Siemens Practices
Maintenance Series

A30808-X5130-D110-1-B920
Issue 1, May 1986

SATURN® IIE EPABX

MAINTENANCE AND TROUBLESHOOTING

Issued by Office Systems Group
5500 Broken Sound Boulevard N.W., Boca Raton, Florida 33431 (305) 994-8100 • Telex: 515052

Siemens Information Systems, Inc. Printed in U.S.A.

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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.

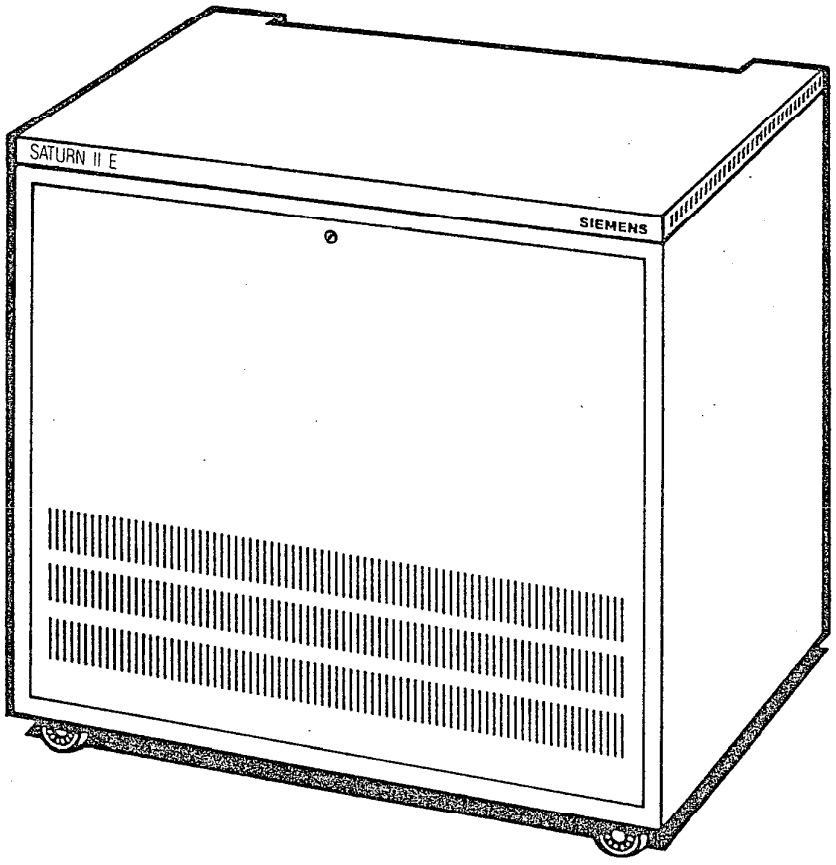

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Figure 1.00 SATURN IIE System Basic Cabinet

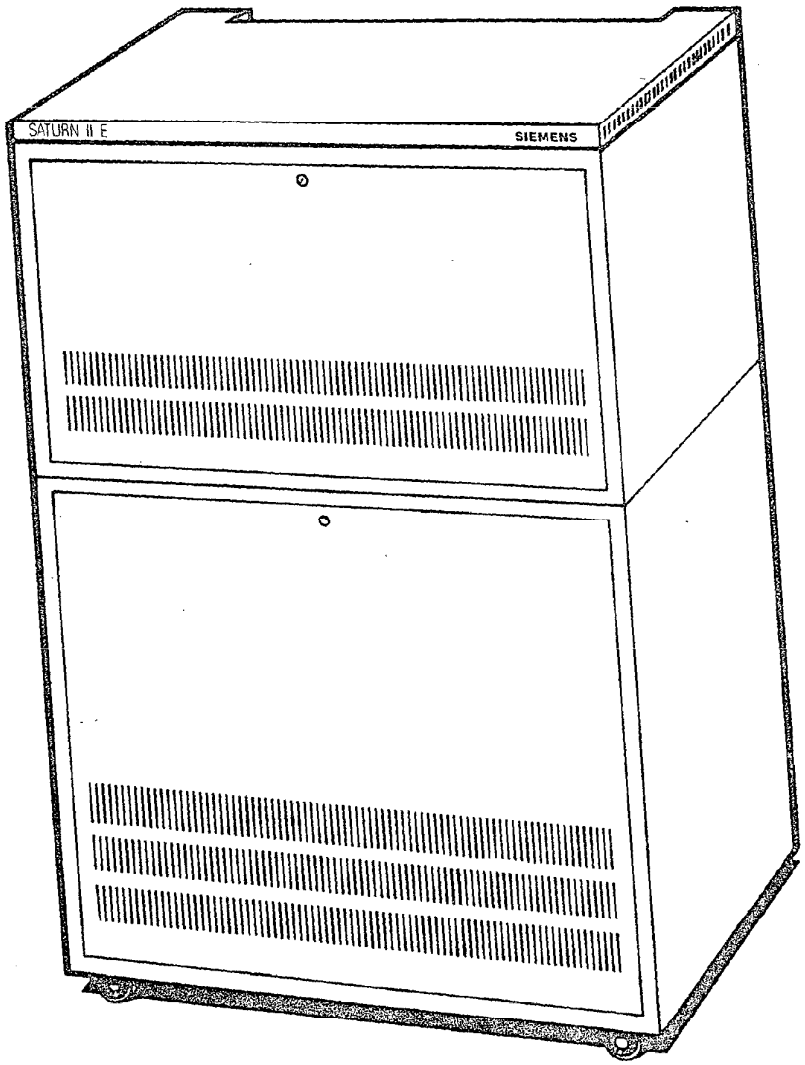

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Figure 1.01 SATURN IIE System with Basic and Expansion Cabinets

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

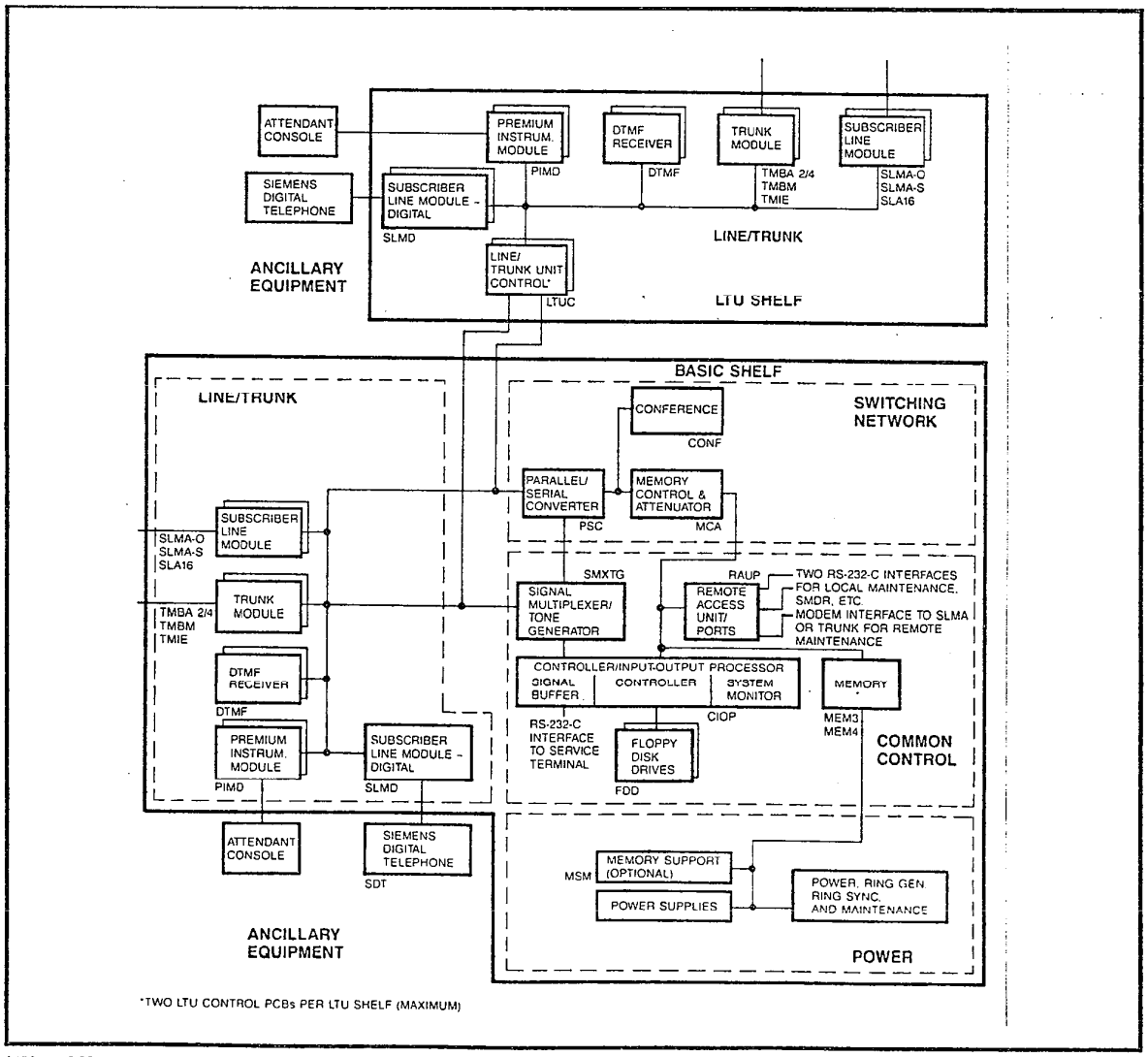

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Figure 2.00 SATURN IIE System Block Diagram

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.

