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General Series

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SATURN® IIE EPABX

GENERAL DESCRIPTION

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SECTION 1.00 INTRODUCTION

1.01 Purpose. This practice provides a general description of the SATURN IIE digital Electronic Private Automatic Branch Exchange (EPABX), including the hardware, software, technical characteristics, and functional block diagram.

1.02 Scope. Section 2 of this practice provides an overview of the SATURN IIE System, including information on the hardware and software configurations, plus data pertaining to system features and characteristics. Sections 3 through 5 provide information on the SATURN IIE System equipment cabinets and shelves, and their related power supplies and module assemblies. Descriptions of the various printed circuit boards used in the SATURN IIE System are presented in Section 6. Section 7 presents information on a standard service terminal and the attendant console, and peripheral station equipment. Finally, Section 8 describes Station Message Detail Recording (SMDR). Table 1.00 defines the common mnemonics used in this practice.

1.03 Siemens SATURN IIE Practices. The practices, issue numbers and dates for the SATURN IIE EPABX are listed in the Practices Documentation Index A30808-X5130-A190-★-B987.

NOTE: Always refer to the latest issue of the applicable index to obtain the latest issue number of a practice.

1.04 Siemens Customer Support Services. Siemens maintains a nationwide network of field service offices. Contact the Siemens regional office for any engineering assistance which may be required.

Table 1.00 Mnemonics Used in This Practice

MNEMONIC	DESCRIPTION
ACC	Access
ACD	Automatic Call Distribution
ANA	Assigned Night Answer
ATT	Attendant
AUD	Audible
CCS	Hundred Call-Seconds
CCSA	Common Control Switching Arrangement
CIOP	Controller/Input-Output Processor
CMU	Customer Memory Update
CO	Central Office
CODEC	Coder/Decoder
CONF	Conference
CPU	Central Processing Unit
DCI	Data Communications Interface
DEST	Destination
DID	Direct Inward Dialing
DISA	Direct Inward System Access
DIT	Dedicated Incoming Trunk
DTMF	Dual Tone Multifrequency
E&M	Receive and Transmit
EPABX	Electronic Private Automatic Branch Exchange
EPSCS	Enhanced Private Switched Communications Service
FDD	Floppy Disk Drive
FX	Foreign Exchange
LCR	Least Cost Routing
LDN	Listed Directory Number
LED	Light Emitting Diode
LTU	Line/Trunk Unit
LTUC	Line/Trunk Unit Control
LTUPS	Line/Trunk Unit Power Supply
MCA	Memory Control and Attenuator
MDF	Main Distribution Frame
MMC	Meet-Me Conference
MEM3	Memory 3 (256K)
MEM4	Memory 4 (1 Megabyte)
MSM	Memory Support Module
NAK	Negative Acknowledgement
OPR	Operator Call Queue Answer
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PFI	Power Failure Interrupt
PIMD	Premium Instrument Module Digital

Table 1.00 Mnemonics Used in This Practice (Continued)

MNEMONIC	DESCRIPTION
PROM	Programmable Read Only Memory
PSC	Parallel/Serial Converter
PSU	Power System Unit
RAM	Random Access Memory
RAUP	Remote Access Unit/Ports
RCL	Recall Queue Answer
RGEN	Ring Generator
RLS	Release Individual Party
RT	Route
SCC	Specialized Common Carrier
SDT	Siemens Digital Telephone
SLA16	Subscriber Line Module Analog – 16 Lines
SLMA-O	Subscriber Line Module Analog – Off-Premises
SLMA-S	Subscriber Line Module Analog – Station
SLMD	Subscriber Line Module Digital
SMDR	Station Message Detail Recording
SMXTG	Signal Multiplexer/Tone Generator
SNAP	Special Night Answer Position
SPCL	Special
SRC	Source
TMBA-2	Two-Wire E&M Trunk
TMBA-4	Four-Wire E&M Trunk
TMBM	Central Office Trunk
TMIE	Direct Inward Dialing Trunk
TSU	Time Switching Unit
UNA	Universal Night Answer
WATS	Wide Area Telephone Service
ZUNA	Zoned Universal Night Answer

SECTION 2.00 SYSTEM OVERVIEW

2.01 General. The SATURN IIE System is a state-of-the-art, digital, stored-program EPABX that uses Pulse Code Modulation (PCM)/time division switching techniques. The system is capable of supporting up to 992 ports (lines and trunks). Analog-to-digital and digital-to-analog conversion is provided by a codec per port. The system provides extensive business features previously found only in the largest private telephone systems, plus a number of new innovative features. The system can handle conventional telephones (rotary or tone dialing) and can also be equipped with Siemens Digital Telephones (SDTs).

2.02 Features. The SATURN IIE System is software-controlled; therefore, it can be programmed by the customer to allow for features desired in a particular application. This flexibility allows the system to be arranged to operate with attendant completion of incoming calls, Direct Inward Dialing (DID), Dedicated Incoming Trunks (DITs), or any combination thereof. The features are assignable as: system-level; station-, trunk-, or attendant console-related; and maintenance. As the requirements of the customer change, the various features may be assigned and/or reassigned among the users. When additional features become available, each system may be enhanced via easy-to-use Customer Memory Update (CMU) procedures and/or new load program disks. Refer to the Siemens practice, SATURN IIE EPABX Feature Descriptions, for a comprehensive description of all features. A summary of these features is listed in Table 2.00.

Table 2.00 SATURN IIE Features
Alphabetical Listing by Major Categories

SYSTEM FEATURES
ACD Recorded Announcement Service
Additional Input/Output Devices
Alarm Indication – Major
Alarm Indication – Minor
Alternate Routing
Assigned Night Answer
Automatic On-Line Diagnostic Testing and Reporting
Brownout Protection
Code Call Access
Convection Cooling
Customer Memory Updating
CCSA Access
Central Office (City) Trunk Access
Daytime Trunk Control
Dedicated Incoming Trunks
Dictation Access
Digital Pad Switching
Direct Inward Dialing
Direct Inward System Access
Direct Inward System Access – Shared
Direct Outward Dialing
DID Flexible Station Numbering
DTMF System Outpulsing
DTMF-to-Dial-Pulse Conversion
Eight-Digit Toll Code Restriction
End-to-End DTMF Signaling
EPSCS Access
External Extension Numbering

Table 2.00 SATURN IIE Features
Alphabetical Listing by Major Categories (Continued)

SYSTEM FEATURES (Continued)
Fifteen-Digit Toll Code Restriction
Flexible Intercept Facilities
Flexible System Numbering Plan
FX Trunk Access
High Traffic Capacity
Incoming Class-of-Service Blocking
Least Cost Routing
Least Cost Routing with Provisions for Specialized Common Carrier
Line Lockout – Attendant Intercept
Line Lockout – Automatic
Low Power Consumption
Manual On-Line Diagnostic Testing
Memory Support
Multiple Listed Directory Number
Music on Hold – Line or Trunk Access
Music on Hold – Paging
Music on Hold – System
Night Service Automatic Switching
Off-Premises Station
Power Failure Restart – Floppy Disk
Recall to ANA
Remote Alarm Identification
Remote Customer Memory Updating
Remote On-Line Diagnostic Testing
Remote Traffic and Feature Usage Measurement
Special Night Answer Position
Station Class-of-Service
Station Extension Numbering
Station Message Detail Recording
Station-to-Station Calling
Station-to-Station Class-of-Service Blocking
SMDR Account Codes
System Site ID
T1 Interface
Tandem Trunking
Tie Trunk Access
Traffic and Feature Usage Measurement
Trunk Group Class-of-Service
Trunk-to-Trunk Connections
Uniform Station Distribution Wiring
Variable Timing Parameters
Voice Mail Interface
Voice Paging Access – Zoned and Area
WATS Trunk Access
Zoned Universal Night Answer
ATTENDANT FEATURES
Alert Busy Attendant Indication
Attendant Control of Station Dial Restrictions
Attendant Selective Answering Priority
Automatic Recall on Camp-On
Automatic Recall on Hold
Automatic Recall on No Answer
Automatic Recall Redial
Busy Verification of Station Lines
Busy Verification of Trunks
Call Hold

Table 2.00 SATURN IIE Features
Alphabetical Listing by Major Categories (Continued)

ATTENDANT FEATURES (Continued)
Call Type Display
Call Waiting Indication
Called Extension Status Display
Called Station Number Display
Called Trunk Number Display
Calling Station Number Display
Calling Trunk Number Display
Camp-On
Class of Call Exclusion – Key(s)
Class of Call Exclusion – Programmed
Conference
Console Operation
Control of Facilities
Control of SMDR Facilities
Digital Clock Display
Direct Trunk Access
Direct Trunk Group Access
Extension of Calls
Flexible Key Assignments
Inter-Console Calling and Transfer
Locked Loop Operation
LCR Route Number Display
Minor Alarm Identification
Night Service Control
Numerical Call Waiting Display
Override
Senderized Operation
Serial Calling
Special Account Code Entry – Single-Line Telephone
Special Overflow Answer Position
Switched Loop Operation
Trunk Flash Capability
Trunk Group Alphanumeric Display
Trunk Group Indicators
Volume Control – Audible Alert
Volume Control – Audio
STATION FEATURES
Automatic Call Distribution
Add-On Conference
Attendant Override Security
Automatic Callback on Held Call
Call Forwarding – All Calls
Call Forwarding – Busy Lines
Call Forwarding – Fixed
Call Forwarding – No Answer
Call Forwarding – Return
Call Forwarding – Secretarial
Call Forwarding to Public Network
Call Hold
Call Hold – Flip Flop (Broker)
Call Park
Call Pickup – Directed
Call Pickup – Group
Call Tracing
Call Transfer
Call Transfer Security
Call Transfer with Automatic Camp-On
Call Waiting Indication
Consultation Hold
Data Line Security

Table 2.00 SATURN IIE Features
Alphabetical Listing by Major Categories (Continued)

STATION FEATURES (Continued)
Dial Access to Attendant
Distinctive Ringing
Do Not Disturb
DTMF Dialing
Executive Override
Executive Override – Automatic
Executive Override Security
Executive Override Without Warning Tone
Hold to Attendant
Hot Line Service
Immediate Ringing
Internal Call Queuing – Callback
Internal Call Queuing – Standby
Last Number Redial
Meet-Me Conference
Message Waiting – Automatic Callback
Message Waiting – Cancellation
Message Waiting Capability
Mobile Authorization Codes
Multiline Pickup
Originate Only Service
Outgoing Call Queuing – Callback
Outgoing Call Queuing – Standby
Pilot Number Access
Rotary Dialing
Single-Line Telephone – Special Account Code Entry
Speed Calling – Group
Speed Calling – Individual
Station-Controlled Conference
Station Forced Disconnect
Station Hunting – Busy Advance
Station Hunting – Circular
Station Hunting – No Answer Advance
Station Hunting – Secretarial
Station Hunting – Terminal
Stop Hunt
Terminate Only Service
SDT FEATURES
Abbreviated Ringing – Station Busy
Attendant Identification on Display
Automatic Answer
Automatic Intercom
Automatic Line Preference
Bridged Call
Call Forwarding Display
Call Park Location Number Display
Call Pickup Source Display
Call Privacy
Call Release
Call Transfer to Attendant
Call Waiting Display
Callback Number Display
Common Audible Ringing
Conference Mode Display
Dial Input Verification Display
Direct Station Selection
Direct Trunk Group Selection
Direct Trunk Selection
Duration of Call Display

Table 2.00 SATURN IIE Features
Alphabetical Listing by Major Categories (Continued)

SDT FEATURES (Continued)
Exclusive Hold
Executive Intercom
Feature Buttons
Forced Call Forwarding
Hands-Free Mute
Hands-Free Operation
I-Use Indication
Incoming Call Display
Manual Hold
Manual Intercom
Message Waiting – Selective Automatic Callback
Message Waiting – Selective Cancellation
Message Waiting Source Display
Multiline Pickup
On-Hook Dialing
Pickup Buttons
Recall Identification Display
Saved Number Redial
Speed Calling – Individual List Display
Station-Defined Direct Dial
Station Ringer Cutoff
Station Senderized Operation
SMDR Account Code Display
Time-of-Day Display
Timed-Reminder Service
Voice Announce

2.03 Hardware Description. In its basic configuration, the SATURN IIE System is housed in a single light-weight equipment cabinet, called the basic cabinet (shown in Figure 2.00). In its expanded configuration, the SATURN IIE System is housed in a basic cabinet plus an expansion cabinet, as shown in Figure 2.01. The equipment cabinet(s) contain all functional units of the system. The system is divided into five functional blocks of circuits as shown in the block diagram of Figure 2.02. These functional blocks may be directly related to the system's hardware groups. The functional blocks are as follows:

a. Line/Trunk
b. Switching
c. Control
d. Power
e. Ancillary Equipment

The LINE/TRUNK block circuitry is distributed between the basic shelf and the Line/Trunk Unit (LTU) shelf or shelves. It contains the interfacing circuitry for trunks, station lines, SDTs, Dual-Tone Multifrequency (DTMF) receivers, and the Line/Trunk Unit Control (LTUC) circuitry for LTU shelves.

All trunks (incoming and outgoing) are connected to appropriate trunk circuits. (The trunk circuits carry various designations, depending on their type, such as: TMBA, TMBM, TMIE, etc. These are described in Section 6 of this document.) The trunk circuits interface two- and four-wire E&M, loop start, ground start, and DID trunks to the system.

All conventional telephones (rotary dial and DTMF) are connected to a Subscriber Line Module Analog – Station (SLMA-S or SLA16) or Subscriber Line Module Analog – Off-Premises Station (SLMA-O). SDTs are connected to the system via Subscriber Line Modules Digital (SLMD). Premium Instrument Modules – Digital (PIMD) serve as special line interface circuits that connect attendant consoles to the system. The DTMF receivers are used to detect and validate DTMF tones and detect dial tone on outgoing trunk calls.

The LTUC multiplexes and demultiplexes both the signal and the voice highways, and provides the timing signals necessary to address the LTU circuits allocated in an LTU shelf. The LTUC also provides the necessary interface to the CONTROL and SWITCHING blocks from the LTU shelf LINE/TRUNK block. The LTUC circuitry is not required in the basic shelf because the line and trunks circuits there have direct access to the CONTROL and SWITCHING blocks. Each LTU shelf may be equipped with a maximum of two LTUCs.

The CONTROL and SWITCHING block circuitry is contained in the basic shelf. The CONTROL block consists of the Signal Multiplexer/Clock/Tone Generator (SMXTG);the Signal Buffer, Controller/Input-Output Processor (CIOP); the System Memory (MEM3 and MEM4); the Remote Access Unit/Ports (RAUP); two 5-1/4 inch Floppy Disk Drives (FDDs); and a TTY service terminal interface. The CONTROL BLOCK circuitry receives circuit status signals from the LINE/TRUNK block, evaluates these signals, and determines what type of action is required for the proper processing of the call in progress. This can be one of a number of actions, such as setting up a dial tone connection or interconnection of two circuits. The command signals for the required action are sent to the SWITCHING and LINE/TRUNK blocks for processing.

The SMXTG is divided into three functional parts: a signal multiplexer, the system clock generator, and the tone generator. The signal multiplexer is a hardware-controlled scanner/distributor that provides communication between the LTU PCBs (via LTUCs, except for those located on the basic shelf) and the CIOP. The signal multiplexer also handles control and status signals for the 32 speech highways, each of which has 32 time slots. The clock generator produces the 8.19 MHz, 4.096 MHz, 2.048 MHz, and 250 Hz clocking signals required to properly operate the SATURN IIE System. The tone generator produces all of the required supervisory tones (e.g., dial, busy, ringback, etc.), plus DTMF tones for system outdialing, and provides timing windows for tone and dial pulse cadencing.

The Controller/Input-Output Processor (CIOP) consists of the Signal Buffer (SIB) and the main processor. It provides all of the processor and input/output functions required of a basic system. The SIB contains the circuitry that interfaces the signal multiplexer to the CIOP and also provides the interface for the service terminal. The main processor directly provides inputs to the FDD controllers and performs all system control functions. It uses Programmable Array Logic (PAL) and contains Programmable Read-Only Memory (PROM), Random Access Memory (RAM), a microprocessor, and a bus clock.

The minimum system main Memory (MEM) is 1.25 megabytes, consisting of one 1-megabyte RAM module (MEM4) and one 256K RAM module (MEM3). The memory can be expanded by using either MEM3 or MEM4 modules, depending on memory capacity requirements. The memory functions are controlled via a RAM controller and accessed via a common bus.

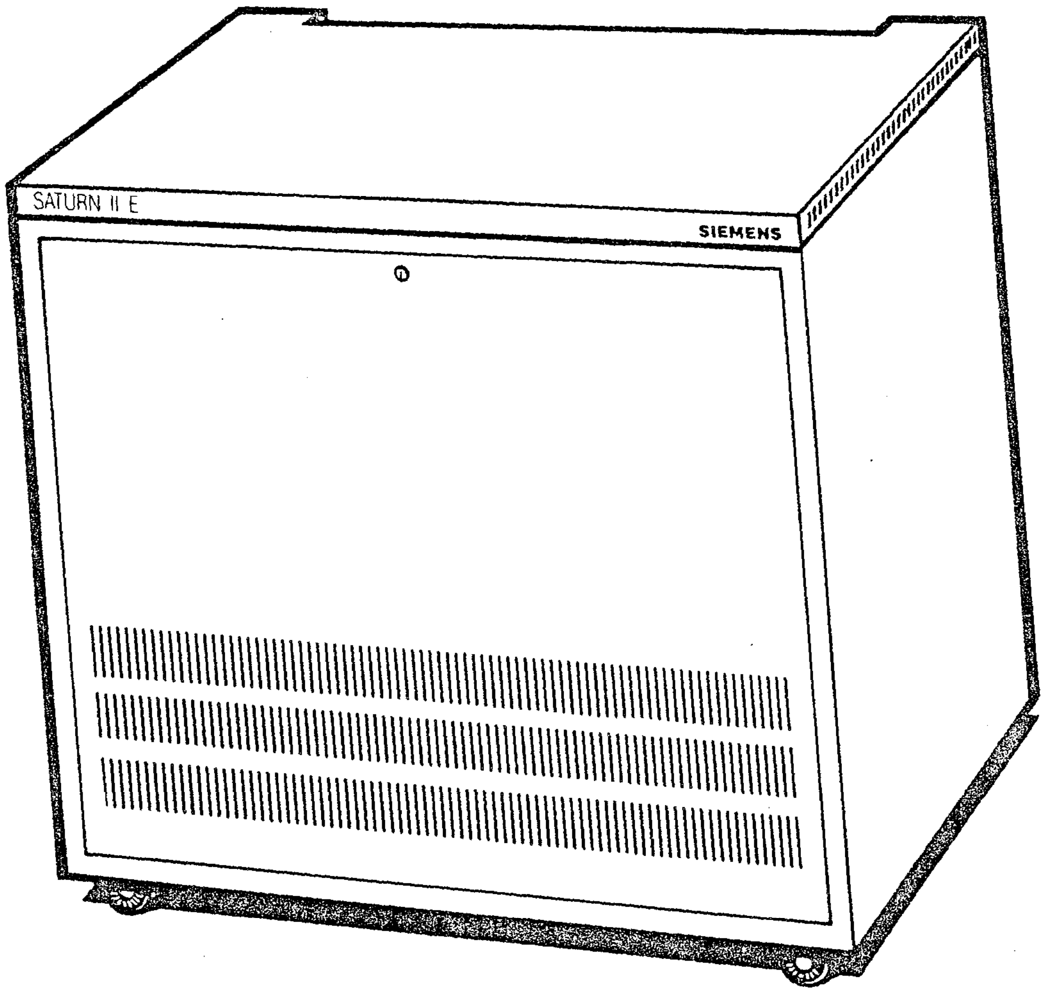

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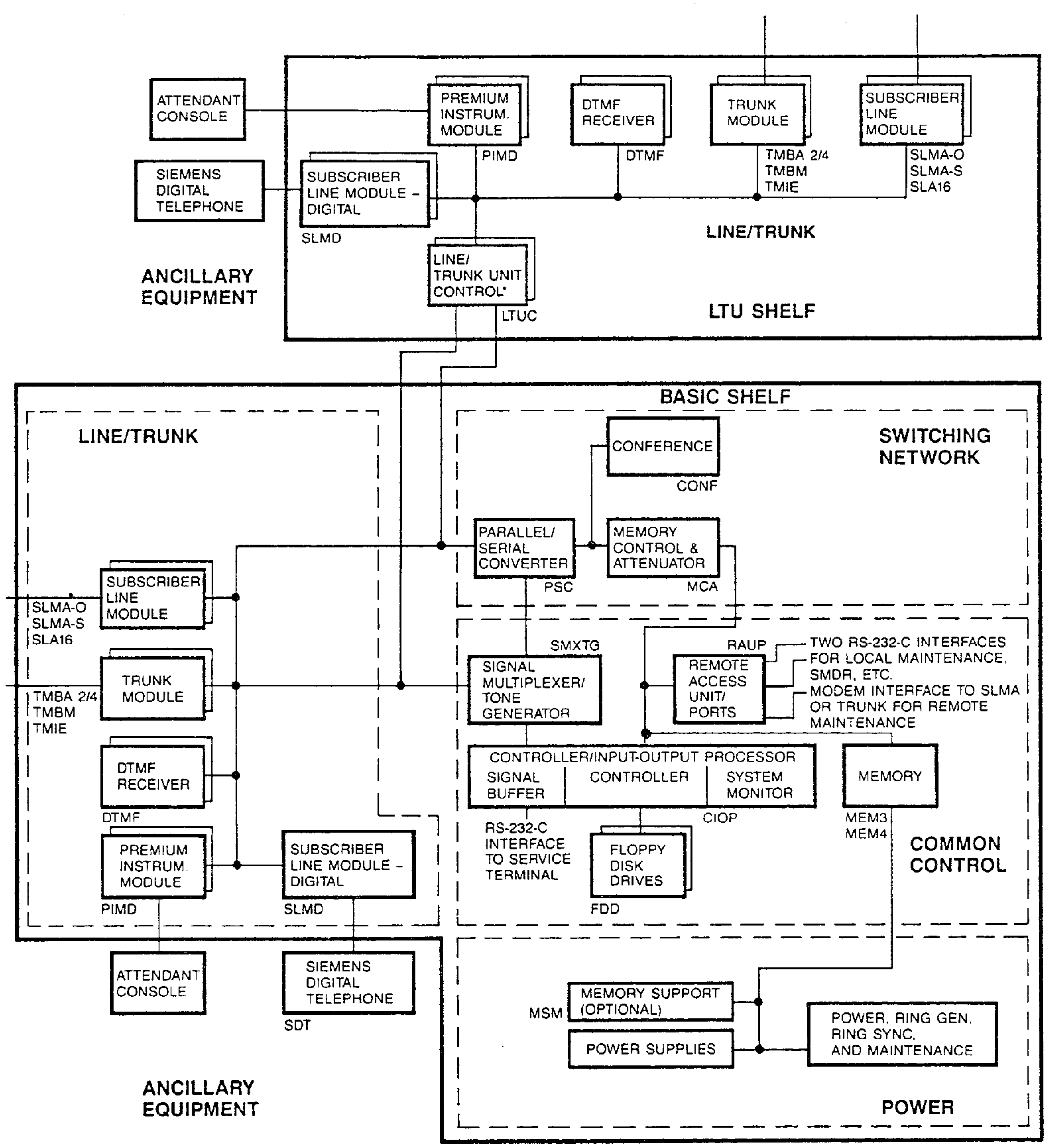
Figure 2.00 SATURN IIE System - Basic Cabinet Only



*TWO LTU CONTROL PCBs PER LTU SHELF (MAXIMUM)

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Figure 2.02. SATURN IIE System Block Diagram

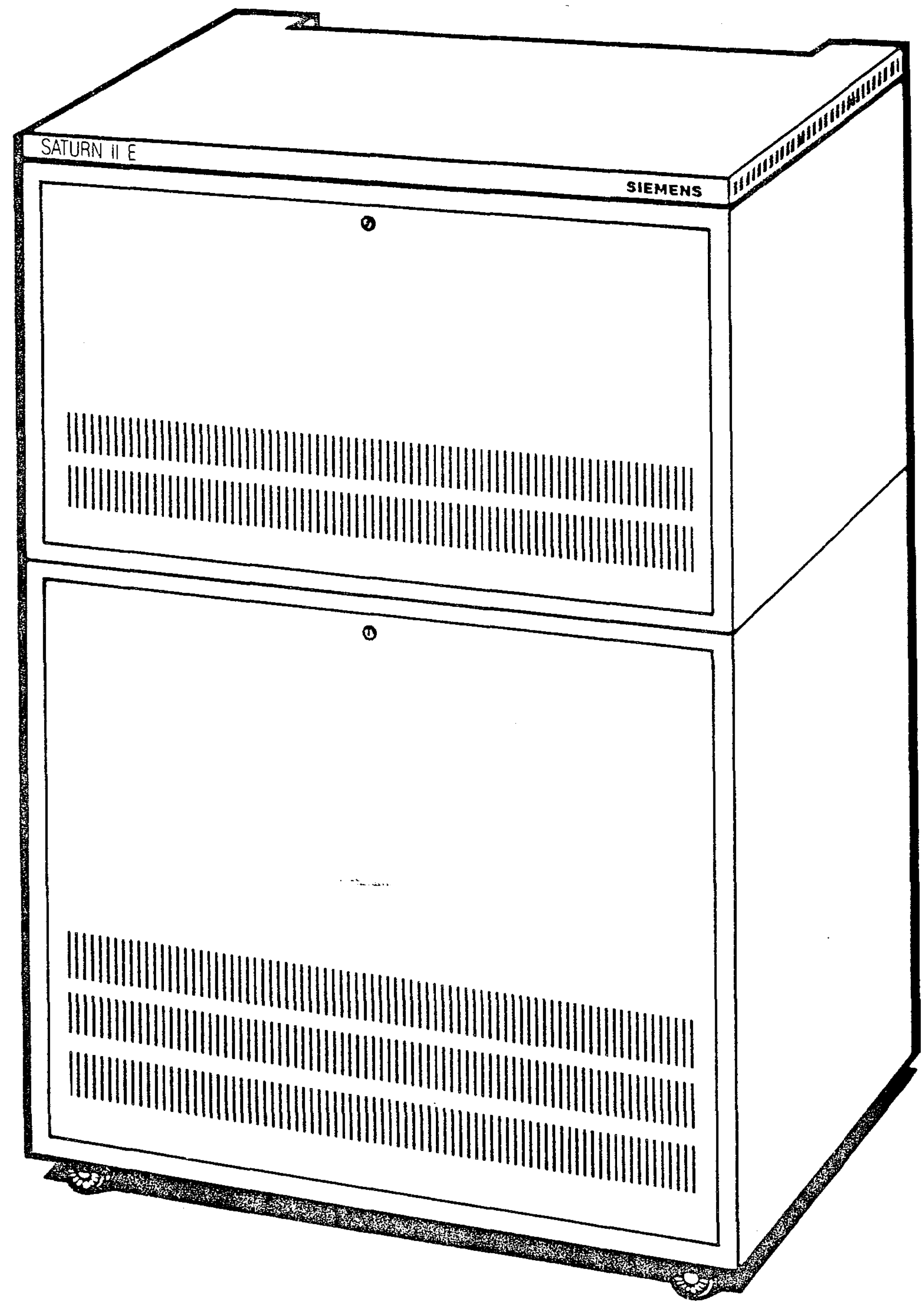

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Figure 2.01 SATURN IIE System – Including Expansion Cabinet

The system also includes two 5-l/4 inch floppy disk drives (FDDs) with one megabyte of memory on each disk for generic and customer data base backup and for CMU procedures.

The Remote Access Unit/Ports (RAUP) module has three (two external) Electronics Industries Association RS-232-C serial asynchronous ports. The two external ports are used for Station Message Detail Recording (SMDR), traffic metering, maintenance, and/or CMU features. The other port is dedicated to the internal RAUP modem (self-setting to either 300 or 1200 baud, depending on the frequency received). Use of the modem provides access for administration and maintenance from a remote service terminal.

The SWITCHING block is under the direction of the CONTROL block. It switches digital signaling data between the LINE/TRUNK block and the CONTROL block and digital voice message data between the SWITCHING block and the LINE/TRUNK block. The SWITCHING block also distributes coded digital control and status data to the CONTROL block circuitry.

The Parallel/Serial Converter (PSC) converts the serial PCM voice signals from the LTUs to eight-bit parallel bytes, which are then multiplexed onto an eight-bit-wide parallel highway and sent to the Memory Control and Attenuator (MCA) circuitry for further processing. The reverse function is also performed to provide serial voice signals back to the LTUs.

The MCA is divided into two functional parts: a time switch unit and the memory control. The time switch unit makes all two-port connections and provides attenuation (as required) for all calls being processed by the system. The memory control receives control data from the processor and causes the time switch unit to make the required connections.

Another element of the SWITCHING block is the Conference (CONF) circuit. The CONF circuit is required for simultaneous connections involving three to seven parties (plus the attendant).

The POWER block of the SATURN IIE System makes use of distributed power to ensure maximum efficiency and reliability. The main POWER section is located on the bottom shelf of the basic cabinet, and one LTU Power Supply (LTUPS) is located next to the left end of each LTU shelf. The main POWER section contains the Power System Unit (PSU) and either one or two -48 Vdc power supplies (-48PS). One of the -48 Vdc power supplies comes with the basic cabinet of the SATURN IIE System. The second -48 Vdc power supply is added when the system is expanded to also contain the expansion cabinet. The PSU contains an ac-dc power supply to provide the +5, -5, +12, and -12 dc voltages used by the basic shelf, a Ring Generator (RGEN), an optional Memory Support Module (MSM) with battery, a fuse/circuit-breaker panel, and maintenance/power logic circuitry.

The ANCILLARY EQUIPMENT block contains the devices which are external to the SATURN IIE System, such as a terminal, the attendant console(s), and the individual telephone sets and SDTs. Additional information regarding the ancillary equipment is presented in Section 7 of this document.

2.04 Software Description. The SATURN IIE System uses software-programmed switching. The system software is contained in two basic areas: on-line (resident) and off-line (nonresident and stored on two 5-1/4 inch floppy disks). The on-line memory is divided into three segments: the generic system software, the customer memory, and an overlay area. Switching control, performed by the Central Processing Unit (CPU), uses data which is stored in generic software. The software that controls the activation of these features resides in the customer memory area, and is alterable via the CMU procedures. (The generic software may not be altered by the customer.) The overlay area of memory contains the administrative and maintenance programs, which are read in from the 5-1/4 inch floppy disks for execution when required by system craft personnel.

The SATURN IIE software is structured such that maintenance and feature upgrade can be easily performed. The SATURN IIE software uses state-event, device-oriented decision tables with a single clock interrupt, event and common queues, and multiple processing levels. A clock interrupt occurs every four milliseconds in the system. These interrupts activate the preprocessor software level which, in turn, processes any change in state condition detected by the peripheral cards. These changes are then queued for processing at the base level processor. The queue is subject to the priority and function of the change.

If, for example, an off-hook state is detected by the preprocessor, it is sorted, prioritized, and queued for the base level processor. After the action request is removed from the queue, the base level processor verifies line appearance and class of service. The base level processor then determines, via the state-event table, the appropriate action required (e.g., to return dial tone to the off-hook line appearance). The base level processor then sends appropriate messages to form a network connection between the line appearance and tone generator circuit ports.

Note that dial tone is generated by the tone generator circuit. The idle level processor (the third level) occurs when free (idle) processing time is used for deferrable maintenance, administrative, and other background testing activities.

Since the features of the SATURN IIE System may be controlled by the customer, an extremely flexible selection and arrangement of the large number of features is possible. In most cases, the features are provided and controlled exclusively by the software routines and require no additional hardware. These features may be added, changed, or deleted by entering the appropriate input commands. In some cases, hardware modifications may be required. These modifications require the installation of one or more printed circuit boards or modification of strapping on existing hardware. Activation of the feature via software is done after completion of any such hardware or wiring changes.

Software changes to the system may be made quickly and with ease. The system accepts simplified, coded instructions via a data entry terminal. The instructions are entered as alphanumeric keywords in response to plain English prompting by the system.

2.05 System Capacities and Specifications. This section of the practice lists the various capacities and specifications pertaining to the SATURN IIE System. The system capacities are outlined in Table 2.01. This table shows the various quantities of stations, trunks, attendant consoles, and other related apparatus that are considered maximum for the SATURN IIE System. Note that all system maximums are not necessarily simultaneously available.

The system uses universal card slots to facilitate individual system configuration engineering.

The SATURN IIE System is compatible with accepted North American telephone industry standards. The system is fully compliant with Federal Communications Commission requirements for connection of terminal equipment to the public telephone network. Table 2.02 lists some of the system transmission characteristics.

The supervisory tones used in the SATURN IIE System (refer to Table 2.03) conform to the North American Precise Tone Plan. Certain timing characteristics associated with various tones can be changed by the customer.

Table 2.01 SATURN IIE System Capacities and Specifications

NOTE: Not all maximums are applicable simultaneously.

TECHNOLOGY	Pulse Code Modulation (PCM) and Time Division Switching Techniques
AVAILABLE SWITCHING PORTS	
Basic Cabinet	224 Ports (Circuits), Basic Shelf 480 Ports (Circuits), Basic Shelf and One LTU Shelf
Basic Cabinet and Expansion Cabinet	736 Ports (Circuits), One LTU Shelf in Expansion Cabinet 992 Ports (Circuits), Two LTU Shelves in Expansion Cabinet
POWER DISSIPATION	
Basic Cabinet	800 watts nominal
Basic plus Expansion Cabinet	1600 watts nominal
CABINET SIZE	
Width	107 cm (42 in.)
Depth	68.6 cm (27 in.)
Height	
Basic Cabinet	111.7 cm (44 in.)
Basic & Expansion Cabinet	179 cm (70.5 in.)
CABINET WEIGHT	
Basic Cabinet	
Fully Loaded	200 kg (440 lbs)
Floor Loading	268.5 kg/sq m (55 lbs/sq ft)
Basic & Expansion Cabinet	
Fully Loaded	311 kg (685 lbs)
Floor Loading	439 kg/sq m (90 lbs/sq ft)
CABINET CONTENTS:	
Basic Shelf	1: Standard
Line/Trunk Unit Shelf	1 to 3: Optional
Floppy Disk Drive	2: Standard
CABINET INPUT POWER REQUIREMENTS	110 Vac, 60 Hz
Basic Cabinet	110 Vac, 60 Hz, 14 Amperes
Basic and Expansion Cabinet	110 Vac, 60 Hz, 26 Amperes*
TEMPERATURE:	
Operating System	4° to 38° C (40° to 100° F)
Storage	-40° to 66° C (-40° to 151° F)
HUMIDITY:	
Operating System	20% to 80% (Noncondensing)**
Storage	0% to 95% (Noncondensing)
ALTITUDE ABOVE SEA LEVEL:	
Operating System	Up to 3,048 meters (10,000 ft)
Storage	Up to 12,192 meters (40,000 ft)

* Uses two ac input power cords

** Above 78 degrees F., humidity must be limited to the equivalent of 49% relative humidity at 100 degrees F.

Table 2.01 SATURN IIE System Capacities and Specifications (Continued)

NOTE: Not all maximums are applicable simultaneously.

DTMF RECEIVERS	32
SWITCHING NETWORK TRAFFIC CAPACITY	36 CCS per port or 1 Erlang per port (non-blocking)
TONE CHANNELS	30 Available
INPUT/OUTPUT INTERFACES	3: RS-232-C 1: Modem
8-PORT CONFERENCE CIRCUITS	4
4-PORT CONFERENCE CIRCUITS	24
SYSTEM FEATURES	
LEAST COST ROUTING	
Area/Office Code Combinations	128,000
Specialized Common Carriers	Up to 3
Digit Number Analysis	Full
Least Cost Routes	50
Trunk Group Elements Within a Route	8
Class-of-Service Priorities	16
Quantity of User On-Hook Queuing Callback Attempts	0 to 9
Dial Tone Detection Available	Full
Time Bands Available	168 (Hour of Day & Day of Week)
Time Schedules Available	8
STATION MESSAGE DETAIL RECORDING	
Call Buffers	255
Standard Account Codes — Numbers	255
Account Codes — Length	1 to 11 Digits per Code
NIGHT SERVICE	
Zoned Universal Night Answer	
• Number of Zones	4
• Trunks per Zone	100%
• Station Access per Zone	100%
Assigned Night Answer	
• Trunk-to-Station Assignments	255
• LDN to ANA Assignments (for DID)	1 per DID Trunk Group
• Special Night Answer Position	1 Station or Hunt Group per System
VOICE MAIL INTERFACE	1 per System
CODE CALLING	
Calling Channels	1
Answerback Channels	Unlimited
AUTHORIZATION CODES	
Direct Inward System Access/Mobile Authorization Codes	2000
SHORT ANNOUNCEMENT SERVICE	
Recorded Announcement Channels for ACD Groups	1
DIAL DICTATION	
Channels	4 (Maximum)
ATTENDANT CONSOLE	
NUMBER OF CONSOLES PER SYSTEM	12 (Maximum)
ATTENDANT KEYS	
Loop Keys	4
Fixed Function Keys	12
Assignable Function Keys	18

Table 2.01 SATURN IIE System Capacities and Specifications (Continued)

NOTE: Not all maximums are applicable simultaneously.

ATTENDANT QUEUES	
Operator Calls (Shared)	48
Incoming Calls (Shared)	255
Recalls (Shared)	48
Trunk Queuing Callback (Shared)	5 (per Console)
DISPLAYS AND INDICATORS	
Number of Display Characters	40
Indicators per Function Key	1
Trunk Group Busy Indicators	24
Miscellaneous Indicators	6
ATTENDANT OVERFLOW FACILITY	
Assigned Positions per System	1 Station or 1 Hunt Group
DISTANCE FROM SYSTEM	610 Cable Meters (2000 Cable Feet)
TRUNKS	
NUMBER OF TRUNK GROUPS PER SYSTEM	32
NUMBER OF TRUNKS	
Total Trunks per System	255
Total per Trunk Group	100
Dedicated Incoming Trunks	255
E&M Type Trunks	255
TRUNK GROUP CLASSES OF SERVICE	1 per Trunk Group
TRUNK GROUP IDENTITY CODES	
Number Available	1 per Trunk Group
Characters per Code	8
ALTERNATE ROUTES PER TRUNK GROUP	3 (Without LCR) 8 Elements per Route with LCR
TRUNK PRIORITY LEVELS (for Attendant Console Queuing)	32
DIRECT INWARD DIALING (DID)	
DID Trunk Groups	32
Number of Digit Translation Tables	4
Digits Expected from Central Office	2 to 5
Digits Absorbed	0 to 3
Digits Prefixed	0 to 2
Digits Translated	2 (Maximum)
Recorded Announcement Channels for Intercept	1
OUTGOING TRUNK QUEUING	
Trunk Groups Assigned with Outgoing Trunk Queuing (Callback and/or Standby)	32
Simultaneous Station Queuing for a Trunk (Callback and/or Standby Shared with Station Automatic Callback)	80
STATIONS	
CONVENTIONAL TELEPHONES	992 (Maximum)
SIEMENS DIGITAL TELEPHONES	*512 (Maximum)

* 16 SLMD cards maximum per shelf.

Table 2.01 SATURN IIE System Capacities and Specifications (Continued)

NOTE: Not all maximums are applicable simultaneously.

STATION FEATURES	
STATION CLASSES OF SERVICE	32
CODE RESTRICTION LISTS	
Eight-Digit Lists	16
Eight-Digit Numbers	16 per List Average (256 Flexible)
Fifteen-Digit Lists	4
Fifteen-Digit Numbers	8 per List Average (32 Flexible)
HUNTING	
Terminal Hunt Groups	Unlimited
Terminal Hunt Group Members	30 per Group
Circular Hunt Groups	Unlimited
Circular Hunt Group Members	30 per Group
Voice/Data Automatic Call Distribution (ACD) Hunt Groups	64
Voice ACD Hunt Group Members	96 per Group
Data ACD Hunt Group Members	96 per Group
Pilot Number Access Hunt Groups	Unlimited
Pilot Number Access Hunt Group Members	30 per Group
CALL PARK	
System Park Locations	10
Station Park Locatiohs (Call Hold)	1 per Station
CALL FORWARDING	
Call Forwarding	
— Variable	
• Availability	100% of Lines
• Simultaneously Active	Unlimited
Call Forwarding	
— Busy Line	
• Availability	100% of Lines
• Simultaneously Active	Unlimited
Call Forwarding	
— No Answer	
• Availability	100% of Lines
• Simultaneously Active	Unlimited
Call Forwarding	
— Secretarial Intercept	
• Availability	100% of Lines
• Simultaneously Active	Unlimited
• Answering Positions	64
Call Forwarding to Public Network	
• Availability	100% of Lines
• Simultaneously Active	32
• Digits per Network Number	18 (Includes Access Code)
CALL PICKUP	
Dial Call Pickup Group	Unlimited
Members per Dial Call Pickup Group	30
Directed Call Pickup Availability	100% of Lines
CONSULTATION, TRANSFER, AND ADD-ON CONFERENCE	
Availability	100% of Lines
Simultaneous Consultations	Unlimited
Simultaneous Transfers	Unlimited
Simultaneous Add-On Conferences	24

Table 2.01 **SATURN IIE System Capacities and Specifications (Continued)**

NOTE: Not all maximums are applicable simultaneously.

STATION FEATURES (Continued)	
CALL WAITING	
Call Waiting Originating	
• Availability	100% of Lines
Call Waiting Terminating	
• Availability	100% of Lines
Simultaneous Calls Waiting	
• Per System	100% of Lines
• Per Line	1 station & any number of trunks
STATION CAMP-ON AND AUTOMATIC CALLBACK	
Availability	100% of Lines
Simultaneous Stations Queued for Callback	80
MESSAGE WAITING LAMPS ON STATIONS	
Availability	100% of stations
Simultaneous Messages Waiting	
• Number per System	108
• Per Conventional Telephone	1
• Per Siemens Digital Telephone (18- and 26-button)	4
SPEED CALLING	
Individual	
• Lists per System	64
• Numbers per List	10
• Digits per Number	18
• Availability	1 Station per List
Group	
• Lists per System	4
• Numbers per List	64
• Digits per Number	18
• Availability	100% per List
System	(See Speed Calling — Group)
LAST NUMBER REDIAL	
Numbers Stored in System	255
Numbers Stored per Station	1
Digits per Number	18
Availability (Stations)	255
NONDIAL LINE SERVICES	
Direct Attendant Signaling Lines	100% of Stations
Switched Direct Line Service	100% of Stations
Nondial Line Destinations	32
TEMPORARY CLASS-OF-SERVICE CHANGE BY ATTENDANT	
Simultaneously Active	Unlimited
SIEMENS DIGITAL TELEPHONES	
Siemens Digital Telephone (SDT)	*512 (Maximum)
Distinct Line Appearances	864
Buttons per Station	16, 18, or 26
Button Appearances per Line	8
Button Maps per System	32
Distance from System	610 Cable Meters (2,000 Cable Feet)

* 16 SLMD cards maximum per shelf.

Table 2.02 Input/Output Impedance, Leak Resistance, and Loop Characteristics

INPUT/OUTPUT IMPEDANCE	
Lines	600 ohms, nominal
Trunks (Strappable)	600 ohms, or Bell City Trunk Termination (OPS Compromise Network)
LOOP CHARACTERISTICS	
Stations Interfaced via SLMA-S or SLA16 Module	1,200 ohms, maximum loop resistance, including telephone 15,000 ohms minimum leak resistance
Stations Interfaced via *SLMA-O Module	1,800 ohms, maximum loop resistance 30,000 ohms minimum leak resistance
Central Office Trunks via TMBM Module	1,200 ohms, maximum loop resistance, with 48-volt (nominal) battery 30,000 ohms minimum leak resistance
Direct Inward Dial Trunks via TMIE Module	2,450 ohms, maximum loop resistance 30,000 ohms minimum leak resistance

* SLMA-O module is registered with FCC for Class C operation

Table 2.03 SATURN IIE Supervisory Audible Tones

Tone Name	Frequency	Timing Rate
Dial Tone	350 + 440 Hz	Steady tone.
Reorder Tone	480 + 620 Hz	Repetition of tone ON for 0.25 second and tone OFF for 0.25 second.
Busy Tone	480 + 620 Hz	Repetition of tone ON for 0.5 second and tone OFF for 0.5 second.
Audible Ring Tone	440 + 480 Hz	Repetition of tone ON for 0.8 – 1.2 seconds and tone OFF for 2.7 – 3.3 seconds.
Recall Dial Tone	350 + 440 Hz	Three bursts of tone ON for 0.08 – 0.12 second and tone OFF for 0.08 – 0.12 second, followed by dial tone.
Special Audible Ring Tone	440 + 620 Hz	Repetition of combined tone ON for 0.8 – 1.2 seconds, followed by 440 Hz tone ON for 0.2 second and tone OFF for 2.7 – 3.3 seconds.
Intercept Tone	440 + 620 Hz	Repetition of alternating the two frequencies, each ON for 0.16 – 0.3 second, with a total cycle duration of 0.5 second.
Call Waiting Tone(s)	440 Hz	One burst of tone ON for 0.1 – 0.3 second for a waiting station call. Two bursts of tone ON for 0.1 – 0.3 second apart for a waiting attendant or trunk call.
Busy Override Tone (also, Attendant Override Tone)	440 Hz	Three bursts of tone ON for 0.25 second and tone OFF for 1.75 seconds, followed by attendant connection.
Executive Override Tone	440 Hz	One burst of tone ON for 2.0 – 4.0 seconds before overriding station intrudes.
Confirmation Tone	350 + 440 Hz	Three bursts of tone ON for 0.08 – 0.12 second, 0.08 – 0.12 second apart.
Camp-On Tone (also, Low Tone or Uninterrupted BusyTone)	480 + 620 Hz	Steady tone.

Table 2.03 SATURN IIE Supervisory Audible Tones (Continued)

Tone Name	Frequency	Timing Rate
Invalid Camp-On Tone	480 + 620 Hz	Repetition of tone ON for 0.125 second and tone OFF for 0.125 second.
Conference Tone	440 Hz	One burst of tone ON for 0.4 – 0.6 second, followed by conferee connection.
Quiet Tone	0 Hz	Steady tone.
Busy Override Injection Tone (also, Privacy Tone)	440 Hz	Bursts of tone ON for 0.25 second, 8 – 20 seconds apart, applied while an overriding party is present on a connection
Route Advance Tone (for Least Cost Routing - LCR)	350 + 440 Hz	One burst of tone ON for 0.08 – 0.12 second.
Warning Tone (also, Expensive Facility Tone - LCR)	440 Hz	One burst of tone ON for 0.8 – 0.12 second.
Test Tone	1004 Hz	Steady tone.
Negative Acknowledgement (NAK) Tone	480 + 620 Hz	1.5 seconds (i.e., three cycles) of reorder tone.

SECTION 3.00 SATURN IIE EQUIPMENT CABINET

3.01 Cabinet Layout. The SATURN IIE System consists of either a basic cabinet only (Figure 3.00) or a basic cabinet plus an expansion cabinet as shown in Figures 3.01 and 3.02. The basic cabinet contains an LTU shelf, a basic shelf, and an area at the bottom of the cabinet where the main power section and floppy disk drives are located.

The basic shelf is always equipped in the system. It contains all the PCBs that make up the common control and switching circuitry for the SATURN IIE System, plus seven LTU channel groups containing 224 port circuits.

One LTU shelf may optionally be equipped in the basic cabinet. It provides an additional 256 ports in eight channel groups for a total of 480 ports in the basic cabinet. This LTU shelf requires an LTU Power Supply (LTUPS).

The expansion cabinet, which mounts on top of the basic cabinet, expands the basic cabinet by either one or two additional LTU shelves (Figures 3.01 and 3.02). Each of these shelves has its own LTUPS and provides eight channel groups for a total of 256 ports per shelf. Thus, when the expansion cabinet is added, the expanded system may have a total of either 736 or 992 ports. When the expansion cabinet is added, the top cover is removed from the basic cabinet and reinstalled as the top cover of the expansion cabinet.

The LTU portion of the system is arranged in channel groups of 32 channels each, one channel being used for each port. Each channel group consists of universal card slots. Some of the channel groups contain four card slots each, and the others contain two card slots each. Each card in a channel group contains either two, four, eight, or sixteen circuits, depending on the card type. Each circuit uses one port on the system (except in the case of the PIMD card, each circuit of which takes up two ports).

The main power section is located at the bottom of the cabinet. This section contains the Power System Unit (PSU), one or two -48 Vdc power supplies depending upon whether or not the expansion cabinet is equipped, and the two FDDs required by the system. The following units are housed within the PSU:

a. ac/dc power supply to supply +5, -5, +12, and -12 Vdc to the basic shelf.

b. Ring generator.

c. Memory Support Module (MSM), optional, with battery.

d. Fuse/circuit breaker panel

e. Control Logic PCB.

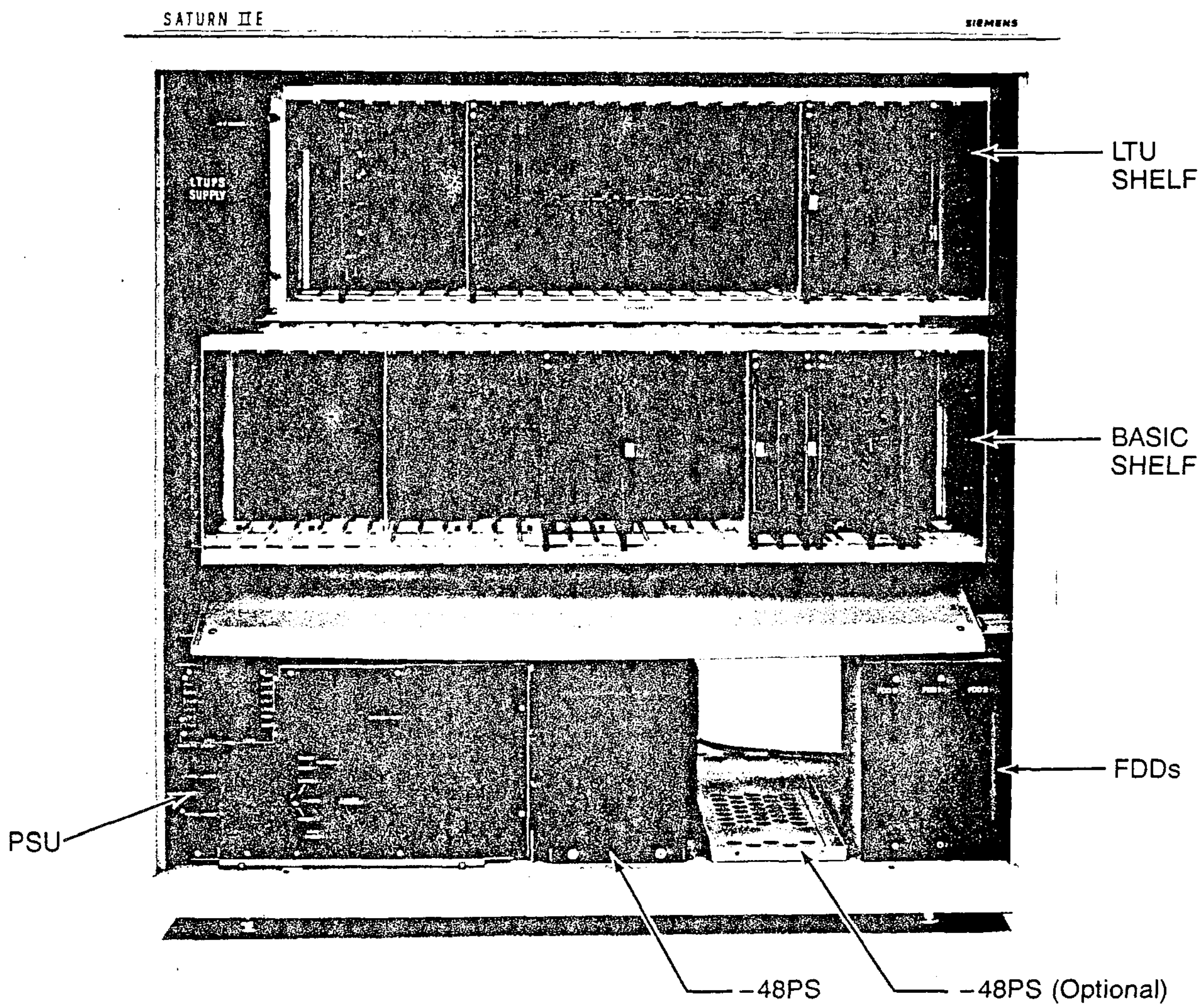

Figure 3.00 SATURN IIE Basic System – Front View

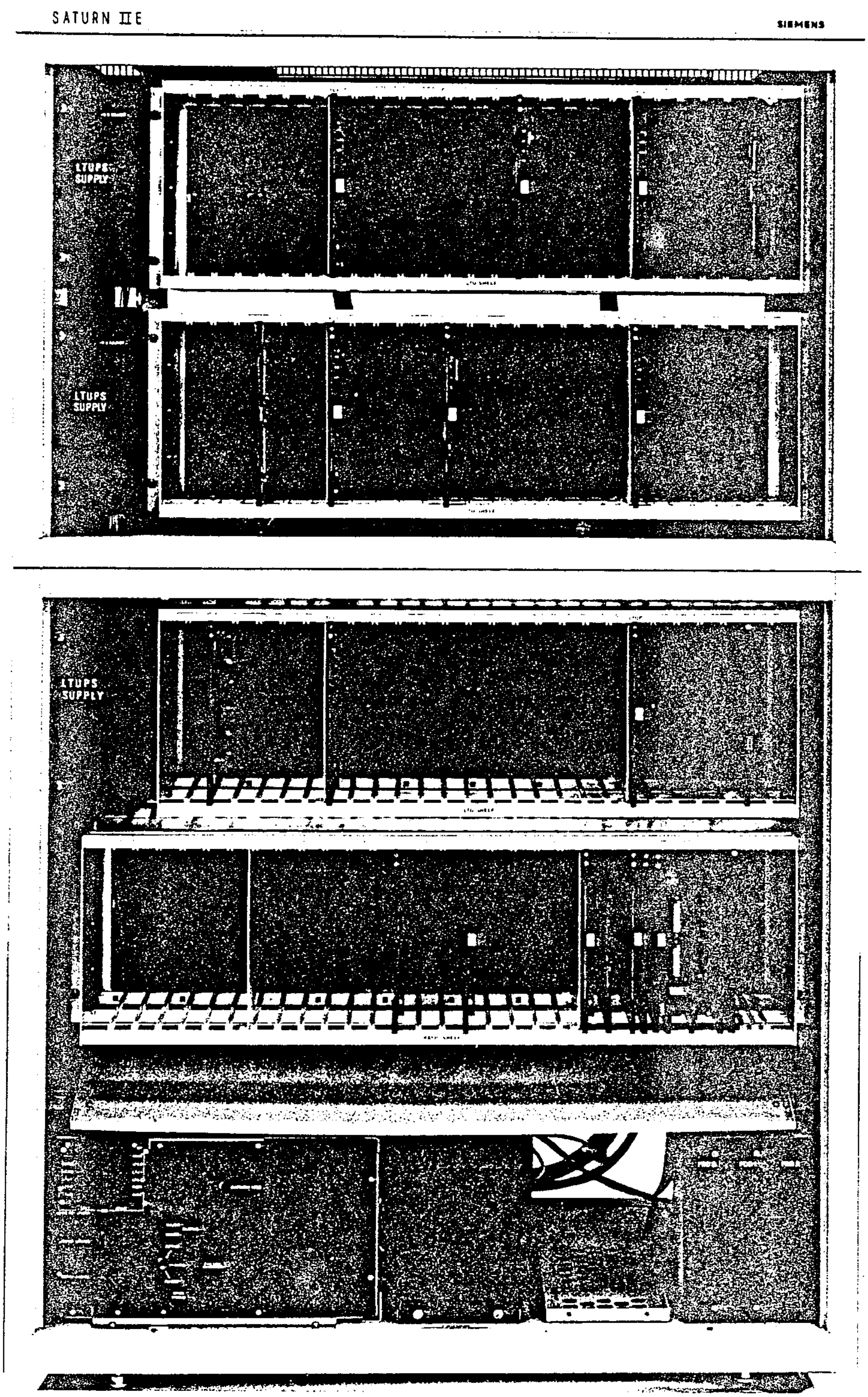

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Figure 3.01 SATURN IIE Expanded System – Front View

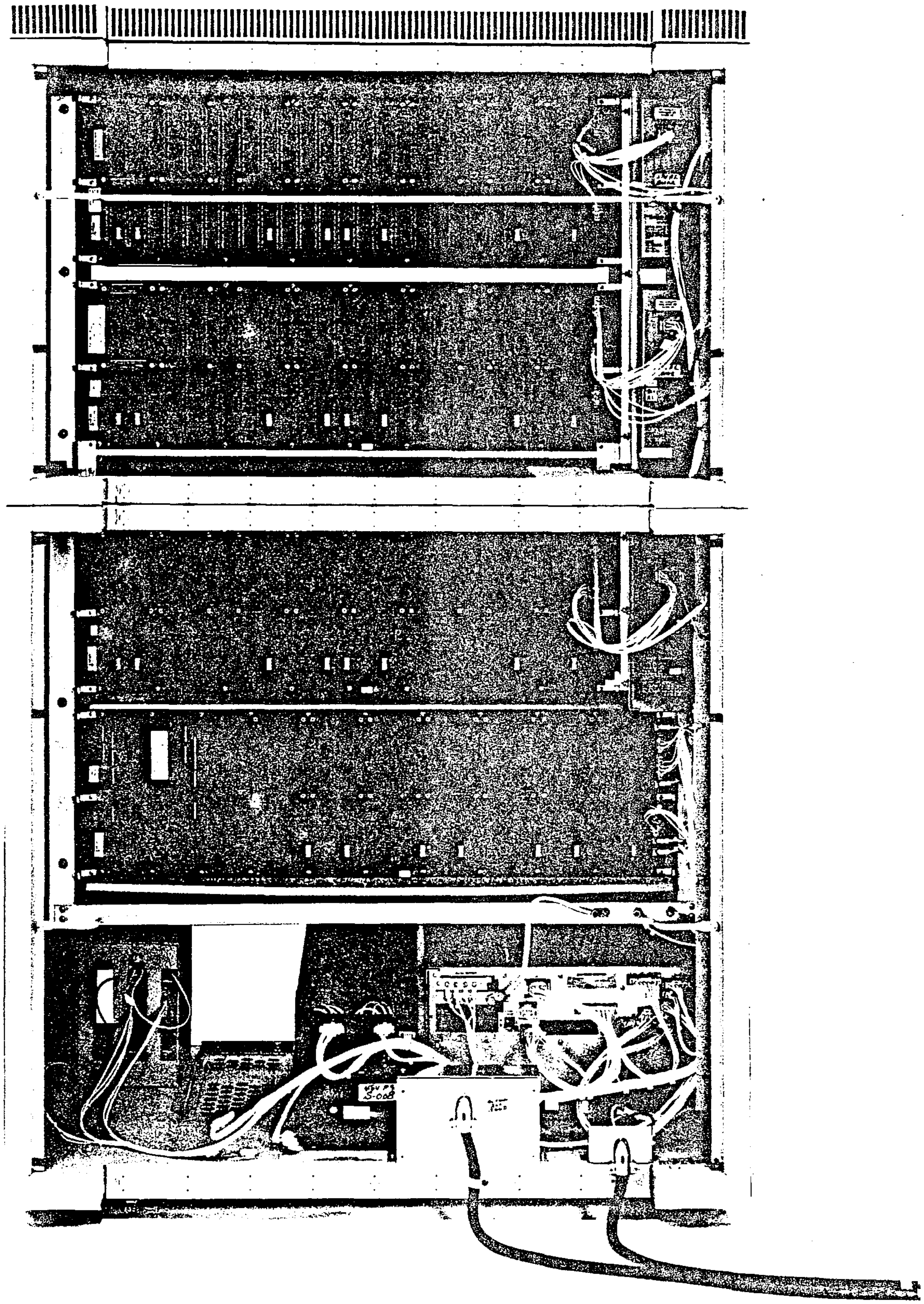

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Figure 3.02 SATURN IIE Expanded System – Rear View

3.02 Line/Trunk Unit Shelf. The LTU shelf, shown in Figure 3.03, can contain eight channel groups of LTU modules, consisting of the DTMF receiver, line, and trunk PCBs, two Line/Trunk Unit Control (LTUC) PCBS, and an LTUPS.

The LTUCs interface with the common control area in the basic shelf and communicate with the LTU peripheral PCBs.

The LTU peripheral PCBs provide the interface between the SATURN IIE System and the external devices, which include the station lines, trunks, and attendant consoles. All of the types of LTU PCBs used in the LTU shelf and the LTU portion of the basic shelf are listed in Table 3.00. The LTUC cards are assigned to slot 6 and/or 19 of the applicable LTU shelf. Assignment of the other LTU PCBs is as described in the Installation document in this series of Practices.

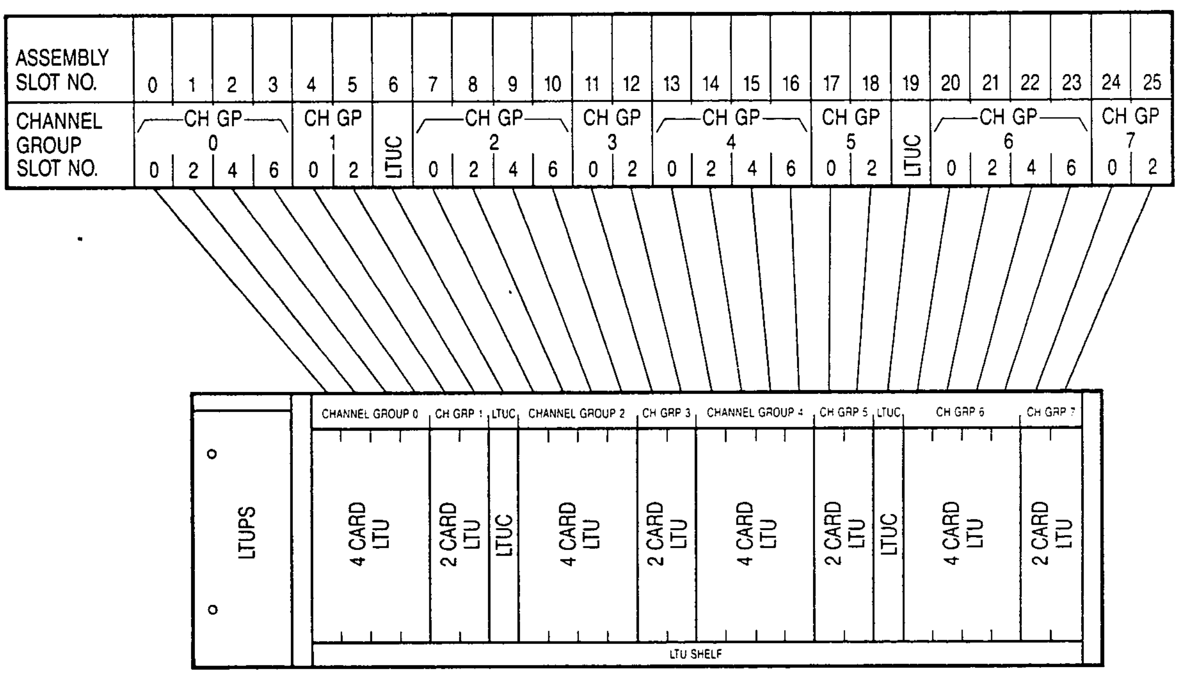

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Figure 3.03 Line/Trunk Unit Shelf

Table 3.00 LTU Printed Circuit Boards on LTU Shelf and Basic Shelf

DESIGNATION	TITLE
DTMF	DUAL-TONE MULTIFREQUENCY RECEIVER (Equip per Data Base Preparation Tables)
LTUC (LTU shelf only)	LINE/TRUNK UNIT CONTROL (One per four channel groups)
PIMD	PREMIUM INSTRUMENT MODULE DIGITAL
SLA16	SUBSCRIBER LINE MODULE ANALOG – 16 LINES
SLMA-O	SUBSCRIBER LINE MODULE ANALOG – OFF-PREMISES STATION
SLMA-S	SUBSCRIBER LINE MODULE ANALOG – STATION
SLMD	SUBSCRIBER LINE MODULE DIGITAL
TMBA-2	2-WIRE E&M TRUNK
TMBA-4	4-WIRE E&M TRUNK
TMBM	CENTRAL OFFICE TRUNK
TMIE	DIRECT INWARD DIALING TRUNK

3.03 Basic Shelf. The basic shelf is shown in Figure 3.04. The basic shelf contains seven channel groups of LTU modules and all the PCBs that make up the common control and switching circuitry of the SATURN IIE System. Figure 3.04 shows the locations of all the PCBs in the basic shelf. The common control and switching PCBs are listed in Table 3.01. Note that two RAM printed circuit boards are provided: one 1 megabyte PCB (MEM4) and one 256 kilobyte PCB (MEM3). This is the minimum RAM configuration. Two additional memory slots (for a total of 4) are provided for future inclusion of more memory if needed. In case of failure of the commercial power source, the Memory Support Module (MSM) protects the data stored in memory for 5 minutes (at present, only three of the memory slots are wired for this protection).

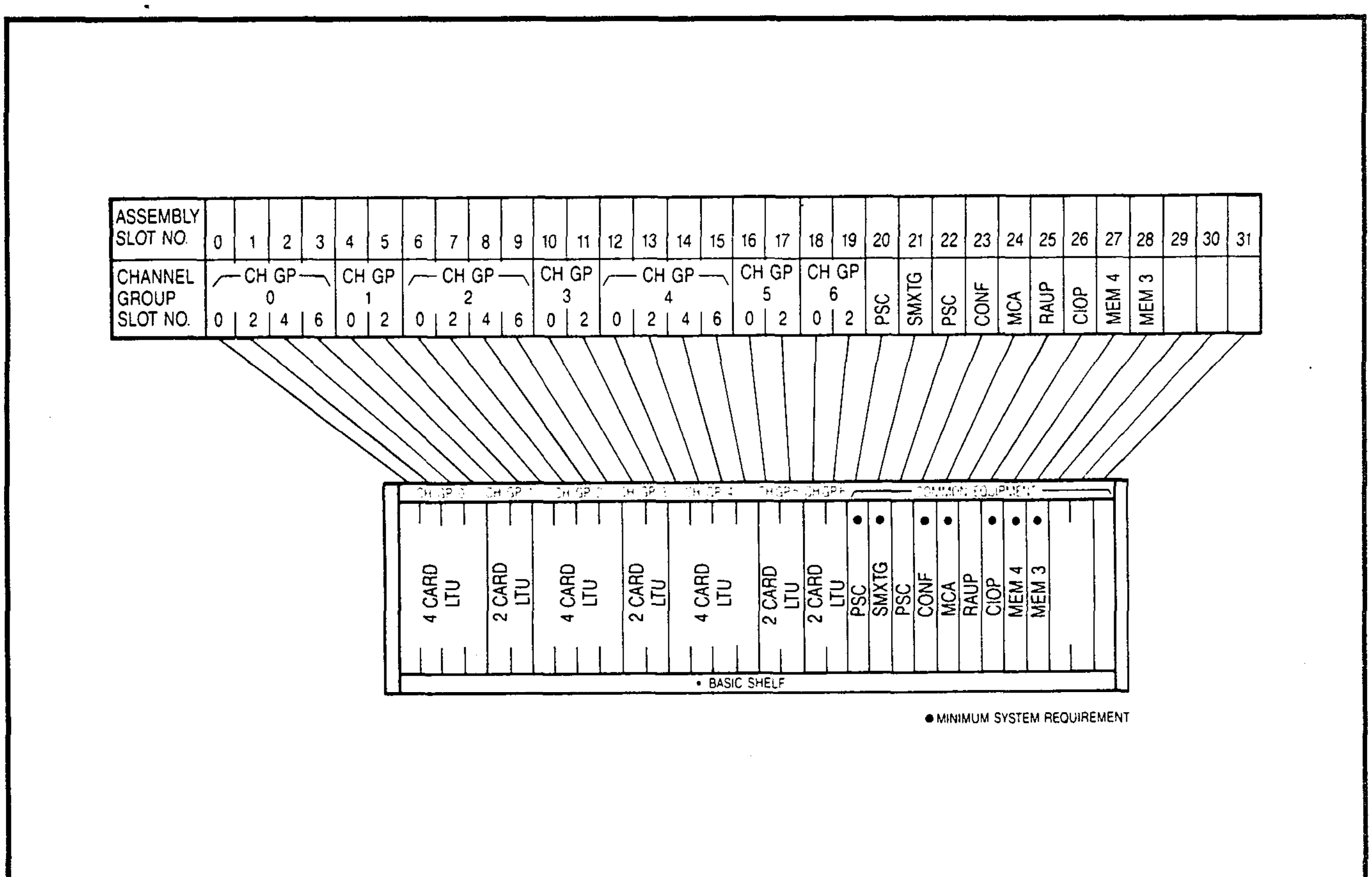

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Figure 3.04 Basic Shelf

Table 3.01 Common Equipment Printed Circuit Boards on Basic Shelf

DESIGNATION	TITLE	ASSIGNED SLOT NUMBER (Note 1)
RAUP	REMOTE ACCESS UNIT/PORTS	25
SMXTG	SIGNAL MULTIPLEXER/TONE GENERATOR	21
MCA	MEMORY CONTROL AND ATTENUATOR	24
CIOP	CONTROLLER/INPUT-OUTPUT PROCESSOR	26
MEM4 MEM3	MEMORY (4) 1 megabyte MEMORY (3) 256K	27 28
PSC	PARALLEL-TO-SERIAL CONVERTER	20 22 (Note 2)
CONF	CONFERENCE	23

NOTES: 1. Slot numbers refer to card slots in basic shelf.
2. Second PSC required only when system includes expansion cabinet.

SECTION 4.00 POWER SUPPLIES

4.01 Main Power Section. As noted previously, the SATURN IIE System makes use of distributed power in the cabinet. Several power supplies are used within the system, some in the main power section located at the bottom of the basic cabinet, some on the LTU shelves (see Figure 4.00). These power supplies provide +5 Vdc, -5 Vdc, +12 Vdc, -12 Vdc, -48 Vdc, and 90 Vac at 20 Hz for ringing voltage. The standard input power for the system is a 110 Vac, 60 Hz commercial source. The main power section consists of the Power System Unit (PSU) and one or two -48 Vdc power supplies: one if there is only the basic cabinet, two if the expansion cabinet is also equipped. (In systems where only the basic cabinet is used, there is a single ac power inlet at the rear of the cabinet; when the expansion cabinet is also used, a second ac power inlet at the rear of the basic cabinet is provided. The Installation practice in this series gives a full description of the steps necessary when making this change.)

Two floppy-disk drives (FDD0 and FDD1) are located on the same shelf as the main power section.

4.02 Power System Unit. The PSU is an integrated assembly containing the following functional elements (described in paragraphs 4.03 through 4.07):

a. Basic shelf power supply
b. Memory Support Module (MSM), optional
c. Control logic
d. Ring generator
e. Power supply circuit breakers

4.03 Basic Shelf Power Supply. The basic shelf power supply is an ac-to-dc converter that provides +5, -5, +12, and -12 Vdc power to the basic shelf.

4.04 Memory Support Module. The Memory Support Module (MSM) assembly is an optional battery backup package that provides +5 Vdc to the RAM memory when the commercial ac power source fails. In the event of such failure, the battery maintains the data stored in memory for at least five minutes. When the ac power source is restored within this period, the memory does not have to be reloaded from disk; system operation can begin immediately. The MSM is capable of another 5-minute backup cycle after 30 minutes of recharging. (The unit includes the battery charging apparatus and is under a "float" charge during normal operation.) For power failure periods longer than 5 minutes, program memory is automatically reloaded from floppy disk when power is restored.

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4.05 Control Logic. The control logic performs the following functions:

a. Power Failure Interrupt (PFI). Generates a nonmaskable interrupt to the CIOP when input power drops to the brown-out level (95 to 97.5 Vac) and returns to normal when power becomes higher than 100 Vac.

b. Ring synchronization. Generates the timing signals for operating and releasing ringing relays.

c. Ringing/message-waiting control. Selects either ring output or message-waiting output for connection to the ringing bus.

d. Fuse alarms. Monitors each fuse and causes an alarm upon any fuse failure.

4.06 Ring Generator. The ring generator is a single-frequency power supply that provides 90 Vac rms at 20 Hz for station ringing, and 97 Vdc (nominal) for message waiting indications. It provides sufficient power to ring up to 42 stations simultaneously (21 stations each on two different phases of ringing) and to provide a message-waiting indication on 108 stations simultaneously.

4.07 Power Supply Circuit Breakers. There are circuit breakers for each of the ac inputs to the system (e.g., to the basic shelf power supply, each LTUPS, each -48PS, etc).

4.08 Line/Trunk Unit Power Supply. The LTUPS module assembly is an ac-to-dc converter which provides +5, -5, +12, and -12 Vdc power to its associated LTU shelf. This supply, located adjacent to the left side of each LTU shelf, powers one entire LTU shelf.

4.09 48-Volt Power Supply. The -48 Volt Power Supply (-48PSn, where n is designated 0 through 1 in the cabinet) module assembly is an ac-to-dc converter that provides two -48 Vdc outputs. One -48 Vdc output is used for talk battery for analog lines (SLTs), and the other -48 Vdc output is used for PIMD/SLMD applications (i.e., powering attendant consoles and SDTs, respectively) and power input to the ringing generator in the PSU. The system cabinet may contain either one or two -48PS module assemblies: one for the basic cabinet and a second when the expansion cabinet is equipped.

SECTION 5.00 MISCELLANEOUS MODULE ASSEMBLIES

5.01 Floppy Disk Drive. Two FDDs are used as random-access storage devices, each using a floppy disk as the back-up memory storage medium. The double-sided, quad-density, 5-1/4 inch, removable disks are capable of storing one megabyte of formatted data each.

SECTION 6.00 PRINTED CIRCUIT BOARDS

6.01 Dimensions. The plug-in PCBs are 230 mm (9.02 in.) high by 280 mm (11.02 in.) deep. A complete list of the PCBs used in the SATURN IIE System is shown in Table 6.00.

Each PCB has two edge-connector tab areas with 60 terminals each. The PCBs plug into two mating 60-pin connectors mounted on the backplane of the basic and LTU shelves. There are two types of PCBs: peripheral and control. The type of PCB may be readily identified because the peripheral PCBs have a notch separating the edge connector tab areas and the control PCBs do not. Two extractor levers, mounted on the front edge of each PCB, allow for easy insertion or removal from the shelf connectors.

Some PCBs and module assemblies include strapping options. Refer to the SATURN IIE EPABX Installation Procedures practice for detailed information pertaining to these options.

Table 6.00 SATURN IIE Printed Circuit Boards

DESIGNATION/TITLE		FUNCTION
CIOP	CONTROLLER/INPUT-OUTPUT PROCESSOR	Main controller and input-output processor. Interfaces both floppy disk drives, system memory, the RAUP, the SMXTG, and the MCA. The signal buffer, part of the CIOP, directly controls the service terminal interface.
DTMF	DUAL-TONE MULTI-FREQUENCY RECEIVER	Detects and validates DTMF tone. Contains 4 receivers per PCB, plus dial tone detector circuitry.
MEM3	MEMORY (256K)	MEM3 and MEM4 together provide 1.25 megabytes of dynamic RAM for call processing, which is loaded initially from floppy disks. All SATURN IIE systems require at least 1.25 megabytes of memory.
MEM4	MEMORY (1 MEGABYTE)	
MCA	MEMORY CONTROL AND ATTENUATION	Provides the time-switching function and the interface between the switching network and the speech highways; provides attenuation (as required) for all calls, and receives control data from the CIOP to make the required two-port connections.
CONF	CONFERENCE CIRCUIT	Provides 4 eight-port conference circuits plus 24 four-port conference circuits required for the consultation and transfer feature.
PSC0	PARALLEL/SERIAL CONVERTER	Provides interface between the switching network and the speech highways in the basic cabinet.
PSC1*	PARALLEL/SERIAL CONVERTER	Provides interface between the switching network and the speech highways in the expansion cabinet.
LTUC	LINE/TRUNK UNIT CONTROL	Provides the timing signals necessary to address a peripheral PCB. Multiplexes and demultiplexes both signal and voice highways.
PIMD	PREMIUM INSTRUMENT MODULE DIGITAL	Provides an interface between the system and two attendant consoles.
RAUP	REMOTE ACCESS UNIT/PORTS	Two external and one internal RS-232-C ports allow remote access to the system for maintenance and administrative functions. The internal port is dedicated to a 103 or 212A modem.
SLMA-S	SUBSCRIBER LINE MODULLE ANALOG – DIGITAL	Provides eight interfaces between rotary dial and/or DTMF station instruments and the system.
SLA16	SUBSCRIBER LINE ANALOG – 16 LINES	Provides 16 interfaces between rotary dial and/or DTMF station instruments and the system.
SLMD	SUBSCRIBER LINE MODULE DIGITAL	Provides an interface between eight Siemens Digital Telephones (SDTs) and the system.

* Optional PCB

Table 6.00 SATURN IIE Printed Circuit Boards (Continued)

DESIGNATION/TITLE		FUNCTION
SLMA-O	SUBSCRIBER LINE MODULE ANALOG – OFF-PREMISES STATION	Provides an interface between the system and four Off-Premises Stations (OPS). This module is resgistered with the FCC for Class C off-premises operation.
SMXTG	SIGNAL MULTIPLEXER/TONE GENERATOR (32 CHANNEL)	Distributes control signals; receives status signals from the 992 ports; contains the system clock source; produces all of the required supervisory signals (e.g., dial tone, busy tone, ringback tone) and the DTMF tone pairs required for system outpulsing.
TMBA-2	2-WIRE E&M TRUNK	Provides four trunk circuits, each arranged for either one-way or two-way direct inward and outward service with two-wire E&M signaling.
TMBA-4	4-WIRE E&M TRUNK	Provides four trunk circuits, each arranged for either one-way or two-way direct inward and outward service with four-wire E&M signaling.
TMBM	CENTRAL OFFICE TRUNK	Provides four trunk circuits, each arranged for either one-way or two-way direct inward and outward service for CO, FX, and WATS applications.
TMIE	DIRECT INWARD DIALING TRUNK	Provides four trunk circuits, each arranged for one-way direct inward dialing service applications from the CO.

6.02 Controller/Input-Output Processor. The CIOP board, shown in Figure 6.00, contains the main processor (consisting of a microprocessor and related bus circuitry), signal interface circuitry, PROM and RAM. The CIOP board also contains timing circuitry, maintenance and reinitialization switches, status indicators and a Signal Buffer (SIB).

The main processor provides the input/output function for the floppy-disk-drive controllers. The SIB processor controls the RS-232-C interface to the service terminal (TTY).

6.03 Signal Multiplexer/Tone Generator. The SMXTG PCB, shown in Figure 6.01, contains three circuits. Two of these consist of the signal multiplexer and the clock generator. The signal multiplexer circuit is a hardware-controlled scanner/distributor that provides communication between the peripheral PCBs and the CIOP. It also handles the control and status signals for the 32 speech highways, each of which has 32 time slots.

The clock generator portion consists of a crystal-controlled oscillator and down counter which produces the 8.19 MHz, 4.096 MHz, 2.048 MHz, and 250 Hz clocking signals required by various elements of the SATURN IIE System.

The tone generator produces all of the required supervisory tones (e.g., dial tone, ringback tone, busy tone, etc.) and provides software-controlled timing windows for dial pulse timing and tone cadences.

6.04 Parallel/Serial Converter. The PSC board, shown in Figure 6.02, converts the serial PCM voice signals from the LTUs to eight-bit parallel bytes, which are then multiplexed onto an eight-bit-wide parallel highway and sent to the MCA circuitry for further processing. The PSC also provides this function in reverse to provide a serial voice path back to the LTUs. One PSC is required for the basic shelf, and another is added when the expansion cabinet is equipped.

6.05 Memory Control and Attenuation. The Memory Control and Attenuation (MCA) PCB, shown in Figure 6.03, contains two circuits: the Time Switch Unit (TSU) and the control memory. The TSU makes all two-port connections and provides attenuation for all calls being processed with the SATURN IIE System.

The control memory receives control data from the main processor and causes the PSU and the conference units to make the required connections.

6.06 Conference. The CONF board, shown in Figure 6.04, is required for all conference connections involving three to seven parties. It provides four 8-port conference circuits and twenty-four 4-port conference circuits required for consultation and transfer features.

6.07 Memory. One 256K PCB (MEM3), shown in Figure 6.05, and one 1-megabyte PCB (MEM4), shown in Figure 6.06, are supplied with the system to provide the overall minimum required memory of 1.25 megabytes. The memory functions are controlled via a RAM controller and accessed via a common bus.

6.08 Dual-Tone Multifrequency Receiver. The DTMF board, shown in Figure 6.07, provides the means for detecting and validating DTMF tones and dial tone. Each DTMF board contains four separate DTMF and dial tone receiver circuits (numbered 0, 2, 4, and 6).

6.09 Remote Access Unit/Ports. The Remote Access Unit/Ports (RAUP) PCB, shown in Figure 6.08, has three (two external) Electronics Industries Association RS-232-C serial asynchronous ports. The two external ports are used for Station Message Detail Recording (SMDR), traffic metering, maintenance, and/or CMU features. The other port is dedicated to the internal RAUP modem (self-setting to either 300 or 1200 baud, depending on the frequency received). Use of the modem provides access for administration and maintenance from a remote service terminal.

6.10 Line/Trunk Unit Control. The LTUC, shown in Figure 6.09, multiplexes and demultiplexes both the signal highway and the voice highway, and provides the timing signals necessary to address the LTU circuits allocated in an LTU shelf. The LTUC also provides the necessary interface to the control and switching blocks from the LTU circuitry. The LTUC is not required in the basic shelf because the line and trunks circuits there have direct access to the control and switching circuitry. Each LTU shelf requires one LTUC for every four channel groups, for a maximum of two LTUCs per LTU shelf.

6.11 Subscriber Line Module Analog – Station. The SLMA-S board, shown in Figure 6.10 provides an interface between conventional rotary-dial or DTMF-signaling telephone sets and the SATURN IIE System. The SLMA-S provides eight ports. Each of the eight circuits (numbered 0 through 7) provides the required supervision and signaling for its associated peripheral equipment.

6.12 Subscriber Line Module Analog – Off-Premises Station. The SLMA-O board, shown in Figure 6.11, provides an interface between Off-Premises Stations (OPS) and the SATURN IIE System. The Off-Premises Stations can be rotary dial or DTMF signaling telephones. The SLMA-O provides four ports. Each of the four circuits (numbered 0, 2, 4 and 6) provides the required supervision and signaling for its associated peripheral equipment. The OPS stations can operate over a loop of 0 to 1800 ohms.

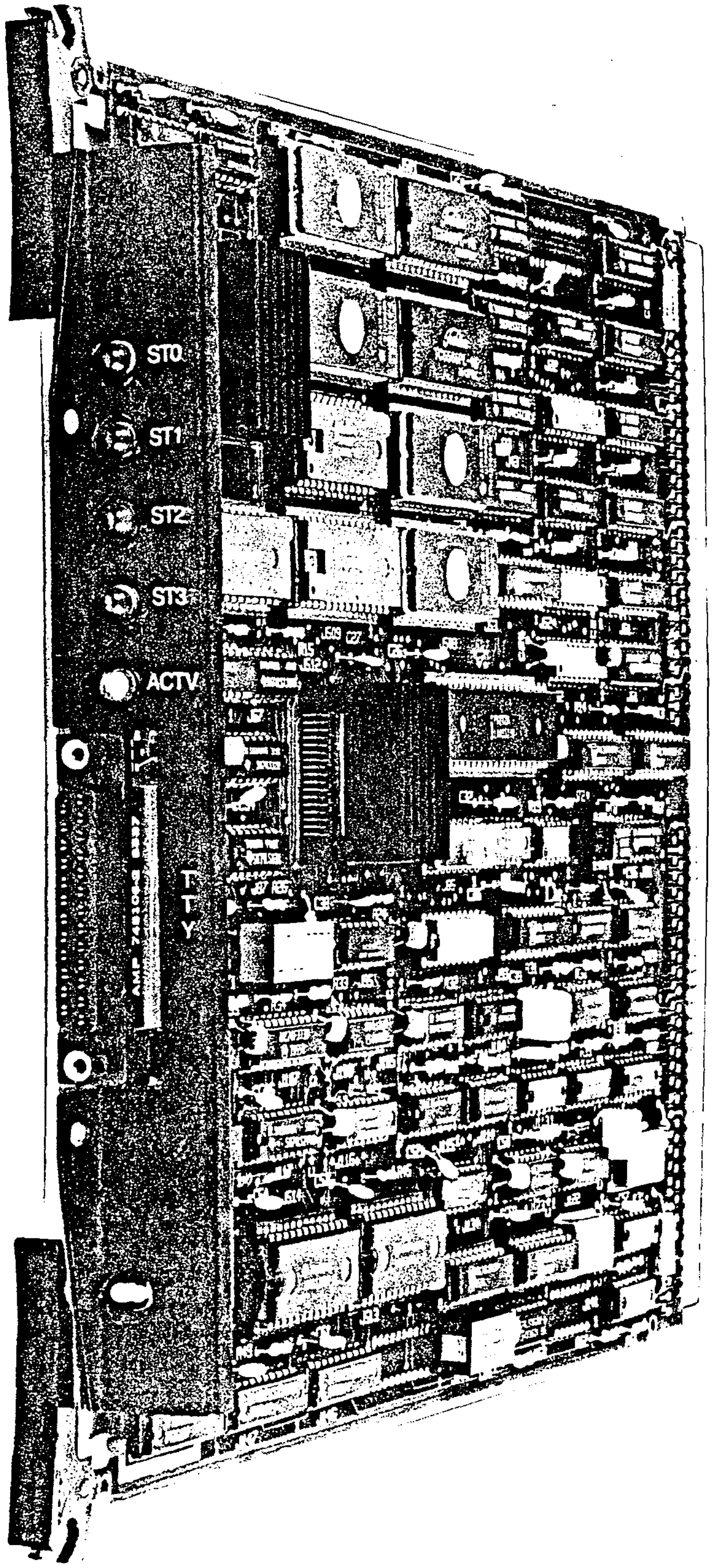

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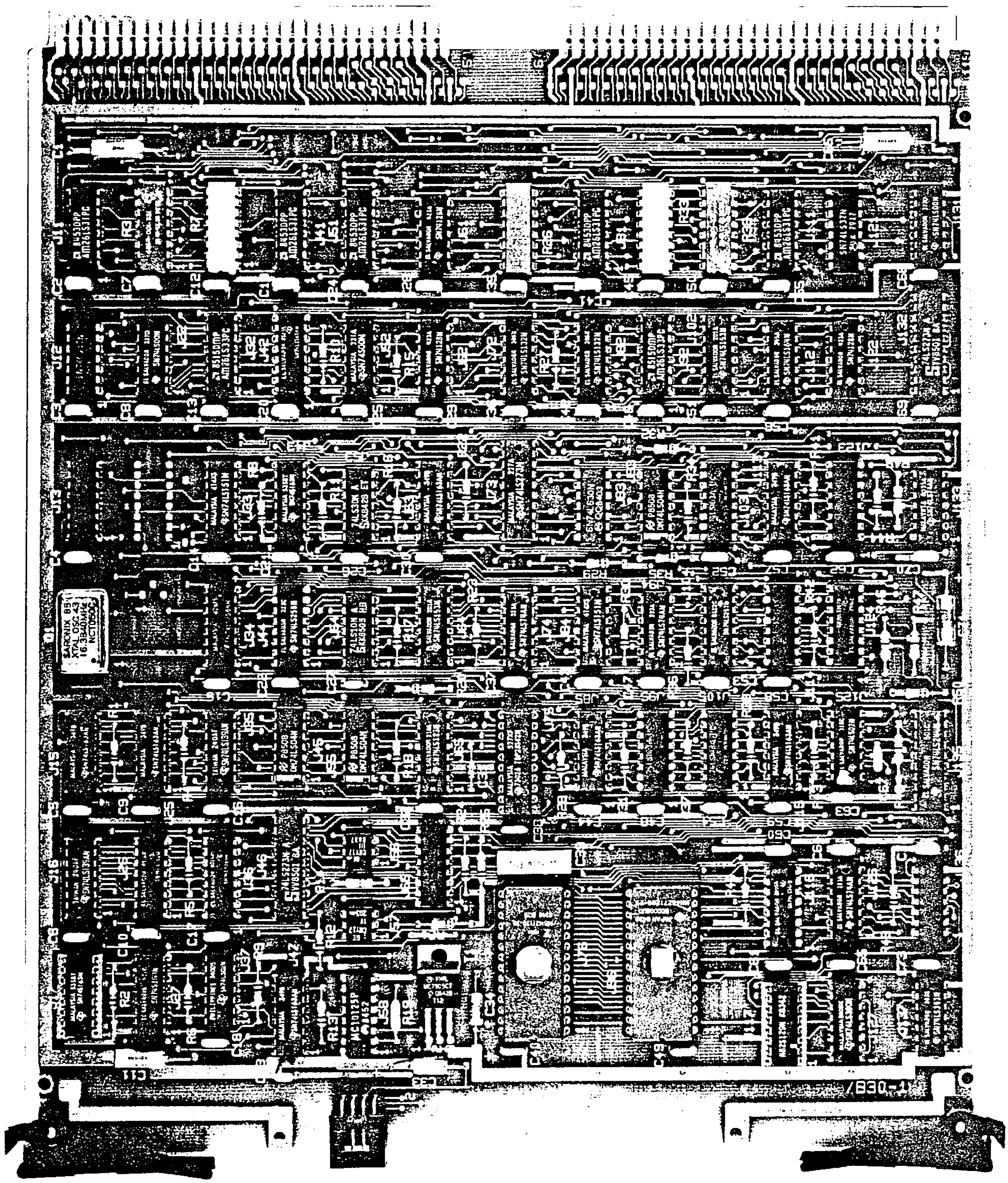
Figure 6.00 Controller/Input-Output Processor Printed Circuit Board



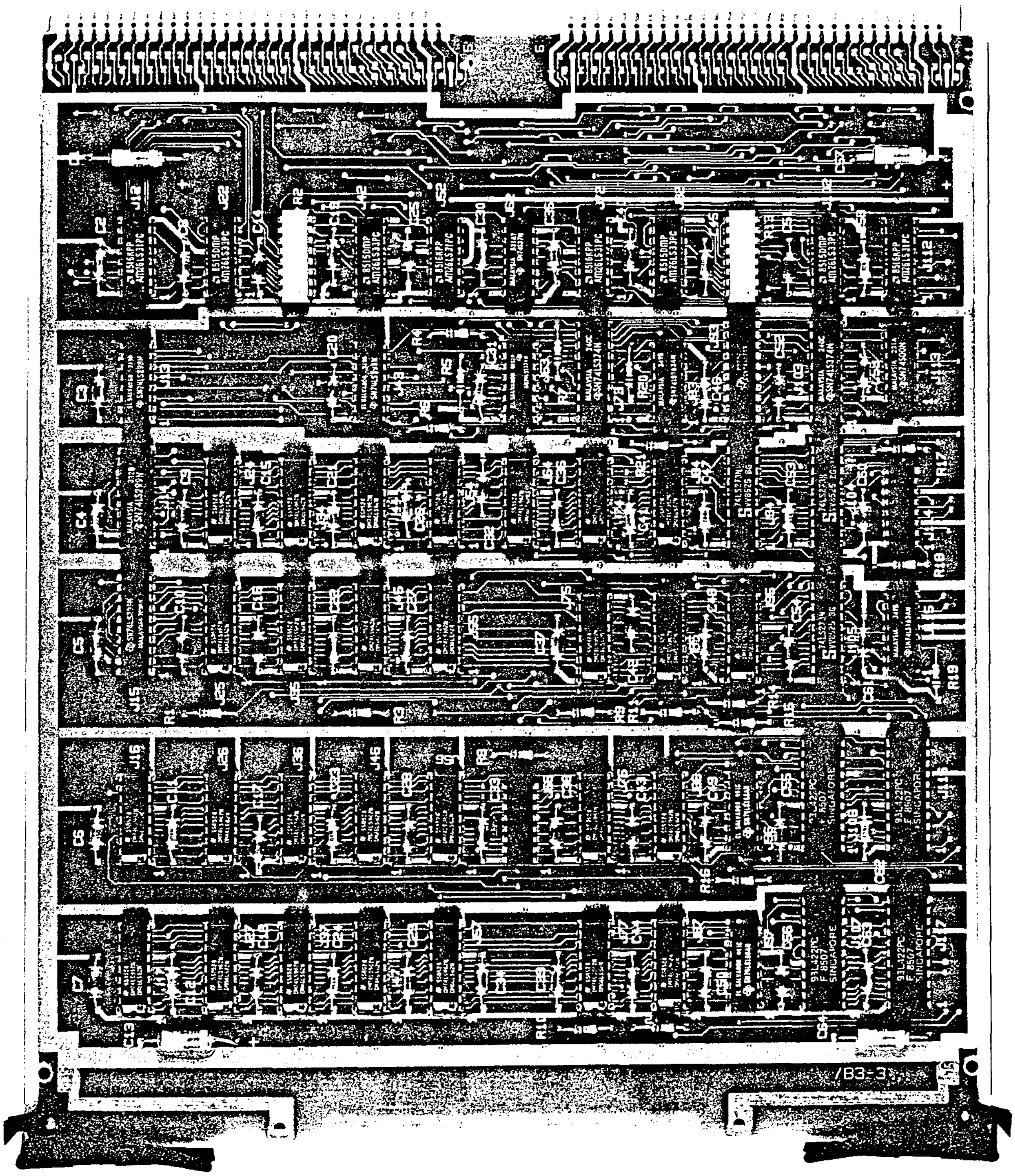


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Figure 6.02 Parallel/Serial Converter Printed Circuit Board

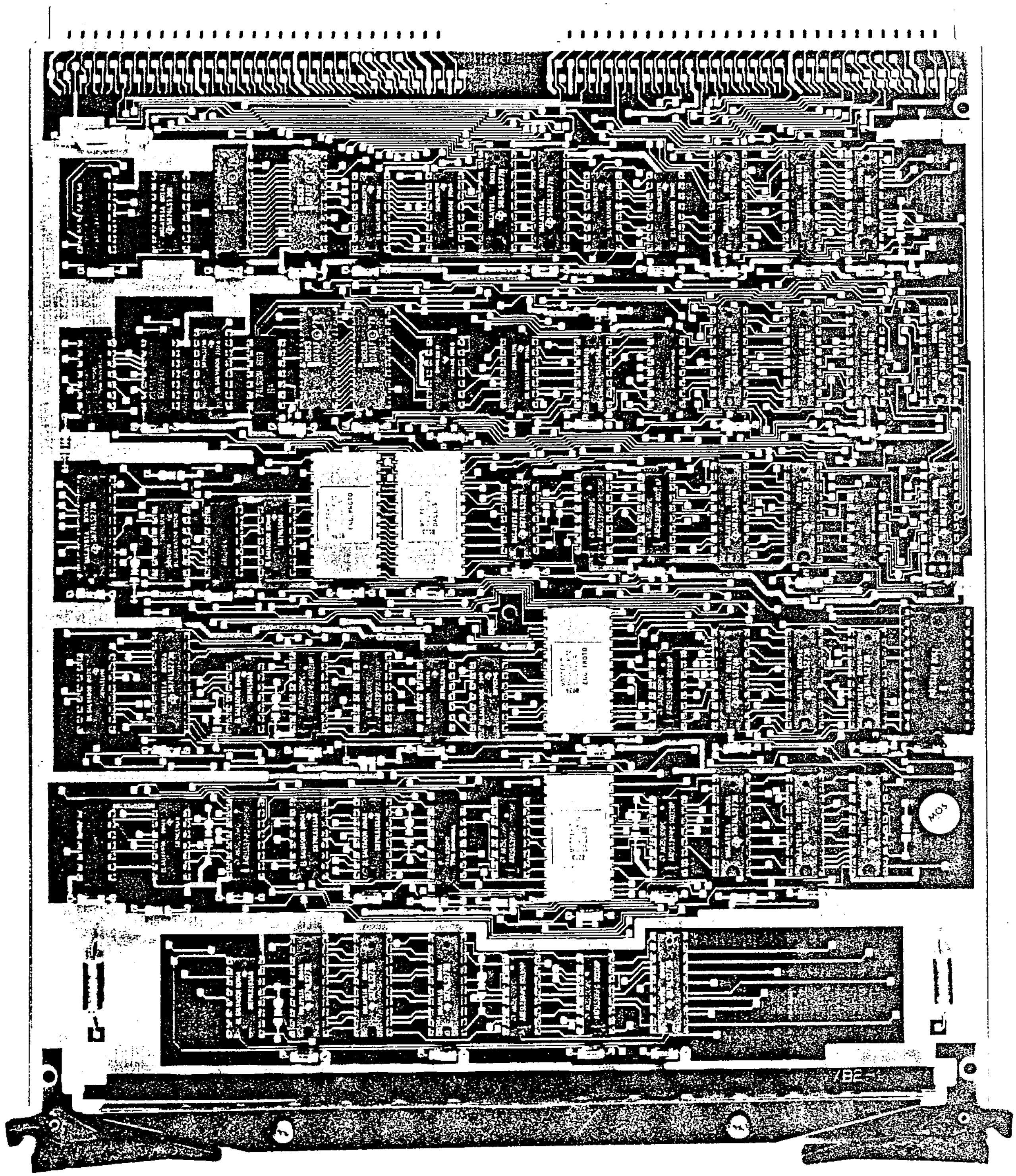

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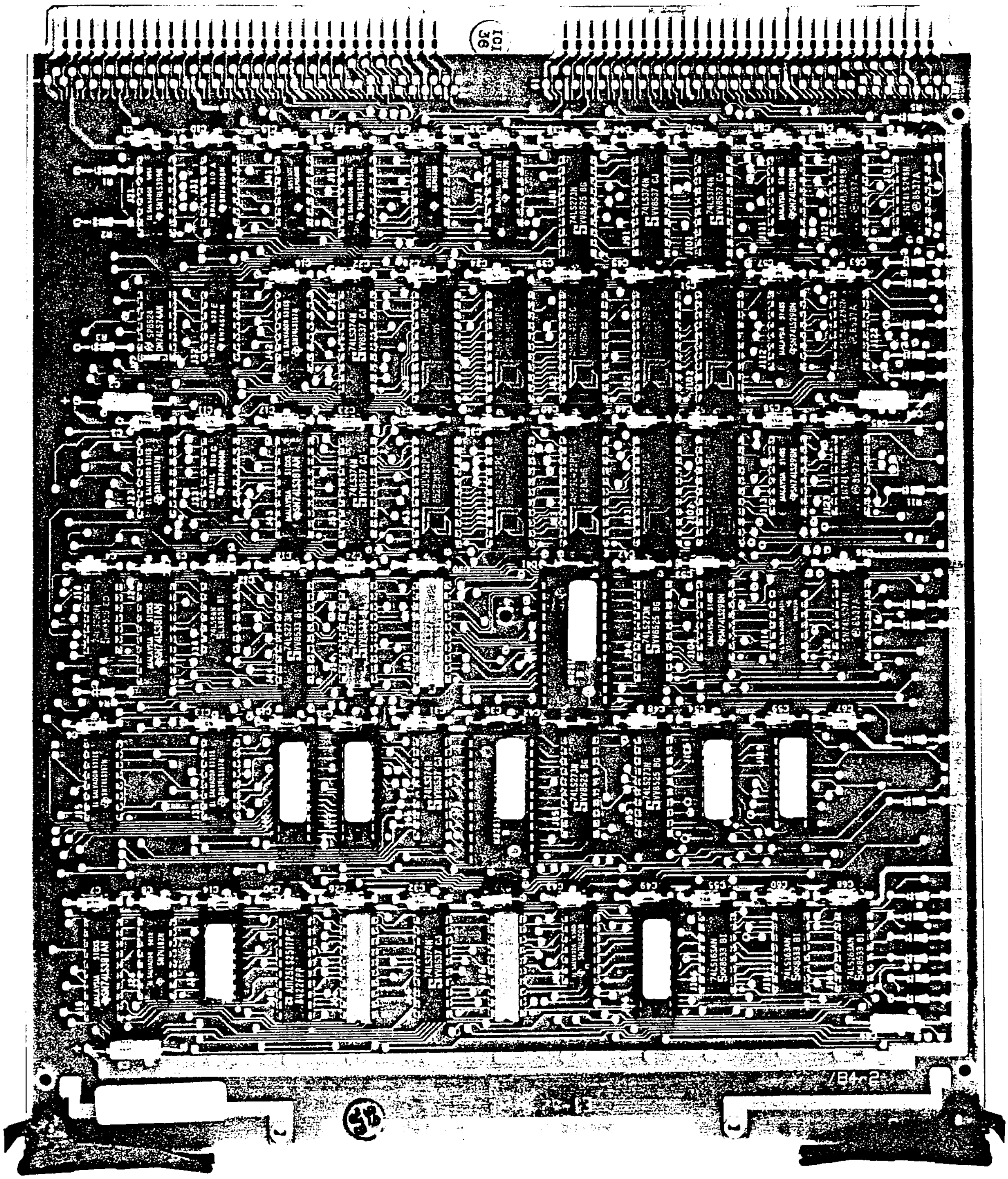
Figure 6.03 Memory Control and Attenuation Printed Circuit Board



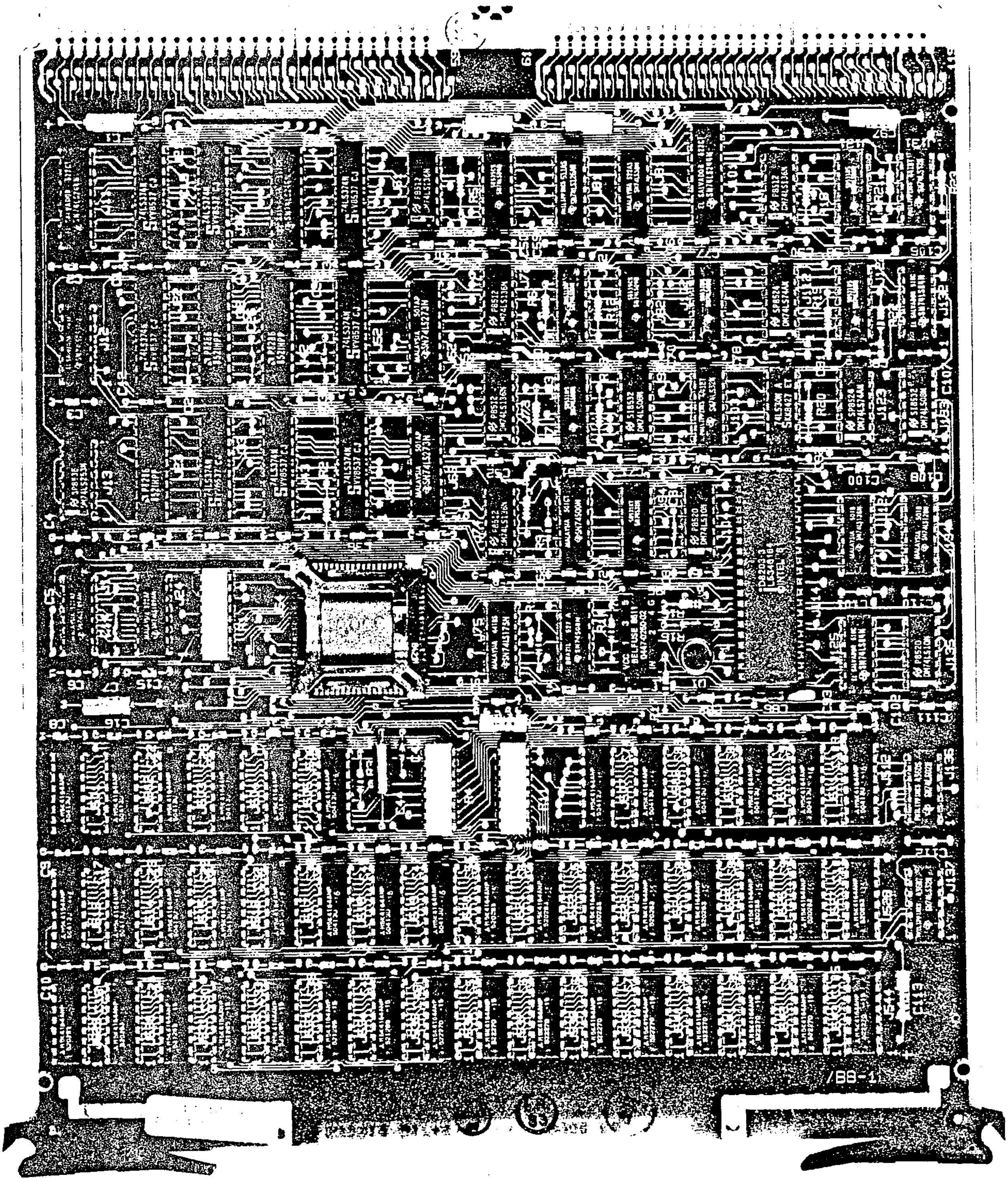


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Figure 6.05 Memory 3 (MEM3) Printed Circuit Board

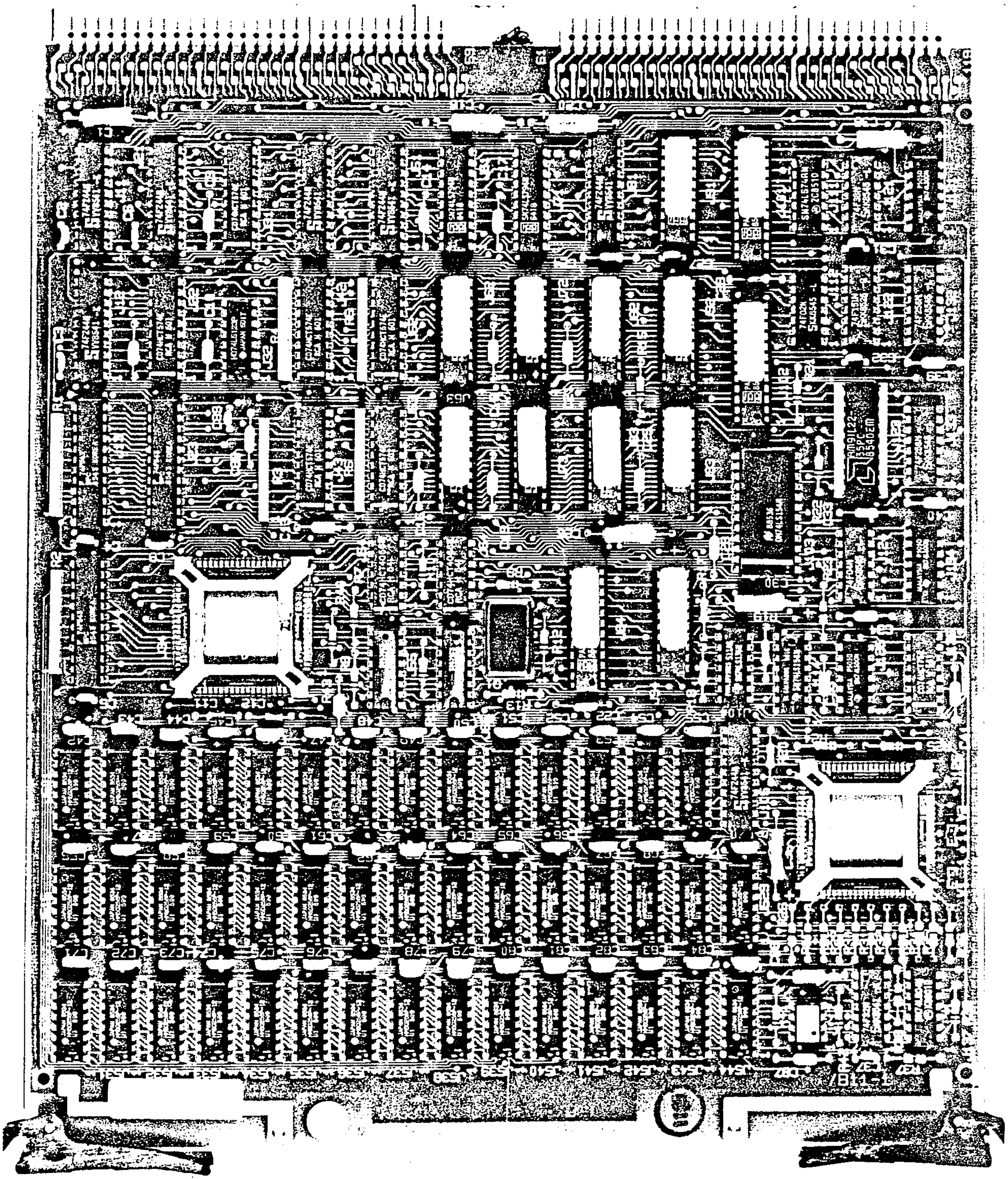

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Figure 6.06 Memory 4 (MEM4) Printed Circuit Board

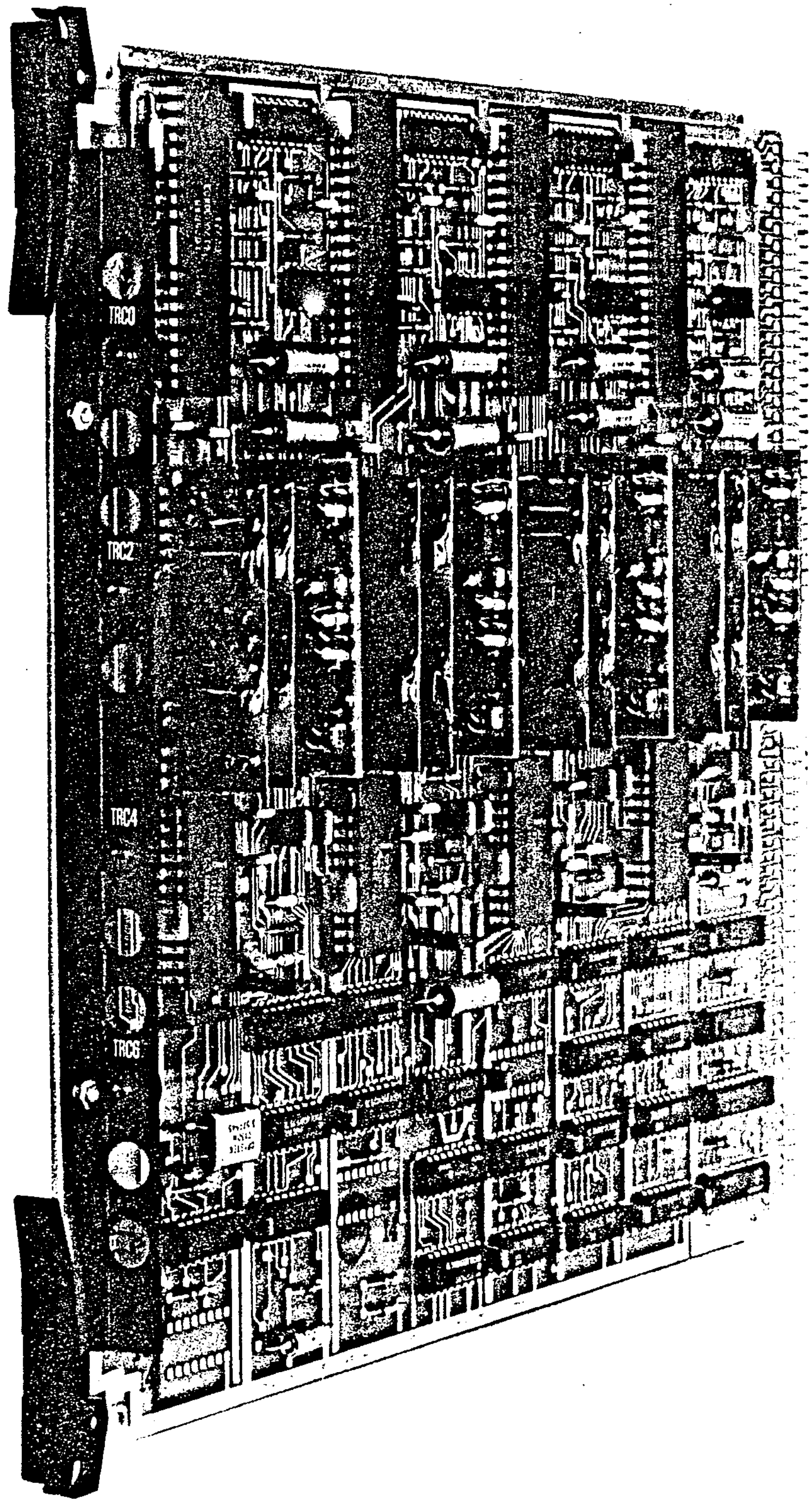

Figure 6.07 Dual-Tone Multifrequency Receiver Printed Circuit Board

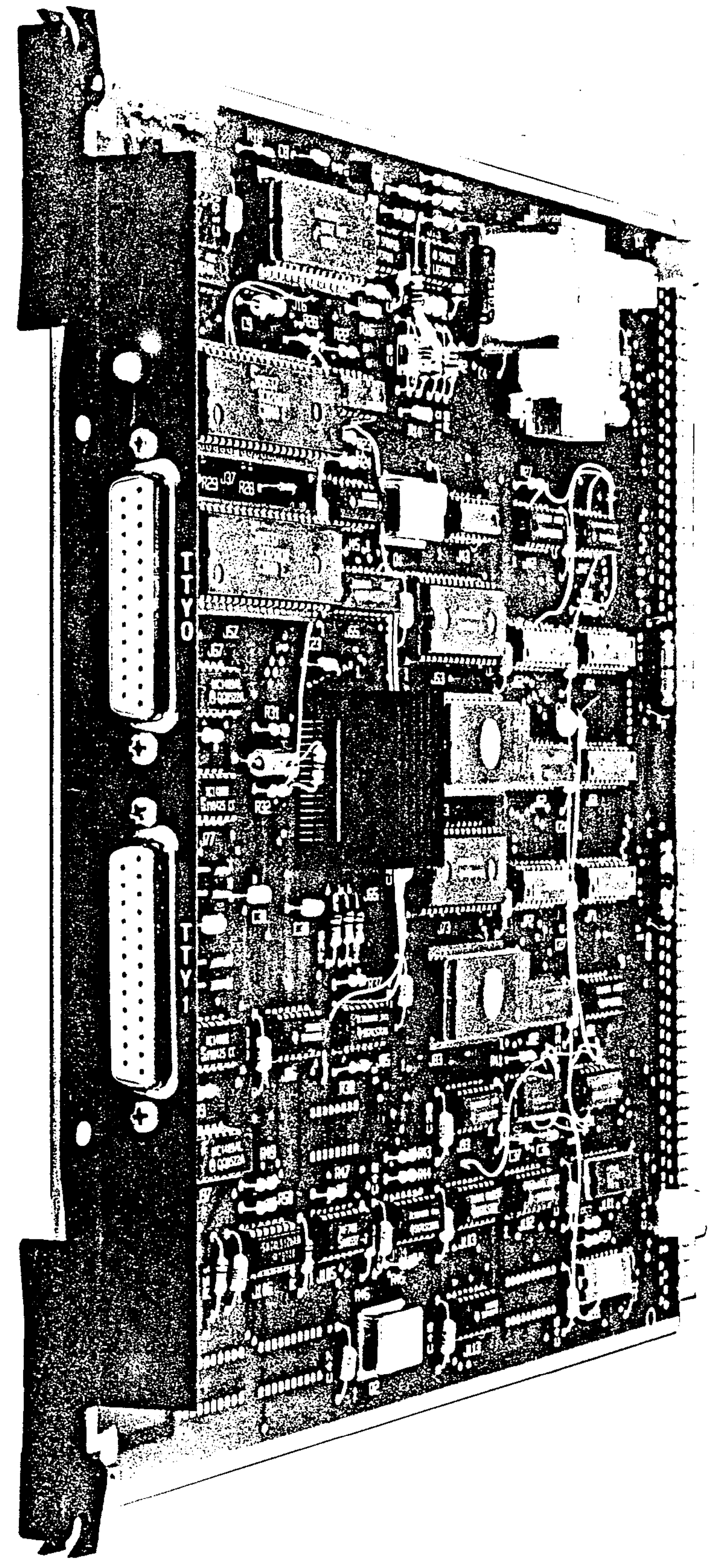

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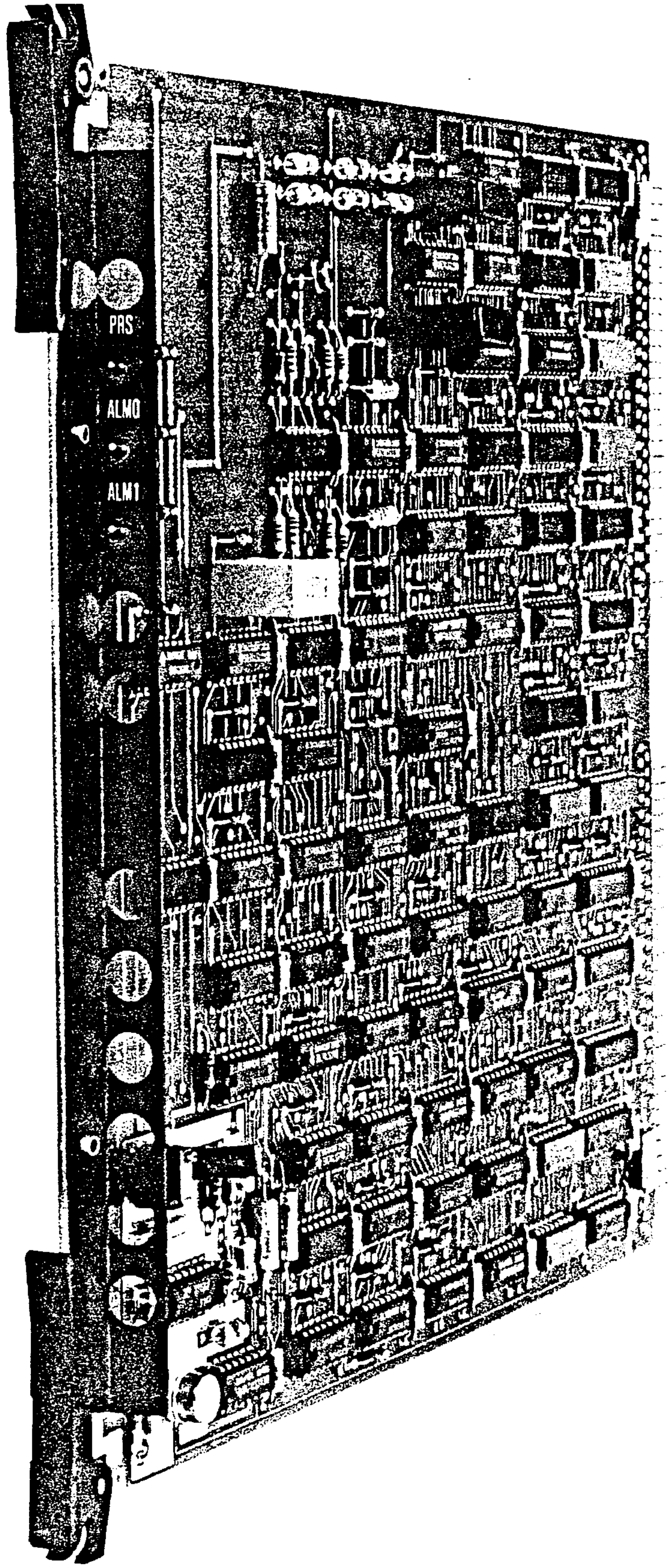
Figure 6.08 Remote Access Unit/Ports Printed Circuit Board


PRS
ALM0
ALM1

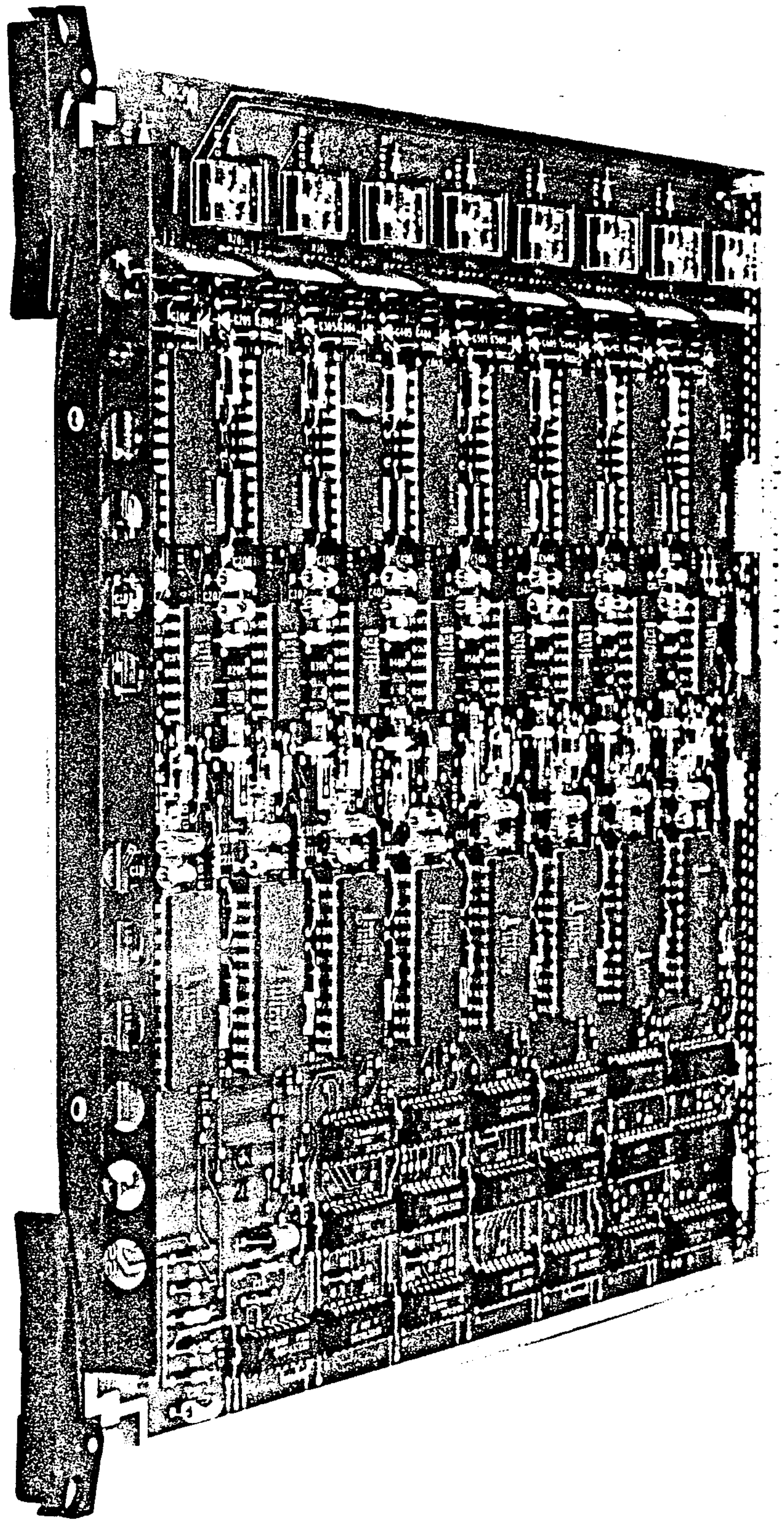


Figure 6.10 Subscriber Line Module Analog – Station Printed Circuit Board

6.13 Subscriber Line Module Analog – 16 Lines. The SLA16 board, shown in Figure 6-12, provides an interface between conventional rotary dial or DTMF-signaling telephone sets and the SATURN IIE system. The SLA16 provides 16 circuits, numbered 0 through 15, which, in installed systems, are renumbered as two sets of 0 through 7 as explained in the Installation practice. Each circuit provides the required supervision and signaling for its associated peripheral equipment.

6.14 Premium Instrument Module Digital. The PIMD board shown in Figure 6.13, serves as a special line interface circuit connecting attendant consoles to the SATURN IIE System. The PIMD circuitry communicates with the system via digitally-encoded messages. (The codecs and filters for the analog-to-digital conversion are located within the attendant consoles.) Each PIMD contains two dual-channel circuits, and is capable of serving two attendant consoles.

6.15 Subscriber Line Module Digital. The SLMD board, shown in Figure 6.14, serves as a special line interface circuit connecting SDTs to the SATURN IIE System. The SLMD circuitry communicates with the system via digitally-encoded messages. (The codecs and filters for the analog-to-digital conversion are located within the SDT). Each SLMD contains eight circuits (numbered 0 through 7).

6.16 Trunk Types. The SATURN IIE System can be equipped with a variety of common trunk types. A list of these trunk types and the corresponding trunk designations used in the SATURN IIE System is provided in Table 6.01. Examples of the types of signaling and supervision available are shown in Table 6.02. The signaling/supervision options within a particular trunk type are available on a strappable basis on the individual PCB. Refer to the Installation Procedures practice for more detailed information regarding the strapping options.

6.17 Two-Wire E&M Trunk. The Siemens Two-Wire Both-Way Trunk Module (TMBA-2) PCB, shown in Figure 6.15, provides either one-way or two-way, direct inward and outward private line facility service, with E&M signaling. The TMBA-2 contains four separate trunk circuits (numbered 0, 2, 4, and 6). Each circuit provides two-wire analog service between the SATURN IIE System and private line facility equipment. Separate E&M signaling leads are provided. The trunk circuits translate the incoming analog signals into PCM signals (and the outgoing PCM signals into analog signals).

6.18 Four-Wire E&M Trunk. The Siemens Four-Wire Both-Way Trunk Module (TMBA-4) PCB, shown in Figure 6.16, provides either one-way or two-way, direct inward and outward private line facility service, with E and M signaling. The TMBA-4 contains four separate trunk circuits (numbered 0, 2, 4, and 6). Each circuit provides four-wire analog service between the SATURN IIE System and private line facility equipment. Separate E & M signaling pairs are provided. The trunk circuits translate the incoming analog signals into PCM signals (and the outgoing PCM signals into analog signals).

6.19 Central Office Trunk. The Siemens Both-Way Trunk Module (TMBM) PCB, shown in Figure 6.17, provides either one-way or two-way, inward and/or outward trunk service for Central Office (CO), Foreign Exchange (FX), and Wide Area Telephone Service (WATS) applications. The TMBM contains four separate trunk circuits (numbered 0, 2, 4, and 6). Each circuit provides two-wire analog service between the SATURN IIE System and a CO loop-start or ground-start trunk. The trunk circuits translate the incoming analog signals into PCM signals (and the outgoing PCM signals into analog signals).

6.20 Direct Inward Dialing Trunk. The Siemens Incoming Trunk Module (TMIE) PCB, shown in Figure 6.18, provides one-way DID service from the CO to the SATURN IIE System. Each TMIE contains four separate trunk circuits (numbered 0, 2, 4, and 6). The trunk circuits translate the incoming analog signals into PCM signals (and the outgoing PCM signals into analog signals).

