TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Check if system is up and running; use SHOW ALARMS command, check Main Control card status indicators. Is system running?	Yes: • Go to step 2. No : • Refer to Primary Troubleshooting Procedures.	see Note 2
2	Initiate console self tests by disconnecting, then reconnecting the console.	• Go to step 3.	
3	Check if console is inoperative and one of the following is true: • HOLD 1 LED flashing • HOLD 2 LED flashing • HOLD 3 LED flashing • All LEDs on always	Yes: • Replace console. No : • Go to step 4.	
4	Check if the following message is on console display: CONSOLE HARDWARE PROBLEM 123456789 ERROR CODE 1 PLEASE NOTE DETAILS ON REPAIR TAG	Yes: • Replace console. Problem fixed. No : • Go to step 5.	see Note 7
5	Check if one of the following messages are on console display:	No: • Go to step 10. Yes:	
	WAITING FOR SYNCHRONIZATION 123456789 PLEASE WAIT	• Go to step 6.	
	WAITING FOR COMMUNICATION 123456789 PLEASE WAIT	• Go to step 8.	see Note 1
6	Check cabling from console to PABX. Errors in cabling?	Yes: • Correct wiring problems. No : • Go to step 7.	
7	Use voltmeter to check for presence of voltage between leads T1 and T2, T1 and R2, T2 and R1, R1 and R2 at the MDF. Any voltage (should be difference of 48 volts)?	Yes: • Go to step 8. No : • Go to step 13.	see Fig 3-3
8	Check programming for the console and associated module - (CDE Forms 01, 07 and the console's COS). Programming errors?	Yes: • Correct as required. No : • Go to step 9.	see Note 5

CHART 3-11 (Cont'd)
ATTENDANT CONSOLE TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
9	Replace the console. Does the problem persist?	Yes: • Refer to the troubleshooting procedures for the Console Module. No : • Problem fixed.	
10	Check maintenance log for indications of problems with Console module or Universal card. Any such indications?	Yes: • Refer to the applicable troubleshooting procedures. No : • Go to step 11.	
11	Check programming for the console and associated module - (CDE Forms 01, 07 and the console's COS). Programming errors?	Yes: • Correct as required. No : • Go to step 12.	see Note 5
12	Replace console. Does problem persist?	No : • Problem fixed. Yes: • Go to step 13.	
13	Check the status of the suspect module.	• Use the SHOW STATUS command, and check for abnormal conditions. • Go to step 14.	see Note 2
14	Perform a directed test on the corresponding console.	• Use the TEST DEVICE TYPE CONSOLE command. • Go to step 15.	see Note 2 see Note 3
15	Check for test failure.	Fail: • Reseat the card and the module, then rerun the test. • If failure persists, go to step 16. Pass: • Problem fixed.	
16	Use SHOW CONFIG command on the card slot to identify any other modules on the Universal card. Other modules?	Yes: • Go to step 17. No : • Go to step 18.	
17	Perform directed tests on any other consoles, E & M trunk modules, and DTMF receiver modules on the affected Universal card. Do these fail as well?	Yes: • If all fail, go to step 21; if one fails, replace the faulty module. No : • Go to step 18.	
18	Replace the console interface module and retest. Does problem persist?	Yes: • Go to step 19. No : • Problem fixed.	

CHART 3-11 (Cont'd)
ATTENDANT CONSOLE TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
19	Is one of the other modules on the Universal a Music On Hold (MOH) module?	Yes: • Go to step 20. No : • Go to step 21.	see Note 6
20	Remove the MOH module, and check if problem persists. Does problem persist?	Yes: • Go to step 21. No : • Problem fixed. Replace faulty MOH module.	
21	Replace Universal card and retest.	Pass: • Problem fixed. Fail: • Possible problem with Main Control card. Go to step 22.	
	STEP 22 SHOULD BE DONE ONLY DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL - CHECK IF THIS CORRECTS THE PROBLEM. DO NOT DO STEP 22 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
22	Power down the system; replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	

Notes:
1. These messages are displayed when communication cannot be made between the system and the console. If communication is established, the message is erased.
2. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.
3. This indirectly tests the operation of the Console module.
4. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details on cabling.
5. Refer to Sections MITL9108-093-105-NA, Features Description and MITL9108-093-210-NA, Customer Data Entry for details.
6. This step checks if a faulty MOH/Pager module is preventing the console module from functioning properly.
7. "Error Code 1" indicates that the console failed its power-up self tests.

SUPERSET 4™ Set

3.14 The SUPERSET 4™ set is a microprocessor-controlled telephone set which interconnects with the SX-200® DIGITAL PABX system. It provides visual PABX feature prompting by means of a Liquid Crystal Display (LCD) panel, and permits up to 15 line appearances. The SUPERSET 4™ set derives its power from the system, and all voice and signal communication between the set and the system is achieved via the normal Tip and Ring leads. No special cabling is required for the SUPERSET 4™ set, nor is any AC supply required. The SUPERSET 4™ set is connected to the system via one of two card types. The COV line card connects the SUPERSET 4™ set to the system through the digital bays, while the SUPERSET® Line card connects the set through analog bays, if present. Chart 3-12 shows the steps involved in the troubleshooting of the SUPERSET 4™ set. The line cards described above have their own related troubleshooting procedures.

CHART 3-12
SUPERSET 4™ SET TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Identify the extension number of the suspect SUPERSET® set.	• Go to step 2.	
2	Obtain a SUPERSET error summary from the maintenance / CDE terminal.	• Use the SHOW SSET_ERRORS command and check for abnormal conditions. • If errors are indicated, go to step 6; otherwise, go to step 3.	see Note 1
3	Check maintenance log for indications of problems with the COV card / SUPERSET® card. Any indication?	Yes: • Refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 4.	
4	Check if problem exists with other sets from other line cards.	Yes: • Refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 5.	
5	Check if problem exists with other sets from the same line card.	Yes: • Refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 8.	
6	Check if errors occurred on more than one card.	Yes: • Refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 7.	
7	Check if errors occurred in more than one circuit.	Yes: • Refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 8.	
8	Perform SUPERSET 4™ Loopback Test from the suspect SUPERSET® set.	Pass: • Go to step 10. Fail: • Go to step 9.	see Note 2
9	Replace the suspect SUPERSET® set, and rerun the Loopback test from the new set.	Pass: • Problem fixed. Fail: • Go to step 10.	
10	Check that the voltage across the Tip and Ring leads at the SUPERSET 4™ (with the set connected, and on-hook) is between 40 VDC and 48 VDC.	Yes: • Go to step 11. No : • Replace the set, and remeasure. If still out of range, go to step 11.	
11	Check cabling.	• If no cabling problems, go to step 12.	

CHART 3-12 (Cont'd)
SUPERSET 4™ SET TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
12	Check if the resistance of the loop exceeds 200 ohms.	No : • Go to step 13. Yes: • Check for loose connection and remeasure. If still out of range, refer to the troubleshooting procedures for the COV or SUPERSET® Line card.	
13	Check if display reads "No Communication" or "Consecutive Errors".	Yes: • If set has not been replaced yet, replace it. Otherwise, refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 14.	
14	Take the receiver off-hook and check if dial tone is returned.	Yes: • Go to step 17. No : • Go to step 15.	
15	Check if side tone is present.	Yes: • Go to step 16. No : • Refer to troubleshooting procedures for the COV or SUPERSET® Line card.	
16	Check if calls may be completed without dial tone.	Yes: • Problem with Main Control card - go to step 18. No : • Refer to troubleshooting procedures for the COV or SUPERSET® Line card.	
17	If problem persists, check the Class Of Service options of the set.	• If there are programming errors, correct them; otherwise refer problem to Mitel field service.	see Note 3
	STEP 18 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL. IF ANALOG BAYS ARE PRESENT, THESE MAY BE RESET USING THE "MASTER RESET" PUSHBUTTON ON THE SCANNER CARD. CHECK IF THE RESET SOLVES THE PROBLEM. DO NOT PROCEED TO STEP 18 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
18	Check if line card is of type 9109-020.	Yes: • Go to step 23. No : • Go to step 19.	
19	Power down the affected bay via the power switch on the maintenance panel/top panel.	• Go to step 20.	
20	Replace the Digital Interface card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 21. No : • Problem fixed.	

CHART 3-12 (Cont'd)
SUPERSET 4™ SET TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
21	Replace the Peripheral Control card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 22. No : • Problem fixed.	
22	Replace the Scanner card; power up the bay. Does the fault persist?	Yes: • Possible problem with Main Control card; go to step 23. No : • Problem fixed.	
23	Power down the system; replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	

Notes: 1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.

2. SUPERSET 4™ Loopback Test is System Feature # 26. Refer to CDE Form 02 - Feature Access Codes for the actual access code. If there is no dial tone, the test fails.

3. Refer to Section MITL9108-093-105-NA, Features Description for details of features and options.

SUPERSET 3™ Set

3.15 The SUPERSET 3™ set is a microprocessor-controlled telephone set which interconnects with the SX-200® DIGITAL PABX system. The set permits up to 12 line appearances. The SUPERSET 3™ set derives its power from the system, and all voice and signal communication between the set and the system is achieved via the normal Tip and Ring leads. No special cabling is required for the SUPERSET 3™ set, nor is any AC supply required. The SUPERSET 3™ set is connected to the system via one of two card types. The COV line card connects the SUPERSET 3™ set to the system through the digital bays, while the SUPERSET Line card connects the set through analog bays, if present. Chart 3-13 shows the steps involved in the troubleshooting of the SUPERSET 3™ set. The line cards described above have their own related troubleshooting procedures.

CHART 3-13
SUPERSET 3™ SET TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Identify the extension number of the suspect SUPERSET® set.	• Go to step 2.	
2	Obtain a SUPERSET® error summary from the maintenance / CDE terminal.	• Use the SHOW SSET_ERRORS command and check for abnormal conditions. • If errors are indicated, go to step 6; otherwise, go to step 3.	see Note 1
3	Check maintenance log for indications of problems with the COV card / SUPERSET® card. Any indication?	Yes: • Refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 4.	
4	Check if problem exists with other sets from other line cards.	Yes: • Refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 5.	
5	Check if problem exists with other sets from the same line card.	Yes: • Refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 8.	
6	Check if errors occurred on more than one card.	Yes: • Refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 7.	
7	Check if errors occurred in more than one circuit.	Yes: • Refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 8.	
8	Check that the voltage across the Tip and Ring leads at the SUPERSET 3™ set (with the set connected, and on-hook) is between 40 VDC and 48 VDC.	Yes: • Go to step 9. No : • Replace the set, and remeasure. If still out of range, go to step 9.	
9	Check cabling.	• If no cabling problems, go to step 10.	
10	Check if the resistance of the loop exceeds 200 ohms.	No : • Go to step 11. Yes: • Check for loose connection and remeasure. If still out of range, refer to the troubleshooting procedures for the COV or SUPERSET® Line card.	

CHART 3-13 (Cont'd)
SUPERSET 3™ SET TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
11	Check if all three line appearance LEDs are permanently on.	Yes: • If set has not been replaced yet, replace it. Otherwise, refer to the troubleshooting procedures for the COV or SUPERSET® Line card. No : • Go to step 12.	
12	Take the receiver off-hook and check if dial tone is returned.	Yes: • Go to step 15. No : • Go to step 13.	
13	Check if side tone is present.	Yes: • Go to step 14. No : • Refer to troubleshooting procedures for the COV or SUPERSET® Line card.	
14	Check if calls may be completed without dial tone.	Yes: • Problem with Main Control card - go to step 16. No : • Refer to troubleshooting procedures for the COV or SUPERSET® Line card.	
15	If problem persists, check the Class Of Service options of the set.	• If there are programming errors, correct them; otherwise refer problem to Mitel field service.	see Note 2
	STEP 16 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL. IF ANALOG BAYS ARE PRESENT, THESE MAY BE RESET USING THE "MASTER RESET" PUSHBUTTON ON THE SCANNER CARD. CHECK IF THE RESET SOLVES THE PROBLEM. DO NOT PROCEED TO STEP 16 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
16	Check if card is of type 9109-020.	Yes: • Go to step 21. No : • Go to step 17.	
17	Power down the affected bay via the power switch on the maintenance panel/top panel.	• Go to step 18.	
18	Replace the Digital Interface card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 19. No : • Problem fixed.	
19	Replace the Peripheral Control card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 20. No : • Problem fixed.	
20	Replace the Scanner card; power up the bay. Does the fault persist?	Yes: • Possible problem with Main Control card; go to step 21. No : • Problem fixed.	
21	Power down the system; replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	

Notes: 1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.

2. Refer to Section MITL9108-093-105-NA, Features Description for details of features and options.

4. SUBSYSTEM TROUBLESHOOTING PROCEDURES

MAIN CONTROL CARD

4.01 The following paragraphs outline the troubleshooting procedures for the Main Control Card (Part No. 9109-003).

Configuration

4.02 The Main Control card consists of the following:

	Name	Part No.
•	Main Control card	9109-003
•	DX Module	-
•	DRAM module	-
•	Decryption module	-
•	EPROM	-

Main Control Card Power-Up Tests

4.03 The Main Control card power-up tests are run automatically upon operation of the SYSTEM RESET pushbutton located on the Main Control card front panel. The test results are indicated in code form on the Main Control card's 7-segment displays, also located on the Main Control card front panel.

Note: The Main Control card 7-segment displays are also used for the troubleshooting of the Floppy Disk Subsystem - refer to the Floppy Disk Subsystem troubleshooting procedures.

First-Step Checks

4.04 Prior to replacing cards as directed by the Main Control card troubleshooting procedures, carry out the following checks:

(a) Reseat the suspect card.

(b) Check for bent pins at the backplane or module connector, where applicable.

If the above does not clear the fault, proceed to replace the card.

Power-Up Sequence

4.05 The Main Control card power-up sequence is outlined in detail in Section MITL9108-093-353-NA, General Maintenance Information. See Emergency Troubleshooting Procedures (Chart 2-2) for Main Control card procedures.

DIGITAL BAY CONTROL SUBSYSTEM

4.06 The following paragraphs detail the troubleshooting procedures for the Digital Bay Control subsystem.

Configuration

4.07 The Digital Bay Control subsystem consists of one card - the Bay Control card (Part No. 9109-017-000-NA).

Bay Control Power-Up Tests

4.08 The Bay Control card power-up tests are run automatically upon power-up of the associated bay, or a reset of the Main Control card. Failure of any of the power-up tests will result in the flashing of the Bay Control card ALARM LED soon after initialization.

First-Step Checks

4.09 Prior to replacing cards as directed by the Digital Bay Control subsystem troubleshooting procedures, carry out the following checks:

(a) Reseat the suspect card.

(b) Check for bent pins at the backplane or module connector, where applicable.

If the above does not clear the fault, proceed to replace the card.

Power-Up Sequence

4.10 The Bay Control card power-up sequence is outlined in detail in Section MITL9108-093-353-NA, General Maintenance Information. Chart 4-1 summarizes the troubleshooting procedures for the Bay Control card.

CHART 4-1
BAY CONTROL CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up
1	Check if the Bay Control card status LEDs indicate problems (see Table 4-1), or if the Main Control 7-segment displays indicate a Bay Control problem - displays show one of the following: 3 4 0 or 0	• Go to step 2.
2	Verify the power is available in the affected bay (there should be one or more LEDs lit on the Bay Control card, or any other card in the affected bay). Power available?	Yes: • Go to step 3. No: • This indicates a bay power supply problem. Refer to Bay Power Supply Troubleshooting Procedures.
3	Check if all three Bay Control card status LEDs are on.	Yes: • Go to step 4. No: • Go to step 11.
4	Reset the Bay by switching the Bay Power Supply OFF, and then ON again.	• Go to step 5.
5	Check if all three Bay Control card status LEDs light up and remain on.	Yes: • This indicates that there is no communication between the Bay Control and the Main Control. • Go to step 6. No: • Go back to step 1.
6	Check the PCM cable connecting the bay backplane to the control backplane - ensure it is firmly connected at both ends.	• Connect the cable properly as required. • If the cable is connected properly, replace the cable; if the problem persists, go to step 7.

STEP 7 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT MAY HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. DO NOT PROCEED TO STEP 7 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.

Step	Action	Description / Follow-up
7	Power down the affected bay and remove the Bay Control card.	• Go to step 8.
8	Ensure all switches (SW1-1, SW1-2, SW2-1, SW2-2) are in the CLOSED position (see Figure 4-1).	• Close all switches as required; go back to step 4. • If this is not the problem, go on to step 9.
9	A problem with the DX chips on the Bay Control card could cause these symptoms - replace the Bay Control card.	• If the problem persists, reinstall the original Bay Control card and go to step 10.

CHART 4-1 (Cont'd)
BAY CONTROL CARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up
10	A problem with the DX module on the Main Control card, or with Main Control card itself could cause these symptoms. Replace Main Control card.	• If problem persists, contact MITEL Field Service.
11	Check if Bay Control card ALARM LED is flashing.	Yes • Go to step 12. No: • Go to step 15.
STEP 12 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT MAY HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. DO NOT PROCEED TO STEP 12 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
12	Power down the affected bay via the switch on the bay power supply.	• Go to step 13.
13	A problem with the Bay Control card on-board EPROM could cause these symptoms - remove card and ensure EPROM is installed correctly. (See Figure 4-1).	• Install EPROM correctly as required. • If EPROM is installed correctly, go to step 14.
14	Replace Bay Control card.	• If problem persists, contact MITEL Field Service.
STEP 15 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT MAY HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. DO NOT PROCEED TO STEP 15 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
15	Check if there is an intermittent problem of loss of voice in Bays 3 and 4.	Yes: • Go to step 16. No: • Go to step 18.
16	Power down the affected bay and remove the Bay Control card.	• Go to step 16.
17	Ensure all switches (SW1-1, SW1-2, SW2-1, SW2-2) are in the CLOSED position (see Figure 4-1).	• Close all switches as required and go back to step 4. • If this is not the problem, go to step 18.
18	Contact MITEL Field Service.	

TABLE 4-1
BAY CONTROL CARD STATUS LEDs

TX LED	RX LED	ALARM LED	Meaning
on	on	on	Bay Control card is either waiting for, or has lost communication with the Main Control card. If this state persists for more than a few seconds, there is no communication.
flashing	flashing	on	Bay Control card is being downloaded by the Main Control card.
flashing	flashing	off	Bay Control card is up and running and communicating to the Main Control card.
off	off	off	This is the normal operating condition of the Bay Control card.
-	-	flashing	There is a failure on the Bay Control card.

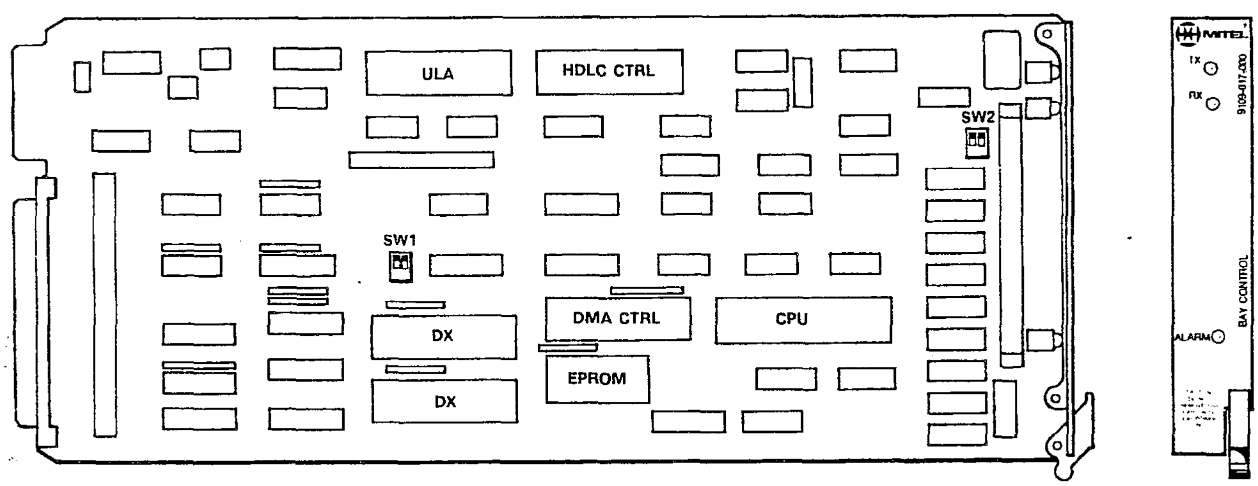


Figure 4-1 Bay Control Card Device Locations

ANALOG BAY PERIPHERAL CONTROL SUBSYSTEM

4.11 The following paragraphs detail the troubleshooting procedures for the Analog Bay Peripheral Control Subsystem.

Configuration

4.12 The Analog Bay Peripheral Control Subsystem consists of the following cards:

Name	Part No.
• Peripheral Control Card (PCC)	9108-203-000-NA
• PCC EPROM	-
• Digital Interface Card (DIC)	9108-002-000-NA
• DIC EPROM	-
• Scanner Card	9110-104-000-NA, 9110-004-000-NA

Peripheral Control Subsystem Power-Up Tests

4.13 The Peripheral Control Subsystem power-up tests are run automatically upon operation of the SYSTEM RESET pushbutton located on the Scanner card front panel. The test results are indicated in code form on the Scanner card's 7-segment displays, also located on the Scanner card front panel.

First-Step Checks

4.14 Prior to replacing cards as directed by the Peripheral Control Subsystem troubleshooting procedures, carry out the following checks:

(a) Reseat the suspect card.

(b) Check for bent pins at the backplane or module connector, where applicable.

If the above does not clear the fault, proceed to replace the card.

Power-Up Sequence

4.15 The Peripheral Control subsystem power-up sequence is outlined in detail in Section MITL9108-093-353-NA, General Maintenance Information. Chart 4-2 summarizes the troubleshooting procedures for the Peripheral Control subsystem.

CHART 4-2
ANALOG PERIPHERAL BAY TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	If Scanner 7-segment displays do not read "b3" or "b4", press MASTER RESET pushbutton on the Scanner card front panel.	• Go to step 2.	
2	Check if power-up tests have begun.	Yes: • Go to step 7. No : • Go to step 3.	see Note 1
3	Ensure bay power is turned on.	• TOP SHELF POWER switch on the maintenance panel should be in the ON position. • Go to step 4.	
4	Verify that power is available in the bay.	Yes: • Go to step 5. No : • This indicates a power supply problem. Refer to the Rear Door Power Supply troubleshooting procedures.	
5	Check if Scanner card 7-segment displays are blank.	Yes: • Go to step 6. No : • Go to step 7.	
6	Replace Scanner card.	• Go to step 7.	
7	Check if the Scanner card 7-segment displays show the following error code : E 2	Yes: • Go to step 8. No : • Go to step 15.	
8	Power down the affected bay via the switch on the maintenance panel.	• Go to step 9.	
9	Remove PCC card and verify that the EPROM IC is installed properly.	• If problem persists, go to step 10.	
	STEP 10 SHOULD BE DONE DURING PERIODS OF LOW OR NO TRAFFIC, AS IT WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE. BEFORE PROCEEDING, ATTEMPT A SYSTEM RESET, USING THE "SYSTEM RESET" PUSHBUTTON ON THE MAIN CONTROL CARD FRONT PANEL - CHECK IF THIS CORRECTS THE PROBLEM. DO NOT PROCEED TO STEP 10 UNLESS SPECIFICALLY DIRECTED TO IT FROM A PREVIOUS STEP.		
10	Power down the affected bay via the power switch on the maintenance panel.	• Go to step 11.	
11	Replace the Digital Interface card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 12. No : • Problem fixed.	

CHART 4-2 (Cont'd)
ANALOG PERIPHERAL BAY TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
12	Replace the Peripheral Control card; power up the bay. Does fault persist?	Yes: • Power down shelf; go to step 13. No : • Problem fixed.	
13	Replace the Scanner card; power up the bay. Does the fault persist?	Yes: • Possible problem with Main Control card; go to step 14. No : • Problem fixed.	
14	Power down the system; replace the Main Control card. Does the fault persist?	Yes: • Refer problem to Mitel field service. No : • Problem fixed.	
15	Check if the Scanner card 7-segment displays show the following error code: E 1	Yes: • Go to step 16. No : • Go to step 17.	
16	Replace the PCC card.	• If problem persists, contact Mitel Field Service.	
17	Check if the Scanner card 7-segment displays show one of the following status codes: b b 3 4	Yes: • The bay is functioning correctly. No : • Go to step 18.	see Note 2
18	Check if the Scanner card 7-segment displays show one of the following status codes: 0 A A A	Yes: • Go to step 19. No : • Go to step 22.	
19	Press the MASTER RESET push-button on the front panel of the Scanner card.	• If problem persists, go to step 20.	
20	Verify PCM cabling from front of DIC card to Bay 2 backplane (Bay 3 and Bay 4 DIC cards), or from Bay 4 DIC card to Bay 5 DIC card.	• Correct faulty cabling as required. • If problem persists, go to step 21.	see Note 3 see Note 4
21	Power down the affected shelf and replace the DIC card.	• If problem persists, may indicate a problem with the Main Control card. Refer to Main Control card troubleshooting procedures.	
22	If anything else is on the Scanner card 7-segment displays, press the MASTER RESET push-button on the Scanner card front panel.	• If the problem persists, power down the affected bay, and replace the affected DIC card. • If the problem persists, contact Mitel Field Service.	see Note 3

Notes to Chart 4-2:

1. The correct 7-segment display reset sequence is: 00, bb, 0A, b3 (or b4). Refer to Section MITL9108-093-353-NA, General Maintenance Information for details on the Scanner card LED codes.
2. At this point, if there is no call processing in the affected bay, contact Mitel Field Service.
3. In the peripheral cabinet, the affected DIC card will have the "Rx" LED on (i.e., not off, not flashing) and the "Tx" LED off.
4. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details on DIC card cabling.

FLOPPY DISK SUBSYSTEM

4.16 The following paragraphs detail the troubleshooting procedures for the Floppy Disk Subsystem. Chart 4-3 outlines the troubleshooting procedures for the Floppy Disk Subsystem. Note that some troubleshooting of the Floppy Disk Subsystem is done implicitly through the troubleshooting of the Main Control card.

Configuration

4.17 The Floppy Disk Subsystem consists of the following components:

Name	Part. No.
• Floppy Disk Drive	9109-024-000-NA, 9109-124-000-NA
• Main Control Card	9108-003-000-NA
• Interconnecting cables	–

Action in Case of Power Loss

4.18 In order to prevent corruption of the data on the floppy diskettes, care should be taken to disable system access to the disk drive unit prior to taking it off-line for troubleshooting purposes. Always release the lock-latch before removing power from the unit. Similarly, always ensure power is applied to the disk drive before inserting the diskette.

CHART 4-3
FLOPPY DISK SUBSYSTEM TROUBLESHOOTING PROCEDURES

Step	Action		Description / Follow-up	Remarks
1	Ensure bay power is turned on.		• Bay power supply switch should be in the ON position. • Go to step 2.	
2	Verify that power is available in the bay. (Measure at backplane.)	Yes: No :	• Go to step 3. • This indicates a power supply problem. Refer to the Bay Power Supply troubleshooting procedures.	see Fig 2-2
3	Verify power cable and signal ribbon cable are properly connected to the backplane.		• Go to step 4.	see Note 1
4	Check if Main Control card 7-segment displays show the following error code: E. 1	Yes: No :	• Indicates original system diskette has been replaced, and logs are pending; go to step 5. • Go to step 6.	see Note 4 see Note 2
5	Either (a) Re-insert original diskette, or (b) Restart system		• NOTE : ONLY RESTART THE SYSTEM DURING LOW OR NO TRAFFIC CONDITIONS, AS THIS HAS AN ADVERSE EFFECT ON SYSTEM PERFORMANCE.	see Note 3
6	Check if Main Control card 7-segment displays show the following error code: E. 2	Yes: No :	• Indicates original system diskette has been replaced; go to step 7. • Go to step 8.	
7	Either (a) Re-insert original diskette, or (b) Restart system		• NOTE : ONLY RESTART THE SYSTEM DURING LOW OR NO TRAFFIC CONDITIONS, AS THIS HAS AN ADVERSE EFFECT ON SYSTEM PERFORMANCE.	
8	Check if Main Control card 7-segment displays show the following error code: E. 3	Yes: No :	• Indicates that the disk drive is empty, and that disk updates are pending; go to step 9. • Go to step 10.	see Note 2
9	Either (a) Re-insert original diskette, or (b) Insert new diskette and restart the system		• NOTE : ONLY RESTART THE SYSTEM DURING LOW OR NO TRAFFIC CONDITIONS, AS THIS HAS AN ADVERSE EFFECT ON SYSTEM PERFORMANCE.	see Note 3

CHART 4-3 (Cont'd)
FLOPPY DISK SUBSYSTEM TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
10	Check if Main Control card 7-segment displays show the following error code: E. 4	Yes: • Indicates that the disk drive is empty; go to step 11. No : • Go to step 12.	
11	Either (a) Re-insert original diskette, or (b) Insert new diskette and restart the system	• NOTE : ONLY RESTART THE SYSTEM DURING LOW OR NO TRAFFIC CONDITIONS, AS THIS HAS AN ADVERSE EFFECT ON SYSTEM PERFORMANCE.	
12	Check if Main Control card 7-segment displays show the following error code: E. 5	Yes: • Indicates that there is an obstruction over the diskette "write notch" (i.e., a write-protect sticker); remove it. No : • Go to step 13.	
13	Refer to the troubleshooting procedures for the Main Control card.		

Notes: 1. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details of the Floppy Disk Drive installation.

2. Disk update information (e.g., log reports) is stored in system RAM until a period of low traffic before being transferred to the floppy disk.

3. If system is restarted at this point, the pending logs will be lost.

4. Software GENERIC 1001 error codes are: E.1, E.2, E.3, E.4, and E.5; Software GENERIC 1000 error codes are: 1E, 2E, 3E, 4E, and 5E.

POWER SUBSYSTEM

4.19 The SX-200® DIGITAL PABX power subsystem consists of up to four bay power supplies, or up to two rear-door power supplies, depending upon the configuration of the system. The optional uninterruptable power suppiy (UPS) is optional, and is user-supplied. Charts 4-4 and 4-5 outline the troubleshooting procedures for the power subsystem.

CHART 4-4
REAR-DOOR POWER SUPPLY TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Check if the 'AC POWER ON' LED, located on the rear panel of the power supply is on.	Yes: • Go to step 5. No : • Go to step 2.	see Note 1
2	Verify that the system is plugged securely into the commercial AC source	• Replace / repair cord as required. • Go to step 3.	
3	Check the AC power LINE fuse located on the rear panel of the power supply.	• If it has blown, replace it; otherwise, go to step 4.	see Note 1
4	Verify the commercial AC source with an AC meter, or by connecting another device to it.	• If commercial AC source is out of spec, ensure that a UPS is connected. • Verify that the UPS is functioning correctly. • Go to step 5.	
5	Check if the CONVERTER INPUT circuit breaker is tripped (OFF).	Yes: • Switch it to the ON position; if it trips to the OFF position again, replace the power supply. No : • Go to step 6.	see Note 1
6	Check the connection from the rear-door power supply (harness) to the shelf backplane.	• Repair / replace any faulty wiring. • Go to step 7.	see Note 2
7	Check that the TOP SHELF POWER switch on the maintenance panel/top panel is in the ON position.	• Go to step 8.	
8	Verify that the maintenance panel cable is connected correctly to the Interconnect card inside the cabinet.	• Repair / replace broken switch(es). • Repair / replace faulty wiring. • Go to step 9.	see Note 2
9	Check backplane for bent pins, foreign material, damage, etc.	• If backplane is damaged, replace it; otherwise, go to step 10.	
10	Check the backplane voltages (from terminal block on upper left corner of backplane).	• If they are out of spec, go to step 11. • If they are in spec, power supply is functioning correctly.	see Note 3
11	Replace the rear-door power supply.		

Notes: 1. Refer to Section MITL9108-093-353-NA, General Maintenance Information for location of LEDs, fuses, inputs, and outputs of the rear-door power supply.

2. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation, for details on these connections.

3. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation, for the measuring points. See Tables 4-2 and and 4-3 for the expected voltages. Remove all peripheral wiring before making measurements.

CHART 4-5
BAY POWER SUPPLY TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Check if the power switch on the front panel bay power supply is in the "ON" position, and the associated LED is on.	Yes: • Go to step 8. No : • The power supply is not turned on. Put the power switch into the "ON" position. • Go to step 2.	
2	Verify that the system is plugged securely into the commercial AC power source.	• Replace / repair cord as required. • Go to step 3.	
3	Check if the cabinet has a rear-door power supply.	Yes: • Verify that it is functioning properly - refer to the Rear-door power supply troubleshooting procedures. • If it is functioning properly, go to step 5. No : • Go to step 4.	see Note 1
4	Check the connection between the AC line filter (on the rear door) and the AC distribution panel, located beneath the equipment shelves.	• Secure connections / replace cable as required. • Go to step 6.	see Note 2
5	Check the connection between the rear-door power supply and the AC distribution panel, located beneath the equipment shelves.	• Secure connections / replace cable as required. • Go to step 6.	see Note 2 see Note 3
6	Verify the wiring inside the AC distribution panel.	• Replace / repair wiring as required. • Go to step 7.	
7	Check connection from AC distribution panel to the bay power supply.	• Secure connection / replace cable as required. • Go to step 8.	see Note 2
8	Check backplane voltages.	• If they are out of spec, go to step 9. • If they are within spec, power supply is functioning correctly.	see Note 4
9	Replace the bay power supply.		

Notes: 1. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for information on power supply configurations.

2. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details on power supply cabling.