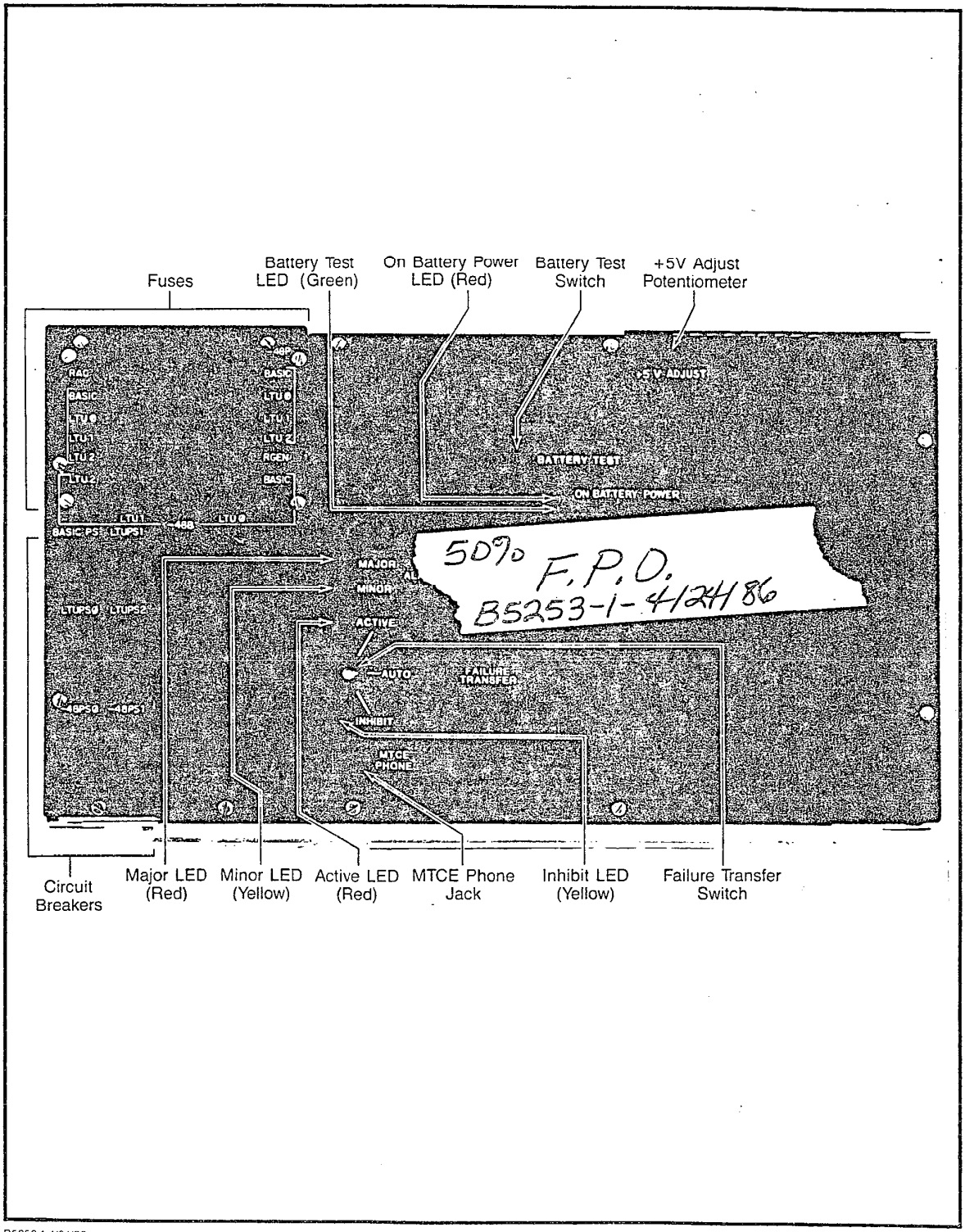

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Figure 2.01 Power System Unit, (PSU) Front View

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.

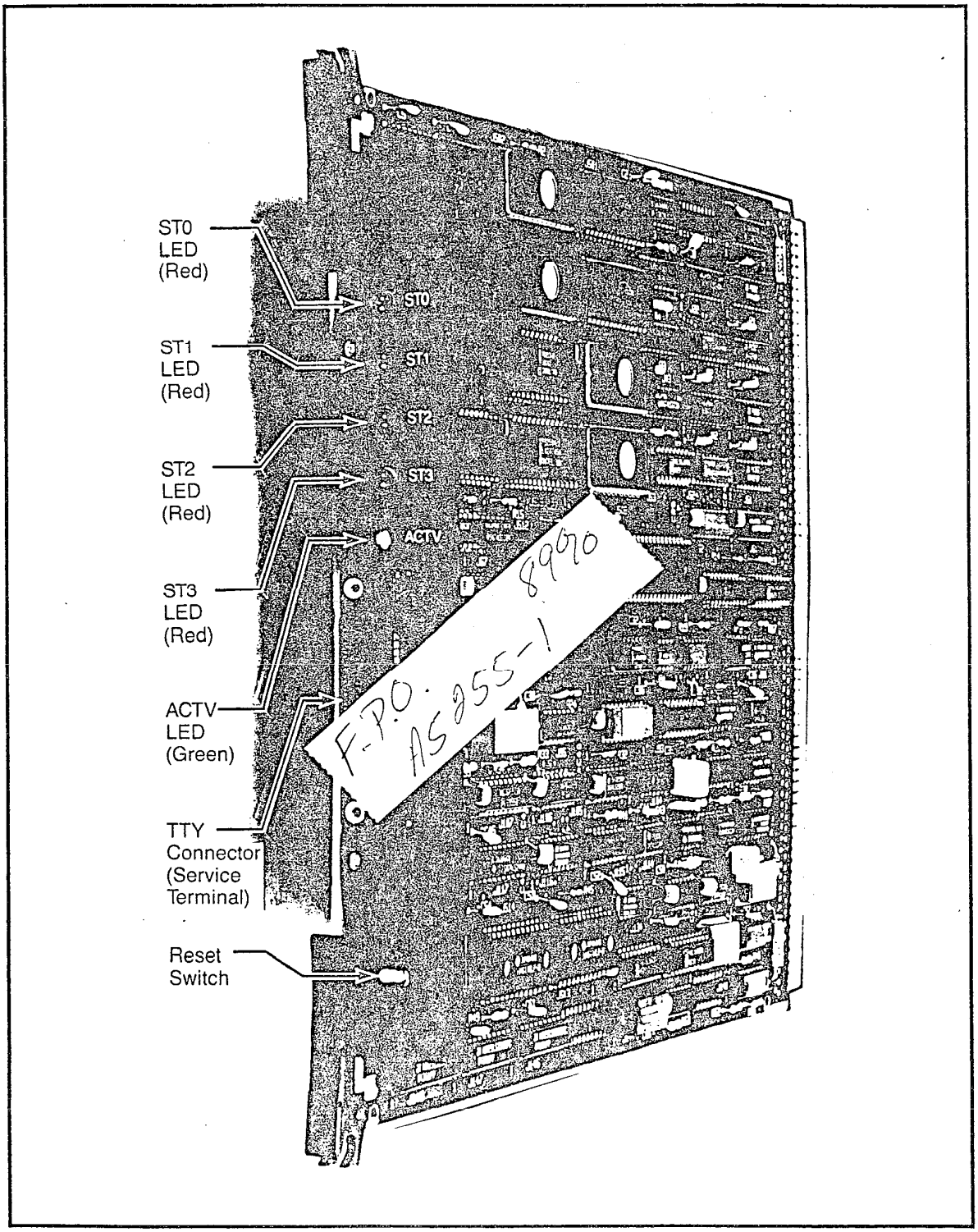

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Figure 2.02 Controller/Input-Output Processor Printed Circuit Board (CIOP)