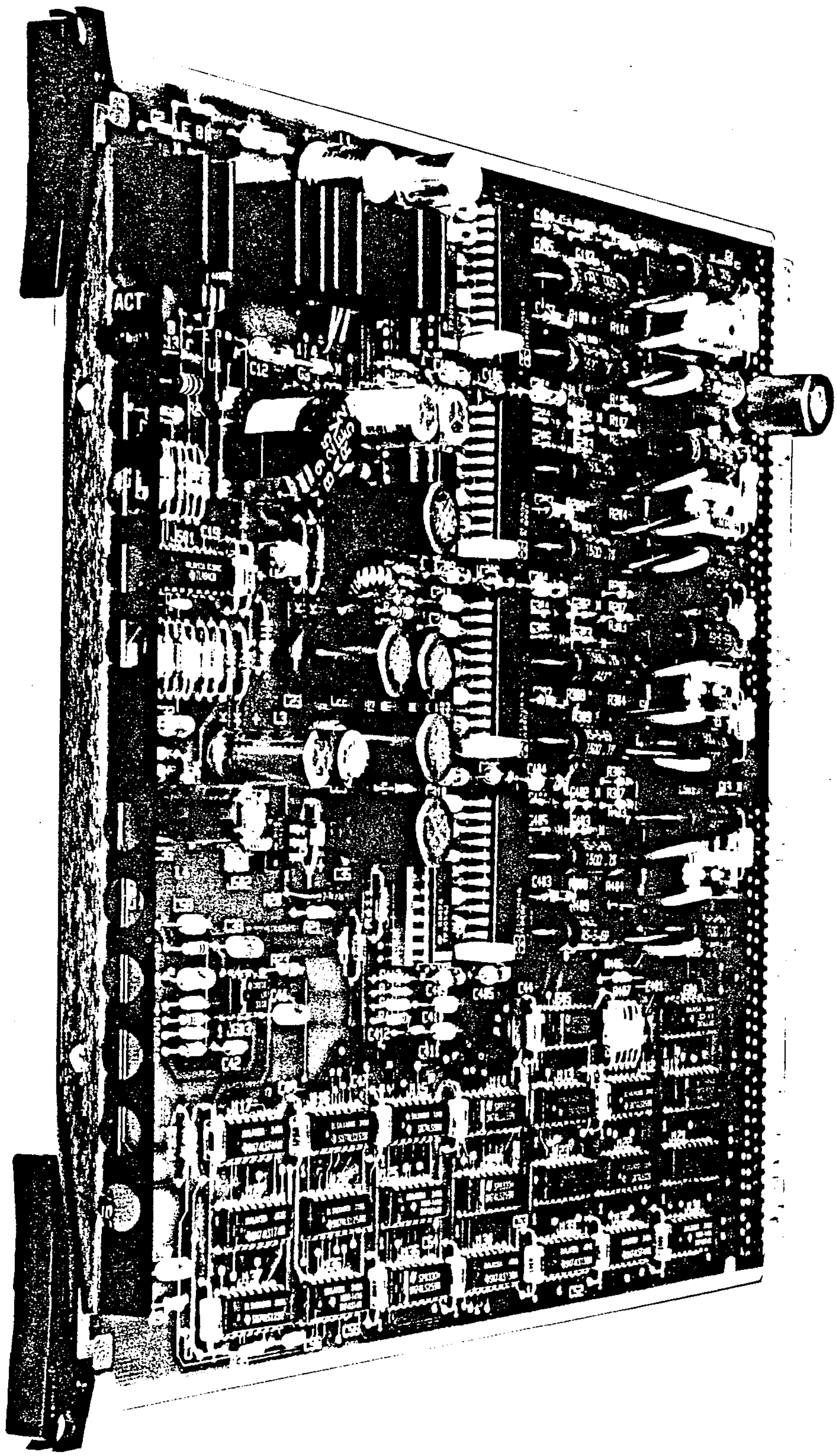


Figure 6.11 Subscriber Line Module Analog – Off-Premises Station Printed Circuit Board

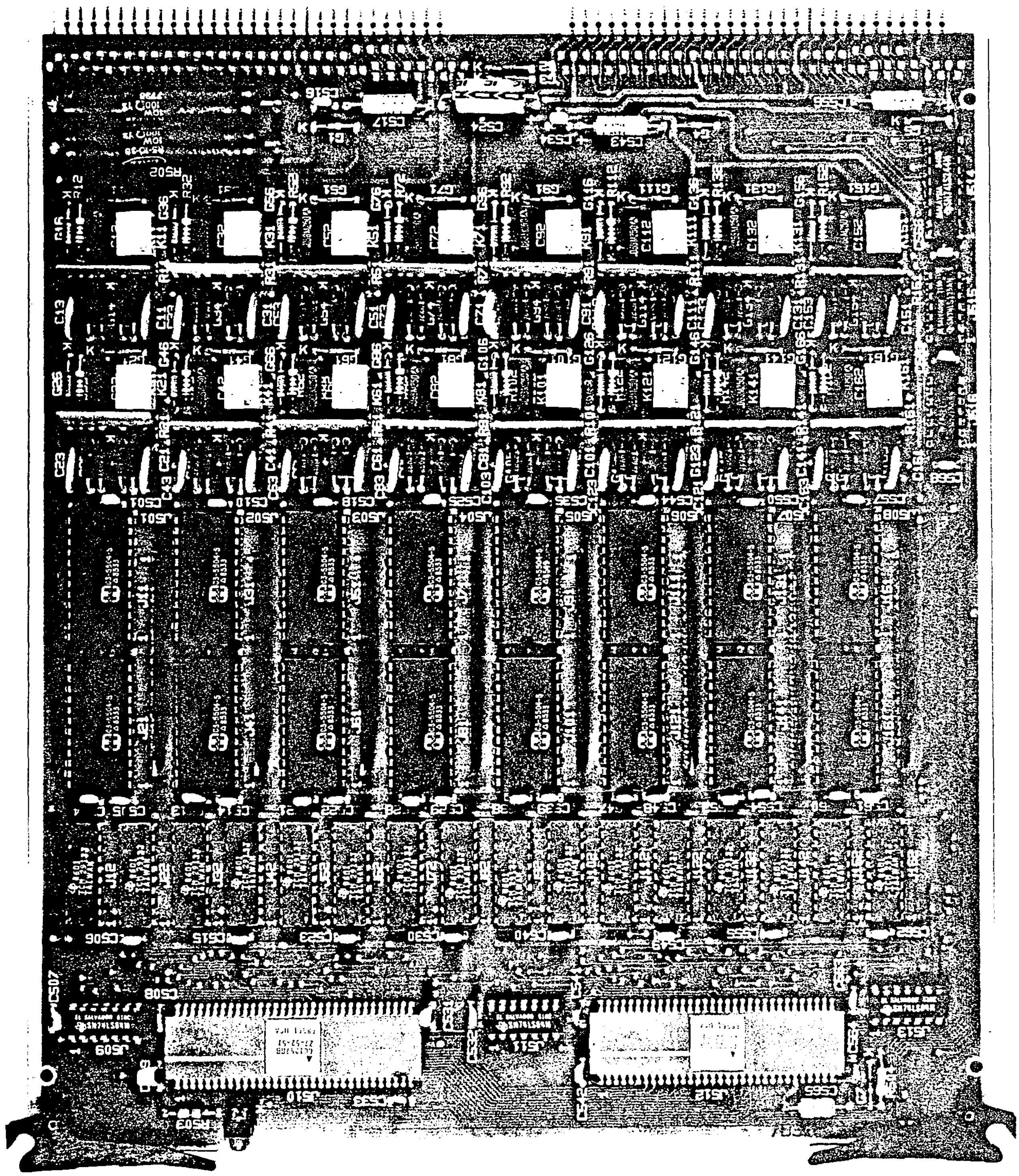


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Figure 6.12 Subscriber Line Module Analog – 16 Lines Printed Circuit Board

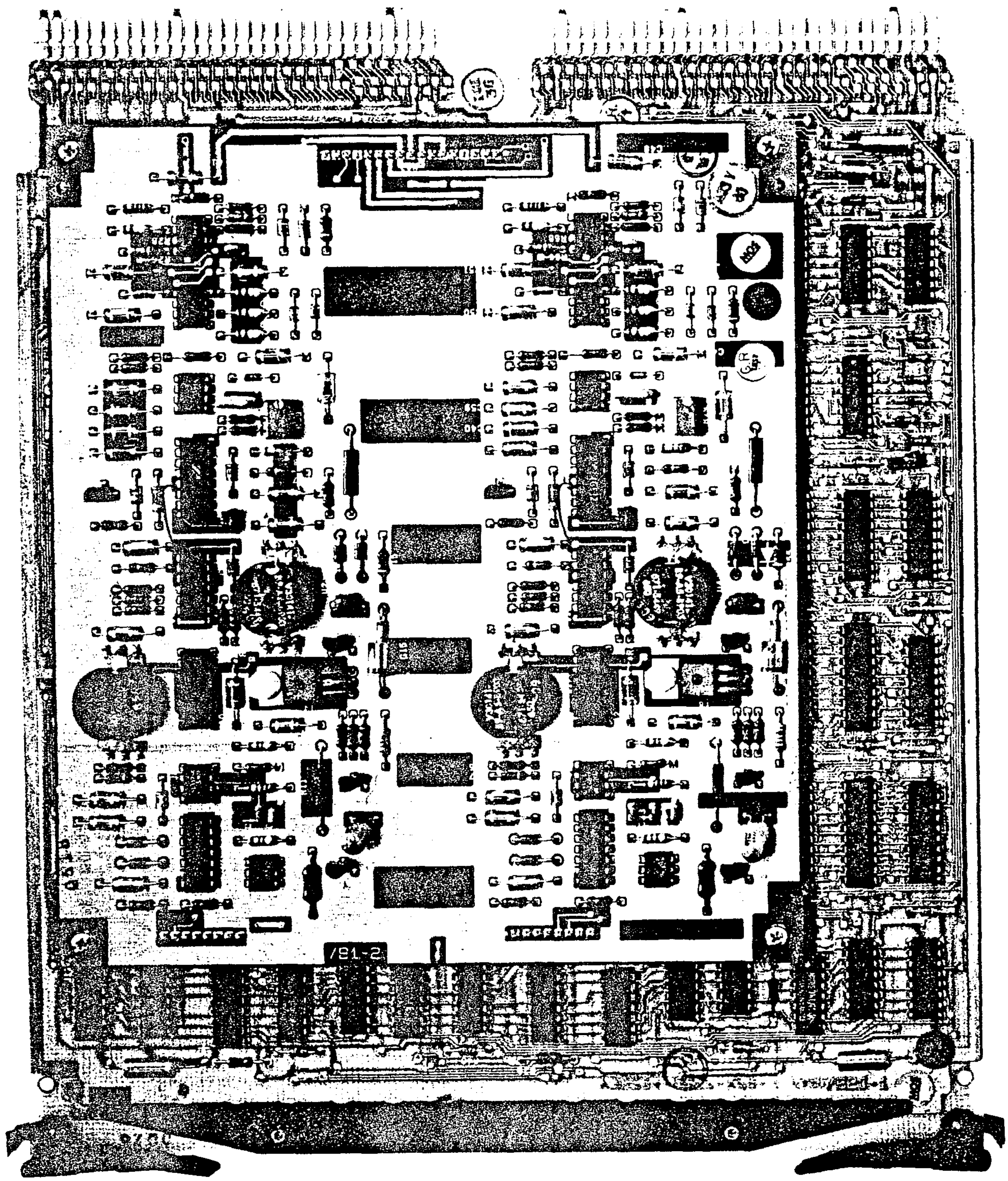


Figure 6.13 Premium Instrument Module Digital Printed Circuit Board

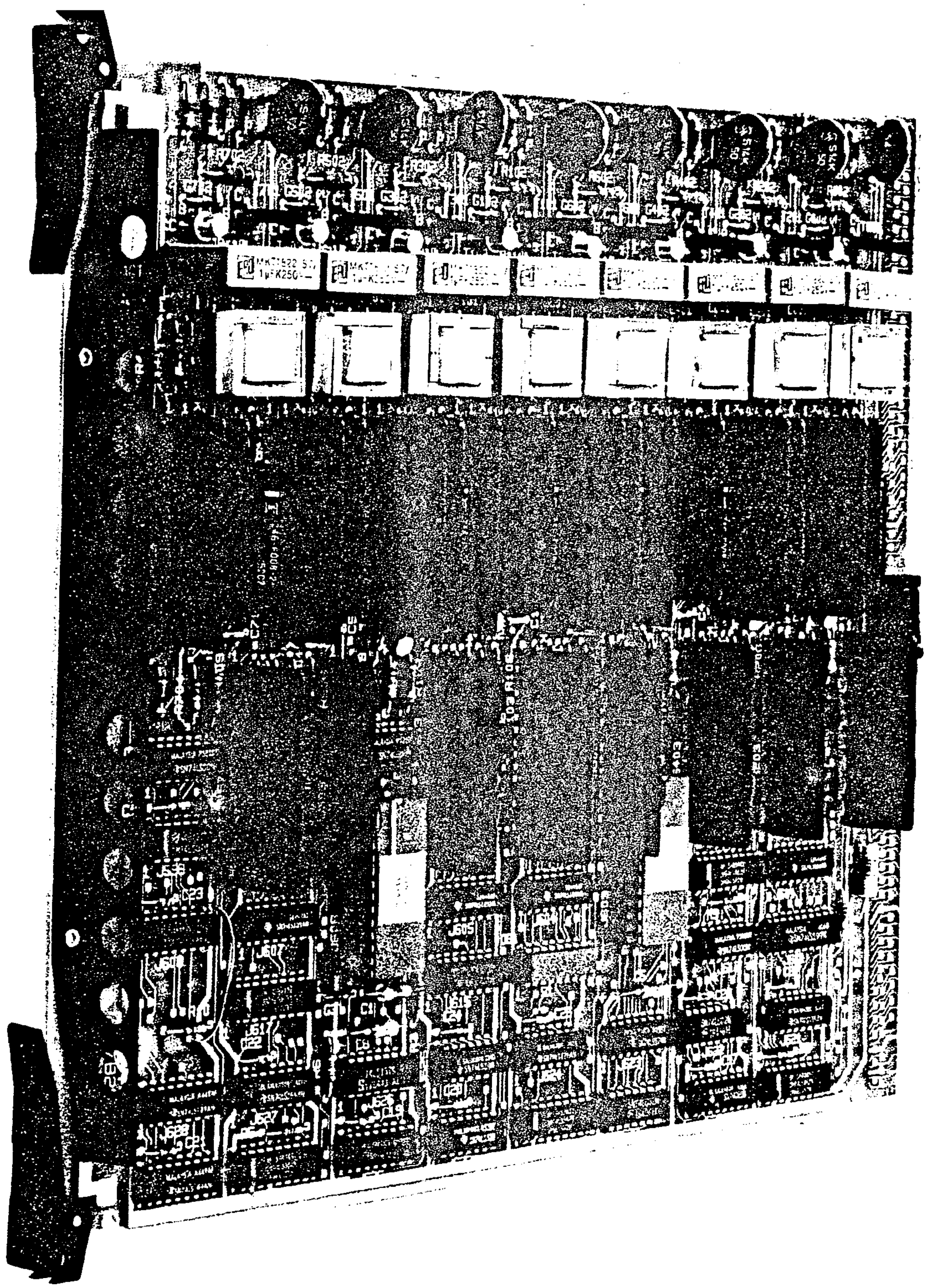


Figure 6.14 Subscriber Line Module Digital Printed Circuit Board

Table 6.01 Trunk Types Used in the SATURN IIE System

TRUNK PCB DESIGNATION/TITLE		APPLICATION
TMBM	- CENTRAL OFFICE (CO) - FOREIGN EXCHANGE (FX) - WIDE AREA TELEPHONE SERVICE (WATS)	Bothway (Two-Way) Incoming (One-Way) Outgoing (One-Way)
TMIE	- DIRECT INWARD DIALING (DID)	Direct Inward Dialing Trunks (One-Way Incoming)
TMBA-2	- TIE TRUNK (2 WIRE) E&M	Bothway (Two-Way) Incoming (One-Way) Outgoing (One-Way)
TMBA-4	- TIE TRUNK (4 WIRE) E&M	Bothway (Two-Way) Incoming (One-Way) Outgoing (One-Way)

Table 6.02 Trunk Signaling and Supervision

SIGNALING/SUPERVISION TYPE	SATURN TRUNK TYPE: TMBM (CO, FX, WATS)	TMIE (DID)	TMBA-2 TMBA-4 (E&M)
SUPERVISION (Answer & Disconnect)			
Loop	X		
Loop/Reverse Battery	X	X	
E&M, Type I			X
E&M, Type II			X
INCOMING SEIZURE			
Loop Closure		X	
Ground Start (Tip Ground)	X		
E-Lead Off-Hook (1)			X
INCOMING ADDRESS SIGNALING			
Dial Pulse		X	X
DTMF (2)	X (DISA)	X	X
Automatic (Ring Down) (3)	X		X
INCOMING OR CO SENDER START			
Delay Dial		X	X
Immediate Dial		X	X
Wink Start		X	X
OUTGOING ADDRESS SIGNALING			
Dial Pulse	X	N/A	X
DTMF	X	N/A	X
OUTGOING SENDER START			
Delay Dial		N/A	X
Immediate Dial		N/A	X
Dial Tone Detection	X	N/A	X
Wink Start		N/A	X
Manual (None)	X	N/A	X

NOTES:
1. Applicable to E&M types I and II.
2. DTMF address signals are expected on DISA trunks **after** answer.
3. Incoming seizure is automatic (ringdown) on TMBM. Incoming address signals are not expected prior to answer.

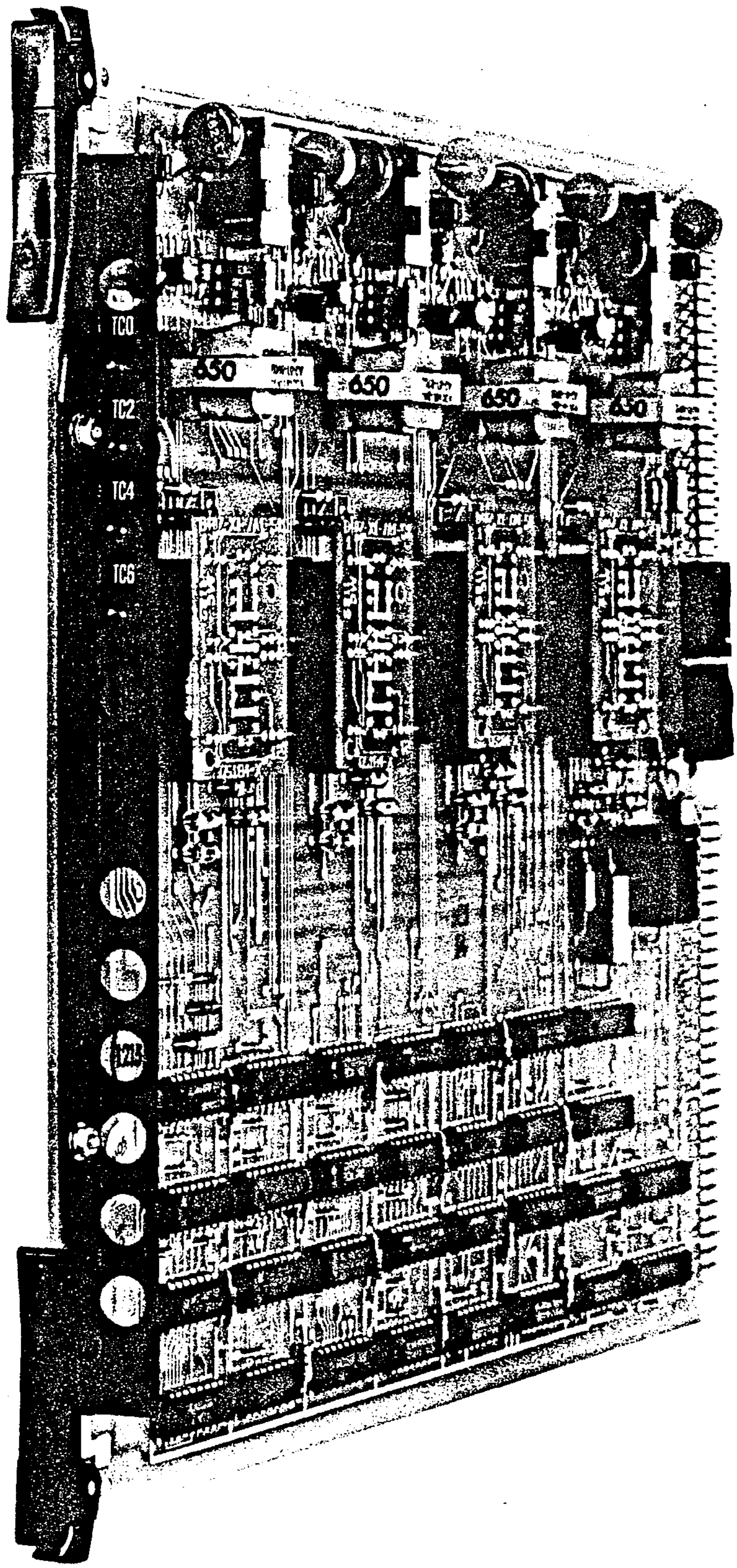


Figure 6.15 Two-Wire E&M Trunk (TMBA 2) Printed Circuit Board

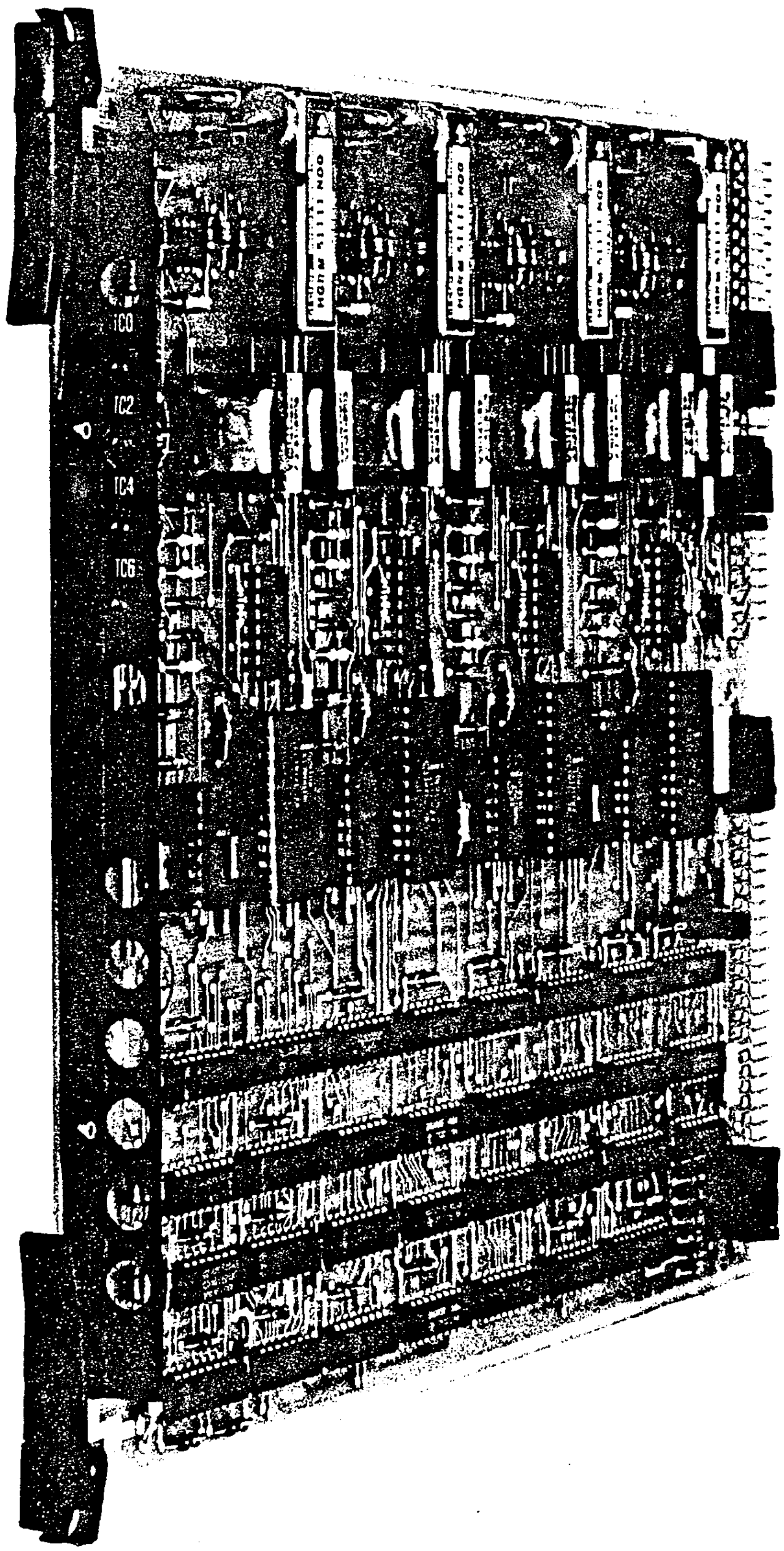
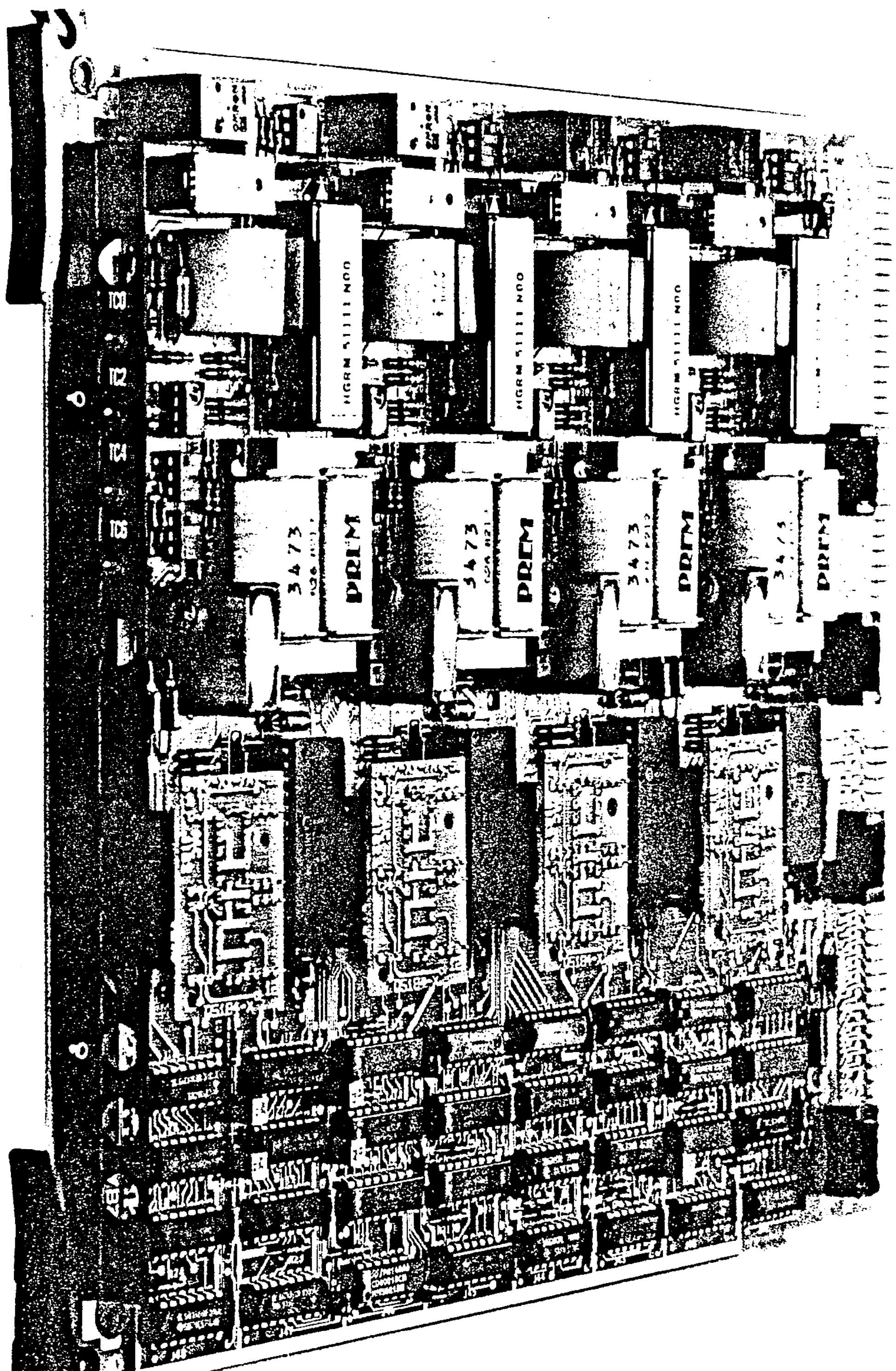


Figure 6.16 Four-Wire E&M Trunk (TMBA-4) Printed Circuit Board



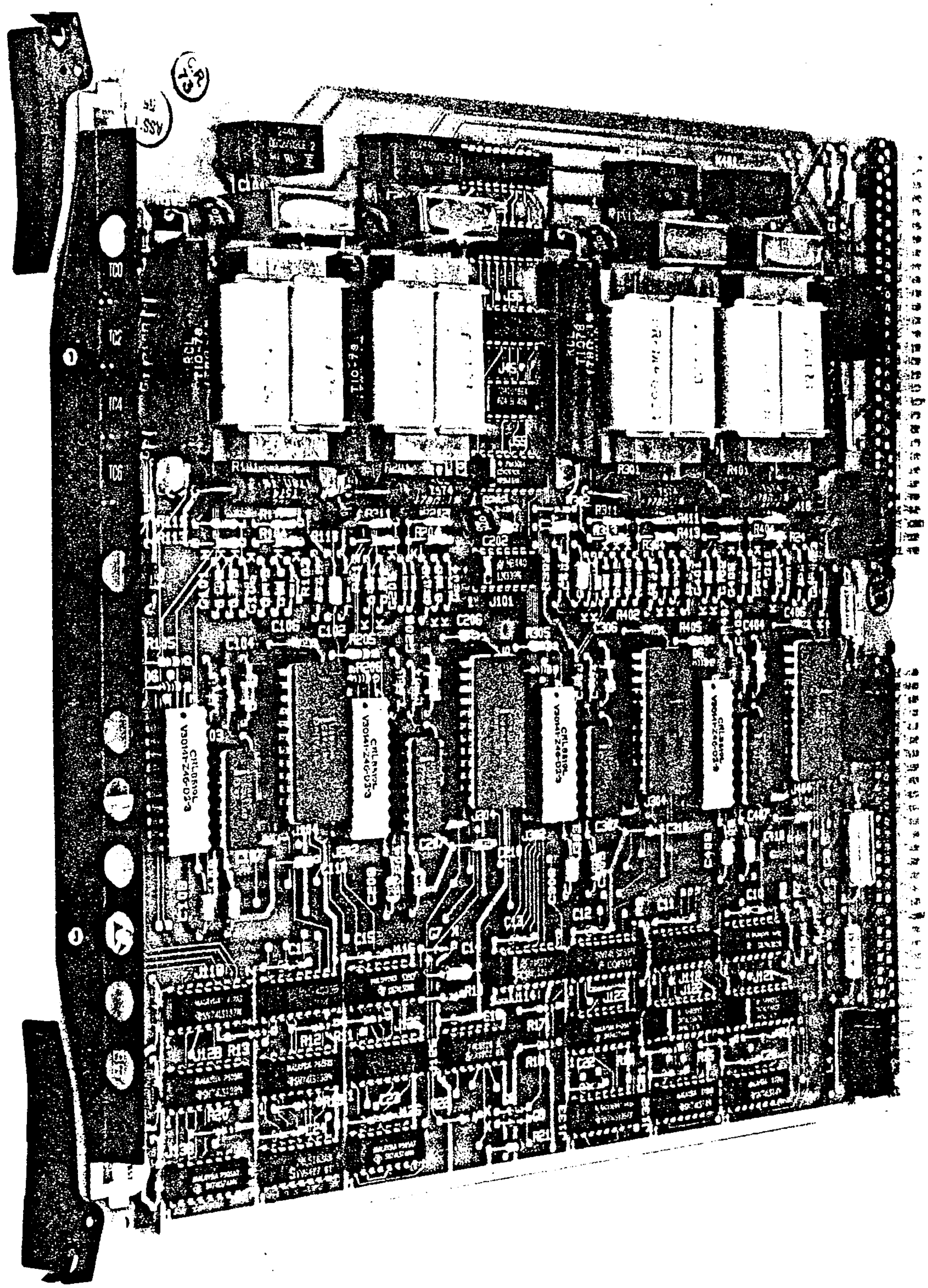


Figure 6.18 Direct Inward Dialing Trunk (TMIE) Printed Circuit Board

SECTION 7.00 SATURN IIE ANCILLARY EQUIPMENT

7.01 Service Terminal. A keyboard/printer data terminal equipped with an RS-232-C interface may be used to input maintenance and administrative commands to the system. The terminal is primarily used to enter data into the system for processing CMU procedures. The CMU procedures are used to make changes to the customer memory portion of the system memory, such as adding a station or trunk, changing a station's extension number or class of service, or adding features to the system. The system memory contains all of the data relating to the programmable features and options the customer can select, arrange, and rearrange.

The administrative procedures can be performed during normal system operation with no interference to normal call processing. The CMU procedures are easy to use and provide plain English prompting for the benefit of the user. The new data that is entered is then recorded on the floppy disk (by means of a "save" command) as a permanent record for system backup purposes. An example of an administrative CMU procedure is shown in Figure 7.00.

The SATURN IIE System can also be provided with the Remote Customer Memory Update feature, which permits the updating process to be initiated from a remote (off-premises) location. This feature utilizes a modem that is built into the Remote Access Unit/Ports (RAUP). Changes to the customer memory can be completed through either local or long-distance trunks, tie trunks, or any SATURN IIE station. The requirements for the remote data terminal are specified in the Siemens practice, SATURN IIE EPABX Customer Memory Update Procedures. Information pertaining to the use of such a data terminal for CMU changes is also included in that practice.

Besides the modem port, the system provides three ports for data terminals (one on the CIOP, two on the RAUP) In addition to the administrative functions described above, the system also compiles data pertaining to Station Message Detail Recording (SMDR) and traffic through the system. The SMDR and/or traffic data may be outputted via another port(s) to another printer/terminal or to an independent reporting system for post-processing.

USER INPUT:

> 〉 **ADD COSASSN**

User inputs the command (ADD) and keyword for Class-of-Service Assignment (COSASSN)

SYSTEM PROMPT:

> CLASS OF SERVICE NUMBER (0-31) =

System prompts the user for the class of service (COS) number to be assigned.

USER INPUT:

> CLASS OF SERVICE NUMBER (0-31) = **5**

User inputs "5" to indicate COS 5 is being assigned.

SYSTEM PROMPT:

> CLASSMARK ASSIGNMENTS =

System prompts the user for the feature classmarks to be assigned to COS 5.

USER INPUT:

> CLASSMARK ASSIGNMENTS = **HKFLSH FWDALL FWDTONTWK PARK**

User inputs the classmarks to indicate the features to be assigned to COS 5. (In this example, the following features are assigned: Hookflash, HKFLSH; Call Forwarding — All Calls, FWDALL; Call Forwarding to Public Network, FWDTONTWK; and Call Park, PARK. Hookflash is required to be assigned for certain features, including Call Park.)

SYSTEM PROMPT:

> ALLOWED TRUNK GROUPS (0-31) =

System prompts the user for the trunk group numbers to which COS 5 is to be allowed access.

USER INPUT:

> ALLOWED TRUNK GROUPS (0-31) = **3**

User inputs the trunk group number to which COS 5 is to be allowed. (In this example, only trunk group 3.)

Figure 7.00 Example of Administrative CMU Procedure

SYSTEM PROMPT:

TOLL CODE REST LIST NUMS (0-19) =

System prompts the user for the toll code restriction list(s) to apply to COS 5.

USER INPUT:

TOLL CODE REST LIST NUMS (0-19) = **7**

User inputs the toll code restriction list(s) to which COS 5 is to be allowed access. (In this example, only toll code restriction list 7.)

SYSTEM PROMPT:

RESTRICTED ACD GROUP NUMS (0-63) =

System prompts the user for the ACD group number(s) from which COS 5 is restricted from accessing.

USER INPUT:

RESTRICTED ACD GROUP NUMS (0-63) =

User does not wish to assign a restricted ACD group at this time, therefore no entry is made. ("Enter" key is depressed to obtain next prompt or response.)

SYSTEM PROMPT:

RESTRICTED STATION COS'S (0-31) =

System prompts the user for the station class of service number(s) from which COS 5 is restricted from accessing.

USER INPUT:

RESTRICTED STATION COS'S (0-31) =

User does not wish to assign a restricted station COS at this time, therefore no entry is made. ("Enter" key is depressed to obtain next prompt or response.)

SYSTEM RESPONSE:

ADD STNCOS 83-01-03 11:41:47 CLASS OF SERVICE ADDED

System acknowledges addition of the new class of service, followed by the calendar date (January 3, 1983) and the current time (11:41:47).

USER INPUT:

〉**SAVE CUSTDATA**

User inputs the command (SAVE) and the keyword for Customer Data (CUSTDATA) to save the changed data to the floppy disk. (In the event of a system restart, the system reloads automatically from the floppy disk. Therefore, any changed data that has not been "saved" must be reentered.)

Figure 7.00 Example of Administrative CMU Procedure (Continued)

7.02 Attendant Console. The attendant console, shown in Figure 7.01, is a desk-top unit with which the attendant processes calls, using pushbutton keys and an alphanumeric display. It is 46.99 cm (18.5 in.) wide, 13.08 cm (5.15 in.) high, and 26.47 cm (10.42 in.) deep. A maximum of twelve attendant consoles can be provided in the SATURN IIE System. A telephone handset is furnished with the console. An optional headset may be substituted for the handset. Both tone and visual indicators alert the attendant to incoming calls. The level of the tone signal may be controlled by a volume control located at the front edge of the console.

The attendant console provides switched-loop operation, with single-loop appearance to simplify call handling. The advantages of stored-program processing allow the attendant to have complete information about calls directed to the console. The attendant has complete control over calls directed to the console and a number of other features by means of the preset and programmable console keys and the display.

The attendant console is microprocessor-controlled, and contains a codec/filter for voice analog/digital conversion. The console receives its required power from the main system, which can be up to a distance of 610 cable meters (2,000 cable feet).

Connections to the console are made through industry-standard, modular, connector-ended cables that provide voice, control signals, and power. A standard two-pair cable is used to make the connection from the SATURN IIE System to a modular jack located near the console.

The upper portion of the console contains the display section, which gives the attendant the necessary information to correctly identify the call being serviced. The display section includes a 40-character, alphanumeric vacuum-fluorescent display. The following types of indications are provided by the display:

a. Time of day

b. Station numbers of calling and called parties

c. Class of service of calling station

d. Busy/idle/out-of-service status

e. Intercept information

f. Call queuing lengths (This information is presented to the attendant automatically between the servicing of calls.)

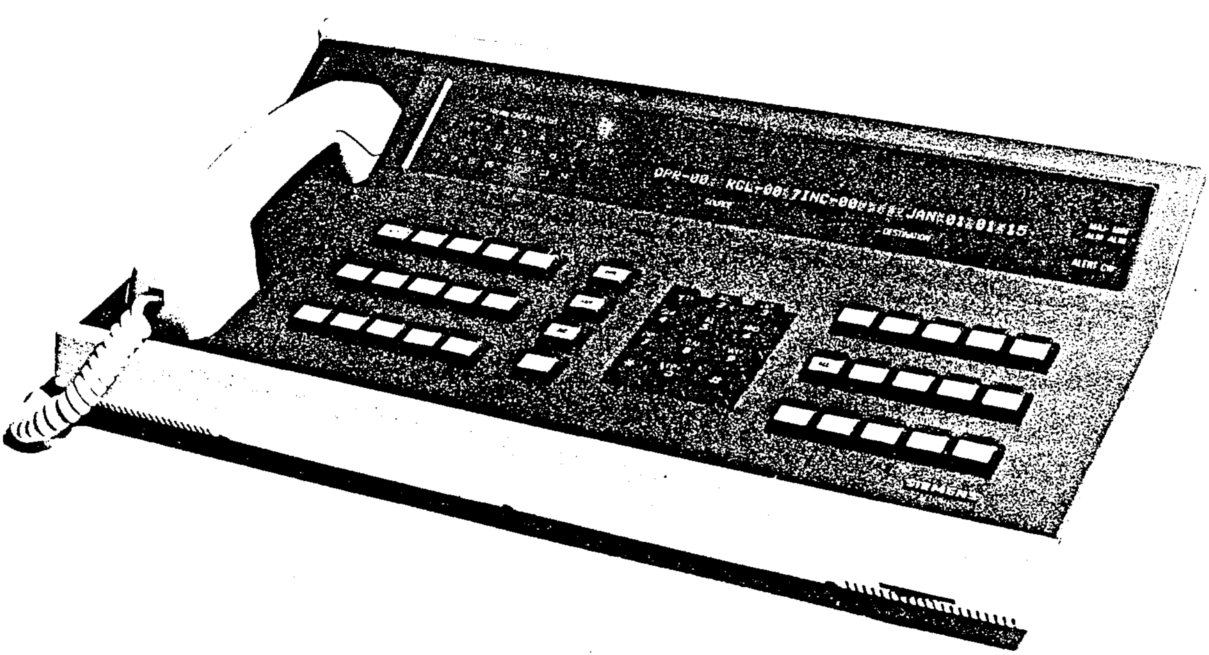


Figure 7.01 SATURN Attendant Console

In addition to the call data information listed above, the display may also be used for both call data display and for displaying system status to the attendant (such as the system's failure history) plus major and minor alarm indicators.

The lower portion of the console contains a keyboard assembly that allows the attendant to process the various types of calls, initiate station and trunk calls, and access special features (such as conferencing, paging, and night service). All keys are nonlocking and have single built-in Light-Emitting Diode (LED) indicators that light steadily or flash to indicate a particular operating condition. A full explanation of the operation of the attendant console is provided in the Siemens practice, SATURN EPABX Attendant Console General Description and Operating Instructions.

Eighteen keys on the attendant console are fully assignable by the customer to meet customized needs. The remaining sixteen keys are preset for the functions required in all systems. These keys are labeled and assigned as follows:

ANS	Answer (System selects type of call: operator, incoming, or recall)
ATT RLS	Attendant release from all parties
AUD ON/OFF	Audible signal control – on/off
BOTH	Both source and destination party select
DEST	Destination party select
TIME	Time display
INC	Incoming call queue answer
LOOPn	Loop selection (Loop 1 through Loop 4)
NIGHT	Night operation
OPR	Operator call queue answer
RCL	Recall queue answer
RLS	Release of individual party
SRC	Source party select

Calls requiring attendant assistance are directed automatically to one of three call identification keys. Each key has a corresponding holding queue that allows the attendant to select one of the three types of calls: incoming trunk calls; operator ("dial 0") calls; or recalls (calls that have already been serviced by the attendant and for some reason have returned to the console for additional attendant assistance). By means of an LED indicator, the call identification keys indicate to the attendant the type of call waiting to be serviced and thereby permit the attendant to process each call selectively.

In addition to the above three keys, an "answer" key is provided. This key can be used to answer waiting calls on a "first-in, first-out" basis. When the attendant uses the answer key, the longest waiting call (regardless of whether the call is in the incoming, operator, or recall queue) is presented to the console for servicing.

SECTION 8.00 STATION MESSAGE DETAIL RECORDING

8.01 General. Station Message Detail Recording (SMDR) provides detailed records of incoming and outgoing trunk calls. The SATURN System records all detail information for outgoing CO, WATS, FX and Tie trunk calls and incoming CO, WATS, FX and Tie trunk calls. Intra-switch, station-to-station, station-to-attendant, and attendant-to-station calls are not recorded.

The SMDR program is resident in the system and can be activated/deactivated by the attendant on a per-trunk-group basis. When activated, the SMDR program remains on-line and runs continuously until it is deactivated. While running, it provides chronological reports of calls via one of the output port(s) of the RAUP or the TTY port on the CIOP.

The SMDR output device is assignable from the service terminal and this information is saved such that, if the system is reloaded, SMDR resumes operation automatically to its assigned output port.

The recording of calls is customer selectable on a per-incomingtrunk-group basis and on a per-outgoing-LCR-route-element basis, or on a per-outgoing-trunk-group basis if direct trunk group access is used.

When a call detail recording buffer is not available and an internal or outgoing call is attempted, the call will be either blocked or allowed to proceed without recording, based on a system option flag (defined via a CMU procedure). Incoming calls are never blocked.

8.02 Call Record Items. The call data items that are included in the SMDR report are described in below. An example of an SMDR printout is provided in Figure 8.00.

a. Record Type. This single-character field precedes the Source Identity field and does not have a heading. The character indicates the record type as follows: "T" for call trace, and blank for voice call.

b. Source Identity. This field identifies the originating (i.e., calling) party of the call on record. It includes the subscriber extension number for an outgoing call or the trunk group and trunk group member number for an incoming trunk call.

   The source identity is left blank for calls originated by, and not extended from, an attendant.

c. Destination Identity. This data identifies the terminating (i.e., answering) party of the call on record. It is the trunk group and trunk group member number of the trunk used for the outgoing call or the subscriber extension number in the case of an incoming trunk call.

   The destination identity is left blank for incoming calls terminated at, but not extended (or transferred) from, an attendant, Special Night Answer Position (SNAP), Zoned Universal Night Answer (ZUNA), Assigned Night Answer (ANA), or Special Overflow Answering Position (SOAP). If the incoming call is extended (or transferred) by the attendant, SNAP, ZUNA, ANA, or SOAP, the destination identity identifies the transferred-to-subscriber extension number or, trunk group and trunk group member number (i.e., trunk-to-trunk connection).

d. Least Cost Route Selection Route Number. This data identifies the route member used to route the call. This field is blank for internal and incoming calls and outgoing calls that do not utilize LCR (i.e., Direct Access trunks).

e. Access Code. This data identifies the routing access code dialed by the user after going off-hook (and receiving internal dial tone).

   When speed calling is used, this field contains the effective routing access code, rather than the speed calling access code.

f. Dialed Digits or Called Number. These are the digits dialed by the user after dialing any routing access code. The number of digits may vary up to a maximum of 16. They may include, for example, in chronological order, either of the following:

   - International Gateway Code, plus country code, plus remaining digits for International Direct Distance Dialing.
   - Prefix 0 or 1, plus area code (3 digits), plus Office Code (3 digits) plus Station Number (4 digits), i.e., up to 11 digits for domestic Direct Distance Dialing. Note that either prefix and/or area code may not be required for many local area calls.

   When speed calling is used, this field contains the effective destination address rather than the speed calling access code and member number dialed by the user.

   When Least Cost Routing (LCR) is used, this field contains the effective address dialed by the user rather than those outpulsed as a result of the LCR outdialing rule.

g. Authorization Code Index. (See Account Code/Authorization Code for the definition of "authorization code"). When an authorization code is entered and it is not "displayable" (i.e., is secret), a two-character index to the authorization code is listed in this field. A person with the proper authorization can use this index to obtain the full authorization code, and unauthorized persons are restricted from obtaining it.

   For some applications, such as for resale of services, a large number of authorization codes may be required. In such cases, if the index exceeds 99, the " ** " is printed in this two-character field.

h. Starting Time of Call. This field indicates the time of day, in hours, minutes and seconds at which recording commenced. For incoming calls, this is the time at which the call is answered. For outgoing calls over trunks that return answer supervision, this is the time at which answer supervision is received. For outgoing calls over trunks not returning answer supervision, this is the end of outpulsing time incremented by a customer adjustable filtering time. (If the holding time does not exceed the filtering time, the call is not recorded.)

i. Call Duration. Call duration is the elapsed time from the starting time of the call until the call is released. The duration is recorded in hours, minutes and seconds with the leading zeros and colon suppressed for hours.

   If the system time of day is adjusted while recording is in progress, it will not affect the validity of the reported call duration.

j. Special Identity. Whenever an attendant, SNAP, ZUNA, ANA, or SOAP is involved in answering an incoming trunk call, or whenever the attendant is involved in placing an outgoing trunk call, or whenever LCR routes a call over an expensive facility or a specialized common carrier, or whenever a call is forwarded to the public network, a special identity character is recorded.

   The following special identity characters are defined for this field:

   - 1-12 – Attendant Console 1-12
   - S – SNAP
   - Z – ZUNA
   - A – ANA
   - O – SOAP
   - E – LCR Expensive Facility
   - F – Call Forwarding to Public Network
   - B, C, D – LCR Specialized Common Carrier. Identity of SCCs 0, 1, and 2, respectively.

k. Account Code/Authorization Code. This field usually provides the account code data associated with the call record. However, if an authorization code is entered, and it is defined as "displayable" (i.e., the code is not secret), then this code is printed instead of the account code.

   An authorization code is a special security code (up to 6 digits) to allow an authorized subscriber to upgrade, for that call only, the class of service giving the user a special feature or otherwise unauthorized facility. When an authorization code is required, it is usually entered after the access code and prior to dialing the called number digits. Use of authorization codes include calls made from a restricted telephone using the Mobile Authorization Code feature and incoming calls on Direct Inward System Access trunks.

   The account code data is either the standard (i.e., default) account code assigned for the station or the special account code entered by the station user or the attendant, if applicable, for the outgoing call; the standard account code assigned for the station is used in the case of an incoming call.

   When a station accesses an LCR route element or a direct access trunk group not marked for special account codes, the standard account code assigned to the station is recorded. If no account code is assigned, the field is left blank.

   Authorization codes will be prefixed by "#" to distinguish them from account codes.

l. Pooled Modem Group. Refer to Siemens practice OC II General Description and Feature Supplement.

The following special considerations are applicable to the call data items:

- Station Call Transfer. A separate call record is generated each time a call is transferred by a station, except for incoming trunk calls transferred by a SNAP, ANA, ZUNA, or SOAP station, in which case the same call record is continued and a special identity character is recorded.

- Starting Time of DISA Call. On an incoming DISA call, an SMDR record shows the start time as the answer time of the destination, and not as the answer time of the DISA trunk.

- Attendant Controlled Conference. The source or destination identity for a party connected to an attendant-controlled conference is "ACC X" with "X" representing the conference circuit (1-8). "ACC X" appears as the source identity for parties called by an attendant and added to the conference. "ACC X" appears as the destination identity for parties who call into an attendant and are added to the conference.

- Meet-Me Conference. The source or destination identity for a party connected to a meet-me conference is "MMC X" with "X" representing the conference circuit (1-8). "MMC X" appears as the source identity for parties called by an attendant and added to the conference. "MMC X" appears as the destination identity for parties who dialed directly into the conference or call into an attendant and are added to the conference. Any account code applied to a meet-me conference must be entered by an attendant.

- Alternate Trunk Groups. If a trunk is accessed via direct trunk group access, the SMDR option to record or not record the call is based on the assignment of the primary trunk group, even when an alternate route is selected. When LCR is used, the SMDR option is based on the LCR route element used.

- Station Hunting. The account code and destination identity is that of the final (i.e., answering) station.

- Call Forwarding (internal). The account code is that of the forwarded (i.e., dialed) station and the destination identity is that of the forwarded-to (i.e., answering) station.

- Call Forwarding to Public Network. When an incoming trunk calls a station which is forwarded to the public network, two SMDR records are generated: one showing the incoming trunk as the source ID and the forwarded station as the destination ID; the other showing the forwarded station as the source ID and the out-going trunk as the destination ID. An internal station calling the forwarded station generates one SMDR call record showing the forwarded station as the source ID and the outgoing trunk as the destination ID. All records show the account code of the forwarded station.

8.03 Special SMDR Messages. The list below defines special messages, that is, messages other than call records, that are printed on the SMDR device.

a. Page Header. Each new page of SMDR call records is preceded by the page header. The page header identifies the current date and time (24-hour notation), and the page number of that date's report. The page header also provides the data headings for the call detail record items.

b. Daily Trailer. The call record report is concluded for the current data at midnight with the daily trailer. The daily trailer identifies the date of the report and the total number of pages printed for that date. The next day's report is automatically started at the top of the next page.

c. Attendant Activated (SMDR) Recording. The following message is printed when the attendant activates the SMDR recording for a particular trunk group:

   *** SMDR ACTIVATED FOR TRUNK GROUP xx BY ATTENDANT yy AT zz:zz:zz ***

   (where xx = activated trunk group number, yy = attendant number, zz:zz:zz = time of activation).

d. Attendant Deactivated (SMDR) Recording. The following message is printed when the attendant deactivates the SMDR recording for a particular trunk group:

   *** SMDR DEACTIVATED FOR TRUNK GROUP xx BY ATTENDANT yy AT zz:zz:zz ***

   (where xx = deactivated trunk group number, yy = attendant number, zz:zz:zz = time of deactivation).

e. Annoyance Call Trace. The annoyance call trace feature prints a message formatted identically to a call record, with the following exceptions:

   - A "T" is printed in the Record Type field.
   - The source identity shows the subscriber extension number of the station activating the annoyance call trace.
   - The destination identity shows the subscriber extension number of the trunk group and trunk group member number of the connected party.
   - Nothing is shown for RT, ACC. CODE, DIALED DIGITS, AUTH IDX., CALL DURATION, SPCL ID, and ACCT CODE/AUTH CODE.
   - The START TIME shows the time at which the annoyance call trace was made.

DATE AUG 09, 1984 TIME 13 57 53 PAGE 1

	SRCE ID	DEST ID	RT	ACC CODE	DIALED DIGITS	AUTH IDX	START TIME	CALL DURATION	SPCL ID	ACCT CODE / AUTH CODE	MP
	7100	02/00	00	9	3884543		13:57 09	0 16		8200	
	7216	08/01	03	9	17375354		13:52 31	4 58		5500	
	22/09	10/00	12		7541		13:51.18	6 14			
	1496	07/01	09	9	8323801		13.57 24	0 16		7200	
	7234	19/03	04	9	16094242400		13 57.32	0 10		7300	
	7164	08/00	09	9	5833487		13 57 10	0·39		5320	
	7344	02/02	00	9	4830561		13.58.09	0 01		5230	
	7234	19/01	04	9	16094242400		13 57 54	0 39		7300	
	1296	08/02	09	9	4458234		13·54·01	4 34		5320	
	7623	02/03	00	9	3689721		13 58 20	0 31		5230	
	7403	02/04	00	9	4870049		13.50 41	8:13		0800	
T	7003	04/11					13 51·04				
	7409	05/01	04	9	13168435943		13·58:51	0 06		0800	
	7100	02/00	00	9	4839200		13:58:37	0 29		8200	
	7220	10/00	12		7520		13·59·14	0·16		5970	
	22/06	7186					13 59 24	0 11		7800	
	7234	19/02	04	9	16094242400	03	13:59.11	0 32		2100	
	4222	11/00	01	9	0112233317826		13 58:57	1 28		5320	
	22/04	7233					13 58.29	2 22		7300	
	22/02	7286					14·00.52	0 16		7800	
	7188	08/01	03	9	18630545		14:58 40	2 30		7800	
	4312	03/02		81	4367		14 01.37	0 23		56743980347	
	7409	05/01	04	9	13168435543		14·00·22	2 00		0800	
	22/09	7122					14.02·31	0 09		5300	
	7235	08/02	03	9	15522171		15 02 32	0 30		7300	
	11/00	7420					15 02 51	0 29		0800	
	7149	07/00	03	9	19047857503		15·03·01	0 19		5910	
	7235	08/02	03	9	16658077		15 03 15	0 12		7300	
	400:	10/04	12		7541		15 02.58	1·08	2		
	7235	08/02	03	9	18136658077		15.03 41	0 30		7300	
	22/03	7380					15.03·52	0 21		7710	
	7428	07/02	09	9	7417556		15 04 21	0 22		5210	
	7189	19/01	04	9	14084225502		15 03:09	1 40		7800	
	11/00	7410					15 03·20	1 33		0800	
	22/03	3287					15·04 13	0 51		7710	
	7344	02/05	00	9	4830561		15 05 02	0 02		5230	
	1231	02/03	00	9	9427916		15 04.44	0 37		5910	
	MMC 1	03/00	02	9	9949950		15·05 22	0 02	2		
	7219	02/01	00	9	7511030		15 04:02	1·51		5280	
	7183	08/01	03	9	17377400		15.06:20	0·03		5620	
	03/03	4320					15 04·43	1 41		41256352225	
	7234	19/02	04	9	16094242400		15 04 47	1 44		7300	
	7381	02/00	00	9	18004320190		15 02 26	4 15		7710	
	22/04	7197					15 05·47	1 26		7800	
	ACC 2	03/02		81	4320		15·07 02	0·13	3		
	7344	02/00	00	9	4830561		15 07 17	0 02		5230	
	1250	07/01	03	9	18139573200		15·05 55	1 45		8200	
	7623	02/00	00	9	3917954		15 07.39	0 18		5230	
	22/11	10/00	12		7581		15 08 16	0·06			
	7342	02/00	00	9	9735265		15 08 16	0 14		5230	
	7183	08/02	03	9	17377400		15·08 36	0 10		5620	
	22/05	7203					15 07 51	1 00		7600	
	11/13	4444					18 12 10	0 48	S		
	17/05	3312					19·22 19	1 22	Z		
	01/00	7250					21·18 01	2 53	D		
	02/07	4352					21 39 28	5 11	A		

END SMDR RECORDS FOR JUNE 12, 1984
TOTAL PAGES FOR THIS DATE 2

A3437-1-5/20/85

Figure 8.00 Example of SMDR Printout

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SATURN® IIE EPABX

FEATURE DESCRIPTIONS

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1.01 Purpose of Document

The purpose of this document is to provide descriptions of all SATURN IIE (SATURN II - Expanded) Electronic Private Automatic Branch Exchange (EPABX) features. In this document, these SATURN IIE features are divided into the following four major categories:

- System Features
- Attendant Console Features
- Station Features
- Siemens Digital Telephone (SDT) Features.

An alphabetical list of these features, separated by category, is provided in Table 1.00. All mnemonics used in this document are listed and defined in Table 1.01.

1.02 General Information about Features

Features are the characteristics and capabilities of a telepho switching system. The features provided by the SATURN I EPABX System include the basic calling features such Station-to-Station Calling, Call Transfer, and Call Forwardin More elaborate features are also included, such as Least-Cc Routing, Station Message Detail Recording, and 15-Digit T Code Restriction.

The SATURN IIE EPABX features are designed to provide flexible and powerful telephone switching system that sati fies the user's communication requirements.

Table 1.00 SATURN IIE EPABX Features

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Table 1.00 SATURN IIE EPABX Features (Continued)

Table 1.00 SATURN IIE EPABX Features (Continued)

Table 1.00 SATURN IIE EPABX Features (Continued)

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Table 1.00 SATURN IIE EPABX Features (Continued)

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Table 1.01 Mnemonics Used in This Practice

MNEMONIC	DESCRIPTION
ACD	Automatic Call Distribution
ANA	Assigned Night Answer
ASCII	American Standard Code for Information Interchange
ATT RLS	Attendant Release
CCS	Hundred Call-Seconds
CCSA	Common Control Switching Arrangement
CFWD	Call Forwarding
CIOP	Controller/Input-Output Processor
CMU	Customer Memory Updating
CO	Central Office
COS	Class-Of-Service
DDD	Direct Distance Dialing
DID	Direct Inward Dialing
DISA	Direct Inward Dialing Access
DISAS	Direct Inward Dialing Access – Shared
DIT	Dedicated Incoming Trunks
DOD	Direct Outward Dialing
DSS	Direct Station Selection
DTMF	Dual Tone Multifrequency
EPABX	Electronic Private Automatic Branch Exchange
EPSCS	Enhanced Private Switched Communications Svc.
FX	Foreign Exchange
I/O	Input/Output
INC	Incoming
IOP	Input/Output Processor
LCR	Least Cost Routing
LDN	Listed Directory Number
LED	Light-Emitting Diode
MAJ ALM	Major Alarm
MIN ALM	Minor Alarm
MEM	Memory Module
MDF	Main Distribution Frame
OPR	Operator
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PSU	Power System Unit
RAM	Random Access Memory
RAUP	Remote Access Unit/RS-232 Ports
RCL	Recalls
SCC	Specialized Common Carrier
SDT	Siemens Digital Telephone
SET	Siemens Electronic Telephone
SLMA	Subscriber Line Module Analog
SLMA-S	Subscriber Line Module Analog – Station
SLT	Single Line Telephone
SMDR	Station Message Detail Recording
SNAP	Special Night Answer Position
SOAP	Special Overflow Answer Position
WATS	Wide Area Telephone Service
ZUNA	Zoned Universal Night Answer

SECTION 2.00 SYSTEM FEATURES

2.01 System Overview

The SATURN IIE System is a stored-program controlled Electronic Private Automatic Branch Exchange (EPABX), which uses Pulse Code Modulation (PCM)/Time Division switching. The SATURN IIE EPABX System is capable of switching both voice and data.

The SATURN IIE System is housed in a light-weight equipment cabinet called the Basic Cabinet. In its expanded configuration, the SATURN IIE System is housed in a Basic Cabinet plus an Expansion Cabinet. The Equipment Cabinet(s) contain all functional units of the system.

Plug-in printed circuit boards (PCBs) are installed in the cabinet. These PCBs contain the circuits for common control, switching, and for the peripherals required in system operation. The SATURN IIE EPABX provides from 224 to 480 ports in the basic cabinet. The expanded cabinet (stacked atop the basic cabinet) provides an additional 256 to 512 ports (992 ports maximum).

An optional Remote Access Unit board provides two RS-232-(ports for general use and one modem port for remote acces: A single RS-232-C port is provided by the CIOP board in th basic system for system interface.

The SATURN IIE EPABX System can be arranged to accom modate conventional telephones (rotary dialing and dual-ton multifrequency (DTMF) dialing) as well as Siemens Digital Te ephones (SDTs). The SATURN IIE EPABX can be equippe with a maximum of 12 attendant consoles or it can be opera ed without any consoles. One cable pair is required to inte connect each SDT to the SATURN IIE EPABX switchin system.

Administrative additions and changes are made by input c simplified instructions in plain English format via a local c remote service terminal. These modifications can be mad during system operation without interference to normal ca processing.

The following paragraphs describe the features that ar characteristic for the SATURN IIE EPABX System.

2.02 General Features

a. Additional Input/Output Devices

The SATURN IIE EPABX is capable of connecting input/output devices via three RS-232-C interface I/O ports and one port connected to a modem to allow remote access. All I/O ports can include, but are not limited to, local service terminal, Station Message Detail Recording (SMDR), automatic traffic measurement reporting, and on-line maintenance and administrative access. The RAUP contains an internal modem with a dedicated RS-232-C interface which provides a remote dial-up maintenance port (line or trunk interface).

b. Brownout Protection

The SATURN IIE EPABX power supply is designed to tolerate frequency deviations of as much as 3 Hz above or below the normal input frequency (60 Hz) and input voltage variations from 95 to 130 Vac.

c. Convection Cooling

The SATURN IIE EPABX, because of its low power consumption and efficient equipment layout, does not require the use of forced-cooling fans or similar equipment. The cabinet is designed to make full use of convection cooling of all the equipment while maintaining temperature design limits. However, the system must be located within an ambient environment ranging from 4 degrees C to 38 degrees C (40 degrees F to 100 degrees F), and a relative humidity range of 20% to 80%.

d. Digital Pad Switching

The SATURN IIE EPABX inserts the proper gain or loss into all connection paths to ensure correct transmission levels.

e. DTMF-to-Dial Pulse Conversion

DTMF-to-Dial Pulse Conversion enables DTMF stations to complete outgoing central office (CO) calls over dial pulse CO trunks. The SATURN IIE EPABX translates the DTMF station-generated signals and converts them to dial pulse digits for transmission to the CO.

f. Dual-Tone Multifrequency System Outpulsing

Dual-Tone Multi-frequency (DTMF) tones are generated as a SATURN IIE EPABX function on outward-dialed calls over DTMF Central Office (CO) trunks. DTMF outpulsing can be provided, regardless of the station dialing type (DTMF, digital, or rotary).

g. End-to-End DTMF Signaling

The SATURN IIE EPABX sends DTMF tones through the public network to the distant end. The transmission of DTMF tones is used for a variety of purposes, including computer access, control functions, and inward call completion at the distant switching system.

h. High Traffic Capacity

The switching network of the SATURN IIE EPABX is designed to be non-blocking. This network provides up to 36 CCS (1 Erlang) per port.

i. Low Power Consumption

The SATURN IIE EPABX has been designed to provide maximum efficient use and distribution of power via distributed power supplies. Power consumption depends on the system configuration: the total number and combination of lines, trunks, SDTs, attendant consoles, and any auxiliary equipment. A fully-equipped basic cabinet uses a nominal 800 Watts. A fully-equipped system with basic and expansion cabinets uses a nominal 1600 Watts.

j. Memory Support

If an ac power failure occurs, the optional memory support battery supplies the necessary power to maintain the Random Access Memory (RAM) for a minimum of 3 minutes. When power is restored, the internal battery backup, after 30 minutes of charging, is capable of another 3-minute cycle.

k. Off-Premises Stations

The SATURN IIE EPABX extends the station line circuits to industry-standard telephones located at a site remote (off-premises) to the system.

l. Station Class-of-Service

The SATURN IIE EPABX provides a maximum of 32 station classes-of-service. Each class-of-service can be arranged in memory to allow or deny access to any combination of features included in the system. For each station, class-of-service codes are stored in memory. These codes can be changed at any time by using the Customer Memory Updating (CMU) procedures.

Table 2.00 lists the features which can be assigned to individual stations through class-of-service codes.

m. System Site Identification (ID)

The SATURN IIE EPABX enables the entry of a specific customer's site identification into the customer portion of the system memory: site location, site name, site number, and/or similar information. These data can contain up to l6 characters and are printed out, via the terminal, as a heading at the beginning and end of each CMU session.

n. Trunk Group Class-of-Service

The SATURN IIE EPABX allows the assignment of a variety of attributes to each trunk group in the system. Data established on a per-trunk-group basis include: applicable toll code restriction lists, restricted station classesof-service, alternate trunk groups for routing purposes, incoming/outgoing control signaling information, incoming/outgoing call-usage types, attendant console answering priority, Direct Inward Dialing (DID) prefixing/deletion/conversion information, night answering assignments, and assigned trunk group alphanumeric display characters.

o. Uniform Station Distribution Wiring

The SATURN IIE EPABX maintains consistent cabling requirements regarding size, type, and number of cabling pairs connecting all types of station instruments such as single-line telephones (SLTs) and Siemens Digital Telephones (SDTs). A maximum of one cable pair is required between each instrument and the system.

2.03 Administration Features

a. Customer Memory Updating

The CMU feature allows authorized personnel at a designated service terminal to enter and make changes to customer memory during normal system operation with no interference to current call processing.

Customer memory, a portion of the complete system memory, contains the data relating to system configuration, including programmable features and options which the customer can select and arrange. Changes to customer memory are made by using plain English terms rather than numeric codes, thereby simplifying data base updates.

b. Remote Customer Memory Updating

This feature allows authorized personnel at a service terminal to enter and make changes to customer memory from a central depot or off-premises location. Changes can be made during normal system operation with no interference to current call processing. The service terminal must be equipped with a type 103/113- or 212A-compatible modem of the originate-type. The SATURN IIE EPABX is provided with a compatible modem of the answer-type equipped (internally) in the RAUP.

Access to the SATURN IIE EPABX is gained by dialing a preassigned public or private network number. Refer to the feature, "Customer Memory Updating."

c. Remote Traffic and Feature Usage Measurement

Detailed traffic and feature usage measurement information is obtained from a service terminal that is located remote to the SATURN IIE EPABX. The service terminal must be equipped with a type 103/113- or 212A-compatible modem of the originate-type.

The SATURN IIE EPABX is provided with a compatible modem of the answer-type equipped (internally) in the RAUP. Access to the SATURN IIE EPABX is gained by dialing a preassigned public or private network number. Refer to the feature, "Traffic and Feature Usage Measurement."

d. Station Message Detail Recording (SMDR)

The Station Message Detail Recording feature provides a detailed record of all completed incoming and/or outgoing trunk calls by trunk group. Intraswitch station-to-station, station-to-attendant, and attendantto-station calls are not recorded. The following information is recorded:

- Access Code
- Account Code/Authorization Code
- Authorization Code Index
- Call Duration
- Destination Identity
- Dialed Digits or Called Number
- LCR Route Selection Number
- Record Type
- Source Identity
- Special Identity
- Starting Time of Call.

The monitored data can be recorded on a suitable printer (via an RS-232-C interface) for hard-copy printout reports. Suitable accounting devices (e.g., SMDR unit) can also be connected to this interface.

The SMDR feature allows a service terminal user to enable or disable the following:

- SMDR call record output for all incoming and/or outgoing calls over all trunk groups;
- SMDR call record output for all incoming calls over a particular trunk group;
- SMDR call record output for all outgoing calls over a particular trunk group.

e. Station Message Detail Recording (SMDR) Account Codes

Account codes can be used in conjunction with SMDR on incoming and outgoing trunk calls for such purposes as cost accounting or client billing. The account codes can be up to 11 numeric digits in length.

Two types of account codes are used: (i) standard (or default) account codes and (ii) special account codes. Default account codes are assigned to stations and are automatically activated when a station user originates or receives a call over a trunk. Special account codes must be entered from the user's telephone after the user has dialed a trunk group access code (e.g., "9" for a CO trunk) or after an LCR access code and desired destinations number. A station user may also override a default account code or previously entered special account code with another special account code at any time during an established trunk call.

Recall dial tone is heard when a special account code is required. If a special account code is not entered when requested by the system, the user is restricted from making the call. Only the number of account-code digits is checked by the SATURN IIE EPABX System.

Attendant consoles and SDTs can be assigned an account button, thus obviating the need for the user to display and change account codes on a per-call basis.

f. Traffic and Feature Usage Measurement

This feature provides the SATURN IIE EPABX with the capability of automatically or manually monitoring and recording various system operations for which traffic and feature usage information is desirable.

Two different types of measurements are provided. The first type is event (peg) counts, which give an actual count of the number of times a particular operation has occurred in the system. The second type is usage counts, which give the approximate total time a particular resource is in use during a certain time interval. This count is given in CCS (hundred call-seconds).

The traffic and feature usage measurement data are stored in system memory. These data can be transmitted as output to a service terminal at designated intervals (15 minutes to 24 hours, in increments of 1 minute), or on request. Normally, reporting periods are specified in multiples of 15 minutes.

For a list of the types of event counts and usage counts that are monitored and recorded in the SATURN IIE EPABX, refer to Table 2.01, "Traffic and Feature Usage Measurement."

g. Variable Timing Parameters

This feature provides for authorized personnel to change the timing parameters of system operating functions. The timing parameters are changed by using CMU procedures.

2.04 Flexible Numbering Features

a. DID Flexible Station Numbering

Direct Inward Dialing (DID) calls from the CO are routed through the SATURN IIE EPABX to the appropriate station. The CO forwards the last 2, 3, 4, or 5 digits of the directory number as an EPABX station address. The SATURN IIE EPABX can either absorb or prefix the leading digit(s) which are forwarded to it.

For example, if the CO forwards 48801 and the station number plan uses numbers 0 through 999, the Saturn IIE EPABX System can delete the 48 so that station 801 is rung. On the other hand, if the CO forwards only 01 and the stations are numbered from 800 through 899, then the number "8" is prefixed by the SATURN IIE EPABX, and station 801 is rung.

The SATURN IIE EPABX System can also translate numbers into another range. For example, if the CO forwards the numbers 300 through 399 but the internal station numbering plan starts with 500 (500 through 599), the "3" (the hundreds digit) can be translated to a "5" by the system. This number translation is also provided for the tens digit (in a 2-digit numbering plan) and the thousands digit (in a 4digit numbering plan).

With this DID flexible numbering concept, the external CO numbering plan can be made to agree with the internal station addresses.

Table 2.00 Station Class-of-Service Features

FEATURES
ACD Group Access
Apparatus Test Access
Attendant Call Hold Retrieve
Attendant Override Security
Automatic Answer – Automatic and Executive Intercom
Automatic Answer – Prime Line
Call Forwarding – All Calls/Busy Lines/No Answer
Call Forwarding – Fixed
Call Forwarding – Secretarial
Call Forwarding to Public Network
Call Hold
Call Hold – Flip-Flop (Broker)
Call Park
Call Pickup – Directed
Call Pickup – Group
Call Tracing
Code Call Access
Data Line Security
Diagnostic Test Access
Dictation Access
Do-Not-Disturb
Eight-Digit Toll Code Restriction Lists
Executive Override
Executive Override – Automatic
Executive Override No Tone Security
Executive Override Security
Executive Override Without Warning Tone
Fifteen-Digit Toll Code Restriction Lists
Forced Release
Ignore Flash
Internal Call Queuing – Callback/Standby
Internal Call Queuing – Standby (Originating)
Internal Call Queuing – Standby (Terminating)
Last Number Dialed
Least Cost Routing Access
LCR Alternate Trunk Group Advance
(Immediate, Timed, or No Advance)
LCR User Priority Level
Meet-Me Conference
Message Waiting Activation
Message Waiting – Automatic Callback; and
Message Waiting – Cancellation
Outgoing Call Queuing – Callback
Outgoing Call Queuing – Standby
Ringback
Saved-Number Redial
Speed Calling – Group (1 – 4 Groups)
Speed Calling – Individual
Station Class-of-Service Exclusion
Station-Controlled Conference
Station-Controlled Trunk-to-Trunk Connection
Station Hunting – Busy Advance
Station Hunting – No Answer Advance
Stop Hunt
Terminating Trunk Group Call Exclusion
Trunk Group Access
Trunk-to-Trunk Connection
Voice Page Access (Specific Zone or Combination of Zones)
Zoned Universal Night Answer

Table 2.01 Traffic and Feature Usage Measurement

CATEGORY	EVENT COUNTS	USAGE COUNTS IN CCS
System Related	Conference Circuit Congestion DTMF Receiver Attempts DTMF Receiver Congestion Ineffective Attempts Number of Connections to Hunt Groups Number of Connections to Terminal Devices	DTMF Receiver Usage Hunt Group Queue Usage Traffic Usage of Conference Devices Traffic Usage of Terminal Devices
Attendant Related	Attendant Extended Calls Attendant Feature Activation Attendant Originated Calls Attendant Overflow Attendant Queue Abandon Attendant Queue Answer Attendant Queue Entries Attendant Queue Jumped Call Exclusions (Note 3) Calls-Waiting Lamps Flashing	Attendant Queue Usage Attendant Usage Calls-Waiting Lamp Flashing Calls-Waiting Lamp On
Trunk Related	Incoming Trunk Attempts Outgoing Trunk Attempts Outgoing Trunk Queuing Trunk Call Busy (Note 1) Trunk Call Completions (Note 1) Trunk Group Congestion Trunk No Answer Count (Note 1)	Incoming Trunk Usage Outgoing Trunk Queue Usage Outgoing Trunk Usage
Station Related	Dial Tone Delay Feature Button Activated Non-Feature Button Activated Internal Attempts Permanent-Line Lockout Count Pickup Button Activated Station Call Busy (Note 2) Station Call Completions (Note 2) Station No Answer Count (Note 2)	ACD Group Usage (All Groups) SDT Group Incoming/ Outgoing Call Usage Station Usage

NOTES: 1 – Incoming Calls
2 – Internal Calls
3 – Incoming, Operator, and Recalls.

2.04 Flexible Numbering Features (Continued)

b. Flexible System Numbering Plan

The SATURN IIE System allows the assignment of station numbers, trunk access codes, and feature access codes in accordance with a customer-established numbering plan.

Station numbers and access codes are assigned and/or changed via CMU procedures and can be from 1 to 4 digits in length. Station numbers and access codes of different lengths are allowed provided that an assignment of one number is not a partial dial sequence of another number. For example, "214" is not allowed in the same system with "2l41".

Any first digit, 0 through 9, may be defined as the beginning of a station number. However, digit 0 is normally reserved for the attendant. The first digit for access codes may be 0 through 9, *, or #.

c. Multiple Listed Directory Numbers

The SATURN IIE EPABX System can be supplied with multiple CO- Listed Directory Numbers (LDNs). Each incoming DID trunk group assigned in the system can be provided with an LDN.

d. Station Extension Numbering

The SATURN IIE EPABX System allows the assignment of an additional number to an existing extension (station) number. These additional station numbers are known as "alias extension numbers" to the primary (existing) station numbers.

2.05 Night Answering Features

a. Assigned Night Answer (ANA)

When all attendant consoles are unstaffed, incoming trunk calls normally directed to the attendant are directed to preselected stations. This arrangement is known as Assigned Night Answer (ANA).

The night answering station(s) can be an individual station or the pilot number of a hunt group. The assignment of trunks or LDNs to ANA stations (for SATURN IIE Systems served by DID trunks) is performed via a CMU procedure.

The night answering stations can make inside and outside calls and can access system features in the normal manner. When in night service, handling of the incoming trunk calls is accomplished by use of the station Call Transfer feature.

b. Night Service Automatic Switching

If an incoming CO call to the attendant console is not answered within a predetermined period of time (variable via a CMU procedure), this feature automatically switches the SATURN IIE System into the night service mode.

c. Special Night Answer Position (SNAP)

The Special Night Answer Position is either a single EPABX station, the pilot number of a hunt group or an Automatic Call Distribution (ACD) group designated to handle incoming night calls which have not been assigned to any other night answering mode.

The SNAP station can access station-related features in the normal manner. Handling of incoming trunk calls is accomplished by use of the Station Call Transfer feature. SNAP stations are also alerted for night answer Transfer With No Answer or Zoned Universal Night Answer (ZUNA) No Answer conditions.

d. Zoned Universal Night Answer (ZUNA)

Arrangements can be made for incoming trunk calls, normally directed to the attendant, to activate a signaling device (bells, gongs, etc.) on the customer's premises when the attendant consoles are unstaffed. This feature is known as Zoned Universal Night Answer (ZUNA).

A maximum of 4 zones, each having an associated signaling device, can be provided in the SATURN IIE System. Incoming calls to a particular zone can be answered by code. Incoming calls are handled by using the station Call Transfer feature. Sounding of a particular signalling device within a zone is accomplished on a per-trunk basis. DID trunks are handled on a trunk-group basis only.

2.06 System Dialing Features

a. Direct Inward Dialing (DID)

This feature allows an incoming call from the CO to reach a SATURN IIE EPABX station without using attendant assistance. Stations having this feature are assigned 7-digit telephone numbers within the numbering range of the DID serving CO.

b. Direct Inward System Access (DISA)

The DISA feature allows an outside party to gain access to its facilities by dialing directly into the SATURN IIE EPABX, without attendant assistance. To use this feature, the party dials a non-published directory number to connect to the SATURN IIE EPABX via a dedicated CO trunk. The user waits for dial tone and then dials a 2- to 6-digit authorization code. After the code has been validated by the system, the party then receives dial tone again and can place a call or use a feature as if the party were at a SATURN IIE EPABX station having the class-of-service associated with that authorization code.

DISA trunks can be accessed during daytime and nighttime service. DISA trunks may not be used for outgoing service as part of another trunk group. The station class-ofservice can be arranged in SATURN IIE memory to include any combination of call privileges. Two thousand authorization codes (DISA or Mobile) are provided in the system.

Each authorization code may be marked as being printable or not printable for SMDR output. If both an account code and a printable authorization code are used on a particular call, then the associated SMDR call record will only contain the authorization code. If a non-printable authorization code is used, then the authorization code index and the account code (if any) are printed.

c. Direct Inward System Access - Shared (DISAS)

The DISA - Shared feature is similar in all respects to DISA, except that the trunk group, which is serving this feature, is shared between DISA and normal operation. When the trunk group is marked as DISAS in the SATURN IIE software, calls to the special DISA directory number are handled as incoming calls as long as at least one attendant console is in operation. These calls are routed to an attendant.

If the system is in the night mode of operation (e.g., no consoles are active), the call is routed via the DISAS trunk group, as described in the feature, "Direct Inward System Access."

d. Direct Outward Dialing (DOD)

The Direct Outward Dialing feature allows authorized station users to complete outward calls without attendant assistance.

e. Station-to-Station Calling

This feature permits any station user to dial other stations within the SATURN IIE EPABX directly without attendant assistance. Note that station calling restrictions may prevent stations of one class-of-service from calling stations of another class-of-service.

2.07 System Alarm Features

a. Alarm Indication - Major

A Major Alarm indicator is provided in the Control Logic Board within the PSU panel. The alarm indicator lights steadily when the system is in a non-operative state and system-failure transfer is active.

b. Alarm Indication - Minor

A Minor Alarm indicator is provided on the maintenance panel and lights steadily when the system is operative and has detected a minor alarm condition. A minor alarm can be the result of a system-detected error, either internal or external, a system event of note, such as an annoyance call trace record, or a failure during an on-line diagnostic test. The indicator remains lit until the alarm is displayed by the system administrator via the appropriate CMU procedure. The system administrator can control, via CMU procedure, the set of detectable errors or events that will be reported as minor alarms.

A Minor Alarm LED (MIN ALM) is also provided on the attendant console and lights steadily for a selected subset (also controllable by the system administrator) of system minor alarms. The indicator remains lit until the alarm is displayed by the system administrator via the CMU procedures, or until the alarm is displayed by the attendant on the attendant console.

c. Remote Alarm Identification

Dry contact closures are used as the interface for identifying both Major and Minor Alarm conditions existing in the SATURN IIE EPABX. The contacts are located in the Power System Unit (PSU) and can be wired to the Main Distributing Frame (MDF). The contact closures can be distributed further, via cable pairs, to a remote location and can be used to activate audible or visual alarms, as needed.

d. Power Failure Restart – Floppy Disk

This feature is used to reload the system memory from the floppy disks when volatile memory can no longer be maintained during a commercial power failure. When commercial power has been restored, the floppy disk drives are automatically activated to reload the various elements of system memory. After reloading is completed, the system is capable of full operation.

2.08 Line Lockout Features

a. Line Lockout – Attendant Intercept

Any station user who remains off-hook without dialing or remains connected to a busy station for more than a predetermined time interval, may be automatically routed to the attendant queue. This feature is provided as an alternative to the normal Line Lockout – Automatic treatment.

b. Line Lockout – Automatic

This feature helps to to prevent a tie-up of the SATURN IIE System's common equipment, such as DTMF receivers. Whenever a telephone handset is left off-hook, listening to dial tone (without dialing), busy tone, reorder tone, intercept tone, etc., for longer than a predetermined period of time, the system automatically releases the station from the SATURN IIE EPABX switching equipment.

When line lockout occurs, the station is disconnected from the system and prevented from making or receiving calls. Placing the telephone handset on-hook or momentarily pressing the hookswitch returns the station to an operable condition.

2.09 Intercept Features

a. Automatic Call Distribution Recorded-Announceme Service

The SATURN IIE EPABX is provided with the capabi ty of connecting an incoming trunk call to a recorde announcement device when all stations in an AC group are busy.

If that particular feature option is provided, an a nouncement advises the caller of a possible delay (e.g a "Please hold" message). After the call has been co nected to the announcement, the SATURN IIE EPAB automatically routes the call to an idle ACD static when one becomes available.

Only one recorded-announcement for intercepts is pe mitted per system.

b. Flexible Intercept Facilities

Calls that cannot be completed because of class-o service restrictions, unassigned station numbers, or ac cess codes are routed to an intercept facility. The ir tercept assignment is made via a CMU procedure.

For DID and tie trunk calls, the intercept is either t the attendant, a recorded announcement, or to a re order tone if no recorded announcement is available

For station and attendant calls, the intercept is alway to intercept tone. The only exception occurs when a station call is intercepted as the result of an attendan imposed dial restriction. In that case the call is route to the attendant. Only one recorded announcement pe intercept is permitted per system.

2.10 Access to Customer-Provided Equipment Feature

a. Code Call Access

Station users can dial an access code and a 1- to 4-digi called-party code to activate customer-provided code call equipment, which controls signaling devices throughout the premises. The signaling devices car be audible and/or visual. The called party can then answer the code call and connect to the calling party by dialing a code call answerback code from any statior served by the SATURN IIE EPABX.

b. Dictation Access

This feature allows station users access to customer-provided dictation equipment in order to record voice messages or play back previously-recorded messages. The dictation equipment is seized by dialing the assigned dictation access code.

Dictation equipment functions such as start, stop, and playback are controlled by dialing the digits assigned for the various functions. A maximum of four dictation channels can be provided in the SATURN IIE EPABX.

c. Music On Hold – Line or Trunk Interface

The SATURN IIE EPABX is able to interface with music to "held-call" conditions. The held call can be the result of Attendant Call Hold, Station Call Hold, Call Park, Manual Hold, or Exclusive Hold conditions.

The Music-On-Hold interface may be assigned as an E&M trunk circuit or as a line circuit (and includes SLMA-S and SLA-16).

d. Music-On-Hold – Paging

This SATURN IIE EPABX System feature allows the customerprovided Music-On-Hold source to be routed to the paging equipment. This arrangement provides music, instead of silence, to the paging zone whenever the paging equipment is idle.

e. Music-On-Hold – System

The SATURN IIE EPABX is able to interface with customer-provided audio equipment in order to provide music to "held call" conditions. The held call can be the result of Attendant Call Hold, Station Call Hold, Call Park, Manual Hold, and Exclusive Hold Conditions.

2.11 Restriction Features

a. Eight-Digit Toll Code Restriction For Direct Trunk Group Access

This feature permits SATURN IIE EPABX to allow or deny stations access to specific CO exchanges, area codes, service codes, operator, and other services encountered on the Direct Distance Dialing (DDD) network. The SATURN IIE EPABX can provide 16 separate and different 8-digit toll code restriction lists. One or more lists may be assigned to each trunk group.

A total of 256 entries may be assigned to the 16 lists. Each entry within a restriction list can be from 1 to 8 digits in length. Each list can be either the "allow" or the "deny" type, and is assigned to stations on a class of-service basis.

b. Fifteen-Digit Toll Code Restriction For Direct Trunk Group Access

This feature permits SATURN IIE EPABX to allow or deny stations access to specific CO exchanges, area codes, service codes, operator, and other services encountered on the Direct Distance Dialing (DDD) network. The SATURN IIE EPABX can provide 4 separate and different 15-digit toll code restriction lists. One or more lists may be assigned to each trunk group.

A total of 32 entries may be assigned to the 4 lists. Each entry within a restriction list can be from 1 to 15 digits in length. Each list can be either the "allow" or the "deny" type, and is assigned to stations on a class-of-service basis.

c. Daytime Trunk Control

The SATURN IIE EPABX System can be arranged to restrict specific trunk groups from access by stations for outgoing calls during daytime operation, and to restore access availability when the system is in night service mode. While daytime trunk control is in effect, only the attendant has access to these trunk groups. Station users who attempt calls over trunks under daytime trunk control are routed to the attendant recall queue. Once answered, the call can be completed at the attendant's discretion.

d. Incoming Class-of Service Blocking

This feature prevents an attendant from extending a call if the station's class-of-service is blocked for the classof-service assigned to the trunk.

e. Station-to-Station Class-of-Service Blocking

This feature prevents stations assigned to a certain class-of-service from accessing stations assigned to another class-of-service. An intercept tone is provided to station users dialing stations that are blocked by their class-of-service.

2.12 Diagnostic and Maintenance Testing Features

a. Automatic On-Line Diagnostic Testing and Reporting

The SATURN IIE EPABX is provided with software self-test routines which verify that certain software and hardware operations, initiated by the main controller, have been successfully completed. If an error occurs, software records the error(s) in the "Failure History Memory," and the minor alarm is activated. Appropriate recovery procedures are executed automatically, if necessary.

The SATURN IIE EPABX is also provided with a repertoire of audits that test the SATURN IIE EPABX common control equipment. Each audit performs a specific test and can be individually enabled or disabled by maintenance personnel via the service terminal.

When the audit is run, detected failures are recorded in the "Failure History Memory," and the minor alarm is activated. Appropriate recovery programs are executed automatically on the failing equipment. All audits do not interfere with normal call-processing activities.

b. Manual On-Line Maintenance Testing

The SATURN IIE EPABX software package includes test programs that permit test calls to be initiated into and through the system to verify correct operation of the peripheral equipment and selected common equipment, such as the tone generator.
Resulting visual and audible responses from these tests make it possible to verify correct operation or to detect and isolate a major portion of system malfunctions. These test programs are accessed from a maintenance classmarked telephone.

c. Remote On-Line Maintenance and Diagnostic Testing

Maintenance testing can be performed at a location remote from the SATURN IIE EPABX. Access to the Maintenance tests is available on a dial-up basis via local or long-distance trunks by using the DISA facility.

Diagnostic testing can also be performed from a remote service terminal via dial-up access to the modem port on the optional RAUP board.

2.13 Trunking Features

a. Alternate Routing

The SATURN IIE EPABX provides automatic routing of outgoing calls via alternate trunk groups when all circuits in the primary trunk group are busy. A maximum of three alternate trunk groups can be assigned when direct trunk group access is used. Least Cost Routing (LCR) allows up to seven alternates.

b. Central Office (City) Trunk Access

Access to CO trunks by SATURN IIE EPABX station users is made by dialing an access code. Digit "9" is most-commonly used for such access.

c. Common Control Switching Arrangement (CCSA) Access

This feature allows station users access to a CCSA network by dialing an access code. A network call is placed by dialing the CCSA number of the desired party. Features available to service incoming and outgoing calls to and from the CCSA network are similar to those available to incoming and outgoing CO calls.

d. Dedicated Incoming Trunks

The use of Dedicated Incoming Trunks (DITs) permits a call to bypass the attendant console and ring at a preassigned internal station or hunt group. An unanswered call can be sent to a night answering arrangement (e.g., ANA, UNA, etc.). via the DIT when the following circumstances exist:

a) the system is not equipped with a console
b) the console is in night service or
c) the console is out-of-service.

All call-forwarding functions apply to DITs, including the transferring of DIT trunk calls to the attendant when the console is in service. A maximum of 255 DITs are provided in the SATURN IIE EPABX.

e. Enhanced Private Switched Communication Service Access

SATURN IIE EPABX station users access an Enhanced Private Switched Communications Service (EPSCS) network by dialing a preassigned access code. By using the EPSCS facility, they may either dial the EPSCS network number of the desired party or an off-network number.

Features available to service incoming calls from the network and outgoing calls to the network are similar to the features available to incoming and outgoing CO calls.

f. Foreign Exchange Trunk Access

An FX trunk is a trunk facility between the EPABX and a CO located beyond the local service area of the serving CO. Such facilities permit the SATURN IIE EPABX System to provide local service to and from the distant service area. Station users gain access to FX trunks by dialing an access code.

g. Least Cost Routing (LCR)

The SATURN IIE EPABX routes outgoing calls over th lowest cost route available at the time of call placemen A station user accesses the LCR feature on a per-ca basis by dialing the LCR feature access code befor dialing the outside number. The routing of the call i selected from a predefined list of eligible trunk group based on the digits dialed by the user, the user's clas of-service, and the time of day.

Trunk groups are ranked from first to last choice (i.e lowest to highest cost), thus providing the lowest co routing for the existing busy/idle condition of the elig ble trunks.

The LCR feature provides Outgoing (trunk) Call Queu ing Callback and Call Queuing – Standby capabilitie To activate the Outgoing Call Queuing – Callback fe ture, the station user dials the LCR access code and th desired destination number. Assuming all routes are bus the station user waits for a steady low tone. Upon recei ing the steady low tone, the station user places the hand set on-hook in order to be placed on queue.

Once on-queue, the station is called back when a trun becomes available. The queue is handled on a firs in, first-out basis. One queue per station is allowed a any time. If another attempt is made to invoke a cal back queue on the same station, the previously queue call is removed from the queue and replaced with th latest request.

When the Outgoing Call Queuing – Callback featur is active, the activating station user may receive c originate other calls. The Outgoing Call Queuing Cal back feature can be cancelled at any time via a diale cancellation code.

The LCR Outgoing Call Queuing – Standby feature an extension of the LCR Callback feature describe above. To invoke this feature, the station user waits of hook in a standby queuing mode and listens to silenc or music (if it is provided). The standby queuing mod eliminates the user going on-hook to be called bac when a trunk becomes available. When a trunk doe become available, the station is connected to the trunl

The station user may convert from standby queuin to callback queuing by going on-hook.

The LCR feature is capable of routing calls over trunk in the public network (i.e., CO, FX, WATS trunks), pr vate network including Common Control Switching A rangement and tie trunks, as well as over Specialize Common Carriers (SCCs).

The LCR feature provides the following additional rou selection criteria:

1. LCR User Priority. Each station class-of-servic user is assigned priority codes that indicate elig ble routes. access is permitted only to those route assigned a priority code which matches one of th priority codes associated with the user's COS.

2. Time-of-Day and Day-of-Week. Time bands (e.g 1 PM through 6 PM, 6 PM through 12 midnigh

called schedules, are assignable on one-hour boundaries for each hour of the day and each day of the week.

A "minutes offset" is provided for each schedule to accommodate rate changes that do not occur on the hour. The selection of a route for a given dialing pattern is variable, depending on the current schedule.

3. Alternate Trunk Group Advance. When an all-trunks-busy condition exists, three modes of advancing from first-choice to lesser-choice trunk groups are provided:

   a) Immediate Advance
   b) Timer-Controlled Advance
   c) No Advance (i.e., the call is routed over the first-choice trunk group only).

   The option of which method to use is stored as a classmark in the station's class-of-service. Attendants are always provided with the Immediate Advance mode.

4. Wide-band tone detectors used in conjunction with flexible outpulsing rules with the SATURN IIE System are used to detect special dial tone provided by several Specialized Common Carriers.

5. The SATURN IIE EPABX may be programmed to switch from DTMF, detect dial tone, to dial pulse in order to route calls via LCR through a switched tandem network. The system is capable of "toggling" from one mode to another, as required for such operation.

6. In order to speed up cut-through on trunk group calls, the LCR feature can be used to analyze the trunk group call digit strings.

7. The SATURN IIE EPABX provides the option of not providing dial tone after dialing the LCR access code on LCR calls.

8. The SATURN IIE EPABX also provides the option to prohibit confirmation tone from being returned after LCR route-selection is completed.

9. The LCR feature provides a filtered dial tone detection option to allow rejection of busy, reorder, and ringback tones.

10. Equal Access to Prime Carrier. The LCR feature is also used to route long-distance calls over all customer selected carriers without dialing a special access code.

    For example: The SATURN IIE System user dials 9 + 1 + NAX + NNX + XXXX. If the route list's outdial rule for the prime carrier is satisfied, the system outdials 1 + NAX + NNX + XXXX; if the route list's outdial rule for a secondary carrier is satisfied, the system outdials 10XXX + NAX + NNX + XXXX.

11. The LCR feature also provides a means for rechecking a lower-cost route even though the call has advanced to, and is in queue for, a more-costly route. This "look back" queuing capability allows a call to be routed over a previously busy but lower-cost route, if a trunk within that trunk group becomes available before the more-costly route is used.

h. Least Cost Routing with Provisions for Specialized Common Carrier

   The LCR feature is capable of routing calls via an SCC through dial or dedicated access. The SCC's directory number and authorization code may be stored in SATURN IIE memory for outdialing. Because an SCC can be accessed over local CO trunks (i.e., dial-up access), the SATURN IIE EPABX provides the capability to turn such access on or off, from an attendant console and/or from a service terminal. Up to three SCCs can be accommodated in the SATURN IIE EPABX.

i. Tandem Trunking

   The SATURN IIE EPABX can act as a tandem switch, routing incoming calls from one switching system to another, without the need for attendant assistance. The major use of this feature is in association with dial tandem tie trunk networks to allow tie trunk connections, and in some cases, to allow incoming tie trunk calls automatic access to the CO trunk for completion of local CO calls.

j. Tie Trunk Access

   This feature allows station users dial access to one-way or two-way tie trunk circuits interconnecting the SATURN IIE EPABX with another switching system. The trunks can be furnished with E&M signaling, and configured for automatic or dial repeating operation with or without second dial tone. Two-wire or four-wire type E&M trunks are available.

k. Trunk-to-Trunk Connections

   This feature allows the attendant to extend an incoming trunk call to an outgoing trunk. Connections can be made among CO, Foreign Exchange (FX), Wide Area Telephone Service (WATS), Direct Inward Dialing (DID), and tie trunks.

   All combinations of these trunks can be connected by the attendant. The only restriction is that the incoming call must have been completed through a trunk that provides disconnect supervision (generally ground start trunks or E&M trunks). If disconnect supervision is not provided and the attendant attempts to make the connection, a three-minute (variable) timer is started. When the timer times out, the trunk-to-trunk connection is recalled to the attendant.

l. Wide Area Telephone Service Trunk Access

   This feature allows station users access to WATS by dialing an access code. WATS enables customers to make calls over extensive geographic areas at special billing rates.

SECTION 3.00 ATTENDANT FEATURES

3.01 Attendant Console Overview

The attendant console is a desk-top-position console from which the attendant handles calls by using pushbutton keys. A maximum of 12 attendant consoles can be provided in the SATURN IIE EPABX.

A telephone handset is furnished with the console. An optional headset may be substituted for the handset. Both tone and visual indicators alert the attendant to incoming calls. The tone may be controlled via a volume control located at the front edge of the console.

The attendant console is provided with a 12-button keypad (digits 0 – 9, *, #) which allows the attendant to complete all types of calls. The dialed digits are digitally encoded, and transmitted to the SATURN IIE EPABX System for processing.

Each attendant console has a 40-character upper- and **lower**-case alphanumeric display, which presents call information to the attendant. This information includes the station number or trunk type, the number of the called and calling parties, and the calling station class-of-service. The alphanumeric display also allows the attendant to monitor the system alarm conditions.

Connections to the console are made through a three-pair modular connector-ended cable which provides voice, control signals, and power. The cable is installed through the bottom rear of the console via a plug-in jack. Two of the pairs are used for data transmit and receive, plus SATURN-provided power. The third pair to the modular jack is a spare pair.

The attendant console(s) can be located up to 2000 cable feet (610 meters) from the SATURN IIE EPABX.

The following paragraphs describe the features that are related to the attendant console only. Refer to SECTION 4.00: STATION FEATURES, for additional console-related features.

3.02 General Features

a. Console Operation

Incoming calls are uniformly distributed among the attendant consoles. Any station user can dial-access a selected attendant when multiple consoles are provided.

The SATURN EPABX can also function without an attendant console. For consoleless operation, assigned UNA and/or ANA stations can handle incoming calls by utilization of the Call Transfer and Internal Call Queuing — Standby features.

b. Flexible Key Assignments

The attendant console is equipped with one digital 12button keypad and 34 non-locking keys, each containing one internal status indicator Light-Emitting Diode (LED). Sixteen keys have fixed assignments, and provide the basic control functions for the console. The remaining 18 keys are flexibly assignable by using CMU procedures. These keys can be programmed to provide the following functions:

1. Attendant Conference (up to three keys can be assigned.)
2. Attendant Control of Facilities (one or more keys can be assigned)
3. Attendant Override
4. Attendant Overflow
5. Call Park
6. Direct Trunk Group Access (one or more keys can be assigned)
7. Message Waiting — Activate
8. Message Waiting — Cancel
9. Minor Alarm
10. SMDR Account Code Input
11. Trunk Flash
12. Volume Control — Audio (receive only)
13. Class of Call Exclusion Keys (up to three keys can be assigned).

c. Senderized Operation

The attendant may dial as many digits as required to reach a destination. The attendant does not have to remain on the call once dialing is completed.

3.03 Call Handling Features

a. Attendant Selective Answering Priority

Three separate call answering keys on the console allow the attendant to manually select among Incoming (INC), Recalls (RCL), and Operator (OPR) calls.

These calls are answered according to customer-established priorities. Additionally, each trunk group can be assigned an answering priority level code that allows incoming trunk calls in higher-priority trunk groups to be connected to the attendant before longer-waiting calls in lower-priority trunk groups.

However, any call waiting in a lower-priority trunk group for longer than a preset time, is connected before any calls waiting in a higher-priority trunk group. Trunk calls within the same priority trunk group(s) are connected on a first-in-first-out basis.

b. Call Hold

This feature allows the attendant to place a station or trunk call on hold so that the attendant can place another call, or perform other activities such as paging. Four loop keys and associated LEDs are provided on the console to facilitate the hold capability.

A call is placed on hold by depressing an idle loop key on the console. The loop LED provides supervision over the call. The loop LED winks when a call is being held, flashes on recalls, and lights steadily when the attendant reconnects to the held call.

This feature also allows a held call to be connected to an incoming call. After answering a call, the attendant can connect the two calls by depressing the Destination (DEST) key, followed by the loop key associated with the call being held.

To retrieve an attendant-held call, a station user having the proper class-of-service goes off-hook, then keys the Attendant Call Hold Retrieve access code, followed by a three-digit Attendant Call Hold location number. The Attendant Call Hold location number consists of the Attendant number (01 through 12) plus the Hold Loop Key number (1 through 4) used by the particular attendant; e.g., the Access Code + 021 (Attendant number 02, Hold Loop Key number 1).

To retrieve the held call, a station user must go from an idle on-hook condition to off-hook, and receive regular dial tone. If the call in the accessed call location is a two-party (i.e., locked loop) call, has already been retrieved, or has already been disconnected by the held party, the station user receives reorder tone after dialing the complete Attendant Call Hold Retrieve access code.

Additionally, the Call Hold feature allows the attendant to page a party, and request the paged party to retrieve a held loop call. The paged party can retrieve the held call by dialing an announced retrieval code from any SATURN IIE EPABX station having the proper class-of-service.

c. Camp-On

This feature allows the attendant to extend a trunk call to a busy station. When this feature is invoked, the trunk party is automatically placed in a waiting mode while a call-waiting tone is directed to the busy station. The called party, upon hearing the call-waiting tone, can connect to the waiting call by going on-hook and being recalled, or by using the Call Hold – Flip-Flop (Broker) feature. A maximum of two trunk calls can be camped-on to a busy station.

d. Class-of-Call Exclusions – Key(s)

The SATURN IIE EPABX attendant(s) can control certain types of traffic incoming to the console(s) by operating assignable exclusion keys corresponding to the type of call (incoming calls (INC), operator calls (OPR), and or recalls (RCL).

e. Class-of-Call Exclusions – Programmed

The SATURN IIE System can exclude certain types of traffic from designated attendant consoles via CMU procedures. Such types of calls may be incoming (INC), operator (OPR), and/or recalls (RCL).

f. Conference

This feature allows the attendant to establish a conference of up to seven parties (assignable via CMU procedures). The attendant gains access to a conference circuit, and adds members to the conference by operating a Conference key. Status information is provided to the attendant by a LED located within the Conference key. A maximum of three Conference keys can be provided on the console.

g. Extension of Calls

The attendant may extend all types of incoming calls. Incoming trunk calls may be extended to a SATURN IIE EPABX station, or to another trunk. Incoming station calls (dial "0", attendant recall, etc.) may be extended to a trunk or to another station.

h. Inter-Console Calling and Transfer

This feature allows an attendant at one attendant console to call an attendant, or transfer a call to an attendant, at another attendant console. Each attendant console must be assigned a unique number.

i. Locked Loop Operation

This feature allows the attendant, who normally works in a switched-loop environment, to retain supervision or recall capability on any particular call by placing the call on an attendant loop rather than releasing it. While the loop is "locked," its use is dedicated to that call, and may not be used for processing other calls.

Four loop keys are used for locked-loop operation. The attendant "locks" a call on the loop by depressing an idle loop key. This action simultaneously releases the attendant from the connection. The attendant is then able to process other calls. The attendant may lock any twoparty call on a loop, including station-to-station, station-to-trunk, trunk-to-station, and trunk-to-trunk calls.

The attendant may reenter a locked loop connection by depressing the associated loop key. Before the attendant reenters the connection, conference tone is provided to the two talking parties. The attendant is then immediately connected in conference with both parties on the loop. Once the attendant has reentered the connection, the attendant may:

1. Split one of the parties to talk privately by depressing the Source (SRC) or Destination (DEST) key.
2. Release from the loop with the two other parties remaining connected on the loop.
3. Release the locked loop connection (both parties released) by depressing the Release (RLS) key:

As a customer-definable system option, the attendants may be denied the ability to reenter a locked loop connection held on a console unless specifically recalled by the station user. Secrecy is implemented by providing automatic splitting of the trunk party when the attendant enters the connection after being recalled by the station. This action allows the station user to speak privately with the attendant.

j. Override

This feature allows the attendant, when connected to an incoming trunk call, to enter into an existing busy station-to-station or station-to-trunk connection and inform the station user about the waiting trunk call. The Override feature is generally used to announce high-priority or emergency calls.

A warning tone is provided to both parties before the conversation is overridden. The attendant can break into any established two-party call or three-way call, provided that no feature restricting attendant override is active (i.e., Attendant Override Security or Data Line Security).

k. Serial Calling

This feature allows the attendant to connect an incoming trunk party to a series of stations, without having the incoming trunk party hang up and redial the attendant for each call.

The attendant initiates a serial call by connecting the trunk party to the first desired station, and ""locking" the call on the attendant loop. When station disconnect is detected, the SATURN IIE EPABX System automatically places the trunk in the recall queue.

A unique display of the recall appears on the alphanumeric display. The attendant continues the serial call by answering the recall, then dialing the next requested station number and locking the call on the attendant loop.

l. Special Overflow Answer Positions

The console attendant can depress a special overflow key during high traffic conditions, and divert the overflow of incoming calls to a Special Overflow Answer Position (SOAP).

When the attendant depresses the overflow key, all calls presently in, or intended for, the incoming call queue that exceed a predefined threshold value are routed to the SOAP. Additionally, incoming trunk calls that have waited in the attendant incoming call queue beyond a predetermined period of time are routed to the SOAP.

The SOAP can be a ZUNA facility, SNAP position, ACD hunt group, pilot number hunt group, or an individual station. The SOAP can access station-related features in the normal manner. Handling of incoming trunk calls is accomplished by use of the station Call Transfer feature.

m. Switched Loop Operation

This feature allows the attendant to extend an EPABX station or trunk call to another station or trunk by depressing the Attendant Release (ATT RLS) key. Depression of the ATT RLS key automatically releases the loop and allows the attendant to process other calls.

The attendant is allowed to release from the call before the second party answers, either in the camp-on or in the ringing state. No call supervision is provided; however, a means for recalling unanswered calls on a timed basis is provided.

n. Trunk Flash Capability

The attendant console can be provided with a special key allowing the attendant to simulate a hookswitch flash to request toll operator assistance on outgoing calls.

3.04 Recall Features

a. Automatic Recall on Camp-On

The attendant is automatically recalled if the attendant extends an incoming trunk call to a busy station, and the called party does not answer the waiting call within a preset time. The timing period is variable, and is assigned in customer memory by using a CMU procedure. A visual indication appears on the alphanumeric display consoles to identify the recall.

b. Automatic Recall on Hold

The attendant is automatically recalled on calls hel by the attendant past a predetermined period of tim A visual indication appears on the console's alphanu meric display to identify each type of recall. The tir ing period is variable, and is assigned in custome memory by using a CMU procedure.

c. Automatic Recall on No Answer

In the SATURN IIE EPABX System, the attendant is au tomatically recalled if a trunk call being processed ha remained unanswered past a predetermined period time. A visual indication appears on the console's a phanumeric display to identify a recall, thus allowin the attendant to respond appropriately. The timing pe od is variable, and is assigned in customer memo by using a CMU procedure.

d. Automatic Recall Redial

When an attendant has been recalled by a station trunk call that was originally extended by the attendar the original destination of the call appears on the co sole display. By activation of a single key on the co sole, the attendant can reextend the call to the sar destination without keying in the entire number.

3.05 Display Features

a. Call Type Display

The types of calls appearing at the attendant's po tion are visually displayed, allowing the attendant answer each call with an appropriate verbal respons The display indicates whether the call is an Incomin Recall, or Operator call.

b. Called Extension Status Display

The alphanumeric display indicates the following formation about the called station:

BUSY	– Attendant extended to a bu station.
RINGING	– Attendant extended to an ic station.
CALL PICK-UP	– Attendant extended to a stati that is being picked up another station.
CFWD RINGING	– Attendant extended to a call f warded station; destination ic
DATA PRIVACY	– Attendant extended to a bu data-private station.
DONT DISTURB	– Attendant extended to a stati which has activated Do-N Disturb.
HUNT RINGING	– Attendant extended to a bu station in a hunt group and call hunted to an idle station that group.

LINE LOCKOUT	– Attendant extended to a locked-out station.
OUT OF SVC	– Attendant extended to an out-of-service station.
ACD RINGING	– Attendant extended to a ACD group.
BY-OV	– Attendant override of a busy station.
CF/BY	– Attendant extended to a call forwarded station, destination busy.
CFWD TO NTWK	– Attendant extended to a station that is call forwarded to the public network.
VACANT NUMBER	– Attendant extended to a vacant number or code.

c. Called Station Number Display

When the attendant places a call to a SATURN IIE EPABX station, the extension number and class-of-service of the called station are displayed on the alphanumeric display.

d. Called Trunk Number Display

When the attendant places an outgoing call, the trunk number and trunk group number of the connected trunk are displayed on the alphanumeric display.

e. Calling Station Number Display

When the attendant receives a station call, the extension number and class of service of the calling station are displayed on the alphanumeric display.

f. Calling Trunk Number Display

When the attendant receives an incoming call, the trunk number and trunk group number of the connected trunk are displayed on the alphanumeric display.

g. Digital Clock Display

The current time-of-day and date are displayed on the alphanumeric display when the console is idle and between calls. When the console is busy, the attendant may obtain the time and date by depressing the TIME key. The time is displayed in hours and minutes in either a 12-hour or 24hour format, depending on a preassigned system option. The attendant can also set the digital clock time and date from the console.

h. Least Cost Routing Route Number Display

For SATURN IIE EPABX Systems provided with the LCR feature, a visual display of the route taken by the attendant completed outgoing calls is provided to the attendant. The display is provided to the attendant upon completion of dialing the public network number.

i. Numerical Call Waiting Display

Between calls and during periods when the attendant console handset is plugged in but not processing calls (idle), the actual number of calls waiting to be answered is displayed on the alphanumeric display. The number of calls waiting is numerically displayed by call type (i.e., Incoming, Recall, and Operator). The display is updated approximately every three seconds.

j. Trunk Group Alphanumeric Display

Arrangements can be made in customer memory to provide a trunk group alphanumeric display as part of the calling trunk display and called trunk number display features.The trunk group alphanumeric display is customer-defined by the assignment of alphanumeric characters to represent the trunk type for each trunk group (i.e., INWATS for an incoming call via an INWATS trunk, LOCAL for an incoming call via a local CO, FX555 for an incoming FX trunk from exchange 555, etc.). Up to eight alphanumeric characters may be assigned by the customer for each trunk group.

3.06 Direct Access Features

a. Direct Trunk Access

This feature allows the attendant to select and access individual trunk circuits. Access to a specific trunk is made by dialing a unique access code, the trunk group number, and the trunk member number. After the trunk is seized, the attendant can place a call over the trunk.

b. Direct Trunk Group Access

This feature allows the attendant to access a trunk group by depressing a key rather than dialing an access code.

3.07 Control Features

a. Attendant Control of Station Dial Restrictions

This feature allows the attendant to temporarily change the class-of-service (COS) of individual stations via the attendant console. The temporary COS may either restrict or add to existing features established by the original COS.

The attendant activates the feature by keying an access code. The attendant is prompted to key the station extension number and the temporary COS number. A confirmation tone is returned to the attendant. The attendant releases the call and the console display and operation return to normal.

The temporary COS can be cancelled and the original COS reinstated by keying a cancellation access code, and the extension number of the changed station. When the station extension number is keyed, the original COS is reinstated and a confirmation tone is returned to the attendant.

b. Control of Facilities

This feature allows the attendant to gain control of a system facility in order to regulate when station users may or may not gain access to that facility. The attendant gains control of a facility by depressing a preassigned key. One or more keys can be assigned on the attendant console to control each of the following: trunk groups, voice paging zones, dial dictation equipment, 8-port conference circuits (Meet-Me Conference and Station Controlled Conference), and code calling. When a station user dials an access code or activates a feature button on an SDT corresponding to a facility that is under attendant control, the call is routed to the attendant. Once answered, access to the desired facility is provided at the attendant's discretion.

An LED located within each control key provides the status of the associated facility. A dark LED indicates the facility is not under attendant control at this time and a lighted LED indicates the facility is presently being controlled by the attendant.

c. Control of Station Message Detail Recording Facilities

The SMDR feature allows trunk group calls to be selectively recorded. This feature is enabled via a CMU procedures. The recording of calls on these trunk groups can also be deactivated and reactivated by the attendant.

d. Night Service Control

Placing the SATURN IIE EPABX system in the night service mode is performed by the attendant depressing the NIGHT key on the console. When multiple consoles are provided, all attendants must depress the NIGHT key before the SATURN System goes in night service. Refer to the system features, "Assigned Night Answer" and "Zoned Universal Night Answer."

3.08 Volume Control Features

a. Volume Control – Audible Alert

The attendant may adjust the volume of the audible alerting device by using a rotary volume control knob located on the console. The alerting device is used to signal the attendant of all incoming calls, recalls, and the occurrence of minor system alarms.

b. Volume Control – Audio

This feature allows the attendant, by depressing a console key, to increase the voice level by a fixed gain on the receive portion of the voice connection. The voice gain may be cancelled any time during the call by the attendant depressing the same button a second time; otherwise the gain is automatically cancelled when the attendant releases from the call.

3.09 System Status Features

a. Alert Busy Attendant Indication

Calls directed to an attendant who is busy handling another call generate a single burst of tone in the attendant's headset/handset. This tone alerts the attendant to the other incoming call(s).

b. Call Waiting Indication

A call waiting LED on the attendant console provides the attendant with a visual indication that calls are waiting to be answered. The call waiting LED lights steadily when a preset number of calls are waiting to be answered. The LED flashes when the number of calls waiting reaches a second preset number; when the LED is dark, no calls are waiting.

c. Minor Alarm Identification

When a minor alarm condition occurs, the MIN ALM LED lights. Failures causing a system minor alarm condition can be displayed by the attendant depressing the Minor Alarm (MIN ALM) key. Depression of the MIN ALM key displays the most recent alarm condition. Additional depressions of the minor alarm key display additional alarm causes, if present. Each minor alarm display consists of the alarm type (e.g., line/trunk unit shelf, memory parity, fuse failure, etc.), the failing equipment location, and the date and time of the failure.

d. Trunk Group Indicators

A group of 24 LEDs are provided on the attendant console. The LEDs are assigned to reflect the busy/idle condition of trunk groups 1-24, respectively. The LED states reflect the following conditions:

1. Steadily lit – All trunks in the associated trunk group are busy.
2. Flashing – The number of busy trunks in the associated trunk group has reached or exceeded a preset threshold. The threshold limit is assigned via a CMU procedure.
3. Dark – The number of busy trunks in the associated trunk group has not exceeded the threshold limit.

3.10 Busy Verification Features

a. Busy Verification of Station Lines

The attendant may verify whether a station line is busy, idle, or in an out-of-service (lockout) state by keying in the station number from the attendant console. The system responds with ringback tone and a display on the console that correlates with a console-to-station call if the station is idle. If the station is busy, the attendant receives busy tone and the display indicates the station number, class of service, and other call information pertaining to that connection, including the station or trunk number of the other party. If the station is out of service (lockout), the display indicates this condition.

b. Busy Verification of Trunks

This feature allows the attendant to determine the busy/idle status of a specific trunk (CO,FX, tie trunk, etc.) without bridging to the trunk. Busy verification of a trunk is performed by the attendant dialing a unique access code and the trunk group number followed by the trunk group member number. If the trunk is busy, the attendant hears busy tone and receives a display identifying the trunk group/number (e.g., 05/03) and the connected party (e.g., extension 1219). If the trunk is idle, the attendant hears dial tone and receives a display identifying the connected trunk.

SECTION 4.00 STATION FEATURES

4.01 Station Overview

This section of the practice describes those features that are related to single-line telephones (rotary and DTMF dialing). Some of these features are also related to the attendant console and the SDT. Following the title of each feature description is one or more codes in parentheses which denote the type of instrument(s) to which the feature applies. Table 4.00 lists these codes and their definitions.

Table 4.00 Station Instrument Codes Used in This Practice

CODE	INSTRUMENT
SLT	Single Line Telephone
ATT	Attendant Console. An asterisk (*) following ATT indicates a button can be assigned to the console to simplify feature operation.
SDT	Siemens Digital Telephone. An asterisk (*) following SDT indicates a button can be assigned to the SDT to simplify feature operation.

4.02 General Features

a. Dial Access to Attendant (SLT,SDT)

Station users may dial the feature access code assigned for general attendant service or dial a discrete attendant extension for a specific attendant.

b. Distinctive Ringing (SLT,SDT)

Several types of distinctive ringing patterns are provided to allow SATURN IIE EPABX station users to distinguish between the different types of incoming calls. The ringing patterns are:

1. One-burst ringing – Identifies an incoming call from another station served by the SATURN IIE EPABX System.

2. Two-burst ringing – Identifies an incoming trunk call (CO, FX, WATS, DID, Tie trunks) and attendant-extended trunk calls.

3. Three-burst ringing – Identifies calls initiated by internal call queuing – callback, outgoing call queuing – callback, station-controlled conference recall to conference master, call transfer security recall, automatic callback on held calls, executive intercom calls (SDT only), and automatic intercom calls (SDT only).

c. DTMF Dialing (SLT)

DTMF dialing allows SLTs equipped for tone dialing to be used with the SATURN IIE EPABX System.

d. Immediate Ringing (SLT,SDT)

Immediate ringing is provided on all calls to stations within the SATURN IIE EPABX System. The called station rings immediately without the need for waiting through the silent period of a ringing cycle.

e. Rotary Dialing (SLT)

Rotary dialing allows SLTs equipped with a rotary dial to be used with the SATURN IIE EPABX System.

4.03 Hold Features

a. Automatic Callback on Held Call (SLT,SDT)

A trunk call that remains on hold beyond a predefined period of time is automatically recalled to the station that held the call or to the attendant (according to a preassigned system option). The predefined period of time is a nominal five minutes but variable via CMU procedures. The automatic callback applies only to trunk calls placed on hold via the Call Hold, Call Park, Manual Hold, and Exclusive Hold features. If the system is optioned to route the held call to the station instead of to the attendant and the callback goes unanswered for a predefined period of time (18 seconds nominal also variable via CMU procedures) or the station to be recalled is busy (possible only for the call hold and call park recalls), the recall is routed to the attendant recall queue.

b. Call Hold (SLT,SDT*)

This feature allows a station user to place any call on hold and hang up without losing the call. After holding the call, the user may originate or receive other calls on the same line and alternate between the two calls (holding one call while speaking to the other).

c. Call Hold – Flip – Flop (Broker) (SLT,SDT*)

This feature allows a station user receiving a call waiting tone to place the call on hold and immediately establish a connection to the waiting call. When no call is waiting, this feature allows the user to place any established call on hold and originate another call on the same line. In either case, the user can return to the held call or alternate between the two calls (holding one call while speaking to the other).

d. Call Park (SLT,ATT*,SDT*)

This feature allows a station user to place a station or trunk call on "system hold" (referred to as "parked") and return to the parked party from the same station or from another SATURN IIE station. A maximum of 10 call park locations are available in the SATURN IIE EPABX.

e. Consultation Hold (SLT,SDT*)

This feature allows a station user to place a call on hold and consult with another party on the same line. After consulting with the other party, the user may remain offhook and be automatically connected to the original party when the consulted party hangs up.

f. Hold to Attendant (SLT,SDT)

This feature allows trunk calls held for station transfer security to be routed to the attendant instead of the transferring station.

4.04 Transfer Features

a. Call Transfer (SLT,SDT*)

This feature allows a station user engaged in a two-party talking connection to transfer the other party to another destination. The following types of transfers are allowed:

- station-to-station
- trunk-to-attendant
- station-to-trunk
- trunk-to-trunk.

Trunk-to-trunk transfers are allowed only when the trunkto-trunk connection option is assigned and call disconnect supervision is provided on at least one of the trunks. All transfers are allowed in the ringing-state.

b. Call Transfer Security (SLT,SDT)

If a trunk call is transferred from one station to another and the second station does not answer within a predetermined time interval, the SATURN IIE EPABX recalls the held party to the station that originally transferred the call or to the attendant recall queue, depending on the pre-assigned system option. This facility also protects against lost trunk calls due to the improper utilization of transfer routines by station users.

c. Call Transfer with Automatic Camp-On (SLT,SDT)

This feature, when used in conjunction with the Call Transfer and Internal Call Queuing-Standby features, allows a station user to transfer an outside call to a busy station. The outside call is camped-on to the busy station.

4.05 Conference Features

a. Add-On Conference (SLT,SDT*)

This feature allows a station user to add a third party to an existing two-party connection. The three-party conference can consist of two stations and one trunk or two trunks and one station.

b. Meet-Me Conference (SLT,ATT,SDT*)

The meet-me conference is prearranged by station users, who dial an access code to be connected to the conference circuit. Trunk conferees are connected to the conference circuit by the attendant. A conference tone is heard by all connected conferees as each new conferee enters the conference. A maximum of seven parties can be connected in the conference at any one time, plus the attendant. The number of trunk parties allowed is variable (maximum of three) and set by CMU procedures.

c. Station-Controlled Conference (SLT,SDT)

This feature allows a station user to access a conference circuit and progressively add internal and/or external parties to the conference connection without the assistance of an attendant. The station user that originates the conference is the conference master. The conference master can add members, remove members, leave the conference to consult with a conferee privately, or call the attendant. If the conference master releases from the conference, the position of conference master can be obtained by any station conference member.

The maximum number of parties allowed in the conference is seven. However, the attendant can enter the conference as an eighth party. The number of trunk parties allowed in the conference is variable (maximum of three) and set by a CMU procedure.

4.06 Queuing Features

a. Call-Waiting Indication (SLT,SDT)

A call-waiting tone is directed toward a busy station upon activation of the Internal Call Queuing – Standby, Executive Override – Automatic, or Attendant Camp-On features. The call-waiting tone notifies the called party that a call is waiting to be answered.

Distinctive call-waiting tone signals are provided to indicate whether the call is from a station or trunk. A single burst of tone represents a waiting-station call and a double burst of tone represents a waiting-trunk call. Call waiting is denied and busy tone is returned to the calling station if the called station is not in a two-party connection.

The call waiting indication is provided upon initial camp-on of the station. If the called station user does not answer the waiting call within a predefined time (nominal 10 seconds), a second tone is directed toward the called station. The delay interval for the second tone is variable via a CMU procedure.

b. Internal Call Queuing – Callback (SLT,SDT)

This feature allows a station user, after dialing a busy station, to wait in a queue and be called back when the station becomes idle.

A station user that encounters a busy tone after dialing a busy station number can establish an automatic callback condition by remaining off-hook until the busy tone changes to low tone. The user can then go on-hook. When both the called station and the activating station become idle, the activating station is rung. Upon answering, the called station is rung. A talking connection is made when the called station user answers. While the automatic callback is active, the activating station user may receive or originate other calls. The automatic callback can be cancelled at any time by dialing a cancellation code.

The SATURN IIE EPABX System can support up to 80 stations simultaneously while waiting for a callback via the Internal Call Queuing – Callback and Outgoing Call Queuing – Callback features. A station may be in only one callback queue at any one time.

c. Internal Call Queuing – Standby (SLT,SDT)

This feature allows a call to a busy station to be held waiting in a special standby queuing mode. While in the standby queuing mode, the calling party is provided with special ringback tone while a call waiting tone is directed toward the busy station user. The busy station user may connect to the calling party either by going on-hook and being recalled or by using the Call Hold – Flip – Flop (Broker) feature. This feature is provided to a station on an automatic originating/terminating or manual originating basis.

1. Automatic Originating – A station assigned this type of standby queuing is automatically placed in the standby queuing mode immediately after originating a call to any busy internal station.

2. Automatic Terminating – A station assigned this type of standby queuing receives a call-waiting signal on any call attempting to terminate on the user's station when the user is busy on another call.

3. Manual originating – This type of standby queuing is provided as an additional procedure option for the Internal Call Queuing – Callback feature. After dialing a busy station and receiving busy tone, the user can establish a standby queuing condition by listening to busy tone until busy tone changes to a steady low tone and then to special ringback tone. Once the special ringback tone is heard, a call-waiting tone is applied toward the busy station which notifies the busy party of a waiting call.

   The activating station user may convert from a standby queuing to an automatic-callback condition at any time by going on-hook. Refer to the Internal Call Queuing Callback feature for further details.

d. Outgoing Call Queuing – Callback (SLT,ATT,SDT)

This feature allows a station user, after dialing a busy outgoing trunk group, to wait in a queue and be called back when a trunk in the trunk group becomes available. The queue is handled on a first-in first-out basis. A station user that encounters a busy tone after dialing a trunk group access code can invoke the Outgoing Call Queuing Callback feature by remaining off-hook until busy tone changes to low tone and then returning on-hook. When a trunk becomes available and the user is next in queue, the SATURN IIE EPABX System automatically calls back the station user. The station user can complete the call originally attempted by going off-hook, listening for dial tone, and dialing the desired outside destination number.

While automatic callback is active, the activating station user may receive or originate other calls. The automatic callback can be cancelled at any time by dialing a cancellation code. This feature provides the attendant with the additional capability of extending a callback to an SLT or SDT party connected on the console. Also, when the attendant is in the queue, the attendant is given priority over SLT and SDT calls.

Each SLT and SDT is allowed only one callback queue request at any one time. Each attendant is allowed up to five queue requests.

e. Outgoing Call Queuing – Standby (SLT,ATT,SDT)

This feature is an extension of the Outgoing Call Queuing – Callback feature. With Outgoing Call Queuing – Standby, instead of going on-hook to be called back when a trunk becomes available, the station user is allowed to wait off-hook in a standby queuing mode and listens to silence or music, if provided. When a trunk becomes available, the station is connected automatically to the trunk. The user may convert from standby queuing to callback queuing at any time by going on-hook. Refer to the Outgoing Call Queuing – Callback feature.

The call-waiting indication is provided upon initial campon of the station. If the called-station user does not answer the waiting call within a preset time interval (nominal 10 seconds), a second tone is directed toward the called station. The delay interval for the second tone is variable via a CMU procedure.

f. Call Waiting – Originating

This feature permits stations having the proper classofservice to have originating call waiting service. When a station with this feature directs a call to a busy station, the calling party is "camped-on" to the busy station in a call waiting state. This occurs regardless of whether the called station is classmarked for call waiting or not. A call waiting indication is directed to the busy station user. If the busy station is a member of a hunt group, hunting is attempted before camp-on is applied.

g. Call Waiting – Terminating

Assigned on a per-station basis and working in conjunction with the system's camp-on facilities, this feature permits a given station to receive any type of call waiting indication. When a call is directed to a busy station with this feature, the calling party is "camped-on" to the busy station in a call waiting state. A call waiting indication is directed to the busy station user. If the busy station is a member of a hunt group, hunting is attempted before camp-on is applied. If the calling party is a station, Direct Inward System Access (DISA) trunk, or tie trunk, special audible ring tone is connected to the calling party while the call is in the waiting mode. If the calling party is a Direct Inward Dialing (DID) trunk, audible ring tone is connected to the calling party while the call is in the waiting mode. This feature is allowed only if the called station user is in a stable two-party talk state. Call Waiting is denied if the call is in a transient state. If denied call waiting, the calling party receives busy tone.

4.07 Call Forwarding Features

a. Call-Forwarding – All Calls (SLT,SDT*)

This feature allows a station user to have all incoming calls terminating at the user's station, forwarded to another station or to the attendant console. As a reminder that call forwarding is activated, the forwarding station hears one short burst of ringing each time a call is forwarded. The station that originated call forwarding may continue to originate other calls while call forwarding is in effect.

If a call is forwarded to a member of a hunt group that is busy, the system hunts for the first idle member in that hunt group. If no idle member is found, the Camp-On, Call Waiting, or Automatic Callback features may be applied on the FWD-TO station. A station within the hunt group that has this feature in effect is skipped during hunting. If the station is called direct (not part of a hunt sequence) the call is forwarded as described in the above paragraph.

Activation of the Call Forwarding – All Calls feature via SDTs is performed on a per-line basis.

b. Call Forwarding – Busy Line (SLT,SDT*)

This feature allows a station user to have all incoming calls terminating at the user's station, forwarded to another station or to the attendant when the station is busy. If the station that has the Call Forwarding Busy Lines feature in effect is idle, calls to that station are completed as usual. If the forwarded-to-station is busy, call forwarding does not occur.

If a call is forwarded to a member of a hunt group that is busy, the system hunts for the first idle member in that hunt group. If no idle member is found, the Camp-On , Call Waiting or Automatic Callback features may be applied on the FWD-TO station. A station within a hunt group that has this feature in effect is skipped during hunting.

If the station is called direct (not part of a hunt sequence) the call is forwarded as described in the above paragraph. Both the Call Forwarding – Busy Lines feature and the Call Forwarding – No Answer feature can be active from the same station at the same time; however, the forwarded-to station must be the same. Activation of the Call Forwarding – Busy Lines feature via SDTs is performed on a per-line basis.

c. Call Forwarding – Fixed (SLT,SDT)

This feature allows a station user to have incoming calls forwarded to a fixed location if the called station is busy or does not answer. When Call Forwarding – Secretarial is assigned, all calls are forwarded. A station can have Fixed or Secretarial Call Forwarding, but not both. For station users allowed to access a Voice Mail System, it is necessary that this feature be assigned to the user's class-of-service.

The station user activates Call Forwarding – Secretarial by dialing the Call Forwarding – Fixed access code. Call Forwarding – Fixed is an option, assignable by CMU, via STNASSN CMU procedure. Calls to the station are then forwarded to the designated station.

If Call Forwarding – Fixed is assigned and the station user activates one of the other call forwarding features (e.g., Call Forwarding – All Calls) the new selected feature will take precedence over Call Forwarding – Fixed.

Call Forwarding – Secretarial is cancelled by the user dialing a cancellation code.

d. Call Forwarding – No Answer (SLT,SDT*)

This feature allows a station user to have all incoming calls forwarded to another station or to the attendant when a call directed to that station remains unanswered for a preset time interval (nominal 18 seconds).

If a call is forwarded to a member of a hunt group that is busy, the system hunts for an idle member in that hunt group. If no member is found, the forwarding station continues to ring for another no-answer time interval. At the end of the time interval, the forwarding process is attempted again. A station within a hunt group that has this feature in effect is skipped during hunting. If the station is called direct (not part of a hunt sequence) the call is forwarded, as described in the above paragraph.

Both the Call Forwarding – No Answer feature and the Call Forwarding – Busy Lines feature can be active from the same station at the same time. However, the forwarded-to station must be the same. Activation of the Call Forwarding – Busy Line feature via SDT is performed on a per-line basis.

e. Call Forwarding – Return (SLT,SDT)

This feature allows a station user that has received a forwarded call to transfer the call to the station from which call forwarding is active. The operation of this feature is identical to the feature "Call Transfer" except instead of dialing the forwarding-station number, the user dials the Call Forwarding – Return feature access code.

f. Call Forwarding – Secretarial (SLT,SDT*)

This feature allows a station user to have all incoming calls terminating at the user's station, forwarded to a pre-assigned station.

A station user activates this feature by dialing the Call Forwarding – Fixed feature access code.

Calls to the station are then forwarded to the designated station. As a reminder that the Secretarial Intercept feature is activated, the station user hears one short burst of ringing each time a call is forwarded. Call Forwarding – Secretarial is canceled by the user dialing a Call Forwarding – Fixed cancellation code or Call Forward cancel code.

Activation of the Call Forwarding – Secretarial feature via SDTs is performed on a per-line basis.

g. Call Forwarding to Public Network (SLT,SDT)

This feature allows a station user to have all incoming calls terminating at the user's station, forwarded to an "outside" directory number. While call forwarding is activated, the forwarding station receives one short burst of ringing for each incoming call to remind the user that forwarding is in effect.

The station user that activated call forwarding may continue to originate other calls while call forwarding is in effect.

Activation of the Call Forwarding to Public Network feature via SDTs is performed on a per-line basis.

4.08 Call Pickup Features

a. Call Pickup – Directed (SLT,SDT*)

This feature allows a station user to answer any ringing station within the SATURN IIE EPABX System by dialing an access code and then the station number of the ringing station. The feature is usually limited by its nature to areas where the station to be picked up can be observed either by a positive audible indication or a visual means (a local ringing indicator).

Any number of stations are capable of being provided with the Call Pickup – Directed feature.

b. Call Pickup – Group (SLT,SDT*)

This feature allows a station user to answer an incoming call that is ringing at another station within a predefined pickup group by dialing an access code. The pickup group consists of a group of stations, generally within hearing distance of ringing, for which any ringing station may be answered by any group member.

The SATURN IIE EPABX System is capable of providing any required number of pickup groups. The maximum number of stations allowed in a pickup group is 30.

4.09 Speed Calling Features

a. Last Number Redial (SLT,SDT*)

This feature allows a station user to have the last number dialed from the user's station automatically redialed, by dialing an access code. This feature is useful when the user has dialed a busy destination and desires to make the call at a later time without having to redial the full number.

b. Speed Calling – Group (SLT,ATT,SDT*)

This feature allows station users to reach frequentlycalled numbers normally associated with outgoing trunk calls by dialing abbreviated dial codes instead of full numbers.