3. In some cabinets the AC distribution panel is located on the floor of the cabinet, behind the equipment shelves. See Section MITL9108-093-200-NA for further details.

4. Refer to Bay 1/2 backplane, and Figure 2-2 for the measuring points; see Tables 4-2 and 4-3 for the expected voltages.

TABLE 4-2
BAY POWER SUPPLY TEST POINT VOLTAGES

Voltage	Minimum	Maximum
+ 5 Vdc	+ 4.925	+ 5.075
+ 12 Vdc	+ 10.8	+ 13.2
− 12 Vdc	− 13.2	− 10.8
− 5 Vdc	− 5.5	− 4.5
− 28 Vdc	− 30.8	− 23.8
−48 Vdc	− 53.76	− 40.8
90 Vac	63.0	99.0

TABLE 4-3
REAR DOOR POWER SUPPLY TEST POINT VOLTAGES

TB	Pin	Voltage	Minimum	Maximum
1	4	+ 8 Vdc	+ 7.6	+ 8.4
	3	0 Vdc	−	−
	2	− 5 Vdc	− 5.3	− 4.7
	1	− 10 Vdc	− 10.5	− 9.5
2	5	− 48 Vdc	− 52.0	− 45.0
	4	GND or 0 Vdc	−	−
	2	90 Vac	85.0	95.0

UNINTERRUPTABLE POWER SUPPLY (UPS)

4.20 Any UPS may be used with the SX-200® DIGITAL PABX, provided that it meets the requirements specified in Section MITL9108-093-200-NA, Shipping, Receiving and Installation. Since these are available from a number of suppliers, only rudimentary troubleshooting procedures for the UPS are provided in this document. Reference should be made to the appropriate manual provided by the manufacturer of the UPS for any self-diagnostic capabilities. Chart 4-6 outlines the troubleshooting procedures for the UPS.

CHART 4-6
UPS TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Verify the connection between the UPS and the commercial AC power source.	• Secure connection / replace cable as required. • Go to step 2.	
2	Verify the connection between the UPS and the PABX.	• Secure connection / replace cable as required. • Go to step 3.	
3	Check if UPS is functioning correctly.	Yes: • Stop. No : • Go to step 4.	
4	Consult manufacturer's instructions and make adjustments.	• IMPORTANT: IF IT IS NECESSARY TO REPLACE THE UPS, THIS MUST BE DONE ONLY DURING PERIODS OF LOW OR, PREFERABLY NO TRAFFIC, AS THIS WILL HAVE AN ADVERSE EFFECT ON SYSTEM PERFORMANCE.	

MAINTENANCE / CDE TERMINAL

4.21 Any terminal which is compatible with RS-232C type interface protocol may be used with the SX-200® DIGITAL PABX. Since these are available from a number of suppliers, only rudimentary troubleshooting procedures are provided in this document. Reference should be made to the appropriate manual provided by the manufacturer of the terminal for any self-diagnostic capabilities. Chart 4-7 outlines the troubleshooting procedures for the video display terminal.

CHART 4-7
MAINTENANCE / CDE TERMINAL TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	See Note 1.		
2	Verify the connection from the commercial AC power source and the terminal.	• Secure connection / replace cable as required. • Go to step 3.	see Note 2
3	Verify the connection from the terminal's RS-232 socket to the RS-232 socket on the maintenance panel (RS-232 pins 2, 3, 4, 5 and 7 are used).	• Secure connection / replace cable as required. • Go to step 4.	see Note 2
4	Check if the terminal passes its own self-diagnostics.	Yes: • Go to step 5. No : • Replace the terminal.	
5	Verify that the communication parameters of the terminal match those of the maintenance port.	• Go to step 6.	see Note 3
6	Verify the wiring from the maintenance panel to the Bay 2 backplane.	• Secure connection / repair wiring as required. • Go to step 7.	see Note 4
7	Replace the terminal.	• If problem persists, go to step 8.	
8	Refer to Main Control card troubleshooting procedures.	• May be necessary to replace Main Control card.	

Notes: 1. If the terminal is out of commission, system maintenance can still be performed via either the testline interface or the attendant console. Refer to Sections MITL9018-093-353-NA, General Maintenance Information and MITL9108-093-315-NA Attendant Console Guide for further details.

2. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of the connections.

3. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of setting communication parameters.

4. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details on wiring of the maintenance panel.

PRINTER

4.22 Any printer which is compatible with RS-232C type interface protocol may be used with the SX-200® DIGITAL PABX. Since these are available from a number of suppliers, only rudimentary troubleshooting procedures are provided in this document. Reference should be made to the appropriate manual provided by the manufacturer of the printer for any self-diagnostic capabilities. Chart 4-8 outlines the troubleshooting procedures for the printer.

CHART 4-8
PRINTER TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Test the printer; use the TEST DEVICE TYPE PRINTER command.	Pass: • Go to step 2. Fail: • Replace printer; if problem persists, go to step 2.	see Note 1 see Note 2
2	Verify the connection from the commercial AC power source and the printer.	• Secure connection / replace cable as required. • Go to step 3.	see Note 4
3	Verify the connection from the printer's RS-232 socket to the RS-232 socket on the Bay 2 backplane (RS-232 pins 2, 3, 4, 5 and 7 are used).	• Secure connection / replace cable as required. • Go to step 4.	see Note 4
4	Check if the printer passes its own self-diagnostics.	Yes: • Go to step 5. No : • Replace the printer.	
5	Verify that the communication parameters of the printer match those of the printer port.	• Go to step 6.	see Note 5
6	Replace the terminal.	• If problem persists, go to step 7.	
7	Refer to Main Control card troubleshooting procedures.	• May be necessary to replace Main Control card.	

Notes:
1. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of procedures.
2. To pass the test, the printer should print an entire page of test data.
3. If the terminal is out of commission, system maintenance can still be performed via the testline interface. Refer to Section MITL9018-093-353-NA, General Maintenance Information for further details.
4. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of the connections.
5. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for details of setting communication parameters.

CABINET COOLING SYSTEM

4.23 The maximum safe internal ambient operating temperature inside the SX-200® DIGITAL PABX control cabinet is 40 degrees celsius. A temperature sensor is installed within the cabinet and is set to trip at 60 degrees celsius. This means that when the user is informed of this (via a log message), the system is definitely OVERHEATING, and immediate action is required. Chart 4-9 outlines the troubleshooting procedures for the cabinet cooling system.

CHART 4-9
CABINET COOLING SUBSYSTEM TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Verify that both of the fans are operating.	Yes: • Go to step 2. No : • Go to step 10.	
2	Verify that temperature within the cabinet is in fact at or near 60 degrees celsius.	• Open the cabinet front door and hold the thermometer deep within the cabinet.	
3	Is the temperature at, or near 60 degrees?	Yes: • Go to step 5. No : • Go to step 4.	
4	The sensor is faulty. Replace the fan unit.		
5	Check the ambient room temperature; is temperature over 40 degrees celsius?	Yes: • This exceeds the maximum operating temperature. Lower temperature, or move the system to a cooler location. No : • Go to step 6.	
6	Check if there is anything obstructing the air inlet vents on the front of the cabinet.	Yes: • Remove the obstruction. No : • Go to step 7.	
7	Check if there is a localized source of heat, such as a malfunctioning power supply, board or rectifier.	Yes: • Attend to the fault – refer to the appropriate troubleshooting procedures. No : • Go to step 8.	
8	Check the air filter; does it require cleaning / replacement.	Yes: • Clean / replace the filter as required. • Go to step 9. No : • Go to step 12.	see Note 1
9	Wait briefly – verify that the filter change brings temperature down – measure with thermometer and check for maintenance log message.	Yes: • Problem fixed. No : • Go to step 12.	
10	Check AC connection from AC distribution panel to the fan unit.	• Secure connection / replace cord as required. • Go to step 11.	see Note 2
11	Check if AC power is available throughout the system.	Yes: • Go to step 12. No : • Refer to power subsystem troubleshooting procedures.	
12	Replace the fan unit.		

Notes: 1. Refer to Section MITL9108-093-353-NA, General Maintenance Information for details on filter maintenance.

2. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details on cabling.

POWER FAIL TRANSFER SYSTEM

General

4.24 Power fail transfer relays are provided in order to allow essential service to be maintained in the event of failure of a critical item of equipment, or a serious degradation of service. Power to the transfer relays is maintained during normal operation, but during power fail transfer conditions, power is cut off from the relays. This releases them, connecting selected ONS or OPS lines directly to selected CO trunks.

4.25 Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details on the location of the PFT cards. Chart 4-10 outlines the troubleshooting procedures for the power fail transfer system.

Note: In order to prevent misunderstanding, it is emphasized that the relays are NORMALLY OPERATED, and are RELEASED to effect the transfer operation.

CHART 4-10
POWER FAIL TRANSFER BOARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
1	Check if the system is operational.	Yes: • Go to step 2. No : • Go to Chart 2-2.	
2	Check if the entire system is in power fail transfer mode - refer to the maintenance log.	Yes: • Go to step 3. No : • Go to step 7.	
3	Verify that −48 Vdc is available in all bays.	Yes: • Go to step 4. No : • Go to the applicable power supply troubleshooting procedure.	
4	Verify that the maintenance panel switches are not set to power fail transfer.	• If they are, return them to the normal operating position. • Go to step 5.	see Note 1
5	Verify the −48 Vdc feed to the power fail transfer card - through the maintenance panel switches, to the interconnect card, to the power fail transfer card.	• Secure wiring / replace wiring as required. If problem persists, go to step 6.	see Note 2
6	Verify the connections at the interconnect field.	• Repair connections as required; if problem persists, go to step 17.	see Note 3
7	Check if entire peripheral cabinet is in the power fail transfer condition.	Yes: • Go to step 8. No : • Go to step 12.	
8	Verify that −48 Vdc is available in all bays used in the cabinet.	Yes: • Go to step 9. No : • Go to the applicable power supply troubleshooting procedure.	
9	Verify that the maintenance panel switches are not set to power fail transfer.	• If they are, return them to the normal operating position. • Go to step 10.	see Note 1
10	Verify the −48 Vdc feed to the power fail transfer card - through the maintenance panel switches, to the interconnect card, to the power fail transfer card.	• Secure wiring / replace wiring as required. If problem persists, go to step 11.	see Note 2
11	Verify the connections at the interconnect field.	• Repair connections as required; if problem persists, see Note 3 and go to step 17.	
12	Check if a single bay is in the power fail transfer condition.	Yes: • Go to step 13. No : • Go to step 15.	

CHART 4-10 (Cont'd)
POWER FAIL TRANSFER BOARD TROUBLESHOOTING PROCEDURES

Step	Action	Description / Follow-up	Remarks
13	Verify that -48 Vdc is available in the affected bay.	Yes: • Go to step 14. No : • Go to the applicable power supply troubleshooting procedure.	
14	Verify the connections at the interconnect field.	• Repair connections as required; if problem persists, see Note 3 and go to step 17.	
15	Check if one or more separate stations are in the power fail transfer condition.	Yes: • Go to step 16. No : • No problem with power fail transfer system.	
16	Verify the connections at the interconnect field.	• Repair connections as required; if problem persists, go to step 17.	see Note 3
17	Replace the affected power fail transfer card.	• If problem persists, contact Mitel Field Service.	

Notes: 1. Refer to Section MITL9108-093-353-NA, General Maintenance Information for details on the switch settings.

2. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details on PFT card wiring.

3. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details on PFT connections to the interconnect field.

APPENDIX A
MAINTENANCE LOG MESSAGES

General

A1.01 This Appendix contains the complete set of information messages which are recorded in the maintenance log when a significant event occurs. Each message is self-explanatory, identifying the event and providing details about it. Information on options available to maintenance personel is included under the "Action Required" heading.

A1.02 There are three types of log report; they are as follows:

1. Fault Report - a report generated when the maintenance system or Call Processing detects a fault, or an abnormal condition.

2. Reset Report - a report generated when a bay or the system is reset.

3. Alarm Report - a report generated when a change in any of the alarm levels occurs.

A1.03 This Appendix is divided into three sections which correspond to the three types of log messages. The 'Fault Reports' section is arranged using the Alarm Code, an index number specific to the type of fault indicated. The Reset and Alarm Report sections are arranged in a logical manner.

A1.04 Information on access to the maintenance log, and the use of other maintenance tools may be found in Section MITL9108-093-351-NA, RS-232 Maintenance Terminal. Information on overall maintenance philosophy and specific diagnostic tests may be found in Section MITL9108-093-353-NA, General Maintenance Information.

TABLE A1-1
FAULT REPORTS

Alarm Code		Message	Action Required
Generic 1000	Generic 1001		
00	00	Channel number 19, link number 07 failed junctor test Alarm Code = 00	Do a directed test on the specified link to verify the problem. Note that link 02 corresponds to Bay 03, link 05 corresponds to Bay 04, and link 07 corresponds to Bay 05. If the problem persists, refer to the Analog Junctor Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS command.
01	01	Channel number 19, link number 07 failed junctor dgl codec Alarm Code = 01	Do a directed test on the specified link to verify the problem. Note that link 02 corresponds to Bay 03, link 05 corresponds to Bay 04, and link 07 corresponds to Bay 05. If the problem persists, refer to the Digital Interface Card Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS command.
02	02	Channel number 19, link number 07 failed junctor ang codec Alarm Code = 02	Do a directed test on the specified link to verify the problem. Note that link 02 corresponds to Bay 03, link 05 corresponds to Bay 04, and link 07 corresponds to Bay 05. If the problem persists, refer to the Digital Interface Card Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS command.
03	03	DLIC module failed at 02 03 01 00 console test Alarm Code = 03	Do a directed test on the specified circuit to verify the problem. If the problem persists, refer to the Console/DLIC module Part of this Section. Replace as required. Otherwise, investigate further, using the MONITOR DIAGNOSTICS and SHOW STATUS commands.
04	04	DLIC module failed at 02 03 01 00 console dgl codec Alarm Code = 04	Do a directed test on the specified circuit to verify the problem. If the problem persists, refer to the Console/DLIC module Part of this Section. Replace as required. Otherwise, investigate further, using the MONITOR DIAGNOSTICS and SHOW STATUS commands.
05	05	DLIC module failed at 02 03 01 00 console ang codec Alarm Code = 05	Do a directed test on the specified circuit to verify the problem. If the problem persists, refer to the Console/DLIC module Part of this Section. Replace as required. Otherwise, investigate further, using the MONITOR DIAGNOSTICS and SHOW STATUS commands.
06	06	ONS card failed at 02 01 01 00 ext 2101 inject codec test Alarm Code = 06	Do a directed test on the specified circuit to verify the problem. If the problem persists, refer to the Fault Isolation Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS and SHOW STATUS commands.

TABLE A1-1 (Cont'd)
FAULT REPORTS

Alarm Code		Message	Action Required
Generic 1000	Generic 1001		
06 (Cont'd)	06 (Cont'd)	COV card failed at 01 05 01 00 ext 1501 inject codec test Alarm Code = 06 LS/GS trk card failed at 02 02 01 00 inject codec test Alarm Code = 06 E&M module failed at 02 02 01 00 inject codec test Alarm Code = 06 DTMF RX module failed at 02 02 01 00 inject codec test Alarm Code = 06	
07	07	ONS card failed at 02 01 01 00 ext 2101 Dgl L/B codec test Alarm Code = 07 COV card failed at 01 05 01 00 ext 1501 Dgl L/B codec test Alarm Code = 07 LS/GS trk card failed at 02 02 01 00 Dgl L/B codec test Alarm Code = 07 E&M module failed at 02 02 01 00 Dgl L/B codec test Alarm Code = 07 DTMF RX module failed at 02 02 01 00 Dgl L/B codec test Alarm Code = 07	Do a directed test on the specified circuit to verify the problem. If the problem persists, refer to the Fault Isolation Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS and SHOW STATUS commands.
08	08	ONS card failed at 02 01 01 00 ext 2101 Ang L/B codec test Alarm Code = 08 COV card failed at 01 05 01 00 ext 1501 Ang L/B codec test Alarm Code = 08 LS/GS trk card failed at 02 02 01 00 Ang L/B codec test Alarm Code = 08 E&M module failed at 02 02 01 00 Ang L/B codec test Alarm Code = 08 DTMF RX module failed at 02 02 01 00 Ang L/B codec test Alarm Code = 08	Do a directed test on the specified circuit to verify the problem. If the problem persists, the fault is isolated to the specified circuit. Refer to the appropriate Part of this Section. Replace as required. Otherwise, investigate further, using the MONITOR DIAGNOSTICS and SHOW STATUS commands.
10	10	ONS card failed at 02 01 01 00 ext 2101 Hook test Alarm Code = 10	Do a directed test on the specified circuit to verify the problem. If the problem persists, refer to the ONS Line card Part of this Section. Replace as required. Otherwise, investigate further, using the MONITOR DIAGNOSTICS and SHOW STATUS commands.
11	11	ONS card failed at 02 01 01 00 ext 2101 Adc reference test Alarm Code = 11 LS/GS trk card failed at 02 02 01 00 ADC reference test Alarm Code = 11	Do a directed test on the specified circuit to verify problem. If the problem persists, refer to the Fault Isolation Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS and SHOW STATUS commands.

TABLE A1-1 (Cont'd)
FAULT REPORTS

Alarm Code		Message	Action Required
Generic 1000	Generic 1001		
13	13	LS/GS trk card failed at 02 02 01 00 Hybrid loopback test Alarm Code = 13	Do a directed test on the specified circuit to verify the problem. If the problem persists, the fault is isolated to the specified circuit. Refer to the appropriate Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS and SHOW STATUS commands.
14	14	DTMF RX module failed at 02 02 01 00 DTMF receiver test Alarm Code = 14	Do a directed test on the specified circuit to verify the problem. If the problem persists, the fault is isolated to the specified DTMF Receiver. Refer to the DTMF Receiver Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS and SHOW STATUS commands.
15	15	PRINTER failed at 00 00 02 00 Printer down Alarm Code = 15	Do a directed test on the printer to verify this. Check if printer is off-line or disconnected. Refer to printer troubleshooting procedures.
n/a	16	Signal Pro failed at 00 00 06 00 DSP memory test Alarm Code = 16	Do a directed test on the DSP to verify the problem. If it persists, refer to the Main Control card Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS command.
n/a	17	Signal Pro failed at 00 00 06 00 DSP tone detect test Alarm Code = 17	Do a directed test on the DSP to verify the problem. If it persists, refer to the Main Control card Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS command.
n/a	18	Signal Pro failed at 00 00 06 00 DSP tone gen Alarm Code = 18	Do a directed test on the DSP to verify the problem. If it persists, refer to the Main Control card Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS command.
n/a	19	Signal Pro failed at 00 00 06 00 DSP conference test Alarm Code = 19	Do a directed test on the DSP to verify the problem. If it persists, refer to the Main Control card Part of this Section. Otherwise, investigate further, using the MONITOR DIAGNOSTICS command.
16	100	Signal Pro failed at 00 00 06 00 DSP went insane Alarm Code = 100	Do a directed test on the DSP to verify the problem. If the problem persists, refer to Main Control card troubleshooting procedures.

TABLE A1-1 (Cont'd)
FAULT REPORTS

Alarm Code		Message	Action Required
Generic 1000	Generic 1001		
17	101	ONS card failed at 02 01 01 00 ext 2101 OFF hook too long Alarm Code = 101 Stn line card failed at 03 01 01 00 ext 3101 OFF hook too long Alarm Code = 101 COV card failed at 01 05 01 00 ext 1501 OFF hook too long Alarm Code = 101 Superset card failed at 03 01 01 00 ext 3101 OFF hook too long Alarm Code = 101	Information only.
18	102	ONS card failed at 02 01 01 00 ext 2101 Card removed Alarm Code = 102 Stn line card failed at 03 01 01 00 ext 3101 Card removed Alarm Code = 102 COV card failed at 01 05 01 00 ext 1501 Card removed Alarm Code = 102 Superset card failed at 03 01 01 00 ext 3101 Card removed Alarm Code = 102 LS/GS trk card failed at 02 02 01 00 Card removed Alarm Code = 102 CO trunk card failed at 02 02 01 00 Card removed Alarm Code = 102 E&M trunk card failed at 02 02 01 00 Card removed Alarm Code = 102 DID trunk card failed at 02 02 01 00 Card removed Alarm Code = 102 UNIV card type failed at 02 03 01 00 Card removed Alarm Code = 102	Verify card has been removed. If alarm is raised due to this, either replace/re-install the card, or deprogram it via CDE. Refer to Section MITL9108-093-210-NA, Customer Data Entry for details.

TABLE A1-1 (Cont'd)
FAULT REPORTS

Alarm Code		Message	Action Required
Generic 1000	Generic 1001		
19	103	ONS card passed at 02 01 01 00 ext 2101 Card installed Alarm Code = 103 Stn line card passed at 03 01 01 00 ext 3101 Card installed Alarm Code = 103 COV card passed at 01 05 01 00 ext 1501 Card installed Alarm Code = 103 Superset card passed at 03.01 01 00 ext 3101 Card installed Alarm Code = 103 LS/GS trk card passed at 02 02 01 00 Card installed Alarm Code = 103 CO trunk card passed at 02 02 01 00 Card installed Alarm Code = 103 E&M trunk card passed at 02 02 01 00 Card installed Alarm Code = 103 DID trunk card passed at 02 02 01 00 Card installed Alarm Code = 103 UNIV card type passed at 02 03 01 00 Card installed Alarm Code = 103	Information only.
20	104	ONS card failed at 02 01 01 00 ext 2101 Wrong card in slot Alarm Code = 104 Stn line card failed at 03 01 01 00 ext 3101 Wrong card in slot Alarm Code = 104 COV card failed at 01 05 01 00 ext 1501 Wrong card in slot Alarm Code = 104 Superset card failed at 03 01 01 00 ext 3101 Wrong card in slot Alarm Code = 104 LS/GS trk card failed at 02 02 01 00 Wrong card in slot Alarm Code = 104 CO trunk card failed at 02 02 01 00 Wrong card in slot Alarm Code = 104 E&M trunk card failed at 02 02 01 00 Wrong card in slot Alarm Code = 104 DID trunk card failed at 02 02 01 00 Wrong card in slot Alarm Code = 104 UNIV card type failed at 02 03 01 00 Wrong card in slot Alarm Code = 104	The specified card type is not programmed for the specified card slot. Use the SHOW CONFIG command to observe the correct configuration. Either insert the correct card type, or reprogram the card slot (see Section MITL9108-093-210-NA, Customer Data Entry).

TABLE A1-1 (Cont'd)
FAULT REPORTS

Alarm Code		Message	Action Required
Generic 1000	Generic 1001		
21	105	COV card failed at 01 05 01 00 ext 1501 Superset Unplugged Alarm Code = 105 Superset card failed at 03 01 01 00 ext 3101 Superset Unplugged Alarm Code = 105	The specified extension has been unplugged. If this is not the case, check wiring.
22	106	Database failed at 00 00 04 00 Serious ram shortge Alarm Code = 106	This is a warning. Stop CDE programming activity. Wait for a low traffic period, and reset the system. If this persists, search for an Alarm Code 24 message. Watch for further occurrences.
23	107	Database failed at 00 00 03 00 Serious dsk shortge Alarm Code = 107	This is a warning. Stop CDE activity. Wait for a low traffic period, perform a COPY DATABASE, and reset the system using the new database. If this persists, search for an Alarm Code 25 message. Watch for further occurrences.
24	108	RAM failed at 00 00 04 00 No Ram space left Alarm Code = 108	No further CDE programming will be possible. There is no RAM space available. Wait for a period of low traffic, and reset the system. If further programming is required, other devices, account code numbers, ARS strings, or speed call numbers will have to be deprogrammed.
25	109	DISK failed at 00 00 03 00 No Disk space left Alarm Code = 109	No further CDE programming will be possible. There is no disk space available. Wait for a period of low traffic, perform a COPY DATABASE, and reset the system using the new database. If further programming is required, other devices, account numbers, ARS strings, or speed call numbers will have to be deprogrammed.
26	110	ONS card failed at 02 01 01 00 ext 2101 Msg reg overflow Alarm Code = 110 Stn line card failed at 03 01 01 00 ext 3101 Msg reg overflow Alarm Code = 110 COV card failed at 01 05 01 00 ext 1501 Msg reg overflow Alarm Code = 110 Superset card failed at 03 01 01 00 ext 3101 Msg reg overflow Alarm Code = 110	The message registration counter for the specified extension has overflowed. The overflow threshold is 50,000. Ensure that the counters are periodically reset at the Attendant Console.
27	111	LS/GS trk card failed at 02 02 01 00 Can't seize trunk Alarm Code = 111 CO trunk card failed at 02 02 01 00 Can't seize trunk Alarm Code = 111 E&M trunk card failed at 02 02 01 00 Can't seize trunk Alarm Code = 111 DID trunk card failed at 02 02 01 00 Can't seize trunk Alarm Code = 111	Verify the wiring from the trunk circuit to the public network. Correct as required. Refer to Section MITL9108-093-200-NA, Shipping, Receiving, and Installation. If this is not the problem, suspect failure or bad wiring at the Central Office.

TABLE A1-1 (Cont'd)
FAULT REPORTS

Alarm Code		Message	Action Required
Generic 1000	Generic 1001		
28	112	LS/GS trk card failed at 02 02 01 00 Can't release trunk Alarm Code = 112 CO trunk card failed at 02 02 01 00 Can't release trunk Alarm Code = 112 E&M trunk card failed at 02 02 01 00 Can't release trunk Alarm Code = 112 DID trunk card failed at 02 02 01 00 Can't release trunk Alarm Code = 112	No release signal was received from the Central Office. Verify wiring. Refer to Section MITL9108-093-200-NA, Shipping, Receiving, and Installation for details.
29	113	UNIV card type failed at 02 03 01 00 Exceeds power rating Alarm Code = 113	The total power rating of the modules installed on the specified Universal card exceeds the maximum permitted total power rating. Refer to Section MITL9108-093-200-NA, Shipping, Receiving and Installation for details.
30	114	PRINTER failed at 00 00 02 00 SMDR printer down Alarm Code = 114	The printer used for SMDR printing is off-line or not working. Check printer. Refer to printer troubleshooting procedures.
31	115	Disk failed at 00 00 03 00 Disk removed/Bad ID	Contact MITEL Field Service.
32	116	Disk passed at 00 00 03 00 Disk inserted	Information only.
33	117	RAM failed at 00 00 05 00 CMOS checksum failed Alarm Code = 115	This is not a serious problem if it occurs once. However, if it is persistent, refer problem to field service.
34	118	COV card failed at 01 05 01 00 ext 1501 Card in low pwr slot Alarm Code = 118 UNIV card type failed at 02 03 01 00 Card in low pwr slot Alarm Code = 118	The specified card is a high power card installed in a low power slot. Use SHOW CONFIG command to obtain information on the card slot. Re-install/reprogram the card for a high power slot.
35	119	Temp sense failed at 00 00 07 00 System over-heated Alarm Code = 119	System is overheating. Inspect fan cooling system. If inoperative, refer to the Fan/Cooling System Part of this Section.
36	120	Temp sense passed at 00 00 07 00 Temp back to normal Alarm Code = 120	Information only.

TABLE A-1 (Cont'd)
FAULT REPORTS

Alarm Code		Message	Action Required
Generic 1000	Generic 1001		
37	121	PFT sense failed at 00 00 08 00 Bay has cut through Alarm Code = 121 BAY failed at 03 00 00 00 Bay has cut through Alarm Code = 121	The digital bays have gone into Power Fail Transfer mode. Use SHOW ALARMS command and examine logs further to find the actual cause of the cut through. The specified analog bay has gone into Power Fail Transfer mode. Check for messages indicating that other bays have cut through. Use SHOW ALARMS command and examine logs further to find the actual cause of the cut through.
38	122	PFT sense passed at 00 00 08 00 Bay has cut back Alarm Code = 122 BAY passed at 03 00 00 00 Bay has cut back Alarm Code = 122	The specified bay has been cut back to normal operation. Verify that appropriate action was taken to rectify the event which caused the cut through.
n/a	123	ONS card failed at 02 01 01 00 ext 2101 Recording dev failed Alarm Code = 123 Stn line card failed at 03 01 01 00 ext 3101 Recording dev failed Alarm Code = 123	The recording device attached to the specified port has malfunctioned. Check wiring. Refer to the instructions provided by the maufacturer of the recording device.
n/a	124	PRINTER failed at 00 00 02 00 Wakeup printer down Alarm Code = 124	The printer used for Hotel/Motel wakeup printing is off-line or not working. Check printer. Refer to Printer troubleshooting procedures.
n/a	125	ONS card failed at 02 01 01 00 ext 2101 Wakeup not answered Alarm Code = 125 Stn line card failed at 03 01 01 00 ext 3101 Wakeup not answered Alarm Code = 125 COV card failed at 01 05 01 00 ext 1501 Wakeup not answered Alarm Code = 125 Superset card failed at 03 01 01 00 ext 3101 Wakeup not answered Alarm Code = 125	Information only.

TABLE A1-1 (Cont'd)
FAULT REPORTS

Alarm Code		Message	Action Required
Generic 1000	Generic 1001		
39	126	DISK failed at 00 00 03 00 Disk corrupt Alarm Code = 126	Disk has been corrupted. Check to see if disk is properly installed. Attempt to access the disk by logging into CDE or Maintenance. Reset the system at the earliest low traffic period. New diskette will likely be required.
40	127	DTMF RX module failed at 02 02 01 00 Receiver locked out Alarm Code = 127	Reseat the affected Universal card.
41	128	** anything ** failed at 00 00 00 00 Bad Group Link Alarm Code = 128	Record this and watch for further occurrences. If system performance is degraded substantially, contact MITEL Field Service.
42	129	** anything ** failed at 00 00 00 00 Plid to Swid failed Alarm Code = 129	Record this and watch for further occurrences. If system performance is degraded substantially, contact MITEL Field Service.
n/a	130	RAM failed at 00 00 04 00 Disk VS Ram Failed Alarm Code = 130	Record this and watch for further occurrences. If system performance is degraded substantially, contact MITEL Field Service.
43	131	** anything** failed at 00 00 00 00 Key dB corrupt.	A CDE audit has failed. If this persists, attempt a COPY DATABASE as soon as possible. If this still persists; contact MITEL Field Service.
44	132	** anything ** failed at 00 00 00 00 Trunk number corrupt.	A CDE audit has failed. If this persists, attempt a COPY DATABASE as soon as possible. If this still persists; contact MITEL Field Service.
n/a	133	** anything ** failed at 00 00 00 00 Access code table bad.	A CDE audit has failed. If this persists, attempt a COPY DATABASE as soon as possible. If this still persists; contact MITEL Field Service.
n/a	134	UPS sense failed at 00 00 09 00 UPS not available Alarm Code = 134	The Uninterruptable Power Supply is not operating. Check the relevant wiring (see Section MITL9108-093-200-NA, Shipping, Receiving, and Installation). Refer to the UPS Part of this Section.
n/a	135	UPS sense passed at 00 00 09 00 UPS available Alarm Code = 135	Information only.
n/a	136	UPS sense failed at 00 00 09 00 AC voltage failure Alarm Code = 136	The line AC voltage has failed. Ensure UPS is functioning.
n/a	137	UPS sense failed at 00 00 09 00 Battery/charger Alarm Code = 137	Either the battery is failing, or the battery charger is not functioning. Examine battery, charger, and wiring. Also refer to the instructions provided by the manufacturer of the UPS.

TABLE A1-1 (Cont'd)
FAULT REPORTS

Alarm Code		Message	Action Required
Generic 1000	Generic 1001		
n/a	138	UPS sense failed at 00 00 09 00 AC/battery/charger Alarm Code = 138	There is no line AC voltage. Also, the battery is failing, or the charger is/was not functioning properly. Examine battery, charger and wiring. Also, refer to the instructions provided by the manufacturer of the UPS.

TABLE A1-2
ALARM LOG REPORTS

Alarm Code	Action Required
Tot alarm went from No Alarm to MAJOR Due to threshold change of <see ' Alarm Reasons' in Table A1-3>	Use SHOW ALARMS command for more detailed information. Also see the applicable entry in Table A1-3.
Tot alarm went from MINOR to MAJOR Due to threshold change of <see ' Alarm Reasons' in Table A1-3>	Use SHOW ALARMS command for more detailed information. Also see the applicable entry in Table A1-3.
Tot alarm went from MAJOR to MINOR Due to threshold change of <see ' Alarm Reasons' in Table A1-3>	This is an improvement in service. Information only.
Tot alarm went from MINOR to No Alarm Due to threshold change of <see ' Alarm Reasons' in Table A1-3>	This is an improvement in service. Information only.

TABLE A1-3
ALARM RESET REASONS

Alarm Level Change Reason	Action Required
Alarm level change due to control	If system is not processing calls, reset the system immediately. Otherwise refer to the Main Control card Part of this Section.
Alarm level change due to bay 03 PCM channels	Check the status of the specified bay via the SHOW ALARMS and SHOW STATUS commands. Refer to the 'Analog Peripheral Subsystem' Part of this Section.
Alarm level change due to bay 03 control	Check the status of the specified bay via the SHOW ALARMS and SHOW STATUS commands. Refer to the 'Analog Peripheral Subsystem' Part of this Section.
Alarm level change due to bay 02 lines	Check the status of the lines in the specified bay via the SHOW ALARMS and SHOW STATUS commands. If the problem seems to be isolated to a single card, refer to the appropriate line card Part of this Section.
Alarm level change due to bay 02 trunks	Check the status of the trunks in the specified bay via the SHOW ALARMS and SHOW STATUS commands. If the problem seems to be isolated to a single card, refer to the appropriate trunk card Part of this Section.
Alarm level change due to bay 02 rcvrs	Check the status of the DTMF receivers in the specified bay via the SHOW ALARMS and SHOW STATUS commands. If the problem seems to be isolated to a single card, refer to the DTMF receiver module Part of this Section.