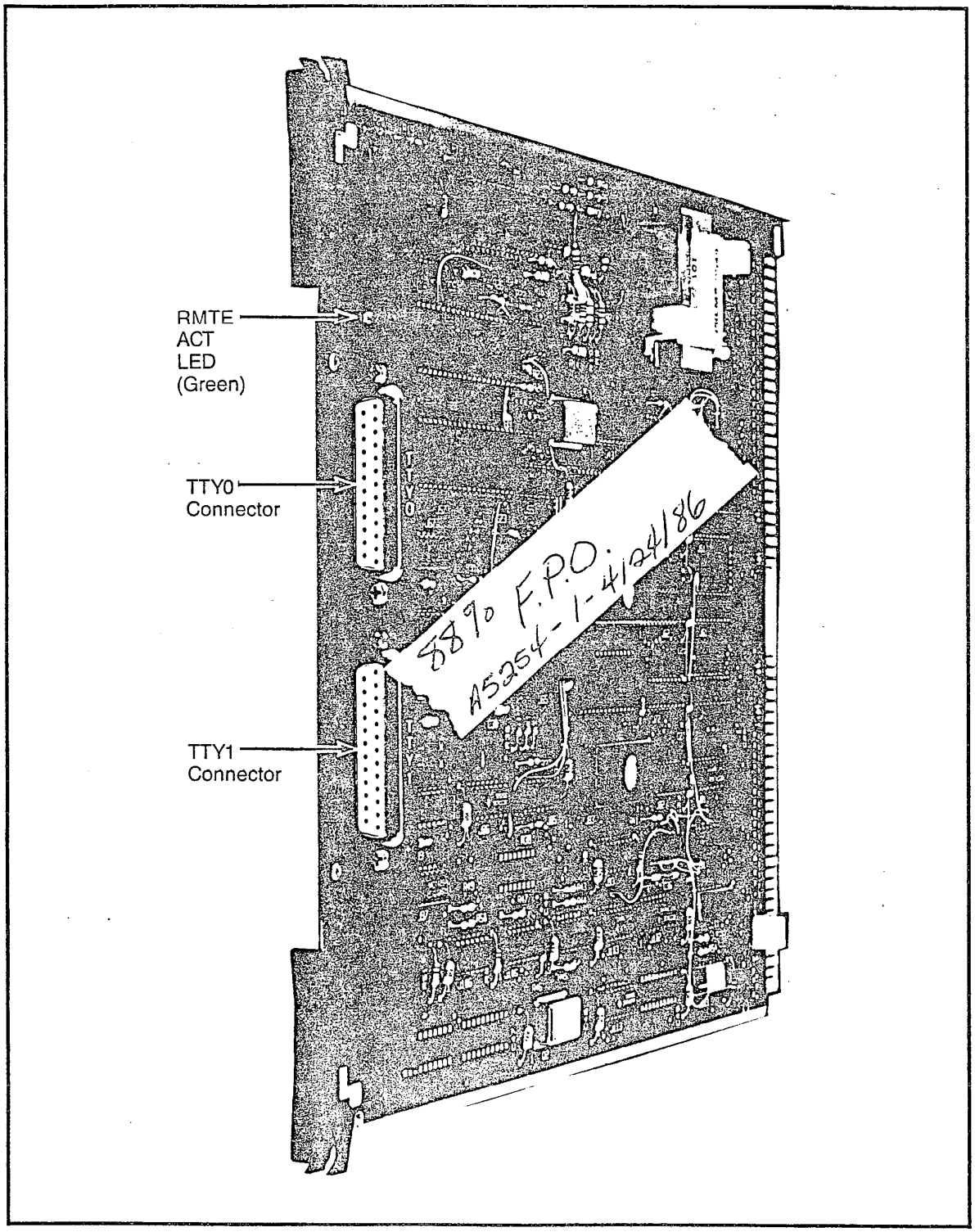

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Figure 2.03 Remote Access Unit/Ports Printed Circuit Board (RAUP)

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 Telephone – 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.

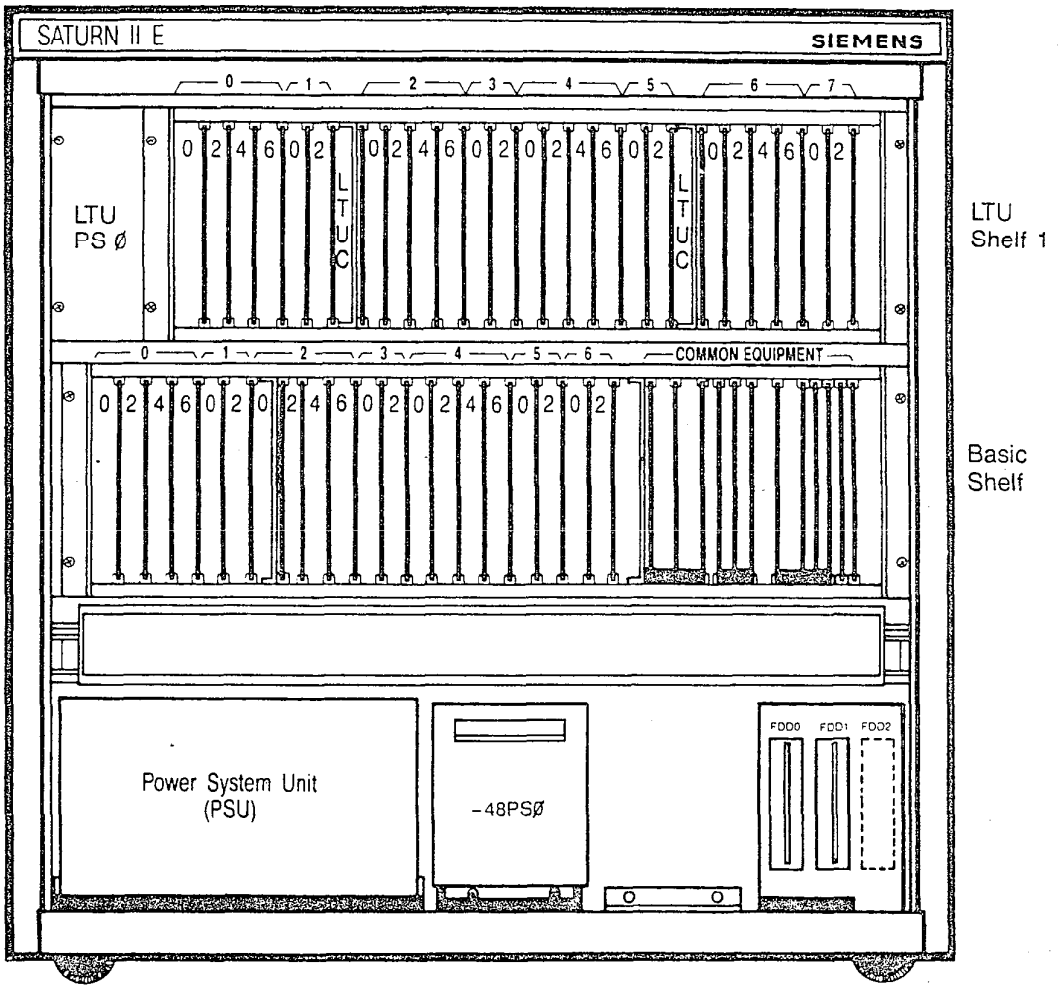

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Figure 2.04 SATURN IIE EPABX Basic Cabinet (Front View)

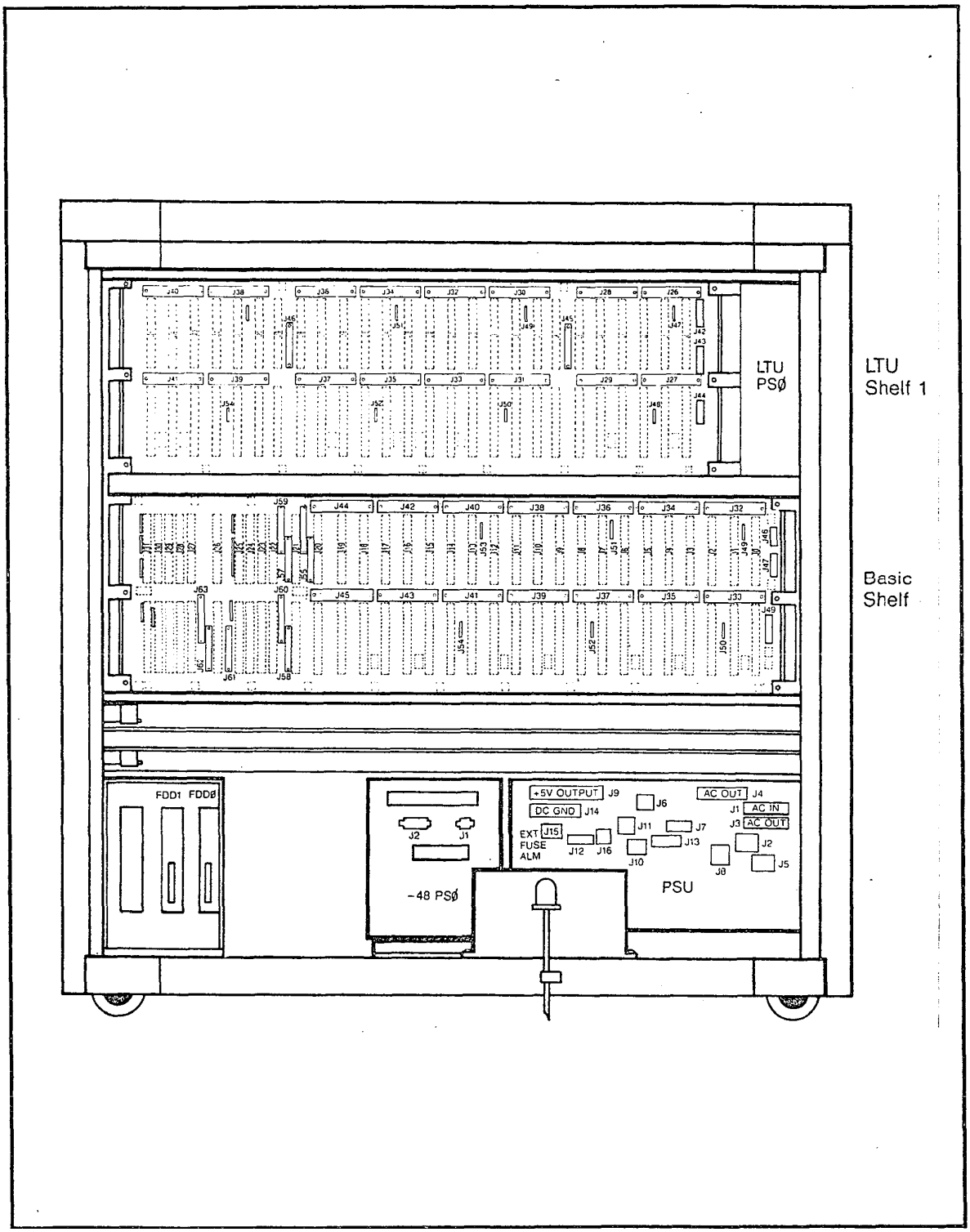

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Figure 2.05 SATURN IIE EPABX Basic Cabinet (Rear View)