Each abbreviated code consists of an access code and a two digit number associated with the external number. Speed calling codes are established and maintained via CMU procedures. The abbreviated codes can be dialed from any station assigned the Speed Calling – Group feature. The SATURN IIE EPABX System has the capability of providing up to four speed calling groups and storing in memory a maximum of 64 frequently-called numbers per group. Each number can be a maximum of 18 digits long.

c. Speed Calling – Individual (SLT,SDT*)

This feature allows a station user to reach frequentlycalled number by dialing abbreviated dial codes instead of full numbers. The station user provided with the Speed Calling – Individual feature programs the numbers into system memory from the user's station set. The abbreviated codes can be dialed only from the station set at which they were programmed.

The SATURN IIE EPABX System has the capability of providing the Speed Calling – Individual feature to a maximum of 128 stations. A maximum of 10 frequently-called numbers can be programmed from each station. Each number can be a maximum of 18 digits long.

NOTE: The Jr. DYAD provides an inherent Speed Dial feature button which stores in its own memory a maximum of 10 frequently-called numbers. Each number can be a maximum of 25 digits long.

4.10 Station Hunting Features

a. Pilot Number Access (SLT,SDT)

This feature allows a station user to dial a pre-assigned pilot number and automatically be connected to an idle station within a pre-assigned hunt group. Station hunting occurs only when the hunt group is accessed via the pilot number. The pilot number is a number that is not assigned to a station. Pilot number hunting searches through a prearranged group for an idle station from the first assigned designated station in the group to the end of the group. The call is completed to the first idle station encountered. If all stations are busy, busy tone is heard. Stations within a pilot hunt group can be called directly by dialing the normal assigned extension number, in which case no hunting occurs.

b. Station Hunting – Busy Advance

This feature allows the system to search for an idle station in a hunt group if the station called is busy. The feature is activated when a call is made to a busy station within a hunt group. If the station is busy, the system only checks the class-of-service of the hunt group member who was called and proceeds through the group as if each member in the hunt group had the same class-of-service as the member to whom the call was made.

This feature is selected by setting the Busy Advance classmark (HUNTBUSY) in the station Class-of-Service (COS).

In a system where neither Busy Advance (HUNTBUSY) nor No Answer Advance (HUNTNOANS) classmarks are set, the system performs both functions. If HUNTBUSY alone is set within COS, the HUNTNOANS function is deleted. If HUNTNOANS alone is set within COS, the HUNTBUSY function is deleted. If both classmarks are set, both functions will be performed.

c. Station Hunting – Circular (SLT,SDT)

An incoming call to a busy station assigned to a circular hunt group causes the SATURN IIE EPABX System to progressively search for an idle station within that hunt group. The hunting sequence starts with the called station and ends after all stations in the hunt group are checked, thus completing the call to the first idle station encountered. If all stations are busy, busy tone is heard.

If a call is forwarded to a member of a circular hunt group that is busy, the system hunts for the first idle member in that hunt group. If no idle member is found and the Call Forwarding – No Answer feature is in effect, the forwarding station continues to ring for another no answer interval. At the end of the time interval, the forwarding process is attempted again. If the Call Forwarding – All Calls or Call Forwarding – Busy Lines feature is in effect, the forwarding station user may activate the Internal Call Queuing – Standby or Internal Call Queuing Callback features. A station within the circular hunt group that has this feature in effect is skipped during hunting. If the station is called direct (not part of a hunt sequence) the call is forwarded as described previously.

The hunting sequence can be arranged for either consecutive or non-consecutive numbers. The SATURN IIE EPABX System is capable of providing any required number of circular hunt groups. A maximum of 30 stations can be assigned to each circular hunt group.

d. Station Hunting – No Answer Advance (SLT,SDT)

This feature searches for another idle station in a hunt group if a ringing station is not answered within a predetermined period of time. The search for call completion advances until the last station is reached, in which case the last station rings until an automatic recall is initiated.

e. Station Hunting – Secretarial (SLT,SDT)

This feature allows calls to a busy hunt group to be automatically routed to a common station or to a common hunt group. The common station or hunt group can be assigned to handle overflow calls from one or several hunt groups. Two circular hunt groups cannot be combined.

f. Station Hunting – Terminal (SLT, SDT)

An incoming call to a busy station, assigned to a terminal hunt group, causes the SATURN IIE EPABX System to progressively search for an idle station within that hunt group. The hunting sequence starts with the called station and ends with the last station in the group completing the call to the first idle station encountered. If all stations are busy, busy tone is heard.

If a call is forwarded to a member of a terminal hunt group that is busy, the system hunts for an idle member in that hunt group.

If no idle member is found and the Call Forwarding – No Answer feature is in effect, the forwarding station continues to ring for another no answer interval. At the end of the time interval, the forwarding process is attempted again. If the Call Forwarding – All Calls or Call Forwarding – Busy Line feature is in effect, the forwarding station user can activate the Internal Call Queuing – Standby or Internal Call Queuing Callback features.

A station within the terminal hunt group that has this feature in effect is skipped during hunting. If the station is called direct (not part of a hunt sequence) the call is forwarded as previously described.

The hunting sequence can be arranged for either consecutive or non-consecutive numbers. The SATURN IIE EPABX is capable of providing any required number of terminal hunt groups. A maximum of 30 stations can be assigned to each terminal hunt group.

g. Stop Hunt (SLT,SDT)

This feature provides the capability for hunt groups to be temporarily reduced in size. The hunt list is shortened by a station user dialing the stop hunt access code from the station in which all succeeding stations are to be excluded from the hunting list.

For example, if the hunt sequence included extensions 234-235-236-237-238 and the stop hunt access code is dialed at extension 236, the new hunt sequence would be extensions 234,235,236. The hunt group can be returned to its full size by a station user dialing the stop hunt cancellation code from the station at which the Stop Hunt feature was activated.

h. Automatic Call Distribution (SLT,SDT)*

- **ACD Incoming Call Completion.** When an incoming (CO) call is directed to an ACD group and no station within that group is immediately available for assignment, completion of the call takes place in the following sequence: ringing is detected and continues for a timed period. The caller is then connected to the announcement, if provided. After that, the caller is connected to silence or music, if provided.

- **FIFO Queue Operation.** Answering of all incoming (CO) calls to the same ACD hunt group is performed on a strictly first-in/first-out (FIFO) basis. For instance, if the oldest call is connected to an announcement and is only part way through it when a station becomes available, the call is immediately disconnected from the announcement and connected to the available station.

- **Timing of CO Ringing.** If announcement capability is used in the ACD hunt group, answer supervision is not returned to the central office until the station selected actually answers.

  If the announcement capability is used in the group, ringing continues until either the selected station answers or the announcement is connected. When either of these occurs, answer supervision is returned to the central office.

- **Music-on-Hold (MOH) Delay.** When this feature is implemented, waiting callers receive MOH, which continues until a station is assigned to the call. When a station is assigned, the caller receives ringback tone until the station answers.

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* These four features are basic SATURN features; additional SATURN ACD features are also available. "ACD" has been referred to as "UCD" in previous sales literature.

4.11 Message Waiting Features

a. Message Waiting – Automatic Callback (SLT,SDT*)

A station user that receives a message waiting indication, can have the SATURN IIE EPABX System automatically attempt a connection to the activating station by dialing an access code.

b. Message Waiting – Cancellation (SLT,SDT*)

A station user that receives a message from, or sends a message to another station, may cancel the message by dialing the appropriate cancellation access code. When a station user invokes the Message Waiting – Automatic Callback feature, the associated message waiting indication is automatically cancelled as soon as the station from which the message waiting was originated is answered.

c. Message Waiting Capability (SLT, ATT*,SDT*)

This feature allows a station user to send a message waiting indication to a party at another station. The message waiting indication consists of a flashing lamp and/or a display on the alphanumeric display (SDT 18- and 26-button sets only).

The message Waiting feature can be activated toward any SATURN IIE EPABX System station as long as the station has the capability to receive Message Waiting indications. Activation of the Message Waiting feature can be performed either immediately after dialing a busy station number or without first attempting a call to the destination station.

Only one message may terminate at an SLT at any one time. The maximum number of messages that can terminate at an SDT is four.

4.12 Privacy Features

a. Attendant Override Security (SLT,SDT)

Stations assigned this feature may not be overridden by the attendant.

b. Data Line Security (SLT,SDT)

Stations assigned this feature may not be overridden, camped-on, or receive any other signals (e.g., call waiting tone) when the station is busy.

c. Do-Not-Disturb (SLT,SDT*)

A station user that wishes not to be disturbed by incoming calls may activate the Do-Not-Disturb feature and make the user's station appear busy. When this feature is active, all calls to the station receive a busy tone. The user may originate calls in the normal manner. However, each time the user goes off-hook, recall dial tone is heard as a reminder that the station is in the Do-Not-Disturb mode. Activation of the Do-Not-Disturb feature via SDTs is performed on a per-line basis. Intercom calls and Voice calls are not affected by activation of the Do-Not-Disturb feature. Message Waiting may be activated to a station that has the Do-Not-Disturb feature active.

d. Executive Override (SLT,SDT*)

This feature allows a station user, upon encountering a busy or special ringback tone on an internal call, to enter into the existing connection for the intended purpose of announcing a high priority or emergency call. A warning tone is provided to both parties before the conversation is overridden. (This tone may be repeated.) Executive Override cannot be invoked if the called station is not in a stable two-party state, established in a three-way connection, assigned with Data Line Security or Executive Override Security, connected to an attendant or customer-provided equipment (paging, dictation, code calling), or no 4 port conference bridge is available. If the called station is in the Do-Not-Disturb mode, this feature is overridden causing the station to ring as in a station-to-station call.

e. Executive Override – Automatic (SLT,SDT)

This feature allows a station user to camp-on to a busy station and automatically break into the call in progress if the called party does not answer within a predetermined period of time. Before the call is overridden, a warning tone is heard by the two conversing parties, alerting them of the impending override. The override function does not occur if the called station is not in a stable two-party talk state, established in a three-way connection, assigned with Data Line Security, or Executive Override Security, connected to an attendant or customer-provided equipment (paging, dictation, code calling), or no 4 port conference bridge is available. If the called station is in the Do-Not-Disturb mode, this feature is overridden causing the station to ring as in a station-to-station call.

f. Executive Override Security (SLT, SDT)

Stations assigned this feature may not be overriden by individuals employing the Executive Override Without Warning Tone feature.

g. Executive Override No Tone Security (SLT, SDT)

Stations assigned this feature may not be overriden by individuals employing the Executive Override Without Warning Tone feature.

h. Executive Override Without Warning Tone (SLT, SDT)

This feature allows station users, upon encountering busy or special ringback tone on an internal call, to enter into the existing connection for the purpose of announcing a high priority or emergency call. No warning tone is provided to the conversing parties. This feature cannot be invoked if the called station is not in a stable two-party connection, established in a three-way connection classmarked with Data Line Security or Executive Override Security – No Tone, connected to an attendant or customer-provided equipment (paging, dictation, code calling), or no 4 port conference bridge is available. If the called station is in the Do-Not-Disturb mode, this feature is overridden causing the station to ring as in a station-to-station call.

Both features, Executive Override (With Warning Tone) and Executive Override Without Warning Tone, may coexist in the system. Stations may be assigned either, both, or neither feature, based upon their individual class-of-service. The type of override performed, when allowed, is determined by the access code dialed.

While listening to busy or special ringback tone, the calling party depresses the hookswitch and receives recall dial tone. The calling party then dials the access code assigned to Executive Override Without Warning Tone. After a steady, low tone is received, a third party is connected to the existing conversation.

If either talking party's class-of-service is classmarked for Data Line Security or Executive Override Security – No Tone, reorder tone is returned to the calling party.

WARNING

The use of the Executive Override Without Warning Tone feature may be contrary to law and could result in criminal penalties in some jurisdictions. You should consult your attorney before using this feature.

4.13 Special Station Assignment Features

a. Hot Line Service (SLT,SDT)

This feature allows stations to be programmed for automatic dialing of a predetermined destination number upon the station user going off-hook. The destination may be any place which can be reached by dialing (SATURN IIE EPABX station or attendant, exchange network telephone, etc). Calls terminate at these stations in the normal manner. Any number of SATURN IIE EPABX stations can have this service. However, the maximum number of allowed destinations is 32.

b. Originate-Only Service (SLT,SDT)

A station user at a station assigned this feature is allowed to originate calls only. Calls cannot terminate at this station.

c. Terminate-Only Service (SLT,SDT)

A station user at a station assigned this feature is allowed to receive calls only. Calls are not allowed to be originated from this station.

4.14 Additional Features

a. Call Tracing (SLT,ATT,SDT)

This feature allows a station user to have certain call data recorded on an SMDR device (e.g., printer). The SMDR device records the calling number (if an internal call) or the incoming trunk or trunk group number (if an external call), the called number, and the date and time of the call.

b. Mobile Authorization Codes (SLT,SDT)

This feature allows individuals to dial a two-to-six digit authorization code from any SATURN IIE EPABX station and temporarily gain access to a pre-assigned class-of-service. The individual then can place a call or activate a feature that otherwise would be restricted from the station. An authorization code is assigned to a class-of-service by using a CMU procedure. After the authorization code is dialed, recall dial tone is returned to the individual to indicate that the class-of-service defined by the authorization code is in effect.

The user then can dial the number that otherwise would have been restricted by the station's class-of-service.

After the individual goes on-hook, the class-of-service defined by the authorization code is removed, and the station's original class-of-service becomes active.

Two thousand authorization codes (DISA or Mobile) are provided in the SATURN IIE EPABX System.

c. The Single-Line Telephone Special Account Code Entry (SLT)

This feature allows SLT station users, while engaged in a call, to change the account code to which the call is charged to a special account number.

While engaged in a conversation with a trunk party (either incoming or outgoing), the station user momentarily depresses the hookswitch and receives recall dial tone.

The user then dials the access code for the SLT – Special Account Code Entry feature, gets recall dial tone again, then dials the special account code. The user then receives confirmation tone and is reconnected to the trunk party.

d. Station Forced Disconnected (SLT)

A station used with automatic answering equipment (e.g., paging, dictation, modems, etc.), which is interfaced via an SLMA-S, can be provided with a loop current interrupt immediately after a calling party disconnect is detected to prevent the equipment from remaining in a busy state. This feature is assigned via the line class-of-service.

e. Voice Mail Interface (SLT,SDT)

The Voice Mail Interface feature allows the SATURN IIE EPABX System to interface with voice mail systems. Operation of the voice mail system must be in accordance with the manufacturer's specifications for the voice mail system used.

Call Forwarding – Fixed, Call Forwarding – Variable, or Call Forwarding – Busy may be used to direct calls to the system when acctivating voice mail.

SECTION 5.00 SIEMENS DIGITAL TELEPHONE FEATURES

5.01 Siemens Digital Telephone Overview (SDT)

The SATURN SDT is a sophisticated, digital electronic telephone which is available in three configurations: 16-button Jr. DYAD, 18-button DYAD, and 26-button DYAD, respectively. The buttons can be flexibly assigned to several lines, trunks, and/or features.

An alphanumeric liquid crystal display is provided on the 18- and 26-button SDTs. The alphanumeric display provides various information about a call or feature such as the digits dialed from the SDT, identity of an incoming call, messages, etc.

All SDTs are provided with a built-in speaker and separate volume controls for adjusting the receive loudspeaker volume and the audible alerting tones. (Refer to the User Guide for adjustment instructions.)

Each SDT is equipped with a single communication channel which is used exclusively for voice communications. The SDTs can be located up to 2,000 cable feet (610 meters) from the SATURN IIE EPABX.

The DYAD is also equipped with a built-in microphone; the speaker/microphone combination arrangement allows the DYAD to be provided with Hands-Free Operation features.

Refer to Section 4.00 for additional SDT-related features.

5.02 General Features

a. Automatic Line Preference

Connection to a given pick-up line on an SDT can be provided on an automatic basis. Each SDT can be assigned one originating and one terminating preference. The originating preference options are: Prime Line Preference, Last Line Preference, and Idle Line Preference. The terminating preference options are: Ringing Line Preference and Incoming Line Preference. If an automatic line preference is not assigned, the SDT user must manually depress a pick-up button each time the user originates and answers a call.

1. Originating Line Preferences

a) Prime Line Preference. This preference option automatically selects for the SDT station user, the prime line pick-up button when the user goes off-hook to originate a call.

b) Last Line Preference. This preference option automatically selects for the SDT station user that goes off-hook, the same line pick-up button to which the user was connected the last time the user was off-hook on the SDT.

c) Idle Line Preference. This preference option automatically selects for the SDT station user, an idle EPABX line pick-up button when the user goes off-hook to originate a call.

2. Terminating Line Preferences

a) Ringing Line Preference. This preference option automatically selects for the on-hook SDT station user, a pick-up button associated with a call in the ringing state. Pick-up buttons associated with lines that are not assigned to ring on the SDT are not selected.

b) Incoming Line Preference. This preference option automatically selects for the on-hook SDT station user, a pick-up button associated with an incoming call. The line pick-up button associated with an incoming call is selected regardless of whether the line is in the ringing or alerting state at that SDT.

A terminating line preference takes precedence over an originating line preference when a terminating call exists. The SDT user may override an automatic preference by preselecting a pick-up button prior to going off-hook.

b. Call Release

In applications where the on-hook (or off-hook) state of the SDT cannot be provided by way of the hookswitch, the user can obtain the on-hook (off-hook) state by depressing the release feature button. The Release feature button is normally assigned to SDTs from which the user makes use of a headset instead of a handset, or when the user attaches the handset to an acoustically-coupled device (i.e., modem).

c. Call Transfer to Attendant

An SDT station user engaged on an incoming or outgoing call may transfer the call to the attendant for further assistance by depressing the Attendant Transfer feature button and going on-hook. Alternatively, the user may depress the Attendant Transfer button, wait until the attendant answers, announce the call, and then go on-hook to transfer the call.

d. Feature Buttons

Feature buttons are non-locking pushbuttons on the SDT assigned to provide direct access to SATURN IIE EPABX System features in lieu of the more traditional requirement of dialing feature access codes. An LED located within each feature button, except in buttons 5 and 10 at the bottom on the 18- and 26-button SDTs and the bottom eight buttons on the 16-button SDT, provides the active/inactive status of most features.

e. Forced Call Forwarding

This feature allows an SDT station user to forward a waiting or ringing call to a preassigned station by depressing the Forced Call Forwarding feature button. The forwarded-to station is assigned via a CMU procedure. If the forwarded-to station does not answer the call within 30 seconds (adjustable via a CMU procedure), the call is transferred to the attendant console

f. I-Use Indication

This feature is used by the SDT station user to determine which line the user is presently utilizing. The SDT user activates this feature by depressing the I-Use feature button. This causes all button LEDs to momentarily go dark with the exception of the button LED corresponding to the line in use by the user. The I-Use Indication lasts for a period of 1.5 seconds. This feature is activated automatically when the user goes off-hook or depresses a pick-up button for pre-selection.

g. Multiline Pickup

This feature allows a SDT station user to have access to several lines. Each line is assigned to a separate pick-up button and corresponds to an EPABX line, CO trunk, WATS trunk, FX trunk, etc. Calls may be originated from or received at any appearance of a particular line by operation of the appropriate pick-up button. Each pick-up button is provided with an LED that indicates the status of the associated line.

Each digital telephone set must have one (and only one) Prime Line assigned. This line may have appearances at other sets but may not be the Prime Line for those sets. In addition to the Prime Line, each set may have line appearances which are not Prime Lines for any set. Such lines are known as "phantom" lines. Phantom lines may also have multiple appearances. A maximum of 128 phantom lines may be assigned in all loads within the SATURN IIE EPABX System. Phantom lines are not to be confused with "alias" numbers, which are multiple station numbers assigned to the same station without separate pick-up buttons. (Alias numbers also apply to single-line telephone sets.) Single-line telephone sets may also have a line appearance or multiple line appearances on digital telephone sets.

h. Pickup Buttons

Pick-up buttons are non-locking pushbuttons on the SDT assigned to provide direct originating and/or terminating access to an EPABX line, trunk, intercom or system facility (e.g., paging). An LED located within each feature button, except in buttons 5 and 10 at the bottom on the 18- and 26-button SDTs and the bottom eight buttons on the 16-button SDT, provides the current busy/idle status of the associated facility.

i. Station Senderized Operation

Individual SDTs only transmit inaudible digital signals to the SATURN IIE EPABX System common control equipment. If the call is intended to leave the system, the common control equipment stores the digital signals and converts them to dial pulses or DTMF signals, as required, for further transmission to the connecting office. A tone generator, located inside each SDT, produces an audible tone each time a keypad key is depressed as confirmation of a key depression.

5.03 Ringing Features

a. Abbreviated Ringing – Station Busy

Abbreviated ringing is provided when an SDT station user is active on a call and an incoming call appears on another pick-up button that is programmed to ring on the SDT. When the call first appears, one short burst of tone is heard. The tone is heard only once. The LED within the associated pick-up button flashes, as normal, to indicate the alerting call. If the user goes on-hook to answer the incoming call, the normal ringing tone pattern is heard.

b. Common Audible Ringing

Each pick-up line on a multiple line SDT is assigned as either a ringing or non-ringing appearance. A line that appears on more than one SDT can ring on one, a combination, all, or none of the line appearances.

c. Station Ringer Cutoff

The feature allows the SDT station user to disable the SDT's audible alert tone by depressing the Station Ringer Cutoff feature button. When the audible alert tone is disabled, all ringing features associated with line appearances are turned off regardless of the call type and/or ringing assignments for the SDT. The station user may enable the audible alert tone function by again depressing the Station Ringer Cutoff feature button.

5.04 Direct Access Features

a. Direct Station Selection

The Direct Station Selection (DSS) feature allows automatic dialing of a preassigned station number when the SDT station user goes off-hook on a pick-up line and depresses the appropriate DSS feature button. Each SDT can be equipped with one or more DSS feature buttons, each corresponding to a station number assigned via a CMU procedure. An LED, located within each DSS feature button, provides a visual indication of the busy/idle status of the associated station.

b. Direct Trunk Group Selection

A pick-up button can be assigned on one or more SDTs for direct, rather than dial, access of a trunk group. Up to eight SDTs can have an appearance of the trunk group. The busy/idle status of the trunk group is indicated via an LED located within the associated pick-up button. A dark LED indicates at least one trunk is idle in the trunk group and a lighted LED indicates all trunks in the trunk group are busy. No incoming calls terminate on this pickup button.

c. Direct Trunk Selection

A pick-up button can be assigned on one or more SDTs for direct, rather than dial, access of a specific trunk. Up to eight SDTs can have an appearance of a specific trunk. The busy/idle status of the trunk is indicated via an LED located within the associated pick-up button. A dark LED indicates the trunk is idle and lighted LED indicates the trunk is busy. Incoming calls over the trunk cause the LED to flash at all appearances of the trunk. Ringing is provided at all trunk appearances assigned to ring.

d. Saved Number Redial

After dialing a destination number and while still off-hook, the SDT station user may store into system memory the just-dialed number by depressing the Saved Number Redial feature button. Later the user can have the stored number automatically redialed by depressing the same feature button. Only one number can be stored at a time at each SDT.

e. Station-Defined Direct Dial

The Station-Defined Direct Dial feature allows a station user to access either another station within the system or various system feature access codes, by depressing a feature button. No dialing is required by the station user to invoke this feature.

A string of up to four digits can be assigned to each SDT button. This digit string can consist of group speed call access codes, individual speed call access codes, feature access codes, or extension numbers. A minimum of 1 and a maximum of 16 station-defined direct dial buttons can be used with the SDT.

5.05 Hold Features

a. Exclusive Hold

This feature allows the SDT station user to place a call in a special hold mode, such that only the station user that held the call can retrieve the call, even though the line may appear at other stations. Exclusive hold is activated by depressing the Exclusive Hold feature button which causes the associated line pick-up LED at the activating station to flutter and light steadily at all other appearances of the line. The call may be retrieved by the station user again depressing the pick-up button.

b. Manual Hold

This feature allows the SDT station user to place a call in a special hold mode, such that other station users having access to the same line appearance can retrieve the call. Manual hold is activated by depressing the Manual Hold feature button causing the associated line pick-up LED to wink at all appearances of the line on hold. The call may be retrieved at any station with an appearance of the line by the station user depressing the winking pick-up button.

5.06 Intercom Features

a. Automatic Answer

The Automatic Answer feature applies to station-to-station, Automatic Intercom, and Executive Intercom calls. (The feature cannot be used with attendant-extended trunk or DID calls.) This feature can be limited to Automatic Intercom and Executive Intercom calls by class-of-service assignment.

The Automatic Answer feature requires that the station also have the Hands-Free feature assigned. Automatic Answer can be alternately turned ON or OFF by depressing the AUTO ANSWER feature button. The LED in the AUTO ANSWER feature button is lit when the feature is activated. In that case, an incoming station or intercom call causes three short bursts of alerting tone. The set is then automatically placed in the Hands-Free mode.

b. Automatic Intercom

This feature provides a talking path between two designated SDTs with automatic signaling of the called SDT. An Automatic Intercom call is initiated by depressing the dedicated intercom button associated with the called SDT. The station number of the called SDT is displayed on the alphanumeric display.

c. Executive Intercom

This feature allows the SDT station user, by depressing the Executive Intercom feature button and keying a single digit code, to connect to another SDT within a prearranged intercom group. Each SDT can be equipped with multiple Executive Intercom feature buttons with each button corresponding to a separate intercom group. Each intercom group can have a maximum of ten member stations. The executive intercom call is distinguished from other types of intercom calls by three-burst ringing at the called SDT.

d. Manual Intercom

This feature allows the SDT station user to connect to a common intercom path by depressing th Manual Intercom pickup button. All manual intercom LEDs light steadily when the station user connects to the intercom. A maximum of eight SDTs can be connected to a manual intercom group at any one time. Signaling of one or up to a maximum of eight predetermined SDTs within the intercom group is performed by depressing the Manual Signaling feature button. When the Manual Signaling feature button is depressed, a continuous tone is heard at the preassigned SDT(s) for as long as the button is depressed.

e. Voice Announce

The Voice Announce feature may be used in conjunction with Automatic Intercom and Executive Intercom calls only. This feature establishes a one-way communication path which allows a calling party to be heard over the called party's SDT's built-in speaker.

When Voice Announce is used, only a one-way conversation path exists from the SDT of the calling party to the SDT of the called party. To allow a two-way conversation, the called party must either go off-hook or enter the Hands Free mode of operation (if provided).

Voice Announce can be alternately turned ON or OFF by depressing the VOICE ANN feature button. The LED in the VOICE ANN feature button is lit when the feature is activated. In that case, an incoming intercom call causes three short bursts of alerting tone. The calling party receives one short burst of ringback tone, after which the calling party may converse over the called party's speaker.

Other calls in progress are not interrupted by Voice Announce calls. The called party may, if desired, place an existing call on hold to receive an incoming Voice Announce call.

5.07 Display Features (18- and 26-Button SDTs only)

a. Attendant Identification on Display

An SDT station user dialing the attendant or receiving a call from the attendant results in the attendant indicator and attendant identification number being displayed on the alphanumberic display (e.g., ATT 400).

b. Call Forwarding Display

An SDT station user that activates a call-forwarding feature is provided with a display of the forwarded-destination number when the SDT is not in use (e.g., FWD-TO 419). An SDT station user that receives a forwarded call is provided with a display that indicates the number of the station that activated call forwarding and the source number or designation of the calling party (e.g., CF 1234 LOCAL).

c. Call Park Location Number Display

An SDT station user that parks a call by depressing the Call Park feature button is provided with a display that identifies the location of the parked call.

d. Call Pickup Source Display

An SDT station user that answers a call via the Dial Call Pickup feature is provided with a visual display of the picked-up station number and the source number or designation of the calling party (e.g., PU 3939 LOCAL).

e. Call Waiting Display

An SDT station user that receives a call waiting signal is provided with a display that includes the call waiting indicator, the station number or trunk identity of the call waiting to be answered, and the station number or trunk identity of the connected party.

f. Callback Number Display

An SDT station user is provided with a callback number display upon receiving a call for an automatic callback that was initiated earlier by the user. The display includes the callback indicator and the station number to which automatic callback was initiated (e.g., CALLBCK 1219).

g. Conference Mode Display

An SDT station user is provided with a conference display (CONF) whenever the user is engaged in a conference connection.

h. DID Call Forward Display

With this feature, the alphanumeric display on an Attendant console shows that the incoming call is a DID trunk call forwarded by another station.

The SDT displays "CF" the identity of the station forwarding the call, and a DID trunk identifier message.

The ATT displays "IN VIA CFWD", the DID trunk group and trunk member, and the forwarding station's class-of-service and identity.

i. Dial Input Verification Display

This feature allows an SDT station user, dialing a destination number or access code, to verify the digits dialed from the SDT. As each digit is dialed from the digital keypad, the digit is displayed on the alphanumeric display, scrolling the dialed digits from right to left.

j. Duration of Call Display

This feature provides a display of the elapsed time the SDT station user has been engaged on a particular call. The time is displayed in minutes and tenths of minutes and incremented in one-tenth intervals. The feature is activated and deactivated by the user depressing the Duration-of-Call feature button.

k. Incoming Call Display

An SDT station user that receives an incoming call is provided with a display of the source of the calling party. The call source is defined in SATURN IIE memory as a station number for internal calls and a trunk-type display for external calls.

The station number display consists of the calling party's extension number (e.g., 1219). The trunk-type display is customer-defined by the assignment of up to eight alphanumeric characters to represent the trunk-type (e.g., TIE-NY, WATS, LOCAL, etc.). The trunk-type display is assigned on a trunk-group basis.

l. Message Waiting Source Display

An SDT station user that receives a message waiting indication is provided with a display that includes the message "CALL" and the station number from which message waiting was activated (e.g., CALL 1212).

m. No Answer Advance Display

With this feature, the alphanumeric display on the SDT that is used as the destination for the No Answer Advance hunting feature will show "NA" to indicate that the call is a No Answer Advance, the identity of the station that did not answer, and the identity of the calling station.

n. Recall Identification Display

An SDT station user that answers a call that is part of a recall receives a recall identification display on the alphanumeric display (e.g., RECALL 1234).

o. Speed Calling – Individual List Display

This feature allows an SDT station user to display the individual's speed call list of directory (or station) numbers. The display can be used as a reference for dialing speed call numbers or for making changes to the list. The first number of the speed call list can be displayed by depressing the Speed Call feature button while remaining on-hook. Additional depressions of the Speed Call feature button cause other members of the speed call list to be displayed in sequence.

p. Station Message Detail Recording Account Code Display

This feature allows an SDT station user to depress the Account Code feature button and display the preassigned default account code or the special account code entered previously by the user. The display includes the account code indicator and account code to which the present call is being recorded (e.g., ACCT 55101024567). The user may change the account code to another account code at any time during an established call.

q. Time-of-Day Display

This feature allows an SDT station user to obtain the time of day, by depressing the Time-of-Day feature button. The time is obtained from the SATURN IIE EPABX System clock and displayed in either a 12-hour or 24-hour format depending on the system option in use. The nominal time for the display is 1.5 seconds (variable via CMU procedures). Thereafter, the display goes blank and is replaced by whatever display existed prior to the activation of this feature or an updated display.

r. Timed Reminder

The Timed Reminder feature provides the SDT user with a timed alarm-type alert. Up to four timed reminders per SDT may be programmed within a 24-hour period.

When the system clock reaches the same time value as the timed reminder setting, a continuous tone is emitted and the SET ALARM feature button's LED starts flashing. To display the timed reminder settings, the SDT user depresses the SET ALARM feature button while on-hook. The feature button's LED lights steadily and the first timed reminder appears in the display. The alarm number is shown to the extreme left of the display; the time setting to the extreme right.

Additional depressions of the SDT SET ALARM feature button causes each timed reminder to be displayed in sequence. After Alarm 4 has been displayed, the display mode is exited by depressing the feature button again.

The display goes blank or returns to a previously-existing display and the feature button's LED extinguishes.

The alarm ceases and the SDT ALARM feature button's LED extinguishes when one of the following occurs:

- SDT user goes off-hook,
- SET ALARM feature button is depressed, or
- Alarm duration interval of 10-seconds (nominal) has elapsed.

The display is then restored to the previous display.

5.08 Message Waiting Features

a. Message Waiting – Selective Automatic Callback (18- and 26-button SDTs only)

This feature allows an SDT station user to display each message that is waiting at the user's SDT (i.e., CALL 1219) and respond to any particular message by initiating an automatic callback to the associated station.

To display each message that exists at the SDT, the user remains on-hook and repetitively depresses the Message Waiting – Automatic Callback feature button. Each button depression displays the next succeeding message. To initiate an automatic callback in response to a particular message, the user displays the desired message, goes offhook, and depresses the Message Waiting – Automatic Callback feature button.

b. Message Waiting – Selective Cancellation

This feature allows an SDT station user to selectively cancel any or all messages waiting at the user's SDT. A particular message is cancelled by the user displaying the desired message and depressing the Message Waiting Cancellation feature button.

5.09 Privacy Features

a. Bridged Call

This feature allows three station users to be off-hook on the same line when multiple appearances of the line exist. An SDT user can bridge on a line already occupied by two other parties, by depressing the pick-up button corresponding to the occupied line. A conference tone is heard by the connected parties before bridging occurs. If the Call Privacy feature is activated, bridging is denied.

b. Call Privacy

Activation of the Call Privacy feature on a specific line prevents all other parties from bridging on that line. Arrangements can be made in SATURN IIE software for automatic activation of call privacy each time the user goes off-hook or manual activation of call privacy by the station user depressing the Privacy feature button. In either case, call privacy can be deactivated by the station user depressing the Privacy feature button.

5.10 Special Station Operation Features

a. Hands-Free Mute

The Hands-Free Mute feature allows users of an SDT equipped with the Hands-Free feature to disable the SDT built-in microphone while the Hands-Free feature is active. This permits private conversation locally without being overheard by the calling party.

The Hands-Free Mute feature is operational only when the Hands-Free feature is selected (HANDS FREE button LED lit). When the Hands-Free feature is selected, the Hands-Free Mute feature may be alternately turned ON or turned OFF by depressing the Hands-Free MUTE feature button. The SDT built-in microphone is muted (turned OFF) when the LED in the MUTE button is lit. Conversely, the SDT built-in microphone is active (turned ON) when the LED is off.

The Hands-Free Mute feature has no control over the handset microphone.

b. Hands-Free Operation

This feature allows an SDT station user to originate or answer a call and converse with the other party without lifting the handset. Call progress tones such as dial tone, busy tone, audible ringback tone, etc., and the voice of the called party are heard over the speaker built into the SDT. To talk to the party, the user speaks into the built-in microphone. To originate a hands-free call, the user selects an idle pick-up button, depresses the HandsFree feature button, listens for dial tone over the speaker and dials the desired destination number. To answer an incoming call, the user depresses the appropriate pick-up button, and depresses the Hands-Free feature button.

No handset is required during the hands-free call. The user can convert from hands-free to handset operation any time during the call by picking up the handset.

Hands-Free requires the use of an SDT equipped for Hands-Free operation.

c. On-Hook Dialing

This feature allows an SDT station user to originate a call without lifting the handset until the called party has answered. Call progress tones such as dial tone, busy tone, audible ringback tone, etc., and the voice of the called party are heard over the speaker built into the SDT. To originate a call, the user selects an idle pick-up button, depresses the On-Hook Dialing feature button, listens for dial tone over the speaker, and dials the desired destination number. If the user encounters busy tone, the call may be disconnected by again depressing the On-Hook Dialing feature button. If the called station is idle, the user hears audible ringback tone. When the called party answers, the party's voice is heard over the speaker. To talk to the called party, the user must convert to normal handset operation by picking up the handset.

For SDTs assigned the On-Hook Dialing feature and a Push-to-Talk feature button, the user can originate or answer a call and converse with the other party without lifting the handset. The Push-to-Talk feature button must be depressed while the user speaks into the microphone and released to hear the other party's response over the speaker.

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SATURN® IIE EPABX

INSTALLATION PROCEDURES

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SECTION 1.00 INTRODUCTION

1.01 Purpose. This practice provides instructions for craft personnel responsible for site preparation and installation of the SATURN IIE (Saturn II- Expanded) System, up to, but not including, power turn-on.

This practice is divided into the following sections.

Section 1 Introduction
Section 2 Equipment Location and Identification
Section 3 Customer Site Preparation
Section 4 Equipment Installation Procedures
Section 5 System Signal and Power/Ground Cabling and Termination
Section 6 MDF Cabling and Terminating Arrangements

Table 1.00 defines the common mnemonics used in this practice.

1.02 Siemens SATURN IIE Practices. The practices and dates for the SATURN IIE EPABX are listed in the Practices Documentation Index A30808-X5130-A190-★-B987.

NOTE: Always refer to the latest issue of the applicable index to obtain the latest issue of a practice.

1.03 Siemens Customer Support Services. Siemens maintains a nationwide network of field service offices. Contact the nearest Siemens regional office for any engineering assistance which may be required.

Table 1.00 Mnemonics Used in This Practice

MNEMONIC	DEFINITION
ALM	Alarm
CIOP	Controller/Input-Output Processor
CO	Central Office
CONF	Conference
COT	Central Office Trunk
DCI	Data Communication Interface
DID	Direct Inward Dialing
DOD	Direct Outward Dialing
DTMF	Dual-Tone Multifrequency
EIA	Electronics Industries Association
EPABX	Electronic Private Automatic Branch Exchange
FCC	Federal Communications Commission
FDD	Floppy Disk Drive
IOP	Input/Output Processor
KSDA	Keyset Daughter Board "A"
LED	Light-Emitting Diode
LTU	Line/Trunk Unit
LTUC	Line/Trunk Unit Control
LTUPS	Line/Trunk Unit Power Supply
MCA	Memory Control and Attenuator
MDF	Main Distribution Frame
MEM	Memory
MRA	Material Return Authorization
MSM	Memory Support Module
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PEN	Port Equipment Number
PIMD	Premium Instrument Module Digital
PRS	Protection Restore Signal
PSC	Parallel/Serial Converter
PSU	Power System Unit
RAC	Ringing AC
RAM	Random Access Memory
RAUP	Remote Access Unit/Ports
REN	Ringer Equivalence Number
RGEN	Ring Generator
RMW	Ringing Message Waiting
ROM	Read Only Memory
SDT	Siemens Digital Telephone
SLA16	Subscriber Line Analog – 16 Lines
SLMA-S	Subscriber Line Module Analog – Station
SLMA-O	Subscriber Line Module Analog – Off-Premises
SLMD	Subscriber Line Module Digital
SMDR	Station Message Detail Recording

Table 1.00 Mnemonics Used in This Practice (Continued)

MNEMONIC	DEFINITION
SPG	Single Point Ground
SMXTG	Signal Multiplexer/Clock Tone Generator
TC	Trunk Circuit
TELCO	Telephone Company
TMBA-2	2-Wire E & M Trunk
TMBA-4	4-Wire E & M Trunk
TMBM	Central Office Trunk
TMIE	Direct Inward Dialing Trunk
TTY	Teletypewriter

1.04 Federal Communications Commission (FCC) Rules and Regulations. In compliance with FCC's Part 15 and 68 Rules and Regulations, the subsequent statements are presented to the user:

a. Installation of the SATURN IIE EPABX equipment must be performed by authorized personnel only.

b. This equipment generates and uses radio frequency energy and if installed properly will not cause interference to radio communications. It has been tested and found to comply with the limits for a class "A" computing device pursuant to subpart "J" of Part 15, FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

   Operation of this equipment in a residential area may cause interference, in which case the user will be required to take whatever measures may be required to correct the interference.

c. Information on all devices which are configured for connection to the public telephone network may be requested by the telephone company. Table 1.01 provides the necessary information that may be requested by the telephone company on the FCC-registered SATURN devices configured for connection to the public telephone network. In addition, if failure transfer circuitry is to be used, the FCC Registration Number and Service Code of the failure transfer equipment and failure transfer telephone sets must also be furnished to the telephone company.

d. Siemens-supplied cables and wiring meet the FCC requirements for fully protected premises wiring. System MDF cables can be ordered directly from Siemens. If installation of non-fully-protected premises wiring is to be performed, such installation must conform to Section 68.215 of the FCC part 68 Rules and Regulations.

e. Connection of party lines and coin telephones to the public telephone network is prohibited by the FCC.

f. Under certain circumstances, the local telephone company may temporarily discontinue service and make changes in facilities and services which may affect the operation of this equipment. However, the telephone company will give adequate notice in writing to allow the user to maintain uninterrupted service.

g. Although telephone sets are not provided as part of the SATURN EPABX, the following extract from FCC Public Notice Number 1718, dated January 9, 1984, is provided: "FCC rules prohibit the use of non-hearing-aid-compatible telephones in the following locations:

(1) Any public or semipublic location where coin-operated or credit card telephones may be found.

(2) Elevators, highways and tunnels (automobile, subway, railroad or pedestrian) where a person with impaired hearing might be isolated in an emergency.

(3) Places where telephones are specifically installed to alert emergency authorities such as fire, police or medical assistance personnel.

(4) Hospital rooms, residential health care facilities, convalescent homes, and prisons, specifically where telephones are used for signaling life-threatening or emergency situations if alternative signaling methods are not available.

(5) Work stations for hearing impaired personnel.

(6) Hotel, motel, apartment lobbies; in stores where telephones are used by patrons to order merchandise; in public transportation terminals where telephones are used to call taxis, or to reserve lodging or rental automobiles.

(7) Hotel and motel rooms. (At least ten percent of the rooms must contain hearing-aid-compatible telephones which will be provided to hearing impaired customers upon request.)"

NOTE: All telephones and station apparatus are to be customer-provided and are to be FCC-registered units.

h. If trouble is experienced with this equipment, the procedures contained in the SATURN IIE EPABX Maintenance and Troubleshooting practice should be performed by qualified maintenance personnel to isolate and correct the malfunction. If an FCC-registered device (refer to Table 1.01) is malfunctioning and a spare is not available, the telephone company must be notified that the device is malfunctioning and such device must be disconnected from the public telephone network. The telephone company must also be notified when the faulty device has been repaired or replaced and such device is reconnected to the public telephone network.

i. Each system, as shipped, is accompanied by a Material Return Authorization (MRA) kit. This kit contains instructions and related documentation for returning defective equipment for repair. Specific warranty information is provided by Siemens to each dealer authorized to sell, install and maintain SATURN equipment.

Table 1.01 FCC Registration Information
FCC Registration Number B1586K-14442-MF-E

Interfacing Device	Siemens Device Model or Part Number	Private Line Facility Interface Code/ Service Code	Ringer Equivalence No. (REN)	No. of Leads	USOC Jack No.	Comments
TIE TRUNKS 2-Wire T/R, E&M Type I Signaling	TMBA2 (S30810-Q429-X-★-B900)	TLM11M/9.0F	—	4-ea.	RJ2EX	RJ2EX-Jack provides up to 12 bridged tie trunks.
4-Wire T/R & T1/R1, E&M Type 1 Signaling	TMBA4 (S30810-Q430-X-★-B900)	TLM31M/9.0F	—	6-ea.	RJ2GX	RJ2GX-Jack provides up to 6 bridged tie trunks.
2-Wire T/R, E&M Type II Signaling	TMBA2 (S30810-Q429-X-★-B900)	TLM12M/9.0F	—	6-ea.	RJ2FX	RJ2FX-Jack provides up to 8 bridged tie trunks.
4-Wire T/R & T1/R1, E&M Type II Signaling	TMBA4 (S30810-Q430-X-★-B900)	TLM32M/9.0F	—	8-ea.	RJ2HX	RJ2HX-Jack provides up to 6 bridged tie trunks.
CENTRAL OFFICE TRUNKS: 2-Wire Loop Start	TMBM	—	0.9B	2-ea.	RJ21X	
2-Wire Ground Start	(S30810-Q414-X-★-B900)	—	0.9B	2-ea.	RJ21X	
DIRECT-IN-DIALING TRUNKS: 2-Wire (Incoming Only)	TMIE (S30810-Q415-X-★-B900)	—	—	2-ea.	RJ21X	RJ21X-Jack provides up to 25 bridged T/R T(MR)/R(MR) T(A1)/R(A1) or T(OPS)/R(OPS)
OFF-PREMISES STATION: 2-Wire Class C	SLMA-O (S30810-Q1733-X-★-B900)	OL13C	—	2-ea.	RJ21X	
AUXILIARY DEVICES: Failure Transfer Ckts. (See Vendor's FCC#)	(Note: Not provided by Siemens)	—	—		RJ21X	

SECTION 2.00 EQUIPMENT LOCATION AND IDENTIFICATION

2.01 General. The SATURN IIE System is housed in a single, lightweight equipment cabinet with expansion capabilities. An LTU shelf can be added within the basic cabinet; in addition an expansion cabinet which contains one or two LTU shelves can be mounted on top of the basic cabinet. Figures 2.00 and 2.01 show the basic cabinet and expansion cabinet. The block diagram shown in Figure 2.02 identifies the functional blocks of circuits into which the system is divided. These functional blocks are related to the system hardware groups.

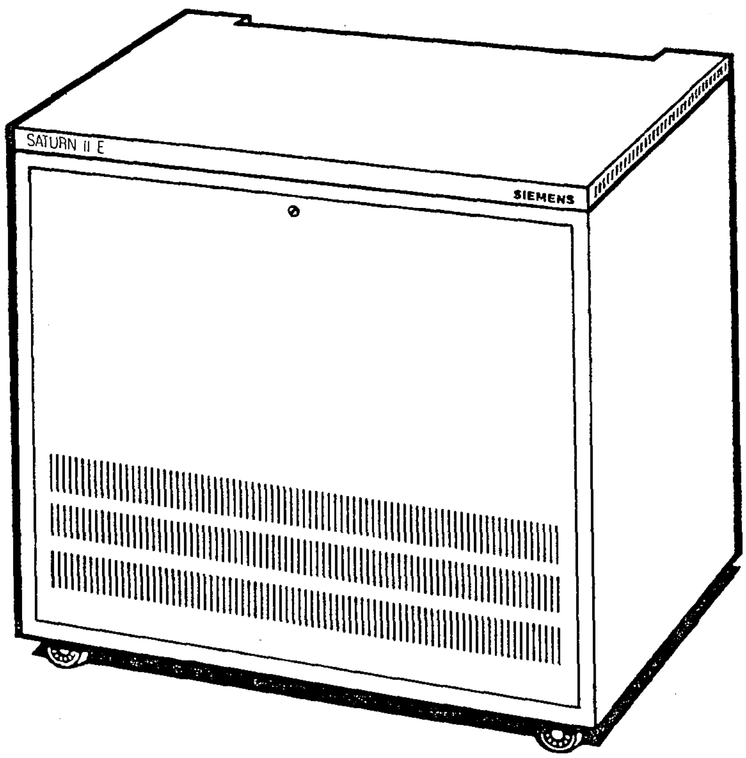
2.02 SATURN IIE Cabinets. Figures 2.03 through 2.07 show the basic and expanded configurations for the SATURN IIE System. The identification, location, and functional description of the equipment contained in the system cabinet is presented below.

a. Equipment Shelves. The basic cabinet can contain one or two shelves, a required basic shelf and an LTU shelf for expansion. The expansion cabinet can contain one or two LTU shelves.

b. Power and Distribution Equipment. The SATURN IIE System makes use of distributed power in the cabinet. Several power modules of various sizes are located alongside and at the bottom of the system cabinet. For further information, refer to Figure 2.03.

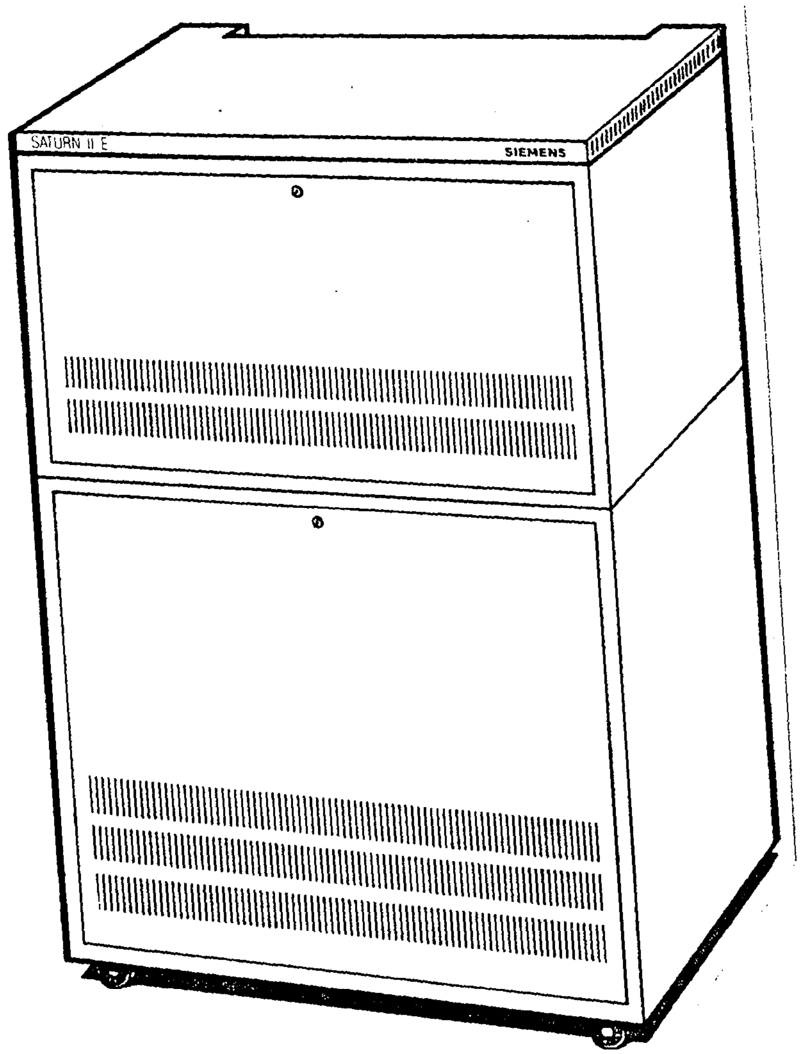
c. Miscellaneous Equipment. Two Floppy Disk Drives (FDD) provide random data storage, using floppy disks as the data storage medium. The FDDs are located at the bottom of the rack (see Figure 2.03).

d. Printed Circuit Boards. Two types of Printed Circuit Boards (PCBs) are used, common equipment PCBs and peripheral interfacing PCBs. Refer to Table 2.03 for further information on the common equipment PCBs, and Table 2.04 for information on the peripheral interfacing PCBs.



A4979-1-4/7/86

Figure 2.00 SATURN IIE Basic Cabinet (with Front Panel)



A4978-1-4/7/86

Figure 2.01 SATURN IIE Basic and Expansion Cabinets (with Front Panel)

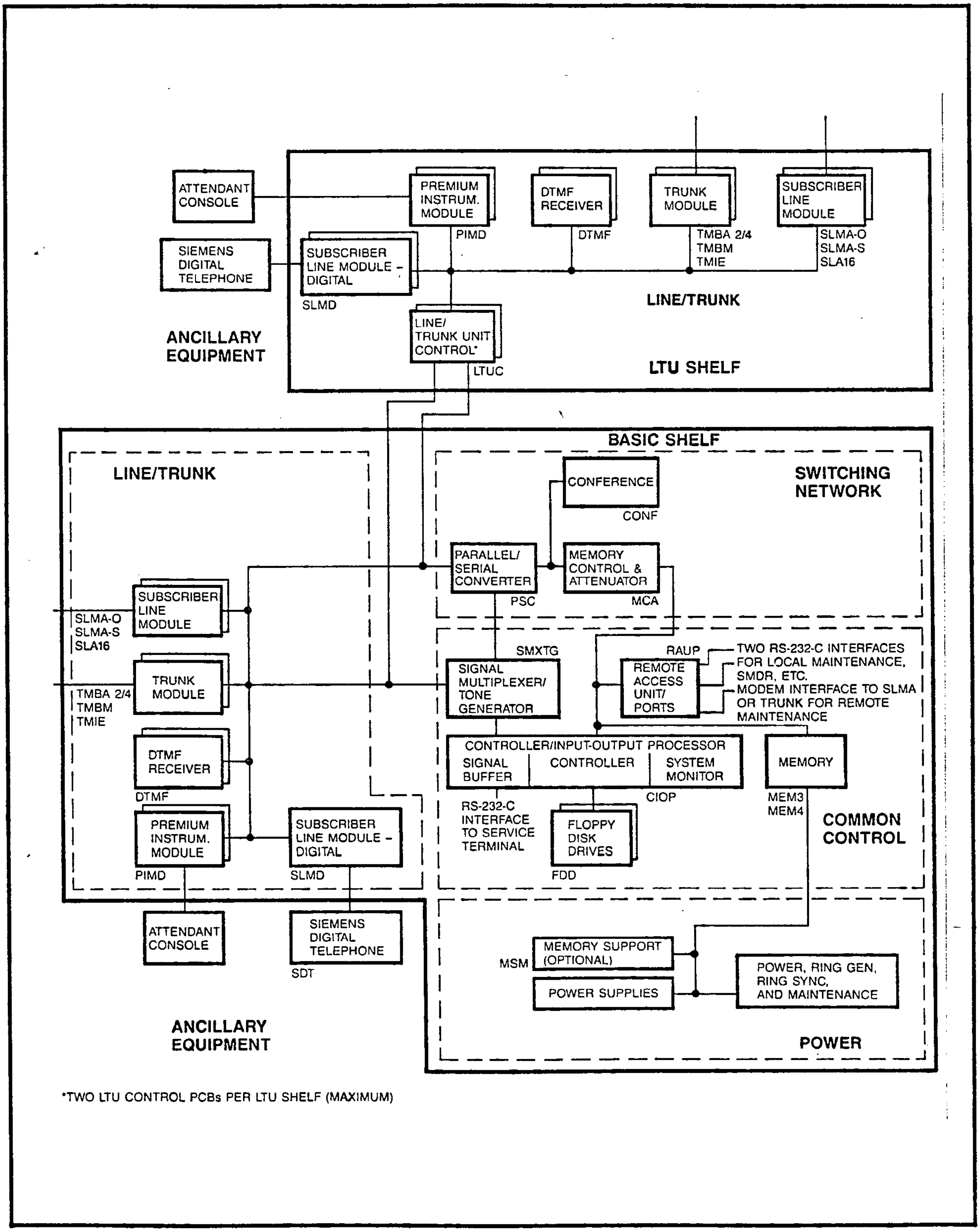


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Figure 2.02 SATURN IIE System Block Diagram

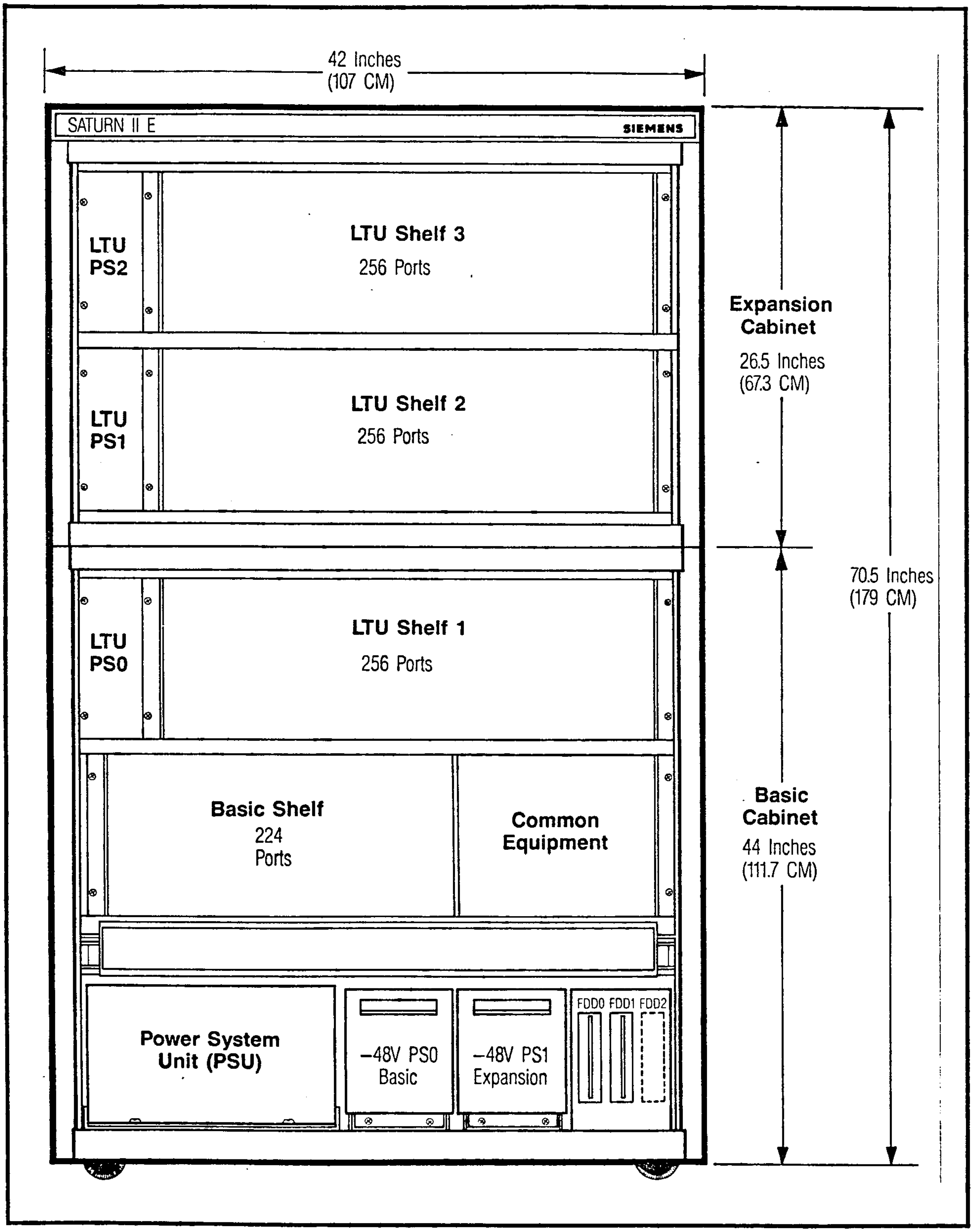

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Figure 2.03 SATURN IIE Equipment Configuration

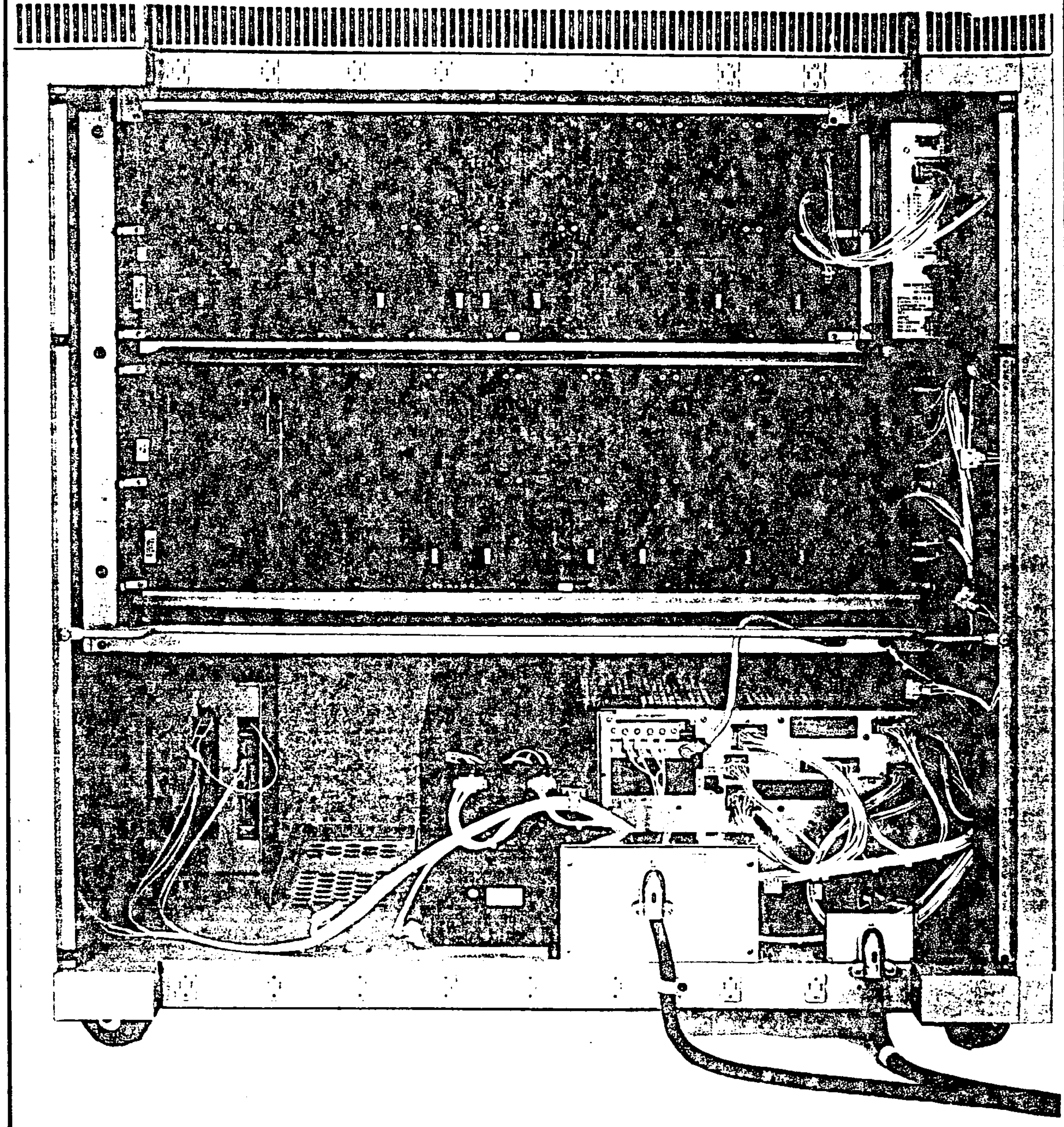

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Figure 2.04 SATURN IIE Basic Cabinet (Rear View)

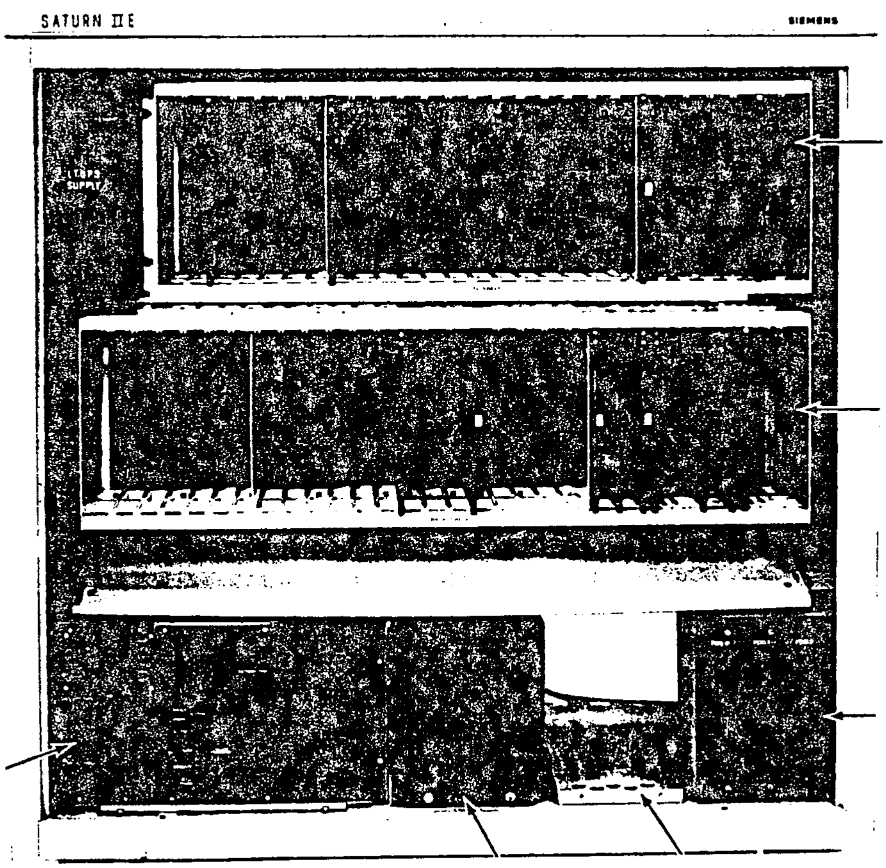

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Figure 2.05 SATURN IIE Basic Cabinet (Front View)

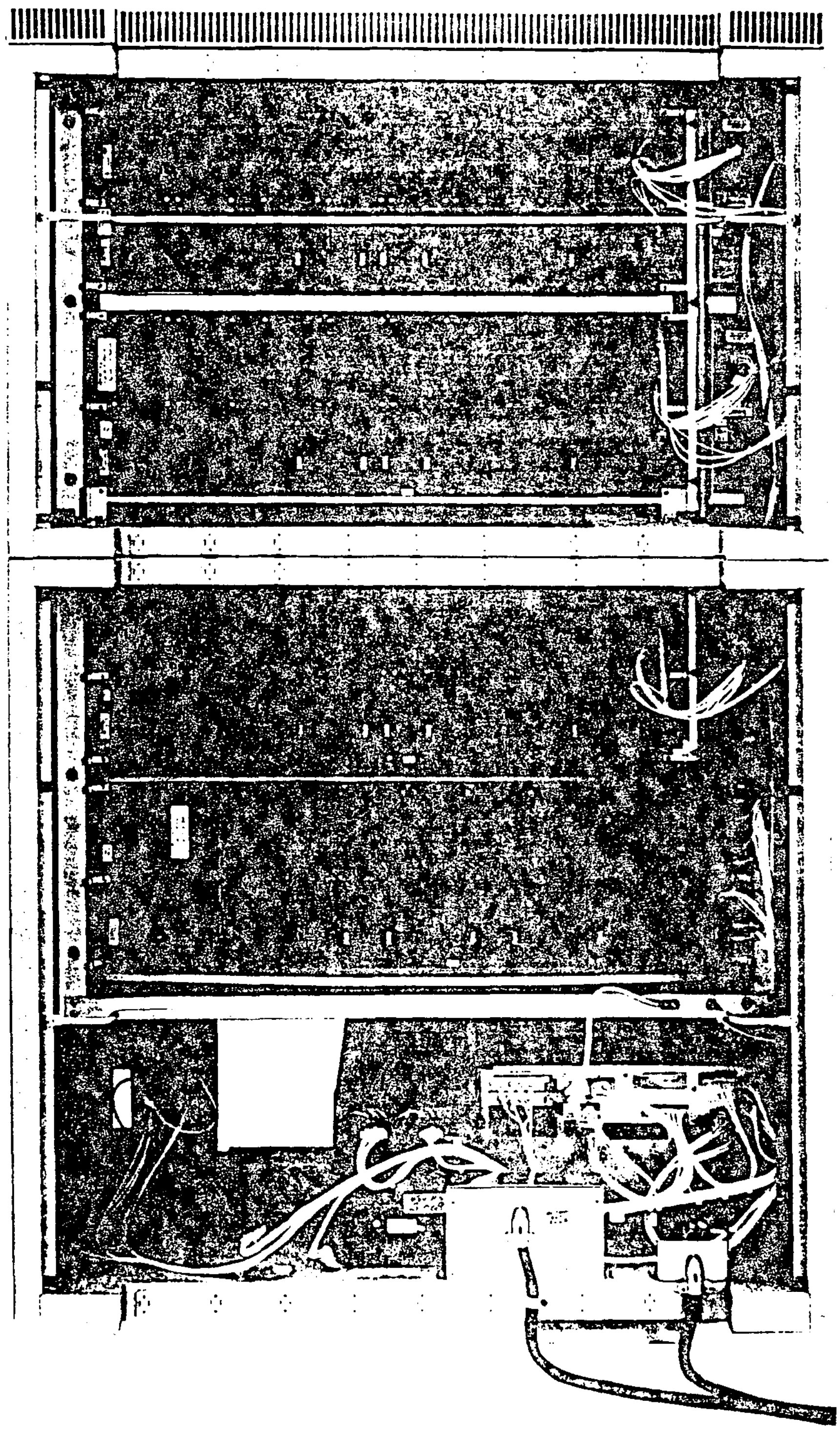

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Figure 2.06 SATURN IIE Basic Cabinet and Expansion Cabinet (Rear View)

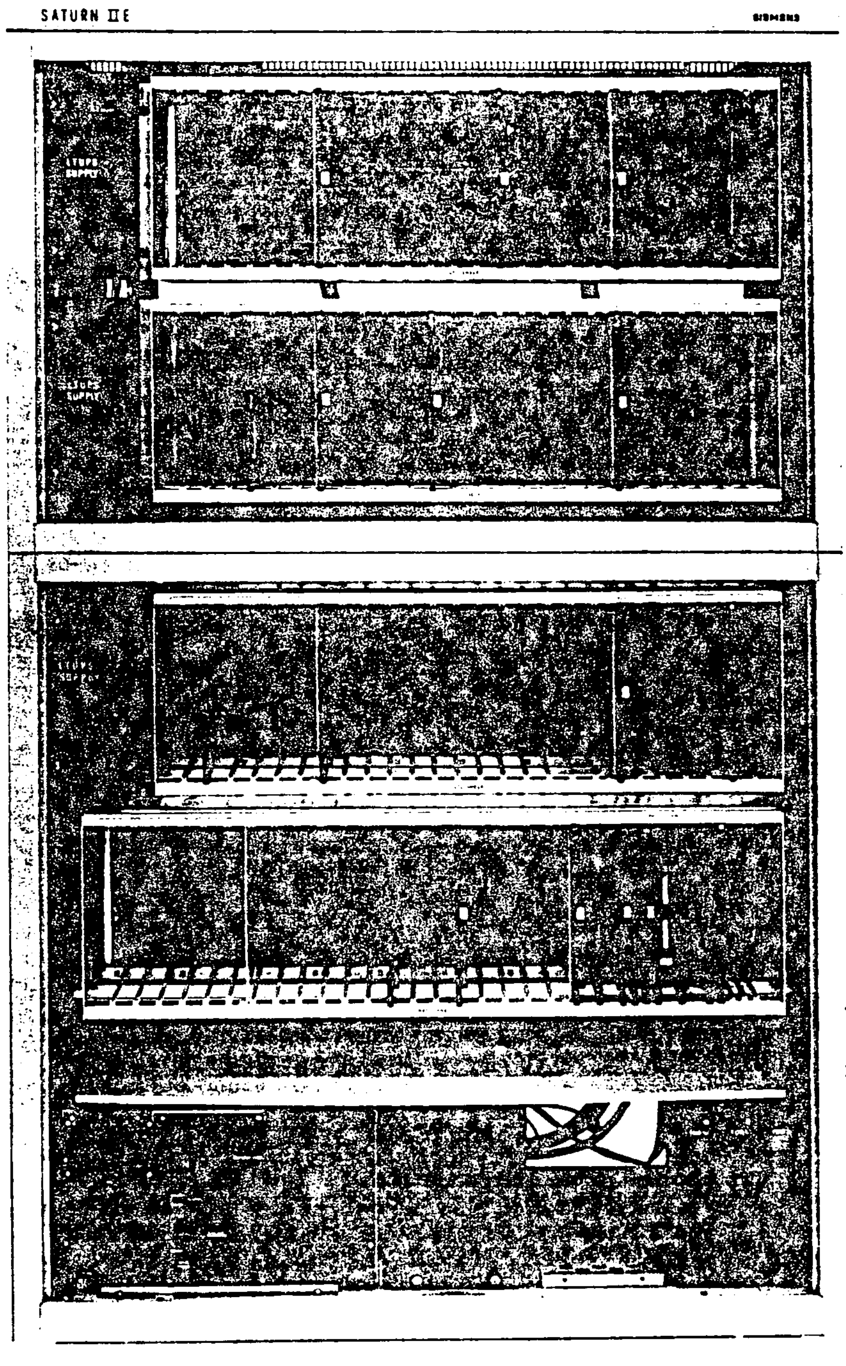

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Figure 2.07 SATURN IIE Basic Cabinet and Expansion Cabinet (Front View)

Table 2.00 Identification and Functional Description of Equipment Shelves

BASIC	Basic Shelf. The basic shelf has both common equipment and peripheral PCBs which make up the common control and switching network circuitry of the system. In addition, the basic shelf also contains three 4-card Line/Trunk Unit (LTU) channel groups, and four 2-card LTU channel groups.
LTU	Line/Trunk Unit Shelf. One LTU shelf can be installed in the basic cabinet and two can be installed in the expansion cabinet. Each LTU shelf has peripheral interface PCBs. The peripheral PCBs provide the interface circuitry between the system and external devices. In addition, each LTU shelf is equipped with a Power Supply (LTUPS) for supplying the logic voltages of +/- 5 Vdc and +/- 12 Vdc.
	NOTE: The guidelines shown in Table 2.04 should be followed when assigning peripheral PCBs to the basic and LTU shelves.

Table 2.01 Identification and Functional Description of Power and Distribution Equipment

PSU	The PSU front panel provides the access and control point to various system maintenance functions and serves as the main AC and DC power distribution point to the following: a. AC power, via circuit breakers, to the PSU, LTUPS units, and -48PS0, and -48PS1 (see Table 4.06 for detailed information). b. Fused -48Vdc outputs for talk battery, signaling battery, SLMD and PIMD applications to all channel groups in the basic and LTU Shelves and the input to the RGEN module (see Table 4.06 for detailed information). c. Fused 90Vac, 20Hz for Ringing AC (RAC) and Ringing Message Waiting (RMW) to all channel groups in the basic and LTU shelves (see Table 4.06 for detailed information).
-48PS0	The -48PS is an AC-to-DC converter which provides -48Vdc output voltage. This voltage is used for talk battery, signal battery, SLMD and PIMD applications for station instruments, SDTs, trunks, and attendant consoles, respectively. The -48PS also powers the RGEN modules. A single -48PS (-48PS0) is adequate for the basic cabinet applications.
-48PS1	A second -48PS (-48PS1) is required when the expansion cabinet is included.
MSM	Memory Support Module. The MSM contained within the PSU is an optional battery backup package that provides +5Vdc to the RAM memory when the commercial AC power fails. In the event of such failure, the battery maintains the data stored in memory for at least five minutes. When the AC source is restored within this period , the memory does not have to be reloaded from floppy disk; system operation can begin immediately. The MSM is capable of anther 5-minute backup cycle after 30 minutes of recharging. The MSM includes the battery charging circuitry and is under a "float" charge during normal operation. The MSM is located within the PSU.

Table 2.02 Identification and Functional Description of Miscellaneous Equipment

FDD0 FDD1	Floppy Disk Drive 0/1. The floppy disk drive (FDD) provides the backup memory for the following: system initialization, system reload, administration, and maintenance testing.

Table 2.03 Identification, Location and Functional Description of Common Equipment PCBs

MNEMONIC	TITLE AND FUNCTION	SLOT NUMBER
SMXTG	Signal Multiplexer/Clock/Tone Generator (SMXTG) PCB is divided into three functional parts: the signal multiplexer, the clock generator, and the tone generator. The SMXTG is a hardware-controlled scanner/distributor, which provides an interface between the line/trunk units and CIOP. The SMXTG handles control and status signals for 32 highways. The clock generator provides the 8.192MHz, 4.048MHz, and 250Hz clocking signals required to operate the system. The tone generator provides various tone outputs from which all the system DTMF tones and supervisory tones are derived. The tone generator also provides a square wave timing signal for system generated dial pulses.	21
MEM4	The MEM4 PCB provides 1 Megabyte of memory and its supporting logic to store system data. The memory is organized as 512k words X 16 bits/word, with memory divided into sixteen 64K byte pages, write protection provided in 1K word segments. MEM4 is arranged for battery backup memory protection to safeguard stored data during short term power outages. Also, an error-correction code is provided to correct any single-bit error and detect double-bit errors existing in a word.	27-29
MEM3	The MEM3 PCB provides 256k bytes of memory and its supporting logic to store system data. The memory is organized as 128k words X 16 bits/word, with memory write protection provided in 1K word segments. MEM3 is arranged for battery backup memory protection to safeguard stored data during short term power outages. Also, an error-correction code is provided to correct any single-bit error and detect double-bit errors existing in a word.	27-29
RAUP	Remote Access Unit/ Ports. The RAUP allows remote access to the system for maintenance and administrative functions. The RAUP is located in slot 25 of the basic shelf and does not use up any time slots.	25
CIOP	Controller/Input Output Processor. Contains the Signal Buffer and processor and performs the input/output functions in the system. An RS-232-C connector is provided for the service terminal.	26
PSC	Parallel/Serial Converter.Converts serial PCM voice signals to parallel signals, and then multiplexes them into parallel flow. The parallel data is sent to the Memory Control and Attenuator (MCA) for further processing; the reverse function is performed by the PSC to provide serial voice signals back to the LTUs. PSC 0 - basic and LTU Shelf 1. PSC 1 - LTU Shelves 2 & 3.	20,22
MCA	Memory Control and Attenuator. The MCA is divided into two functional parts, a Time Switch Unit and Memory Control. The time switch unit makes all two party connections and provides attenuation (as required) for all system calls. The memory control receives data from the processor and causes the time switch to make the required connections.	23
CONF	Conference (CONF). The CONF function provides the switching control for conferences involving 3 to 7 parties plus attendant.	21

Table 2.04 Identification, Location and Functional Description of Peripheral Interfacing PCBs

MNEMONIC	TITLE AND FUNCTION	SLOT NUMBER
SLMA-S	Subscriber Line Module Analog – Station. The SLMA-S provides eight peripheral ports for rotary dial and/or DTMF analog stations.	0-5,7-18,20-25
SLMA-O	Subscriber Line Module Analog – Off-Premises Station. The SLMS-O provides four peripheral ports for Off-Premises rotary dial and/or DTMF stations and the system.	0-5,7-18,20-25
SLMD	Subscriber Line Module – Digital. The SLMD provides eight interfacing circuits between the SDTs and the system.	0-5,7-18,20-25
SLA16	Subscriber Line Module Analog. The SLA16 PCB provides sixteen interfacing circuits between rotary dial and/or DTMF stations and the system.	0,1,4,5,7,8,11-14, 17,18,20,21,24,25
LTUC	Line/Trunk Unit Control (LTUC). The LTUC buffers the signal between the common equipment and the peripheral modules in the LTU shelves. It also provides fault monitoring and reporting of failure associated with the 128 ports it handles. Two are required on each LTU shelf. The LTUC in slot 6 provides exchange of signaling and information between channel groups 0 through 3 (128 ports) and the common equipment. The LTUC in slot 19 provides exchange of signaling and information between channel groups 4 through 7 (128 ports) and the common equipment.	6,19
DTMF	Dual-Tone Multifrequency Receiver. The DTMF PCB detects and validates DTMF digits (tone pairs). In addition to dial tone detector circuitry, the DTMF PCB contains four circuits per PCB. A maximum of three DTMF PCBs are allowed per LTU shelf. The maximum number of DTMF PCBs is eight per system, distributed evenly in the shelves.	0-5,7-18,20-25
PIMD	Premium Instrument Module-Digital. The PIMD provides two peripheral ports between attendant consoles. The PIMD provides two circuits but requires eight time slots to operate.	0-5,7-18,20-25
TMBA-2	2-Wire E&M Trunk. The TMBA-2 PCB provides four trunk circuits. Each is arranged for either one-way or two-way incoming and outgoing service with two-wire voice transmission and E&M signaling.	0-5,7-18,20-25
TMBA-4	4-Wire E&M Trunk. The TMBA-4 PCB provides four trunk circuits. Each is arranged for either one-way or two-way incoming and outgoing service with two-wire voice transmission and E&M signaling.	0-5,7-18,20-25
TMBM	Central Office Trunk. The TMBM PCB provides four trunk circuits. Each is arranged for either one-way or two-way incoming and outgoing service for Central Office (CO), Foreign Exchange (FX), and WATS applications.	0-5,7-18,20-25
TMIE	Direct Inward Dialing Trunk. The TMIE PCB provides four trunk circuits.Each is arranged for one-way direct inward dialing service applications from the CO.	0-5,7-18,20-25

2.03 Port Equipment Numbering. The SATURN IIE System utilizes a four-digit numbering plan to identify each port in the system. These four digits are used to identify the actual physical location of the port. Recall that the system cabinets include several shelves, and that each shelf contains a number of PCBs. Physically, as well as electronically, the system is divided into seven channel groups for the basic shelf and eight channel groups for each LTU shelf. The PCBs in each of these channel groups contain two, four, eight, or sixteen circuits each. Using the above data, the four-digit numbering scheme was developed to allow each circuit in the system to be identified by a unique Port Equipment Number (PEN). The PEN numbering scheme is shown in Figure 2.08 and explained below.

For convenience, the four digits of the PEN are designated WXYZ. The "thousands" (W) digit of the PEN identifies the shelf in which the port is located: "0" for the basic shelf, and "1," "2," or "3," for the applicable LTU shelf, as shown in Figure 2.08. The "hundreds" (X) digit of the PEN identifies the channel group in which the port is located, as shown in Figure 2.08. There are seven channel groups in the basic shelf, numbered 0 through 6, and eight channel groups in each LTU shelf, numbered 0 through 7 (see Figures 2.09 and 2.10). The "tens" (Y) digit of the PEN identifies the channel group slot number. For the basic shelf, channel groups 0, 2, and 4 contain four card slots each (numbered 0, 2, 4, and 6), and channel groups 1, 3, 5, and 6 contain two card slots each (numbered 0 and 2). For each LTU shelf, channel groups 0, 2, 4, and 6 contain four card slots each (numbered 0, 2, 4, and 6) and channel groups 1, 3, 5 and 7 contain two card slots each (numbered 0 and 2). See Figure 2.10. (The LTU card slots labeled "LTUC" contain no ports and therefore are not included in the numbering plan).

The SATURN IIE System employs "virtual" slots in addition to the physical slots in each channel group. Two virtual slots are added to the four-card channel groups and two virtual slots are added to the two-card channel groups. The virtual slots are numbered 1 and 3 and are paired with slots 0 and 2, respectively. This has the effect of depicting the channel groups as six-slot and four-slot channel groups, respectively. The virtual slots are used in the numbering scheme only when a 16-circuit card is installed. For example, when an SLA16 is installed in slot 0, its top eight circuits are assigned to slot 0 and its bottom eight circuits are assigned to virtual slot 1. As each channel group is allotted only 32 time slots, only two SLA16s may be placed in any one channel group. In addition, the software interface enforces compliance with the following rules:

a. A sixteen-circuit card (i.e., SLA16) cannot be used in slot 4 or slot 6, regardless of the type of cards used in slots 0 and 2.

b. If an SLA16 is used in slot 0, slot 4 must be left empty.

c. If an SLA16 is used in slot 2, slot 6 must be left empty.

Caution

Insertion of any card in slot 4 with an SLA16 in slot 0 (or in slot 6 with an SLA16 in slot 2) will result in port contention and consequent system malfunction.

The "units" (Z) digit of the PEN identifies the circuit on the PCB that is associated with the port. The circuit numbers for PCBs are designated as follows:

a. Two-circuit PCBs (PIMDs): circuits 0 and 2.

b. Four-circuit PCBs (trunks, DTMF receivers, and SLMA-Os): circuits 0, 2, 4, and 6.

c. Eight-circuit PCBs (SLMA-Ss and SLMDs): circuits 0 through 7.

d. Sixteen-circuit PCBs (SLA16s): two sets of 0 through 7 (see explanation for "tens" above).

As an example of PEN numbering, assume that the circuit in question is circuit 5 located on the PCB in card slot 4 of channel group 2 of shelf 3. The PEN number of the circuit would be 3245. That is:

Shelf (W)	3
Channel Group (X)	2
Slot (Y)	4
Circuit (Z)	5

As a second example, assume that the circuit in question is the second circuit on the bottom half of an SLA16 PCB located in card slot 0 of channel group 1 of the basic shelf. In this case, the PEN number would be 0111. That is:

Shelf (W)	0
Channel Group (X)	1
Slot (Y)	1
Circuit (Z)	1

Note, in this example, that the slot number is 1, even though the physical slot is slot 0, and that the circuit is PEN numbered 1 even though it is the tenth circuit on the PCB. This is because the second eight circuits on the SLA16 are assigned to a virtual slot (in this case, slot 1) and numbered 0 to 7 as explained above.

2.04 Allocation of Printed Circuit Boards. The SATURN IIE System line and trunk PCBs, as noted previously, contain either two, four, eight or sixteen circuits each. (Each circuit uses one port on the system.) The system is arranged in channel groups of 32 channels each; a channel is used for each port. The basic shelf contains seven channel groups and the LTU shelf contains eight channel groups. Each channel group consists of universal card slots. Some of the channel groups contain four card slots each, and the others contain two card slots each.

Allocation of both initially-equipped PCBs and future PCBs should be carefully planned during the configuration of the initial system site so as assign the ports in the most efficient manner. In a two-card channel-group, the use of anything other than 16-port cards will cause a loss of ports. For instance, the assignment of two four-port PCBs to a two-card channel group would only use eight ports in that channel group, thus making the remaining twenty-four ports unavailable for use. In four-card channel groups, use of cards of less than eight channels each will also result in the loss of availability of some of the channel group's ports.

The card slot position in each LTU shelf universally accepts any SATURN IIE peripheral interface module; however, certain limitations exist regarding the placement of these modules due to the distribution of time slots within a shelf. There are also guidelines that may be followed to achieve optimum time slot usage. These limitations and guidelines are based on the number of time slots each peripheral interface module uses, as follows:

Peripheral Interface Module	Time Slots Used
Subscriber Line Module – Analog-16 (SLA16)	16
Subscriber Line Module – Analog (SLMA-S)	8
Premium Instrument Module – Digital (PIMD)	8
Subscriber Line Module – Digital (SLMD)	8
Central Office Trunk (TMBM)	4
Direct Inward Dialing Trunk (TMIE)	4
2-Wire E/M Tie Trunk (TMBA-2)	4
4-Wire E/M Tie Trunk (TMBA-4)	4
Dual Tone Multifrequency Receiver (DTMF)	4
Subscriber Line Module – Analog – Off-Premise (SLMA-O)	4

Except as noted above, 4 and 8 time slot peripheral interface modules can be used in any slot of any LTU. Certain uses of peripheral interface modules in SATURN IIE results in unusable time slots, as follows:

	Unusable Time Slots 2 Card LTU	4 Card LTU
4 Time Slot Module	12	4
0 Time Slot Module	8	0
16 Time Slot Module	0	0

While not prohibited by the hardware/software design, it is recommended that special consideration be given to the placement of E&M trunk modules in the LTUs so that the E&M leads do not share any MDF cables with audio pairs. If an E&M trunk module is placed into any of slots 0, 2, or 4 of a four-slot LTU, none of these slots should be filled with eight- or sixteen-port modules. If an E&M trunk module is placed into slot 6 of a four-slot LTU or either of slots 0 or 2 of the two-slot LTUs situated to the immediate right of the four-slot LTU, none of these slots should be filled with eight- or sixteen-port modules.

In addition, the total number per shelf of any one type of module is limited by the power supply feeding that shelf. These limitations are as follows:

	Basic Shelf (1)	**LTU Shelf (1)**
SLMD Modules	16	16
DTMF Modules	4	2
Trunk Modules (2)	20	16

Notes:

1. Each power supply (in the basic shelf) can drive more than the number of modules shown above. The number shown represents the maximum guaranteed quantities that can be powered by each supply, independent of how the rest of the shelf is populated.
2. At least 50 per cent of the trunks are assumed to be TMBMs. As the percentage of TMBMs is increased, the trunk module drive capability increases.

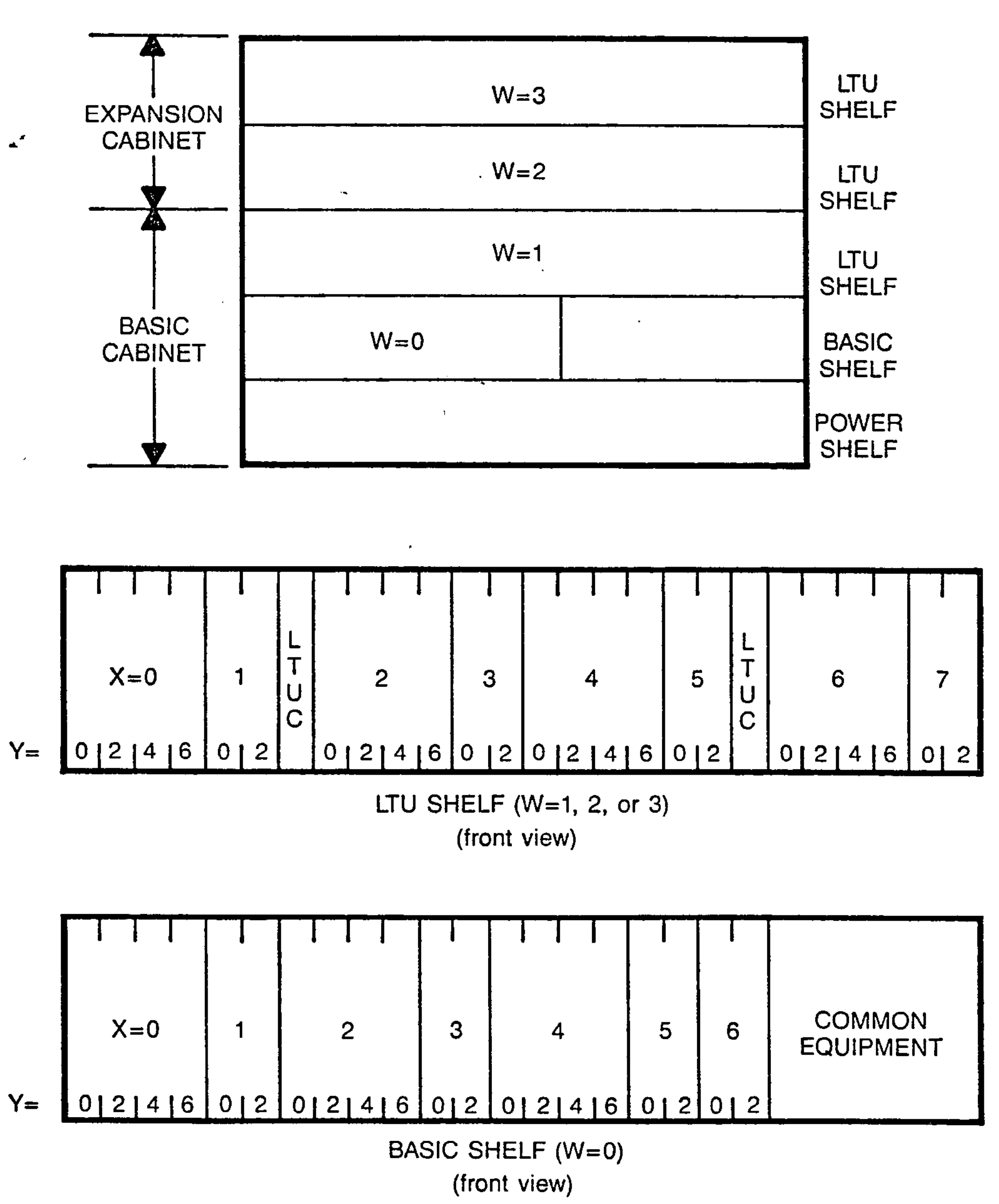

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Figure 2.08 Port Equipment Numbering Method

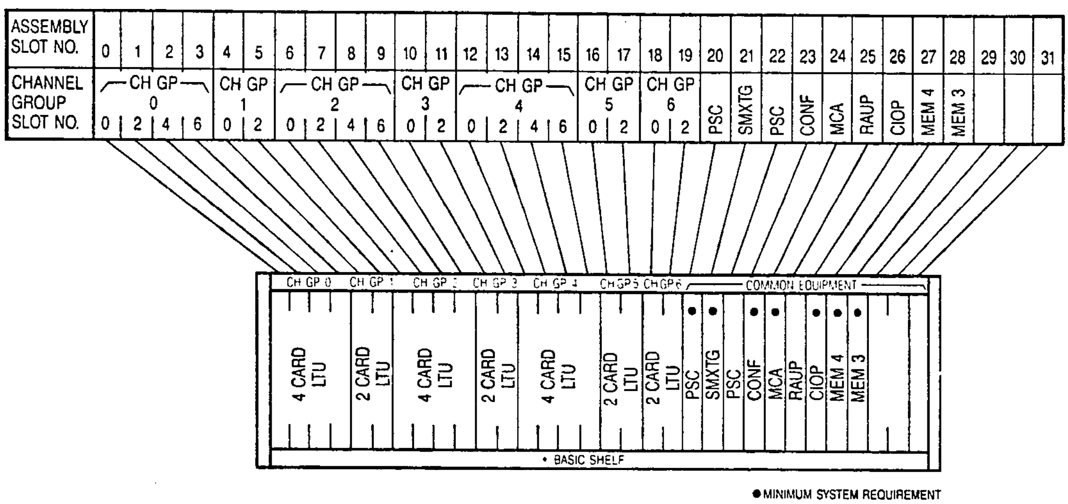

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Figure 2.09 Basic Shelf Channel and Slot Number

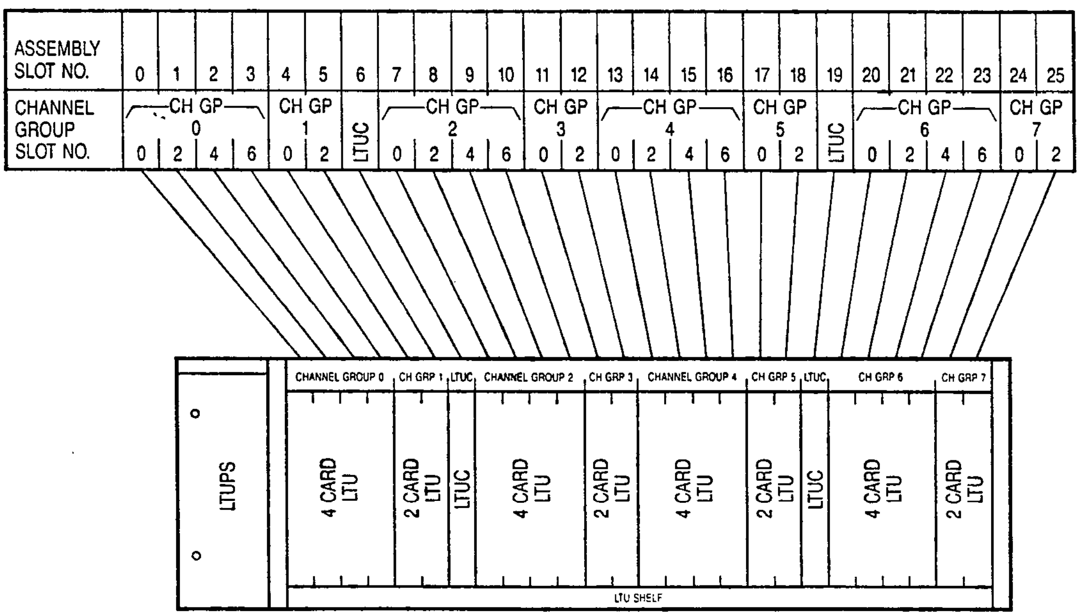

Figure 2.10 LTU Shelf Channel and Slot Number

SECTION 3.00 CUSTOMER SITE PREPARATION

3.01 General. This section specifies the equipment room preparation and house cabling procedures used to install a SATURN IIE System. Included is a recommended MDF layout for the system.

3.02 Equipment Room Preparation. The SATURN IIE System may be located in a dedicated room. This room, designated "equipment room" in this practice, must meet the environmental requirements set forth below. If on-site service equipment and spares are to be provided, adequate storage facilities should be available. Adequate lighting should be provided for normal installation and maintenance activities. Walls should be painted or otherwise sealed.

a. Environmental Requirements. The following environmental requirements for the equipment room must be observed to ensure a high grade of service performance and reliability for the SATURN IIE System. Failure to observe these environmental requirements may seriously degrade the service, performance and reliability of the system and may result in the voiding of its warranty.

1. Lightning and Surge Arrestor Protection. The interfacing circuits (e.g., trunk circuits) of the SATURN IIE System are designed to withstand voltage surges specified in the EIA proposed standard for Physical Environment for Telephone Terminal Equipment, and FCC's Part 68 Rules and Regulations. Lightning can cause high voltage surges on leads connected to exposed outside plant facilities. Protection of these outside plant interface leads (i.e., CO-PBX trunk, tie trunk, and off-premises station interface leads which connect to outside facilities) from foreign potentials and currents must be provided by installing commercially available protection equipment meeting the above specified guidelines. The Siemens lightning and surge arrestor equipment can be purchased separately and used when protection above and beyond the specified requirements is necessary for a given installation.

2. Temperature and Humidity. The SATURN IIE System is designed to operate in an indoor, controlled environment. Extreme low or high temperatures may degrade the service performance and reliability of the system. Avoid installing the equipment cabinet in unheated areas or areas which are subject to high temperatures. Table 3.00 lists the operating and storage temperatures for the system and ancillary equipment. Maximum service performance and reliability of the system is obtained when the room temperature does not exceed the normal office environment temperature range. Under no circumstances should the room temperature exceed the maximum temperature range. Storage temperatures apply only to non-operating equipment. Extreme low or high humidity may also degrade service performance and reliability of the system. Low relative humidity increases the chance of static electricity discharges; high relative humidity increases the chance of moisture condensation. Table 3.00 also lists the operating and storage humidity ranges for the system and ancillary equipment. Maximum service performance and reliability of the system is obtained when the room relative humidity does not exceed the normal office environment humidity range. Under no circumstances should the room relative humidity exceed the maximum humidity range. Storage humidity range applies only to non-operating equipment.

3. Contaminants. The SATURN IIE System should be protected from exposure to airborne contaminants (e.g., corrosive gases, particulate materials, aerosols, etc.) which may affect service performance and reliability of the system. Avoid exposure to hydrogen sulfide, sulfur dioxide, nitrogen oxides, or other gases which are corrosive. Smoky and dusty environments should be avoided since the contact resistance of the connectors may be affected. Aerosols such as oil, solvents and other industrial chemicals should also be avoided as they also affect contact resistance. Extremely dusty environments may destroy PCBs by damaging their connectors. Such damage may not be repairable and may cause system failures that are difficult to isolate and correct.

4. Air Conditioning. Air conditioning equipment provided for the SATURN IIE equipment room must be capable of maintaining the temperature and humidity ranges specified in Table 3.00. Such equipment should contain air filters to reduce contaminants as noted above. The air conditioning equipment should be regularly maintained by the customer to ensure proper performance, and to maintain a positive room pressure. It is recommended that the air conditioning equipment be powered from an AC branch circuit separate from that used for powering the SATURN IIE System. The cyclic, inductive loads presented by such equipment may affect service performance and reliability of the system.

Table 3.00 Equipment Cabinet Temperature/Humidity Ranges

CONDITION	RANGE
Operating	4° to 38.0°C (40° to 100°F) 20% to 80% (noncondensing)
Storage	-40° to 66.0° (-40° to 150.8°F) 0% to 95% (noncondensing)

5. Floor Insulation. Carpeting is not normally recommended because of its tendency to produce high-voltage electrostatic charges, which can severely damage electronic components. For installations where carpeting is required, a specially treated carpeting should be used. An acceptable carpeting is a carpet that has a rubber backing and a network of metal filaments between the backing and the pile. The special carpeting should cover the complete installation area and extend at least three

feet on all sides of the SATURN IIE System cabinet. A connection must be made between the metal filaments and earth ground. This ground connection must not be the SATURN IIE System ground.

b. Cabinet Space and Floor Loading Specifications. The following specifications are presented to aid craft personnel in selecting an adequate equipment room for the SATURN IIE System:

1. Cabinet Space Specifications. The equipment room should be sized for one cabinet assembly and adequate space for normal installation and maintenance activities. Other peripheral equipment (i.e., service terminal) may be located near the cabinet assembly or the MDF. Figure 3.00 illustrates the recommended space required for the equipment cabinet of the SATURN IIE System. Figure 3.01 illustrates the physical dimensions of the basic cabinet and Figure 3.02 the expansion cabinet.

2. Cabinet Floor Loading Specifications. The basic cabinet weighs 440 pounds and floor loading is 55 lb./sq ft. The basic and expansion cabinets together weighs 685 pounds and floor loading is 90 lb./sq ft (equally distributed)

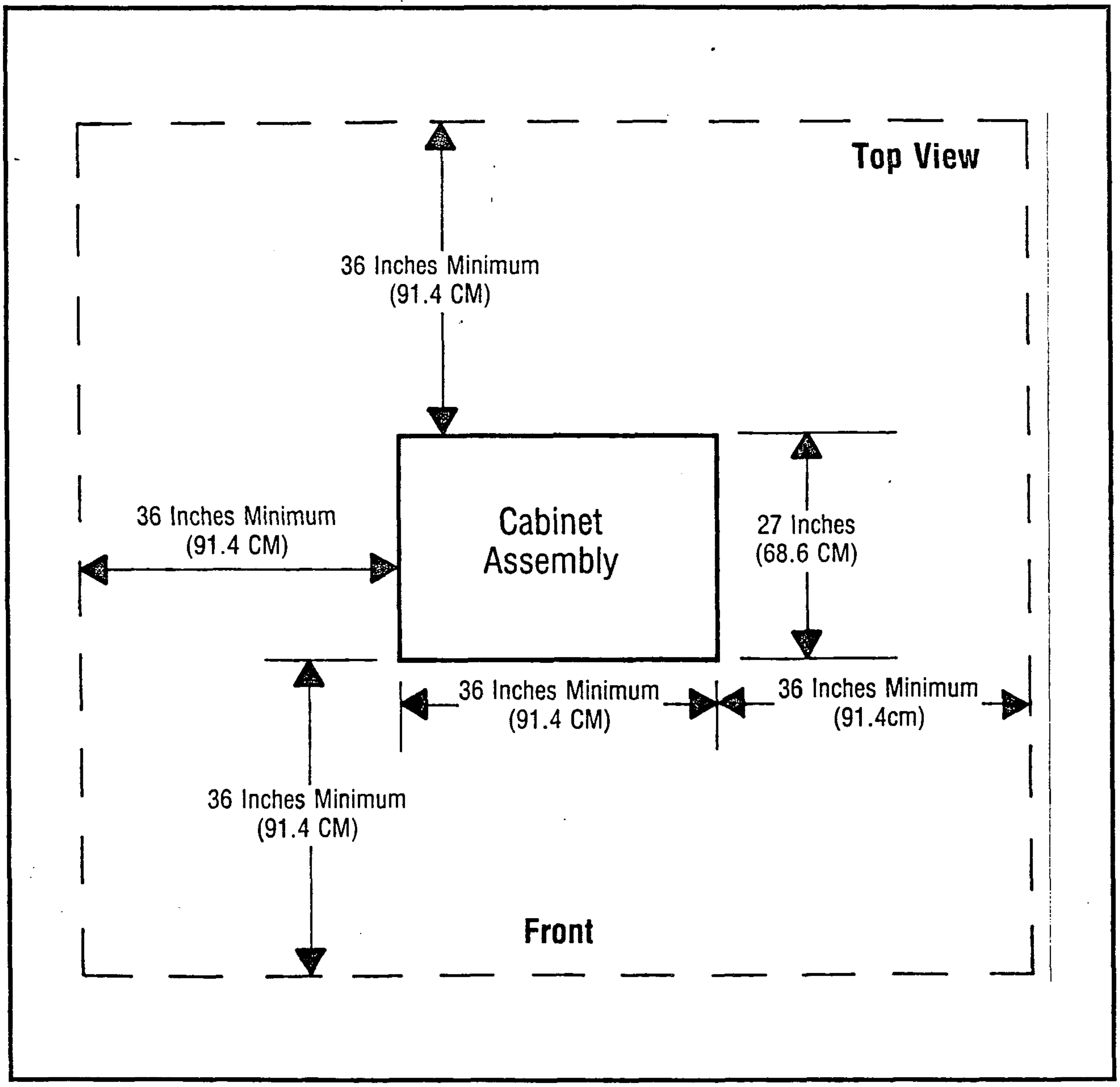

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Figure 3.00 SATURN IIE System Space Requirements

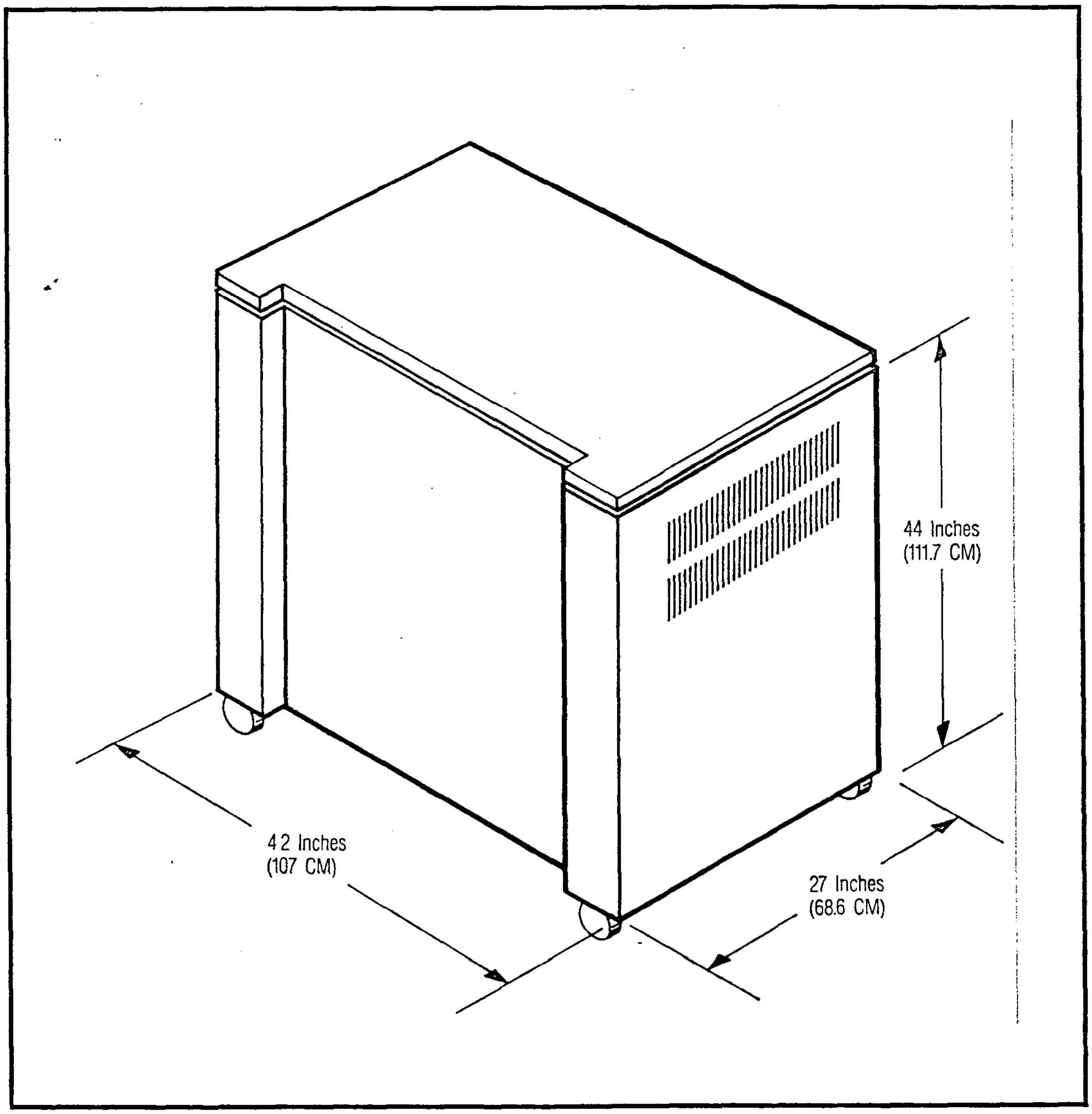

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Figure 3.01 Basic Cabinet Physical Dimensions (Rear View)

Table 3.01 Basic and Expansion Cabinets AC Input Power Requirements

NOMINAL INPUT	NORMAL			BROWNOUT & EMERGENCY		
	VOLTAGE		FREQUENCY (Hz)	VOLTAGE		FREQUENCY (Hz)
	MIN	MAX		MIN	MAX	
110-Vac	100	127	60 ± 0.1	95	130	60±3.0

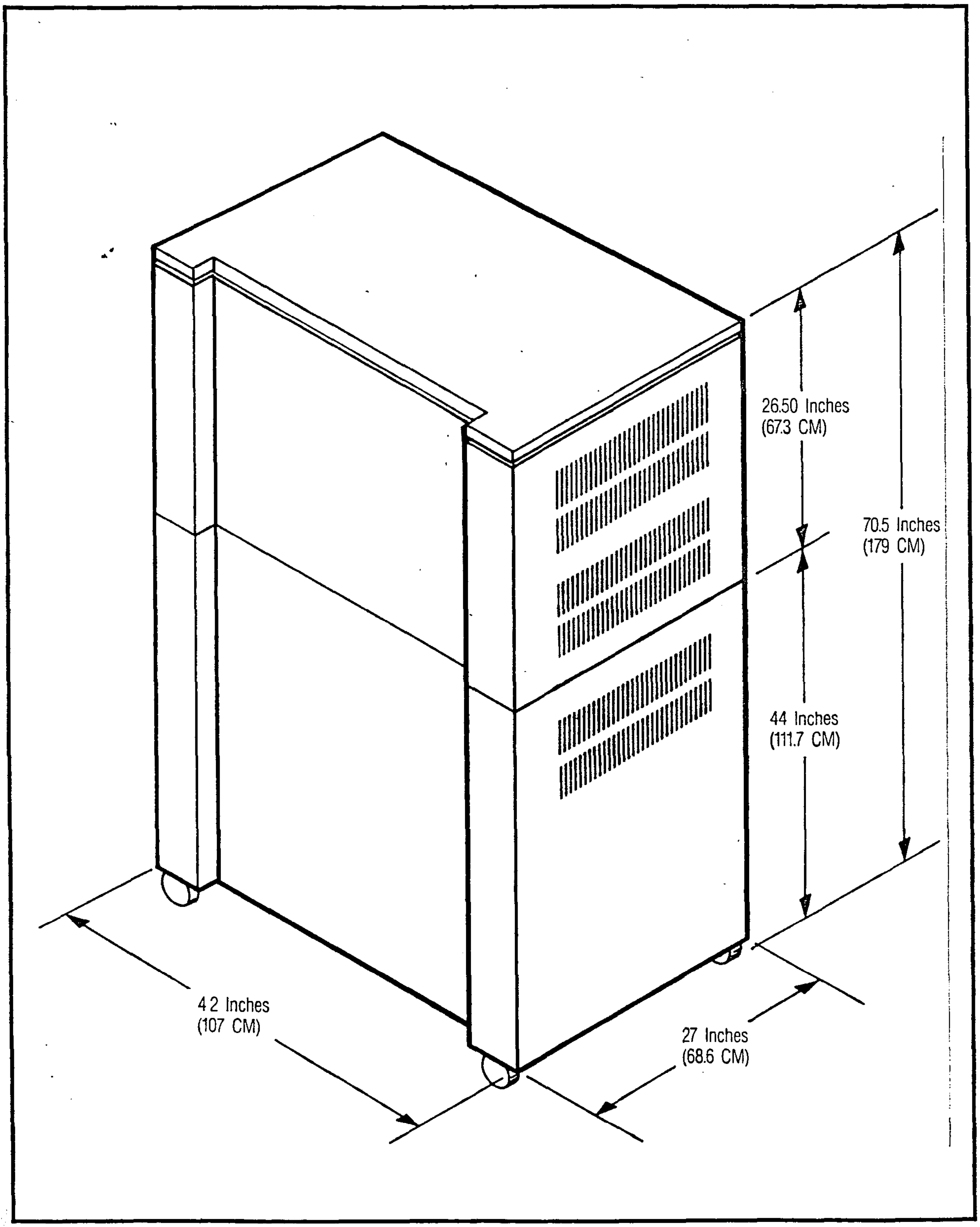

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Figure 3.02 Basic and Expansion Cabinets Physical Dimensions

c. Cabinet Input Power and Grounding Requirements. The following information is presented to aid craft personnel in selecting an adequate AC power source, as well as a ground source, for powering a SATURN IIE System cabinet.

1. AC Input Power Requirements. One AC input source is required for the basic cabinet. A second AC input source is required when the expansion cabinet is added, as shown in Figure 3.03. The AC input power source must meet the parameters specified in Table 3.01. A 12-foot long (3.6 meters) 3-conductor power cord is supplied with the equipment cabinet. One end of this power cord is terminated on a terminal box located at the bottom rear of the equipment cabinet. The other end of the power cord is terminated with a three-prong connector that plugs into an AC power source outlet (i.e., commercial AC wall outlet or receptacle). This AC power receptacle should comply with the following recommendations:

   a) The AC power receptacle should be located within the length of the supplied power cord (i.e., 12 feet) and easily accessible for maintenance activities.

   b) The AC power receptacle must provide fused 110Vac (single-phase) power at 60Hz capable of delivering 20 Amps.

   c) The AC power receptacle should be fused independently from all other AC power receptacles.

   d) The AC power receptacle must only be controlled from the branch circuit breaker panel and not by a local light switch.

   e) The AC power cords for the basic and expansion cabinet require separate mounting brackets

   f) A warning tag should be attached to the circuit breaker controlling the AC power receptacle to prevent accidental removal of power.

   g) The AC power cords for the basic and expansion cabinets require separate mounting brackets.

   h) A warning tag should be attached to the power cord connector to prevent accidental removal of cord. If possible, the power cord should be clamped near the AC power receptacle to minimize movement.

2. Ground Requirements. The cabinet assembly is grounded via its power cord. In addition to this ground, an earth ground is required. This earth ground can be a metallic cold water pipe, ground field, copper ground rod, etc., and must not exceed two ohms in resistance. The earth ground conductor is attached to the cabinet frame ground via a lug which accepts a 6-gauge conductor. The wire gauge size used for earth ground is determined by the ground wire length from the cabinet assembly to the selected earth ground (refer to Table 3.02). Earth ground connections for the equipment cabinet are shown in Figure 3.03.

   Note: Change the ground lug if wire gauge is too large (see Table 3.02).

d. MDF Preparation. In accordance with FCC's Part 68 Rules and Regulations for "Fully Protected Premises Wiring", the SATURN IIE equipment registration, the following requirements must be observed:

1. System to MDF Cabling Requirements. Accomplished via double-ended 50-conductor (24AWG twisted 25-pair) cable not exceeding 25 feet from point to point connection.

2. MDF Cable Terminating Block Types. The terminating blocks to be mounted at the MDF for the system cable are dual 50-prong-row prewired, connector-ended blocks.

3. Suggested MDF Layout. Figure 3.05 illustrates the suggested MDF layout for the cabinet assembly.

3.03 House Cabling Preparation. To aid craft personnel with house cabling, the following requirements are presented:

a. General House Cabling Requirements. All standard station lines should meet the National Electric Code clearance requirements (this is a standard telephone industry practice).

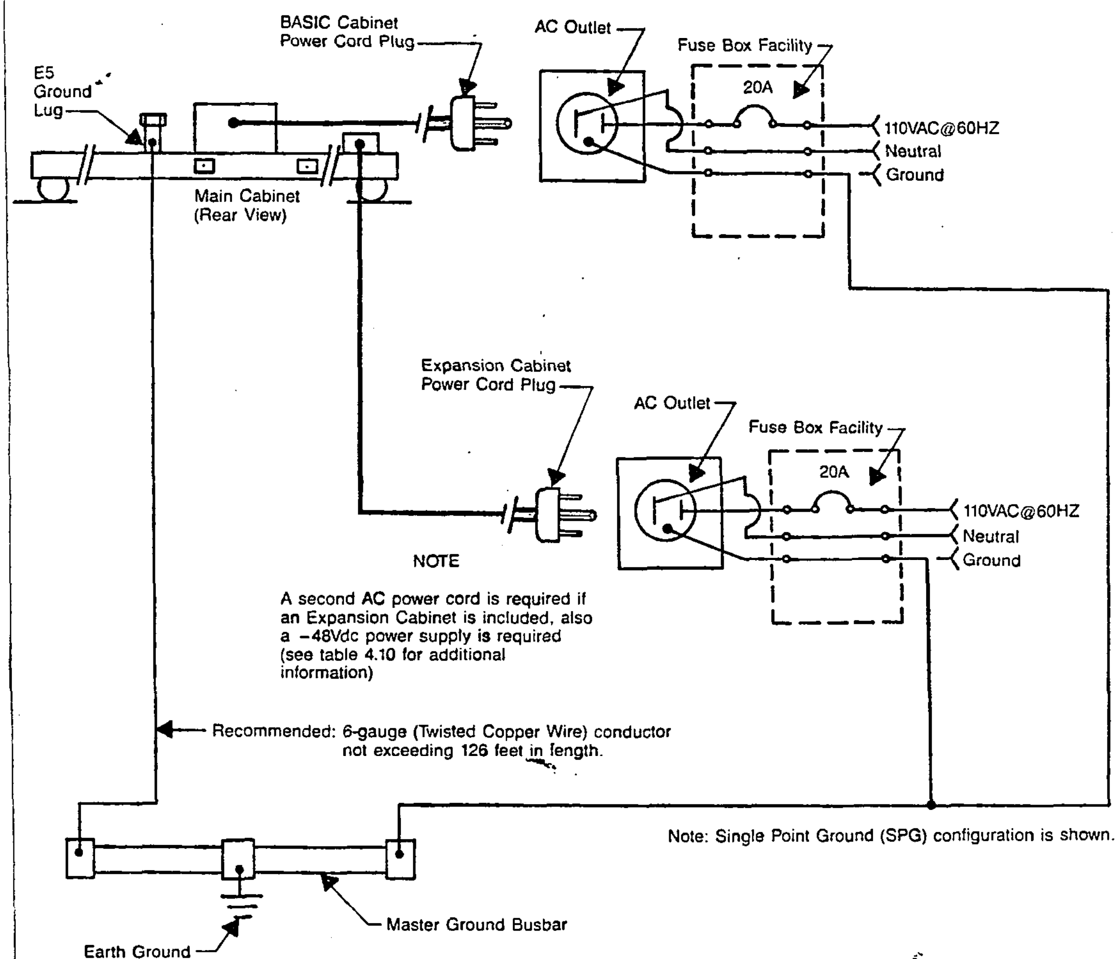

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Figure 3.03 SATURN IIE System Main Power/Ground Connections

Table 3.02 Ground Conductor Length vs. Wire Gauge

GAUGE	6*	4	2	1	0	00
FEET	126	201	320	404	509	642
METERS	38	61	98	123	155	196

(* = Recommended first choice)

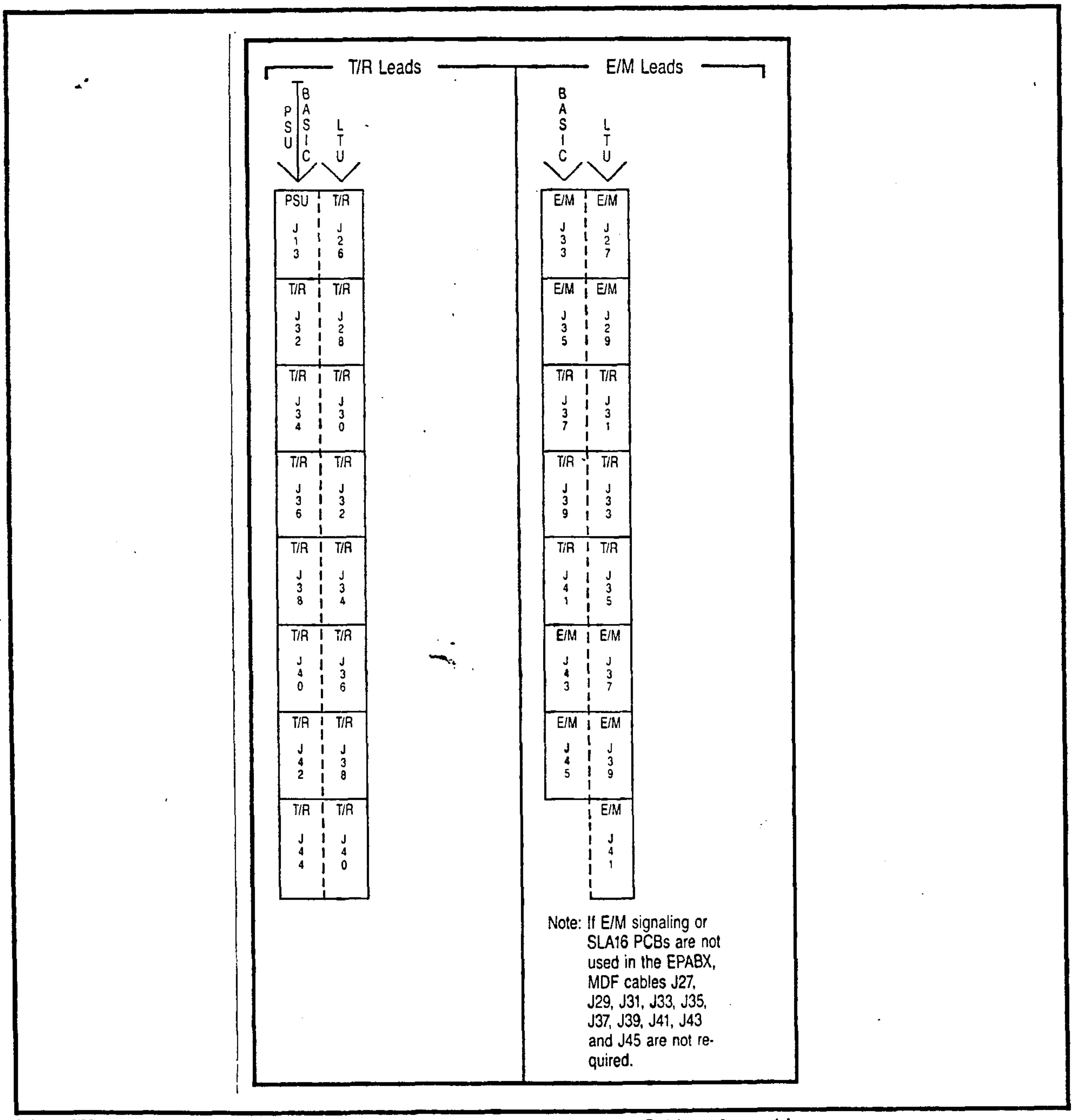

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Figure 3.04 Suggested MDF Layout for Cabinet Assembly

b. SATURN IIE Console, SDT Cabling Requirements. When such SATURN ancillary equipment is to be installed, the following requirements must be observed:

1. Required House Cabling. The house cabling between the SATURN IIE System and SATURN Ancillary Equipment can be any cable length up to and including 4000 feet. A four conductor (24AWG twisted two pair) cable should be used to obtain a higher cable length run than can be attained from a standard telephone cable (i.e.; quad cable or non-twisted cable). Quad cable may be used, but its usage is limited by the cable length limits listed in Table 3.03.

2. House Cabling Precautions. Consoles and SDT's transmit data instead of voice signals; therefore, point-to-point connection is required (bridge taps on such cables are not allowed). Failure to observe this requirement will causes a console or SDT to malfunction.

Table 3.03 Cable Running Limitations When Using Non-Twisted Two-Pair Cable

TOTAL CABLE LENGTH RUN (IN FEET)	TWISTED TWO-PAIR CABLE LENGTH (MAX.) (IN FEET)	NON-TWISTED TWO-PAIR CABLE LENGTH (MAX.) (IN FEET)
500	500	500
1000	1000	1000
1500	1500	1500
2000	2000	1200*
2500	2500	900*
3000	3000	700*
3500	3500	500*
4000	4000	200*

NOTE: * = Only run the allowable quad cable length; the remaining cable length must be the 24AWG twisted two-pair cable type.

Example: Total cable length = 3000 feet; limit of 700 feet of the quad cable type plus 2300 feet of the 24AWG twisted two-pair cable type.

SECTION 4.00 EQUIPMENT INSTALLATION PROCEDURES

4.01 General. The SATURN IIE System is shipped in kits and as individual items according to customer requirements. This section contains the necessary information to install the various equipment kits and items listed in Table 4.00.

Table 4.00 SATURN IIE EPABX Orderable Items List

AVAILABLE EQUIPMENT	PART NO.	COMMENTS
Basic Cabinet (110Vac 60Hz)	L30808-X5130-A1-★-B90	Refer to Table 4.01.
Basic Shelf	Part of basic cabinet	
Name Plate Logo	C39324-A9679-B15-★-B900	
Expansion Cabinet (Includes 2nd AC Power Cord)	L30808-X5130-A4-★-B900	Refer to Table 4.03
LTU expansion shelf Includes: LTU Shelf LTUC LTUPS Cable Assembly Power(W21 & W22) LTUPS-LTU Cable Assembly Signal (W14,W15,W16,& W17)basic and LTU shelves	L30808-X5130-A7-★-B900 S30804-B5198-X-★-B900 S30810-Q0428-X-★-B900 L30808-X5130-A39-★-B900 C39195-A9679-A5-★-B900 C39195-A9679-A3-★-B900	Refer to Table 4.03
POWER AND DISTRIBUTION EQUIPMENT: Memory Support Module (MSM)	L30808-X5130-A34-★-B900	Refer to Table 4.08
Memory Battery Pack	L30808-X5130-A51-★-B900	Refer to Table 4.09
Expansion Shelf Power Supply LTUPS (+/-5Vdc,+/-12Vdc)	L30808-X5130-A39-★-B900	Refer to Table 4.03
PSU Fuse Kit (Includes following Fuses) Fuse½ Amp. 125V Fuse 5 Amp. 125V Fuse 10 Amp. 125V	L30808-X5050-A12-★-B900 or L30808-X5131-A52-★-B900	
MISCELLANEOUS EQUIPMENT: Floppy Disk Drive (FDD) Module	L30808-X5130-A50-★-B900	Refer to Table 4.12
PERIPHERAL INTERFACE PRINTED CIRCUIT BOARDS: Dual-Tone Multifrequency (DTMF) Receiver PCB	S30810-Q431-X2-★-B900	Refer to Table 4.13
Premium Instrument Module Digital (PIMD) PCB	S30810-Q432-X-★-B900	Refer to Table 4.14
Subscriber Line Module Analog Station (SLMA-S) PCB	S30810-Q1674-X-★-B900	Refer to Table 4.15

Table 4.00 SATURN 11E EPABX Orderable Item List (Continued)

AVAILABLE EQUIPMENT	PART NO.	COMMENTS
Subscriber Line Module Analog – Off-Premises Station (SLMA-O) PCB	S30810-Q1739-X-★-B900	Refer to Table 4.16
Subscriber Line Module Digital (SLMD) PCB	S30810-Q1724-X-★-B900	Refer to Table 4.17
Central Office Trunk (TMBM) PCB	S30810-Q414-X-★-B900	Refer to Table 4.19
Direct Inward Dialing Trunk (TMIE) PCB	S30810-Q415-X-★-B900	Refer to Table 4.20
Two-Wire E&M Trunk (TMBA-2) PCB	S30810-Q429-X-★-B900	Refer to Table 4.21
Four-Wire E&M Trunk (TMBA-4) PCB	S30810-Q430-X-★-B900	Refer to Table 4.22
Line/Trunk Unit Control (LTUC)	S30810-Q428-X-★-B900	Refer to Table 4.31
Subscriber Line Module Analog – 16 Line (SLA16)	S30810-Q1790-X-★-B900	Refer to Table 4.18
COMMON EQUIPMENT PRINTED CIRCUIT BOARDS: Signal Multiplexer/Tone Generator (SMXTG)	S30810-Q1791-X-★-B900	Refer to Table 4.24
Remote Access Unit/Port (RAUP)	S30810-Q1792-X-★-B900	Refer to Table 4.27
Memory Control and Attenuator (MCA)	S30810-Q0416-X-★-B900	Refer to Table 4.26
Conference (CONF)	S30810-Q0417-X-★-B900	Refer to Table 4.25
Parallel/Serial Converter (PSC)	S30810-Q0419-X100-★-B900	Refer to Table 4.23
System Memory 1 megabyte (MEM 4)	S30810-Q1775-X-★-B900	Refer to Table 4.29
System Memory 256 Kb (MEM 3)	S30810-Q1740-X-★-B900	Refer to Table 4.30
Controller (CIOP)	S30810-Q1789-X-★-B900	Refer to Table 4.28
Attendant Console	L30808-X5130-A8-★-B900	Refer to Table 4.32

4.02 Basic Cabinet. The SATURN IIE System consists of an equipment cabinet with expansion capabilities; an expansion shelf (See Paragraph 4.03) and expansion cabinet (See Paragraph 4.04) can be added to the basic cabinet (See Paragraph 4.03) for detailed information). The basic equipment cabinet is mounted upright on a wooden pallet and enclosed in a corrugated sleeve and cap as shown in Figure 4.00. To uncrate an equipment cabinet, perform the following procedures (refer to Figures 4.01 and 4.02 for details):

a. Cut the two vertical plastic straps securing the corrugated cap and sleeve onto the wooden pallet.

b. Remove the corrugated cap and any packaging material from the top of the equipment cabinet. Remove the corrugated sleeve by cutting open one of its corners with a cutting knife, or by lifting it over the cabinet assembly if overhead space is sufficient.

c. Cut the two vertical plastic straps securing the equipment cabinet onto the wooden pallet. Remove any packaging material and the vinyl-plastic shroud covering the equipment cabinet.