TABLE A1-4
RESET LOG REPORTS

Reset Log Message	Action Required
Main Control was reset due to power up	Information only. Main Control card is reset at power-up.
Main Control was reset due to pushbutton	The SYSTEM RESET pushbutton on the Main Control card was pushed. Investigate.
Main Control was reset due to watch dog timer Main Control was reset due to local bay cause Main Control was reset due to msg link failure Main Control was reset due to software error Process 00 <<ANYTHING>> at address 012345 Main Control was reset due to software error RAM parity error at address = 012345 Main Control was reset due to software error Process 00 has overflowed its stack Main Control was reset due to software error Exception = <<ANYTHING>>at address 012345	* In all cases, check if Main Control card is functioning; if not, go to Emergency Troubleshooting procedures (Chart 2-2).

APPENDIX B
PART NUMBERS

B1.01 Table B1-1 shows the marketing part numbers for the circuit cards and modules of the SX-200® DIGITAL PABX. For further information, refer to Section MITL9108-093-150-NA, Ordering Information.

TABLE B1-1
PART NUMBERS

Card Type	Part Number
ONS Line Card	9109-010-000-NA
OPS Line Card	9109-040-000-NA
COV Line Card	9109-020-000-NA
8 Station Line Card	9110-110-000-NA
SUPERSET Line Card	9110-410-000-NA
LS/GS Trunk Card	9109-011-000-NA
DID Trunk Card	9109-031-000-NA
E&M Trunk Module	9109-013-000-NA
Trunk Circuit Card	9110-011-000-NA
CO Trunk Circuit Card	9109-211-000-NA
E&M Trunk Circuit Card	9110-013-000-NA
DID/Tie Trunk Circuit Card	9110-031-000-NA
Universal Card	9109-005-000-NA
DTMF Receiver Module	9109-016-000-NA
Console Interface Module	9109-025-000-NA
Music On Hold/Pager Module	9109-018-000-NA
Main Control Card	9109-003-000-NA
Peripheral Control Card	9108-203-000-NA
Digital Interface Card	9108-002-000-NA
Scanner Card	9110-104-000-NA
Power Fail Transfer Card	9109-030-000-NA
Cutover Card	9108-030-000-NA

APPENDIX C
TROUBLESHOOTING KIT

C1.01 The following is a recommended list of items required in the Field Service Engineering Troubleshooting Kit:

- One of each circuit card as a spare, including modules
- Butt set
- Digital multimeter
- Moving coil multimeter
- Static strap
- Ground mat
- Assorted screwdrivers, wrenches
- Long nose pliers
- Spare fuses
- Wire strippers
- Fan filter.

APPENDIX D

LOOP CURRENT MEASUREMENT

D1.01 There are two methods available to measure loop current:

- In-Line method.
- Voltage conversion measurement.

If it is not possible to break the loop (i.e., open the Tip or Ring lead) the second method may be used; however, it is not as accurate.

D1.02 In-Line Method. The procedure for the in-line method of measuring loop current is shown in Figure D1-1 and is described as follows:

1. Open either the Tip or Ring lead of the trunk facility by removing one of the bridge clips on the MDF.
2. Insert an ammeter where the clip was.
3. Take current readings at the instant the trunk is seized, and after the call has been completed. Do this in both incoming and outgoing directions.
4. Release the trunk and repeat the measurements several times on the same Central Office at peak and low traffic hours.
5. Repeat the above using different Central Office trunks.

D1.03 Voltage Conversion Method. This method of loop current measurement should be used only in such instances when it is not desirable to open the Tip or Ring leads. The procedure is as follows:

1. With the trunk seized, use a voltmeter to measure the voltage between the Tip and Ring of the trunk.
2. This voltage is then used to calculate the loop current (see below).
3. Release the trunk and repeat the measurement several times using the same Central Office trunk at peak and low traffic hours.
4. Repeat the above measurements using different Central Office trunks.
5. Typical equivalent resistance seen between Tip and Ring, when the trunk is seized, is approximately 250 ohms.

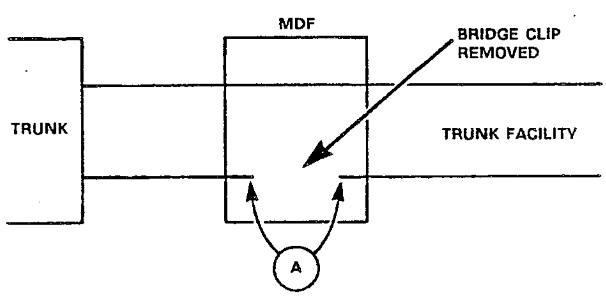


Figure D1-1 In-Line Current Measurement

6. The following is a simple calculation used to obtain the loop current value:

$$\text{Loop Current} = \frac{\text{measured Tip to Ring voltage}}{250}$$

APPENDIX E
LOOP START VS GROUND START CHECK

E1.01 The loop start vs ground start check should be performed as follows (also refer to Figure E1-1):

1. Locate the PBX trunk circuit Tip and Ring on the connecting block at the MDF.

2. Remove the bridge clips on the Tip and Ring (i.e., disconnect the PBX trunk circuit from the Central Office Tip and Ring).

3. Connect the butt set across the Central Office Tip and Ring.

4. Go off-hook with the butt set. If Central Office dial tone is returned, then the Central Office trunk is loop start.

5. If no dial tone is returned, then momentarily ground the Ring lead with a butt set off-hook across Tip and Ring. If Central Office dial tone is returned, then the Central Office is ground start.

6. If still no dial tone is returned, repeat the previous step and ground the Tip lead instead. If Central Office dial tone is returned, the Central Office trunk is ground start (however, the Tip and Ring are reversed).

7. If still no dial tone is returned in either of these cases, there is a problem (perhaps Tip and Ring opened or shorted, or a large ground differential between PABX ground and Central Office ground.) Check PABX ground. If PABX ground is good, then report problem to telephone company.

Note: In most cases with ground start trunks, dial tone may be returned by grounding either Tip or Ring. If this should occur, repeat the 5th and 6th steps using the butt set in its "on-hook" or "monitor" state. Hold the ground lead on for a few seconds; CO should return dial tone as long as the ground lead is connected.

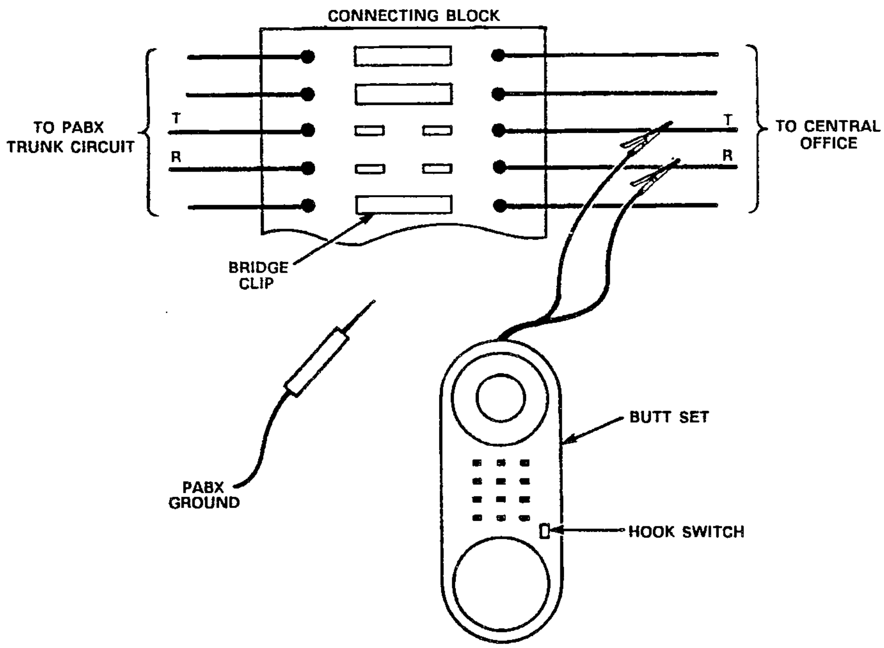


Figure E1-1 Loop Start Versus Ground Start Check

APPENDIX F

MITEL REPAIR TAG

General

F1.01 Any card or any other device found faulty must be returned with a Mitel Repair Tag (see Figure F1-1). The following information must be included on the repair tag:

1. The date on which the device was returned.
2. The location of the point of origin (the installation site).
3. The company name.
4. The product name (i.e., SX-200® DIGITAL).
5. The system serial number (located on the front of the cabinet).
6. The software generic (i.e., GENERIC 1001).
7. The software Revision (i.e., 480P/B46.6 9-SEP-1986).
8. The assembly part number of the item being returned (i.e., DTMF Receiver Module - 9019-016-000-NA).
9. The assembly serial number of the item being returned – this is a white sticker located on the card itself.
10. Any pertinent alarm/error displays; this may include circuit card alarm LEDs, 7-segment displays, console or maintenance terminal error messages, or maintenance log messages.
11. A brief description of the symptoms of the problem.
12. Indicate whether the fault occurred during installation, or while the system was in service.
13. Include any further information that may be useful on the rear of the repair tag.

For Customer Use

MITEL® Repair Tag

1. Date: ______
2. Location: ______
3. Company: ______

4. Product Name: ______
5. System Serial No.: ______
6. Software ID Generic: ______
   Revision: ______
7. Assembly No.: ______
8. Assembly Serial No.: ______

9. Alarm/Error Displays: ______

(BE SURE TO INCLUDE ALL DISPLAYED INFORMATION)

10. Trouble Symptoms ______

11. Failure Occurred A) During Installation ☐
    B) In Service ☐

Repair Tag Order No.: 9110-098-018-NA, Issue 3

Further Details ______

0264 KS CEN 7/84 H

CAUTION: PLEASE ENSURE PCB ASSEMBLY IS RETURNED IN ANTISTATIC BAG.

KA0013R0

Figure F1-1 The Mitel Repair Tag

APPENDIX G
CALL PROCESSING INFORMATION

G1.01 – Digital Bay to Digital Bay Call

1. The Main Control Card (MCC) scans for on-hook/off-hook change of state.
2. An extension goes off-hook in Bay 1.
3. The MCC detects the off-hook during its line card scan.
4. MCC checks for the COS of the extension to determine if the call is allowed.
5. The MCC checks for an idle receiver.
6. The MCC connects the DTMF receiver to the line circuit through the DX matrix on a PCM channel.
7. The MCC connects the same channel to the Digital Signal Processor (DSP) to provide dial tone.
8. The MCC monitors the circuit for rotary pulses.
9. The DTMF receiver detects any DTMF tones and sends a message to the MCC indicating the value of the dialed digits.
10. On receipt of the first digit, the MCC removes the DSP from the assigned channel.
11. The MCC monitors the digits dialed and checks the idle/busy condition of the destination.
12. If the destination is idle, the MCC connects the DSP to the originator and ringback is supplied.
13. The MCC sends the originator a cadence message to provide interruption of the ringback tone.
14. The MCC sends ringing to the Bay Power Supply from the DSP via a DX link.
15. The Bay Power Supply amplifies and routes the ringing to the destination.
16. The MCC sends a message to the destination to turn ringing on.
17. When the destination answers, the MCC detects the off-hook change of state.

18. Ringing is removed from the destination.

19. Ringback is removed from the originator.

20. A channel is connected between the originator and the destination.

21. The MCC scans for on-hook/off-hook changes of state.

22. When an on-hook is detected, the MCC removes the channel, and the call is terminated.

G1.02 - Analog Bay (Rotary) to Analog Bay Call

1. The Scanner card scans the line circuits for on-hook/off-hook changes of state.

2. An extension goes off-hook in Bay 3.

3. The Scanner detects an off-hook during the line card scan.

4. The Scanner sends an IRQ to the Peripheral Control Card (PCC).

5. The PCC determines the originator, generates a message and passes it to the Digital Interface Card (DIC).

6. The DIC formats and sends a message to the MCC.

7. The MCC checks the originator's COS to determine if the call is allowed.

8. The MCC checks for an idle DTMF receiver.

9. The MCC sends a message to the PCC to connect a junctor to the originator.

10. The MCC assigns a channel of the link to the junctor, and conects the DTMF receiver to the channel through the DX matrix.

11. The MCC connects the same channel to the DSP to provide dial tone.

12. The PCC monitors the circuit for rotary pulses.

13. The DTMF receiver detects any DTMF tones and sends a message to the MCC indicating the value of the tones.

14. On receipt of the first digit, the MCC removes the DSP from the assigned channel.

15. The MCC monitors the digits dialed and checks the idle/busy condition of the destination.

16. If the destination is idle, the MCC connects the DSP to the originator and ringback tone is supplied.

17. The MCC sends a cadence message to the PCC of the originator to provide interruption of the ringback tone.

18. The MCC sends a message to the PCC to ring the destination.

19. When the destination answers, the Scanner detects the off-hook.

20. The Scanner sends an IRQ to the PCC.

21. The PCC stops ringing and sends a message to the MCC indicating that the destination is off-hook.

22. Ringback is removed from the originator.

23. Since both parties are in Bay 3, the MCC sends a message to the PCC to provide a connection between the originator and the destination using a speech path. (There are no PCM channels used in this connection).

24. The Scanner scans for on-hook/off-hook changes of state.

25. When an on-hook is detected, the PCC sends a message to the MCC indicating that the extension(s) have gone on-hook; the call is terminated.

SX-200® DIGITAL
PRIVATE AUTOMATIC BRANCH EXCHANGE (PABX)
RS-232 MAINTENANCE TERMINAL

CONTENTS PAGE

CONTENTS (CONT'D) PAGE

CONTENTS (CONT'D) PAGE

LIST OF ILLUSTRATIONS

LIST OF TABLES

1. GENERAL

Introduction

1.01 This Section is intended to assist maintenance personnel in obtaining the maximum benefit from the extensive built-in maintenance features of the SX-200® DIGITAL PABX with Generic 1000 and Generic 1001 software. It provides information on the setting up and use of the RS-232 Maintenance Terminal, which is the prime maintenance tool on the SX-200® DIGITAL system. The maintenance terminal is also used for Customer Data Entry (CDE) and Traffic Measurement. All of those functions are also accessible from the Attendant Console. Since the scope of this Section is primarily maintenance-related, refer to Sections MITL9108-093-210-NA, Customer Data Entry and MITL9108-093-450-NA, Traffic Measurement for information on these topics.

Reason for Reissue

1.02 This is reissued to provide additional information.

How to Use this Section

1.03 This Section has been arranged in such a way as to serve two distinct functions: first, as a self-teaching guide for those using the SX-200® DIGITAL PABX maintenance terminal for the first time; secondly, as a reference manual for those requiring review material. For the first group, it is recommended that the section be read through carefully, preferably with a maintenance terminal available so that the various commands may be tried out as the material is studied. For the second group, it is recommended that the index be used as a reference to the features and commands available.

2. SETTING UP

Terminal Type

2.01 The SX-200® DIGITAL PABX maintenance subsystem is designed to interface with virtually any 80-column terminal having an RS-232 type interface. The terminal may be either a video display terminal or a hard copy teleprinter. For ease of operation, a video display terminal capable of using the ANSI X3.64-1977 special character set for special graphics (i.e., VT-100 compatible) is preferred. The system prompts the user to specify the terminal type at the start of the login sequence (see paragraph 2.05). To ensure compatibility with the maintenance subsystem, the terminal should be set up for the following data characteristics:

- 8 data bits
- 1 start bit
- 1 stop bit
- no parity.

The maintenance subsystem will automatically set itself to the terminal's baud rate; however, the terminal baud rate must be one of:

- 300
- 600
- 1200
- 2400
- 4800
- 9600.

Connection to the System (Terminal)

2.02 The maintenance terminal is connected to the SX-200® DIGITAL PABX by means of a standard 25-pin RS-232 cable. One end of the cable is plugged into the main RS-232 communication port of the terminal; the other end is plugged into the RS-232 Maintenance Connector port on the system Maintenance Panel located above Bays 1 and 2 on the Control Cabinet (see Figures 2-1 and 2-2). The Maintenance Port Selection Switch at the right of the panel should be set to "TERMINAL (DTE)". Alternatively, a modem may be plugged into the "REMOTE" connector, located on the rear maintenance panel, for communication with a remote maintenance terminal. The port selection switch should be set to "MODEM (DCE)". Note that a terminal MAY NOT be connected directly to the "REMOTE" connector. Note also that the "REMOTE" and "LOCAL" connectors may not be used concurrently.

Connection to the System (Printer)

2.03 If required, a printer (or any other ASCII output device) may be connected to the system by means of a standard 25-pin RS-232 cable. One end of the cable is connected to the RS-232 port of the printer; the other end is connected to socket J29 on the backplane of Bay 2 on the Control Cabinet (see Figure 2-3). The printer should initially be set up for the following data characteristics:

- 8 data bits
- 1 start bit
- 1 stop bit
- no parity
- 1200 baud.

Note that the baud rate of the printer port may be changed via a command from the maintenance terminal.

Login Procedures

2.04 With the terminal powered-up, or reset, the system is ready for the user to log in. Pressing the RETURN key twice within 1 second causes the system to automatically determine the terminal's baud rate, and to query the user for the terminal type as follows:

```
            1 -  VT-100 COMPATIBLE
            2 -  TTY TYPE
SELECT A TERMINAL TYPE     :
```

If the terminal is capable of using special graphic characters, enter 1; if not, enter 2. The system will then query the user for the type of action or application intended; i.e., Maintenance or Customer Data Entry (CDE):

```
            1 -  MAINTENANCE
            2 -  CDE
            6 -  QUIT
SELECT AN APPLICATION ( OR QUIT TO START OVER ) :
```

If the maintenance system (or CDE) is being accessed by another terminal, an attendant console, or the test line, the following message will be returned:

```
MAINTENANCE or CDE IN USE by Console ext : 1234
PLEASE TRY AGAIN LATER
```

This will happen because only one user may access maintenance or CDE at any one time. Assuming that there are no users currently logged in, the system will return the username prompt after an application number (1 or 2) is chosen:

```
ENTER USERNAME :
```

2.05 Users of the SX-200® DIGITAL PABX system have five levels of system access priority available when logging-in to the maintenance terminal. Each level has its own username, and corresponding command privileges (see Appendix A). The usernames are, in descending order of priority:

- INSTALLER

- MAINT1
- MAINT2
- SUPERVISOR
- ATTENDANT.

Respond to the username prompt by entering one of these usernames. The system will then query the user for a password:

ENTER PASSWORD :

The SX-200® DIGITAL system database contains one default password for all of the usernames. Passwords may be changed as required (see paragraph 4.06). The default password for all users is "1000". Note that, for security reasons, the system does not echo the password back to the terminal. If the password is accepted, the system will prepare to set up the maintenance screen, displaying the following message for a brief moment:

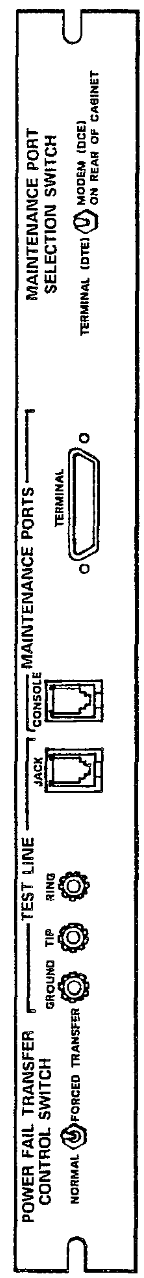
PLEASE WAIT...

Logout Procedures

2.06 To ensure the security of the system, the logout procedure should be used whenever the maintenance terminal is to be left unattended. To log out, the user enters the QUIT softkey (see paragraph 3.02) to get out of the maintenance application. At this point, the following prompt is returned:

1 - MAINTENANCE
2 - CDE
6 - QUIT
SELECT AN APPLICATION (OR QUIT TO START OVER) :

Enter "6" to log out.



KA0038R0E0

Figure 2-1 SX-200® DIGITAL Control Maintenance Panel (Universal Cabinet)

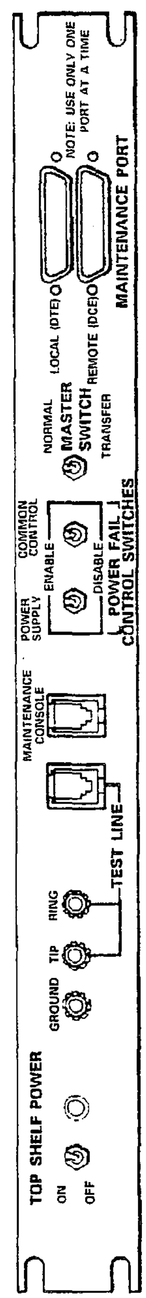


Figure 2-2 SX-200® DIGITAL Control Maintenance Panel (Standard Cabinet)

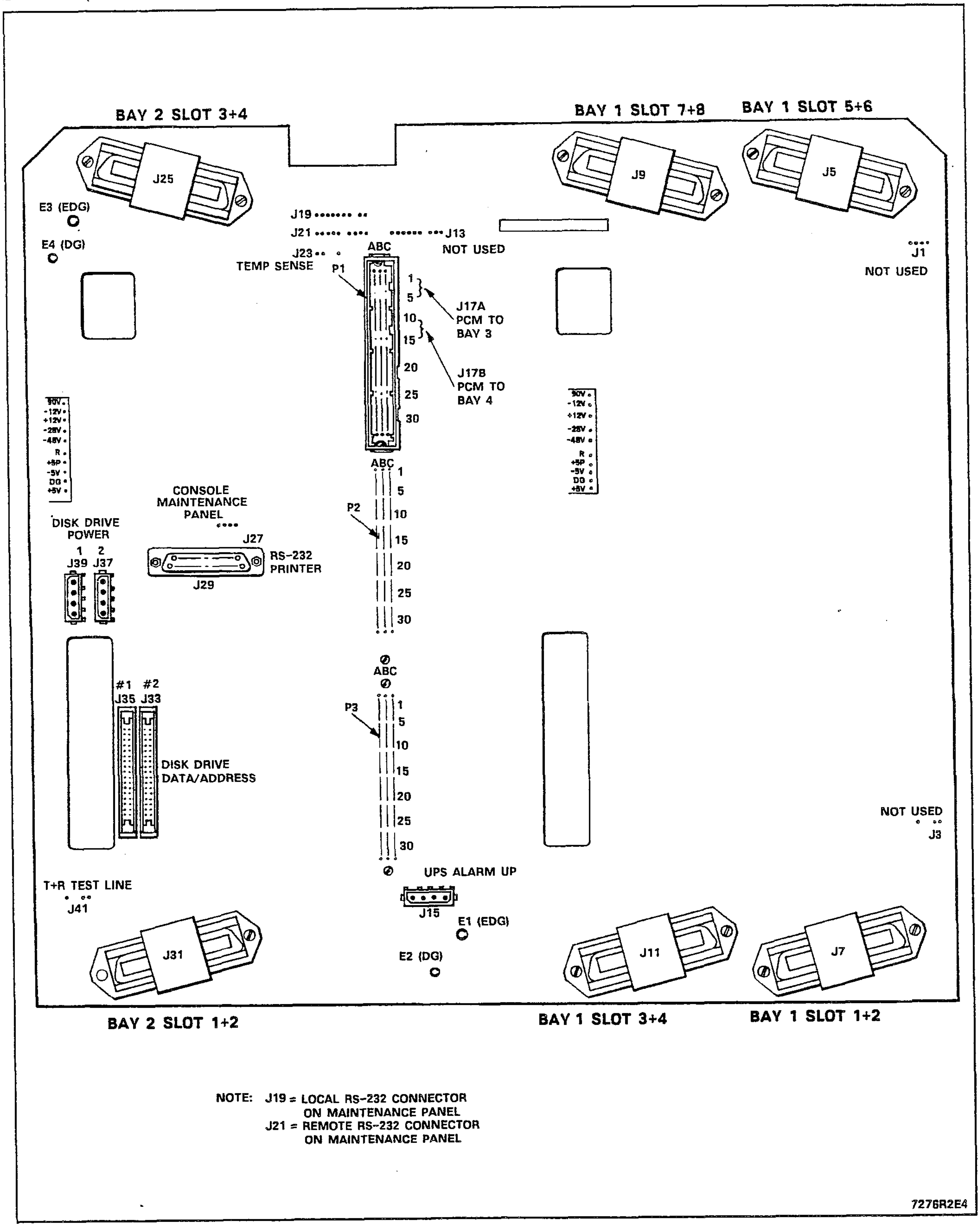


Figure 2-3 SX-200® Bay 2 Backplane

3. MAINTENANCE COMMAND INPUT

Maintenance Terminal Display

3.01 The maintenance display screen is shown in Figure 3-1. There are five distinct and separate areas to the screen:

1. **Status Line** : This occupies a single line above the bordered area, and displays the time and date, and the system alarm status.

2. **Header Line** : This occupies the top line within the bordered area. It identifies the running software version, and its creation date. It also describes which MAINTENANCE menu is currently being displayed; one of Main Menu, System, Diagnostics, Traffic Measurement, Logs, or Reports.

3. **Applications Area** : This occupies the next 12 lines in the bordered area. Output information resulting from command input is displayed in this area.

4. **Command Line:** This occupies the line directly below the Applications Area. Commands are echoed onto this line as they are input by the user. Responses to command input (other than data; e.g., error messages) are also returned here.

5. **Softkey Area** : The Softkey Area changes dynamically with the MAINTENANCE mode (System, Diagnostics, Traffic Measurement, Logs, or Reports) and identifies the functions of the maintenance terminal's 10 softkeys. The Softkey Area occupies the bottom two lines of the bordered area: the first line identifies the functions of softkeys 1 through 5; the second line identifies the function of softkeys 6 through 10.

Softkey Presentation

3.02 Command entry on the SX-200® DIGITAL PABX is designed to make commands easy to use, even for those using the maintenance terminal for the first time. All commands are entered using softkeys. "Softkeys" are programmable keys, the functions of which may be changed to suit any particular application. The maintenance terminal has 10 such keys; they are the number keys (1 through 0) on the terminal keyboard. The "1" key corresponds to softkey 1 in the Softkey Area; all other softkeys are similar.

Entering of Commands

3.03 Commands are entered by pressing the desired softkeys in sequence, terminating each command sequence with softkey 0, the ENTER softkey. Note that pressing the conventional keyboard RETURN key has the same effect as the ENTER softkey. As softkeys are pressed, they are displayed on the Command Line. After the ENTER softkey is pressed, the command is processed by the maintenance system, and the appropriate response is returned.

Incorrect Command Entry

3.04 The SX-200® DIGITAL user interface provides a comprehensive set of error messages to inform the user of incorrect command entry. While the softkey-oriented command input interface minimizes the chance of incorrect command entry, the error messages provide concise descriptions of the input error. A summary of the error messages with descriptions may be found in Appendix B.

Non-VT-100 Compatible Terminal Use

3.05 When using a terminal not compatible with VT-100, softkeys are presented as described above, but without the graphic bordering. Similarly, commands are entered in exactly the same manner. Instead of a Title line, the current menu is identified by the command input prompt:

- SYS> - System level menu
- DIAG> - Diagnostics level menu
- TRAFF> - Traffic Measurement menu
- LOGS> - Logs level menu
- REP> - Reports level menu.

Device Number Parameters

3.06 Some commands require the inclusion of card/circuit location numbers (referred to as physical location identification numbers - bay number, slot number, circuit number, sub-circuit number) or extension numbers as part of the input. The user is prompted for these, one at a time on the Command Line of the screen:

enter Bay, then press RETURN:
enter Slot, then press RETURN:
enter Circuit, then press RETURN:
enter Sub-circuit, then press RETURN:

OR

enter Extension number: then press RETURN:

When these prompts occur, the softkeys are disabled, and the required numbers must be entered in the conventional manner; using the keyboard number keys and pressing the RETURN key after each entry. Note that if a 2-digit number is entered, the RETURN key is not required. When all of the required device numbers have been entered, the appropriate softkeys will again be presented.

Note: When entering circuit location numbers, the sub-circuit qualifier is often not required, and may be answered by simply pressing the RETURN key. The only devices that require sub-circuit numbers are Universal card modules such as DTMF Receiver Modules and Music-On-Hold/Pager Modules.

Wild Card Characters

3.07 Wild card characters may be used to perform some command-initiated functions on a range of devices. This is done simply by not specifying circuit location numbers when prompted (pressing only the RETURN key). For example, entering Bay 1, but not specifying the slot, circuit or sub-circuit would translate to "all circuits on all cards in Bay 1". Note that this does not apply to all commands; refer to the individual command descriptions.

Cancelling a Command

3.08 The user may cancel any command at any point before entering the ENTER softkey; this is done by pressing the CANCEL softkey. The effect of this is that any softkeys that were entered and echoed back onto the Command Line are now cancelled, leaving the Command Line empty and ready for new command input.

Command Line Correction

3.09 The user may correct a current command input line before entering the ENTER softkey, without having to cancel and enter the command over again. This is done by pressing the DELETE key. Each time the DELETE key is pressed, the most recently entered soft-key or device number is deleted.

Figure 3-1 Top Level Maintenance Terminal Screen Layout

4:27 7-AUG-86 alarm status = NO ALARM

SX-200 DIGITAL GENERIC 1001 480P/B46.5	19-AUG-1986	Main menu		
1-SYSTEM	2-	3-DIAGNOSTICS	4-	5-TRAFFIC_MEAS
6-QUIT	7-LOGS	8-	9-REPORTS	0-

4. SYSTEM LEVEL FUNCTIONS

Introduction

4.01 The System Level of operation contains a conglomeration of commands that are not necessarily maintenance applications, but affect maintenance in some way (e.g., the setting of time, date, and passwords). To access the system level commands, press the SYSTEM softkey. All of the following operations are done while in the System Level.

Time Setting and Verification

4.02 The system time-of-day may be set and verified from the maintenance terminal. Note that the user may specify the time in either 12-hour or 24-hour format by using the PM softkey as required. To set the system time from the maintenance terminal, press the following softkeys:

SET
TIME

At this point the softkeys are disabled, and the user is prompted to press the desired time:

enter Time HH:MM

After entering a valid time, the user may implement the new time-of-day by pressing the ENTER softkey, or cancel the new time by pressing the CANCEL softkey.

The user may verify the time-of-day by pressing the following softkeys:

SHOW
TIME
ENTER

Date Setting and Verification

4.03 The system date may be set and verified from the maintenance terminal. To set the system date from the maintenance terminal, press the following softkeys:

SET
DATE

At this point the softkeys are disabled, and the user is prompted to press the desired date:

enter Date DD/MM/YY

After entering a valid date, the user may implement the new date by pressing the ENTER softkey, or cancel the new date by pressing the CANCEL softkey.

The user may verify the date by pressing the following softkeys:

SHOW
DATE
ENTER

Terminal/Printer Port Status Report

4.04 The maintenance user may view the current data characteristics of the SX-200® DIGITAL PABX maintenance terminal and printer ports. Information in the reports includes communication speed (baud rate), the parity sense (odd, even, or none) and the number of stop bits. To view the status of the maintenance terminal port, press the following softkeys:

SHOW
DEVICE
MAINT-PORT
ENTER

To view the status of the printer port, enter the following softkeys:

SHOW
DEVICE
PRINTER-PORT
ENTER

An example of a status report is shown in Figure 4-1.

Software Version Report

4.05 The software version report provides the maintenance user with information on the currently running software load. The information includes software load iteration number and date of creation. To obtain a software version report, press the following softkeys:

SHOW
IDENTITY
ENTER

Figure 4-1 Terminal/Printer Port Status Report

4:27 7-AUG-86 alarm status = NO ALARM

```
SX-200 DIGITAL GENERIC 1001 480P/B46.5      19-AUG-1986           System

SHOW DEVICE PORT     : MAINTENANCE
            SPEED    : 9600 BPS
            PARITY   : NONE
            STOP BITS : 1

            THE PRINT DEVICE IS SET TO THE PRINTER PORT
```

1-SET	2-SHOW	3-COPY	4-MONITOR	5-
6-QUIT	7-	8-RE-START	9-STOP	0-

Password Change

4.06 It is recommended, for system security, that passwords be changed regularly once the SX-200® DIGITAL PABX has been put into service. Password changes may be made by the affected username, or any other username with a higher priority (see paragraph 2.06). A password may be any string of alphanumeric characters of up to 20 characters in length (any more characters are ignored).

Important: Entering new passwords with alphabetic characters will make login from the Attendant Console impossible, as only numeric characters may be entered from the console.

To change the password, press the following softkeys:

SET
PASSWORD
(select the required Username)
ENTER

The system then prompts the user for the old password:

Enter Old Password then press RETURN:

The user enters the old password, and the system prompts the user for the new password:

Enter New Password then press RETURN:

The system then prompts the user to verify the new password:

Enter New Password to verify then press RETURN:

After the user verifies the new password, the system implements the password change; the old password is no longer valid. An incorrect entry of the old or new passwords will cause the password changing process to be aborted. Note that neither the old nor the new passwords are echoed back to the maintenance terminal display.

Baud Rate Setting (Terminal)

4.07 The baud rate of the SX-200® DIGITAL maintenance terminal port may be changed from its value at login time. Any one of six different baud rates may be chosen: 300, 600, 1200, 2400, 4800 or 9600 baud. To change the terminal baud rate, press the following softkeys:

SET
SPEED
MAINT-PORT

At this point, the softkeys are disabled, and the system prompts the user to input the desired baud rate:

enter speed then press RETURN:

After a value is entered, the user may implement it by pressing the ENTER softkey, or cancel it by pressing the CANCEL softkey. Note that this operation changes the baud rate of the SX-200® DIGITAL port only; the baud rate of the maintenance terminal itself must be changed separately. Refer to the manufacturer's instructions for the particular terminal being used.