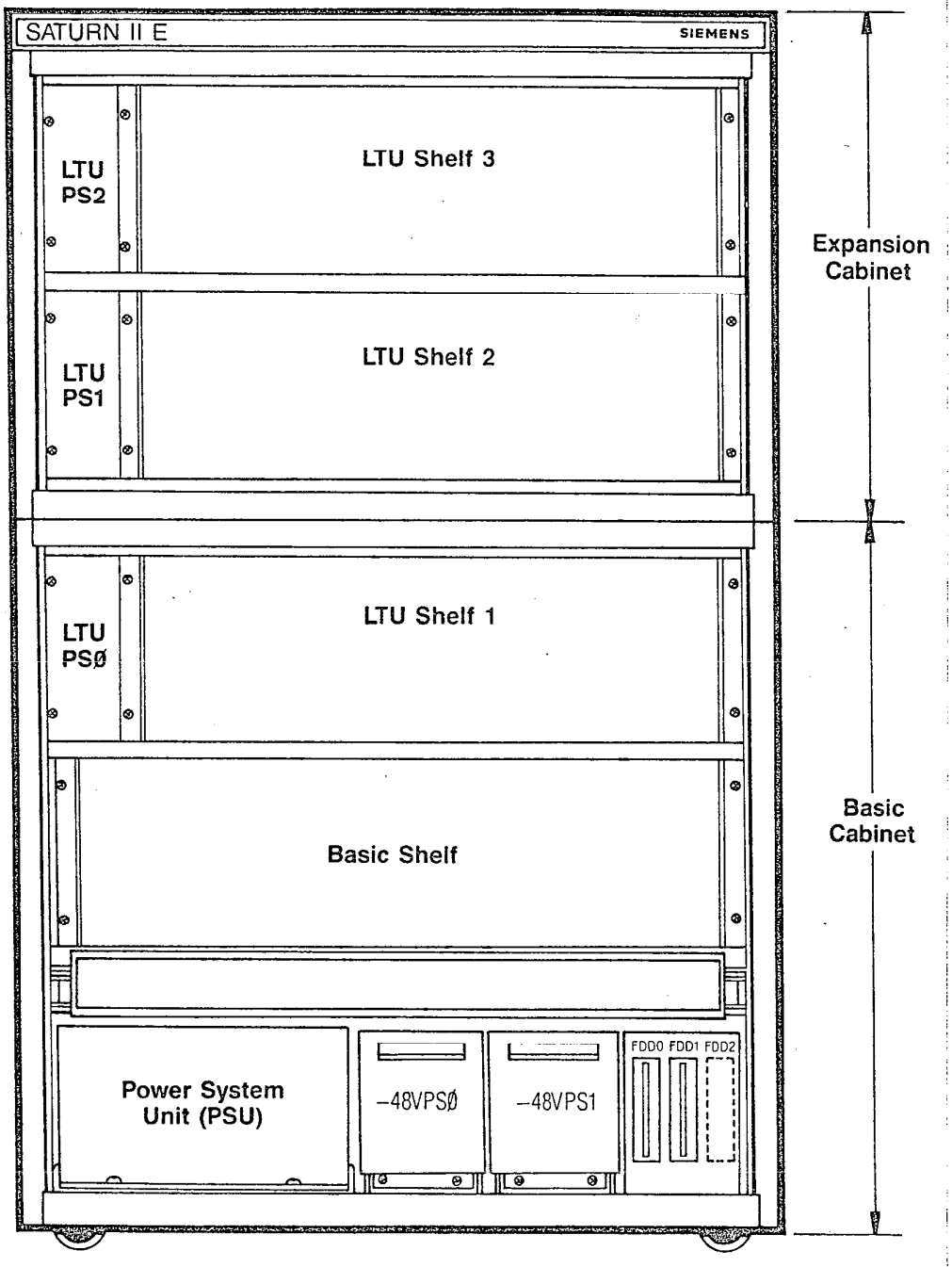

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Figure 2.06 SATURN IIE EPABX Basic and Expansion Cabinets (Front View)

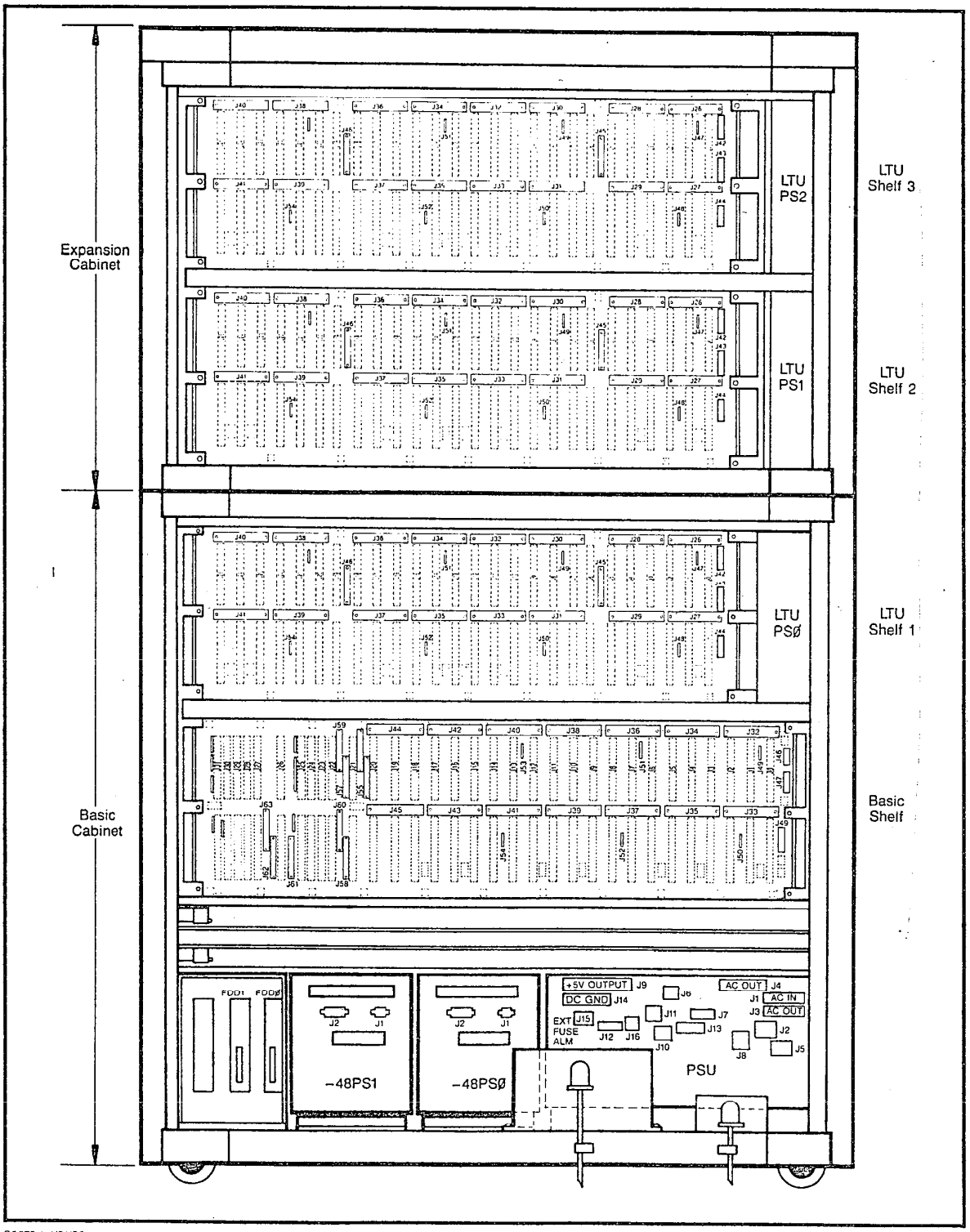

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Figure 2.07 SATURN IIE EPABX Basic and Expansion Cabinets (Rear View)

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.

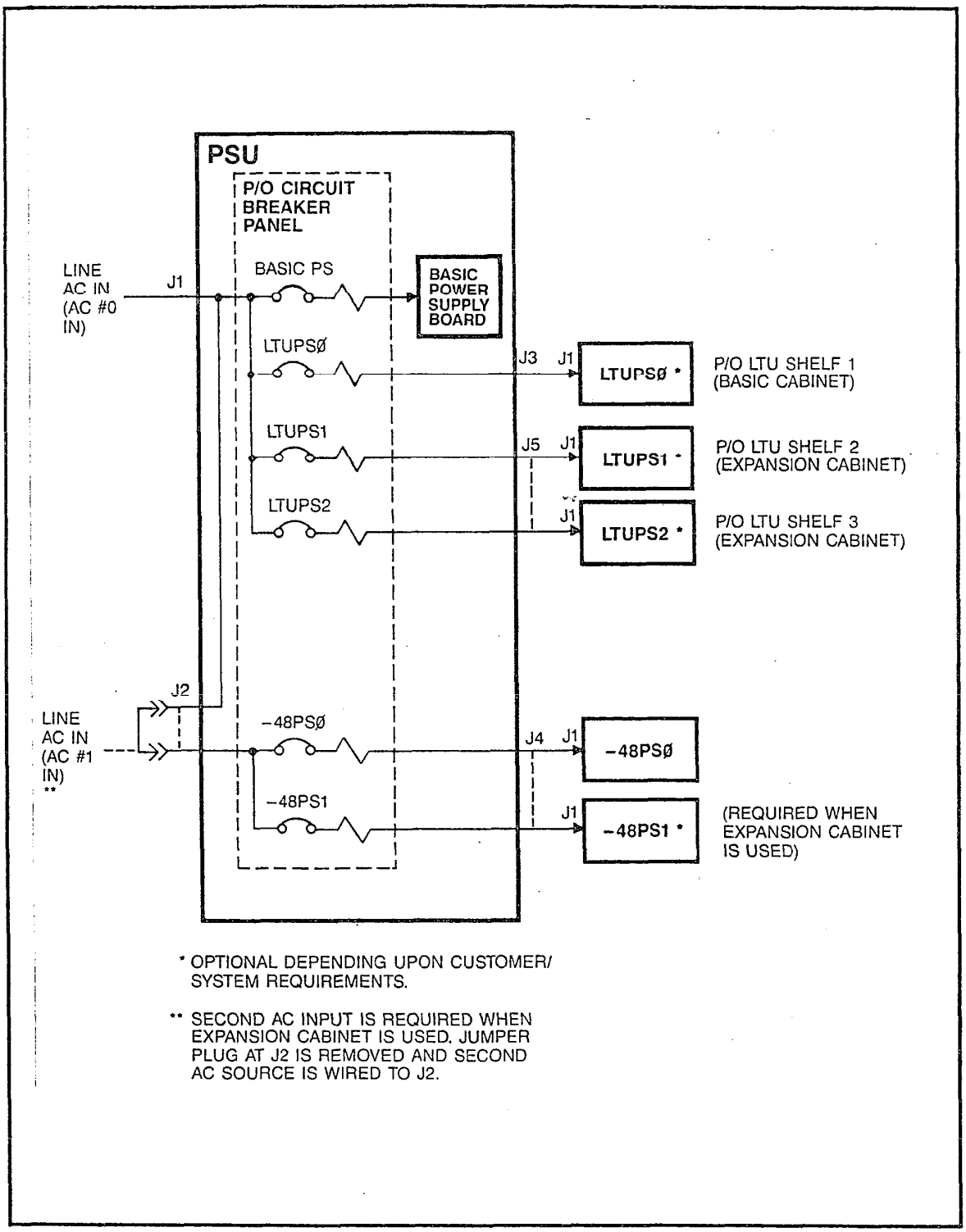

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Figure 2.08 Block Diagram of AC Input to Power Supply Assemblies and Modules