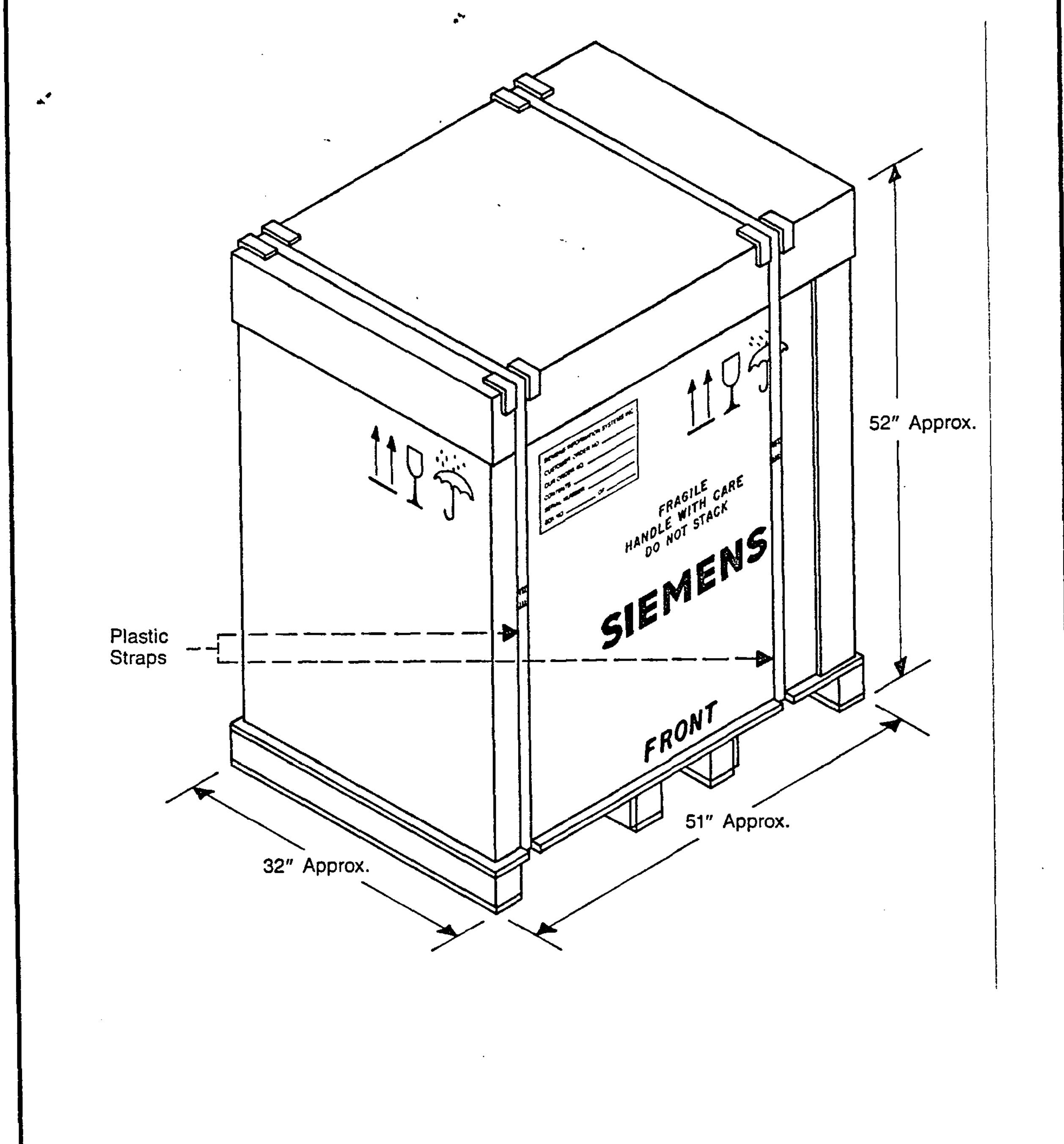

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Figure 4.00 Basic Cabinet Container

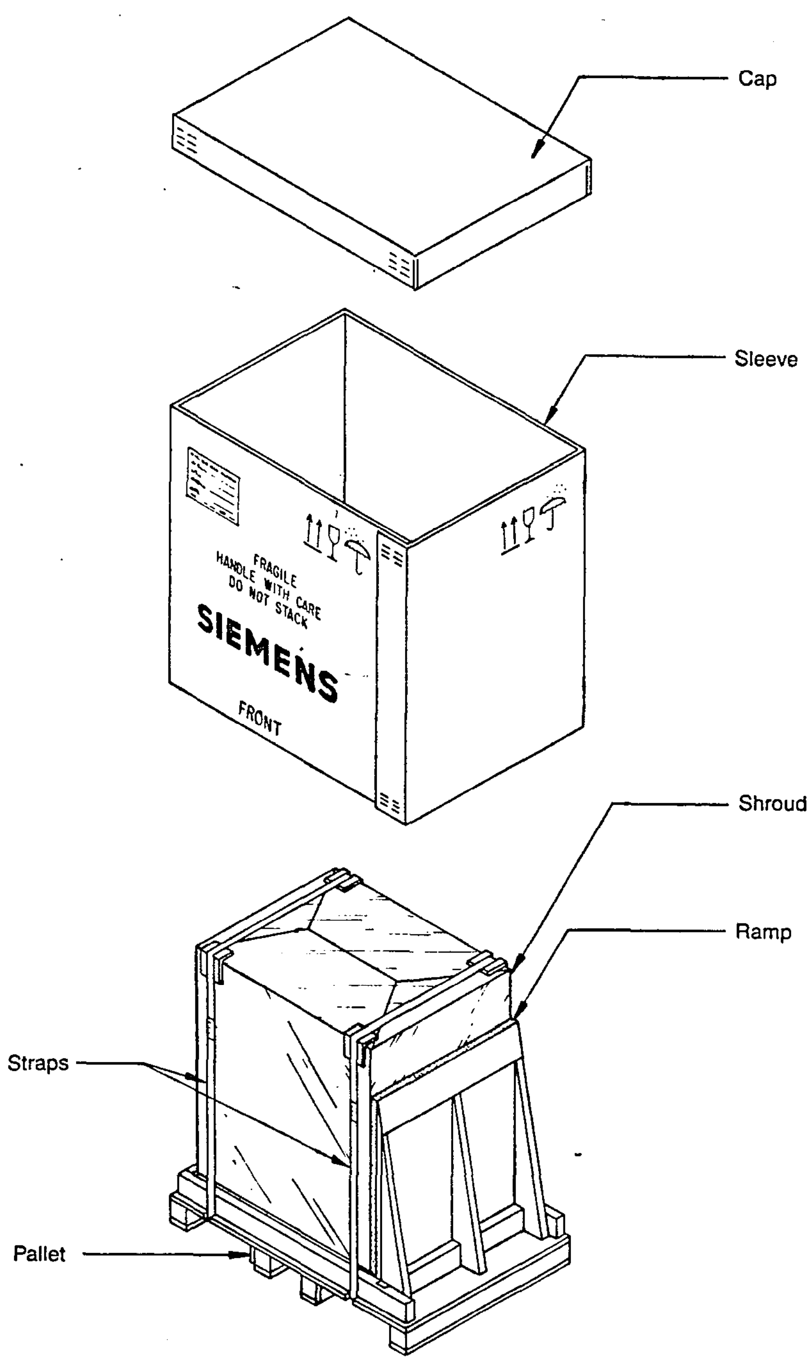

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Figure 4.01 Basic Cabinet Packaging Method

d. Remove ramp from its packaged location and place into position as shown in Figure 4.02. Carefully push the cabinet out of position and onto the ramp to unload it. Note, unloading of cabinet is a two-man job.

After unloading the cabinet, do not lift it with a fork-lift or lifting device since structural damage may occur. Each cabinet contains four 360 degree casters to facilitate its movement. Refer to Table 4.01 for further information on the basic cabinet.

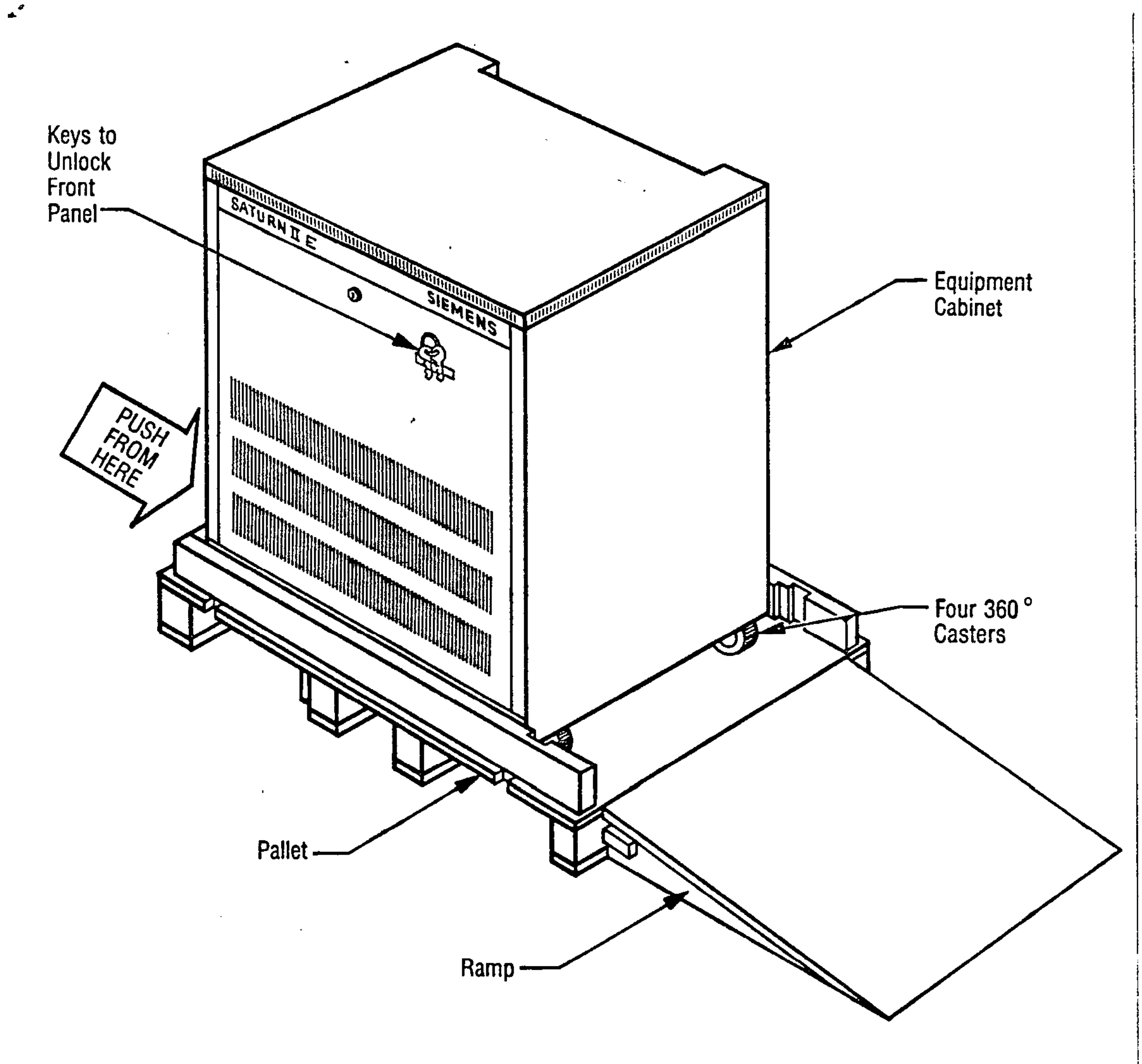

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Figure 4.02 Basic Cabinet Unloading Method

Table 4.01 Basic System

QTY.	EQUIPMENT	Ref.	PART NO.
1	Basic Cabinet Assembly		S30805-G5112-X-★-B900
1	Name Plate Assembly Instructions		C39324-A9679-B15-★-B931
1	Name Plate Logo		C39324-A9679-B15-★-B900
1	Packing for Common Carrier		C39365-A9679-A1-★-B900
1	Signal Multiplexer/Tone Generator (SMXTG) PCB	Slot 21	S30810-Q1791-X-★-B900
1	Remote Access Unit/Ports (RAUP) PCB	Slot 25	S30810-Q1792-X-★-B900
1	Memory Control and Attenuator (MCA) PCB	Slot 24	S30810-Q0416-X-★-B900
1	Conference (CONF) PCB	Slot 23	S30810-Q0417-X-★-B900
1	Parallel/Serial Converter (PSC) PCB	Slot 20	S30810-Q0419-X100-★-B900
1	System Memory 1 megabyte (MEM 4) PCB	Slot 27	S30810-Q0419-X-★-B900
1	System Memory 256Kb (MEM 3) PCB	Slot 28	S30810-Q1740-X-★-B900
1	Controller/Input-Output Processor (CIOP) PCB	Slot 26	S30810-Q1789-X-★-B900
1	Power Cable Assembly (PSU-basic shelf,LTU,LTUPS, -48PS0/1,FDD0/1/2)	W1	C39195-A9679-A1-★-B900
1	Signal Cable Assembly (Basic Shelf – PSU J12)	W2	C39195-A9679-A2-★-B900
1	Signal Cable Assembly (Basic Shelf – LTU0/1/2)	W3	C39195-A9679-A3-★-B900
1	Signal Cable Assembly (Basic Shelf – FDD0 or FDD1)	W4	C39195-A9679-A4-★-B900
1	Power Cable Assembly (LTUPS J1) to (LTU0 J42, J43,J44)	W5	C39195-A9679-A5-★-B900
1	Power Cable Assembly (2nd AC Input – PSU J2) Cables A6 & A7 used for expansion cabinet only.	W7	C39195-A9679-A7-★-B900
1	Ground Cable Assembly FDD0 or FDD1 or FDD2 – E8	W8	C39195-A9679-A8-★-B900
1	Ground Cable Assembly (PSU J14) to E7	W9	C39195-A9679-A9-★-B900
1	Signal Cable Assembly (Basic Shelf J62) to FDD½ W14 is deleted if FDD2 is used.	W11 & W14	C39195-A9679-A11-★-B900
1	Signal Cable Assembly (Basic Shelf J55) to (LTU J45)	W15	C39195-A9679-TBA-★-B900
1	Power Cable Assembly (Basic Shelf – FDD0 or FDD1)	W20	C39195-A9679-A8-★-B900

DESCRIPTION: The basic system consists of a single equipment cabinet equipped with the equipment configuration shown in Figures 4.05 and 4.06. The minimum basic system provides for up to 224 ports and can be expanded an additional 256 ports for a maximum port capacity of 480 ports. Additional ports can be added by installing an expansion cabinet.

INSPECTION PROCEDURES: After unloading the equipment cabinet, check for obvious physical damage to the cabinet assembly and perform the following:

1. Remove front panel and check that the equipment configuration matches with the equipment listed in this table. Keys for locking the cabinet are taped to the front panel.
2. Remove rear panel and check that the equipment configuration matches the remaining equipment listed in this table. Refer to Section 5.00 of this practice to verify the signal and power/ground termination points.

Table 4.01 Basic System (Continued)

	3. Replace front and rear panels, if necessary, and move equipment cabinet to its approximate final position.
ADDITIONAL EQUIPMENT REQUIRED:	Per installation-site configuration to meet customer requirements.
OBSERVATIONS:	None; the common equipment PCBs and modules equipped with the basic system are already in their corresponding positions.
INSTALLATION PROCEDURES:	1. Place equipment cabinet in its final position and adjust the four levelers located underneath the cabinet assembly, shown in Figure 4.06, to prevent movement while performing remaining installation tasks. 2. After securing equipment cabinet in its final position, remove front and rear panels and any remaining packaging material or loose objects. 3. At the bottom rear of the equipment cabinet, locate Lug No. E5 and connect the conductor from the selected earth ground. Refer to Section 3.00 for details on earth grounding and Section 5.00 for details on power/ground cabling. Also, do not connect the AC power cord at this time. 4. Refer to Table 4.02 if the LTU shelf and its power supply module are to be installed. 5. Refer to Tables 4.08 and 4.09 if the optional MSM is to be installed. 6. Refer to Table 4.10 if an additional -48Vdc power supply is to be installed as the -48PS1 module. 7. Refer to Table 4.06 for insertion of the PSU grasshopper-type fuses into their corresponding locations on the PSU fuse/circuit-breaker panel. 8. Insert the peripheral interfacing PCBs into their site-allocated card slots in the basic shelf. Trunk type PCBs (i.e., TMBA-2, TMBA-4, TMBM, and TMIE PCBs) may require strapping changes to meet the CO or PABX signaling termination. Refer to Tables 4.19 through 4.22 for further information on these peripheral interfacing PCBs. 9. Recheck that the common equipment PCBs are in their corresponding card slot locations. The CIOP PCB requires switch settings changes to meet the operating characteristics of the service terminal to be used, if any. Refer to Tables 4.23 through 4.30 for further information on these common equipment PCBs. 10. Refer to Section 6.00 in this practice to run and connect the required MDF cables. After running and connecting MDF cables, do not cross-connect at this time. 11. Refer to SATURN IIE EPABX Installation Test Procedures practice for further instructions.

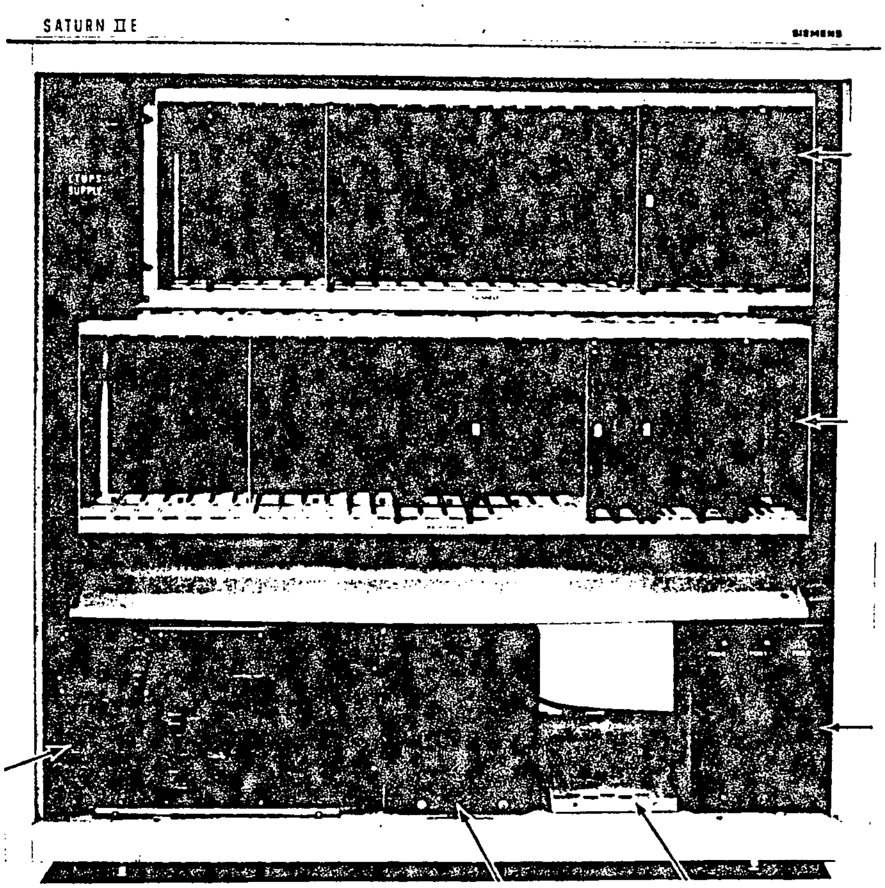

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Figure 4.03 Basic Cabinet (Front View)

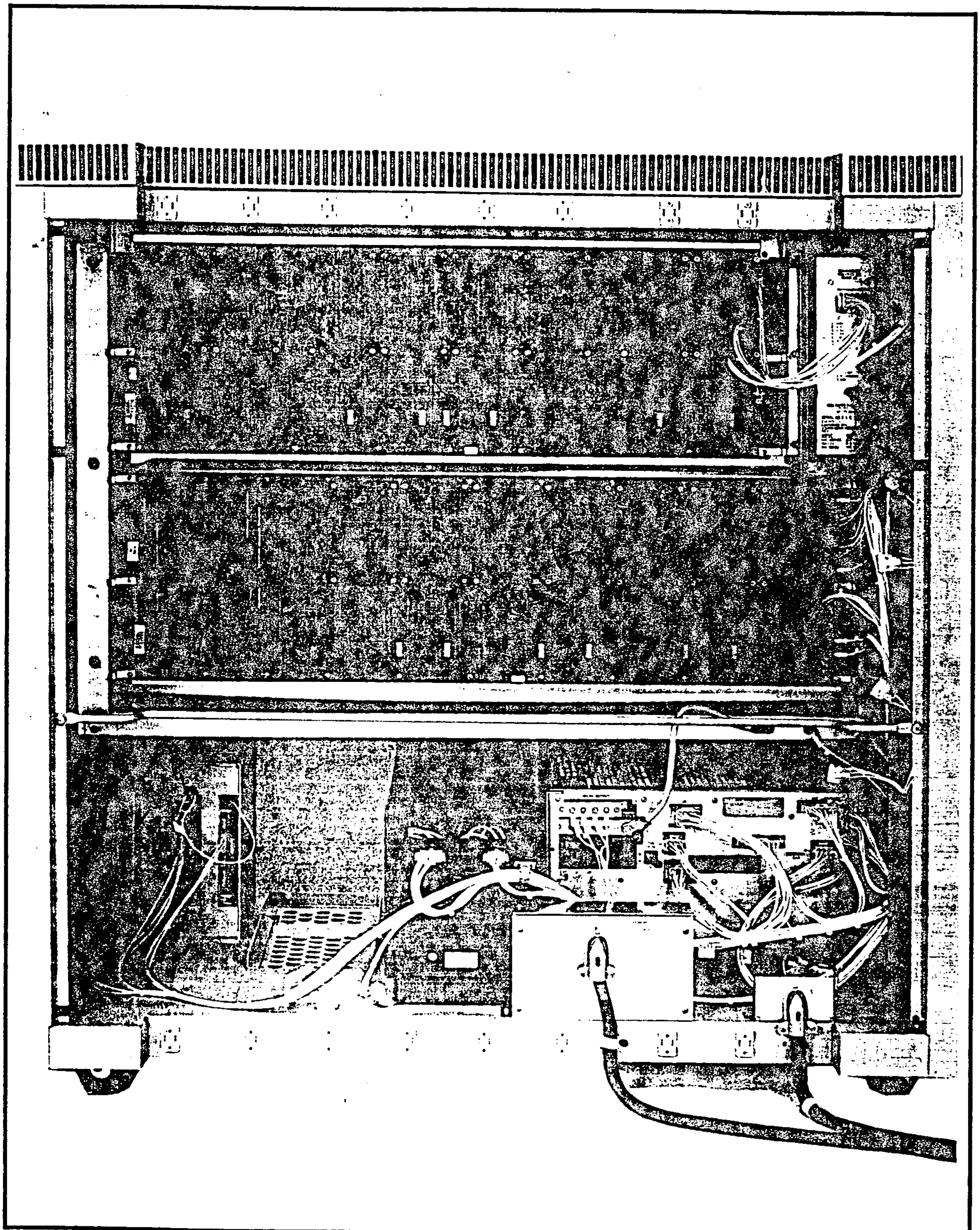

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Figure 4.04 Basic Cabinet (Rear View)

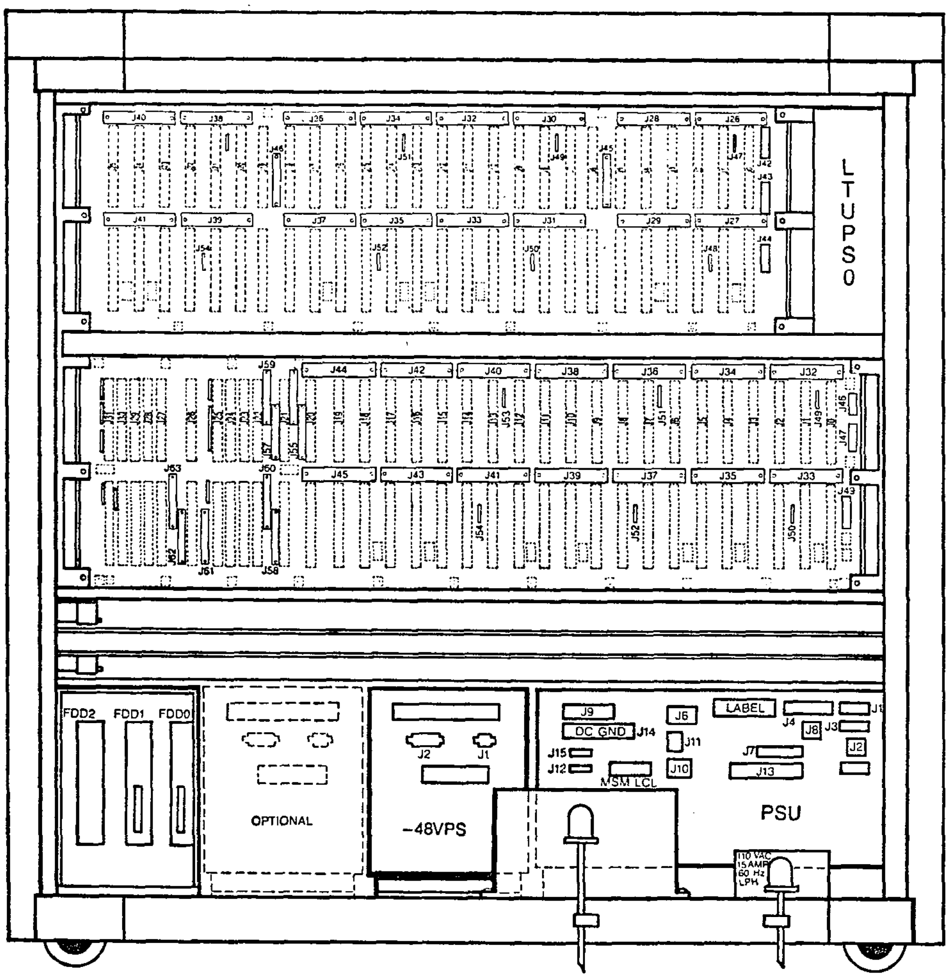

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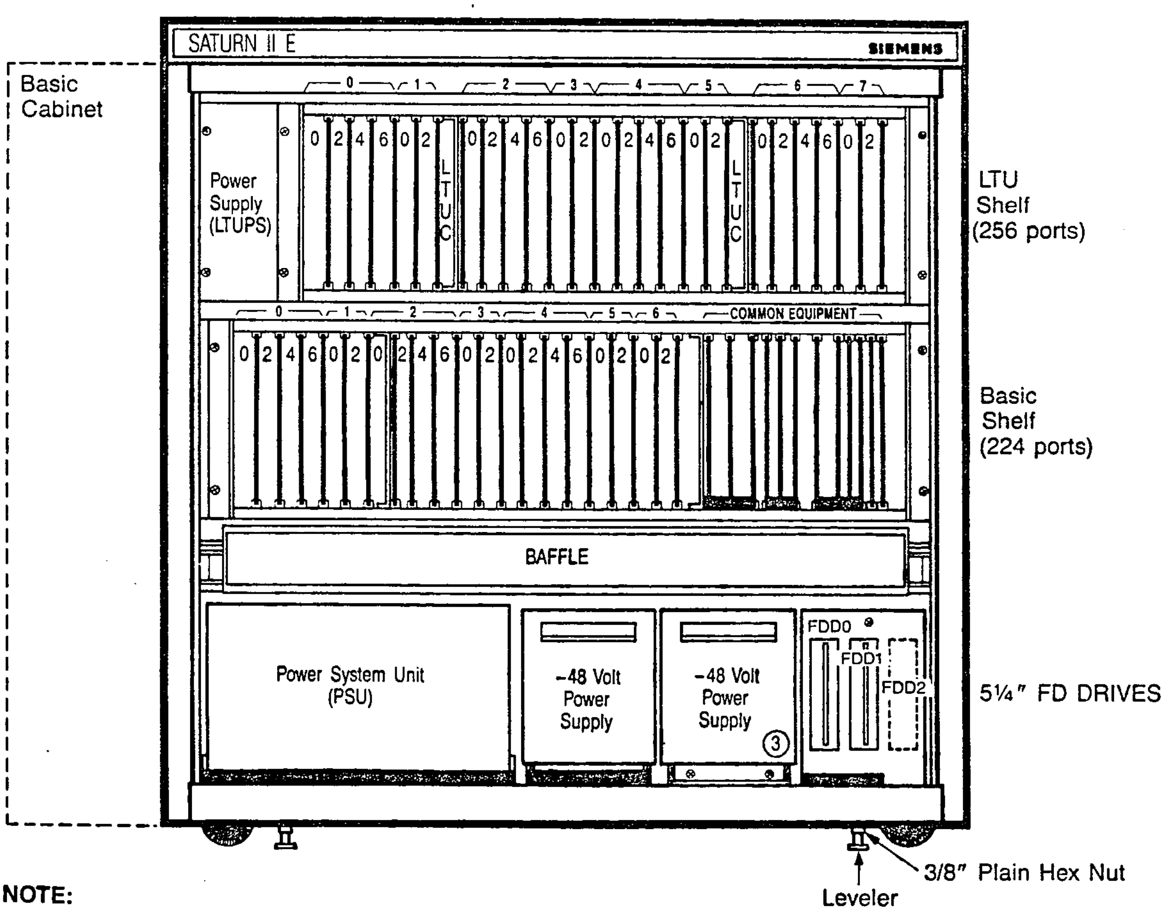
Figure 4.05 Basic Cabinet Connector Configuration



NOTE:
Shaded area shows items equipped in Main Cabinet.
③ optional equipment

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Figure 4.06 Basic Cabinet Equipment Configuration and Securing Procedures

4.03 LTU Shelf. The LTU shelf can be installed in the basic and expansion equipment cabinets. The LTU shelf is unpackaged as shown in Figure 4.07. Refer to Table 4.02 for further information on the LTU shelf.

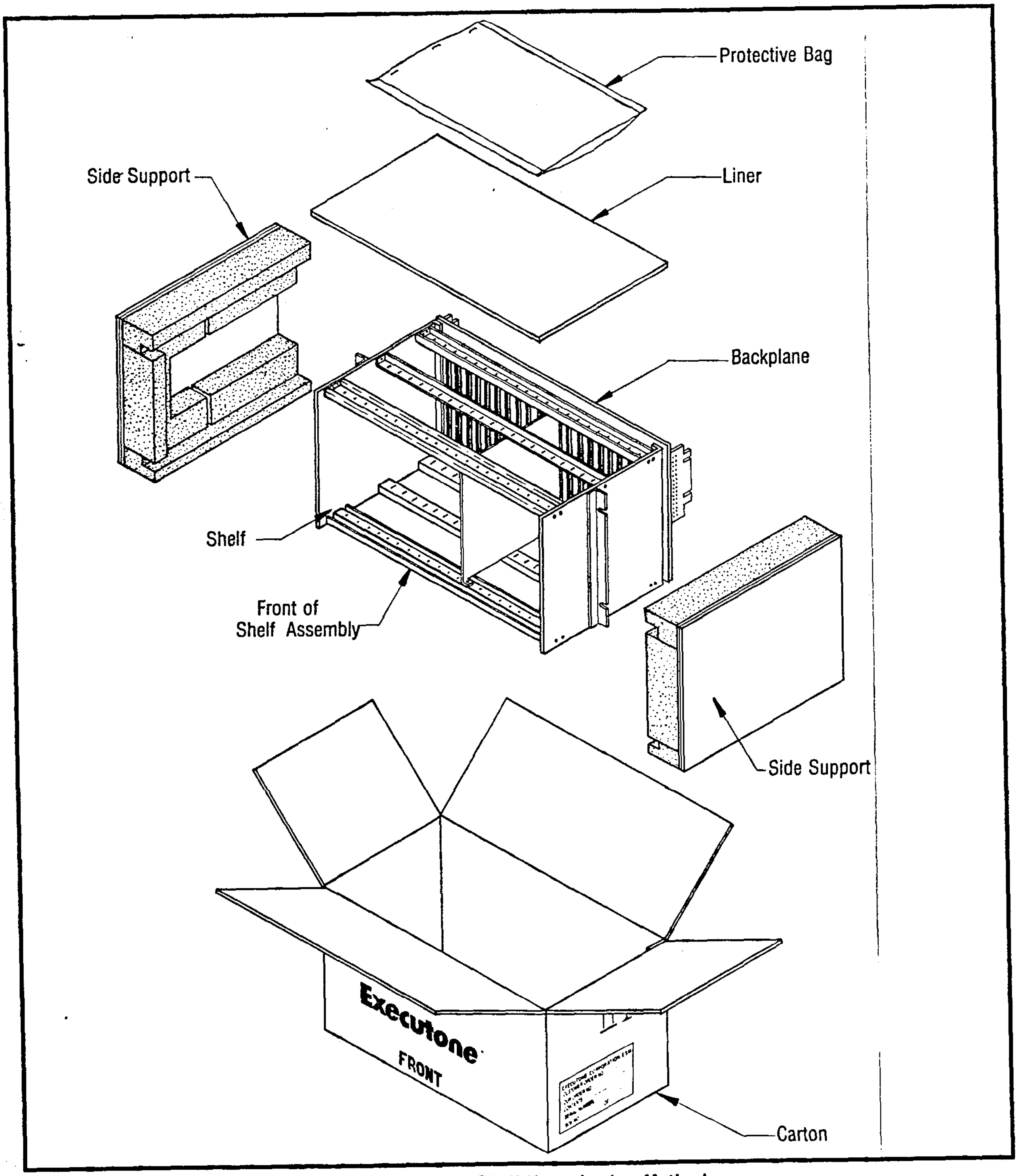

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Figure 4.07 LTU Shelf Unpackaging Method

Table 4.02 Line/Trunk Unit Shelf

EQUIPMENT	Card SLOT	PART NO.
LTU Shelf Assembly		S30804-B5197-X7-*-B900
LTU Power Supply		V30141-Z0113-A15-*-B900
Dual-Tone Multifrequency (DTMF) Receiver PCB	0-5/7-18,20-25	S30810-Q431-X2-*-B900
Premium Instrument Module Digital (PIMD) PCB	0-5,7-18,20-25	S30810-Q432-X-*-B900
Subscriber Line Module Analog – Station (SLMA-S) PCB	0-5,7-18,20-25	S30810-Q1674-X-*-B900
Subscriber Line Module Analog – Off-Premises Station (SLMA-O) PCB	0-5,7-18,20-25	S30810-Q1739-X-*-B900
Subscriber Line Module Digital (SLMD) PCB	0-5,7-18,20-25	S30810-Q1724-X-*-B900
Central Office Trunk (TMBM) PCB	0-5,7-18,20-25	S30810-Q414-X-*-B900
Direct Inward Dialing Trunk (TMIE) PCB	0-5,7-18,20-25	S30810-Q415-X-*-B900
Two-Wire E&M Trunk (TMBA-2) PCB	0-5,7-18,20-25	S30810-Q429-X-*-B900
Four-Wire E&M Trunk (TMBA-4) PCB	0-5,7-18,20-25	S30810-Q430-X-*-B900
Subscriber Line Module Analog – 16 Line (SLA16) PCB	0,1,4,5,7,8, 11-14,17,18,20, 21,24,25	S30810-Q1790-X-*-B900
Line/Trunk Unit Control (LTUC) PCB	6,19	S30810-Q428-X-*-B900

NOTE: One LTU Shelf and one LTUPS are required for expansion of the basic cabinet. The expansion cabinet can contain a maximum of two LTUs Shelfs and two LTUPS.

DESCRIPTION: Each LTU Shelf provides 256 ports. A total of three LTU shelves can be installed within a SATURN IIE system: one in the basic cabinet and one or two in the expansion cabinet.

INSPECTION PROCEDURES: After unpacking carton, check for obvious physical damage to the shelf assembly. Also check that the equipment configuration matches this table.

ADDITIONAL EQUIPMENT REQUIRED: Each LTU shelf requires an LTU Power Supply (LTUPS) module.

OBSERVATIONS: Mounting of the ribbon cable holder supplied with the LTU shelf is not required on the LTU backplane.

INSTALLATION PROCEDURES:

1. Mount the four U-type metal fasteners supplied in the Mounting Hardware Kit on the corresponding hole openings in the cabinet frame above the basic shelf assembly.
2. Remove the six backplane screws shown in Figure 4.10.
3. Insert the LTU shelf assembly into position in the cabinet frame. Once the shelf is in position, insert the four screws from the Mounting Hardware Kit as shown in Figure 4.11 and secure.
4. Replace the six backplane screws previously removed in step 2 into their corresponding locations, making sure that the busbar flanges are interconnected with backplane.

   Note: Prior to installation of power cables, check that the associated LTUPS circuit breaker is turned off.
5. Refer to Table 4.11 to install the configured power supply module (i.e., LTUPS).
6. Connect the power cable assembly supplied in the protective bag as shown in Figure 4.10. Refer to Section 5.00 in this practice for details on signal and power/ground cabling.
7. After installing the LTU shelf, do not power-up its associated power supply or cross-connect any associated cables at the MDF. Refer to SATURN II EPABX Installation Test Procedures practice for further instructions.

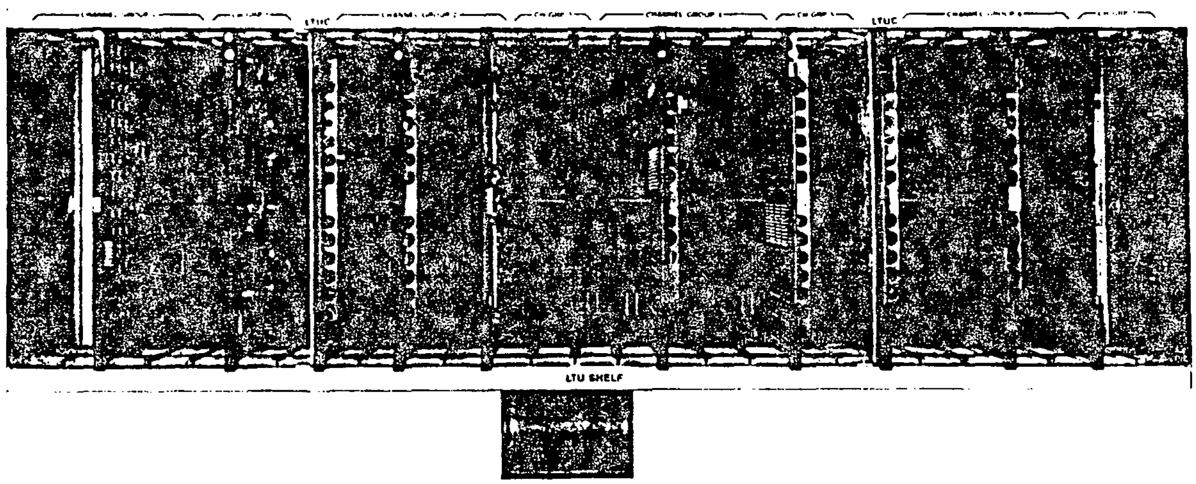

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Figure 4.08 LTU Shelf (Front View With PCBs)

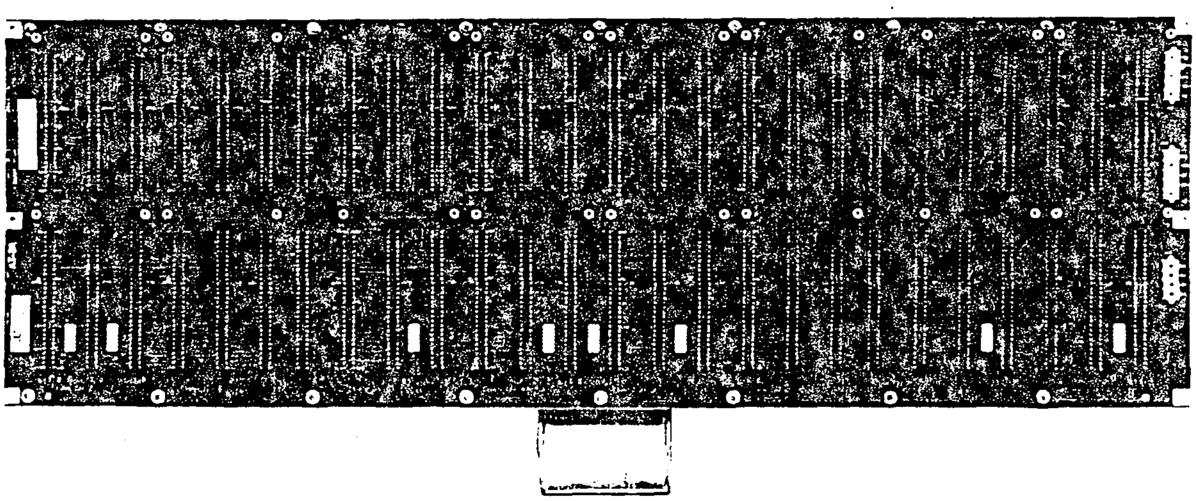

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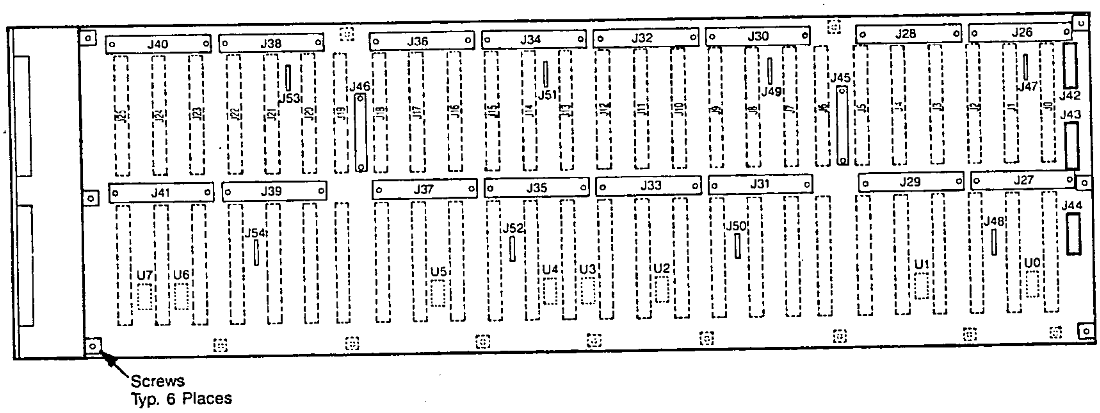
Figure 4.09 LTU Shelf (Rear View)



Note: These screws should first be removed from the backplane, then the shelf should be installed by reinserting the screws through the busbar tabs.

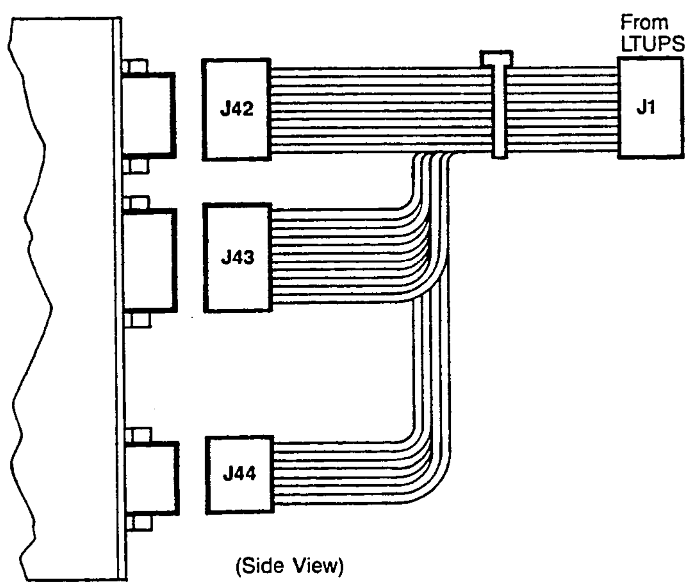


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Figure 4.10 LTU Shelf Connectors (Rear View)

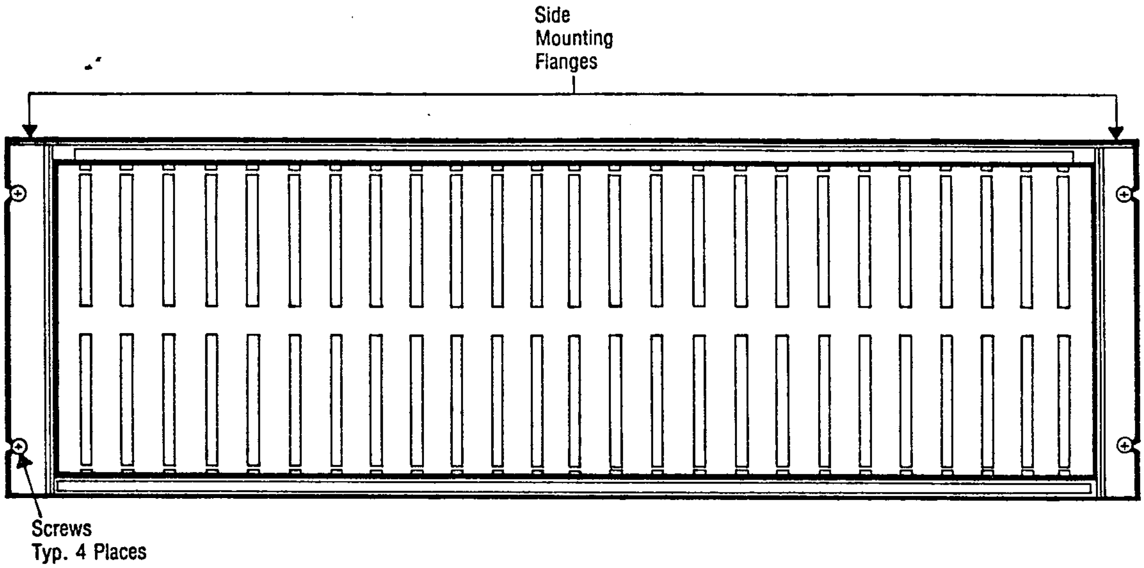

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Figure 4.11 LTU Shelf Mounting Procedures

4.04 Expansion Cabinet. The expansion cabinet is shipped in a cardboard box as shown in Figures 4.12 and 4.13. To uncrate an equipment cabinet, perform the following procedures:

a. Cut the two vertical plastic straps securing the corrugated cap and sleeve to the wooden pallet.

b. Remove the corrugated cap and any packaging material from the top of the equipment cabinet. Remove the corrugated sleeve by cutting open one of its corners with a cutting knife, or by lifting it over the cabinet assembly if overhead space is sufficient.

c. Cut the two vertical plastic straps securing the expansion cabinet to the wooden pallet. Remove any packaging material and the vinyl-plastic shroud covering the expansion cabinet, and unload the expansion cabinet.

d. The expansion cabinet is mounted on the top of the basic cabinet after the basic cabinet top cover is removed. The top cover is then reused on the top of the expansion cabinet. Refer to Table 4.03 for further information on the LTU equipment cabinet.

Note: Connector plug J2, located on the rear panel, contains jumpers for AC power when no expansion cabinet is used. If an expansion cabinet is to be used, remove plug J2 and connect a second AC power cord.

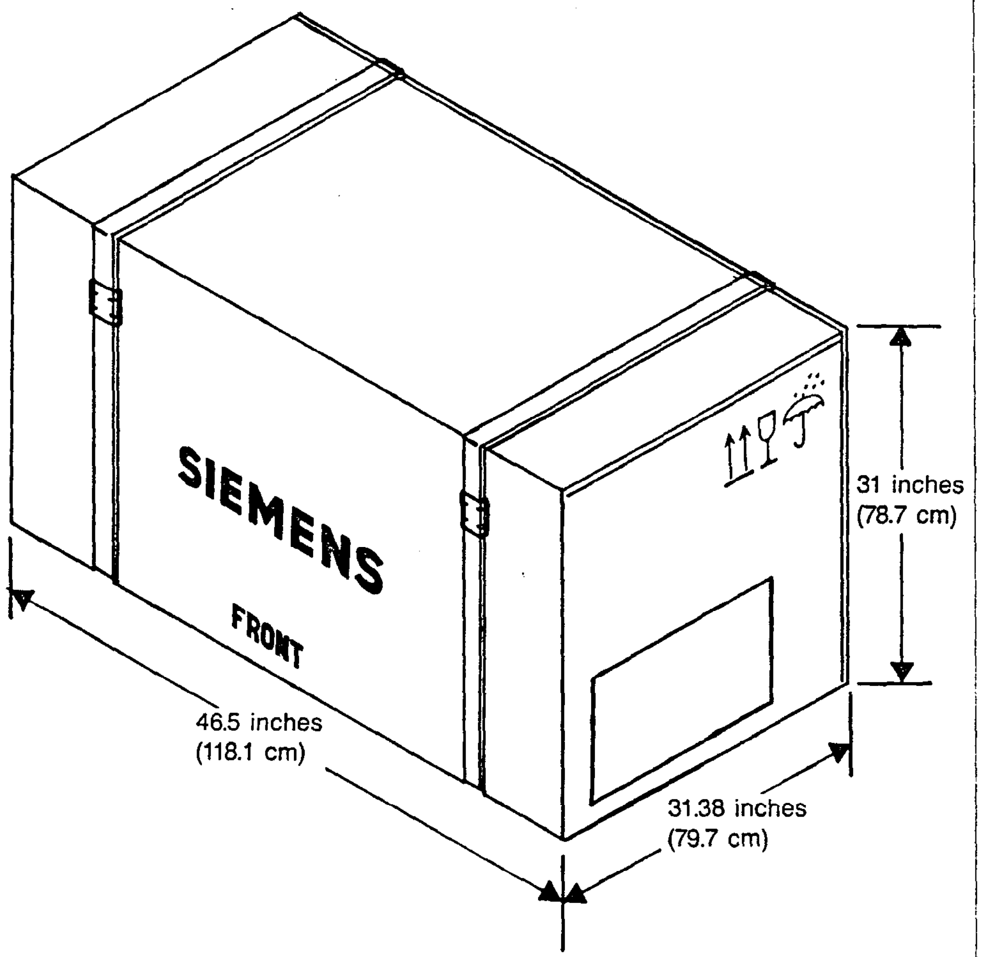

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Figure 4.12 Expansion Cabinet Container

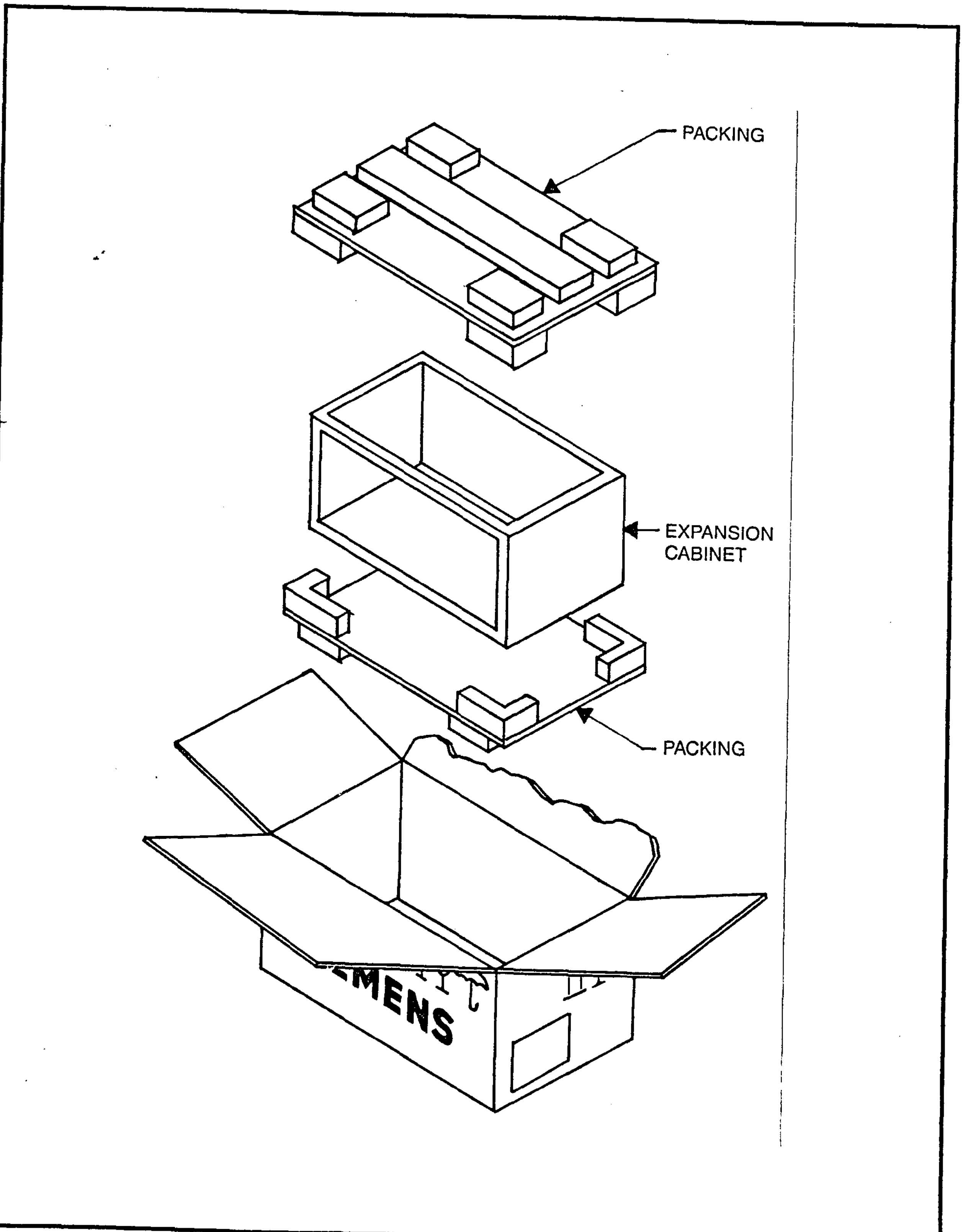

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Figure 4.13 Expansion Cabinet Unpackaging Method

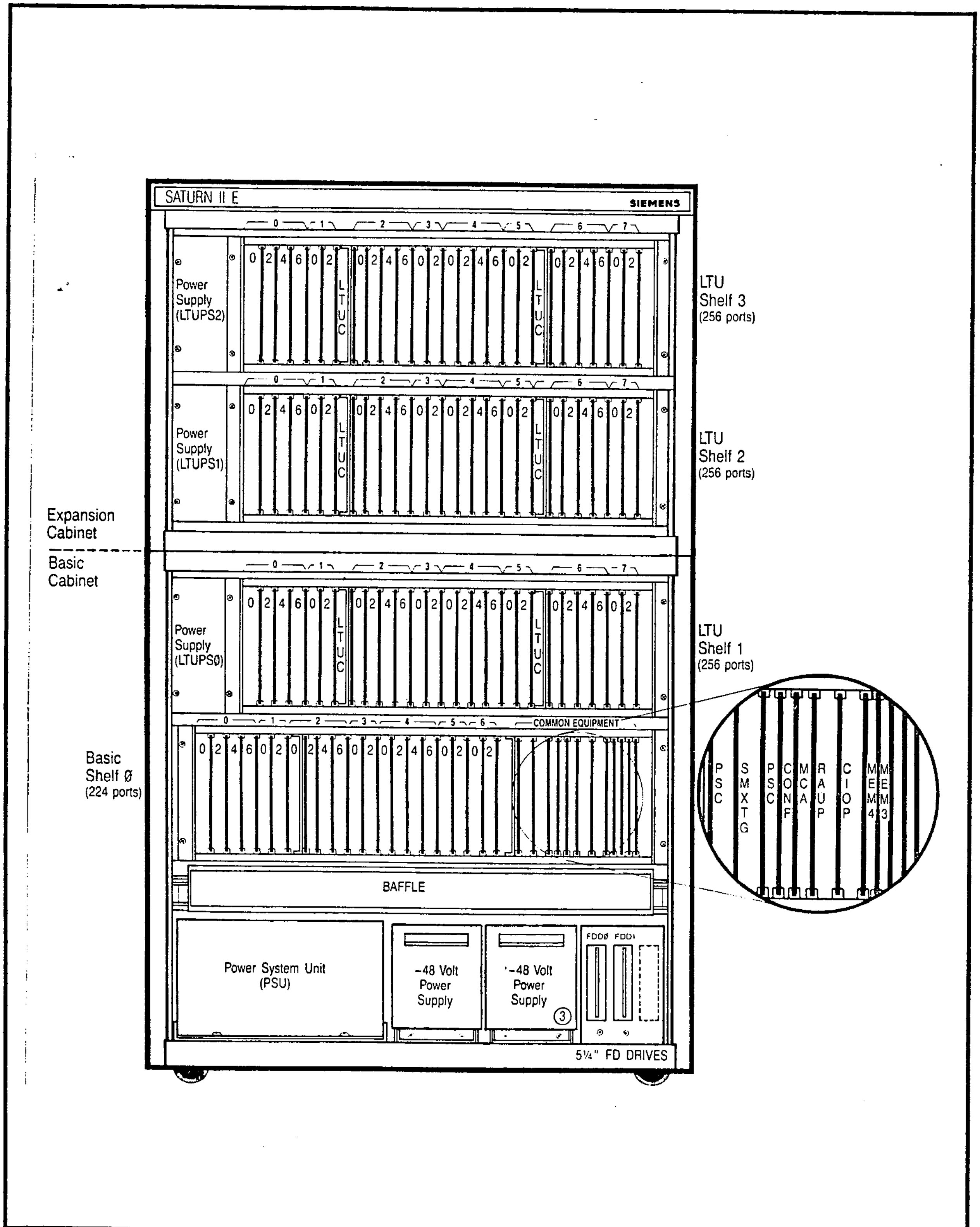

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Figure 4.14 Basic and Expansion Cabinets Equipment Configuration

Table 4.03 Expansion Cabinet and Cabling

QTY.	EQUIPMENT	Cable No.	PART NO.
1	Expansion Cabinet Assembly	-	S30805-G5113-X04-*-B900
1	Power Cable Assembly (PSU J5 & J8) (LTUS 1,J1 & J2) (LTU J1 & J2)	W6	C39195-A9679-A6-*-B900
1	Power Cable Assembly (2nd AC Input)		C39324-A9679-A7-*-B900
1	Signal Cable Assembly (BASS J60) to (LTUS 1, J46) (BASS J58) to (LTUS 1, J45) (BASS J59) to (LTUS 2, J46) (BASS J57) to (LTUS 2 J45)	 W21 W22 W23 W24	C39195-A9679-A3-*-B900
1	Power Cable Assembly (LTUPS 1 J1) to (LTUS 1,J42, J43,J44) (LTUPS 2 J1) to (LTUS 2,J42, J43,J44)	 W25 W15	C39324-A9679-A5-*-B900

DESCRIPTION: The expansion cabinet provides 256 ports per shelf. Two shelves can be installed in the expansion cabinet. For installation information pertaining to the expansion shelf, refer to Table 4.02. Information pertaining to the expansion cabinet is as follows:

INSPECTION PROCEDURES: After unloading equipment cabinet, check for obvious physical damage to the cabinet assembly and perform the following:

1. Remove rear panel and check that the equipment configuration matches the remaining equipment listed in this table. Refer to Section 5.00 of this practice to verify the signal and power/ground termination points.

ADDITIONAL EQUIPMENT REQUIRED: Per installation-site configuration to meet customer requirements.

OBSERVATIONS: All packing material or loose affects should be removed.

INSTALLATION PROCEDURES:

1. Remove the top cover from the basic cabinet as follows:
   a. If an LTU shelf is equipped in the basic cabinet, remove its LTUPS in order to make the screw at the left front corner of the cover accessible. Remove the two screws securing the LTUPS front panel, disconnect the two connectors at the rear, and remove the LTUPS.
   b. Remove the four screws that hold the cover to the basic cabinet. There is a screw near each rear corner and near the left front corner. The fourth screw is located on the right side aproximately half way back from the front to make it accessible from the rear.
2. Bolt the expansion cabinet to the basic cabinet, at four locations. Install the busbars.
3. Bolt the top cover removed in step 1 to the expansion cabinet, at four locations.
4. Secure the LTU shelves to the two metal strips between busbar, using four screws each supplied with the mounting kit.
5. Refer to Table 4.11 for information pertaining to installation of the LTUPS.

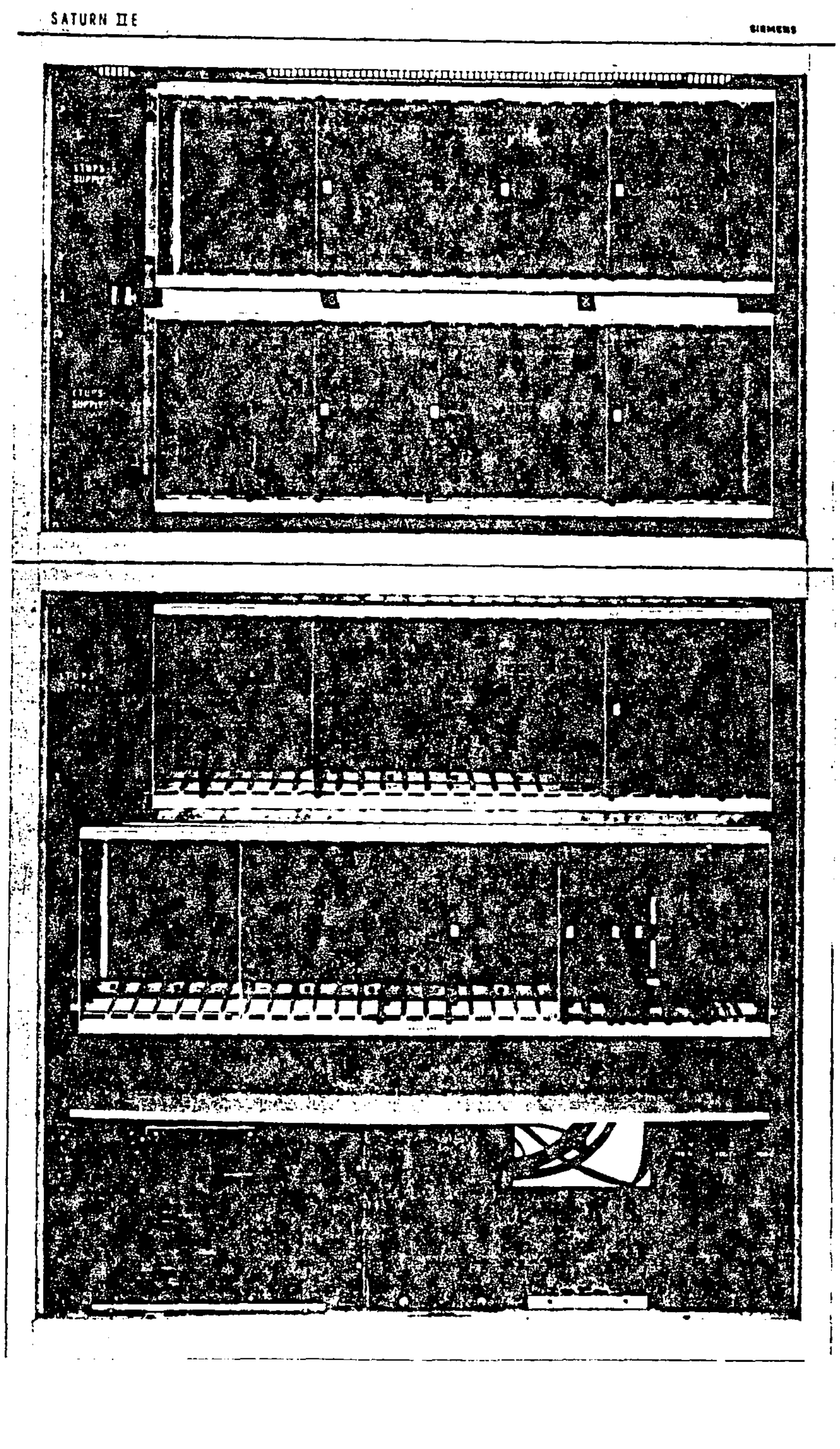

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Figure 4.15 Basic and Expansion Cabinets (Front View)

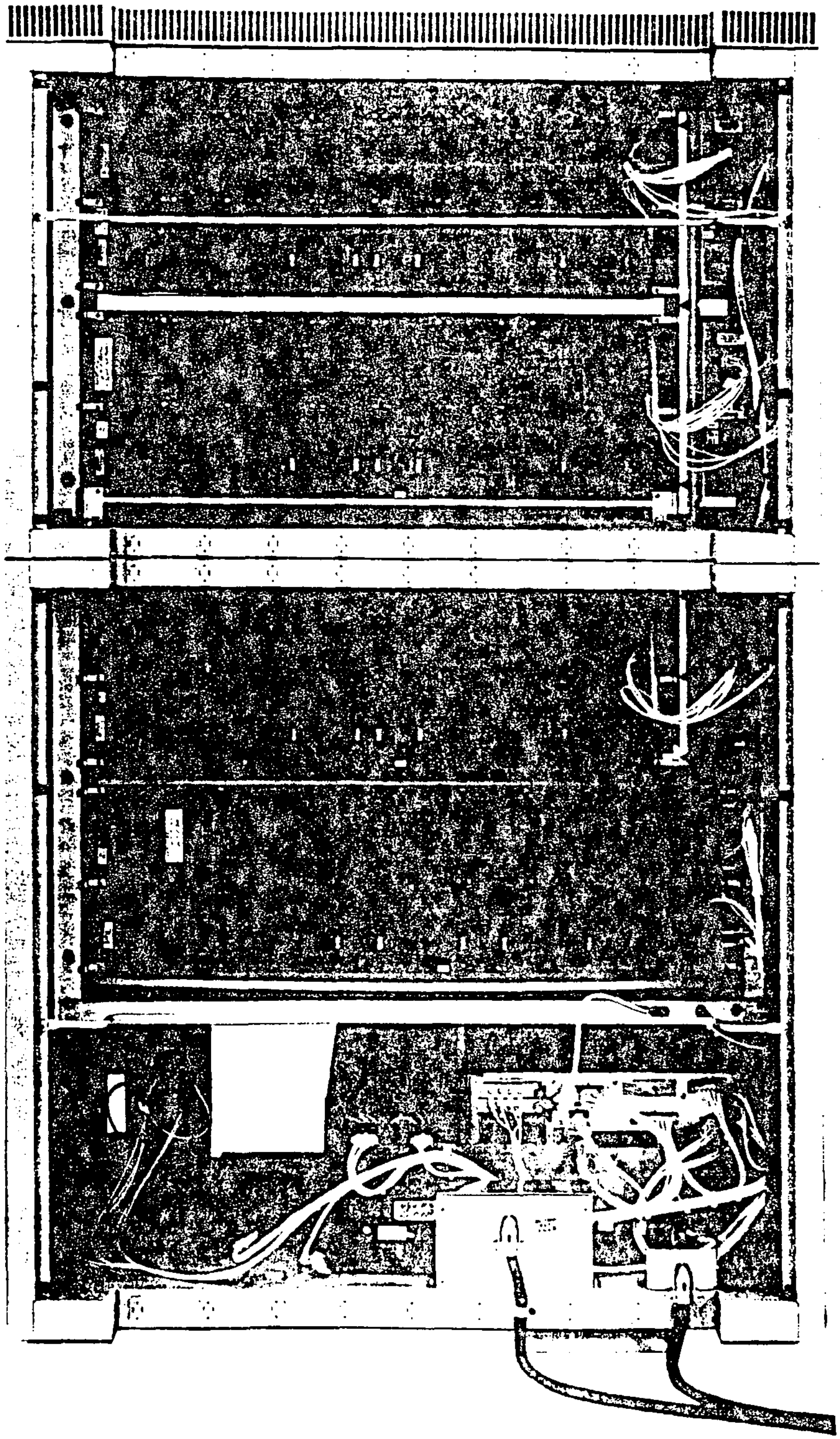

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Figure 4.16 Basic and Expansion Cabinets (Rear View)

4.05 Power and Distribution Equipment. The SATURN IIE System contains several power supply modules of various sizes located within the system. Refer to Tables 4.06 through 4.11 for detailed information on these power modules.

The PSU module contains the modules shown in Figure 4.19. The Repairable Items of the PSU are listed in Table 4.04.

The PSU has a connector plug (J2) on its rear panel, J2 contains jumpers for AC power when no expansion cabinet is used. If an expansion cabinet is to be used, remove plug J2 and connect a second AC power cord (see expansion cabinet installation for further information.

Table 4.04 Power System Unit (PSU) Repairable Items

QTY.	EQUIPMENT	REF.	PART NO.
1	Memory Support Module	Table 4.08	L30808-X5130-A34-*-B900
1	MSM Battery Pack	Table 4.09	L30808-X5130-A51-*-B900

Table 4.05 Control Logic Board

DESCRIPTION: The Control Logic Board, shown in Figure 4.19, is part of the PSU and is not a repairable item. It provides access and control point to various system maintenance functions and serves as the main AC and DC power distribution point to the following:

a. AC power, via circuit breakers, to the PSU, the LTUPS 0, 1, and 2, the -48Vdc Power Supplies (-48PS0 and -48PS1).

b. Fused -48Vdc outputs for talk battery PIMD,and SLMD applications to all channel groups in the basic and LTU shelves, as well as the input to the RGEN module.

c. Fused 90Vac @ 20Hz for Ringing AC (RAC) and 97Vdc for Ringing Message Waiting (RMW) to all channel groups in the basic and LTU shelves.

1. Indicators. The PSU panel has thirteen grasshopper-type fuses which provide visual alarm indications when blown. These fuses and their designations are summarized in Table 4.06. There are four LEDs on the control logic board: their functions are as follows:

   a. Alarm Indicators. One red LED, designated MAJ, when steadily lit, indicates a major alarm condition exists in the system. One yellow LED, designated MIN, when steadily lit, indicates a minor alarm condition exists in the system.

   b. Failure Transfer Status Indicators. One red LED, designated ACTIVE, when steadily lit, indicates the failure transfer relay subsystem is active. One yellow LED, designated INHIBIT, when steadily lit, indicates the failure transfer relay subsystem is inactive. The failure transfer relay subsystem is customer-provided.

2. Switches. The PSU panel contains six switch/circuit breakers. These circuit breakers and their PSU panel designations are summarized in Table 4.06. Also, a three-position switch, designated FAILURE TRANSFER, is provided on the PSU panel. This switch provides a selection of automatic, active, or inhibit operation of the failure transfer relay subsystem.

3. Connectors. One modular jack, designated MTCE PHONE, is provided on the PSU panel. This jack is used as a termination point for the maintenance test phone.

4. Strapping Options. If MSM/LCL in the Memory Support Module is equipped, insert connector J5 on the back of the PSU in MSM receptacle. If MSM is not equipped, insert connector J5 in LCL.

   EXT FUSE ALM. If no External Fuse Alarm, insert jumper clip in J15 on the back of the PSU. If there is an External Fuse alarm, remove jumper clip from J15.

OBSERVATIONS: None.

INSTALLATION PROCEDURES: None. The equipment cabinet comes equipped with a PSU containing a Control Logic Board when shipped from the factory.

Table 4.06 PSU Front Panel Circuit Breakers and Fuses

Fuses			
Fuse No.	**DESIGNATION**	**Functions**	**Rating**
F1	-48p Basic	(-48Vdc to Basic Shelf)	10A
F2	-48P LTU0	(-48Vdc to LTUPS0)	10A
F3	-48P LTU1	(-48Vdc to LTUPS1)	10A
F4	-48P LTU2	(-48Vdc to LTUPS2)	10A
F5	-48B RGEN	(-48Vdc to Ring Generator)	5A
F6	-48B Basic	(-48Vdc to Basic Shelf)	10A
F7	-48B LTU0	(-48Vdc to LTUPS0)	10A
F8	-48B LTU1	(-48Vdc to LTUPS1)	10A
F9	-48B LTU2	(-48Vdc to LTUPS2)	10A
F10	RAC Basic	(Ringing AC to Basic Shelf)	1/2A
F11	RAC LTU0	(Ringing AC to LTU Shelf)	1/2A
F12	RAC LTU1	(Ringing AC to LTU Shelf)	1/2A
F13	RAC LTU2	(Ringing AC to LTU Shelf)	1/2A
Circuit Breakers			
CB No.	**DESIGNATION**	**Functions**	**Rating**
CB1	Basic PS	AC Power to Basic Power Supply	10A
CB2	LTUPS0	AC Power to LTU Power Supply	5A
CB3	LTUPS1	AC Power to LTU Power Supply	5A
CB4	LTUPS2	AC Power to LTU Power Supply	5A
CB5	-48PS0	AC Power to -48V Power Supply	10A
CB6	-48PS1	AC Power to -48V Power Supply	10A

NOTE: Fuses F1 through F13 are "grasshopper" type fuses in which a spring wire indicates when a fuse has blown.

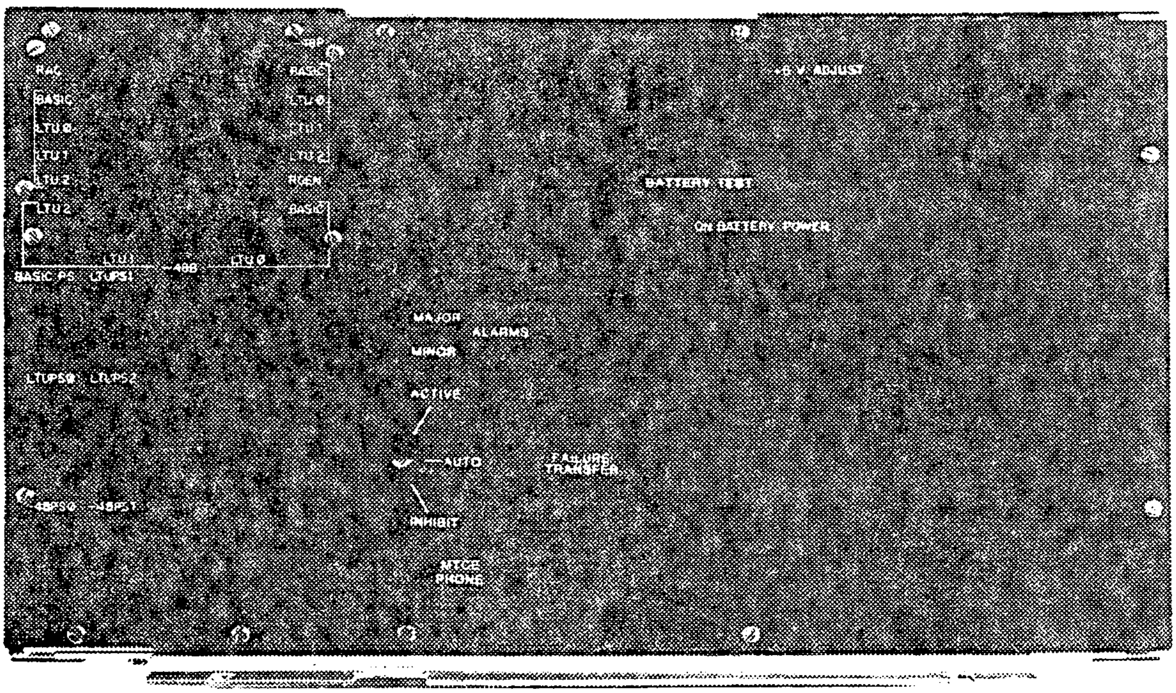

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Figure 4.17 Power System Unit (PSU) 110 Vac @ 60 Hz (Front View)

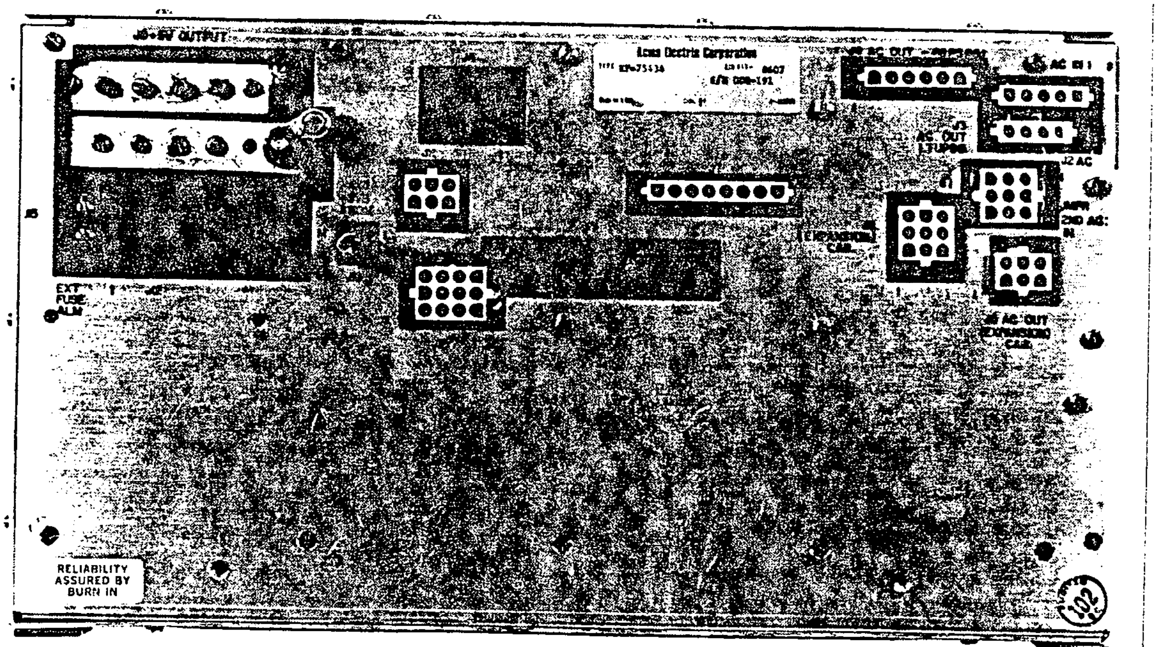

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Figure 4.18 Power System Unit (PSU) 110 Vac @ 60 Hz (Rear View)

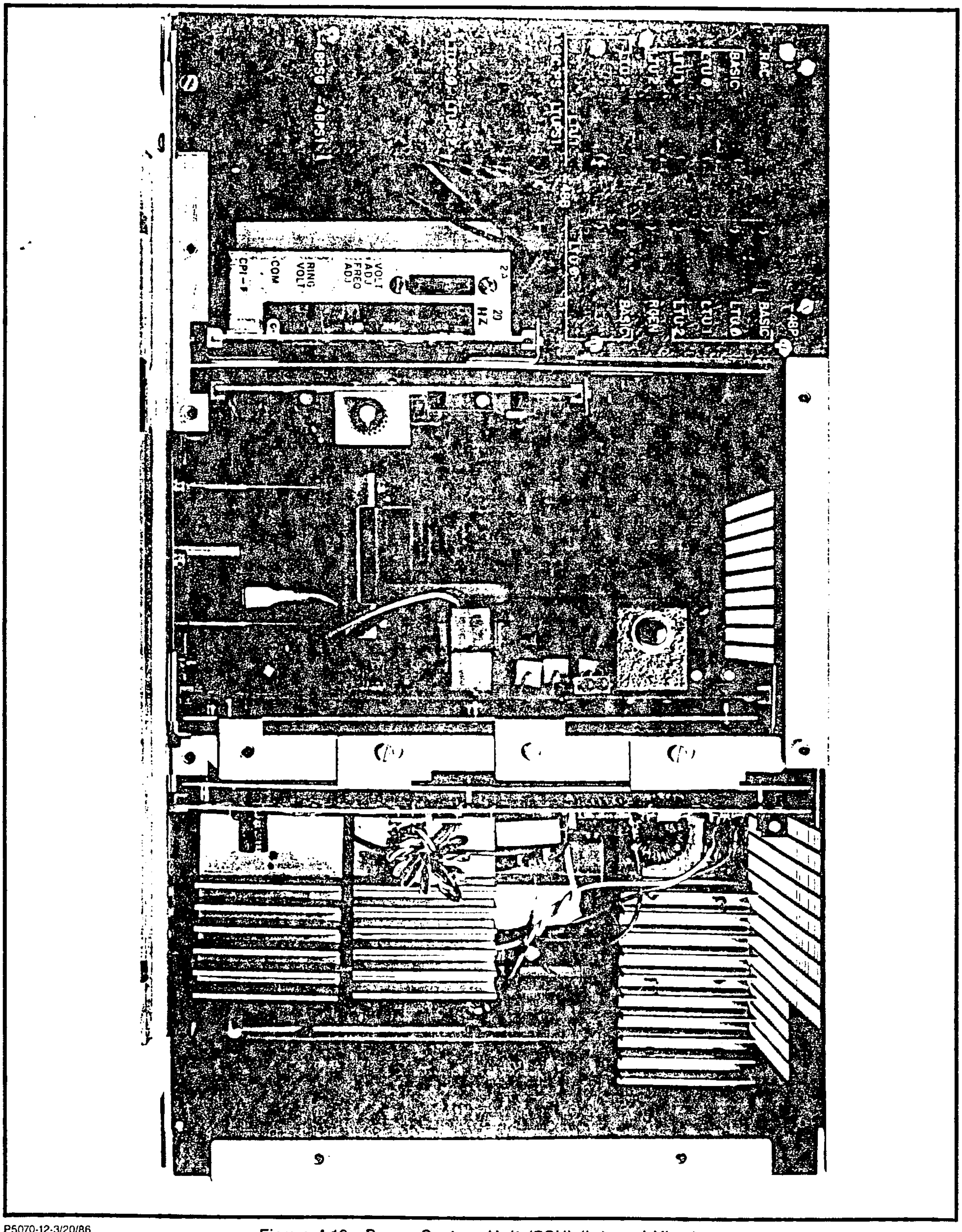

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Figure 4.19 Power System Unit (PSU) (Internal View)

Table 4.07 Ring Generator (RGEN) Module

DESCRIPTION:	One RGEN module, shown in Figures 4.19 and 4.20, is part of the PSU and is not a repairable item. The RGEN module provides 90Vac rms @ 20Hz for Ringing AC (RAC) and 97Vdc for Ringing Message Waiting (RMW) to the basic and LTU shelves.
OBSERVATIONS:	The RGEN module contains a reset type internal fuse (rated @ 5-A), but the associated 5-A fuse on the PSU panel is the controlling fuse for the RGEN module. Refer to Figure 4.20 for location of this internal fuse.
INSTALLATION PROCEDURES:	None. The equipment cabinet comes equipped with a PSU containing a Ring Generator Module when shipped from the factory.

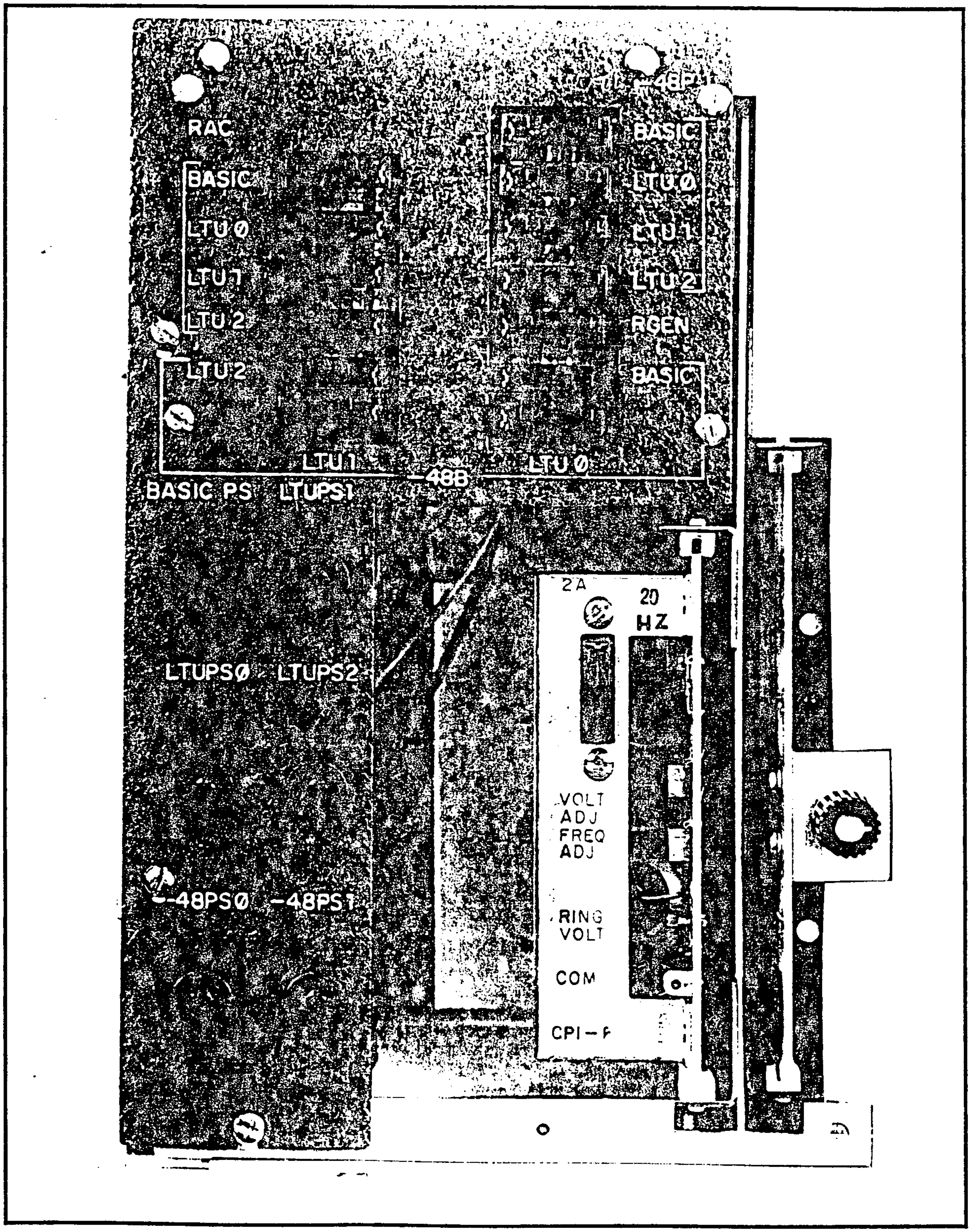

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Figure 4.20 RGEN Module (Front View)

Table 4.08 Memory Support Module (MSM) PCB (L30808-X5130-A7-★-B900)

DESCRIPTION:

The optional MSM, shown in Figure 4.19, is contained in a sealed package and is designed to provide +5Vdc to the memory modules in the Basic Shelf if the local AC power fails. In the event of a local power failure, the MSM battery maintains data stored in memory for at least five minutes. When the local power is restored, the battery is capable of another 5-minute cycle after 30 minutes of charging. The charging provision is built into the MSM. Access for the battery test is through the PSU front panel (labelled BATTERY TEST). See Figure 4.17.

Note: If optional MSM is installed, adjustment of the PSU 5 Vdc output voltage is required. Connect voltmeter between J16 MSM connector pin and J9 (5V OUTPUT), located on the PSU rear panel. Adjust the +5V ADJUST potentiometer located on the PSU front panel. The PSU +5 Vdc output must be adjusted to 50 millivolts below +5MEM/+5B.

1. Indicators. The MSM has a green and a red LED:

   a. The green LED is controlled by the MSM Battery Test Switch and is normally extinguished when the test switch is not being depressed. When the Battery Test Switch is depressed, the LED is lit steadily if the battery is within acceptable voltage limits. If the battery is below the acceptable voltage limits, the green LED remains extinguished.

   b. The red LED is normally extinguished. In the event of an AC power failure and the battery is powering the memory, the LED is steadily lit. When the AC power source is restored, the red LED is extinguished.

2. Switches. The MSM contains one switch called the Battery Test Switch, which is a momentary switch. When depressed,it disconnects the battery from the charging circuit and connects it to a test load and battery test indicator circuit.

3. Strapping Options. MSM/LCL. If the Memory Support Module is equipped, remove connector J16 on the back of the PSU from the LCL receptacle, and insert it in the MSM receptacle.

OBSERVATIONS:

None.

INSTALLATION PROCEDURES:

Note: PSU circuit breaker CB1 must be in the off position before the MSM PCB is installed in the PSU.

1. The MSM module is installed within the PSU module. No installation preparation is required. If replacement is required, perform the following steps:

   a. Remove the seven screws securing the PSU front panel (refer to Figure 4.17).

   b. Remove two screws installed in the vertical partition and two screws installed in the base of the PSU chassis.

2. For installation,locate the two plastic card guides in the PSU which support the MSM PCB. Engage the MSM PCB (not the metal backing plate) into the card guides. The MSM PCB should engage smoothly into the mating connector at the rear of the PSU. If the connector does not engage, check the connector pins for alignment. After the MSM PCB is installed, secure the MSM PCB with the two screws removed in step 1.

3. Install the battery connector wire from the Battery pack into the mating connector on the MSM PCB.

4. Replace the PSU front panel.

   Note: The LCL/MSM option strap on the rear of the PSU must be changed before the PSU circuit breaker is turned on.

5. Place PSU circuit breaker CB1 in on position.

6. Refer to the SATURN IIE EPABX Installation Test Procedures practice for further instructions to test the MSM operation.

Table 4.09 MSM Battery Pack (L30808-A5130-A51-*-B900)

NO.	QTY.	EQUIPMENT	REF.	PART NO.
1	1	MSM Battery Pack		V30141-Z0049-A5-*-B900
2	1	Mounting Hardware Kit		C39281-A9675-D2-*-B900

DESCRIPTION: The MSM Battery Pack, shown in Figure 4.19, is contained within the PSU module and is always required when an MSM PCB is equipped in the system. The Battery Pack provides +5Vdc to the system's memory in the basic shelf for a 5-minute period when local power failure occurs. It is capable of another 5minute cycle after a 30 minute charge.

OBSERVATIONS: Check for leaky battery.

INSTALLATION PROCEDURES:

NOTE: PSU circuit breaker CB1 must be in the off position before the MSM Battery Pack is installed in the PSU.

1. The MSM Battery Pack is installed within the PSU module. If replacement is required, perform the following steps:

   a. To access the MSM Battery Pack, remove the seven screws securing the PSU front panel, refer to Figure 4.17.

   b. Remove the two screws on the base plate. Lift the Battery Pack from the alignment pin. Remove wire connector going to MSM module and pull out MSM Battery Pack.

   c. Disconnect the Battery Pack connector wire from the MSM PCB mating connector and remove the faulty Battery Pack.

2. For installation attach the battery mounting brackets to the battery. The Battery Pack may be manufactured by Sonnenschein or by Gates Energy Products.

3. Replace the PSU front panel.

   Note: The LCL/MSM option strap on the rear of the PSU must be changed before the PSU circuit breaker is turned on.

4. Refer to the SATURN IIE EPABX Installation Test Procedures practice for further instructions to test the MSM operation.

Table 4.10 –48Vdc Power Supply (-48PS) Module, 110 Vac @ 60Hz) (S30050-K5668-X-*-B900)

QTY.	EQUIPMENT	PART NO.
1	-48PS (110/220V @ 60Hz) Module	S30050-K5668-X-*-B900
1	Mounting Hardware Kit	C39281-A9675-D2-*-B900

DESCRIPTION: The -48PS module, shown in Figure 4.21, is an AC-to-DC converter which provides two -48Vdc outputs. One -48Vdc output is used for talk battery and the other -48Vdc output is used for PIMD/SLMD applications (i.e., powering attendant consoles, SDTs) and powering the RGEN module. The system cabinet may contain from one to two -48PS modules. Only one -48PS module is required when only the basic cabinet is equipped. When an expansion cabinet is added, a second -48PS module is required.

1. Indicators. None.

2. Switches. None

3. Strapping Options. The PSU and -48PS module come factory-strapped for 110Vac operation.

OBSERVATIONS: -48PS0 is sufficient for basic cabinet. The additional -48PS1 is required when for the expansion cabinet is equipped.

Table 4.10 −48Vdc Power Supply (-48PS) Module, 110 Vac @ 60Hz) (S30050-K5668-X-★-B900) (Continued)

INSTALLATION PROCEDURES:	1. Mount the two U-type fasteners contained in the Mounting Hardware Kit on the mounting flange hole openings where the -48PS module is to be installed. 2. Lift and position the -48PS module over the mounting flange containing the U-type fasteners. Once in position, insert the remaining four screws with washers from the Mounting Hardware Kit through the front and rear hole openings and secure into position. 3. For connections of power cable assemblies, refer to Section 5.00 in this practice for details on power/ground cabling. Before connecting the power cables, check that the associated circuit breaker on the PSU panel is in the OFF position. 4. After performing the above procedures, refer to the SATURN IIE EPABX Installation Test Procedures practice for further instructions to test the -48PS modules when powering up. Note: When the expansion cabinet is equipped, -48PS1 module and a second AC power cord are required; remove J2 jumper plug from PSU.

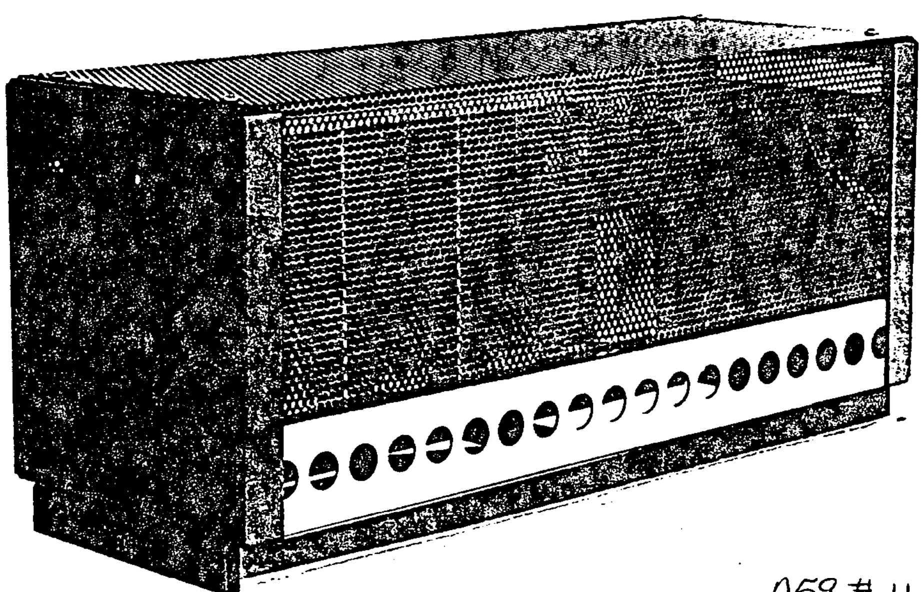

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Figure 4.21 −48PS (110 Vac @ 60Hz) Module (Front View)

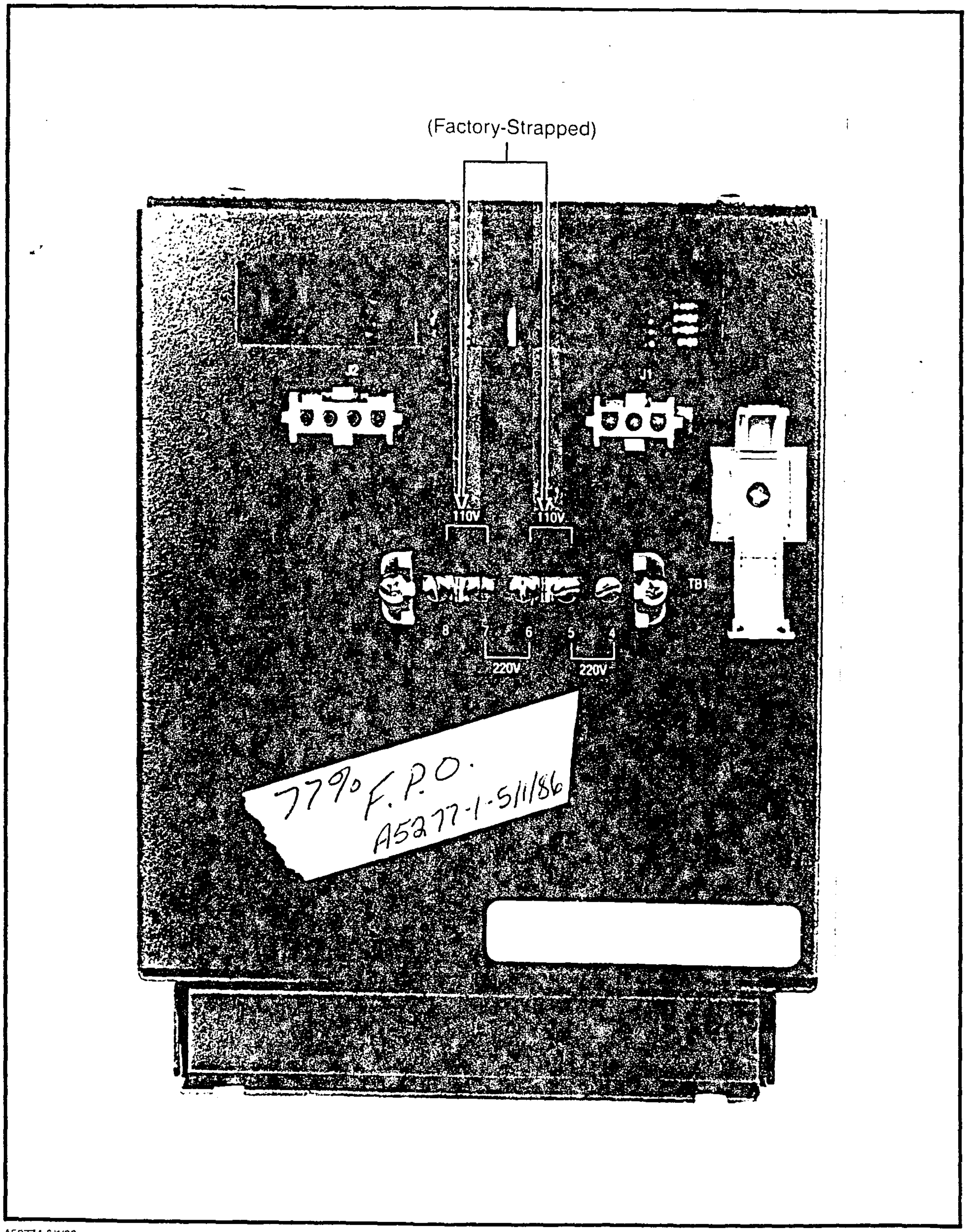

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Figure 4.22 −48PS (110 Vac @ 60HZ) Module (Rear View)

Table 4.11 LTU Power Supply (LTUPS) Module, 110 Vac @ 60Hz (L30808-X5130-A39-*-B901)

QTY.	EQUIPMENT	REF.	PART NO.
1	LTUPS Module Assembly		V301141-Z011-A15-B900

DESCRIPTION

The LTUPS module, shown in Figure 4.23, is used to power the LTU shelf. The LTUPS module is a switching power supply which provides +5Vdc, -5Vdc, +12Vdc and -12Vdc output power to the LTU shelf.

1. Indicators. None.
2. Switches. None.
3. Strapping Options. Verify that the LTUPS is internally strapped for 110Vac input voltage, before installing.

OBSERVATIONS:

When the LTU shelf is equipped, an LTU Power Supply module is required for powering purposes.

INSTALLATION PROCEDURES:

1. Insert the LTUPS from the front of the cabinet. Slide into place and fasten with 2 screws supplied with the mounting kit.
2. For connections of power cable assemblies, refer to Section 5.00 for details on power/ground cabling. Before connecting power cables, check that the associated circuit breaker on the PSU panel is in the OFF position.
3. After installing the LTUPS module, refer to SATURN IIE EPABX Installation Test Procedures practice for further instructions to test the power supply when powering up.

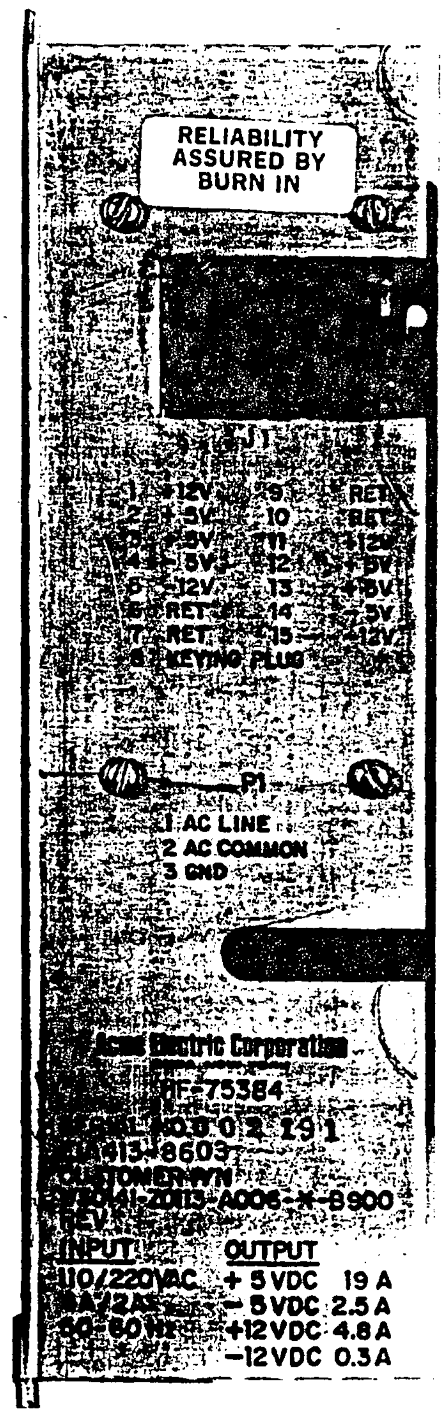

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Figure 4.23 LTU Power Supply (LTUPS) Module, 110 Vac @ 60HZ

4.06 Miscellaneous Equipment. The Floppy Disk Drives (FDDs) are data storage modules which use a 5- 1/4 inch floppy disk as the data storage medium. The double-sided, quad density, removable disk is not shipped with the FDD module and requires compliance with certain licensing agreements prior to its delivery. Refer to Table 4.12 for further details on the FDD modules.

Table 4.12 Floppy Disk Drive (FDD) Module (L30808-X5130-A50-★-B900)

QTY.	EQUIPMENT	REF.	PART NO.
1	FDD Module Assemblies		V30141-Z0121-A6-★-N900

DESCRIPTION

The FDD module, shown in Figure 4.24, is a data storage device which uses a floppy disk (not included) as the data storage medium. The double-sided, quad density, removable disk is capable of storing a minimum of 1.0 megabyte of formatted data. Two FDD modules are equipped in the system (FDD0 and FDD1). The FDDs provide the backup memory for system initialization, system reload, administration, and maintenance testing.

1. Indicators. One red LED located on the front panel which momentarily lights when a read/write function is being executed.
2. Switches. One release switch lever on the front panel used for locking or releasing the floppy disk.
3. Strapping Options. None.

INSPECTION PROCEDURES: None.

OBSERVATIONS:

1. When handling the FDD module, avoid finger contact with the contact heads.
2. When handling the Common Control Feature Disk, avoid finger contact with its surface.
3. Never attempt to close switch lever on the front panel unless a disk is inserted.

INSTALLATION PROCEDURES:

The equipment cabinet comes equipped with two Floppy Disk Drive Modules when shipped from the factory. If replacement of a defective FDD is required, perform the following steps:

1. Remove the seven screws securing the PSU front panel,and then remove four screws on the FDD retaining plate, disconnecting two connector plugs. Slide out the FDD from the mounting bracket and remove ground wire.
2. To install a new FDD, perform the inspection procedures in steps a through f; and then install the FDD by following in reverse the procedures described in step 1.
   a. Place FDD on clean bench surface with the PCB on its side and its front panel facing checker.
   b. Manually rotate motor. Observe that the motor rotates freely and smoothly.
   c. Operate front panel release lever. Observe that carrier mechanism opens to insert flexible disk cartridge and that centering cone is released from spindle hub.
   d. Insert disk cartridge fully. Observe that spring-loaded latch is enaged and that disk cartridge is seated properly over drive mechanism.
   e. Rotate spindle drive mechanism. Observe smooth rotation of floppy disk.
   f. Do not close lever without disk or blank cartridge being inserted.
3. For signal and power connections, refer to Section 5.00 in this practice for details on signal and power/ground cabling.
4. Refer to the SATURN IIE EPABX Installation Test Procedures practice for further instructions before powering up.

Table 4.12 Floppy Disk Drive (FDD) Module (L30808-X5130-A50-*-B900) (Continued)

	a. Place FDD on clean bench surface with the PCB on its side and front panel facing checker.
	b. Manually rotate motor. Observe that the motor rotates freely and smoothly.
	c. Operate front panel release lever. Observe that carrier mechanism opens to insert flexible disk cartridge, and that centering cone is released from spindle hub.
	d. Insert disk cartridge fully. Observe that spring-loaded latch is enaged and that disk cartridge is seated properly over drive mechanism.
	e. Rotate spindle drive mechanism. Observe smooth rotation of floppy disk.
	f. Do not close lever without disk or blank cartridge being inserted.

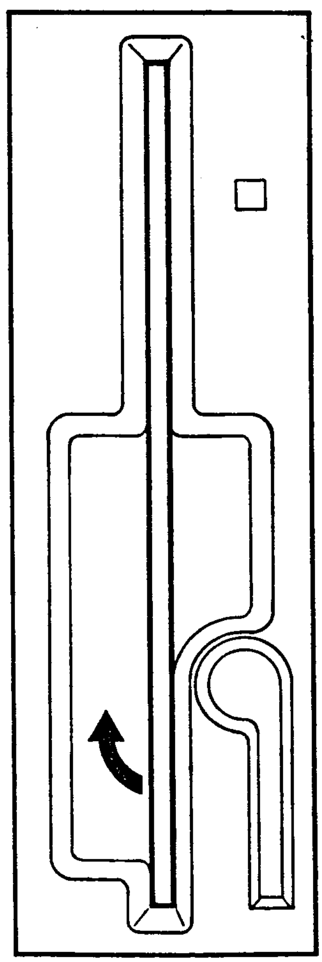

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Figure 4.24 Floppy Disk Drive (FDD) Typical Module (Front View)

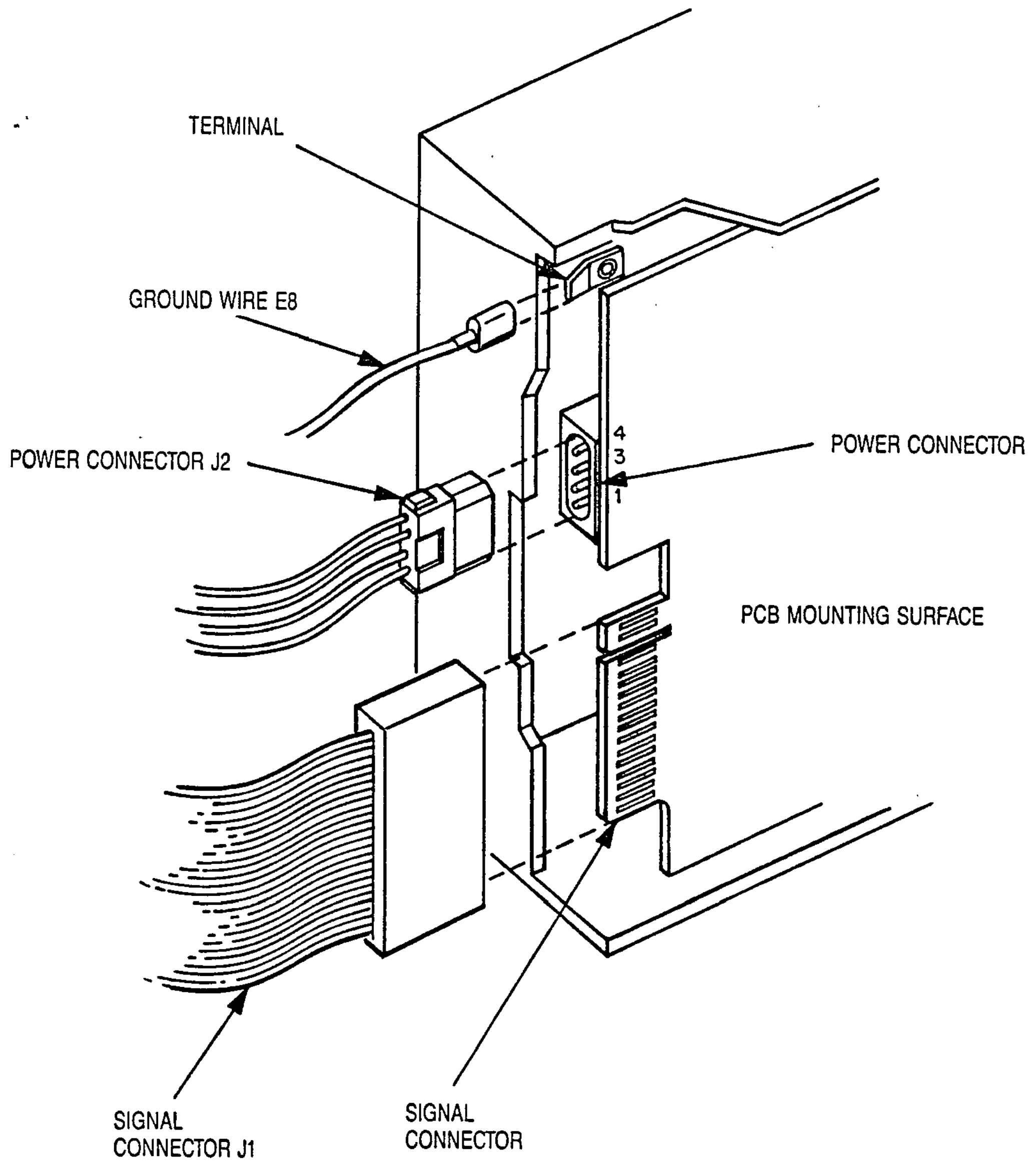

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Figure 4.25 Floppy Disk Drive (FDD) Module (Connector Locations)

4.07 Printed Circuit Boards. The plug-in PCBs are 230mm (9.02 in.) high by 280mm (11.02 in.) deep. Each PCB has two edge-connector tab areas with 60 terminals each. The PCBs plug into mating 60-pin connectors mounted on the backplanes of the basic and LTU shelves. Two extractor levers, mounted on the faceplate of each PCB, allow for easy insertion or removal from the shelf connectors. Each PCB comes factory-shipped inside an anti-static bag to protect the MOS integrated circuits. Each bag is enclosed in foam material inside its carton as shown in Figure 4.26.

CAUTION

Craft personnel handling PCBs with MOS integrated circuits must first free themselves from electrostatic charge by touching the frame of an already grounded system cabinet or by wearing grounded wrist straps. Failure to observe this practice may result in damage to the PCBs due to electrostatic discharge.

There are two types of PCBs: peripheral interfacing PCBs and common equipment PCBs. The type of PCB may be readily identified because the peripheral PCBs have a notch separating the two edge connectors and the common equipment PCBs do not. Refer to the following tables for further information on the peripheral interfacing PCBs and common equipment PCBs.

a. Peripheral Interfacing PCBs:

1. Table 4.13 – Dual-Tone Multifrequency (DTMF) Receiver
2. Table 4.14 – Premium Instrument Module Digital (PIMD)
3. Table 4.15 – Subscriber Line Module Analog – Station (SLMA-S)
3. Table 4.16 – Subscriber Line Module Analog – Off-Premises (SLMA-O)
3. Table 4.17 – Subscriber Line Module Digital (SLMD)
3. Table 4.18 – Subscriber Line Module Analog – 16 Line (SLA16)
4. Table 4.19 – Central Office Trunk (TMBM)
5. Table 4.20 – Direct Inward Dialing Trunk (TMIE)
6. Table 4.21 – Two-Wire E&M Trunk (TMBA-2)
7. Table 4.22 – Four-Wire E&M Trunk (TMBA-4)

b. Common Equipment PCBs:

1. Table 4.23 – Parallel/Serial Converter (PSC)
2. Table 4.24 – Signal Multiplexer/Clock/Tone Generator (SMXTG)
3. Table 4.25 – Conference (CONF)
4. Table 4.26 – Memory Control & Attenuation (MCA)
5. Table 4.27 – Remote Access Unit/Ports (RAUP)
6. Table 4.28 – Controller/Input-Output Processor (CIOP)
7. Table 4.29 – Memory 1.0 Megabyte (MEM4)
8. Table 4.30 – Memory 256K Kilobyte (MEM3)
9. Table 4.31 -Line/Trunk Unit Control (LTUC)

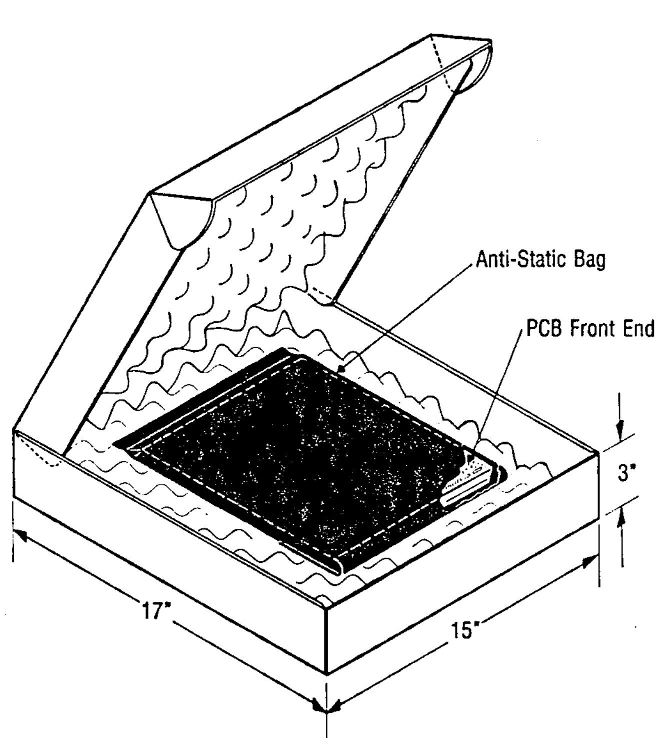

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Figure 4.26 PCB Packaging Method

Table 4.13 Dual-Tone Multifrequency (DTMF) Receiver PCB (S30810-Q431-X2-*-B900)

DESCRIPTION	The DTMF PCB, shown in Figure 4.27, contains four circuits (0, 2, 4, and 6) utilizing four ports. Under no circumstances should more than three DTMF receiver cards be assigned on one shelf. This requirement is a limitation of the power supply. Each circuit provides the means for dial tone detection and validation of DTMF tones. 1. Indicators. There are four red LEDs (TRC0, TRC2, TRC4 and TRC6) on the faceplate of the PCB. Each LED indicates the following status conditions of one of the four assigned DTMF receiver circuits: a. LED steadily lit – The associated DTMF receiver circuit is busy. b. LED extinguished – The associated DTMF receiver circuit is idle and in-service. The LED always remains extinguished for unassigned DTMF receiver circuits. c. LED flashing – The associated DTMF receiver circuit is idle and in an out-of-service state. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in any channel group in the basic or LTU shelf for optimum port usage. Refer to Section 2.00 of this practice for details.

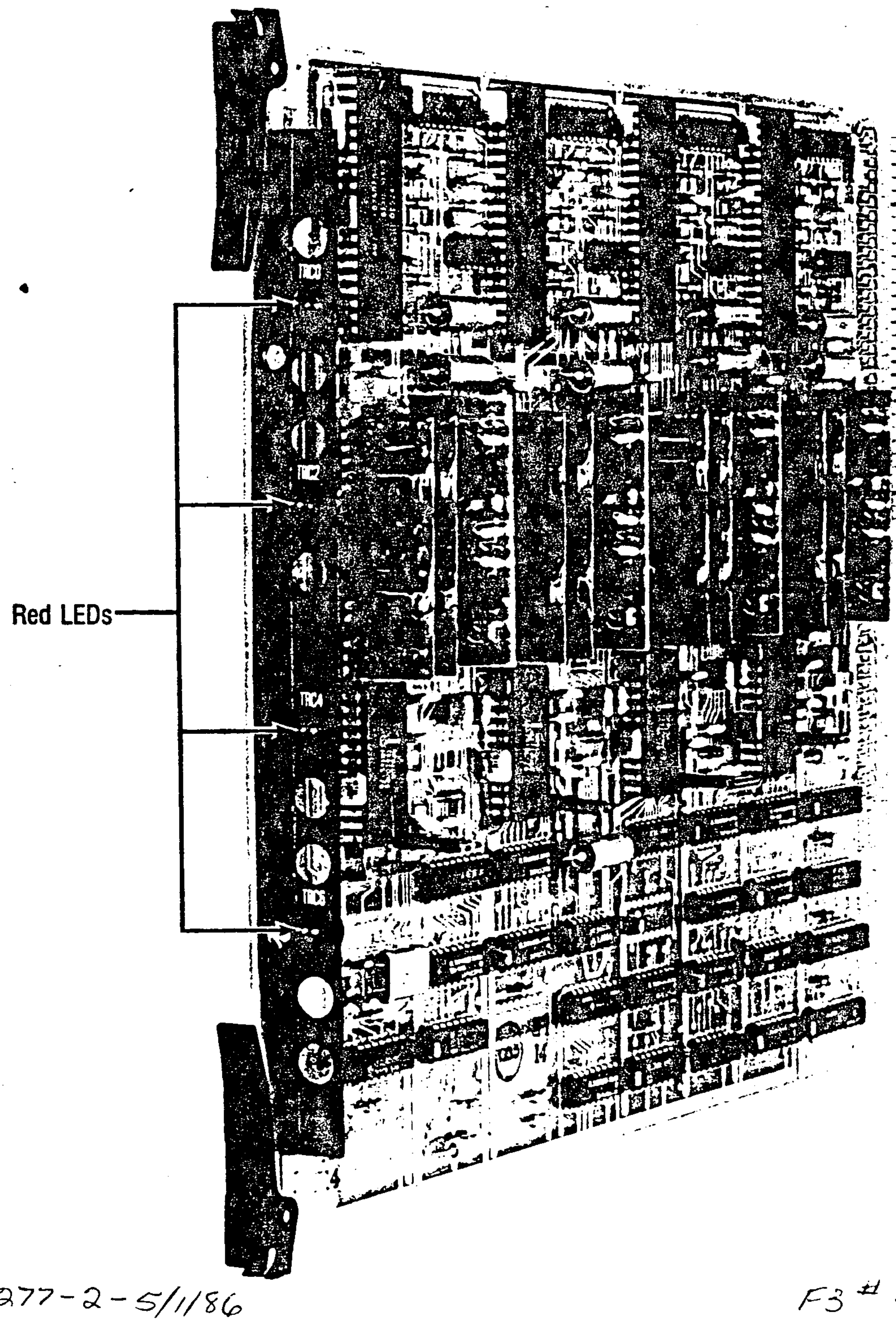

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Figure 4.27 DTMF PCB

Table 4.14 Premium Instrument Module Digital (PIMD) PCB (S30810-Q432-X-*-B900)

DESCRIPTION:	The PIMD PCB serves as a special line interface circuit connecting attendant consoles to the system. The PIMD communicates with the system via digital data messages. Each PIMD PCB, shown in Figure 4.28, contains two circuits. 1. Indicators. None. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in any channel group in the basic or LTU shelf for optimum port usage. Refer to Section 2.00 of the practice for details.

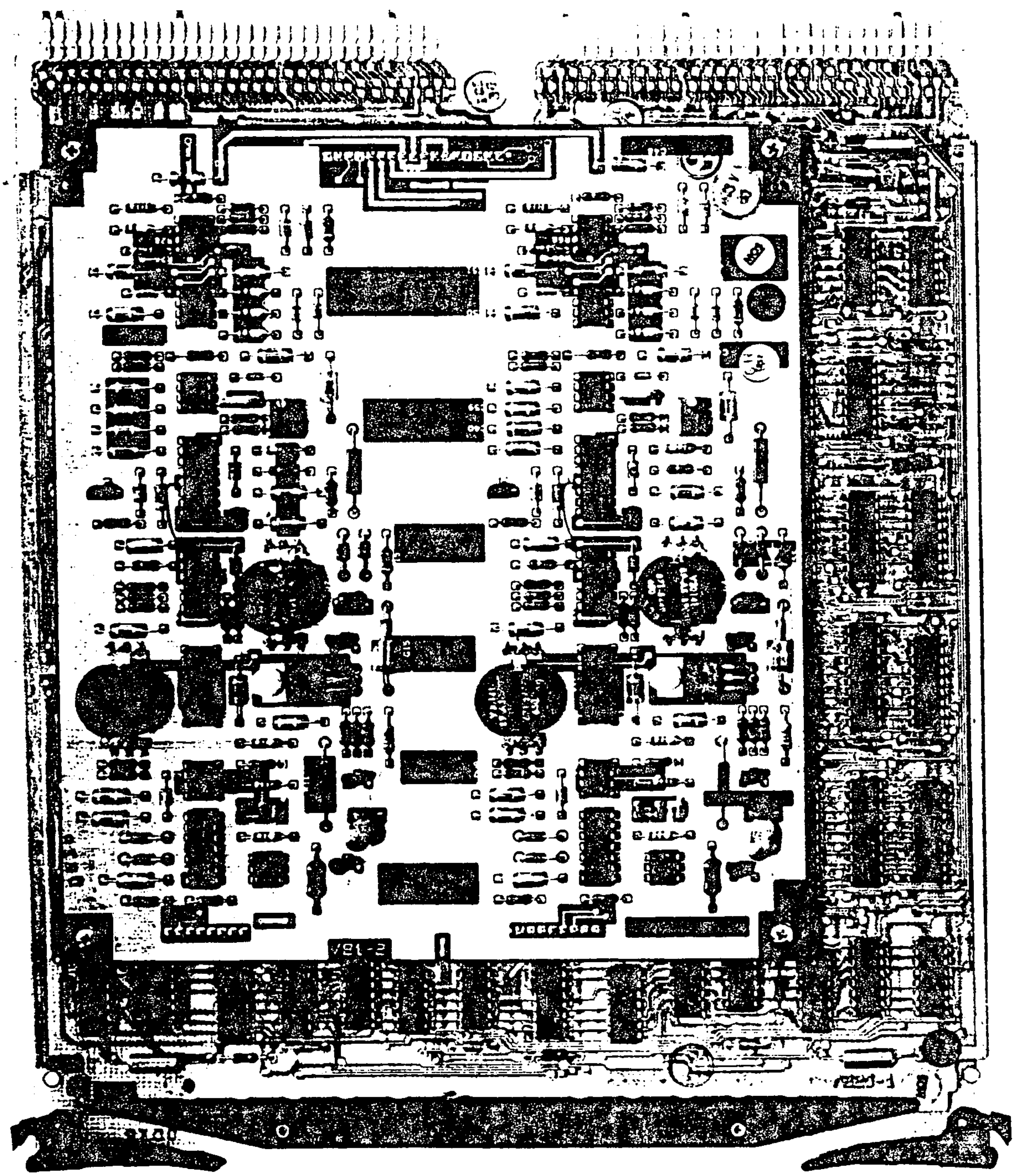

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Figure 4.28 PIMD PCB

Table 4.15 Subscriber Line Module Analog – Station (SLMA-S) PCB (S30810-Q1674-X-*-B900)

DESCRIPTION:	The SLMA-S PCB provides an interface between standard telephone sets (rotary dial and pushbutton) and the system. The SLMA-S PCB, shown in Figure 4.29 , contains eight circuits (0 – 7) and utilizes eight ports. Each circuit provides the required supervisory signaling plus the analog-to-PCM and PCM-to-analog transformation. 1. Indicators. One green LED which indicates the following status conditions: a. LED lit steadily – One or more of the line circuits are busy. b. LED extinguished – All assigned line circuits are idle and in-service. c. LED flashing – All assigned line circuits are idle and one or more line circuits are in the out-of-service state. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	The SLMA-S PCB can be used to terminate dial dictation circuits or ZUNA (Zoned Universal Night Answer) bells zoned for up to four zones, or other special equipment circuits.
INSTALLATION PROCEDURES:	Locate in any channel group per best port capacity.

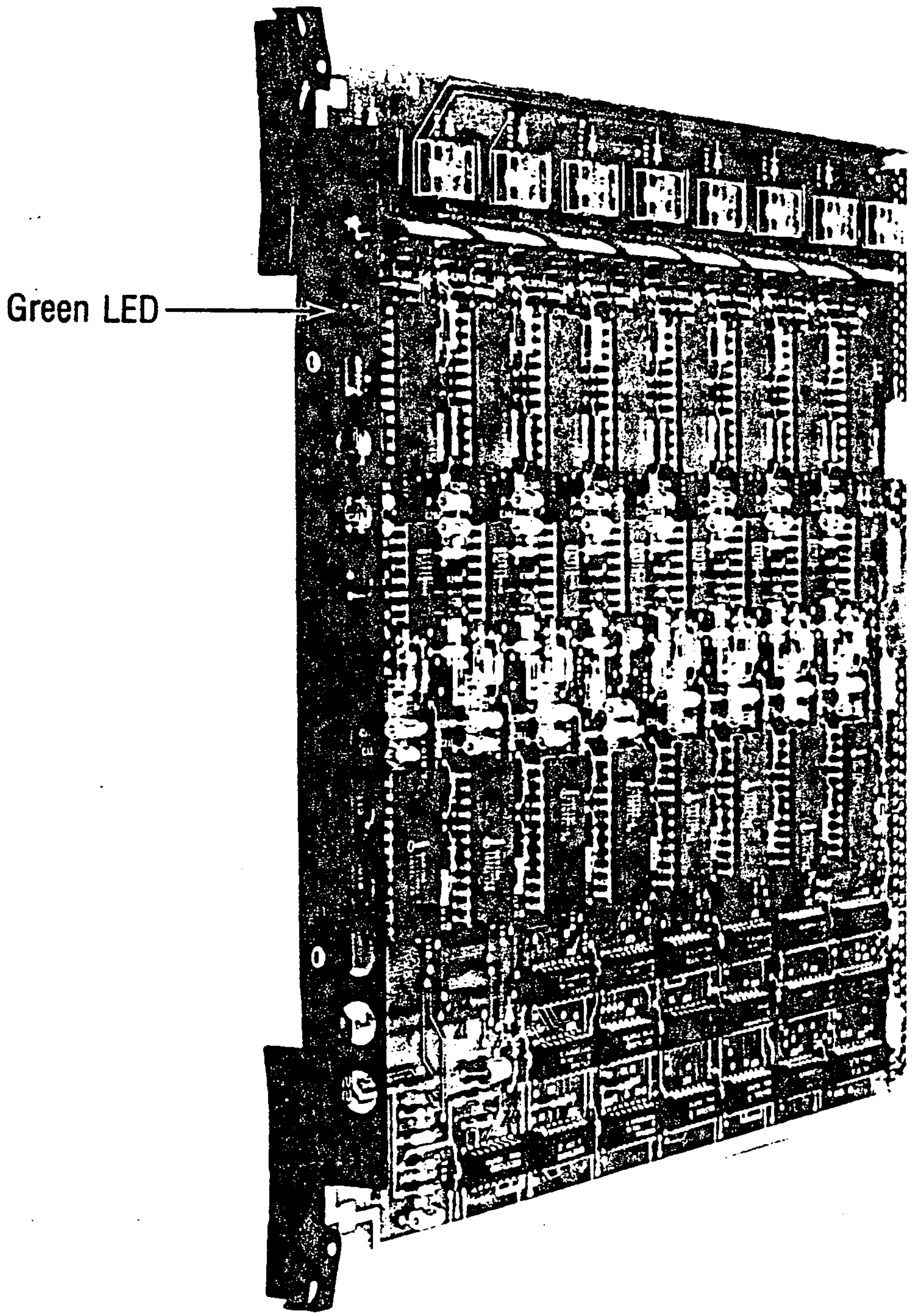

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Figure 4.29 SLMA-S PCB

Table 4.16 Subscriber Line Module Analog – Off-Premises (SLMA-O) PCB (S30810-Q1739-X-★-B900)

DESCRIPTION:	The SLMA-O PCB provides an interface between standard telephone sets (rotary dial and pushbutton) which are Off-Premises and the system. The SLMA-O PCB, shown in Figure 4.30, contains four circuits (0, 2, 4, 6) and utilizes four ports. Each circuit provides the required supervisory signaling plus the analog-to-PCM and PCM-to-analog transformation. The Off-Premises station can operate over a loop of 0 to 1800 Ohms, and is registered with the FCC for class "C" operation. 1. Indicators. One green LED which indicates the following status conditions: a. LED lit steadily – One or more of the line circuits are busy. b. LED extinguished – All assigned line circuits are idle and in-service. c. LED flashing – All assigned line circuits are idle and one or more line circuits are in the out-of-service state. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in any channel group per best port capacity. Refer to Section 2.00 of this practice for details.