Baud Rate Setting (Printer)

4.08 The baud rate of the SX-200® DIGITAL printer port may be changed from its default value of 1200 baud. Any one of six different baud rates may be chosen: 300, 600, 1200, 2400, 4800 or 9600 baud. To change the printer port baud rate, press the following softkeys:

SET
SPEED
PRINTER-PORT

At this point, the softkeys are disabled, and the system prompts the user to input the desired baud rate:

enter speed then press RETURN:

After a value is entered, the user may implement it by pressing the ENTER softkey, or cancel it by pressing the CANCEL softkey. Note that this operation changes the baud rate of the SX-200® DIGITAL port only; the baud rate of the printer itself must be changed separately. Refer to the manufacturer's instructions for the particular printer being used.

Setting Print Device

4.09 Several applications (e.g., Maintenance logs, SMDR Reports, and Traffic Reports) have access to the printer port; access is set up automatically on system initialization. It is possible for the user to change this access if required. The user may cause all printing to occur on the maintenance terminal screen rather than on the printer. The user must be logged in to have printing at the terminal. To enable the maintenance terminal as the print device, press the following softkeys:

SET
PRINT-DEVICE
MAINT-PORT
ENTER

To enable the system printer port as the print device (the default condition), press the following softkeys:

SET
PRINT-DEVICE
PRINTER-PORT
ENTER

The status of the print device may be verified via the SHOW DEVICE command.

Database Copying

4.10 The user may make a copy of the system database on another floppy disk for use as a backup source. Note that only the database is copied; the diskette being written to must already have the system software stored on it. To copy the database, press the following softkeys:

COPY
DATABASE
ENTER

At this point, the system starts loading the database from the diskette into the system RAM memory. When this is done, the system prompts the user to remove the diskette, and to insert a new diskette:

Insert new disk, close door and press CONTINUE

At this point the user may press the CONTINUE softkey to write to the new diskette, or the CANCEL softkey to abort the process. If the user presses the CONTINUE softkey the saved database will be written to the new diskette; the save will take approximately 1 minute. When the process is completed, the following message is returned to the terminal:

Copy successful. If upgrading then RESET - else press CANCEL to continue.

The backup diskette and the original diskette will now have identical databases. See Appendix C for additional information.

THE MONITOR COMMAND

Monitor Diagnostics

4.11 The MONITOR DIAGNOSTICS command is a "window" into the maintenance system's diagnostic controller, the Maintenance Manager. With this, the user may monitor the progress of the SX-200® DIGITAL diagnostics as they are being run. See Part 6 of this Section for further information on diagnostics.

4.12 To monitor the progress of the currently running diagnostic, press the following softkeys:

MONITOR
DIAGNOSTICS

At this point the user may press the ENTER softkey to begin the monitor process, or the CANCEL softkey to cancel the command. If the user presses the ENTER softkey, diagnostic data will be written on the Application Area of the screen.

4.13 The user may alter the manner in which the monitor display is updated, through the use of the "STEP" and "CONTINUOUS" softkeys. Pressing the "CONTINUOUS" softkey will cause the display to be updated continuously and automatically; it is not necessary to enter any other commands until the user wishes to stop the diagnostic monitoring process. Pressing the "STEP" softkey will enable the user to advance through the diagnostic process step-by-step.

An example of the monitor output is in Figure Ot4-2 (for definition of terms, see Table 4-1).

Figure 4-2 Example of MONITOR DIAGNOSTICS Display

4:27 7-AUG-86 alarm status = MINOR

```
SX-200 DIGITAL GENERIC 1001 480P/B46.5   19-AUG-1986          System

SYST    BG  74  NW  0   SY  0   PU  0   FI  0   PR      FR 0 0   UI  0
BAY     BG  12  NW  0   SY  0   PU  0   FI  0   PR      FR 0 0   UI  0
CARD    BG  12  NW  0   SY  0   PU  0   FI  0   PR      FR 0 0   UI  0
DEV     BG  1   NW  0   SY  0   PU  0   FI  0   PR      FR 0 0   UI  0

DEV   PLID   1   3   1   0   EXT/TRUNK   1301   CURR  MODE  background
CARD  TYPE  ons              BKGRND EN  on      MODE  STAT  dg avail
CARD  STAT  instld           PWR UP EN  off     DIAG  NAME  digitl codec
CCT   TYPE  ons              FAILCOUNT   0      DIAG  STAT  state 2
CCT   STAT  okay             CCTS PROG  12      DIAG  RSLT    -
JUNCTR NUM -

MONITOR DIAGNOSTICS
```

1-	2-STEP	3-CONTINUOUS	4-	5-CANCEL
6-	7-	8-	9-	0-

(For definition of terms, see Table 4-1)

4.14 The following is a summary of the terms used in the "Monitor Diagnostics" display:

TABLE 4-1
TERMS USED IN MONITOR DIAGNOSTICS DISPLAY

Term	Meaning
SYST	The total systemwide number of devices waiting to be tested on the following queues: BG - Background diagnostic queue NW - unused SY - unused PU - Power-up diagnostic queue PR - Power-up diagnostic retry queue (CP had device) FI - second chance test queue FR - second chance test retry queue (CP had device) UI - User (directed diagnostic) queue
BAY	The number of devices in this Bay (see "DEV PLID") waiting to be tested, on the same queues as above.
CARD	The number of devices on this card (see "DEV PLID") waiting to be tested, on the same queues as above.
DEV	Tests pending for the circuit being monitored.
DEV PLID	The physical location identification of the circuit being monitored; a 4- to 8-digit number representing Bay, slot, circuit and sub-circuit numbers.
CARD TYPE	The type of card being monitored; one of the following: main cntl - Main Control card (DSP testing) ons - ONS line card universal - Universal card rcvr mod - DTMF Receiver module moh mod - Music on Hold module ls/gs - CO trunk card cons mod - DLIC (digital line interface circuit) module perip ctl - PCC card for junctor testing superset - COV line card did trunk - DID trunk card em trunk - E&M trunk card ops line - OPS line card emtrk mod - E&M trunk module
CARD STAT	The status of the card being monitored; one of the following: instld - the correct card type is installed unplug - the card is either unplugged, or not installed wrong - an incorrect card type is installed

TABLE 4-1 (CONT'D)
TERMS USED IN MONITOR DIAGNOSTICS DISPLAY

Term	Meaning
CCT TYPE	The type of circuit being monitored; one of the following: ons - ONS line circuit rcvr - DTMF Receiver module moh - Music on Hold module ls/gs - CO trunk circuit cons - DLIC (digital line interface circuit) module jnctr - junctor cov - COV line circuit did trunk - DID trunk circuit ops line - OPS line circuit e & m - E&M trunk circuit
CCT STAT	The status of the circuit being monitored; one of the following: okay - available to CP and maintenance progr - programmed in CDE but not installed unprog - installed but not programmed in CDE suspct - suspect - failed one diagnostic test bsyout - busied-out by maintenance user isol - fault isolated to this circuit unisol - fault found, not isolated
EXT/TRUNK	Extension number/trunk number of the device being monitored
BKGRND EN	Background diagnostics enable flag; either "on" or "off"
PWR UP EN	Power-up diagnostics enable flag; either "on" or "off"
FAILCOUNT	Indicates number of times a faulty device must pass diagnostics consecutively before it will be returned to active service. Range 0-7.
CCTS PROG	Number of circuits programmed for the specified card type
CURR MODE	The current test mode; one of the following: backgrnd - background diagnostics power up - power-up diagnostics pwr rtry - power-up diagnostics retry fault isol - diagnostic second-chance fi-retry - diagnostic second-chance retry user - directed diagnostics
MODE STAT	The status of the specified test mode; one of the following: idle - reqst dev - requesting device to test dev locatd - located device to test dev n/a - device being used by call processing res alloc - test resources allocated res n/a - test resources could not be allocated dg avail - determined which test to run reqst test - message to PCC to request test enter test - message to PCC to start test

TABLE 4-1 (CONT'D)
TERMS USED IN MONITOR DIAGNOSTICS DISPLAY

Term	Meaning
MODE STAT (cont'd)	dg active - testing wait msg - waiting for test result diag done - current diagnostic done dg pending - other tests pending on circuit dgs compl - all tests done dg incompl - test incomplete dg aborted - circuit taken by CP before test completed audit req - requests out of sync; checking
DIAG NAME	The current diagnostic test being run; one of the following: force hi/low - junctor test digital codec - codec digital loopback test analog codec - codec analog loopback test inject codec - codec transmission test status check - console test message lamp - message lamp/ringer present test switch hook - switchhook test a/d convert - A/D converter reference test analog hybrd - hybrid analog loopback test dtmf tones - DTMF receiver test printer port - printer port test dsp mem test - DSP memory test dsp tone det - DSP tone detection test dsp tone gen - DSP tone generation test dsp conf test - DSP conference test
DIAG STAT	The current diagnostic state; one of the following: pass state - current test has passed isolated - fault detected, isolated unisolated - fault detected, unisolated state 1 state 2 Note: States 1 through 7 are dependent upon state 3 the device under test; refer to Section state 4 MITL9108-093-353-NA, General Maintenance state 5 Information for further details state 6 state 7
DIAG RSLT	Result of the most recent diagnostic test; one of the following: pass - test passed without errors fail - error(s) occurred inconcl - inconclusive; call processing aborted the test or the PCC failed to return a message dev n/a - device not available - being used by CP

Monitor Logs

4.15 The user may monitor the progress of the SX-200® DIGITAL maintenance logs as they occur. When the monitor logs process is running, the maintenance logs will be output to the print device as well as being recorded on the system floppy disk. The output device may be either the maintenance terminal, or the system printer port. If monitoring logs on the system printer port, the user may log out from the maintenance terminal without first stopping the monitor process. However, if the user is monitoring logs on the maintenance terminal, the monitor process must first be stopped before logging out. The print device may be set via the SET PRINT-DEVICE command (see paragraph 4.09). To monitor logs, press the following softkeys:

MONITOR
LOGS
ENTER

For further information on maintenance logs, see Part 6 of this Section, and Section MITL9108-093-353-NA, General Maintenance Information.

Monitor SMDR

4.16 The user may monitor the progress of the SX-200® DIGITAL SMDR reports as they occur. Unlike the MONITOR LOGS command, monitoring of SMDR may only be done at the maintenance terminal. It is not necessary to select a print device in this case, as monitoring will be output to the maintenance terminal automatically. This does not affect the spontaneous printing of SMDR data to the system printer port. To monitor SMDR reports at the maintenance terminal, press the following softkeys:

MONITOR
SMDR
ENTER

Refer to Section MITL9108-093-451-NA, Station Message Detail Recording for further information on SMDR.

Initiating System Reset

4.17 The Re-start command allows the maintenance user to reset the system. The purpose of this is to optimize the integrity of the system software. This should be done only during a period of low or no call processing traffic, as the system will be totally inoperative for a period of approximately 1 minute. To initiate a system reset, enter the following softkeys:

RE_START
RESET_SYSTEM
ENTER

4.18 The maintenance user may also program the system to reset at a predetermined time of day. This may be set for a particular day or daily. To program a system reset, press the following keys:

SET
RESET_TIME
DAY/TIME

(press one of the seven "day" softkeys or DAILY)
TIME
(enter the hour and minutes in 24 hour format - hours must be 01 - 24)
ENTER

4.19 The maintenance user may also program the system to reset after one or more system software anomalies. To program the system to reset after a single software anomaly, press the following keys:

SET
RESET_TIME
IMMEDIATELY
ENTER

To program the system to reset after 11 such anomalies, press the following keys:

SET
RESET_TIME
AFTER_N_FLTS
ENTER

System Reset Report

4.20 The maintenance user may obtain a report indicating when, and under what conditions a system reset will occur. To obtain such a report, press the following keys:

SHOW
RESET_TIME
ENTER

Setting of Alarm Thresholds

4.21 Alarm thresholds may be programmed by the maintenance user to facilitate the requirements of a particular system. Table 4-2 shows the default values of the alarm thresholds. Refer to Section MITL9108-093-353-NA, General Maintenance Information for further details on the alarms and alarm thresholds. To change the alarm thresholds for lines throughout the entire system, press the following softkeys:

SET
ALARM_THRESH
SYSTEM
ENTER
LINES
(enter the desired MINOR Alarm threshold percentage, or press RETURN to leave unchanged)
(enter the desired MAJOR Alarm threshold percentage, or press RETURN to leave unchanged)
(enter the desired CRITICAL Alarm threshold, or press RETURN

to leave unchanged)
ENTER

4.22 The procedure for changing alarm thresholds for trunks, DTMF receivers and PCM channels (junctors) is the same as that shown for lines. The only difference is that the TRUNKS, RECEIVERS or PCM-CHANNELS softkeys are used in place of the LINES softkey.

4.23 Alarm thresholds may be changed on a bay basis as well. The procedure is the same as that shown above, the only difference being that the BAY softkey is used in place of the SYSTEM softkey. DTMF receiver thresholds may be changed only in digital bays.

4.24 In all cases, the Alarm Threshold table will be shown in the Applications area of the screen. An example of the Alarm Threshold table is shown in Figure 4-3.

TABLE 4-2
DEFAULT ALARM THRESHOLDS

ALARM CATEGORY (Peripheral Devices)	ALARM THRESHOLDS		
	Minor	Major	Critical
Lines	0%	20%	0
Trunks	0%	10%	0
DTMF Receivers	0%	25%	0
PCM Channels (Junctors)	10%	25%	1

Figure 4-3 Example of Alarm Threshold Display

4:27 7-AUG-86 alarm status = MINOR

SX-200 DIGITAL GENERIC 1001 480P/B46.5 19-AUG-1986 System

ALARM TYPE = SYSTEM	ALARM CATEGORY (Peripheral Devices)	THRESHOLDS		
		MINOR	MAJOR	CRITICAL
	LINES	0%	20%	0
	TRUNKS	0%	10%	0
	PCM CHANNELS (JUNCTORS)	10%	25%	1
	DTMF RECEIVERS	0%	25%	0

SET ALARM_THRESH SYSTEM

1-LINES	2-TRUNKS	3-RECEIVERS	4-PCM-CHANNELS	5-CANCEL
6-	7-	8-	9-	0-

5. REPORTS LEVEL FUNCTIONS

Introduction

5.01 The Reports Level of operation is a conglomeration of static commands that are designed to display maintenance information. Types of reports available are: configuration, alarm status, circuit status, PCM path status and SUPERSET® errors. To access the reports level commands, press the REPORTS softkey. All of the following operations are possible while in the Reports Level.

EQUIPMENT CONFIGURATION REPORT

5.02 The Configuration report provides the maintenance user with information on the hardware which is currently installed in the system. The user may request a configuration report on a specific card slot, a specific extension number, a specific device type, or the entire system. The information provided includes:

- the physical location(s), in terms of bay number, slot number, and circuit (module) number
- the installed type of card/module
- the card/module type programmed for that location.

Entire System

5.03 To obtain a configuration report on the entire system, press the following softkeys:

SHOW
CONFIG
ALL
ENTER
(MORE or CANCEL)

Specific Card Slot

5.04 To obtain a configuration report on a specific card slot, press the following softkeys:

SHOW
CONFIG
BAY/SLOT/CCT
(enter the required bay, slot and circuit numbers, pressing the RETURN key after each one)
ENTER

Specific Extension

5.05 To obtain a configuration report on a specific extension number, press the following softkeys:

SHOW
CONFIG
EXT-NUM
(enter the required extension number, then press the RETURN key)
ENTER

5.06 In all cases, the system will output the configuration data in the Applications Area of the screen. In cases where the data requires more space than is available on the screen, the user is prompted to request more data via the MORE softkey, or to cancel the output via the CANCEL softkey. An example of a configuration report is shown in Figure 5-1.

Figure 5-1 Example of Configuration Report Display

4:27 7-AUG-85 alarm status = MINOR

BAY/SLT/CCT			PROGRAMMED	INSTALLED
2	1	0	DID trunk card	DID trunk card
2	2	0	CO trunk card	CO trunk card
2	3	0		
2	4	0	DID trunk card	DID trunk card
3	1	0	ONS card	ONS card
3	2	0	ONS card	ONS card
3	3	0	ONS card	ONS card
3	4	0	ONS card	ONS card
3	5	0	ONS card	ONS card
3	6	0	ONS card	ONS card
3	7	0	ONS card	COV card
3	8	0	E&M trunk card	E&M trunk card

SHOW CONFIG ALL

1-	2-	3-	4-	5-CANCEL
6-	7-	8-	9-	0-MORE

ALARM STATUS REPORT

5.07 The Alarms Manager is a software program which monitors the performance of the SX-200® DIGITAL PABX, compares it to a set of default thresholds and, if the system performance is below the specified level, causes an alarm to be raised. There are four alarm categories:

- Lines
- Trunks
- DTMF Receivers
- PCM Channels (junctors).

There are four alarm levels defined:

- NO ALARM
- MINOR
- MAJOR
- CRITICAL

There are three types of alarms:

- **Bay Alarms** - these are the alarm levels of the categories specific to each separate bay in the system.

- **System Alarms** - these are the alarm levels of the categories 'on a systemwide basis.

- **Overall Alarm** - this is the overall system alarm level, taking into account all of the bay alarms and system alarms in all categories. Note that this is displayed at all times above the upper right corner of the enclosed area of the maintenance display.

For more information on alarms, see Section MITL9108-093-353-NA, General Maintenance Information.

Alarm Report - System - All Devices

5.08. The user may obtain an alarm report on the entire system (i.e., all device types, in all bays of the system) by pressing the following softkeys:

SHOW
ALARMS
ALL
ALL
ENTER
(MORE or CANCEL)

Alarm Report - Specific Bay - All Devices

5.09 The user may obtain an alarm report on all of the device types in a specific bay by pressing the following softkeys:

SHOW
ALARMS
ALL
BAY NUM
(enter the required bay number, then press the RETURN key)
ENTER

Alarm Report - System - Specific Device Type

5.10 The user may obtain an alarm report on a specific device type (category) by pressing the following softkeys:

SHOW
ALARMS
DEVICE TYPE
(LINES or TRUNKS or RECEIVERS)
ALL
ENTER

Alarm Report - Specific Bay - Specific Device Type

5.11 The user may obtain an alarm report on a specific device type (category) in a specific bay by pressing the following softkeys:

SHOW
ALARMS
DEVICE TYPE
(LINES or TRUNKS or RECEIVERS)
BAY NUM
(enter the required bay number, then press the RETURN key)
ENTER

5.12 In all cases, the system will output the alarm status data in the Applications Area of the screen. In cases where the data requires more space than is available on the screen, the user is prompted to request more data via the MORE softkey, or to cancel the output via the CANCEL softkey. An example of an alarm report is shown in Figure 5-2.

Figure 5-2 Example of Alarm Status Display

4:27 7-AUG-86 alarm status = MINOR

CATEGORY	BAY#/SYS	TOTAL	UNAVAIL	% UNAV	ALARM	MINOR	MAJOR	CRITCL
Lines	: Bay 1 :	24 :	2 :	8% :	Minor :	0% :	20% :	0
Lines	: Bay 2 :	24 :	2 :	8% :	Minor :	0% :	20% :	0
Lines	: Bay 3 :	32 :	0 :	0% :	:	0% :	20% :	0
Lines	: Bay 4 :	32 :	0 :	0% :	:	0% :	20% :	0
Lines	: Bay 5 :	32 :	0 :	0% :	:	0% :	20% :	0
Lines	: System :	144 :	4 :	3% :	Minor :	0% :	20% :	0
Trunks	: Bay 1 :	6 :	0 :	0% :	:	0% :	10% :	0
Trunks	: Bay 2 :	18 :	1 :	6% :	Minor :	0% :	10% :	0
Trunks	: Bay 3 :	24 :	0 :	0% :	:	0% :	10% :	0
Trunks	: Bay 4 :	24 :	0 :	0% :	:	0% :	10% :	0
Trunks	: Bay 5 :	24 :	0 :	0% :	:	0% :	10% :	0
Trunks	: System :	96 :	1 :	1% :	Minor :	0% :	10% :	0

SHOW ALARMS ALL ALL

1-	2-	3-	4-	5-CANCEL
6-	7-	8-	9-	0-MORE

(For definition of terms, see Table 5-1)

5.13 The following is a summary of the terms used in the alarm status report:

TABLE 5-1
TERMS USED IN THE ALARM STATUS REPORT

Term	Meaning
CATEGORY	The alarm classification; one of the following: - lines - trunks - DTMF receivers - PCM channels
BAY#/SYS	The range of the specified alarm category; one of: Bay 1, Bay 2, Bay 3, Bay 4, Bay 5 or System; i.e., a specific bay, or the entire system.
TOTAL	Total number of devices in the specified category in the specified range; e.g., a total of 24 lines in Bay 1.
UNAVAIL	Total number of devices unavailable to Call Processing in the corresponding TOTAL.
% UNAV	The percentage of devices unavailable to Call Processing in the corresponding TOTAL.
ALARM	The current alarm level in the specified range.
MINOR	The Minor Alarm threshold – a percentage of the total number of devices in the specified range.
MAJOR	The Major Alarm threshold – a percentage of the total number of devices in the specified range.
CRITCL	The Critical Alarm threshold – the actual minimum number of devices in the specified range.

EQUIPMENT STATUS REPORT

5.14 The equipment status report provides the maintenance user with information concerning the current Call Processing and Maintenance states of any device or range of devices. The information provided includes:

- the physical location(s), in terms of bay number, slot number, circuit number, and sub-circuit number
- the extension number (where applicable)
- the programmed type of circuit
- the maintenance status of the circuit
- the software status of the circuit
- the hardware status of the circuit
- background diagnostics status
- power-up diagnostics status
- PCM link and channel number used (where applicable).

Status - Entire Bay

5.15 To obtain an equipment status report on an entire bay, press the following softkeys:

SHOW
STATUS
BAY/SLOT/CCT
(enter the required bay number, press the RETURN key, and enter only the RETURN key for the slot, circuit and sub-circuit prompts)
ENTER

Status - Specific Card Slot

5.16 To obtain an equipment status report on a specific card slot, press the following softkeys:

SHOW
STATUS
BAY/SLOT/CCT
(enter the required bay, and slot numbers, pressing the RETURN key after each one; enter only the RETURN key for the circuit and sub-circuit prompts)
ENTER

Status - Specific Circuit

5.17 To obtain an equipment status report on a specific circuit, press the following softkeys:

SHOW
STATUS
BAY/SLOT/CCT
(enter the required bay, slot and circuit numbers, pressing the RETURN key after each one)
ENTER

Status - Specific Extension

5.18 To obtain an equipment status report on a specific extension number, press the following softkeys:

SHOW
STATUS
EXT-NUM
(enter the required extension number, then press the RETURN key)
ENTER

5.19 In all cases, the system will output the equipment status data in the Applications Area of the screen. In cases where the data requires more space than is available on the screen, the user is prompted to request more data via the MORE softkey, or to cancel the output via the CANCEL softkey.

An example of an Equipment Status Report is shown in Figure 5-3.

Figure 5-3 Example of Equipment Status Report

4:27 7-AUG-86 alarm status = MINOR

BB	SS	CC	SC	NUM	TYPE	BG	PWR	MTSTAT	SWSTAT	HWSTAT	TxLk	TxCh	RxLk	RxCh
1	3	1	0	1301	ons	on	off	okay	rbk	idle	8	28	8	28
1	3	2	0	1302	ons	on	off	okay	err	idle	8	0	8	0
1	3	3	0	1303	ons	on	off	okay	rng	idle	8	30	8	30
1	3	4	0	1304	ons	on	off	okay	idle	maint	-	-	-	-
1	3	5	0	1305	ons	on	off	okay	dlg	idle	8	4	8	4
1	3	6	0	1306	ons	on	off	okay	idle	idle	-	-	-	-
1	3	7	0	1307	ons	on	off	okay	idle	idle	-	-	-	-
1	3	8	0	1308	ons	on	off	okay	idle	idle	-	-	-	-
1	3	9	0	1309	ons	on	off	okay	idle	idle	-	-	-	-

SHOW STATUS 01 ** ** **

1-	2-	3-	4-	5-CANCEL
6-	7-	8-	9-	0-MORE

(For definition of terms, see Table 5-2)

5.20 The following is a summary of the terms used in the Equipment Status Report:

TABLE 5-2
TERMS USED IN THE EQUIPMENT STATUS REPORT

Term	Meaning
BB	The bay in which the device is located
SS	The card slot in which the device is located
CC	The circuit number of the device
SC	The sub-circuit number of the device (where applicable)
NUM	The extension or trunk number of the device (where applicable); a number up to five digits in length.
TYPE	The circuit type; one of the following: ons - ONS line circuit (digital bay) cov - COV line circuit (digital bay) rcvr - DTMF Receiver module moh - Music on Hold module ls/gs - CO trunk circuit (digital bay) cons - DLIC (digital line interface circuit) module jnctr - junctor did - DID trunk e&m - E&M trunk stn - ONS line circuit (analog bay) sset - COV line circuit (analog bay) cotrk - CO trunk circuit (analog bay)
SWSTAT	The current call processing (CP) software status; for lines and trunks, one of the following: bot - busied-out bst - receiving busy tone cpd - camped on dlg - dialing dnd - do not disturb err - receiving reorder tone hfi - handsfree idle hfr - handsfree ringing hfs - handsfree suspended hld - consultation hold idle - lok - locked-out pag - paging pkd - parked (held by attendant) rbk - ringback rng - ringing stw - stowed (hard or call hold) sus - suspended tlk - talking tkd - trunk dial wfj - waiting for junctor

TABLE 5-2 (CONT'D)
TERMS USED IN THE EQUIPMENT STATUS REPORT

Term	Meaning
SWSTAT (cont'd)	wfl - waiting for line wfo - waiting for off-hook The current call processing (CP) software status, for receivers and junctors; one of the following: free - ready for use by CP busy - currently in use by CP down - currently unavailable to CP mtbusy - being tested by maintenance bsyout - busied-out by maintenance suspct - suspect, failed test, retest pending susrtr - suspect, being retested
MTSTAT	The current maintenance status; one of the following: okay - available to CP and maintenance progr - programmed in CDE but not installed unprog - installed but not programmed in CDE suspct - suspect - failed diagnostic test once bsyout - busied-out by maintenance - failed diagnostic test at least twice, or busied-out by maintenance user isol - fault isolated to this circuit unisol - fault found, not isolated
HWSTAT	The current hardware status; one of the following: idle - available to CP busy - busy down - card not present - unavailable to CP maint - maintenance busy - busied-out by maintenance diagnostics
BG	Background diagnostics enabled; either "on" or "off"
PWR	Boot diagnostics enabled; either "on" or "off"
TxLk	PCM transmit link used (where applicable) - a number between 0 and 15
TxCh	PCM transmit channel in the specified link used (where applicable) - a number between 0 and 31
RxLk	PCM receive link used (where applicable) - a number between 0 and 15
RxCh	PCM receive channel used in the specified link (where applicable) - a number between 0 and 31

SUPERSET Error Report

5.21 The SUPERSET error report provides the maintenance user with an up-to-date record of all of the SUPERSET 3™ and SUPERSET 4™ set transmission checksum errors which have occurred since the system was initialized, or since they were last cleared (see paragraph 7.42). To obtain a SUPERSET error report, press the following softkeys:

SHOW
SSET_ERRORS
ENTER

The system will output the SUPERSET error data in the Applications Area of the screen. In cases where the data requires more space than is available on the screen, the user is prompted to request more data via the MORE softkey, or to cancel the output via the CANCEL softkey. An example of a SUPERSET error report is shown in Figure 5-4.

Error counts should be at equal levels for all SUPERSET® sets. A SUPERSET® set with an error count significantly higher than the average is suspect; this would indicate a problem with either the line circuit or the set itself.

Channel Map Report

5.22 The Channel Map Report provides the maintenance user with the current status of the system's PCM links. The user may choose between either PHYSICAL or LOGICAL channels. To obtain a channel map report, press the following softkeys:

SHOW
CHANNEL-MAP
PHYSICAL
LINK-NUMBER
(enter the desired LINK number, followed by the RETURN key or simply press the RETURN key to show all links)
ENTER

or

SHOW
CHANNEL-MAP
LOGICAL
CHANNEL-NUM
(enter the desired CHANNEL number, followed by the RETURN key or simply press the RETURN key to view all 256 channels).
ENTER

The system will output the Channel Map Report in the Applications area of the screen. In cases where the data requires more space than is available on the screen, the user is prompted to request more data via the MORE softkey, or to cancel output via the CANCEL softkey. An example of a Channel Map Report is shown in Figure 5-5. Table 5-3 gives a summary of the terms used in the Channel Map Report.

Figure 5-4 Example of SUPERSET Error Report

4:27 7-AUG-86 alarm status = MINOR

PLID	EXT.#	ERRORS	PLID	EXT.#	ERRORS	PLID	EXT.#	ERRORS
3 3 1 0	3301	2	3 3 2 0	3302	1	3 3 3 0	3303	0
3 3 4 0	3304	0	3 3 5 0	3305	0	3 3 6 0	3306	0
3 3 7 0	3307	0	3 3 8 0	3308	0	3 4 1 0	3401	0
3 4 2 0	3402	0						

SHOW SSET_ERRORS

1-	2-	3-	4-	5-CANCEL
6-	7-	8-	9-	0-MORE

Figure 5-5 Example of Channel Map Report

4:27 7-AUG-86 alarm status = MINOR

Chn	Rx	Tx	Chn	Rx	Tx	Chn	Rx	Tx	Chn	Rx	Tx
1 :	free	: free :	2 :	free :	free :	3 :	free	: free :	4 :	free :	free :
5 :	free	: free :	6 :	cp_busy :	cp_busy :	7 :	free	: free :	8 :	free :	free :
9 :	free	: free :	10 :	free :	free :	11 :	free	: free :	12 :	free :	free :
13 :	free	: free :	14 :	free :	free :	15 :	free	: free :	16 :	free :	free :
17 :	free	: free :	18 :	free :	free :	19 :	free	: free :	20 :	free :	free :
21 :	free	: free :	22 :	free :	free :	23 :	free	: free :	24 :	mt_busy :	mt_busy :
25 :	free	: free :	26 :	free :	free :	27 :	free	: free :	28 :	free :	free :
29 :	free	: free :	30 :	free :	free :	31 :	free	: free :	32 :	free :	free :

Link Number : 4

SHOW CHANNEL-MAP PHYSICAL LINK-NUMBER 04

1-	2-	3-	4-	5-CANCEL
6-	7-	8-	9-	0-MORE

TABLE 5-3
TERMS USED IN THE CHANNEL MAP REPORT

Term	Meaning
chn	- Channel number
Rx	- Receive channel
Tx	- Transmit channel
free	- ready for use by CP
busy	- currently in use by CP
down	- currently unavailable to CP
mt_busy	- being tested by maintenance
bsy_out	- busied out by maintenance
suspect	- failed test, retest pending
s_retry	- being retested
moh	- music on hold

6. MAINTENANCE LOG FUNCTIONS

Introduction

6.01 The purpose of the Maintenance Log is to record all maintenance-related information, including anything which affects the functioning or the capacity of the system. Typical maintenance log entries would be circuits failing diagnostics, cards being unplugged, and alarm level changes. The user may read, delete and print log entries, as well as set a variety of printing options. For the READ, PRINT and DELETE commands, the following qualifiers apply:

1) ALL - causes all log entries to be read, printed or deleted.

2) NEWEST - causes the most recent user-defined number of log entries to be read, printed, or deleted.

3) OLDEST - causes the oldest user-defined number of log entries to be read, printed, or deleted.

For further information on the Maintenance Log, refer to Section MITL9108-093-353-NA, General Maintenance Information. To access the logs level commands, press the LOGS softkey. All of the following operations are possible while in the Logs Level.

READING LOG ENTRIES

All Log Entries

6.02 To read all of the maintenance log entries, press the following softkeys:

READ
ALL
ENTER

Newest Log Entries

6.03 To read the newest user-defined number of maintenance log entries, press the following softkeys:

READ
NEWEST
(enter the number of log entries to be read)
ENTER

Oldest Log Entries

6.04 To read the oldest user-defined number of maintenance log entries, press the following softkeys:

READ
OLDEST
(enter the number of log entries to be read)
ENTER

6.05 In all cases, the system will output the requested number of log entries into the Applications Area of the screen. In cases where the log data requires more space than is available on the screen, the user is prompted to request more log data via the MORE softkey, or to cancel the output via the CANCEL softkey. An example of reading logs is shown in Figure 6-1.

Figure 6-1 Example of LOGS READ Display

4:27 7-AUG-86 alarm status = MINOR

SX-200 DIGITAL GENERIC 1001 480P/B46.5 19-AUG-1986 Logs				
1985-JUN-21 15:33:01	ONS card failed at loc 02 01 00 00 OFF hook too long Error number = 17			
1985-JUN-21 11:11:19	COV card failed at loc 03 03 00 00 SS4 unplugged Error number = 21			
1985-JUN-21 09:23:25	Tot alarm went from No Alarm to MINOR Alarm level change due to Bay 03 trunks			
1985-JUN-21 09:23:25	trunk card failed at loc 03 09 00 00 Can't seize trunk Error number = 27			
READ LOGS ALL				
1-	2-	3-	4-	5-CANCEL
6-	7-	8-	9-	0-MORE

DELETING LOG ENTRIES

All Log Entries

6.06 To delete all of the maintenance log entries, press the following softkeys:

DELETE
ALL
ENTER
CONFIRM
ENTER

Newest Log Entries

6.07 To delete the newest user-defined number of maintenance log entries, press the following softkeys:

DELETE
NEWEST
(enter the number of log entries to be deleted)
ENTER

Oldest Log Entries

6.08 To delete the oldest user-defined number of maintenance log entries, press the following softkeys:

DELETE
OLDEST
(enter the number of log entries to be deleted)
ENTER

In all cases, the system will echo the command into the Applications Area of the screen. The user may verify that the particular log entries have been deleted, using the READ command.