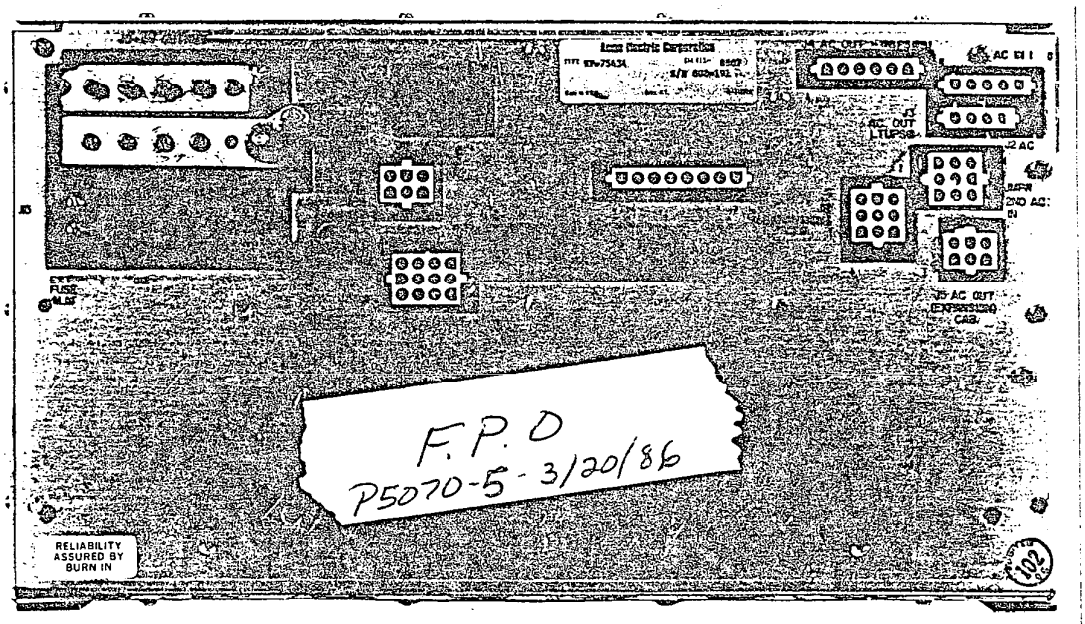

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Figure 2.09 Layout of Connectors and Terminals on PSU Rear Panel

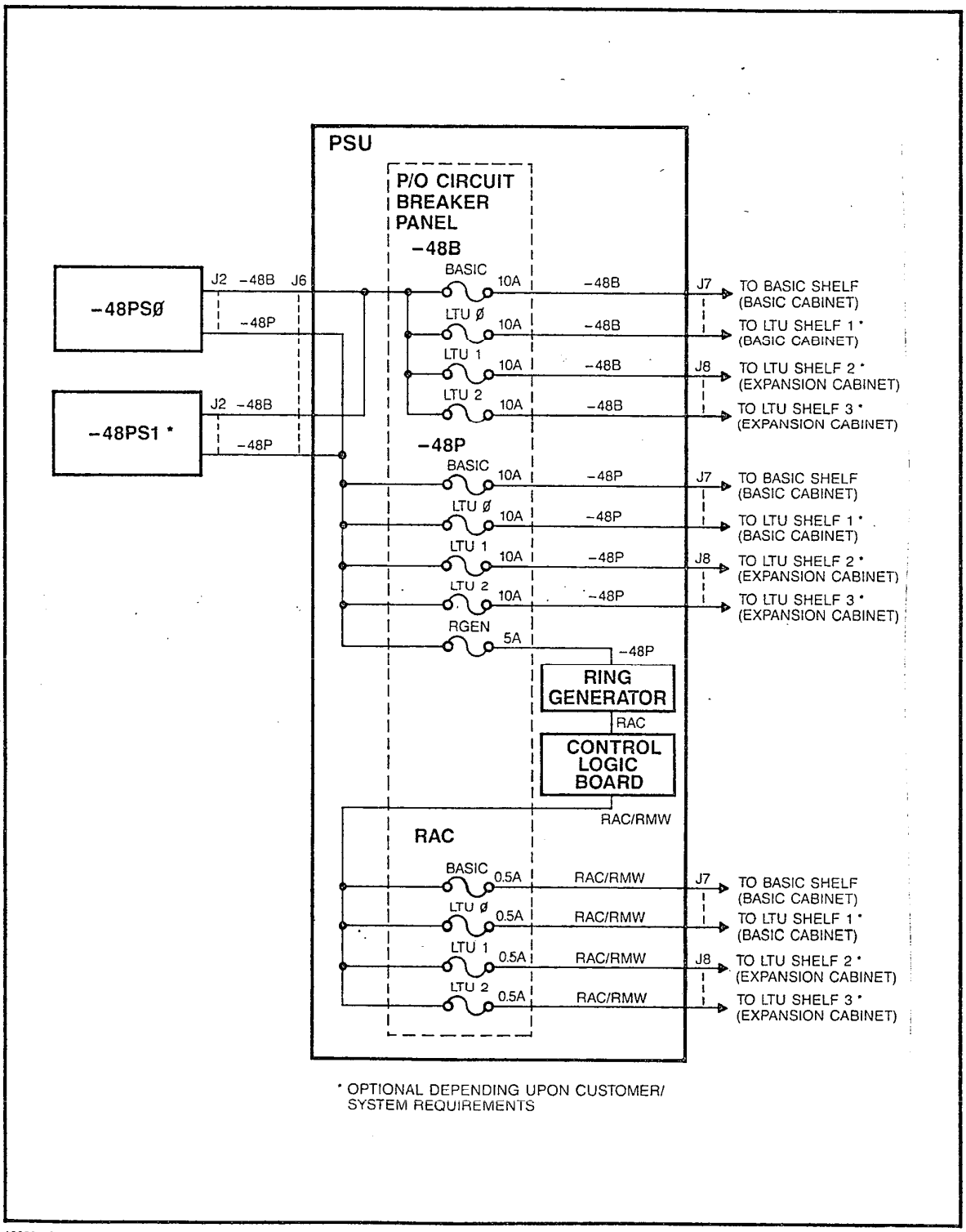

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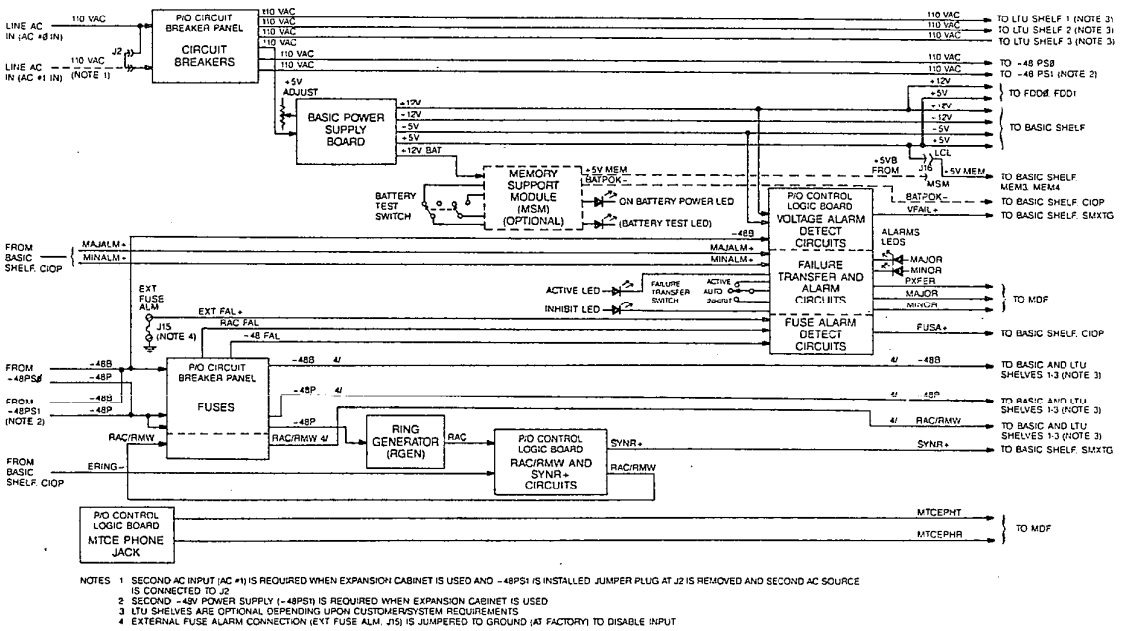
Figure 2.10 Fusing of -48 Volt Outputs from -48PS0 and -48PS1

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 ALM0 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.