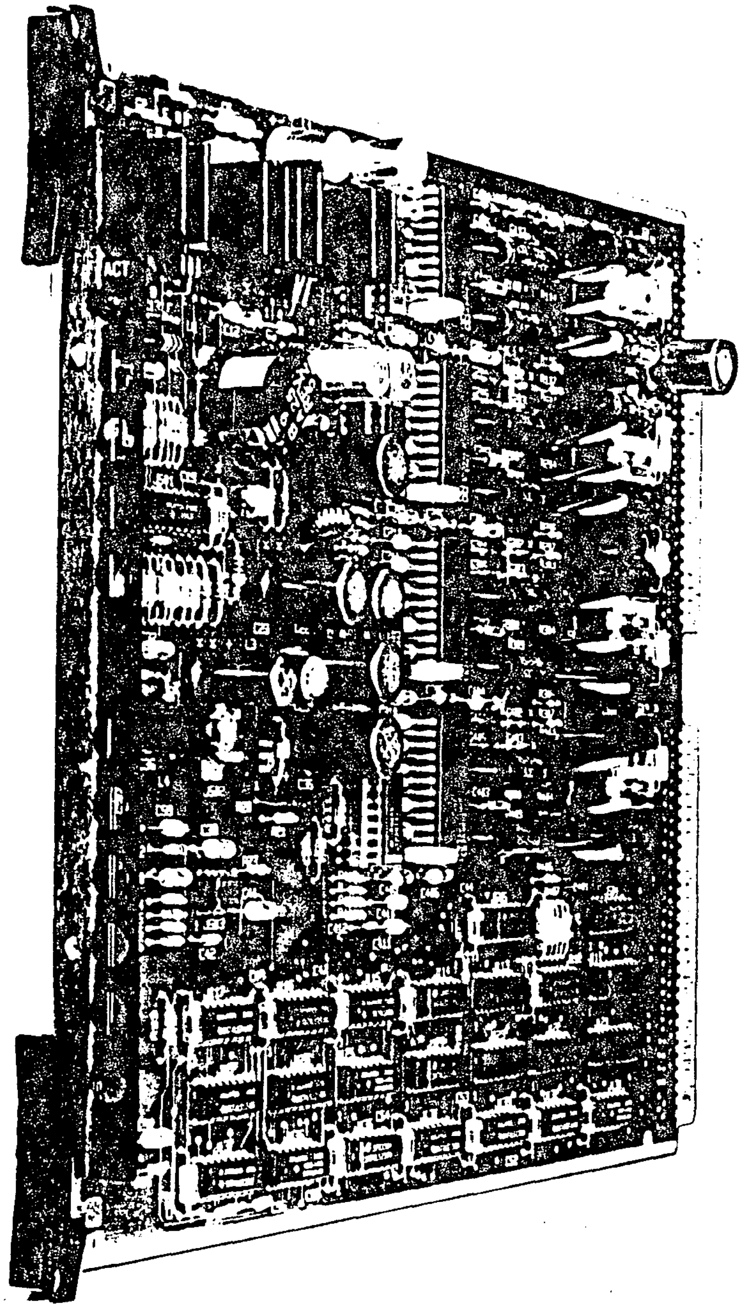

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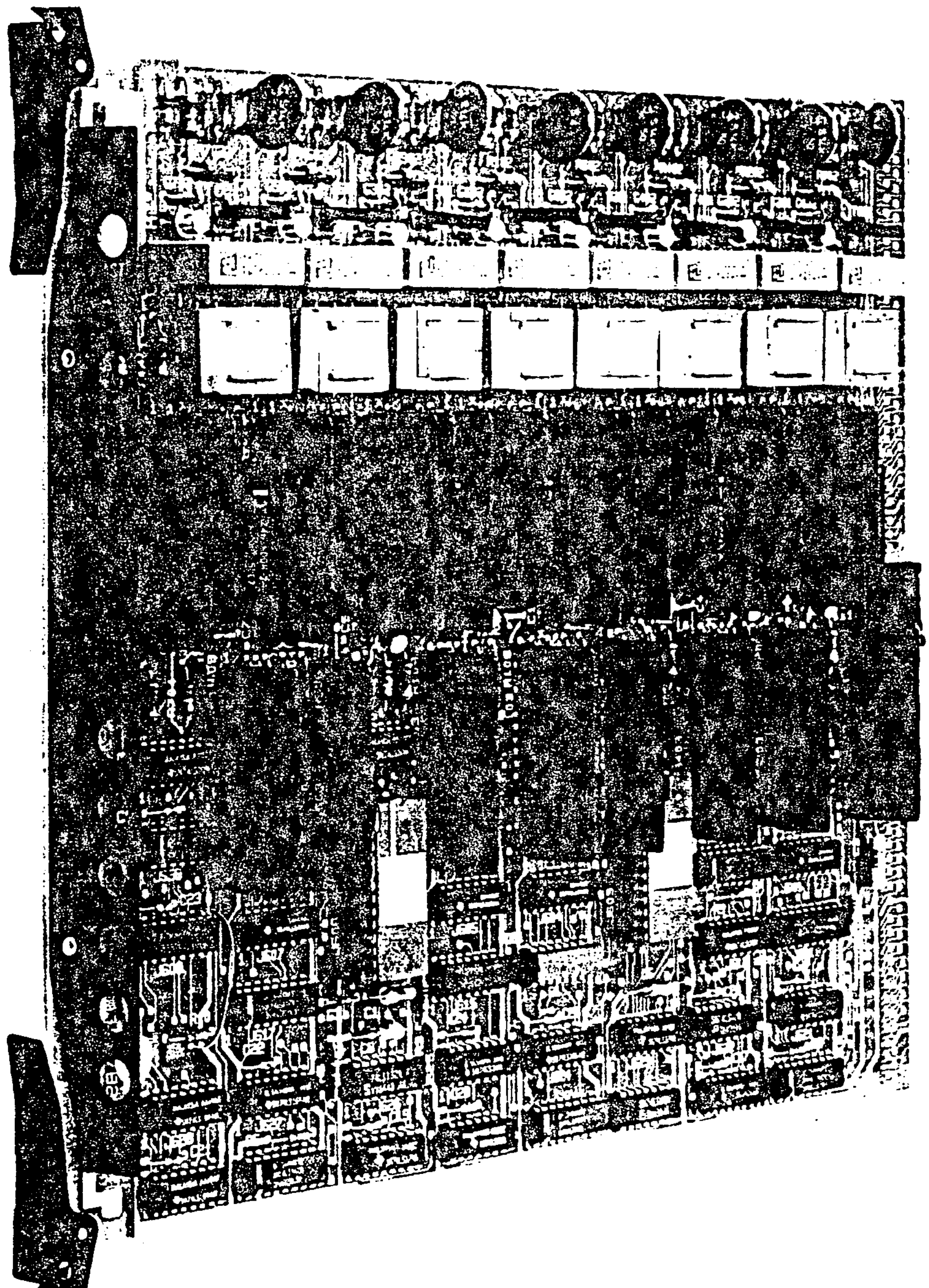
Figure 4.30 SLMA-O PCB

Table 4.17 Subscriber Line Module Digital (SLMD) PCB (S30810-Q1724-X-*-B900)

DESCRIPTION:	The SLMD PCB provides an interface between standard Siemens digital telephone (SDT) sets and the system. The SLMD PCB, shown in Figure 4.31 , contains eight circuits (0-7) and utilizes eight ports. 1. Indicators. One red LED which indicates the following status conditions: a. LED lit steadily – One or more of the line circuits are busy. b. LED extinguished – All assigned line circuits are idle and in-service. c. LED flashing – All assigned line circuits are idle and one or more line circuits are in the out-of-service state. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in any channel group in the basic or LTU shelf for optimum port usage. Refer to Section 2.00 of this practice for details.



F16
~~FX6~~

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Figure 4.31 SLMD PCB

Table 4.18 Subscriber Line Analog – 16 Line(SLA16) PCB (S30810-Q1790-X-*-B900)

DESCRIPTION:	The SLA16 PCB, shown in Figure 4.32, provides sixteen interfacing circuits (0-7 for upper half and 0-7 in virtual slot for lower half) between rotary dial and/or DTMF stations and the system. 1. Indicators. One green LED which indicates the following status conditions: a. LED lit steadily – One or more of the line circuits are busy. b. LED extinguished – All assigned line circuits are idle and in-service. c. LED flashing – All assigned line circuits are idle and one or more line circuits are in the out-of-service state. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in any channel group in the basic or LTU shelf for optimum port usage. Refer to Section 2.00 of this practice for details.

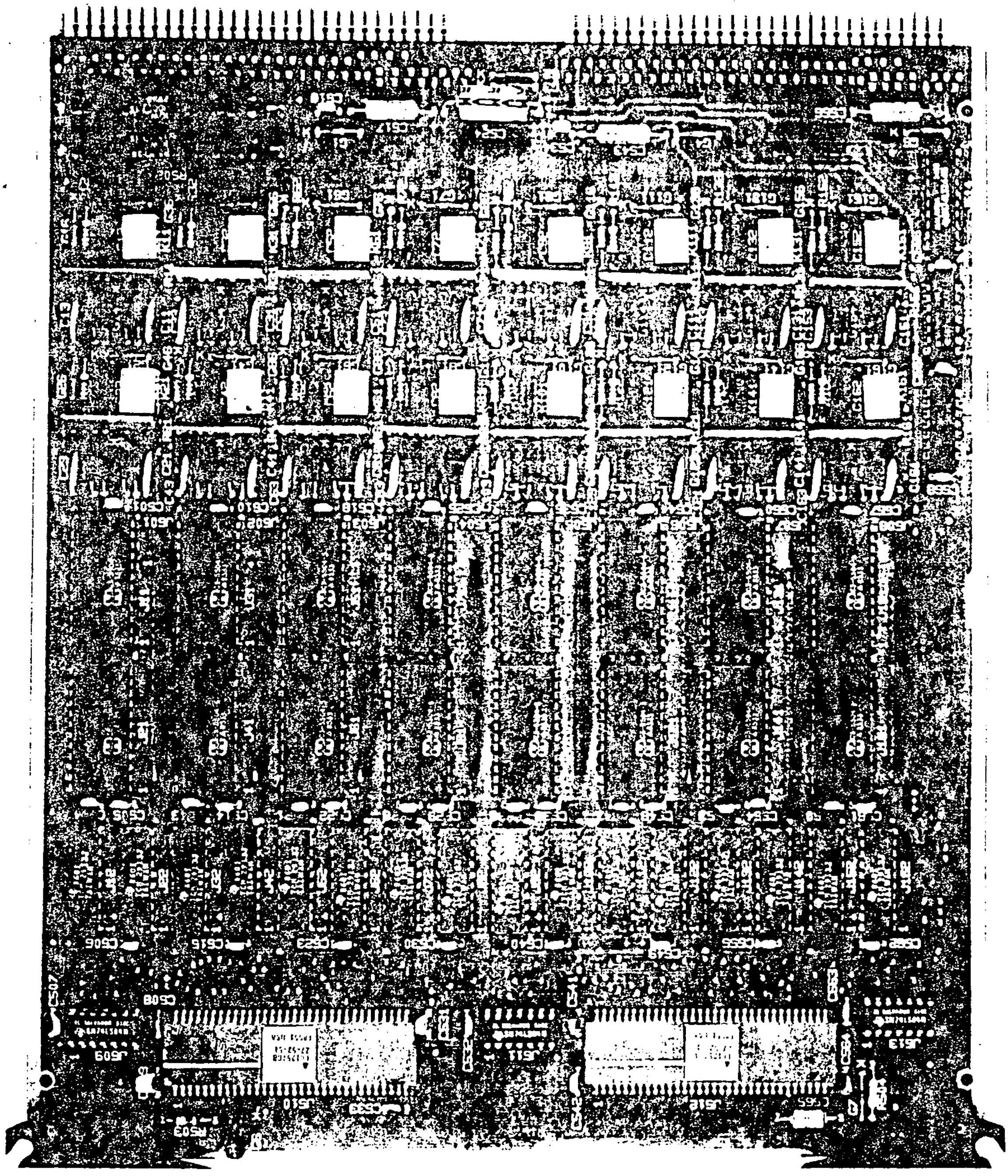

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Figure 4.32 SLA16 PCB

Table 4.19 Central Office Trunk (TMBM) PCB (S30810-Q414-X-*-B900)

DESCRIPTION:	Refer to Figure 4.33 for a typical layout of a trunk-type PCB. The TMBM PCB, shown in Figure 4.34, contains four trunk circuits (0, 2, 4, and 6) utilizing four ports. Each TMBM circuit provides a two-wire loop interface between the system and a central office (CO) trunk. The trunk circuits send and receive dc supervisory signals and perform the analog-to-PCM and PCM-to-analog transformation into and out of the System highways. The TMBM PCB is also known as the CO Trunk (COT) PCB. 1. Indicators. There are four red LEDs (TC0, TC2, TC4, and TC6) on the faceplate of the PCB. Each LED indicates the following status conditions of the for assigned trunk circuits: a. LED steadily lit – The associated trunk circuit is busy. b. LED extinguished – The associated trunk circuit is idle and inservice. The LED always remains extinguished for unassigned trunk circuits. c. LED flashing – The associated trunk circuit is idle and in the out-ofservice state. 2. Switches. None. 3. Strapping Options. The TMBM PCB provides strapping options for ground-start or loop-start signaling, as well as return loss termination (600 Ohms or OPS compromise network) by means of reversible balance board. Refer to Figure 4.34 for the strapping assignments.
OBSERVATIONS:	When the Code Calling feature is used, one TMBM port can be assigned for that feature.
INSTALLATION PROCEDURES:	Locate in any channel group in the basic or LTU shelf for optimum port usage. Refer to Section 2.00 of this practice for details.

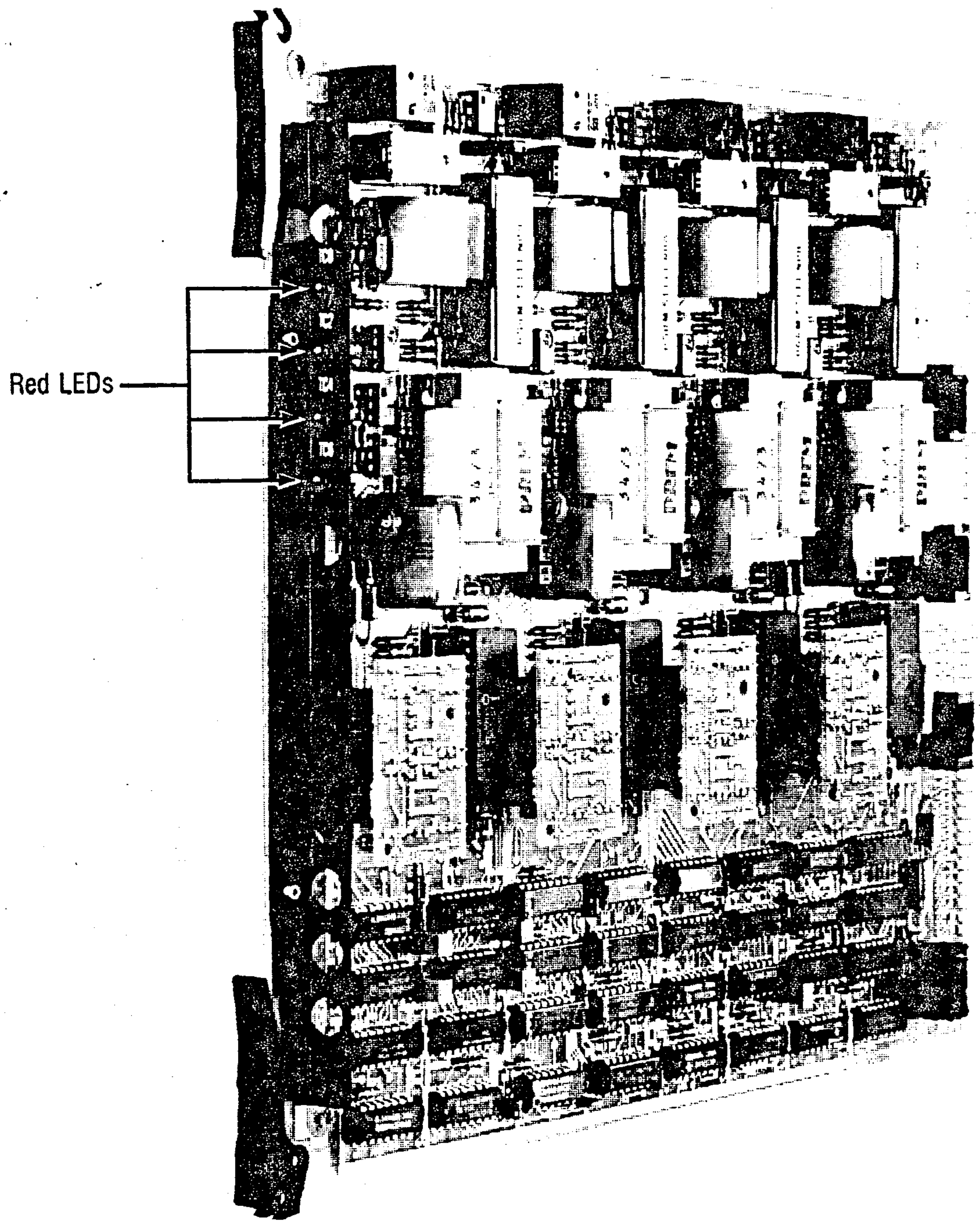

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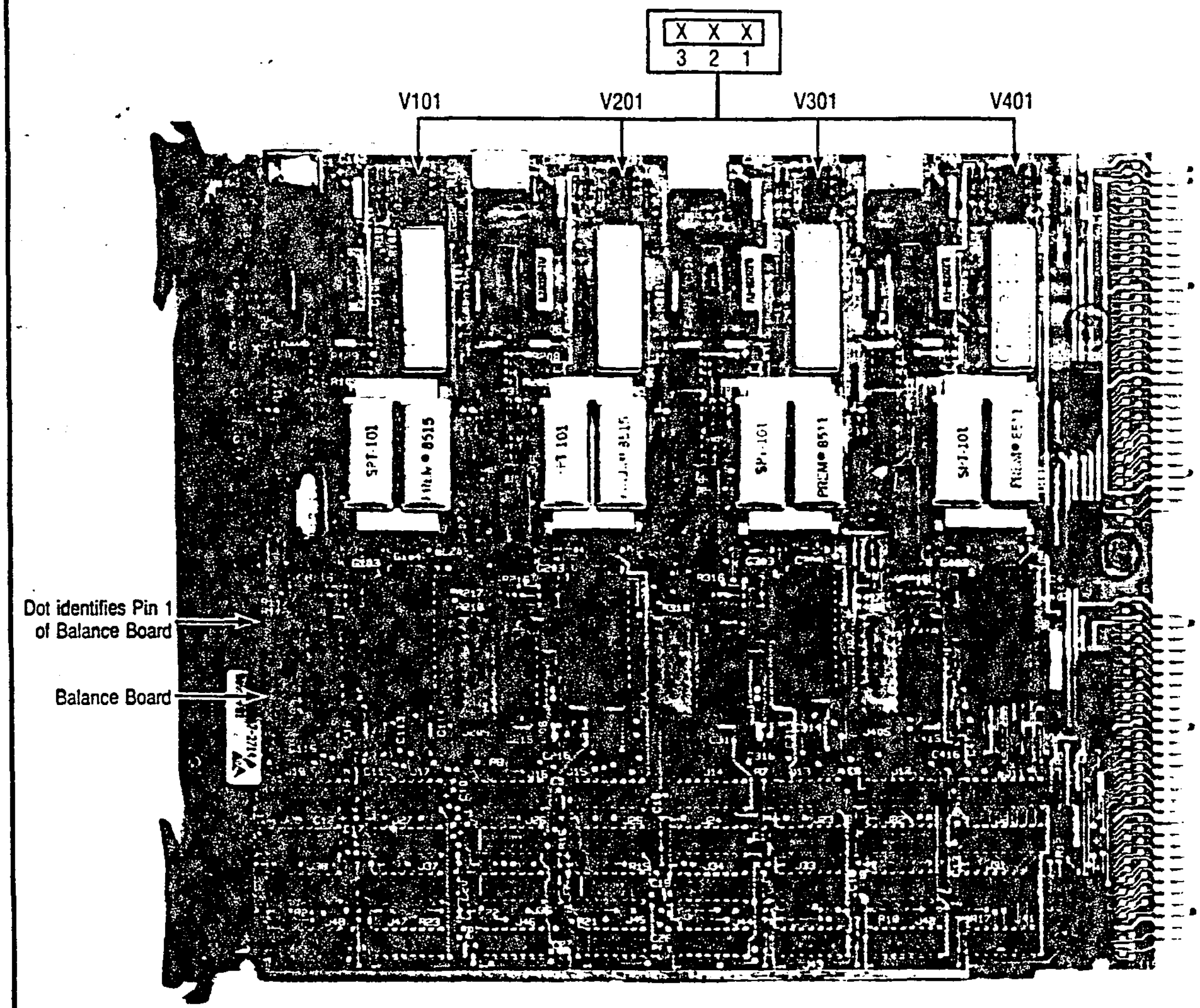
Figure 4.33 Typical Layout of a Trunk-Type PCB

Function	Jumper	Pins
GND Start	V101-V401	1 to 2
Loop Start*	V101-V401	2 to 3



Balance Board Return Loss

A. With pin one of balance board in pin one of balance board socket (as shown above) the return loss termination is: 600 Ohms +2.16μF.

B. With pin one of balance board in pin twelve of balance board socket (reverse), the return loss termination is: nominal 900 Ohms.

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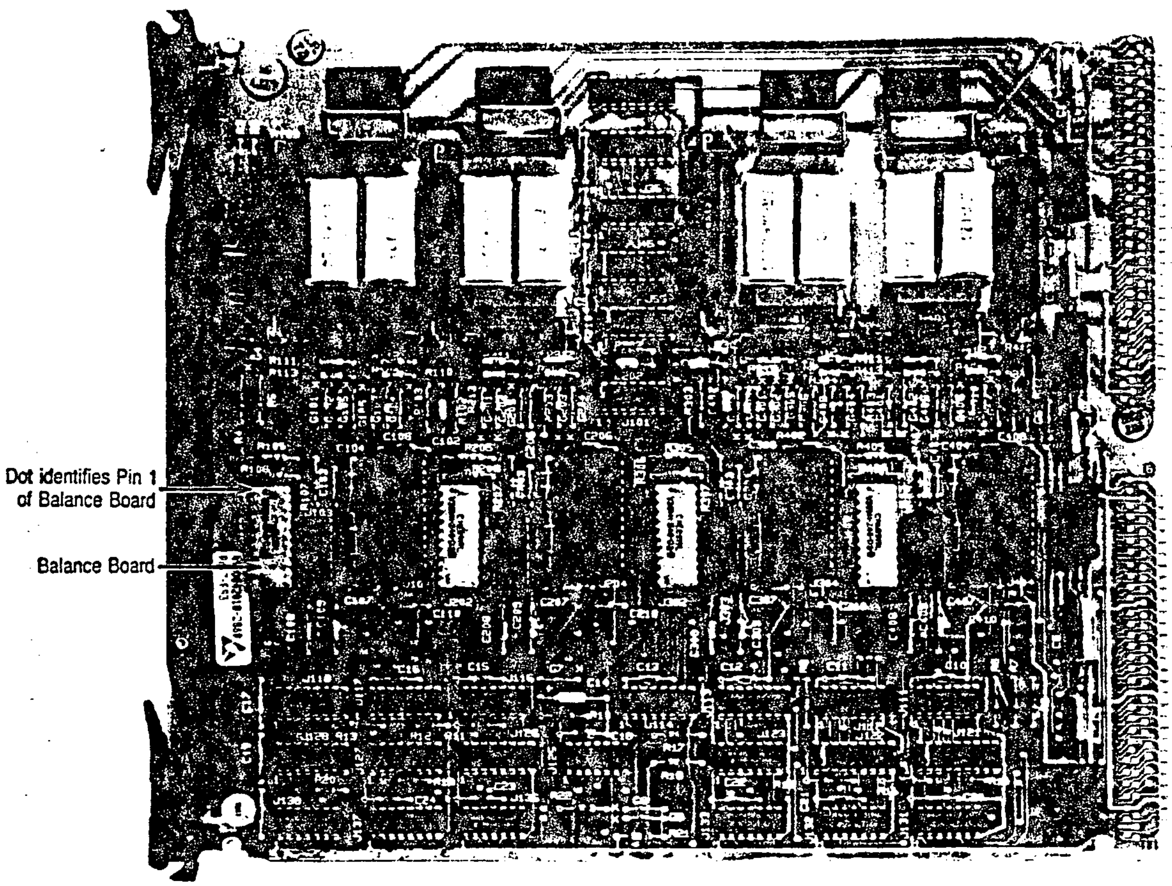
Figure 4.34 TMBM PCB

Table 4.20 Direct Inward Dialing Trunk (TMIE) PCB (S30810-Q415-X-*-B900)

DESCRIPTION:	The TMIE PCB, shown in Figure 4.35, contains four trunk circuits (0, 2, 4, and 6) utilizing four ports. Each TMIE trunk circuit provides direct inwarddialing service from a CO to the system . The trunk circuits send and receive dc supervisory signals, provide loop battery, and perform the analog to PCM and PCM to analog transformation. The TMIE PCB is also referred to as a DID trunk board. 1. Indicators. There are four red LEDs (TC0, TC2, TC4, and TC6) on the faceplate of the PCB. Each LED indicates the following status conditions of one of the four assigned Trunk Circuits: a. LED steadily lit - The associated trunk circuit is busy. b. LED extinguished - The associated trunk circuit is idle and in-service. The LED always remains extinguished for unassigned trunk circuits. c. LED flashing - The associated trunk circuit is idle and in the out-of-service state. 2. Switches. None. 3. Strapping Options. Balance board options for return loss termination (600 ohms or OPS compromise network) are shown on Figure 4.35.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in any channel group in the basic or LTU shelf for optimum port usage. Refer to Section 2.00 of this practice for details.



Balance Board Return Loss

A. With pin one of balance board in pin one of balance board socket (as shown above) the return loss termination is: 600 Ohms +2.16μF.

B. With pin one of balance board in pin twelve of balance board socket (reverse), the return loss termination is: nominal 900 Ohms.

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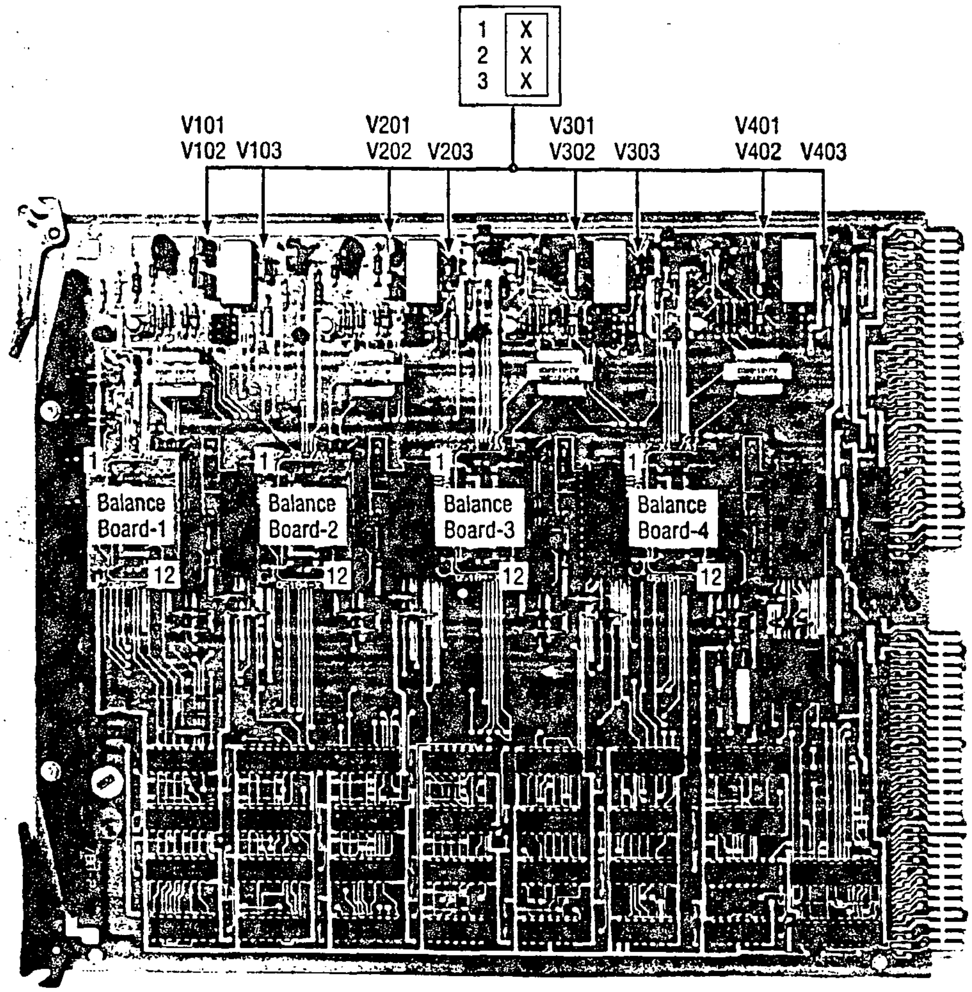
Figure 4.35 TMIE PCB

Table 4.21 Two-Wire E&M Trunk (TMBA-2) PCB (S30810-Q429-X-*-B900)

DESCRIPTION:	The TMBA-2 (E&M signaling) PCB, shown in Figure 4.36, provides either one-way or two-way incoming and outgoing trunk service. The TMBA-2 PCB contains four separate two-wire trunk circuits (0, 2, 4, and 6) utilizing four ports. Each trunk circuit provides a 2-wire voice pair and E&M signaling leads between the system and a distant PABX or signaling equipment. The trunk circuits send and receive dc supervisory signals and perform the analog-to-PCM and PCM-to-analog transformation into and out of the SATURN System highways. 1. Indicators. There are four red LEDs (TC0, TC2, TC4, and TC6) on the faceplate of the PCB. Each LED indicates the following status conditions of one of the four assigned trunk circuits a. LED steadily lit – The associated trunk circuit is busy. b. LED extinguished – The associated trunk circuit is idle and in-service. The LED always remains extinguished for unassigned trunk circuits. c. LED flashing – The associated trunk circuit is idle and in the out-of-service state. 2. Switches. None. 3. Strapping Options. The TMBA-2 PCB provides strapping options for E&M signaling (type I, IA, or II), as well as return loss termination (600 Ohms or OPS compromise network) via balance boards. Refer to Figure 4.36 for the strapping assignments.
OBSERVATIONS:	When the Paging (with Answerback) feature is used, from one to four TMBA-2 ports can be assigned for each page zone.
INSTALLATION PROCEDURES:	Locate in any channel group in the basic or LTU shelf for optimum port usage. Refer to Section 2.00 of this practice for details.



TMBA2 PCB E&M Signaling Table

Function	Jumper	Pins	Jumper	Pins	Jumper	Pins	Comments
Type I*	V101 V201 V301 V401	1 to 2	V102 V202 V302 V402	1 to 2	V103 V203 V303 V403	2 to 3	Provides two E&M MDF signaling leads: E/M (or EA/MA).
Type IA	V101 V201 V301 V401	Open	V102 V202 V302 V402	2 to 3	V103 V203 V303 V403	1 to 2	This private line type interface is similar to above but is only used in Europe; information upon request.
Type II	V101 V201 V301 V401	2 to 3	V102 V202 V302 V402	2 to 3	V103 V203 V303 V403	Open	Provides four E&M MDF signaling leads: E/SG/M/SB (or EA/EB/MA/MB).

* = Factory-Strapped

NOTE: The latest Balance Board is a hybrid ceramic DIP where pin 1 is identified by a dot.

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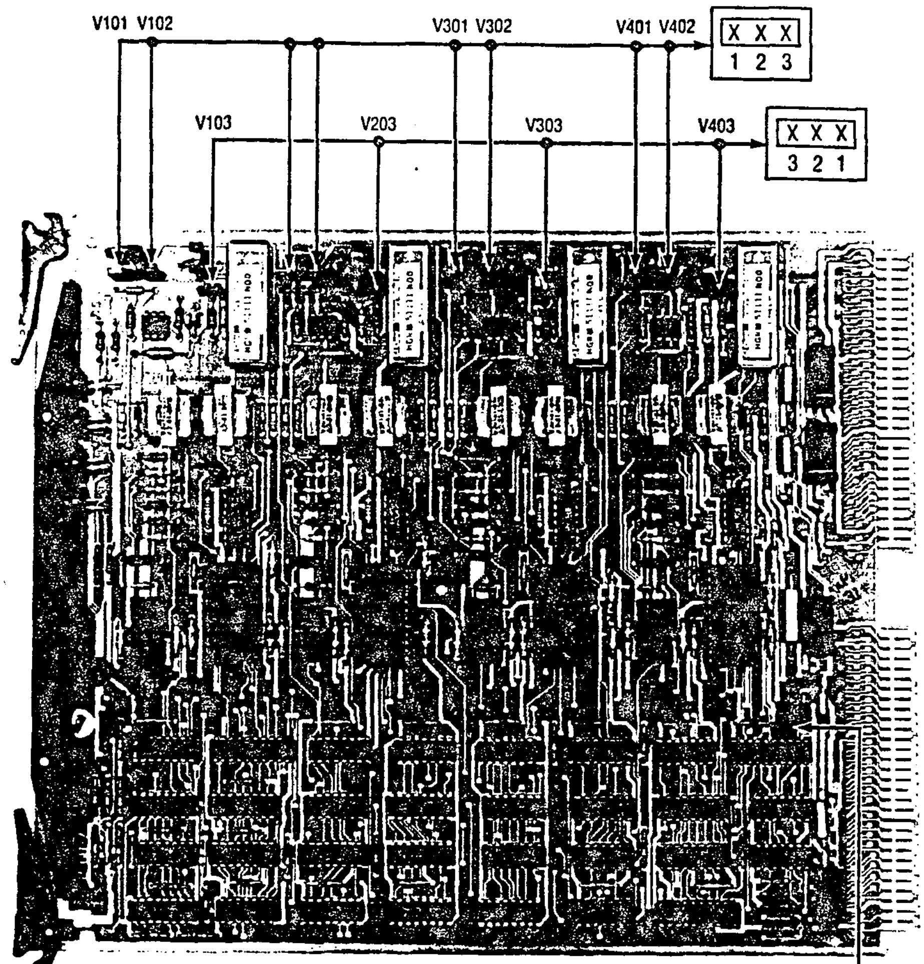
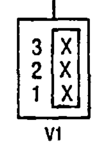
Figure 4.36 TMBA-2 PCB

Table 4.22 Four-Wire E&M Trunk (TMBA-4) PCB (S30810-Q430-X- * -B900)

DESCRIPTION:	The TMBA-4 (E&M type signaling) PCB, shown in Figure 4.37, provides either one-way or two-way incoming and outgoing service. The TMBA-4 PCB contains four separate four-wire trunk circuits (0, 2, 4, and 6) utilizing four ports. Each trunk circuit provides a voice transmit pair, a voice receive pair and E&M signaling leads between the system and a remote PABX or signaling equipment . The trunk circuits send and receive dc supervisory signals and perform the analog-to-PCM and PCM-to-analog transformation into and out of the system highways. 1. Indicators. There are four red LEDs (TC0, TC2, TC4, and TC6) on the faceplate of the PCB. Each LED indicates the following status conditions of one of the four assigned trunk circuits: a. LED steadily lit – The associated trunk circuit is busy. b. LED extinguished – The associated trunk circuit is idle and in-service. The LED always remains extinguished for unassigned trunk circuits. c. LED flashing – The associated trunk circuit is idle and in the out-of-service state. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	1. When the Paging (without Answer back) feature is used, from one to four TMBA-4 ports can be assigned for each page zone. 2. When the Intercept Announcement feature is used, only one TMBA-4 port can be assigned for that feature. 3. When the ACD Announcement feature is used, only one TMBA-4 port can be assigned for that feature. 4. When the Music on Hold feature is used, only one TMBA-4 port can be assigned for that feature.
INSTALLATION PROCEDURES:	Locate in any channel group in the basic or LTU shelf for optimum port usage. Refer to Section 2.00 of this practice for details.





TMBA4 PCB E&M Signaling Strap Table

Function	Jumper	Pins	Jumper	Pins	Jumper	Pins	Comments
Type I*	V101 V201 V301 V401	1 to 2	V102 V202 V302 V402	2 to 3	V103 V203 V303 V403	1 to 2	Provides two E&M MDF signaling leads: E/M (or EA/MA).
Type IA	V101 V201 V301 V401	Open	V102 V202 V302 V402	1 to 2	V103 V203 V303 V403	2 to 3	This private line type interface is similar to above but is only used in Europe; information upon request.
Type II	V101 V201 V301 V401	Open	V102 V202 V302 V402	Open	V103 V203 V303 V403	2 to 3	Provides four E&M MDF signaling leads: E SG M SB (or EA EB MA MB).
Dial P1*	V1	1 to 2					Normal position (do not alter strap).
Dial P2	V1	2 to 3					Future use (do not use).

(* = Factory-Strapped)

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Figure 4.37 TMBA-4 PCB

Table 4.23 Parallel/Serial Converter (PSC) PCB (S30810-Q419-X10-*-B900)

DESCRIPTION:	The PSC PCB, shown in Figure 4.38, converts the serial Pulse Code Modulation (PCM) voice signals to parallel signals and multiplexes these signals onto an eight-bit parallel highway. These parallel signals are then transferred to the MCA board for further processing. The reverse function is also performed by the PSC when the signals are returned from the MCA for forwarding to the peripheral circuits. 1. Indicators. None. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in basic shelf slots 20 and 22.

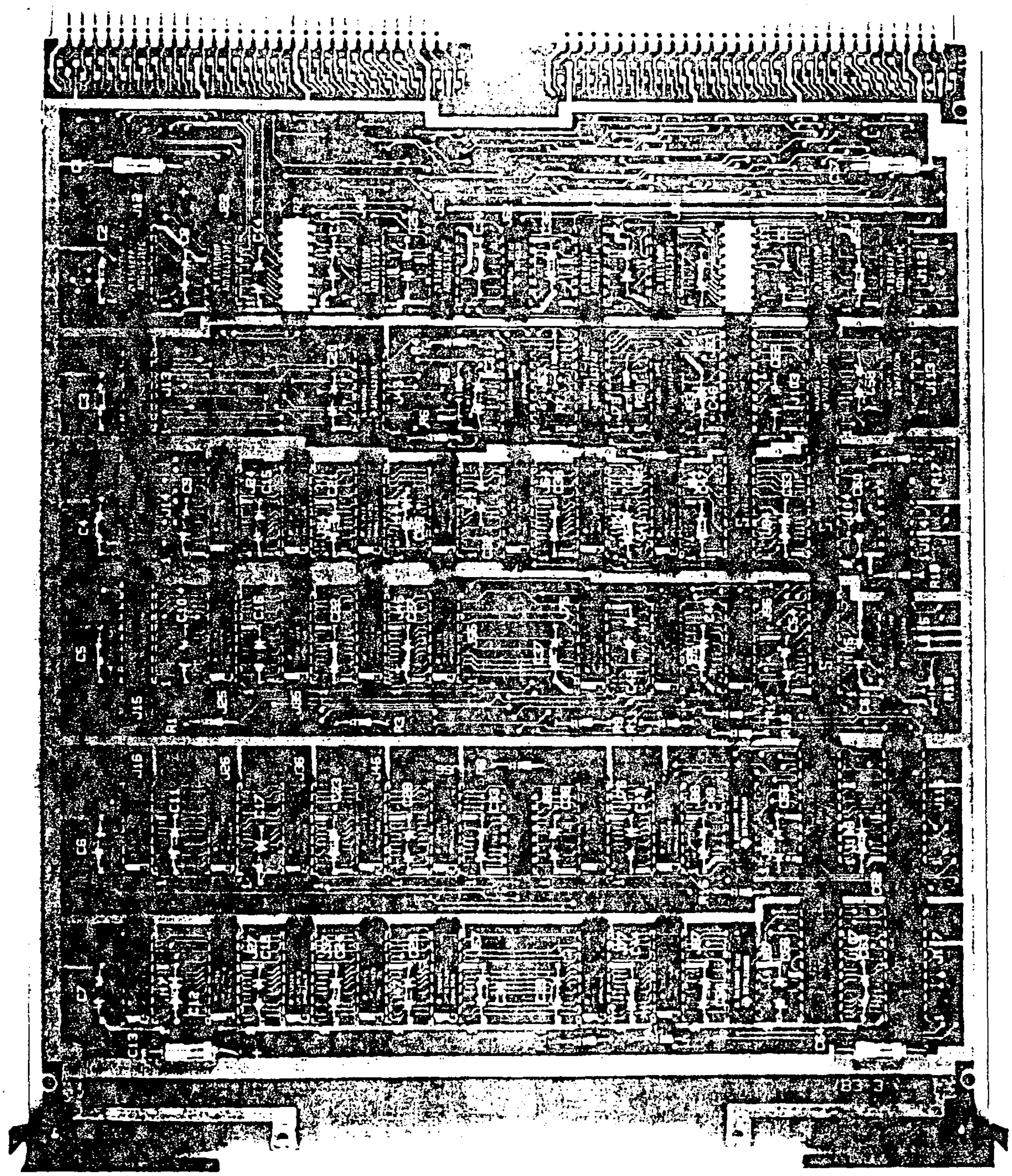

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Figure 4.38 PSC PCB

Table 4.24 Signal Multiplexer/Clock/Tone Generator (SMXTG) PCB (S30810-Q1791-X-★-B900)

DESCRIPTION:	The SMXTG PCB, shown in Figure 4.39, is divided into three functional parts: the signal multiplexer, the clock generator, and the tone generator. The SMXTG is a hardware-controlled scanner/distributor which provides an interface between the line/trunk units and the CIOP and handles control and status signals. The clock generator produces the 8.192MHz, 4.096MHz, 2.048MHz, and 250Hz clocking signals required to operate the system. The tone generator provides various tone outputs from which all the system DTMF tones and supervisory tones are derived. The tone generator also provides a square wave timing signal for system generated dial pulses. 1. Indicators. None. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in the basic shelf slot 21.

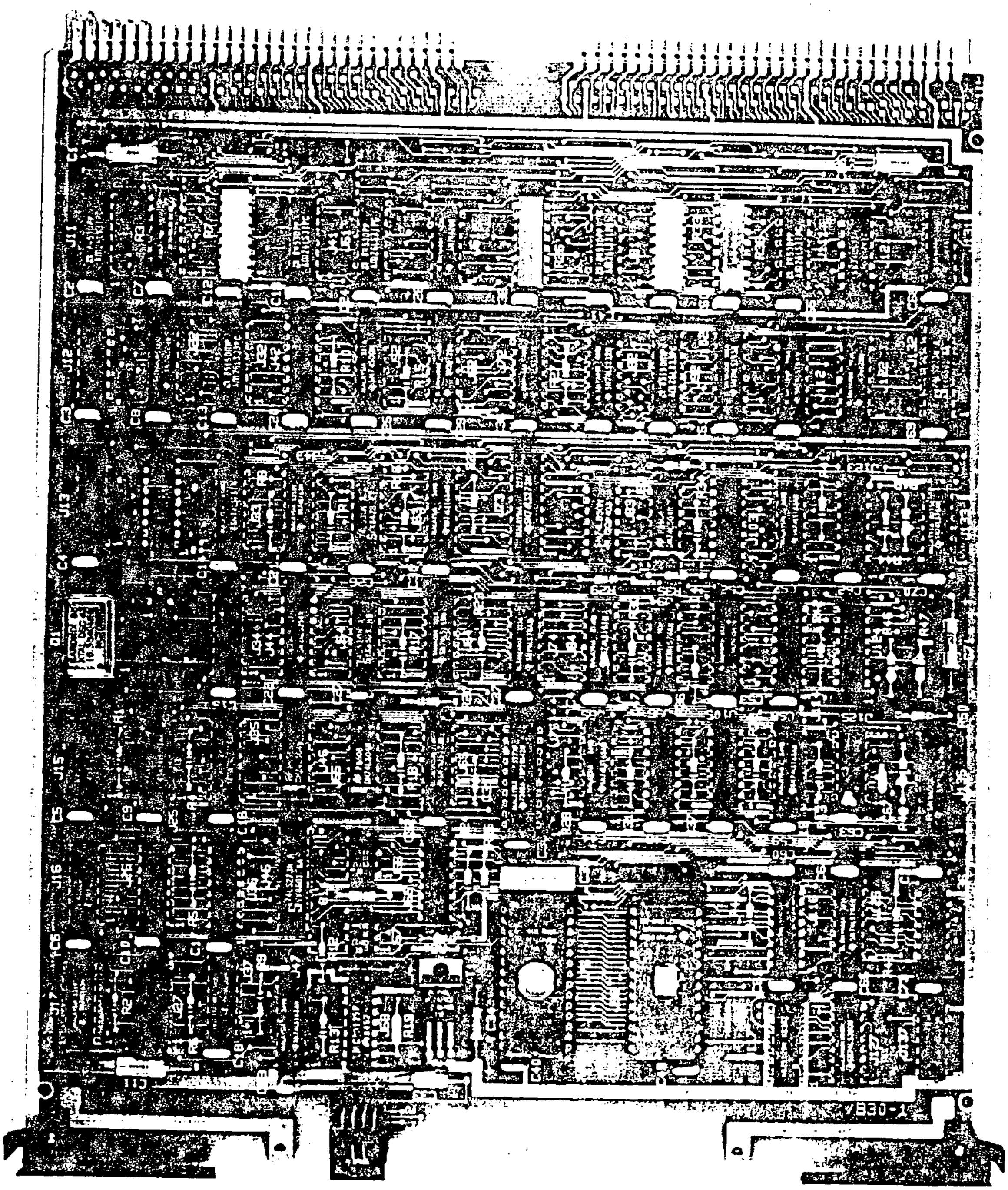

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Figure 4.39 SMXTG PCB

Table 4.25 Conference (CONF) PCB (S30810-Q417-X-*-B900)

DESCRIPTION:	The CONF PCB, shown in Figure 4.40, makes all connections involving three to eight ports. The PCB provides four, 8-port and twenty-four 24, 4-port conference circuits. A maximum of two conference PCBs, CONF0 and CONF1, can be allocated in a LTU shelf. CONF0 PCB is standard with the system, CONF1 is optional. 1. Indicators. None. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in the basic shelf slot 23.

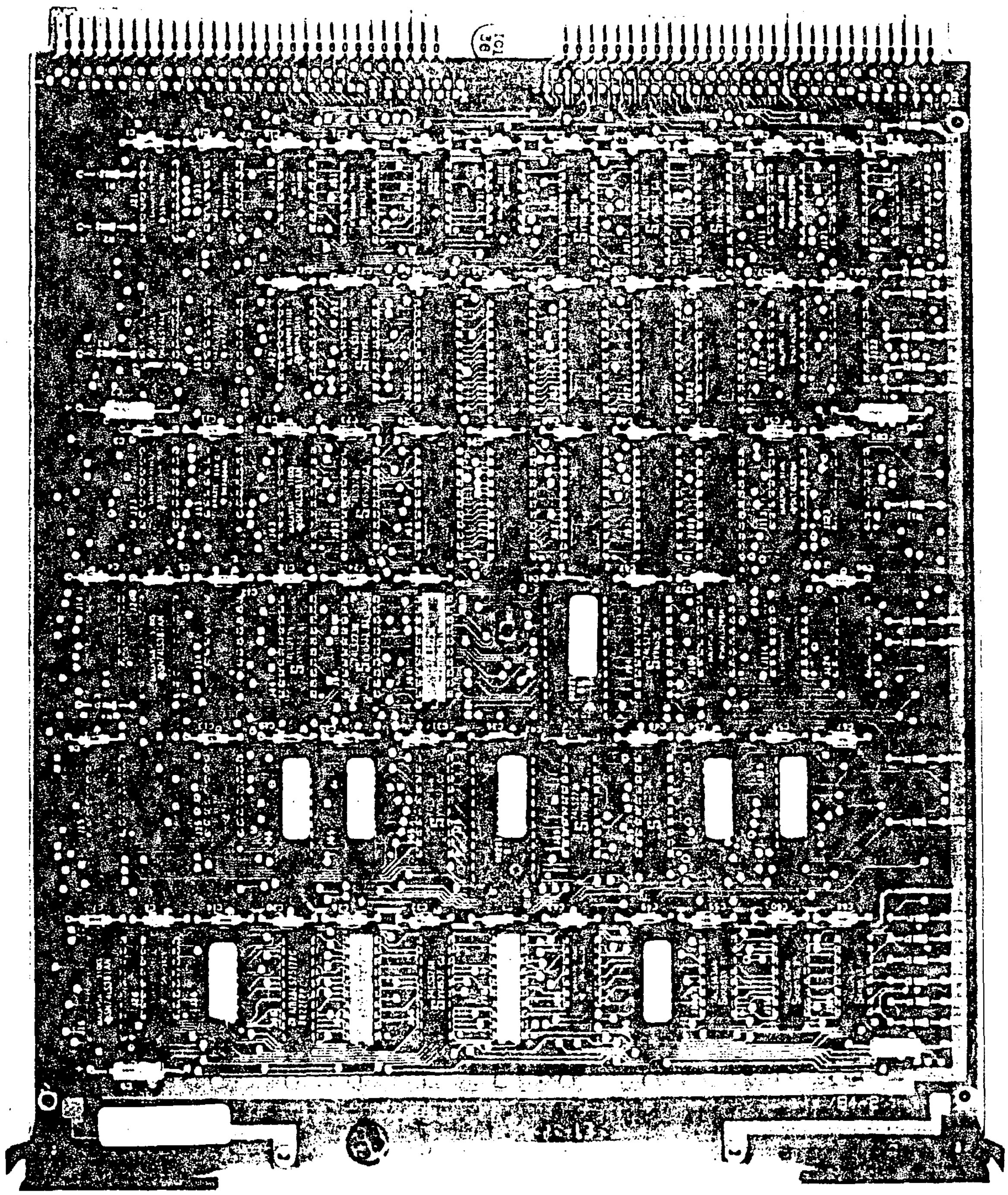

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Figure 4.40 CONF PCB

Table 4.26 Memory Control and Attenuation (MCA) PCB (S30810-Q416-X-*-B900)

DESCRIPTION:	The MCA PCB, shown in Figure 4.41, is divided into two functional parts: a Time Switch Unit (TSU) and a controller. The TSU makes all port connections and provides attenuation for all calls being processed in the system. The controller receives control data from the main central processor and causes the TSU and conference unit(s) to make the required connections. 1. Indicators. None. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in the basic shelf slot 24.

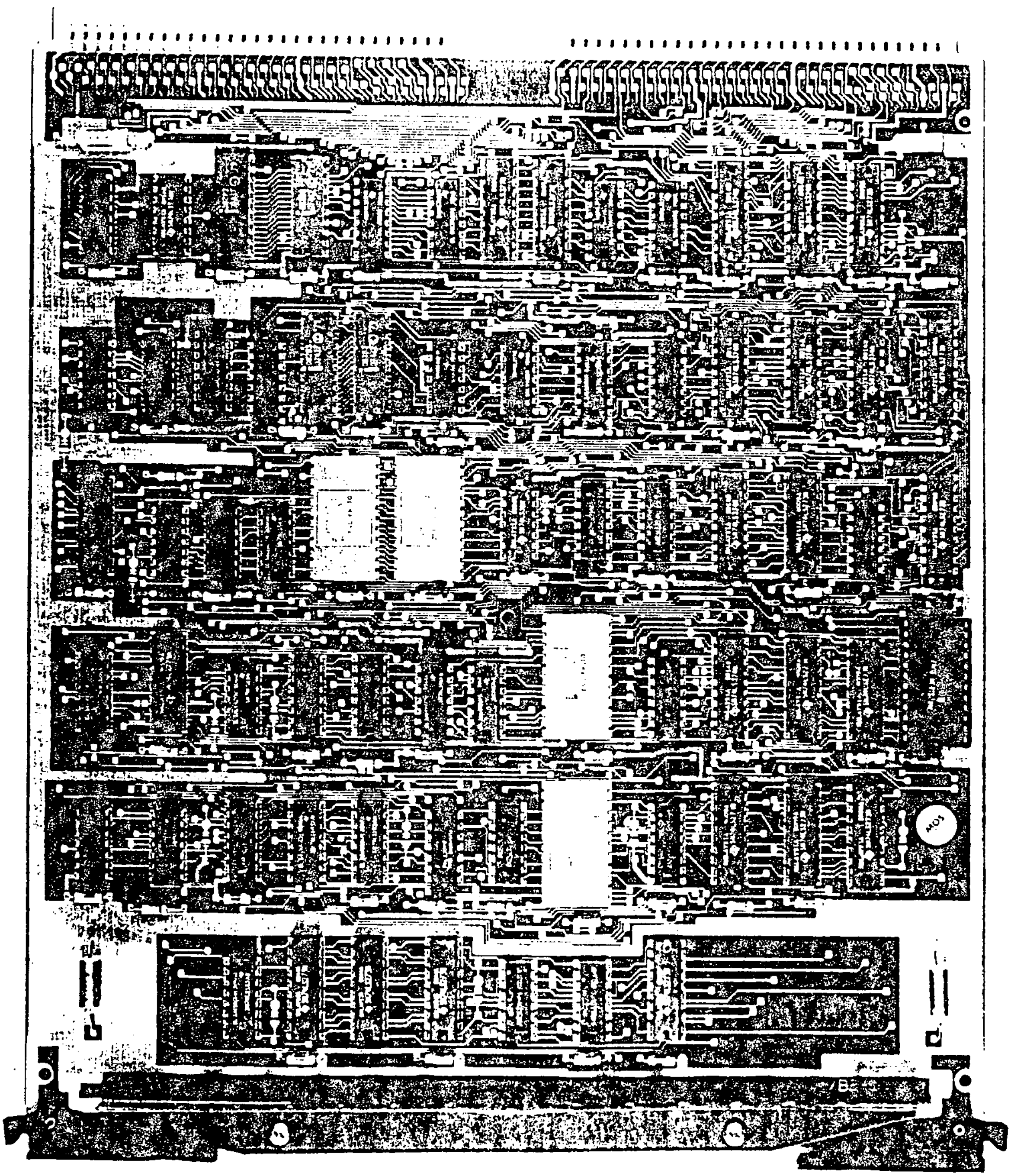

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Figure 4.41 MCA PCB

Table 4.27 Remote Access Unit/Ports (RAUP) PCB (S30810-Q1792-X- * -B900)

DESCRIPTION:

The RAUP PCB, shown in Figure 4.42, contains a built in modem and interfaces with the CIOP, MCA and MEM for the transfer of data to and from terminals and the modem port. It supports three serial ports which can be connected to any device that supports serial communication. Two of the ports are RS232 type for TTY0 and TTY1 interfaces, the third is a 212A modem port for communications from a remote terminal.

Note: The RAUP Module is required in the system.

The 212A modem port is answer only; no call origination capabilities exist. The port is equipped with a loop-start trunk circuit and can interface with an SLMA or directly to a TELCO trunk. Firmware causes the modem to self-set to 300 or 1200 baud to match the incoming baud rate. The default baud rate is 300. Programmable via CMU controlled options are:

Data Bits 7 or 8	(Default 7)
Stop Bits 1 or 2	(Default 1)
Parity or No Parity	(Default Parity)
Parity Odd or Even	(Default Even)

Both RS232 serial ports are configured as Data Communications Equipment (DCE). The baud rate is programmable via CMU for both ports. Any of the following 6 baud rates are available. The default baud rate is 9600.

110	300	1200
2400	4800	9600

Connections can be made to the RAUP PCB after insertion in slot 25. Any desired RS-232-C type device(s) with a DTE interface (25 pin D-type male) can be connected to the RAUP TTY0 or TTY1 ports. TTY0 is the upper connector and TTY1 is the lower connector. The desired port configuration for TTY0 and TTY1 for baud rate, number of data bits, and parity may have to be adjusted via the system service terminal to successfully communicate with the connected device. The modem port is connected upon card insertion to a tip and ring pair that terminate at the back Saturn IIE common control back plane at interface plug J44 pins 24 and 49, respectively. From this point the pair can be connection to a patch block for external connection to a trunk or station line.

1. Switches. None.
2. Strapping Options. None.

OBSERVATION:

There is one green LED; when lit indicates that the modem port is in use.

WARNING

The RAUP PCB contains CMOS circuitry, which can be damaged by static electricity. Anti-static bags should be used when the RAUP PCB is shipped or stored. Whenever possible, a grounding strap should be worn by personal handling the RAUP PCB.

INSTALLATION PROCEDURES:

Locate in the basic shelf slot number 25.

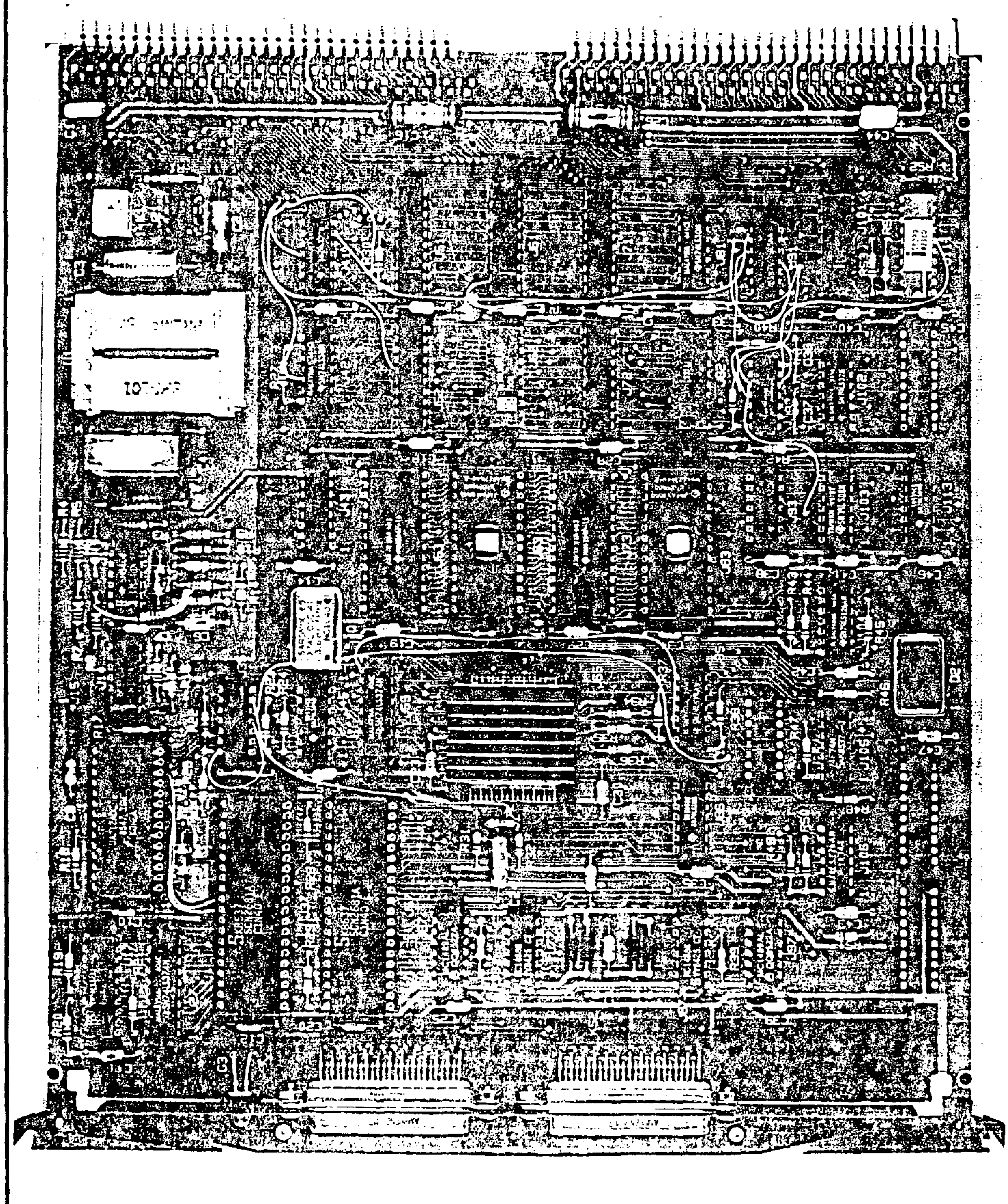

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Figure 4.42 RAUP PCB

Table 4.28 Controller/Input-Output Processor (CIOP) PCB (S30810-Q1789-X-*-B900)

DESCRIPTION:	The CIOP PCB, shown in Figure 4.43, contains the main central processor, which processes incoming data from the peripheral devices via the SMXTG, makes decisions based on the data received using instructions stored in memory and, as a result of these decisions, issues commands for call processing. The Signal Input Buffer (SIB) contains a processor which controls the CIOP TTY port. Software controlled options for TTY port are as follows: Data Bits 7 or 8 (Default 7) Stop Bits 1 or 2 (Default 1) Parity or No Parity (Default Parity) Parity Odd or Even (Default Even) 1. Indicator. There is one green LED. When lit it indicates that the TTY port is in use. 2. Switches. The TTY port is controlled by switch settings unless overridden by software. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in basic shelf slot number 26.

~~300 BAUD~~

DIPSWITCH SETTINGS:

	300	1200	2400	9600
3	0	1	0	1
4	0	0	1	1

	OPEN	CLOSED
1	O	
2	O	
3	O	300 BAUD
4	O	
5		1
6	O	
7	O	
8		1

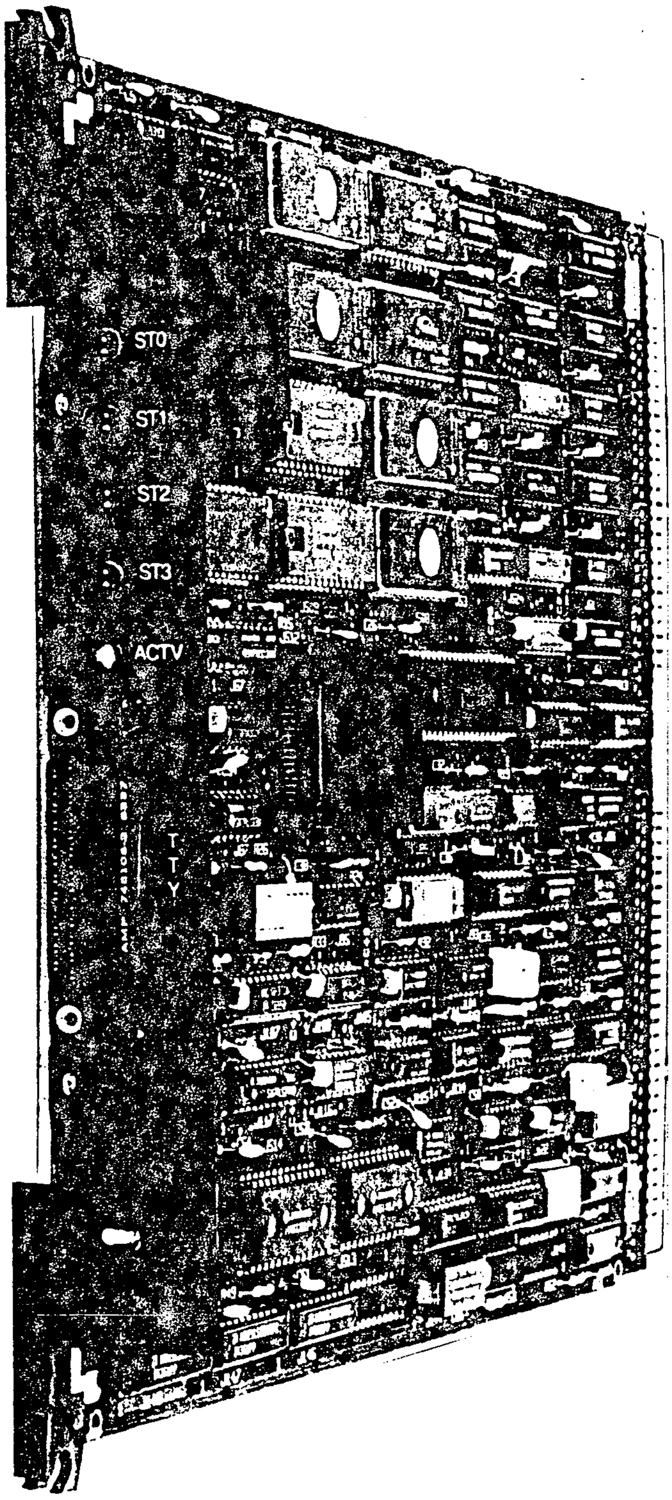

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Figure 4.43 CIOP PCB

Table 4.29 Memory 1.0 Megabyte (MEM4) PCB (S30810-Q1775-X-*-B900)

DESCRIPTION:	The MEM4 PCB, shown in Figure 4.44, provide 1.0 megabyte of dynamic Random Access Memory (RAM) and its supporting logic to store system data. The memory is organized as 512K words X 16 bits/word, and divided into 64K byte pages. Memory write protection is provided in 1K word segments. MEM4 is arranged for battery backup memory protection to safeguard stored data during short term power outages. Also, an Error-Correcting Code is provided to correct any single-bit errors and detect double-bit errors existing in a word. 1. Switches. None, 2. Strapping Options. MEM4 PCB V1 and V2 must be strapped as follows to provide for 1.0 megabyte of memory: V1 strapped between 1 and 2 V2 strapped between 2 and 3
OBSERVATIONS:	Check LEDs for normal indications (Refer to Maintenance and Troubleshooting Section)
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in basic shelf slot number 27.

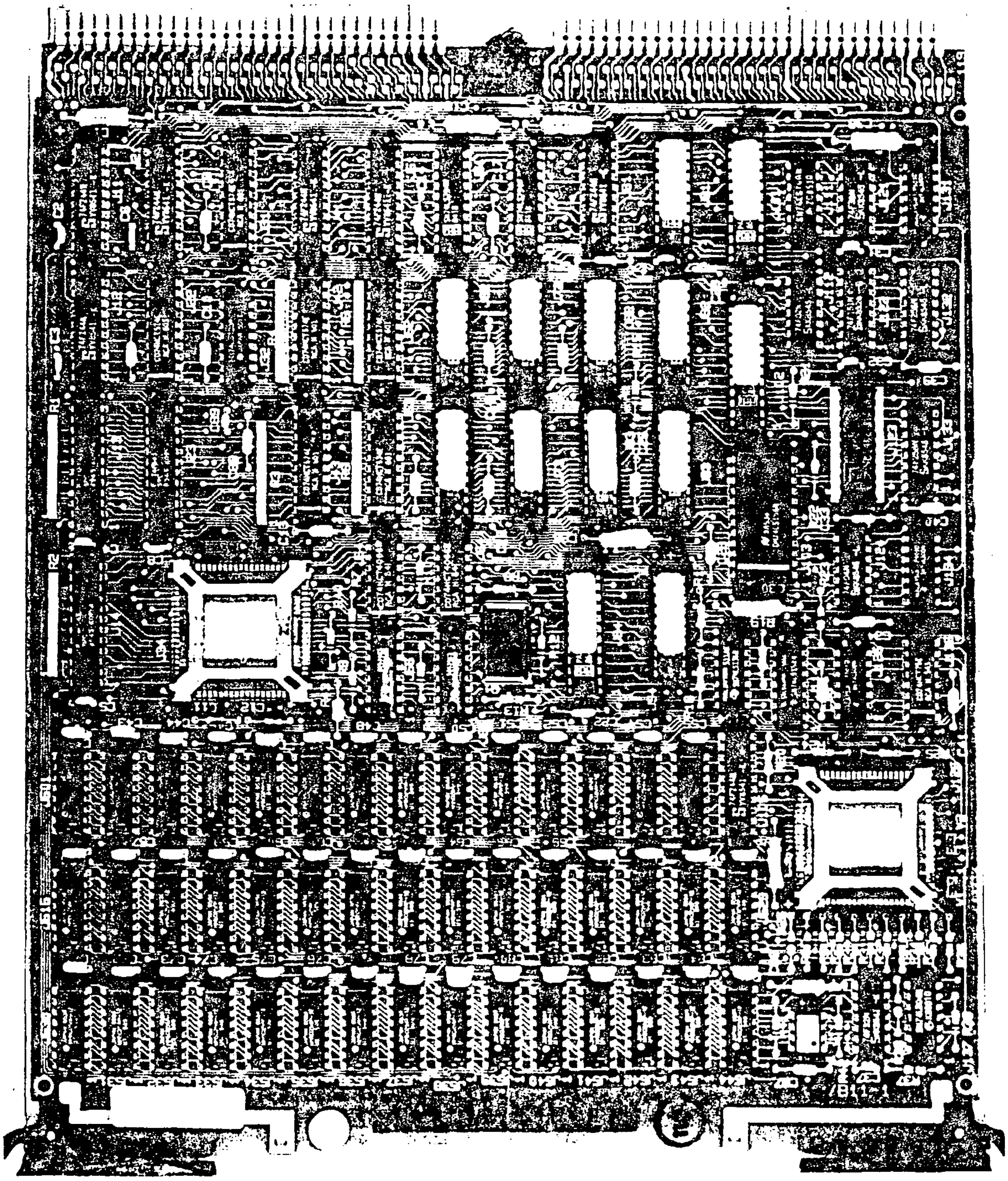

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Figure 4.44 MEM4 PCB

Table 4.30 Memory 256 Kilobyte (MEM3) PCB (S30810-Q1740-X-*-B900)

DESCRIPTION:	The MEM3 PCB, shown in Figure 4.45, provide 256 kilobytes of dynamic Random Access Memory (RAM) and its supporting logic to store system data. The memory is organized as 128K words X 16 bits/ word, with memory write protection provided in 1K word segments. MEM3 is arranged for battery backup memory protection to safeguard stored data during short term power outages. Also, an Error-Correcting-Code is provided to correct any single-bit errors and detect double-bit errors existing in a word. 1. Indicator. None. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in basic shelf slot number 28.

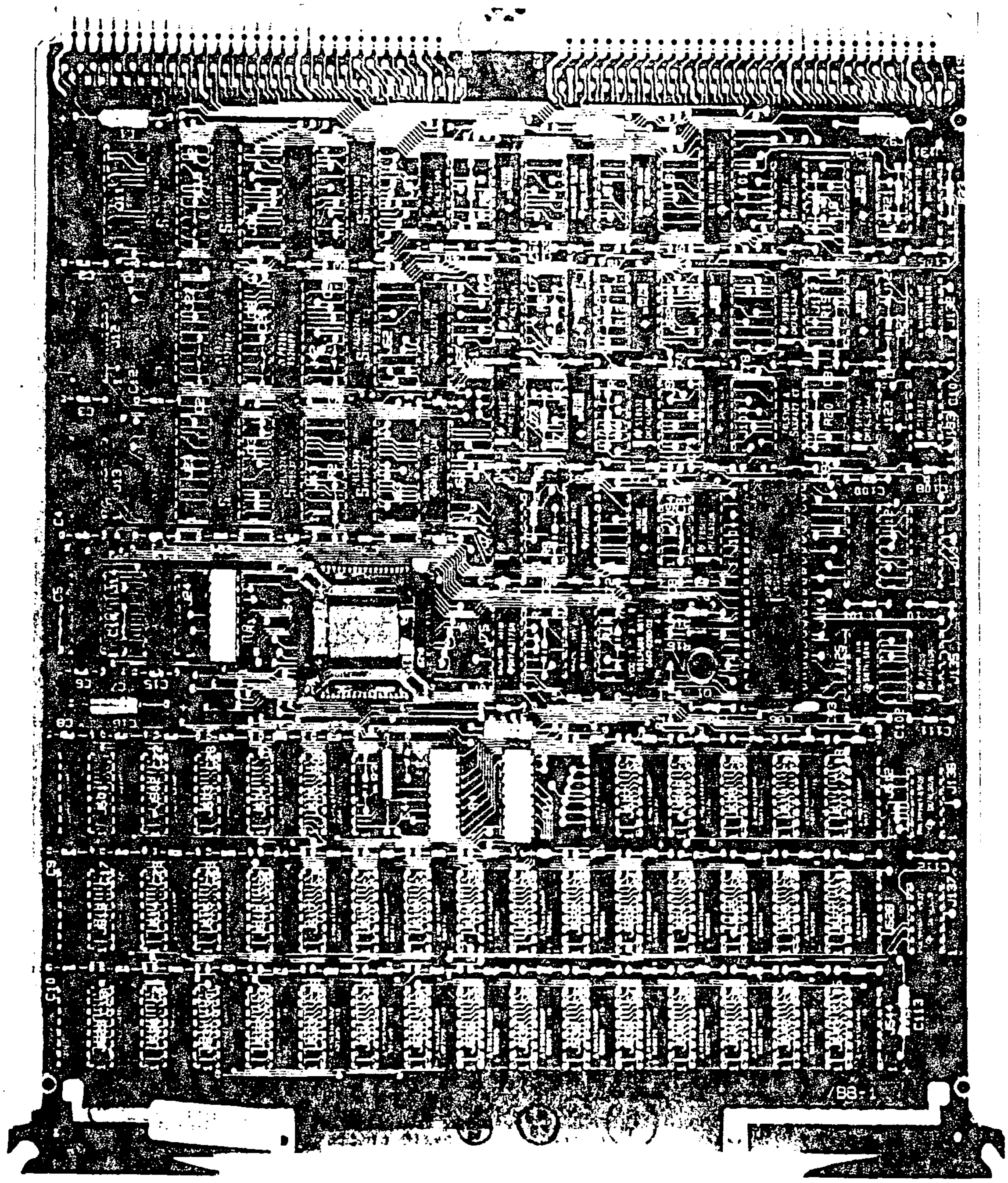

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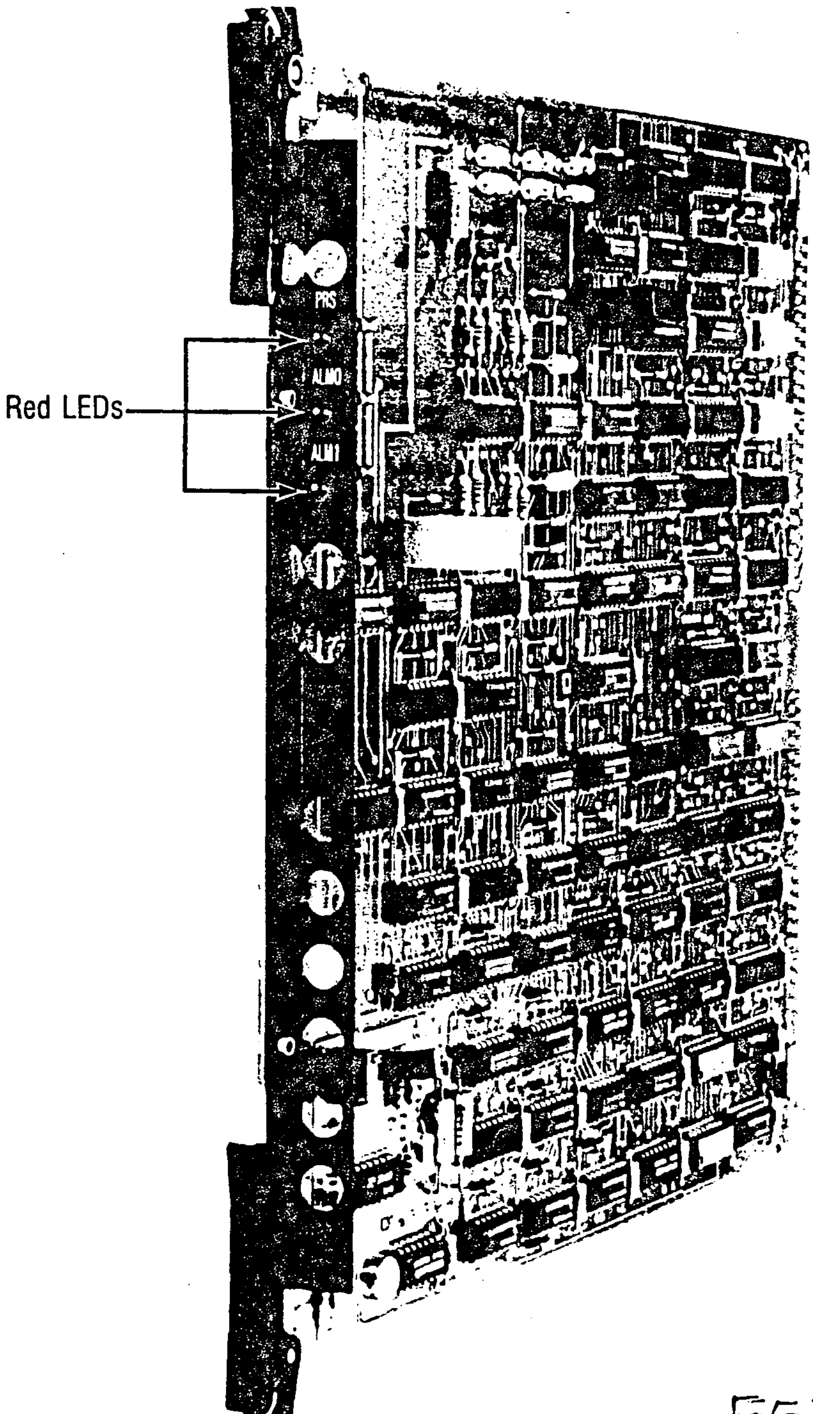
Figure 4.45 MEM3 PCB

Table 4.31 Line/Trunk Unit Control (LTUC) PCB (S30810-Q428-X-*-B900)

DESCRIPTION:	The LTUC PCB, shown in Figure 4.46, provides the timing signals necessary to address a line/trunk unit. It multiplexes and demultiplexes both signal and voice highways. It also provides fault monitoring and reporting of failures associated with the 128 ports it handles. 1. Indicators. Three red LEDs, designated PRS, ALM0, and ALM1, provide visual indications of existing malfunctions as follows: a. Protection Restore Signal (PRS), when steadily lit, indicates that one of the following malfunctions is present: 1. No common control on line. 2. +12Vdc under voltage. 3. -5Vdc under voltage. 4. -48Vdc under voltage. Note: The PRS is delayed 40 ms (nominal) after the occurrence of any one of the previous conditions: b. Alarm 0 (ALM0), when steadily lit, indicates that one of the following malfunctions is present: 1. Loss of CLK-A (2.048MHz clock) of common control 0 2. Loss of SYP (4ms time pulse) of common control 0 3. Loss of SYNR (ring sync) of common control 0 c. Alarm 1 (ALM1). ALM1 is not used in the SATURN IIE 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	Locate in LTU shelf slots 6 and 19.



F5 # 11

A5277-9-5/1/86

Figure 4.46 LTUC PCB

4.08 Attendant Console. The attendant console is used primarily to answer external calls (i.e., incoming trunk calls) and extend such calls to the appropriate internal stations. The console may also be used to assist in placing outgoing calls and handling special system functions such as paging, message waiting and conference calling. A maximum of 12 attendant consoles can be interfaced with a particular system. Refer to Table 4.32 for further information on the attendant console.

Table 4.32 Attendant Console (L30808-X5130-A8-★-B900)

DESCRIPTION:	The attendant console, shown in Section 2.00, is a desk-top unit with which the attendant processes calls and accesses special system features using pushbutton keys and an alphanumeric display. It is 46.99 cm (18.5 in.) wide, 13.08 cm (5.15 in.) high, and 26.47 cm (10.42 in.) deep. A telephone handset is furnished with the console. An optional headset may be substituted for the handset. 1. Indicators. None. 2. Switches. None. 3. Strapping Options. None.
OBSERVATIONS:	None.
INSTALLATION PROCEDURES:	1. Connect the modular coiled cord to the handset and console. 2. Connect the modular line cord into rear of console and a standard modular jack receptacle. Check that the connections in the modular jack receptacle coincide with those shown in Figure 4.47. 3. Insert the appropriate key labels into the plastic caps and lock into their corresponding positions in the console. 4. After the system has been tested, perform the appropriate MDF crossconnections to one PIMD circuit per console. Refer to Section 6.00 in this practice for details.

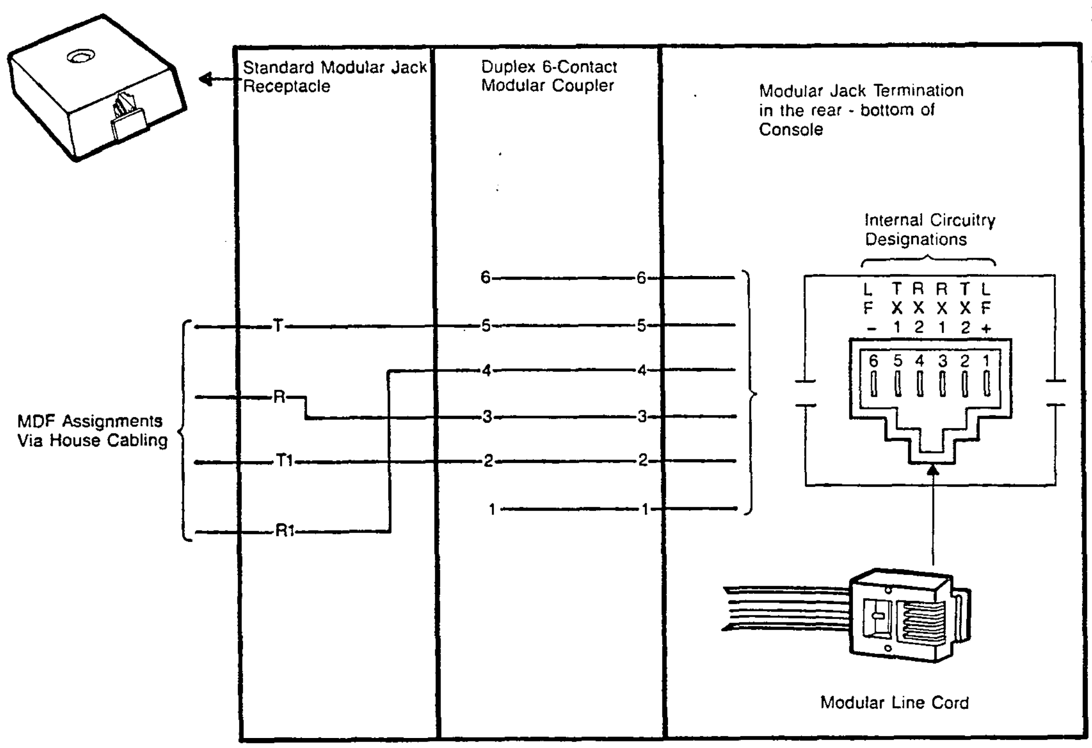


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Figure 4.47 Attendant Console Connections

SECTION 5.00 SYSTEM SIGNAL AND POWER/GROUND CABLING ARRANGEMENTS

5.01 General. This section provides the signal and power/ground-cabling arrangements for the SATURN IIE System. Tables 5.00 and 5.01 list all the cable reference numbers used throughout this practice. The tables provide point-to-point cable terminations and refer users to the appropriate cabling illustration for quick reference. The following illustrations are included in this section:

NOTE: When an LTU shelf is not equipped its corresponding signal cable connector on the basic shelf must have a Berg jumper inserted across pins 29 and 30 in order to suppress LTU shelf failure alarm. The connectors are designated as follows:

a. Basic shelf connectors J55 and J56 , jumpered if LTU1 shelf is missing.

b. Basic shelf connectors J58 and J60 , jumpered if LTU2 shelf is missing.

c. Basic shelf connectors J57 and J59 , jumpered if LTU3 shelf is missing.

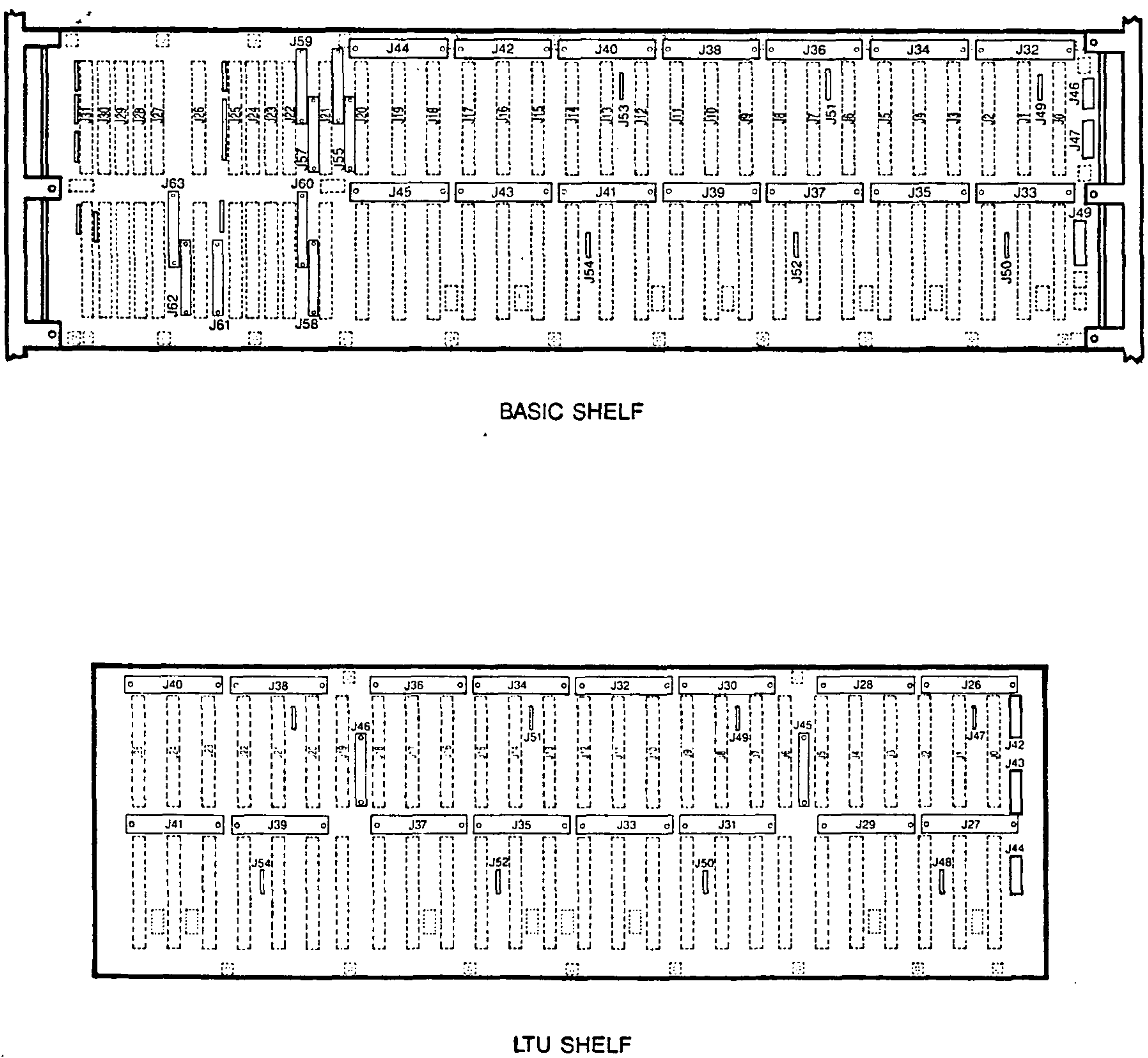

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Figure 5.00 Backplane Connectors

Table 5.00 Signal and Power/Ground Cabling Reference List (Basic Cabinet)

CABLE REF. NO.	FIGURE REF. NO.	CABLE TYPE		TERMINATION POINTS			
				(A)		(B)	
		SIGNAL	POWER/ GROUND	EQUIPMENT	CONNECTOR	EQUIPMENT	CONNECTOR
W1	5.01		X	PSU	J3,J4,J6, J7 J9, J10, J11, E6	-48PS0	J1,J2
						-48PS1	J1,J2
						basic	J46-J48, E1-E4
						LTUPS0	J1,J2
						FDD2	–
W2	5.03	X		basic	J61	PSU	J12
W3	5.03	X		basic	J56	LTU1	J46
W4	5.03	X		basic	J63	FDD0	–
W5	5.01		X	LTU1	J1	LTUPS1	J42-J43
W7	5.01		X	2nd AC Input		PSU	J2
W8	5.01		X	FDD0	–	GRD	E8
W9	5.01		X	PSU	J14	GRD	E7
W11	5.03	X		basic	J62	FDD1 FDD2	– –
W12	5.01	X		FDD3	–	GRD	E8
W13	5.03	X		basic	J55	LTU1	J45
W14	5.03	X		basic	J63	FDD1	–
W18			X	FDD2	-	GRD	E8
W19	5.01		X	PSU	E2	GRD	E1

Table 5.01 Signal and Power/Ground Cabling Reference List (Expansion Cabinet)

CABLE REF. NO.	FIGURE REF. NO.	CABLE TYPE		TERMINATION POINTS			
				(A)		(B)	
		SIGNAL	POWER/ GROUND	EQUIPMENT	CONNECTOR	EQUIPMENT	CONNECTOR
W6	5.02		X	PSU	J5,J8	LTUPS1	J1,J2
						LTUPS2	J1,J2
W15	5.02		X	LTUPS1	J1	LTU2	J42-J43
W21	5.04	X		basic	J60	LTU2	J46
W22	5.04	X		basic	J58	LTU2	J45
W23	5.04	X		basic	J59	LTU3	J46
W24	5.04	X		basic	J57	LTU3	J45
W25	5.02		X	LTUPS2	J1	LTU3	J42-J43

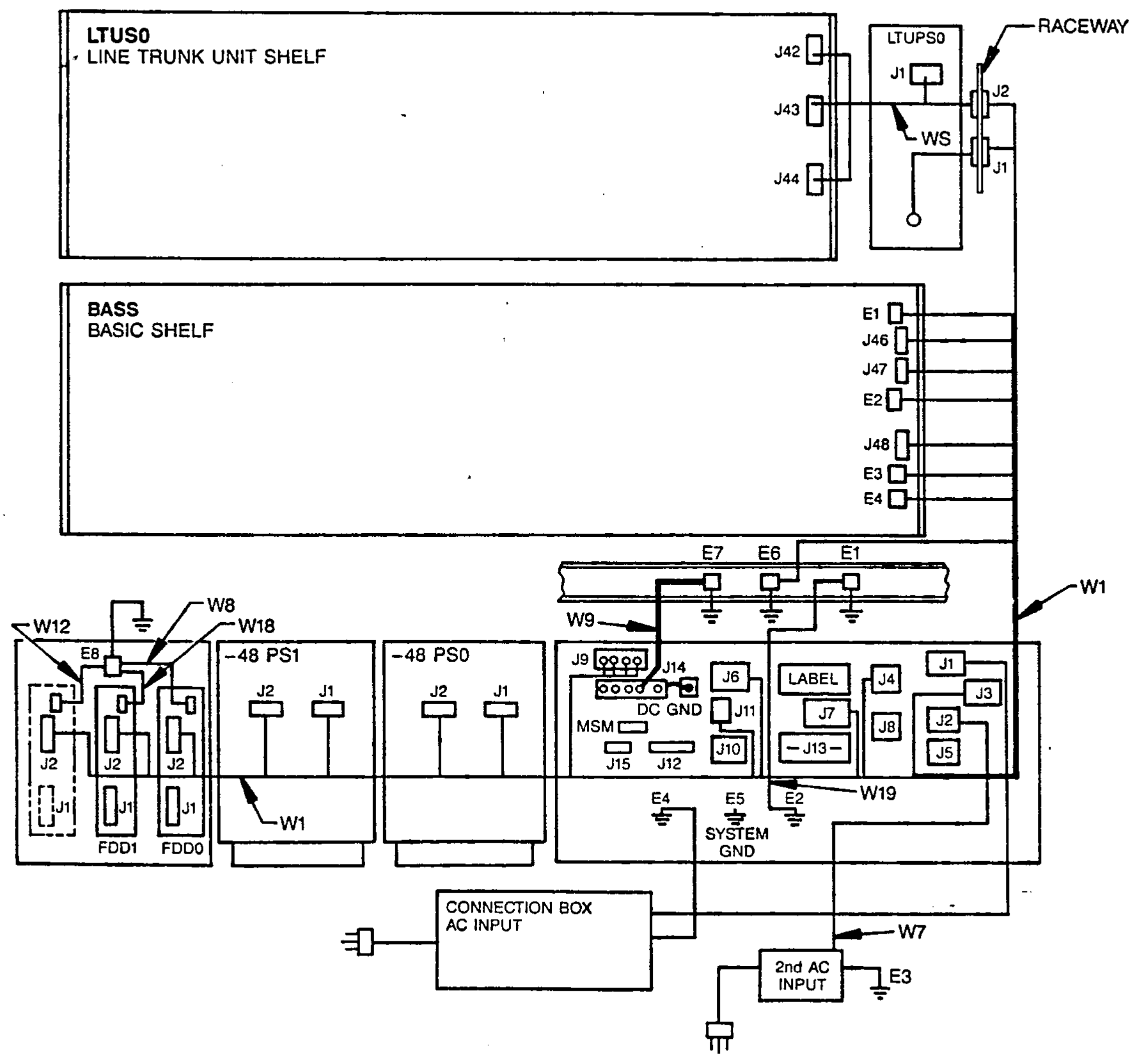

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Figure 5.01 Power/Ground Distribution (Basic Cabinet)

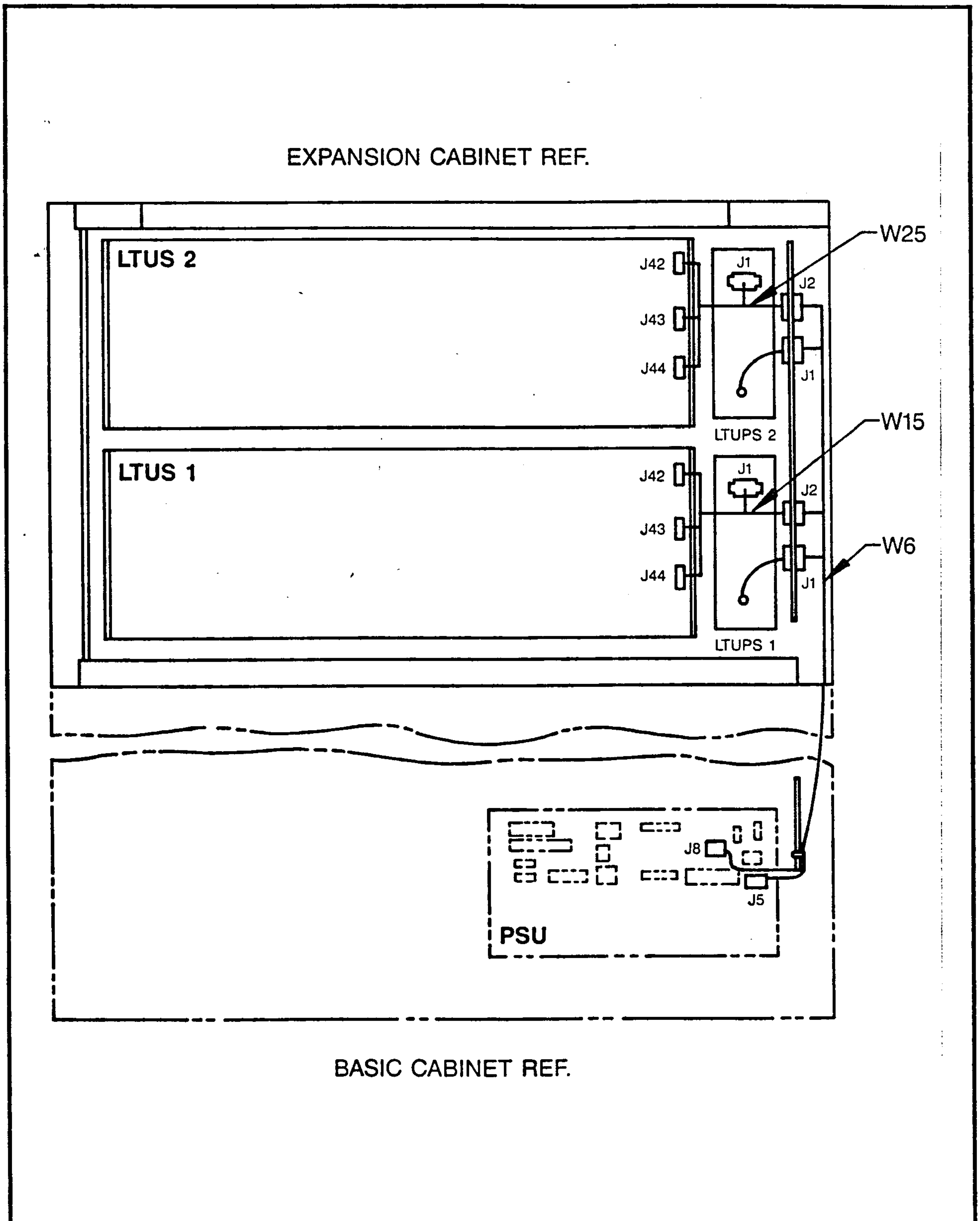

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Figure 5.02 Power/Ground Distribution (Expansion Cabinet)

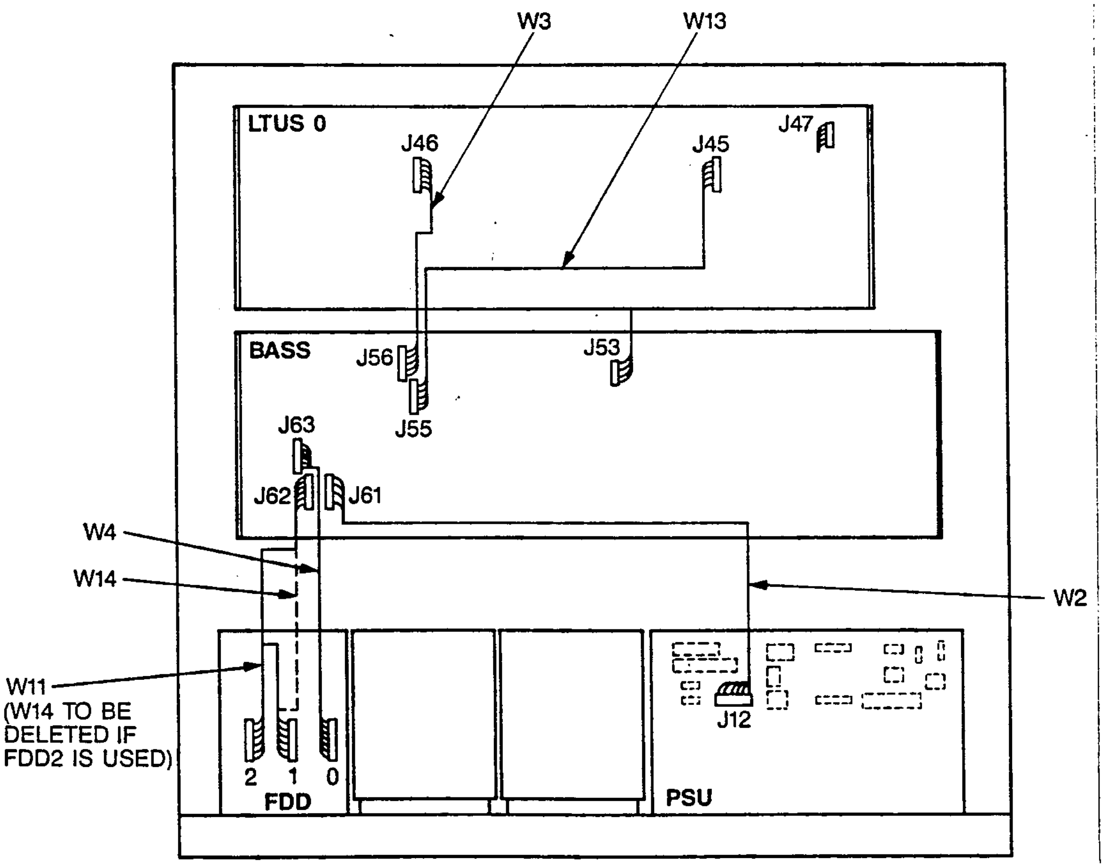

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Figure 5.03 Signal Cable Distribution (Basic Cabinet)

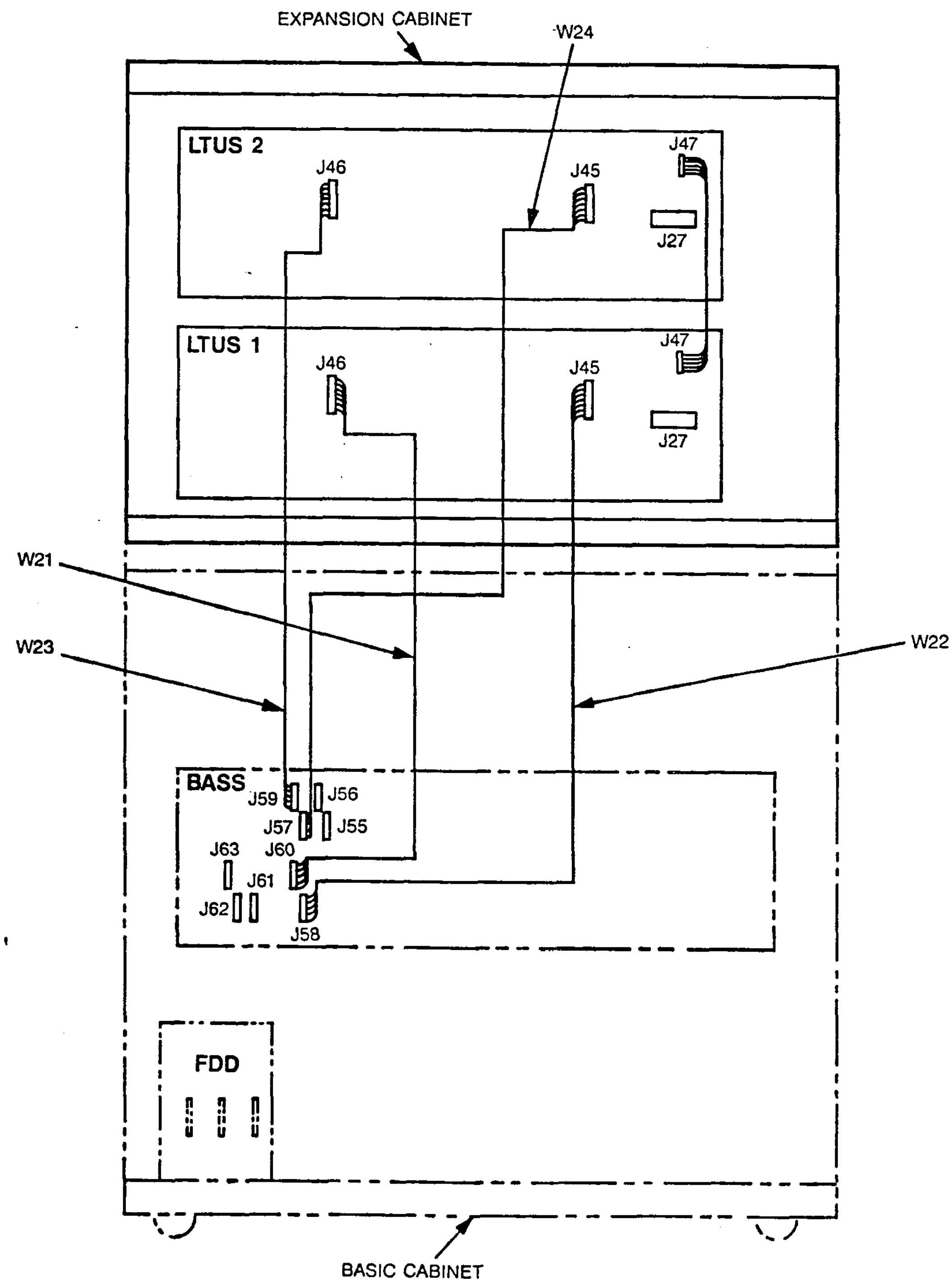

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Figure 5.04 Signal Cable Distribution (Expansion Cabinet)

SECTION 6.00 MDF CABLING AND TERMINATING ARRANGEMENTS

6.01 General. This section provides the MDF cabling procedures and termination arrangements for the SATURN IIE System.

6.02 MDF Cabling. MDF cabling for the SATURN IIE System can be accomplished through either the top or bottom of the cabinet (refer to Figures 6.00 and 6.01). The tie-wrap holders at the top and bottom of the cabinet provide the means to easily form and secure MDF cables into position. Each MDF cable connector (system side) should contain a 180° hood (refer to Figure 6.02) to connect into the backplane connector and secured via two captive-type screws. Figure 6.03 provides an overview of the backplane MDF cable connectors and their corresponding card slot allocations on the basic and LTU shelves. Figure 6.04 provides information pertaining to connector/pin numbers for tip/ring and E&M leads.

6.03 MDF Terminating Arrangements. Tables 6.00 through 6.14 provide the necessary information on the terminating arrangement at the MDF. Tables 6.00 through 6.06 provides the MDF designations for the T&R leads for the basic shelf . Tables 6.07 through 6.14 provides the MDF designations for the T&R leads for the expansion shelves . For information on MDF cross-connections, refer to SATURN IIE EPABX Installation Test Procedures Practice.

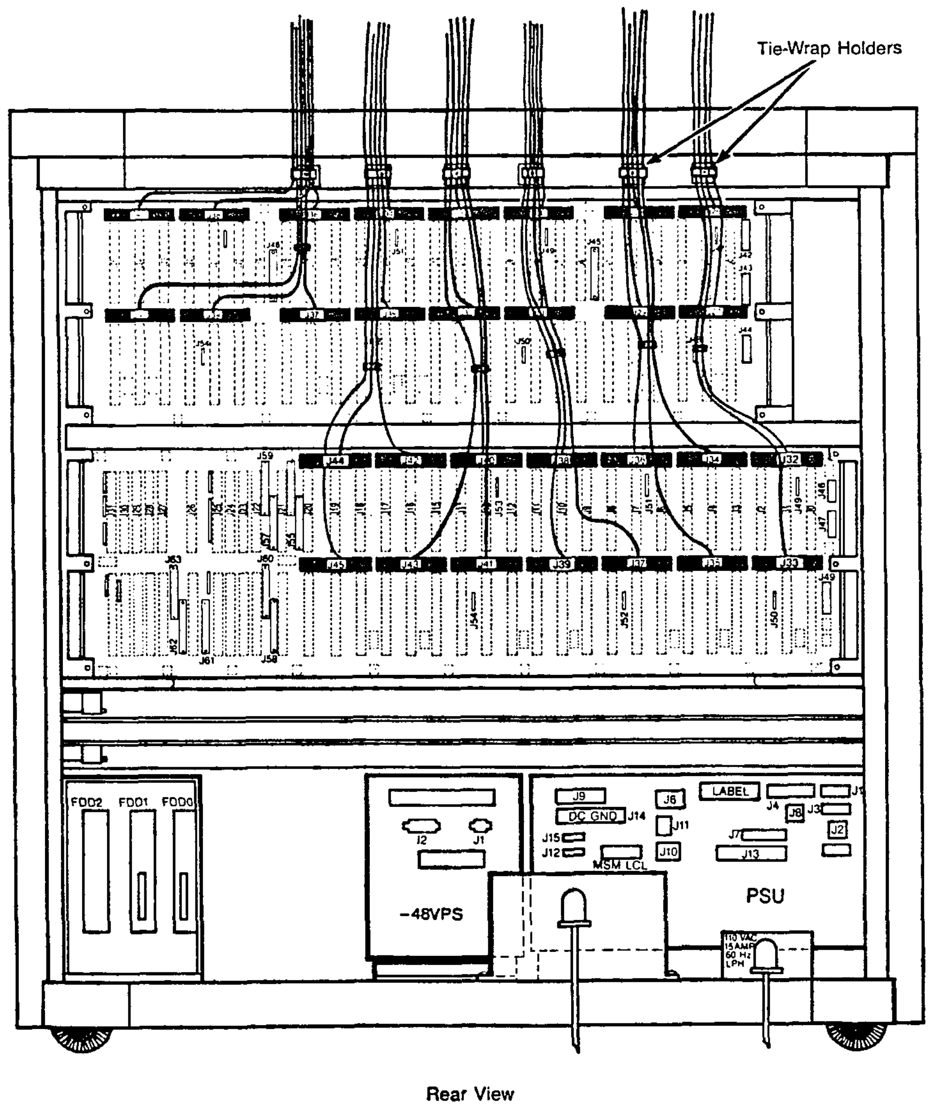

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Figure 6.00 MDF Cabling via Top of Cabinet Assembly (View of Typical Cabinet)

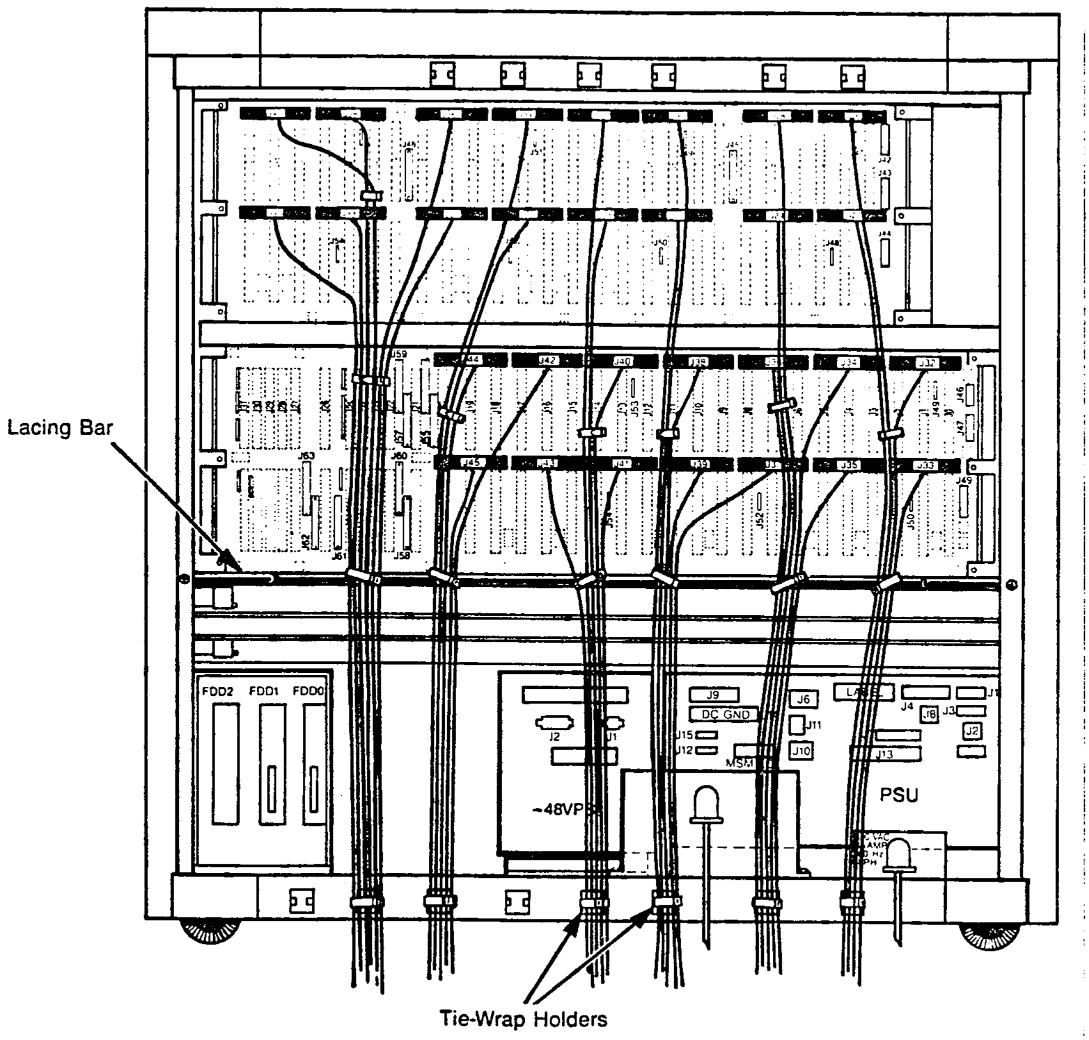

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Figure 6.01 MDF Cabling via Bottom of Cabinet Assembly (View of Typical Cabinet)

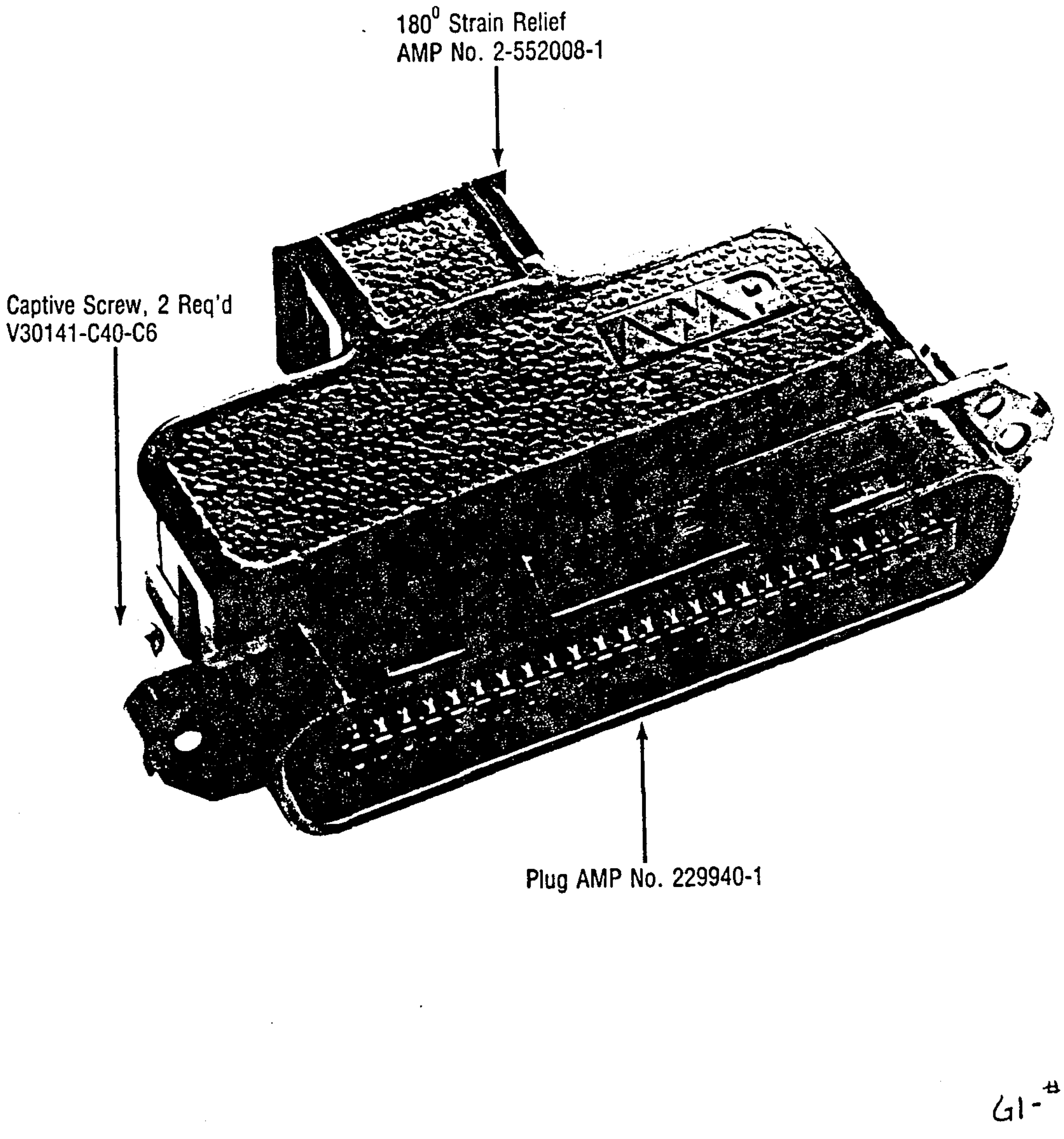

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Figure 6.02 Required MDF Cable Connector

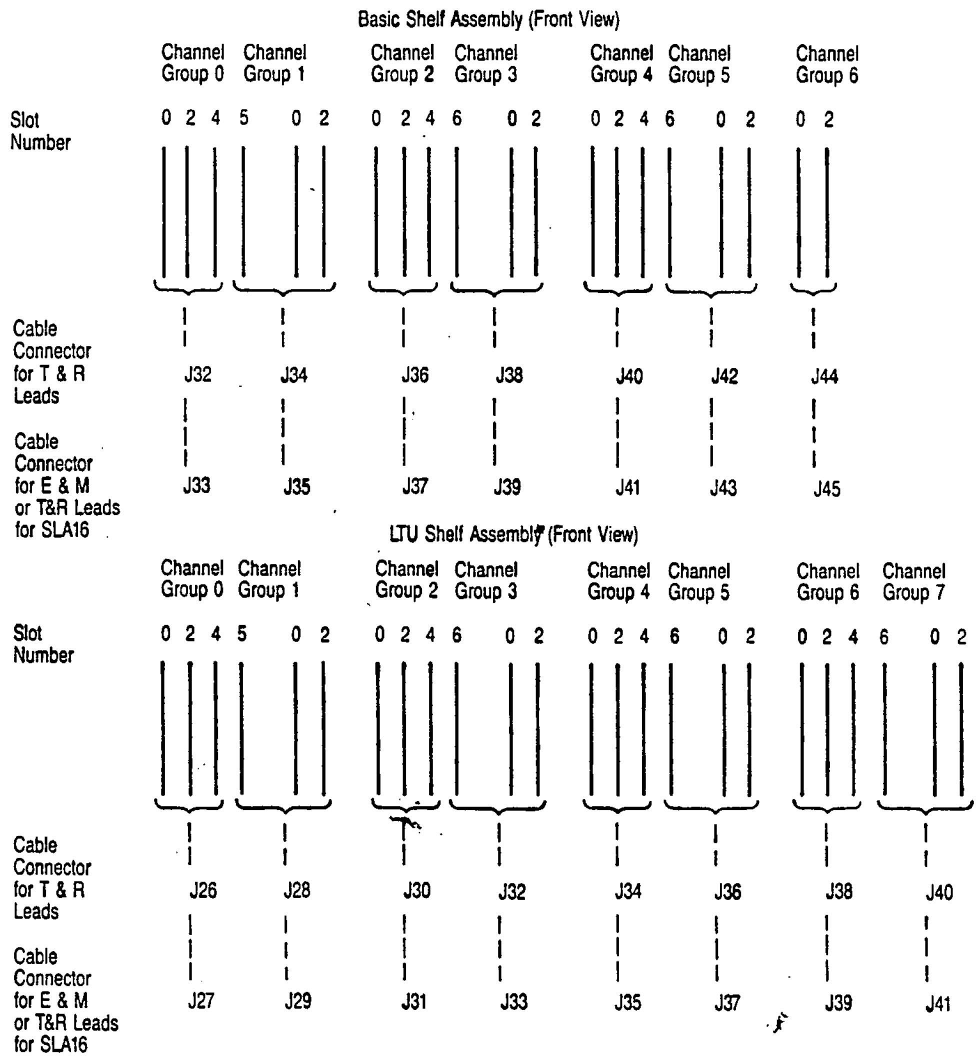

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Figure 6.03 Overview of MDF Cable Connections (Sheet 1 of 2)

ASSIGNMENT OF PENs

W X Y Z

Shelf (basic = 0, LTU = 1, 2, 3)

Channel Group (0-7; see above)

Card Slot (0-6; see below for SLA16)

Circuit (0-7; see below for SLA16)

For SLA16 Boards:
Circuits 0-7: Use slot number (Y) as shown above.
Circuits 8-15: Use slot number +1 (Y+1)

EXAMPLE: SLA16 assigned to LTU Shelf 2, Channel Group 3, Slot 0

PENs of first 8 circuits: 2300 through 2307
T/R leads of circuits are located on connector J32

PENs of second 8 circuits: 2310 through 2317
T/R leads of circuits are located on connector J33

Figure 6.03 Overview of MDF Cable Connections (Sheet 2 of 2)

Siemens Practices
Installation Series

A30808-X5130-B120-1-B928
Issue 1, May 1986

SATURN® IIE EPABX

INSTALLATION TEST PROCEDURES

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SECTION 1.00 INTRODUCTION

1.01 Purpose. The equipment comprising the SATURN IIE (SATURN II-Expanded) System is completely tested at the factory prior to shipment. The inspections and tests covered in this practice verify that the EPABX equipment has been properly installed; ensure that no damage was incurred during transit; and confirm that the system is completely operational. Table 1.00 defines the mnemonics used throughout this practice.

CAUTION

Installation test procedures on the SATURN IIE EPABX must be performed only by Siemens certified personnel.

1.02 Scope. This practice is divided into the following sections which are presented in the sequential order of performance after initial installation of a SATURN IIE System. When additional equipment is installed to an existing and active SATURN IIE System, it is the responsibility of craft personnel to determine the sequential order of the test procedures contained in these sections.

a. Section 1.00 – Introduction
b. Section 2.00 – Preparatory Activity
c. Section 3.00 – Ground Tests
d. Section 4.00 – Power-Up Tests
e. Section 5.00 – Operating Program Loading
f. Section 6.00 – On-Line Diagnostic Tests
g. Section 7.00 – Installation Test Procedures Checklist

1.03 Siemens SATURN IIE Practices. The practices, issue numbers and dates for the SATURN IIE EPABX are listed in the Practices Documentation Index A30808-X5130-A190-*-B987. Always refer to the latest issue of the application index to obtain the latest issue number of a practice.

1.04 Siemens Customer Support Services. Siemens maintains a nationwide network of field service offices. Contact the Siemens regional office for any engineering assistance that may be required.

Table 1.00 Mnemonics Used in This Practice

MNEMONIC	DEFINITION
ACD	Automatic Call Distribution
ALM	Alarm
ASCII	American Standard Code for Information Interchange
CIOP	Controller/Input-Output Processor
CMU	Customer Memory Update
CO	Central Office
CONF	Conference Module
COT	Central Office Trunk
DCI	Data Communication Interface
DID	Direct Inward Dialing
DIP	Dual Inline Package
DP	Dial Pulse
DTE	Data Terminal Equipment
DTMF	Dual Tone Multifrequency
EIA	Electronics Industries Association
EPABX	Electronic Private Automatic Branch Exchange
FDD	Floppy Disk Drive
IRAM	Input Random Access Memory
LTU	Line/Trunk Unit
LTUPS	Line/Trunk Unit Power Supply
LED	Light-Emitting Diode
MCA	Memory Control and Attenuation
MDF	Main Distribution Frame
MEM3	256kb Memory
MEM4	1Mb Memory
MOS	Metal Oxide Semiconductor
MRA	Material Return Authorization
MSM	Memory Support Module
MTCE	Maintenance
OOS	Out-of-Service
ORAM	Output Random Access Memory
PABX	Private Automatic Branch Exchange
PCB	Printed Circuit Board
PEN	Port Equipment Number
PIMD	Premium Instrument Module Digital
PSC	Parallel/Serial Converter
PSU	Power Supply Unit

Table 1.00 Mnemonics Used in This Practice (Continued)

MNEMONIC	DEFINITION
RAUP	Remote Access Unit/Ports
RGEN	Ring Generator
SLA16	Subscriber Line Module Analog – 16 lines
SLMA	Subscriber Line Module Analog
SLMA-S	Subscriber Line Module Analog – Station
SLMD	Subscriber Line Module Digital
SMXTG	Signal Multiplexer/Tone Generator
SPC	Stored-Program-Controlled
SPG	Single Point Ground
TMBA-2	Two-Wire E&M Trunk
TMBA-4	Four-Wire E&M Trunk
TMBM	Central Office Trunk
TMIE	Direct Inward Dialing Trunk
TMS	Transmission Measuring Set
TSTAPP	Test – Apparatus
TSTDIAG	Test – Maintenance Diagnostic
TTY	Teletypewriter
UNA	Universal Night Answer
ZUNA	Zoned Universal Night Answer
-48PS	-48Vdc Power Supply

SECTION 2.00 PREPARATORY ACTIVITY

2.01 General. This section describes the test equipment required to perform the installation test procedures, handling precautions for Printed Circuit Boards (PCBs) with Metal Oxide Semiconductor (MOS) integrated circuits, guidelines for removal and replacement of PCBs and power supplies, and initial visual inspection procedures.

2.02 Test Equipment Required. The following test equipment is required to perform the procedures contained in this practice:

a. Digital Multimeter. A digital multimeter of good commercial quality with an accuracy of ± 1.0% or better. The digital multimeter is used to perform the ground tests and output voltage tests.

b. Maintenance Test Phone. For both Dial Pulse (DP) and Dual Tone Multifrequency (DTMF) systems, a lineman's test set or a single line telephone. A modular jack (MTCE PHONE) is provided on the front panel of the PSU for connecting the maintenance test phone when equipped with a modular plug. When the maintenance test phone is not equipped with a modular plug, a station appearance can be used via the Main Distribution Frame (MDF). The maintenance test phone is used to perform the on-line diagnostic tests.

c. Data Service Terminal. A Keyboard-Send-Receive (KSR) data terminal equipped with a standard ASCII keyboard and an EIA RS-232C interface (Silent 700 Series — Model 743 KSR — Texas Instruments, or equivalent). The data service terminal is used to input installation dependent data (i.e., system data base) into system memory when the standard data base format is supplied with the SATURN IIE System.

d. Transmission Measuring Set. A transmission measuring set (TMS) used to measure the transmission quality of a trunk or station (Hewlett Packard HP-3551A or equivalent). Refer to the manual On-Line Diagnostic Tests, Outgoing Trunk Test and Station Line Test.

2.03 Handling Precautions for PCBs with MOS Integrated Circuits. It is important that craft personnel handling PCBs with MOS integrated circuits free themselves from electrostatic charge by touching a grounded cabinet frame before handling such PCBs, or by wearing grounded wrist straps. Failure to observe this practice may result in damage to MOS PCBs due to electrostatic discharge.

WARNING

Hazardous voltages exist within the equipment cabinet. Be extremely careful when performing testing/troubleshooting procedures with the equipment panel(s) removed.

2.04 PCB Removal and Replacement Guidelines. In many instances during testing, the corrective action for a procedure in which the proper verification was not obtained requires that a PCB or a power supply be removed and replaced with a spare. Table 2.00 provides the guidelines that should be observed when removing and replacing PCBs and power supplies in an active system.

2.05 Initial Visual Inspection Procedures. The visual inspection procedures contained in Table 2.01 must be performed to ensure that the equipment comprising the SATURN IIE System has been properly installed and configured to meet the installation requirements. Before proceeding with the visual inspections, the front, rear and side panels of the cabinet should be removed to allow thorough inspection of the equipment.

Table 2.00 PCB and Power Supply Removal Guidelines

MODULE OR UNIT		SERVICE STATE	SPECIAL INSTRUCTIONS
CIOP		NA	Notes 1 and 2
CONF		NA	Notes 1 and 2
DTMF		OOS	Note 3
FDD0, FDD1		NA	None
LTUC	*	NA	Note 4
LTUPS	*	NA	Note 5
MCA		NA	Notes 1 and 2
MEM3		NA	Notes 1 and 2
MEM4		NA	Notes 1 and 2
MSM	*	NA	Note 1
MSM Battery	*	NA	Note 6
PIMD		OOS	Note 3
PSC		NA	Notes 1 and 2
PSU		NA	Note 7
RAUP		NA	Notes 1 and 2
SLA16		OOS	Note 3
SLMA-O		OOS	Note 3
SLMA-S		OOS	Note 3
SLMD		OOS	Note 3
SMXTG		NA	Notes 1 and 2
TMBA-2		OOS	Note 3
TMBA-4		OOS	Note 3
TMBM		OOS	Note 3
TMIE		OOS	Note 3
-48PS0		NA	Note 8
-48PS1	*	NA	Note 8

* Optional depending upon customer/system requirements.
NA = Not Applicable; OOS = Out-of-Service

Notes:

1. System outage (halts call processing). Set BASIC PS circuit breaker on PSU to off.
2. Open FDD and remove floppy disk before removing PCB. After new PCB is inserted, reinsert floppy disk, close FDD, set BASIC PS circuit breaker on PSU to on, and press reset switch on CIOP.
3. Wait for in-process calls to complete.
4. Removal places one-half of ports in shelf out-of-service.
5. Before removal, set related LTUPS circuit breaker on PSU to off. Removal places all ports in shelf out-of-service.
6. Battery may be replaced with power applied to system.
7. System outage (halts call processing). Before removal, set all circuit breakers to off, open FDDs and remove floppy disks. After replacement, reinsert floppy disks, close FDDs, set circuit breakers to on, and press reset switch on CIOP.
8. Set related circuit breaker on PSU to off. May halt call processing depending upon system configuration and traffic. If there are two -48Vdc power supplies (where system includes an Expansion Cabinet), the remaining supply may have sufficient capacity to support system operation.