PRINTING LOGS ON SYSTEM PRINTER

All Log Entries

6.09 To print all of the maintenance log entries onto the system printer, press the following softkeys:

PRINT
ALL
ENTER

Newest Log Entries

6.10 To print the newest user-defined number of maintenance log entries, press the following softkeys:

PRINT
NEWEST
(enter the number of log entries to be printed)
ENTER

Oldest Log Entries

6.11 To print the oldest user-defined number of maintenance log entries, press the following softkeys:

PRINT
OLDEST
(enter the number of log entries to be printed)
ENTER

In all cases, the system will echo the command into the Applications Area of the screen.

Setting Print Device

6.12 The user may specify to which device the PRINT command will send log entries. The default print device is any device connected to the system printer port. This may be changed to the maintenance terminal such that the PRINT command will behave much like the READ command. To set the maintenance terminal as the print device, press the following softkeys:

SET
PRINT-DEVICE
MAINT-PORT
ENTER

To set the system printer port as the print device (the default condition), press the following softkeys:

SET
PRINT-DEVICE
PRINTER-PORT
ENTER

Setting Automatic Printing

6.13 Maintenance log entries may be printed without the need of a maintenance user to explicitly request printing using the "PRINT" command. This is accomplished by automatic printing. Requesting automatic printing eliminates the danger of losing maintenance log information due to overflow. When the maintenance log contains 75% new (unprinted) log entries, the new entries are automatically printed. The maintenance log contains a maximum of 96 log entries. To initiate the automatic printing of logs, press the following softkeys:

SET
AUTOPRINT
ON
ENTER

The system will echo the command into the Applications Area of the screen.

7. DIAGNOSTIC FUNCTIONS

7.01 The Diagnostics Level of operation is a conglomeration of active testing-related commands that are designed to assist the maintenance user in ensuring that the SX-200® DIGITAL PABX is operating at peak performance. The available commands allow the user to enable, schedule and initiate diagnostic testing, and to take equipment out of service, and return it to service.

Introduction

7.02 Four types of diagnostics are available to the maintenance user; they are:

1. **PROM-Based Diagnostics** - are run only on system initialization and are not user-controlled. These are the only tests that verify the Main Control and Peripheral Control cards.

2. **Power-up Diagnostics** - if enabled, run once, starting at system initialization.

3. **Background Diagnostics** - if enabled, start running after power-up diagnostics have completed, and run continuously.

4. **Directed Diagnostics** - tests initiated by the maintenance user from the maintenance terminal, console, or butt set.

7.03 Power-up, background and directed diagnostics are capable of testing the following devices:

- ONS line circuits (in digital bays only)
- CO trunk circuits (in digital bays only)
- DTMF receiver circuits (in digital bays only)
- Analog junctor circuits (in analog bays only)
- Console interface (in digital bays only).

Note: It is not possible to test individual cards and circuits in the analog bays. Also, the DEVICE TYPE softkey must be used to test, enable/disable diagnostics for the analog junctors. Refer to Section MITL9108-093-353-NA for further information.

The user may check the status of the Power-up and Background diagnostics via the SHOW STATUS command for a specified group of devices (see paragraph 5.14).

The Maintenance Manager

7.04 The Maintenance Manager is a software program which manages the running of diagnostics on the SX-200® DIGITAL PABX. Its duties include the scheduling of tests, the invoking of tests, the logging of errors, and the removal of faulty devices from service. The Maintenance Manager tests devices one at a time from one of six prioritized queues. The priority scheme of the queues is as follows, in ascending order:

- Background diagnostic queue
- Power-up diagnostic queue
- Power-up diagnostic retry queue
- Diagnostic second-chance queue
- Diagnostic second-chance retry queue
- User (directed diagnostic) queue.

For further information on diagnostics, refer to Section MITL9108-093-353-NA, General Maintenance Information. To access the diagnostic level commands, press the DIAGNOSTICS softkey. All of the operations described in the following paragraphs are possible while in the Diagnostics Level.

ENABLING POWER-UP DIAGNOSTICS

For an Entire Bay

7.05 The user may enable power-up diagnostics for an entire bay by pressing the following softkeys:

MORE_KEYS
ENABLE-DIAG
POWER-UP
BAY/SLOT/CCT
(enter the required bay number then press the RETURN key four times)
ENTER

For an Entire Peripheral Card

7.06 The user may enable power-up diagnostics for an entire peripheral card by pressing the following softkeys:

MORE_KEYS
ENABLE-DIAG
POWER-UP
BAY/SLOT/CCT
(enter the required bay; press the RETURN key; enter the required card slot number; press the RETURN key three times)
ENTER

For a Specific Circuit

7.07 The user may enable power-up diagnostics for a specific circuit by pressing the following softkeys:

MORE_KEYS
ENABLE-DIAG
POWER-UP
BAY/SLOT/CCT
(enter the required bay, slot, circuit and sub-circuit numbers,

pressing the RETURN key after each one)
ENTER

For a Specific Extension

7.08 The user may enable power-up diagnostics for a specific extension number by pressing the following softkeys:

MORE_KEYS
ENABLE-DIAG
POWER-UP
EXT-NUM
(enter the required extension number, then press the RETURN key)
ENTER

For a Specific Device Type

7.09 The user may enable power-up diagnostics for a specific device type by pressing the following softkeys:

MORE_KEYS
ENABLE-DIAG
POWER-UP
DEVICE TYPE
(press one of the softkeys shown in Table 7-1)
ENTER

TABLE 7-1
DEVICE TYPES

Softkey	Meaning
ONS	ONS line card.
LS/GS TRUNK	LS/GS trunk card.
RECEIVERS	DTMF receiver module.
JUNCTOR	Junctors (PCM channels).
PRINTER	System printer.
CONSOLE	Attendant console.
DSP	Digital signal processor.
EM	E&M trunk module.
COV	COV line card.
DID	DID trunk card.
OPS	OPS line card.

7.10 In all cases, the system will echo the command into the Applications Area of the screen. The user may verify that the particular power-up diagnostics have been enabled via the SHOW STATUS command (see paragraph 5.14).

DISABLING POWER-UP DIAGNOSTICS

For an Entire Bay

7.11 The user may disable power-up diagnostics for an entire bay by pressing the following softkeys:

MORE_KEYS
DISABLE-DIAG
POWER-UP
BAY/SLOT/CCT
(enter the required bay number, then press the RETURN key four times)
ENTER

For an Entire Peripheral Card

7.12 The user may disable power-up diagnostics for an entire peripheral card by pressing the following keys:

MORE_KEYS
DISABLE-DIAG
POWER-UP
BAY/SLOT/CCT
(enter the required bay; press the RETURN key; enter the required card slot number; press the RETURN key three times)
ENTER

For a Specific Circuit

7.13 The user may disable power-up diagnostics for a specific circuit by pressing the following softkeys:

MORE_KEYS
DISABLE-DIAG
POWER-UP
BAY/SLOT/CCT
(enter the required bay, slot, circuit and sub-circuit numbers, pressing the RETURN key after each one)
ENTER

For a Specific Extension

7.14 The user may disable power-up diagnostics for a specific extension number by pressing the following softkeys:

MORE_KEYS
DISABLE-DIAG
POWER-UP
EXT-NUM
(enter the required extension number, then press the RETURN key)
ENTER

For a Specific Device Type

7.15 The user may disable power-up diagnostics for a specific device type by pressing the following softkeys:

MORE_KEYS
DISABLE-DIAG
POWER-UP
DEVICE TYPE
(press one of the softkeys shown in Table 7-1)
ENTER

7.16 In all cases, the system will echo the command into the Applications Area of the screen. The user may verify that the particular power-up diagnostics have been disabled via the SHOW STATUS command (see paragraph 5.14).

ENABLING BACKGROUND DIAGNOSTICS

For an Entire Bay

7.17 The user may enable background diagnostics for an entire bay by pressing the following softkeys:

MORE_KEYS
ENABLE-DIAG
BACKGROUND
BAY/SLOT/CCT
enter the required bay number; then press the RETURN key four times)
ENTER

For an Entire Peripheral Card

7.18 The user may enable background diagnostics for an entire peripheral card by pressing the following keys:

MORE_KEYS
DISABLE-DIAG
POWER-UP
BAY/SLOT/CCT
(enter the required bay; press the RETURN key; enter the required card slot number; press the RETURN key three times)
ENTER

For a Specific Circuit

7.19 The user may enable background diagnostics for a specific circuit by pressing the following softkeys:

MORE_KEYS
ENABLE-DIAG
BACKGROUND
BAY/SLOT/CCT
(enter the required bay, slot, circuit and sub-circuit numbers, pressing the RETURN key after each one)
ENTER

For a Specific Extension

7.20 The user may enable background diagnostics for a specific extension number by pressing the following softkeys:

MORE_KEYS
ENABLE-DIAG
BACKGROUND
EXT-NUM
(enter the required extension number, then press the RETURN key)
ENTER

For a Specific Device Type

7.21 The user may enable background diagnostics for a specific device type by pressing the following softkeys:

MORE_KEYS
ENABLE-DIAG
BACKGROUND
DEVICE TYPE
(press one of the softkeys shown in Table 7-1)
ENTER

7.22 In all cases, the system will echo the command into the Applications Area of the screen. The user may verify that the particular background diagnostics have been enabled via the SHOW STATUS command (see paragraph 5.14).

DISABLING BACKGROUND DIAGNOSTICS

For an Entire Bay

7.23 The user may disable background diagnostics for an entire bay by pressing the following softkeys:

MORE_KEYS
DISABLE-DIAG
BACKGROUND
BAY/SLOT/CCT
(enter the required bay number, then press the RETURN key four times)
ENTER

For an Entire Peripheral Card

7.24 The user may disable background diagnostics for an entire peripheral card by pressing the following keys:

MORE_KEYS
DISABLE-DIAG
POWER-UP
BAY/SLOT/CCT
(enter the required bay; press the RETURN key; enter the required card slot number; press the RETURN key three times)
ENTER

For a Specific Circuit

7.25 The user may disable background diagnostics for a specific circuit by pressing the following softkeys:

MORE_KEYS
DISABLE-DIAG
BACKGROUND
BAY/SLOT/CCT
(enter the required bay, slot, circuit and sub-circuit numbers, pressing the RETURN key after each one)
ENTER

For a Specific Extension

7.26 The user may disable background diagnostics for a specific extension number by pressing the following softkeys:

MORE_KEYS
DISABLE-DIAG
BACKGROUND
EXT-NUM
(enter the required extension number, then press the RETURN key)
ENTER

For a Specific Device Type

7.27 The user may disable background diagnostics for a specific device type by pressing the following softkeys:

MORE_KEYS
DISABLE-DIAG
BACKGROUND
DEVICE TYPE
(press one of the softkeys shown in Table 7-1)
ENTER

7.28 In all cases, the system will echo the command into the Applications Area of the screen. The user may verify that the particular background diagnostics have been disabled via the SHOW STATUS command (see paragraph 5.14).

DIRECTED TESTING

7.29 Directed diagnostics consist of exactly the same tests as the power-up and background diagnostics, but are initiated by the user from the maintenance terminal, and have priority over power-up and background diagnostics. Directed tests also differ from power-up and background tests in that they return immediate responses to the user via the maintenance terminal.

On a Specific Circuit

7.30 To run a directed test on a specific circuit, press the following softkeys:

TEST
BAY/SLOT/CCT
(enter the required bay, slot, circuit and sub-circuit numbers, pressing the RETURN key after each one)
ENTER

On a Specific Extension

7.31 To run a directed test on a specific extension number, press the following softkeys:

TEST
EXT-NUM
(enter the required extension number, then press the RETURN key)
ENTER

On a Specific Device Type

7.32 To run a directed test on a specific device type, press the following softkeys:

TEST
DEVICE TYPE
(press one of the softkeys shown in Table 7-1)
ENTER

In all cases, the system will output the test results in the Applications Area of the screen. An example of a directed test is shown in Figure 7-1.

Range Testing

7.33 It is possible for the maintenance user to test a range of devices using wild card characters. To test an entire bay, press the following softkeys:

TEST
BAY/SLOT/CCT
(enter the required bay number)
(answer the slot, circuit and sub-circuit prompts by pressing the RETURN key)
ENTER

To test an entire card, specify the bay and the slot, but answer the circuit and sub-circuit prompts by pressing only the RETURN key.

BUSYING OUT EQUIPMENT

7.34 Peripheral circuits may be placed in a state such that they are accessible only through maintenance. While in this state, the device will appear busy when requested by Call Processing. The following circuit types can be busied-out in this manner:

- ONS lines
- CO trunks
- DTMF receivers
- analog junctors
- SUPERSET Lines
- LS/GS Trunks
- E&M Trunks
- DID Trunks
- 8 Station Lines

Specific Circuits

7.35 To busy out a specific circuit, press the following softkeys:

MORE_KEYS
BUSY-OUT
BAY/SLOT/CCT
(enter the required bay, slot, circuit and sub-circuit numbers, pressing the RETURN key after each one)
ENTER

Specific Extensions

7.36 To busy out a specific extension number, press the following softkeys:

MORE_KEYS
BUSY-OUT
EXT-NUM
(enter the required extension number, then press the RETURN key)
ENTER

7.37 In either case, the system will echo the command into the Applications Area of the screen. The user may verify that the particular circuit or extension number has been busied-out via the SHOW STATUS command (see paragraph 5.14).

In the event that a circuit is in use by call processing when the maintenance user tries to busy it out, the circuit will not be busied-out until the extension goes on-hook. This, however, does not apply to junctors.

RETURNING BUSY EQUIPMENT TO SERVICE

Specific Circuits

7.38 To return a specific circuit to service, press the following softkeys:

MORE_KEYS
RET-TO-SVC
BAY/SLOT/CCT
(enter the required bay, slot, circuit and sub-circuit numbers, pressing the RETURN key after each one)
ENTER

Specific Extensions

7.39 To return a specific extension number to service, press the following softkeys:

MORE_KEYS
RET-TO-SVC

EXT-NUM
(enter the required extension number, then press the RETURN key)
ENTER

CLEARING SUPERSET® ERROR COUNTER

For Specific Circuits

7.40 To clear the SUPERSET Error Counter for a specific SUPERSET circuit, press the following softkeys:

CLEAR
SSET_ERRORS
BAY/SLOT/CCT
(enter the required bay, slot, circuit and sub-circuit numbers, pressing the RETURN key after each one)
ENTER

Figure 7-1 Example of Directed TEST Display

4:27 7-AUG-86 alarm status = MINOR

SX-200 DIGITAL GENERIC 1001 480P/B46.5	19-AUG-1986	Diagnostics

TEST 02 01 03 **

TOTAL TESTS RUN = 1 TOTAL TESTS FAILED = 0 PLID TESTED = 2 1 3 0

1-TEST	2-SHOW	3-CLEAR	4-	5-
6-QUIT	7-	8-	9-STOP_TEST	

For Specific Extensions

7.41 To clear the counter for a specific extension, press the following softkeys:

CLEAR
SSET_ERRORS
EXT-NUM
(enter the required extension number, then press the RETURN key)
ENTER

For All SUPERSET® Sets

7.42 To clear the entire SUPERSET error counter, press the following softkeys:

CLEAR
SSET_ERRORS
ALL
ENTER

7.43 The user may verify the error counter clearing via the "SHOW SSET_ERRORS" command, which operates in the Diagnostics Level in the same manner as it does in the Reports Level, as described in paragraph 5.21.

8. OTHER MAINTENANCE TERMINAL APPLICATIONS

Customer Data Entry (CDE)

8.01 The RS-232 Maintenance Terminal is also the main device used for the programming of customer data. At the start of the login procedure, the user is queried to start either a Maintenance session or a CDE session (see paragraph 2.05). Only a VT-100 compatible terminal may be used for CDE. For further information on CDE, see Section MITL9108-093-210-NA, Customer Data Entry.

Traffic Measurement

8.02 Traffic Measurement is a separate level in Maintenance. All of the information in Part 3 (Command Input) of this Section applies to Traffic Measurement as well. See Section MITL9108-093-450-NA, Traffic Measurement for command descriptions and other information on Traffic Measurement.

APPENDIX A
USERNAME COMMAND PRIVILEGES

A1.01 The following Table lists all the command privileges of all of the valid username levels:

TABLE A1-1
USERNAME COMMAND PRIVILEGES

COMMAND	Installer	Maint1	Maint2	Supervisor	Attendant
SET TIME	X	X	X	X	X
SET DATE	X	X	X	X	X
SET PASSWORD	X	X	X	X	X
SET SPEED	X	X			
SET PRINT-DEV	X	X			
SHOW DATE	X	X	X	X	X
SHOW TIME	X	X	X	X	X
SHOW DEVICE	X	X	X	X	X
SHOW IDENTITY	X	X	X	X	X
COPY DATABASE	X	X	X		
MONITOR SMDR	X	X	X	X	
MONITOR DIAG	X	X	X	X	
MONITOR LOGS	X	X	X	X	
STOP MONITOR	X	X	X	X	
TEST	X	X			
SHOW SSET_ERRORS	X	X			
CLEAR SSET_ERRORS	X	X			
ENABLE/DISABLE BG DIAGS	X	X			
ENABLE/DISABLE PWR UP DIAGS	X	X			
BUSY-OUT RETURN TO SVC	X	X			
TRAFFIC SET	X	X	X	X	
RESTART	X				
SET RESET_TIME	X				
SET ALARM_THRESH	X				

TABLE A1-1 (CONT'D)
USERNAME COMMAND PRIVILEGES

COMMAND	Installer	Maint1	Maint2	Supervisor	Attendant
TRAFFIC SHOW	X	X	X	X	
TRAFFIC PRINT	X	X	X	X	X
TRAFFIC READ	X	X	X	X	X
TRAFFIC STOP	X	X	X	X	X
LOGS SET PRINT	X	X			
LOGS SET AUTO	X	X			
LOGS READ	X	X			
LOGS PRINT	X	X			
STOP PRINT LOGS	X	X			
LOGS DELETE	X	X			
SHOW ALARMS	X	X			
SHOW CONFIG	X	X	X		
SHOW STATUS	X	X	X		
SHOW SSET_ERRORS	X	X			
SHOW CHANNEL_MAP	X	X	X		

APPENDIX B

MAINTENANCE TERMINAL ERROR MESSAGES

B1.01 The following Table lists all of the status and error messages which may appear at the maintenance terminal during a maintenance session:

TABLE B1-1
MAINTENANCE TERMINAL ERROR MESSAGES

Message	Meaning
The access code XXX does not exist	The specified access code does not exist. Use SHOW STATUS command to check the status code.
Value must be <= 255	Whenever there is a prompt for "Number of Entries", up to three digits may be entered but only values up to 255 are acceptable.
Card not installed	No card is installed at the specified location. Use SHOW CONFIG command to check the state of the card.
The value XX is outside the valid range for SUBCIRCUIT	The specified sub-circuit number is invalid for this particular device type. Use SHOW STATUS command to verify card type and number of programmed circuits.
Device could not be returned to service	The device was already in service. Use SHOW STATUS command to verify the circuit's status.
Invalid parameter "XX". TIME (or DATE) not set.	Time may be set to 00:00 - 23:59, date may be set to 01 - 31 for days, 01 - 12 for months, 00 - 99 for years. Valid month entries are dependent upon the Roman calendar.
Invalid day for the month specified. Date not set.	As above, for example, an attempt to set the date to the 30th of FEB.
Error updating disk database. Insert original disk and press CANCEL.	At the start of the COPY DATABASE sequence, the database is updated before it is read. This may indicate failure of this stage. If not, new diskette may be corrupted, or may not have system software, or database is corrupted.
Error initializing new disk. Insert original disk and press CANCEL.	Verify new diskette has been inserted. Verify disk drive door is closed. Verify new diskette has system software. New diskette may be corrupted.

TABLE B1-1 (CONT'D)
MAINTENANCE TERMINAL ERROR MESSAGES

Message	Meaning
Disk does not respond	System may be too busy to handle the COPY DATABASE sequence – try again when the system is less busy. May be problem with communication with diskette – check the connections to the disk drive. Verify that there is a diskette in the drive. Repeated failure indicates a problem – refer to Section MITL9108-093-350-NA, Troubleshooting.
Reading database, please wait...	This is a status message only. Database is being read from disk to system RAM as part of the COPY DATABASE command.
Writing database, please wait...	This is a status message only. Database is being written from system RAM to disk as part of the COPY DATABASE command.
The value "XX" is invalid for BAY (or JUNCTOR).	Valid junctor numbers are 00 – 31. Use SHOW CONFIG command to find the valid bay numbers.
The minute value "XX" is out of range. Start time not set.	Used in traffic measurement for invalid values in the SET START TIME command.
The hour value "XX" is out of range. Start time not set.	Same as above, but for the hour value.
Traffic measurement already in progress. STOP first.	In Traffic measurement some parameters cannot be changed while traffic measurement is collecting data. Specifically, these are: PERIOD DURATION START TIME
Unable to update disk.	When doing any operations with the logs; i.e., READ, PRINT or even the ALARMS command from the console, the diskette is first updated. This indicates failure of this stage. Check for presence of a diskette in the drive. Ensure the disk drive door is closed.
There are no logs currently on the disk.	There are no logs on the diskette to READ or PRINT.
Unable to read the disk.	Occurs in conjunction with the READ PRINT and ALARMS commands. Verify there is a diskette present. Ensure disk drive is closed.
Unable to print. Maintenance print already in progress.	There can be only one PRINT or READ occurring at one time. If required, enter STOP PRINT command to initiate a second PRINT.

TABLE B1-1 (CONT'D)
MAINTENANCE TERMINAL ERROR MESSAGES

Message	Meaning
Disk I/O failure - database may be corrupted	A disk access has failed and may have corrupted the database. One of the following is likely - disk drive door is open - there is no diskette installed. - the diskette has a write protect sticker on it - a disk read or write failed.
This command is not available on this device	i.e., SET PRINT-DEVICE MAINTENANCE-PORT on the console, or SET SPEED MAINTENANCE-PORT on the console.
Change terminal speed and press RETURN when ready	An instruction message rather than an error message; appears when changing the speed of the maintenance port while on the maintenance terminal.
An invalid or incorrect password was entered	Displayed in SET PASSWORD when the old password does not match that stored in the system, or when the new passwords contain invalid characters (i.e., has characters other than ['A'..'Z', 'a'..'z', 0..9 or blank characters])
Print not in progress OR unable to stop. Try again later.	There was no PRINT process running when STOP PRINT was entered.
The value "XXXX" is invalid for SPEED	Valid values are 300, 600, 1200, 2400, 4800, and 9600. All other values are unacceptable.
Must specify at least a bay number in Bay/Slot/Cct.	When entering BAY/SLOT/CCT (PLID) the user has the option of entering default values for SLOT, CIRCUIT and SUBCIRCUIT, but not for BAY.
A specific value cannot follow the default value "XX" in Bay/Slot/Cct.	If the user has entered a default value for the BAY/SLOT/CIRCUIT prompt, a specific value cannot follow.
Circuit XX does not exist on this card.	Use SHOW CONFIG command to verify installed cards.
Warning. Sub_circuit field ignored for this card.	Sub-circuit parameter was entered, but was not required. Information only.
Univeral Card. Module X in Bay/Slot/Module is out of range (1 - 4).	The user has chosen a universal card but the module number is out of range (i.e., not between 1 and 4).
Universal Card. Sub_circuit X does does not exist on module YY.	The user has chosen a Universal card; the module number is valid and exists but the sub-circuit number specified does not.

TABLE B1-1 (CONT'D)
MAINTENANCE TERMINAL ERROR MESSAGES

Message	Meaning
Diagnostics for all junctors of the bay have been enabled/disabled.	Diagnostics on junctors may be enabled/ disabled only on a bay basis.
Must specify both the bay and the junctor number.	For the TEST command and the BUSY-OUT, RET-TO-SVC commands both the bay and junctor must be specified explicitly.
No programmed device within specified range.	There are no programmed devices within the specified range. Use SHOW CONFIG command to check range.
TIMEOUT PERIOD EXPIRED. Press Return to login.	After being prompted for the username, the user has 10 seconds to begin entering characters.
Please wait, accessing disk . . .	This is a status message only. The system needs time to access the disk.
MONITOR LOGS already in use!	User attempted to monitor logs twice. Logs are currently being monitored.
Copy failed. Disk is write protected.	User attempted to copy a copy-protected diskette. Remove copy protect tab, or insert new diskette as required.
Busy out sequence initiated -- check device status for success/failure	Use SHOW STATUS command to verify busy-out success.

APPENDIX C

INSTALLATION OF NEW SOFTWARE

C1.01 This Appendix outlines the procedures involved in the installation of new or upgraded software. Additional information may be found in Section MITL9108-093-200-NA, Shipping, Receiving and Installation. The SX-200® DIGITAL PABX software is stored on a single 5 1/4 inch floppy diskette; the database is also stored here. When upgraded software is procurred, it is desirable to simply copy the customized database from the old software diskette onto the new software diskette, rather that re-entering the database manually. The procedures for this are outlined below.

Procedure

C1.02 It is important to note that these procedures involve a complete reset of the system (needed to initialize the new software). Therefore, this procedure should be done only at night, or during a period of low traffic to ensure minimum effect upon system users. To install new software, follow the following procedures in Table C1-1.

TABLE C1-1
NEW SOFTWARE INSTALLATION

Step	Procedure
1	Select the MAINTENANCE application at the maintenance terminal, and log in. See Paragraph 2.05 of this Section.
2	Press the SYSTEM softkey to access the System Level in the Maintenance Application.
3	To record the database, enter the following softkeys: COPY DATABASE ENTER
4	Wait for the database to be read into DRAM; this is complete when the following message is presented at the maintenance terminal: Insert new disk, close door and press CONTINUE.
5	Remove the original floppy diskette from the disk drive.
6	Insert the new software diskette into the disk drive, and move the latch into the closed position.
7	Press the CONTINUE softkey to write the database on to the new floppy diskette.
8	Wait for the write to complete; this is indicated by the following message: Copy successful. Press CANCEL to continue.

TABLE C1-1 (CONT'D)
NEW SOFTWARE INSTALLATION

Step	Procedure
9	At this point, if it is not desirable to reset the system. Remove the new software diskette from the disk drive, insert the original diskette, press the CANCEL softkey, and wait for an appropriate time. Otherwise, proceed to Step 10.
10	Press the SYSTEM RESET pushbutton on the Main Control card (see Section MITL9108-093-200-NA, Shipping, Receiving and Installation).
11	Wait for the reset to complete; this is indicated by the green ACTIVE LED indicator on the Main Control card flashing on and off. The system is now running the new software. Note: It will be possible to log into the maintenance terminal approximately 2 minutes after pressing the SYSTEM RESET pushbutton.

SX-200® DIGITAL
PRIVATE AUTOMATIC BRANCH EXCHANGE (PABX)
GENERAL MAINTENANCE INFORMATION

CONTENTS PAGE

CONTENTS (CONT'D) PAGE

LIST OF ILLUSTRATIONS

FIGURE TITLE PAGE

LIST OF ILLUSTRATIONS (CONT'D)

LIST OF TABLES

1. INTRODUCTION

General

1.01 This Section describes the maintenance philosophy, features, and facilities of the SX-200® DIGITAL Private Automatic Branch Exchange (PABX). Included are the use of diagnostic tests, maintenance aids, local and remote terminals, and other tools available to assist maintenance users in ensuring a continued high standard of efficiency and performance. Further details concerning SX-200® DIGITAL PABX maintenance may be found in the Sections listed in Table 1-1.

TABLE 1-1
SX-200® PRACTICES

MITL9108-093-100-NA	General Description
MITL9108-093-105-NA	Features and Services
MITL9108-093-180-NA	Engineering Information
MITL9108-093-350-NA	Troubleshooting
MITL9108-093-351-NA	RS-232 Maintenance Terminal

Reason for Issue

1.02 This is the first issue of this Section.

The SUPERSET 4™ Set

1.03 For information on the SUPERSET 4™ set, see Section MITL9108-093-107-NA, SUPERSET 4.

The SUPERSET 3™ Set

1.04 For information on the SUPERSET 3™ set, see Section MITL9108-093-106-NA, SUPERSET 3.

2. SYSTEM OVERVIEW

General

2.01 The SX-200® DIGITAL PABX system is a fully electronic solid-state microprocessor-controlled switching system employing digital switching techniques and incorporating special peripheral devices and architecture to provide a modern integrated office communications system. A block diagram of the system is shown in Figures 2-1 and 2-2.

Maintenance

2.02 The modular design and functional packaging of the system permits rapid location and replacement of defective equipment. Circuit malfunctions are detected by diagnostic tests automatically initiated by the Central Processing Unit (CPU). These tests are detailed in Part 6 of this Section. The use of troubleshooting procedures is outlined in Section MITL9108-093-350-NA. Troubleshooting helps to locate the defective circuit card or assembly, in order to indicate to the service personnel the required field-replaceable unit. Diagnostic tests and procedures generally do not interfere with users unaffected by the malfunction.

Physical Description

2.03 The SX-200® DIGITAL PABX equipment cabinets are of metal construction, and are shown in Figures 2-3 and 2-4. All connections from the cross-connecting terminals to the system equipment cabinets are made using standard connector cables. Connections between cross-connecting terminals, the Attendant Console and external equipment are made in accordance with accepted practice. A more detailed physical description may be found in Section MITL9108-093-100-NA, General Description.

2.04 As an option, the SX-200® DIGITAL PABX may be fitted with a standby Uninterruptable Power Supply (UPS). The reserve power should maintain system operation for approximately 2 hours in the event of a primary power failure. Each cabinet in a multi-cabinet system must be fitted with one dedicated UPS. Refer to the manufacturer's instructions for information on installation and maintenance.

Control Equipment Cabinet

2.05 The door on the front of the SX-200® control equipment cabinet provides access to the system maintenance panel, two digital equipment bays on the bottom shelf, two more digital bays or an analog bay in the top shelf, and the Main Control (MC) card. The rear doors provide access to the backplanes, equipment interface connectors, and the SX-200® power supply. Connection to an optional peripheral equipment cabinet is made through the cable ducts located at the bottom of either of the cabinet side panels.