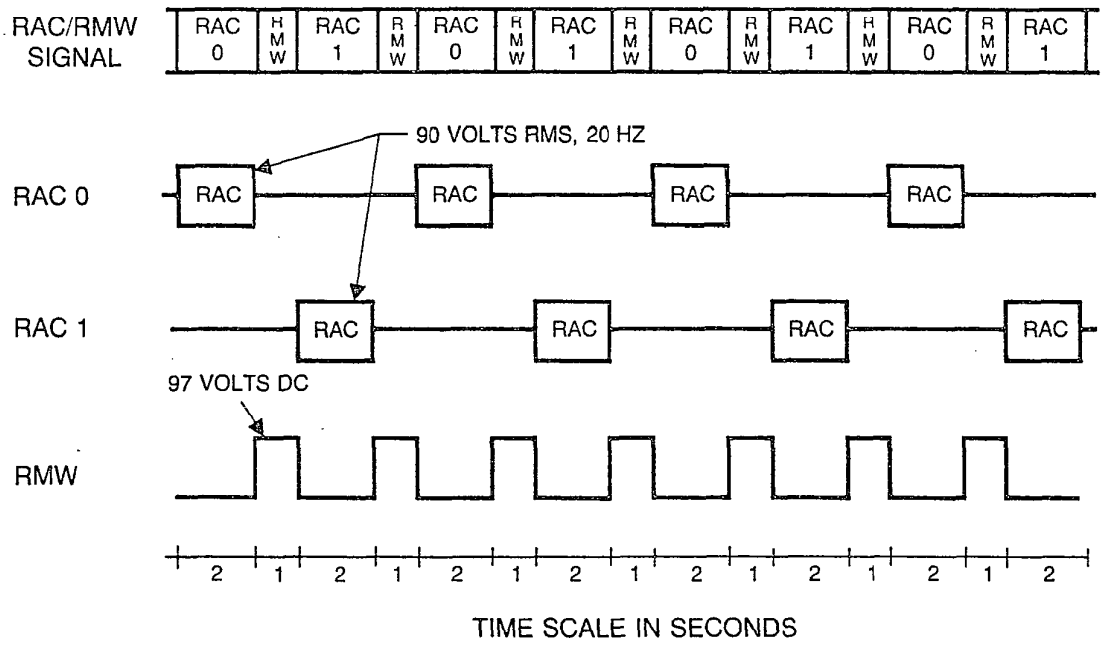
With the FAILURE TRANSFER mode select switch in the ACTIVE position, failure transfer is initiated regardless of the status of the monitored voltages and MAJALM+ signal.

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.



A2279-5-5/25/83

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.

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. Shut-down 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 ± 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

<table><tr><th>aa</th><th>I/O Device</th><th>PCB</th></tr><tr><td>00</td><td>Floppy Disk Drive 1</td><td>CIOP</td></tr><tr><td>01</td><td>Floppy Disk Drive 2</td><td>CIOP</td></tr><tr><td>02</td><td>Floppy Disk Drive 3</td><td>CIOP</td></tr><tr><td>03</td><td>Service Term'l(TTY)</td><td>CIOP</td></tr><tr><td>04</td><td>RS232C CH 0 (TTY0)</td><td>RAUP</td></tr><tr><td>05</td><td>RS232C CH 1 (TTY1)</td><td>RAUP</td></tr><tr><td>06</td><td>Modem</td><td>RAUP</td></tr></table></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 ** +12Vdc −12Vdc	- 4.9 to − 5.2 + 4.9 to + 5.2 +11.3 to +12.7 -11.3 to -12.7	J10-1 J9-1, -2, -3, -4; J11-1, -2; J6-3 J10-10, -11; J11-4, -5; J6-6 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 -48P	 −48Vdc −48Vdc	 -43.0 to -53.0 -43.0 to -53.0	 J2-1 J2-3
-48PS1 * (if an Expansion Cabinet is included) -48B -48P	 −48Vdc −48Vdc	 -43.0 to -53.0 -43.0 to -53.0	 J2-1 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.

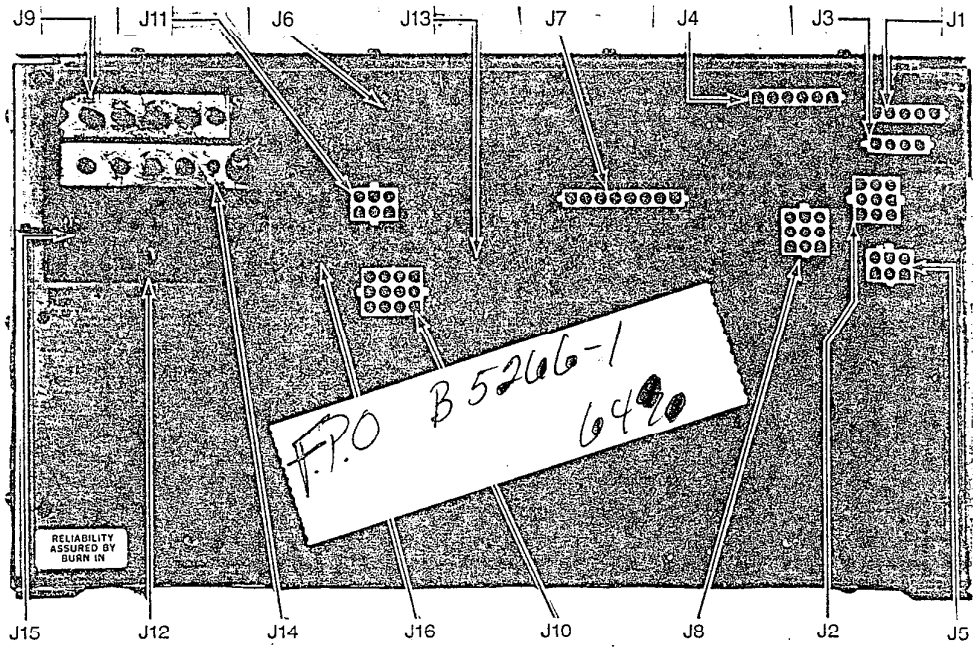
(2) If the voltage remains low, replace the PSU. (If optional MSM is installed, adjust PSU +5Vdc output versus MSM output as specified in Table 4.05.)

(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–		J2–		J3–		J4–		J5–	
1,2	Ac line	1-3	Ac line	1	Ac line	1,2	Ac line	1,2	Ac line
3,4	Ac neutral	4-6	Ac neutral	2	Ac neutral	3,4	Ac neutral	3	Ac ground
5	Ac ground	7	Ac ground	3	Not used	5,6	Ac ground	4,5	Ac neutral
		8,9	Not used	4	Ac ground			6	Ac ground
J6–		J7–		J8–		J9–		J10–	
1,2	−48Vdc**	1,2	−48Vdc**	1,2	−48Vdc**	1-4	+5Vdc	1	−5Vdc
3	+5Vdc	3,4	−48Vdc***	3	−48Vdc***			2	Not used
4,5	−48Vdc***	5	Not used	4,5	Not used			3	+5Vdc (+5B)
6	+12Vdc	6,7	RAC/RMW	6	−48Vdc***			4	Not used
7,8	Ground	8	Not used	7,8	RAC/RMW			5-8	Ground
9	RAC return			9	Not used			9	Not used
10-12	Ground							10,11	+12Vdc
								12	−12Vdc
J11–		J12		J13		J14–		J15	
1-2	+5Vdc	Signal leads to/from Basic Shelf		PXFER, MAJOR, MINOR alarm contacts; MTCE PHONE connections to MDF		1-4	Dc ground	External fuse alarm connections	
3	Ground								
4,5	+12Vdc								
6	Ground								

J16
LCL +5Vdc
MSM +5Vdc (+5B)*

* Present if optional MSM is installed.
** −48P
*** −48B

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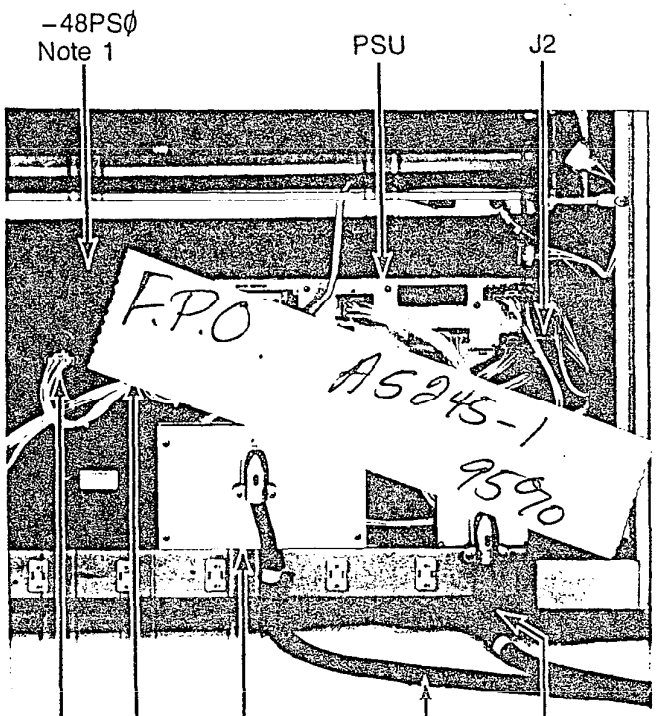
Figure 4.00 Power System Unit (PSU) Power Connections



J2/P2 Pin	J1/P1 Pin	Junction Box	LINE AC IN (AC#Ø IN)	LINE AC IN (AC#1 IN) Note 2
1 −48Vdc (−48B)	1 Ac Line			
2 Ground	2 Ac Neutral			
3 −48Vdc (−48P)	3 Ac Ground			
4 Ground				

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.