Table 2.01 Visual Inspection

STEP	VISUAL INSPECTION	REFERENCE
1	Check that the cabinet ac power cord is not connected to an electrical outlet.	
2	Check that the -48Vdc power supply is strapped for 110Vac or 220Vac.	SATURN IIE EPABX Installation Procedures Practice (Section 4.00)
3	Check that all circuit breakers on the Power System Unit (PSU) are in the OFF position and fuses inserted.	SATURN IIE EPABX Installation Procedures Practice (Section 4.00)
4	If the MSM is installed, check that the Battery Packk is not connected but inserted into corresponding position. Also check that the PSU is strapped for MSM operation.	SATURN IIE EPABX Installation Procedures Practice (Section 4.00)
5	Check that each PCB in the system is withdrawn from its backplane connector.	
6	Check that the DIP switch settings for the CIOP board are set to meet the operating characteristics of the particular data service terminal to be used to input the installation-dependent data(i.e.,data base) into system memory when the standard data base format is supplied with the SATURN IIE System.	SATURN IIE EPABX Installation Procedures Practice (Section 4.00)
7	Check that each trunk-type PCB (i.e., TMBM, TMIE, TMBA-2 and/or TMBA-4) is properly strapped according to the operating characteristics of the trunk facility of the Central Office (CO) or distant PABX.	SATURN IIE EPABX Installation Procedures Practice (Section 4.00)
8	Check that the intercabinet signal and power/ground cabling arrangements are complete and all connectors are firmly seated according to the referenced illustrations (Figures 2.00 through 2.03).	Figures 2.00 through 2.03
9	Check that Berg Clips are on pins 27 and 28 of unused signal cable connectors on basic shelf.	SATURN IIE EPABX Installation Procedures Practice (Section 4.00)

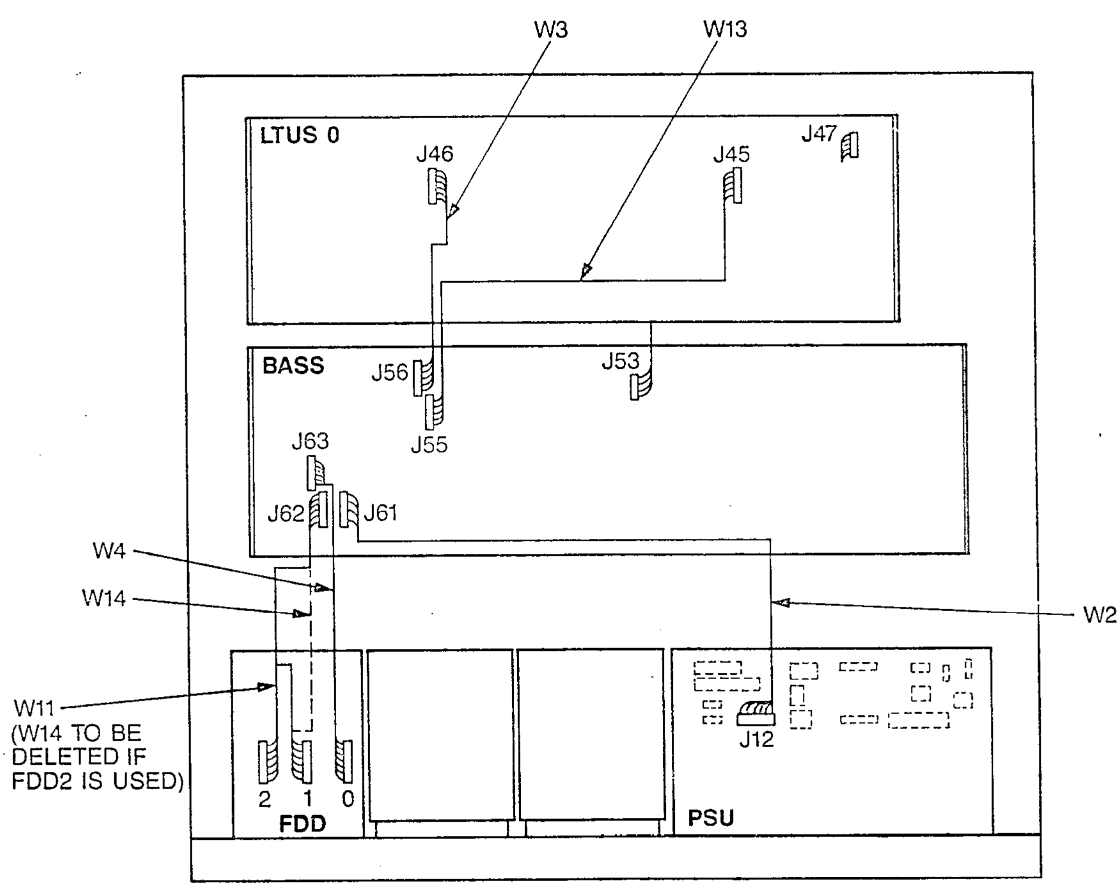

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Figure 2.00 Signal Cable Distribution for the SATURN IIE System (Basic Cabinet)

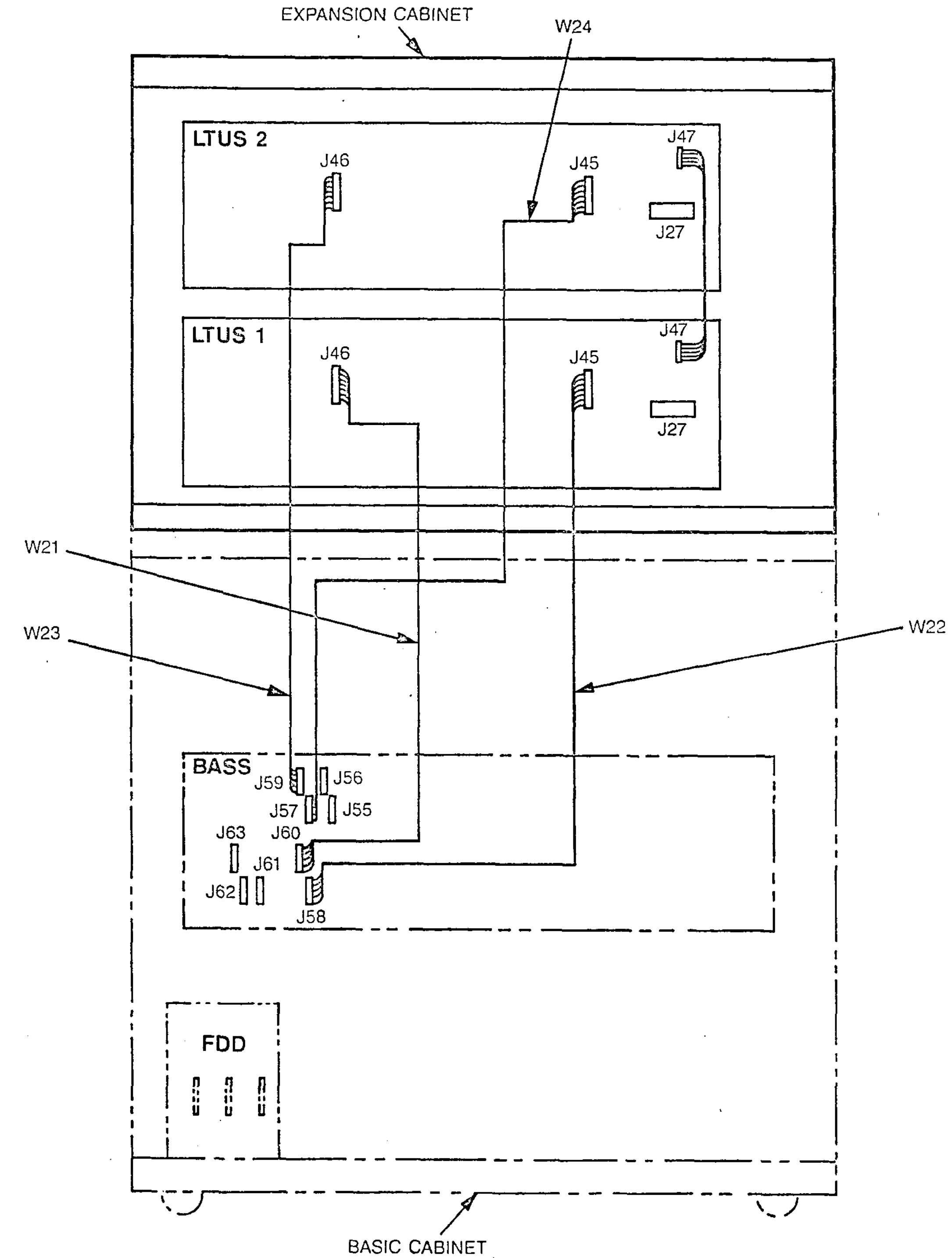

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Figure 2.01 Signal Cable Distribution for the SATURN IIE System (Expansion Cabinet)

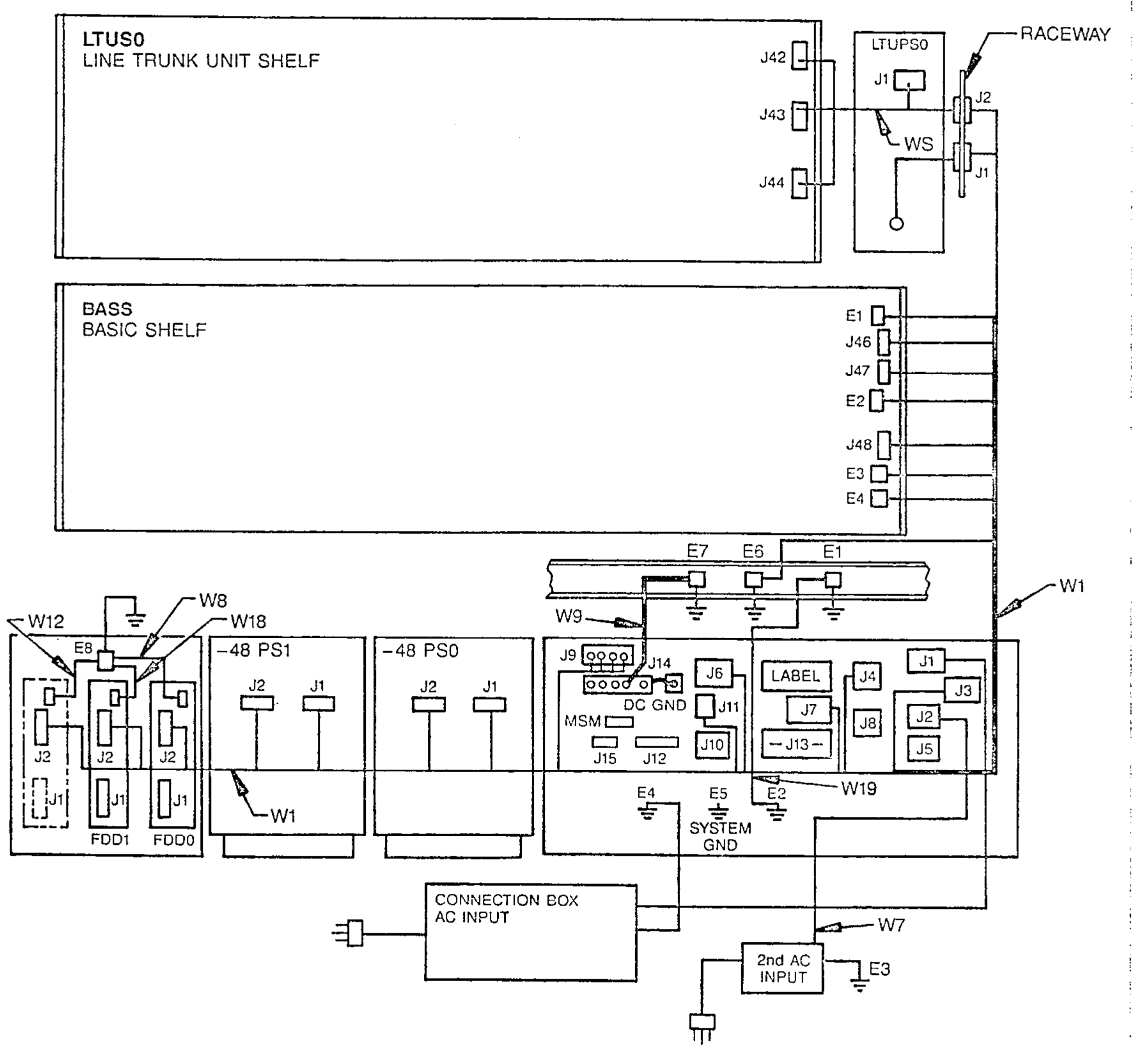

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Figure 2.02 Power/Ground Distribution for the SATURN IIE System (Basic Cabinet)

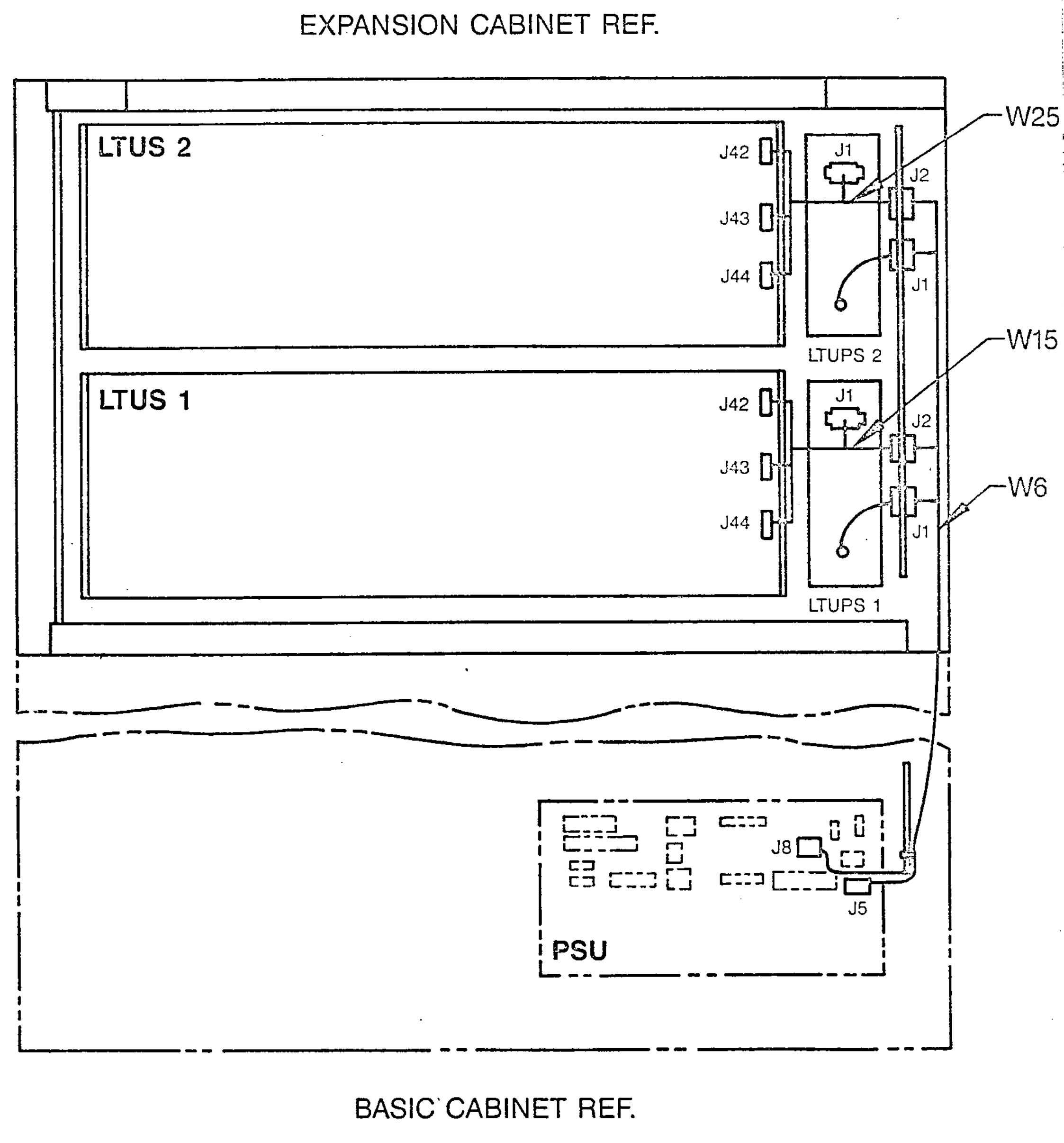

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Figure 2.03 Power/Ground Distribution for the SATURN IIE System (Expansion Cabinet)

SECTION 3.00 GROUND TESTS

3.01 **General.** The SATURN IIE System must be connected to an earth ground (i.e., metallic cold water pipe or master ground busbar) in addition to the safety ground in the ac power cord. A 6-gauge (twisted copper wire) conductor should be connected between the grounding lug E5 located on the bottom of the cabinet frame and the selected earth ground (refer to Section 3.00 in the SATURN IIE EPABX Installation Procedures practice for details). The following tests must be performed to ensure that proper earth ground connections have been accomplished, and that ground connections within the cabinet assembly have not been damaged or loosened during shipment.

WARNING

Hazardous voltages exist within the equipment cabinet. Be extremely careful when performing testing/troubleshooting procedures with the equipment panel(s) removed.

3.02 **System Ground Test.** Before proceeding with the test procedures indicated in Table 3.00, check that the earth ground connections are secure and ground conductors are firmly positioned on grounding lug E5 at the bottom of the cabinet frame.

3.03 **Shelf Ground Continuity Test.** Each LTU shelf assembly within the cabinet assembly is grounded via two vertical busbars. Before proceeding with the test procedures indicated in Table 3.01, check that each shelf backplane is interconnected with the busbar flanges and adequately secured into position.

Table 3.00 System Ground Test

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	If connected, remove ac power cord from commercial power outlet.		
2	Short digital multimeter test leads together and note resistance of test leads.		
3	Set digital multimeter to lowest resistance range and connect its leads between the U-ground pin of the ac power cord and the U-ground socket in the commercial power outlet (refer to Figure 3.00 for details).	Resistance measured should be betweem 0 and 2 ohms greater than the measured test lead resistance.	If a reading greater than 2 ohms is obtained, the faulty ground connection must be isolated and corrected before continuing with the installation test procedures
4	Repeat procedure with second ac power cord if optional expansion cabinet is incorporated into system.	Same as step 3 above.	Same as step 3 above.

Table 3.01 Shelf Ground Continuity Test

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	If connected, remove ac power cord from commercial power outlet.		
2	Set digital multimeter to lowest resistance range and connect its leads between ground lug E5 located at the bottom of the cabinet frame, and one of the busbar/backplane attaching screws for each existing LTU shelf (refer to Figure 3.01)	Resistance measured should be between 0 and 1 ohm greater than the measured multimeter test lead resistance.	If a reading greater than 1 ohm is obtained, the faulty ground connection must be corrected before continuing the installation test procedures.

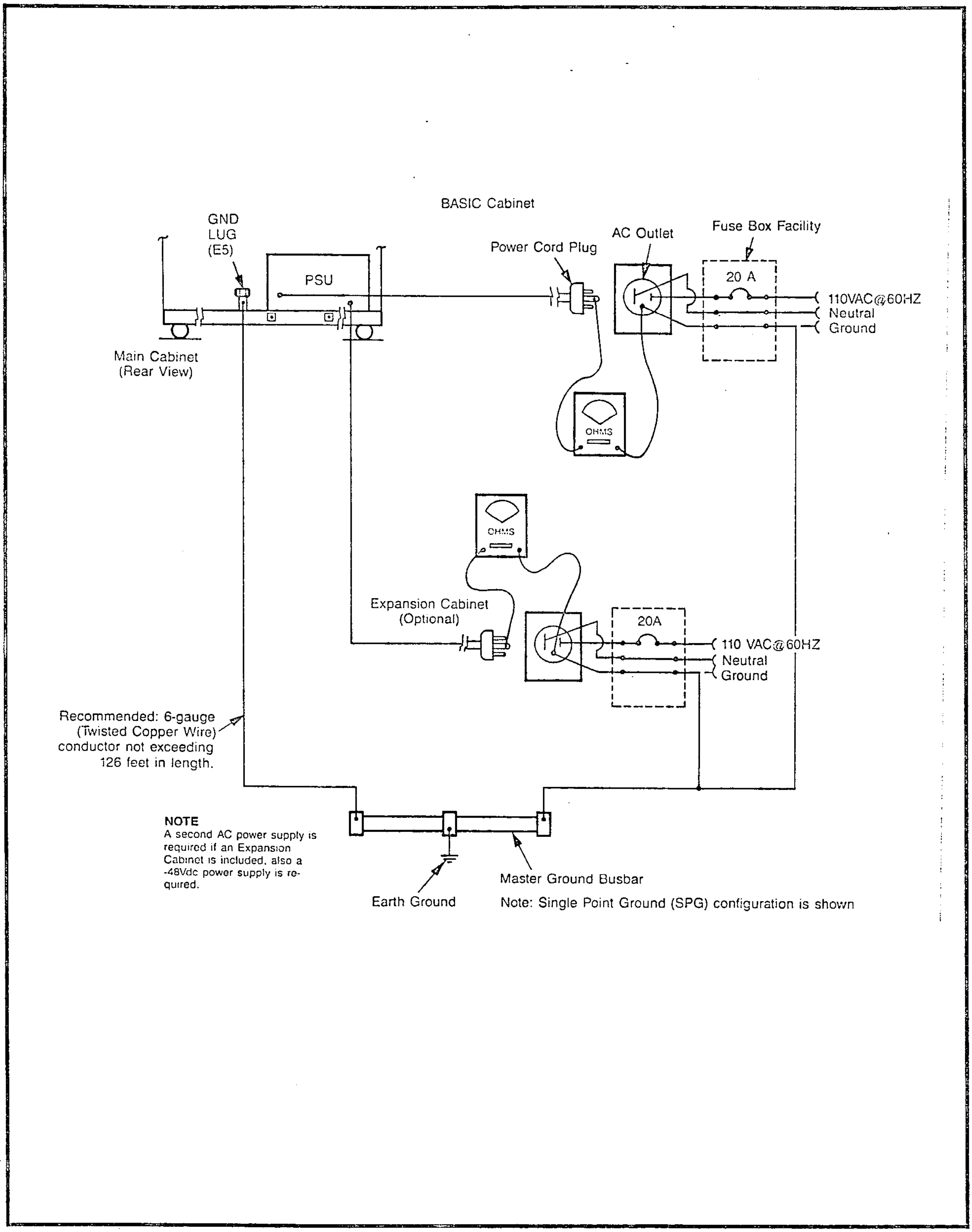

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Figure 3.00 System Ground Test Connections

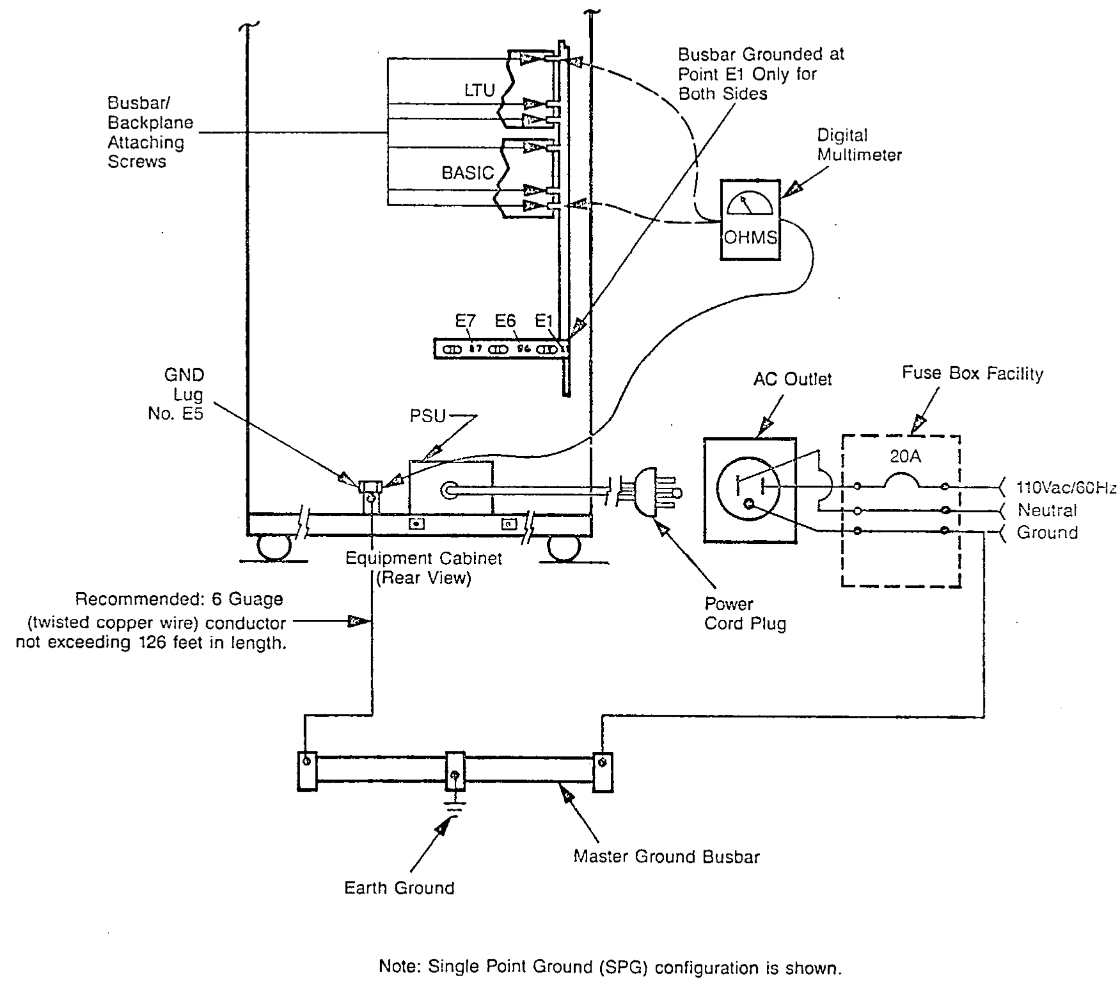

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Figure 3.01 Shelf Ground Continuity Test Connections

SECTION 4.00 POWER-UP TESTS

4.01 **General.** The SATURN IIE System makes use of distributed power in the equipment cabinet. Several power supplies are used in the system. These power supplies provide +5Vdc, -5Vdc, +12Vdc, -12Vdc, -48Vdc, 90Vac-20Hz ringing voltage and message waiting voltage, from a 110Vac 60Hz input power source. After satisfactorily performing the ground tests indicated in Section 3.00, the following tests must be performed to ensure that proper power cable connections have been accomplished and that the power supplies inside the cabinet assembly have not been damaged during shipment.

WARNING

Hazardous voltages exist within the equipment cabinet. Be extremely careful when performing testing/troubleshooting procedures with the equipment panel(s) removed.

4.02 **Power-Up/Output Voltage Tests.** Before proceeding with the test procedures indicated in Table 4.00, check that all power cable assemblies are properly secured into their corresponding locations. Note that the test procedures in Table 4.00 include procedures for testing the optional MSM, when equipped in the system.

Table 4.00 Power-Up/Output Voltage Test

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	If not previously done, extract each PCB in the system from its respective backplane connector in basic and LTU shelves.		
2	Check that all circuit breakers on the PSU are in the off positions and that all fuses are inserted in their corresponding locations.		
3	Using the digital multimeter (or an ac polarity indicator), verify that the commercial ac power receptacle used for powering the system has the proper polarity.	Polarity indication must coincide with Figures 3.00 and 3.01.	If polarity indication does not coincide, correct before proceeding with the remainder of test in this table.
4	Connect the ac power cord(s) to the commercial ac power receptacle(s).		
5	Place the following circuit breakers on the PSU to the on (up) position: a) Basic PS b) -48PS0 c) -48PS1 (if equipped) d) LTUPS0 (if equipped) e) LTUPS1 (if equipped) f) LTUPS2 (if equipped)		
6	If the optional MSM module is equipped in the system, proceed as follows: a) If not previously done, connect and insert battery pack into the MSM assembly.		
	b) Press the BATTERY TEST switch on the PSU and release after verification has been obtained.	The associated green LED should light steadily.	If the green LED remains extinguished, the battery pack is below acceptable voltage limits. Let MSM charge battery pack and retry test after 30 minutes have elapsed. If green LED remains extinguished, the battery pack is defective and requires replacement.

Table 4.00 Power-Up/Output Voltage Test (Continued)

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
	c) On the PSU, place the circuit breaker designated BASIC PS in the off (down) position.	The red LED designated BATTERY TEST should be steadily lit.	If the red LED remains extinguished, replace the MSM.
	d) On the PSU, place the circuit breaker designated BASIC PS to the on (up) position.	The red BATTERY TEST LED should be extinguished.	If the red LED remains steadily lit, either the cabinet ac power cord is not connected to the commercial ac power receptacle or a local ac power failure has occurred.
7	Set digital multimeter to appropriate dc voltage scale for the following tests.		NOTE If further troubleshooting information is required during these testing procedures, refer to SATURN IIE EPABX Maintenance and Troubleshooting Practice.
8A	To measure the unloaded basic shelf input voltages, proceed as follows:		
	a) On basic backplane shown in Figure 4.00, take reading between terminal E1, E2, E3 or E4 and ground.	Voltage measured should read between +4.5 and +5.5 Vdc.	If reading is not within tolerance, adjust +5V ADJUST potentiometer on PSU. If still out-of-tolerance replace PSU.
	b) On basic backplane connector J46, shown in Figure 4.00, take readings between pins 2 and 3.	Voltage measured should read between −43 and −53Vdc.	If reading is not within tolerance, check the -48P-BASIC fuse in PSU. If fuse is good, replace -48PS0.
	c) Set digital multimeter to appropriate Vac scale and take reading between pins 1 and 2 of J46.	Voltage measured should be between 75 and 100 Vac.	If the voltage is not present, check and replace RGEN fuse or RAC BASIC fuse on PSU. If fuses are good, replace RGEN PCB. If voltage still not present, replace PSU.
	d) Set digital multimeter to appropriate Vdc scale and take readings between the following pins on basic backplane connector J47 (shown in Figure 4.00):		
	1) Pins 1 and 3.	Voltage measured should be between −4.9 and −5.2Vdc	If reading is not within tolerance, replace the PSU.
	2) Pins 2 and 3.	Voltage measured should be between −43 and −53Vdc	If reading is not within tolerance, check the -48B BASIC fuse on PSU. If the fuse is good, replace -48PSO.
	e) On basic backplane connector J48, shown in Figure 4.00, take readings between the following pins:		
	1) Pins 1 and 4.	Voltage measured should read between −11.3 and −12.7Vdc.	If reading is not within tolerance, replace the PSU.
	2) Pin 2 or 3 and pin 4.	Voltage measured should be between +11.3 and +12.7Vdc.	If reading is not within tolerance, replace the PSU.
	3) Pins 4 and 5.	Voltage measured should be between 4.85 and 5.15Vdc.	If reading is not within tolerance, check that J16 on the rear panel of the PSU is strapped to the MSM terminal. If the strap is in place, replace the MSM.

Table 4.00 Power-Up/Output Voltage Test (Continued)

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
	f) Connect positive lead of digital multimeter to pin 5 of connector J48 and negative lead to terminal E1 on basic backplane. (Refer to Figure 4.00.)	Voltage measured should read + 0.05Vdc.	If reading is not 0.05 Vdc, adjust +5V ADJUST potentiometer on PSU. If adjustment is not effective, replace PSU.
8B	After satisfactorily completing step 8A, proceed as follows to measure the loaded basic shelf input voltages.		
	a) On the PSU, place the circuit breaker designated BASIC PS in the off (down) position.	The MSM red LED designated BATTERY TEST should be steadily lit.	
	b) Plug all previously extracted PCBs on the basic shelf into their respective backplane connectors.		
	c) On the PSU, place the circuit breaker designated BASIC PS in the on (up) position.	The MSM red LED designated BATTERY TEST should be extinguished.	
	d) Repeat measuring procedures on basic backplane connectors J46, J47, J48 and terminals E1-E4 as indicated in step 8A.	Same verification as in steps 8A a) through e), except that +5Vdc at terminal E1 should read between 4.85 and 5.15Vdc under load.	
9A	To measure the unloaded LTU shelf input voltages (if applicable), proceed as follows:		
	a) On the LTU backplane connector J42,shown in Figure 4.01,take a reading between the following pins:		
	1) Pins 1 and 3.	Voltage measured should be between +4.5 and +5.5Vdc.	If reading is not within tolerance, adjust +5V ADJUST potentiometer on LTUPS. If the adjustment does not bring voltage into tolerance,replace LTUPS.
	2) Pins 3 and 5.	Voltages measured should be between −4.9 and −5.2Vdc.	If reading is not within tolerance, replace appropriate LTUPS.
	3) Pins 3 and 4.	Voltage measured should be between −43 and −53Vdc.	If reading does not coincide with verification reading, check the -48P LTU fuse on PSU. If fuse is good, replace -48PS0.
	4) Set digital multimeter to read Vac and connect between pins 2 and 3.	Voltage measured should be between 75 and 100Vac.	If voltage is not present, check/replace RGEN fuse or RAC LTU0 fuse on PSU. If fuses are good, replace PSU.
	b) Set digital multimeter to appropriate Vdc scale.		
	c) On LTU backplane connector J43,shown in Figure 4.01, take a reading between the following pins:		

Table 4.00 Power-Up/Output Voltage Test (Continued)

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
	1) Pins 1 and 3.	Voltage measured should read between +4.5 and +5.5Vdc.	If reading is not within tolerance, adjust +5V ADJUST potentiometer on LTUPSO. If adjustment does not bring the voltage into tolerance, replace LTUPSO.
	2) Pins 1 and 2.	Voltage measured should read between −43 and −53Vdc.	If reading is not within tolerance, replace -48PSO. If voltage not present, check -48B LTU0 fuse on PSU. If fuse is good, replace -48PS0.
	3) Pins 1 and 4.	Voltage measured should read between +11.3 and +12.7Vdc.	If reading is not within tolerance, replace LTUPSO.
	4) Pins 1 and 5.	Voltage measured should read between −11.3 and −12.7Vdc.	If reading is not within tolerance, replace LTUPSO.
	d) On LTU backplane connector J44 shown in Figure 4.01, take a reading between pins 1 and 2 or pins 1 and 3.	Voltage measured should read between +4.5 and +5.5Vdc.	If reading is not within tolerance, check +5V cabling between between basic shelf and LTU
9B	Repeat steps 9A a) through d) for expansion cabinet LTU shelf voltages (if applicable) substituting -48PS1 for -48Vdc power supply and appropriate LTUPS.		
9C	After satisfactorily completing steps 9A and 9B, proceed as follows to measure the loaded LTU shelf input voltages:		
	a) On the PSU, place the circuit breakers designated LTUPS0,LTUPS1,and LTUPS2 in the off (down) positions.		
	b) Plug all previously extracted PCBs on the LTU shelves into their respective backplane connectors.		
	c) On the PSU, place the circuit breakers designated LTUPSO, LTUPS1, and LTUPS2 in the on (up) positions.		
	d) Repeat measurements on LTU backplane connectors J42, J43, and J44 per step 9A.	Voltages measured should be within same tolerances except +5Vdc supply should read between 4.85 and 5.15 Vdc.	

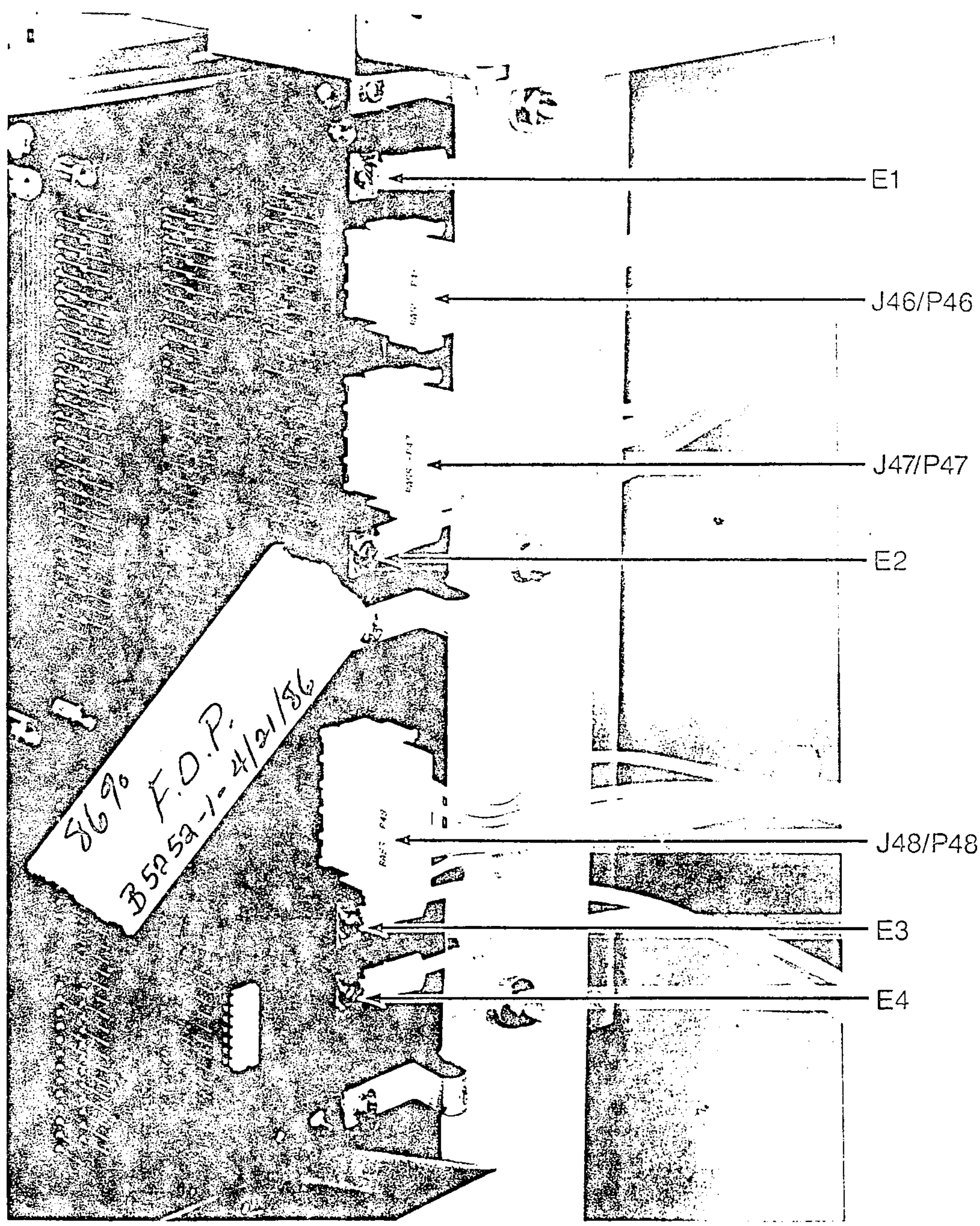

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Figure 4.00 Location of Input Voltage Connectors on Basic Backplane

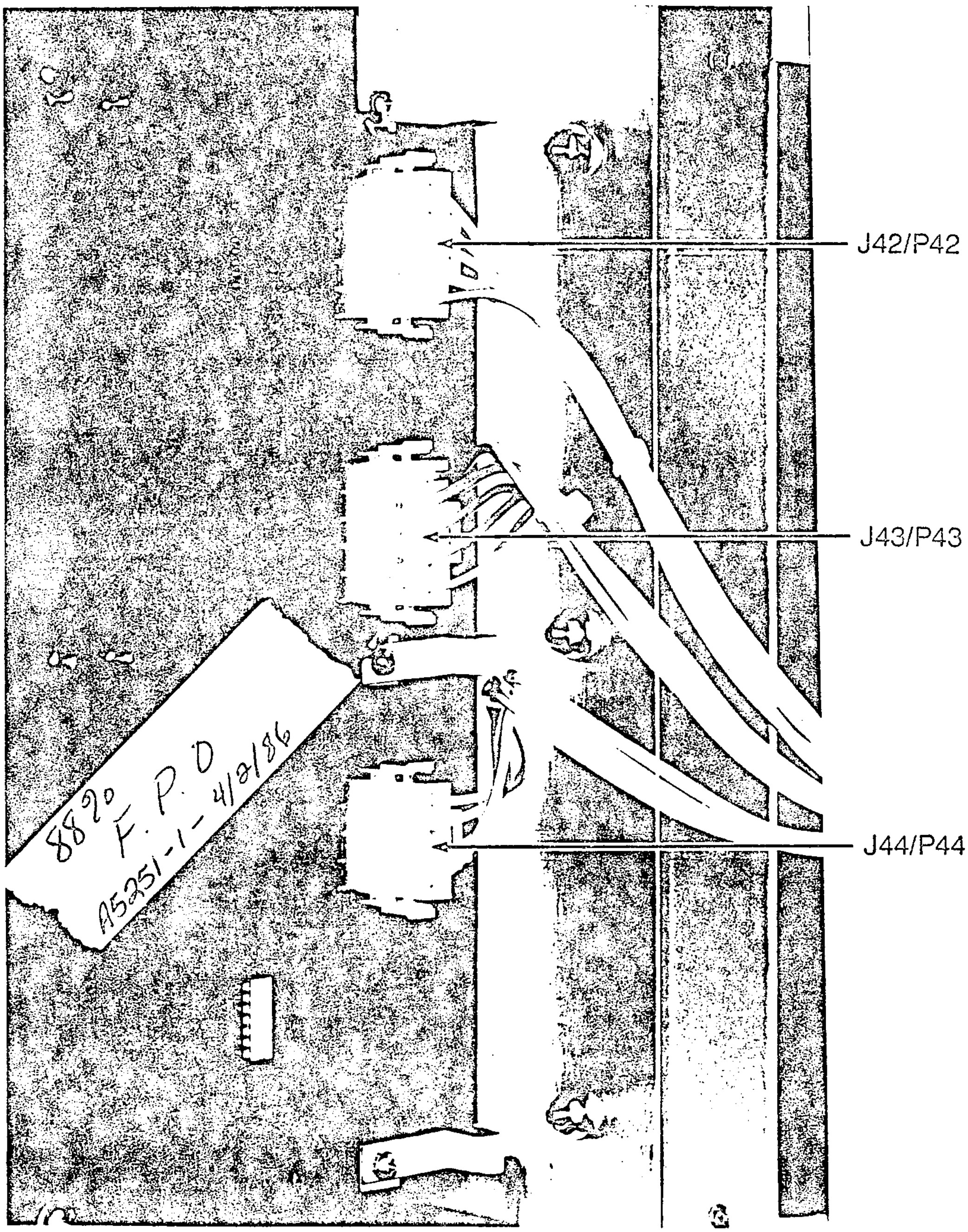

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Figure 4.01 Location of Input Voltage Connectors on LTU Backplane

SECTION 5.00 OPERATING PROGRAM LOADING

5.01 **General.** The SATURN IIE EPABX is a Stored-Program-Controlled (SPC) system. The system is shipped with two identical floppy disks that contain the basic operating and the installation-dependent data. The operating program uses the installation-dependent data, commonly referred to as the system data base, to complete and process calls as required by the customer. This information includes such items as the number of station lines and trunks in the system, as well as their operating characteristics.

The exact equipment configuration of the SATURN IIE System must be defined in the data base in order for the system to operate properly. Depending on how the system is ordered, the data base is supplied in a standard format or, on request, can be supplied completely defined and prepared by Siemens. When the standard data base format is supplied, via the SATURN EPABX Data Base Preparation practice, the equipment configuration of the particular installation-site must be evaluated to determine if additional information must be added to the floppy disks. The floppy disks are updated via a service terminal. The procedures for defining the data base and inputting the data to memory are described in the SATURN EPABX Data Base Preparation practice and SATURN EPABX Customer Memory Update (CMU) Procedures practice.

5.02 **Loading Operating Disks.** After satisfactorily completing the Power-Up/Output Voltage Tests in Section 4.00, the system's operating program, contained on the floppy disks, is loaded into the FDD modules for the initial processor initialization. Both floppy disks are loaded, with either disk placed in either drive (FDD0 or FDD1). Before proceeding with the loading procedures indicated in Table 5.00, the following precautions must be observed when handling the floppy disks. Figure 5.00 illustrates the floppy disk and storage envelope.

a. Prior to using a floppy disk, leave disk in the same environment as the FDD module for at least 5 minutes.

b. Do not place heavy objects on floppy disk.

c. Do not write on floppy disk.

d. Do not touch floppy disk surface while handling. Damage to FDD head may occur due to skin oil picking up dirt.

e. Always return floppy disk to storage envelope when it is not in use.

5.03 **Inputting CMU Data to Floppy Disk.** After satisfactorily loading the operating disks as indicated in Table 5.00, refer to the SATURN EPABX Data Base Preparation practice which defines the particular system's data base, and SATURN EPABX Customer Memory Update (CMU) Procedures practice to input the installation-dependent data to memory.

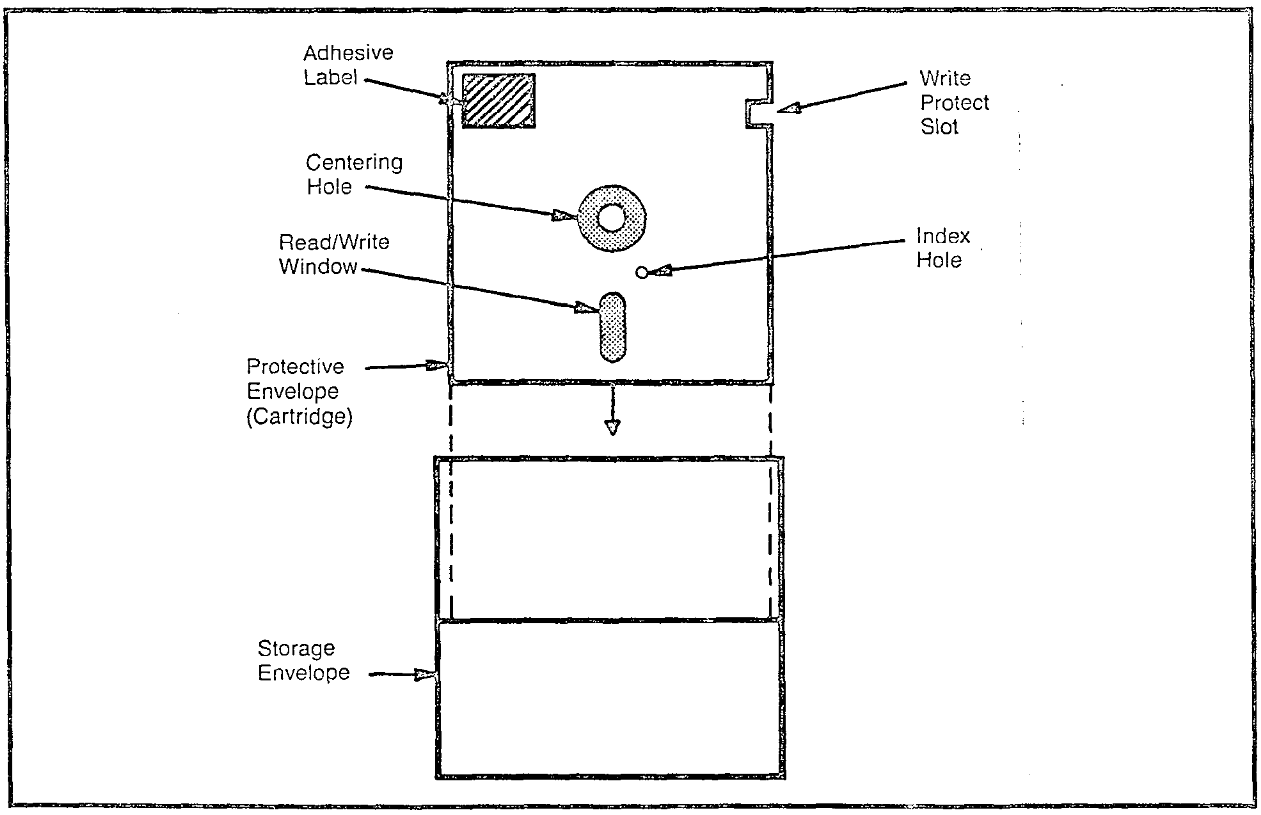

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Figure 5.00 Floppy Disk and Storage Envelope

WARNING

Hazardous voltages exist within the equipment cabinet. Be extremely careful when performing testing/troubleshooting procedures with the equipment panel(s) removed.

Table 5.00 Loading Procedures for Operating Disk

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	On the PSU, shown in Figure 5.01, place the FAILURE TRANSFER switch in the AUTO position.		
2	Insert a floppy disk into slot opening of each FDD until it stops (Figure 5.02). NOTE: Either system disk may be placed in either FDD.		
3	Close FDD latch to secure floppy disk in place.		
4	Perform the following operations on the CIOP PCB (Figure 5.03).		
	a) Connect service terminal to TTY connector on CIOP PCB (Figure 5.03).	Set CIOP DIP switches (Figure 5.03) for service terminal in use per Table 5.01.	
	b) Depress the reset switch located under the CIOP TTY connector. Use pencil or other nonmetallic object to depress the switch.	The following three messages should appear on the service terminal: 1) THE SIB SIDE IS READY FOR USE 2) READY TO START BOOT LOADER 3)*** BOOT LOADER COMPLETE*** After the last message, the red ST0-ST3 LEDs perform a cycling sequence and the green ACTV LED remains lit. When the loading process is complete, the red LEDs stop cycling and one LED remains lit for a few seconds, then cycling starts again. The green LED (ACTV) remains lit. If no failures occur during processor initialization, the four red LEDs display a code indicating that processor initialization has been completed and the processor is on-line. Concurrently, the service terminal displays software version, data base version, patch level of disk software, site information and the prompt ENTER PASSWORD. If it is desired to perform CMU procedures or clear the alarm stack, enter the appropriate password. If the proper password is entered, a date-and-time prompt is displayed. If an incorrect password is entered, INVALID PASSWORD ENTERED is displayed.	If a failure occurs during initialization, the LEDs flash a binary value to indicate loading error as described in Table 5.02. Should any of the failures described in Table 5.02 occur during processor initialization, remove the floppy disks from FDDs and insert the spare floppy disks into the FDDs. If no failures occur, the floppy disks previously removed are defective. If the same failure occurs, refer to ACTION column in Table 5.02.

Table 5.00 Loading Procedures for Operating Disk (Continued)

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
5	If the operating disks that were loaded did not contain a Siemens-prepared data base, refer to SATURN EPABX Data Base Preparation practice to define the particular system data base, and the SATURN EPABX Customer Memory Update Procedures practice to input the installation-dependent data to the system memory.		

Table 5.01 CIOP DIP Switch Settings

CAUTION:

Before removing CIOP PCB to set switches, place BASIC PS circuit breaker on the PSU to the off (down) position. After replacement of CIOP PCB, place circuit breaker back to the on (up) position.

SWITCH NUMBER	SWITCH ON (CLOSED)	SWITCH OFF (OPEN)
1	Maintenance/ Test	Normal
2	Not Used	Not Used
3&4	Baud Rate (see note)	Baud Rate (see note)
5	One Stop Bit	Two Stop Bits
6	Odd Parity	Even Parity
7	Parity Disabled	Parity Enabled
8	Seven Bits	Eight Bits

NOTE: The following are the baud rate combinations for switches 3 and 4.

SW3	SW4	BAUD RATE
OFF	OFF	300
ON	OFF	1200
OFF	ON	2400
ON	ON	9600

Table 5.02 LED Display Values for Loading Errors

ST0 LED	ST1 LED	ST2 LED	ST3 LED	HEX CODE	ERROR DETECTED	ACTION
OFF	OFF	OFF	OFF	0	Start of self test not halted	----------------------
OFF	OFF	OFF	ON	1	Main processor error	Note 1
OFF	OFF	ON	OFF	2	EPROM checksum error	Note 1
OFF	OFF	ON	ON	3	MEM slot 0 low 64k test error	Notes 1 and 3
OFF	ON	OFF	OFF	4	8k by 8 static RAM test error	Note 1
OFF	ON	OFF	ON	5	IRAM memory test error	Note 1
OFF	ON	ON	OFF	6	ORAM memory test error	Note 1
OFF	ON	ON	ON	7	SIB side error	Note 1
ON	ON	OFF	OFF	C	Global memory error	Notes 1 and 3
ON	ON	OFF	ON	D	Watchdog timer error	Note 1
ON	ON	ON	OFF	E	SIB serial loopback test error	Note 1
ON	ON	ON	ON	F	SIB counter timing test error	Note 1
ON	OFF	OFF	OFF	8	Start boot process (self test done)	----------------------
ON	OFF	OFF	ON	9	Disk controller error	Note 1
ON	OFF	ON	OFF	A	Drive not ready error	Note 2
ON	OFF	ON	ON	B	CRC retry errors exceed 8	Note 2

Notes:

1. Upon failure, retry loading procedure. If failure persists, replace CIOP PCB.
2. Upon failure, retry loading procedure using another set of floppy disks. If failure persists, check/replace disk drives and then CIOP PCB, if necessary.
3. If reload and CIOP PCB replacement (Note 1) is not effective, replace memory PCBs starting from slot 0 until failure is no longer present.

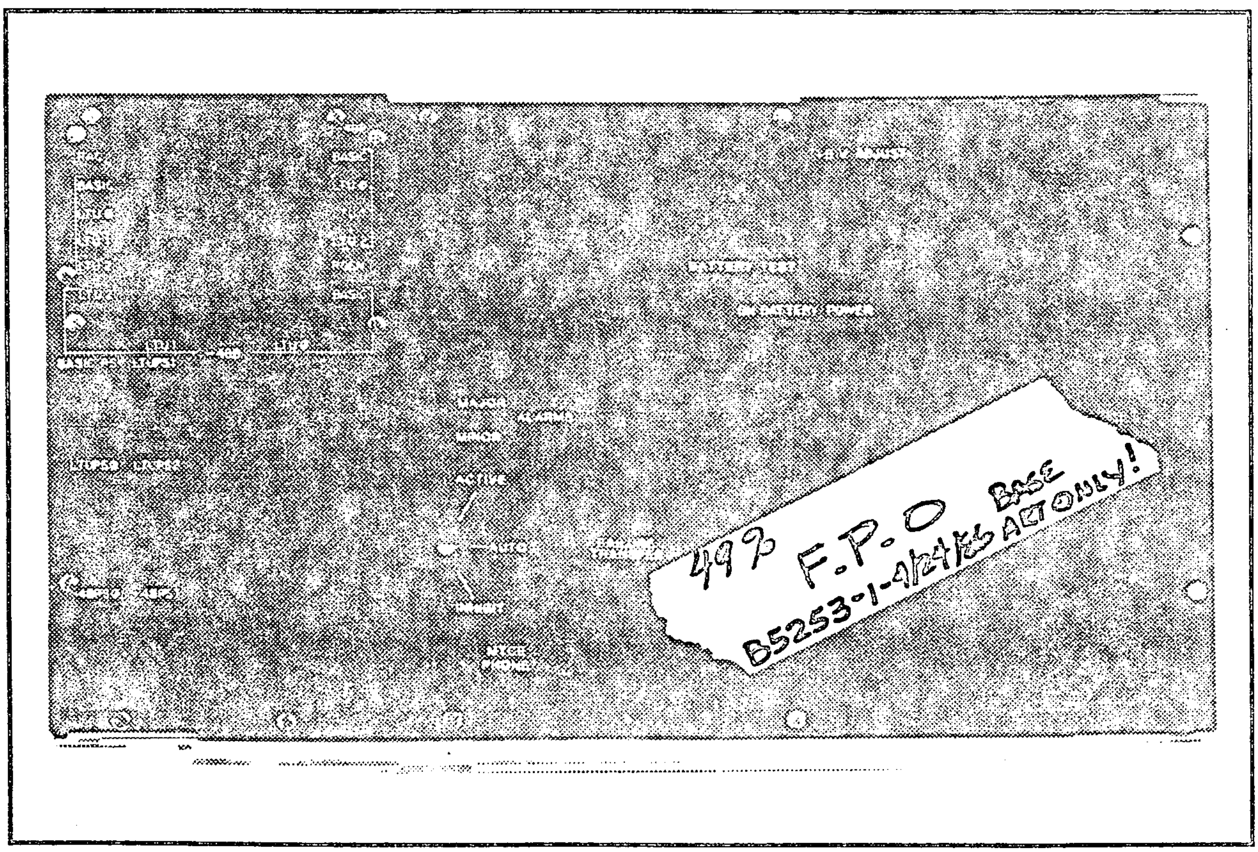

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Figure 5.01 Power System Unit (Front View)

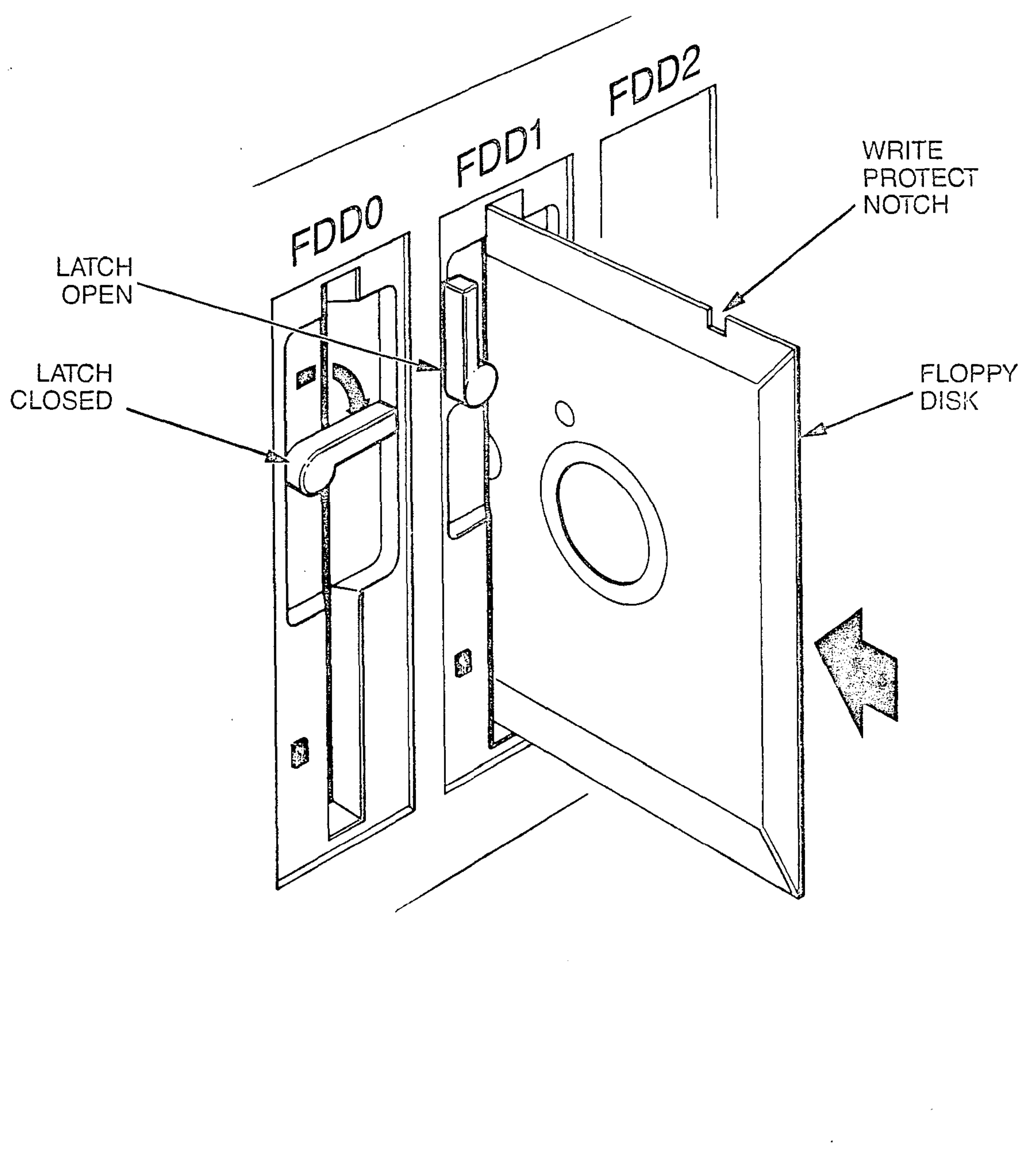

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Figure 5.02 Floppy Disk Loading Procedures

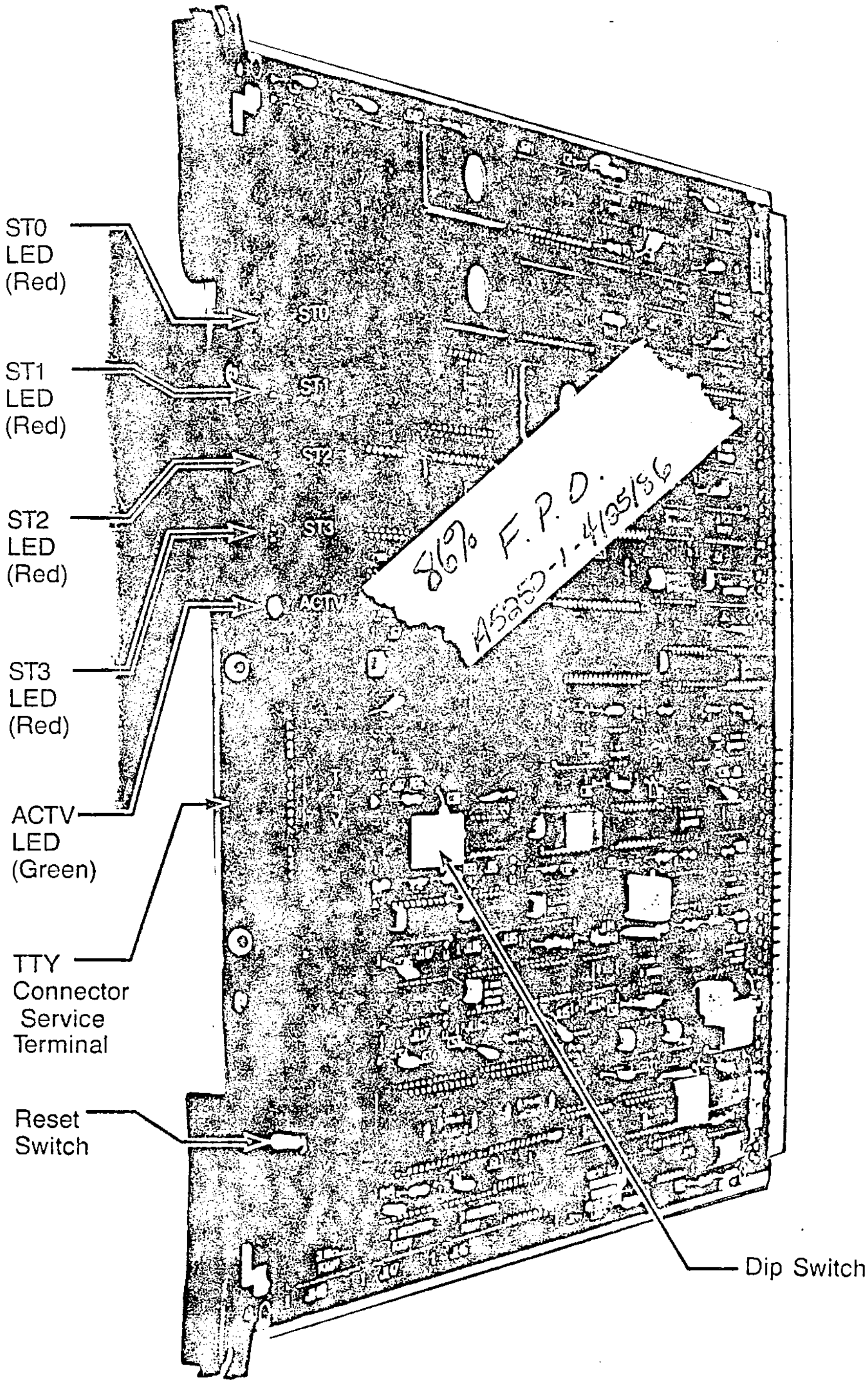

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Figure 5.03 CIOP Printed Circuit Board

SECTION 6.00 ON-LINE DIAGNOSTIC TESTS

6.01 General. After satisfactorily loading the operating disk and inputting CMU data to system memory via a service terminal, the operational capability of the system must be verified after the necessary MDF cross-connections are performed. The SATURN IIE System software contains a group of system and apparatus (ancillary equipment) diagnostic test routines which are accessed via the maintenance phone. Resulting visual and/or audible responses from these on-line diagnostic tests make it possible to verify correct operation or detect and isolate system and apparatus malfunctions. If in doubt about a SATURN PCB or apparatus malfunctioning, craft personnel should refer to the SATURN IIE EPABX Maintenance and Troubleshooting practice for further details. If a SATURN PCB or apparatus is proven to be defective, craft personnel should proceed according to the instructions contained in the MRA kit.

6.02 Connection of Maintenance Phone and Modem. Figures 6.00 and 6.01 provide the details for the maintenance phone and modem initial MDF cross-connections. Figure 6.00 also identifies the leads used when interfacing other maintenance related equipment such as a power failure transfer subsystem and dry contact closures for remote minor and major alarm indications. Note that such equipment is customer-provided and craft personnel should follow the manufacturer's instructions when installing them. To connect the maintenance phone and modem, the initial MDF cross-connections are as follows:

a. Maintenance Phone. At the MDF connecting block on which PSU cable J13 is terminated, cross-connect the T&R leads of pair number 1 (W/BL- BL/W) to the T&R leads of the subscriber line circuit assigned for maintenance purposes (refer to Figure 6.00 for details). Note that this subscriber line circuit must be classmarked with the Maintenance Diagnostic Test (TESTDIAG) and Apparatus Test (TSTAPP) features.

b. Modem. From the system T&R connecting block that allocates system MDF cable J44 from the basic shelf, cross-connect the T&R of pair number 24 (V/BR- BR/V) to the T&R leads of the subscriber line circuit to be used for modem application (refer to Figure 6.01 for details). The subscriber line circuit to be used for modem application must be assigned to a class of service in which the Data Line Security (DATASEC) classmark has been enabled.

After the above initial MDF cross-connections have been performed, the DTMF telephone set to be used as the maintenance phone can be connected to the modular jack designated MTCE PHONE on the PSU if equipped with a standard modular plug, or connected at the MDF to the T&R leads of the associated subscriber line circuit. Note that if a permanent maintenance phone is desired in the equipment, it may be installed near the front of the cabinet, and cross-connected per Figure 6.02.

6.03 MDF Cross-Connecting Procedures. After the maintenance phone and modem connections have been completed, perform the necessary MDF cross-connections according to the equipment configuration plan. The following illustrations are provided to assist craft personnel in the MDF cross connections of peripheral interfacing devices:

a. Figures 6.02 and 6.03 – Cross-Connections for rotary or pushbutton Single Line Telephone Instruments interfacing with SLMA-S and SLA16 PCBs, respectively.

b. Figure 6.04 – Cross-Connections for Siemens Digital Telephone Interfacing with SLMD PCB.

c. Figure 6.05 – Cross-Connections for SATURN Attendant Console.

d. Figure 6.06 – Cross-Connections for Central Office (CO) and Direct Inward Dialing (DID) Trunks.

e. Figure 6.07 – Cross-Connections for Two-Wire (Type I) E&M Tie Trunks.

f. Figure 6.08 – Cross-Connections for Four-Wire (Type I) E&M Tie Trunks.

g. Figure 6.09 – Cross-Connections for Two-Wire (Type II) E&M Tie Trunks.

h. Figure 6.10 – Cross-Connections for Four Wire (Type II) E&M Tie Trunks.

i. Figure 6.11 – Cross-Connections for Recorded Announcement Equipment (DID and Tie Trunk Vacant Number Intercept, and ACD Announcement Service).

j. Figure 6.12 – Cross-Connections for Code Calling Equipment with or without Answerback Capability.

k. Figure 6.13 – Cross-Connections for DTMF Dial Dictation Equipment.

l. Figures 6.14 and 6.15 – Cross-Connections for Music-on-Hold Feature via a Music Source, interfacing with a TMBA4 and an SLMA/SLA16 PCB, respectively.

m. Figure 6.16 – Cross-Connections for Zoned Paging Equipment With Answerback Capability.

n. Figure 6.17 – Cross-Connections for Zoned Paging Equipment Without Answerback Capability.

o. Figure 6.18 – Cross-Connections for Zoned Universal Night Answer (ZUNA or UNA) Signaling Equipment.

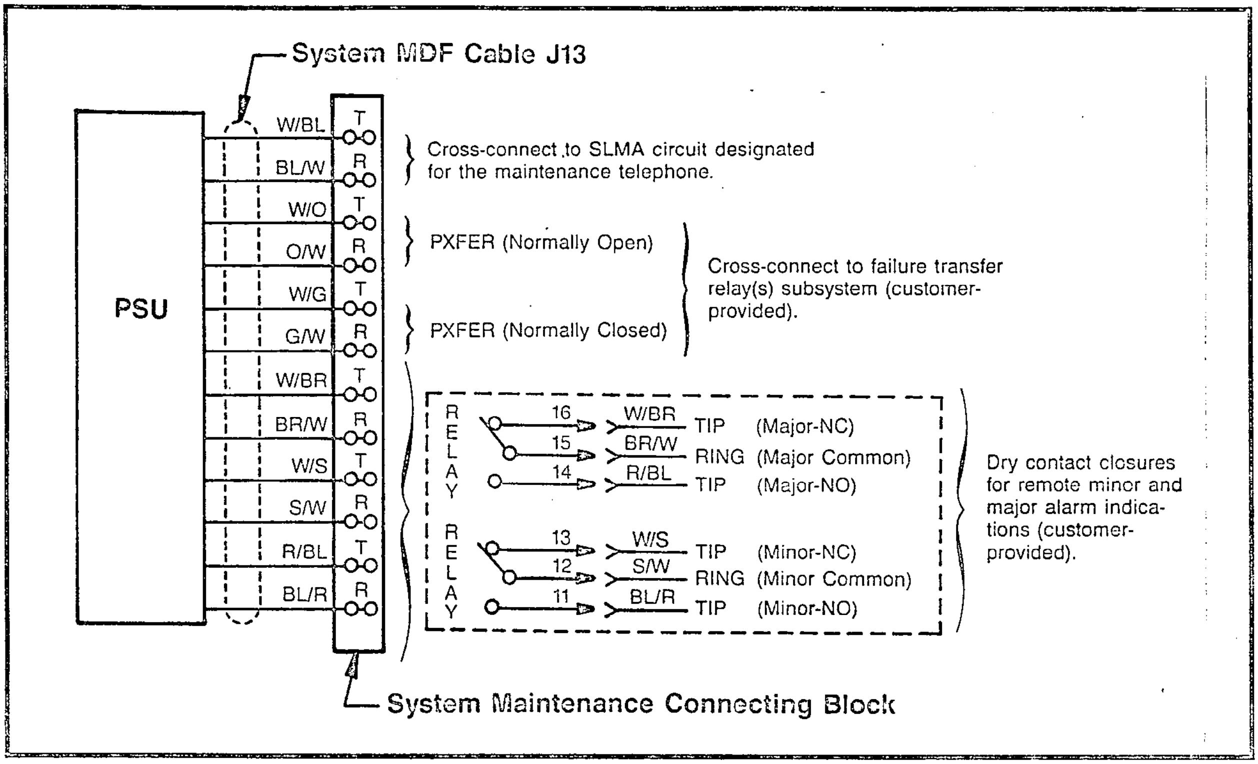

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Figure 6.00 Maintenance Phone and Maintenance-Related Cross-Connections

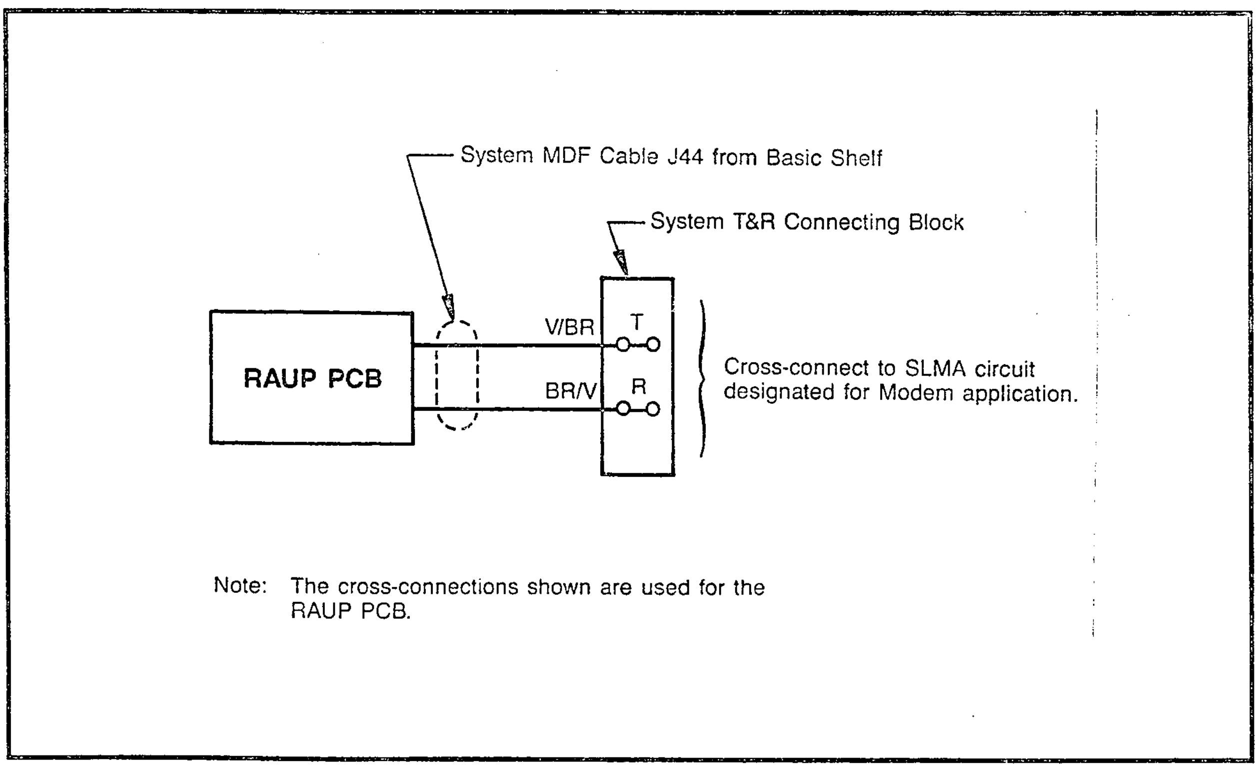

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Figure 6.01 Modem Cross-Connections

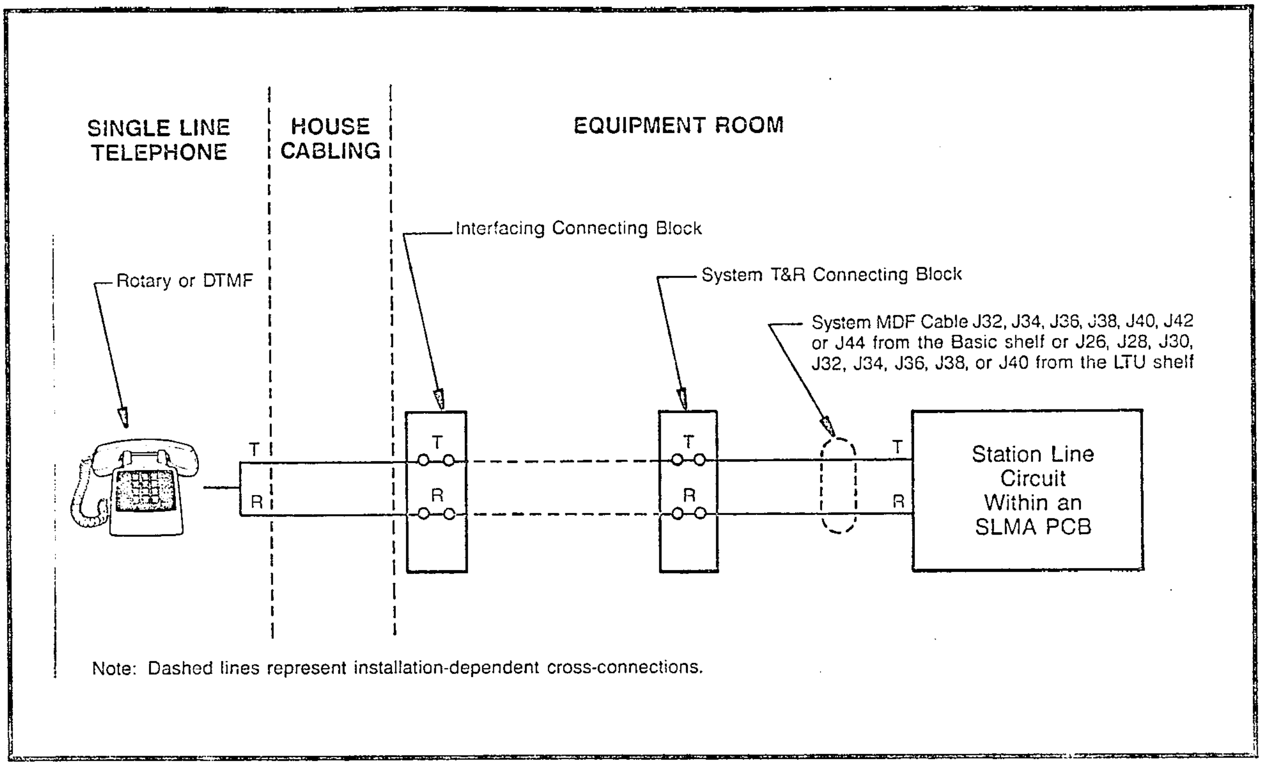

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Figure 6.02 Single Line Telephone Cross-Connections Using SLMA PCB

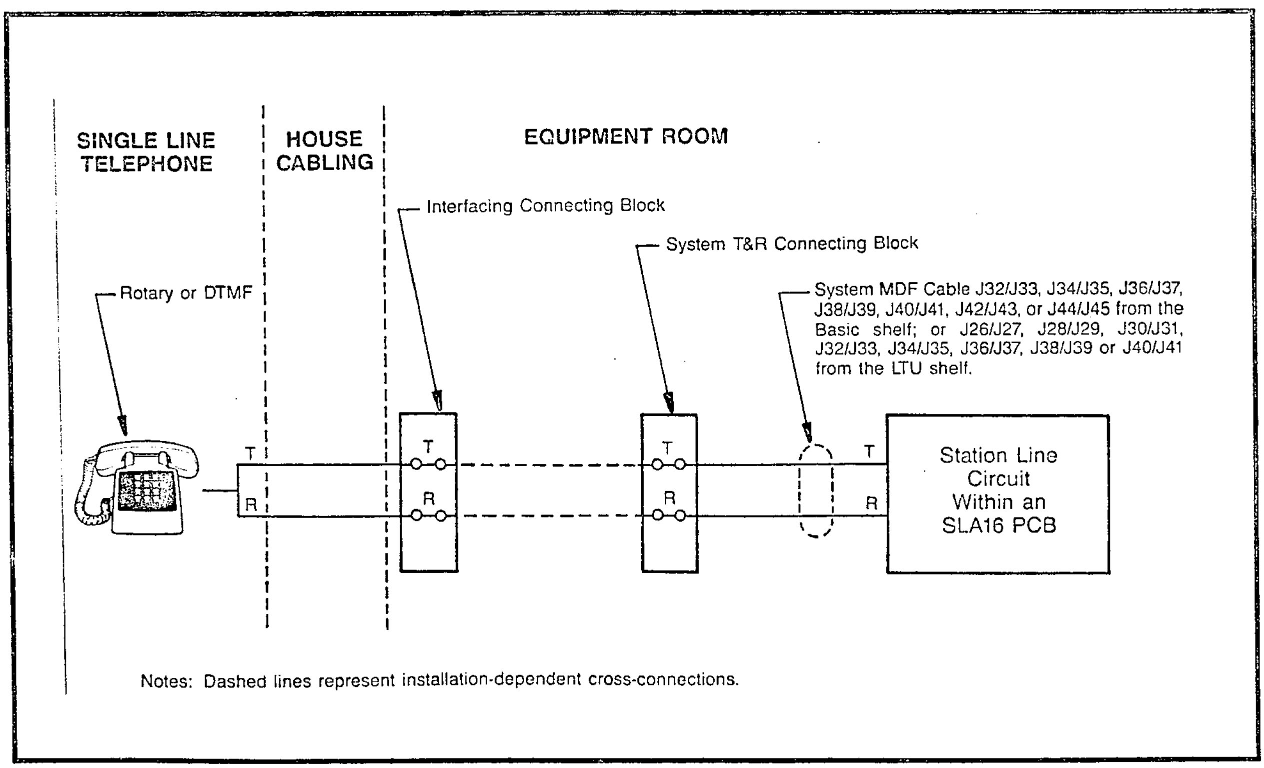

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Figure 6.03 Single Line Telephone Cross-Connections Using SLA16 PCB

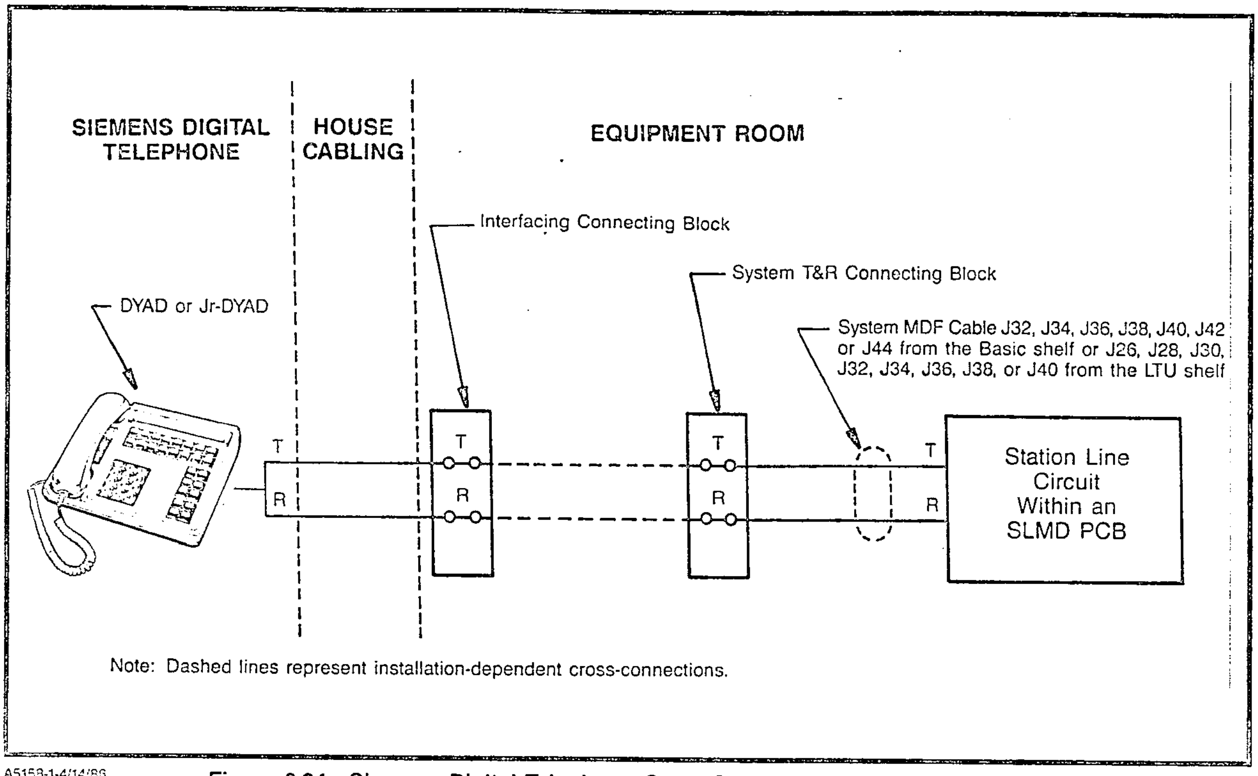

Figure 6.04 Siemens Digital Telephone Cross-Connections Using SLMD PCB

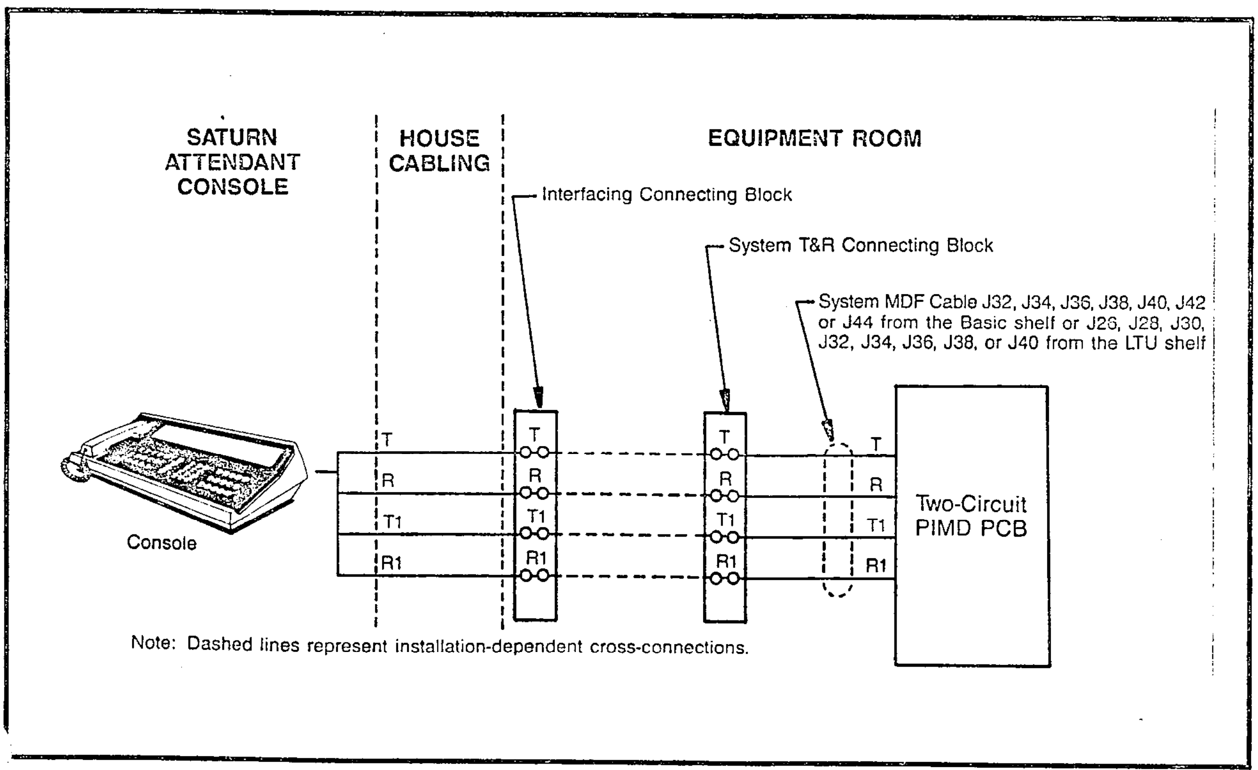

Figure 6.05 SATURN Attendant Console Cross-Connections

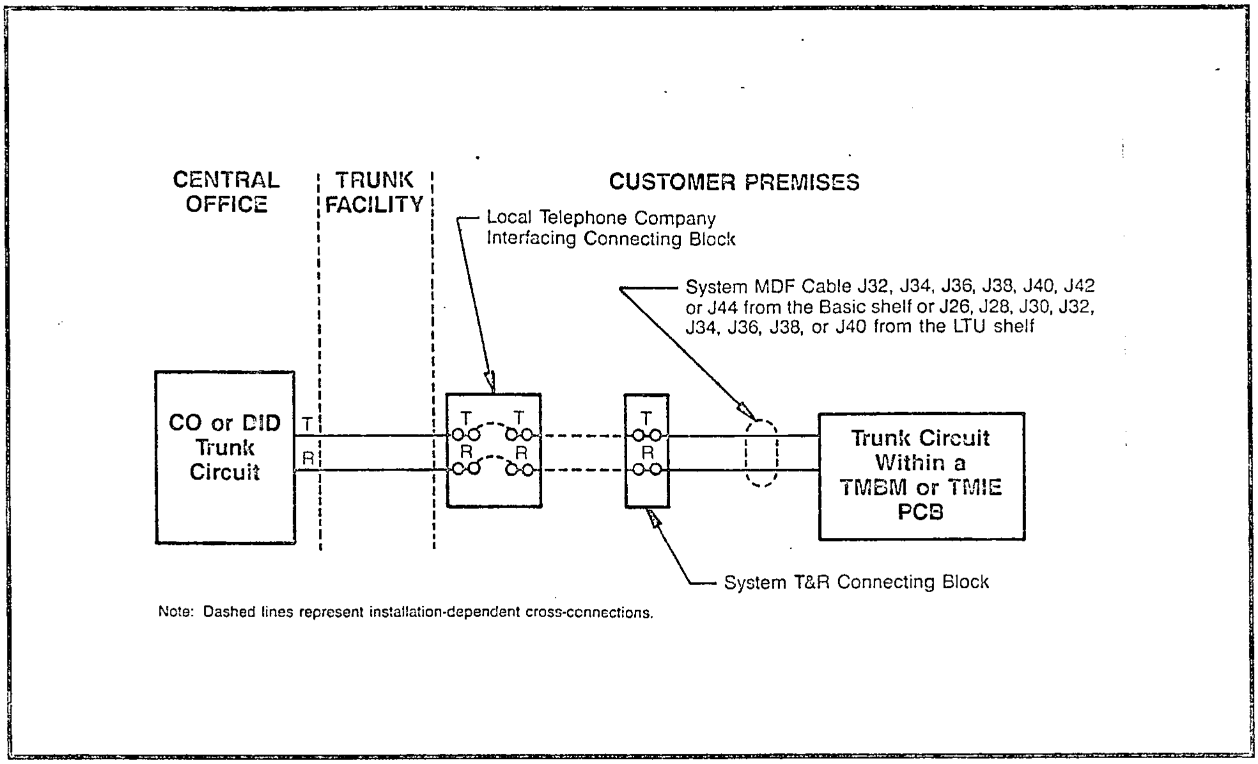

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Figure 6.06 CO and DID Trunk Cross-Connections

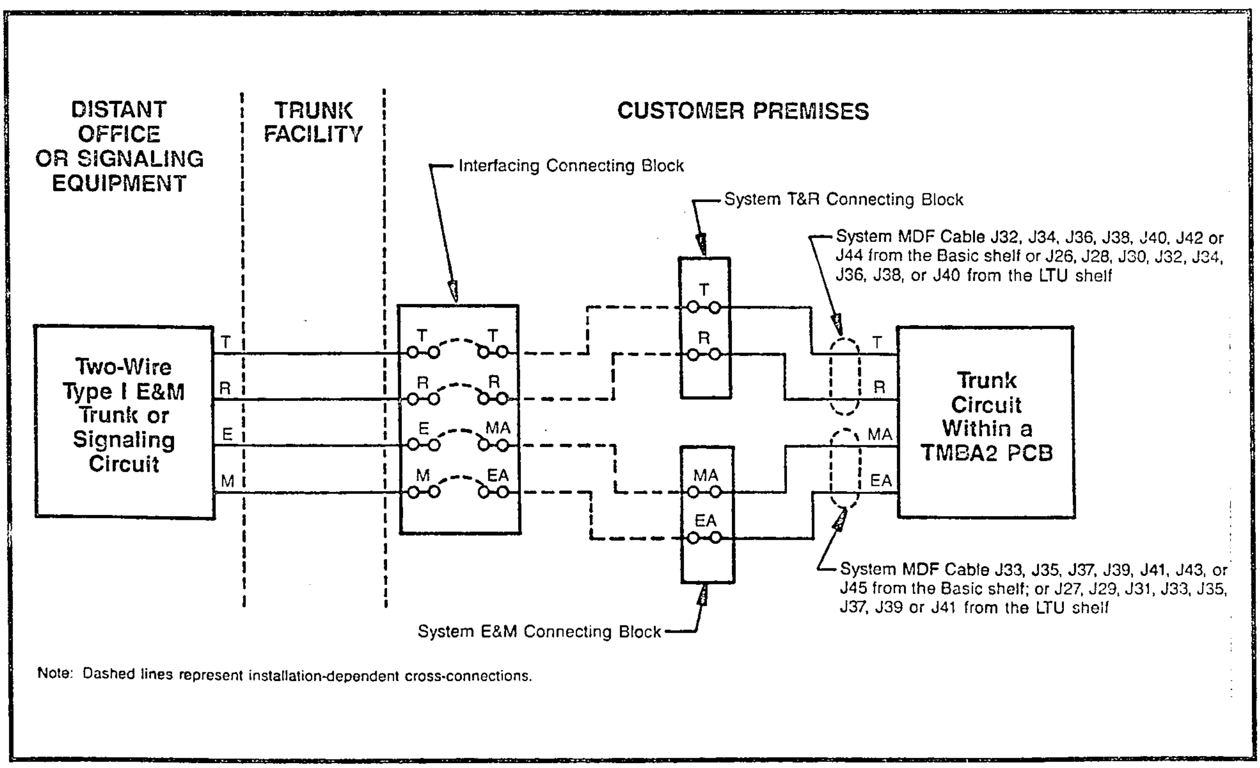

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Figure 6.07 Two-Wire (Type I) E&M Trunk Cross-Connections

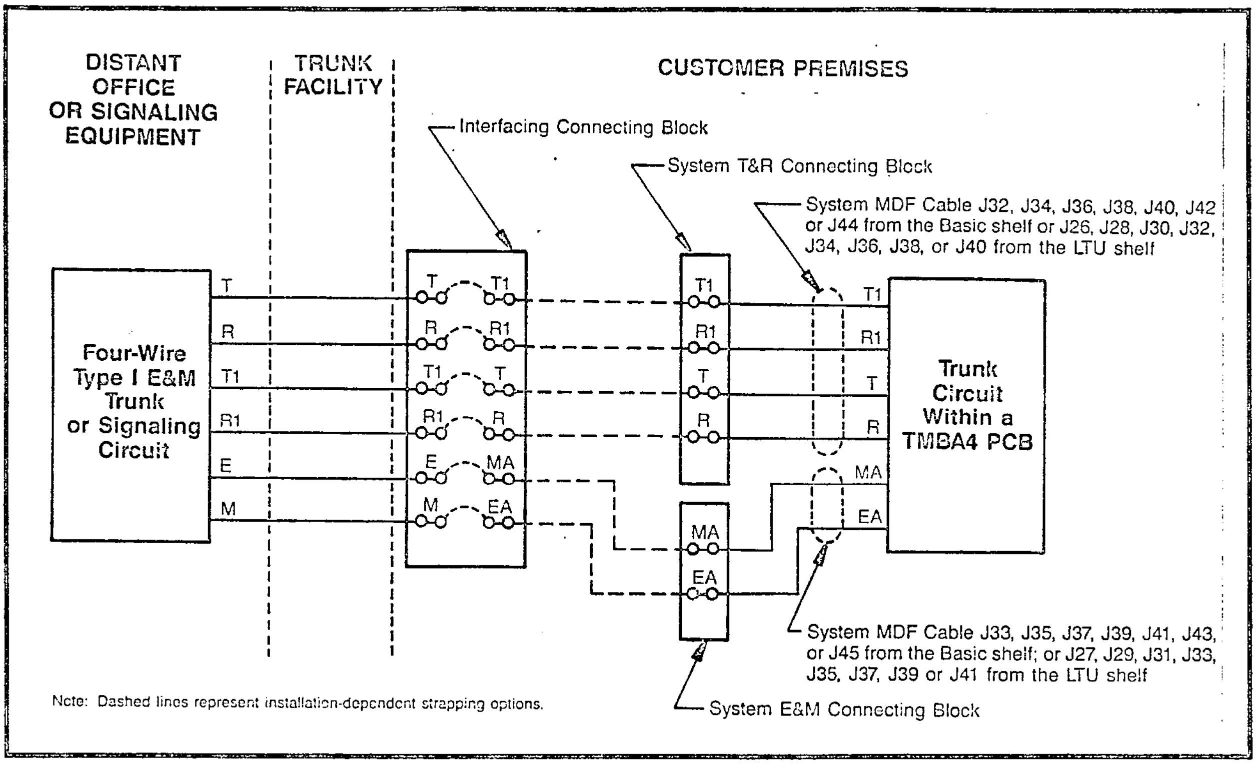

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Figure 6.08 Four-Wire (Type I) E&M Trunk Cross-Connections

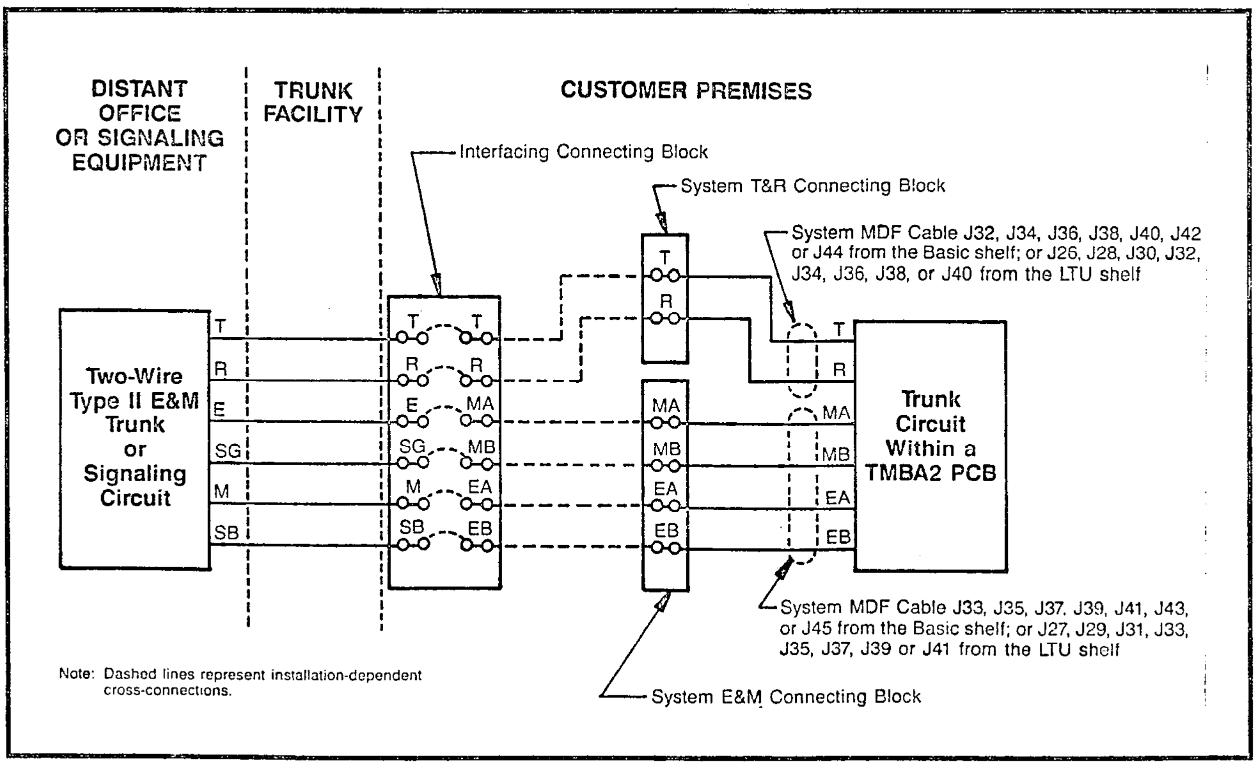

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Figure 6.09 Two-Wire (Type II) E&M Trunk Cross-Connections

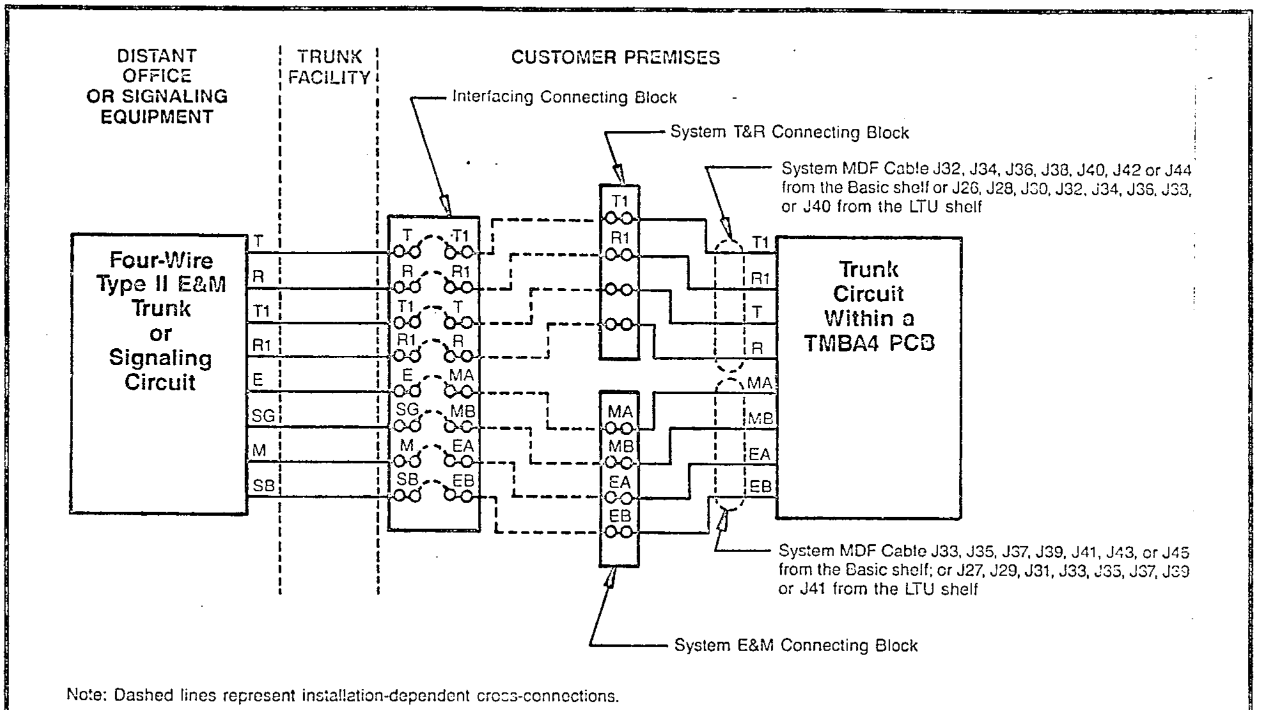

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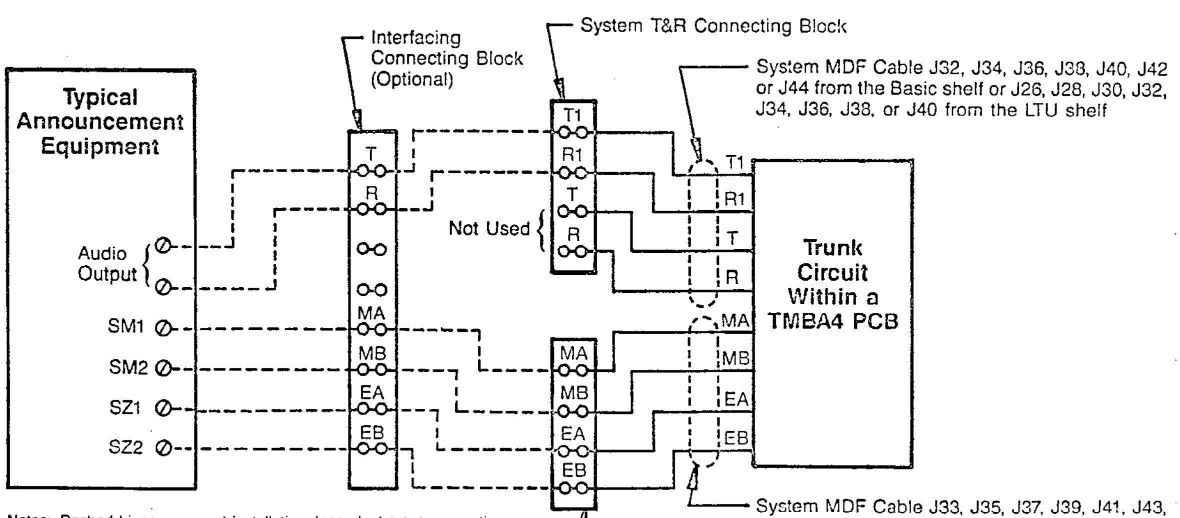
Figure 6.10 Four-Wire (Type II) E&M Trunk Cross-Connections



Notes: Dashed Lines represent installation-dependent cross-connections.

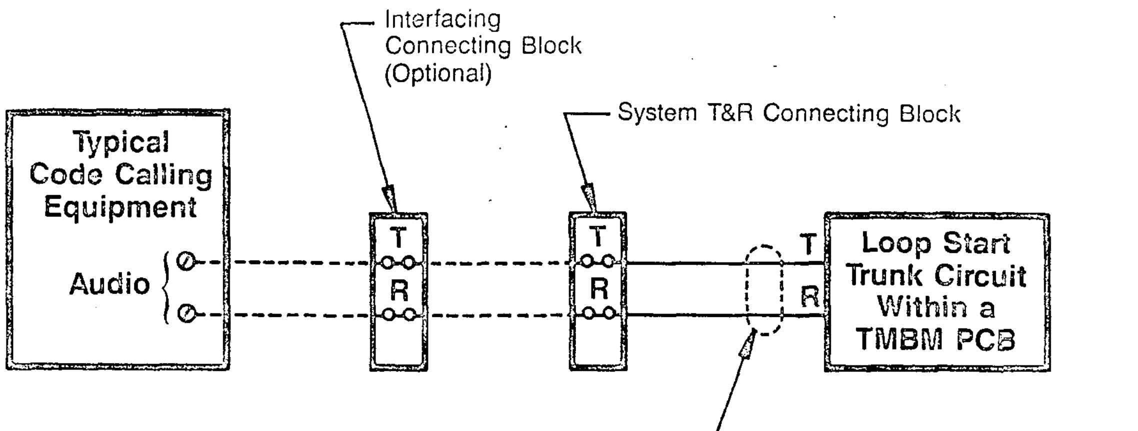
Some announcement machines send both Start Message (SM) and Make Busy (MB) signals over same pair (EA/EB).

Maximum of one DID-type and one ACD type announcement machines can be interfaced with the system.

When maintenance procedures are to be performed on announcement machine, the associated trunk circuit must first be taken out-of-service. Failure to observe this will cause users to be routed to an out-of-service device and receive silence instead of busy tone.

A5126-1-4/8/86

Figure 6.11 Recorded Announcement (DID and Tie Trunk Vacant Number Intercept, and ACD Announcement Service) Cross-Connections



Notes: Dashed lines represent installation-dependent cross-connections

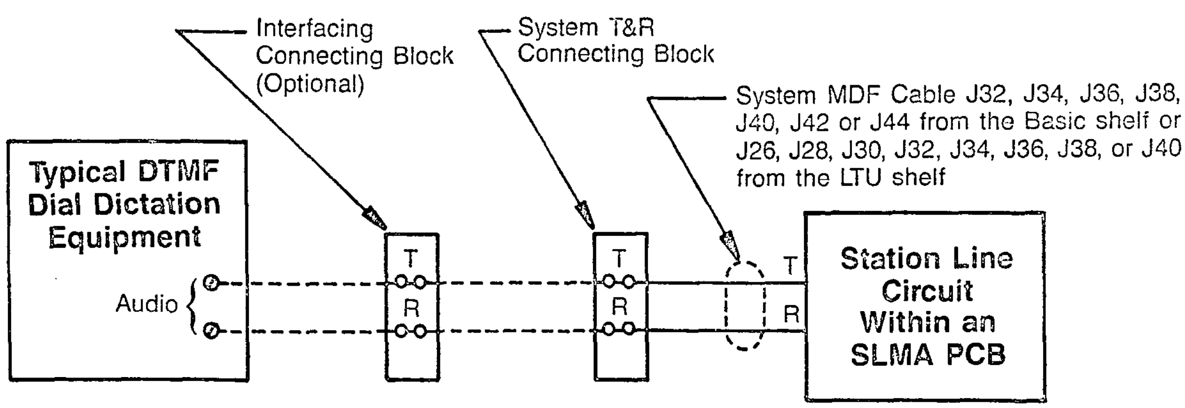
Bi-directional connection to code calling device for both calling and answerback channels shown.

Maximum of one code calling equipment (with or without answerback capability) can be interfaced with the system.

When maintenance procedures are to be performed on code calling equipment, associated trunk circuit must first be taken out-of-service. Failure to observe this will cause users accessing code calling to receive unanswered ringback tone instead of busy tone.

A5119-1-4/8/86

Figure 6.12 Code Calling (With or Without Answerback) Cross-Connections



Notes: Dashed lines represent installation-dependent cross-connections.

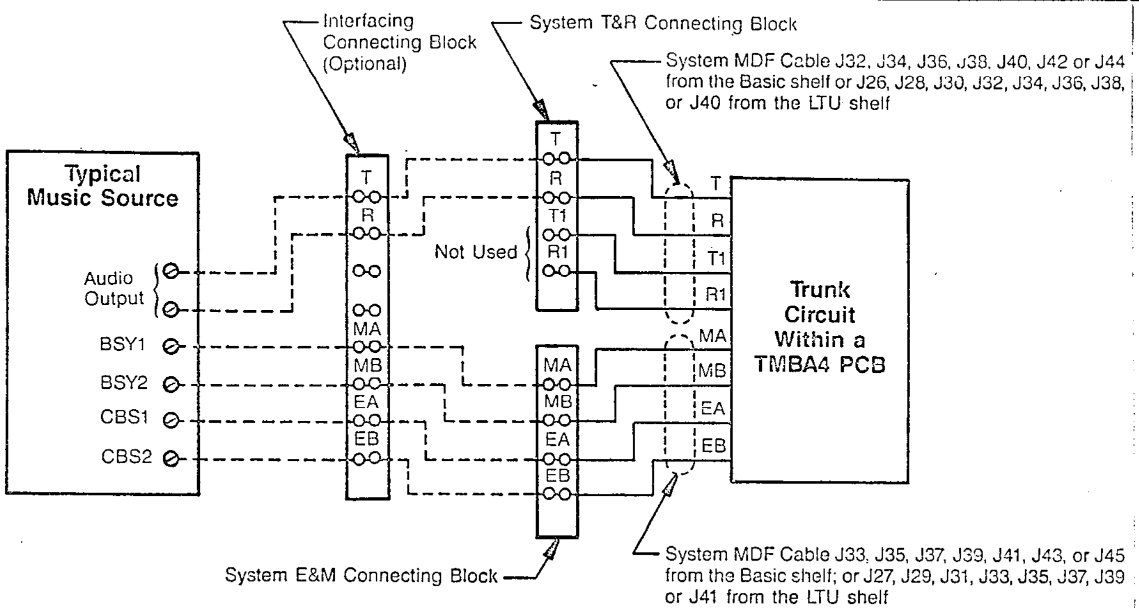
Bi-directional connecection to DTMF dictation equipment shown.

Maximum of four DTMF dial dictation circuits can be interfaced with the system.

When maintenance procedures are to be performed to a dial dictation equipment, the associated SLMA circuit must first be taken out-of-service. Failure to observe this will cause users accessing the dial dictation equipment to hunt to an out-of-service device and receive unanswered ringback tone instead of being routed to an in-service device or receiving busy tone.

A5140-1-4/9/86

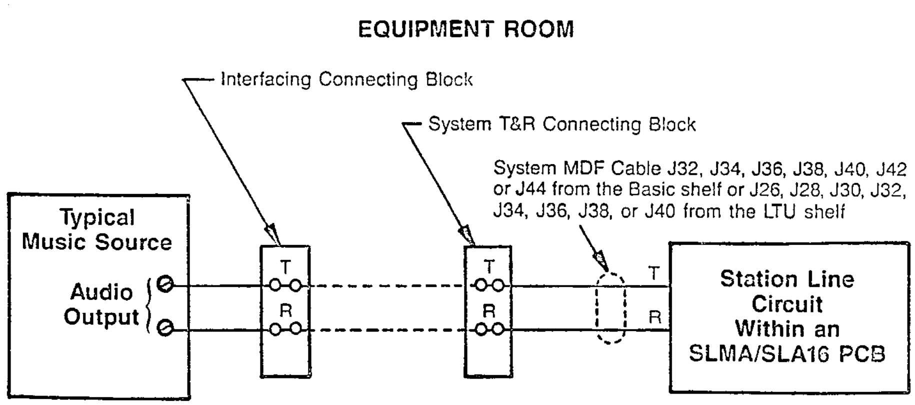
Figure 6.13 Dial Dictation (DTMF) Cross-Connections



Notes: Dashed lines represent installation-dependent cross-connections. Broadcast type connection from music source shown. Two kinds of music source can be cross-connected, continuous type and demand type. For continuous music, the E&M leads are not used; and for demand music, the E&M leads are used.

A5155-1-4/8/86

Figure 6.14 Music-on-Hold Cross-Connections Using TMBA4 PCB



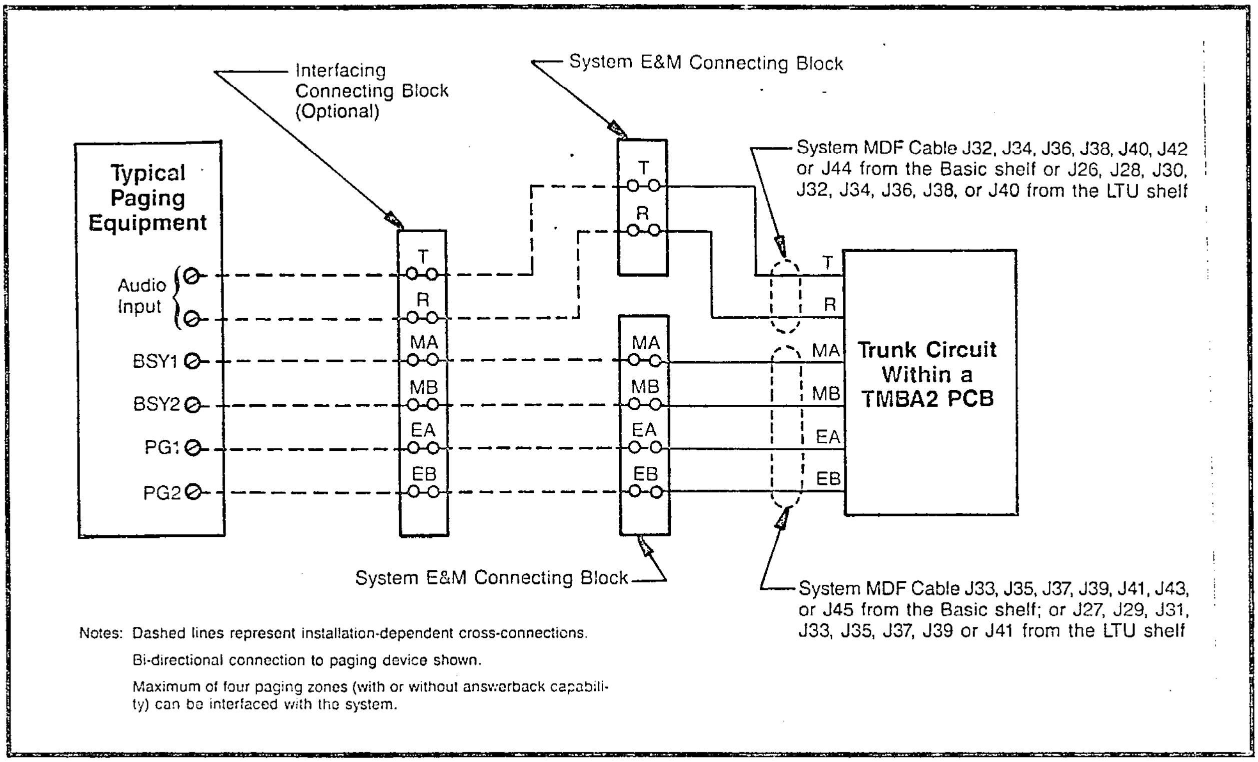
Notes: Dashed lines represent installation-dependent cross-connections.

System MDF Cable connections are shown for an SLMA PCB. For SLA16 connections, refer to Figure 6.03.

Only continuous type music sources may be cross-connected.

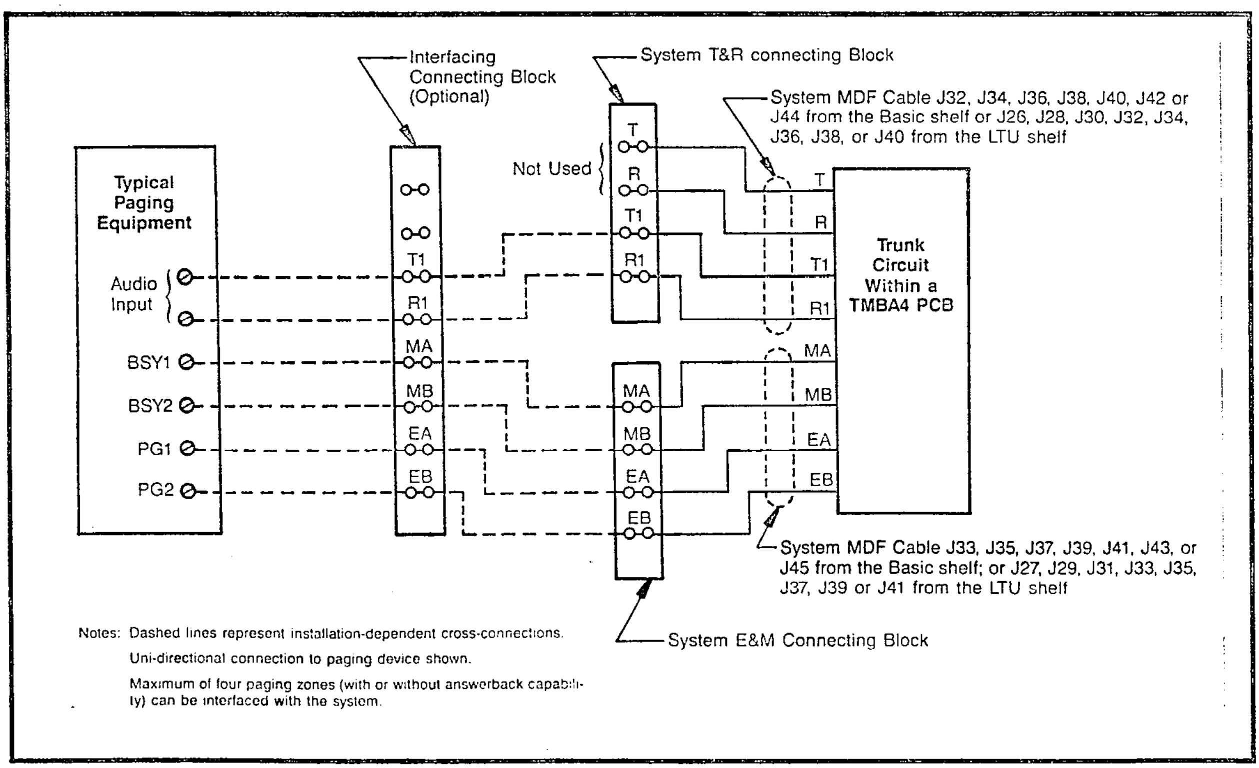
A5156-1-4/8/86

Figure 6.15 Music-on-Hold Cross-Connections Using SLMA/SLA16 PCB



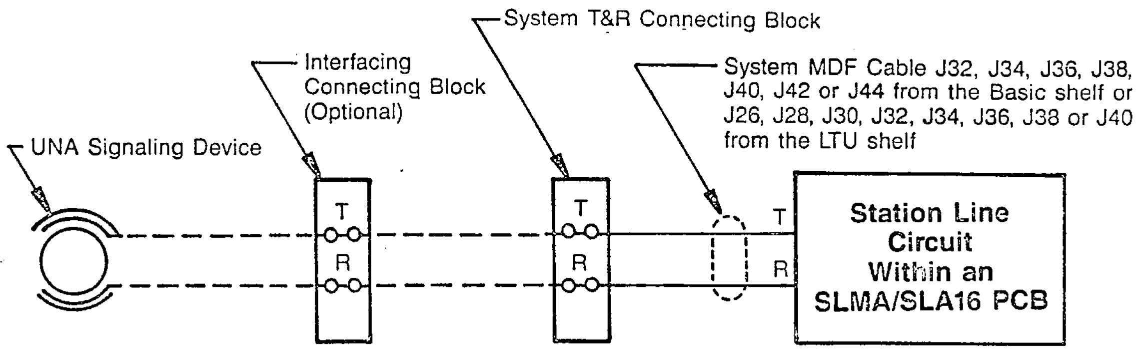
A5159-1-4/9/86

Figure 6.16 Paging With Answerback Cross-Connections



A5160-1-4/9/86

Figure 6.17 Paging Without Answerback Cross-Connections



Notes: Dashed lines represent installation-dependent cross-connections.

System MDF Cable connections are shown for an SLMA PCB. For SLA16 connections, refer to Figure 6.03.

An AC signaling device operated by 20Hz ringing voltage must be connected to an SLMA circuit used for UNA. Each UNA circuit will drive up to four equivalent ringer loads. For installations requiring -48Vdc or a dry contact closure for UNA, appropriate external equipment must be used.

The system will support up to four UNA signaling zones (i.e.; ZUNA); one SLMA circuit is assigned per zone.

A5157-1-4/9/86

Figure 6.18 Universal Night Answer (UNA) Cross-Connections

6.04 System Diagnostic Tests. After the necessary MDF cross-connections have been completed, the on-line diagnostic tests and procedures are performed to verify the operational capability of the system. Note that the subsequent on-line diagnostic tests and procedures are presented in the sequence in which they should be performed under normal installation conditions. It is the responsibility of craft personnel to determine the sequence in which such tests and procedures should be performed when unusual installation conditions exist. Unless otherwise indicated, these tests can be performed with SDTs and/or DTMF SLTs.

a. Tone Generator Test. This system diagnostic test routine verifies that each tone provided by the SMXTG PCB is generated properly. In addition, the test also checks the connection path(s) through the Memory Time Switch (MTS). Refer to Table 6.00 for the necessary procedures to perform the tone generator test.

b. DTMF Receiver Test. This system diagnostic test routine verifies that a DTMF receiver circuit in a particular DTMF PCB is operating properly. The test also checks the connection path(s) through the MTS. Refer to Table 6.02 for the necessary procedures to perform the applicable DTMF receiver circuit test(s). This test requires a Type 2500 DTMF Pushbutton Telephone Set.

c. Station Line Test. This apparatus diagnostic test routine verifies that the supervisory and transmission capabilities between an SLMA, SLA16 or SLMD circuit and associated station or Siemens Digital Telephone instrument are operating properly. This test is performed from the station instrument under test and applies to both single line telephones (rotary or pushbutton) and Siemens Digital Telephones. Refer to Table 6.03 for the necessary procedures to perform the applicable station line test(s).

d. DTMF Pad Test. This apparatus diagnostic test routine verifies that the DTMF keypad performance, including the transmission capabilities, of any DTMF pushbutton-type station instrument is operating properly. The test is performed from the station instrument under test and only applies to single line telephones equipped with a DTMF keypad. Note that a Siemens Digital Telephone cannot be used for this test since data, not tones, are transmitted from the SDTs pushbutton keypad. Refer to Table 6.04 for the necessary procedures to perform the applicable DTMF pad test(s).

e. Console Test. This apparatus diagnostic test routine verifies that the data and speech highways to and from an attendant console are operating properly. The test also verifies that the console LED indicators, alphanumeric display unit and audible alerting device are operating properly. The test is performed from the console under test. Refer to Table 6.05 for the necessary procedures to perform the applicable console tests.

f. Siemens Digital Telephone Button Tests. These apparatus diagnostic test routines verify that the signaling highways to and from Siemens DYAD and JR-DYAD telephones are operating properly. In addition, the tests also verify that the LEDs and the audible alerting devices of the telephones are operating properly. The tests are performed using the DYAD and JR-DYAD telephones. Refer to Tables 6.07 and 6.08 for the necessary procedures to perform the applicable Siemens digital telephone button tests.

g. Siemens Digital Telephone Display Test. This apparatus diagnostic test routine verifies that the signaling highways to and from the Siemens DYAD telephones are operating properly. In addition, the tests also verify that the alphanumeric display unit and the audible alerting devices are operating properly. The tests are performed using the DYAD telephones under test. Refer to Table 6.09 for the necessary procedures to perform the Siemens digital telephone display tests.

h. Trunk Test. This system diagnostic test verifies that the supervisory and transmission capabilities of an outgoing (or outgoing portion of a two-way) trunk are operating properly. In addition, the test also verifies the connection path(s) through the MTS. Refer to Table 6.11 for the necessary procedures to perform the applicable trunk tests.

i. Placing Circuit(s) In-Service. This system procedure allows craft personnel to place an assigned circuit in service from an out-of-service state. This procedure works in parallel with the CMU procedure that changes a circuit's state. Refer to Table 6.12 for the necessary procedures to perform the applicable in-service placement of circuits.

j. Placing Circuit(s) Out-of-Service. This system procedure allows craft personnel to place an assigned circuit out-of service from an in-service state. This procedure works in parallel with the CMU procedure that changes a circuit's state. Refer to Table 6.13 for the necessary procedures to perform the applicable out-of-service placement of circuits.

WARNING

Hazardous voltages exist within the equipment cabinet. Be extremely careful when performing testing/troubleshooting procedures with the equipment panel(s) removed.

Table 6.00 Tone Generator Test

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone returned.	
3	Dial 1 for tone generator test.	None.	
4A	Dial 00 if all tones are to be tested and verify that all tones returned are undistorted.	All tones are returned in the sequence shown in Table 6.01 for two seconds each; test repeats until the maintenance test phone is placed on-hook or hook flashed.	If any tone(s) is returned distorted retry test two more times. If distortion continues, replace the SMXTG PCB. Note that the first 16 tones are hardware interrupted. If continuous tones are returned, replace the SMXTG PCB.
4B	Dial the individual test number shown in Table 6.01 if a particular tone is to be tested.	Chosen tone returned until maintenance test phone is placed on-hook or hook-flashed.	If chosen tone is returned distorted, retry test two more times. If distortion continues, replace the SMXTG PCB.
5A	If additional tests or procedures are to be performed, hook-flash the maintenance test phone and dial the next code (Diagnostic Test Access Code is not redialed).	Recall dial tone is returned.	
5B	If no additional tests or procedures are to be performed, place the maintenance test phone on-hook.	None.	

Table 6.01 Tone Generator Test Numbers

TEST NUMBER	TONE
00	Circular Sequence
01	DTMF-1 (697Hz + 1209Hz)
02	DTMF-2 (697Hz + 1336Hz)
03	DTMF-3 (697Hz + 1477Hz)
04	DTMF-4 (770Hz + 1209Hz)
05	DTMF-5 (770Hz + 1336Hz)
06	DTMF-6 (770Hz + 1477Hz)
07	DTMF-7 (852Hz + 1209Hz)
08	DTMF-8 (852Hz + 1336Hz)
09	DTMF-9 (852Hz + 1477Hz)
10	DTMF-0 (941Hz + 1336Hz)
11	DTMF-* (941Hz + 1209Hz)
12	DTMF-# (941Hz + 1477Hz)
13	DTMF-A (697Hz + 1633Hz)
14	DTMF-B (770Hz + 1633Hz)
15	DTMF-C (852Hz + 1633Hz)
16	DTMF-D (941Hz + 1633Hz)
17	Dial Tone (350Hz + 440Hz)
18	Busy Tone (480Hz +620 Hz)
19	Reorder Tone (Fast Busy Tone)
20	Test Tone (1004Hz @-16dBm)
21	Low Tone (440Hz)
22	Audible Ring (440Hz + 480Hz – uninterrupted)
23	Intercept Tone (440Hz + 620Hz)
24	LDN Call Identification Tone (400 Hz + 480 Hz – interrupted)
25	Called Party Tone (2100 Hz – uninterrupted)
26	Remote Hold Recall Identification Tone (400 Hz)
27	Quiet Tone

Table 6.02 DTMF Receiver Test

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial # for DTMF receiver test.	None.	
4	Dial the four-digit PEN number of the DTMF receiver circuit to be tested.	Dial tone returned and the associated DTMF receiver circuit LED in the DTMF PCB is lit steadily.	If busy tone is returned, the DTMF receiver circuit is busy. Retry later. If intercept tone is returned, the DTMF receiver circuit is not assigned (check data base assignment).
5	Depress the maintenance test phone keypad's buttons in the following sequence. a) For 12-button phones: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, * and #. b) For 16-button phones: A, B, C, D, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *, and #.	Test tone (1004Hz at -16dBm) returned.	If intercept tone is returned at any time, either the DTMF receiver or the maintenance phone's key-pad is not operating properly, or the buttons were depressed in the wrong sequence. Retry test with another DTMF phone. If intercept tone is returned again, replace the DTMF receiver circuit.
6A	If additional tests or procedures are to be performed, hook-flash maintenance test phone and dial the next code (Diagnostic Test Access Code is not redialed).	Recall dial tone is returned and the associated DTMF receiver circuit LED in the DTMF PCB is extinguished.	
6B	If no additional tests or procedures are to be performed, place the maintenance test phone on-hook.	The associated DTMF receiver circuit LED in the DTMF PCB is extinguished.	

Table 6.03 Station Line Test

NOTES: 1) If the system option flag TSTDIAG has been enabled in the data base or the station under test is classmarked with the TSTAPP feature, the maintenance test phone is not required to enable or disable the Apparatus Diagnostic Test routines; therefore, perform only steps 5 through 10.

2) If the system option flag TSTDIAG has been disabled in the data base or the station under test is not classmarked with the TSTAPP feature, the maintenance test phone is required to enable or disable the Apparatus Diagnostic Test routines; therefore, perform the entire procedure (steps 1 through 11).

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the Apparatus tests.	Confirmation tone is returned.	
4	Place the maintenance test phone on-hook.	None.	
5	Place the station under test off-hook.	Dial tone is returned	
6	Dial the Test-Station Line Access Code.	Confirmation tone is returned.	

Table 6.03 Station Line Test (Continued)

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
7	Place station under test on-hook.	Ringing returned.	If ringing is not heard, switch the station instrument to determine if it is defective. If ringing is still not heard, replace the associated subscriber line PCB.
8	Pick up handset to answer test call.		
9	Verify that the test tone level is correct by using a TMS.	Test tone (1004Hz @ -16dBm) is returned.	If the returned test tone level is weak, swap the instrument to determine if it is defective If the test tone level increases considerably, replace the station instrument. If test tone level remains weak, replace the associated subscriber line PCB (SLMA, SLA16 or SLMD).
10	Place station under test on-hook.	None.	
11	If no additional Test routines are to be performed, proceed as follows:		
	Place maintenance test phone off-hook.	Dial tone is returned.	
	Dial the Diagnostic Test Access Code	Recall dial done is returned.	
	Dial 2 to disable test routine.	None.	
	Place maintenance phone on-hook.	None.	

Table 6.04 DTMF Pad Test

NOTES: 1) If the system option flag TSTDIAG has been enabled in the data base or the station under test is classmarked with the TSTAPP feature, the maintenance test phone is not required to enable or disable the Apparatus Test routines; therefore, perform only steps 5 through 8.

2) If the system option flag TSTDIAG has been disabled in the data base or the station under test is not classmarked with the TSTAPP feature, the maintenance test phone is required to enable or disable the Apparatus Test routines; therefore, perform the entire procedure (steps 1 through 9).

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the tests.	Confirmation tone returned.	
4	Place maintenance test phone on-hook.	None.	
5	Place DTMF station under test off-hook.	Dial tone returned.	
6	Dial the Test DTMF Pad Access Code.	Recall dial tone is returned.	

Table 6.04 DTMF Pad Test

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
7	Depress the DTMF keypad buttons in the following sequence: For 12-button phones: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, * and #. For 16-button phones: A, B, C, D, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, * and #.	Recall dial tone ceases. After all the DTMF keypad buttons are depressed in the sequence indicated, test tone (1004Hz @ -16dBm) is returned for one minute.	If busy tone is returned at any time, either the DTMF key pad buttons were depressed in the wrong sequence,the DTMF keypad of the station under test is defective or the subscriber line circuit is defective. To locate failure, retry test to verify that the keypad buttons were not depressed out of sequence. If problem persists, swap the station instrument to determine if it is defective. If problem remains, replace the appropriate subscriber line PCB.
8	Verify the level of test tone by using a TMS.		If the measured test tone is correct but is weak, replace the station set. If the measured tone is low, replace the subscriber line PCB SLMA or SLA16).
9	Place DTMF station under test on-hook to terminate test.	None.	
10	If no additional apparatus tests are to be performed, proceed as follows:		
	Place maintenance test phone off-hook.	Dial tone is returned.	
	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
	Dial 2 to disable the Apparatus Tests.	None.	
	Place maintenance test phone on-hook.	None.	

Table 6.05 Console Test

NOTES: 1) If the system option flag TSTDIAG has been enabled in the data base, the maintenance test phone is not required to enable and disable the Apparatus Test routines; therefore, perform only steps 5 through 9.

2) If the system option flag TSTDIAG has been disabled in the data base, the maintenance test phone is required to enable and disable the Apparatus Test routines; therefore, perform the entire procedure (steps 1 through 10).

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the Apparatus Tests.	Confirmation tone is returned.	
4	Place maintenance test phone on-hook.	None.	
5	At the Console under test dial the Attendant Console Test access code when the console is in an idle state.	Recall dial tone is returned. Also the access code is displayed momentarily, then the display changes to CONSOLE TEST and all button LEDs are extinguished.	If reorder tone is returned, the Attendant Console Test routine is in use, retry later.