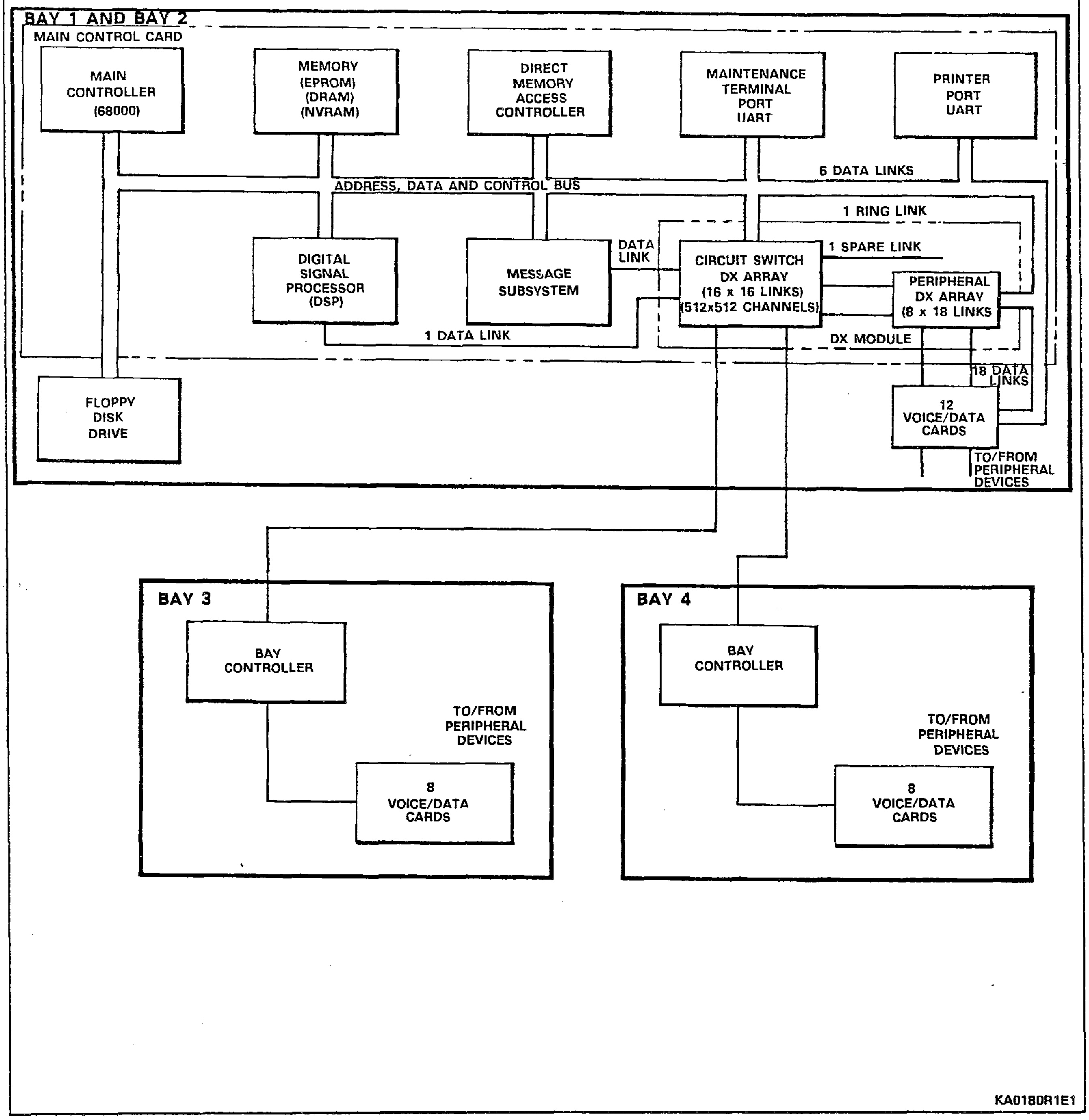


Figure 2-1 System Block Diagram (336-Port Configuration)

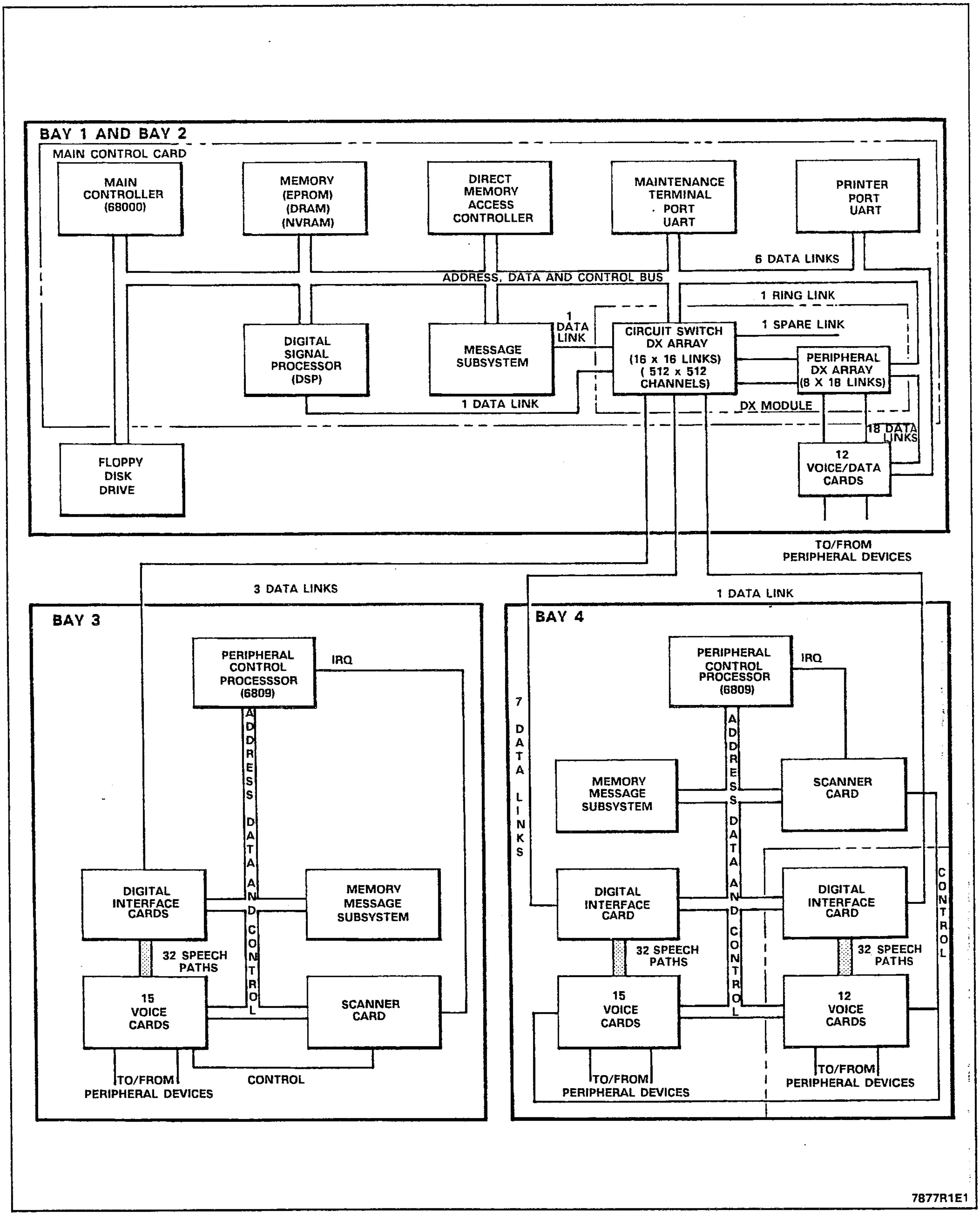


Figure 2-2 System Block Diagram (480-Port Configuration)

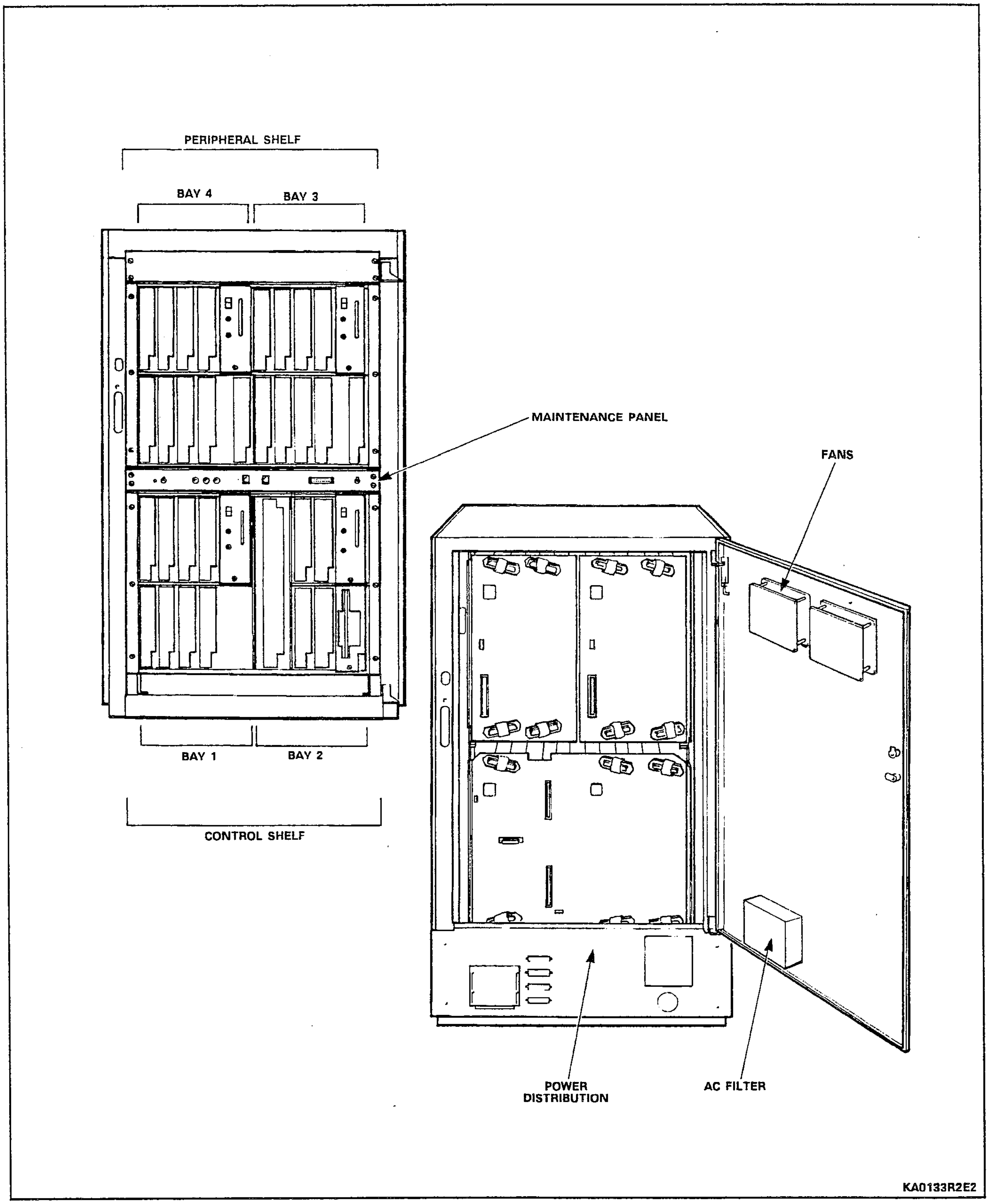


Figure 2-3 SX-200® DIGITAL Equipment Cabinets (336-Port Configuration, Universal SX-200® DIGITAL Control Cabinet)

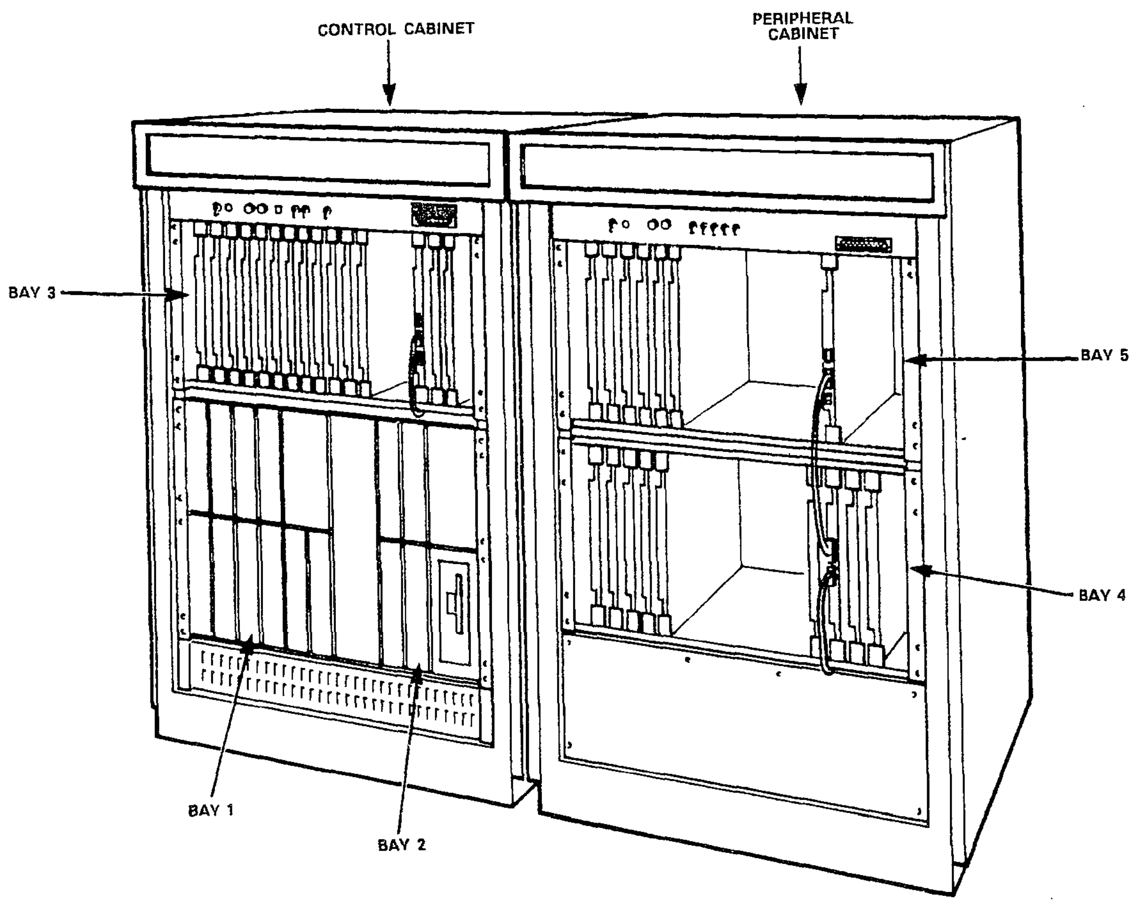


Figure 2-4 SX-200® DIGITAL Equipment Cabinets (480-Port Configuration, Standard SX-200® DIGITAL Control Cabinet)

Peripheral Equipment Cabinet (for 480-Port Configuration only)

2.06 The door on the front of the SX-200® DIGITAL peripheral equipment cabinet provides access to the peripheral maintenance panel, and two analog equipment bays. The rear doors provide access to the backplanes, equipment interface connectors and the SX-200® DIGITAL power supply. Connection to the control equipment cabinet is made through the cable ducts located at the bottom of either of the cabinet side panels.

Digital Equipment Bays

2.07 Digital equipment bays house the voice/data digital peripheral cards. Digital bays reside only in the control equipment cabinet. Bays 1, 3 and 4 (optional) may contain up to eight digital cards, a Bay Control card, and a bay power supply. Bay 2 (not optional) may contain up to four digital cards, a bay power supply and a floppy disk drive unit.

Analog Equipment Bays

2.08 Analog equipment bays house the analog peripheral circuit cards, a Digital Interface Card (DIC), a Peripheral Control Card (PCC), and an Interrupt Scanner card (Bay 5 requires only a DIC card). Analog equipment bays are optional, and reside in either the control equipment cabinet (Bay 3) or the peripheral equipment cabinet (Bays 4 and 5). Analog bays may contain up to 14 analog cards each.

Main Control Card

2.09 The Main Control card is the "brain" of the SX-200® DIGITAL PABX. It is responsible for call processing, tone generation and detection, voice conferencing, circuit and message switching, sending diskette information to the Peripheral Control cards, and the generation of ringing signal.

Technical/Electrical Characteristics

2.10 See Section MITL9108-093-180-NA, Engineering Information.

Attendant Console

2.11 The SX-200® DIGITAL Attendant Console (Figure 2-5) is enclosed in an attractive, streamlined housing. Located on the left side of the console are a pair of handset/headset cable connections allowing simultaneous operation and supervision. The console keyboard contains two rows of seven fixed function keys, two rows of five softkeys, and a full numeric keypad. The console LCD display, mounted above the keyboard, displays the active state of calls in progress, among other things. See Section MITL9108-093-315-NA, Attendant Console Description for further details.

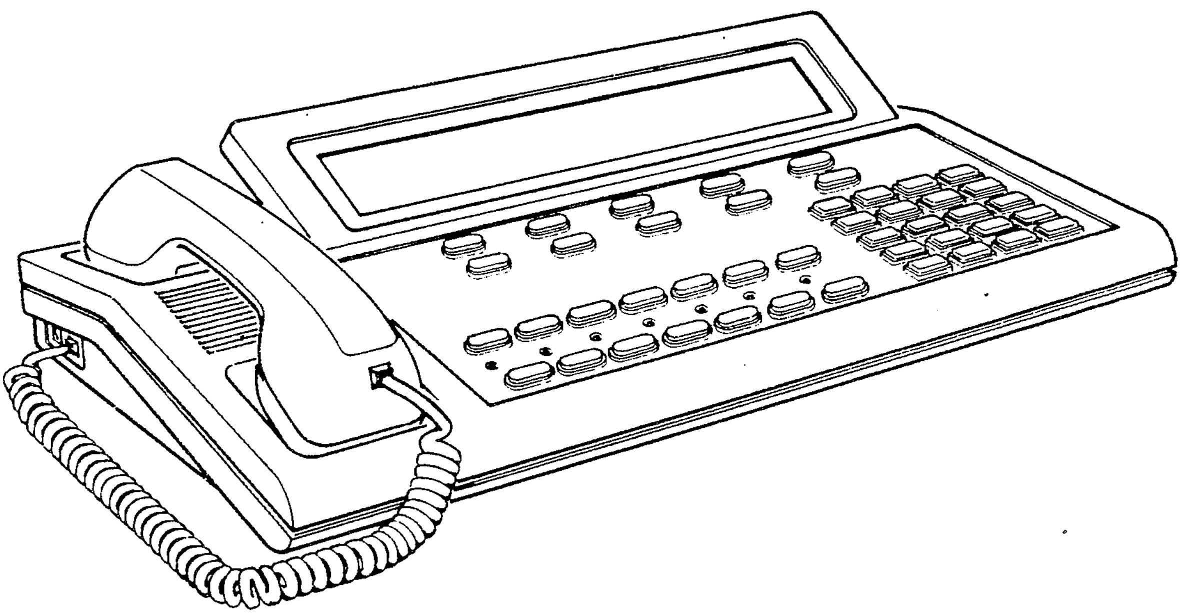


Figure 2-5 Attendant Console

3. MAINTENANCE AIDS

The Maintenance Terminal

3.01 The RS-232 ASCII Maintenance Terminal (see Figures 3-1 and 3-2) is the primary maintenance tool for the SX-200® DIGITAL PABX. A wide range of commands are available at the maintenance terminal to help the user to locate and replace faulty equipment. For further information, refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal.

3.02 The SX-200® DIGITAL Attendant Console (see Figure 2-5) may be used as an alternate maintenance work station. All of the commands available at the maintenance terminal are available at the attendant console as well.

Control Cabinet Maintenance Panel

3.03 Located at the front of the control equipment cabinet is the control maintenance panel (see Figures 3-3 and 3-4). This provides maintenance personnel with access to the system through the maintenance ports and test line connectors. Also housed on the control maintenance panel are the Power Fail Transfer control switches, and the power on/off switch and LED power indicator for Bay 3 (480-Port Configuration only).

3.04 **Maintenance Port.** These connectors are provided to allow the maintenance person to connect an RS-232 ASCII terminal to the system for maintenance or programming purposes. The terminal may be connected either directly to the system (using the LOCAL port), or indirectly, via a modem (using the REMOTE port). Note that only one of the Maintenance Ports may be used at any point in time. Note that the Remote Maintenance port is located on the Universal cabinet's rear panel. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal for further information.

3.05 **Power Fail Transfer Control Switches.** These switches allow the maintenance person to determine the type of failure that will cause a power fail transfer to occur (refer to Section MITL9108-093-105-NA, Features Description for information on power fail transfer). There are three options: transfer on power supply failure, transfer on common control failure, or transfer on either power supply or common control failure. These options are selected by switching the POWER SUPPLY and COMMON CONTROL switches to the ENABLE and DISABLE positions as required. The MASTER SWITCH allows the maintenance person to manually force a power fail transfer, by switching to the TRANSFER position. For normal system operation, this switch should always be in the NORMAL position.

3.06 **Maintenance Console.** This connector allows the maintenance person to connect an Attendant Console directly to the maintenance panel for maintenance or programming purposes, in lieu of an RS-232 ASCII terminal. To facilitate operation of a maintenance console, there must be a Console Module installed on a Universal card

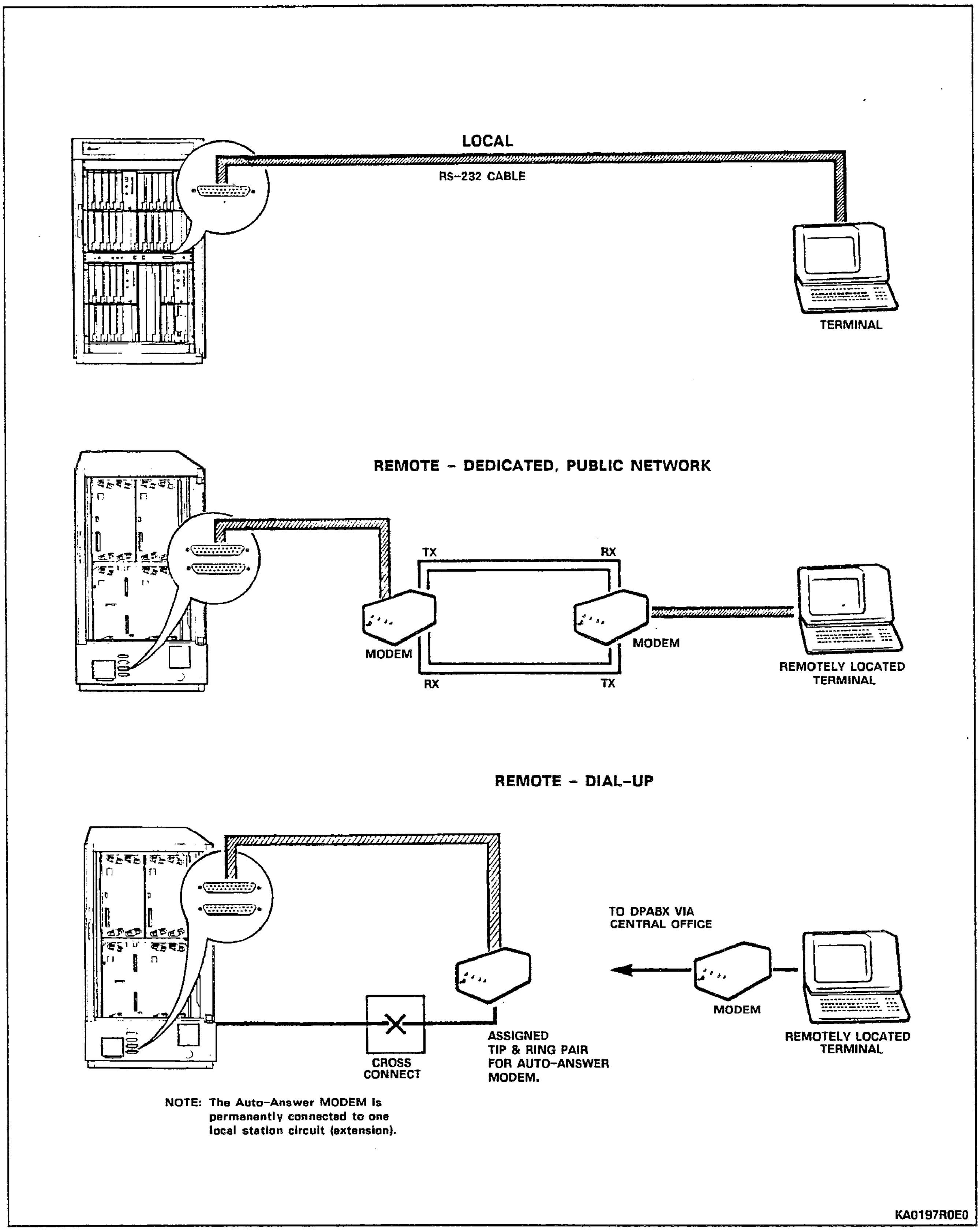


Figure 3-1 Maintenance Terminal Connection (Universal SX-200® DIGITAL Control Cabinet)

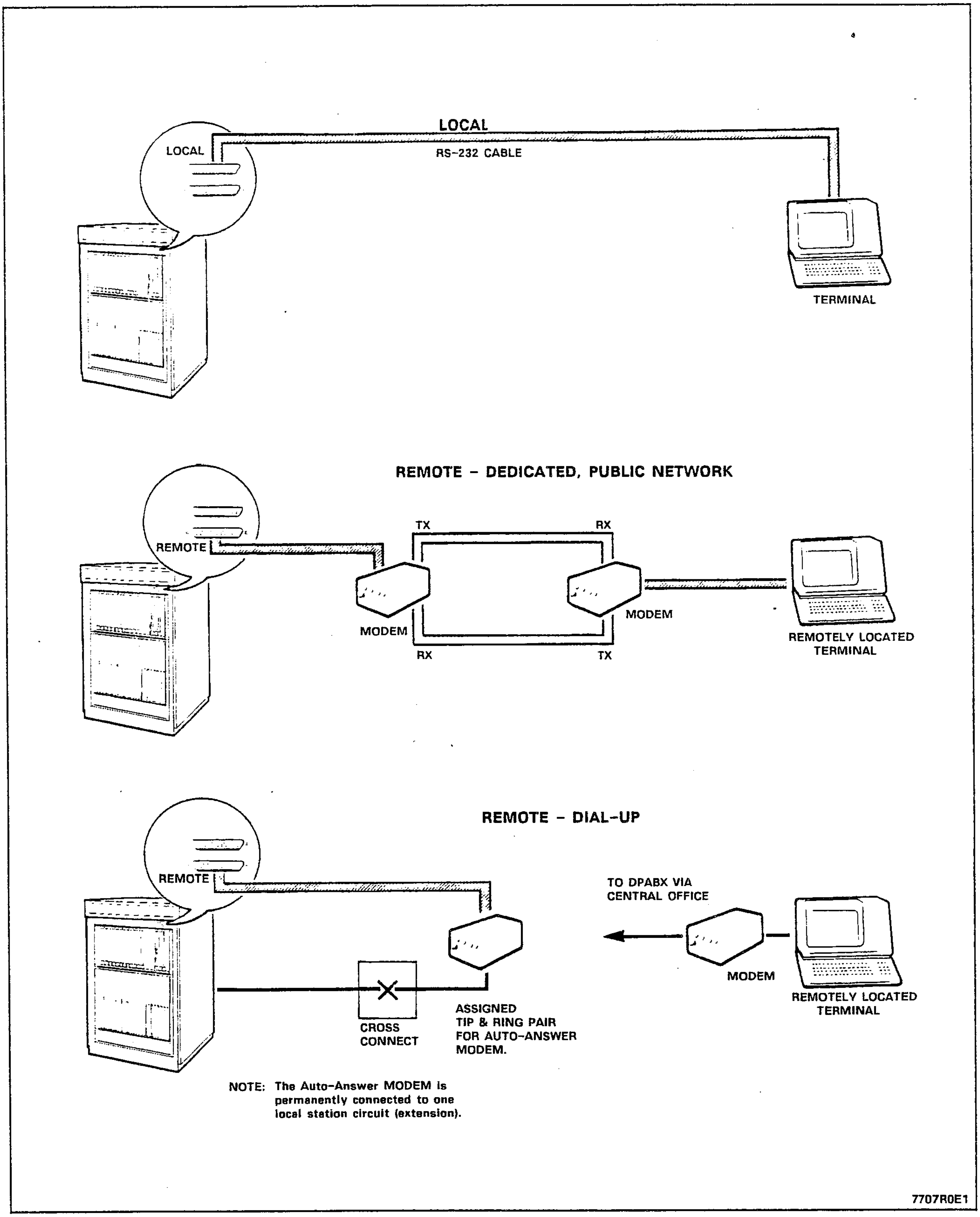


Figure 3-2 Maintenance Terminal Connection (Standard SX-200® DIGITAL Control Cabinet)

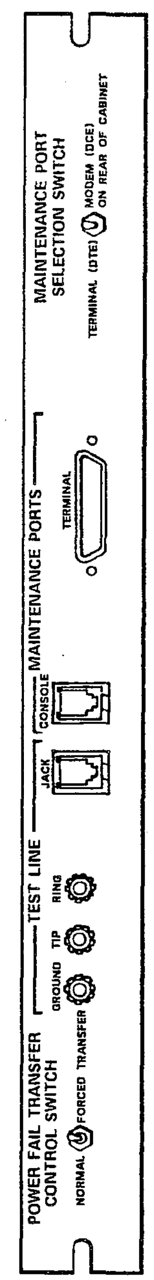


Figure 3-3 SX-200® Control Cabinet Maintenance Panel (Universal SX-200® DIGITAL Control Cabinet)

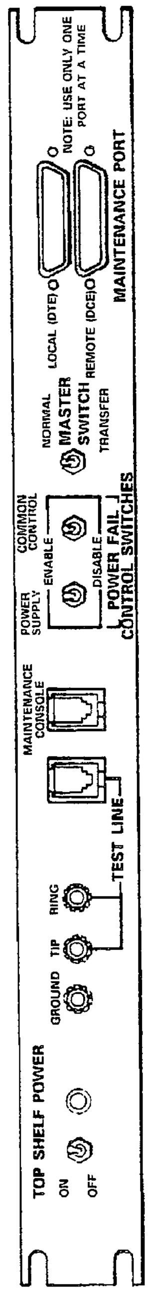


Figure 3-4 SX-200® Control Cabinet Maintenance Panel (Standard SX-200® DIGITAL Control Cabinet)

located in bay 2, slot 3, circuit 1. Refer to Section MITL9108-093-315-NA, Attendant Console Information for information on console operation.

3.07 Test Line Connectors. These connectors allow the maintenance person to access individual lines, trunks and receivers for testing purposes. The test line also has the capability of removing circuits from service, and accessing speech paths and the system printer. To facilitate operation of the test line, there must be an ONS line card installed in bay 2, slot 1. Refer to Part 7 of this Section for further information on the test line.

Peripheral Cabinet Maintenance Panel

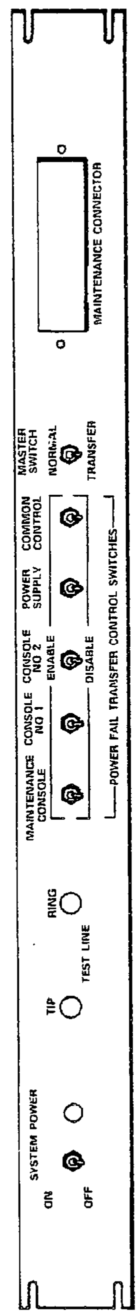
3.08 Located at the top of the peripheral equipment cabinet is the peripheral maintenance panel (see Figure 3-5). This provides maintenance personnel with access to the power fail transfer switches for the peripheral equipment cabinet. These switches allow the maintenance person to determine the type of failure that will cause a power fail transfer in the peripheral equipment cabinet. There are three options: transfer on power supply failure, transfer on common control failure, or transfer on either power supply or common control failure. These options are selected by switching the POWER SUPPLY and COMMON CONTROL switches to the ENABLE and DISABLE positions as required. The MASTER SWITCH allows the maintenance person to manually force a power fail transfer, by switching to the TRANSFER position. For normal system operation, this switch should always be in the NORMAL position.

Important: Note that the switches labelled MAINTENANCE CONSOLE, CONSOLE NO. 1 and CONSOLE NO. 2 must always be in the DISABLE position.

System Maintenance Log

3.09 The system maintenance log is a floppy-disk-based record of maintenance-related information. Any event which has the potential of affecting the functioning or the capacity of the system is entered into this log. There are three types of log reports possible:

1. Fault report – A report is generated whenever Call Processing or the maintenance system detects an error or an abnormal condition.
2. Reset report – A report is generated whenever a bay or the Main Controller is reset.
3. Alarm level change report – A report is generated whenever a change in the overall system alarm level occurs.



7984R0E0

Figure 3-5 Peripheral Cabinet Maintenance Panel

4. ALARMS

General

4.01 Alarms are the means through which the SX-200® DIGITAL PABX is able to determine its own functional state. The Alarm Manager software program monitors the performance of all peripheral devices in the system, and compiles up-to-date statistics on anomalies. The level of alarm is determined by the actual or potential effect on service that the anomalies cause.

Alarm Levels

4.02 There are four distinct levels of alarm defined for the SX-200® maintenance system. These levels are intended to give the maintenance person up-to-date information on the severity of existing anomalies. The four alarm levels are:

1. NO ALARM – This indicates that the system is functioning properly.
2. MINOR – This indicates that there are problems affecting the system in small proportion.
3. MAJOR – This indicates that there are problems causing a serious systemwide degradation of service.
4. CRITICAL – This indicates that there has been a total loss of call processing capability; an automatic power-fail transfer (PFT) is invoked.

Alarm Categories

4.03 There are four basic alarm categories, all relating to peripheral equipment. All problems affecting system performance will fall into one or more of these categories. Failure of other system components will indirectly cause failure of peripheral equipment. The categories are:

- Lines
- Trunks
- DTMF Receivers
- PCM Channels (junctors).

Alarm Types

4.04 Since the SX-200® DIGITAL PABX is modular in design, the Alarm Manager keeps alarm statistics in a modular fashion. For this reason, the alarms are divided into three types:

1. Bay Alarms – These are the alarm levels of the categories specific to each separate bay in the system.

2. System Alarms - These are the alarm levels of the categories on a systemwide basis.

3. Overall Alarm - This is the overall system alarm level, taking into account all of the bay alarms and system alarms in all categories.

Alarm Thresholds

4.05 For each alarm category, the thresholds represent the alarm level trip points; the precise divisions between the alarm levels. The thresholds are simple percentages, indicating availability; the number of working devices is compared to the number of programmed devices. The critical alarm threshold, however, is not a percentage, but rather a precise numerical valve. When the number of available devices falls below this number, a Critical Alarm is raised. The thresholds are programmable (refer to Section MITL9108-093-351-NA); the default values are specified in Table 4-1.

Note: Alarm thresholds are NOT programmable in software Generic 1000.

Alarm Totals

4.06 The Alarm Manager keeps a record of the total numbers of the various devices that should be available to Call Processing, as well as the actual number that are available. Alarm totals are maintained for each of the alarm categories in each bay, as well as for the entire system. These totals are compared to the alarm thresholds, to determine the level of alarm that is raised.

TABLE 4-1
ALARM THRESHOLDS

ALARM CATEGORY (Peripheral Devices)	ALARM THRESHOLDS		
	MINOR	MAJOR	CRITICAL
Lines	0%	20%	0
Trunks	0%	10%	0
DTMF Receivers	0%	25%	0
PCM Channels (Junctors)	10%	25%	1

5. THE MAINTENANCE MANAGER

General

5.01 The Maintenance Manager is the central maintenance software program in the SX-200® DIGITAL PABX system software. Its responsibility includes the receiving of requests to run diagnostic tests, managing the test schedules (queues) and initiating testing.

Diagnostic Test Queues

5.02 Diagnostic tests are grouped into three different categories: Power-up, Background and Directed. To reflect this, the test schedules (queues) are prioritized along the same categories. Table 5-1 describes the queues in ascending order of priority. When the Maintenance Manager schedules a device for a particular type of diagnostic test, it places the device in the appropriate diagnostic test queue. When the maintenance person disables a diagnostic test type via the maintenance interface, the corresponding test requests are removed from the associated test queue. The priority scheme is designed to ensure that testing requested by the maintenance person via the maintenance terminal is handled immediately.

TABLE 5-1
DIAGNOSTIC TEST QUEUES

Diagnostic Test Queue	Priority	Description
Background Queue	6	This queue has the lowest priority; any device with background diagnostics enabled will normally be tested once during each pass through the system. Note: Background Diagnostics can be manually disabled.
Power-up Queue	5	If a device has power-up diagnostics enabled, and is both programmed and installed, it will be put on this queue. Note: Power-up Diagnostics must be manually enabled.
Power-up Retry Queue	4	If a device could not be tested when on the Power-up Queue, it will be placed on this higher priority queue to be tested as soon as possible.
Fault Isolation Queue	3	If a previously healthy device fails a test, it will be flagged "SUSPECT" and tested again from this queue. If it fails here, it is removed from service.
Fault Isolation Retry Queue	2	If a device could not be tested when on the Fault Isolation queue, it will be placed on this higher priority queue to be tested as soon as possible.
Directed Test (User) Queue	1	This is the highest priority test queue. Devices in this queue will be tested immediately; results will be reported to initiating user port.

Testing

5.03 The Maintenance Manager controls the entire test sequence on any device under test. The general test sequence for any peripheral device is as follows:

1. The Maintenance Manager locates a device with diagnostic test requests pending on one of the test queues.
2. The device is requested from Call Processing for testing. If the device is idle, the request will be granted.
3. Any resources required to perform tests on the device are allocated.
4. The series of tests for the particular device is invoked.
5. When testing has been completed, the status of the device is updated.
6. If the device status has changed, this will be logged into the Maintenance log, and the alarm levels will be updated.
7. Resources required for testing are released.
8. The device is then returned to Call Processing, providing all tests passed. If any of the tests failed, the device will be retested; failure in this case will result in the device being removed from service.

5.04 When the Maintenance Manager has control of a device for testing purposes, it must follow a set of "guidelines" designed to make diagnostic testing both transparent to system users, and efficient. These include:

(a) If Call Processing requires a device while it is being tested, the Maintenance Manager immediately aborts the test and releases the device.

(b) When a device fails a diagnostic test, it will be tested a second time to verify the fault. If it fails again, it will be removed from service.

(c) When a device fails diagnostic tests, and is subsequently removed from service, it shall remain out of service until it passes seven successive diagnostic tests.

(d) If a device scheduled for power-up or fault-isolation diagnostic testing cannot be tested, it will be rescheduled for testing on a higher priority test queue, and retried on 5 minute intervals.

(e) Each device may have background and/or power-up diagnostics selectively disabled by the maintenance person via the maintenance interface.

Fault Recovery

5.05 Once a device fails diagnostic testing, it is removed from active service; it can no longer be used by Call Processing. There are three different circumstances through which the device can be returned to active service. They are:

1. The most common method should be through the troubleshooting procedures outlined in Section MITL9108-093-350-NA, Troubleshooting. This entails repairing or replacing the affected card. When re-installed, the device is automatically tested, and if it passes, is returned to service.

2. The maintenance person has the option of returning a faulty device to service, should that be desirable. This is done via the maintenance interface (terminal, console, or testline) – see Section MITL9108-093-351-NA, RS-232 Maintenance Terminal.

3. When a device fails diagnostic testing and is subsequently removed from service, the Maintenance Manager continues testing it. If a device passes seven consecutive tests after being removed from service, it will be returned to service.

The Maintenance Database

5.06 All cards that are programmed via Customer Data Entry (CDE) have associated with them an up-to-date status record located in system DRAM memory. These are known as the Maintenance Device Work Areas (DWA), and aid the system in determining the state of every device in the system at any point in time. Table 5-2 describes all of the information stored in the device work areas.

TABLE 5-2
THE MAINTENANCE DEVICE WORK AREA

DWA Entry	Description
Physical Location	The physical location (bay, slot, circuit, subcircuit) of the device.
Card Type	The type of card programmed in the specified location; i.e., ONS Line Card, DTMF Receiver Module, etc.
Card Status	The status of the card; one of: instld - the correct card type is installed unplug - the card is programmed, but is either unplugged, or not installed wrong - an incorrect card type is installed.
Test Request Pending Counter	The number of outstanding requests for diagnostics tests for the card, on each of the six test queues.
Test Request Pending Flag	For each circuit on the card, and for each test queue, this indicates outstanding test requests.
Circuit Status	The status of the circuit, one of: okay - available to CP and maintenance progr - programmed in CDE but not installed unprog - not programmed in CDE suspct - suspect - failed one diagnostic test bsyout - busied-out from the maintenance terminal, the console, the test line, or the manual switches (applies to analog trunks only) isol - fault isolated to this circuit unisol - fault found, not isolated.
Power-up Enable	Indicates for each circuit on the card, if power-up diagnostics are enabled.
Background Enable	Indicates for each circuit on the card, if background diagnostics are enabled.

6. DIAGNOSTIC TESTS

General

6.01 For each physical device in the SX-200® DIGITAL PABX there is a special set of diagnostic tests specifically designed to test the device as thoroughly as possible. If faults are detected, broader ranges of tests may be run in an attempt to isolate the fault to the board level, and to ensure that isolated faults are not merely side effects of other problems. The diagnostics are divided into four different functional groups. This is necessary to facilitate the different characteristics of the various devices in the system. For example, a line circuit may be tested at any time; whereas the system RAM or the CPU may not, as the system software requires them at all times. Note that cards in the analog bays may be tested only indirectly, by testing the voice paths that they are connected to. Table 6-1 describes the four types of diagnostic tests. Table 6-2 shows which devices are tested by each of the four types of diagnostics.

TABLE 6-1
DIAGNOSTIC TYPES

Diagnostic Type	Description
PROM-Based	These are the only tests that thoroughly verify the Main Control and Peripheral Control cards. They can be initiated only by resetting the system.
Power-up	If enabled (by default they are not) run once, starting at system initialization. These tests can be enabled from the maintenance terminal or the console.
Background	If enabled, start running after power-up diagnostics have completed, and run continuously. These tests can be enabled from the maintenance terminal or the console. The default condition for this type of diagnostic test is "ON".
Directed	These are tests initiated by the maintenance user from the maintenance terminal, console, or test line.

Note: Power-up, Background, and Directed diagnostics are actually the same set of tests; the difference lies only in the manner in which they are invoked.

TABLE 6-2
DIAGNOSTIC COVERAGE

Device Type	Power-up	Background	Directed	PROM
ONS Line (digital)	yes	yes	yes	
COV Line (digital)	yes	yes	yes	
OPS Line (digital)	yes	yes	yes	
LS/GS Trunk (digital)	yes	yes	yes	
DID Trunk (digital)	yes	yes	yes	
E&M Trunk Module (digital)	yes	yes	yes	
DTMF Receiver Module	yes	yes	yes	
Console Module	yes	yes	yes	
Music/Pager Module	see Note 2			
System Printer	yes	yes	yes	
Analog Voice Paths (Junctors)	yes	yes	yes	
Main Control Card				yes
Digital Signal Processor (DSP)	yes	yes	yes	
Bay Control Card				yes
Analog Bay Control Cards				yes
8-Station Line (analog)	see Note 1			
SUPERSET® Line (analog)	see Note 1			
CO Trunk (analog)	see Note 1			
DID Trunk (analog)	see Note 1			
E&M Trunk (analog)	see Note 1			
Tie Trunk (analog)	see Note 1			

Notes: 1. Analog devices may only be tested indirectly, through the testing of the Analog Junctors.
2. Music/Pager module cannot be tested, as the device is always busy.

Main Control Card Tests

6.02 Due to the nature of the Main Control Card, it is not possible to thoroughly test it in the on-line environment. Therefore, most testing is performed only on initialization (i.e., power-up and reset). These tests reside in the Main Control card's onboard EPROM, and test virtually all of the card's main functional blocks. If any of the tests should fail, a unique error code will be displayed on the dual 7-segment display status indicators located on the front panel of the card. These codes are shown in Table 8-1.

6.03 The following tests are performed on the Main Control Card:

- Processor Viability Test
- PROM Checksum Test
- Dynamic RAM Chip Select Independence Test
- Dynamic RAM Data Bit Independence Test
- Memory Address Line Independence Test
- Memory Address Space Independence Test
- DMA Controller Test.

Bay Control Card Tests

6.04 Like the Main Control card, it is not possible to thoroughly test the Bay Control card in the on-line environment. Therefore, most testing is performed only on initialization (power up and reset). The tests reside in the Bay Control card's on-board EPROM, and test most of the card's functional blocks. If any of the tests should fail, the alarm LED on the card's front panel will flash.

6.05 The following tests are performed on the Bay Control card:

- Processor Viability Test
- PROM Checksum Test
- Dynamic RAM Chip Select Independence Test
- Dynamic RAM Data Bit Independence Test
- Memory Address Line Independence Test
- Memory Address Space Indipendence Test.

Peripheral Control Complex Tests

6.06 The Peripheral Control Complex consists of one Peripheral Control (PCC) Card, one Digital Interface (DIC) Card, and one Scanner card. Like the Main Control card, it is not possible to thoroughly test the Peripheral Control card, in the on-line environment. Therefore, testing is performed only on initialization (i.e., power-up and reset). These tests reside in the onboard EPROM on both the DIC card and the PCC, and test most of the functionality of the DIC and PCC cards, along with indirect testing of the Scanner card. If any of the tests should fail, a unique error code will be displayed on the dual 7-segment display status indicators located on the front panel of the Scanner card. These codes are shown in Tables 8-3 and 8-4.

Peripheral Device Tests

6.07 There is a unique sequence of tests specifically designed for each type of peripheral device in the system. These test sequences include some device-specific tests along with some common tests. The test sequences are described in Tables 6-3 through 6-9. The actual tests are described in the following paragraphs. Refer to Sections MITL9108-093-120-NA, LS/GS Trunk Card Description and MITL9108-093-130-NA, ONS Line Card Description for information on peripheral circuit hardware.

6.08 A/D Conversion Reference Test. This test verifies the operation of the Analog-to-Digital converter by checking the level on the PCM Encoder/Decoder (CODEC) reference source. All digital lines and trunks undergo this test.

6.09 Inject Codec Test. This test verifies the operation of the PCM paths from the DX Matrix on the Main Control Card to the CODEC on the peripheral card, and back again; this includes the DX Data memory, and the peripheral backplane. The digital loopback capabilities of the CODEC are also verified. If this test fails, it is not possible for the system to ascertain where the fault occurred (i.e., the DX Matrix, the peripheral backplane, or the peripheral card).

6.10 Digital Codec Loopback Test. This test is similar to the Inject Codec Test, in that it verifies the operation of the PCM paths from the DX Matrix, to the CODEC on the peripheral card, and back again. However, this test also verifies the integrity of a tone transmitted from the Main Control card's digital signal processor (DSP) along these paths. Once again, if the test fails, it is not possible for the system to isolate the fault completely.

6.11 Analog Codec Loopback Test. This test is basically the same as the Digital Codec Loopback Test, but verifies the CODEC encode, decode and filter functions as well. Since this test will always follow the Digital Codec Loopback Test, failure of the test will isolate the fault to the CODEC itself.

6.12 Hybrid Loopback Test. This test is similar to the Analog Codec Loopback Test, but carries the test further, to the hybrid. Again, if this test fails, the fault is isolated to the device under test.

6.13 Switchhook Simulation Test. This test verifies about half of the line interface circuitry by simulating an off-hook condition on the Subscriber Line Interface Circuit (SLIC) hybrid. Note that the tip and ring leads are not disturbed by this test. If the test fails, the fault is isolated to the line circuit. Note that during this test the circuit LED on the line card will flash briefly.

6.14 DTMF Receiver Frequency Test. This test verifies the ability of the DTMF Receiver circuit to correctly receive DTMF digits. A series of DTMF digits are transmitted from the digital signal processor (DSP), along a PCM path, to the DTMF Receiver circuit; the received tone is then compared to the original tone. If the test fails, the fault is isolated to the DTMF receiver under test.

6.15 Console Test. This test verifies the operation of the console; it consists of a status message being sent from the console to the Maintenance Manager. If the test fails, the fault cannot be isolated to the console.

6.16 Junctor Force High/Low Test. If analog bays are present, this test verifies the operation of the analog junctors. This is done by ensuring that the junctor can independently be forced to high state, low state and ground state. If the test fails, the fault is isolated to the junctor under test.

6.17 **Junctor Digital Codec Loopback Test.** This test, performed on analog bays, if present, is similar to the Digital Codec Loopback Test; it verifies operation of the PCM paths from the Main Controller Card to the Peripheral Control Card, to the CODEC on the DIC Card, and back again, using a tone transmitted from the tone generator. If the test fails, it is not possible for the system to isolate the fault.

6.18 **Junctor Analog Codec Loopback Test.** This test, performed on analog bays, if present, is similar to the Junctor Digital Codec Loopback Test, but verifies the DIC CODEC encode, decode and filter functions as well. Since this test will always succeed the Junctor Digital Codec Loopback Test, failure of the test will isolate the fault to the DIC CODEC.

6.19 **Digital Signal Pocessor Test.** There are four tests which verify the DSP on the Main Control card. These tests verify the DSP's memory, conferencing capabilities, and ability to generate and detect tones.

TABLE 6-3
ONS/OPS LINE DIAGNOSTIC SEQUENCE

Diagnostic State	Test Name	Circuit State if Test Fails
state 1	A/D conv reference	faulty, unisolated
state 2	Inject CODEC	faulty, unisolated
state 3	digital CODEC loopback	faulty, unisolated
state 4	analog CODEC loopback	faulty, isolated
state 5	switchhook	faulty, isolated

TABLE 6-4
LS/GS TRUNK DIAGNOSTIC SEQUENCE

Diagnostic State	Test Name	Circuit State if Test Fails
state 1	A/D conv reference	faulty, unisolated
state 2	Inject CODEC	faulty, unisolated
state 3	digital CODEC loopback	faulty, unisolated
state 4	analog CODEC loopback	faulty, isolated
state 5	hybrid loopback	faulty, isolated

TABLE 6-5
DTMF RECEIVER DIAGNOSTIC SEQUENCE

Diagnostic State	Test Name	Circuit State if Test Fails
state 1	Inject CODEC	faulty, unisolated
state 2	digital CODEC loopback	faulty, unisolated
state 3	analog CODEC loopback	faulty, isolated
state 4	DTMF tones	faulty, isolated

TABLE 6-6
CONSOLE DIAGNOSTIC SEQUENCE

Diagnostic State	Test Name	Circuit State if Test Fails
state 1	console test	faulty, unisolated

TABLE 6-7
ANALOG VOICE PATH (JUNCTOR) DIAGNOSTIC SEQUENCE

Diagnostic State	Test Name	Circuit State if Test Fails
state 1	junctor force hi/low	faulty, unisolated
state 2	junctor digital CODEC	faulty, unisolated
state 3	junctor analog CODEC	faulty, isolated

TABLE 6-8
COV LINE/E&M TRUNK DIAGNOSTIC SEQUENCE

Diagnostic State	Test Name	Circuit State if Test Fails
state 1	Inject CODEC	faulty, unisolated
state 2	digital CODEC loopback	faulty, unisolated
state 3	analog CODEC loopback	faulty, isolated.

TABLE 6-9
DID TRUNK DIAGNOSTIC SEQUENCE

Diagnostic State	Test Name	Circuit State if Test Fails
state 1	A/D conv reference	faulty, unisolated
state 2	Inject CODEC	faulty, unisolated
state 3	digital CODEC loopback	faulty, unisolated
state 4	analog CODEC loopback	faulty, isolated

7. TEST LINE

General

7.01 The test line interface is designed to provide the maintenance person with a portable, inexpensive and readily available tool for diagnosing system failures and performing maintenance functions. A powerful subset of the maintenance functionality available via the maintenance terminal is available at the test line interface. In addition, the maintenance person can place calls without having a permanently wired extension on the premises.

Connection to Test Line

7.02 Two connection points for the test line are provided on the control maintenance panel on the control cabinet (see Figures 3-3 and 3-4); either an RJ-11 jack type connector or a pair of "banana plugs" may be used. These connectors are hardwired directly from the control maintenance panel to the port located in Bay 2, Slot 1, Circuit 1 of the control cabinet. The system will accept either rotary dial or DTMF dialing through this interface.

Programming

7.03 Before the test line package may be used, an access code must first be programmed through Customer Data Entry (CDE). Information on programming may be found in Section MITL9108-093-210-NA, Customer Data Entry. The user must first call up Form 02 (Feature Access Codes). Once in this form, the user must assign an access code to Feature Number 18 (Maintenance Function - Test Line); this must not conflict with existing access codes or with the system numbering plan.

Test Line Access

7.04 To access test line, connect a set to one of the test line connectors on the maintenance panel. Lift the handset, wait for dial tone and enter the following:

- The test line access code; as specified in CDE
- One of the valid test line command codes (see Table 7-1)
- If required, enter the circuit location number or junctor number.

Note that when CDE or maintenance is accessed via the maintenance terminal or Attendant Console, the test line cannot be accessed. In these cases, the user will receive busy tone upon dialing the test line access code. Also note that after accessing the test line, if no action is taken for 90 seconds, the test line session will be automatically terminated.

TABLE 7-1
TEST LINE COMMAND CODES

COMMAND CODES Numeric	Alphabetic	Description
26	BO	Busy-Out device
77	RS	Return device to Service
83	TD	Test Device
85	TJ	Test Junctor
25	BJ	Busy-Out Junctor
75	RJ	Return Junctor to service
38	DT	Direct Trunk select
87	TP	Test Printer
35	DL	Dump Logs
23	CD	Copy Database

Test Line Indicator LEDs

7.05 The test line software uses the dual 7-segment display status indicators on the Main Control card as status indicators. When the user enters the test line access code on the test line set, the LEDs go blank, indicating that the system is waiting for command input. After the user enters a command sequence, the LEDs will display the results of the action performed. See Table 7-2.

Test Line Tones

7.06 The test line software uses some of the existing system-generated tones as audible status indicators. Approximately 10 seconds after the user enters the test line access code on the test line set, a short ring burst, followed by dial tone is heard, indicating that the system is waiting for command input. After the user enters a command sequence, the returned tone will indicate the result of the action performed. See Table 7-3 for a complete list of the tones.

Command Input

7.07 Commands are entered on the test line by dialing command codes using the DTMF keypad or rotary dial of the set being used. These command codes are listed in Table 7-1.

TABLE 7-2
TEST LINE STATUS INDICATOR CODES

Status Code	Meaning
PA	The attempted operation was successful (pass).
FA*	The attempted operation was unsuccessful (fail).*
(blank)	System is waiting for command input.
II	Test was inconclusive.
EE	Fatal disk error; refer to Section MITL9108-093-350-NA, Troubleshooting.
E5	Invalid command or device location entered; only those commands in Table 7-1 are acceptable.
CC	Diskette information has been loaded into RAM; insert new diskette (see paragraph 7.22).
bb	Device was busy. Try again later.
7E	An invalid physical location number was entered. Enter bay number (e.g., 02), slot number (e.g., 04), and circuit number (e.g., 06).
FF	Unknown error. Attempt operation again - ensure correct use of command codes (see Table 7-1).
1E	Error in acquiring the software ID of the testline. Attempt operation again - ensure correct use of command codes (see Table 7-1). Use maintenance terminal or console if necessary.
2E	Possible software error. Attempt operation again - ensure correct use of command codes (see Table 7-1). Use maintenance terminal or console if necessary.

* Failure of any of the test line command sequences will necessitate the use of the more sophisticated maintenance tools available from the maintenance terminal or console. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal.

TABLE 7-3
TEST LINE STATUS TONES

Tone Type	Meaning
Dial tone	System is waiting for command input.
Camp-on tone (single beep)	The attempted operation was successful (Pass).
Reorder tone*	The attempted operation* was unsuccessful (fail).
Trunk camp-on tone (double beep)	Test was inconclusive.
Ringback tone (continuous)	Diskette information has been loaded into RAM; insert new diskette (see paragraph 7.22).
Ringback tone (double beep)	Initial maintenance access.
Busy Tone	Device was busy. Try again later.
Silence	Test line software is being read from disk.

* Failure of any of the test line command sequences will necessitate the use of the more sophisticated maintenance tools available from the maintenance terminal or console. Refer to Section MITL9108-093-351-NA, RS-232 Maintenance Terminal.

Commands Available

7.08 Although the complete set of maintenance commands are not provided, the available test line commands permit the maintenance person to perform most maintenance functions. For a complete list of the available commands, see Table 7-1. The commands are described below.

Specifying Equipment

7.09 Many of the test line command sequences require the maintenance person to specify a circuit or junctor as part of the command input. Circuits are specified using their physical location numbers (bay, slot, circuit, subcircuit). For example, a receiver circuit at location Bay 2, Slot 3, Circuit 3, Subcircuit 4 would be specified as "02 03 03 04". A line circuit at location Bay 2, Slot 1, Circuit 6 would be specified as "02 01 06 00". Note that circuits with no subcircuit number (i.e., lines and trunks) must be specified with "00" as the subcircuit.

7.10 Junctors are specified using their assigned junctor numbers and the required bay number. The junctor number is a 2-digit number from 00 to 31; the bay number is a 2-digit number from 01 to 05. For example, Junctor 5 in Bay 3 would be specified as "05 03".

Normal Extension Calls

7.11 The test line has access to normal extension facilities, and is subject to Class Of Service (COS) and Class Of Restriction (COR) restrictions. It is not necessary to enter the test line access code or a special command code to make normal extension calls.

Direct Trunk Select Command (DT)

7.12 This command allows the maintenance person to directly select any trunk in the system from the test line. To select a trunk, enter the test line access code, followed by the direct trunk select code (38), followed by the physical location number of the required trunk. If the trunk is not busy and in working order, the status indicators will revert to whatever was present before the testline was accessed and dial tone will be heard. The trunk is then ready for use.

7.13 If the trunk is in use (busy) at the time of access, it is not selected; if the trunk is not functional, the status indicators will read "FA".

Busy-Out Command (BO)

7.14 This command allows the maintenance person to busy out any peripheral device in the system except consoles and the test line circuit. To do this, enter the test line access code, followed by the Busy-Out device code (26), followed by the physical location number of the device. If the device was in use (busy) at the time of access, the status indicators will read "PA" and the trunk will be busied as soon as it reaches the idle state. If the operation succeeds, the status indicators will read "PA" and a single beep tone will be heard. "FA" and reorder tone indicate failure - see Table 7-2.

Return Device To Service Command (RS)

7.15 This command allows the maintenance person to return to service any peripheral device that was previously removed from service via maintenance. To do this, enter the test line access code, followed by the Return Device to Service code (77), followed by the physical location number of the device. "PA" on the status indicators and a single beep tone will indicate that the device was returned to service. "FA" and reorder tone indicate failure - see Table 7-2.

Busy-Out Junctor Command (BJ)

7.16 This command allows the maintenance person to remove from service any analog junctor in the system. To do this, enter the test line access code, followed by the Busy-Out Junctor code (25), followed by the junctor number, and the bay number. "bb" on the status indicators and a single beep tone will indicate that the junctor was busied-out. "FA" and reorder tone indicate failure - see Table 7-2.

Return Junctor To Service Command (RJ)

7.17 This command allows the maintenance person to return to service any analog junctor that was previously removed from service via maintenance. To do this, enter the test line access code, followed by the Return Junctor to service code (75), followed by the junctor number and the bay number. "PA" on the status indicators and a single beep tone indicate that the junctor was returned to service. "FA" and reorder tone indicate failure - see Table 7-2.

Test Device Command (TD)

7.18 This command allows the maintenance person to test any peripheral circuit in the digital bays. To test a device, enter the test line access code, followed by the Test Device code (83), followed by the physical location number of the device. "PA" on the status indicators and a single beep tone indicate that the test passed. "FA" and reorder tone indicate that the test failed.

Test Junctor Command (TJ)

7.19 This command allows the maintenance person to test any of the analog junctors in any bay in the system. To test a junctor, enter the test line access code, followed by the Test Junctor code (85), followed by the junctor number and the bay number. If the junctor was in use (busy) at the time of access, the status indicators will read "bb"; attempt the test later. "PA" on the status indicators and a single beep tone indicate that the test passed. "FA" and reorder tone indicate that the test failed.

Dump Logs Command (DL)

7.20 This command allows the maintenance person to print the system maintenance log on to the system printer. To print (dump) the logs, enter the test line access code, followed by the Dump Logs code (35). "PA" on the status indicators and a single beep tone indicate that the system has started sending the logs to the printer. "FA" and reorder tone indicate failure - see Table 7-2.

Test Printer Command (TP)

7.21 This command allows the maintenance person to test the system printer. To do this, enter the test line access code, followed by the Test Printer code (87). The printer should then print two full pages of all of the printable characters. "PA" on the status indicators and a single beep tone indicate that the system has started sending test data to the printer. "FA" and reorder tone indicate that the test failed.

Copy Database Command (CD)

7.22 This command allows the maintenance person to copy the database from the system floppy diskette onto another system floppy diskette. To copy the database, do the following:

1. Enter the test line access code. When the system is ready audiable ringing is heard, followed by dial tone.
2. Enter the Copy Database code (23) - silence is heard.
3. Wait until ringback, and MCC 7-segment displays read "CC".
4. Remove the original diskette - audiable ringback continues.
5. Insert the new diskette.
6. Enter "1" to begin copying to the new diskette, ringback stops and the test line will be silent.
7. Wait until the status indicators read "CC", then enter "2" to continue to normal operation.
8. After entering "2" the status indicators will read "PA" and a single burst of tone will be provided to indicate that the action completed successfully.

8. MAINTENANCE CONTROLS AND INDICATORS

General

8.01 The following paragraphs describe the maintenance controls and indicators found on the components of the SX-200® DIGITAL Private Automatic Branch Exchange. Most of the indicators are software-controlled, and provide maintenance personnel with information on the current status of the SX-200® DIGITAL PABX.

Maintenance Panels

8.02 Most of the SX-200® DIGITAL PABX maintenance functionality is accessed through the maintenance panels. The maintenance panels are described in detail in Part 3 of this Section; further functionality is described in Section MITL9108-093-351-NA, RS-232 Maintenance Terminal.

Main Control Card

8.03 On the Main Control Card, there are five status LEDs, two 7-segment LED status indicators, and two pushbuttons. All of these controls and indicators are labelled clearly on the Main Control Card's front panel (see Figure 8-1). The functions of the controls and indicators are described in the following paragraphs.

8.04 **System Reset Button.** As the name suggests, this is the manual system reset button. When pressed, the system will cease all activity, run all initialization tests, and reload the software from the floppy diskette. Note that this should never be done while the SX-200® DIGITAL PABX is handling traffic, as all calls will immediately be dropped, and the system will switch to Power Fail Transfer mode.

8.05 **Plane Transfer Button.** This is similar in function to the system reset button. When pressed, the system will cease all activity and run a checksum test on the software; if this fails, the software will be reloaded from the floppy diskette. Otherwise, the system will reinitialize. Note that this should never be done while the SX-200® DIGITAL PABX is handling traffic, as all calls will immediately be dropped, and the system will switch to Power Fail Transfer mode.

8.06 **Seven-Segment Display Status Indicators.** The Main Control card status indicators consist of two 7-segment display LEDs, arranged vertically, as shown in Figure 8-1. The top display LED is the most significant while the lower display LED is the least significant. The function of the Main Control card status indicators depends upon the software currently being executed. At system initialization, they indicate the status of the Main Control card tests; this is summarized in Table 8-1. When the maintenance person is accessing the test line facility, the status indicators are totally dedicated to this function; refer to Part 7 of this Section for further details on the test line. Problems with the system floppy disk drive will be indicated by error codes on the displays (see Table 8-2). Finally, the status indicators will show the physical location of the most recent card to have a problem entered

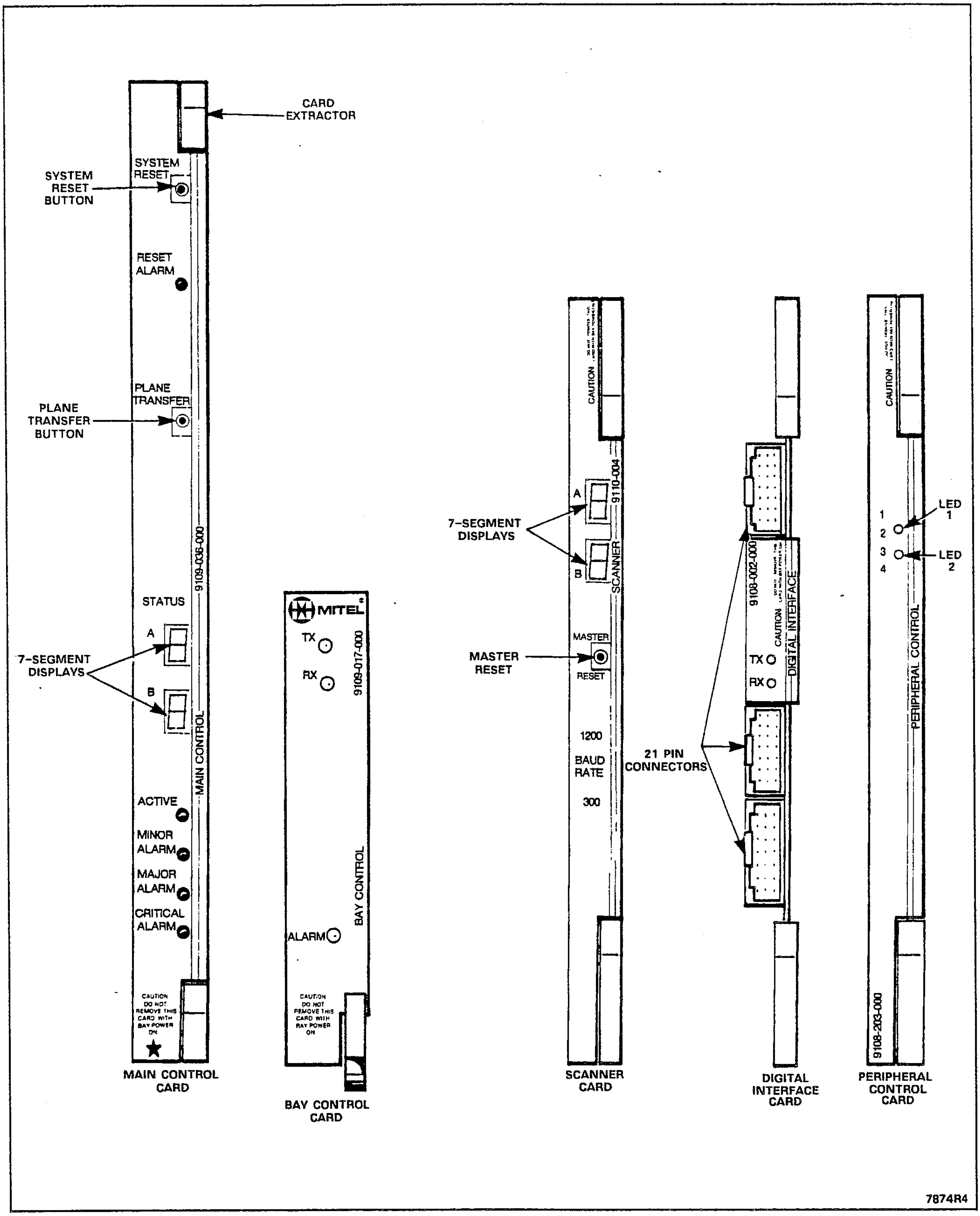


Figure 8-1 Control Card Front Panels

into the Maintenance Log. The card's bay number (top) and slot number (bottom) will be displayed. During normal operation when no applications are using the status indicators, a pair of horizontal dashes will be displayed.

TABLE 8-1
MAIN CONTROL CARD TEST STATUS CODES

Test Name	Test Code	Error Code
Bus Error Vector/Stack Test	0	E0
Processor Viability Test	1	E1
PROM Checksum Test	2	E2
RAM Load Checksum Test	3	E3
Limited RAM Test	4	E4
DMA Controller Test	5	E5
RAM Chip Select Test	6	E6
RAM Data Bit Indep. Test	7	E7
Memory Address Test	8	E8
Memory Space Test	9	E9
* Booting System Software	b OR b.	Eb or Eb.

*Note that, upon test failure, test error codes will be flashed for 1 second, after which testing will begin again from test # 1.

8.07 **Reset Alarm LED.** This indicator will light when the system has been reset.

8.08 **Active LED.** This green LED serves as an indication of the health of the system. A steady 1 second pulse cycle indicates that the system is up and running. Should the LED remain constantly on or off, this indicates that the system is not running; in this case Section MITL9108-093-350-NA, Troubleshooting should be consulted.

8.09 **Alarm Status LEDs.** The bottom three LEDs on the main control card are the alarm status LEDs; only one of these LEDs may be on at any one time. They indicate the overall system alarm level; one of: MINOR ALARM, MAJOR ALARM or no alarm. If none of the alarm status LEDs are on, the system should be in perfect working order. Refer to Part 4 of this Section for further information on alarms.

Bay Control Card

8.10 The Bay Control card has three status LEDs, labelled TX, RX and ALARM. The TX and RX LEDs indicate communication (transmit and receive) with the Main Control card. The ALARM LED has two functions. A flashing ALARM LED indicates a failure on the Bay Control card. A permanently lit ALARM LED indicates that the Bay Control card is waiting for, or has lost communication with the Main Control card.

See Table 8-3 for a summary of the Bay Control card status LED states.

Peripheral Control Card

8.11 The Peripheral Control card (PCC) has two status LEDs, labelled "1" and "2", located on the card's front panel (see Figure 8-1). These LEDs are used along with the Scanner card's 7-segment display status indicators during the Peripheral Control card initialization sequence. Table 8-3 summarizes the functions of the PCC LEDs.

Digital Interface Card

8.12 The Digital Interface Card (DIC) has two status LEDs, labelled "TX" and "RX", located on the card's front panel (see Figure 8-1). These LEDs have two different functions. During DIC initialization, they are used along with the Scanner card's 7-segment display status indicators to display initialization status. Table 8-4 summarizes the LED information for this case. During peripheral bay loading, they are used to indicate message traffic between the main control and the peripheral control. In this case, the TX LED indicates message information is being transmitted from the peripheral control to the main control. Similarly, the RX LED indicates message information being transmitted from the main control to the peripheral control.