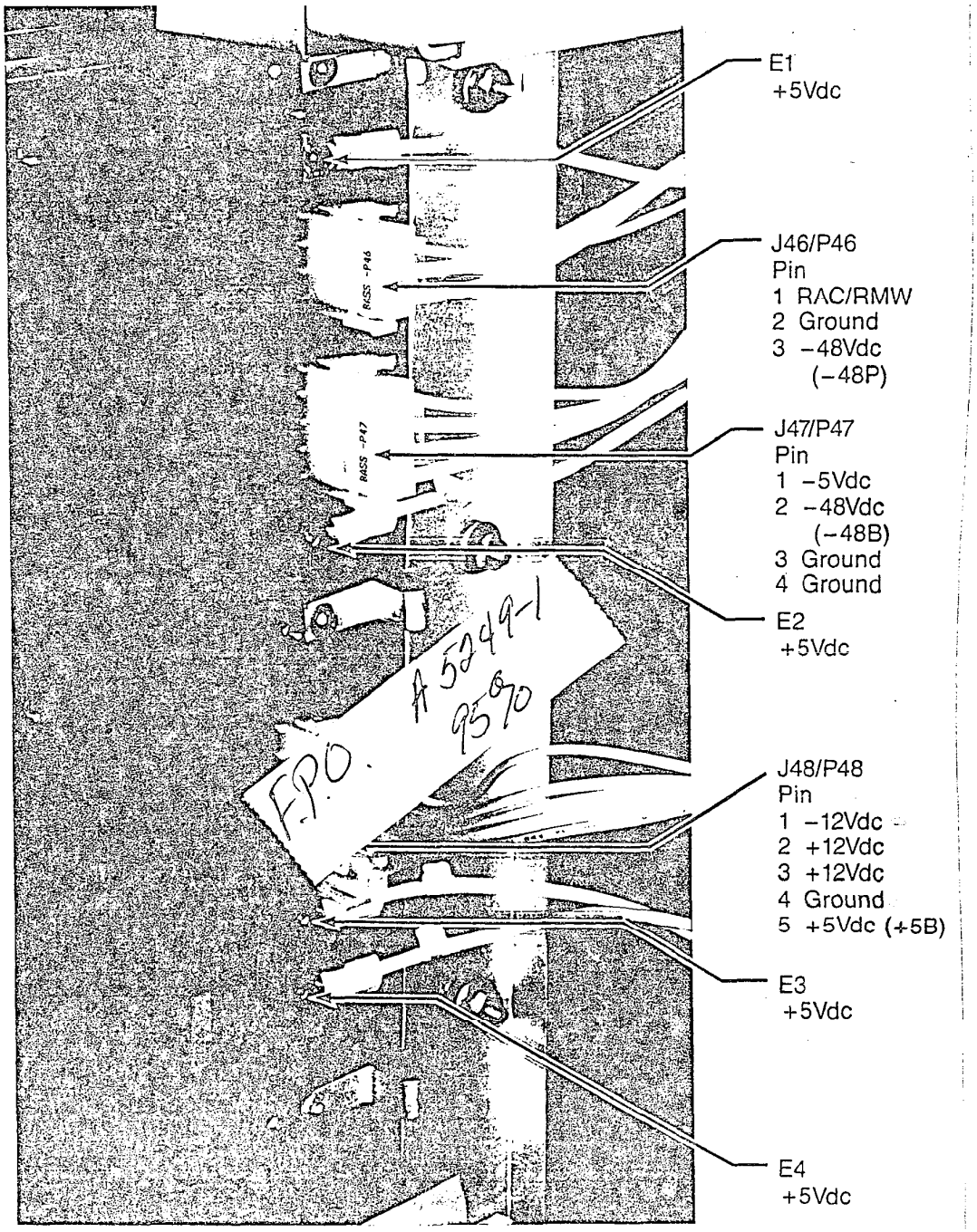

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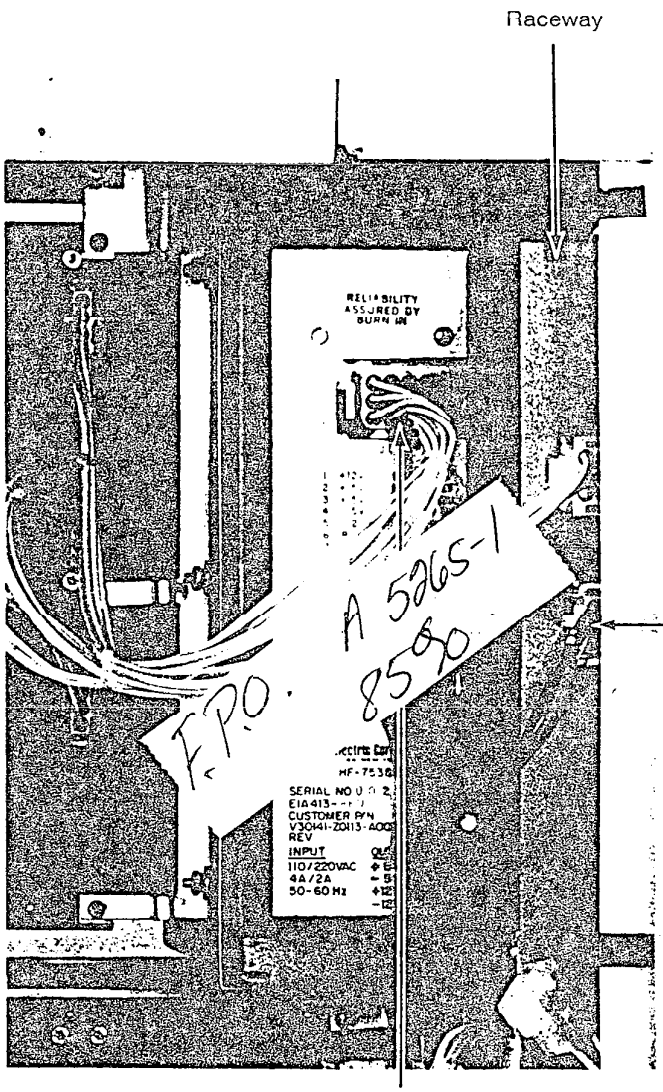
Figure 4.02 Basic Shelf Backplane Power Connections



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

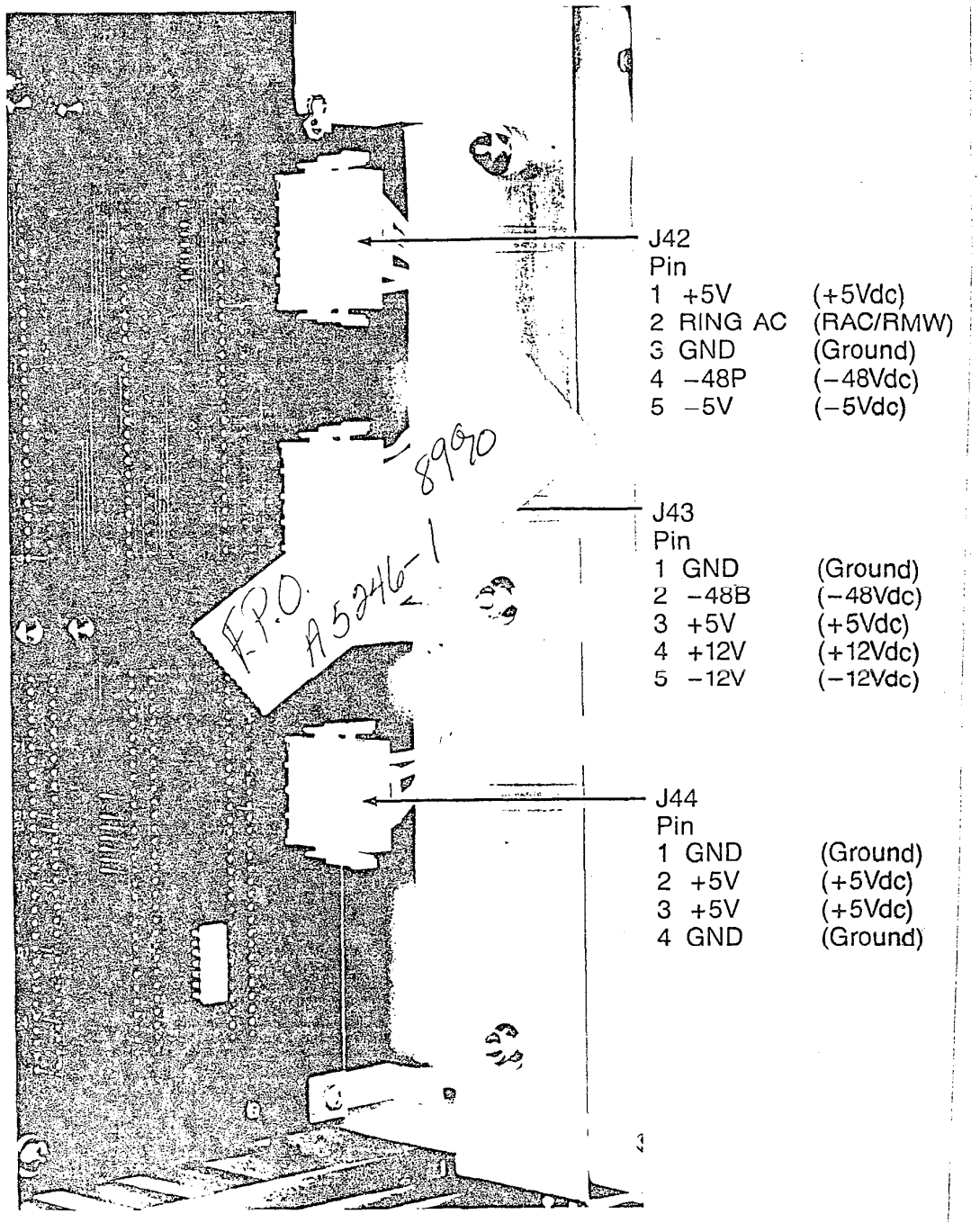

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Figure 4.04 LTU Shelf Backplane Power Connections

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.	