Table 6.05 Console Test (Continued)

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
6	Depress the console's keypad buttons in the following sequence: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, * and #.	All digits dialed are displayed (accumulate).	If proper verification is not obtained or busy tone is returned at any time, the keypad buttons or console buttons were depressed out of sequence, the console is defective, or PIMD circuit is defective. To isolate the failure, retry test to verify that the buttons were not depressed out of sequence.
7	Depress the console's feature buttons in the sequence shown in Figure 6.19.	Each button LED lights when depressed and extinguishes when the next key is depressed.	
8	After the last button in the sequence is depressed, depress any console button to initiate the display test. The display can be suspended by depressing any key on the console and resumed in the same manner.	Groups of eight of each of the displayable characters are scrolled in the sequence shown in Table 6.06. After the last character is displayed (under score character), the display unit is cleared and the following LEDs momentarily light then extinguish in the following sequence: a) TRUNK GROUP STATUS 1 – 24 b) SOURCE c) DESTINATION d) ALERT e) CW f) MAJ ALM g) MIN ALM After the above indications are completed the following indications occur: Ringback tone is returned. All LEDs on the display assembly flash.. After the above indications are completed the following indications occur: Ringback tone is returned. All LEDs on the display assembly flash. The audible alerting device sounds at intervals. REMOVE HANDSET is displayed.	If proper verification is not obtained or busy tone is returned again, replace associated PIMD PCB to verify whether the PIMD circuit or the console is defective. If proper verification is obtained, replace the associated PIMD PCB. If proper verification is not obtained or busy tone is returned again, replace the console.
9	Remove and reinsert handset assembly to terminate test, or wait 30 seconds for test timeout.	INSERT HANDSET is displayed while handset is removed. After handset is reinserted, console returns to normal operation.	
10	If no additional apparatus tests are to be performed, proceed as follows:		
	Place maintenance test phone off-hook.	Dial tone is returned.	
	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
	Dial 2 to disable the Apparatus Tests.	None.	
	Place maintenance test phone on-hook.	None.	

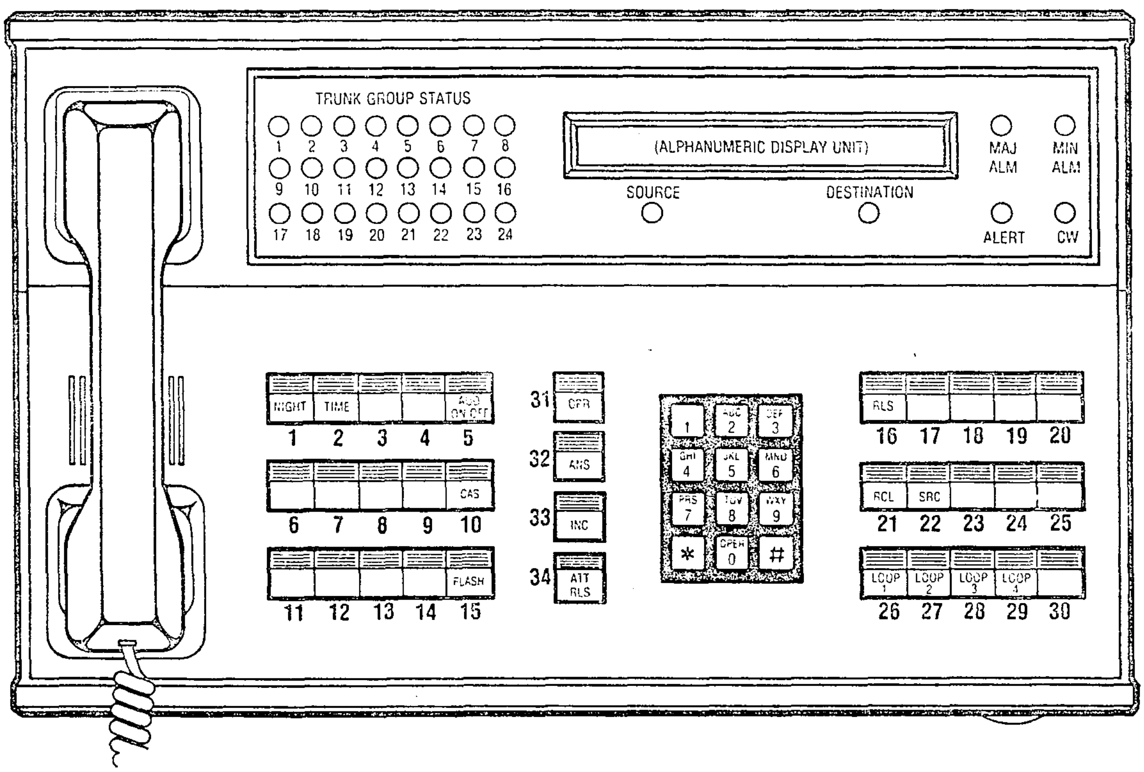


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Figure 6.19 Attendant Console Keypad and Feature Button Depression Sequence

Table 6.06 Attendant Console Displayable Characters

ORDER	CHARACTER	ORDER	CHARACTER
1.	! ! ! ! ! ! ! !	33.	A A A A A A A A
2.	" " " " " " " "	34.	B B B B B B B B
3.	# # # # # # # #	35.	C C C C C C C C
4.	$ $ $ $ $ $ $ $	36.	D D D D D D D D
5.	% % % % % % % %	37.	E E E E E E E E
6.	& & & & & & & &	38.	F F F F F F F F
7.	| | | | | | | |	39.	G G G G G G G G
8.	((((((((	40.	H H H H H H H H
9.	))))))))	41.	I I I I I I I I
10.	* * * * * * * *	42.	J J J J J J J J
11.	+ + + + + + + +	43.	K K K K K K K K
12.	, , , , , , , ,	44.	L L L L L L L L
13.	- - - - - - - -	45.	M M M M M M M M
14.	. . . .	46.	N N N N N N N N
15.	/ / / / / / / /	47.	O O O O O O O O
16.	0 0 0 0 0 0 0 0	48.	P P P P P P P P
17.	1 1 1 1 1 1 1 1	49.	Q Q Q Q Q Q Q Q
18.	2 2 2 2 2 2 2 2	50.	R R R R R R R R
19.	3 3 3 3 3 3 3 3	51.	S S S S S S S S
20.	4 4 4 4 4 4 4 4	52.	T T T T T T T T
21.	5 5 5 5 5 5 5 5	53.	U U U U U U U U
22.	6 6 6 6 6 6 6 6	54.	V V V V V V V V
23.	7 7 7 7 7 7 7 7	55.	W W W W W W W W
24.	8 8 8 8 8 8 8 8	56.	X X X X X X X X
25.	9 9 9 9 9 9 9 9	57.	Y Y Y Y Y Y Y Y
26.	: : : : : : : :	58.	Z Z Z Z Z Z Z Z
27.	; ; ; ; ; ; ; ;	59.	[[[[[[[[
28.	< < < < < < < <	60.	\ \ \ \ \ \ \ \
29.	= = = = = = = =	61.	]]]]]]]]
30.	> > > > > > > >	62.	^ ^ ^ ^ ^ ^ ^ ^
31.	? ? ? ? ? ? ? ?	63.	_ _ _ _ _ _ _ _
32.	@ @ @ @ @ @ @ @		

Table 6.07 Siemens Digital Telephone – DYAD Button Test

NOTES: 1) If the system option flag TSTDIAG has been enabled in the data base or the Siemens Digital Telephone under test is classmarked with TSTAPP feature, the maintenance test phone is not required to enable or disable the Apparatus Diagnostic routines; therefore, perform only steps 5 through 9.

2) If the system option flag TSTDIAG has been disabled in the data base or the Siemens Digital Telephone under test is not classmarked with the TSTAPP feature, the maintenance test phone is required to enable or disable the Apparatus Diagnostic routines; therefore, perform the entire procedure (steps 1 through 10).

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place the maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the Apparatus Diagnostic Tests.	Confirmation tone is returned.	
4	Place maintenance test phone on-hook.	None.	
5	Place Siemens DYAD Telephone off-hook.	Dial tone is returned.	
6	Dial the Siemens Digital Telephone Test Access Code.	Recall dial tone is returned.	
		The access code is momentarily displayed, then the display unit and button LEDs are extinguished.	If reorder tone is returned, the Siemens DYAD Telephone Button Test is in use, try later.
7	Depress the Siemens DYAD Telephone keypad buttons as, follows: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *, #.		If proper verification is not obtained or busy tone is returned at any time, either the keypad buttons or feature buttons were depressed out of sequence, the DYAD Telephone is defective, or the SLMD circuit is defective. To isolate the failure, retry test to verify that the buttons were not depressed out of sequence.
8	Depress the DYAD feature buttons in the sequence shown in Figure 6.20 and according to the Siemens DYAD Telephone model.	Button LEDs light when depressed and extinguish when the next button is depressed.	If proper verification is not obtained or busy tone is returned again, replace the Siemens DYAD Telephone under test with a known good DYAD Telephone and retry test. If proper verification is not obtained or busy tone is returned again, replace the SLMD PCB.
		After the last button is depressed, the following indications occur:	
		Ringback tone is returned.	
		All button LEDs flash.	
		The audible alerting device sounds at intervals.	
		TEST COMPLETE is displayed.	
9	Place Siemens DYAD Telephone under test on-hook to terminate test.	Siemens DYAD Telephone returns to normal operation.	
10	If no additional Apparatus Diagnostic Test routines are to be performed, proceed as follows:		
	Place maintenance test phone off-hook.	Dial tone is returned.	
	Dial the Diagnostic Test Access code.	Recall dial tone is returned.	
	Dial 2 to disable the Apparatus Diagnostic Test.	None.	
	Place maintenance test phone on-hook.None.	None.	

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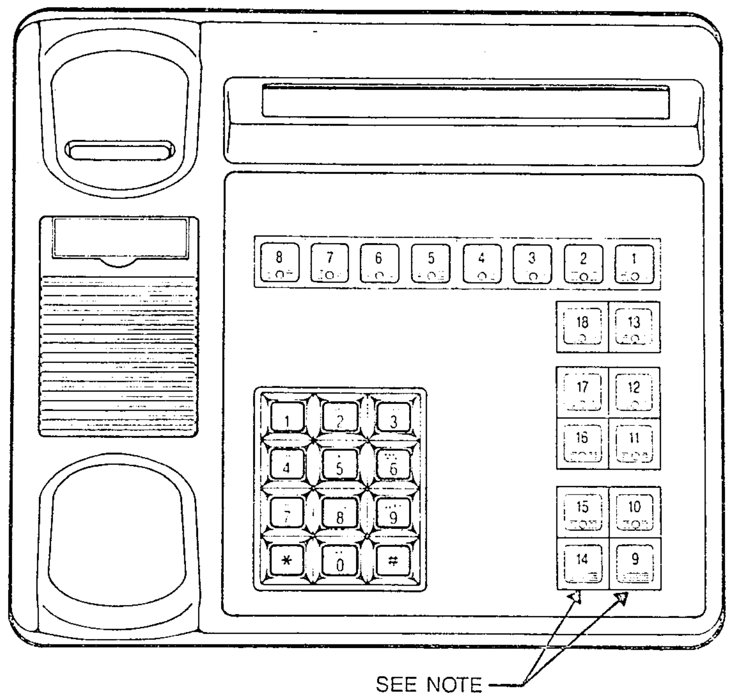
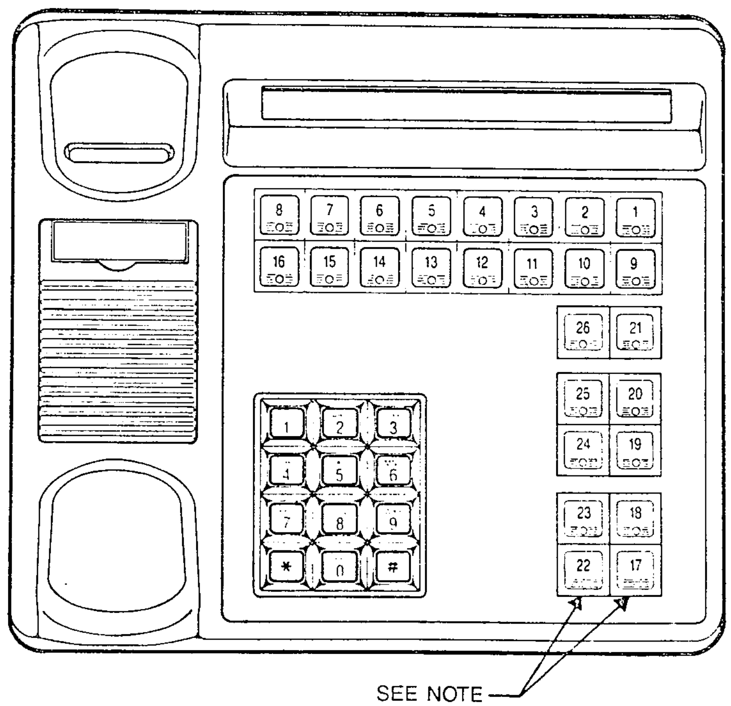


26 BUTTON DYAD



NOTE: These buttons do not contain LEDs.

A5132-1-4/21/86

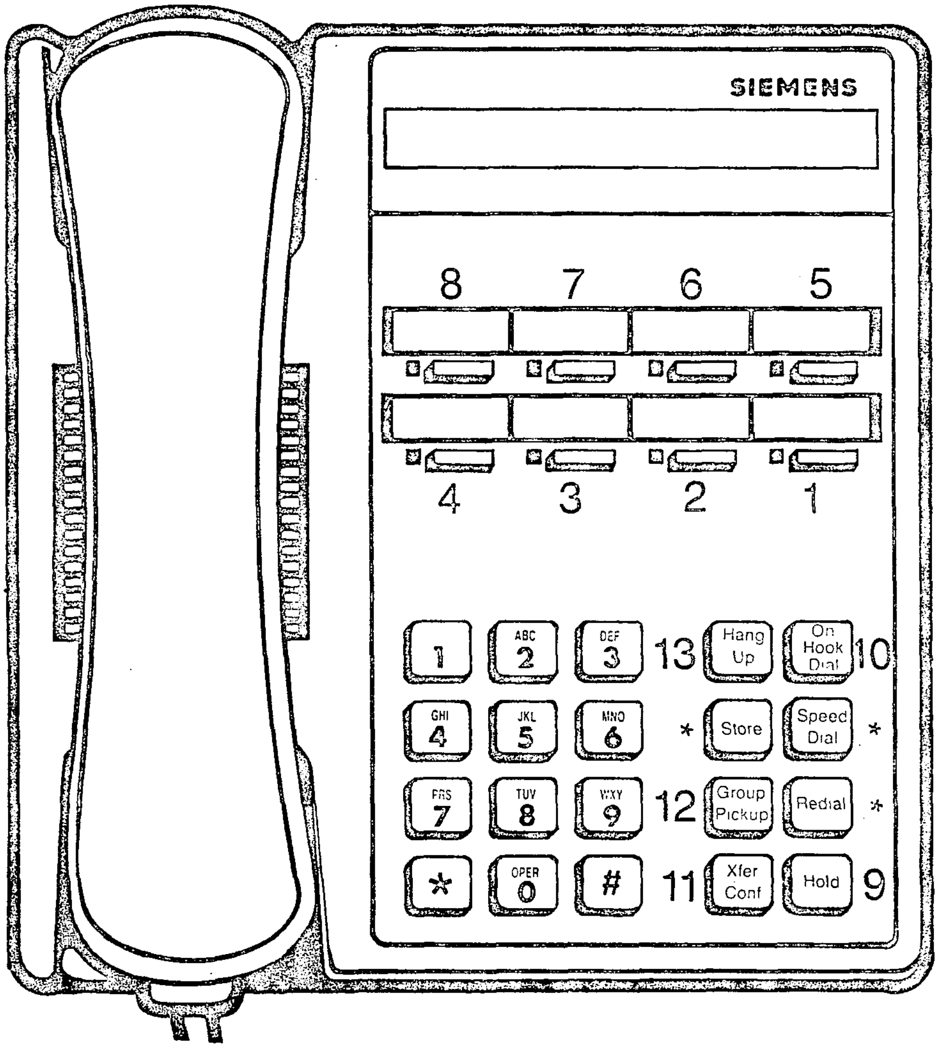
Figure 6.20 Siemens DYAD Telephone Button Depression Sequence

Table 6.08 Siemens Digital Telephone - JR-DYAD Button Test

NOTES: 1) If the system option flag TSTDIAG has been enabled in the data base or the Siemens Digital Telephone under test is classmarked with TSTAPP feature, the maintenance test phone is not required to enable or disable the Apparatus Diagnostic routines; therefore, perform only steps 5 through 9.

2) If the system option flag TSTDIAG has been disabled in the data base or the Siemens Digital Telephone under test is not classmarked with the TSTAPP feature, the maintenance test phone is required to enable or disable the Apparatus Diagnostic routines; therefore, perform the entire procedure (steps 1 through 10).

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place the maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the Apparatus Diagnostic Tests.	Confirmation tone is returned.	
4	Place maintenance test phone on-hook.	None.	
5	Place JR-DYAD Telephone off-hook.	Dial tone is rereturned.	
6	Dial the Siemens Digital Telephone Test Access Code.	Recall dial tone is returned.	If reorder tone is returned, the Siemens JR-DYAD Telephone Button Test is in use, try later.
7	Depress the Siemens JR-DYAD Telephone keypad buttons as, follows: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *, #.		If proper verification is not obtained or busy tone is returned at any time, either the keypad buttons or feature buttons were depressed out of sequence, the JR-DYAD Telephone is defective, or the SLMD circuit is defective. To isolate the failure, retry test to verify that the buttons were not depressed out of sequence.
8	Depress the JR-DYAD feature buttons in the sequence shown in Figure 6.21.	Button LEDs light when depressed and extinguish when the next button is depressed. After the last button is depressed, the following indications occur: Ringback tone is returned. All button LEDs flash. The audible alerting device sounds at intervals.	If proper verification is not obtained or busy tone is returned again, replace the Siemens JR-DYAD Telephone under test with a known good JR-DYAD Telephone and retry test. If proper verification is not obtained or busy tone is returned again, the SLMD circuit is defective and the SLMD PCB requires replacement.
9	Place Siemens JR-DYAD Telephone under test on-hook to terminate test.	Siemens JR-DYAD Telephone returns to normal operation.	
10	If no additional Apparatus Diagnostic Test routines are to be performed, proceed as follows:		
	Place maintenance test phone off-hook.	Dial tone is returned.	
	Dial the Diagnostic Test Access code.	Recall dial tone is returned.	
	Dial 2 to disable the Apparatus Diagnostic Test.	None.	
	Place maintenance test phone on-hook.	None.	



NOTES:
* These feature buttons are not testable.
Buttons 9 through 13 do not contain LEDs.

A5139-1-4/18/85

Figure 6.21 Siemens JR-DYAD Telephone Button Depression Sequence

Table 6.09 Siemens Digital Telephone -DYAD Display Test

NOTES: 1) If the system option flag TSTDIAG has been enabled in the data base or the Siemens Digital Telephone under test is classmarked with TSTAPP feature, the maintenance test phone is not required to enable or disable the Apparatus Diagnostic routines; therefore, perform only steps 5 through 9.

2) If the system option flag TSTDIAG has been disabled in the data base or the Siemens Digital Telephone under test is not classmarked with the TSTAPP feature, the maintenance test phone is required to enable or disable the Apparatus Diagnostic routines; therefore, perform the entire procedure (steps 1 through 10).

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the Apparatus Diagnostic test.	Confirmation tone is returned.	
4	Place maintenance test phone on-hook.	None.	
5	Place the Siemens Digital Telephone under test off-hook.	Dial tone returned.	
6	Dial the Siemens Digital Telephone test access code.	Recall dial tone is returned. The Access code is momentarily displayed, then the display unit clears.	If reorder tone is returned, the Siemens Digital Telephone Display Test is being used, retry later.
7	Depress any button in the Siemens Digital Telephone under test to initiate test. (Note: The display test can be suspended any time by depressing any button. The test can be resumed at any time in the same manner.)	Groups of 16 of each of the displayable characters are scrolled in the sequence shown in Table 6.09. After the last character (underscore) is displayed the following occurs: Ringback tone is returned. All button LEDs flash and the audible alerting device sounds at intervals. TEST COMPLETE is displayed.	If verification is not obtained, either the Siemens Digital Telephone or the SLMD circuit is defective. Replace Siemens Digital Telephone with a good one and retry test. If verification is obtained, replace the Siemens Digital Telephone. If verification is still not obtained, replace the SLMD PCB.
8	Place Siemens Digital Telephone on-hook to terminate test or wait 30 seconds for test timeout.		
9	If no additional Apparatus Diagnostic Tests are to be performed, proceed as follows:		
	Place maintenance test phone off-hook.	Dial tone returned.	
	Dial the Diagnostic Test Access Code. Recall dial tone returned.	Recall dial tone is returned	
	Dial 2 to disable the Apparatus Diagnostic Test.	None.	
	Place maintenance test phone on-hook.	None.	

Table 6.10 Siemens Digital Telephone Displayable Characters

ORDER	CHARACTER	ORDER	CHARACTER
1.	! ! ! ! ! ! ! ! ! ! ! ! ! ! ! !	33.	A A A A A A A A A A A A A A A A
2.	" " " " " " " " " " " " " " " "	34.	B B B B B B B B B B B B B B B B
3.	# # # # # # # # # # # # # # # #	35.	C C C C C C C C C C C C C C C C
4.	$ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $	36.	D D D D D D D D D D D D D D D D
5.	%%%%%%%%%%%%%%%%	37.	E E E E E E E E E E E E E E E E
6.	& & & & & & & & & & & & & & & &	38.	F F F F F F F F F F F F F F F F
7.	' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	39.	G G G G G G G G G G G G G G G G
8.	((((((((((((((((	40.	H H H H H H H H H H H H H H H H
9.	))))))))))))))))	41.	I I I I I I I I I I I I I I I I
10.	* * * * * * * * * * * * * * * *	42.	J J J J J J J J J J J J J J J J
11.	+ + + + + + + + + + + + + + + +	43.	K K K K K K K K K K K K K K K K
12.	• • • • • • • • • • • • • • • •	44.	L L L L L L L L L L L L L L L L
13.	————————————————	45.	M M M M M M M M M M M M M M M M
14.	. . . .	46.	N N N N N N N N N N N N N N N N
15.	/ / / / / / / / / / / / / / / /	47.	O O O O O O O O O O O O O O O O
16.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	48.	P P P P P P P P P P P P P P P P
17.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	49.	Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q
18.	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	50.	R R R R R R R R R R R R R R R R
19.	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	51.	S S S S S S S S S S S S S S S S
20.	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	52.	T T T T T T T T T T T T T T T T
21.	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	53.	U U U U U U U U U U U U U U U U
22.	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	54.	V V V V V V V V V V V V V V V V
23.	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	55.	WWWWWWWWWWWWWWWW
24.	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	56.	X X X X X X X X X X X X X X X X
25.	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	57.	Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y
26.	: : : : : : : : : : : : : : : :	58.	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z
27.	; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;	59.	[[[[[[[[[[[[[[[[
28.	< < < < < < < < < < < < < < < <	60.	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
29.	= = = = = = = = = = = = = = = =	61.	]]]]]]]]]]]]]]]]
30.	> > > > > > > > > > > > > > > >	62.	^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^
31.	? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?	63.	_ _ _ _ _ _ _ _
32.	@@@@@@@@@@@@@@@@		

Table 6.11 Outgoing Trunk Test

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 2 to enable trunk test.	None.	
4	Dial the two-digit trunk group number (00 through 31) containing the trunk circuit to be tested.	None.	
5	Dial the two-digit trunk number (00 – 99) of the trunk circuit to be tested.	CO or PABX dial tone is returned. Also, the associated trunk circuit LED on the trunk PCB is lit steadily to indicate the trunk has been seized outgoing.	If reorder tone is returned, the selected trunk circuit is either an incoming-type, invalid, or not assigned (check data base assignments). If busy tone is returned, the selected trunk is in use, retry later. If CO or PABX dial tone is not returned, verify trunk MDF cross-connections and attempt to access CO/PABX trunk using a butt set. If the trunk is working properly replace the trunk PCB under test and retry test.
6	For CO-type trunks (i.e., TMBM PCB), dial the test tone number provided by the local phone company.	Test tone (1004Hz) is returned.	
7	Verify that the returned test tone level is correct, using a TMS.		If the returned test tone level is weak, replace PCB with another having the same characteristics and retry test. If returned test tone level increases considerably, trunk PCB is defective and should be replaced. If the test tone level is still weak, contact CO repair service to verify trunk facility.
8A	If additional tests or procedures are to be performed, hook-flash the maintenance test phone and dial the next code (Diagnostic Test Access Code is not redialed).	Recall dial tone is returned.	
8B	If no additional tests or procedures are to be performed, place the maintenance test phone on-hook.	None.	

Table 6.12 Placing Circuit(s) In-Service

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 7 for placing a circuit in-service.	None.	
4A	If a single circuit is to be placed in-service, dial the four digit PEN number of the circuit.	Confirmation tone is returned.	If reorder tone is returned, the selected circuit is invalid or unassigned. Check data base assignments.
4B	If all the circuits in a PCB are to be placed in-service, dial the first three digits of the PEN number for the PCB followed by digit 8. For an SLA16, dial the first three digits of the PEN number associated with the first eight circuits followed by an 8, then dial the first three digits of the associated PEN number for the second eight circuits (W,X,Y+1) followed by an 8.	Confirmation tone is returned.	If reorder tone is returned the selected PCB is invalid or unassigned Check data base assignments.
5A	If additional tests or procedures are to be performed, hook-flash the maintenance test phone and dial the next code (Diagnostic Test Access Code is not redialed).	Recall dial tone is returned.	
5B	If no additional tests or procedures are to be performed, place the maintenance test phone on-hook.	None.	

Table 6.13 Taking Circuit(s) Out-of-Service

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 8 for placing a circuit out-of-service.	None.	
4A	If a single circuit is to be placed out-of-service, dial the four digit PEN number of the circuit.	Confirmation tone is returned.	If reorder tone is returned, the selected circuit is invalid or unassigned. Check data base assignments.
4B	If all the circuits in a PCB are to be placed out-of-service dial the first three digits of the PEN number for the PCB followed by digit 8. For an SLA16, dial the first three digits of the PEN number associated with the first eight circuits followed by an 8, then dial the first three digits of the associated PEN number for the second eight circuits (W,X,Y+1) followed by an 8.	Confirmation tone is returned.	If reorder tone is returned the selected PCB is invalid or unassigned. Check data base assignments.

Table 6.13 Taking Circuit(s) Out-of-Service (Continued)

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
5A	If additional tests or procedures are to be performed, hook-flash the maintenance test phone and dial the next code (Diagnostic Test Access Code is not redialed).	Recall dial tone is returned.	
5B	If no additional tests or procedures are to be performed place the maintenance test phone on-hook.	None.	

SECTION 7.00 INSTALLATION TEST PROCEDURES CHECKLIST

7.01 General. After performing the installation test procedures contained in this practice, each installation test procedure performed should be recorded to ensure that all tests have been completed satisfactorily. Use Table 7.00, Installation Test Procedures Checklist, for this purpose. This table can be used as a sign-off sheet, if required.

Table 7.00 Installation Test Procedures Checklist

NO.	TEST PROCEDURE	CHECK	REFERENCE
1	SYSTEM GROUND TEST		TABLE 3.00
2	SHELF GROUND CONTINUITY TEST		TABLE 3.01
3	POWER-UP/OUTPUT VOLTAGE TEST		TABLE 4.00
4	TONE GENERATOR TEST		TABLE 6.00
5	DTMF RECEIVER TEST		TABLE 6.02
6	STATION LINE TEST		TABLE 6.03
7	DTMF PAD TEST		TABLE 6.04
8	CONSOLE TEST		TABLE 6.05
9	SIEMENS DIGITAL TELEPHONE -DYAD BUTTON TEST		TABLE 6.07
9A	SIEMENS DIGITAL TELEPHONE – JR-DYAD BUTTON TEST		TABLE 6.08
10	SIEMENS DIGITAL TELEPHONE – DYAD DISPLAY TEST		TABLE 6.09
11	OUTGOING TRUNK TEST		TABLE 6.10
12	CUSTOMER SPECIFIC FEATURE TEST		(NOT APPLICABLE)

Siemens Practices
Maintenance Series

A30808-X5130-D110-1-B920
Issue 1, May 1986

SATURN® IIE EPABX

MAINTENANCE AND TROUBLESHOOTING

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SECTION 1.00 INTRODUCTION

1.01 Purpose. This maintenance series practice provides step-by-step instructions for troubleshooting and repairing a malfunctioning SATURN IIE (SATURN II – Expanded) Electronic Private Automatic Branch Exchange (EPABX) System. The information contained in this practice allows maintenance personnel to locate and correct malfunctions during precutover and postcutover of the system. Figures 1.00 and 1.01 illustrate the two cabinet configurations of the SATURN IIE System.

CAUTION

Maintenance procedures on the SATURN IIE EPABX must be performed only by Siemens certified personnel.

Table 1.00 defines the mnemonics used in this practice.

1.02 Scope. The information contained in this practice is divided into the following four sections:

a. Introduction
b. Maintenance Overview
c. Preventive Maintenance
d. Troubleshooting and Repair Procedures

1.03 Siemens SATURN IIE Practices. The practices, issue numbers, and dates for the SATURN IIE EPABX are listed in the Practices Documentation Index A30808-X5130-A190-*-B987.

NOTE: Always refer to the latest issue of the applicable index to obtain the latest issue number of the practice.

1.04 Siemens Customer Support Services. Siemens maintains a nationwide network of field service offices. Contact the Siemens regional office for any engineering assistance which may be required.

1.05 What to Do in Case of Trouble with FCC-Registered Equipment. When trouble is experienced with FCC-registered equipment of the SATURN IIE EPABX, the procedures contained in this document should be followed, by qualified maintenance personnel, to isolate and correct the malfunction. If spare equipment is not available, the telephone company must be notified that the equipment is faulty and this equipment must be disconnected from the public telephone network. The telephone company must also be notified when the faulty equipment has been repaired or replaced and such equipment is reconnected to the public telephone network.

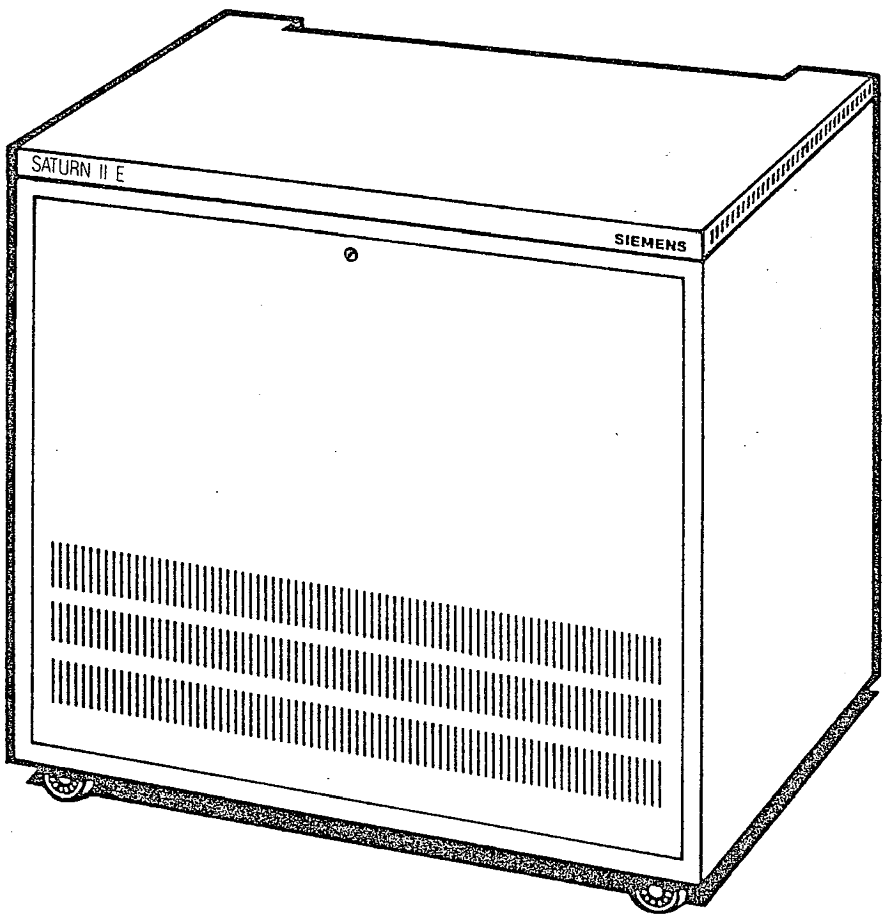

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Figure 1.00 SATURN IIE System Basic Cabinet

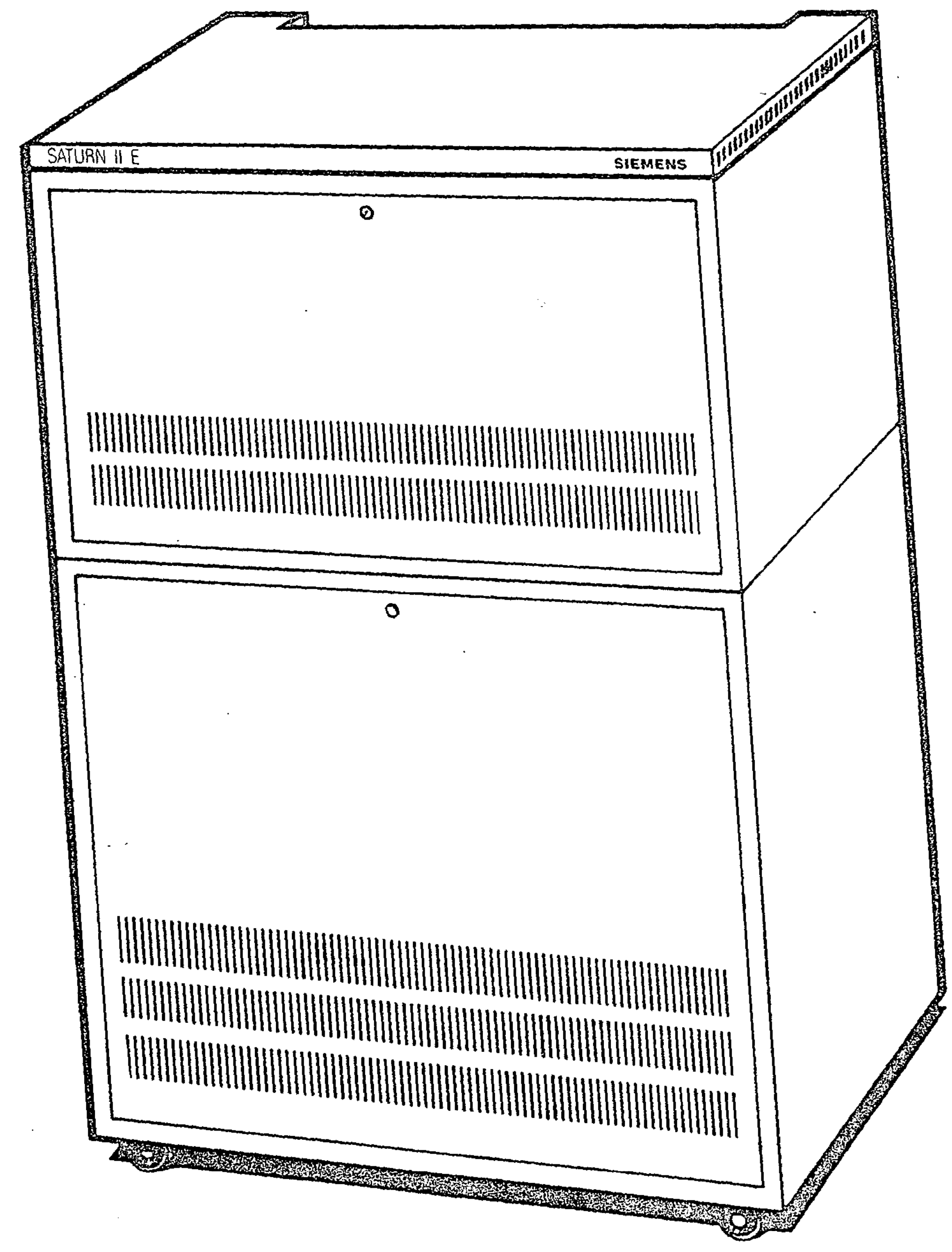

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Figure 1.01 SATURN IIE System with Basic and Expansion Cabinets

Table 1.00 Mnemonics Used in This Practice

MNEMONIC	DEFINITION
ACD	Automatic Call Distribution
ANA	Assigned Night Answer
ASCII	American Standard Code for Information Interchange
CE	Common Equipment
CIOP	Controller/Input-Output Processor
CMU	Customer Memory Update
CO	Central Office
CONF	Conference
CRC	Cyclic Redundancy Check
CRT	Cathode Ray Tube
DCI	Data Communications Interface
DID	Direct Inward Dialing
DIP	Dual Inline Package
DISA	Direct Inward System Access
DIT	Dedicated Incoming Trunk
DP	Dial Pulse
DTE	Data Terminal Equipment
DTMF	Dual-Tone Multifrequency
DTR	Data Terminal Ready
DVM	Digital Voltmeter
EIA	Electronics Industries Association
EPABX	Electronic Private Automatic Branch Exchange
FDD	Floppy Disk Drive
Hz	Hertz
IRAM	Input Random Access Memory
I/O	Input/Output
LDN	Listed Directory Number
LED	Light-Emitting Diode
LRU	Least Replaceable Unit
LSI	Large Scale Integration
LTU	Line/Trunk Unit
LTUC	Line/Trunk Unit Control
LTUPS	Line/Trunk Unit Power Supply
MCA	Memory Control and Attenuator
MDF	Main Distribution Frame
MEM3	System Memory – 256 kilobyte
MEM4	System Memory – 1 Megabyte
MOS	Metal Oxide Semiconductor
MSI	Medium Scale Integration
MSL	Main/Satellite Link
MSM	Memory Support Module
MTCE	Maintenance
MTS	Memory Time Switch
ORAM	Output Random Access Memory
PABX	Private Automatic Branch Exchange
PCB	Printed Circuit Board
PEN	Port Equipment Number
PIMD	Premium Instrument Module Digital
PRS	Protection Reload Signal
PSC	Parallel-to-Serial Converter
PSU	Power System Unit
RAC/RMW	Ring AC/Ring Message Waiting
RAUP	Remote Access Unit/Ports
RGEN	Ring Generator
RLT	Release Link Trunk
RMS	Root-Mean-Square Amplitude
RMTE ACT	Remote Active
SDT	Siemens Digital Telephone
SIB	Signal Buffer
SLA	Subscriber Line Analog
SLA16	Subscriber Line Module Analog – 16 Lines
SLMA-O	Subscriber Line Module Analog – Off Premises

Table 1.00 Mnemonics Used in This Practice (Continued)

MNEMONIC	DEFINITION
SLMA-S	Subscriber Line Module Analog – Station
SLMD	Subscriber Line Module Digital
SLT	Single-Line Telephone
SMDR	Station Message Detail Recording
SMXTG	Signal Multiplexer/Tone Generator
T&R	Tip and Ring
TMBA-2	2-Wire E&M Trunk
TMBA-4	4-Wire E&M Trunk
TMBM	Central Office Trunk
TMIE	Direct Inward Dialing Trunk
TMS	Transmission Measuring Set
TTY	Teletypewriter
-48PS	-48Vdc Power Supply

SECTION 2.00 MAINTENANCE OVERVIEW

2.01 Introduction. This section describes the design considerations and maintenance facilities incorporated in the SATURN IIE EPABX. The maintenance concept for the EPABX is based on detecting and isolating failures to the Least Replaceable Unit (LRU), replacing the faulty LRU, and restoring normal service as soon as possible. The maintenance concept does not include the replacement of components on Printed Circuit Boards (PCBs). When a PCB is found to be defective, the PCB must be replaced and the original sent to the repair facility.

2.02 General. In its basic configuration, the SATURN IIE System is housed in a single light-weight equipment cabinet, called the Basic Cabinet (shown in Figure 1.00). In its expanded configuration, the SATURN IIE System is housed in a Basic Cabinet plus an Expansion Cabinet, which is mounted on top of the Basic Cabinet as shown in Figure 1.01. The equipment cabinet(s) contain all functional units of the system. The system is divided into five functional blocks of circuits as shown in the block diagram of Figure 2.00. These functional blocks may be directly related to the system's hardware groups. The functional blocks are as follows:

a. Line/Trunk
b. Switching
c. Control
d. Power
e. Ancillary Equipment

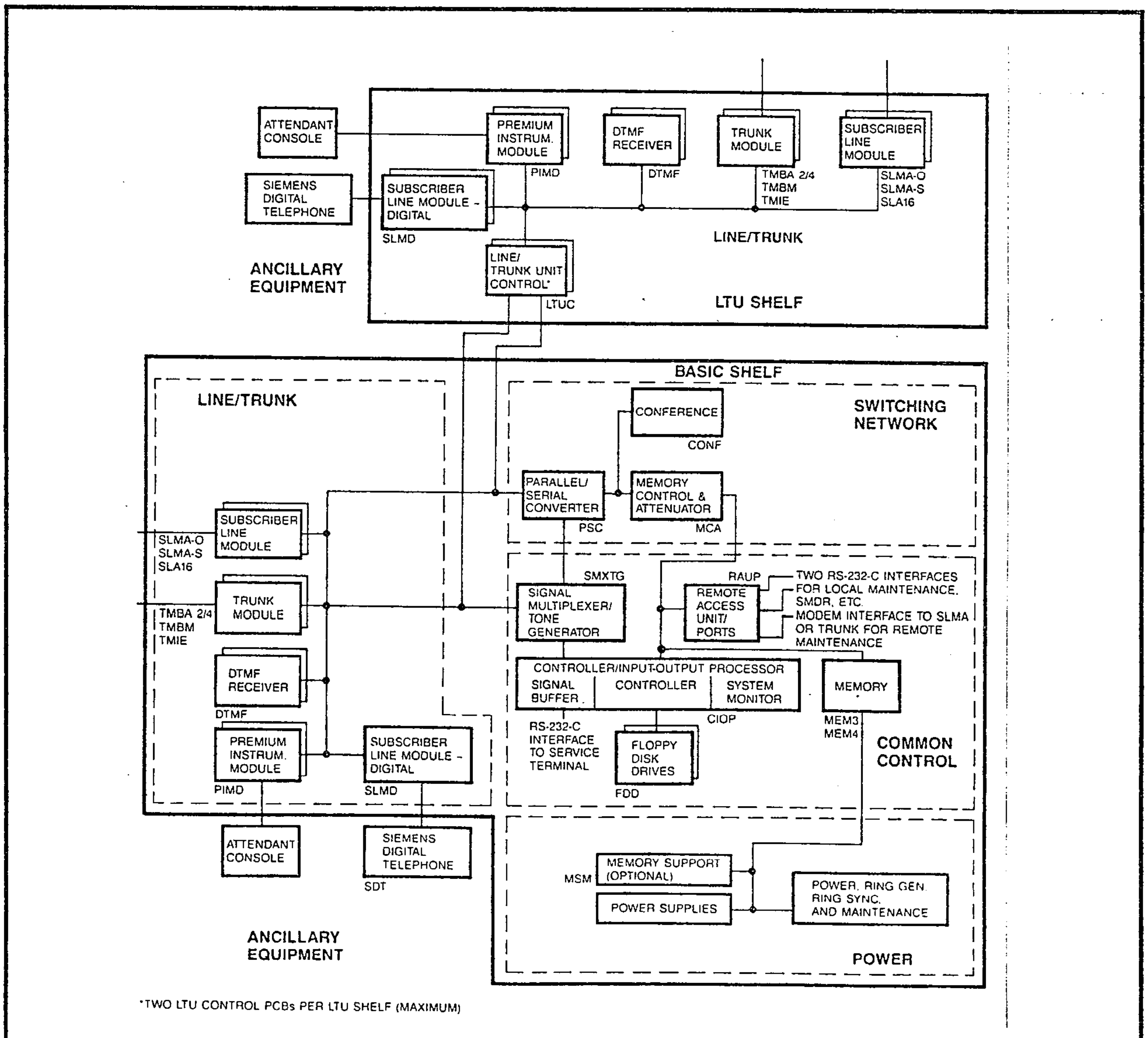

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Figure 2.00 SATURN IIE System Block Diagram

2.03 Design Considerations. The design considerations incorporated in the SATURN IIE EPABX are discussed below.

a. Component Packaging. The SATURN IIE EPABX architecture is modularly designed to allow maintenance personnel to quickly recognize and isolate failures. Modularity is achieved primarily by using Large Scale Integration (LSI) and Medium Scale Integration (MSI) techniques. Extensive use of these techniques allows greater circuit density on each PCB thereby reducing the total number of PCBs in the SATURN IIE EPABX.

b. Dependability. Dependability is the ability of the SATURN IIE EPABX to automatically test system functions; detect and analyze failures; reset and/or clear detected failures by attempting automatic recovery; and report reconfigurations and failures when automatic recovery is not possible. The primary objective of dependability is to maintain the SATURN IIE EPABX in good operating condition and, when failures occur, to locate and identify such failures as soon as possible with minimal service effect to the customer.

2.04 Maintenance Facilities. Maintenance facilities are equipment and features which allow maintenance functions of the SATURN IIE EPABX to be performed. The maintenance facilities are listed below and described in the subsequent paragraphs.

a. Power System Unit (PSU)
b. Maintenance Phone
c. Service Terminal
d. Manual On-Line Diagnostic Tests
e. Automatic On-Line Diagnostic Testing and Reporting
f. Alarm Indicators and Classification
g. Alarm Error Codes

2.05 Power System Unit. The Power System Unit (Figure 2.01) provides maintenance personnel central access to the system's maintenance functions. The items discussed below are contained on the PSU to centralize its maintenance functions. Other items on the PSU, such as fuses and circuit breakers, are discussed elsewhere in this document.

a. ALARMS. The ALARMS indicator section consists of two light-emitting diode (LED) indicators which, when steadily lit, provide a visual status of alarm condition(s) existing in the system. The red LED is designated MAJOR for a major alarm condition and, when lit, indicates that the system is unable to process calls and failure transfer is enabled. The yellow LED is designated MINOR for a minor alarm condition(s) and, when lit indicates at least one of the automatic on-line diagnostic tests has detected a failure in the system; however, the system is still processing calls.

b. FAILURE TRANSFER. The FAILURE TRANSFER section is a three-position switch with two associated LED indicators used to enable or disable, either automatically or manually, a customer-provided failure transfer relay subsystem. The failure transfer relays are external to the system and are designed to connect Central Office (CO) trunks to preselected stations in the event of a major alarm or power failure. During a major alarm or power failure, the Tip and Ring (T&R) leads of the preselected failure transfer stations are automatically switched, via the failure transfer relays (optionally provided by the customer), to the CO side of the trunk cable pairs at the Main Distribution Frame (MDF). This action allows the stations to originate and terminate calls. Note that a ground start button may be required on the preselected failure transfer station instrument(s) to allow origination of calls on ground start CO trunks. Maintenance personnel can select one of the three following transfer modes:

1. AUTO. The Automatic (AUTO) mode, is the normal position for the FAILURE TRANSFER switch. In the event of major alarm or power failure, this mode automatically enables the failure transfer relays to connect the preselected failure transfer stations directly to the CO trunks and bypass the EPABX. Note that, while in this mode and in the event of a major alarm or power failure, no internal calls can be originated from the preselected failure transfer stations.

2. INHIBIT. The inhibit (INHIBIT) mode prevents the failure transfer relays from connecting the preselected failure transfer stations directly to the CO trunks that bypass the EPABX in the event of a major alarm. All the preselected failure transfer stations remain connected to their assigned station ports unless a power failure occurs. The failure transfer relays are operated by a power failure (power failure transfer takes precedence over the inhibit mode). Note that the associated INHIBIT (yellow LED) indicator is steadily lit when the inhibit mode is selected. Also, when in the inhibit mode, the system's optional remote major alarm indicator is disabled, except when a power failure occurs. The inhibit mode allows on-site maintenance personnel to perform maintenance functions without causing a system failure transfer to occur or to falsely alert the optional remote alarm location. It is the responsibility of the on-site maintenance personnel to monitor the system's grade of service in the inhibit mode, to be sure its service quality has not deteriorated to a point where system failure transfer would be beneficial.

3. ACTIVE. The active (ACTIVE) mode forces the failure transfer relays to connect the preselected failure transfer stations directly to the CO trunks and bypass the EPABX. While in this mode, no internal calls can be originated from the preselected failure transfer stations; however, the other stations are not prevented from originating calls, providing that the EPABX is operational. Note that the associated red LED indicator is steadily lit when the active mode is selected. Also, when the active mode is selected, the optional system's remote alarm location is alerted that the EPABX was bypassed by the system failure transfer circuits.

c. MTCE PHONE. The Maintenance Phone (MTCE PHONE) section provides a modular jack which permits connection of the maintenance phone to the maintenance line circuit of the EPABX. The maintenance line may be assigned to any Port Equipment Number (PEN). Usually PEN 0000 is assigned to the maintenance phone. The T&R leads of the modular jack are brought out to the MDF for cross-connection to the assigned maintenance line circuit.

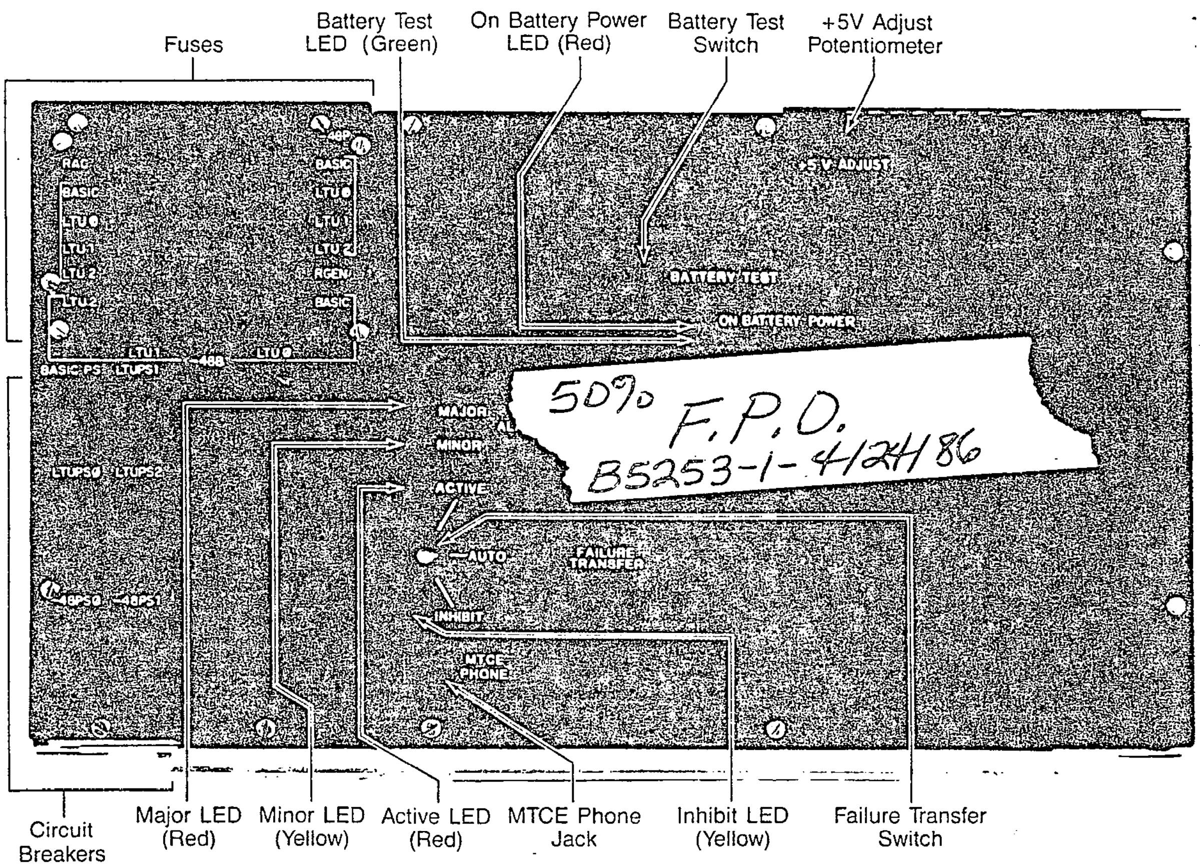

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Figure 2.01 Power System Unit, (PSU) Front View

2.06 Maintenance Phone. The maintenance phone can be either a portable test phone, test set, or a standard two-wire station instrument used to access the maintenance functions of the system, either locally or remotely.

a. Local Maintenance Functions. The maintenance line is usually assigned as a Dual-Tone Multifrequency (DTMF) station type; however, a Dial Pulse (DP) or DTMF maintenance phone may be connected to it. Local interfacing of the maintenance phone with the maintenance functions is achieved via the maintenance line circuit by connecting its line cord to either the designated jack (i.e., MTCE PHONE) on the PSU front panel or the T&R leads of the PEN assigned and cross-connected at the MDF. Once interfaced, the maintenance phone can access a repertoire of system and apparatus diagnostic test programs by dialing the maintenance diagnostic test access code (customer assignable via CMU procedures).

   During local maintenance functions, a hookswitch flash at any point in a test clears any diagnostic conditions, releases any resources, and returns the maintenance phone to the point where a test select code may be dialed.

b. Remote Maintenance Functions. The maintenance phone, when used for remote (off-site) maintenance functions, must be assigned as a DTMF station type. In DP systems, a DTMF receiver must be assigned so that the maintenance phone can be used to communicate with the system. Maintenance personnel at a remote area can gain access to the diagnostic test programs by dialing the directory number associated with the Direct Inward System Access (DISA) feature, an appropriate two- to four-digit authorization code, and the diagnostic test access code; or an attendant can complete an incoming call to the test number.

   During remote maintenance operations, the hookswitch flash signal cannot be sent over the public telephone network to the maintenance port; therefore, after each test is completed, maintenance personnel must redial the DISA trunk directory number in order to perform further tests.

2.07 Service Terminal. The service terminal is a customer-provided CRT or keyboard-printer data terminal. It provides further troubleshooting capabilities in addition to the maintenance phone by interfacing, either locally or remotely, with the maintenance functions of the system via a dedicated data port. Once interfaced, the service terminal can be used to gain access to a repertoire of auditing routines and the failure history memory as well as performing CMU procedures.

a. Local Maintenance Functions. The service terminal, when used for local (on-site) maintenance functions, must be equipped with an EIA RS-232-C interface. Local interfacing of the service terminal with the system's maintenance functions is achieved via a dedicated data port by connecting its signal cable to the 25-pin RS-232-C TTY connector on the front of the CIOP PCB (Figure 2.02). DIP switches on the CIOP PCB permit the baud rate to be set at 300, 1200, 2400, or 9600 baud. One or both of the TTY connectors on the front of the RAUP (Figure 2.03) may also be used for local maintenance functions. These interfaces (also RS-232-C compatible) are programmable to any of 15 baud rates between 50 and 9600 baud. The default baud rate is 9600.

b. Remote Maintenance Functions. The RAUP PCB (Figure 2.03) of the SATURN IIE System has a designed-in, serial modem port to facilitate communication, via standard telephone lines, between a remote modem and terminal and the main system processor. This modem, which is answer-only and does not dial out, self-sets to either 300 baud or 1200 baud depending upon the incoming baud rate. (The modem port and either or both of the two TTY ports of the RAUP may all be used simultaneously if desired.) A green Remote Active (RMTE ACT) LED on the RAUP lights steadily to indicate when the carrier detect signal is active on the modem accessed by the remote service terminal. The service terminal at the remote site must be equipped with an originating-type modem compatible with modem type 103 or 212A. Maintenance personnel at a remote area can gain access to the system's maintenance functions by:

   1. Dialing the listed directory number for the system EPABX attendant and requesting the attendant (or ANA station user, if the system is in the night mode) to extend to a station number which is cross-connected to the SLA port dedicated to the RAUP modem.

   2. In systems equipped with Direct Inward Dialing (DID), dialing the DID extension number of a station which is cross-connected to the SLA port dedicated to the RAUP modem.

   3. Dialing the listed directory number associated with the Direct Inward System Access (DISA) feature, a three- or four-digit authorization code, and the number assigned to a station cross-connected to the SLA port dedicated to the RAUP modem.

   4. Dialing the listed directory number of a dedicated loop-start CO trunk circuit connected directly to the RAUP modem.

Once the SLA circuit associated with the service terminal and the RAUP modem port has been accessed, the answer tone is heard when the handset assembly is to be placed in the data mode (e.g., placed in an acoustic coupler). Refer to the SATURN IIE EPABX Customer Memory Update (CMU) Procedures practice and the service terminal's operating manual to coordinate proper operating procedures before any command inputs are entered.

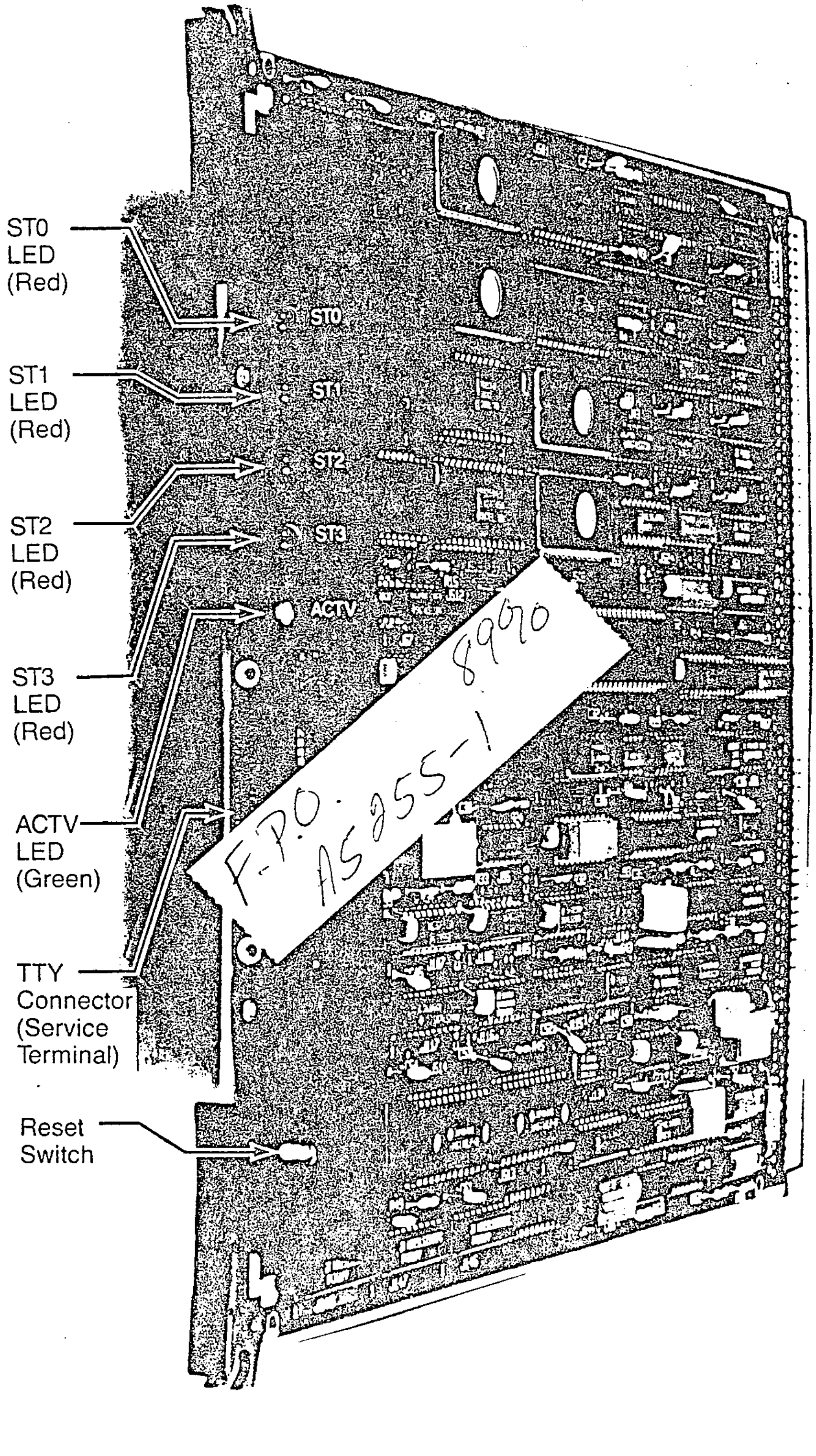

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Figure 2.02 Controller/Input-Output Processor Printed Circuit Board (CIOP)

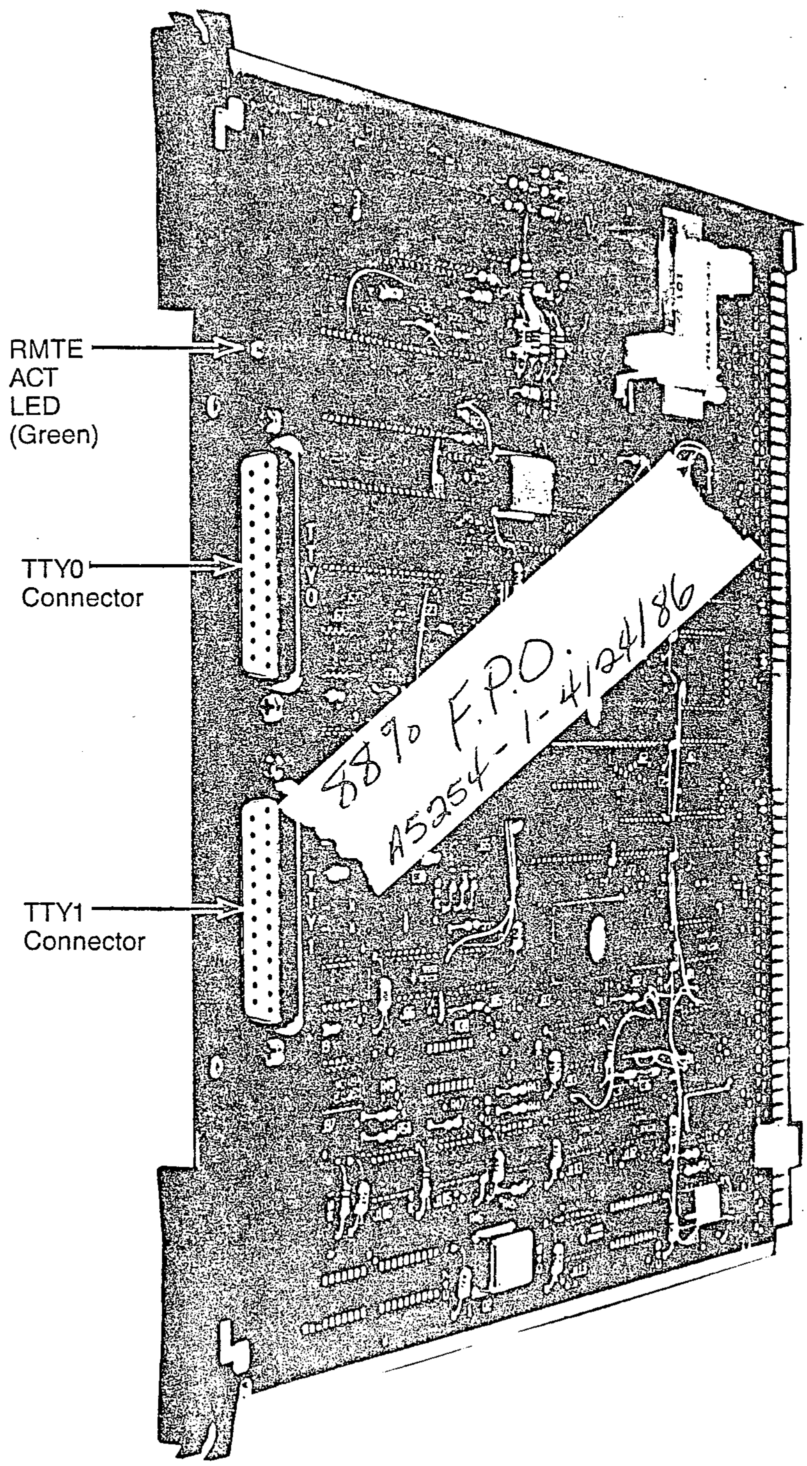

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Figure 2.03 Remote Access Unit/Ports Printed Circuit Board (RAUP)

2.08 Manual On-Line Diagnostic Tests. The SATURN IIE EPABX software includes a group of system diagnostic and apparatus diagnostic test programs which are used via the maintenance phone. Resulting visual and/or audible responses from these tests make it possible to verify correct operation or detect and isolate system and apparatus malfunctions.

2.09 System Diagnostic Tests. The system diagnostic programs permit calls and procedures to be initiated into and through the system to verify the correct operation of the call processing functions of the system equipment.

In order to access the system diagnostic tests, the maintenance diagnostic test access code (customer assignable via a CMU procedure) must first be dialed by using the maintenance phone. Once the maintenance diagnostic test access code has been entered into the system, the following listed tests and procedures can be performed:

- Tone Generator Test (Refer to Table 4.06)
- Outgoing Trunk Test (Refer to Table 4.08)
- DTMF Receiver Test (Refer to Table 4.09)
- Placing Circuits In Service (Refer to Table 4.10)
- Taking Circuits Out of Service (Refer to Table 4.11)

a. Tone Generator Test. This test verifies each tone produced by the tone generator, located in the SMXTG PCB, either individually or in a circular sequence. This test is performed, either locally or remotely, by dialing test select code 1 from the maintenance phone. After the digit 1 is dialed, two more digits are dialed to select the individual tone to be tested or to initiate the automatic circular sequencing of all tones. If an individual tone is selected, the maintenance phone is connected to that tone (through the MTS) as long as it remains off-hook. If the automatic circular sequence is initiated, each tone is connected to the maintenance phone (through the MTS) for approximately 2 seconds with an intertone silence period of 0.25 to 0.5 second. The test automatically advances to the next tone in a circular sequence as long as the maintenance phone remains off-hook.

b. Outgoing Trunk Test. This test verifies the supervisory and transmission capabilities (in the outgoing direction) of any individually selected outgoing or two-way trunk circuit on either a TMBM, TMBA-2, or TMBA-4 PCB. The test also checks the connection path through the MTS. This test is performed either locally or remotely, via the maintenance phone by dialing the test select code 2. After the digit 2 is dialed, the trunk group number (00 to 31) followed by the trunk number within the particular trunk group (00 to 99) is dialed. The maintenance phone is then cut-through to the specific trunk circuit selected, seizing it in the outgoing direction. Seizure is confirmed when dial tone is returned to the maintenance phone. The transmission quality of the trunk can be checked by dialing the CO milliwatt test tone number or the test tone access code of the EPABX (if provided). The milliwatt test tone frequency and level (1004 Hz @ 0dBm) may be measured by means of a Transmission Measuring Set (TMS).

c. DTMF Receiver Test. This test verifies any individually selected DTMF receiver circuit on a DTMF PCB. The test also checks the connection path through the Memory Time Switch (MTS). This test is performed, either locally or remotely, via the maintenance phone by dialing test select code #. After the # is dialed, the Port Equipment Number (PEN) of the particular DTMF receiver circuit under test is dialed. The pushbuttons on the DTMF keypad of the maintenance phone are then depressed in a fixed sequence. If the telephone has a 12-button keypad, the buttons are depressed in the following sequence: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, ⋆, and #. If the telephone has a 16-button keypad, the buttons are depressed in this sequence: A, B, C, D, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, ⋆, and #. After depressing the pushbuttons in the applicable fixed sequence, a test tone (1004 Hz) is returned if the DTMF receiver circuit under test recognized all the tones associated with the pushbuttons. If the pushbuttons are depressed in the wrong sequence or the DTMF receiver circuit under test failed to recognize a particular tone, intercept tone is returned.

d. Placing Circuits In Service. This procedure allows maintenance personnel to place an assigned circuit in service from an out-of-service state. This procedure is performed, either locally or remotely, via the maintenance phone by dialing test select code 7. After 7 is dialed, the PEN of the particular circuit to be placed in service (in either an SLMA-O, SLMA-S, SLA16, SLMD, PIMD, DTMF, TMBM, TMBA-2, TMBA-4, or TMIE PCB) is dialed. Note that all circuits on a particular PCB (with exception of the SLA16 PCB) are placed in service by entering the digit 8 as the circuit location of the PEN (e.g., 0028 places all circuits in the basic shelf, designated as shelf 0, channel group 0, slot 2, in service). If all 16 circuits of an SLA16 PCB are to be placed in service, they are placed in service eight circuits at a time. The first eight circuits for an SLA16 (in the same shelf, channel group, and slot as above) are placed in service as described, i.e., by entering 0028. The second eight circuits are placed in service by dialing 0038 (a 1 is added to the basic slot number to designate the second eight circuits on an SLA16 PCB). If the procedure fails, either due to entry of an invalid circuit number or because the slot number is unassigned, reorder tone is returned. Successful completion of the procedure is indicated by the return of confirmation tone.

e. Taking Circuits Out of Service. This procedure allows maintenance personnel to take an assigned circuit out of service from an in-service state. This procedure is performed, either locally or remotely, via the maintenance phone by dialing test select code 8. After the digit 8 is dialed, the PEN of the particular circuit (in either an SLMA-O, SLMA-S, SLA16, SLMD, PIMD, DTMF, TMBM, TMBA-2, TMBA-4, or TMIE PCB) to be taken out of service is dialed. Note that all circuits on a particular PCB (with exception of the SLA16 PCB) are taken out of service by entering the digit 8 as the circuit location of the PEN (e.g., 0208) places all circuits in the basic shelf (0), channel group 2, slot 0 out of service). If all 16 circuits of an SLA16 PCB are to be taken out of service, the procedure is performed eight circuits at a time. The first eight circuits for an SLA16 (in the same shelf, channel group, and slot number as above) are taken out of service as described, i.e., by entering 0208 The second eight circuits are taken out of service by dialing 0218 (a 1 is added to the basic slot number to designate the second eight circuits on an SLA16 PCB). When this procedure is enabled, it allows existing calls on the circuits to be completed before being taken out of service. If the procedure fails, because the selected circuit is either invalid or unassigned, reorder tone is returned. Successful completion of the procedure is indicated by the return of confirmation tone after the circuit is taken out of service (i.e., after calls in progress are completed). In addition, maintenance personnel are not required to wait for confirmation tone before placing the maintenance phone on-hook to take the circuit out of service. Once this procedure is enabled, it automatically takes the particular circuit out of service as each call is completed.

2.10 Apparatus Diagnostic Tests. The apparatus diagnostic tests permit testing of the various types of telephones and consoles that may be interfaced with the SATURN IIE EPABX. These tests verify proper operation of Single Line Telephones, Siemens Digital Telephones (DYADs and JR-DYADs), and Attendant Consoles connected to the EPABX.

In order to test a SATURN apparatus, the craftsperson must enable the apparatus test program via the maintenance phone, by dialing the maintenance diagnostic test access code, followed by the test select code 3. Note that this procedure is not required if the apparatus test program has been permanently enabled as a SATURN System option. Once the apparatus test program is enabled, the following listed apparatus tests can be performed:

- Station Line Tests (Refer to Tables 4.12 and 4.13)
- Attendant Console Test (Refer to Table 4.14)
- Siemens Digital Telephone – DYAD Button Test (Refer to Table 4.16)
- Siemens Digital Telephone – JR-DYAD Button Test (Refer to Table 4.17)
- Siemens Digital Telepnone – DYAD Display Test (Refer to Table 4.18)

a. Station Line Tests. The following tests can be performed on a SATURN EPABX station instrument:

1. Dial Pad Test. This test checks the transmission capabilities and DTMF keypad performance of any DTMF instrument. This test can only be enabled after dialing the apparatus diagnostic test select code 3 from the maintenance phone, if required, and the dial pad test access code (customer assigned via a CMU procedure) from the station instrument under test. After the dial pad test access code is dialed, recall dial tone is returned and the dial pad keys are depressed in a fixed sequence. If the telephone has a 12-button keypad, the buttons are depressed in the following sequence: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *, and #. If the telephone has a 16-button keypad, the buttons are depressed in this sequence: A, B, C, D, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, * and #.

   As each key is depressed, data are sent from the instrument to the test program. If a data error or an incorrect sequence is detected, busy tone is returned. Successful completion of this test is indicated by the return of a test tone (1004Hz @ -16dBm). The transmission quality of the station can then be verified by measuring the test tone frequency and level by using a TMS.

2. Ringback Test. This test checks the supervisory and transmission capabilities of any station instrument (rotary dial, DTMF and Siemens Digital Telephone). This test can only be enabled after dialing the apparatus diagnostic test select code 3 from the maintenance phone, if required, and the ringback test access code (customer assignable via a CMU procedure) from the station instrument under test. After the ringback test access code is dialed, confirmation tone is returned, and the user places the station instrument on-hook. When the station instrument rings, its supervisory capabilities are verified. Upon answering the ringing (going off-hook), a test tone (1004 Hz @ -16dBm) is applied to the station line. The transmission quality of the station can then be verified by measuring the test tone frequency and level by using a TMS.

b. Attendant Console Test. This test checks the data and speech highways to and from an attendant console, its LED indicators, display module, and audible alerting device. The test can only be enabled after dialing the apparatus diagnostic test select code 3 via the maintenance phone, if required, and the attendant console test access code (customer assignable via CMU procedure) from the attendant console under test. After the attendant console test access code is dialed, the console keys are depressed in a fixed sequence. As each is depressed, data are sent from the console to the test program. If a data error occurs or an incorrect sequence is depressed, busy tone is returned to the console. Display module and LED indications are provided to verify correct operation of the transmit and receive circuits of the console. Successful completion of this test is indicated by the returning of ringback tone to the console handset or headset and the sounding of an audible alerting device in the instrument.

c. Siemens Digital Telephone – DYAD Button Test. This test checks the signaling highways to and from a DYAD Telephone, its LED indicators, and audible alerting device. The test can only be enabled after dialing the apparatus diagnostic test select code 3 via the maintenance phone, if required, and the Siemens Digital Telephone button test access code (customer assignable via a CMU procedure) from the DYAD Telephone under test. After the Siemens Digital Telephone button test access code is dialed, the DYAD Telephone keypad and feature buttons are depressed in a fixed sequence. As each button is depressed, data are sent from the DYAD Telephone to the test program. If a data error or an incorrect sequence is detected, busy tone is returned to the DYAD Telephone. LED indications are provided to verify correct operation of the transmit and receive circuits of the DYAD Telephone. Successful completion of the test is indicated by the returning of ringback tone to the DYAD Telephone handset and the sounding of an audible alerting device in the telephone.

d. Siemens Digital Telephone – JR-DYAD Button Test. This test checks the signaling highways to and from a JR-DYAD Telephone, its LED indicators, and audible alerting device. The test is very similar to that for the DYAD Telephone described above with the exception that the operation of certain buttons (and successful test completion) is indicated at the end of the test by the return of ringback tone and actuation of the audible alerting device in the JR-DYAD Telephone.

e. Siemens Digital Telephone – DYAD Display Test. This test checks the signaling highways to and from a DYAD Telephone, its display module, and audible alerting device. The DYAD Telephone display test can only be enabled after dialing the apparatus diagnostic test select code 3 via the maintenance phone, if required, and the Siemens Digital Telephone display test access code (customer assignable via a CMU procedure) from the DYAD Telephone under test. After the Siemens Digital Telephone display test access code is dialed, the DYAD Telephone alphanumeric display and its address signaling scheme are tested. These tests consist of shifting the entire alphanumeric character set through each character position on the display module. Successful completion of the test is indicated by the returning of ringback tone to the DYAD Telephone handset and the sounding of an audible alerting device in the DYAD Telephone. The pass/fail status of the test is based on observation by maintenance personnel of the characters displayed.

2.11 Automatic On-Line Diagnostic Testing and Reporting. The SATURN EPABX System is provided with software self-test routines and audit test routines which check for failures occurring in the system. When a failure is detected, pertinent data regarding the failure is recorded in an area of memory called "Failure History" and the appropriate major or minor alarm is enabled. Recovery programs are automatically executed as necessary on the failing equipment. The failure history memory can record 32 system failures (error messages) along with the identity of the failing equipment and the date and time of occurrence for each failure. When the failure history memory is full, new failures push-off the oldest failure of the failure history memory. The MIN ALM key on the attendant console is used to display the failures recorded in the failure history memory. The failure history memory can also be accessed from a local or remote service terminal.

2.12 Self-Test Routines. The SATURN EPABX is provided with software self-test routines which verify that certain call processing operations, initiated by the main controller have been successfully completed by the peripheral circuits. If a call processing error occurs, the error(s) is recorded in the failure history memory and the appropriate major or minor alarm is enabled. Recovery programs are automatically executed as necessary on the faulty equipment.

a. Connect Test. When a trunk is seized outgoing, a 3-second (nominal) timer is set. If the CO or distant equipment does not acknowledge the seizure (e.g., ground return on tip lead, loop current, dial tone detection, or wink-start signal) before the timer expires, a connect error message is recorded in the failure history memory and the minor alarm indicators are lighted. An attempt is made to reroute the call over another trunk.

b. Disconnect Test. When a trunk is released by the SATURN EPABX, a 20-second (nominal) timer is set. If the CO does not release the trunk (e.g., ground removed from tip lead, open-loop condition on DID trunk or E lead) before the timer expires, a disconnect error message is recorded in the failure history memory and the minor alarm indicators are lighted. The trunk is left in the idle off-hook state (not disconnected, i.e., it is usable).

c. Fuse Alarm Test. Whenever a fuse on the PSU front panel fails, a fuse failure message is recorded in the failure history memory and the minor alarm indicators are lighted. The SATURN IIE System continues to process calls normally for the circuits still reporting events. If a fuse failure occurs affecting a major portion of the system (e.g., common equipment), the major alarm indicators are lighted by virtue of other failures that will result from the blown fuse.

d. Input/Output Processor Tests. The CIOP and RAUP provide return codes for each command to indicate whether or not the requested operation was successful. If the return code indicates an error or the CIOP or RAUP detects an internal failure, an error message is recorded in the failure history memory and the minor alarm indicators are lighted. If the CIOP detects an error that prevents the initialization of the system when an initialization is required, the major alarm indicators are lighted.

e. LTU Clock Test. Hardware monitors built into the Signal Multiplexer/Tone Generator (SMXTG) PCB are used to detect loss of principal clock, clock synchronization, or ring synchronization. If a failure is detected, an LTU Clock error message is recorded in the failure history memory and the minor alarm indicators are lighted. The location of the failure is indicated in the error message.

f. Mainbus Timeout Test. The system watchdog timer is set each time the mainbus receives a command. If the timer expires before an acknowledgement is returned, a mainbus timeout error message is recorded in the failure history memory and the minor alarm indicators are lighted.

g. Memory Parity Test. If a word is addressed that has incorrect parity, the parity detector on the addressed memory module generates an interrupt. A memory parity error message is recorded in the failure history memory and the minor alarm indicators are lighted.

h. Memory Protect Test. If a write is attempted to a word in write protected memory, the write protect detector on the addressed memory module generates an interrupt. A memory protect error message is recorded in the failure history memory and the minor alarm indicators are lighted.

i. Memory Support Test. A voltage level detector circuit provides a software testable signal that indicates when the memory support battery voltage is below an acceptable voltage level. This signal is sampled once per hour by software. If the software testable signal indicates that the battery is low or disconnected, a memory support failure message is recorded in the failure history memory and the minor alarm indicators are lighted.

j. PIMD or SLMD Synchronization Test. When a PIMD PCB loses synchronization with an attendant console or an SLMD PCB loses synchronization with an SDT or DCI, a PIMD error message is recorded in the failure history memory and the minor alarm indicators are lighted.

k. Presence Alarm Test. The scan data returned for each port circuit contains a presence bit. If the presence bit goes inactive for 3 seconds or changes state (active/inactive) six times in 3 seconds, a presence alarm message is recorded in the failure history memory and the minor alarm indicators are lighted. The presence alarm is not generated for ports marked as out-of-service.

l. SMXTG Clock Test. When the SMXTG 1 kHz clock fails, an SMXTG clock failure message is recorded in the failure history memory and the major alarm indicators are lighted.

m. Software Loop Test. When a software loop error exists, a software loop error message is recorded in the failure history memory and the minor alarm indicators are lighted. If the number of errors is excessive, the major alarm indicators are lighted.

n. Software Trap Test. When an event occurs for a given circuit type, the state/event table for that circuit type is accessed to determine what software action is to be taken in response to the event. If the event is illogical in regard to the state of the circuit, a software trap error message is recorded in the failure history memory and the minor alarm indicators are lighted.

2.13 Audit Routines. The SATURN IIE EPABX software includes a repertoire of audit routines which are executed during processor idle time. These routines provide automatic testing of system equipment. Each audit routine is designed to be individually enabled (activated) or disabled (inactivated) from the automatic routining sequence. This enable/disable capability is only accessible by maintenance personnel via a service terminal. When an auditing routine is enabled, detected failures are recorded in the failure history memory and the appropriate major or minor alarm is enabled. All failures are identified by the AUDIT error message (refer to Table 4.02). Recovery programs are automatically executed as necessary on faulty equipment. Additionally, each audit routine is designed to be executed on demand by maintenance personnel via a local or remote service terminal. Immediate results (reasonable execution time considered) of pass or fail conditions are provided upon completion of each audit routine. The failure indication can be displayed by accessing the failure history memory. The following listed audit programs are described in subsequent paragraphs.

- Memory Parity Audit Test
- Memory Content Audit Test
- Input/Output Loop-Around Audit Test
- Speech Highway Audit Test
- DTMF Receiver/Tone Generator Audit Test
- MTS Memory Control Audit Test
- Digital Apparatus Audit Test
- Trunk Activity Audit Test

a. Memory Parity Audit Test. The memory parity audit test checks each memory address for correct parity of its contents. If a parity error is detected, the error is recorded in the failure history memory, the MINOR alarm indicator on the PSU is lit, and recovery is automatically attempted. This audit routine is intended to be used by maintenance personnel as a demand-executed audit routine only to be run when memory is first installed or suspected faulty. This routine should normally be disabled from automatically running on an in-service system, since it may unnecessarily disrupt service if it detects an error in a normally unused portion of the memory. The standard system data base has this audit routine disabled.

b. Memory Content Audit Test. Verifies the check sum of control memory areas. If a conflict of data is detected, the error is recorded in the failure history memory, the MINOR alarm indicator on the PSU is lit, and recovery is automatically attempted.

c. Input/Output Loop-Around Audit Test. The input/output loop-around audit test provides verification of the input/output interface circuits for the equipped CIOP and RAUP PCBs. This audit routine checks the complete I/O interface of each PCB. This audit routine is not intended to provide a test of the peripheral equipment accessing the interfaces. If the loop-around test fails, the failure is recorded in the failure history memory and the MINOR alarm indicator on the PSU is lit.

d. Speech Highway Audit Test. The speech highway audit test checks the individual port's codec operation, speech highway, and MTS switching elements for correct data/voice transfer. This audit routine transmits a DTMF tone to a selected idle line or trunk port in the loopback mode. It then receives the results via a DTMF receiver. If the DTMF tone is not properly received, the failure is recorded in the failure history memory and the MINOR alarm indicator on the PSU is lit.

e. DTMF Receiver/Tone Generator Audit Test. The DTMF generator/receiver audit test checks the tone generator's DTMF outputs and each equipped DTMF receiver in the system by connecting each DTMF tone output from the tone generator to the input of the DTMF receiver. The DTMF receiver is then scanned for proper decoding of the tones. Each idle DTMF receiver is cycled through all DTMF tones. Detected failures are recorded in the failure history memory. If an individual DTMF receiver is faulty, it is placed in an out-of-service state and the MINOR alarm indicator on the PSU is lit. If the tone generator is faulty, the MAJOR alarm indicator on the PSU is lit.

f. MTS Memory Control Audit Test. The MTS memory control audit test provides verification of the MTS memory on the MCA printed circuit board. A series of values are written to and then read from each MTS memory location. If a mismatch occurs between the data written and the data read, the failure is recorded in the failure history memory and the MINOR alarm indicator on the PSU is lit.

g. Digital Apparatus Audit Test. The digital apparatus audit test is used to verify the operation of data devices (DCIs) connected to the system and used either as terminal controllers or for pooled modems. When the test is initiated, the system maintenance channel is checked first. If the maintenance channel is functional, then an idle data device is looped-back (at the device) and a fixed data pattern is written to the maintenance channel. After a short delay, the data is read back and, if it matches the original data, the data device is considered to be fully operational and other idle data devices are located for testing. If the first loop-back test fails, the associated SLMD is looped-back and the data pattern test is repeated. If the second test fails, an SLMD fault is suspected; if the second test passes, a DCI failure or wiring fault is suspected. When either or both tests fail, the PEN of the failed device and the test(s) failed is recorded in the failure history and the MINOR alarm indicator on the PSU is lit.

h. Trunk Activity Audit Test. The trunk activity audit test checks each assigned trunk in any prerequested trunk group for possible abnormal activity. Activity is monitored by maintaining attempts event and occupancy usage counts for each trunk in the trunk group. Signaling problems will be indicated by seizures of either excessively short or extremely long duration, as evidenced by the events and usage counts. One-way incoming trunks experiencing signaling problems may remain idle for long periods when traffic density is high.

2.14 Alarm Indicators and Classification. Major alarm (MAJOR) and Minor alarm (MINOR) indicators are provided in the ALARMS indicator area of the PSU front panel and attendant console. These alarm indicators provide an indication of one of three possible system alarm conditions:

a. No Alarm (MAJOR and MINOR alarm indicators dark) — No detectable failures are present in the system.

b. Minor Alarm (MINOR alarm indicator lighted) — At least one of the automatic on-line diagnostic tests has detected a failure in the system and maintenance personnel attention is required when possible.

c. Major Alarm (MAJOR alarm indicator lighted) — The system is in a non-operative state and the system's failure transfer relays are active, if provided. Immediate maintenance personnel attention is required. Note that certain major alarm conditions could prevent the major alarm (MAJ ALM) indicator on the attendant console from being lighted. Examples are primary power failure, console power failure, and -48PS failure.

2.15 Power Distribution and Failures. Each SATURN IIE EPABX Basic Cabinet is provided with the following power-related assemblies and modules (refer to Figures 2.04 and 2.05):

- Power System Unit (PSU) containing:

  Circuit Breaker (and Fuse) Panel Basic Power Supply Board Ring Generator (RGEN) Module Control Logic Board Memory Support Module (MSM), optional

- -48 Vdc Power Supply (-48PS0).

- Line/Trunk Unit Power Supply (LTUPS), optional. When the Basic Cabinet is equipped with an LTU shelf, an LTUPS is required in the LTU shelf.

If an Expansion Cabinet is added to the Basic Cabinet, the following power supplies are added (refer to Figures 2.06 and 2.07):

- -48 Vdc Power Supply (-48PS1). A -48 Vdc Power Supply is added in the space adjacent to -48PS0 in the Basic Cabinet.

- Line/Trunk Unit Power Supply(s) (LTUPS). An LTUPS is required in each LTU shelf in the Expansion Cabinet.

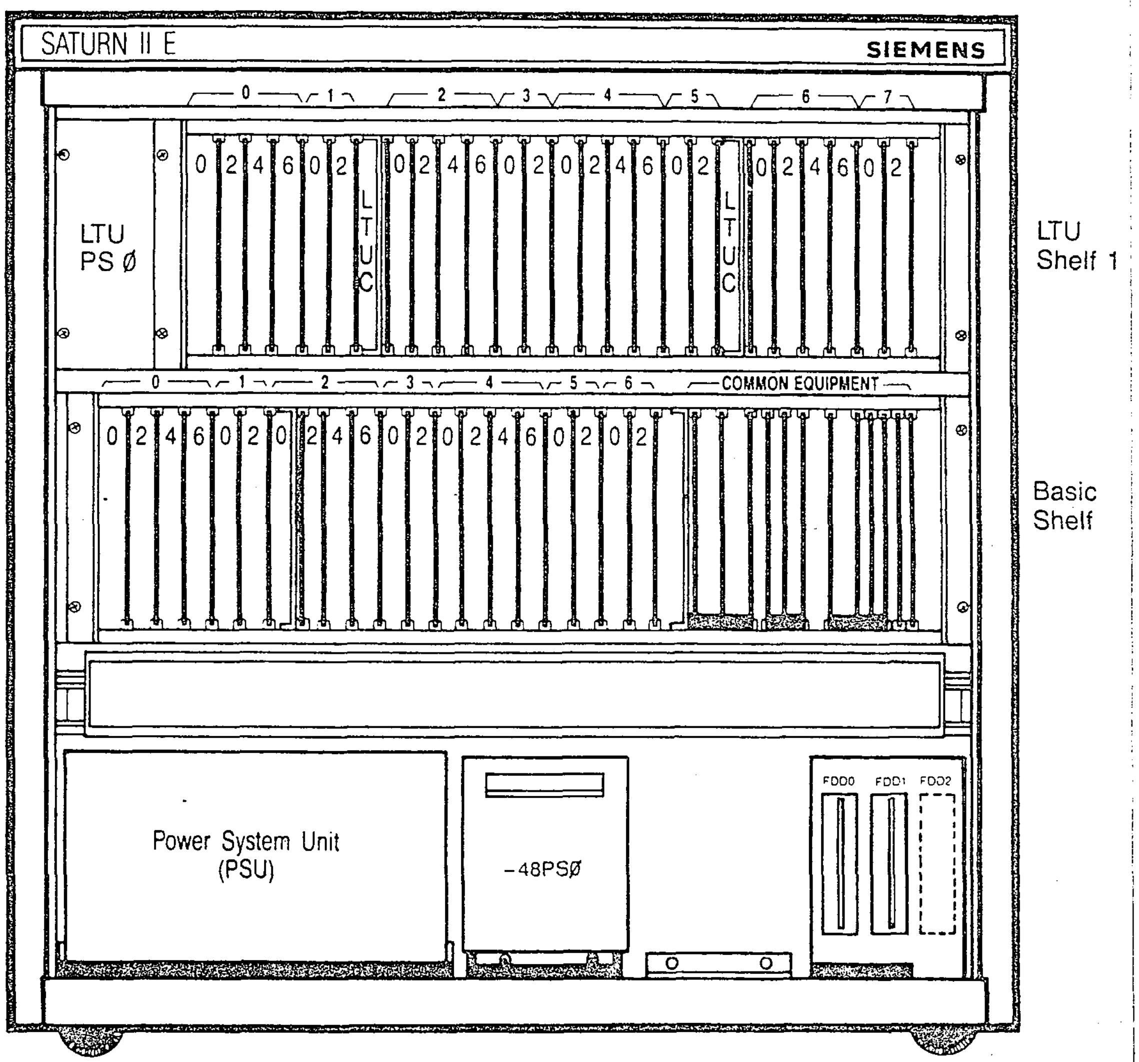

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Figure 2.04 SATURN IIE EPABX Basic Cabinet (Front View)

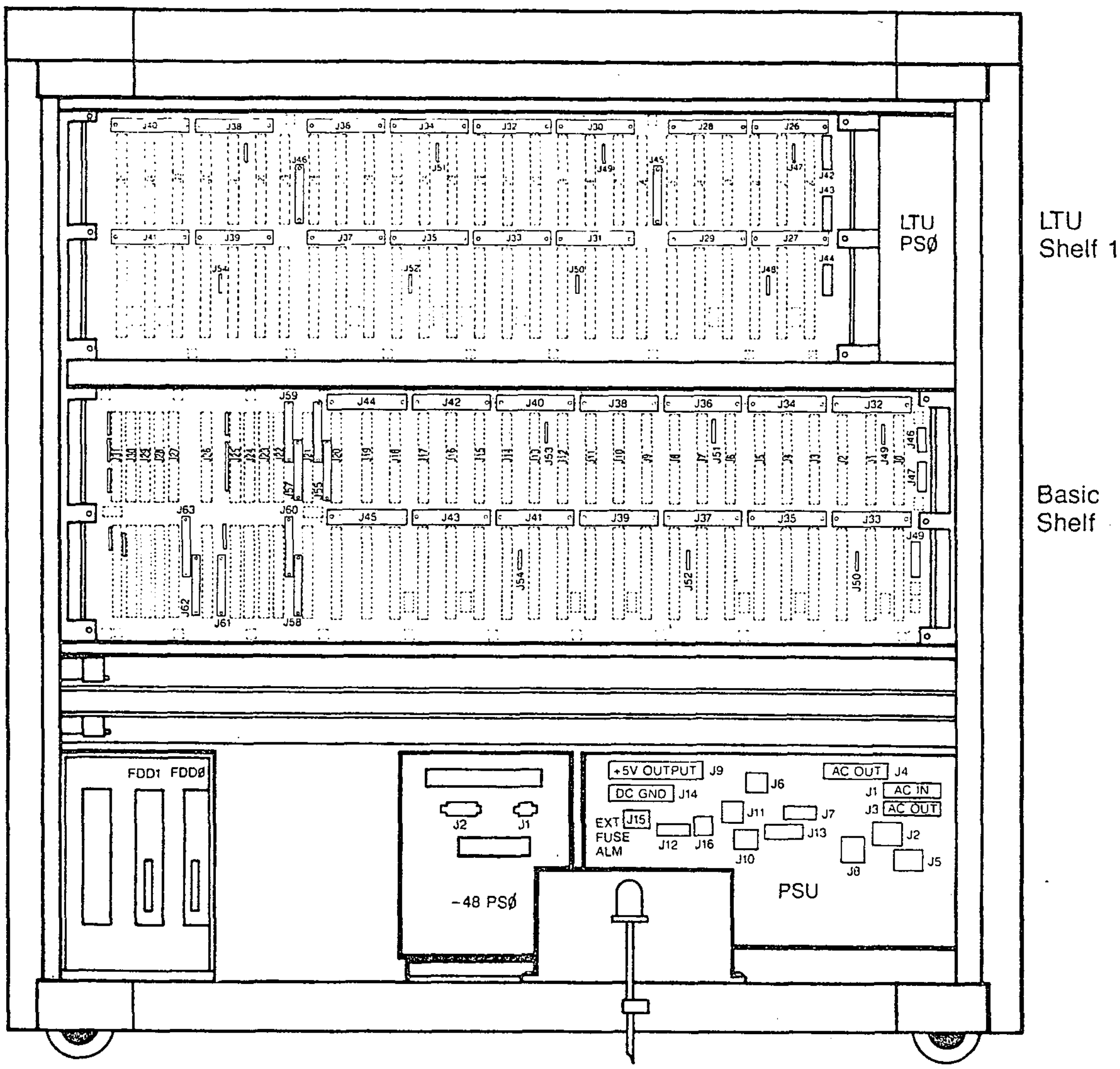

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Figure 2.05 SATURN IIE EPABX Basic Cabinet (Rear View)

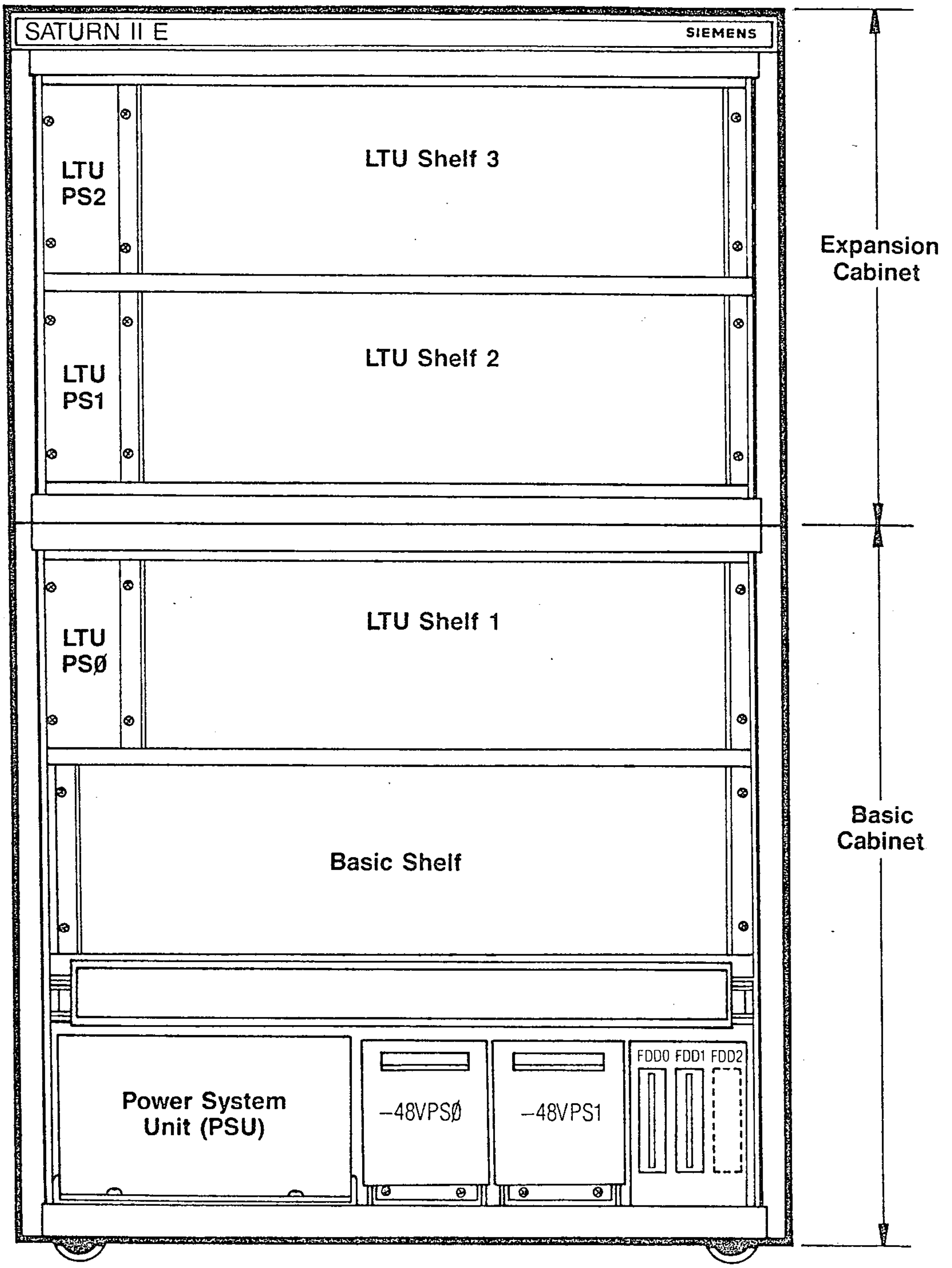

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Figure 2.06 SATURN IIE EPABX Basic and Expansion Cabinets (Front View)

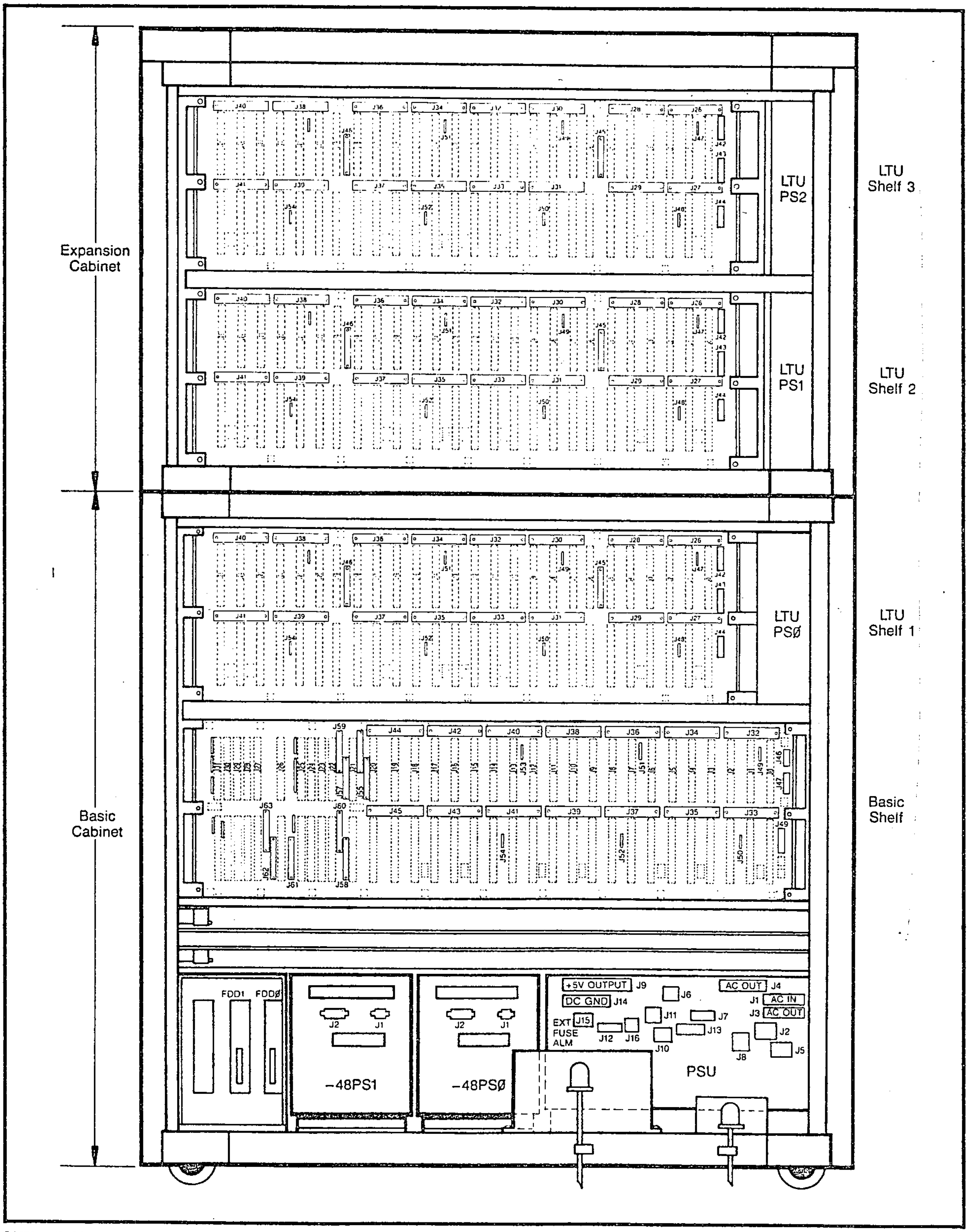

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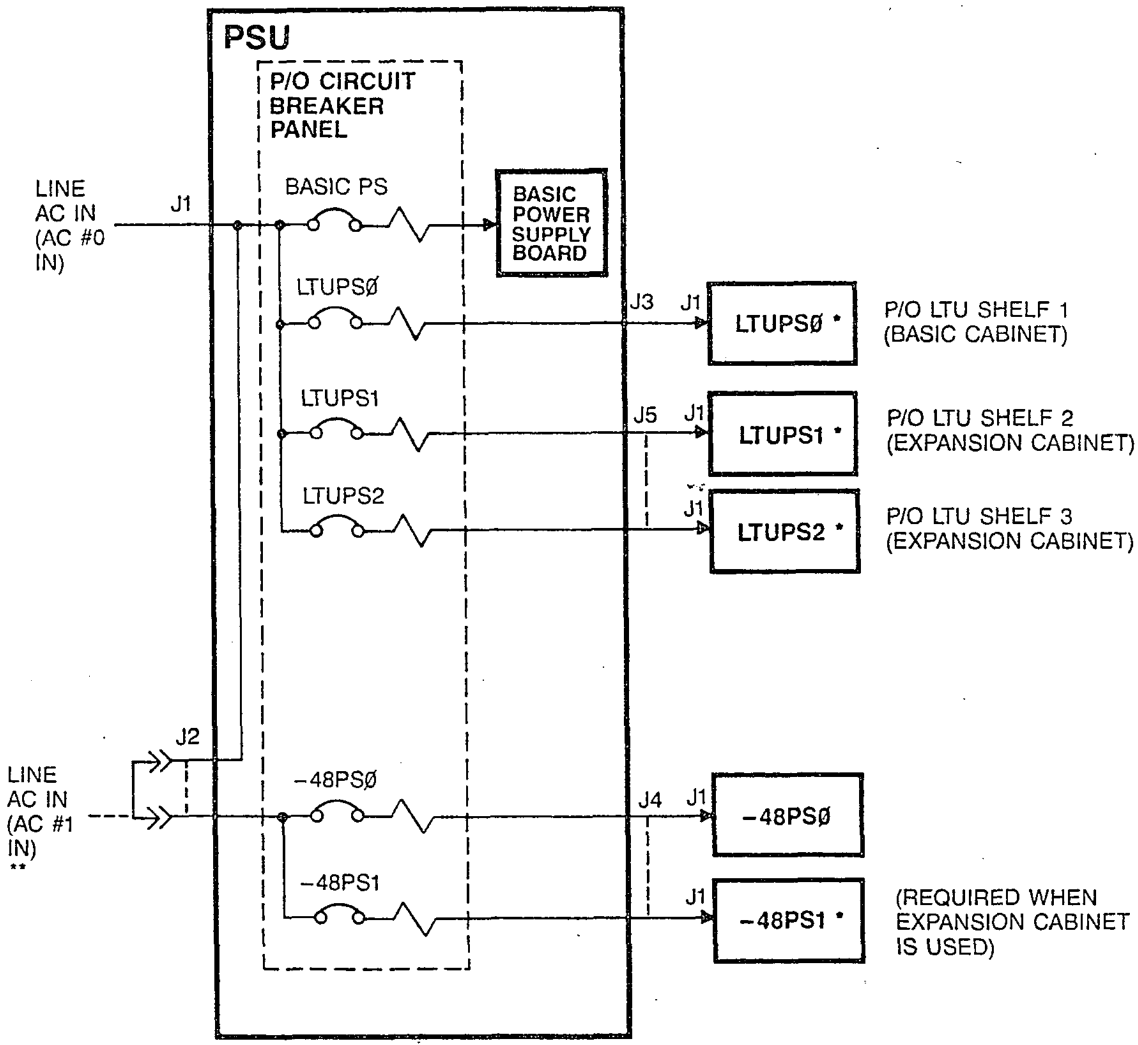
Figure 2.07 SATURN IIE EPABX Basic and Expansion Cabinets (Rear View)

Figure 2.08 is a block diagram which shows the ac power input to the Power System Unit and ac power distribution to the various system power supplies via the PSU circuit breaker panel. All circuit breakers and fuses are mounted on the PSU front panel. (Refer to Figure 2.01.) Figure 2.09 shows the layout of input/output connectors and terminals on the rear panel of the PSU. Table 2.00 lists the designations and functions of these connectors and terminals.

Figure 2.10 is a block diagram showing the fusing of -48 volt outputs from the -48PS module(s). As shown, these -48 volt outputs are supplied to the Basic and LTU Shelves and the Ring Generator (RGEN) module. Also shown is the fusing of the RAC/RMW (ringing signal) output of the Control Logic Board which is distributed to the Basic and LTU Shelves.

The function and consequences of a failure of each of these modules is described below:

a. Power System Unit (PSU). The PSU performs a number of major functions in the SATURN IIE System. It provides (1) dc voltages necessary for operation of the Line/Trunk and Common Equipment PCBs in the Basic Shelf and Floppy Disk Drives FDD0 and FDD1, (2) ac distribution to and circuit breaker protection on the ac inputs of all system power supplies, (3) -48Vdc distribution and fuse protection on the -48PS outputs to the Basic Shelf and optional LTU Shelf(s), (4) it generates and provides synchronization of the ringing (RAC/RMW) signal and provides fuse protection and distribution of the ringing signal to the Basic Shelf and optional LTU Shelf(s), (5) it provides fuse, voltage, and alarm detection and monitoring, and (6) failure transfer control and major and minor alarm indications when a failure or alarm condition is detected. In addition to the above, the PSU provides mounting facilities and power input to the optional Memory Support Module (MSM) when it is provided in the system. The various circuits and components that make up the PSU are listed and described below. Refer to Figure 2.11 for a block diagram of the PSU.



* OPTIONAL DEPENDING UPON CUSTOMER/ SYSTEM REQUIREMENTS.

** SECOND AC INPUT IS REQUIRED WHEN EXPANSION CABINET IS USED. JUMPER PLUG AT J2 IS REMOVED AND SECOND AC SOURCE IS WIRED TO J2.

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Figure 2.08 Block Diagram of AC Input to Power Supply Assemblies and Modules

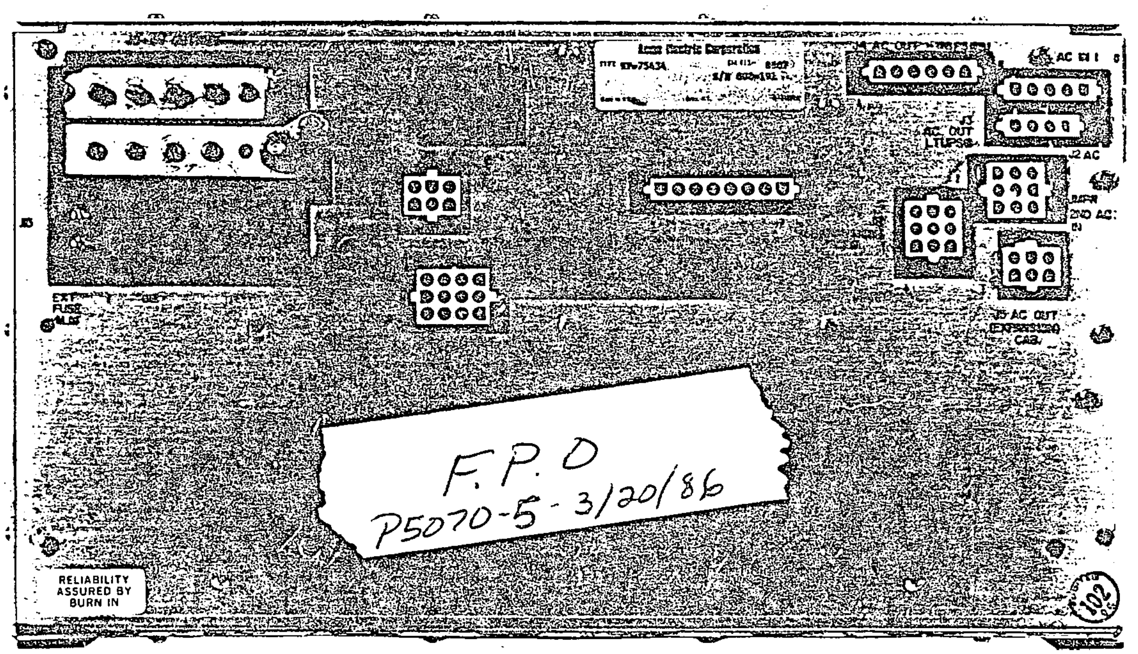

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Figure 2.09 Layout of Connectors and Terminals on PSU Rear Panel

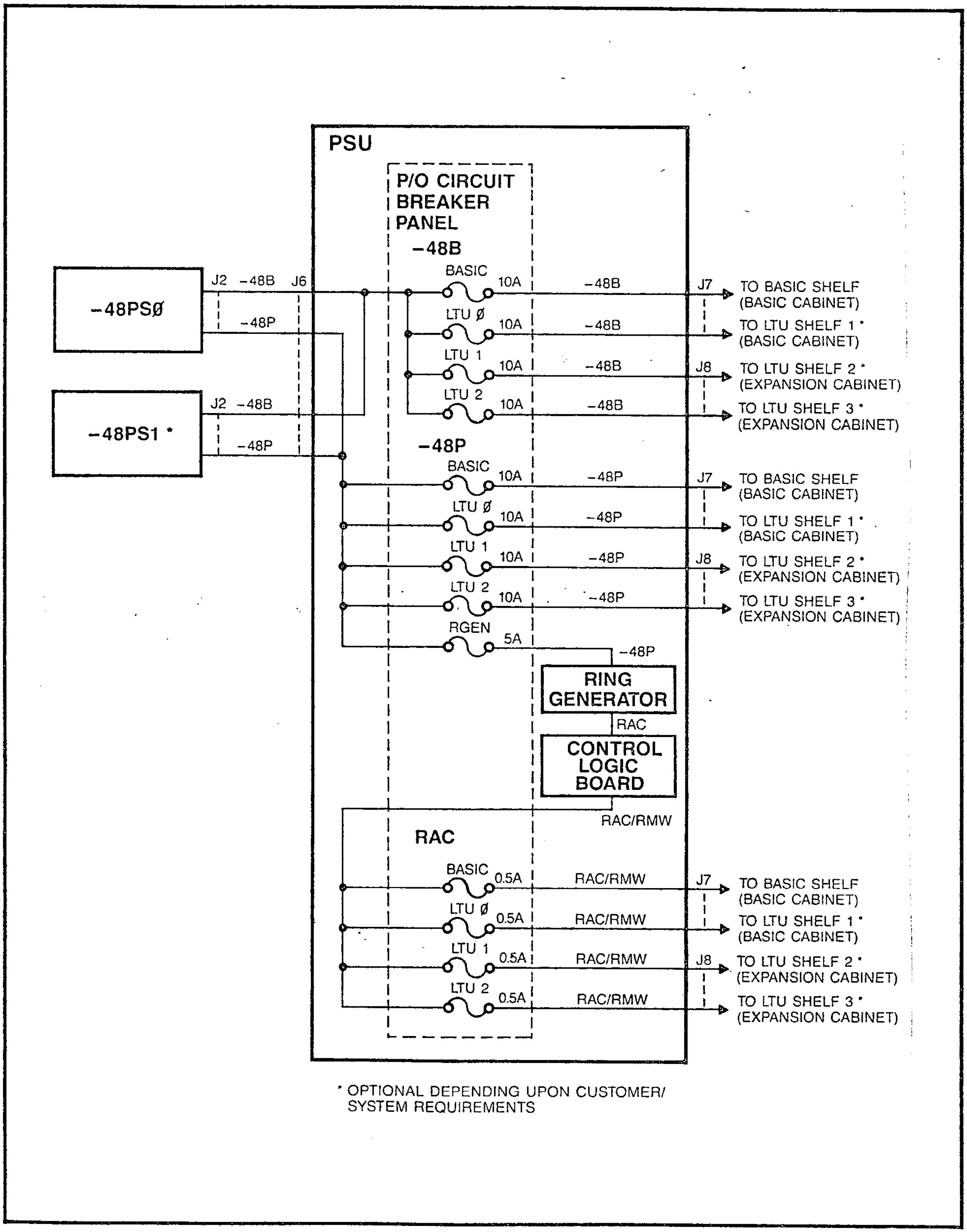

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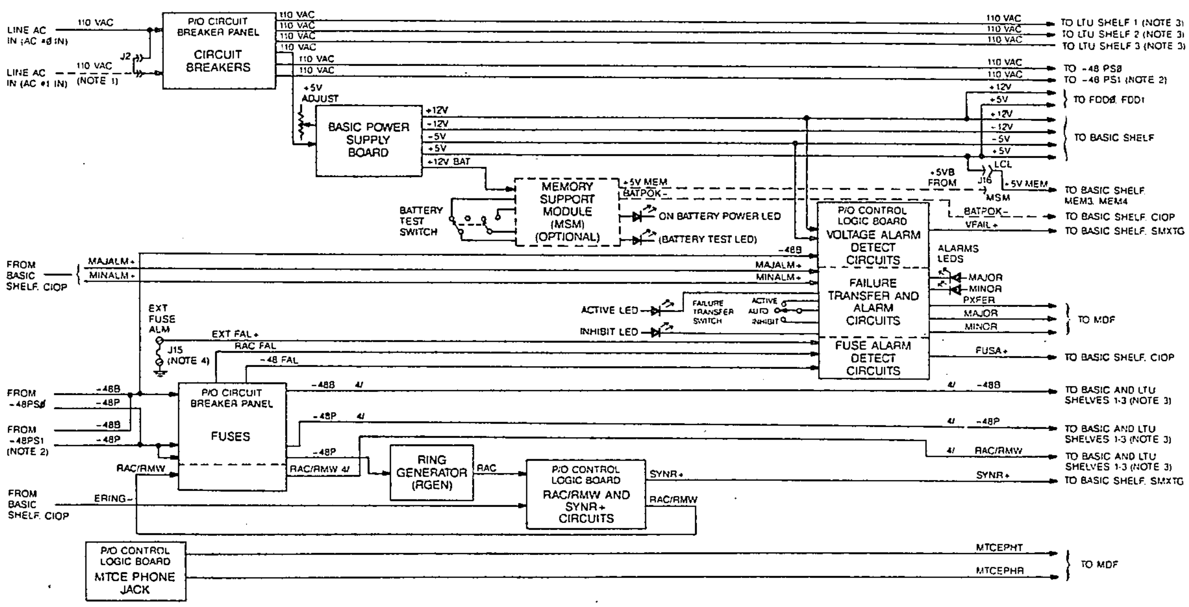
Figure 2.10 Fusing of -48 Volt Outputs from -48PS0 and -48PS1

Table 2.00 Functions of Connectors and Terminals on PSU Rear Panel

DESIGNATION	FUNCTION
	Note: Refer to Figure 2.09.
J1	AC power input (AC#0 IN) for distribution to PSU Power Supply Board, LTU Shelf power supplies, and -48PS0 if system consists of Basic Cabinet only
J2	AC power input (AC#1 IN) to -48PS0 and -48PS1 in systems consisting of Basic and Expansion Cabinets. Otherwise, provides jumper plug connection for routing ac power to -48PS0 via PSU Circuit Breaker Panel
J3	AC power to LTUPS0 in LTU Shelf 1
J4	AC power to -48PS0 and -48PS1
J5	AC power to LTUPS1 (LTU Shelf 2) and LTUPS2 (LTU Shelf 3) in Expansion Cabinet
J6	-48B and -48P inputs from -48PS0 and -48PS1; +5V and +12V distribution to FDD2 (not equipped at this time)
J7	-48B, -48P, and RAC/RMW distribution to Basic and LTU 1 Shelves in Basic Cabinet
J8	-48B, -48P, and RAC/RMW distribution to LTU Shelves 2 and 3 in Expansion Cabinet
J9	+5V distribution to Basic Shelf (busbar lug connections)
J10	-5V, +5VB, -12V, and +12V distribution to Basic Shelf
J11	+5V and +12V distribution to FDD0 and FDD1
J12	SYNR+, FUSA+, BATPOK-, and VFAIL+ to Basic Shelf. ERING-, MINALM+, and MAJALM+, from Basic Shelf.
J13	Failure Transfer Control, Major and Minor Alarm Status, and Maintenance Telephone to MDF
J14	D.C. GND (busbar lug connections)
J15	EXT FUSE ALM (external fuse alarm input; disabled when jumper is installed)
J16	MSM/LCL jumper for +5V memory power



NOTES
1. SECOND AC INPUT (AC #1) IS REQUIRED WHEN EXPANSION CABINET IS USED AND -48PS1 IS INSTALLED JUMPER PLUG AT J2 IS REMOVED AND SECOND AC SOURCE IS CONNECTED TO J2
2. SECOND -48V POWER SUPPLY (-48PS1) IS REQUIRED WHEN EXPANSION CABINET IS USED
3. LTU SHELVES ARE OPTIONAL DEPENDING UPON CUSTOMER/SYSTEM REQUIREMENTS
4. EXTERNAL FUSE ALARM CONNECTION (EXT FUSE ALM, J15) IS JUMPERED TO GROUND (AT FACTORY) TO DISABLE INPUT

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Figure 2.11 Power System Unit (PSU) Block Diagram

1. Front Panel Fuses, Controls, and Indicators. The following are mounted on or visible through openings in the PSU front panel:

   - Fuses for all -48Vdc and ringing (RAC/RMW) voltages to the Basic and optional LTU Shelves (part of Circuit Breaker Panel)
   - Circuit breakers for ac inputs to all system power supplies (part of Circuit Breaker Panel)
   - MAJOR (red) and MINOR (yellow) alarm (ALARMS) indicators (part of Control Logic Board)
   - FAILURE TRANSFER switch and associated ACTIVE (red) and INHIBIT (yellow) indicators (part of Control Logic Board)
   - MTCE PHONE (maintenance telephone) jack (part of Control Logic Board)
   - BATTERY TEST pushbutton switch and associated ON BATTERY POWER (red) and Battery Test (green) indicators (part of MSM)
   - +5 V ADJUST potentiometer (part of Basic Power Supply Board)

   (a) Fuses. All -48 volt inputs and RAC/RMW inputs to the LTU and Basic Shelves are fused as shown in Figure 2.10.

   Failure of a fuse to blow under fusing current conditions is very unlikely. To ensure proper protection, always replace a blown fuse with one of the correct value (refer to Figure 2.10).

   (b) Circuit Breakers. All system power supply modules, including the Basic Power Supply Board in the PSU, are protected at their input by a circuit breaker as shown in Figure 2.08.

   The remaining PSU controls and indicators are discussed below in text covering the individual PSU modules.

2. Basic Power Supply Board. The PSU Basic Power Supply Board (refer to Figure 2.11) is a switching power supply which provides +5Vdc, -5Vdc, +12Vdc, and -12Vdc for operation of line/trunk unit and common equipment PCBs in the Basic Shelf, the FDDs, and the Control Logic Board and optional MSM in the PSU.

   Failures in the Basic Power Supply Board could affect operation of the complete system or, selectively, certain types of line/trunk units or common equipment PCBs in the Basic Shelf, voltage and fuse alarm monitoring, SYNR+ and RAC/RMW generating, and failure transfer circuits on the Control Logic Board, the MSM in the PSU, and the FDDs. Although the PSU provides the dc voltages necessary to operate the floppy disk drive motors, circuits in the CIOP control the voltages. The floppy disk drive select circuit in the CIOP switches dc to the motors of floppy disk drives FDD0 and FDD1 using the MOTORON0- and MOTORON1- signals, respectively. A failure in this circuitry could prevent switching of dc to a motor or cause dc to be switched to a motor when it should be switched off. The inability to switch either motor on may be due either to a disconnected power cable between the PSU and the FDD (PSU J11 and FDD J2) or a disconnected control cable between the Basic Shelf (J63 for FDD0; J62 for FDD1) and the FDD signal connector, J1.

   In the event of a failure in the Basic Power Supply Board, the PSU should be replaced.

3. Ring Generator (RGEN) Module. The RGEN module in the PSU generates the ringing ac voltage (RAC) used in the SATURN IIE System. This voltage has a nominal 20Hz, 90 volts RMS sinusoidal waveform. The RGEN module has a rated output power of 25 Watts and is powered from -48VP via fuse F5 (RGEN) on the PSU front panel. The output voltage (RAC) is routed to the Control Logic Board where it is interleaved with the Ring Message Waiting signal (RMW) to form the RAC/RMW signal. The RAC/RMW signal is distributed to the Basic and LTU Shelves via RAC fuses F10 through F13 on the PSU front panel.

   In the event of a failure in the Ring Generator Module, the PSU should be replaced.

4. Control Logic Board. The Control Logic Board contains circuits and components which perform the following functions.

   - Fuse Alarm Detection
   - Ring Synchronization (SYNR+) Signal Generation
   - Ringing AC/Ring Message Waiting (RAC/RMW) Signal Generation
   - Voltage and Alarm Monitoring
   - Failure Transfer Control
   - Failure Transfer and Alarm Output Relays
   - Major and Minor Alarm Indicators
   - Maintenance Telephone Jack

   (a) Fuse Alarm Detect Circuit. The fuse alarm detect circuit monitors each fuse and, upon sensing a blown fuse condition, sends a Fuse Alarm signal (FUSA+) to the Controller/Input-Output Processor (CIOP) PCB. A fuse alarm will cause a minor alarm condition in the SATURN IIE System; however, the location of the blown fuse must be determined by a visual check of the fuses on the front panel of the PSU. These fuses are "grasshopper" type fuses in which a spring wire indicates by its position away from normal that the fuse has blown. (The spring wire also provides the alarm contact.) If used, a fuse alarm may also be provided through the external fuse alarm connections (EXT FUSE ALM, J15) on the rear panel of the PSU. Normally closed external relay contacts are wired to the terminals and, when these contacts open, a fuse alarm (FUSA+) output will be sent to the CIOP. The EXT FUSE ALM terminals are jumpered at the factory to disable the function.

A failure in the fuse alarm detect circuit may cause spurious fuse alarm (FUSA+) signals or prevent a fuse alarm signal, depending on the nature of the fault. A spurious fuse alarm may occur due to a disconnected cable from J12 of the PSU module to the basic shelf as well as a fault in the CIOP PCB.

If a fuse is blown but no fuse alarm is indicated, the fault could be in the fuse alarm detect circuit in the PSU Control Logic Board or circuits in the CIOP PCB.

If the Fuse Alarm Detect Circuit on the Control Logic Board fails, replace the PSU.

(b) Ring Synchronization Signal (SYNR+) Circuit. The SYNR+ signal is used in the SLMA-O, SLMA-S, and SLA16 PCBs to control the operation and release of the ring relays. The SYNR+ signal is routed from the PSU to the SMXTG PCB in the Basic Shelf. It is buffered in the SMXTG PCB and then distributed to each line/trunk group on the Basic and LTU shelves. Loss of the SYNR+ signal will generate an alarm signal and light the ALMO LED on the affected LTUC PCB. Refer to Table 4.03.

(c) Ringing AC/Ring Message Waiting (RAC/RMW) Signal Circuit. The RAC signal from the PSU RGEN module and the ERING- signal from the CIOP PCB are used in the generation of the RAC/RMW signal in the PSU Control Logic Board.

The RAC/RMW signal consists of 2-second intervals of RAC signal interleaved with 1-second intervals of RMW signal. The transitions from RAC to RMW and from RMW to RAC are controlled by the ERING- signal.

The RAC signal is nominally 90 Vac RMS 20Hz and the RMW signal is nominally 97 Vdc. The RAC/RMW signal consists of two interleaved phases as shown in Figure 2.12.

During the RAC signal intervals, telephones in the ring mode will ring and the associated message waiting lamps will flicker. During the RMW signal intervals, telephones in the message waiting mode will have their message waiting lamps lighted steadily. The associated ringer will not sound.

Thus telephones will ring with a 2 seconds on, 4 seconds off cadence and the message waiting lamps will light with a 1 second on, 2 seconds off cadence.

Failure of the RAC/RMW circuit on the Control Logic Board may result in improper RAC or RMW signals and/or improper timing of these signals. Such faults may be detected audibly and visually.

If the Ringing AC/Ring Message Waiting (RAC/RMW) Circuit on the Control Logic Board fails, replace the PSU.

(d) Voltage and Alarm Monitoring Circuit. The voltage and alarm monitoring circuit is provided on the Control Logic Board in the PSU. The +12Vdc and and -5Vdc outputs of the PSU Basic Power Supply Board and the -48B output voltage from the -48PS module(s) are monitored by the circuit. A loss of one or more of the three voltages causes a voltage failure signal (VFAIL+) to be sent to the SMXTG in the Basic Shelf and results in a minor alarm.

The +5Vdc, +5.2Vdc, and -12Vdc voltages are not monitored. The reason for this is that a loss, or low level, of the +5Vdc will affect operation of all line/trunk unit PCBs on the Basic Shelf and will cause generation of a PRESENCE ERROR alarm from all of these PCBs to be recorded in the system's failure history memory.

The loss, or low level, of +5.2Vdc on the Basic Shelf will cause complete system failure. (However, if an MSM module is installed, the memory will be retained for at least 5 minutes.)

The -12Vdc is used on the DTMF and RAUP modules. Therefore, a loss or low level of this voltage on the LTU or Basic Shelves, will be evidenced by misoperation of the RAUP PCB on the Basic Shelf and the DTMF PCBs on other shelves, as applicable.

If the Voltage and Alarm Monitoring Circuit on the Control Logic Board fails, replace the PSU.

(e) Failure Transfer Control Circuit. With the FAILURE TRANSFER mode select switch on the front of the PSU set to the AUTO position, an active MAJALM+ signal from the CIOP PCB in the Basic shelf will initiate a failure transfer.

With the FAILURE TRANSFER mode select switch in the ACTIVE position, failure transfer is initiated regardless of the status of the monitored voltages and MAJALM+ signal.

With the FAILURE TRANSFER mode select switch in the INHIBIT position, failure transfer is inhibited regardless of the status of the monitored voltages and MAJALM+ signal.

If the Failure Transfer Control Circuit on the Control Logic Board fails, replace the PSU.

(f) Failure Transfer and Alarm Output Relays. Failure transfer/major alarm and minor alarm relays in the PSU Control Logic Card have contact sets connected to pins on connector J13 on the rear panel of the PSU.

Both relays are normally operated. Contact sets of one of the relays are used to control remote failure transfer (PXFER) and provide major alarm (MAJOR) status. A contact set on the other relay provides minor alarm (MINOR) status.

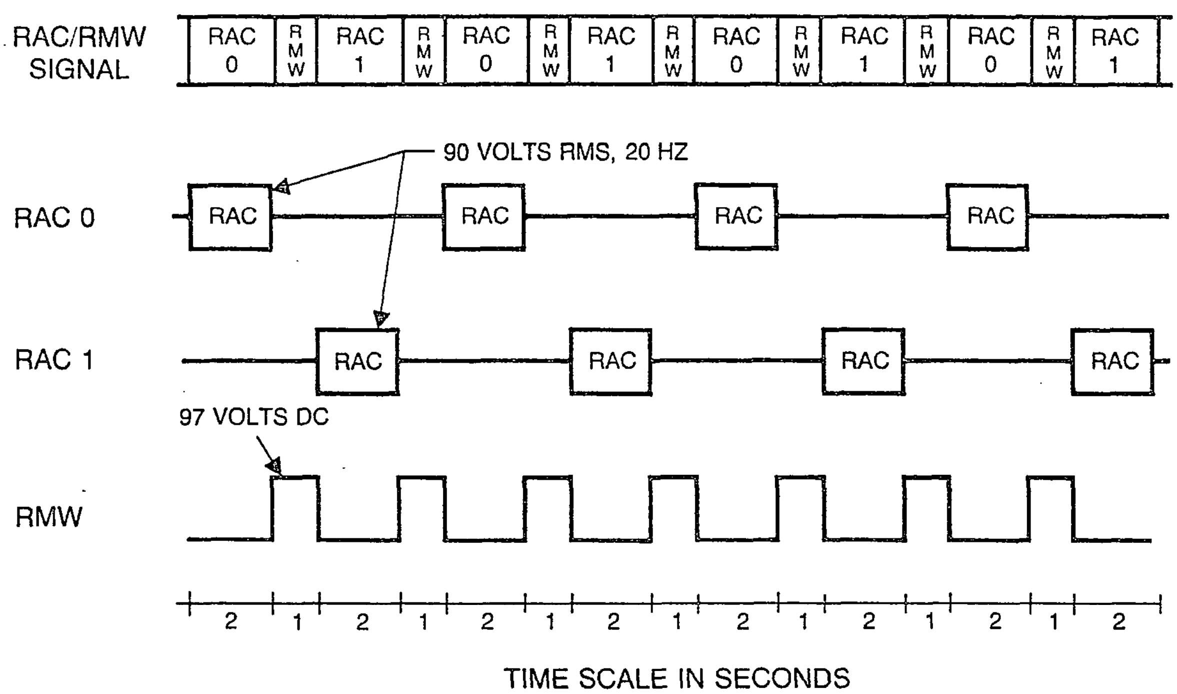

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Figure 2.12 RAC/RMW Signals

Both normally closed and normally open contact arrangements are provided for failure transfer and for major alarm and minor alarm outputs to allow use of external equipment responding to either arrangement. Connections are normally made to the MDF for distribution of the failure transfer, major alarm, and minor alarm functions.

The relay contacts connected to J13 will give an output status for the various combinations of MAJALM+ and MINALM+ signals as shown in Table 2.01.

If a fault is suspected in the Failure Transfer and Alarm Output Relays on the Control Logic Board, replace the PSU.

(g) Major and Minor Alarm Indicators. The MAJOR and MINOR ALARMS indicators are visible through openings in the PSU front panel and light when MAJALM+ and MINALM+ signals are received from the CIOP. Table 2.02 shows alarm indicator states for combinations of MAJALM+ and MINALM+ signals from the CIOP. If an alarm indicator is faulty, replace the PSU.

(h) Maintenance Telephone (MTCE PHONE) Jack. A standard modular jack is accessible through the front of the PSU for plug-in of a maintenance telephone. The jack is connected to pins on connector J13 on the PSU rear panel as indicated in Table 2.01. Connector J13 is wired to the MDF. If the jack or interconnecting printed circuit or PSU wiring is faulty, replace the PSU.

Contacts only to operate external PFT apparatus

Table 2.01 Pin Functions at Connector J13 on the PSU

J13 PIN	PIN LEAD AND RELAY CONTACT STATUS	FUNCTION
1 Ring 26 Tip	(Not Applicable) (Not Applicable)	Maintenance Phone
2 Ring 27 Tip 3 Ring 28 Tip	(Normally Open) (Common) (Normally Closed) (Common)	Failure Transfer
31 Tip 4 Ring 29 Tip	(Normally Closed) (Common) (Normally Open)	Major Alarm
6 Tip 5 Ring 30 Tip	(Normally Open) (Common) (Normally Closed)	Minor Alarm
Note: The relay contact status shown in this table applies when both relays are not operated (in accordance with standard convention). However, under normal system operating conditions, both relays are operated. Therefore, under normal system operating conditions, the relay contacts are the reverse of those shown in this table.		

Table 2.02 Alarm LEDs and Output Status at Connector J13 on the PSU

ALARM STATUS	LED LIT	OUTPUT STATUS (J13)
Neither MINALM+ nor MAJALM+ Active	None	Normal
MINALM+ Only Active	MINOR only	Minor Alarm Only
MAJALM+ Only Active	MAJOR only	Major Alarm, Failure Transfer
Both MINALM+ and MAJALM+ Active	MAJOR only	Major Alarm, Failure Transfer

5. Memory Support Module (MSM). The MSM is an optional module which provides +5Vdc (+5VB) with internal battery back-up for the memory chips in the memory (MEM3 and MEM4) PCBs in the common equipment section of the Basic Shelf. The MSM contains a linear regulator and battery charger, a battery, and sensing circuits to detect power failure, battery overvoltage, and battery failure. Protection for output overvoltage, whether due to an externally applied overvoltage or due to an internal fault, is provided by means of a crowbar and output disconnect circuit. If the protection circuit is activated, clear the fault condition and then switch the BASIC PS circuit breaker on the PSU off (down) and then on (up) again to restore the +5VB output.

   Upon removal of the fault condition causing excessive output current, normal output capability is automatically restored.

   The battery contained in the MSM is a standard sealed plug-in assembly which may be removed and replaced from the front of the Basic Cabinet by removing the PSU front panel. A BATTERY TEST switch and associated green LED are mounted on the front of the MSM and are visible through openings in the PSU front panel. A red LED (ON BATTERY POWER) mounted on the front of the MSM and also visible through the PSU front panel indicates whether the memory integrated circuits (ICs) in the memory PCBs are being powered from the internal MSM battery.

b. -48Vdc Power Supply (-48PS0, -48PS1). The -48PS module is a ferroresonant transformer power supply which provides talking battery voltage (-48VB) and premium -48Vdc (-48VP) for the Basic and LTU Shelves. The -48VP output is used for powering the RGEN module (in the PSU) and the SDTs and attendant consoles via SLMD and PIMD PCBs, respectively. The -48VB output is derived from the -48VP voltage, after additional filtering, and is used for talk battery to the SLMA-O, SLMA-S, and SLA16 modules.

   Because of its ferroresonant transformer design, the -48PS has inherent output voltage limiting and is capable of supplying a considerable output current overload without damage (although the output voltage will decrease). It contains a thermal cut-off switch to protect against overheating due to excessive output current overload or an internal fault. This thermal cut-off switch will operate and remove power from the power supply if the ferroresonant transformer overheats. Shutdown due to an overvoltage condition causes the power supply output to latch off. To unlatch the power supply output and resume normal operation, clear the fault condition and set the associated input circuit breaker (-48PS0 or -48PS1, located on the PSU front panel) to off (down) and then on (up) again. This unlatches the protection mode and allows the power supply to resume normal operation.

   One or two -48PS modules may be installed, depending upon system size and cabinet configuration. A system consisting of only a Basic Cabinet requires only one -48PS module; a system using both a Basic and an Expansion Cabinet requires two. When two -48PS modules are installed, the -48VB and -48VP outputs of the power supplies are paralleled in the PSU. Whether one or two power supply modules are used, the outputs are distributed, via fuses on the PSU front panel, to the Basic and LTU Shelves. The -48VP (-48P) outputs are distributed to the shelves via fuses F1 through F4. The RGEN module in the PSU is also powered by a -48VP output through fuse F5. The -48VB (-48B) outputs are distributed to the shelves via fuses F6 through F9.

   If a fault condition in a -48Vdc Power Supply cannot be cleared, replace the power supply.

c. Line/Trunk Unit Power Supply (LTUPS). The LTUPS is the standard power supply used to power the LTU shelf. It has four outputs: +5Vdc, -5Vdc, +12Vdc, and -12Vdc. All LTUPS outputs have overvoltage, overcurrent, and short-circuit protection.

   An overvoltage at any output, whether due to an internal failure or an external bridging of a high voltage to a lower voltage output, will result in shut-down of the power supply and cause all outputs to drop to approximately zero volts. An overcurrent or short-circuit at any output will cause that output to go into current limiting. Shut-down due to an overvoltage condition causes the power supply output to latch off. To unlatch the power supply output and restore normal operation, the associated input circuit breaker (LTUPS0, LTUPS1, or LTUPS2, located on the PSU front panel) must be set to off (down) and then on (up) again. This unlatches the protection mode and allows the power supply to resume normal operation.

   The power supplies are designed to automatically restore to normal operation when an output overcurrent or short-circuit condition is cleared. Note that an output fault should not normally trip an input circuit breaker.

   The power supplies are further protected against internal faults by internal fuses and a thermal cut-off switch. The internal fuses, located in the input circuitry, will blow under certain internal fault conditions to protect against the propagation of further fault conditions. The thermal cut-off switch will operate if the internal fault conditions cause overheating in the power supply. Operation of this switch will cause the power supply to go into the same protective mode as an overvoltage condition.

   Internal fault conditions which cause an increase in the input current to the trip point of the input circuit breaker will normally trip the circuit breaker. However, if the circuit breaker is faulty and does not trip, the internal fuses and thermal cut-off switch will provide a degree of backup protection. If an internal fuse blows, replacement of the power supply is required.

   The -12Vdc output of the LTUPS is used only in DTMF PCBs. A loss of this output or a deviation below the normal operating limit will be evidenced only by improper operation of the DTMF PCBs.

   If a fault condition in an LTUPS cannot be cleared, replace the power supply.

SECTION 3.00 PREVENTIVE MAINTENANCE

3.01 General. The following general-type service routines are suggested for proper upkeep of the SATURN IIE EPABX. The service routines should be performed on an annual basis unless otherwise specified.

a. Hardware and Cabling. Check for general mechanical integrity, no loose or broken parts and connectors. Tighten or repair as necessary.

b. Cabinet Exterior. Clean exterior of cabinet using a soft cloth dampened with a solution of water and a mild detergent.

c. Air Vents. Inspect air vents at top and bottom of cabinet for unrestricted air passage. Clear vents as necessary.

3.02 Floppy Disk Drives. Some manufacturers of floppy disk drives recommend periodic cleaning of the disk drive heads. The schedule of cleaning depends on usage and the surrounding environment but cleaning every 3 to 6 months is normally suggested. Use the head cleaning kit recommended by the manufacturer of the disk drives and follow the procedure outlined in Table 3.00 to clean the heads.

Table 3.00 Floppy Disk Head Cleaning Procedure

STEP	PROCEDURE	VERIFICATION
1	Open the doors on both floppy disk drives.	
2	Replace one program disk with the cleaning disk; close that disk drive door (leave other door open).	
3	Access any CMU procedure from the service terminal (e.g., DISPLAY STNASSN).	System attempts to locate a CMU overlay file; red LED on disk drive lights. NOTE: An I/O error message appears at service terminal. This is normal. However, if the CMU procedure already resides in system memory, repeat step 3 for different CMU procedure.
4	Repeat the above procedure for the second floppy disk drive.	

SECTION 4.00 TROUBLESHOOTING AND REPAIR PROCEDURES

4.01 General. This section of the practice provides step-by-step instructions for the troubleshooting and repair of malfunctions or failures during precutover or postcutover of the SATURN IIE EPABX.

WARNING

Hazardous voltages exist within the equipment cabinet. Be extremely careful when performing maintenance and troubleshooting procedures with the equipment panel(s) removed.

4.02 Test Equipment. The following test equipment is required to perform the procedures contained in this practice.

a. Digital Voltmeter. A digital voltmeter of good commercial quality with an accuracy of $\pm$ 0.1%. The digital voltmeter is used to perform input and output voltage tests.

b. Maintenance Test Phone. A test set or a single-line telephone may be used as a maintenance test phone for both Dial Pulse (DP) and Dual Tone Multifrequency (DTMF) systems. A modular jack (MTCE PHONE) is provided on the front panel of the PSU for connecting the maintenance test phone when it is equipped with a modular plug. When the maintenance test phone is not equipped with a modular plug, a station appearance at the MDF can be used for test connections. The maintenance test phone is used to perform the manual on-line diagnostic tests.

c. Data Service Terminal. A Keyboard-Send-Receive (KSR) data terminal equipped with a standard ASCII keyboard and an EIA RS-232-C interface (Silent 700 Series — Model 743 KSR — Texas Instruments, or equivalent). The data service terminal is used to access CMU procedures, a repertoire of auditing routines and the failure history memory.

d. Transmission Measuring Set. A Transmission Measuring Set (TMS) is used to measure the transmission quality of a trunk or station. Refer to the manual on-line diagnostic tests, Outgoing Trunk Test and Station Line Tests.

4.03 PCB and Power Supply Removal and Replacement. In many instances during troubleshooting, corrective actions may require that a suspected faulty PCB or power supply be removed and replaced with a spare. The following guidelines should be followed when removing and replacing these items.

CAUTION

Craft personnel handling PCBs with MOS integrated circuits must first free themselves from electrostatic discharge by touching the cabinet chassis ground or wearing grounded wrist straps. Failure to observe this practice will result in damage to such PCBs due to electrostatic discharge.

a. Refer to Table 4.00 before removing a PCB or power supply.

b. Before inserting a PCB or installing a power supply, verify (when applicable) that correct strapping options are installed. (Refer to Siemens SATURN IIE Practice covering Installation Procedures.)

4.04 System Fails to Reload. During normal system operation, the upper four red LEDs (ST0, ST1, ST2, and ST3) on the CIOP PCB (Figure 2.02) provide a binary display that constantly decrements.

When processor initialization is requested, either manually via depression of the Reset switch on the CIOP PCB or automatically via self-test or audit test routines, all four indicators momentarily light steadily. As various initialization events are completed, the binary value of the four indicators are decremented. If no failures occur during system initialization, all four indicators momentarily extinguish then begin a continuous decrement sequence indicating normal system operation. If a failure is encountered during the initialization period; the four LED indicators momentarily stop decrementing and display a binary value that represents the point at which the initialization failed. The corrective repair procedure for the indicated binary value is provided in Table 4.01. Note that the failure indication is displayed only for a short period of time (approximately 1 second); after which the system attempts to reinitialize. This cycle is repeated until the failure is corrected.

4.05 Alarm Conditions and Reporting. The SATURN IIE System is provided with software self-test routines and audit test routines which constantly check for system failures. When a failure or failures occur, the detected failure(s) are recorded as error messages in the failure history memory and the appropriate major or minor alarm indicator is lighted. A description of each alarm type is provided in Section 2.00, Maintenance Overview. The corrective action required for a given alarm type is provided in Table 4.02 (Alarm Reporting and Processing).

Table 4.00 PCB and Power Supply Removal Guidelines

MODULE OR UNIT	SERVICE STATE	SPECIAL INSTRUCTIONS
CIOP	NA	Note 1
CONF	NA	Note 1
DTMF	OOS	Note 2
FDD0, FDD1	NA	None
LTUC *	NA	Note 3
LTUPS *	NA	Note 4
MCA	NA	Note 1
MEM3	NA	Note 1
MEM4	NA	Note 1
MSM *	NA	Note 1
MSM Battery *	NA	Note 5
PIMD	OOS	Note 2
PSC	NA	Note 1
PSU	NA	Note 6
RAUP	NA	Note 1
SLA16	OOS	Note 2
SLMA-O	OOS	Note 2
SLMA-S	OOS	Note 2
SLMD	OOS	Note 2
SMXTG	NA	Note 1
TMBA-2	OOS	Note 2
TMBA-4	OOS	Note 2
TMBM	OOS	Note 2
TMIE	OOS	Note 2
-48PS0	NA	Note 7
-48PS1 *	NA	Note 7

* Optional depending upon customer/system requirements.
NA = Not Applicable, OOS = Out-of-Service

Notes:

1. System outage (halts call processing). Set BASIC PS circuit breaker on PSU to off. Open FDDs and remove floppy disks before removing PCB. After new PCB is inserted, reinsert floppy disks, close FDDs, set BASIC PS circuit breaker on PSU to on, and press reset switch on CIOP.
2. Wait for in-process calls to complete.
3. Removal places one-half of ports in shelf out-of-service.
4. Before removal, set related LTUPS circuit breaker on PSU to off. Removal places all ports in shelf out-of-service.
5. Battery may be replaced with power applied to system.
6. System outage (halts call processing). Before removal, set all circuit breakers to off, open FDDs and remove floppy disks. After replacement, reinsert floppy disks, close FDDs, set circuit breakers to on, and press reset switch on CIOP.
7. Set related circuit breaker on PSU to off. May halt call processing depending upon system configuration and traffic. If system has two -48Vdc power supplies (-48PS0 and -48PS1), the remaining supply may support system operation.

Table 4.01 **Failure Indications on Controller/Input-Output Processer Printed Circuit Board, CIOP**

ST0 LED	ST1 LED	ST2 LED	ST3 LED	HEX CODE	ERROR DETECTED	ACTION
OFF	OFF	OFF	OFF	0	Start of self test not halted	None
OFF	OFF	OFF	ON	1	Main processor error	Note 1
OFF	OFF	ON	OFF	2	EPROM checksum error	Note 1
OFF	OFF	ON	ON	3	MEM0 slot low 64k test error	Notes 1 and 2
OFF	ON	OFF	OFF	4	8k by 8 static RAM test error	Note 1
OFF	ON	OFF	ON	5	IRAM memory test error	Note 1
OFF	ON	ON	OFF	6	ORAM memory test error	Note 1
OFF	ON	ON	ON	7	SIB side error	Notes 1 and 3
ON	ON	OFF	OFF	C	Global memory error	Notes 1 and 2
ON	ON	OFF	ON	D	Watchdog timer error	Note 1
ON	ON	ON	OFF	E	SIB serial loopback test error	Notes 1 and 3
ON	ON	ON	ON	F	SIB counter timing test	Notes 1 and 3
ON	OFF	OFF	OFF	8	Start boot process (self test done)	None
ON	OFF	OFF	ON	9	Disk controller error	Note 1
ON	OFF	ON	OFF	A	Drive not ready error—	Note 4
ON	OFF	ON	ON	B	CRC retry errors exceed 8	Note 4

Notes:

1. Upon failure, retry loading procedure. If failure persists, replace CIOP PCB.
2. If procedure in Note 1 fails to correct fault, replace memory PCBs starting with slot MEM0.
3. If procedure in Note 1 fails to correct fault, replace SMXTG PCB.
4. Upon failure, retry loading procedure using another set of floppy disks. If failure persists, check/replace disk drives. If fault is not corrected, replace CIOP PCB.

Table 4.02 Alarm Reporting and Processing

ALARM TYPE	CORRECTIVE ACTION
a. AUDIT eeee(pp) aaaa bbbb cccc dddd mm/dd hh:mm eeee = error number (pp)* = ID of process aaaa* = error information bbbb* = error information cccc* = error information dddd* = error information mm/dd = date of error hh:mm = time of error	
(1) If eeee = 1428	The memory contents audit routine has detected a checksum error in protected memory. A system reload is automatically initiated. If the system appears to be performing correctly with the exception of this error, craft personnel can disable the memory contents audit routine until the cause can be isolated by a systematic replacement of memory PCBs to isolate the failing PCB. If the memory contents audit routine is disabled, craft personnel should avoid saving customer data to the disk, since this operation could corrupt the disk as well.
(2) If eeee = 1433	DTMF receiver unusable. The DTMF receiver audit routine has detected a failing DTMF receiver. If no DTMF receivers are already out-of-service, the suspected DTMF receiver is placed in the out-of-service craft state. If one or more DTMF receivers are already out-of-service, the suspected DTMF receiver is left in-service. NOTE: Out-of-service craft state means that the system has automatically placed the circuit in such a state and requires craft personnel to manually return it to an in-service state. If the problem is repetitive, replace the associated DTMF PCB during a low-traffic period, taking care to place all circuits in the PCB out-of-service (craft) before removing it. NOTE: The PEN of the suspected DTMF receiver is identified as indicated in the error message below. "AUDIT 1433(18) wxyz 0000 0000 0000 hh/dd hh:mm" wxyz = PEN
(3) If eeee = 1438	I/O peripheral device or PCB failure. The I/O loop around audit routine has detected a failed I/O device or associated PCB. If the problem is repetitive, repair or replace the failing device or replace the associated I/O PCB (CIOP or RAUP). NOTE: The identity of the failing device or I/O PCB is indicated in the error message below. "AUDIT 1438(18) 00aa 00bb 0000 0000 mm/dd hh:mm"
* = For Siemens field service use only.	

Table 4.02 Alarm Reporting and Processing (Continued)

<table>
<tr><th>ALARM TYPE</th><th>CORRECTIVE ACTION</th></tr>
<tr><td></td><td>aa = I/O device and associated PCB identity number
bb = Device return code

aa | I/O Device | PCB
00 | Floppy Disk Drive 1 | CIOP
01 | Floppy Disk Drive 2 | CIOP
02 | Floppy Disk Drive 3 | CIOP
03 | Service Term'l(TTY) | CIOP
04 | RS232C CH 0 (TTY0) | RAUP
05 | RS232C CH 1 (TTY1) | RAUP
06 | Modem | RAUP</td></tr>
<tr><td>(4) If eeee = 1468 **</td><td>Maintenance channel failure.

The data device audit routine detected a failure of the maintenance loopback channel used to run loopback tests on data devices. The data device audit routine must be terminated until the maintenance loopback channel can be restored.

Possible trouble sources:

(1) Faulty SMXTG PCB.

(2) Faulty MCA PCB.</td></tr>
<tr><td>(5) If eeee = 1469</td><td>SIB read error during data loop around test.

The SIB (line scanning processor) on the CIOP PCB failed to respond to a read command during the data device audit routine. The data device audit routine is terminated.

Possible trouble source:

(1) Faulty CIOP PCB.</td></tr>
<tr><td>(6) If eeee = 1471</td><td>Data device audit error (bad path).

The identified data device failed the peripheral interface loopback (LB5) test run by the data device audit routine.

Possible trouble sources:

(1) Faulty SLMD or PIMD PCB.

(2) Faulty MCA PCB.

(3) Faulty SMXTG PCB.

(4) Faulty CIOP PCB.

NOTE: The PEN of the failed data device is identified as indicated in the error message below.

"AUDIT 1471(18) wxyz 0000
0000 0000 mm/dd hh:mm"

wxyz = PEN</td></tr>
<tr><td colspan="2">** = Applies to OC II software feature package only.</td></tr>
</table>

Table 4.02 Alarm Reporting and Processing (Continued)

ALARM TYPE	CORRECTIVE ACTION
(7) If eeee = 1472 **	Data device audit error (bad path). The identified data device passed the peripheral interface loopback (LB5) test run by the data device audit routine, but failed the remote channel loopback (LB3) test. Possible trouble sources: (1) Faulty data device (DCI). (2) Faulty cabling from SLMD to DCI. NOTE: The PEN of the failed data device is identified as indicated in the error message below. "AUDIT 1472(18) wxyz 0000 0000 0000 mm/dd hh:mm" wxyz = PEN
b. CONNECT eeee(pp) PEN=wxyz mm/dd hh:mm eeee = error number (pp)* = ID of process wxyz = PEN mm/dd = date of error hh:mm = time of error	
(1) If eeee = 1439	MTS audit failure. The MTS (time switch) audit routine has detected a possible port failure on the MCA PCB when attempting to connect the specified device to a special test port. If the problem is repetitive, the MCA PCB should be replaced. The failure of a time switch port may cause the identified port to experience intermittent connections. NOTE: The PEN of the affected device is identified as indicated in the error message on the left.
(2) If eeee = 2148 †	RLT no answer condition detected (CAS attendant position unstaffed). This branch PABX detected has a no answer condition on the identified RLT trunk to the CAS main PABX. The CAS attendant positions appear to be unstaffed. The RLT has been placed out-of-service. If no other RLT trunks remain in-service, the branch PABX will operate in the night mode until the RLT trunks are manually placed back in-service. Instruct CAS attendants to use the deactivate feature prior to leaving consoles unstaffed.

* = For Siemens field service use only.
** = Applies to OC II software feature package only.
† = Applies to CAS software feature package only.

Table 4.02 Alarm Reporting and Processing (Continued)

ALARM TYPE	CORRECTIVE ACTION
c. DISCONNECT 1440(18) PEN = wxyz mm/dd hh:mm 1440 = error number (18)* = ID of process wxyz = PEN mm/dd = date of error hh:mm = time of error	MTS audit failure. The MTS (time switch) audit routine has detected a possible port failure on the MCA PCB when attempting to connect the specified port to quiet tone. If the problem is repetitive, the MCA PCB should be replaced. The failure of a time switch port may cause the identified port to experience intermittent connections. NOTE: The PEN of the affected device is identified as indicated in the error message on the left.
d. FUSE FAILURE (18) mm/dd hh:mm (18)* = ID of process mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1427.	Fuse failure. The automatic equipment test routines have detected a fuse failure alarm. Locate and replace the blown fuse on the PSU front panel.
e. I/O ERROR eeee(pp) INFO = a, b, cccc mm/dd hh:mm eeee = error number (1026 or 1027) (pp)* = ID of process a = ID of PCB b = ID of connector/interface or device cccc* = error information mm/dd = date of error hh:mm = time of error	A failure occurred during an I/O operation. The operation completed with an unexpected result or did not complete in the allocated time period. If problem is repetitive, replace indicated PCB, FDD, or repair or replace faulty I/O device. NOTE: The identity of the suspected faulty PCB, connector/ interface, I/O device, or FDD is provided in the error message above and indicated by the letters "a" and "b" in the message. If "b" is an even number, the fault is in the transmit path; if an odd number, the the receive path is faulty.

a	b	PCB	Connector/ Interface/Device
0	0	RAUP	TTY0
0	1	RAUP	TTY0
0	2	RAUP	TTY1
0	3	RAUP	TTY1
0	4	RAUP	modem interface
0	5	RAUP	modem interface
1	1	CIOP	TTY/Service Term'l
1	2	CIOP	TTY/Service Term'l
2	0	CIOP	FDD0
2	1	CIOP	FDD1
2	2	CIOP	FDD2 (Not Used)

* = For Siemens field service use only.

Table 4.02 Alarm Reporting and Processing (Continued)

<table>
<tr><th>ALARM TYPE</th><th>CORRECTIVE ACTION</th></tr>
<tr><td>f. LTU FAILURE (18) PEN'S
aaaa TO bbbb mm/dd hh:mm

(18)* = ID of process
aaaa = 1st number in range of PENs affected by failure
bbbb = last number in range of PENs affected by failure
mm/dd = date of error
hh:mm = time of error

NOTE: For reference only, the error number of this error message is 1424.</td><td>LTU (or Basic Shelf) clock failure error.

The identified shelf and LTUC (where applicable) has lost communication with the CE. The error may be a result of the following:

(1) Blown shelf fuse on the PSU front panel.

(2) A faulty LTU shelf power supply, LTUPS.

(3) A faulty LTUC PCB.

(4) Loss of critical signals (CKA, SYP, or SYNR) from the CE as a result of an SMXTG PCB or other failure.

NOTE: The PEN range in the error message identifies the shelf and PCB experiencing faults. The following table correlates each possible PEN range to a specific shelf and suspected faulty PCB. The associated LTU clock is indicated in the fourth column. (Refer also to Table 4.03 for LTUC PCB alarm information.)

<table>
<tr><th>aaaa bbbb (PEN Range)</th><th>SHELF</th><th>PCB</th><th>LTU CLK</th></tr>
<tr><td>0000 0267</td><td>Basic</td><td>SMXTG</td><td>0</td></tr>
<tr><td>0300 0637</td><td>Basic</td><td>SMXTG</td><td>1</td></tr>
<tr><td>1000 1337</td><td>LTU 1</td><td>LTUC 0</td><td>2</td></tr>
<tr><td>1400 1737</td><td>LTU 1</td><td>LTUC 1</td><td>3</td></tr>
<tr><td>2000 2337</td><td>LTU 2</td><td>LTUC 0</td><td>4</td></tr>
<tr><td>2400 2737</td><td>LTU 2</td><td>LTUC 1</td><td>5</td></tr>
<tr><td>3000 3337</td><td>LTU 3</td><td>LTUC 0</td><td>6</td></tr>
<tr><td>3400 3737</td><td>LTU 3</td><td>LTUC 1</td><td>7</td></tr>
</table>

NOTE: If replacement of the indicated LTUC fails to correct the fault condition, replace the SMXTG PCB.</td></tr>
<tr><td>g. MBUS T/O (pp)
LOC=aaaa:bbbb mm/dd hh:mm

(pp)* = ID of process
aaaa:
bbbb* = address of program which initiated the unsuccessful memory request
mm/dd = date of error
hh:mm = time of error

NOTE: For reference only, the error number for this error message is 1402.</td><td>Multibus timeout error.

Memory failed to respond to a data request from the main processor. If problem is repetitive, consult Siemens field service representative.</td></tr>
<tr><td>h. MEM PAR eeee(pp) STAT=aaaa
ADDR=bbbb MEMc mm/dd hh:mm

eeee = error number
(pp)* = ID of process
aaaa* = error information
bbbb* = error information
c = memory PCB slot ID number in Basic Shelf
mm/dd = date of error
hh:mm = time of error</td><td></td></tr>
<tr><td colspan="2">* = For Siemens field service use only.</td></tr>
</table>

Table 4.02 Alarm Reporting and Processing (Continued)

ALARM TYPE	CORRECTIVE ACTION
(1) If eeee = 1405	Correctable memory parity error on a MEM3 or MEM4 PCB. A parity error was detected and corrected on the MEM3 or MEM4 PCB as identified by the slot number in this error message. If the problem occurs more than once in a single week, the identified memory PCB should be replaced. NOTE: The slot number identity of the faulty memory PCB is provided in the following error message: "MEM PAR 1405(pp) STAT=aaaa ADDR=bbbb MEMc mm/dd hh:mm" c = slot number identity of of faulty memory PCB.
(2) If eeee = 1410	Uncorrectable memory parity error in control memory on a MEM3 or MEM4 PCB. An uncorrectable parity error was signaled by the MEM3 or MEM4 PCB as identified by the slot number in this error message. If the problem occurs more than once in a single month, the identified memory PCB should be replaced. An automatic system reload is triggered. NOTE: The slot number identity of the faulty memory PCB is provided in the following error message: "MEM PAR 1410(pp) STAT=aaaa ADDR=bbbb MEMc mm/dd hh:mm" c = slot number identity of faulty memory PCB.
(3) If eeee = 1411	Uncorrectable memory parity error in dynamic memory on a MEM3 or MEM4 PCB. An uncorrectable parity error was signaled by the MEM3 or MEM4 PCB as identified by the slot number in this error message. If the problem occurs more than once in a single month, the identified memory PCB should be replaced. A hard restart is triggered. NOTE: The slot number identity of the faulty memory PCB is provided in the following error message: "MEM PAR 1411(pp) STAT=aaaa ADDR=bbbb MEMc mm/dd hh:mm" c = slot number identity of of faulty memory PCB.
(4) If eeee = 1414	Correctable memory parity error on a memory PCB. The correctable error threshold for this memory PCB has been reached, no further correctable error will be reported. Immediately replace the identified memory PCB. NOTE: The identity of the memory PCB is provided as indicated in the error message shown for error number 1405.
* = For Siemens field service use only.	

Table 4.02 Alarm Reporting and Processing (Continued)

ALARM TYPE	CORRECTIVE ACTION
i. MEM PROT (pp) LOC=aaaa:bbbb ADDR=cccc:dddd mm/dd hh:mm (pp)* = ID of process aaaa: bbbb* = error information cccc: dddd* = error information mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1406.	The main processor attempted to write into protected memory. If problem is repetitive, consult Siemens field service representative.
j. MEMORY SUPPORT FAILURE (18) mm/dd hh:mm (18)* = ID of process mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1426.	The automatic equipment test routines have detected a failure of the system memory support hardware. The error indicates a missing, failed or discharged MSM memory support battery in the PSU.
k. PIMD OVERCUR (pp) PEN=wxyz mm/dd hh:mm (pp)* = ID of process wxyz = PEN mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1435.	PIMD or SLMD overcurrent error. The identified digital device has drawn too much current from the associated PIMD or SLMD PCB causing a device shutdown. The device has been taken out-of-service and must be manually placed back in-service. Possible trouble sources are: (1) Faulty console (if PIMD); faulty SDT or DCI (if SLMD). (2) Faulty cabling between console and PIMD PCB; faulty cabling between SDT or DCI and SLMD PCB. (3) Faulty PIMD or SLMD PCB. (4) Possible short on line. NOTE: The affected digital device is identified by the PEN provided in the error message shown above.
l. PIMD ERR eeee(07) PEN=wxyz mm/dd hh:mm eeee = error number (07)* = ID of process wxyz = PEN dd/mm = date of error hh:mm = time of error	
(1) If eeee = 1464	PIMD or SLMD failure. An excessive number of PIMD or SLMD error events (PIMD or SLMD failure or loss of synchronization) were detected on the identified port. The device has been taken out-of-service and must be manually placed back in-service.
* = For Siemens field service use only.	

Table 4.02 Alarm Reporting and Processing (Continued)

ALARM TYPE	CORRECTIVE ACTION
	NOTE: This error also occurs when a PIMD or SLMD PCB is removed without first taking it out-of-service. Possible trouble sources: (1) Faulty console, SDT, or DCI. (2) Faulty cabling between apparatus and PIMD or SLMD PCB. (3) Faulty PIMD or SLMD PCB. (4) Faulty SMXTG PCB if PEN indicates Basic Shelf; faulty LTUC PCB (first), then faulty SMXTG (second) if PEN indicates LTU Shelf.
(2) If eeee = 1465	PIMD or SLMD response error. The identified port has repeatedly failed to respond to restart commands issued by the common control. The digital device has been taken out-of-service and must be manually placed back in-service. Possible trouble sources: (1) Faulty console, SDT, or DCI. (2) Faulty cabling between apparatus and PIMD or SLMD PCB. (3) Faulty PIMD or SLMD PCB. (4) Faulty SMXTG PCB if PEN indicates Basic Shelf; faulty LTUC PCB (first), then faulty SMXTG (second) if PEN indicates LTU Shelf. (5) Digital device not connected.
m. PRESENCE (pp) PEN=wxyz mm/dd hh:mm (pp)* = ID of process wxyz = PEN number mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1408.	The central processor has detected the removal of a subscriber line module (SLMA-O, SLMA-S, or SLA16 PCB). Each defined line circuit on the PCB should generate a presence error when the PCB is removed. A large number of unexplained presence errors may indicate the following: (1) A blown BASIC or LTU shelf fuse on the PSU front panel. (2) A faulty LTUPS or a fault in the PSU. (3) A faulty LTUC PCB on the affected shelf. (4) A faulty SMXTG PCB. Intermittent unexplained presence errors may indicate any of the previous mentioned problems, or a failure of the power supply ring synchronization circuitry contained in the PSU.
* = For Siemens field service use only.	

Table 4.02 Alarm Reporting and Processing (Continued)

ALARM TYPE	CORRECTIVE ACTION
n. RELOAD : MANUAL RESET (pp) mm/dd hh:mm (pp)* = ID of process mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1488.	A system reload, initiated via the CIOP Reset pushbutton, has been completed. This message is followed by a "S/W TRAP" message indicating the type of recovery (i.e., a reload).
o. RELOAD : MEM4 REFRESH FAILURE (pp) mm/dd hh:mm (pp)* = ID of process mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1485.	A hardware fault on the MEM4 PCB caused a loss of memory refresh. An automatic system reload has been initiated and completed as a result of the fault. This message is followed by a "S/W TRAP" message indicating the type of recovery (i.e., a reload). If the problem is repetitive, replace the MEM4 PCB.
p. RELOAD : RECOVERY ACTION (pp) mm/dd hh:mm (pp)* = ID of process mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1486.	Software has initiated and completed a system reload either automatically due to excessive restarts or manually through a RECOVERY CMU Procedure (BEG RECOVERY). This message is followed by a "S/W TRAP" message indicating the type of recovery (i.e., a reload). If system reload due to excessive restarts is repetitive, consult Siemens field service representative.
q. RELOAD : POWER FAILURE (pp) mm/dd hh:mm (pp)* = ID of process mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1489.	A system reload has been initiated and completed due to a primary power loss and loss of +5Vdc power input to the memory PCBs. (1) In systems equipped with an MSM, the capacity of the MSM battery to provide power to the memory PCBs was exceeded or an MSM battery failure has occurred. The MSM battery will be recharged to capacity during normal system operation. If a battery failure is suspected, perform the MSM Test provided in Table 4.04. (2) In systems without an MSM, a primary power failure has occurred and resulted in the loss of +5Vdc input to the memory PCBs. Restoration of primary power returns the system to operation. The message shown above is followed by a "S/W TRAP" message indicating the type of recovery (i.e., a reload). If system reloads due to excessive power failures are repetitive, consult Siemens field service representative.
r. RELOAD : WATCHDOG TIMING FAILURE (pp) mm/dd hh:mm (pp)* = ID of process mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1487.	CIOP watchdog timing logic has initiated and completed a system reload due to excessive watchdog timeouts or because software failed to acknowledge a watchdog timeout interrupt. This message is followed by a "S/W TRAP" message indicating the type of recovery (i.e., a reload). If problem is repetitive, replace the CIOP PCB. If problem persists, consult Siemens field service representative.

* = For Siemens field service use only.

Table 4.02 Alarm Reporting and Processing (Continued)

ALARM TYPE	CORRECTIVE ACTION
s. RESTART : POWER FAILURE (pp) mm/dd hh:mm (pp)* = ID of process mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1470.	In an MSM equipped system, a hard restart has been initiated and completed due to a momentary power loss. The MSM maintained the +5Vdc power input to the memory PCBs. This message is followed by a "S/W TRAP" message indicating the type of recovery (i.e., a hard restart). If problem is repetitive, check local power source and consult Siemens field service representative.
t. SMXTG CLOCK FAILURE (pp) mm/dd hh:mm (pp)* = ID of process mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1425.	The automatic equipment test routines have detected a possible failure of the SMXTG master system clock. A system reload is automatically initiated. If the master clock has actually experienced a hard failure, the failed common control equipment will be unable to process telephone calls until it is corrected. If problem is intermittent, the system reload may clear the intermittent condition. If a hard failure (or repetitive intermittent failures) occurs, the following are the possible trouble sources: (1) Faulty SMXTG PCB. (2) Faulty CIOP PCB.
u. S/W LOOP ERROR x (pp) LOC=aaaa:bbbb mm/dd hh:mm x = watchdog identity; (pp)* = ID of process aaaa: bbbb* = error information mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1407.	A system watchdog detected a possible software loop error. If problem is repetitive, consult Siemens field service representative. NOTE: The watchdog identity (x) is provided in the following list: 1 = foreground (interrupt) watchdog 2 = background (idle time) watchdog
v. S/W TRAP eeee (pp) aaaa bbbb cccc dddd mm/dd hh:mm eeee = error number (pp)* = ID of process aaaa* = error information bbbb* = error information cccc* = error information dddd* = error information mm/dd = date of error hh:mm = time of error	
(1) If eeee = 1039	Service terminal timeout error. A service terminal operation did not complete in the allocated time period. If the problem is repetitive, replace the CIOP PCB.
* = For Siemens field service use only.	

Table 4.02 Alarm Reporting and Processing (Continued)

ALARM TYPE	CORRECTIVE ACTION
(2) If eeee = 1300	System restart marker. This error entry logs the date and time whenever the system goes through a system restart (recovery). Analyze the errors preceding this error to determine the cause of the restart. NOTE: The type of restart is identified in the following error message: "S/W TRAP 1300 (05) aaaa bbbb cccc dddd mm/dd hh:mm" aaaa = type of restart, as follows: If aaaa = 0000; soft restart (calls preserved) If aaaa = 0001; hard restart (calls dropped) If aaaa = 0002; system reload from disk (calls dropped)
(3) If eeee = 1403	Spurious memory interrupt. A memory error interrupt occurred, but the main processor could not identify the memory PCB which signaled the error. If the error is repetitive, systematically replace each of the memory (MEM3 and MEM4) PCBs until the faulty PCB is located.
(4) If eeee = 1404	Invalid memory interrupt. A memory error interrupt occurred, but the memory PCB which generated the error cannot correctly identify the error type. If the error is repetitive, replace the faulty memory (MEM3 or MEM4) PCB. NOTE: Slot identification of the faulty memory PCB location (in the COMMON EQUIPMENT section of the Basic Shelf) is indicated in the error message below: "S/W TRAP 1404 (pp) aaaa 0000 0000 0000 mm/dd hh:mm" aaaa = Memory slot identification number aaaa / SLOT NAME 0000 / MEM0 0001 / MEM1 0002 / * MEM2 0003 / * MEM3 * Not currently used.
(5) If eeee = 1409	System clock failure. System software has detected a possible master clock failure, resulting in a loss of clock interrupts. A system reload is automatically initiated. If the master clock has actually experienced a hard failure, the failed common control equipment will be unable to process telephone calls until it is corrected.

Table 4.02 Alarm Reporting and Processing (Continued)

ALARM TYPE	CORRECTIVE ACTION
	If the problem is intermittent, the system reload may clear the intermittent condition. If a hard failure (or repetitive intermittent failures) occurs, possible sources of the trouble are: (1) Faulty SMXTG PCB. (2) Faulty CIOP PCB.
(6) If eeee = 1444	Disk write error during data base save operation. A disk error was detected during a data base save operation (via CMU procedure SAVE CUSTDATA). The disk save operation was aborted and the contents of the disk are now questionable. This error stack entry is accompanied by an immediate error message to craft personnel who attempted the save operation. Craft personnel should reattempt the save operation until successful. If the problem is repetitive, the disk, disk drive (FDD) module, or the CIOP PCB may be faulty. NOTE: The system should not be left unattended with a questionable disk in the disk drive (FDD) module, since this could result in a lengthy outage if a reload from disk should become necessary for any reason.
(7) If eeee = 1445	Disk directory error during data base save operation. A disk error was detected during a data base save operation (via CMU procedure SAVE CUSTDATA). The disk save operation was aborted and the contents of the disk are now questionable. This error stack entry is accompanied by an immediate error message to craft personnel who attempted the save operation. Craft personnel should reattempt the save operation until successful. If the problem is repetitive, the disk, disk drive (FDD) module, or the CIOP PCB may be faulty. NOTE: The system should not be left unattended with a questionable disk in the disk drive (FDD) module, since this could result in a lengthy outage if a reload from disk should become necessary for any reason.
(8) If eeee = 1446	Data table checksum error detected during system load. The system data base load software detected a checksum error during the system start-up operation. No recovery action is initiated. This error may indicate a memory problem, disk corruption, or a faulty CIOP PCB. However, this error will occur on the first reload after a software upgrade procedure, and on each succeeding reload until the CMU procedure SAVE CUSTDATA is performed. In this instance, no corrective action (other than the CMU procedure SAVE CUSTDATA) is necessary.
(9) If eeee = 1490	A power failure has occurred with MSM present and apparently operating, but software has detected that memory is not valid. An automatic system reload has been initiated and completed as a result.

Table 4.02 Alarm Reporting and Processing (Continued)

ALARM TYPE	CORRECTIVE ACTION
	This message is followed by "RELOAD : POWER FAILURE" and "S/W TRAP" messages (1489 and 1300) respectively, indicating the type and time of the recovery. If system reloads resulting in these error messages are repetitive: 1. Replace MEM3 and MEM4 PCBs. 2. Verify MSM operation. 3. Consult Siemens field service representative.
(10) If eeee = 2133 ††	MSL number mismatch in main satellite network. The software detected that a serious data base inconsistency exists within the main satellite network. For proper main satellite network operations, both ends of each MSL trunk must correctly know the identity of the trunk (MSL number). The MSL number audit has determined that two ends of the identified trunk do not agree regarding the trunk identity. Lost calls will occur until the inconsistency is corrected. NOTE: The trunk identity is provided as indicated in the error message below. "S/W TRAP 2133 (pp) 00aa 00bb 0ccc 0000 mm/dd hh:mm" aa = trunk group number bb = trunk member number ccc = MSL number sent from the distant PABX
w. TONE GENERATOR FAILURE (18) mm/dd hh:mm (18)* = ID of process mm/dd = date of error hh:mm = time of error NOTE: For reference only, the error number for this error message is 1432.	The DTMF receiver audit routine has detected a failure of the tone generator. A soft restart is initiated to restart the tone generator. If the problem is repetitive, the SMXTG PCB should be replaced.
x. TRACE REQUEST BY EXT=aaaa ON EXT=bbbb mm/dd hh:mm aaaa = station which requested the trace bbbb = connected station NOTE: For reference only, the error number for this error message is 1609.	The identified station dialed a call trace request access code. This information is printed on the SMDR alarm channel if equipped and simultaneously logged in the failure history memory. Contact the requesting party and determine the reason for the request. The most common reasons are: (1) A nuisance call was in progress. (2) A bad connection was experienced.
y. TRACE REQUEST BY EXT=aaaa ON TRUNK=bb/cc mm/dd hh:mm aaaa = station which requested the trace bb = trunk group number cc = trunk member number NOTE: For reference only, the error number for this error message is 1609.	The identified station dialed a call trace request access code. This information is printed on the SMDR alarm channel if equipped and simultaneously logged in the failure history memory. Contact requesting party and determine the reason for the request. The most common reasons are described above.

* = For Siemens field service use only.
†† = Applies to MS software feature package only.

Table 4.03 Failure Indications on LTUC Printed Circuit Board

LED	LED STATUS	PROBABLE CAUSE	CORRECTIVE ACTION
PRS	Dark	No failures are detected	None.
PRS	Lighted *	LTUC is not communicating with common control; +12Vdc undervoltage, -5Vdc undervoltage, or -48Vdc undervoltage NOTE: When the system is reloading and common control is inactive, the PRS LED on each LTUC PCB lights steadily as a normal system function. If no failures are detected after the system reloads, the LEDs extinguish.	1. Proceed to paragraph 4.06 Power Failures. 2. Replace associated LTUC PCB. 3. Check cabling between SMXTG and LTUC. 4. Replace SMXTG PCB. 5. Replace CIOP PCB. 6. Call Siemens field service representative.
ALM0	Dark	No failures are detected.	None.
ALM0	Lighted *	Loss of CLKA (2.048 MHz clock, 4ms timing pulse), or SYNR (ring synchronization) from common control.	1. If all LTUC PCBs have this alarm LED lighted, replace SMXTG PCB in CE section of Basic Shelf. 2. Check cabling between SMXTG and LTUC. 3. If only one LTUC PCB has this alarm LED lighted, replace the LTUC PCB.
ALM1	Dark	Not used in SATURN IIE.	Not applicable.

* If PRS and ALM0 indicators are lit, check power supply voltages before replacing PCB modules. If -48Vdc is lost, PRS and ALM0 indicators will be lit on all shelves affected.

Table 4.04 Memory Support Module (MSM) Battery Test

CAUTION

*Do **not** depress the BATTERY TEST switch if the ON BATTERY POWER (red) indicator is already lighted. This indicator lights when commercial power is interrupted and the MSM battery is powering the system memory. Depression of the BATTERY TEST switch under this condition will disconnect the MSM battery, cause the loss of system memory, and necessitate a memory reload when commercial power is restored.*

STEP	PROCEDURE	VERIFICATION	CORRECTIVE ACTION
1	Press in and hold the BATTERY TEST switch on the front of the PSU. The associated green LED indicator lights steadily.	If the green LED indicator remains extinguished, the MSM battery pack is below acceptable voltage limits and requires replacement.	Replace MSM battery pack
2	Release the BATTERY TEST switch.	The green LED indicator extinguishes.	

4.06 Power Failures. When a loss of power is suspected to be the cause of failures in the system, the craftsperson should follow the guidelines described below. (Refer to paragraph 2.15, Power Distribution and Failures, for descriptive information on the power supplies.)

- Visually check the PSU front panel (Figure 2.01) for blown fuses and tripped circuit breakers. Refer to paragraph 4.06a.
- If PSU fuses and circuit breakers are normal but all LEDs on the cabinet(s) are extinguished (i.e., the system is not processing calls), check the ac input voltage(s) to the Basic Cabinet, the PSU, and the -48PS module(s) (-48PS0 and, -48PS1 if applicable). (When an Expansion Cabinet is included in the system, a second ac input is wired to the Basic Cabinet and feeds the two -48 Vdc power supplies (-48PS0 and -48PS1) via PSU connector, J2.) If ac is measured, check the dc output voltages from the PSU in the Basic Cabinet. Refer to paragraph 4.06b.
- If PSU fuses and circuit breakers are normal and the system is processing some calls (i.e., status indicators on the CIOP PCB are decrementing), check the dc input voltages to the Basic Shelf or ac input voltage to the LTUPS(s) on the LTU shelf or shelves, if applicable, in which problems are being experienced. Refer to paragraph 4.06c.
- If the ac input voltages to the Basic Cabinet, PSU, -48PS module(s), and LTU shelf or shelves are correct, check the dc output voltages of the PSU, -48PS module(s), and the LTUPS module(s) on the LTU shelf or shelves, if applicable. Refer to paragraph 4.06d.

When voltages are to be checked, the voltages must be within the ranges specified in Table 4.05.

WARNING

Hazardous voltages exist within the equipment cabinet. Be extremely careful when performing maintenance and troubleshooting procedures with the equipment panel(s) removed.

CAUTION

Before disconnecting or connecting power cables leading to and from system power supplies, switch the associated circuit breaker on the PSU front panel to the off (down) position.

a. Visually check the PSU front panel for blown fuses (grasshopper-type) and tripped circuit breakers (refer to Figure 2.01).

1. If a -48B fuse has blown,

NOTE: If it is known or believed that a previous event or action by the craftsperson may have caused a transient fault condition which caused the fuse to blow, proceed to step (a) below; otherwise proceed to step (b) below.

(a) Replace the -48B fuse. If the fuse blows again, proceed to step (b) below.

(b) Remove all subscriber line modules (SLMA-O, SLMA-S, and SLA16 PCBs) and E&M trunk modules (TMBA-2 and TMBA-4 PCBs) from the shelf protected by the blown fuse. Do not remove the DTMF, SLMD, and PIMD PCBs from the shelf.

(c) Replace the fuse again.

(1) If the fuse does not blow, one of the modules removed in step (b) is probably at fault. Reinsert the subscriber line and trunk modules one at a time and recheck the fuse after each module is inserted. If the fuse blows after reinserting a module, the module is defective. Replace the module.

(2) If the fuse blows again, the most probable location of the fault is the PSU. Replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

2. If a -48P fuse has blown,

NOTE: If it is known or believed that a previous event or action by the craftsperson may have caused a transient fault condition which caused the fuse to blow, proceed to step (a) below; otherwise proceed to step (b) below.

(a) Replace the -48P fuse. If the fuse blows again, proceed to step (b) below.

(b) Remove all SLMD and PIMD PCBs in the associated shelf. Do not remove the subscriber line modules (SLMA-O, SLMA-S, or SLA16 PCBs), DTMF modules, trunk modules (TMBA-2, TMBA-4, TMBM, or TMIE PCBs) or common control modules (CE PCBs) in the shelf.

(c) Replace the fuse again.

(1) If the fuse does not blow, an SLMD or PIMD PCB is at fault. Reinsert the SLMD and/or PIMD PCB(s) in the shelf, one at a time and recheck the fuse after each module is inserted. If the fuse blows after reinserting a module, the module is defective. Replace the module.

(2) If the fuse blows again, the most probable location of the fault is the PSU. Replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

3. If the RGEN fuse has blown,

NOTE: If it is known or believed that a previous event or action by the craftsperson may have caused a transient fault condition which caused the fuse to blow, proceed to step (a) below; otherwise proceed to step (b) below.

Table 4.05 Allowable Voltage Ranges

MODULE/OUTPUT	NOMINAL VOLTAGE	VOLTAGE RANGE	CONNECTOR-PIN
LTUPS * (if system is equipped with LTU shelf(s))	+ 5Vdc +12Vdc −12Vdc − 5Vdc	+ 4.9 to + 5.2 +11.3 to +12.7 -11.3 to -12.7 - 4.9 to − 5.2	J1-2, -3, -12, -13 J1-1, -11 J1-5, -15 J1-4, -14
PSU	− 5Vdc + 5Vdc **	- 4.9 to − 5.2 + 4.9 to + 5.2	J10-1 J9-1, -2, -3, -4; J11-1, -2; J6-3
	+12Vdc	+11.3 to +12.7	J10-10, -11; J11-4, -5; J6-6
	−12Vdc	-11.3 to -12.7	J10-12
MSM * (+5MEM/+5B)	+ 5Vdc **	+ 4.9 to + 5.3	J10-3
RGEN	90Vac (RMS) @ 20Hz	75.0 to 100.0	(Not directly measurable)
RAC/RMW	90Vac (RMS) @ 20Hz (for 2 seconds) +97Vdc (for 1 second) alternating	See Figure 2.12	J7-6 to Basic Shelf, J7-7 to LTU Shelf 1*, J8-7 to LTU Shelf 2*, J8-8 to LTU Shelf 3*
-48PS0			
-48B	−48Vdc	-43.0 to -53.0	J2-1
-48P	−48Vdc	-43.0 to -53.0	J2-3
-48PS1 * (if an Expansion Cabinet is included)			
-48B	−48Vdc	-43.0 to -53.0	J2-1
-48P	−48Vdc	-43.0 to -53.0	J2-3

* Optional.
** If optional MSM is installed, PSU +5 Vdc output must be adjusted to 50 millivolts below +5MEM/+5B output provided by MSM (with memory PCBs installed). Adjustment (+5 V ADJUST) is accessible through PSU front panel (refer to Figure 2.01).

(a) Replace the fuse.

(b) If the fuse blows again, replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

4. If an RAC fuse has blown,

NOTE: If it is known or believed that a previous event or or action by the craftsperson may have caused a transient fault condition which caused the fuse to blow, proceed to step (a) below; otherwise proceed to step (b) below.

(a) Replace the fuse. If the fuse blows again, proceed to step (b) below.

(b) Remove all subscriber line modules (SLMA-O, SLMA-S, or SLA16 PCBs) in the associated shelf. Do not remove the PIMD, SLMD, DTMF, trunk (TMBA-2, TMBA-4, TMBM, or TMIE PCBs) or common control (CE PCBs) modules in the shelf.

(c) Replace the fuse again.

(1) If the fuse does not blow, a subscriber line module (SLMA-O, SLMA-S, or SLA16 PCB) is at fault. Reinsert the subscriber line modules in the shelf, one at-a-time and recheck the fuse after each module is inserted. If the fuse blows after reinserting a module, the module is defective. Replace the module.

(2) If the fuse blows again, the most probable location of the fault is the PSU. Replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

5. If a circuit breaker has tripped to the off (down) position,

(a) Switch the circuit breaker to the on (up) position.

(1) If the circuit breaker does not trip to off immediately, continue to observe it for a period of time to determine that it remains on. Also, check system for proper performance.

(b) If the circuit breaker trips off (down) again, switch it on again.

(1) If the circuit breaker does not trip to off immediately, continue to observe it for a period of time to determine that it remains on. Also, check system for proper performance.

(2) If the circuit breaker trips off again, replace the associated power supply as indicated below:

BASIC PS circuit breaker: replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

LTUPS0 circuit breaker: replace the LTUPS on LTU Shelf 1.

LTUPS1 circuit breaker: replace the LTUPS on LTU Shelf 2 in the Expansion Cabinet.

LTUPS2 circuit breaker: replace the LTUPS on LTU Shelf 3 in the Expansion Cabinet.
-48PS0 circuit breaker: replace -48PS0.
-48PS1 circuit breaker: replace -48PS1.

(3) If the circuit breaker trips off again, the most probable location of the fault is the PSU. Replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

b. If the fuses and circuit breakers are normal but all LEDs on the cabinet(s) are extinguished (i.e., no calls are being processed), perform the following voltage checks:

1. Check the ac input voltage to the Basic Cabinet:

(a) Connect one lead of the DVM to pin 1 and the other lead to pin 3 of connector P1 (connected to J1) on the rear panel of the PSU (refer to Figure 4.00). Be careful not to damage the connector housing or contacts.

(b) If ac voltage is measured, replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

(c) If no ac voltage is measured, check the ac voltage at the ac power source outlet.

(1) If no ac voltage is measured, commercial power is not being supplied to the SATURN System.

(2) If the ac voltage is correct at the ac power source outlet, check power cable and connections in cabinet junction box (refer to Figure 4.01).

2. To check the ac input to a particular -48PS module,

(a) Connect one DVM lead to pin 1 and the other lead to pin 2 of the plug mated to connector J1 on the -48PS module (refer to Figure 4.01). Be careful not to damage the plug housing or contacts.

(b) If no ac voltage is measured, replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

3. Check the dc output voltages from the PSU (+5V, -5V, +12V and -12V) appearing at connectors J47 and J48 on the Basic Shelf backplane (refer to Figure 4.02). For each voltage shown in Figure 4.02, connect the common (-) DVM lead to the ground busbar and insert the positive (+) DVM lead into the associated wire slot of the wiring harness plug. Be careful not to damage the plug housing or contacts.

(a) If only one output voltage from the PSU to the Basic Shelf backplane is low (refer to Table 4.05 for the acceptable voltage ranges), suspect that excessive current load on that output is causing current foldback protection to be in effect. This may be due to a short circuit or partial short circuit in a PCB installed in the Basic Shelf or the PSU may be defective. To isolate the fault, proceed as follows:

(1) Remove all PCBs in the Basic Shelf and recheck the incorrect voltage.

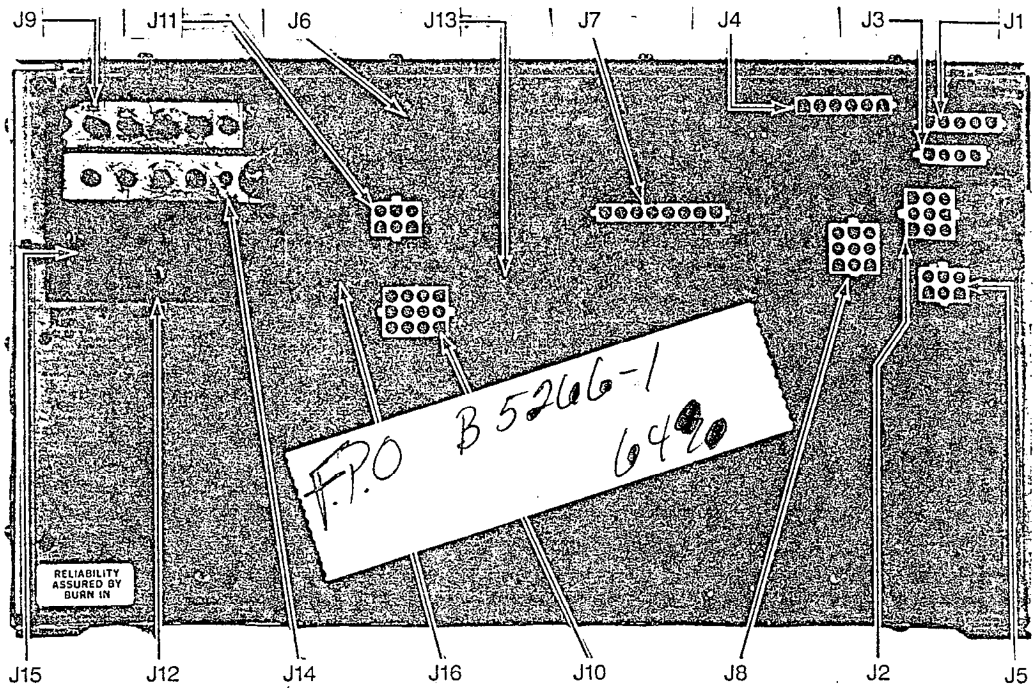
(2) If the voltage remains low, replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

(3) If the voltage returns to normal after removing all PCBs in the Basic Shelf, a PCB is probably at fault. Reinsert the PCBs in the shelf, one at-a-time and recheck the voltage after each PCB is inserted. If the incorrect voltage reading returns after inserting a PCB, the PCB is defective. Replace the PCB.

(b) If all PSU output voltages are low as measured at the Basic Shelf, the PSU may have experienced an overvoltage condition at its output which caused the overvoltage protection circuitry to latch the PSU into a shut down mode. This may be due to a short circuit or partial short circuit between two output voltages. When a short circuit is cleared, it is necessary to switch the BASIC PS circuit breaker on the PSU to off (down), then on (up) again, to clear the latched shut down condition. To isolate the faulty equipment proceed as follows:

(1) Remove all PCBs from the Basic Shelf.

(2) Switch the associated BASIC PS circuit breaker on the PSU to off (down), then on (up) again. Check the PSU output voltages once again at the Basic Shelf. If the voltages remain low, replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)



J1–
1,2 Ac line
3,4 Ac neutral
5 Ac ground

J2–
1-3 Ac line
4-6 Ac neutral
7 Ac ground
8,9 Not used

J3–
1 Ac line
2 Ac neutral
3 Not used
4 Ac ground

J4–
1,2 Ac line
3,4 Ac neutral
5,6 Ac ground

J5–
1,2 Ac line
3 Ac ground
4,5 Ac neutral
6 Ac ground

J6–
1,2 −48Vdc**
3 +5Vdc
4,5 −48Vdc***
6 +12Vdc
7,8 Ground
9 RAC return
10-12 Ground

J7–
1,2 −48Vdc**
3,4 −48Vdc***
5 Not used
6,7 RAC/RMW
8 Not used

J8–
1,2 −48Vdc**
3 −48Vdc***
4,5 Not used
6 −48Vdc***
7,8 RAC/RMW
9 Not used

J9–
1-4 +5Vdc

J10–
1 −5Vdc
2 Not used
3 +5Vdc (+5B)
4 Not used
5-8 Ground
9 Not used
10,11 +12Vdc
12 −12Vdc

J11–
1-2 +5Vdc
3 Ground
4,5 +12Vdc
6 Ground

J12
Signal leads to/from Basic Shelf

J13
PXFER, MAJOR, MINOR alarm contacts; MTCE PHONE connections to MDF

J14–
1-4 Dc ground

J15
External fuse alarm connections

J16
LCL +5Vdc
MSM +5Vdc (+5B)*

* Present if optional MSM is installed.
** −48P
*** −48B

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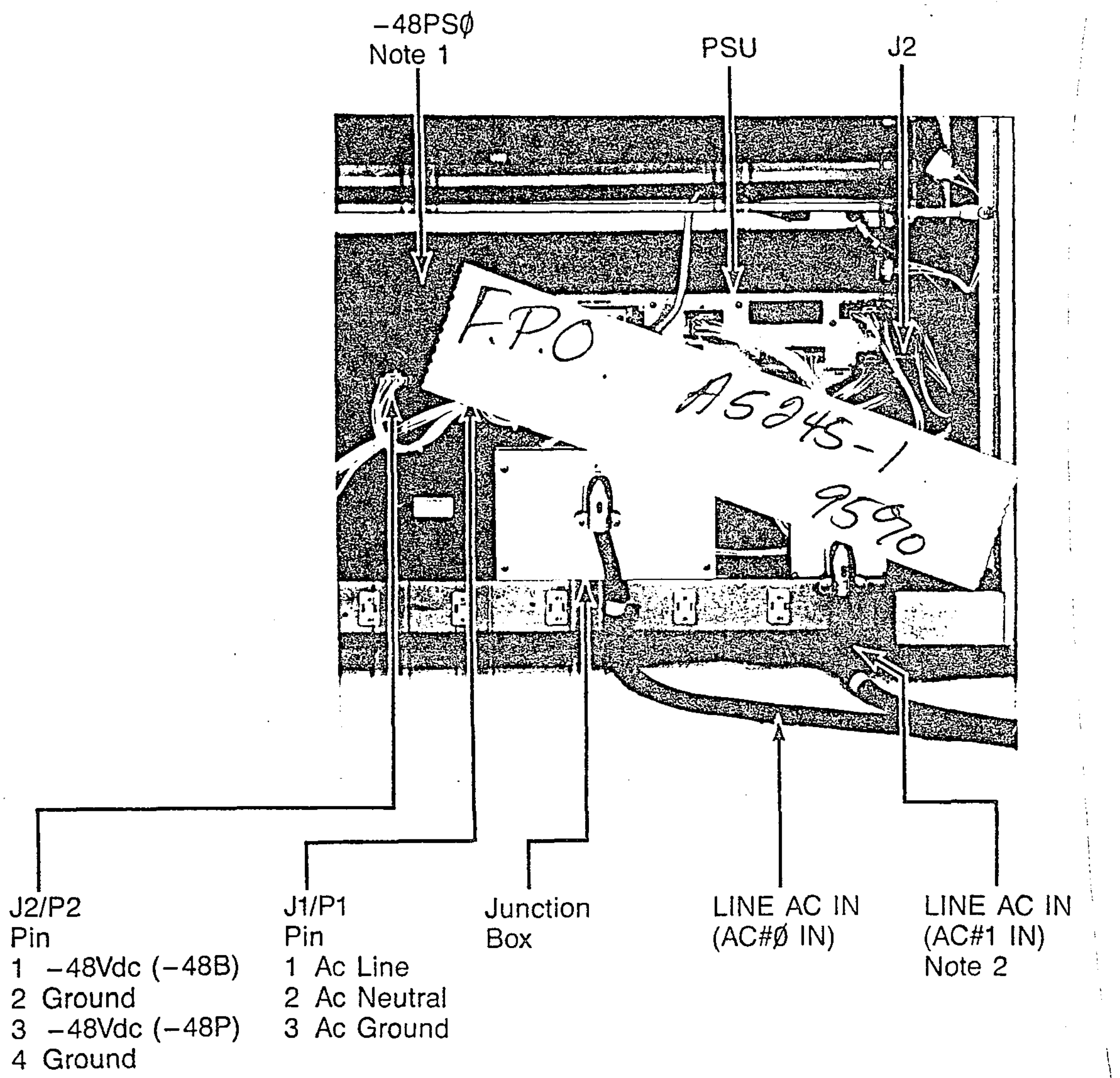
Figure 4.00 Power System Unit (PSU) Power Connections



Notes:

1. When −48PS1 is installed, voltages on connectors J1 and J2 are the same as those on −48PSØ.
2. Second AC input is required only when expansion cabinet is used and −48PS1 is installed. Jumper plug at PSU J2 is removed and second AC source is connected to J2.

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Figure 4.01 -48PS0 Module Power Connections

(3) If the voltages return to normal after removing all the PCBs, a PCB has probably shorted. Reinsert the PCBs in the shelf, one at a time, and recheck the the PSU output voltages at the Basic Shelf after each PCB is inserted. If the low voltage readings return after inserting a PCB, the PCB is defective. Replace the PCB.

(c) If all output voltages from the PSU are zero and ac is applied to the input, switch off all PSU circuit breakers and replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

c. If PSU circuit breakers and fuses are normal and the system is processing some calls (i.e., status indicators on the CIOP PCB are decrementing), check appropriate voltages for the shelf or shelves experiencing problems. If problems appear to be in the Basic Shelf, check dc input voltages to the shelf. If problems appear to be in an LTU shelf, check the ac input voltage to the shelf LTUPS then check the dc output voltages provided by the LTUPS.

To check the ac input to a particular LTUPS,

1. Connect one lead of the DVM to pin 1 and the other lead to pin 2 of the LTUPS ac input connector on the raceway (refer to Figure 4.03). Be careful not to damage the connector housing or contacts.

2. If no ac voltage is measured, replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

d. If the ac input voltage to the LTUPS is correct, check the dc output voltages from the associated LTUPS module. The LTUPS output voltages can be checked at connector J1 on the LTUPS and at connectors J42, J43, and J44 on the LTU shelf backplane. To check the output voltages, refer to Figure 4.03 for the location of the connector on the rear of the LTUPS and Figure 4.04 for the locations of connectors J42, J43, and J44 on the LTU shelf backplane. For each voltage indicated in Figures 4.03 and 4.04, connect the common (-) DVM lead to the ground busbar and insert the positive (+) DVM lead in the associated wire slot of the connector. Be careful not to damage the connector housings or contacts.

1. If only one output voltage is low (refer to Table 4.05), suspect that excessive current load on that output is causing current foldback protection to be in effect. This may be due to a short circuit or partial short circuit within a PCB installed in the shelf, or the LTUPS module may be at fault. To isolate the faulty equipment proceed as follows:

NOTE: If the +5Vdc is low, the voltage can be increased by turning the +5 V ADJUST potentiometer on the front of the LTUPS clockwise.

(a) Remove all PCBs in the LTU shelf and check the voltage again.

(b) If the voltage is still low, replace the LTUPS module.

(c) If the voltage returns to normal after removing all the PCBs, a PCB has probably shorted. Reinsert the PCBs into the shelf, one at a time. Check whether the low voltage returns after inserting each PCB. If the low voltage returns after inserting a PCB, the PCB is defective. Replace the PCB.

2. If all output voltages from the LTUPS module are low, suspect that the LTUPS module has experienced an overvoltage condition at its output which has caused the overvoltage protection circuitry to latch the LTUPS into a shut down mode. This may be due to a short circuit or partial short circuit between two output voltages. When the short circuit is cleared, it will be necessary to switch the associated LTU shelf input circuit breaker OFF and then ON to clear the "latched shut down condition."

(a) Remove all PCBs in the LTU shelf.

(b) Switch the LTU circuit breaker on the PSU module off and then ON to determine if the shut down condition is cleared.

(c) Check the LTUPS output voltages again.

(1) If the voltages are still low, replace the LTUPS module.

(2) If the voltages return to normal after removing all the PCBs, the latched shut down condition has cleared, indicating that a PCB has probably shorted. To determine which PCB(s) is defective, reinsert the PCBs into the shelf, one at a time. After inserting each PCB, again check the output voltages of the LTUPS module. If the low voltages return after inserting a PCB, the PCB is defective. Replace the PCB.

(3) If all output voltages from the LTUPS module are zero and there is ac input to the module, replace the LTUPS module.

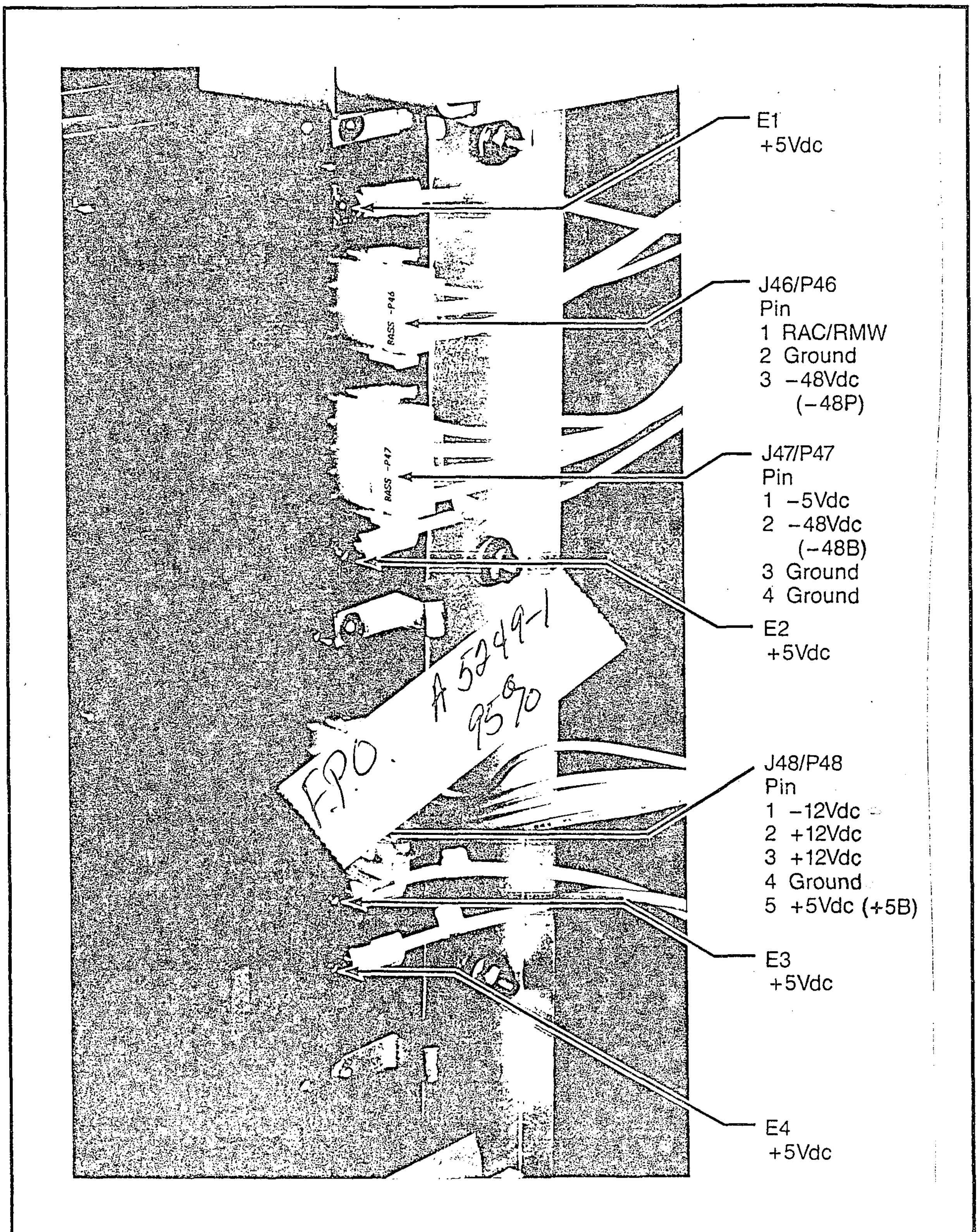
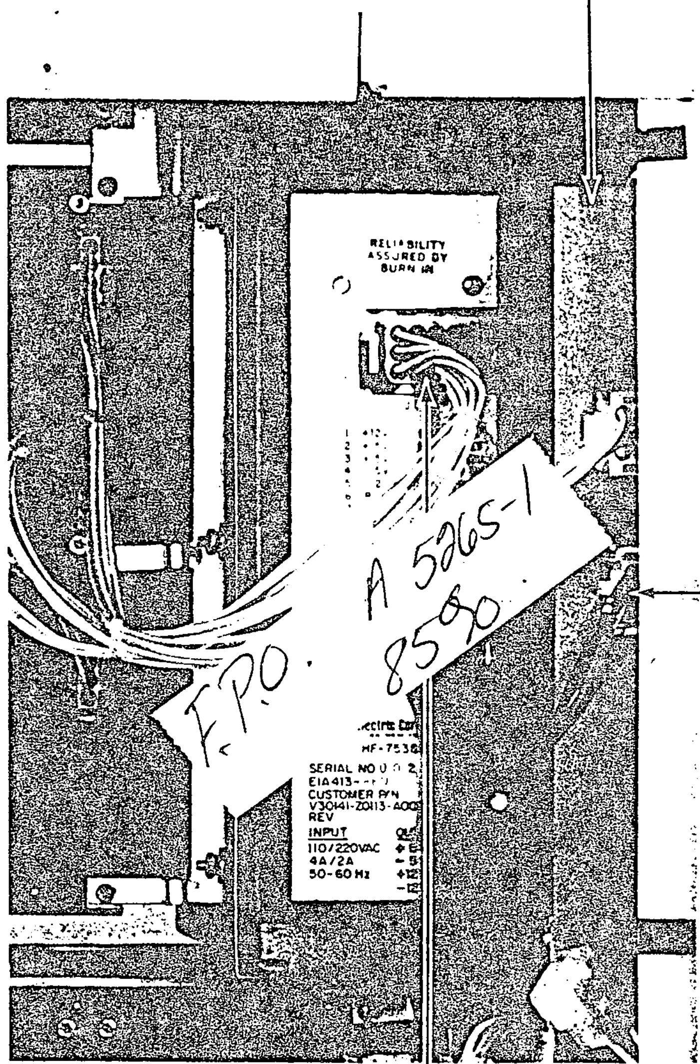


Figure 4.02 Basic Shelf Backplane Power Connections

Raceway



P1
Pin
1 AC Line
2 AC Common
3 GND

J1

Pin		Pin		Pin	
1	+12V	6	RET	11	+12V
2	+5V	7	RET	12	+5V
3	+5V	8	Keying Plug	13	+5V
4	−5V	9	RET	14	−5V
5	−12V	10	RET	15	−12V

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Figure 4.03 LTUPS Module Power Connections

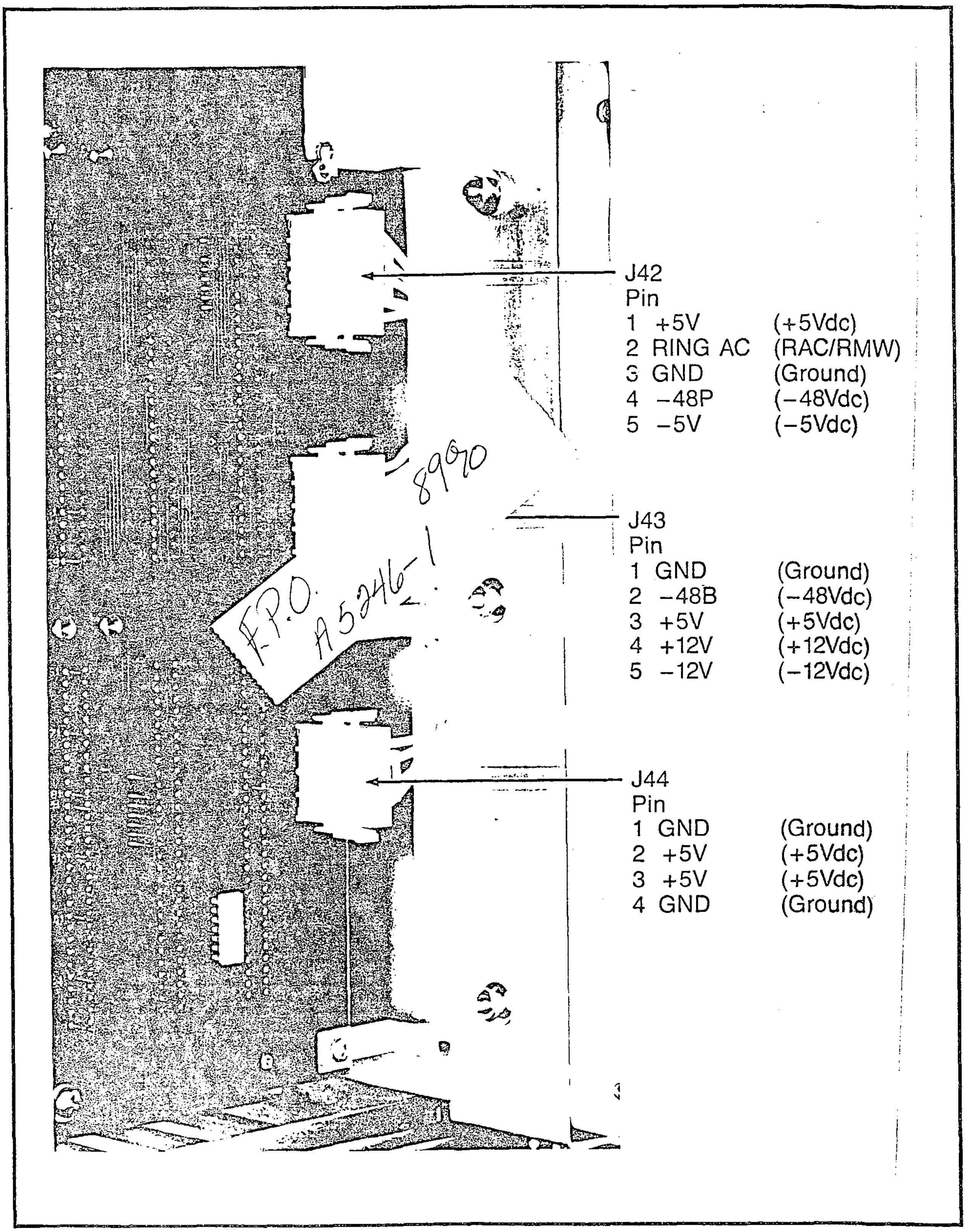

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Figure 4.04 LTU Shelf Backplane Power Connections

4.07 Single-Line Telephone Related Failures. Step-by-step instructions for troubleshooting the single-line telephone (SLT) (i.e., 500- or 2500-type analog instrument) are provided below:

a. If the SLT is completely inoperative (i.e., no talk battery),

1. Using the SERVICE CMU Procedure, check service state of the circuit serving this SLT.

(a) If in-service, continue with step 2.

(b) If out-of-service – craft, return the circuit to the in-service state (Table 4-10), and verify operation. Continue with step 2 if the SLT remains inoperative.

(c) If out-of-service – automatic, attempt to return the circuit to the in-service state (Table 4-10).

(1) If circuit returns to the in-service state and the failure clears, the problem was transient. If transient problems recur on the same circuit, continue with step 2.

(2) If the circuit remains in the out-of-service – automatic state, continue with step 2.

2. Using the ALMDATA CMU Procedure, check the Failure History Memory for system alarm messages. The corrective repair procedures for system alarm messages are provided in Table 4.02.

3. If more than one SLT fails at the same time,

(a) If all affected SLTs are assigned to the same subscriber line module (SLMA-O, SLMA-S, or SLA16 PCB) replace the subscriber line module.

(b) Replace the SMXTG PCB.

4. If only one SLT fails,

(a) Check the line with a test set or replace the SLT with a known good SLT. If the problem disappears, replace the faulty SLT.

(b) Replace the associated subscriber line module (SLMA-O, SLMA-S, or SLA16 PCB).

(c) Replace the SMXTG PCB.

b. If the SLT rings continuously,

1. Replace the associated subscriber line module (SLMA-O, SLMA-S, or SLA16 PCB).

c. If dial tone cannot be heard,

1. Using the SERVICE CMU Procedure, check service state of the circuit serving this SLT.

(a) If in-service, continue with step 2.

(b) If out-of-service – craft, return the circuit to the in-service state (Table 4-10), and verify operation. Continue with step 2 if the SLT remains inoperative.

(c) If out-of-service – automatic, attempt to return the circuit to the in-service state (Table 4-10).

(1) If circuit returns to the in-service state and the failure clears, the problem was transient. If transient problems recur on the same circuit, continue with step 2.

(2) If the circuit remains in the out-of-service – automatic state, continue with step 2.

2. Using the ALMDATA CMU Procedure, check the Failure History Memory for system alarm messages. The corrective repair procedures for system alarm messages are provided in Table 4.02.

3. If dial tone cannot be heard at more than one SLT,

(a) If all affected SLTs are assigned to the same subscriber line module (SLMA-O, SLMA-S, or SLA16 PCB), replace the associated subscriber line module.

(b) Perform the Tone Generator Test (Table 4.06).

(c) If the Tone Generator Test passes but the failure still persists, replace the associated SMXTG PCB.

4. If dial tone cannot be heard on one SLT only,

(a) Check line with a test set or replace the SLT with a known good SLT. If the problem disappears, replace the faulty SLT.

(b) Replace the associated subscriber line module (SLMA-O, SLMA-S, or SLA16) PCB.

d. If dial tone is distorted or at a low level,

1. If dial tone is distorted or at a low level on only one SLT, replace the SLT with a known good SLT.

2. If dial tone is distorted or at a low level on more than one SLT,

(a) Perform the Tone Generator Test (Table 4.06).

(b) If the Tone Generator Test passes but the failure still persists, replace the associated PSC PCB and recheck dial tone. (PSC0 for Basic Cabinet; PSC1 for Expansion Cabinet, if applicable.)

(c) If failure persists, reinsert original PSC PCB and replace the MCA PCB.

e. If the SLT dial pad is suspected of being faulty, perform the DTMF Dial Pad Test (Table 4.12).

f. If the SLT fails to ring,

1. Using the SERVICE CMU Procedure, check service state of the circuit serving this SLT.

(a) If in-service, continue with step 2.

(b) If out-of-service – craft, return the circuit to the in-service state (Table 4-10), and verify operation. Continue with step 2 if the SLT remains inoperative.

(c) If out-of-service – automatic, attempt to return the circuit to the in-service state (Table 4-10).

(1) If circuit returns to the in-service state and the failure clears, the problem was transient. If transient problems recur on the same circuit, continue with step 2.

(2) If the circuit remains in the out-of-service – automatic state, continue with step 2.

2. Using the ALMDATA CMU Procedure, check the Failure History Memory for system alarm messages. The corrective repair procedures for system alarm messages are provided in Table 4.02.

3. Perform the Station Line Test (Table 4.13) to verify ringing capability.

4. Verify that the problem is not due to the activation of a SATURN feature (e.g., Do Not Disturb, Call Forwarding, etc.).

5. Replace the SLT with a known good SLT. If the problem is corrected, replace the faulty SLT.

6. Replace the associated subscriber line module (SLMA-O, SLMA-S, or SLA16) PCB.

4.08 Attendant Console Related Failures. Step-by-step instructions for troubleshooting the attendant console are provided below:

a. If the console is completely inoperative (i.e., no dial tone, no audible alerting, no functioning buttons and LED indicators),

1. Using the SERVICE CMU Procedure, check service state of the circuit serving this console.

(a) If in-service, continue with step 2.

(b) If out-of-service – craft, return the circuit to the in-service state (Table 4-10) and verify operation. Continue with step 2 if the console remains inoperative.

(c) If out-of-service – automatic, attempt to return the circuit to the in-service state (Table 4-10).

(1) If circuit returns to the in-service state and the failure clears, the problem was transient. If transient problems recur on the same circuit, continue with step 2.

(2) If the circuit remains in the out-of-service – automatic state, continue with step 2.

2. Using the ALMDATA CMU Procedure, check the Failure History Memory for system alarm messages. The corrective repair procedures for system alarm messages are provided in Table 4.02.

3. Verify that the line cord is properly seated in the modular jacks. One end of the line cord plugs into the rear base of the console and the other end connects to the modular connecting block. Also insure that the handset cord is properly seated in the handset console jacks.

4. Replace the associated PIMD PCB.

5. Replace the console with a known good console. If the problem is corrected, replace the faulty console.

b. If static is heard in the handset,

1. Replace the handset.

2. Replace the handset coiled cord.

3. Replace the associated PIMD PCB.

4. Replace the console with a known good console. If the problem is corrected, replace the faulty console.

c. If the console is not operating properly (i.e., nonfunctioning LED(s), button(s), alphanumeric display, audible alerting device, etc.):

1. Perform the Attendant Console Test (refer to Table 4.14).

2. If the Attendant Console Test passes but the failure persists,

(a) Replace the associated PIMD PCB.

(b) Replace the console with a known good console. If the problem is corrected, replace the faulty console.

(c) Replace the SMXTG PCB.

4.09 Siemens Digital Telephone (SDT) Related Failures. Step-by-step instructions for troubleshooting SDTs are provided below:

a. If the SDT is completely dead (i.e., no dial tone, no audible alerting, no functioning buttons and LED indicators),

1. Using the SERVICE CMU Procedure, check service state of the circuit serving this SDT.

(a) If in-service, continue with step 2.

(b) If out-of-service – craft, return the circuit to the in-service state (Table 4-10), and verify operation. Continue with step 2 if the SDT remains inoperative.

(c) If out-of-service – automatic, attempt to return the circuit to the in-service state (Table 4-10).

(1) If circuit returns to the in-service state and the failure clears, the problem was transient. If transient problems recur on the same circuit, continue with step 2.

(2) If the circuit remains in the out-of-service – automatic state, continue with step 2.

2. Using the ALMDATA CMU Procedure, check the Failure History Memory for system alarm messages. The corrective repair procedures for system alarm messages are provided in Table 4.02.

3. If more than one SDT fails at the same time,

(a) If all affected SDTs are assigned to the same SLMD PCB, replace the PCB.

(b) Replace the SMXTG PCB.

4. If only one SDT fails,

(a) Verify that the line cord connectors are properly seated in the modular jacks. One end of the line cord plugs into the rear base of the SDT and the other end connects to the modular connecting block. Also insure that the handset cord connectors are properly seated in the handset and SDT jacks.

(b) Replace the SDT with a known good SDT. If the problem is corrected, replace the faulty SDT.

(c) Replace the associated SLMD PCB.

(d) Replace the SMXTG PCB.

b. If the trouble report indicates that one or more LED indicators or buttons do not operate properly,

1. Verify that the problem is not due to the misunderstanding of a feature by the SDT user.

2. Perform the Siemens Digital Telephone button test (Table 4.16 for DYAD telephones or Table 4.17 for JR-DYAD telephones).

3. If the Siemens Digital Telephone button test passes but the problem persists:

(a) Replace the SDT with a known good SDT. If the problem is corrected, replace the faulty SDT.

(b) Replace the associated SLMD PCB.

c. If the trouble report indicates that the display unit on the SDT is not operating properly,

1. Verify that the problem is not due to the misunderstanding of a feature by the SDT user.

2. Perform the Siemens DYAD Telephone Display Test (Table 4.18).

3. If the display test passes but the problem persists:

(a) Replace the SDT with a known good SDT. If the problem is corrected, replace the faulty SDT.

(b) Replace the associated SLMD PCB.

d. If the SDT dial pad is suspected of being faulty, perform the Siemens Digital Telephone button test (Table 4.16 for DYAD telephones or Table 4.17 for JR-DYAD telephones).

e. If the SDT fails to ring,

1. Using the SERVICE CMU Procedure, check service state of the circuit serving this SDT.

(a) If in-service, continue with step 2.

(b) If out-of-service – craft, return the circuit to the in-service state (Table 4-10), and verify operation. Continue with step 2 if the SDT remains inoperative.

(c) If out-of-service – automatic, attempt to return the circuit to the in-service state (Table 4-10).

(1) If circuit returns to the in-service state and the failure clears, the problem was transient. If transient problems recur on the same circuit, continue with step 2.

(2) If the circuit remains in the out-of-service – automatic state, continue with step 2.

2. Using the ALMDATA CMU Procedure, check the Failure History Memory for system alarm messages. The corrective repair procedures for system alarm messages are provided in Table 4.02.

3. Perform the Siemens Digital Telephone Button Test (Table 4.16 for DYAD telephones or Table 4.17 for JR-DYAD telephones), as applicable. This test checks the audible alerting device in the SDT. If the alerting device does not sound as described in the Siemens Digital Telephone Button Test, try adjusting the volume level of the tone ringer (DYAD Telephones) or the audible alert tone level (JR-DYAD Telephones). (The tone ringer or alert tone level control is the black knob located on the underside of the telephone.)

4. If the Siemens Digital Telephone button test passes but the problem persists, verify that the problem is not due to the activation of a SATURN IIE feature (e.g., Do Not Disturb, Station Ringer Cutoff, Call Forwarding, etc.).

5. Replace the SDT with a known good SDT. If the problem is corrected, replace the faulty SDT.

6. Replace the associated SLMD PCB.

f. If the SDT rings continuously,

1. Replace the SDT with a known good SDT. If the problem is corrected, replace the faulty SDT.

2. Replace the associated SLMD PCB.

g. If dial tone cannot be heard,

1. Using the SERVICE CMU Procedure, check service state of the circuit serving this SDT.

(a) If in-service, continue with step 2.

(b) If out-of-service – craft, return the circuit to the in-service state (Table 4-10), and verify operation. Continue with step 2 if the SDT remains inoperative.

(c) If out-of-service – automatic, attempt to return the circuit to the in-service state (Table 4-10).

(1) If circuit returns to the in-service state and the failure clears, the problem was transient. If transient problems recur on the same circuit, continue with step 2.

(2) If the circuit remains in the out-of-service – automatic state, continue with step 2.

2. Using the ALMDATA CMU Procedure, check the Failure History Memory for system alarm messages. The corrective repair procedures for system alarm messages are provided in Table 4.02.

3. If dial tone cannot be heard at more than one SDT,

(a) If all affected SDTs are assigned to the same SLMD PCB, replace the PCB.

(b) Perform the Tone Generator Test (Table 4.06).

(c) If the Tone Generator Test passes but the failures persist, replace the SMXTG PCB.

4. If dial tone cannot be heard at one SDT only,

(a) Replace the SDT with a known good SDT. If the problem is corrected, replace the faulty SDT.

(b) Replace the associated SLMD PCB.

h. If dial tone is distorted or at a low level,

1. If dial tone is distorted or at a low level at only one SDT, replace the SDT with a known good SDT.

2. If dial tone is distorted or at a low level on more than one SDT,

(a) Perform the Tone Generator Test (Table 4.06).

(b) If the Tone Generator Test passes but the failure still persists, replace the associated PSC PCB and recheck dial tone (PSC0 for Basic Cabinet; PSC1 for Expansion Cabinet).

(c) If failure persists, reinsert original PSC PCB and replace the MCA PCB.

i. If static is heard in the handset,

1. Replace the handset.

2. Replace the handset coiled cord.

3. Replace the SDT with a known good SDT. If the problem is corrected, replace the faulty SDT.

4. Replace the associated SLMD PCB.

4.10 Manual On-Line Diagnostic Tests. Step-by-step procedures for the system and apparatus diagnostic tests are described in Tables 4.06 through 4.18.

a. System Diagnostic Tests. The following system diagnostic tests and procedures can be performed:

- Tone Generator Test (Table 4.06)
- Outgoing Trunk Test (Table 4.08)
- DTMF Receiver Test (Table 4.09)
- Placing Circuit(s) In-Service (Table 4.10)
- Taking Circuit(s) Out-of-Service (Table 4.11)

b. Apparatus Diagnostic Tests. The following apparatus diagnostic tests can be performed:

- DTMF Dial Pad Test (Table 4.12)
- Station Line Test (Table 4.13)
- Attendant Console Test (Table 4.14)
- Siemens DYAD Telephone Button Test (Table 4.16)
- Siemens JR-DYAD Telephone Button Test (Table 4.17)
- Siemens DYAD Telephone Display Test (Table 4.18)

4.11 Automatic On-Line Audit Tests. The SATURN IIE EPABX is provided with a repertory of audit test routines that are used to test the EPABX equipment during processor idle time. These audit test routines can be enabled and disabled by using Customer Memory Update (CMU) Procedures at a service terminal. When an audit test routine is enabled, detected failures are recorded in the failure history memory and the appropriate major and minor alarm indicators are lighted. Appropriate recovery routines are executed automatically on the failing equipment.

The procedures for enabling and disabling the audit test routines are described in Siemens practice SATURN IIE EPABX Customer Memory Update Procedures. The following audit test routines can be enabled and disabled.

- Memory Parity Audit Test
- Memory Content Audit Test
- Input/Output Loop-Around Audit Test
- Speech Highway Audit Test
- DTMF Receiver/Tone Generator Audit Test
- MTS Memory Control Audit Test
- Digital Apparatus Audit Test
- Trunk Activity Audit Test

4.12 Spare Parts. The troubleshooting instructions are based on the assumption that spare Printed Circuit Boards (PCBs) and other replaceable assemblies are available on the premises, centralized job site, or some location convenient to the EPABX. A list of spare parts and associated part numbers is provided in Siemens practice SATURN IIE EPABX Installation Procedures.

Table 4.06 Tone Generator Test

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone returned.	
3	Dial 1 for tone generator test.	None.	
4A	Dial 00 if all tones are to be tested and verify that all tones returned are undistorted.	All tones are returned in the sequence shown in Table 4.07 for 2 seconds each. Test repeats until the maintenance test phone is placed on-hook or hook-flashed.	If any tone(s) is returned distorted, retry test two more times. If distortion continues, replace the SMXTG PCB. Note that the first sixteen tones are hardware interrupted. If continuous tones are returned, replace the SMXTG PCB.
4B	Dial the individual test number shown in Table 4.07 if a particular tone is to be tested.	Chosen tone returned until maintenance test phone is placed on-hook or hook-flashed.	If chosen tone is returned distorted, retry test two more times. If distortion continues, replace the SMXTG PCB.
5A	If additional tests or procedures are to be performed, hook-flash the maintenance test phone and dial the next code (Diagnostic Test Access Code is not redialed).	Recall dial tone is returned.	
5B	If no additional tests or procedures are to be performed, place the maintenance test phone on-hook.	None.	

Table 4.07 Tone Generator Test Numbers

TEST NUMBER	TONE
00	Circular Sequence
01	DTMF-1 (697Hz + 1209Hz)
02	DTMF-2 (697Hz + 1336Hz)
03	DTMF-3 (697Hz + 1477Hz)
04	DTMF-4 (770Hz + 1209Hz)
05	DTMF-5 (770Hz + 1336Hz)
06	DTMF-6 (770Hz + 1477Hz)
07	DTMF-7 (852Hz + 1209Hz)
08	DTMF-8 (852Hz + 1336Hz)
09	DTMF-9 (852Hz + 1477Hz)
10	DTMF-0 (941Hz + 1336Hz)
11	DTMF-* (941Hz + 1209Hz)
12	DTMF-# (941Hz + 1477Hz)
13	DTMF-A (697Hz + 1633Hz)
14	DTMF-B (770Hz + 1633Hz)
15	DTMF-C (852Hz + 1633Hz)
16	DTMF-D (941Hz + 1633Hz)
17	Dial Tone (350Hz + 440Hz)
18	Busy Tone (480Hz + 620 Hz)
19	Reorder Tone (Fast Busy Tone)
20	Test Tone (1004Hz @ -16dBm)
21	Low Tone (440Hz)
22	Audible Ring (440Hz + 480Hz – uninterrupted)
23	Intercept Tone (440Hz + 620Hz)
24	LDN Call Identification Tone (400 Hz + 480 Hz – interrupted)
25	Called Party Tone (2100 Hz – uninterrupted) (see NOTE)
26	Remote Hold Recall Identification Tone (400 Hz)
27	Quiet Tone

NOTE: The Called Party Tone applies to SATURN Systems programmed with the Office Communications II (OC II) software package.

Table 4.08 Outgoing Trunk Test

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 2 to enable trunk test.	None.	
4	Dial the two-digit trunk group number (00 through 31) containing the trunk circuit to be tested.	None.	
5	Dial the two-digit trunk number (00 – 99) of the trunk circuit to be tested.	CO or PABX dial tone is returned. Also, the associated trunk circuit LED on the trunk PCB is lit steadily to indicate the trunk has been seized outgoing.	If reorder tone is returned, the selected trunk circuit is either an incoming-type, invalid, or not assigned (check data base assignments). If busy tone is returned, the selected trunk is in use; retry later. If CO or PABX dial tone is not returned, verify trunk MDF cross-connections and attempt to access CO/PABX trunk using a test set. If the trunk is working properly, replace the PCB for the trunk circuit under test and retry test.
6	For CO-type trunks (i.e.,TMBM PCB), dial the test tone number provided by the local phone company.	Test tone (1004Hz) is returned.	
7	Verify that the returned test tone level is correct, using a TMS.		If the returned test tone level is weak, replace PCB with another having the same characteristics and retry test. If returned test tone level increases considerably, replace trunk PCB and retry test. If the test tone level is still weak, contact CO repair service to verify trunk facility.
8A	If additional tests or procedures are to be performed, hook-flash the maintenance test phone and dial the next code (Diagnostic Test Access Code is not redialed).	Recall dial tone is returned.	
	If no additional tests or procedures are to be performed, place the maintenance test phone on-hook.	None.	

Table 4.09 DTMF Receiver Test

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial # for DTMF receiver test.	None.	
4	Dial the four-digit PEN of the DTMF receiver circuit to be tested.	Dial tone is returned and the associated DTMF receiver circuit LED in the DTMF PCB is lit steadily.	If busy tone is returned, the DTMF receiver circuit is busy; retry later. If reorder tone is returned, the DTMF receiver circuit is not assigned (check data base assignment).
5	Depress the maintenance test phone keypad buttons in the following sequence. a. For 12-button phones: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, * and #. b. For 16-button phones: A, B, C, D, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, * and #.	Test tone (1004Hz @ -16dBm) is returned.	If intercept tone is returned at any time, either the DTMF receiver or the maintenance phone keypad is not operating properly, or the buttons were depressed in the wrong sequence. Retry test with another DTMF phone. If intercept tone is returned again, the DTMF receiver circuit is defective. Replace the DTMF PCB.
6A	If additional tests or procedures are to be performed, hook-flash maintenance test phone and dial the next code (Diagnostic Test Access Code is not redialed).	Recall dial tone is returned and the associated DTMF receiver circuit LED in the DTMF PCB is extinguished.	
6B	If no additional tests or procedures are to be performed, place the maintenance test phone on-hook.	The associated DTMF receiver circuit LED in the DTMF PCB is extinguished.	

Table 4.10 Placing Circuit(s) In-Service

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code	Recall dial tone is returned.	
3	Dial 7 for placing a circuit(s) in-service.	None.	
4A	If a single circuit is to be placed in-service, dial the four-digit PEN of the circuit.	Confirmation tone is returned.	If reorder tone is returned, the selected circuit is invalid or unassigned. Check data base assignments.
4B	If all the circuits in a PCB (except an SLA16 PCB) are to be placed in-service, dial the first three digits of the PEN (W, X, and Y) for the PCB, followed by the digit 8. For an SLA16 PCB, dial the first three digits of the PEN (designating the shelf, channel group, and slot; W, X, and Y) followed by the digit 8, to place the first group of eight circuits in-service. To place the second group of eight circuits in-service, add 1 to the slot number when dialing the first three digits of the PEN (i.e. W, X, Y+1), then dial the digit 8.	Confirmation tone is returned.	If reorder tone is returned, the PEN of the selected PCB (or SLA16 circuit group) is invalid or unassigned. Check data base assignments.

Table 4.10 Placing Circuit(s) In-Service (Continued)

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
5A	If additional tests or procedures are to be performed, hook-flash the maintenance test phone and dial the next code (Diagnostic Test Access Code is not redialed).	Recall dial tone is returned.	
5B	If no additional tests or procedures are to be performed, place the maintenance test phone on-hook.	None.	

Table 4.11 Taking Circuit(s) Out-of-Service

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 8 for taking a circuit(s) out-of-service.	None.	
4A	If a single circuit is to be taken out-of-service, dial the four-digit PEN of the circuit.	Confirmation tone is returned.	If reorder tone is returned, the selected circuit is invalid or unassigned. Check data base assignments.
4B	If all the circuits in a PCB (except an SLA16 PCB) are to be taken out-of-service, dial the first three digits of the PEN (W, X, and Y) for the PCB, followed by the digit 8. For an SLA16 PCB, dial the first three digits of the PEN (designating the shelf, channel group, and slot; W, X, and Y) followed by the digit 8, to take the first group of eight circuits out-of-service. To take the second group of eight circuits out-of-service, add 1 to the slot number when dialing the first three digits of the PEN (i.e. W, X, Y+1), then dial the digit 8.	Confirmation tone is returned.	If reorder tone is returned, the PEN of the selected PCB (or SLA16 circuit group) is invalid or unassigned. Check data base assignments.
5A	If additional tests or procedures are to be performed, hook-flash the maintenance test phone and dial the next code (Diagnostic Test Access Code is not redialed).	Recall dial tone is returned.	
5B	If no additional tests or procedures are to be performed, place the maintenance test phone on-hook.	None.	

Table 4.12 DTMF Dial Pad Test

NOTES: 1. If the system option flag TSTDIAG has been enabled in the data base or the station under test is class-marked with the TSTAPP feature, the maintenance test phone is not required to enable or disable the Apparatus Test routines; therefore, perform steps 5 through 8.

2. If the system option flag TSTDIAG has been disabled in the data base or the station under test is not class-marked with the TSTAPP feature, the maintenance test phone is required to enable or disable the Apparatus Test routines; therefore, perform steps 1 through 9.

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the tests.	Confirmation tone returned.	
4	Place maintenance test phone on-hook.	None.	
5	Place DTMF station under test off-hook.	Dial tone is returned.	
6	Dial the Test DTMF Pad Access Code.	Recall dial tone is returned.	
7	Depress the DTMF keypad buttons in the following sequence: For 12-button phones: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, * and #. For 16-button phones: A, B, C, D, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, * and #.	Recall dial tone ceases. After all the DTMF keypad buttons are depressed in the sequence indicated, test tone (1004Hz @ -16dbm) is returned for one minute.	If busy tone is returned at any time, either the DTMF keypad buttons were depressed out of sequence, the DTMF keypad of the station under test is defective, or the subscriber line circuit is defective. To isolate the failure, retry the test. If problem persists, replace the station instrument to determine if it is defective. If problem is not resolved, replace the associated subscriber line module (SLMA-O,SLMA-S,or SLA16) PCB.
8	Verify the level of test tone by using a TMS.		If the measured test tone is correct but weak, replace the station set. If the measured tone is low, replace associated subscriber line module (SLMA-O, SLMA-S, or SLA16 PCB).
9	Place DTMF station under test on-hook to terminate test.	None.	
10	If no additional Apparatus Tests are to be performed, proceed as follows:		
	Place maintenance test phone off-hook.	Dial tone is returned.	
	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
	Dial 2 to disable the Apparatus Tests.	None.	
	Place maintenance test phone on-hook.	None.	

Table 4.13 Station Line Test

NOTES: 1. If the system option flag TSTDIAG has been enabled in the data base or the station under test is class-marked with the TSTAPP feature, the maintenance test phone is not required to enable or disable the Apparatus Diagnostic Test routines; therefore, perform steps 5 through 10.

2. If the system option flag TSTDIAG has been disabled in the data base or the station under test is not class-marked with the TSTAPP feature, the maintenance test phone is required to enable or disable the Apparatus Diagnostic Test routines; therefore, perform steps 1 through 11.

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the Apparatus tests.	Confirmation tone is returned.	
4	Place the maintenance test phone on-hook.	None.	
5	Place the station under test off-hook.	Dial tone is returned.	
6	Dial the Test-Station Line Access Code.	Confirmation tone is returned.	
7	Place station under test on-hook.	Ringing returned.	If ringing is not heard, replace the station instrument to determine if it is defective. If ringing is still not heard, replace the associated subscriber line module (SLMA-O, SLMA-S, or SLA16 PCB).
8	Pick up handset to answer test call.	Test tone (1004Hz @ -16dbm) is returned.	
9	Verify that the test tone level is correct by using a TMS.		If the returned test tone level is weak, replace the instrument to determine if it is defective. If the test tone level increases considerably, replace the station instrument. If test tone level remains weak, the subscriber line circuit is defective. Replace the associated subscriber line module (SLMA-O, SLMA-S, or SLA16 PCB).
10	Place station under test on-hook.	None.	
11	If no additional Test routines are to be performed, proceed as follows:		
	Place maintenance test phone off-hook.	Dial tone is returned.	
	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
	Dial 2 to disable test routine.	None.	
	Place maintenance phone on-hook.	None.	

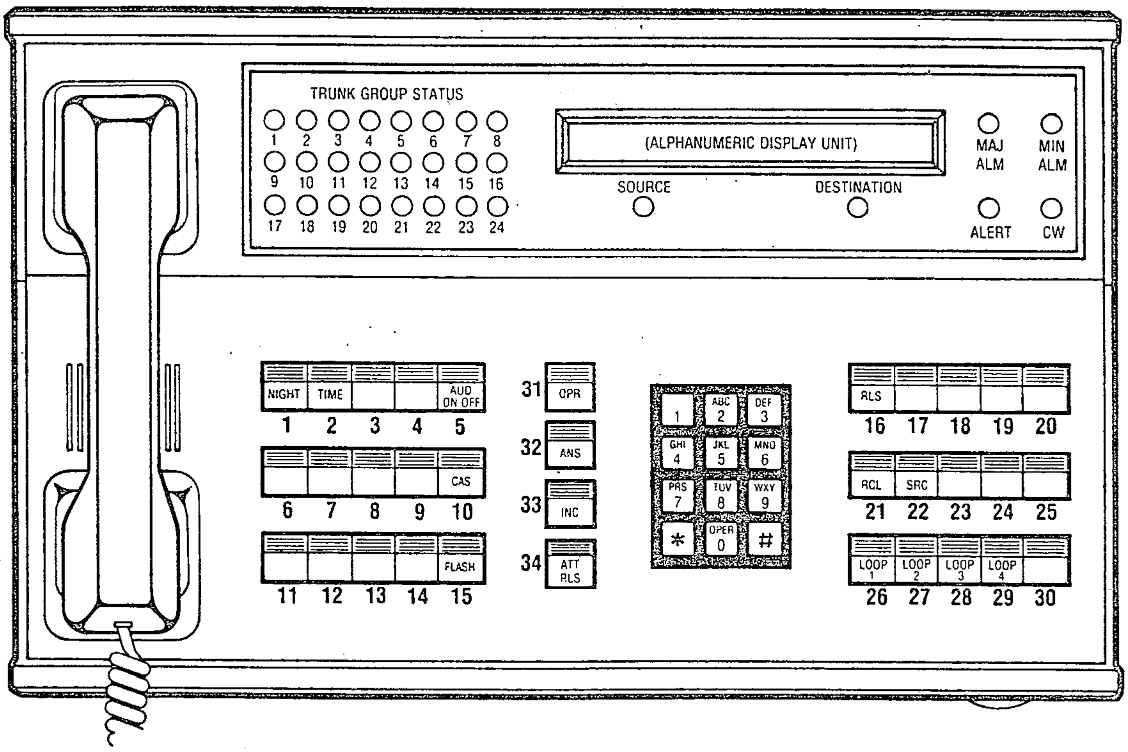

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Figure 4.05 Attendant Console Keypad and Feature Button Depression Sequence

Table 4.14 Attendant Console Test

NOTES: 1. If the system option flag TSTDIAG has been enabled in the data base, the maintenance test phone is not required to enable and disable the Apparatus Test routines; therefore, perform steps 5 through 9.

2. If the system option flag TSTDIAG has been disabled in the data base, the maintenance test phone is required to enable and disable the Apparatus Test routines; therefore, perform steps 1 through 10.

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the Apparatus Tests.	Confirmation tone is returned.	
4	Place maintenance test phone on-hook.	None	
5	At the Console under test, dial the Attendant Console Test access code when the console is in an idle state.	Recall dial tone is returned, the access code is displayed momentarily, then the display changes to CONSOLE TEST and all button LEDs are extinguished.	If reorder tone is returned, the Attendant Console Test routine is in use; retry later.
6	Depress the console's keypad buttons in the following sequence: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, * and #.	All digits dialed are displayed (accumulate).	If proper verification is not obtained or busy tone is returned, either: (1) buttons were depressed out of sequence, (2) the console is defective, or (3) the PIMD is faulty. Retry the test. If proper verification is not obtained or busy tone is returned again, replace the associated PIMD PCB and retry the test. (1) If proper verification is obtained, replace the PIMD PCB. (2) If proper verification is not obtained or busy tone is returned, replace the console.
7	Depress the console's feature buttons in the sequence shown in Figure 4.05.	Each button LED lights when depressed and extinguishes when the next button is depressed.	Same as step 6.
8	After the last button in the above sequence is depressed, depress any console button to initiate the display test. The display can be suspended by depressing any button on the console and resumed in the same manner.	Groups of eight of each of the displayable characters are scrolled in the sequence shown in Table 4.15. After the last character is displayed (under score character), the display unit is cleared and the following LEDs momentarily light then extinguish in the following sequence: a) TRUNK GROUP STATUS 1 – 24 b) SOURCE c) DESTINATION d) ALERT e) CW f) MAJ ALM g) MIN ALM After the above indications are completed, the following indications occur: Ringback tone is returned. All LEDs on the display assembly flash. The audible alerting device sounds at intervals. REMOVE HANDSET is displayed.	If proper verification is not obtained or busy tone is returned, either: (1) the console is defective, or (2) the PIMD is faulty. Retry the test. If proper verification is not obtained or busy tone is returned again, replace the associated PIMD PCB and retry the test. (1) If proper verification is obtained, replace the PIMD PCB. (2) If proper verification is not obtained or busy tone is returned, replace the console.

Table 4.14 Attendant Console Test (Continued)

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
9	Remove and reinsert handset assembly to terminate test, or wait 30 seconds for test timeout.	INSERT HANDSET is displayed while handset is removed. After handset is reinserted, console returns to normal operation.	
10	If no additional Apparatus Tests are to be performed proceed as follows:		
	Place maintenance test phone off-hook.	Dial tone is returned.	
	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
	Dial 2 to disable the Apparatus Tests.	None.	
	Place maintenance test phone on-hook.	None.	

Table 4.15 Attendant Console Displayable Characters

ORDER	CHARACTER	ORDER	CHARACTER
1.	! ! ! ! ! ! ! !	33.	A A A A A A A A
2.	" " " " " " " "	34.	B B B B B B B B
3.	# # # # # # # #	35.	C C C C C C C C
4.	$ $ $ $ $ $ $ $	36.	D D D D D D D D
5.	% % % % % % % %	37.	E E E E E E E E
6.	& & & & & & & &	38.	F F F F F F F F
7.	| | | | | | | |	39.	G G G G G G G G
8.	((((((((	40.	H H H H H H H H
9.	))))))))	41.	I I I I I I I I
10.	* * * * * * * *	42.	J J J J J J J J
11.	+ + + + + + + +	43.	K K K K K K K K
12.	, , , , , , , ,	44.	L L L L L L L L
13.	- - - - - - - -	45.	M M M M M M M M
14.	. . . .	46.	N N N N N N N N
15.	/ / / / / / / /	47.	O O O O O O O O
16.	0 0 0 0 0 0 0 0	48.	P P P P P P P P
17.	1 1 1 1 1 1 1 1	49.	Q Q Q Q Q Q Q Q
18.	2 2 2 2 2 2 2 2	50.	R R R R R R R R
19.	3 3 3 3 3 3 3 3	51.	S S S S S S S S
20.	4 4 4 4 4 4 4 4	52.	T T T T T T T T
21.	5 5 5 5 5 5 5 5	53.	U U U U U U U U
22.	6 6 6 6 6 6 6 6	54.	V V V V V V V V
23.	7 7 7 7 7 7 7 7	55.	W W W W W W W W
24.	8 8 8 8 8 8 8 8	56.	X X X X X X X X
25.	9 9 9 9 9 9 9 9	57.	Y Y Y Y Y Y Y Y
26.	: : : : : : : :	58.	Z Z Z Z Z Z Z Z
27.	; ; ; ; ; ; ; ;	59.	[[[[[[[[
28.	〈 〈 〈 〈 〈 〈 〈 〈	60.	\ \ \ \ \ \ \ \
29.	= = = = = = = =	61.	]]]]]]]]
30.	〉 〉 〉 〉 〉 〉 〉 〉	62.	^ ^ ^ ^ ^ ^ ^ ^
31.	? ? ? ? ? ? ? ?	63.	_ _ _ _ _ _ _ _
32.	@ @ @ @ @ @ @ @		

Table 4.16 Siemens DYAD Telephone Button Test

NOTES: 1. If the system option flag TSTDIAG has been enabled in the data base or the Siemens Digital Telephone under test is class-marked with TSTAPP feature, the maintenance test phone is not required to enable or disable the Apparatus Diagnostic routines; therefore, perform only steps 5 through 9.

2. If the system option flag TSTDIAG has been disabled in the data base or the Siemens Digital Telephone under test is not class-marked with the TSTAPP feature, the maintenance test phone is required to enable or disable the Apparatus Diagnostic routines; therefore perform the entire procedure (steps 1 through 10).

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place the maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the Apparatus Diagnostic Tests.	Confirmation tone is returned.	
4	Place maintenance test phone on-hook.	None.	
5	Place Siemens DYAD Telephone off-hook.	Dial tone is returned.	
6	Dial the Siemens Digital Telephone Test Access Code.	Recall dial tone is returned. The access code is momentarily displayed, then the display unit and button LEDs are extinguished.	If reorder tone is returned, the Siemens DYAD Telephone Button Test is in use; try again later.
7	Depress the Siemens DYAD Telephone keypad buttons as follows: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *, #.		If proper verification is not obtained or busy tone is returned at any time, either: (1) buttons were depressed out of sequence, (2) the DYAD Telephone is defective, or (3) the SLMD circuit is faulty. Retry the test. If proper verification is not obtained or busy tone is returned again, replace the DYAD Telephone with a known good DYAD Telephone. Retry the test. (1) If proper verification is obtained, replace the DYAD Telephone. (2) If proper verification is not obtained or busy tone is returned, the SLMD circuit is faulty. Replace the associated SLMD PCB.
8	Depress the DYAD Telephone feature buttons in the sequence shown in Figure 4.06 and according to the Siemens DYAD Telephone model.	Button LEDs light when depressed and extinguish when the next button is depressed. After the last button is depressed, the following indications occur: Ringback tone is returned. All button LEDs flash. The audible alerting device sounds at intervals. TEST COMPLETE is displayed.	Same as step 7.

Table 4.16 Siemens DYAD Telephone Button Test (Continued)

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
9	Place Siemens DYAD Telephone under test on-hook to terminate test.	Siemens DYAD Telephone returns to normal operation.	
10	If no additional Apparatus Diagnostic Test routines are to be performed, proceed as follows:		
	Place maintenance test phone off-hook.	Dial tone is returned.	
	Dial the Diagnostic Test Access code.	Recall dial tone is returned.	
	Dial 2 to disable the Apparatus Diagnostic Test.	None.	
	Place maintenance test phone on-hook.	None.	

18 BUTTON DYAD

26 BUTTON DYAD

NOTE: These buttons do not contain LEDs.

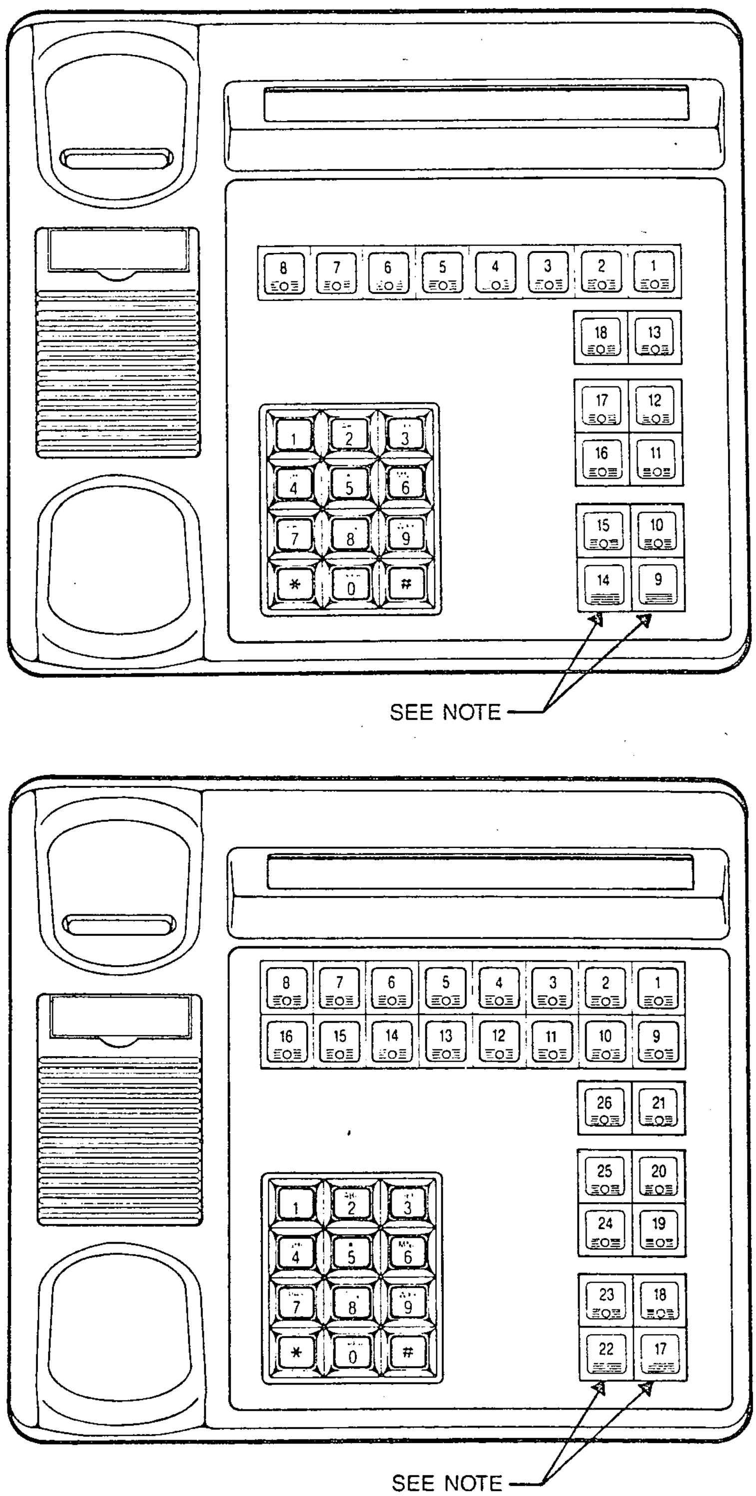

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Figure 4.06 Siemens DYAD Telephone Button Depression Sequence

Table 4.17 Siemens JR-DYAD Telephone Button Test

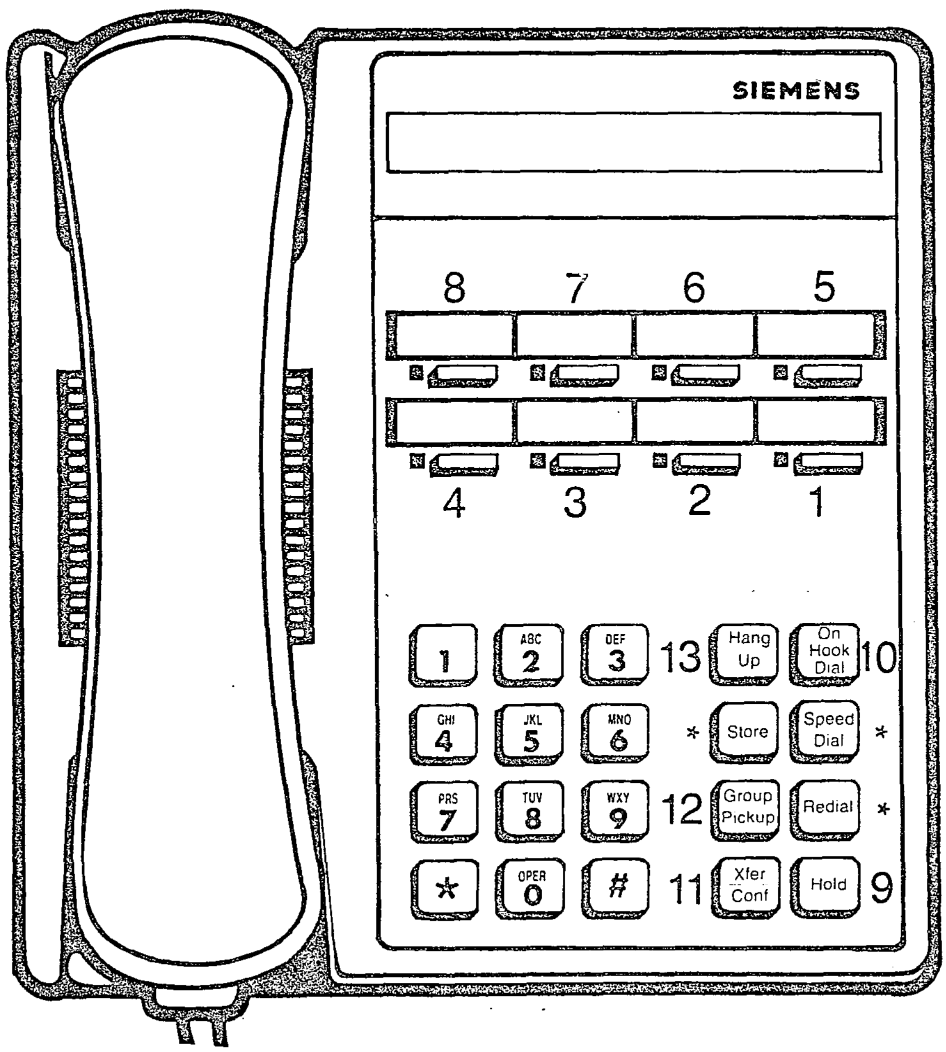
NOTES: 1. If the system option flag TSTDIAG has been enabled in the data base or the Siemens Digital Telephone under test is class-marked with TSTAPP feature, the maintenance test phone is not required to enable or disable the Apparatus Diagnostic routines; therefore, perform steps 5 through 9.

2. If the system option flag TSTDIAG has been disabled in the data base or the Siemens Digital Telephone under test is not class-marked with the TSTAPP feature, the maintenance test phone is required to enable or disable the Apparatus Diagnostic routines; therefore perform steps 1 through 10.

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place the maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the Apparatus Diagnostic Tests	Confirmation tone is returned.	
4	Place maintenance test phone on-hook.	None.	
5	Place JR-DYAD Telephone off-hook.	Dial tone is returned.	
6	Dial the Siemens Digital Telephone Test Access Code.	Recall dial tone is returned.	If reorder tone is returned, the Siemens JR-DYAD Telephone Button Test is in use; try again later.
7	Depress the Siemens JR-DYAD Telephone keypad buttons as, follows: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *, #.		If proper verification is not obtained or busy tone is returned at any time, either: (1) buttons were depressed out of sequence, (2) the JR-DYAD Telephone is defective, or (3) the SLMD circuit is faulty. Retry the test. If proper verification is not obtained or busy tone is returned again, replace the JR-DYAD Telephone with a known good JR-DYAD Telephone. Retry the test. (1) If proper verification is obtained, replace the JR-DYAD Telephone. (2) If proper verification is not obtained or busy tone is returned, the SLMD circuit is faulty. Replace the associated SLMD PCB.
8	Depress the JR-DYAD feature buttons in the sequence shown in Figure 4.07.	Button LEDs light when depressed and extinguish when the next button is depressed. After the last button is depressed, the following indications occur: Ringback tone is returned. All button LEDs flash. The audible alerting device sounds at intervals.	Same as step 7.

Table 4.17 Siemens JR-DYAD telephone Button Test (Continued)

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
9	Place Siemens JR-DYAD Telephone under test on-hook to terminate test.	Siemens JR-DYAD Telephone returns to normal operation.	
10	If no additional Apparatus Diagnostic Test routines are to be performed, proceed as follows:		
	Place maintenance test phone off-hook.	Dial tone is returned.	
	Dial the Diagnostic Test Access code.	Recall dial tone is returned.	
	Dial 2 to disable the Apparatus Diagnostic Test.	None.	
	Place maintenance test phone on-hook.	None.	



NOTES:
* These feature buttons are not testable.
Buttons 9 through 13 do not contain LEDs.

A5139-1-4/18/86

Figure 4.07 Siemens JR-DYAD Telephone Button Depression Sequence

Table 4.18 Siemens DYAD Telephone Display Test

NOTES: 1. If the system option flag TSTDIAG has been enabled in the data base or the Siemens Digital Telephone under test is class-marked with TSTAPP feature, the maintenance test phone is not required to enable or disable the Apparatus Diagnostic routines; therefore perform steps 5 through 9.

2. If the system option flag TSTDIAG has been disabled in the data base or the Siemens Digital Telephone under test is not class-marked with the TSTAPP feature, the maintenance test phone is required to enable or disable the Apparatus Diagnostic routines; therefore perform steps 1 through 10.

STEP	PROCEDURE	VERIFICATION	IF VERIFICATION IS NOT OBTAINED
1	Place maintenance test phone off-hook.	Dial tone is returned.	
2	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
3	Dial 3 to enable the Apparatus Diagnostic test.	Confirmation tone is returned.	
4	Place maintenance test phone on-hook.	None	
5	Place the Siemens DYAD Telephone under test off-hook.	Dial tone is returned.	
6	Dial the Siemens Digital Telephone Display Test Access Code.	Recall dial tone is returned. The Access code is momentarily displayed, then the display unit clears.	If reorder tone is returned, the Siemens Digital Telephone Display Test is being used; retry later.
7	Depress any button in the Siemens DYAD Telephone under test to initiate test. (Note: The display test can be suspended any time by depressing any button. The test can be resumed at any time in the same manner.)	Groups of sixteen of each of the displayable characters are scrolled in the sequence shown in Table 4.19. After the last character (underscore) is displayed, the following occurs: Ringback tone is returned. All key LEDs flash. The audible alerting device sounds at intervals. TEST COMPLETE is displayed.	If proper verification is not obtained, either: (1) the DYAD Telephone is defective, or (2) the associated SLMD circuit is faulty. Retry the test. If proper verification is not obtained, replace the DYAD Telephone with a known good DYAD Telephone. Retry the test. (1) If proper verification is obtained, replace the DYAD Telephone. (2) If proper verification is not obtained, the SLMD circuit is faulty. Replace the associated SLMD PCB.
8	Place DYAD Telephone on-hook to terminate test or wait 30 seconds for test timeout.		
9	If no additional Apparatus Diagnostic Tests are to be performed, proceed as follows:		
	Place maintenance test test phone off-hook.	Dial tone is returned.	
	Dial the Diagnostic Test Access Code.	Recall dial tone is returned.	
	Dial 2 to disable the Apparatus Diagnostic Test.	None.	
	Place maintenance test phone on-hook.	None.	

Table 4.19 Siemens DYAD Telephone Displayable Characters

ORDER	CHARACTER	ORDER	CHARACTER
1.	! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! !	33.	A A A A A A A A A A A A A A A A A
2.	" " " " " " " " " " " " " " " " "	34.	B B B B B B B B B B B B B B B B B
3.	# # # # # # # # # # # # # # # # #	35.	C C C C C C C C C C C C C C C C C
4.	$ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $	36.	D D D D D D D D D D D D D D D D D
5.	%%%%%%%%%%%%%%%%%	37.	E E E E E E E E E E E E E E E E E
6.	& & & & & & & & & & & & & & & & &	38.	F F F F F F F F F F F F F F F F F
7.	' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	39.	G G G G G G G G G G G G G G G G G
8.	(((((((((((((((((	40.	H H H H H H H H H H H H H H H H H
9.	)))))))))))))))))	41.	I I I I I I I I I I I I I I I I I
10.	* * * * * * * * * * * * * * * * *	42.	J J J J J J J J J J J J J J J J J
11.	+ + + + + + + + + + + + + + + + +	43.	K K K K K K K K K K K K K K K K K
12.	• • • • • • • • • • • • • • • • •	44.	L L L L L L L L L L L L L L L L L
13.	—————————————————	45.	MMMMMMMMMMMMMMMMM
14.	. . . .	46.	N N N N N N N N N N N N N N N N N
15.	/ / / / / / / / / / / / / / / / /	47.	O O O O O O O O O O O O O O O O O
16.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	48.	P P P P P P P P P P P P P P P P P
17.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	49.	Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q
18.	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	50.	R R R R R R R R R R R R R R R R R
19.	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	51.	S S S S S S S S S S S S S S S S S
20.	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	52.	T T T T T T T T T T T T T T T T T
21.	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	53.	U U U U U U U U U U U U U U U U U
22.	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	54.	V V V V V V V V V V V V V V V V V
23.	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	55.	WWWWWWWWWWWWWWWWW
24.	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	56.	X X X X X X X X X X X X X X X X X
25.	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	57.	Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y
26.	: : : : : : : : : : : : : : : : :	58.	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z
27.	; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;	59.	[[[[[[[[[[[[[[[[[
28.	< < < < < < < < < < < < < < < < <	60.	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
29.	= = = = = = = = = = = = = = = = =	61.	]]]]]]]]]]]]]]]]]
30.	> > > > > > > > > > > > > > > > >	62.	^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^
31.	? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?	63.	_ _ _ _ _ _ _ _
32.	@@@@@@@@@@@@@@@@@		