TABLE 8-2
DISKETTE ERROR CODES

Error Code		
Generic 1000	**Generic 1001**	**Meaning**
1E	E.1	Diskette has been changed since the previous access.
2E	E.2	Diskette has been changed since the previous access. Some updates are still pending on the original diskette.
3E	E.3	Disk is unusable.
4E	E.4	Disk is unusable. Updates are still pending.
5E	E.5	The current diskette cannot be written to; there is a write protect sticker on it.

TABLE 8-3
BAY CONTROL CARD STATUS LEDS

TX LED	RX LED	Alarm LED	Meaning
on	on	on	Bay Control card is either waiting for, or has lost communication with the Main Control card. If this state persists for more that a few seconds, there is no communication.
flashing	flashing	on	Bay Control card is being downloaded by the Main Control card.
flashing	flashing	off	Bay Control card is up and running and communicating to the Main Control card.
off	off	off	This is the normal operating condition of the Bay Control card.
-	-	flashing	There is a failure on the Bay Control card.

TABLE 8-4
PERIPHERAL CONTROL CARD TEST STATUS INDICATORS

Test Name	Test Pass		Test Fail	
	PCC LEDs	Scanner LEDs	PCC LEDs	Scanner LEDs
PCC PROM Checksum Test	LED 1 on	00	LED 1 on	E2
*PCC RAM Checksum Test	LED 1 on	00	LED 1 on	-
PCC RAM Test	LED 1 on	00	LED 1 on	E1
** DIC card tests pass	both off	bb	-	-
** Ready for bay downloading	both off	A0 AA	- -	- -
** Download done	both off	b3 b4	- -	- -

* The "PCC RAM Test" is run only if this test fails; hence there is no "test fail" error code.

** A0 indicates that Bay 3 is ready for downloading; AA indicates that Bays 4 and 5 are ready. Similarly, b3 indicates Bay 3 has finished loading; b4 indicates Bays 4 and 5 have finished.

TABLE 8-5
DIGITAL INTERFACE CARD TEST STATUS INDICATORS

Test Name	Test Pass		Test Fail	
	DIC LEDs	Scanner LEDs	DIC LEDs	Scanner LEDs
DIC to PCC Link Test	both off	03	RX on	**
DIC RAM Test	both off	05	RX on	**
DIC PROM Checksum Test	both off	07	RX on	**
DX Connect Memory Test	both off	0b	RX on	**
DIC HDLC Test	both off	10	RX on	**
DIC Hardware Timer Test	both off	13	RX on	**
* all tests passed	both off	14	-	-
* waiting for download	both off	bb	-	-

* Due to the speed of the testing, if all tests pass, the scanner card LEDs will appear to display "bb" immediately.
** Indeterminate

Scanner Card

8.13 On the Scanner card, there are a pair of 7-segment display status indicators, a pushbutton, and eight DIP switches. All of these controls and indicators are labelled clearly on the Scanner card's front panel (see Figure 8-1). The functions of the controls and indicators are described in the following paragraphs.

8.14 **Master Reset Pushbutton.** Pressing the master reset pushbutton on the Bay 3 scanner card will cause all activity in Bay 3 to cease, all PROM-based tests on the Bay 3 peripheral control complex to run, and the peripheral software to be reloaded into Bay 3. Pressing the master reset pushbutton on the Bay 4 scanner card will cause all activity in Bays 4 and 5 to cease, all PROM-based tests on the Bay 4 and 5 control cards to run, and the peripheral software to be reloaded into Bay 4. Note that this should never be done while the SX-200® DIGITAL PABX is handling traffic, as all calls in the affected bay(s) will immediately be dropped.

8.15 **Seven-Segment Display Status Indicators.** The Scanner card 7-segment display LEDs, arranged vertically, as shown in Figure 8-1. The top display LED is the most significant while the lower display LED is the least significant. The function of the displays depends upon the software currently being executed. At system initialization, they indicate the status of the Peripheral Control card and Digital Interface Card PROM-based tests; these are summarized in Tables 8-4 and 8-5.

8.16 **DIP Switches.** These have no functionality.

Peripheral Circuit Cards

8.17 Analog Cards. Analog line and trunk peripheral cards have a small red LED associated with each circuit. When a circuit is involved in a call, its associated LED will be on; when it is not in use, the LED will be off. Line circuit LEDs will flash at a rate of 10 pulses per second when the circuit is receiving dial pulses.

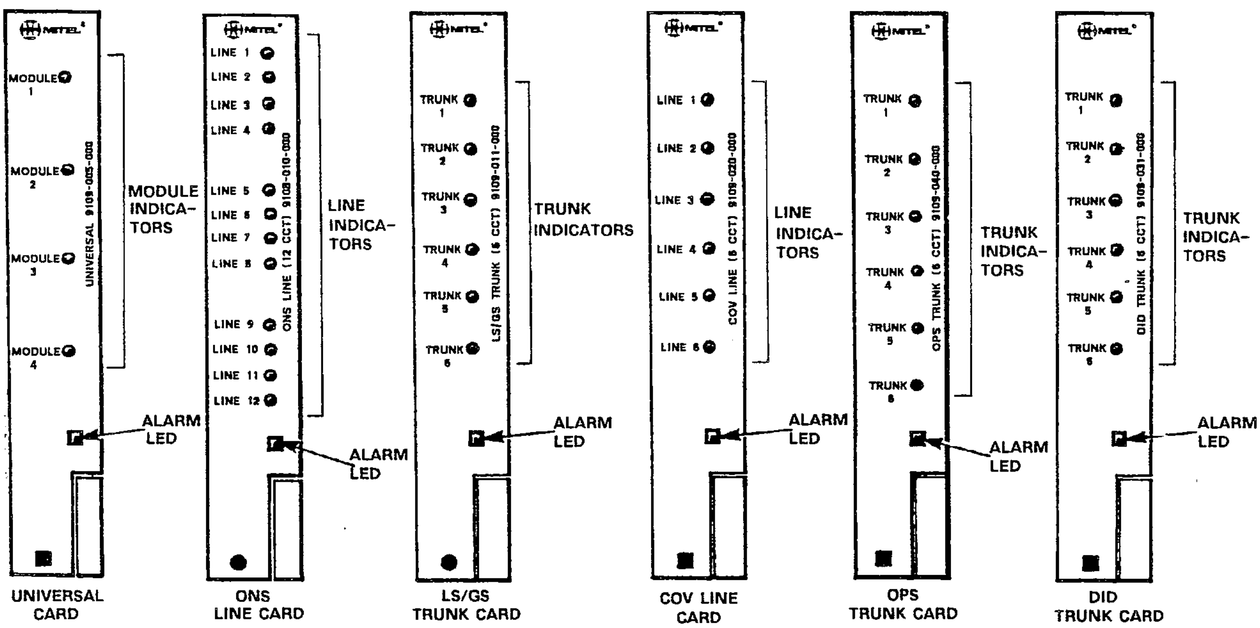
8.18 Digital Cards. Digital card LEDs have all of the functionality of the analog card LEDs, but with several enhancements. When a digital circuit is removed from service by the maintenance system, the associated LED will flash with a period of 1/2 second on and 1/2 second off. Each digital peripheral card has an alarm LED located at the bottom of the card's front panel. If any circuit on the card has a known fault or if a card is installed in an unprogrammed or incorrect card slot, the alarm LED will flash with a period of 1/2 second on and 1/2 second off. See Figure 8-2.

Attendant Console

8.19 The SX-200® DIGITAL PABX Attendant Console function LEDs (see Figure 8-3) are used as maintenance indicators during the console initialization sequence. Tables 8-6 and 8-7 describe the console maintenance indicators.

TABLE 8-6
ATTENDANT CONSOLE MAINTENANCE LED INDICATORS

Test Name	Test Fail Indication
Console RAM Test	HOLD 1 LED flashes.
Console EPROM Test	HOLD 2 LED flashes.
Console IRQ Test	HOLD 3 LED flashes.
Console LED Test	Any of the console LEDs fail to go on, and stay on for 2 seconds.



KA0207R1E1

Figure 8-2 Peripheral Card Front Panels

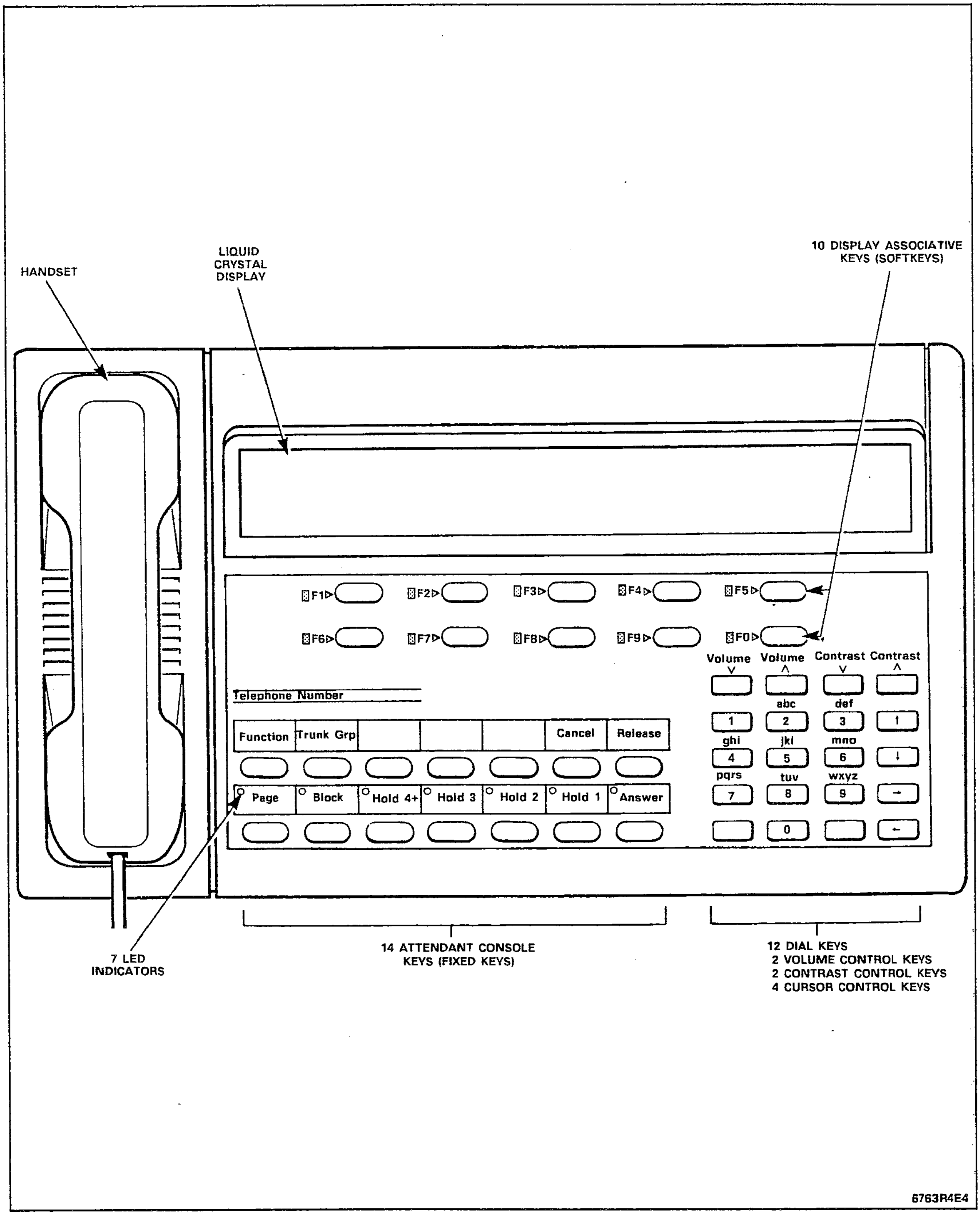


Figure 8–3 Attendant Console Keyboard

TABLE 8-7
ATTENDANT CONSOLE LCD DISPLAY MESSAGES

Message	Meaning
CONSOLE HARDWARE FAILURE 123456789 ERROR CODE 1 PLEASE NOTE DETAILS ON REPAIR TAG	Console power-up tests failed.
WAITING FOR SYNCHRONIZATION 123456789 PLEASE WAIT	Power is available, but there is no synchronization to the line.
WAITING FOR COMMUNICATION 123456789 PLEASE WAIT	Console is synchronized, but no messages are being received from the system.

Note: In all cases, refer to Section MITL9108-093-350-NA, Troubleshooting.

Power Supplies

8.20 **Rear Door Power Supplies.** Any SX-200® DIGITAL PABX cabinet that includes analog bays will use a rear door power supply (see Figure 8-4). The AC POWER LED indicates the presence of AC power connected to the power supply. The CONVERTER INPUT LED indicates the presence of transformed power at the DC converter input. The EQUIPMENT SHELF POWER ON LED indicates whether or not the TOP SHELF POWER ON switch on the maintenance panel is in the ON position. The RESERVE BATTERY CONNECTED LED is not used.

8.21 **Bay Power Supplies.** Each digital equipment bay requires one Bay Power Supply (see Figure 8-5). There are two LED indicators located on the front panel of the bay power supply; the top LED is the power ON indicator, and the bottom LED is the ring generator indicator. The ring generator indicator will flash on only when ringing signal is applied.

Floppy Disk Drive

8.22 The SX-200® DIGITAL PABX floppy disk drive has one LED on its front panel; it indicates when the disk drive magnetic heads are in contact with the floppy diskette. Note that power should never be turned off while this LED is on; if this is necessary, first turn the lever to the 'diskette removal position' (see Figure 8-6).

Power Fail Transfer Card

8.23 The Power Fail Transfer card is located on the inside of the peripheral equipment cabinet on the side panel (see Figure 8-7). The power fail transfer LED is located at the top of the card (see Figure 8-9). When this LED is on, the system is in normal operation; when the LED is off, the system is in power fail transfer mode. The PFT card in the Control Cabinet has no status LEDs.

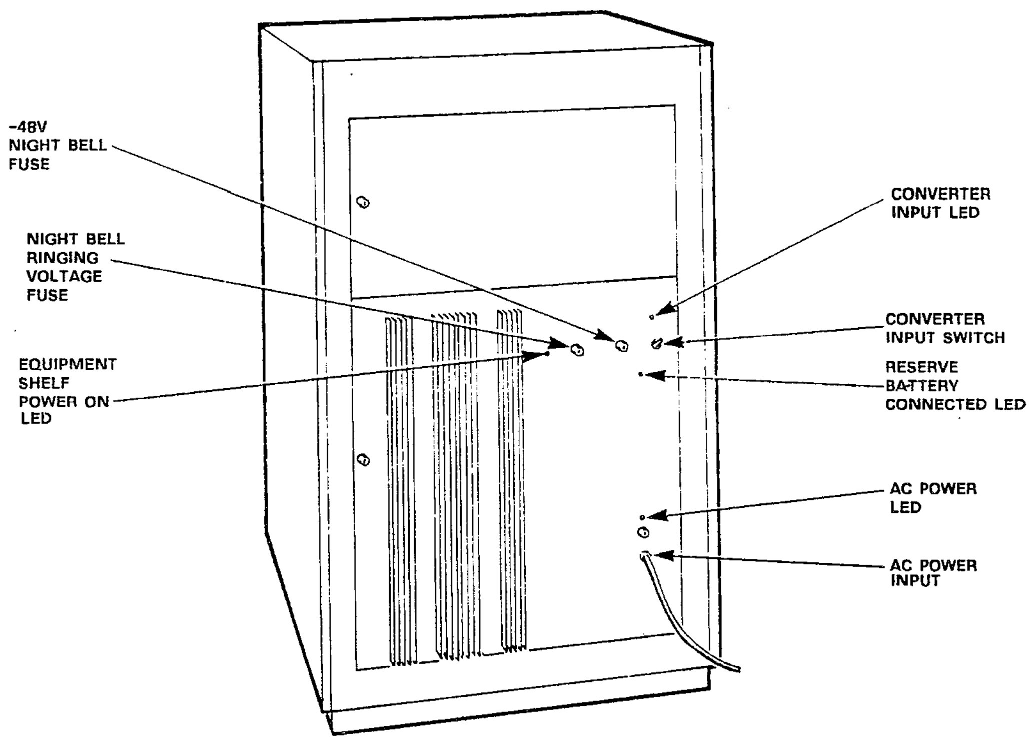


Figure 8-4 Rear Door Power Supply Indicators

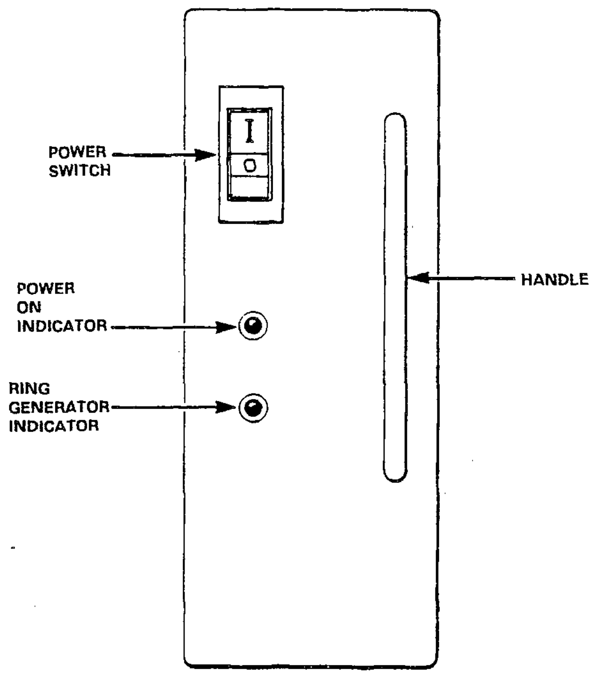


Figure 8-5 Bay Power Supply

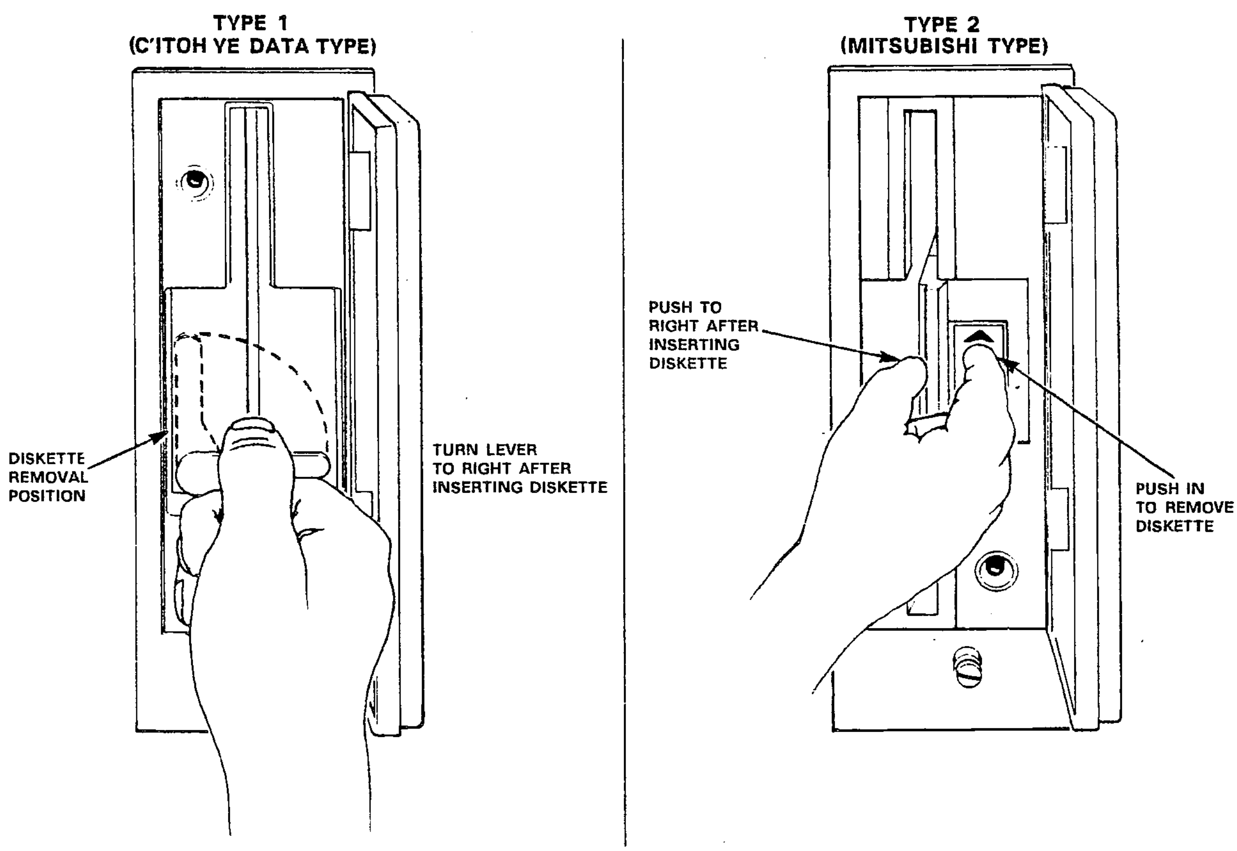


Figure 8–6 SX–200® DIGITAL Disk Drive

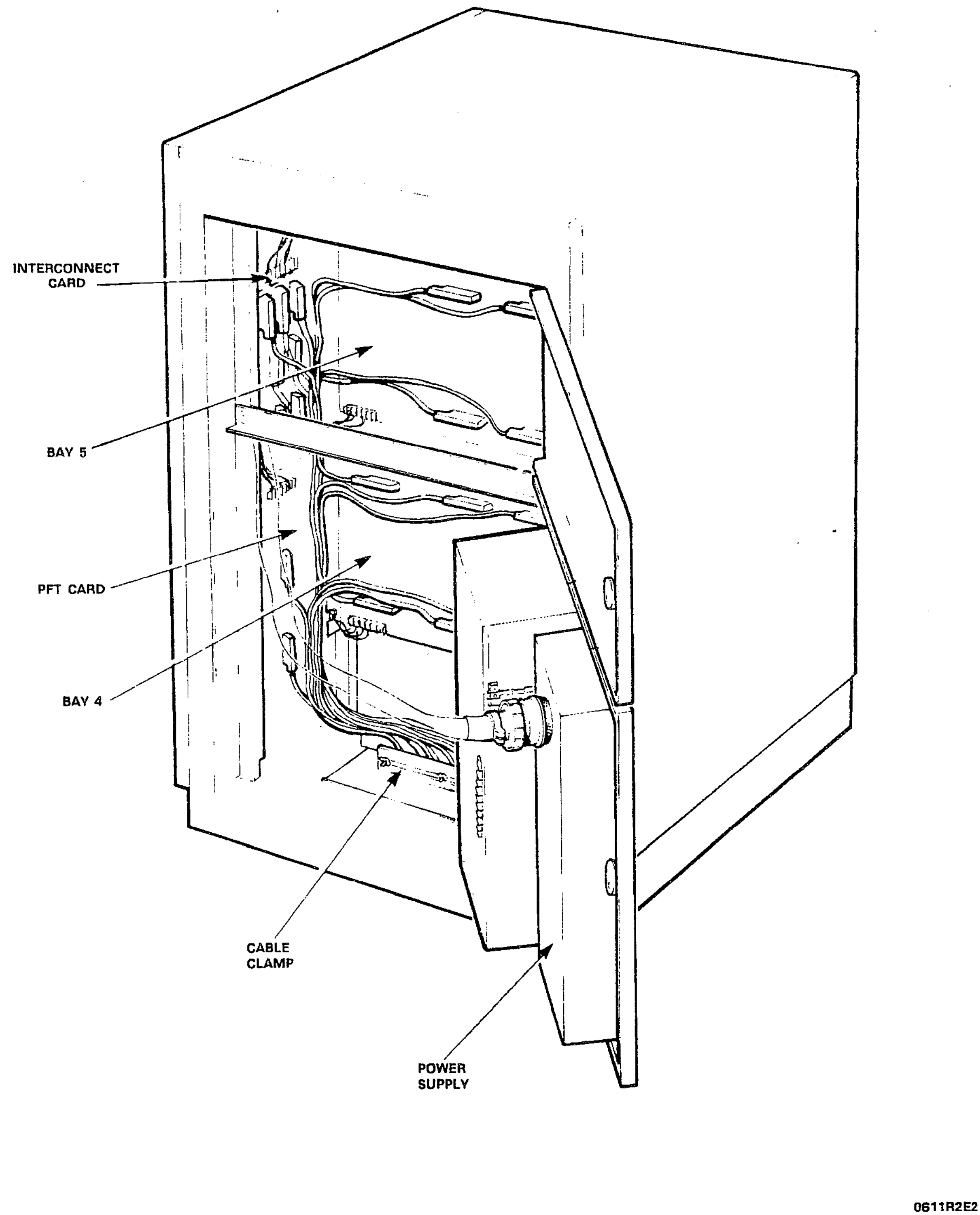


Figure 8-7 Power Fail Transfer Card Location - Peripheral Cabinet

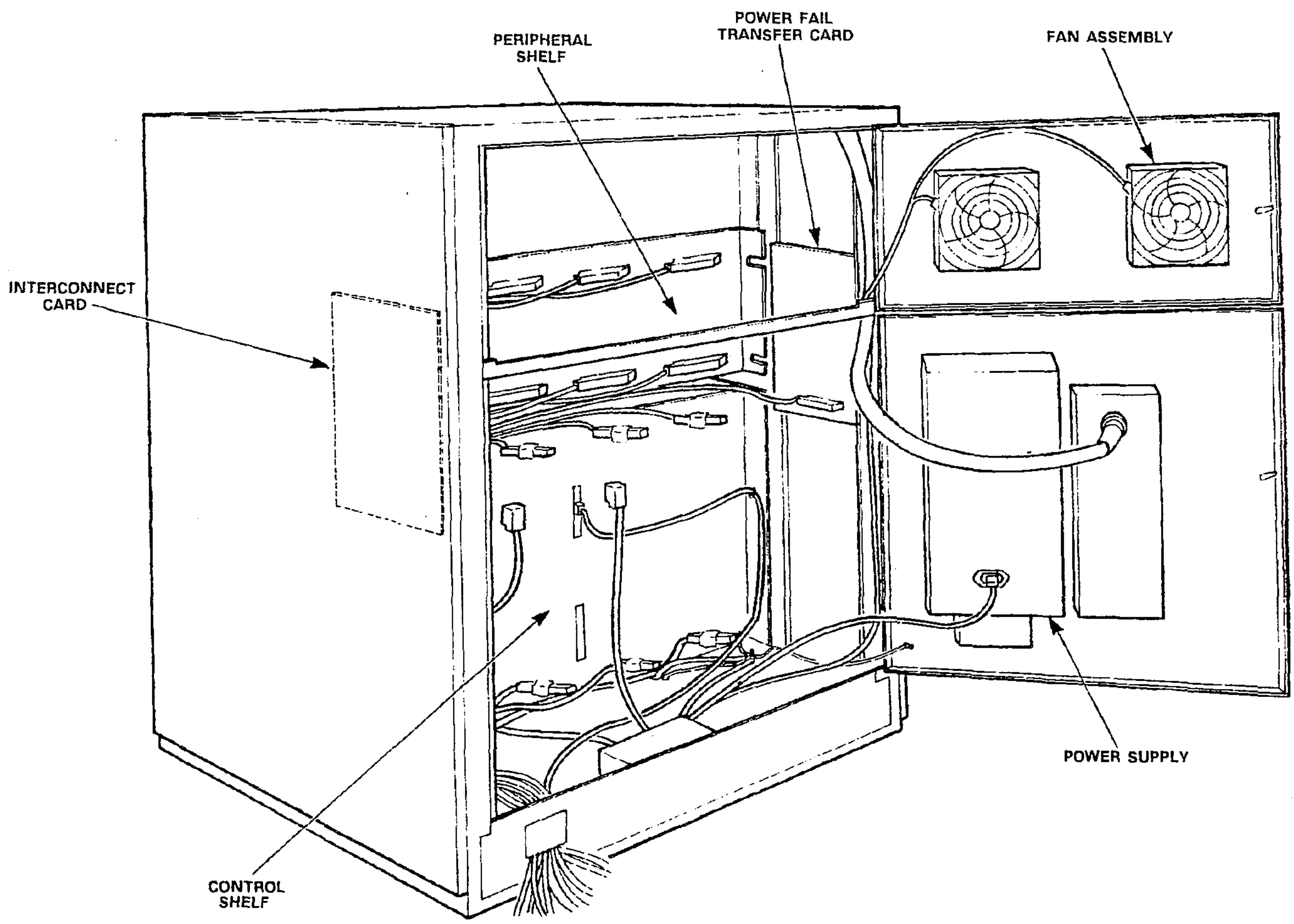


Figure 8-8 Power Fail Transfer Card Location - Universal Control Cabinet

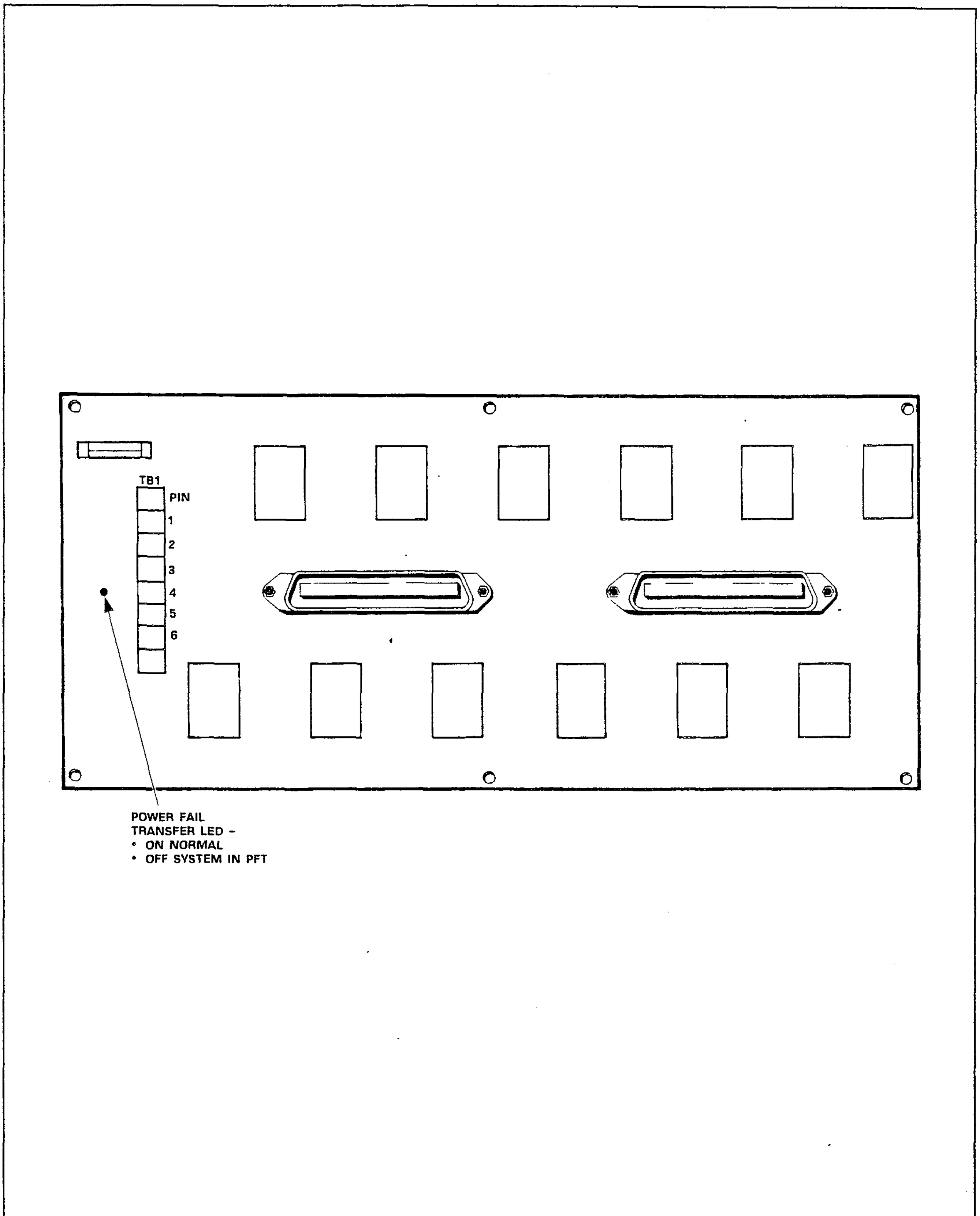


Figure 8-9 Power Fail Transfer Card (480-Port Configuration)

APPENDIX A
ROUTINE MAINTENANCE

A1.01 The procedures described in the following paragraphs are the only routines required for the SX-200® DIGITAL PABX, and are necessary due to the mechanical nature or limited operational life of the components concerned.

Air Filter

A1.02 An air filter is positioned in the SX-200® DIGITAL PABX control cabinet to remove dust and particles from the air flow so as to maintain a clean environment within the cabinet. It is important that the filter be checked frequently, and cleaned regularly, since failure to do so will cause a reduction in the airflow, and a consequent buildup of excess heat within the cabinet, leading ultimately to component failure.

A1.03 The air filter is located on the inside of the control cabinet front door, at the bottom. It is held over the intake vent by a velcro strip bordering the vent. To remove the filter, simply pull it from the velcro strip border. To install the filter, simply place it over the vent, and firmly press the edges onto the velcro border.

A1.04 The filter may be cleaned by washing in hot water and detergent. After several washings, the filter may begin to deteriorate; at this point, it should be replaced.

A1.05 The intervals at which this should be done will depend upon the environment in which the SX-200® DIGITAL PABX is located. Regardless of environmental considerations, however, the filter should be changed at least every 6 months.