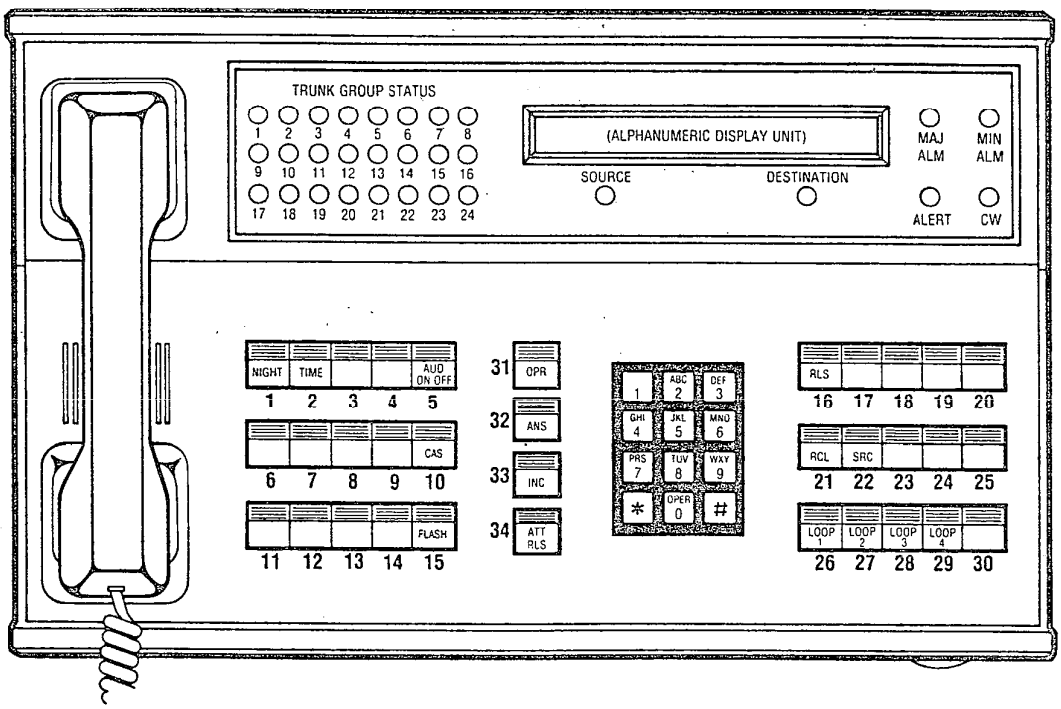

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Figure 4.05 Attendant Console Keypad and Feature Button Depression Sequence

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.	

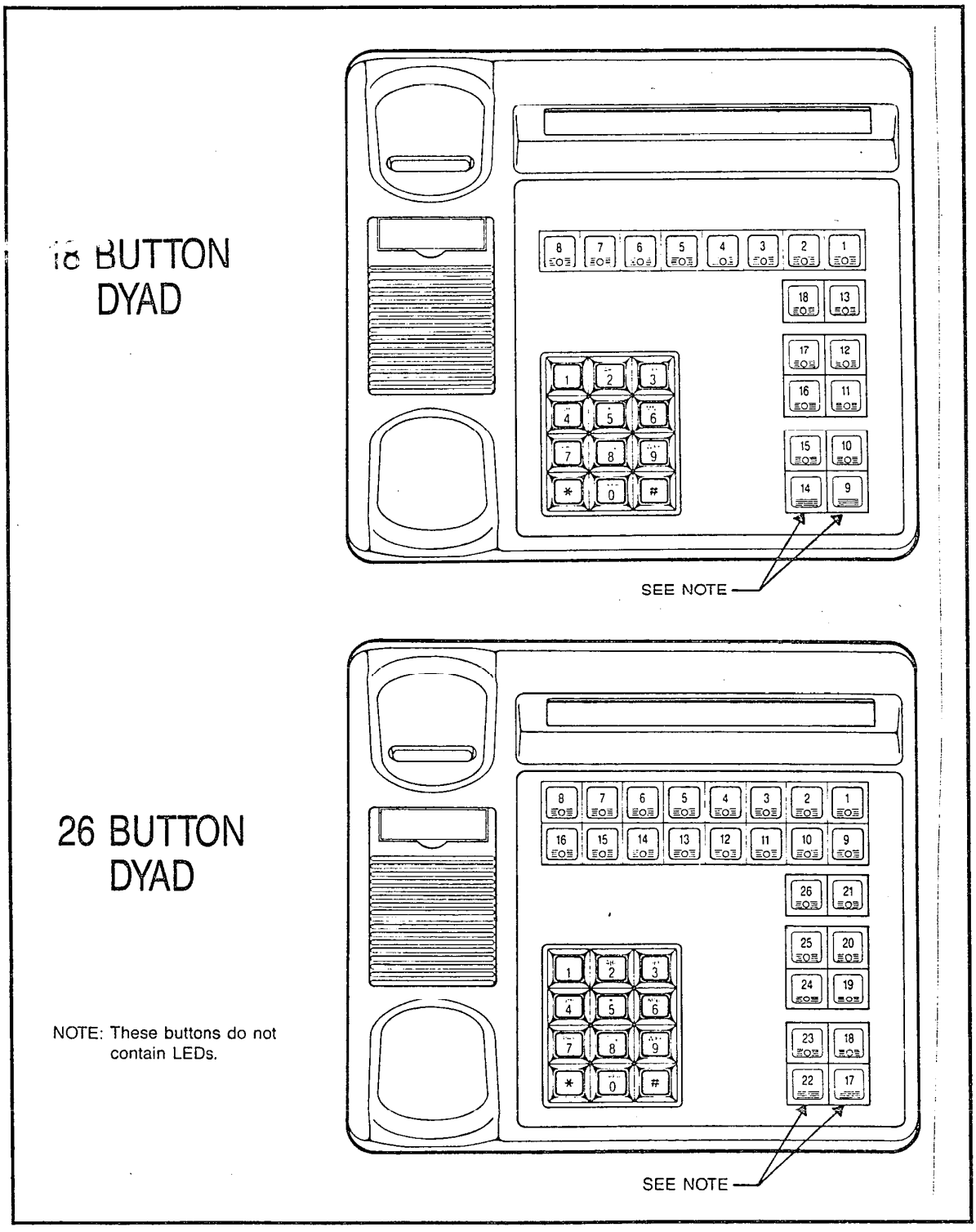

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Figure 4.06 Siemens DYAD Telephone Button Depression Sequence

Table 4.17 Siemens JR-DYAD Telephone Button Test

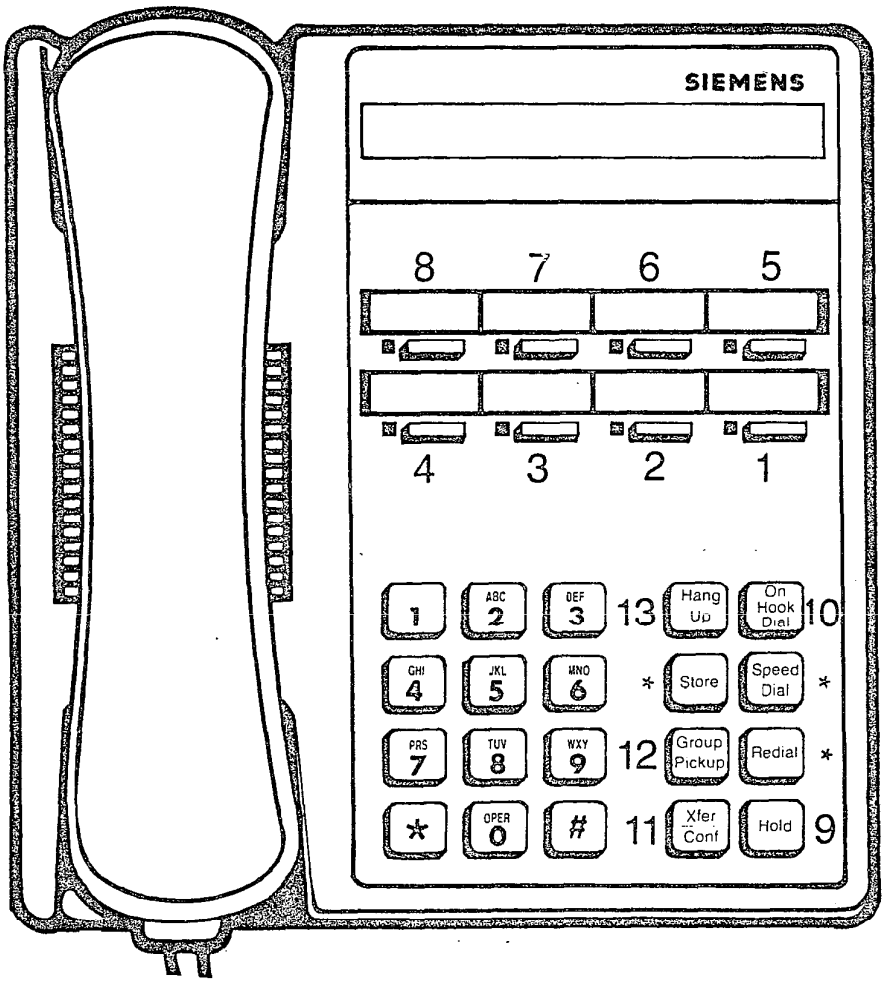
NOTES: 1. If the system option flag TSTDIAG has been enabled in the data base or the Siemens Digital Telephone under test is class-marked with TSTAPP feature, the maintenance test phone is not required to enable or disable the Apparatus Diagnostic routines; therefore, perform steps 5 through 9.

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.

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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
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.	W W W W W W W W W W W W W W W W
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.	@ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @		