
SX-5[®]

**Communications
System**



SX-5*
COMMUNICATIONS SYSTEM
DOCUMENTATION INDEX

1. GENERAL

1.02 This section lists MITEL Standard Practices which have been issued pertaining to the SX-5 Communications System.

2. DOCUMENTATION INDEX

2.01 The complete set of practices are listed in Table 2-1.

TABLE 2-1
DOCUMENTATION INDEX

Section	Title
MITL9103-098-100-NA	General Description
MITL9103-098-105-NA	Features and Services Description
MITL9103-098-150-NA	Ordering Information
MITL9103-098-180-NA	Engineering Information
MITL9103-098-200-NA	Shipping, Receiving and Installation Procedures
MITL9103-098-205-NA	Programming and Installation Forms
MITL9103-098-320-NA	System Test
MITL9103-098-350-NA	Troubleshooting

SX-5*

COMMUNICATIONS SYSTEM

GENERAL DESCRIPTION

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2. GENERAL DESCRIPTION

2.01 The SX-5 is an extremely compact and reliable electronic telephone communications system employing solid-state space division switching, and stored program control. The system can accommodate two Central Office trunks and six extensions. The SX-5 is compatible with most existing Private Branch Exchanges (PBX's), and Central Office (CO) equipment. The system provides:

- Extremely small size (approximately 0.34 cubic feet) (9,628 cu. cm))
- Low power consumption (TYP. 0.4 amps)
- Simultaneous use of DTMF and Rotary Dial extensions
- DTMF to Dial Pulse Conversion
- Direct Trunk Select or Trunk Group Operation
- Simple installation and Maintenance
- Many cost effective standard features
- Console-less operation
- Optional reserve power unit

2.02 The SX-5 consists of a single cabinet, holding the switching circuitry and power supply. System power is 110 volts or 220 volts at 60 or 50 Hz, fed through the power cable from a commercial power outlet. All other connections to the system are made using standard telephone connection cable and screw-down terminals. Refer to Fig. 2-1, SX-5 Equipment Cabinet. Optionally, the two CO trunks may be connected via standard RJ11C connectors. The Main Card, which contains the switching circuitry, is accessible at two levels. The first level of entry allows access to the terminal strip, LED's, and system switches. The second level of entry allows module replacement by a qualified technician.

1. GENERAL

Introduction

1.01 This section contains a brief description of the SX-5 Communications System, and its features and services.

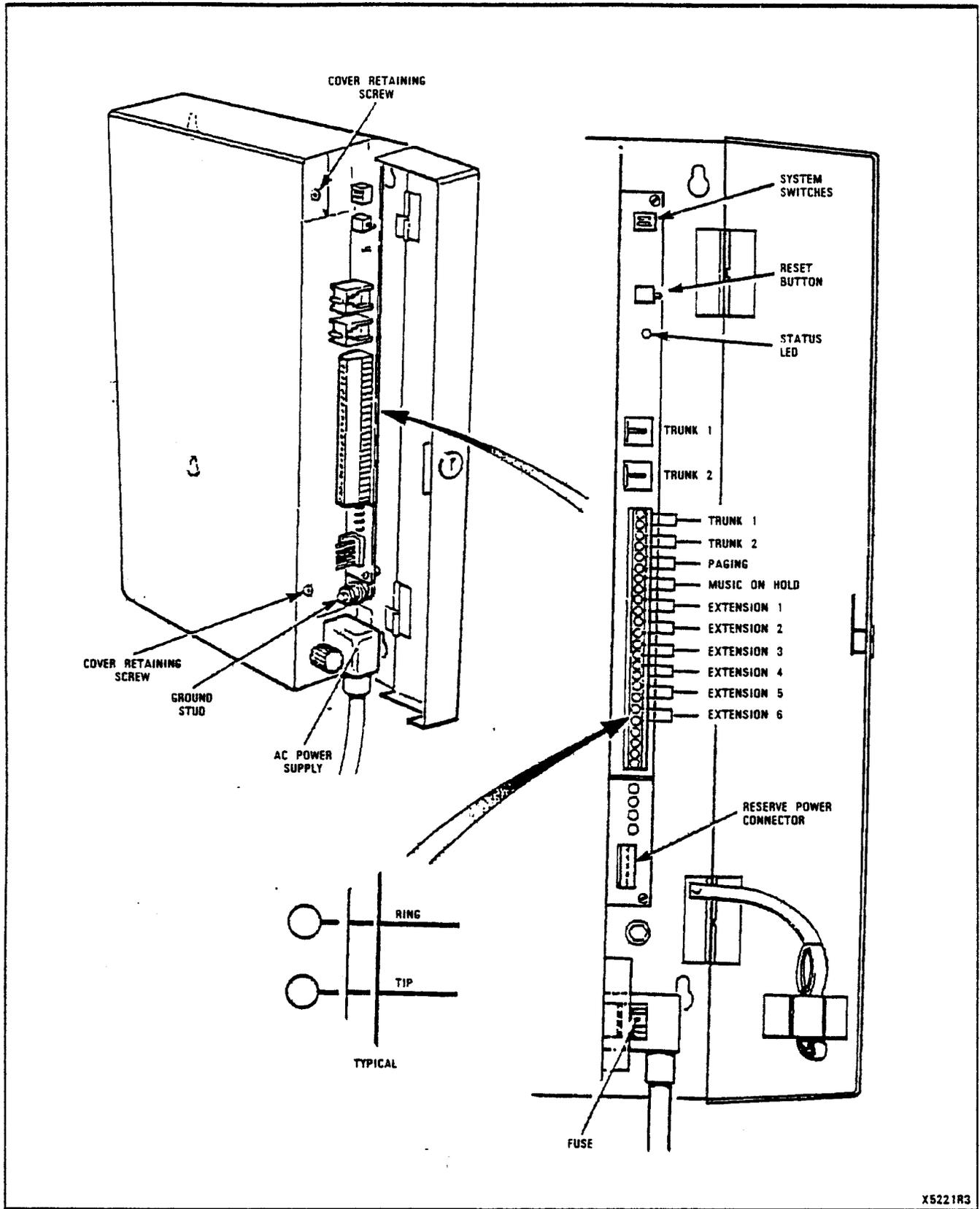


Fig. 2-1 SX-5 Equipment Cabinet

2.03 The extremely compact size and attractive design of the SX-5 allows the system to be mounted in any office or home environment.

Reserve Power

2.04 If required, the SX-5 may be connected to a reserve power supply which will maintain system operation for a minimum of 45 minutes (average two hours).

Maintenance

2.05 The SX-5 is shipped fully equipped from the factory. In case of a malfunction, maintenance can be simplified to system replacement or, if module faults are identified, the second level of entry allows module replacement by a qualified technician. Refer to Section 8 Installation and Maintenance Requirements of this practice.

Note: The second level of entry should only be attempted by a qualified technician.

Documentation

2.06 Table 2-1 lists all MITEL practices associated with the SX-5 Communications System.

3. PHYSICAL DESCRIPTION

Card Enclosure

3.01 The SX-5 consists of a single enclosure, containing the printed circuit cards, with a lockable access door on the right-hand side. The overall dimensions of the system are shown in

Fig. 3-1. The total weight of the system is 12.5 lbs. (5.7 kg). All connections to the system, power cord and standard telephone cable pairs enter at the bottom of the SX-5 access door and are terminated directly on the terminals at the right-hand edge of the Main Card.

Note: The SX-5 and all primary and reserve power supplies should be grounded in accordance with accepted practices to prevent damage to the system. MITEL provides technical bulletins, as well as the detailed installation information contained in Section MITL9103-098-200-NA, concerning correct installation practices. These are available on request. Adherence to the practices outlined in these bulletins will minimize the possibility of damage to electronic devices (such as the SX-5) from static discharge and AC power surges.

Refer to:

- CTIB-80-20-100/200-001, Installation Practices and Protection Techniques.
- 9180-960-000-NA, Customer Bulletin (Grounding).
- 9180-960-001-NA, Customer Bulletin (Surge Protection).
- MITL9103-098-200-NA, Shipping, Receiving and Installation Procedures.

System Switches

3.02 The SX-5 has two system switches located on the upper right-hand side of the Main Card. The top most switch is the Programming Switch, Switch 2 (SW2). This switch enables programming and is also used to reload the

**TABLE 2-1
SX-5 DOCUMENTATION**

SECTION	TITLE
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MITL9103-098-105-NA	Features and Services Description
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MITL9103-098-205-NA	Programming
MITL9103-098-320-NA	Extension Test Procedures
MITL9103-098-350-NA	Maintenance and Troubleshooting

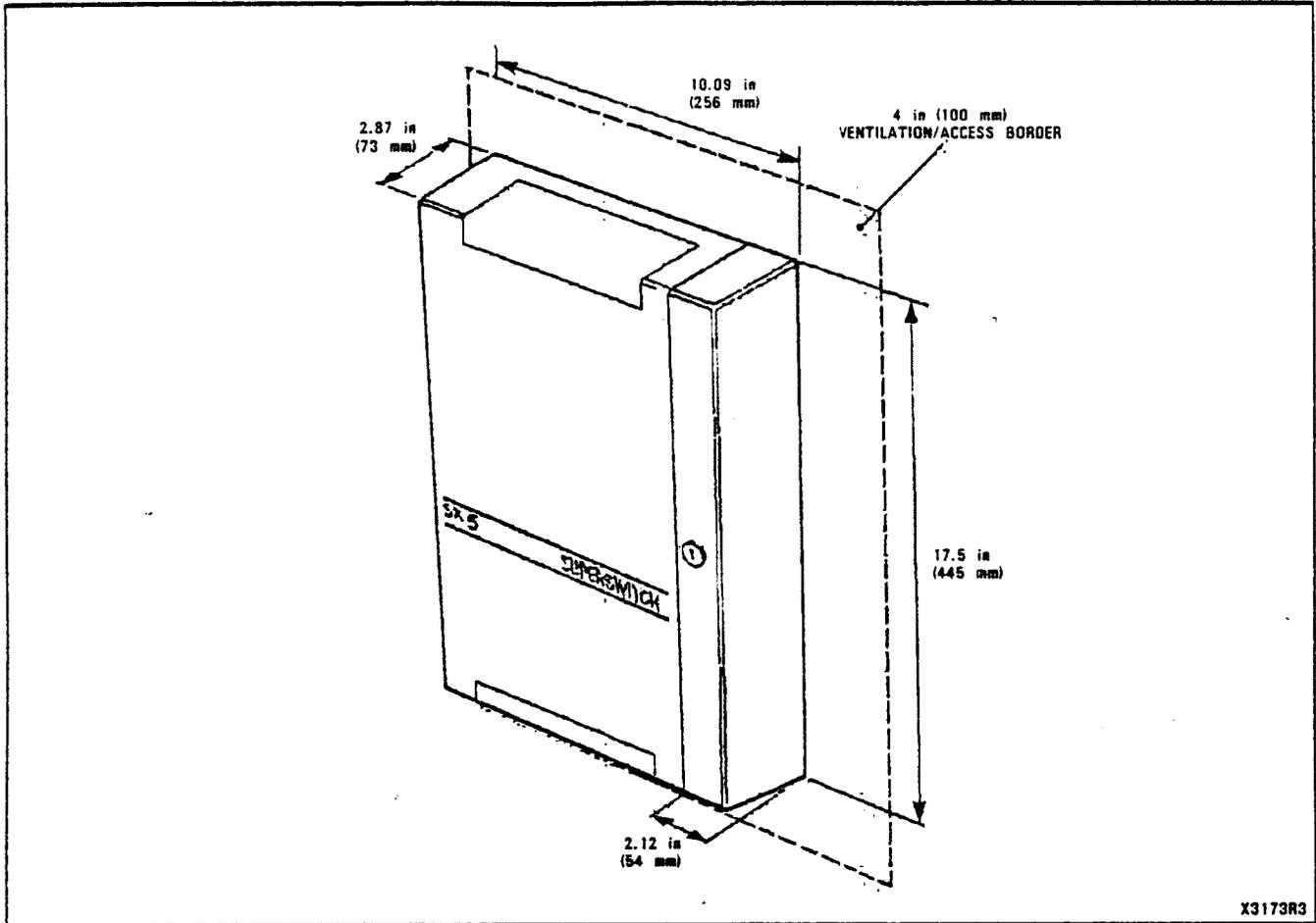


Fig. 3-1 SX-5 Dimensions

system default data. Switch 1 (SW1) is located directly below SW2. This switch enables either Direct Trunk Select or Trunk Group Operation. Below the system switches is the system reset button.

form Control Functions (i.e. Night Service Select), or as a normal extension.

Circuit Cards

3.03 All printed circuit cards employed in the system are identical in construction and consist of a fiberglass board with printed circuit patterns on both of its faces. Table 3-1 lists the card types, their dimensions and weights.

TABLE 3-1
CARD TYPES

Card Type	Dimensions	Weight
Main Card	11.1 in. x 9.7 in. 282 mm x 246 mm	1.19 lb 0.54 kg
Power Supply Card	2.5 in. x 9.7 in. 64 mm x 246 mm	0.56 lb 0.26 kg
Trunk Module	6 in. x 4.38 in. 152 mm x 111.3 mm	0.37 lb 0.17 kg
Memory Module	7.0 in. x 4.0 in. 178 mm x 102 mm	0.31 lb 0.14 kg

Control Extension

3.04 The extension connected to Equipment Number 1 (EN 1) is known as the 'Control Extension'. The 'Control Extension' may be used either to program the system, depending on the position of the uppermost switch (SW2), to per-

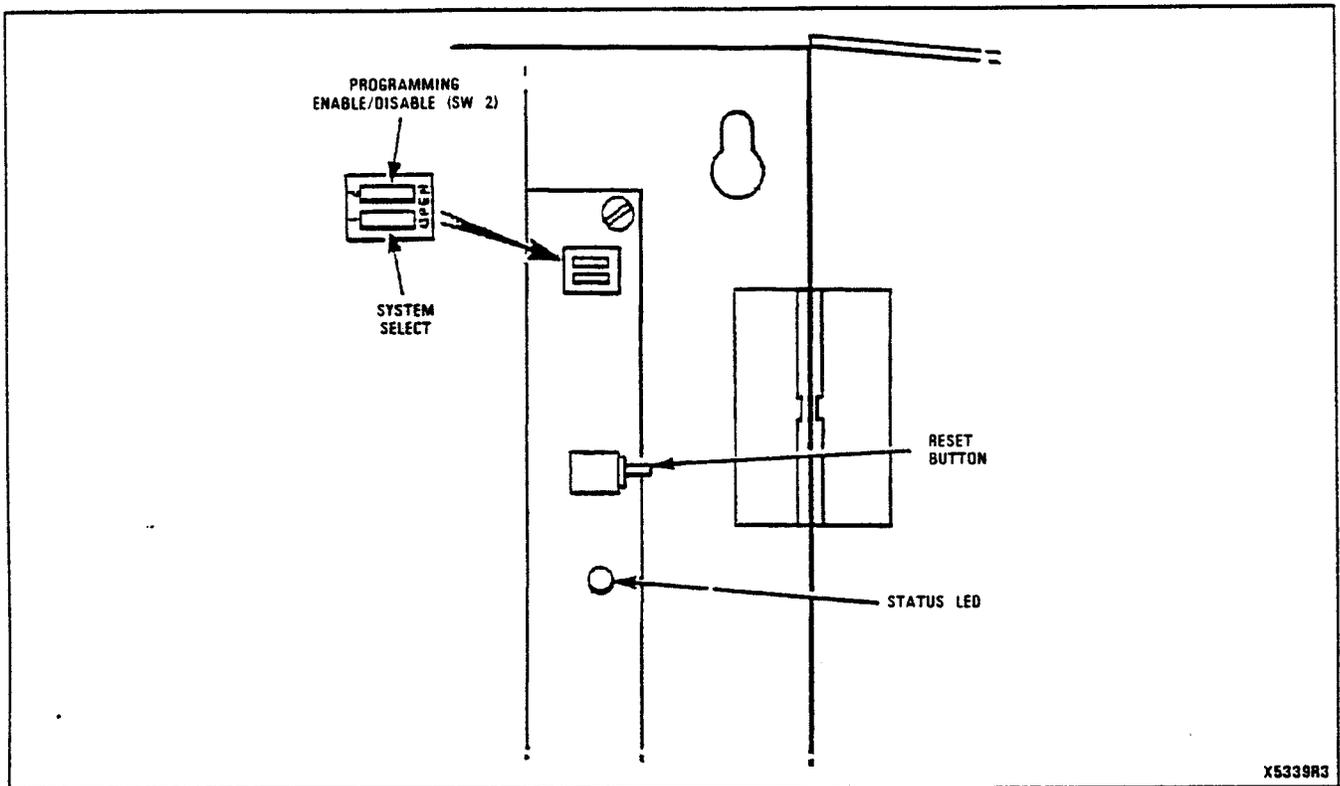


Fig. 3-2 SX-5 System Switches

System Power

3.05 All system power is supplied from a 110 V to 120 V optional 50 or 60 Hz power supply fused at 1.0 amp (220 V to 240 V operation is optional).

Power Failure Transfer

3.06 Whenever a commercial power failure occurs, the Power Failure Transfer (PFT) relay automatically connects Trunk 1 to Extension 1, and Trunk 2 to Extension 2. In the PFT mode of operation:

- INCOMING CALLS on the two trunks ring the corresponding extension (1 or 2) directly. Ringing voltage is supplied by the local CO.
- OUTGOING CALLS may be originated from either extension. To originate a trunk call over a ground start trunk, extensions must be equipped with a Ground Button or a Loop/Ground converter. When the Ground

Button is momentarily pressed, a ground is applied to the Ring lead, energizing the local CO equipment. Call originations over a loop start trunk do not require the use of the Ground Button or Loop/Ground start converter.

4. FEATURES

General

4.01 The SX-5 comes equipped with a features package Generic 50, which provides the system with a number of features not found in any other system in this line size. These features are detailed in Table 4-1 and each feature is described in Section MITL9103-098-105-NA, Features and Services Description.

Feature Provisioning

4.02 The SX-5 is equipped with a default numbering plan. This commonly used numbering plan is automatically loaded when the system is initially powered up.

TABLE 4-1 SX-5 FEATURES

Alarm Indication	Lockout
Automatic Callback - Busy	Make/Break Ratio
Automatic Callback - Don't Answer	Mixed Station Dialing
Automatic Station Release	Music on Hold
Background Music	Night/Day Service
Call Forwarding - All Calls	Power Failure Restart - Battery
Call Forwarding - Busy	Power Failure Restart - PROM/ROM
Call Hold, Retrieve from any Station	Power Failure Transfer - Both Trunks
Common Audible Ringing	Privacy - Automatic
Console-less Operation	Programmable Disconnect Timing
Control Extension	Programming
Control Functions	Reversal Meaning
Data Line Security	Rotary Dial Pulse-to-Digit Conversion
Default Data	Selectable Numbering Plans
Dial Call Pickup	Selectable Ringing Frequency
Direct-In Lines	Speed Dial
Direct Outward Dialing	Timed Recalls
Direct Trunk Select	Toll Restriction
Discriminating Ringing	Tone-to-Pulse Conversion
i. Trunk vs. Intercom	Transfer/Add-On/Consultation Hold
ii. Trunk 1 vs. Trunk 2	Trunk Camp-On with Indication
Do Not Disturb	Trunk Group Operation
Extension Switchhook Flash Timing	Trunk-to-Trunk plus Extension Conference
Last Number Redial	Voice Paging
	Wait for Dial Tone

4.03 Most system and extension features are inherently activated in the SX-5, thereby reducing the amount of programming necessary.

4.04 Some programming may be necessary to customize the data base for such features as Toll Restriction, or Extension Access to Outgoing Trunks. Any such programming is performed by dialing digits from the Control Extension. To protect customer data from accidental change, System Switch SW 2 can be used to disable Programming Functions.

5. ELECTRICAL CHARACTERISTICS

5.01 The electrical characteristics of the SX-5 are listed in Table 5-1. Refer to Table 5-2 for the SX-5 tone plan.

6. SYSTEM OPERATION

6.01 The SX-5 is a solid-state communications system employing space division switching and microprocessor control of call processing. A block diagram of the SX-5 is shown in Fig. 6-1.

6.02 The microprocessor can access all areas of the SX-5 either for information or to change the state of equipment. The microprocessor scans the extensions and trunks, and controls the connections to the four speech paths. All extensions and trunks have access to each of the four speech paths.

6.03 The SX-5 can operate in either a 'Direct Trunk Select' or 'Trunk Group Operation' mode. This feature is accessed either via the System Switch SW 1 or programming. In the 'Direct Trunk Select' mode, a single-digit access code is dialed for each trunk. When operating in a 'Trunk Group Operation' mode, a single-digit access code will select either idle trunk.

6.04 Incoming trunk calls may be identified by a ringing pattern that is different from the ringing pattern of internal calls. Each incoming trunk can also be identified by its own distinctive ringing pattern. Therefore, it is possible to distinguish between incoming calls on Trunk 1 and Trunk 2, and internal calls. Refer to Section MITL9103-098-105-NA, Features and Services Description - Discriminating Ringing.

TABLE 5-1 SX-5 ELECTRICAL CHARACTERISTICS

Parameter	Detail
Station Loop Limit	600 ohms including set at 20 mA; 360 ohms including set at 25 mA
Minimum Leak Resistance	15,000 ohms
Maximum Number of Ringers per Line	3
Ringing Voltage	90 Vrms, at 17.5, 20, or 25 Hz
Ring Trip	During silent or ringing period
Crosstalk	Better than 75 dB down
Tone Plan	As defined in Table 5-2
Insertion Loss: Station-to-Station	5 dB+/- 0.5 dB at 1000 Hz
Insertion Loss: Station-to-Trunk	0.6 dB+/- 0.4 dB at 1000 Hz
Longitudinal Balance	60 dB minimum, 200-3,400 Hz (on trunks)
Return Loss	16 dB single frequency, 24 dB echo
Idle Circuit Noise	16 dBrnC maximum
Impulse Noise	0 counts above 55 dBrnC for 95% of cases
System Impedance	600 ohms nominal for extensions 900 ohms nominal for trunks (600 ohms optional)
Primary Power	110-120 Vac, 47-63 Hz, 0.6 A maximum, 0.3 A typical (220 V operation optional)
Central Office Loop Limit	1600 ohms maximum
Environmental Requirements	0 - 40°C (32-104°F) 10% - 90% Relative Humidity noncondensing

TABLE 5-2 TONE PLAN

TONE	TONE PLAN 1
Dial Tone	350/440 Hz Continuous
Busy Tone	480/620 Hz 500 ms On, 500 ms Off Repeated continuously
Ringback Tone	440/480 Hz 1 sec On, 3 sec Off Repeated continuously
Reorder Tone	480/620 Hz 250 ms On, 250 ms Off Repeated continuously
Camp-On Tone	440 Hz Single burst of 200 ms
Transfer Dial Tone	350/440 Hz 100 ms On, 100 ms Off Repeated three times, then continuously

7. SYSTEM CONFIGURATION

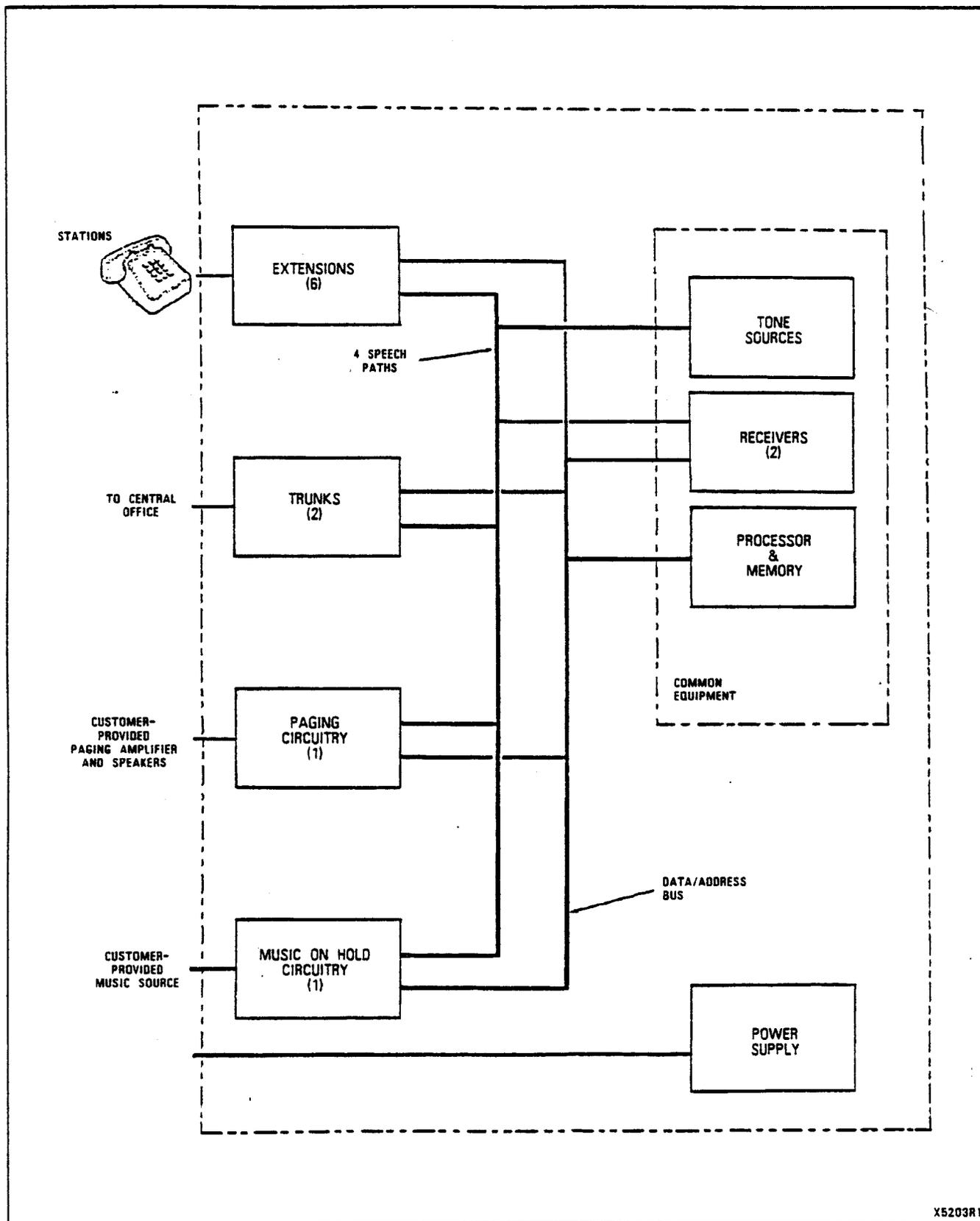
General

7.01 The SX-5 equipment cabinet consists of a single enclosure containing the entire system electronics, and power supply. The system contains four circuit cards: Main Card, Power Supply Card, Trunk Module, and the Memory Module. Main and Power Supply cards are connected to the chassis, with the Trunk and Memory Modules plugging into the Main Card. Keyed connector patterns prevent Trunk and Memory Modules from being plugged into the wrong position.

Circuit Card Description

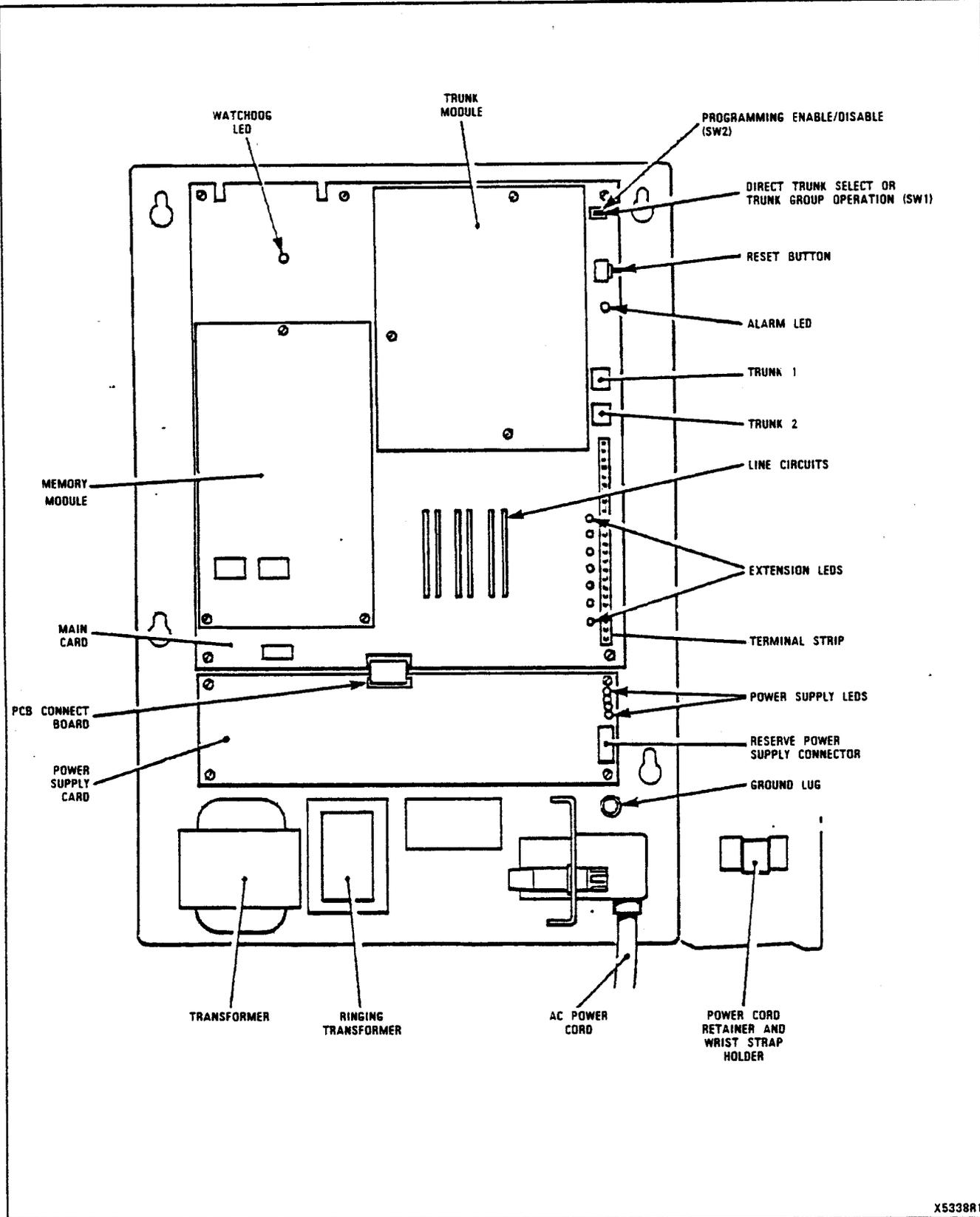
7.02 All circuit cards used in the system are constructed of a fiberglass board with printed circuit patterns on both of its faces. Refer to Fig. 7-1, SX-5 Equipment Layout. The functions of the cards are as follows:

- (a) **MAIN CARD:** contains all the switching circuitry including the six extension interfaces. This card also includes:



X5203R1

Fig. 6-1 SX-5 Block Diagram



X5338R1

Fig. 7-1 SX-5 Equipment Layout

- Central Processing Unit (CPU)
- Terminal Strip
- Reset Button
- System Switches
- Status LED
- Six Extension LED's
- DTMF Receivers
- Paging Circuitry
- Music on Hold Circuitry
- Call Progress Tone Generators.
- Ringing Generator Circuitry

(b) **POWER SUPPLY CARD:** contains all the circuitry necessary to convert commercial AC power to voltages necessary in the operation of the system. Satisfactory operation of the system's voltage sources are indicated by four illuminated LED's on the Power Supply Card. These LED's are visible when the access door is opened. Refer to Figure 7-1, SX-5 Equipment Layout.

(c) **TRUNK MODULE:** plugs into the Main Card and provides access to two CO trunks. This module can be set for ground or loop start operation. There are two types of Trunk Modules available. One type has a nominal impedance of 900 ohms and the other 600 ohms nominal impedance.

(d) **MEMORY MODULE:** plugs into the Main Card. This module includes:

- Read Only Memory (PROM/ROM) holding the system operating instructions
- Non-Volatile Random Access Memory (NV RAM) containing the customer data base
- Customer Data backup batteries protecting the NV RAM against commercial power failure and loss of customer data.
- Random Access Memory (RAM) containing temporary data.

8. INSTALLATION AND MAINTENANCE REQUIREMENTS

Note: Caution is necessary during installation and maintenance of any electronic equipment, such as the SX-5, to avoid possible damage to the system electronics by static discharge. A simple means of avoiding the possibility of such damage, is the use of

the "Static Protection Wrist Strap" attached to one cabinet hinge. MITEL strongly advises the use of this wrist strap; failure to do so can lead to improper system operation and decreased system life.

Installation

8.01 The following requirements must be met when selecting a location for the SX-5 equipment cabinet.

The location **MUST BE:**

- Dry and clean
- Well ventilated
- Well lit
- Easily accessible.

The location **MUST NOT BE:**

- Near a sprinkler system, sweating pipes, steam pipes, or steam vents
- In areas where corrosive fumes or exhaust from machinery is present
- Next to a reproducing or copying machine. A minimum clearance of 10 feet (3 m) must be provided and the room should be ventilated by an exhaust fan if the reproducing machine is not equipped with a filtering system.

8.02 Installation of the SX-5 consists of 5 steps:

1. Mount the SX-5 vertically in the desired location.
2. Set the system switch 1 (SW1) to Direct Trunk. Select (OPEN) or Trunk Group Operation (CLOSED).
3. Connect the Trunk, Extension, Paging, and Music on Hold pairs to the terminal strip connector.
4. Apply power to the system.
5. Program the system, if necessary.

- Refer to Section MITL9103-098-200-NA, Shipping, Receiving and Installation Procedures

Maintenance

8.03 The SX-5 requires no routine maintenance.

In case of a malfunction, there are two choices of action: replace the system or execute troubleshooting procedures. For troubleshooting purposes, two levels of entry are available. The first level of entry allows access to the Status LED, Power Supply LED's, Extension LED's, Terminal Strip, and System Switches. The second level of entry allows access to the replaceable components, i.e. the Trunk and Memory Modules, and Line Circuits. Refer to Section MITL9103-098-350-NA, Maintenance and Troubleshooting.

**THE FOLLOWING AMMENDMENTS SHOULD BE MADE
TO SECTION MITL 9103-098-105-NA
FEATURES AND SERVICES DESCRIPTION
BEFORE USING THE SX-5**

The following amendments should be made to Section MITL9103-098-105-NA, "Features and Services Description", before using the SX-5.

o Page 4, Automatic Callback - Busy, and Page 6, Automatic Callback - Don't Answer:

Now reads: o If the two parties involved in callback hold a conversation (not a conference) before the callback is honoured, the callback will be cancelled automatically.

Change to: o If the two stations involved in callback hold a conversation (including a conference) before the callback is honoured, the callback will be cancelled automatically. If a station that has set up a callback on a trunk accesses that trunk for an outgoing call before the callback can be honored, the callback is cancelled. (However, an incoming call on that trunk or a conference with it will not cancel the callback.)

o Page 7, Automatic Station Release:

Now reads: o
The extension must go on-hook to reestablish service.

o
The extension must go on-hook to reestablish service.

Change to: o
The extension must go on-hook to reestablish service, or flash the switchhook.

o
The extension must go on-hook to reestablish service, or flash the switchhook.

o Page 14, Common Audible Ringing, Conditions:

Now reads: o If the main extension has Call Forwarding - Busy set, the forwarder becomes the temporary main extension of the group.

Change to: o If the main extension has Call Forwarding (either type) set, the forwarder becomes the temporary main extension of the group.

o Page 21, Table 3, Default Data, Ring Groups:

Now reads:	Day Service Ring Group 2 -	
	Main extension	- directory number 12
	Auxiliary member	- directory numbers 12, 13, 14, 15, 16
	Ringling delay	- 2 ringling cycles
	Night Service Ring Group 2 -	
	Main extension	- directory number 12
	Auxiliary member	- directory numbers 12, 13, 14, 15, 16
	Ringling delay	- 0 ringling cycles

Change to: Day Service Ring Group 2 -
 Main extension - directory number 12
 Auxiliary member - directory numbers 11, 13,
 14, 15, 16
 Ringing delay - 2 ringing cycles

Night Service Ring Group 2 -
 Main extension - directory number 12
 Auxiliary member - directory numbers 11, 13,
 14, 15, 16
 Ringing delay - 0 ringing cycles

o Page 22, Dial Call Pickup, Feature Selection:

Now reads: To Remove all Extensions from Both Pickup Groups:
 o Lift the Control Extension handset - dial tone is returned
 o Dial 302 - acknowledge tone is returned.

Change to: To Remove all Extensions from Pickup Group 1:
 o Lift the Control Extension handset - dial tone is returned
 o Dial 3023 - acknowledge tone is returned.

To Remove all Extensions from Pickup Group 2:
 o Lift the Control Extension handset - dial tone is returned
 o Dial 3024 - acknowledge tone is returned.

o Page 24, Direct-In-Lines, Feature Selection:

Now reads: o Set SW2 to OPEN.

Change to: (Delete)

Now reads: o Dial 301 (i. e. Remove ALL auxiliary members from both Ring Groups).

Change to: o Dial 301A
 A = 2 to remove all auxiliary members from Day Ring Group 1
 = 3 to remove all auxiliary members from Night Ring Group 1
 = 4 to remove all auxiliary members from Day Ring Group 2
 = 5 to remove all auxiliary members from Night Ring Group 2

Now reads: o Set SW2 to CLOSED.
 o Reassign remainder of Ring Groups as desired. Refer to Common Audible Ringing within this practice.

Change to: (Delete)

o Page 31, Last Number Redial, Conditions:

Now reads: o Only the last valid trunk call number will be redialed, and then only if it was the last number dialed from the extension.

Change to: o Only the last valid trunk call number will be redialed.

o Page 33, Make/Break Ratio, Programming:

Now reads: A = 3 for a Make/Break ratio of 33/67.

Change to: A = 3 for a Make/Break ratio of 70/40.

o Page 34, Mixed Station Dialing, Description:

Now reads: All SX-5 features are accessible from either type of extension.

Change to: All SX-5 features are accessible from either type of extension, except for speed dial programming which requires a DTMF telephone if the * or # features are to be used. (See Table 7, page 51.)

o Page 45, Reversal Meaning, Feature Selection:

Now reads: o Lift Control Extension handset - dial tone returned.
o Dial 43ABB where

Change to: o Set SW2 to OPEN.
o Lift Control Extension handset - dial tone returned.
o Dial 43ABB where

o Page 50, Speed Dial, Operation:

Now reads: X = the actual speed dial number to be stored. The entries may be the digits 0 to 9 or any of the special codes listed in Table 7.

Change to: X = the actual speed dial number to be stored. The entries may be the digits 0 to 9 or any of the special codes listed in Table 7. Note that a trunk access code is required in the number.

o Page 51, Speed Dial, Operation:

Now reads: o Wait for dial tone.
o Dial the single digit, 1-9 which identifies the speed dial number stored in that position is outputted.

Change to: o Dial the single digit, 1-9 which identifies the speed dial number stored in that position is outputted.
o Wait for dial tone, or pause, if programmed in number.

o Page 54, Timed Recalls, Feature Selection:

Now reads: Refer to Call Hold and Automatic Call Back - Don't Answer Feature Description

Change to: Refer to Call Hold and Transfer/Add-On/Consultation Hold Feature Descriptions

o Page 55, Toll Restriction:

Now reads: Toll calls are defined as those which have a 0, 1, * or #, as the first or second digit after the trunk access code has been dialed, or as calls which receive toll supervision. Denial may be specified to be active on the first and second digit dialed.

Change to: Toll calls are defined as those which have a 0 or a 1 as the first, second, or third digit after the trunk access

code has been dialed, or as calls which receive toll supervision. Denial may be specified to be active on the first, second, and third digit dialed.

Now reads: 7 Restrict call if the first digit dialed is a 1 and the second digit is a 1 or a 0.

Change to: 7 Restrict call if the first digit dialed is a 1 and the third digit is a 1 or a 0 (i. e., 1 + area code).

o Page 58, Transfer/Add-On/Consultation Hold:

Now reads: o A transferred call that exceeds the 'ring no answer' recall time will recall to the transferring extension.

Change to: o A transferred call that exceeds the system recall time will recall to the transferring extension.

Now reads: o If the handset is replace while the third party is ringing, the second party receives ringback tone and waits for the third party to answer. If the third party does not answer within the hold recall time the extension responsible for the transfer rings.

o If the handset is replaced on receipt of busy tone from the third party, the extension is recalled immediately. The second party is camped-on to the third party and receives busy tone. The third party only receives camp-on tone when the second party is a trunk.

Change to: o If the handset is replace while the third party is ringing, the second party receives ringback tone and waits for the third party to answer. If the third party does not answer within the system recall time the extension responsible for the transfer rings.

o If the handset is replaced on receipt of busy tone from the third party, the extension is recalled immediately. If the third party goes on hook, it will also ring.

o Page 59, Trunk Camp-On with Indication, Description:

Now reads: ... the called extension hears two 200ms bursts of camp-on tone every....

Change to: ... the called extension hears one 200ms burst of camp-on tone every....

SX-5*
SUPERSWITCH*
FEATURES AND SERVICES DESCRIPTION

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**Features and Services
Description**

Introduction

This part contains a description of each feature and service provided by the SX-5. Each description contains four parts:

- Description - a detailed description of the feature or service.
- Conditions - a list of any special conditions which should be taken into account when selecting the feature or service.
- Feature Selection - a detailed description of how the feature or service is selected.
- Operation - a brief description of the feature operation.

The terminology of this practice is oriented to the terminology of all SX-5 documentation. Some terminology (for system options, features, etc.) is particular to the SX-5 and does not directly refer to standard industry terms.

Alarm Indication

Description

After every system power-up or reset, the SX-5 runs a diagnostics program to determine the status of the various memory areas in the system. If a malfunction is detected, the Status LED will flash. The rate of flashing indicates the type of fault as detailed in Section MITL9103-098-350-NA. The Status LED is located below the Reset Button on the right-hand edge of the Main Card and is visible when the Access Door is open.

Conditions

The diagnostic program checks the memory only.

Feature Selection

None

Operation

Automatic

**Automatic Callback -
Busy (With Distinctive
Ringing)**

Description

Automatic Callback-Busy allows an extension user (the originating extension), upon encountering a busy extension number or trunk, to have the call connected when the busy extension or trunk becomes free. After reaching a busy number, the calling extension user dials 6, (the feature access code) and replaces the handset. The system continuously monitors the originating extension and the called number. When both parties become free, the system rings the originating extension, using a distinctive ringing pattern (200 ms ON, 200 ms OFF, 200 ms ON, 200 ms OFF, 200 ms ON, 3 s OFF) continuous until the call is answered. When the originating extension answers, the called extension rings or trunk dial tone is heard. If more than one callback request is active on any extension or trunk, the requests are queued and serviced on a first-in, first-out basis.

Conditions

- Callback may be enabled on both extensions and trunks.
- The callback access code is 6.
- An individual callback cannot be cancelled by the extension user.
- A callback will always ring the originating extension, call forwarding has no effect.
- Up to 24 callback requests may be active within the system at any time.
- If the two parties involved in callback hold a conversation (not a conference) before the callback is honoured, the callback will be cancelled automatically.
- Duplicate callback requests are ignored (the original callback request being cancelled).
- The callback access code (6) must be dialed within 10 s of receiving busy tone.
- If a callback is not answered by the originating extension within 4 rings, it is automatically cancelled.
- If the called number (extension or trunk) becomes busy before the originating party answers a callback, the originating party will hear busy tone. By going on-hook the system will automatically re-activate the callback feature.
- All callback requests are lost after recovery from a Power Fail Transfer.
- A callback will be cancelled if not completed within 8 hours.

Feature Selection

None

Operation

To Enable a Callback - Busy:

- Lift the extension handset - dial tone is returned.
- Dial the required extension number or trunk group access code - busy tone is returned.
- Dial the Callback access code (6) within 10 s - dial tone is returned - the originating extension is available for normal use.

To Answer a Callback - Busy:

- The extension user hears discriminating ringing tone (200 ms ON, 200 ms OFF, 200 ms ON, 200 ms OFF, 200 ms ON, 3 s OFF).
- Lift the handset, either ringing tone is heard and the called extension rings, or dial tone is heard from the trunk (see Note).
- If, on lifting the handset, busy tone is heard, someone else had accessed the extension.
- Upon receiving busy tone, go on-hook, the SX-5 will automatically restart Automatic Callback - Busy.

NOTE: For Trunk Callback, the trunk is automatically reserved before the originating extension is rung. This prevents other users from accessing the trunk.

**Automatic Callback -
Don't Answer**

Description

This feature allows an extension user, upon encountering an extension which does not answer, to have the call completed after the called party has returned and used his phone. After the feature has been activated, the system continuously monitors the originating extension and the required number. After the called extension goes off-hook the callback will be handled in the same way as an Automatic Callback - Busy. If more than one callback request is active on any extension, the requests are queued and serviced on a first-in, first-out basis.

Conditions

- An individual callback can not be cancelled by the station.
- A callback will always ring the originating extension; call forwarding has no effect.
- Automatic Callback may be activated on extension numbers only.
- Up to 24 callback requests may be active within the system at any time.
- If the two parties involved in a callback hold a conversation (not a conference) before the callback is honoured, the callback will be cancelled automatically. Duplicate callback requests are ignored (the original callback request is cancelled).
- If a callback is not answered by the originating extension within four rings, it is automatically cancelled.
- If the called party becomes busy before the originating party answers a callback, the originating party will hear busy tone and may dial the callback-busy code.
- All callback requests are lost after recovery from a power failure.

Feature Selection

None

Operation

To set up an Automatic Callback - Don't Answer:

- Dial the required extension number - the extension does not answer.
- Flash the switchhook - dial tone is returned.
- Dial 56 (the Callback - Don't Answer access code) - dial tone is returned.
- Replace the handset - the extension is available for normal use.

To answer an Automatic Callback - Don't Answer:

- The extension rings.
- Lift the handset - ringing tone is returned, the called number rings.

**Automatic Station
Release**

Description

The SX-5 automatically releases and locks out an extension if the user exceeds any of the following time-out periods:

- **Dial Time-Out:** If an extension user does not dial a digit within 10 s of receiving dial tone, dial tone is replaced with reorder tone. Reorder tone is applied for a period of 20 s. If during this time the extension user flashes the switchhook, the extension will immediately receive dial tone and the dial tone timer will be restarted. After 20 s of reorder tone, the extension is released and locked out. The extension user must go on-hook to reestablish service.
- **Interdigit Time-Out:** If after dialing a digit, a user fails to dial another digit within 10 s (interdigit time-out period), reorder tone will be heard. If, during this time, the extension user flashes the switchhook, the extension will immediately receive dial tone and the dial time-out timer will be restarted. If the extension remains off-hook for an additional 20 s, reorder tone is removed and the extension is locked out. The extension must go on-hook to reestablish service.

Conditions

None

Feature Selection

None

Operation

Automatic

Background Music

Description

This feature allows an external music source to be connected to the PA system when paging is not in use. The music source is connected to the system via the terminal strip as detailed in Section MITL9103-098-200-NA. Refer to Music on Hold.

Conditions

- The customer must provide the music source, speakers and paging amplifier.
- Background Music can be enabled and disabled by the Control Extension.
- Background Music is available only when the paging circuit is not in use.
- The volume of the background music is adjusted from the external music source.

Feature Selection

Connect music source to SX-5 as detailed in section MITL9103-098-200-NA.

To Enable Background Music:

- Lift the Control Extension handset - dial tone is returned.
- Dial 3232 - acknowledge tone is returned.
- Replace the handset - Background Music is enabled.

To Disable Background Music:

- Lift the Control Extension handset - dial tone is returned.
- Dial 3231 - acknowledge tone is returned.
- Replace the handset - Background Music is disabled.

NOTE:

Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
 - Two beeps (Tone 2), indicates that the feature was already selected.
- The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Operation

None

**Call Forwarding - All
Calls****Description**

This feature allows an extension user to have all calls to that extension forwarded to any other extension within the SX-5. Incoming calls to the forwarding extensions ring at both the forwarding and forwarded extensions. While Call Forwarding - All Calls is in effect, the forwarding extension may originate calls in the normal manner. A distinctive dial tone is heard when the originating extension goes off-hook to remind the user that call forwarding is enabled.

Conditions

- Callbacks will always ring the originating extension, call forwarding has no effect.
- Only one type of call forwarding may be active on an extension. If an extension has one type of call forwarding active and the user dials a new call forwarding code, the first type of forwarding is cancelled.
- Calls may not be forwarded to trunks.
- Calls may be forwarded on one step only.
- If the calling extension is the party to which the call would be forwarded, call forwarding does not apply.
- If an invalid number is selected as a forwarding number, reorder tone is returned.
- All call forwarding requests are retained after recovery from a power failure.

Feature Selection

None

Operation**To Enable Call Forwarding - All Calls from the Forwarding Extension:**

- Lift the extension handset - dial tone is returned.
- Dial 58 followed by the extension number to which the calls are forwarded.
- Replace the handset - all calls will be forwarded to that extension.

To Disable Call Forwarding - All Calls from the Forwarding Extension:

- Lift the extension handset - distinctive dial tone is returned.
- Dial 58.
- Replace the handset - Call Forwarding - All Calls is cancelled.

To Enable Call Forwarding - All Calls from any Extension:

- Lift the extension handset - dial tone is returned.
- Dial 58.
- Dial the number of the extension to which the calls are to be forwarded, followed by the extension number of the forwarding extension.

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To Disable Call Forwarding - All Calls From any Extension:

- Lift the extension handset - dial tone is returned.
- Dial 58 and then dial the extension number of the forwarding extension twice.
- Replace handset - Call Forwarding - All Calls is cancelled.

Call Forwarding - Busy

Description

This feature allows an extension user to have all calls forwarded to any selected extension within the SX-5, WHEN THE USER'S EXTENSION IS BUSY. When idle the extension user may make and receive calls normally. Also refer to Call Forwarding - All Calls.

Conditions

- Callbacks will always ring the originating extension, call forwarding has no effect.
- Only one type of call forwarding may be active on any extension at any time. If an extension has one type of call forwarding active and the user enters a new call forwarding code, the first type of forwarding is cancelled.
- Calls may not be forwarded to trunks.
- Calls may be forwarded on one step only.
- If an invalid number is selected as a forwarding number, reorder tone is returned.
- Call forwarding does not apply if the calling extension is the party to which the call would be forwarded.
- All call forwarding requests are retained after recovery from a Power Failure.

Feature Selection

None

Operation

To Enable Call Forwarding - Busy from the forwarding extension:

- Lift the extension handset - dial tone is returned.
- Dial 59 followed by the extension number that the calls are to be forwarded to.
- Replace the handset - calls will be forwarded when the extension is busy.

To Disable Call Forwarding - Busy from the Forwarding Extension:

- Lift the extension handset - distinctive dial tone is returned.
- Dial 59.
- Replace the handset - Call Forwarding - Busy is cancelled.

To Enable Call Forwarding - Busy from any Extension:

- Lift the extension handset - dial tone is returned.
- Dial 59 followed by the extension number that the calls are to be forwarded to, and then the extension number of the forwarding extension.
- Replace the handset - calls will be forwarded when the forwarding extension is busy.

To Disable Call Forwarding - Busy from any Extension:

- Lift the extension handset - dial tone is returned.
- Dial 59, and then dial the extension number of the forwarding extension twice.
- Replace the handset - Call Forwarding - Busy is cancelled.

Call Hold

Description

Call Hold allows an extension user to place a trunk call on hold, then replace the extension handset, or use the extension for another call. When the call is placed on hold, the extension user receives an audio indication of which trunk is being held; one burst of tone indicates trunk 1, two bursts indicate trunk 2 (the relevant tone is repeated three times followed by dial tone). The held trunk call may be retrieved either locally, from the holding extension, or remotely from any other extension within the SX-5. If the held call is not retrieved within the Call Hold Recall Time, the call will automatically recall to the holding extension. If Do Not Disturb is enabled on the holding extension it will be overridden.

Conditions

- All features normally active on the extension may be selected while the calls are held.

Feature Selection

No feature selection is required but the Call Hold Recall Time may be specified. To specify the Hold Recall Time:

- Set SW2 to OPEN.
- Lift the Control Extension Handset - dial tone is returned.
- Dial 418A where
A = the number of minutes (1-9) that the call will be held before recalling.
- Set SW2 to CLOSED.

Operation

To Place a Call on Hold:

- Flash the switchhook - the call is placed on Consultation Hold, transfer dial tone is returned.
- Dial 55 - the SX-5 will indicate the held trunk number by bursts of tone (one burst of tone for trunk 1, two bursts of tone for trunk 2) - dial tone is returned.
- The extension placing the call on hold may make or receive calls, or access features in the normal manner.

To Retrieve Trunk 1 from Hold:

- Lift the extension handset - dial tone is returned.
- Dial 51 - the extension is connected to trunk 1.

To Retrieve Trunk 2 from Hold:

- Lift the extension handset - dial tone is returned.
- Dial 52 - the extension is connected to trunk 2.

Clear Function**Description**

This special control function allows the Control Extension user to clear large amounts of data from the customer data base in order that new customer data may be entered.

Conditions

- The clear function may only be used with the functions listed in Table 1.

Feature Selection

None

Operation

To clear a function:

- Lift the Control Extension handset - dial tone is returned.
- Dial the required 3- or 4-digit code specified in Table 1 - acknowledge tone is returned.
- Replace handset - the function is cleared.

NOTE:

Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
 - Two beeps (Tone 2), indicates that the feature was already selected.
- The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Table 1
Clear Function

Code	Clear Function
3012	Remove all auxiliary members from Day Service Ring Group 1
3013	Remove all auxiliary members from Night Service Ring Group 1
3014	Remove all auxiliary members from Day Service Ring Group 2
3015	Remove all auxiliary members from Night Service Ring Group 2
3023	Remove all members from Pick-Up Group 1
3024	Remove all members from Pick-Up Group 2
303	Clear all active Call Forwarding - All Call requests
304	Clear all active Call Forwarding - Busy requests
305x	Remove speed call number x (x=1-9) from the system memory

**Common Audible
Ringing (Ring Groups)**

Description

The SX-5 allows incoming calls to ring more than one extension, if desired. Two independent Ring Groups may be defined, one for each incoming trunk. Each Ring Group may be defined differently for day and night service operation. An incoming trunk call will ring the main extension (trunk 1 rings Ring Group 1 and trunk 2 rings Ring Group 2) and after a specified delay will ring all the members of that Ring Group. When the main extension is busy the incoming trunk call rings the auxiliary members immediately.

Conditions

- Defining the members of a Ring Group and its day/night service selection may be performed from the Control Extension at anytime, the system does not have to be in the programming mode.
- A maximum of two Ring Groups may be specified.
- Only one extension per Ring Group may be defined as the main extension.
- There are no restrictions on Ring Group membership.
- If the main extension has Call Forwarding - Busy set, the forwarder becomes the temporary main extension of the group.

Feature Selection

To Define the Main Extension in a Ring Group:

- Lift the Control Extension handset - dial tone is returned
- Dial 33AB5X where:
 - A = 1 if Ring Group 1 is to be defined
 - A = 2 if Ring Group 2 is to be defined
 - B = 3 if Day Service operation is to be defined
 - B = 4 if Night Service operation is to be defined
 - X = the Equipment Number of the main extension in the ring group.

To Add Auxiliary Members to a Ring Group:

- Lift the Control Extension handset - dial tone is returned.
- Dial 33AB6NX where:
 - A = 1 if the extension is to be added to Ring Group 1
 - = 2 if the extension is to be added to Ring Group 2
 - B = 3 if Day Service operation is to be defined
 - = 4 if Night Service operation is to be defined
 - N = the number of auxiliaries to be added (1-5)
 - X = the Equipment Numbers of the extensions to be added

To Remove an Auxiliary Member from a Ring Group:

- Lift the Control Extension handset - dial tone is returned
- Dial 33AB7X where:
 - A = 1 if the extension is to be removed from Ring Group 1
 - = 2 if the extension is to be removed from Ring Group 2
 - B = 3 if Day Service operation is to be defined
 - = 4 if Night Service operation is to be defined
 - X = the Equipment Number of the extension to be removed

The Equipment Number (EN) of an extension is defined as the second digit of the Extension Number, i.e. the EN of extension 23 is 3.

To Define the Ring Group Ringing Delay:

- Lift the Control Extension handset - dial tone is returned.
- Dial 33AB8X where
 - A = 1 if the delay is to be set for Ring Group 1
 - = 2 if the delay is to be set for Ring Group 2
 - B = 3 if Day Service operation is to be defined
 - = 4 if Night Service operation is to be defined
 - X = the number of times the main extension will ring before the auxiliaries ring (X=1-9)

**Console-less
Operation**

Description

When operating the SX-5, all calls are automatically completed without the use of an attendant console. All extensions within the system are equipped with call handling features (i.e. Call Hold, Transfer/Add-On/Consultation Hold). Refer to Common Audible Ringing, Direct In Lines, Call Hold, and Transfer/Add-On/ Consultation Hold.

Conditions

None

Feature Selection

None

Operation

Automatic

Control Extension

Description

The extension connected to Equipment Number 1 (EN 1) is known as the Control Extension. This extension may be used as a conventional extension or to change programming and control functions of the SX-5.

Conditions

- Only the extension connected to Equipment Number 1 can be used as the Control Extension.
- All programming and control functions are performed from the Control Extension.
- To access Programming, SW2 must be set to OPEN.
- Control Functions may be accessed at any time, regardless of the position of SW2.

Feature Selection

None

Operation

- Set SW2 to OPEN if programming is to be performed.
- Lift the Control Extension handset - dial tone is returned.
- Dial the required Programming or Control Function access code - acknowledge tone is returned as each parameter is changed.
- Replace the handset.
- Set SW2 to CLOSED.

NOTE: Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
- Two beeps (Tone 2), indicates that the feature was already selected.

The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Control Functions

Description

Control Functions are features which control the day-to-day operation of the SX-5, such as switching the system in or out of Night Service. Control Functions may be performed only from the Control Extension (EN 1) and consist of dialing a string of digits to access the features. Table 2 lists the Control Functions and their access codes. Control Functions may be accessed from the Control Extension at any time. Control Function operation is NOT dependent on the setting of SW2.

Table 2
Control Functions

Control Functions	Access Code
Clear Functions	30
Day/Night Service	31
Music Selection, Background Music/Music on Hold	32
Ring Group Settings	33
Pickup Group Settings	34
Speed Dial Number Setting	35

Conditions

- Control Functions may only be performed from the Control Extension.
- All Control Function access codes begin with digit 3.
- Only one Control or Programming Function may be performed at one time.
- If incorrect digits are entered - reorder tone is returned.
- If correct digits are entered - one burst of tone is returned (acknowledge tone 1).
- If correct digits are entered and the state of the system is not altered - two bursts are returned (acknowledge tone 2).
- For further information on Access Codes and individual Control Functions, refer to individual feature descriptions in this practice.

NOTE: Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
 - Two beeps (Tone 2), indicates that the feature was already selected.
- The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Feature Selection

None

Operation

Refer to individual Control Function feature description.

Data Line Security

Description

An extension with this feature enabled cannot receive camp-on tone. A call may be camped-on to an extension with Data Security, but all forms of audio intrusion are prohibited. When Data Line Security is enabled on an extension, it must be noted that:

- Incoming Trunk calls do not ring the extension.
- Camp-on tone is not received by the extension, or any party connected to the extension, when an incoming trunk call is present.

When call forwarding is set by the same extension the forwarded extension will ring or receive camp-on tone.

Conditions

- This feature should only be enabled when data lines are in use (i.e. computer terminals with modems).
- System default data provides no Data Line Security.

Feature Selection

To Enable Data Line Security for an Extension:

- Set Programming Switch (SW2) to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 40X92 where X is the Equipment Number of the extension to which Data Line Security is to be applied - acknowledge tone is returned.
- Replace the handset - Data Line Security is enabled. No audio intrusion (camp-on tone) is allowed.
- Set SW2 to CLOSED.

To Disable Data Line Security for an Extension:

- Set Programming Switch (SW2) to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 40X91 where X is the Equipment Number of the extension for which Data Line Security is to be removed - acknowledge tone is returned.
- Replace the handset - Data Line Security is disabled.
- Set SW2 to CLOSED.

NOTES:

1. Acknowledge tone may be one of two tones; they are:
 - One beep (Tone 1), indicates that the new feature access code has been accepted.
 - Two beeps (Tone 2), indicates that the feature was already selected.
 The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.
2. The Equipment Number of an extension is defined as the second digit of the Extension Number, i.e. the EN of extension 23 is 3.

Operation

Automatic

Default Data

Description

The SX-5 contains a default program with a fully operational customer feature package. The default data contained in the program reflects the customer's typical requirements. Specific requirements may be programmed as detailed in the Programming feature description. The system default data is listed in Table 3.

Conditions

- All systems have default data loaded automatically on initial power-up.

Feature Selection

To Reload the Default Data:

- Set SW2 to CLOSED.
- Press Reset Switch - status LED flashes.
- Set SW2 to OPEN within 8 s of the status LED starting to flash - status LED glows permanently.
- Set SW2 to CLOSED.
- Default data is reloaded.

Operation

None

**Table 3
Default Data**

Feature	Description
Ring Groups	<p>Day Service Ring Group 1 -</p> <ul style="list-style-type: none"> Main extension - directory number 11 Auxiliary members - directory numbers 12, 13, 14, 15 and 16 Ringing delay - 2 ringing cycles <p>Night Service Ring Group 1 -</p> <ul style="list-style-type: none"> Main extension - directory number 11 Auxiliary members - directory numbers 12, 13, 14, 15 and 16 Ringing delay - 0 ringing cycles <p>Day Service Ring Group 2 -</p> <ul style="list-style-type: none"> Main extension - directory number 12 Auxiliary member - directory numbers 12, 13, 14, 15, 16 Ringing delay - 2 ringing cycles <p>Night Service Ring Group 2 -</p> <ul style="list-style-type: none"> Main extension - directory number 12 Auxiliary member - directory numbers 12, 13, 14, 15, 16 Ringing delay - 0 ringing cycles
Speed Dial Numbers	Clear
Pickup Groups	Clear
Extension Characteristics	<p>Trunk 1 access - All extensions allowed</p> <p>Trunk 2 access - All extensions allowed</p> <p>Data Line Security - Not enabled on any extension</p> <p>Speed Dial access - All extensions allowed</p> <p>Toll Control - All extensions Toll allowed</p>
Trunk Characteristics	<p>Start Type - Loop start</p> <p>Disconnect Timing - 500 ms</p> <p>Wait for Dial Tone - No wait</p> <p>Tone-to-Pulse Conversion - Not enabled on any trunk</p>
Numbering Plan	<p>Extension directory numbers - 11, 12, 13, 14, 15 and 16</p> <p>Speed dial access code - 21, 22, 23, to 29</p> <p>Last number redial code - 20</p> <p>Trunk 1 access code - 9</p> <p>Trunk 2 access code - 8 or 9 (depending on the position of system switch 1 at power-up)</p>
Tone Plan	<p>Dial Tone - 350/440 Hz (continuous)</p> <p>Busy Tone - 480/620 Hz (500 ms ON, 500 ms OFF repeated continuously)</p> <p>Ringback Tone - 440/480 Hz (1 s ON, 3 s OFF repeated continuously)</p> <p>Reorder Tone - 440/620 Hz (250 ms ON, 250 ms OFF repeated continuously)</p> <p>Camp-On Tone - 440/480 Hz (Single burst of 200 ms)</p> <p>Transfer Dial Tone - 350/440 Hz (100 ms ON, 100 ms OFF repeated three times, then continuous tone).</p>
Trunk Break/Make Ratio	60/40
Ringing Frequency	20 Hz
Toll Control Plan	<p>Toll Control Plan 1 - Restrict</p> <p>Toll Control Plan 2 - Don't restrict</p>

Dial Call Pickup

Description

This feature allows an extension to answer calls that are ringing at another extension within the same Pickup Group. Pickup groups are used in those cases where Common Audible Ringing is undesirable.

Conditions

- A maximum of two pickup groups are permitted.
- Dial Call Pickup cannot be originated by an extension with a call on consultation hold. If Dial Call Pickup is attempted, the originating extension receives reorder tone and must flash the switchhook to return to the held call.
- An extension cannot be a member of both pickup groups.
- A callback to an extension cannot be "picked up" by any other extension.

Feature Selection

To Add Extensions to a Pickup Group:

- Lift the Control Extension handset - dial tone is returned.
- To add extensions to Pickup Group 1 dial 3413AX - acknowledge tone is returned.

OR

- To add extension to Pickup Group 2 dial 3423AX - acknowledge tone is returned.

where A = the number of extensions to be added to the Pickup group.

X = the equipment number of each extension that is to be added

To Remove an Extension from a Pickup Group:

- Lift the Control Extension handset - dial tone is returned.
- To remove an extension from Pickup Group 1 dial 3414X - acknowledge tone is returned.

OR

- To remove an extension from Pickup Group 2 dial 3424X - acknowledge tone is returned.

where X = the equipment number of the extension to be removed.

To Remove all Extensions from Both Pickup Groups:

- Lift the Control Extension handset - dial tone is returned
- Dial 302 - acknowledge tone is returned.

NOTES:

1. Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.

- Two beeps (Tone 2), indicates that the feature was already selected.

The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

2. The Equipment Number (EN) of an extension is defined as the second digit of the Extension Number, i.e. the EN of extension 23 is 3.

Operation

To Answer a Call within the Pickup Group:

- Lift the extension handset - dial tone is returned.
- Dial 66 - the extension is connected to the calling party.

Direct-In Lines

Description

This feature allows one extension to be used as a private line. Incoming trunk calls to the selected extension will ring that extension only.

Conditions

- The extension designated as a private line must represent the main extension of a Ring Group. The selected Ring Group must comprise that main extension only. Refer to Common Audible Ringing.

Feature Selection

To Assign a Direct-In Line:

- Set SW2 to OPEN.
- Lift Control Extension handset - dial tone is returned.
- Dial 301 (i.e. Remove ALL auxiliary members from both Ring Groups).
- Dial 33AB5X where
 - A = 1 for trunk 1 assignment
 - = 2 for trunk 2 assignment
 - B = 3 if day Ring Groups are in use
 - = 4 if night Ring Groups are in use
 - X = the Equipment Number of the direct-in-line extension
- Replace handset.
- Set SW2 to CLOSED.
- Reassign remainder of Ring Groups as desired. Refer to Common Audible Ringing within this practice.

NOTE: The Equipment Number (EN) of an extension is defined as the second digit of the Extension Number, i.e. the EN of extension 23 is 3.

Operation

None

Direct Outward Dialing

Description

This feature allows any extension within the SX-5 to access the public network by dialing a single-digit Trunk Access Code. Trunks may be selected either individually (Direct Trunk Select) or as a group (Trunk Group Selection). Refer to Direct Trunk Select and Trunk Group Operation, in this practice.

Conditions

When Default Data is Loaded:

- To operate in the Direct Trunk Select mode, SW1 must be set to OPEN.
- To operate in the Trunk Group Operation mode, SW1 must be set to CLOSED.

Feature Selection

To Enable Direct Trunk Select (i.e. Disable Trunk Group Operation):

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 4231 - acknowledge tone is returned.
- Set SW2 to CLOSED.

To Disable Direct Trunk Select (i.e. Enable Trunk Group Operation):

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 4232 - acknowledge tone is returned.
- Set SW2 to CLOSED.

NOTE: Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
- Two beeps (Tone 2), indicates that the feature was already selected.

The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Operation

To Initiate a Trunk Call:

- Lift the extension handset - dial tone is returned.
- Dial the required trunk access code - wait for dial tone
- Dial the Directory Number (i.e. 555-1234)

NOTE: The trunk access codes allocated by the default data are:

- 9, 8 when in the Direct Trunk Select mode.
- 9 when in the Trunk Group Operation mode.

Direct Trunk Select

Description

Selection of this feature allows an extension user to access a specific trunk by dialing the assigned trunk access code. Refer to Selectable Numbering Plans, Trunk Group Operation and Discriminating Ringing.

Conditions

- When default data is loaded, SW1 must be set to OPEN to enable Direct Trunk Select.
- The access code for Trunk 2 is dependent on the numbering plan selected. When numbering plan 1 or 2 is selected, the access code is 8. When numbering plan 3 or 4 is selected, the access code is 7.
- The access code for trunk 1 is 9 regardless of the numbering plan selected.

Feature Selection

To Enable Direct Trunk Select:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 4231 - acknowledge tone is returned.
- Replace the handset - the SX-5 operates in the Direct Trunk Select mode.
- Set SW2 to CLOSED.

To Disable Direct Trunk Select:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 4232 - acknowledge tone is returned.
- Replace the handset - the SX-5 operates in the Trunk Group Operation mode.
- Set SW2 to CLOSED.

NOTE:

Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
 - Two beeps (Tone 2), indicates that the feature was already selected.
- The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Operation

None

Discriminating Ringing

Description

Selection of this option allows an extension user to distinguish between internal calls and incoming trunk calls by distinctive ringing patterns. In addition, different ringing patterns may also be assigned to each incoming trunk, allowing individual trunks to be distinguished. Internal calls have a ringing pattern of 1 s on 3 s off. The ringing pattern for incoming trunk calls is determined when the default data is loaded, dependent on which mode of operation is selected, i.e. Direct Trunk Select or Trunk Group Operation. However the ringing pattern for incoming trunk calls may be changed as detailed in Feature Selection.

Conditions

On Initial Power-up:

- In Trunk Group Operation mode, all incoming trunk calls have the same ringing pattern, 400 ms on, 200 ms off, 400 ms on, 3 s off (i.e. two quick rings), continuous until the call is answered.
- In Direct Trunk Select mode, there is discriminating ringing between Trunk 1 and Trunk 2. For Trunk 1 the ringing pattern is 400 ms on, 3.6 s off, (i.e. one quick ring), continuous until the call is answered. For Trunk 2 the ringing pattern is 400 ms on, 200 ms off, 400 ms on, 3 s off (i.e. two quick rings), continuous until the call is answered.

Feature Selection

To Enable Identical Ringing for Both Trunks:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 4242 - acknowledge tone is returned.
- Replace the handset - Trunks 1 and 2 have the same ringing pattern.
- Set SW2 to CLOSED.

To Enable Discriminating Ringing for Each Trunk:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 4241 - acknowledge tone is returned.
- Replace the handset - Trunks 1 and 2 have different ringing patterns.
- Set SW2 to CLOSED.

NOTE:

Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
- Two beeps (Tone 2), indicates that the feature was already selected.

The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Operation

None

Do Not Disturb

Description

The Do Not Disturb feature may be activated by any extension within the system. Incoming calls to extensions which have Do Not Disturb enabled, receive busy tone. If the Control Extension calls an extension with Do Not Disturb enabled, then it too receives busy tone. When Do Not Disturb is enabled on an extension it must be noted that:

- Incoming trunk calls do not ring the extension.
- Camp-on tone is not received by the extension when an incoming trunk call is present.

When call forward is set by the same extension, the forwarded extension will ring or receive camp-on tone.

Conditions

- In order to be notified of incoming trunk calls, at least one member of each ring group should not have Do Not Disturb assigned to it (i.e. should be disturb).
- Call origination with the Do Not Disturb feature enabled is not affected.
- Extensions that have Do Not Disturb enabled receive a distinctive dial tone (Transfer dial tone) on going off-hook. This reminds the user that the feature is activated.
- An extension which has a trunk call on hold will be recalled when the recall time expires, even when Do Not Disturb is enabled.

Feature Selection

None

Operation

To Set Do Not Disturb at an Extension:

- Lift the extension handset - dial tone is returned.
- Dial 57 - dial tone is returned.
- Replace the handset - all calls to that extension receive busy tone.

To Clear Do Not Disturb from the Extension:

- Lift the extension handset - distinctive dial tone is returned.
- Dial 67 - dial tone is returned.
- Replace the handset - Do Not Disturb is cleared, all calls to that extension operate in the normal manner.

Extension Switchhook Flash Timing

Description

Switchhook flash is the term given to the action of depressing and quickly releasing the telephone switchhook. This feature defines the maximum duration of a switchhook flash. Some users experience difficulty in performing a switchhook flash when the maximum duration is set to 750 ms (3/4 s). To accommodate these users it is possible to define the switchhook flash time to accept flashes of up to 1500 ms (1 1/2 s). Thus a user holding the cradle down for 1 s will no longer hang-up on the call. For a more detailed description of a Switchhook Flash refer to Switchhook Flash in this practice.

Feature Selection

To Set Switchhook Flash Timing

- Lift the Control Extension handset - dial tone is returned.
- Dial 417A where
 - A = 1 for a flash timer of between 150 ms and 750 ms
 - A = 2 for a flash timer of between 150 ms and 1500 ms
 - A = 3 for flash to mean call release
- Acknowledge tone is returned.
- Replace the handset - the Switchhook Flash Timing is defined.

NOTE: Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
 - Two beeps (Tone 2), indicates that the feature was already selected.
- The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Operation

Automatic

**External Feature
Access**

Description

This feature allows a switchhook flash to be extended through the SX-5 to the Central Office (allowing access to the Customer Calling feature provided by the CO) or to a host PBX (allowing access to the features provided by the host PBX).

Conditions

- This feature may only be accessed during an established extension-to-trunk call (not including Trunk-to-Trunk plus Extension conference calls).

Feature Selection

None

Operation

To perform External Feature Access:

- Establish a trunk call.
- Flash the switchhook - trunk is placed on consultation hold at the PBX.
- Dial 0 - a switchhook flash is extended to the CO or the host PBX, at which point either an incoming call from the CO or dial tone from the host PBX is received.

Last Number Redial

Description

This feature allows the last number dialed at each extension to be stored and later redialed automatically, upon request from the associated extension. The request is in the form of a 2-digit Last Number Redial access code.

Conditions

- Only the last valid trunk call number will be redialed, and then only if it was the last number dialed from the extension.
- Wait for Dial Tone (min. 5 s) feature must be programmed.

Feature Selection

Program a Wait for Dial Tone of 5 s minimum. Refer to Wait for Dial Tone in this practice.

Operation

To Select Last Number Redial:

- Lift handset - dial tone is returned.
- Dial Last Number Redial access code; i.e. 20 when extension numbering plan is 11-16, 10 when extension numbering plan is 21-26.

Lockout

Description

This feature is activated immediately if one of the two parties engaged in a call goes on-hook. The party which remained off-hook will be automatically disconnected from the speech path, allowing that speech path to be used for another caller.

Conditions

None

Feature Selection

None

Operation

Automatic

Make/Break Ratio

Description

This feature allows the selection of two different outpulsing ratios (Make/Break) for outgoing trunks. Selection of this feature allows the SX-5 to operate in any country irrespective of the country's standard for make/break ratio.

Conditions

Outpulsing should be set to meet local Central Office conditions.

Programming

To Set Make/Break Ratio

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 447A where
 - A = 2 for a Make/Break ratio of 40/60.
 - A = 3 for a Make/Break ratio of 33/67.
- Acknowledge tone is returned.
- Set SW2 to CLOSED.

NOTE: Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
- Two beeps (Tone 2), indicates that the feature was already selected.

The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Operation

Automatic

Mixed Station Dialing

Description

This feature allows the simultaneous use of rotary and DTMF telephones. All SX-5 features are accessible from either type of extension.

Conditions

- The SX-5 provides tone-to-pulse conversion, therefore DTMF telephones may be used even if the trunks are dial pulse only.

Feature Selection

None

Operation

Automatic

Music on Hold**Description**

This feature allows an external music source to be connected to the system for use with Camp-On and Call Hold features. The music source is connected to the system via the terminal strip. If music is not provided, trunk calls that are on hold or camped-on will hear nothing. The music source can also be used to provide Background Music via the PA system.

Conditions

- Music source should be between 50 and 500 mVrms.
- The music source must be connected as detailed in Section MITL9103-098-200-NA.
- The volume of the Music on Hold feature can be adjusted from the external music source.

Feature Selection**To Enable Music on Hold:**

- Lift the Control Extension handset - dial tone is returned.
- Dial 3242 - acknowledge tone is returned.
- Replace the handset - Music on Hold is enabled.

To Disable Music on Hold:

- Lift the Control Extension handset - dial tone is returned.
- Dial 3241 - acknowledge tone is returned.
- Replace the handset - Music on Hold is disabled.

NOTE:

Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
- Two beeps (Tone 2), indicates that the feature was already selected.

The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Night/Day Service

Description

This feature allows incoming trunk calls to be routed to preselected extensions or Ring Groups when the system is placed in either Day or Night Service by the Control Extension. The assignment of extensions or Ring Groups to which calls are to be routed, may be made by the Control Extension at any time. Refer to Common Audible Ringing.

Conditions

None

Feature Selection

To Select Day Service:

- Lift the Control Extension handset - dial tone is returned.
- Dial 312 - acknowledge tone is returned.
- Replace the handset - Day Ring Groups 1 and 2 are enabled.

To Select Night Service:

- Lift the Control Extension handset - dial tone is returned.
- Dial 313 - acknowledge tone is returned.
- Replace the handset - Night Ring Groups 1 and 2 are enabled.

NOTE:

Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
- Two beeps (Tone 2), indicates that the feature was already selected.

The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

**Power Fail Restart -
Battery**

Description

The customer data describing each individual customer's requirements is held in the Random Access Memory (RAM). In the event of a total power failure, the RAM data is maintained by a battery pack held on the Memory Module. This battery pack will maintain the RAM data intact for up to 600 hours.

Conditions

None

Feature Selection

None

Operation

Automatic

**Power Fail Restart -
PROM/ROM**

Description

All SX-5 call processing programs are held in Read Only Memories (ROM). This type of memory is unaffected by power failure. Call processing starts immediately after power is applied to the system.

Conditions

None

Feature Selection

None

Operation

Automatic

**Power Fail Transfer -
Both Trunks**

Description

The SX-5 provides two Power Fail Transfer circuits. In the event of a malfunction or commercial power failure, these circuits connect extension 1 to trunk 1 and extension 2 to trunk 2.

Conditions

- If a trunk is a ground start trunk, the extension must be equipped with a Ground Start Button, or a Ground Start/Loop Start Converter.
- When power is returned to the system the Power Fail Transfer circuits are reset, causing calls set up over trunks 1 and 2 to be disconnected.

Feature Selection

None

Operation

Automatic

Privacy - Automatic

Description

This feature ensures that the first extension user seizing a free trunk, has sole access to that trunk. This prevents all other extension users with access to that line, from accidentally or intentionally entering the conversation. Privacy is also automatic on internal calls.

Conditions

- Privacy does NOT inhibit three-party conferences. However such conferences only take place at the discretion of the first party to seize the trunk.

Feature Selection

None

Operation

Automatic

Programmable Disconnect Timing

Description

The time taken for the telephone equipment, used in a call set up, to release when the call is terminated, is known as the Disconnect Time. The disconnect time of an SX-5 is extremely fast compared to that of the CO/COs to which it is connected. It is therefore necessary to prevent SX-5 users from accessing a trunk before the CO has released the previous call on that trunk. To do this the SX-5 may be programmed to recognise the disconnect time of a CO, and to inhibit access to a trunk until that time expires. Programmable Disconnect Timing is accessed via the Control Extension. Each trunk must be programmed separately with the same or different Disconnect Timing.

Conditions

- Disconnect Timing must be programmed for each trunk.

Feature Selection

To Enable Disconnect Timing for Trunk 1:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 4314A where
 - A = 1 when a Disconnect Timing of 60 ms is to be programmed.
 - A = 2 when a Disconnect Timing of 500 ms is to be programmed.
 - A = 3 when a Disconnect Timing of 1.5 s is to be programmed.
 - A = 4 when a Disconnect Timing of 4 s is to be programmed.
- Acknowledge tone is returned.
- Replace the handset - Disconnect Timing for Trunk 1 is set.
- Set SW2 to CLOSED.

To Enable Disconnect Timing for Trunk 2:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 4324A where
 - A = 1 when a Disconnect Timing of 60 ms is to be programmed.
 - A = 2 when a Disconnect Timing of 500 ms is to be programmed.
 - A = 3 when a Disconnect Timing of 1.5 s is to be programmed.
 - A = 4 when a Disconnect Timing of 4 s is to be programmed.
- Acknowledge tone is returned.
- Replace the handset - Disconnect Timing for Trunk 2 is set.
- Set SW2 to CLOSED.

- NOTE:** Acknowledge tone may be one of two tones; they are:
- One beep (Tone 1), indicates that the new feature access code has been accepted.
 - Two beeps (Tone 2), indicates that the feature was already selected.
- The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Refer to Section MITL9103-098-205-NA for complete information on Programming Disconnect Timing.

Operation

Automatic

Programming

Description

The SX-5 contains a default program with a fully operational customer feature package. This default data will fill most customer's needs. However, some re-programming may be necessary to fulfill a specific customer's requirements. Programming is performed by dialing digits from the Control Extension (EN 1). Table 4 lists the customer programs that may be modified.

Table 4
Programming

Programmable Data	Access Code
Extension Characteristics	40
System Timers	41
System Selection	42
Trunk Characteristics	43
Nationality (Numbering Plans, etc.)	44
Toll Restriction	45

Conditions

- To enter the programming mode, System Switch 2 (SW2) must be set to OPEN.
- Programming is performed from the Control Extension only.
- Only one parameter can be changed at a time.
- If incorrect digits are dialed, reorder tone is returned.
- If correct digits are entered and the state of the customer's data is changed, Acknowledge Tone 1 is returned.
- If correct digits are entered and the state of the customer's data is not changed, Acknowledge Tone 2 is returned.
- All Feature Access Codes are fixed.
- Extension features are inherent, and cannot be disabled.
- For further programming information, refer to Section MITL9103-098-205-NA, Programming.

Feature Selection

To Program the System:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial the required programming digits - acknowledge tone is returned.
- Replace the handset.
- Set SW2 to CLOSED.

NOTE: Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
 - Two beeps (Tone 2), indicates that the feature was already selected.
- The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

To Verify Data Entry:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Redial the programming digits.
- Listen for Acknowledge Tone 2. Reception of tone 2 indicates that the data is in the system.
- Replace the handset.
- Set SW2 to CLOSED.

NOTE: Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
- Two beeps (Tone 2), indicates that the feature was already selected.

The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Operation

Refer to Section MITL9103-098-205-NA for complete programming instructions.

Reversal Meaning

Description

To indicate incoming calls or disconnect, some Central Offices provide signalling, via Tip-Ring Reversal or Third Wire change of state. The SX-5 can be programmed to recognize these signals.

Conditions

- In all cases, Tip-Ring Reversal is equivalent to Third Wire change of state.
- Reversal Meaning must be programmed for each trunk.
- Both trunks are nonpolarized, in that, on power-up, Tip may be more negative than Ring or vice versa. The SX-5 will consider either state as a valid quiescent state. Only a change in polarity will be considered as a signal.

Feature Selection

To Define Reversal Meaning:

- Lift Control Extension handset - dial tone returned.
- Dial 43A8B where
 - A = 1 if the reversal meaning for trunk 1 is to be programmed.
 - A = 2 if the reversal meaning for trunk 2 is to be programmed.
 - B = 1 if reversal means Not Incoming Call or Disconnect
 - B = 2 if reversal means Incoming Call.
 - B = 3 if reversal means Incoming Call or Disconnect.
- Replace handset - the reversal meaning selected is enabled.
- Set SW2 to CLOSED.

Operation

Automatic

Rotary Dial Pulse-to-Digit Conversion

Description

In some geographical locations telephone sets do not pulse on a 1 : 1 ratio. To accommodate these telephones sets and their associated Central Offices, the SX-5 allows the selection of four different digit translation plans as shown in Table 5 below. This allows the SX-5 to be used in any country irrespective of that country's digit translation. Refer to Selectable Tone Plans and Selectable Ringing Frequency.

Table 5
Rotary Dial Pulse-to-Digit Translation Plans

Translation Code	Digit Dialed										Number of Pulses
	1	2	3	4	5	6	7	8	9	0	
1	1	2	3	4	5	6	7	8	9	10	10
2	2	3	4	5	6	7	8	9	10	1	10
3	9	8	7	6	5	4	3	2	1	10	10
4	10	9	8	7	6	5	4	3	2	1	10

Conditions

None

Feature Selection

To select the required Rotary Dial Pulse-to-Digit Translation Plans:

- Set SW2 to OPEN.
- Lift Control Extension handset - dial tone is returned.
- Dial 440A where A is the desired translation code as defined in Table 5.
- Replace handset - the selected Translation Plan is enabled.
- Set SW2 to CLOSED.

Operation

Automatic

Selectable Numbering Plans

Description

Four different numbering plans are available within the system, as defined in Table 6. Any of these numbering plans may be selected, the default numbering plan being Plan 1. For a complete description of the default customer data, refer to the Default Data description.

Table 6
Default Numbering Plans

Plan	1	2	3	4
Extension Numbers	11	21	11	21
	12	22	12	22
	13	23	13	23
	14	24	14	24
	15	25	15	25
	16	26	16	26
Speed Dial Access Code	2	1	2	1
Trunk 1 Access Code	9	9	9	9
Trunk 2 Access Code	8	8	7	7
Last Number Redial	20	10	20	10

Conditions

None

Feature Selection

To select a Numbering Plan:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 447A - where A is the required numbering plan code as defined in Table 6 above - acknowledge tone is returned.
- Replace handset - the Numbering Plan selected is enabled.
- Set SW2 is CLOSED.

NOTE: Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
- Two beeps (Tone 2), indicates that the feature was already selected.

The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Operation

Automatic

Selectable Ringing Frequency

Description

To accommodate various telephones used throughout the world, the SX-5 provides a selection of three different ringing frequencies, 17.5 Hz, 20 Hz, and 25 Hz. The selectable ringing frequency, when used in conjunction with the Tone Plans and Rotary Dial Pulse-to-Digit Conversion, enables the SX-5 to be used in any country.

Conditions

- The ringing frequency selected applies to all extensions.

Programming

To Select the Ringing Frequency

- Lift the Control Extension handset - dial tone is returned.
- Dial 442A where
 - A = 3 for a ringing frequency of 20 Hz
 - A = 4 for a ringing frequency of 25 Hz
 - A = 5 for a ringing frequency of 17.5 Hz.
- Acknowledge tone is returned.
- Replace handset - the selected ringing frequency is enabled.
- Set SW2 to CLOSED.

NOTE: Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
 - Two beeps (Tone 2), indicates that the feature was already selected.
- The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Operation

Automatic

Speed Dial

Description

This feature allows extensions to use directory numbers in a speed call application. Up to nine directory numbers each having a maximum of 26 digits may be programmed from the Control Extension. Speed Dial numbers are free from Toll Restriction.

Feature Selection

To Allow an Extension Access to the Speed Call Numbers:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 40X02 where
X = the equipment number of the extension that is allowed access to the speed dial numbers.
- Set SW2 to CLOSED.

To Deny an Extension Access to the Speed Call Numbers:

- Set SW2 to OPEN
- Lift the Control Extension handset - dial tone is returned.
- Dial 40X01 where
X = the equipment number of the extension which is to be denied access to the speed call numbers.
- Set SW2 to CLOSED

NOTE: The Equipment Number (EN) of an extension is defined as the second digit of the Extension Number, i.e. the EN of extension 23 is 3.

Operation

To Store a Speed Dial Number:

- Lift the Control Extension handset - dial tone is returned.
- Dial 35ABCX where
A = a single digit, 1-9 which defines the speed dial store position
BC = a 2-digit number indicating the total number of digits in the directory number
X = the actual speed dial number to be stored. The entries may be the digits 0 through 9 or any of the special codes listed in Table 7.

**Table 7
Special Speed Dial Codes**

Code	Meaning
#	International End of Dialing
*1	Pause for 5 s, then outpulse
*2	Wait for dial tone as defined for the system
*3	Allows manual dialed digits to be added to the end of the speed dialed number. (Follow this code with 01-16, the number of digits to be manually inserted.)

NOTE: Each of the codes given in Table 7 is defined as one digit when calculating the total number of digits in the Speed Dial Number (BC).

Operation

- Lift handset - dial tone is returned.
- Dial the speed call access code. (For extensions having a first digit of 1 the access code is 2. For extensions having a first digit of 2 the access code is 1.)
- Wait for dial tone.
- Dial the single digit, 1-9 which identifies the speed dial store position - the speed dial number stored in that position is outpulsed.
- If manual digits are to be added to the speed dial number, dial the required digits.

Switchhook Flash

Description

The two buttons upon which the telephone handset rests when in the on-hook position are known as the switchhook. Switchhook Flash is the term given to the action of depressing and quickly releasing these buttons within a set period. This action is performed during an established call to reconnect the "flashing" extension to the system's control. The user may then access features by dialing the appropriate feature access code, while the second party is put on consultation hold. The timing of a switchhook flash is programmable within the limits outlined in Extension Switchhook Flash Timing of this practice.

Conditions

- The period for which the switchhook is depressed must be within the programmed switchhook flash timing.

Feature Selection

None

Operation

To perform a Switchhook Flash:

- Establish a call.
- Depress the switchhook and quickly release it within the programmed period - interrupted dial tone (transfer dial tone) is received.

System Selection

Description

The SX-5 has two modes of operation: Direct Trunk Select and Trunk Group Operation. In the Direct Trunk Select mode each trunk has its own access code and may only be accessed by an extension user dialing that code. In the Trunk Group Operation only one code is necessary to access either trunk. The mode of operation is selected by the setting of Switch 1 (SW1) when the default data is loaded. Distinctive ringing for Incoming Trunk identification is also enabled when the Direct Trunk Select mode is selected. (Refer to Discriminating Ringing).

Conditions

The setting of switch 1 is only read at the time the default data is loaded. Switch 1 has no effect at any other time.

Feature Selection

To Enable Direct Trunk Select and Disable Trunk Group Operation

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 4231 - acknowledge tone is returned.
- Replace the handset - the SX-5 operates in the Direct Trunk Select mode.
- Set SW2 to CLOSED.

To Disable Direct Trunk Select and Enable Trunk Group Operation.

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 4232 - acknowledge tone is returned.
- Replace the handset - the SX-5 operates in the Trunk Group Operation mode.
- Set SW2 to CLOSED.

NOTE: Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
- Two beeps (Tone 2), indicates that the feature was already selected.

The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Operation

Automatic

Timed Recalls

Description

The SX-5 allows flexible recall times to be specified for calls on hold, camped-on to a busy extension or transferred to an extension. If any of these features are accessed and the recall time is exceeded, the call will automatically be returned to the extension that accessed the feature.

Conditions

- The default values for the recall times are:
Hold - 3 min.
System Recall - 3 rings.

Feature Selection

Refer to Call Hold and Automatic Call Back - Don't Answer Feature Description

Operation

Automatic

Toll Restriction**Description**

Toll Restriction is used to deny an extension the ability to make toll calls. Toll calls are defined as those which have a 0, 1, * or #, as the first or second digit after the trunk access code has been dialed, or as calls which receive toll supervision. Denial may be specified to be active on the first and second digit dialed.

Conditions

- Toll denial on receipt of supervision is dependent on the CO providing supervision on access of the toll network.
- An extension may be allowed or denied access to trunk 1, trunk 2 or both. When an extension is allowed trunk access then either Toll Allowed, Toll Plan 1 or Toll Plan 2 must be assigned to the extension.

Feature Selection

To Define a Toll Control Plan:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 45ABC where
 - A = 1 if toll plan 1 is to be programmed.
 - = 2 if toll plan 2 is to be programmed.
 - B = the required restriction code as defined in Table 8
 - C = 1 if the restriction selected is to be ignored.
 - = 2 if the restriction selected is to be active.
- Set SW2 to CLOSED.

Table 8
Toll Restriction Codes

Code	Restriction
3	Restrict on receipt of supervision
4	Restrict call if the first digit dialed is '0'
5	Restrict call if the first digit dialed is '1'
6	Restrict call if the second digit is dialed '1 or 0', i.e. an area code
7	Restrict call if the first digit dialed is a 1 and the second digit is 1 or a 0.

To Assign a Toll Control Plan to an Extension:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 40X1A where
 - X = the equipment number of the extension to be programmed
 - A = 2 if the extension is toll allowed
 - = 3 if the extension is to access toll control plan 1
 - = 4 if the extension is to access toll control plan 2
- Set SW2 to CLOSED.

Operation

Automatic

Tone-to-Pulse Conversion

Description

This feature allows the SX-5 to automatically convert DTMF signals from DTMF equipment to dial pulse (rotary) signals where the CO or distant end of the outgoing trunk is not equipped to accept DTMF signals.

Conditions

When the "disable outgoing audio until answer supervision" feature is selected there are three methods to reestablish the audio; they are:

- Dial # once the directory number has been dialed.
- Answer supervision has been detected by the SX-5.
- 10 s after dialing the last digit, outgoing audio is automatically reenabled.

Feature Selection

To Specify Tone-to-Pulse Conversion:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 43A6B where
 - A = 1 if Tone-to-Pulse Conversion for trunk 1 is to be specified.
 - A = 2 if Tone-to-Pulse Conversion for trunk 2 is to be specified.
 - B = 1 if conversion is not required.
 - B = 2 if conversion is required.
 - B = 3 if conversion is required and outgoing audio is to be disabled.
- Set SW2 to CLOSED.

**Transfer/Add-On/
Consultation Hold**

Description

This feature allows extension users involved in an active call to place the call on consultation hold and originate a new call. The user may consult privately with the third party, add the third party to the call or transfer the original call to the third party. See Call Hold.

Conditions

- Flash for Transfer/Add-On/Consultation Hold and Flash Means Release are mutually exclusive.
- A transferred call that exceeds the 'ring no answer' recall time will recall to the transferring extension.

Feature Selection

No feature selection is required but the recall time may be specified

Operation

To Consult with a Third Party:

- Flash the switchhook - transfer dial tone is returned and the original call is placed on consultation hold.
- Dial the number of the third party - when the call is answered, the user may consult privately with the third party.

To Add the Third Party to the Call:

- Flash the switchhook - all three parties are connected in a conference call.

Or to Transfer the Call to the Third Party:

- Replace the handset - the original call is transferred to the third party.
- If the handset is replaced while the third party is ringing, the second party receives ringback tone and waits for the third party to answer. If the third party does not answer within the hold recall time the extension responsible for the transfer rings.
- If the handset is replaced on receipt of busy tone from the third party, the extension is recalled immediately. The second party is camped-on to the third party and receives busy tone. The third party only receives camp-on tone when the second party is a trunk.

To Specify the System Recall Time:

- Set SW2 to OPEN
- Lift the Control Extension handset - dial tone is returned
- Dial 419A where
A = the number of 4-second ringing cycles (4 s) allowed before recalling to the transferring extension (1-9).
- Set SW2 to CLOSED.

**Trunk Camp-On with
Indication**

Description

This feature allows incoming trunk calls to be connected (Camped-On) to a busy extension for automatic completion when the extension becomes free. When a call is camped-on to an extension, the called extension hears two 200 ms bursts of camp-on tone every 18 s, to indicate a trunk call is waiting.

Conditions

- When a call is camped-on to an extension, the called extension, and only that extension, will hear the camp-on tone.
- Camp-on tone is not received by any of the parties involved in a call, when one of the parties has Data Line Security set.

Feature Selection

None

Trunk Group Operation

Description

Selection of this feature allows an extension user access to either trunk by dialing the trunk group access code (9). If trunk 1 is busy, the SX-5 will automatically access trunk 2. If both trunks are busy, busy tone is returned. Refer to Discriminating Ringing and Direct Trunk Select.

Conditions

On loading default data SW1 must be set to OPEN to enable Trunk Group Operation.

- The trunk access code is 9.
- When one trunk is busy, the SX-5 automatically accesses the other trunk.
- If both trunks are busy - busy tone is returned.

Feature Selection

To Enable Trunk Group Operation:

- Set SW2 to OPEN.
- Lift the Control Extension handset - dial tone is returned.
- Dial 4232 - acknowledge tone is returned.
- Set SW2 to CLOSED.

NOTE: Acknowledge tone may be one of two tones; they are:

- One beep (Tone 1), indicates that the new feature access code has been accepted.
 - Two beeps (Tone 2), indicates that the feature was already selected.
- The relevant tone is repeated three times. Reorder tone will be received when the dialed code is invalid.

Operation

To Initiate a call in Trunk Group Operation:

- Lift extension handset - dial tone is returned.
- Dial 9 - wait for dial tone
- Dial the required directory number.

**Trunk-to-Trunk plus
Extension
Conferencing**

Description

This feature allows an extension user, who is involved in an established trunk call, to place the trunk on consultation hold and access a second trunk. The user may then converse privately with the third party, or form a three-party conference.

Conditions

- The extension must remain in the conference.
- When the extension goes on-hook, the trunks will be released.
- The extension must be allowed access to the second trunk.

Feature Selection

None

Operation

- Establish a trunk call.
- Flash the switchhook - the first party is put on consultation hold, dial tone is returned.
- Dial the required trunk access code and directory number - two-way conversation with the third party.
- Flash the switchhook to connect the held trunk to the existing call and form a three-party conference.

Voice Paging

Description

Any extension is allowed access to the customer-provided paging equipment. After dialing the required access code (61), the extension users hears a short warning tone, indicating that the extension is connected to the paging circuits. The paging announcement may now be made.

Conditions

- Paging can be accessed from any extension within the SX-5.
- The volume of the paging announcement can be adjusted from the customer-provided paging amplifier.
- The paging amplifier and speaker must be customer-provided and connected as detailed in Section MITL9103-098-200-NA.

Feature Selection

None

Operation

To Enable the Paging Circuitry:

- Lift the extension handset - dial tone is returned.
- Dial 61 - wait for warning tone.
- When the warning tone is heard, connection to the paging equipment is made and the paging announcement can be made.

Wait for Dial Tone**Description**

This feature allows selection of the maximum period of time the system will wait to receive dial tone from a trunk. Digits dialed before dial tone is received, or before the time-out period specified are not outpulsed by the system.

Feature Selection

To Specify the Wait for Dial Tone Period:

- Set SW2 to OPEN.
- Lift the control Extension handset - dial tone is returned.
- Dial 43A5B where
 - A = 1 if the wait for dial tone period is to be specified for trunk 1.
 - = 2 if the wait for dial tone period is to be specified for trunk 2.
 - B = 1 outpulse digits immediately i.e. no wait
 - = 2 wait a maximum of 5 s before outpulsing
 - = 3 wait a maximum of 1 min. before outpulsing.
- Set SW2 to CLOSED.

Operation

None

SX-5*

SUPERSWITCH

ORDERING INFORMATION

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2. ORDERING INFORMATION	1
General	1

- A complete system.
- A deconfigured system comprising a complete system minus its Trunk Module.
- A main assembly comprising a complete system minus its Trunk and Memory Modules.
- Trunk and/or Memory Modules.

1. GENERAL

Introduction

1.01 This section describes the SX-5 equipment that may be ordered from MITEL, and provides the information required to make such an order.

Provision of Spare Equipment

1.02 The sparing of SX-5 equipment is arranged to accommodate complete or partial replacement. Partial replacement allows the customer to utilize his existing spares (i.e. Trunk Modules) and to easily change the generic of the system (i.e. Memory Module replacement). MITEL provides four levels of SX-5 replacement equipment; they are :

Warranty

1.03 The MITEL SX-5 Communications System is warranted against defective material and workmanship. Equipment requiring service or repair during the warranty period is to be packaged in accordance with Section MITL9103-098-200-NA and returned prepaid to the supplier. Repaired or replacement equipment will be returned to the customer, postpaid by MITEL.

2. ORDERING INFORMATION

General

2.01 A detailed description of SX-5 equipment that may be ordered, including part numbers, is given in Tables 1 and 2. Additional items such as installation and marketing aids are listed in Table 3.

TABLE 1
 COMPLETE SYSTEM

EQUIPMENT	PART NUMBER	DESCRIPTION
SX-5 COMMUNICATION SYSTEM	9103-100-100-NA	Complete SX-5 system including 6 line circuits, two trunks (900 ohms), generic package, power supply and documentation.

TABLE 2
 PARTIAL SYSTEMS

EQUIPMENT	PART NUMBER	DESCRIPTION
SX-5 DECONFIGURED SYSTEM	9103-100-000-NA	Complete SX-5 system minus its Trunk Module.
SX-5 MAIN ASSEMBLY	9103-101-000-NA	Complete SX-5 system minus its Trunk Module and Memory Module.
TRUNK MODULE	9102-011-002-NA	Provides 2 loop or ground start trunks, 900 ohms impedance.
SX-5 MEMORY MODULE	9103-006-050-NA	SX-5 generic package containing all operating data and pre-programmed customer data.

TABLE 3
ADDITIONAL ITEMS

ITEM	PART NUMBER	DESCRIPTION
A. HARDWARE		
Modular External Connection Kit	9102-041-000-NA	Consists of 2 lengths of plug-ended line cord and 2 connector blocks. May be used to connect two trunk lines to an SX-5.
Pack of eight SLIC's - Earth Recall	9102-043-001-NA	Provided to facilitate ease of line circuit replacement.
B. DOCUMENTATION		
System Documentation	9103-098-001-NA	Consists of all documents required to install, maintain and operate the SX-5 Communication System (SX-5 MITEL Standard Practices).
SX-5 Station User Guide	9103-953-000-NA	Details extension features operation.
C. BROCHURES		
SX-5 General Brochure	9103-951-998-BB	General brochure for SX-5.
SX-5 Homebuilder Brochure	9103-951-997-BB	A brochure for Home Builders which describes the advantages of incorporating an SX-5 as part of a new home project.
D. PRODUCT BULLETINS		
SX-5 Introductory Product Bulletin	9103-952-001-BB	Product bulletin introducing the SX-5.

NOTE: The last two letters (BB) of the selected support material part numbers specify the address block provided, where;
 NB = Canadian address block;
 NC = U.S. address block.

SX-5*
SUPERSWITCH*
COMMUNICATIONS SYSTEM
ENGINEERING INFORMATION

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General	8	General	19
B. Description of Circuit Cards	8	Transmission Characteristics	19
Memory Module	8	1. GENERAL	
Trunk Module	8	1.01 This section contains the basic engineering information for the SX-5 Communications System (Generic 50).	
Main Card	10	1.02 A summary of the information given in Section MITL9103-098-100-NA and Section MITL9103-098-200-NA, forms an in-	
C. CO Trunks	12		
Ground Start/Loop Start	12		

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roduction to the technical information contained in this section.

2. GENERAL DESCRIPTION

2.01 The SX-5 is a compact and reliable electronic telephone communications system employing solid-state space division switching, and stored program control. The system can accommodate two Central Office trunks and six extensions. The SX-5 is compatible with most existing Private Branch Exchanges (PBX's), and Central Office (CO) equipment. The system provides:

- Simultaneous use of DTMF and Rotary Dial extensions
- DTMF to Dial Pulse Conversion
- Direct Trunk Select or Trunk Group Operation
- Optional reserve power unit

2.02 The SX-5 consists of a single cabinet (see Fig. 2-1), holding the switching circuitry and power supply. The Main Card, which contains the switching circuitry, is accessible at two levels. The first level of entry allows access to the terminal strip, LED's, and system switches. The second level of entry allows the replacement of modules by a qualified technician. An equipment layout is shown in Fig. 2-2.

2.03 The SX-5 is powered by 115 Vac (230 Vac optional) fed through the power cable from a commercial outlet. For further power detail refer to 9.30.

Maintenance

2.04 The SX-5 is shipped fully equipped from the factory. In case of a malfunction, maintenance can be simplified to system replacement or, if module faults are identified, the second level of entry allows module replacement by a qualified technician.

Note: The second level of entry should only be attempted by a qualified technician.

3. PHYSICAL DESCRIPTION

Card Enclosure

3.01 The SX-5 consists of a single enclosure, containing the printed circuit cards, with a lockable access door on the right-hand side. The overall dimensions of the system are shown in Fig. 3-1. The total weight of the system is 12 lbs. (5.5 kg). All connections to the system enter at the bottom of the SX-5 access door and are terminated directly on the terminals at the right-hand edge of the Main Card.

System Switches

3.02 The SX-5 has two system switches located on the upper right-hand side of the Main Card. The top most switch is the Programming Switch, Switch 2 (SW2). This switch enables programming and is also used to reload the system default data. Switch 1 (SW1) is located directly below SW2. This switch enables either Direct Trunk Select or Trunk Group Operation. The system Reset Button is positioned below the system switches.

Circuit Cards

3.03 All printed circuit cards employed in the system are identical in construction and consist of a fiberglass board with printed circuit patterns on both of its faces. Table 3-1 lists the card types, their dimensions and weights.

TABLE 3-1
CARD TYPES

Card Type	Dimensions	Weight
Main Card	11.1 in. x 9.7 in. 282 mm x 246 mm	1.19 lb 0.54 kg
Power Supply Card	2.5 in. x 9.7 in. 64 mm x 246 mm	0.56 lb 0.26 kg
Trunk Module	6 in. x 4.38 in. 152 mm x 111.3 mm	0.37 lb 0.17 kg
Memory Module	7.0 in. x 4.0 in. 178 mm x 102 mm	0.31 lb 0.14 kg

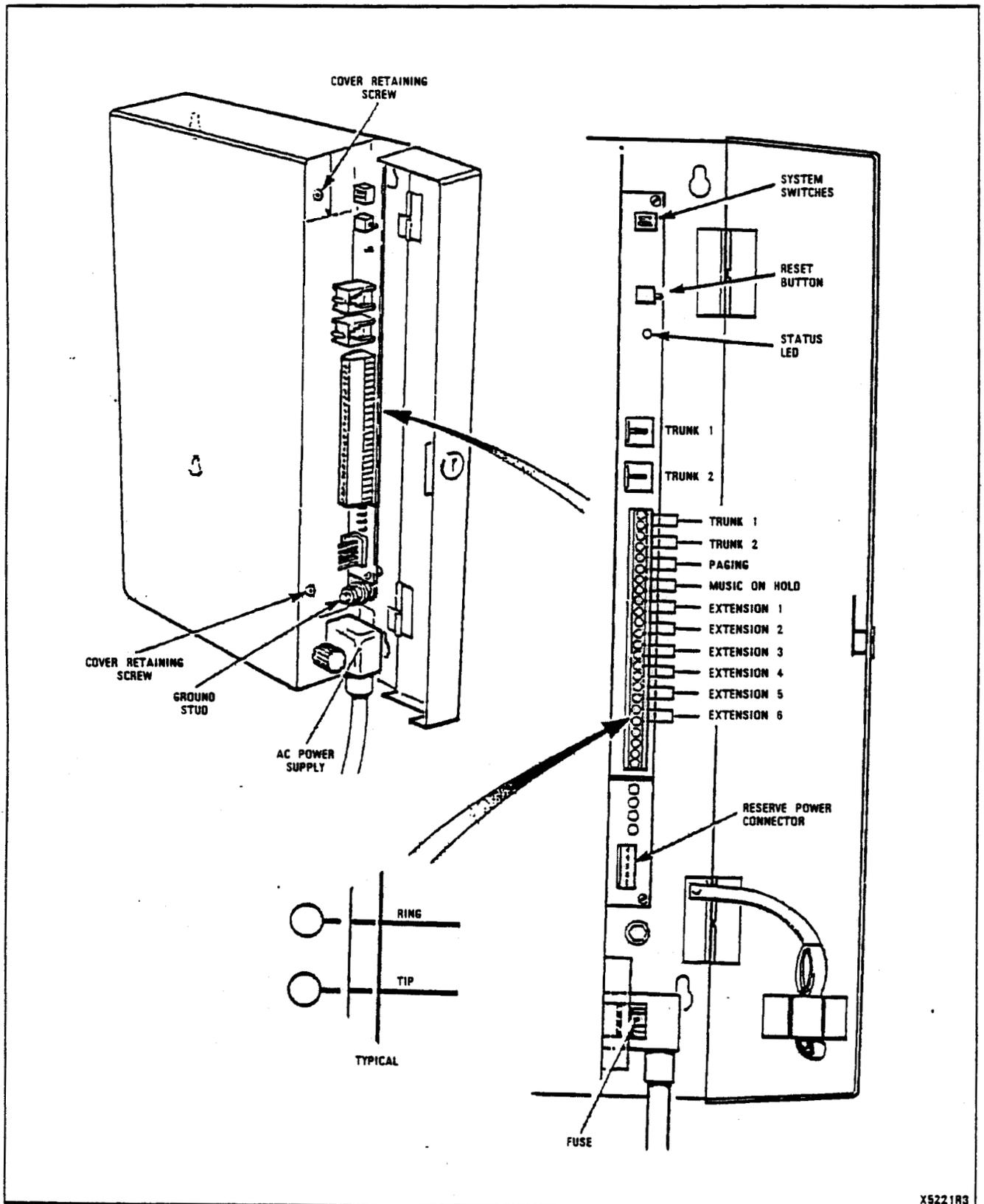
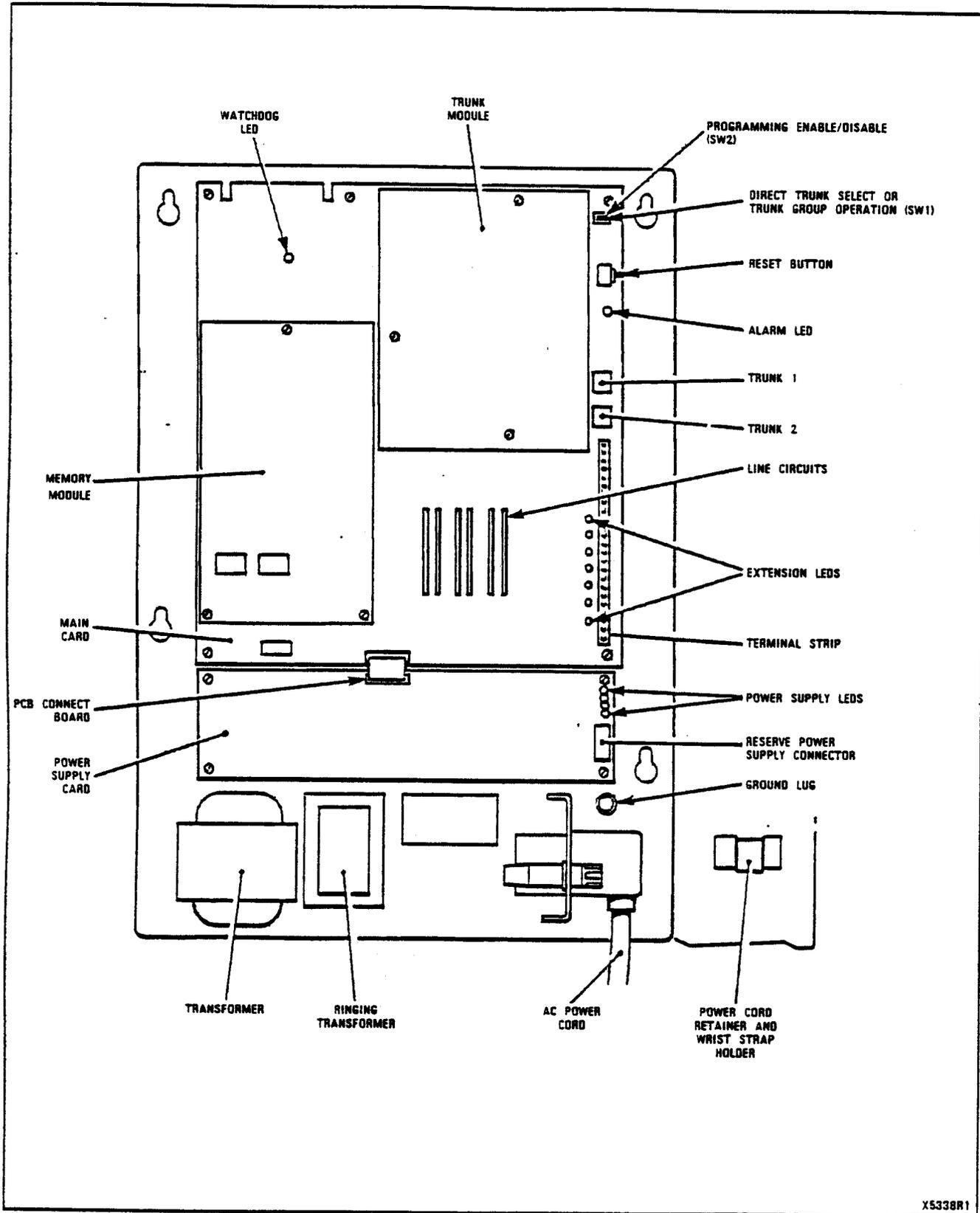


Fig. 2-1 SX-5 Equipment Cabinet



X5338R1

Fig. 2-2 SX-5 Equipment Layout

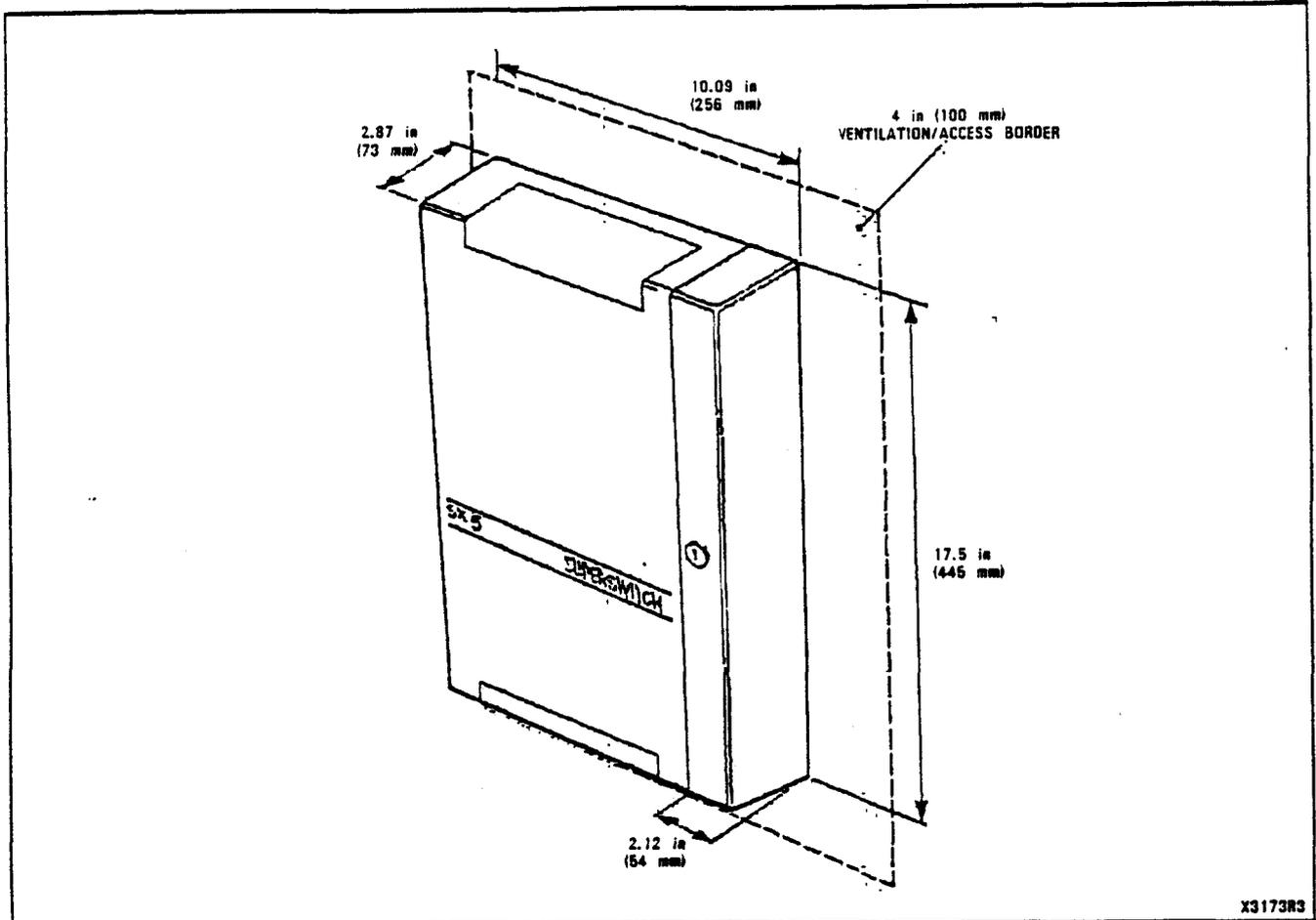


Fig. 3-1 SX-5 Dimensions

4. FEATURES

General

4.01 The SX-5 comes equipped with a features package Generic 50, which provides the system with a number of features not found in any other system in this line size. These features are detailed in Table 4-1, and each feature is described in Section MITL9103-098-105-NA, Features and Services Description.

Feature Provisioning

4.02 The SX-5 is equipped with a default numbering plan. This commonly used numbering plan is automatically loaded when the system is initially powered up.

4.03 Most system and extension features are inherently activated in the SX-5, thereby reducing the amount of programming necessary.

4.04 Some programming may be necessary to customize the data base for such features as Toll Restriction, or Extension Access to Out-going Trunks. Any such programming is performed by dialing digits from the Control Extension. To protect customer data from accidental change, System Switch 2 can be used to disable Programming Functions.

5. SYSTEM CONFIGURATION

General

5.01 The SX-5 equipment cabinet consists of a single enclosure, containing the entire system electronics and power supply. The system contains four circuit cards: Main Card,

TABLE 4-1
SX-5 FEATURES

Alarm Indication	Lockout
Automatic Callback Busy	Make/Break Ratio
Automatic Station Release	Mixed Station Dialing
Background Music	Music on Hold
Call Forwarding - Busy	Night/Day Service
Call Forwarding - All Calls	Power Failure Restart - Battery
Call Hold, Retrieve from any Station	Power Failure Restart - PROM/ROM
Camp-On with Indication	Power Failure Transfer - Both Trunks
Common Audible Ringing	Privacy - Automatic
Console-Less Operation	Programmable Disconnect Timing
Control Extension	Programming
Control Functions	Reversal Meaning
Data Line Security	Rotary Dial Pulse-to-Digit Conversion
Dial Call Pickup	Selectable Numbering Plans
Direct-In Lines	Selectable Ringing Frequency
Direct Outward Dialing	Speed Dial
Direct Trunk Select	Timed Recalls
Discriminating Ringing	Toll Restriction
i. Trunk vs. Intercom	Tone-to-Pulse Conversion
ii. Trunk 1 vs. Trunk 2	Transfer/Add-On/Consultation Hold
Do Not Disturb	Trunk Group Operation
Extension Switchhook Flash Timing	Wait for Dial Tone
Last Number Redial	Voice Paging

Power Supply Card, Trunk Module, and the Memory Module. Main and Power Supply cards are connected to the chassis, with the Trunk and Memory Modules plugging into the Main Card. Keyed connector patterns prevent Trunk and Memory Modules from being plugged into the wrong position.

6. ELECTRICAL CHARACTERISTICS

6.01 The electrical characteristics of the SX-5 are listed in Table 6-2. Refer to Table 6-1 for the SX-5 tone plan.

7. SYSTEM ENVIRONMENTAL AND INSTALLATION REQUIREMENTS

Design Data

7.01 The SX-5 is designed to operate within the following environmental conditions:

- **Temperature** - The system operates satisfactorily in the range of 0°C to 40°C (32°F to 140°F). These are ambient temperatures measured at a point 59.1 in. (150

TABLE 6-1 TONE PLAN

TONE	TONE PLAN 1
Dial Tone	350/440 Hz Continuous
Busy Tone	480/620 Hz 500 ms On, 500 ms Off Repeated continuously
Ringback Tone	440/480 Hz 1 s On, 3 s Off Repeated continuously
Reorder Tone	480/620 Hz 250 ms On, 250 ms Off Repeated continuously
Camp-On Tone	440 Hz Single burst of 200 ms
Transfer Dial Tone	350/440 Hz 100 ms On, 100 ms Off Repeated three times, then continuously

TABLE 6-2
SX-5 ELECTRICAL CHARACTERISTICS

Parameter	Detail
Station Loop Limit	600 ohms including set at 20 mA; 360 ohms including set at 25 mA
Minimum Leak Resistance	15,000 ohms
Maximum Number of Ringers per Line	3
Ringing Voltage	90 Vrms, at 17.5, 20, or 25 Hz
Ring Trip	During silent or ringing period
Crosstalk	Better than 75 dB down
Tone Plan	As defined in Table 6-1
Insertion Loss: Station-to-Station	5 dB+/- 0.5 dB at 1000 Hz
Insertion Loss: Station-to-Trunk	0.6 dB+/- 0.4 dB at 1000 Hz
Longitudinal Balance	60 dB minimum, 200-3,400 Hz (on trunks)
Return Loss	16 dB single frequency, 24 dB echo
Idle Circuit Noise	16 dBrnC maximum
Impulse Noise	0 counts above 55 dBrnC for 95% of cases
System Impedance	600 ohms nominal for extensions 900 ohms nominal for trunks (600 ohms optional)
Primary Power	110-120 Vac, 47-63 Hz, 0.6 A maximum, 0.3 A typical (220 V operation optional)
Central Office Loop Limit	1600 ohms maximum
Environmental Requirements	0 - 40°C (32-104°F) 10% - 90% Relative Humidity noncondensing

cm) above the floor and 1.5 in. (3.8 cm) in front of the equipment.

- **Relative Humidity** - The system operates satisfactorily in the range of 10-90% relative humidity, noncondensing.

Compatibility

7.02 The system is compatible with:

- Single line 2500 or 500 type telephone sets or equivalent station apparatus
- Standard Dial Pulse and DTMF telephone sets
- Step-by-step, crossbar and commonly used electronic central office equipment

Shipping and Storage

7.03 The equipment is designed to withstand shipping by truck, rail, air or sea without damage, when packaged in conventional shipping containers of the manufacturer.

Installation Requirements

7.04 The installation requirements are detailed in Section MITL9103-098-200-NA, Shipping, Receiving and Installation Procedures.

8. PROGRAMMING AND NUMBERING

8.01 The SX-5 is controlled by a microprocessor governed by programs stored in memory. Some of the stored program is set during system initialization when the equipment is commissioned. The features permitted by these programs can be assigned to the system to suit the particular operating requirements. Full details of the programming are given in document MITL9103-098-205-NA, Programming and Installation Forms.

9. TECHNICAL DESCRIPTION

A. Introduction

9.01 The following subsections give a basic technical description of the SX-5 Communications System. Fig 9-1 should be consulted

when reading the descriptive material. The abbreviations used in the description are detailed as follows:

- PROM - Programmable Read Only Memory
- RAM - Random Access Memory
- CO - Central Office
- DP - Dial Pulse Signalling
- DTMF - Dual Tone Multi-Frequency signalling
- GS/LS - Refers to trunk circuits having "Ground Start" (GS) or "Loop Start" (LS) facility.
- OP-AMP - Operational Amplifier
- LED - Light Emitting Diode
- IC - Integrated Circuit
- RMDP - Remote Display Power

General

9.02 The SX-5 is a processor-controlled communications system which employs solid-state space division switching techniques. The processor, which has overall control of the system, is a MC6809.

9.03 System control programs are held PROM and non-volatile (i.e. battery protected) RAM. The working data of the system (i.e. data which reflects the current state of the system) is held in volatile RAM. The processor constantly receives information over the data lines indicating the state of all call-processing curcuitry, e.g. line circuits, trunks, receivers, etc. Any change in state causes decisions to be made, and instructions to be issued by the processor based on programmed data. Instructions are implemented by transferring information along the Address and Data lines to modify logic states in the system and the contents of various registers.

9.04 The system logic contains a continuously running diagnostic program. This program detects errors in the system memories and causes the ALARM LED on the Main Card to flash when such an error is found.

B. Description of Circuit Cards

Memory Module (Fig. 9-2)

9.05 The Memory Module contains the following circuit divisions:

- 40 k bytes of PROM, used to store the system control programs. These programs are loaded at the factory and cannot be altered by site programming.
- 2 k byte of RAM (volatile) used by the processor as a fast read/write store. At any given instant it contains information representing the busy/free states of the system components.
- 1 k byte of RAM (non-volatile). The content of this memory is programmed on-site with data such as system options, class of service, etc. In the event of power failure the data is maintained for up to 600 hours.
- A Write Enable Circuit. This circuit inhibits the writing of data into the non-volatile RAM when the +5 V supply drops below a threshold value.

Trunk Module (Fig. 9-3)

9.06 The Trunk Module provides two CO trunk circuits, an example of which is shown in Fig. 9-3. Trunks may be set for "loop start" or "ground start" working by means of a switch mounted on the trunk module (preset at the factory to "loop start").

9.07 Each trunk circuit contains the following circuit divisions:

- Surge protection - used to protect the trunk circuit from line transients.
- Polarity guard - used to ensure the correct direction of current flow through the active network of the trunk circuit even if Tip and Ring are reversed.
- Current controller - limits the swing of Tip/Ring current within the active network of the trunk circuit.
- Incoming/Outgoing differential amplifiers - used to couple incoming and outgoing audio in order to mute echo paths.
- Outgoing audio transformer - transfers outgoing audio to Tip/Ring current.

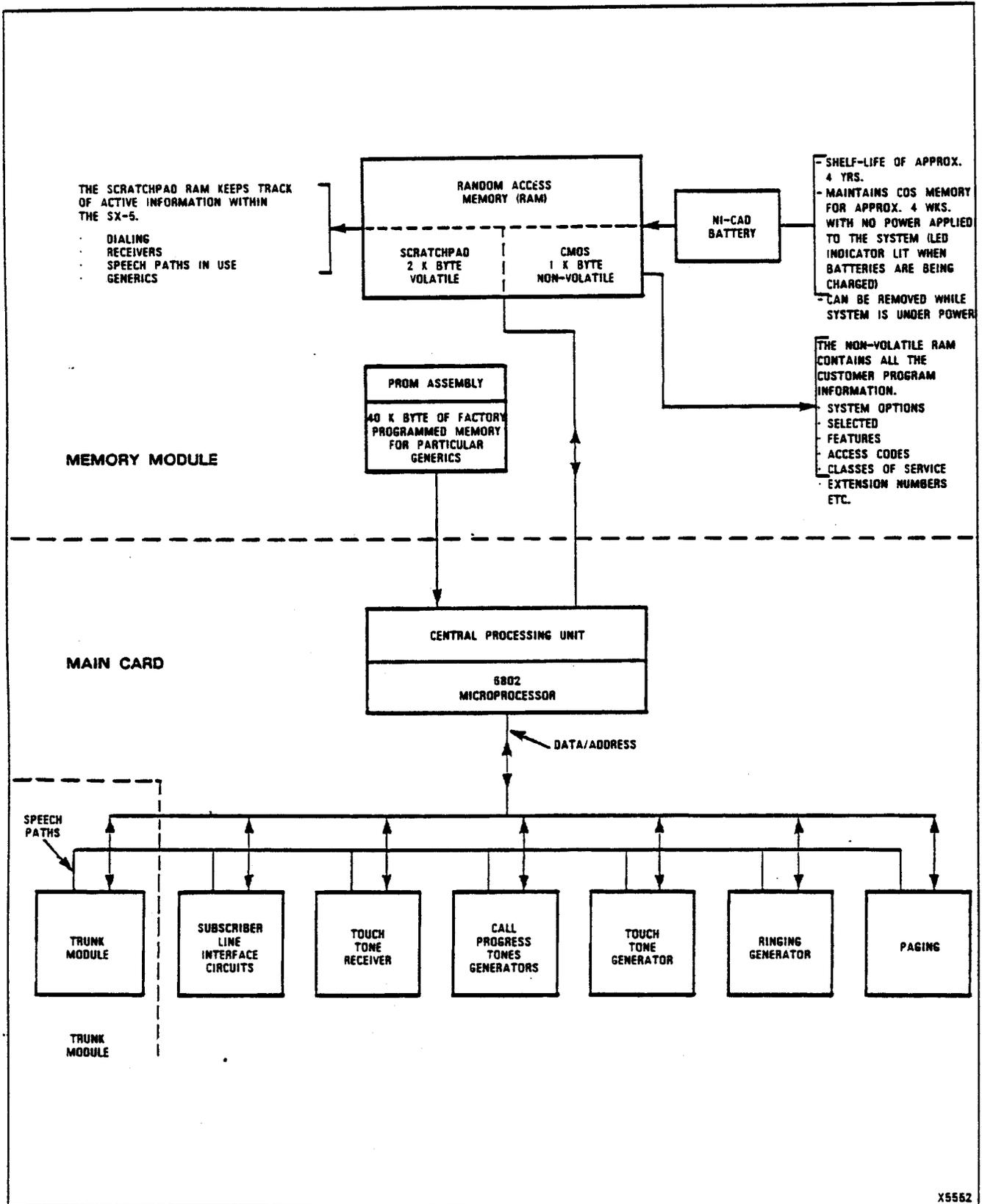


Fig. 9-1 SX-5 Data Flow Interconnection Diagram

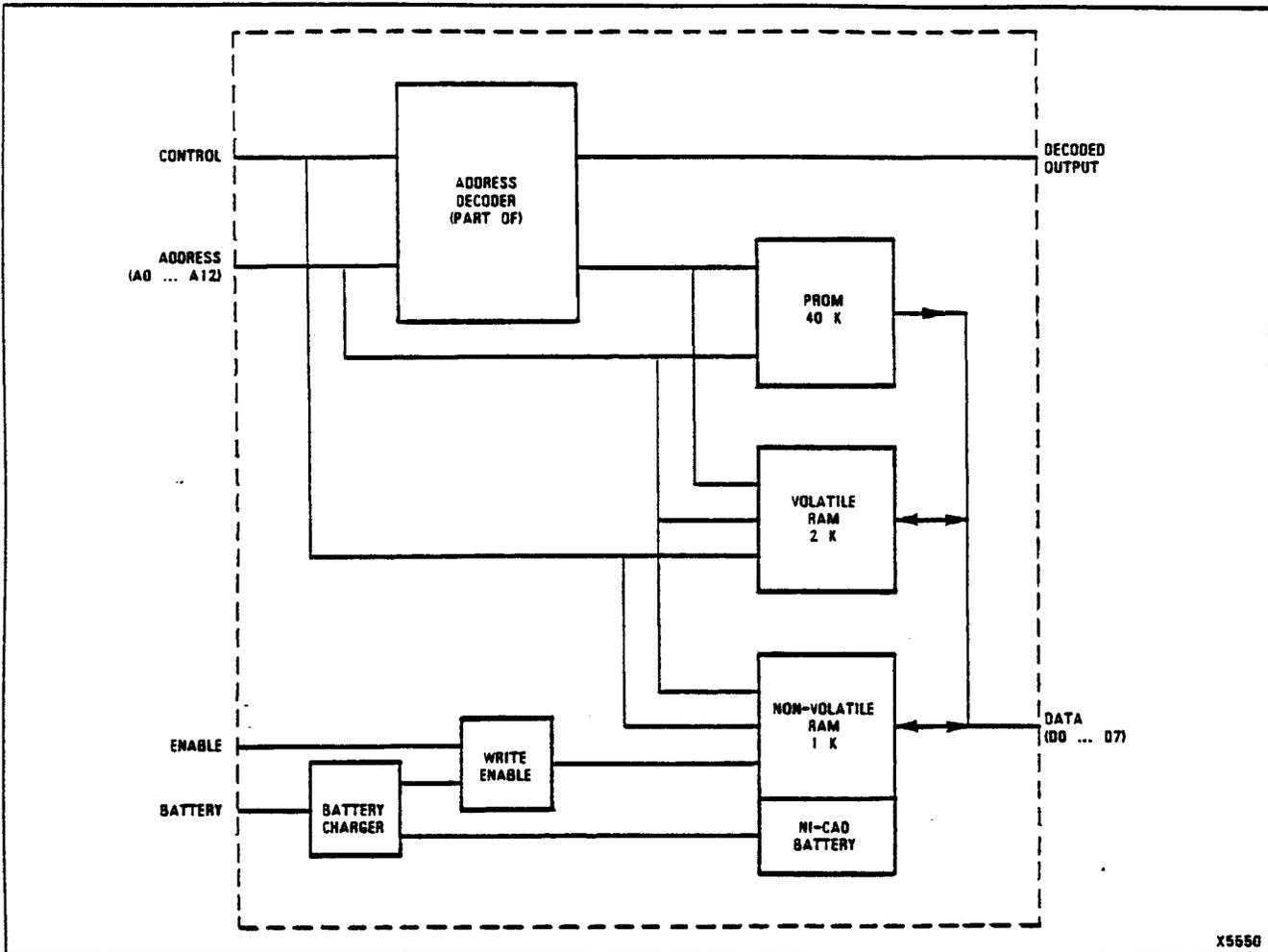


Fig. 9-2 Memory Module

- Tip and Ring status sense - monitors the on-hook/off-hook status of the Tip and Ring.
- Data buffer - provides an interface to the CPU data lines.
- Line relays - comprising three reed relays. One relay is used to terminate the Tip and Ring. The two remaining relays are used to simulate rotary dialing.
- Control switch - interconnects circuit elements of the trunk circuit under the control of information received over the data lines from the CPU.

Main Card (Fig. 9-4)

9.08 The Main Card contains the following circuit divisions:

- Microprocessor (MC6809) - controls the system based on programmed information.

Data is sent (written) and received (read) by the microprocessor over data lines. The destination for written data is identified over the address lines.

- Watchdog timer - provides an automatic system reset in the event of software error.
- Power fail detector - causes the CPU to note the status of the system immediately prior to a power loss. If power is not instantly returned the Power Fail Detector then forces a system reset.
- Address decoder - decodes the address outputs of the microprocessor in order to enable the circuit element which is being addressed.
- Data buffer - a bidirectional buffer which provides additional distribution of data lines

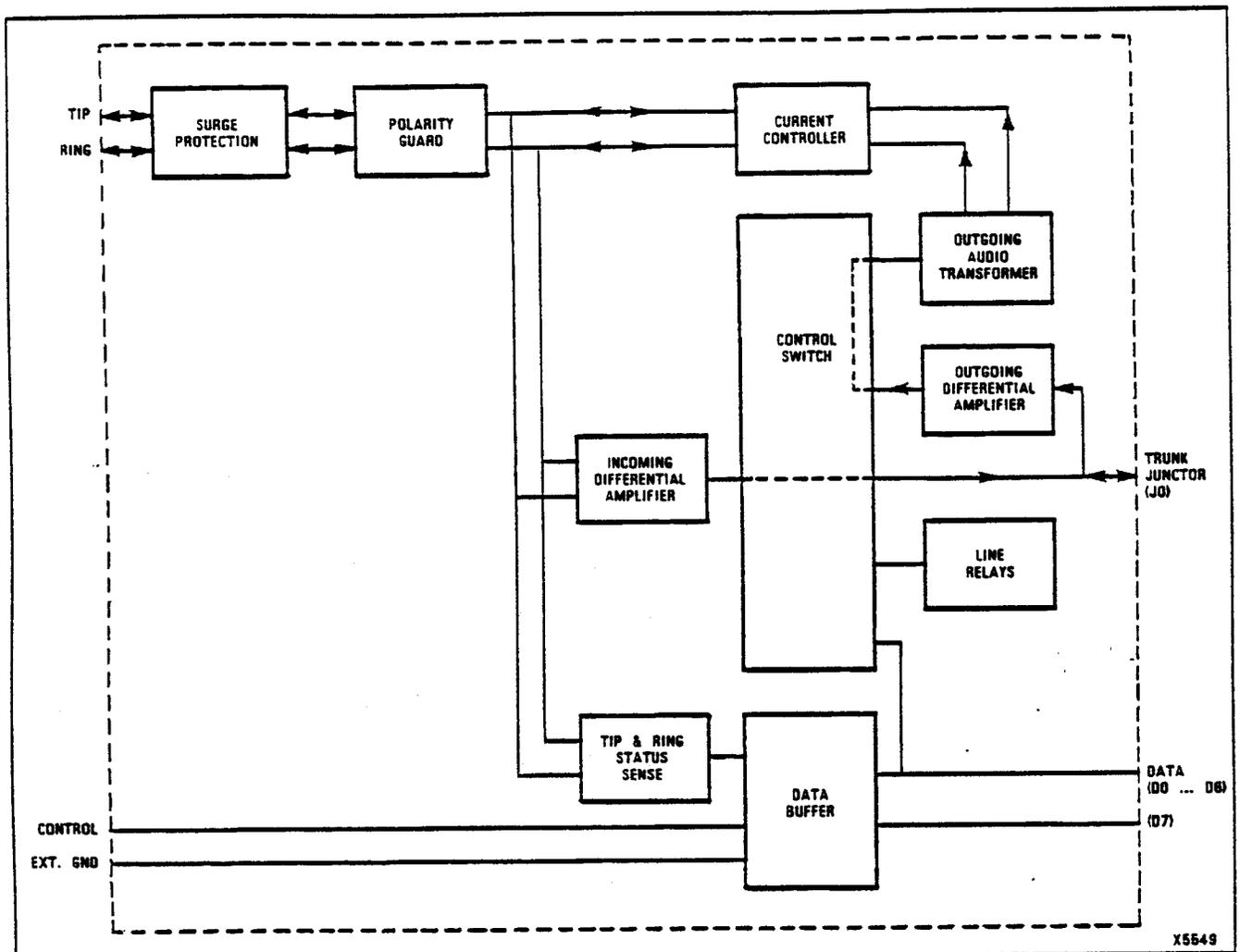


Fig. 9-3 Trunk Circuit (2 circuits per Trunk Module)

- in order to reduce loading on the micro-processor.
- Timers - provide square wave outputs to drive the call progress tone filters.
- Dial tone detector - used during an outgoing trunk call set-up to detect CO dial tone.
- Touch tone generator - converts a 3.58 MHz input to the dual frequencies used in DTMF working.
- Touch tone receivers (2) - decode DTMF signals to produce dialed-digit identity for the CPU.
- System switches - refer to 3.02 for a description of these switches.
- Progress tone generators - convert square wave inputs from the timers to provide audible signals to the user (e.g. Busy Tone).
- Ringing generator - converts a 20 Hz signal (provided by one of the timers) to sine waves in order to drive the transformer, which produces 90 volts ringing.
- System junctors - are the physical connections between the MT8804's shown in Fig. 9-8. The circuits connected to the MT8804's are switched to the junctors under the control of the CPU during a call process.
- SLIC's (6) - provide the interface between the SX-5 and the extensions connected to it.

Power Supply Card (Fig. 9-5)

9.09 The Power Supply Card receives inputs from the AC power transformer and reserve power supply (optional). The circuitry on

the card converts these inputs to the required system voltages.

9.10 The Power Supply Card contains the following circuit divisions:

- Rectifier/Filter - rectifies the output from the AC power transformer, using full wave bridges. The rectified output is filtered to produce RMDP and -24 V unregulated outputs.
- Regulators - regulate the output of the rectifiers to produce the required system voltages.

C. CO Trunks

Ground Start/Loop Start

9.11 Ground Start (refer to Fig. 9-6): Ground start is a handshake method of initiating a CO trunk call. The local trunk circuit grounds the RING lead and awaits recognition by the CO. The CO signals recognition by grounding the previously floating TIP lead. 40 ms after the trunk recognizes 100 ms ground on the TIP lead, a termination is placed across Tip and Ring and 40 ms later the ground on the RING lead is removed. The CO then provides dial tone.

9.12 Loop Start (refer to Fig. 9-7): To seize a loop start trunk, the trunk circuit places a termination across TIP and RING. The CO senses the current flow through the loop and signals that the trunk is available by providing dial tone.

D. Operation

Extension Going Off-Hook

9.13 When an extension goes off-hook loop current is generated. This current is detected by an op-amp which forms part of the SLIC associated with the extension. The output of the op-amp turns on the extension LED mounted on the Main Card and sets a signal, OFF-HOOK. The OFF-HOOK signal from each of the six extension SLIC's is placed, in turn on the data bus via Main Card circuitry, to be looked at by the CPU. The change in state of the OFF-HOOK signal is noted by the CPU and the address of the off-hook extension is written into volatile RAM.

Speech Path (System Junctor) Accessing

9.14 Each junctor switch IC (MT8804) contains four speech paths; each speech path is linked to the corresponding speech path of subsequent junctor switches by a system junctor. The circuits which are connected to the junctor switches (e.g. line circuits, trunk circuits, tone generators, etc.) may be interconnected to each other via the speech paths. Such interconnections are controlled by instructions from the CPU throughout the progress of a call. This concept is illustrated in Fig. 9-8.

Dial Tone

9.15 When the CPU is informed of an off-hook condition it interrogates its RAM to find a free speech path which, when found, is checked via a diagnostic circuit. The tested speech path is then connected to the extension that went off-hook (see 9.14, Speech Path Accessing).

9.16 The CPU searches for an idle Touch Tone Receiver and Dial Tone Generator. The receiver and generator are connected, under control of the CPU, to the same speech path as the extension that went off-hook. The off-hook extension then receives dial tone.

Dialing Internally (From an Extension)

9.17 DTMF and DP signals originate at an extension and are passed over Tip and Ring through the line circuit to a speech path. Detection of the dialed digits takes place on the receiver which has been connected to the same speech path. A receiver is connected when an extension originates a call or when it does a switchhook flash.

Ringin an Extension

9.18 The dialing of a valid extension number prompts the CPU to select the line circuit associated with the called extension (as determined by the programming in the non-volatile RAM). The CPU connects the Ringing Generator to the called extension's line circuit, whereupon the called extension rings. The CPU connects the Ringback Tone Generator to the same speech path as the calling device (extension or trunk) which, as a result, receives ringback tone. When

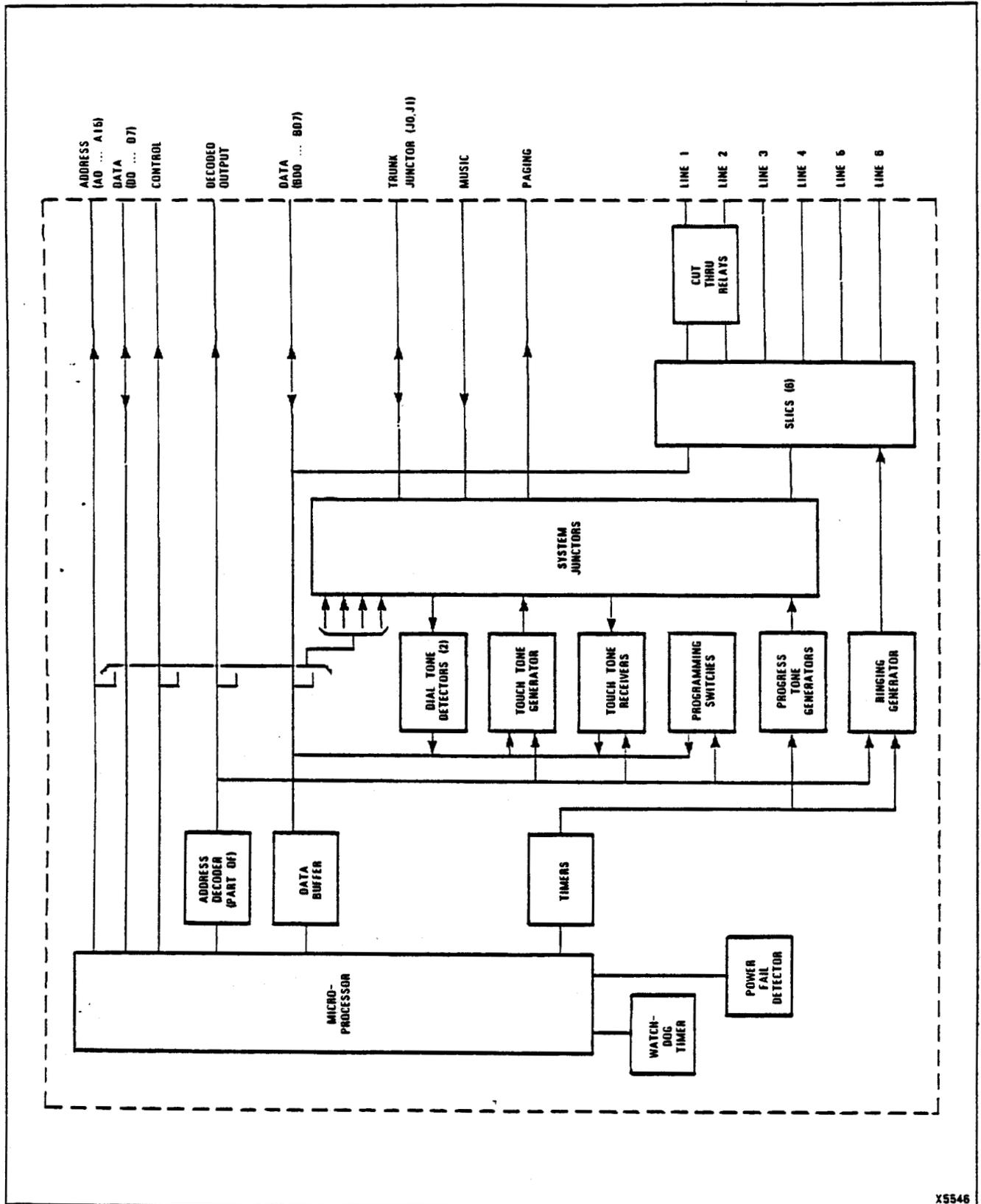


Fig. 9-4 Main Card

X5546

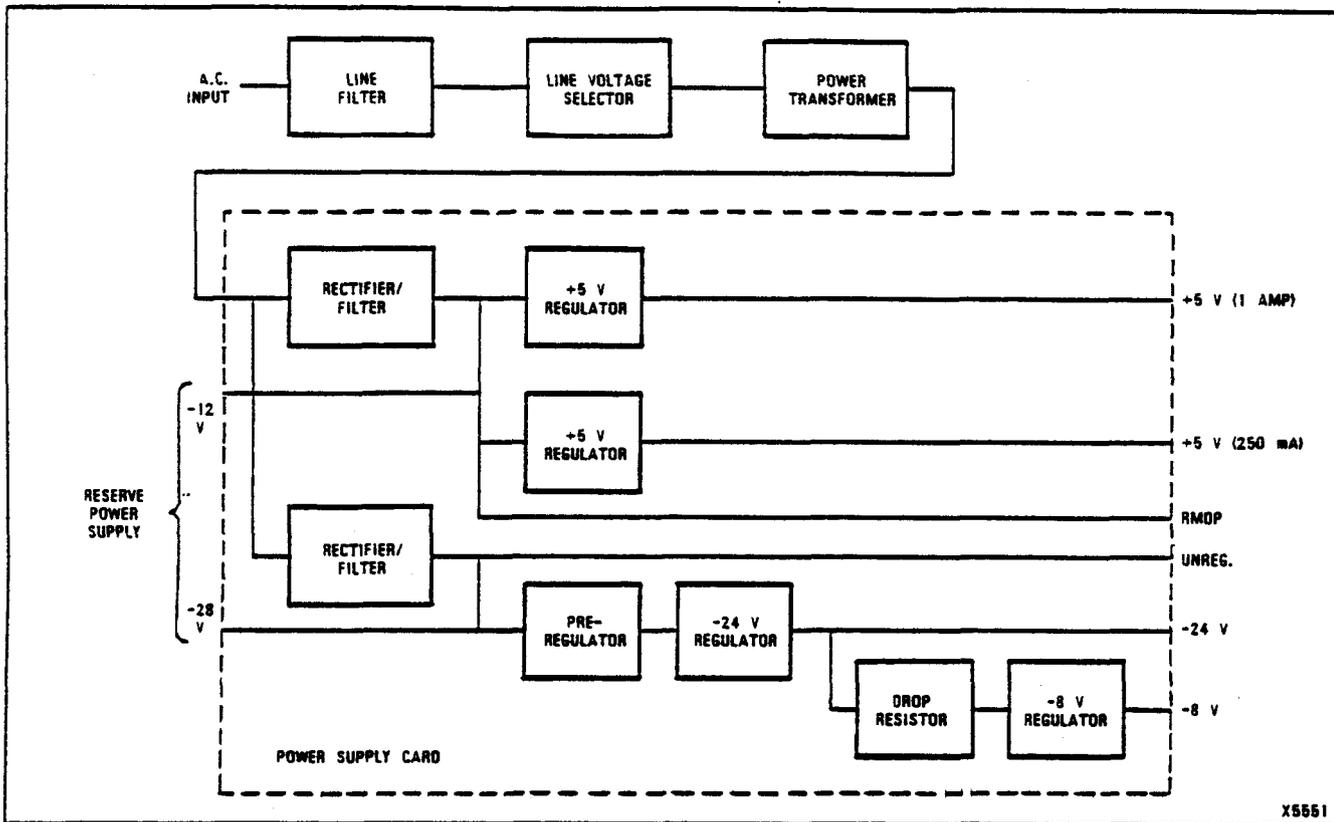


Fig. 9-5 Power Supply Circuit

the called extension answers, its line circuit detects an off-hook condition (see 9.13, Extension Going Off-Hook), which is relayed to the CPU and ringing is disconnected. The CPU then connects the called extension to the same speech path as the calling device (extension or trunk).

Switchhook Flash

9.19 A switchhook flash is defined for the SX-5 as an on-hook condition of between 150 ms and 750 ms (150 ms and 1500 ms as a system option) following an off-hook condition, where a connection has been established between two or three parties.

9.20 When an extension goes on-hook the CPU first checks its memories to determine if "Flash means release" has been programmed. When "Flash means release" has been programmed the extension is disconnected from the speech path and a subsequent off-hook is interpreted as the beginning of a new call (see 9.13, Extension Going Off-Hook).

9.21 When an extension goes on-hook and "Flash means release" has not been programmed, the firmware starts a timer. If the extension goes back off-hook within the specified time period, it is considered to be "flashing". An on-hook of less than 150 ms is considered to be a noise glitch, while an on-hook greater than 1500 ms is considered by the CPU to be a call termination.

9.22 When a switchhook flash is detected, the CPU disconnects the "flashing" extension from its speech path, finds a free speech path (which it tests), and connects the extension to it (see 9.14, Speech Path Accessing). It then connects a dial tone generator and receiver to the speech path (see 9.15, Dial Tone), allowing the extension to dial (see 9.17, Dialing Internally), the number of a third party or a feature access code.

9.23 When a switchhook flash is performed during a two-party call, the second party is removed from the speech path and connected instead to the HOLD junctor. This is a speech path with a low impedance such that it effectively

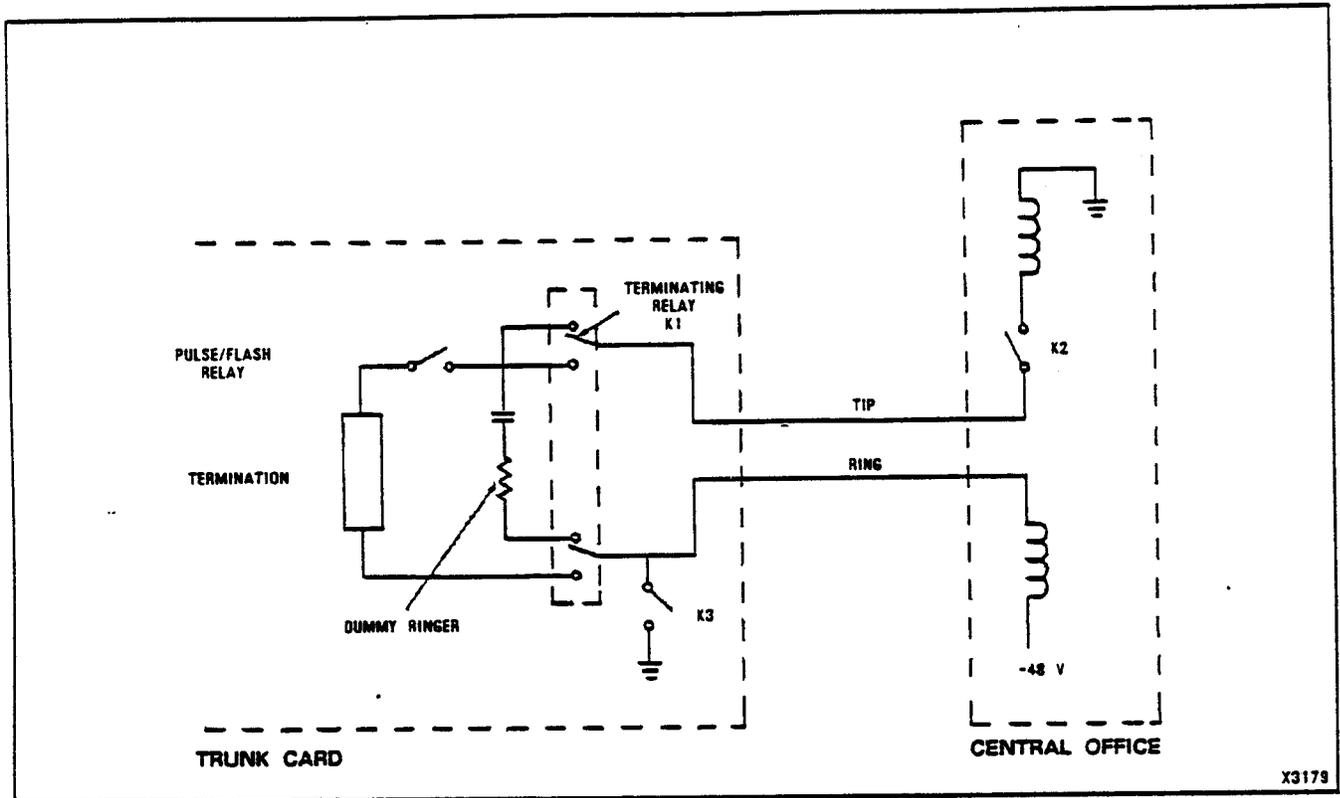


Fig. 9-6 Central Office Trunk Circuit - Ground Start

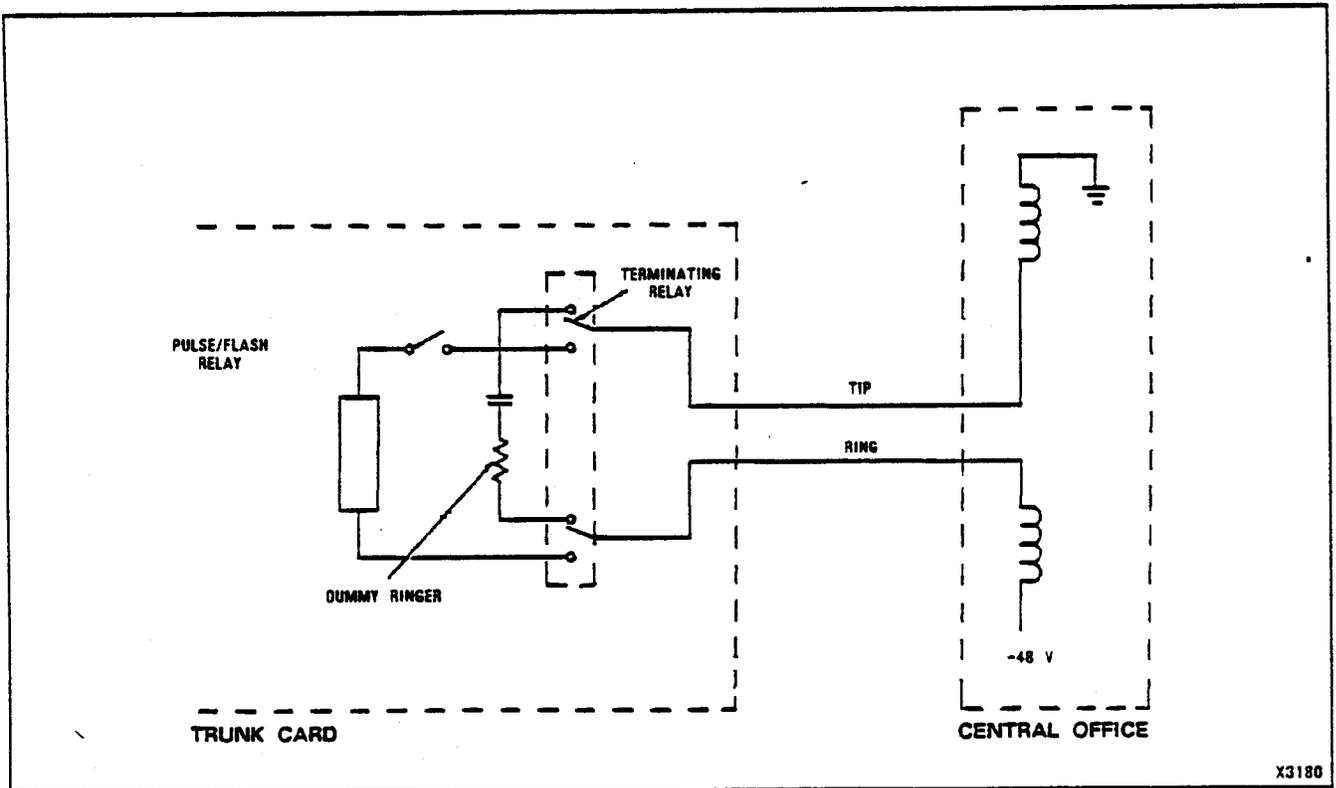


Fig. 9-7 Central Office Trunk Circuit - Loop Start

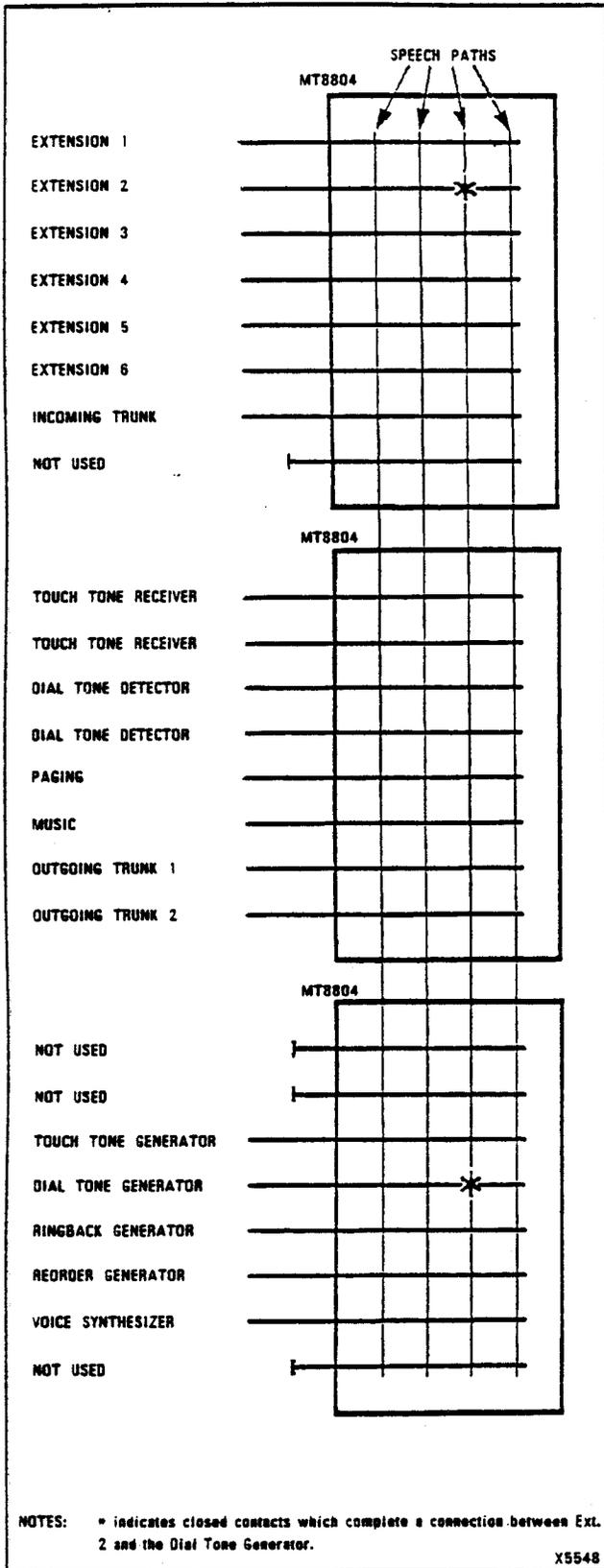


Fig. 9-8 Speech Path Accessing

"grounds" the output of any extension or trunk connected to it, thus preventing parties on the HOLD junctor from hearing each other. Alternatively, music may be connected to the HOLD junctor which will then be heard by calls on hold.

Incoming Calls (GS/LS Trunks)

9.24 A trunk circuit has various methods of recognizing an incoming call. When the trunk is ground start, 6 seconds of ground on the TIP lead or 240 ms of ringing after TIP ground signals that an incoming call is present. When the trunk is loop start, either battery reversal or 240 ms of ringing voltage signals that an incoming call is present. The change in Tip/Ring status is reflected on the data bus leads from the trunk circuit to inform the CPU that an incoming call is present.

9.25 The CPU finds and tests a free speech path, and connects ringing to the appropriate extension (defined by programming). When the ringing extension answers, the CPU connects it and the trunk to the speech path.

Dialing a CO Trunk

9.26 When an extension has gone off-hook and is connected to a dial tone generator and receiver (see 9.15, Dial Tone and 9.17, Dialing Internally), the trunk access code is dialed. Upon determining the validity of this code, the CPU interrogates its memories to find a free trunk circuit. Under the control of the CPU the trunk circuit is connected to the extension's speech path (see 9.14, Speech Path Accessing). If the trunk is a "ground start", the ring lead is grounded and the CPU waits for CO acknowledgement. When acknowledgement is received, the CPU connects the trunk's audio circuitry to the speech path.

9.27 The receiver is disconnected when the trunk access code is detected if: (a) both the extension and trunk are DTMF; or (b) if Toll Denial is not checked. If the extension requires DTMF-to-DP conversion, the receiver connection is maintained until dialing is completed. Toll-Denial requires that the receiver connection be maintained on the speech path until the required number of digits has been dialed.

Trunk Release

9.28 To release a trunk, the current loop must be broken. The current loop is broken when:

- (a) The extension goes on-hook. The CPU detects the on-hook and instructs the trunk to remove the termination and break the loop.
- (b) The distant party goes on-hook (only when the CO trunk is "ground start"). The CO signals the extension that the distant party has gone on-hook by removing the ground on the TIP lead. The change in Tip/Ring status is relayed to the CPU on the data bus and the call is released.
- (c) The trunk cable is physically broken. If the loop is broken, the loss of loop current is relayed to the CPU on the data bus and the call is released.

E. Power Requirements**Power Supplies**

9.29 The primary power supply is 105-125 Vac (optionally 230 Vac), 47-63 Hz. The internal power supplies, derived from the power supply card, are -24 V \pm 5% (460 mA), -8 V \pm 5% (100 mA), +5 V \pm 5% (250 mA) and +5 \pm 5% (1 Amp). These values are chosen in order to obtain the correct voltage on the devices, taking into account voltage drops through the tracks. The maximum ripple level on the power supplies are as follows:

- 2.5 mV peak-to-peak for -24 V
- 0.3 mV peak-to-peak for +5 V (250 mA)
- 1.5 mV peak-to-peak for +5 V (1 Amp)

9.30 The SX-5 power supply has an inherent minimum holdover time of 45 ms. Thus the maximum permitted length of a failure in the primary power supply is 45 ms.

9.31 The SX-5 complies with the FCC Part 68 regulation governing surge protection.

Reserve Power Supply

9.32 If required, the SX-5 may be connected to a reserve power supply which will maintain system operation for a minimum of 45 minutes (average two hours).

Grounding

9.33 The SX-5 should be grounded in accordance with the grounding instructions contained in CTIB-80-20-100/200-001, Installation Practices and Protection Techniques.

10. SIGNALING AND SUPERVISION**General**

10.01 This part details the technical parameters of the SX-5 with regard to signaling and supervisory conditions.

Dial Pulses and DTMF Tones

10.02 The SX-5 is capable of accepting and repeating signals from telephone sets having the parameters given in Table 10-1, Dial Pulse Limits and Table 10-2, DTMF Tone Limits.

10.03 The SX-5 provides the following signal characteristics:

- Dial Pulse Conditions -
 - Pulse rate - 8 to 11 pps
 - Break interval - 58 to 64%
 - Interdigit time - 0.6 to 3 s.

Rotary Dial Pulse-to-Digit Conversion

10.04 A variety of encoding dialing systems are used by different PTT administrations. These can be automatically adapted to, by means of an integrated code conversion facility. The translation codes available are shown in Table 10-3. Refer to MITL9103-098-205-NA, Programming and Installation Forms, for programming details.

Ringling Frequencies

10.05 The nominal ringing frequency of 20 Hz can be set to 17.5 Hz, 20 Hz or 25 Hz during the initialization of the system. Refer to

TABLE 10-1
DIAL PULSE LIMITS

DIAL PULSE DETECTION

PARAMETER	MIN	MAX
Pulse Rate (pps)	8.0	12.0
Break Duration (percent)	50.0	70.0
Break Interval (ms)	41.7	87.5
Make Interval (ms)	25.0	62.5

DIAL PULSE OUTPUTSING

PARAMETER	60/40	66/33
Pulse Rate (pps)	10.0	9.0
Break Duration (percent)	60.0	64.0
Break Interval (ms)	60.0	71.0
Make Interval (ms)	40.0	40.0

TABLE 10-2
DTMF TONE LIMITS

Low Frequency (Hz)	High Frequency (Hz)		
	1209	1336	1477
697	1	2	3
770	4	5	6
852	7	8	9
941	*	0	#
Frequency Deviation	+1.5%		
Per frequency, minimum level	-17 dBm on line circuit		
On Time	Greater than 40 ms		
Interdigit Time	Greater than 40 ms		
Level, Low Group	Greater than -10 dBm		
Level, High Group	Greater than -8 dBm		
Level, DTMF Signal	Less than +2 dB		
Level, Third Frequency	Greater than 40 dB below DTMF signal		

MITL9103-098-205-NA, Programming and Installation Forms.

be up to a maximum of 600 ohms (see Table 10-4).

Terminating Conditions

10.06 The SX-5 caters for or provides the following line and trunk parameters:

- Station Loop - The station loop resistance, including the station apparatus, can
- CO Trunk Loop - The SX-5 will operate with CO trunks up to a maximum of 1600 ohms loop resistance.
- CO Trunk Seizure - The SX-5 maximum seizure resistance is 270 ohms at 30 mA.

TABLE 10-3

TRANSLATION CODE	DIGIT DIALED									
	1	2	3	4	5	6	7	8	9	0
0	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	1
2	9	8	7	6	5	4	3	2	1	10
3	10	9	8	7	6	5	4	3	2	1

NUMBER OF PULSES

TABLE 10-4
STATION LOOP LENGTH VS WIRE GAUGE

WIRE GAUGE	STATION LOOP LENGTH
19	23,900 ft (7,242 m)
20	19,000 ft (5,758 m)
22	12,000 ft (3,636 m)
24	7,500 ft (2,273 m)
26	4,700 ft (1,424 m)

- **CO Trunk Resistance** - In the idle state the resistance towards the CO from the trunk circuit is not less than 30 kohms for ground start, and not less than 10 Mohms for loop start trunks.

extension-to-trunk) are:

$$R_2 = 20 \log_{10} \frac{\text{level at 700 Hz}}{\text{level at 1400 Hz}} \geq 50 \text{ dB}$$

$$R_3 = 20 \log_{10} \frac{\text{level at 700 Hz}}{\text{level at 2100 Hz}} \geq 50 \text{ dB}$$

11. TRANSMISSION

General

11.01 This section specifies the SX-5 transmission characteristics.

Transmission Characteristics

11.02 The insertion loss at 1004 Hz is as follows:

- **Line-to-Line connection:**
5 dB ± 0.5 dB
- **Line-to-Trunk connection:**
0.5 dB ± 0.4 dB

11.03 **Distortion:** The second or third harmonic will not exceed a level of -55 dBm with a 200 or 1004 Hz signal at -10 dBm. With an input signal consisting of 900 Hz and 1004 Hz (each at -13 dBm), the rms sum of all the intermodulation products will not exceed -45 dBm when measured at the output. The equations to calculate the intermodulation distortion (which are applicable to both extension-to-extension and

11.04 **Overload:** The change in attenuation when the level of a 1004 Hz signal is increased from 0 to +7 dBm will not exceed 0.1 dB.

11.05 **Return Loss:** The Return Loss parameters in the talking state are:

- (a) **Extension-to-Extension -**
ERL > 18 dB
SRL > 12 dB
- (b) **Extension-to-Trunk -**
ERL > 18 dB
SRL > 12 dB

11.06 **Longitudinal Balance:** All connections meet the following requirements with respect to Longitudinal Balance.

Minimum

<u>200 Hz</u>	<u>1000 Hz</u>	<u>3000 Hz</u>
58 dB	58 dB	54 dB

SECTION MITL9103-098-180-NA

11.07 Crosstalk Attenuation: The crosstalk attenuation, or coupling loss, between any established connection through the SX-5 and at least 95% of all other connections, when both paths are terminated in 600 or 900 ohms (as required) at each end will be: (The frequency band which applies is 200 to 3400 Hz.)

Line-to-Line: -75 dB minimum
Line-to-Trunk: -75 dB minimum

The level of the disturbing signal is 0 dBm.

11.08 Idle Channel Noise: The total level of all noise sources within the system does not exceed the following limits, on 95% of the connections.

- Line-to-Line -
 - < 16 dBmC (weighted)
 - < 35 dBm (3 k Hz flat)

- Line-to-Trunk -
 - < 16 dBmC (weighted)
 - < 35 dBm (3 k Hz flat)

11.09 Impulse noise in the voice band results in zero counts above a level of 55 dBmC for 90% of cases.

11.10 System Impedances: System impedances are:

- 600 ohms nominal for lines
- 900 ohms nominal for trunks

11.11 Envelope Delay: The delay difference between 400-3200 Hz is:

- Extension-to-Extension < 560 μ s
- Extension-to-Trunk < 280 μ s

SX-5*
SUPERSWITCH
COMMUNICATIONS SYSTEM
SHIPPING, RECEIVING, AND INSTALLATION PROCEDURES

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WARNING: This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been tested and found to comply with the limits for a Class B computing device, in accordance with the specification of Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by switching the equipment Off and On, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorientate the receiver antenna
- relocate the SX-5 cabinet.

TABLE 1-1
SX-5 DOCUMENTATION

SECTION	TITLE
MITL9103-098-100-NA	General Description
MITL9103-098-105-NA	Features and Services Description
MITL9103-098-150-NA	Ordering Information
MITL9103-098-180-NA	Engineering Information
MITL9103-098-200-NA	Shipping, Receiving, and Installation Procedures
MITL9103-098-205-NA	Programming
MITL9103-098-320-NA	Extension Test Procedures
MITL9103-098-350-NA	Maintenance and Troubleshooting

1. INTRODUCTION

General

1.01 This section contains a detailed description of the shipping, receiving and installation procedures for the SX-5 Communications System. Part 2 details the shipping and receiving of the SX-5, and Part 3 the delivery check, which includes the unpacking and inspection of the items delivered. The installation requirements are detailed in Part 4, and the cabling and cross-connections in Part 5. Part 6 gives a synopsis of the detailed installation instructions found in Appendix 2.

Documentation

1.02 Table 1-1 lists all MITEL practices associated with the SX-5 Communications System.

2. SHIPPING AND RECEIVING

WARNING: Caution is necessary when handling electronic equipment such as the SX-5, to avoid possible damage to the system electronics by static discharge. A simple means of avoiding the possibility of such damage is the use of a "Static Protection Wrist Strap" attached to one cabinet hinge. If difficulty is experienced in obtaining the wrist strap con-

tact your nearest MITEL Customer Service representative.

Introduction

2.01 The SX-5 is shipped fully equipped in a single carton (Fig. 2-1). If a large number of systems are to be shipped to one location, 20 systems are packaged in a single shipping container.

System Packaging

2.02 The equipment cabinet is shipped with all electronic assemblies in position. The cabinet is enclosed in an anti-static bag and supported with a shock-absorbant material. The system documentation and mounting template are packaged in the same container as the equipment cabinet. The shipping container consists of a completely enclosed tri-wall carton. During transportation the carton is held closed by two nylon shipping straps. The total weight of a complete system including packaging is approximately 12 lbs. (5.5 kg).

3. DELIVERY CHECK

General

3.01 On arrival at the installation site, all items must be checked against the order form and packing slip. Any discrepancies must be reported immediately.

Unpacking and Handling

3.02 The procedure to be used when unpacking and positioning the SX-5 equipment is detailed in MAP200-001 and MAP200-002.

Inspection

3.03 After arrival at the installation site inspect the SX-5 shipping carton for punctures. If the shipping carton is intact, no further inspection is required. If the shipping carton is damaged, refer to MAP200-001 for detailed instructions.

Defective Items

3.04 If any defective item is found, it should be tagged and returned to the supplier in accordance with accepted procedures.

Repacking for Reshipment

3.05 When the SX-5 equipment is shipped from one location to another, all items must be packaged to prevent damage. Fig. 2-1 shows how the equipment was originally packaged. This method should be followed as closely as possible.

3.06 If the original packaging material is no longer available, the returned parts should be placed in an anti-static bag, wrapped in several layers of air-cushion type wrap, placed in a suitable container, and surrounded with paper to minimize movement of all items.

4. INSTALLATION REQUIREMENTS

Environmental Requirements

4.01 The SX-5 equipment cabinet may be installed vertically in any location which fulfills the requirements of 4.02 and 4.03, and is within the following temperature and humidity limits:

- Temperature 0°-40°C (32° - 104°F)
- Relative Humidity 10-90% (non-condensing).

Space Requirements

4.02 The minimum space required for installation of the SX-5 is shown in Fig. 4-1.

Equipment Cabinet Location

4.03 The following requirements must be met when selecting a location for the SX-5 equipment cabinet.

The location MUST BE:

- Dry and clean
- Well ventilated
- Easily accessible.

The location MUST NOT BE:

- Near a sprinkler system, sweating pipes, steam pipes or steam vents
- In areas with extreme heat or cold
- In areas where corrosive fumes or exhaust from machinery is present
- Next to a reproducing or copying machine. A minimum clearance of 10 feet (3 m) must be provided and the room should be ventilated by an exhaust fan if the reproducing machine is not equipped with a filtering system.

Power Supply Requirements

4.04 The customer must provide a single phase power receptacle, which should adhere to the following recommendations:

- 110-120 V, 60 or 50 Hz, fused and capable of delivering 1.5 A
- The power receptacle should be wired and fused independently from all other receptacles

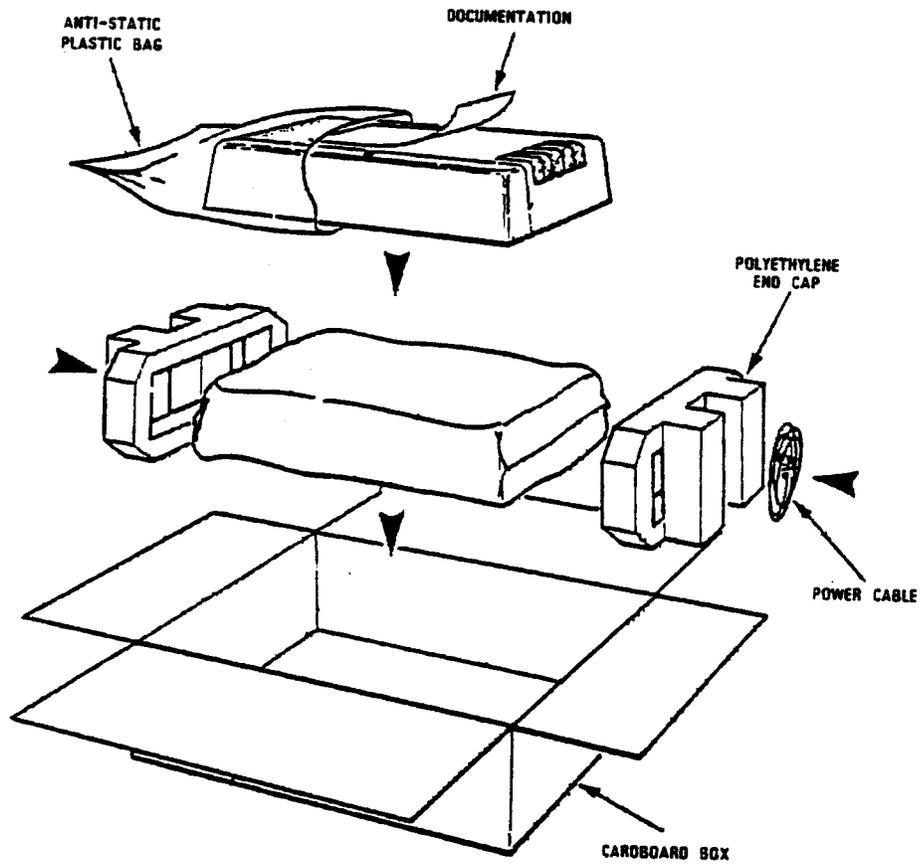


Fig. 2-1 SX-5 Shipping

X3891R1

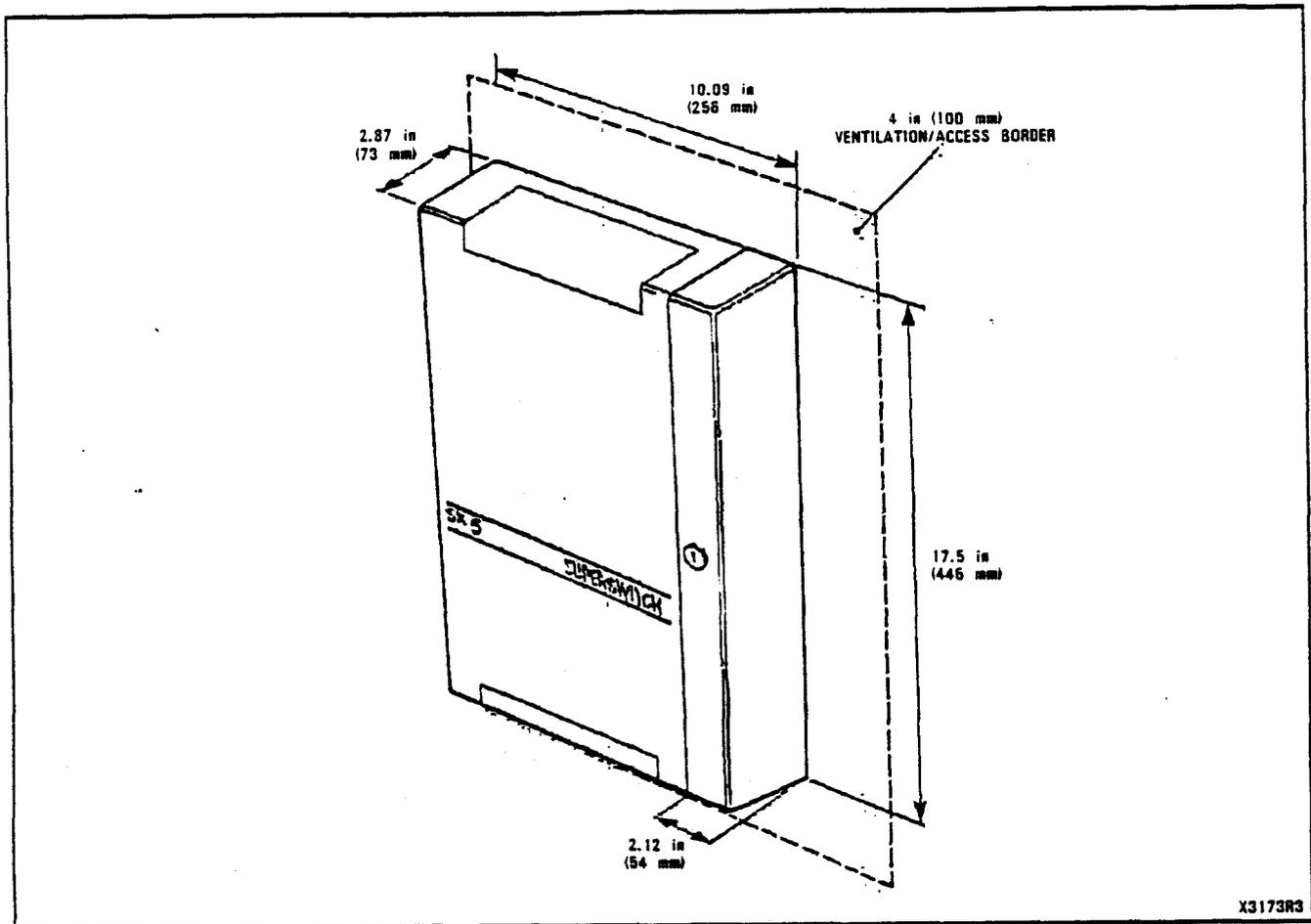


Fig. 4-1 SX-5 Dimensions

- A warning tag should be attached to circuit-breaker-type fuses to prevent unauthorized manual operation
- The power receptacle must not be controlled by a switch
- The power receptacle should be easily accessible for the removal of the plug for maintenance
- The receptacle location should be selected to prevent accidental removal of the power
- The power cord between the cabinet and the receptacle should not present a hazard to the subscriber
- A warning tag should be attached to the plug-end of the power cord to prevent

accidental removal of the cord by the subscriber.

Equipment Ground

4.05 The following is a description of the required PBX equipment grounding practice; a detailed procedure for grounding the system is given in MAP200-003.

- All circuits commons within the cabinet shall derive ground from a single ground concentration point within the cabinet. The cabinet ground concentration point shall derive ground from a single ground concentration point serving all peripherals collocated with the system.
- The system cabinet and all associated ducting hardware along with all collocated peripherals shall not be exposed to any

ground source other than the system single point ground described in (a) above.

- (c) AC service wires bringing AC power to the cabinet shall not share an enclosure or raceway with any other system grounds, DC power distribution wires, or signalling wires. All non-connectorized AC power terminations shall be enclosed by raceways and termination boxes whether these enclosures appear outside or within the system cabinet. This is to ensure that AC service wires cannot fault to circuitry within the system or associated ducting hardware.
- (d) All system hardware shall be provided with an AC fault return path to the system single point ground, which in turn shall be provided with a reliable path to the equipment grounding conductor (i.e. green wire ground or safety ground). The path from system equipment to system single point ground need not be a direct dedicated path, but can be any reliable path to other system hardware which receives the above grounding path.
- (e) All sources of external ground (i.e. system signalling ground to the approved ground source, etc.) shall connect only to the system single point ground. The intent of providing for a system single point ground is to minimize ground loops and prevent lightning from finding a path through system components.

5. CABLING AND CROSS-CONNECTIONS

General

5.01 This part details the cabling and cross-connections required when installing the SX-5 Communications System.

Telephone Set and Trunk Cabling

5.02 Telephone set and trunk cabling terminates on the SX-5 Terminal strip. The station loop limit is 600 ohms (including set) Tip to Ring, and the Central Office trunk loop limit is 1600 ohms.

Note: At present, only a 2-wire connection per extension is required, however, 4-wire cables should be run to allow for future expansion to features.

Cross-Connections

5.03 The extensions connected to Equipment Numbers 1 and 2 have direct access to trunks 1 and 2 respectively in the event of Power Failure (refer to MITL9103-098-100-NA, paragraph 3.06). For this reason, consideration should be given to the type of telephone that is to be connected to Equipment Numbers 1 and 2; e.g. if Trunk 1 is a ground start trunk, the telephone connected to Equipment Number 1 must have a ground button.

5.04 Connection between the equipment cabinet, stations, and trunks should be made using 26 AWG 2-pair cable.

5.05 Cabling connections to the SX-5 terminal strip are shown in Fig. 003-1, MAP200-003, Appendix 2.

6. INSTALLATION

General

6.01 Installation of the SX-5 consists of six steps as detailed in Table 6-1.

Synopsis

6.02 The following paragraphs contain a synopsis for each of the MAP's included in Appendix 2, Installation Procedures. These outlines may be used by the experienced installer to install an SX-5, while making reference to MAP's when necessary.

6.03 System Inspection, MAP200-001:

- Inspect shipping carton for damage
- If damaged return system
- Open shipping carton
- Remove equipment
- Check equipment against packing slip

- Report any missing and/or defective items
- Store shipping material.

- Place SX-5 over screw heads and lower unit
- Ensure unit is secure and level.

6.04 Cabinet Mounting, MAP200-002:

6.05 Cable Connections, MAP200-003:

Note: The SX-5 must be mounted vertically

- Place system in desired location
- Using the mounting template, mark the position of each mounting screw
- Insert mounting screws

- Run and connect extension cables
- Run and connect trunk cables
- Run and connect paging circuit
- Run and connect music on hold
- Plug in the power supply cord.

**TABLE 6-1
SYSTEM INSTALLATION**

STEP	PROCEDURE	SECTION
1	Equipment Unpacking	MITL9103-098-200-NA, MAP200-001
2	System Inspection	MITL9103-098-200-NA, MAP200-002
3	Cabinet Mounting	MITL9103-098-200-NA, MAP200-003
4	Cable Connections	MITL9103-098-200-NA, MAP200-004
5	Program System	MITL9103-098-205-NA
6	Extension Test Procedures	MITL9103-098-320-NA

APPENDIX 1

MITEL ACTION PROCEDURES

GENERAL

A1.01 Task-oriented functions in this section are implemented using MITEL Action Procedures (MAP's).

A1.02 A MAP is a step-by-step procedure using a flow chart principle, written and illustrated, where necessary, to a level of detail that allows both experienced and inexperienced personnel to carry out the tasks detailed. A MAP contains three levels of information as follows:

- (a) **SYNOPSIS:** This level contains the instructions required to complete the procedure.
- (b) For experienced personnel, a series of steps (level one) each numbered (n) and annotated with minimal information.
- (c) For inexperienced personnel, each step referred to in (b) above is amplified by a connected series of numbered substeps (nA) (level two).

A1.03 A typical example of a MAP is shown in Fig. A1-1, with levels (one) and (two) detailed.

MAP SYMBOLS

A1.04 There are four basic symbol shapes which may be used in a MAP. They are defined as follows:

A1.05 AND Block: Used to indicate a level one step that must be performed. Consists of a square with the word AND centered in the block.

A1.06 Action Block: Used to indicate a task outside the scope of the MAP. Consists of a rectangle with text centered in the middle of the block.

A1.07 Decision Block: Used to indicate a decision within the level one steps which must be made. The symbol is based on a hexagon with the top and bottom sides extended. Decision text is centered in the symbol.

A1.08 START/FINISH/Jump To Block: Used to indicate the start and finish of a MAP. Also used to indicate "jump to" points within the MAP, for example "go to (n)" or "return to (n)". The symbol is a rectangle with semicircular ends. Text is centered in the symbol.

THE OPERATOR'S USE OF MAP'S

Experienced Operator

A1.09 For the experienced operator to complete a task using a MAP, reference to the sequential short form level one steps is usually all that is necessary.

Inexperienced Operator

A1.10 If the operator's experience is such that the level one instructions do not contain sufficient information, the level two substeps should be referred to.

TOOLS, TEST EQUIPMENT AND SPECIAL INSTRUCTIONS

A1.11 All tools, test equipment and special instructions that the operator requires to complete a procedure are stated on the first page of each MAP.

UNPACKING AND INSPECTION OF EQUIPMENT
MAP200-001
Issue 1, October 1981
Sheet 3 of 4

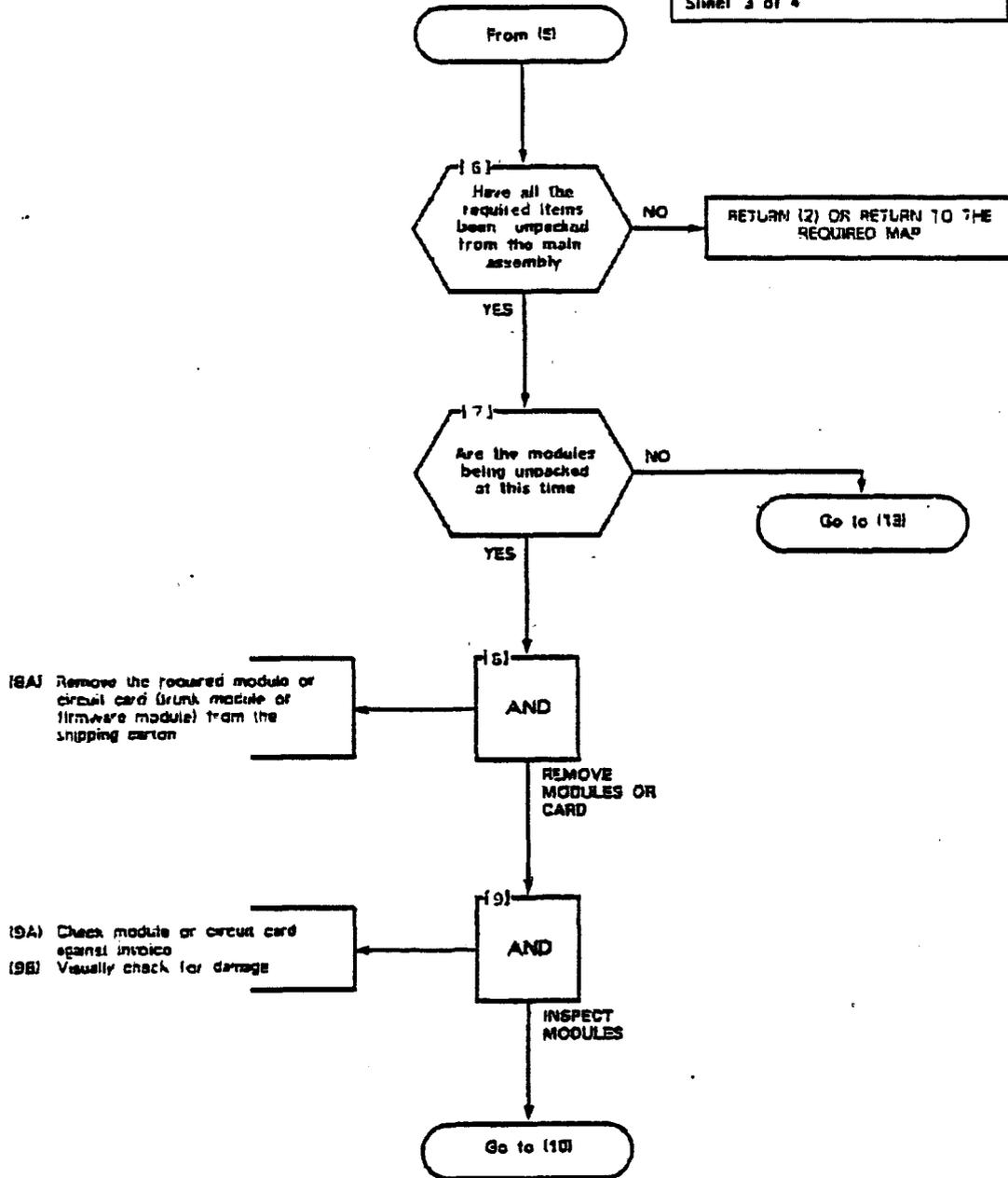


Fig. A1-1 Typical MAP Page (Example Only)

APPENDIX 2

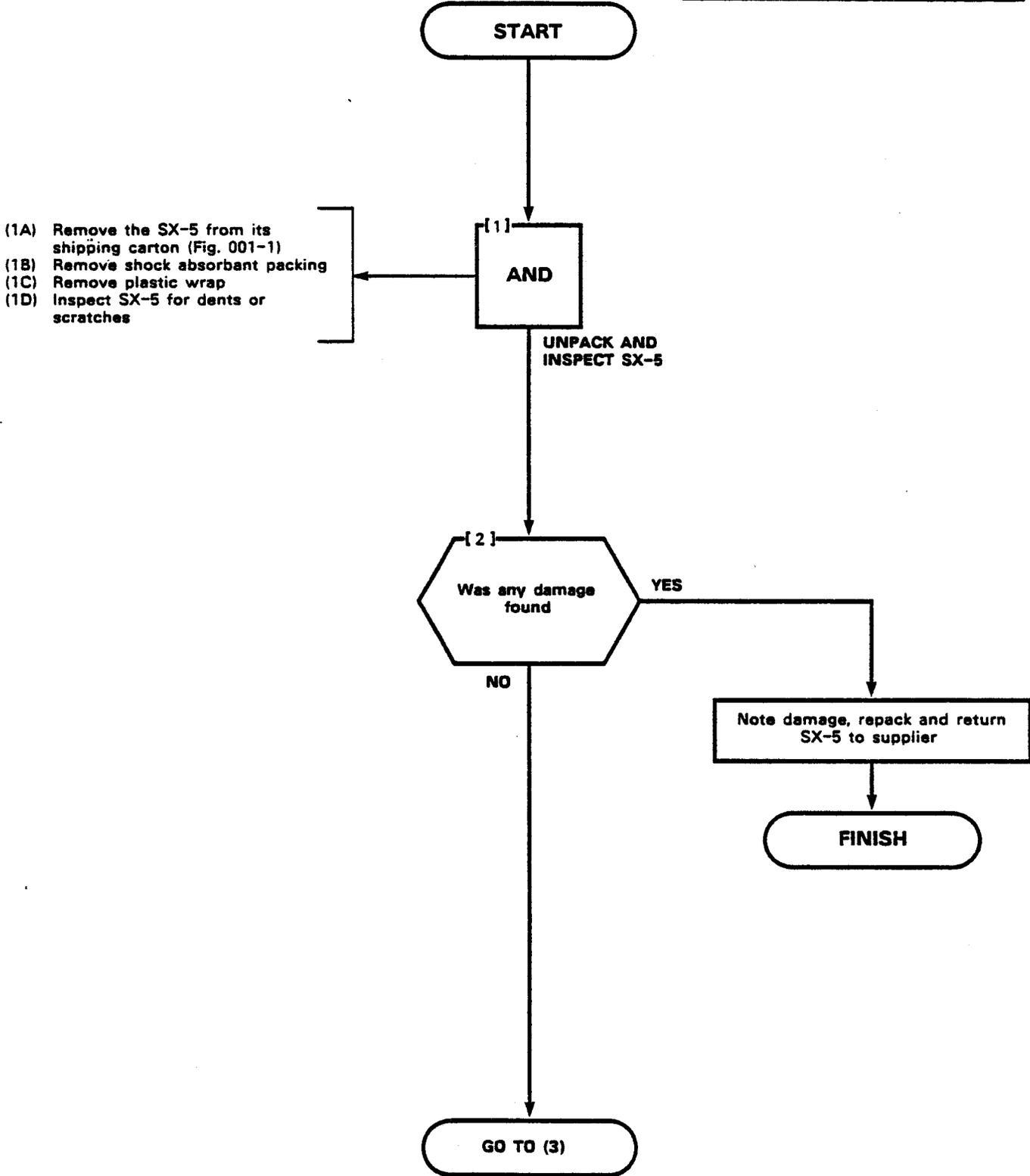
SX-5 INSTALLATION PROCEDURES

1. General

A2.01 The MAP's contained in this Appendix detail the SX-5 installation procedures.

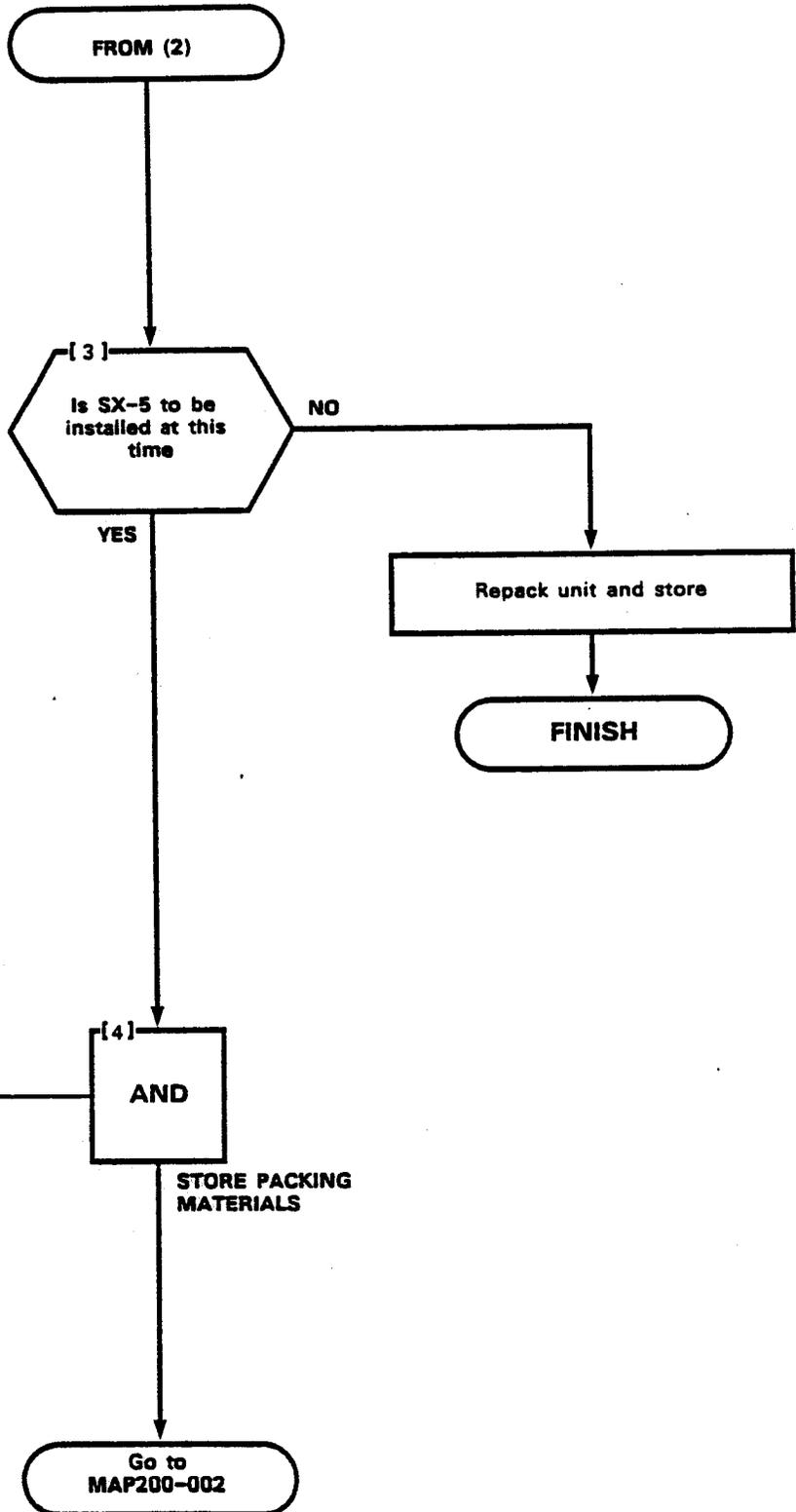
CAUTION: Caution is necessary during installation and maintenance of any electronic equipment, such as the SX-5, to avoid possible damage to the system electronics by static discharge. A simple means of avoiding the possibility of such damage, is the use of the "Static Protection Wrist Strap" attached to one cabinet hinge. MITEL strongly advises the use of this wrist strap; failure to do so can lead to improper system operation and decreased system life.

SYSTEM INSPECTION
MAP200-001
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SECTION MITL9103-098-200-NA

SYSTEM INSPECTION
MAP200- 001
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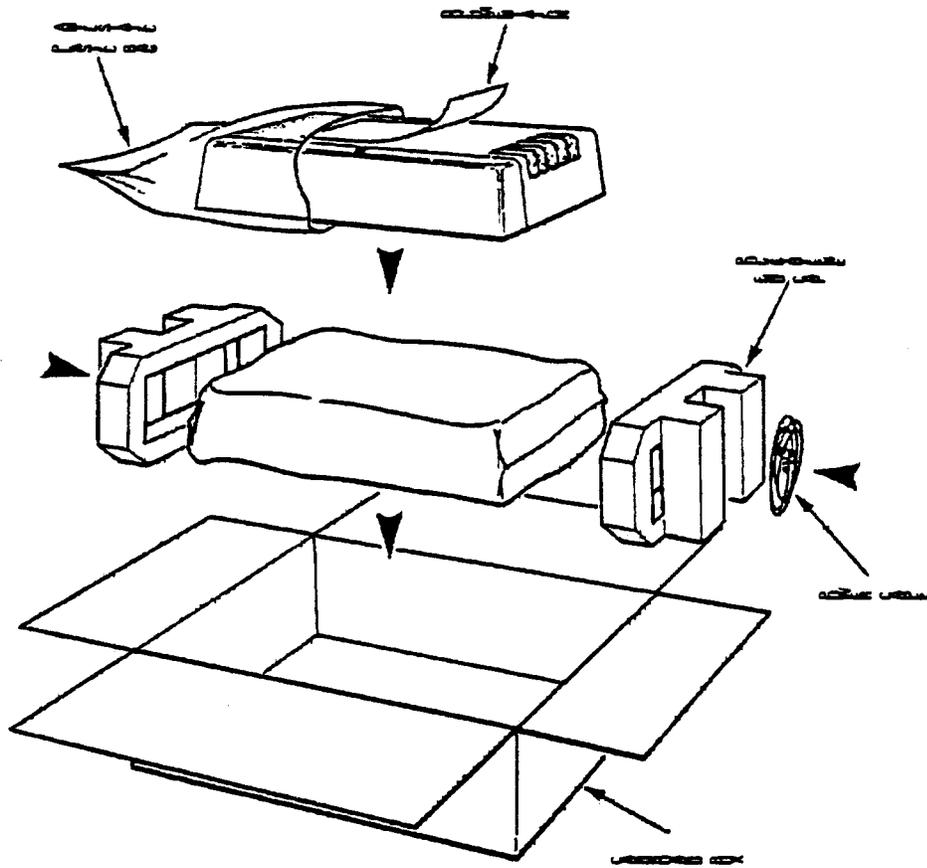
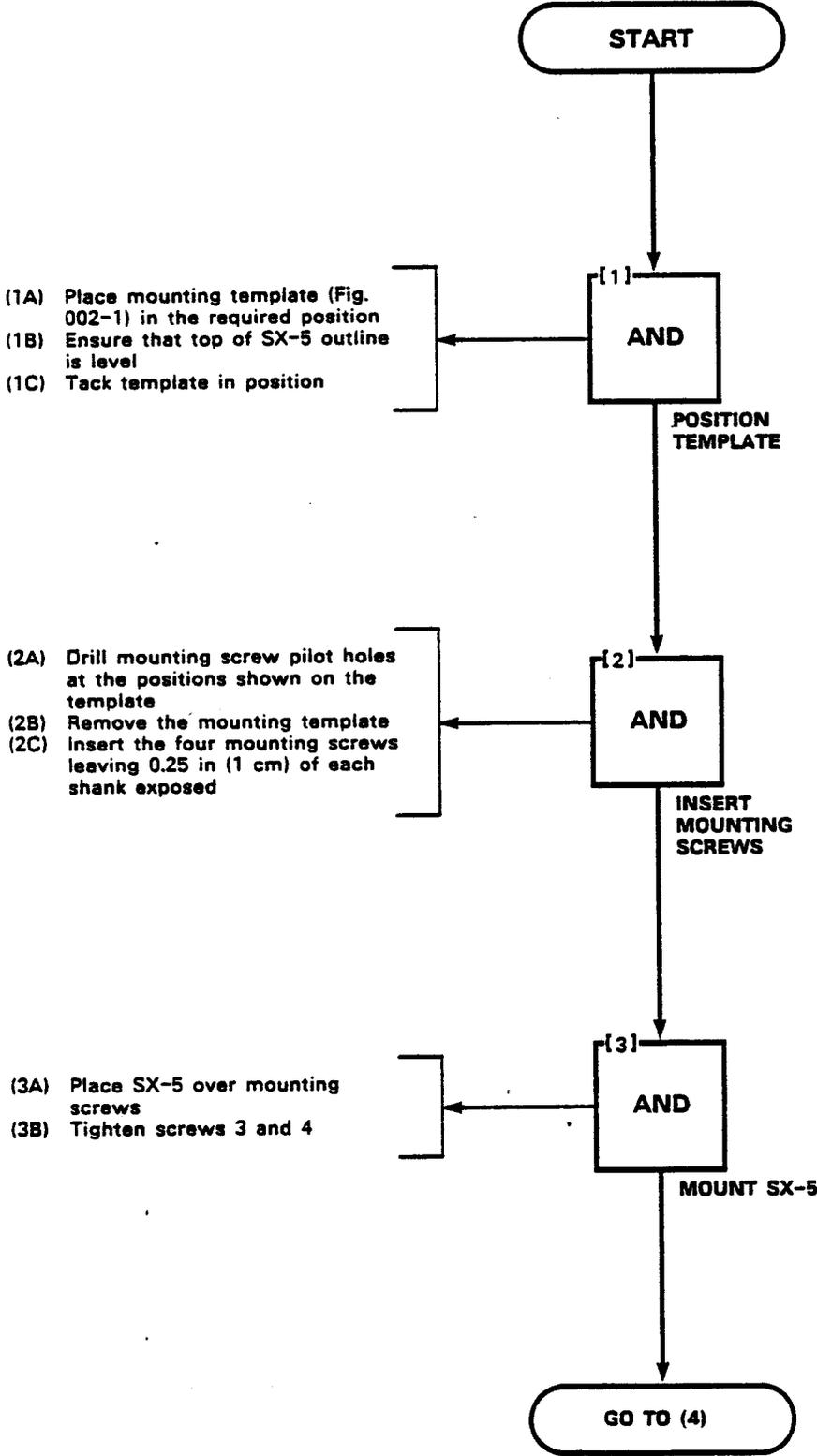


Fig. 001-1 SX-5 Shipping

CABINET MOUNTING
MAP200-002
Issue 1, May 1982
Sheet 1 of 2

TOOLS REQUIRED
Cable (2-pair, 26 AWG)
2 - trunk connection blocks
1 - screwdriver
4 - 1.5 inch screws 1/4 in. shank



CABINET MOUNTING
MAP200- 002
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Sheet 2 of 2

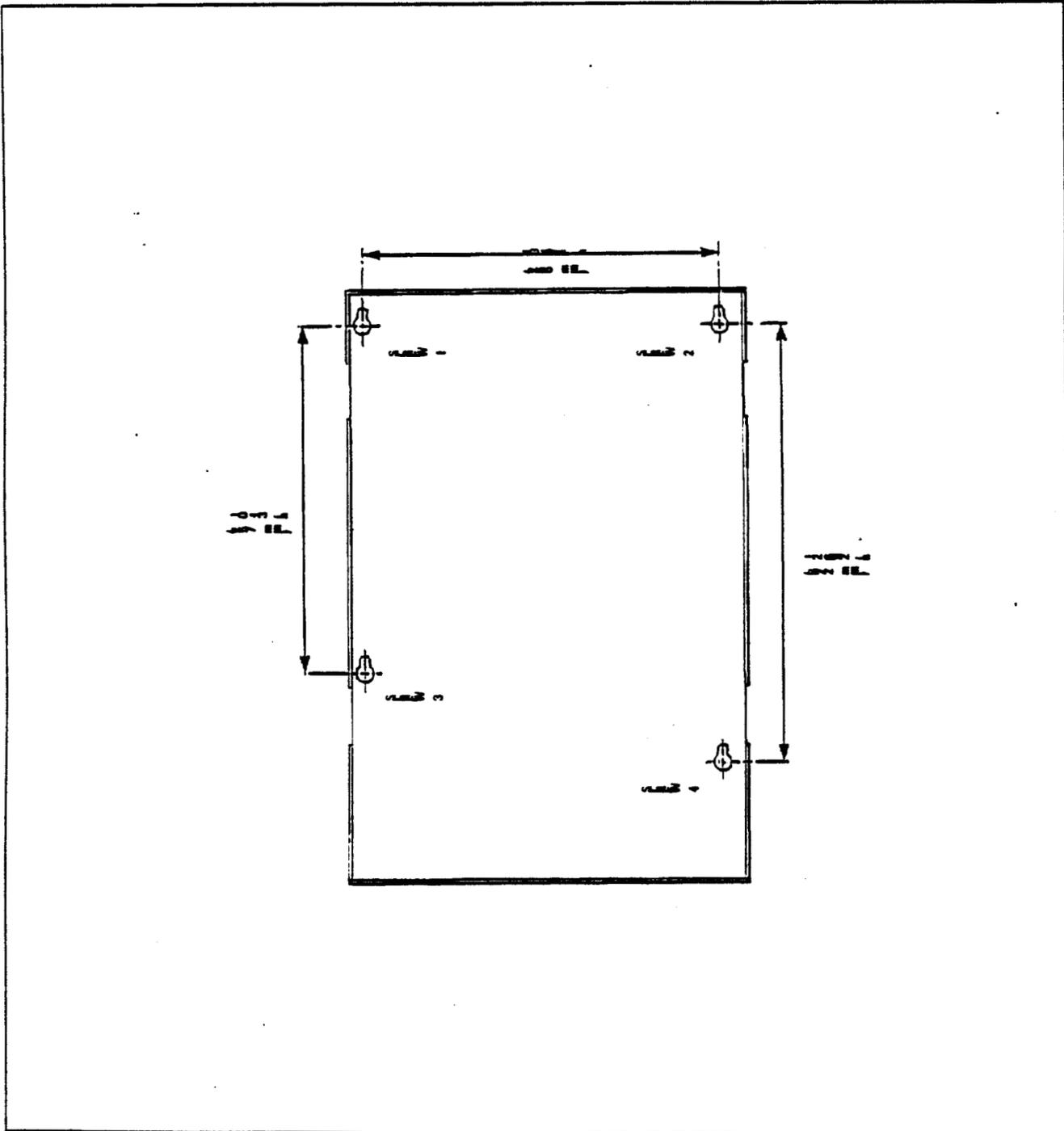


Fig. 002-1 Mounting Template

GROUND START TRUNKS
MAP200-003
Issue 1, May 1982
Sheet 1 of 6

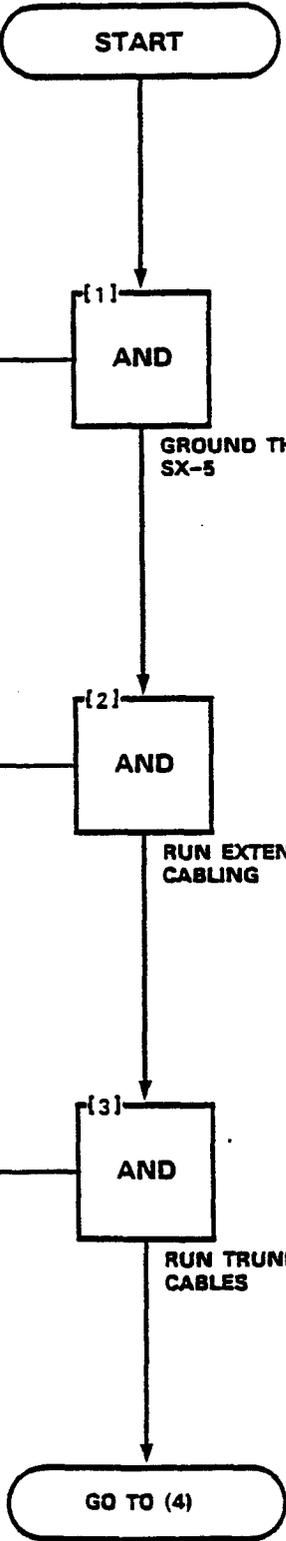
SYNOPSIS
Run and Connect Extensions
Run and Connect Trunks
Run and Connect Paging Circuit
Run and Connect Music on Hold Circuit

TOOLS REQUIRED
 1 - 1/8 in. flat blade screwdriver

- (1A) Run a 6 AWG copper wire between the SX-5 ground stud (Fig: 003-1) and a good ground, e.g. a metal cold water pipe, a ground stake, etc.
- (1B) Connect the 6 AWG ground wire to the SX-5 ground lug
- (1C) Connect the 6 AWG ground wire to the good ground. Refer to MITEL Grounding Instructions. CTIB 80-20-100-200-001

- (2A) Run two-pair cable between one extension location and the SX-5
- (2B) Label cable (labels supplied)
- (2C) Repeat (2A) and (2B) for each extension

- (3A) Run trunk 1 cable to trunk connection block
- (3B) Mark cable
- (3C) Repeat (3A) and (3B) for trunk 2



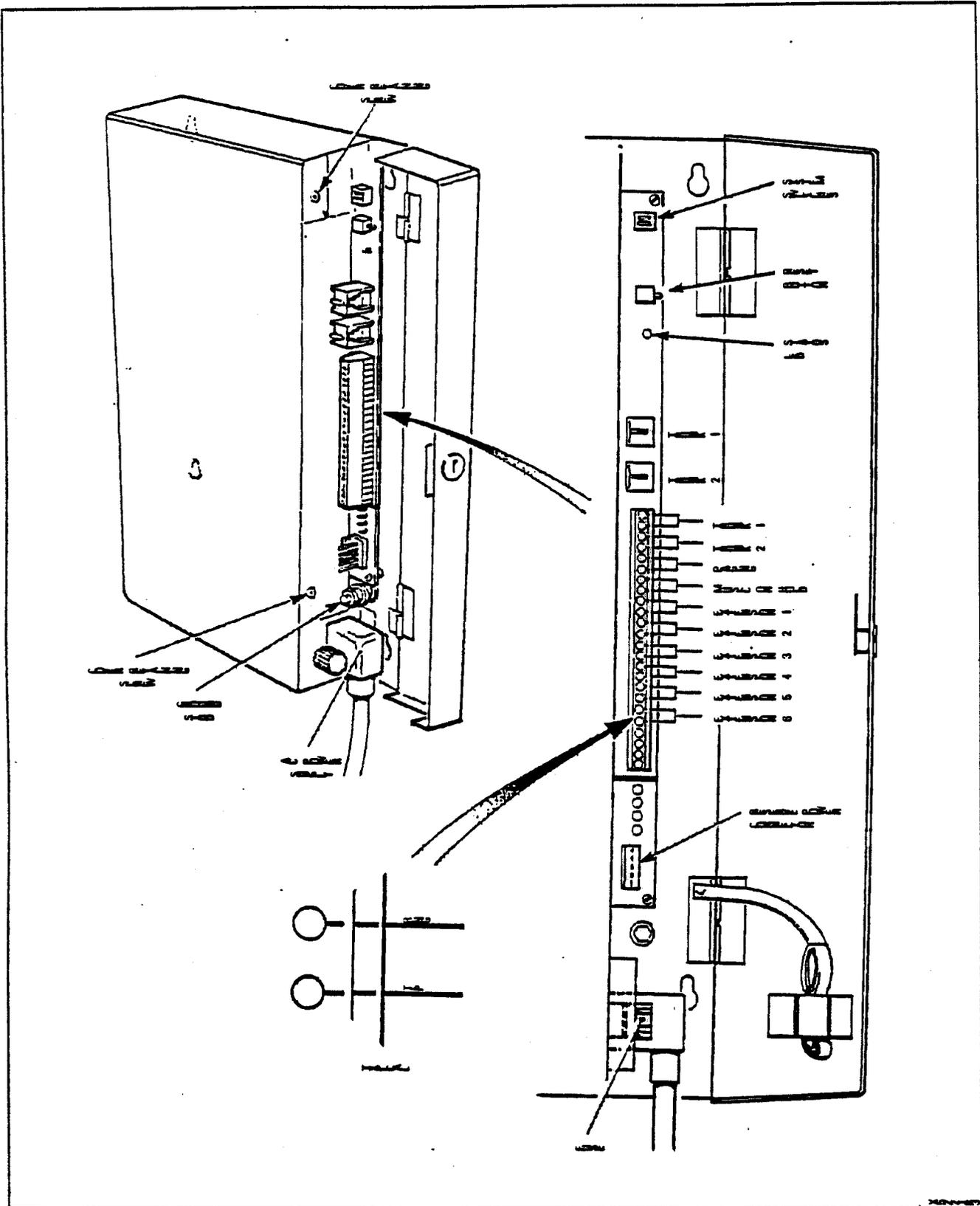
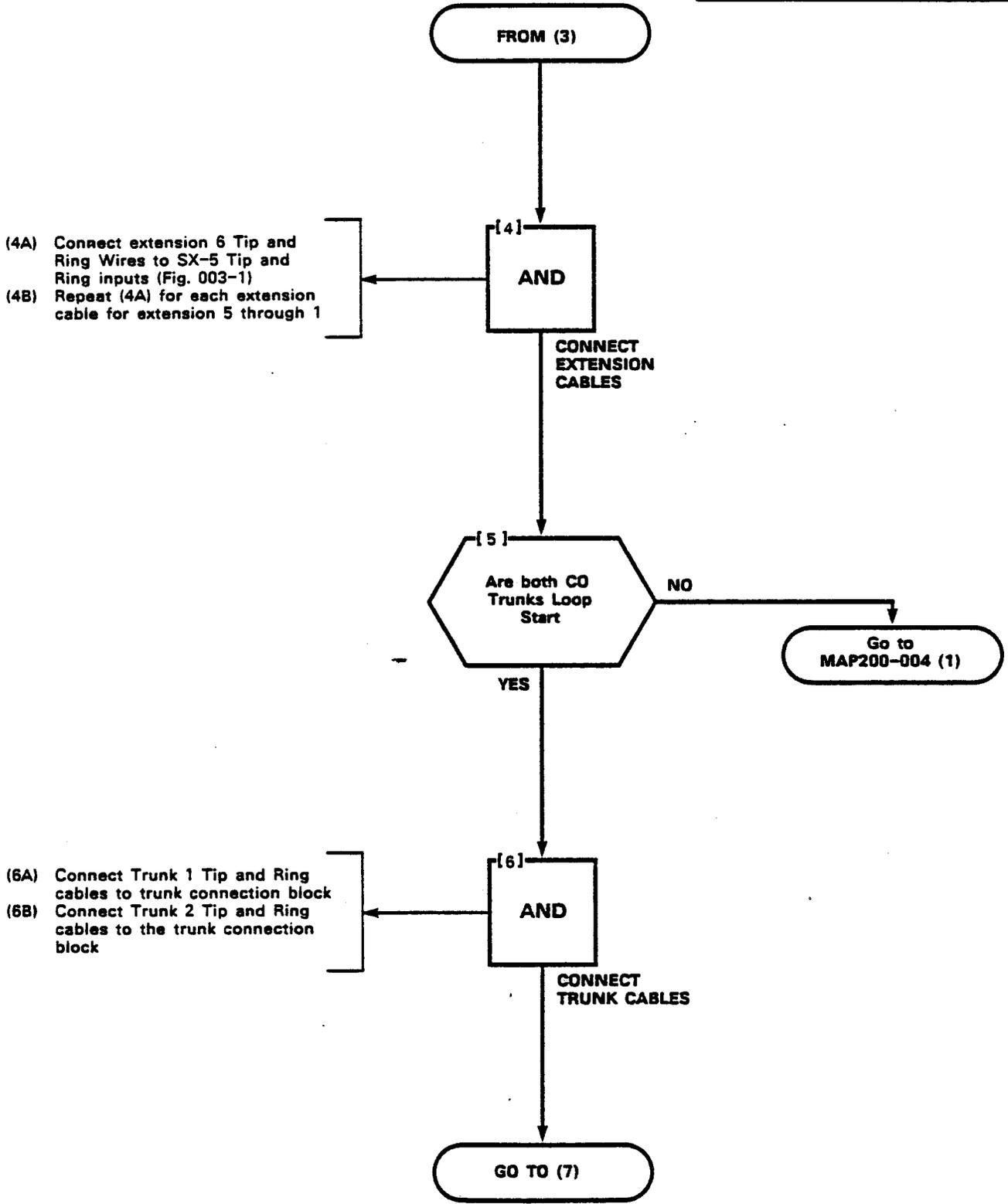


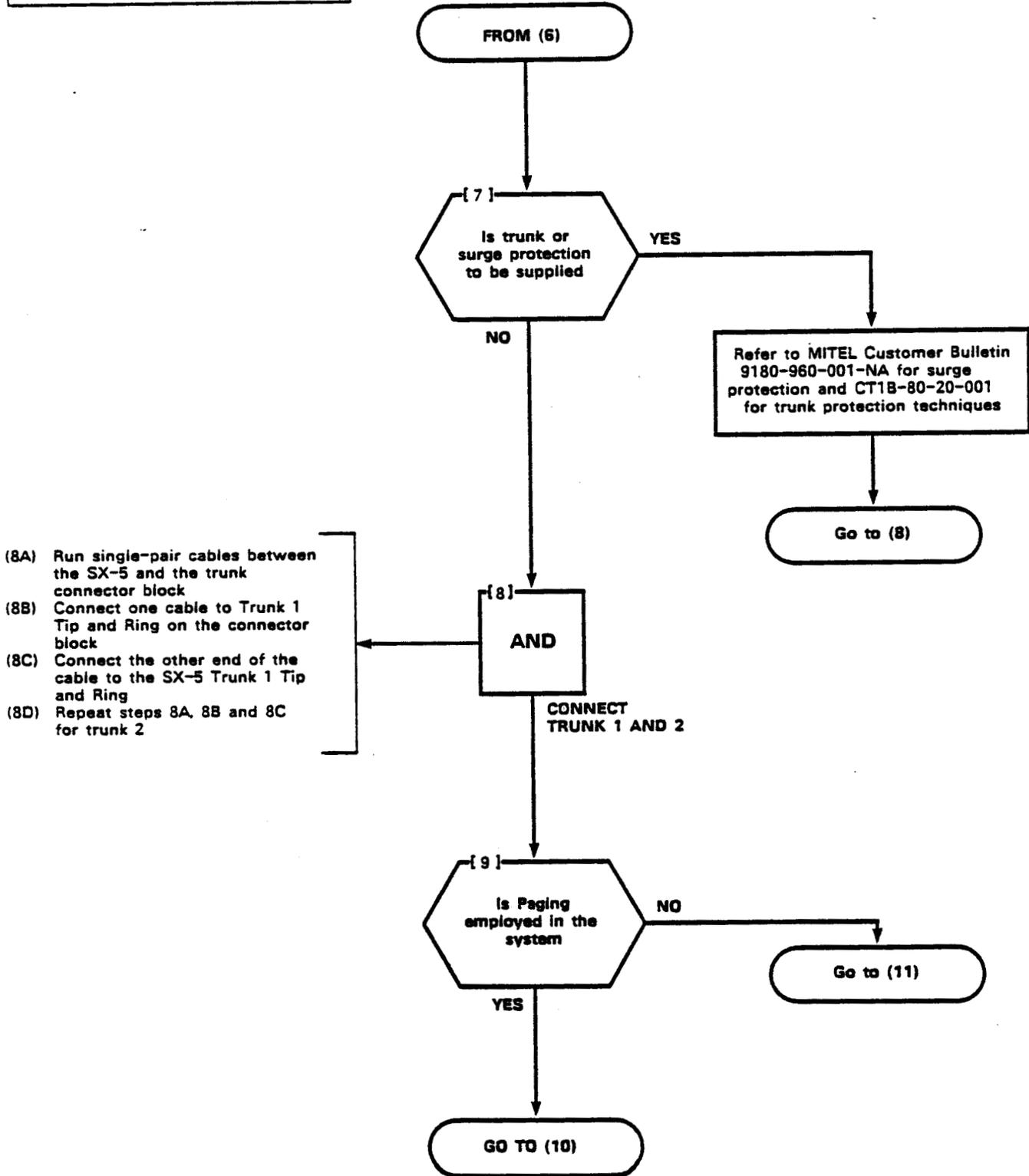
Fig. 003-1 SX-5 Equipment Cabinet

GROUND START TRUNKS
MAP200-003
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Sheet 3 of 6

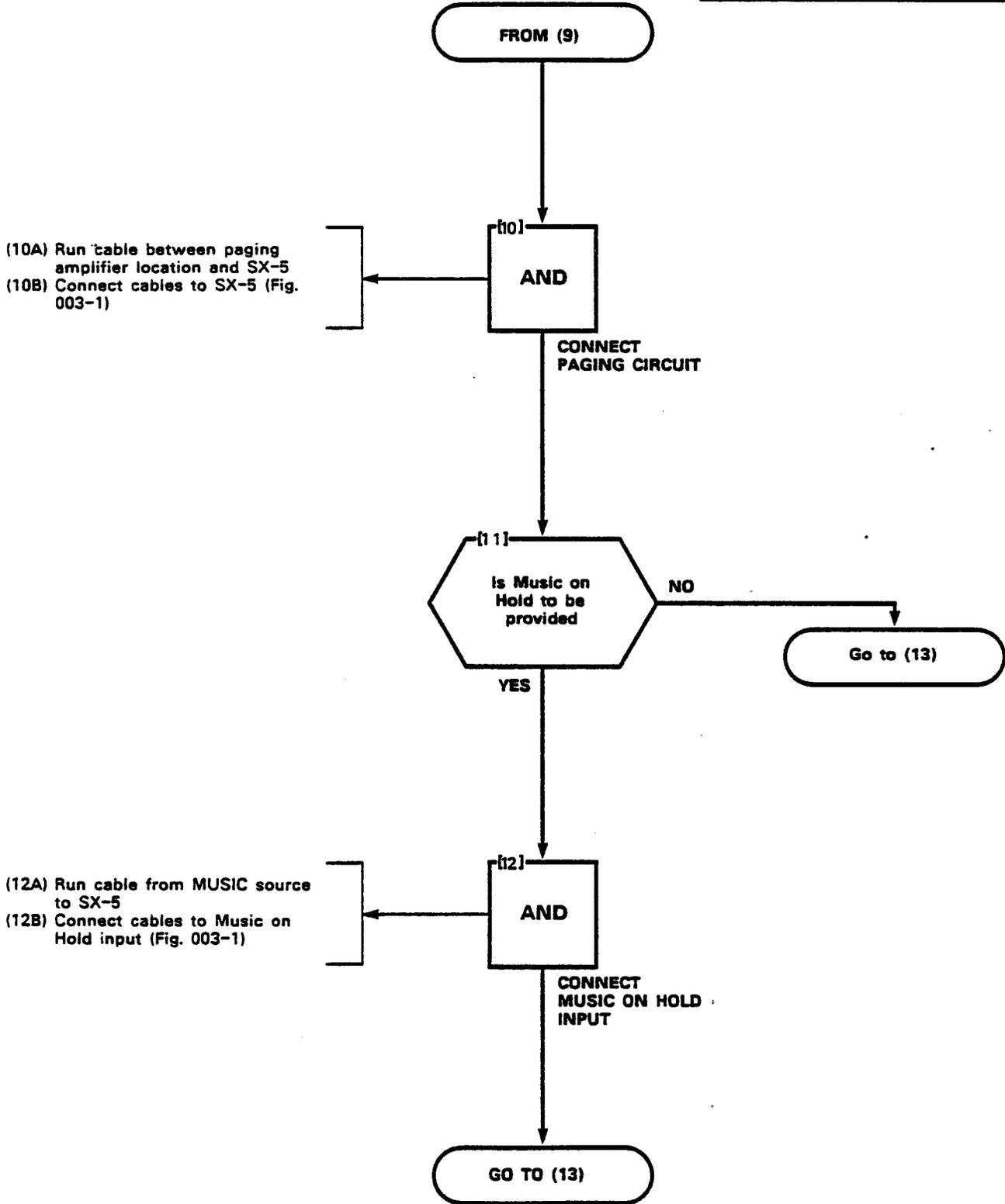


SECTION MITL9103-098-200-NA

GRQUND START TRUNKS
MAP200- 003
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Sheet 4 of 6

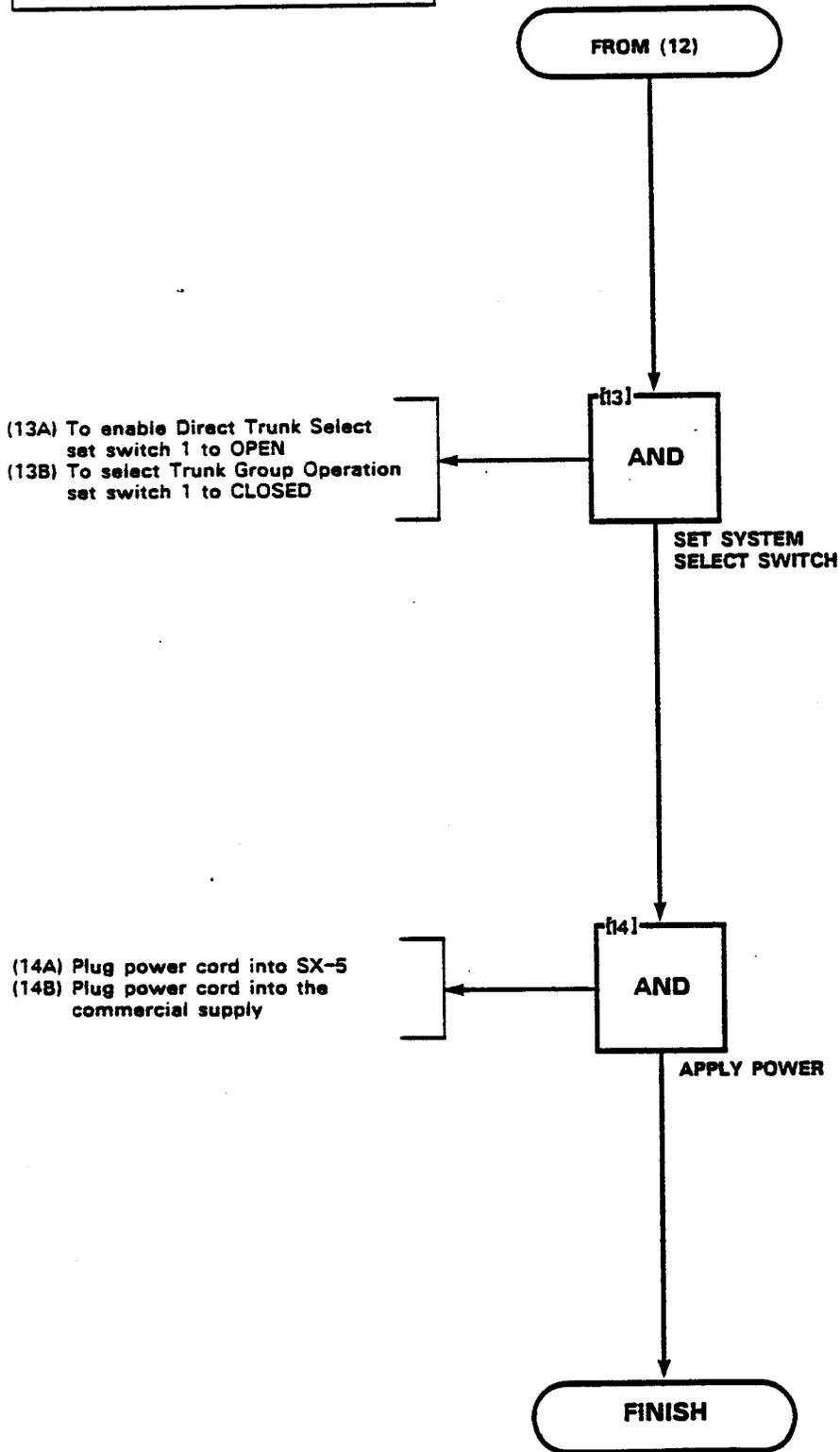


GROUND START TRUNKS
MAP200- 003
Issue 1, May 1982
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SECTION MITL9103-098-200-NA

GROUND START TRUNKS
MAP200- 003
Issue 1, May 1982
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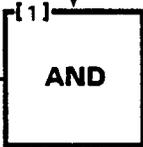
GROUND START TRUNKS
MAP200-004
Issue 1, May 1982
Sheet 1 of 2

TOOLS REQUIRED
1 Phillips screwdriver

CAUTION
The operations described in this MAP may only be performed by a skilled technician.

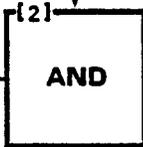
FROM
MAP200-003 (4)

- (1A) Open SX-5 access door and remove the two cover retaining screws, shown in Fig. 003-1 (Page A2-10)
- (1B) Remove the three Trunk Module retaining screws. Refer to Fig. 004-1
- (1C) Carefully lift the Trunk Module off the Main Card.



REMOVE TRUNK MODULE

- (2A) Set the relevant Loop Start and or Ground Start switch to the Ground Start position as shown in Fig. 004-2.



SET LOOP START AND OR GROUND START SWITCHES

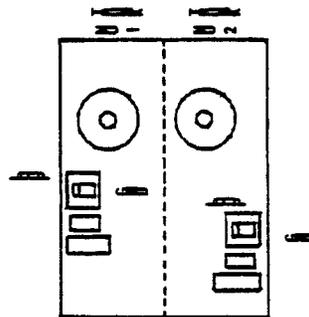
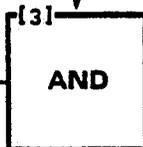


Fig. 004-2

- (3A) Align the Trunk Module pins with the Main Card connectors.
- (3B) Gently push the Trunk Module down onto the Main Card.
- (3C) Replace the three Trunk Module retaining screws. Refer to Fig. 004-1.
- (3D) Close the SX-5 cover and replace the two cover retaining screws shown in Fig. 003-1 (Page A2-10)



REPLACE TRUNK MODULE

Go to
MAP200-003 (5)

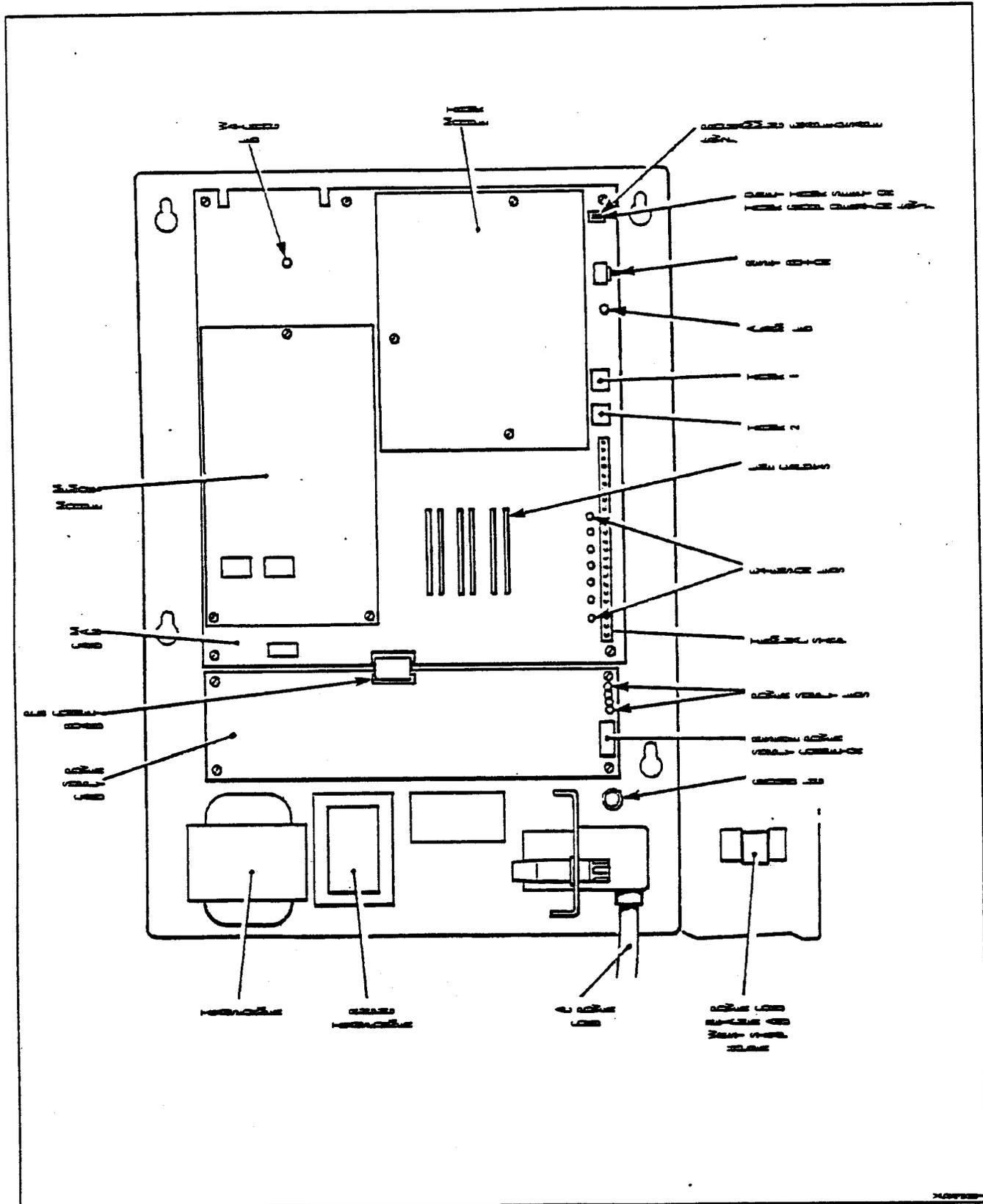


Fig. 004-1 SX-5 Equipment Layout

APPENDIX 3

FCC INTERCONNECTION REQUIREMENTS

A. TELEPHONE COMPANY INTERCONNECTION

General

A2.01 This equipment has been approved by the Federal Communications Commission (FCC) as not being harmful to the telephone network when connected directly to the telephone lines through the standard connector prescribed by the FCC Rule. This section is applicable to telephone interconnection in the United States.

Notification

A2.02 Prior to the interconnection of this equipment, the local telephone company is to be notified; inform the company that you have FCC-registered equipment which you wish to connect to their trunks. Give them the following information:

- The communications system being connected is a MITEL Incorporated Model SX-5
- The 14-digit FCC Registration Number for the SX-5 is BN285B-69976-MF-E
- The Ringer Equivalence number is 1:1B
- The jacks or connectors required are RJ11C.

Connection Limitations

A2.03 Due to the FCC part 68 Rule, no connection can be made to party lines and to coin telephone service.

Network Changes

A2.04 The telephone company may make changes to its communication service; such changes may include the change of trunk circuits, changes in the operational characteristics of its trunk, etc. Before doing this, however, the company shall provide official notification, so that the operation of the SX-5 Communications System service will not be interrupted.

Maintenance Limitations

A2.05 This equipment has been registered with the FCC for direct connection to the telephone network. Under the FCC Program, the user is restricted from making any changes or repairs and from performing any maintenance operations other than those specially included in MITEL Standard Practices.

A2.06 Circuit cards may be removed by the user; however, replacement cards are to be supplied only by MITEL or its authorized agent. No field repair by the user is authorized.

A2.07 Power supply components and cabling are only to be changed or maintained by MITEL or by an authorized agent of MITEL.

Trouble Corrections

A2.08 Most troubles within the SX-5 are corrected by replacing the entire system card or module that is malfunctioning. Card and module replacement can be made by the user.

A2.09 For more complex malfunctions, appropriate field service is provided by MITEL or its authorized agents.

SX-5*

COMMUNICATIONS SYSTEM

PROGRAMMING AND INSTALLATION FORMS

CONTENTS	PAGE
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Control Extension	3
2. PROGRAMMING	3
How to Program	3
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Portions of this data are fixed and require NO customer input. Other portions of data (customer data) may be altered to enable the SX-5 to be customized to meet a customer's specific requirements. The process by which data is loaded into the system memories is known as programming. To minimize programming the SX-5 contains a preprogrammed set of customer data (Default Data) which allows the system to be put into immediate use without customer programming. Unique site information and requirements, such as Toll Control, may then be selected by the customer, if desired.

1. INTRODUCTION

General

1.01 The SX-5 is a microprocessor-controlled switching system. In order to complete calls this microprocessor requires certain information about the calling equipment, the called equipment and connection procedures. This information is described by blocks of data held in the system memories. The data will not be lost or changed when power is removed from the unit.

1.02 This practice describes the method by which programming is performed, and includes programming forms which should be completed prior to programming.

Default Data

1.03 The Default Data, detailed in Table 2, is automatically entered into the system memories at initial power-up. The system is then in a standard operational configuration. Default Data may be reloaded at any time by executing the procedure given in Table 1.

TABLE 1
RELOAD DEFAULT DATA

STEP	ACTION	RESULT
1.	Ensure system switch 1 (SW1) is in the desired position for Direct Trunk Select (OPEN) or Trunk Group Operation (CLOSED)	
2.	Set system switch 2 (SW2) to CLOSED	
3.	Press and release reset switch	Status LED flashes
4.	Set SW2 to OPEN within 6 s of the status LED starting to flash	Status LED glows permanently
5.	Set SW2 to CLOSED	Default data is reloaded.

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**TABLE 2
DEFAULT DATA**

FEATURE	DESCRIPTION
Ring Groups	<p>Day Service Ring Group 1 -</p> <ul style="list-style-type: none"> Main extension - directory number 11 Auxiliary members - directory numbers 12, 13, 14, 15 and 16 Ringing delay - 2 ringing cycles <p>Night Service Ring Group 1 -</p> <ul style="list-style-type: none"> Main extension - directory number 11 Auxiliary members - directory numbers 12, 13, 14, 15 and 16 Ringing delay - 0 ringing cycles <p>Day Service Ring Group 2 -</p> <ul style="list-style-type: none"> Main extension - directory number 12 Auxiliary member - directory numbers 11, 13, 14, 15, 16 Ringing delay - 2 ringing cycles <p>Night Service Ring Group 2 -</p> <ul style="list-style-type: none"> Main extension - directory number 12 Auxiliary member - directory numbers 11, 13, 14, 15, 16 Ringing delay - 0 ringing cycles
Speed Dial Numbers	Clear
Pickup Groups	Clear
Extension Characteristics	<ul style="list-style-type: none"> Trunk 1 access - All extensions allowed Trunk 2 access - All extensions allowed Data Line Security - Not enabled on any extension Speed Dial Access - All extensions allowed Toll Control - All extensions Toll allowed
Trunk Characteristics	<ul style="list-style-type: none"> Start Type - Loop start Disconnect Timing - 500 ms Wait for Dial Tone - No wait Tone-to-Pulse Conversion - Not enabled on any trunk
Numbering Plan	<ul style="list-style-type: none"> Extension directory numbers - 11, 12, 13, 14, 15 and 16 Speed dial access code - 21, 22, 23...29 Last number redial code - 20 Trunk 1 access code - 9 Trunk 2 access code - 8 or 9 (depending on the position of system switch 1 at power-up)
Tone Plan	<ul style="list-style-type: none"> Dial Tone - 350/440 Hz (continuous) Busy Tone - 480/620 Hz (500 ms ON, 500 ms OFF repeated continuously) Ringback Tone - 440/480 Hz (1 s ON, 3 s OFF repeated continuously) Reorder Tone - 440/620 Hz (250 ms ON, 250 ms OFF repeated continuously) Camp-On Tone - 440/480 Hz (Single burst of 200 ms) Transfer Dial Tone - 350/440 Hz (100 ms ON, 100 ms OFF repeated three times, then continuous tone).
Trunk Break/Make Ratio	60/40
Ringing Frequency	20 Hz
Toll Control Plan	<ul style="list-style-type: none"> Toll Control Plan 1 - Restrict Toll Control Plan 2 - Don't restrict

Control Extension

1.04 The extension connected to Equipment Number 1 is known as the Control Extension. This extension may be used:

- As a conventional extension.
- To select features.
- To program customer data.

2. PROGRAMMING

How to Program

2.01 Customer programming of the SX-5 simply requires the programmer to perform four basic operations. They are:

- Place the system into programming mode by setting SW2 to OPEN.
- Dial the required programming code (derived from the installation forms) using the Control Extension.
- Check that the correct acknowledge tone is received (Refer to note).
- Set SW2 to CLOSED to protect the stored customer data.

Note: Acknowledge tone may be one of two tones, they are:

- one beep - indicates that new data has been accepted.
- two beeps - indicates that the data was already stored. This tone may be used to verify existing data.

The relevant tone is repeated three times. Reorder tone will be received when the data is invalid. Dial tone immediately follows Acknowledge tone whereupon subsequent programming codes may be dialed. Each programming code listed in the installation forms represents one program function only. Refer to Example Page.

3. INSTALLATION FORMS DESCRIPTION

General

3.01 Installation forms comprise a complete list of programming codes. The forms should be completed prior to programming and retained as a record of the system configuration.

4. EXAMPLE PAGE

On initial power-up the system memories of the SX-5 are loaded with a standard program package (Default Data). One feature not enabled by this program package is the Data Security Feature.

To enable Data Security on extension 14:

- Set SW2 to OPEN
- Lift the control extension handset, at which point dial tone is received
- Dial 40492
 - where: 4 - Denotes Programming
 - 0 - Denotes Extension characteristics are to be altered
 - 4 - Denotes Equipment Number (i.e. extension Number 14)
 - 9 - Denotes that the Data Security Feature is to be altered
 - 2 - Denotes that the Feature is to be Enabled
- Acknowledge tone is received
- Replace the handset
- Set SW2 to CLOSED

5. REMEMBER PAGE

A SUMMARY OF POINTS TO REMEMBER WHEN PROGRAMMING THE SX-5:

- PROGRAMMING IS ONLY NECESSARY TO MAKE CHANGES TO THE STANDARD PROGRAM PACKAGE (DEFAULT DATA).
- DEFAULT DATA IS AUTOMATICALLY LOADED INTO THE SYSTEM MEMORIES ON POWER-UP.
- DEFAULT DATA MAY BE RELOADED AT ANY TIME BY PERFORMING THE PROCEDURES GIVEN IN TABLE 1. DEFAULT DATA DOES NOT AUTOMATICALLY REPLACE CUSTOMER PROGRAMMING IN THE EVENT OF A POWER RESET.
- WHEN SYSTEM SWITCH 2 (SW2) IS SET TO OPEN, THE SX-5 IS IN PROGRAMMING MODE. WHEN SW2 IS SET TO CLOSED, THE SX-5 IS IN OPERATIONAL MODE.
- PROGRAMMING CODES MAY ONLY BE DIALED FROM THE CONTROL EXTENSION.
- ALL PROGRAMMING CODES BEGIN WITH DIGIT 4.
- THE EQUIPMENT NUMBER (EN) OF AN EXTENSION IS DEFINED AS THE SECOND DIGIT OF THE EXTENSION NUMBER, I.E. THE EN OF EXTENSION 23 IS 3.

6. INSTALLATION FORMS

Notes

- The programming codes shown in bold type indicate the system default data.
- The following tables contain the complete list of programming codes. Only those codes which are necessary to customize the SX-5 need to be dialed.
- Full details of the features listed in the installation forms are given in MITL9103-098-105-NA.

EXTENSION CHARACTERISTICS

FEATURE	DIAL	CHECK DESIRED CODE
<u>TRUNK ACCESS:</u>		
To allow EN1 access to Trunk 1	40172	- - - - -
To deny EN1 access to Trunk 1	40171	- - - - -
To allow EN1 access to Trunk 2	40182	- - - - -
To deny EN1 access to Trunk 2	40181	- - - - -
To allow EN2 access to Trunk 1	40272	- - - - -
To deny EN2 access to Trunk 1	40271	- - - - -
To allow EN2 access to Trunk 2	40282	- - - - -
To deny EN2 access to Trunk 2	40281	- - - - -
To allow EN3 access to Trunk 1	40372	- - - - -
To deny EN3 access to Trunk 1	40371	- - - - -
To allow EN3 access to Trunk 2	40382	- - - - -
To deny EN3 access to Trunk 2	40381	- - - - -
To allow EN4 access to Trunk 1	40472	- - - - -
To deny EN4 access to Trunk 1	40471	- - - - -
To allow EN4 access to Trunk 2	40482	- - - - -
To deny EN4 access to Trunk 2	40481	- - - - -
To allow EN5 access to Trunk 1	40572	- - - - -
To deny EN5 access to Trunk 1	40571	- - - - -
To allow EN5 access to Trunk 2	40582	- - - - -
To deny EN5 access to Trunk 2	40581	- - - - -
To allow EN6 access to Trunk 1	40672	- - - - -
To deny EN6 access to Trunk 1	40671	- - - - -
To allow EN6 access to Trunk 2	40682	- - - - -
To deny EN6 access to Trunk 2	40681	- - - - -

Note: The Equipment Number (EN) of an extension is defined as the second digit of the Extension Number, i.e. the EN of extension 23 is 3.

EXTENSION CHARACTERISTICS (CONT'D)

FEATURE	DIAL	CHECK DESIRED CODE
<u>DATA LINE SECURITY:</u>		
To enable Data Line Security on EN1 To disable Data Line Security on EN1	40192 40191	-- -- -- -- -- -- -- --
To enable Data Line Security on EN2 To disable Data Line Security on EN2	40292 40291	-- -- -- -- -- -- -- --
To enable Data Line Security on EN3 To disable Data Line Security on EN3	40392 40391	-- -- -- -- -- -- -- --
To enable Data Line Security on EN4 To disable Data Line Security on EN4	40492 40491	-- -- -- -- -- -- -- --
To enable Data Line Security on EN5 To disable Data Line Security on EN5	40592 40591	-- -- -- -- -- -- -- --
To enable Data Line Security on EN6 To disable Data Line Security on EN6	40692 40691	-- -- -- -- -- -- -- --
<u>SPEED DIAL:</u>		
To allow EN1 access to Speed Dial To deny EN1 access to Speed Dial	40102 40101	-- -- -- -- -- -- -- --
To allow EN2 access to Speed Dial To deny EN2 access to Speed Dial	40202 40201	-- -- -- -- -- -- -- --
To allow EN3 access to Speed Dial To deny EN3 access to Speed Dial	40302 40301	-- -- -- -- -- -- -- --
To allow EN4 access to Speed Dial To deny EN4 access to Speed Dial	40402 40401	-- -- -- -- -- -- -- --
To allow EN5 access to Speed Dial To deny EN5 access to Speed Dial	40502 40501	-- -- -- -- -- -- -- --
To allow EN6 access to Speed Dial To deny EN6 access to Speed Dial	40602 40601	-- -- -- -- -- -- -- --

Note: The Equipment Number (EN) of an extension is defined as the second digit of the Extension Number, i.e. the EN of extension 23 is 3.

EXTENSION CHARACTERISTICS (CONCL'D)

FEATURE	DIAL	CHECK DESIRED CODE
<u>TOLL CONTROL:</u>		
To disable Toll Control on EN1	40112	-- -- --
To assign Toll Plan 1 to EN1	40113	-- -- --
To assign Toll Plan 2 to EN1	40114	-- -- --
To disable Toll Control on EN2	40212	-- -- --
To assign Toll Plan 1 to EN2	40213	-- -- --
To assign Toll Plan 2 to EN2	40214	-- -- --
To disable Toll Control on EN3	40312	-- -- --
To assign Toll Plan 1 to EN3	40313	-- -- --
To assign Toll Plan 2 to EN3	40314	-- -- --
To disable Toll Control on EN4	40412	-- -- --
To assign Toll Plan 1 to EN4	40413	-- -- --
To assign Toll Plan 2 to EN4	40414	-- -- --
To disable Toll Control on EN5	40512	-- -- --
To assign Toll Plan 1 to EN5	40513	-- -- --
To assign Toll Plan 2 to EN5	40514	-- -- --
To disable Toll Control on EN6	40612	-- -- --
To assign Toll Plan 1 to EN6	40613	-- -- --
To assign Toll Plan 2 to EN6	40614	-- -- --

Note: The Equipment Number (EN) of an extension is defined as the second digit of the Extension Number, i.e. the EN of extension 23 is 3.

TRUNK CHARACTERISTICS

FEATURE	DIAL	CHECK DESIRED CODE
<u>START TYPE:</u> To define Trunk 1 to be Loop Start To define Trunk 1 to be Ground Start To define Trunk 2 to be Loop Start To define Trunk 2 to be Ground Start	43131 43132 43231 43232	--- --- --- ---
<u>DISCONNECT TIMING:</u> To assign a Disconnect Timing of 60 ms to Trunk 1 To assign a Disconnect Timing of 500 ms to Trunk 1 To assign a Disconnect Timing of 1.5 s to Trunk 1 To assign a Disconnect Timing of 4 s to Trunk 1 To assign a Disconnect Timing of 60 ms to Trunk 2 To assign a Disconnect Timing of 500 ms to Trunk 2 To assign a Disconnect Timing of 1.5 s to Trunk 2 To assign a Disconnect Timing of 4 s to Trunk 2	43141 43142 43143 43144 43241 43242 43243 43244	--- --- --- --- --- --- --- ---
<u>WAIT FOR DIAL TONE:</u> To assign No Wait for Dial Tone to Trunk 1 To assign Wait 5 s for Dial Tone to Trunk 1 To assign Wait 1 min. for Dial Tone to Trunk 1 To assign No Wait for Dial Tone to Trunk 2 To assign Wait 5 s for Dial Tone to Trunk 2 To assign Wait 1 min. for Dial Tone to Trunk 2	43151 43152 43153 43251 43252 43253	--- --- --- --- --- ---
<u>TONE-TO-PULSE CONVERSION:</u> To enable Tone-to-Pulse Conversion on Trunk 1 To enable Tone-to-Pulse Conversion and disable Outgoing Audio until answer on Trunk 1 To disable Tone-to-Pulse Conversion on Trunk 1 To enable Tone-to-Pulse Conversion on Trunk 2 To enable Tone-to-Pulse Conversion and disable Outgoing Audio until answer on Trunk 2 To disable Tone-to-Pulse Conversion on Trunk 2	43162 43163 43161 43262 43263 43261	--- --- --- --- --- ---

TRUNK CHARACTERISTICS (CONCL'D)

FEATURE	DIAL	CHECK DESIRED CODE
<p><u>SUPERVISION MEANING:</u></p> <p>To define Trunk 1 as having No Supervision</p> <p>To define Trunk 1 as having Toll Call Supervision</p> <p>To define Trunk 1 as having Answer Supervision</p> <p>To define Trunk 2 as having No Supervision</p> <p>To define Trunk 2 as having Toll Call Supervision</p> <p>To define Trunk 2 as having Answer Supervision</p>	<p>43171</p> <p>43172</p> <p>43173</p> <p>43271</p> <p>43272</p> <p>43273</p>	<p>— — — —</p>
<p><u>REVERSAL MEANING:</u></p> <p>To define the Reversal Meaning for Trunk 1 as being Not Incoming Call or Disconnect</p> <p>To define the Reversal Meaning for Trunk 1 as being Incoming Call</p> <p>To define the Reversal Meaning for Trunk 1 as being Incoming Call or Disconnect</p> <p>To define The Reversal Meaning for Trunk 2 as being Not Incoming Call or Disconnect</p> <p>To define the Reversal Meaning for Trunk 2 as being Incoming Call</p> <p>To define the Reversal Meaning for Trunk 2 as being Incoming Call or Disconnect</p>	<p>43181</p> <p>43182</p> <p>43183</p> <p>43281</p> <p>43282</p> <p>43283</p>	<p>— — — —</p>
<p><u>TRUNK MODE SELECT:</u></p> <p>To allow automatic access to Trunk 2 when Trunk 1 is busy (Trunk Group Operation)</p> <p>To deny automatic access to Trunk 2 when Trunk 1 is busy (Direct Trunk Select)</p>	<p>4232</p> <p>4231</p>	<p>— — — —</p> <p>— — — —</p>
<p><u>TRUNK RINGING:</u></p> <p>To enable Trunk 1 to ring differently to Trunk 2</p> <p>To enable Trunk 1 and Trunk 2 to ring the same</p>	<p>4241</p> <p>4242</p>	<p>— — — —</p> <p>— — — —</p>

SYSTEM SELECTION

FEATURE	DIAL	CHECK DESIRED CODE
<u>TOLL PLANS:</u>		
Toll Plan 1 -		
• To provide restriction on reception of Toll Call Supervision	45132	- - - - -
• To provide no restriction on reception of Toll Call Supervision	45131	- - - - -
• To provide restriction when the first digit dialed is 0	45142	- - - - -
• To provide no restriction when the first digit dialed is 0	45141	- - - - -
• To provide restriction when the first digit dialed is 1	45152	- - - - -
• To provide no restriction when the first digit dialed is 1	45151	- - - - -
• To provide restriction when the second digit dialed is 0 or 1	45162	- - - - -
• To provide no restriction when the second digit dialed is 0 or 1	45161	- - - - -
• To provide restriction when the digits dialed are 1 + area code	45172	- - - - -
• To provide no restriction when the digits dialed are 1 + area code	45171	- - - - -
Toll Plan 2 -		
• To provide restriction on the reception of Toll Call Supervision	45232	- - - - -
• To provide no restriction on the reception of Toll Call Supervision	45231	- - - - -
• To provide restriction when the first digit dialed is 0	45242	- - - - -
• To provide no restriction when the first digit dialed is 0	45241	- - - - -
• To provide restriction when the first digit dialed is 1	45252	- - - - -
• To provide no restriction when the first digit dialed is 1	45251	- - - - -
• To provide restriction when the second digit dialed is 0 or 1	45262	- - - - -
• To provide no restriction when the second digit dialed is 0 or 1	45261	- - - - -
• To provide restriction when the digits dialed are 1 + area code	45272	- - - - -
• To provide no restriction when the digits dialed are 1 + area code	45271	- - - - -

SYSTEM SELECTION (CONT'D)

FEATURE	DIAL	CHECK DESIRED CODE
<u>SELECTABLE NUMBERING PLANS:</u>		
To select Numbering Plan 1	4471	-- -- --
To select Numbering Plan 2	4472	-- -- --
To select Numbering Plan 3	4473	-- -- --
To select Numbering Plan 4	4474	-- -- --
<u>TRUNK BREAK/MAKE RATIO:</u>		
To select a Trunk Break/Make Ratio of 60/40	4412	-- -- --
To select a Trunk Break/Make Ratio of 70/40	4413	-- -- --
<u>RINGING FREQUENCIES:</u>		
To select a Ringing Frequency of 20 Hz	4423	-- -- --
To select a Ringing Frequency of 25 Hz	4424	-- -- --
To select a Ringing Frequency of 17.5 Hz	4425	-- -- --
<u>SWITCHHOOK FLASH TIMER:</u>		
To select a Switchhook Flash Time of 150 - 750 ms	4171	-- -- --
To select a Switchhook Flash Time of 150 - 1500 ms	4172	-- -- --
To accept a Switchhook Flash as a release signal	4173	-- -- --
<u>HOLD RECALL TIMER:</u>		
To select a Hold Recall Time of 1 min.	4181	-- -- --
To select a Hold Recall Time of 2 min.	4182	-- -- --
To select a Hold Recall Time of 3 min.	4183	-- -- --
To select a Hold Recall Time of 4 min.	4184	-- -- --
To select a Hold Recall Time of 5 min.	4185	-- -- --
To select a Hold Recall Time of 6 min.	4186	-- -- --
To select a Hold Recall Time of 7 min.	4187	-- -- --
To select a Hold Recall Time of 8 min.	4188	-- -- --
To select a Hold Recall Time of 9 min.	4189	-- -- --

SYSTEM SELECTION (CONCL'D)

FEATURE	DIAL	CHECK DESIRED CODE
<u>SYSTEM RECALL TIMER:</u>		
To select a System Recall Time of 1 ringing cycle	4191	-- -- --
To select a System Recall Time of 2 ringing cycles	4192	-- -- --
To select a System Recall Time of 3 ringing cycles	4193	-- -- --
To select a System Recall Time of 4 ringing cycles	4194	-- -- --
To select a System Recall Time of 5 ringing cycles	4195	-- -- --
To select a System Recall Time of 6 ringing cycles	4196	-- -- --
To select a System Recall Time of 7 ringing cycles	4197	-- -- --
To select a System Recall Time of 8 ringing cycles	4198	-- -- --
To select a System Recall Time of 9 ringing cycles	4199	-- -- --
<u>*TRUNK DIGIT-TO-PULSE TRANSLATION:</u>		
To select Trunk Digit-to-Pulse Translation Plan 1	4491	-- -- --
To select Trunk Digit-to-Pulse Translation Plan 2	4492	-- -- --
To select Trunk Digit-to-Pulse Translation Plan 3	4493	-- -- --
To select Trunk Digit-to-Pulse Translation Plan 4	4494	-- -- --
<u>*ROTARY DIAL PULSE-TO-DIGIT TRANSLATION:</u>		
To select Rotary Dial-to-Digit Translation Plan 1	4401	-- -- --
To select Rotary Dial-to-Digit Translation Plan 2	4402	-- -- --
To select Rotary Dial-to-Digit Translation Plan 3	4403	-- -- --
To select Rotary Dial-to-Digit Translation Plan 4	4404	-- -- --

* This feature need only be considered in countries where the Pulse-to-Digit ratio is not the standard ratio of 1:1.

SX-5*

COMMUNICATIONS SYSTEM

CONTROL FUNCTIONS

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<p>1. INTRODUCTION</p> <p>1.01 Control Functions are features which may be selected to change the day-to-day status of the SX-5. For example, the allocation of an extension to a different pick-up group is a Control Function. This Section details those Control Functions, the method of selecting them and their status when Default Data is loaded.</p> <p>2. TO SELECT A CONTROL FUNCTION</p> <p>2.01 As with programming, the Control Functions are selected by dialing the appropriate digit stream from the control extension. Unlike programming, the position of system switch 2 (SW2) does not have to be altered when selecting a Control Function (i.e., SW2 remains closed). It may also be noted that all Control Function codes begin with the digit 3, while programming codes begin with the digit 4.</p> <p>Control Extension</p> <p>2.02 The extension connected to Equipment Number 1 is known as the Control Extension. This extension may be used:</p> <ul style="list-style-type: none">• As a conventional extension.	<ul style="list-style-type: none">• To select features (Control Functions).• To program customer data. <p>3. EXAMPLES</p> <p>3.01 Two examples of Control Function feature selection are given in 3.02 and 3.03.</p> <p>Example 1</p> <p>3.02 To define the main extension of Day Service Ring Group 1, proceed as follows:</p> <ul style="list-style-type: none">• Lift the Control Extension handset - dial tone is returned.• Dial 33135X where:<ul style="list-style-type: none">33 - Denotes that a Ring Group is to be altered1 - Denotes Ring Group 13 - Denotes Day Service5 - Denotes that a main member is to be definedX - Denotes the Equipment Number of the extension <p>Example 2</p> <p>3.03 To store a Speed Dial number of, for instance, MITEL CORP in Kanata Ontario (1-613-592-2122), proceed as follows:</p> <ul style="list-style-type: none">• Lift the handset of any extension - dial tone is returned.• Dial 352139*216135922122 where:<ul style="list-style-type: none">35 - Denotes that a Speed Dial number is to be stored
---	--

- 2 - Denotes the Speed Dial store position
 - 13 - Denotes the total number of digits in the Speed Dial number
- 9*216135922122 - Denotes the actual Speed Dial number (including the preceding trunk access code 9, and *2, i.e., Wait for Dial Tone, see Table 3-1).

3.04 The special codes which may be used in a Speed Dial number are given in Table 3-1.

4. CONTROL FUNCTION CODES

4.01 Table 4-1 contains a complete list of Control Function codes. The codes shown in bold type indicate the default data.

**TABLE 3-1
SPECIAL SPEED DIAL CODES**

Code	Meaning
#	International End of Dialing
*1	Pause for 5 s, then outpulse
*2	Wait for dial tone as defined for the system
*3	Allows manual dialed digits to be added to the end of the speed dialed number. (Follow this code with 01-16, the number of digits to be manually inserted.)

NOTE: Each of the codes given in Table 3-1 is defined as one digit when calculating the total number of digits in the Speed Dial Number (BC).

**TABLE 4-1
CONTROL FUNCTION CODES**

CONTROL FUNCTION	DIAL
CLEAR FUNCTIONS:	
To clear all auxiliary members from Day Service Ring Group 1	3012
To clear all auxiliary members from Night Service Ring Group 1	3013
To clear all auxiliary members from Day Service Ring Group 2	3014
To clear all auxiliary members from Night Service Ring Group 2	3015
To clear all members of Pick-Up Group 1	3023
To clear all members of Pick-Up Group 2	3024
To clear all Call Forwarding - All Calls	303
To clear all Call Forwarding - Busy	304
To clear Speed Call number 1	3051
To clear Speed Call number 2	3052
To clear Speed Call number 3	3053
To clear Speed Call number 4	3054
To clear Speed Call number 5	3055
To clear Speed Call number 6	3056
To clear Speed Call number 7	3057
To clear Speed Call number 8	3058
To clear Speed Call number 9	3059
DAY/NIGHT SERVICE:	
To select Day Service Ring Groups 1 and 2	312
To select Night Service Ring Groups 1 and 2	313
MUSIC SELECTION:	
To allow Background Music	3232
To deny Background Music	3231
To allow Music on Hold	3242
To deny Music on Hold	3241

TABLE 4-1 (CONT'D)
CONTROL FUNCTION CODES

CONTROL FUNCTION	DIAL
<p>RING GROUPS:</p> <ul style="list-style-type: none"> - Day Service Ring Group 1 <ul style="list-style-type: none"> To define the Main Member of the group To add Auxiliary Members to the group To remove Auxiliary Members from the group To define the Ring Delay for the group - Day Service Ring Group 2 <ul style="list-style-type: none"> To define the Main Member of the group To add Auxiliary Members to the group To remove Auxiliary Members from the group To define the Ring Delay for the group - Night Service Ring Group 1 <ul style="list-style-type: none"> To define the Main Member of the group To add Auxiliary Members to the group To remove Auxiliary Members from the group To define the Ring Delay for the group - Night Service Ring Group 2 <ul style="list-style-type: none"> To define the Main Member of the group To add Auxiliary Members to the group To remove Auxiliary Members from the group To define the Ring Delay for the group <p>NOTE: X = The Equipment Number (EN) of the extension (1-6) N = The number of EN's to be added (1-5) C = The number of ringing cycles (0-9)</p>	<p>33135X 33136NX 33137X 33138C</p> <p>33235X 33236NX 33237X 33238C</p> <p>33145X 33146NX 33147X 33148C</p> <p>33245X 33246NX 33247X 33248C</p>
<p>PICK-UP GROUPS:</p> <ul style="list-style-type: none"> To add members to Pick-Up Group number 1 To remove a member of Pick-Up Group number 1 To add members to Pick-Up Group number 2 To remove a member of Pick-Up Group number 2 <p>NOTE: X = The Equipment Number (EN) of the extension (1-6) N = The number of EN's to be added (1-6)</p>	<p>3413NX 3414X 3423NX 3424X</p>

TABLE 4-1 (CONT'D)
CONTROL FUNCTION CODES

CONTROL FUNCTION	DIAL
<p>SPEED DIAL: To store a Speed Dial number</p> <p>NOTE: A = A single digit (1-9) which defines the speed dial store position. BC = A 2-digit number indicating the total number of digits in the directory number. X = The actual speed dial number to be stored. The entries may be the digits 0 through 9, or any of the special codes listed in Table 3-1.</p>	35ABCX

SX-5*
SUPERSWITCH*
COMMUNICATIONS SYSTEM
SYSTEM TEST

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1. INTRODUCTION

1.01 This section describes the test procedures which are to be performed when installation and programming of the SX-5 is complete.

2. TEST PROCEDURES

General Description

2.01 The test procedures provide step-by-step sequences of operations which reconstruct typical usage of the features and services provided by the SX-5. Satisfactory completion

of the test procedures confirms that the apparatus has been installed and programmed correctly.

Performing Tests

2.02 The test procedures are detailed in the following charts; each chart details the test procedures applicable to one feature or service. The order in which the tests are performed is not important; they are listed in alphabetical order for ease of reference.

2.03 If any test procedure cannot be completed as described, check:

- That the procedure is applicable to the extension (i.e. the feature being tested is assigned to the extension).
- That the apparatus which provides the feature (e.g. Paging Amplifier) is correctly installed.
- The installation and programming instructions detailed in Section MITL9103-098-200-NA and Section MITL9103-098-205-NA, respectively.

Note: When performing the following test procedures it is assumed that interaction between features will be taken into account by the test person, e.g. the tones included in Chart 12 will not be present if the called extension has Data Line Security enabled.

CHART 1
AUTOMATIC CALLBACK - BUSY

STEP	ACTION	VERIFICATION
To set up Automatic Callback - Busy:		
1	Make an extension busy by lifting the handset.	
2	Dial the busy extension's number from a second extension.	Busy tone is heard.
3	Dial the digit "6" within 10 seconds of receipt of busy tone.	Dial tone is returned and the extension is available for normal use.
4	Replace handset of the second extension.	
To answer Automatic Callback - Busy:		
5	Replace the handset of the busy extension.	The second extension rings.
6	Lift the handset of the second extension.	The called extension rings and ringback tone is received by the calling extension.
7	Lift the handset of the ringing extension.	Ringback tone is removed: two-way conversation.

CHART 2
AUTOMATIC CALLBACK - DON'T ANSWER

STEP	ACTION	VERIFICATION
To set up Automatic Callback - Don't Answer:		
1	Dial the required extension.	Ringtone is heard.
2	Perform a switchhook flash.	Transfer dial tone is heard.
3	Dial the digits "56".	Dial tone is returned and the extension is available for normal use.
4	Replace handset.	
To answer Automatic Callback - Don't Answer:		
5	Lift and replace the handset of the required extension.	The original calling extension rings with distinctive ringing.
6	Lift the handset of the ringing extension.	The required extension rings and ringback tone is received by the calling extension.
7	Lift the handset of the required extension.	Ringback tone removed: two-way conversation.

CHART 3
CALL FORWARDING - ALL CALLS

STEP	ACTION	VERIFICATION
To set up Call Forwarding - All Calls:		
1	Lift the handset at the first extension.	Dial tone is returned.
2	Dial 58 (the Call Forwarding - All Calls access code).	No tone is heard.
3	Dial the number that calls are to be forwarded to.	
4	Replace the handset.	The extension is available for call originations.
5	Establish call to the first extension.	Extension to which calls are forwarded and the first extension ring.
To cancel Call Forwarding - All Calls:		
6	Lift the handset.	Distinctive dial tone is returned.
7	Dial 58 (the Call Forwarding - All Calls access code).	No tone is heard.
8	Replace the handset.	Call Forwarding - All Calls is cancelled.
9	Establish call to the first extension.	First extension rings.

CHART 4
CALL FORWARDING - BUSY

STEP	ACTION	VERIFICATION
To set up Call Forwarding - Busy:		
1	Lift the handset at the first extension.	Dial tone is returned.
2	Dial 59 (the Call Forwarding - Busy access code).	No tone is heard.
3	Dial the number that calls are to be forwarded to.	
4	Replace handset.	The extension is available for normal use.
5	Go off-hook at the first extension.	Dial tone is returned.
6	Establish call to the first extension.	Extension to which calls are forwarded rings.
To cancel Call Forwarding - Busy:		
7	Lift the handset of the first extension.	Distinctive dial tone is returned.
8	Dial 59 (the Call Forwarding - Busy access code).	No tone is heard.
9	Replace the handset at the first extension.	Call Forwarding will not be cancelled until the extension goes on-hook after dialing the code.
10	Lift handset and remain off-hook at first extension.	
11	Establish call to the first extension.	Busy tone is returned to calling extension.
12	Replace all handsets.	

CHART 5
CALL HOLD

STEP	ACTION	VERIFICATION
To place an established trunk call on HOLD:		
1	Perform a switchhook flash at the extension.	The extension receives transfer dial tone. The trunk receives music (if programmed and when connected).
2	Dial 55 (the Call Hold code).	Beep tones are returned indicating the held trunk number (1 beep = trunk 1, 2 beeps = trunk 2), followed by dial tone; the original call is held. The holding extension may make or receive calls or access features in the normal manner.
3	Replace handset.	
To retrieve the Call at any extension:		
4	Lift handset	Dial tone is returned.
5	Dial 51 if Trunk 1 is held or 52 if Trunk 2 is held.	The extension is connected to the call on hold.
6	Replace handset.	

CHART 6
CONSULTATION HOLD/ADD-ON/TRANSFER

STEP	ACTION	VERIFICATION
CONSULTATION HOLD:		
1	Establish a call to an extension.	
2	Extension "A" performs a switchhook flash.	Extension "A" receives transfer dial tone. Extension "B" is put on consultation hold.
3	Extension "A" dials third party.	Third extension rings.
4	Third extension answers.	Extension "A" and third extension are connected. Extension "B" remains on consultation hold.
ADD-ON:		
5	Extension "A" performs switchhook flash.	All three extensions are connected.
TRANSFER:		
6	Extension "A" goes on-hook.	Extension on consultation hold ("B") is connected to third extension.
7	Replace all handsets.	

CHART 7
DIAL CALL PICK-UP

STEP	ACTION	VERIFICATION
1	Dial an extension number.	Called extension rings.
2	Lift the handset of a free extension in the same pick-up group as the ringing extension.	Dial tone is returned.
3	Dial 66 (the group Pick-Up code).	The extension is connected to the incoming call.

CHART 8
DIRECT OUTWARD DIALING (TRUNK GROUP OPERATION)

STEP	ACTION	VERIFICATION
Trunk is free:		
1	Lift handset.	Dial tone is returned.
2	Dial Trunk Group access code. (Default = 9)	Central Office dial tone is returned.
3	Dial desired digits.	Distant telephone rings.
4	Replace handset.	
Both trunks are busy:		
5	Lift handset.	Dial tone is returned.
6	Dial Trunk access code.	Busy tone is returned.
7	Go on-hook.	

CHART 9
DIRECT TRUNK SELECT

STEP	ACTION	VERIFICATION
Trunk is free:		
1	Lift handset.	Dial tone is returned.
2	Dial the Trunk Group access code. (Default Trunk 1 = 9, Trunk 2 = 8).	Central Office dial tone is returned.
3	Dial the desired digits.	Distant telephone rings.
4	Replace handset.	
Both trunks are busy:		
5	Lift handset.	Dial tone is returned.
6	Dial the Trunk access code. (Default Trunk 1 = 9, Trunk 2 = 8).	Busy tone is returned.
7	Go on-hook.	

CHART 10
EXTENSION-TO-EXTENSION CALL

STEP	ACTION	VERIFICATION
Called extension free:		
1	Lift handset	Dial tone is returned.
2	Dial an extension number.	Called extension rings; calling extension receives ringback tone.
3	Called extension answers.	Ringback tone is removed; two-way conversation.
4	Go on-hook at called and calling extensions.	
Called extension busy:		
5	Lift handset	Dial tone is returned.
6	Dial a busy extension number.	Busy tone heard after completion of dialing.
7	Go on-hook at calling extension.	

CHART 11
POWER FAIL TRANSFER

STEP	ACTION	VERIFICATION
Power Failure:		
1	Disconnect power cable.	
2	† Lift handset of the extension connected to Equipment Number 1.	Central Office dial tone is returned.
3	† Lift handset of the extension connected to Equipment Number 2.	Central Office dial tone is returned.
4	Replace handsets.	

† If a trunk is a ground start trunk, the extension must be equipped with a Ground Start Button, or a Ground Start/Loop Start Converter.

**CHART 12
TRUNK CAMP-ON**

STEP	ACTION	VERIFICATION
To set-up Trunk Camp-on:		
1	Establish an extension-to-extension call.	
2	Establish an incoming trunk call to a ring group that includes one of the busy extensions.	Incoming trunk receives ringback tone. The called extension receives one tone burst indicating that an incoming call is waiting.
3	Called extension goes on-hook.	Called extension rings and trunk receives ringback tone.
4	Called extension lifts handset.	Incoming trunk and called extension are connected.

**CHART 13
VOICE PAGING**

STEP	ACTION	VERIFICATION
1	Lift handset.	Dial tone is returned.
2	Dial 61 (Paging access code).	When the warning tone is heard, the extension is connected to the paging equipment and the user may make an announcement.
3	Go on-hook.	

SX-5*
SUPERSWITCH*
COMMUNICATIONS SYSTEM
TROUBLESHOOTING PROCEDURES

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System Dead			
MAP350-104	A1-13		
System Control Dead			
MAP350-105	A1-17		
Extension LED Fault			

INTRODUCTION

1.01 The SX-5 Communications System is a reliable, maintenance free system which employs solid-state technology and modular construction. For these reasons, and in the interest of simplicity, only two methods of fault repair need to be considered they are:

- Complete System Replacement.
- Module Replacement.

2. PREFACE

2.01 This section provides the information required by a repair person to locate and repair any fault which may occur with an SX-5 Communications System. Description of the SX-5 within this section, is contained to the details required to carry out the troubleshooting procedures detailed in MAP's 350-101 through 117. The following documents may be used to provide additional information where necessary:

- MITL9103-098-100-NA, General Description.
- MITL9103-098-105-NA, Features and Services.
- MITL9103-098-150-NA, Ordering Information.
- MITL9103-098-200-NA, Shipping, Receiving and Installation Procedures.
- MITL9103-098-205-NA, Programming and Installation Forms.

2.02 Where fault repair requires module replacement (e.g. Trunk Module) a skilled technician must be employed. Under no circumstances should the repair or replacement of faulty PCB components be carried out.

3. ENTRY INTO AN SX-5 CABINET

General

3.01 The cabinet of an SX-5 should be locked when installation is complete and should remain locked throughout normal use. Only those persons who possess the correct door key may then gain access to the interior of the cabinet.

Levels of Entry

3.02 There are two levels of entry into an SX-5 cabinet. Level 1 Entry allows restricted system access, Level 2 Entry allows unrestricted system access.

Caution: ACTIONS WHICH REQUIRE LEVEL 2 ENTRY TO THE SYSTEM MUST ONLY BE PERFORMED BY A SKILLED TECHNICIAN.

Level 1 Entry

3.03 Level 1 Entry is accomplished by unlocking and opening the access door of the SX-5, which then allows access to:

- System Switches (SW1, SW2)
- Reset Switch
- Alarm Lamp
- Trunk Connectors
- Terminal Strip
- Extension LED's
- Reserve Power Connector
- AC Power Cord
- AC Supply Fuse
- Wrist Ground Strap
- Power Supply LED's.

Level 2 Entry

3.04 Level 2 Entry is accomplished by opening the access door, removing the two cover-retaining screws, located at the top and bottom of the internal blanking plate (refer to Fig. 3-1), and lifting the hinged cover. Level 2 Entry allows access to:

- All items listed in Level 1 Entry
- Trunk Module
- Memory Module
- Subscriber Line Interface Circuits (SLIC's)
- PCB to PCB Jumper
- Main Card
- Power Supply Card

4. MAINTENANCE LED's

Location and Function

4.01 Maintenance LED's provide an immediate status indication of circuit divisions within the SX-5. Table 4-1 details the location and function of these maintenance LED's.

5. TROUBLESHOOTING PROCEDURES

General

5.01 The troubleshooting procedures given in this section are in the form of MAP's. An introduction to the use of MAP's is given in Paras. 5.04. to 5.07. Having located a fault the appropriate repair action (given in the MAP) should

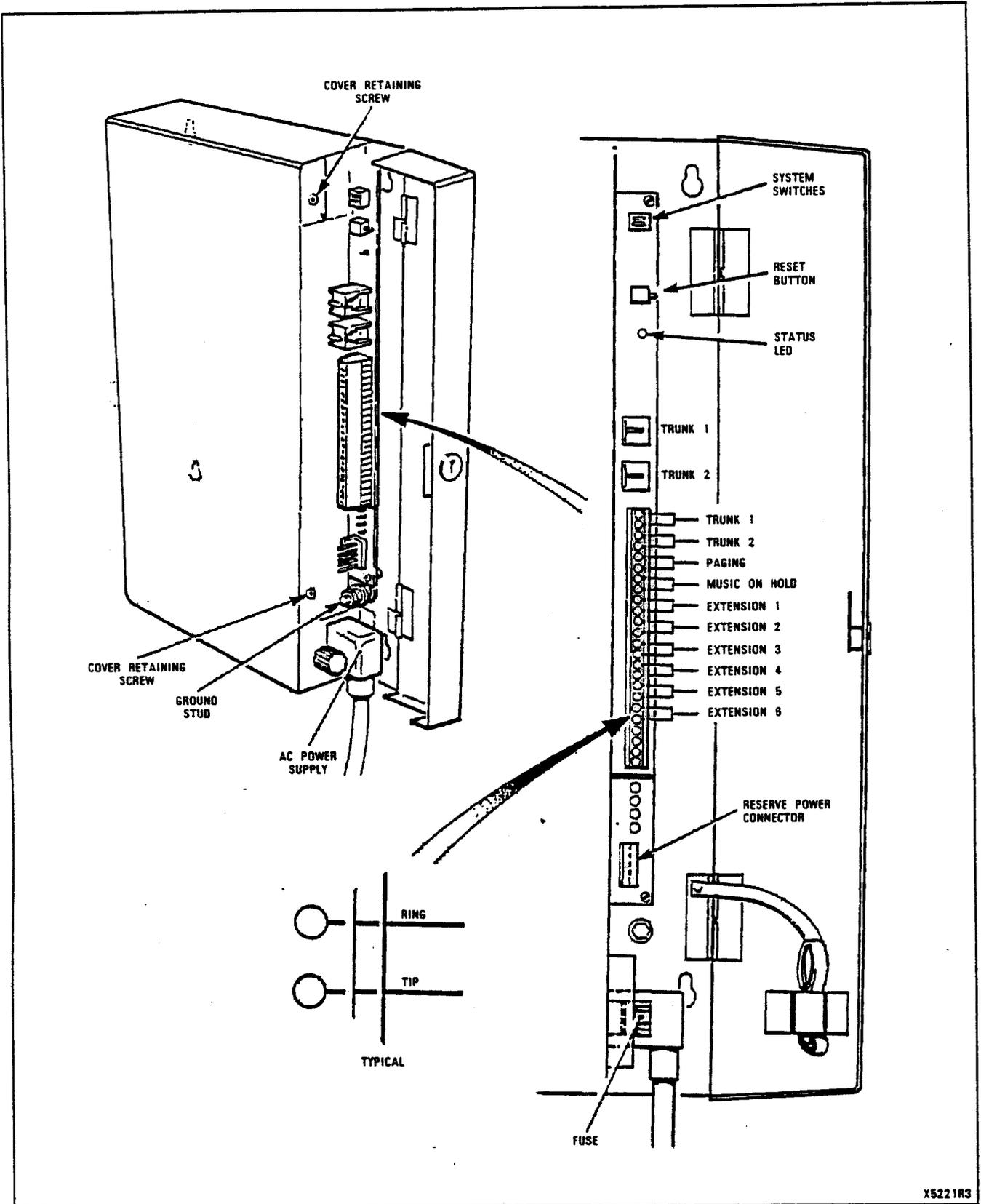


Fig. 3-1 SX-5 Equipment Cabinet

TABLE 4-1
MAINTENANCE LED's

LED	LOCATION	STATUS	MEANING
ALARM (1 OF)	Level 1 Entry immediately below the Reset Switch.	ON	Memory Module OK
		FLASHING†	Memory Module fault
EXTENSION (6 OF)	Level 1 Entry adjacent to the terminal strip.	ON	Line circuit seized
		OFF	Line circuit free
POWER SUPPLY (4 OF)	Level 1 Entry below the terminal strip.	ALL ON	Power supplies correct
		1 OR MORE OFF	Power supply fault
WATCHDOG (1 OF)	Level 2 Entry, in the top left-hand corner of the Main Card.	ON	System processor OK
		FLASHING	System processor fault

† The Alarm Led flashes for 8 seconds after Power-up or System Reset, this does not indicate a Memory Module Fault.

be carried out and the system returned to normal operation.

Precautions

5.02 When troubleshooting the SX-5 certain precautions must be observed, particularly when handling modules or using test equipment to measure voltages. The precautions are as follows:

- (a) The wrist ground strap, located inside the door of the SX-5, must be worn when making either a Level 1 or a Level 2 Entry to the system or when handling modules.
- (b) Conductive packages should be grounded prior to removal and replacement of contents. Suspected faulty cards should be placed in conductive packages to prevent further damage.
- (c) When removing or replacing modules from the SX-5 ensure that power is first switched off, but maintain good ground connections to the equipment.

- (d) Handle modules, as far as practical, by the edges. Avoid contact with exposed electrical connections.

Test Equipment and Tools

5.03 A minimum of equipment is required to troubleshoot an SX-5, which is as follows:

- A multimeter, capable of 0-1 Kohm and 0-120 V measurement.
- A Phillips screwdriver.

Environmental Conditions

5.04 When a fault occurs, and prior to troubleshooting procedures being carried out, the following environmental conditions should be investigated as possible causes of the fault:

- (a) Physical Environment - Do adequate ventilation, cooling and low humidity conditions prevail?
- (b) Electrical Environment - Do potential sources of radio frequency interference (RFI) exist which may affect the operation of the SX-5, e.g. the close proximity of radio

stations, diathermy equipment and the like? MITEL service personnel should be advised of such circumstances where they occur.

- (c) **Primary Power Source** - Is the primary power source adequate, i.e. are there minimum occurrences of power surges or interruptions, and are the applied voltage and frequencies within acceptable limits?
- (d) **Grounding Requirements** - Is the SX-5 properly grounded. Note: See Section MITL9103-098-200-NA, Shipping, Receiving and Installation Procedures.

Description of MAP's

5.05 The SX-5 troubleshooting MAP's provide the user with a logical sequence of operations and fault-related questions which, if used correctly, enable an inexperienced person to locate any fault quickly.

MAP Symbols

5.06 There are four basic symbol shapes which may be used in a MAP, and are defined as follows.

5.07 AND Block: Used to indicate a level one step that must be performed. Consists of a square with the word AND centered in the block.

5.08 OR Block: Used to indicate a choice of level one steps, one of which must be performed. Consists of a rectangle, with the text centered in the block, and with the word OR appearing between the alternative operations.

5.09 The rectangle is also used to border instructions which imply that the operations must perform a task outside the scope of the MAP. The text is centered in the rectangle.

5.10 Decision Block: Used to indicate a decision within the level one steps which must be made. The symbol is based on the hexagon with the top and bottom sides extended. Decision text is centered in the symbol.

5.11 START/FINISH/Jump to Block: Used to indicate the start and finish of a MAP. Also used to indicate "jump to" points within the MAP, for example "go to (n)" or "return to (n)". The

symbol is a rectangle with semicircular ends. Text is centered in the symbol.

Use of MAP's

5.12 The sequence of MAP operations always starts at the top of a MAP and progresses towards the bottom. A MOVE to another MAP may be necessary, depending on the answers to the questions which are contained within the DECISION symbols. The destination of a MOVE is clearly defined within the MOVE symbol. Additional information related to ACTIONS can be found, where necessary, on the left-hand side of the figure, or at the references made within the ACTION symbol.

6. DETAILED PROCEDURES

6.01 Paragraphs 6.02 - 6.10 provide detailed descriptions of the troubleshooting procedures which require Level 2 Entry into the system. Reference to these paragraphs is made at relevant steps in the troubleshooting MAP's. In performing any of these ACTIONS the caution given in Para. 3.02 and the precautions given in Para. 5.02 must be observed.

SLIC Removal/Replacement

6.02 There are six SLIC's in an SX-5 - one per extension - located on the main board between the memory module and the terminal strip (refer to Fig. 6-1). They number 1 through 6 (left to right) and are associated with Equipment Numbers 1 through 6 respectively. The SLIC's are plug-in modules which allows them to be easily interchanged, making fault finding by process of elimination simple.

6.03 To remove a SLIC proceed as follows:

- Remove power from the system, but maintain the ground connection.
- Put on wrist strap.
- Gain access to the SLIC's (refer to Para. 3.04).
- Grip each end of the SLIC between the thumb and forefinger and carefully lift the SLIC away from the main board.

6.04 The replacement procedures for a SLIC are the reversal of those for the removal.

Trunk Module Removal/Replacement

6.05 There is one trunk module in an SX-5, comprising two trunk circuits. The module is located in the top right-hand side of the main board (refer to Fig. 6-1).

6.06 To remove a trunk module proceed as follows:

- Remove power from the system, but maintain the ground connection.
- Gain access to the trunk module (refer to Para 3.04).
- Remove the three screws which secure the module to the main board. Take care not to lose the accompanying washers.
- Working in even stages from the edges of the module, carefully separate the module from the main board.

6.07 The replacement procedures for a trunk module are the reversal of those for the removal. Great care must be exercised to ensure that the connecting pins are correctly seated.

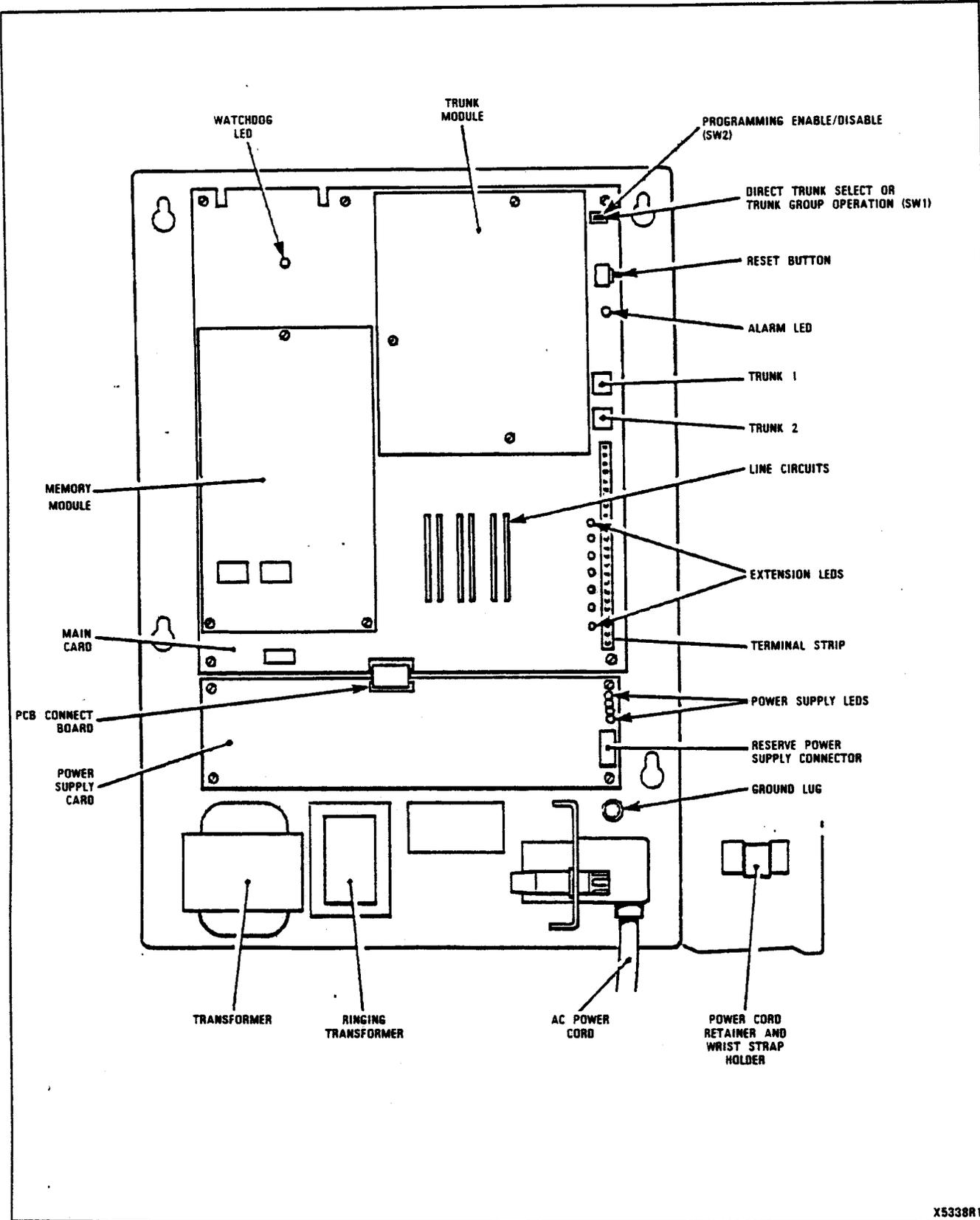
Memory Module Removal/Replacement

6.08 There is one memory module in an SX-5 which is located on the left-hand side of the main board (refer to Fig. 6-1).

6.09 To remove a memory module proceed as follows:

- Remove power from the system, but maintain the ground connection.
- Put on wrist strap.
- Gain access to the memory module (refer to Para 3.04).
- Remove the three screws which secure the module to the main board. Take care not to lose the accompanying washers.
- Working in even stages from the edges of the module, carefully separate the module from the main board.

6.10 The replacement procedures for a memory module are the reversal of those for the removal. Great care must be exercised to ensure that the connecting pins are correctly seated.



X5338R1

Fig. 6-1 SX-5 Equipment Layout

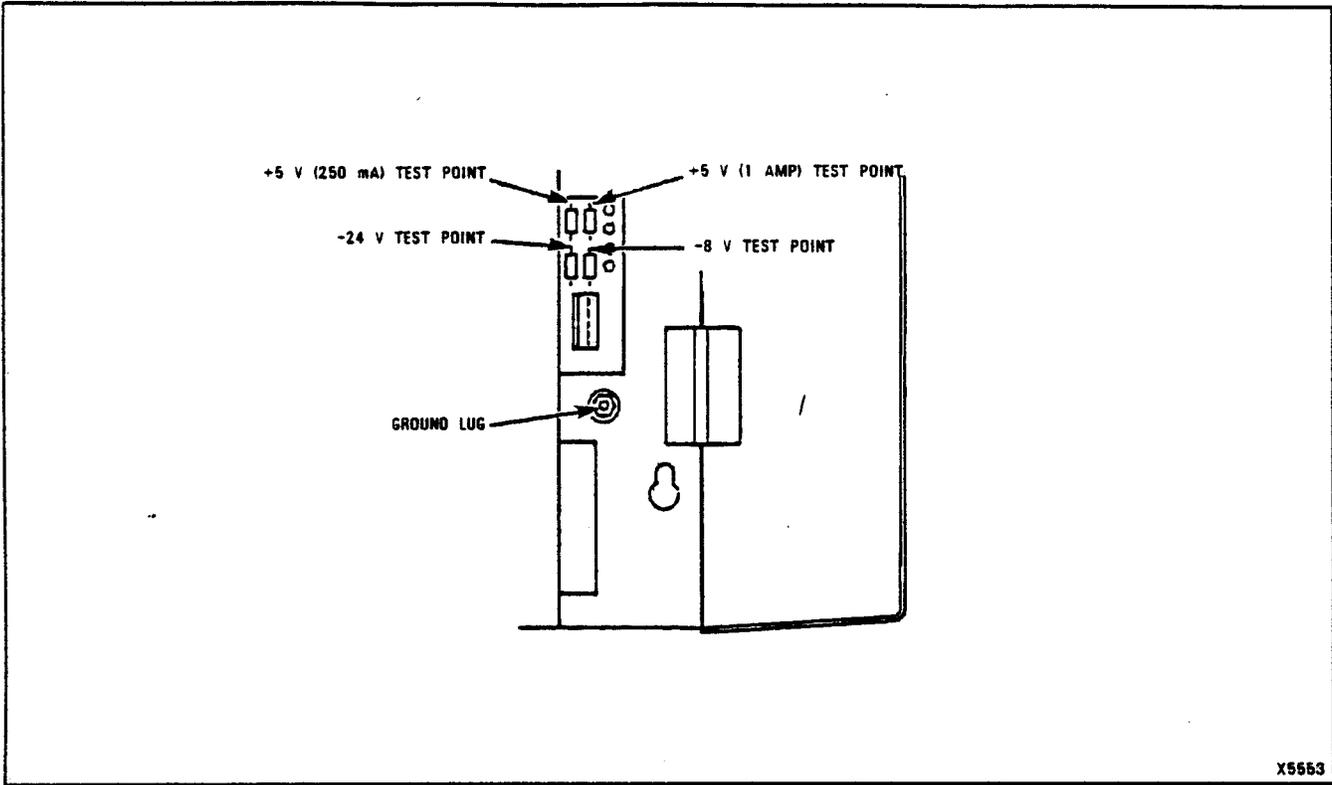


Fig. 6-2 Voltage Test Points

APPENDIX 1

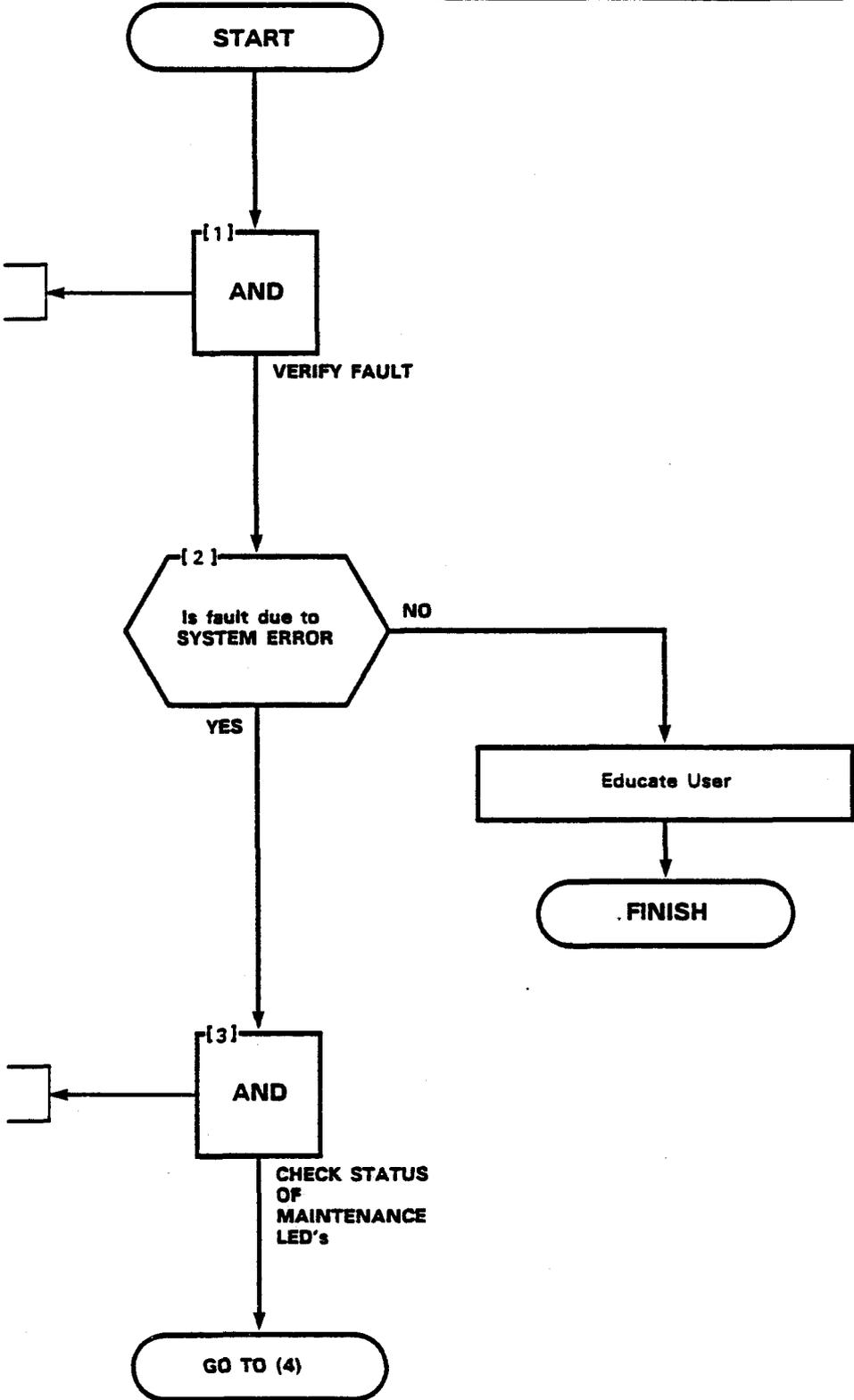
GENERAL

A1.01 The following MAP's detail the procedures to be carried out in order to locate a fault on an SX-5.

Caution: Caution is necessary during troubleshooting of the SX-5 to avoid possible damage to the system electronics by static discharge. A simple means of avoiding the possibility of such damage, is the use of a "Static Protection Wrist Strap" attached to one cabinet hinge. MITEL strongly advises the use of this wrist strap wherever possible; failure to do so can lead to improper system operation and decreased system life.

FAULT SUSPECTED
MAP350- 101
Issue 1, May 1982
Sheet 1 of 4

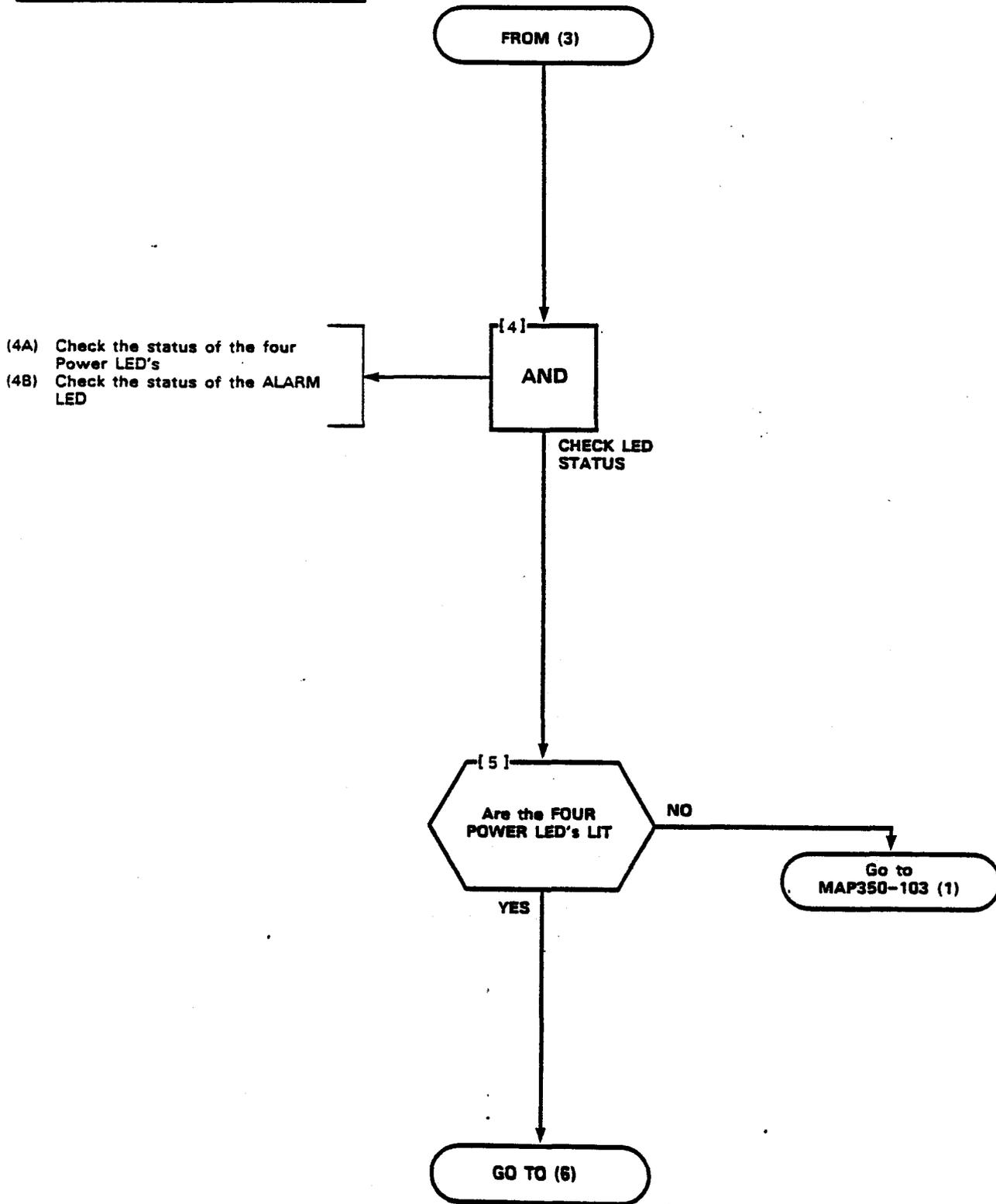
(1A) Attempt to repeat fault



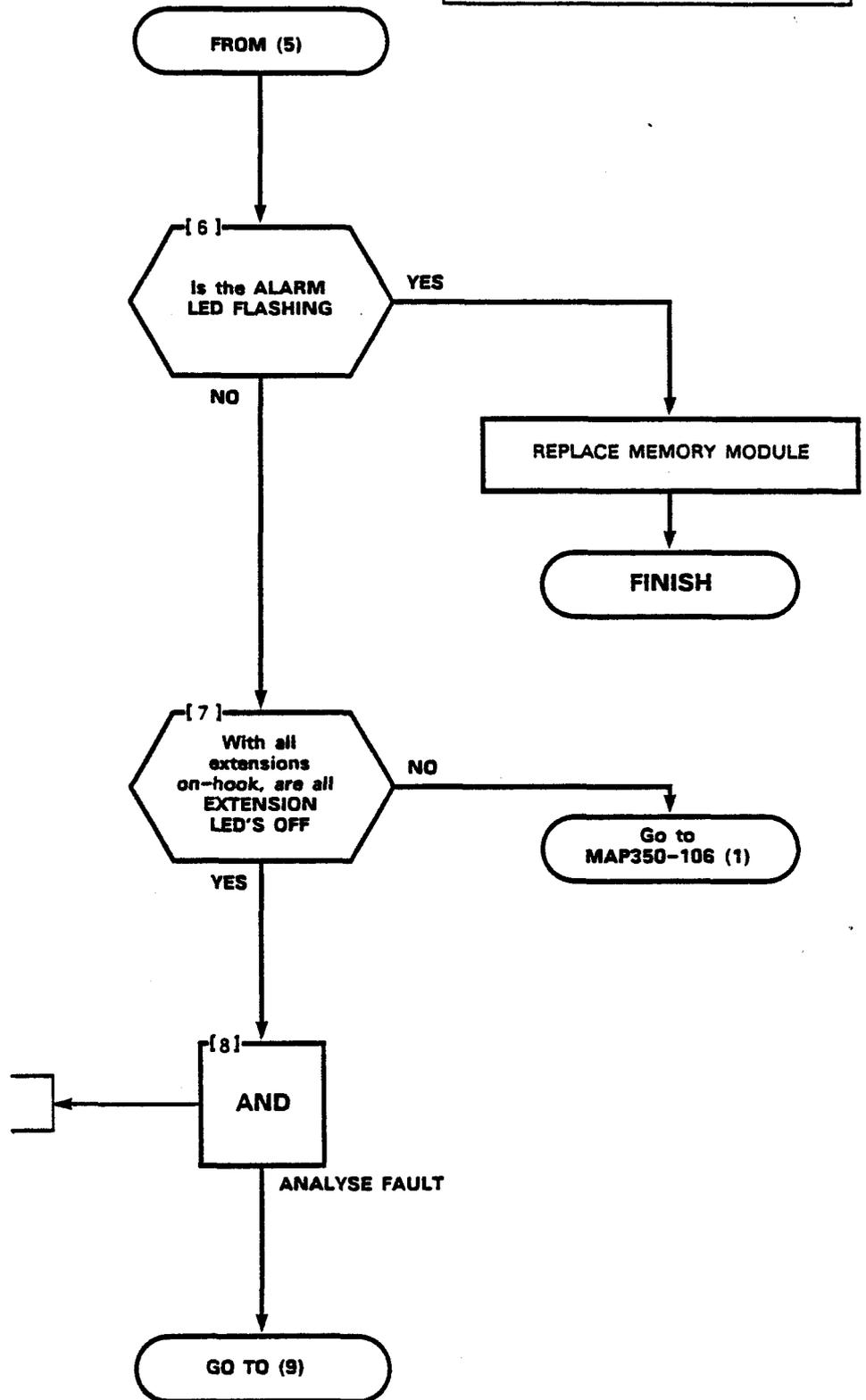
(3A) Refer to Para. 4.01

SECTION MITL9103-098-350-NA

FAULT SUSPECTED
MAP350- 101
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FAULT SUSPECTED
MAP350- 101
Issue 1, May 1982
Sheet 3 of 4



(8A) Study fault symptoms

SECTION MITL9103-098-350-NA

FAULT SUSPECTED
MAP350-101
Issue 1, May 1982
Sheet 4 of 4

FROM (8)

(9)
AND

(9A) Refer to Table 101 Fault Categories

SELECT FAULT
CATEGORY

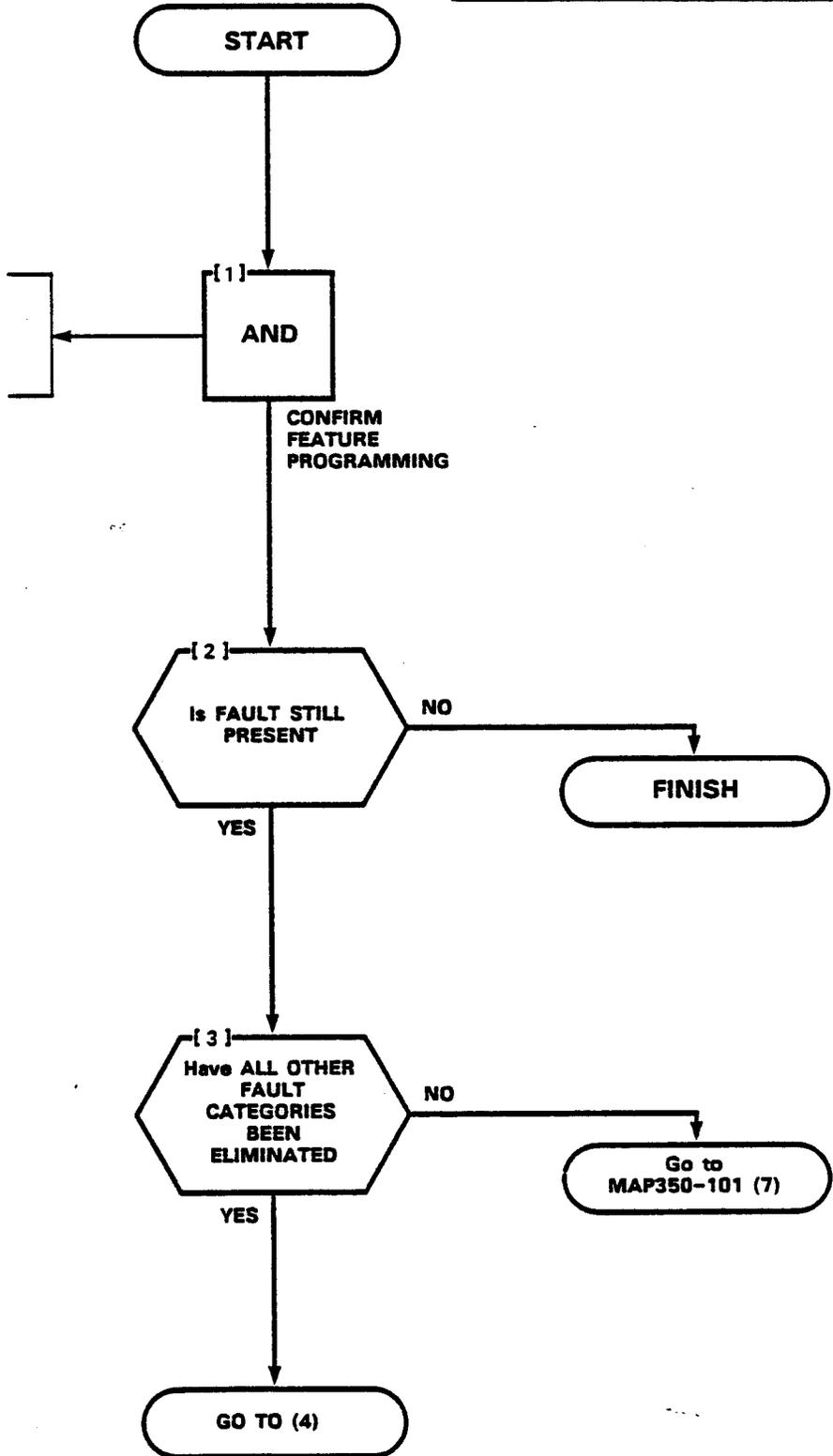
FINISH

TABLE 101
FAULT CATEGORIES

CATEGORY	GO TO
FEATURE FAULT	MAP350-102 (1)
SYSTEM DEAD	MAP350-104 (1)
SYSTEM CONTROL DEAD	MAP350-105 (1)
EXTENSION FAULT	MAP350-107 (1)
TRUNK FAULT	MAP350-113 (1)

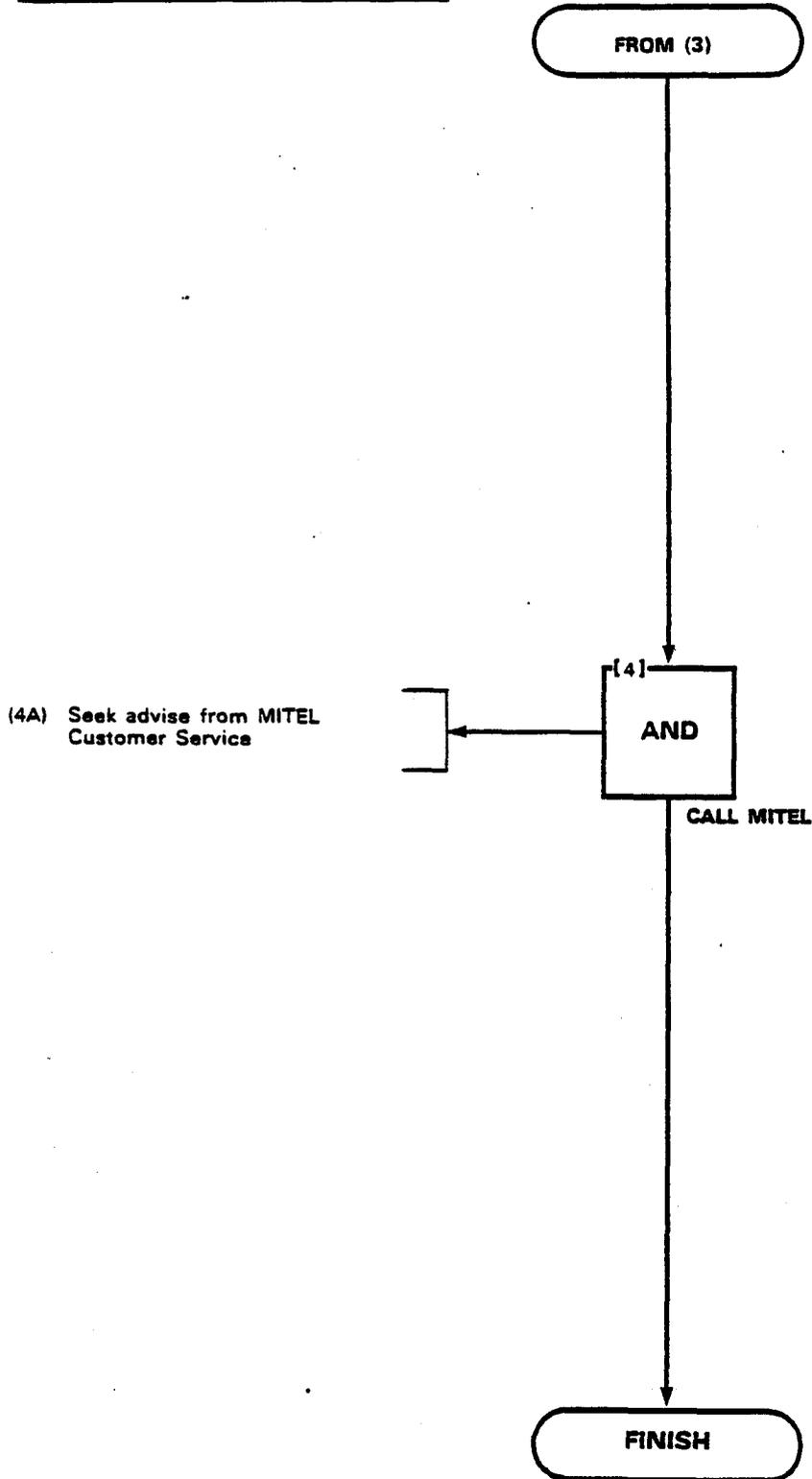
FEATURE FAULT
MAP350- 102
Issue 1, May 1982
Sheet 1 of 2

- (1A) Program the required feature. Refer to MITL9103-098-105-NA
- (1B) Attempt to repeat the fault



SECTION MITL9103-098-350-NA

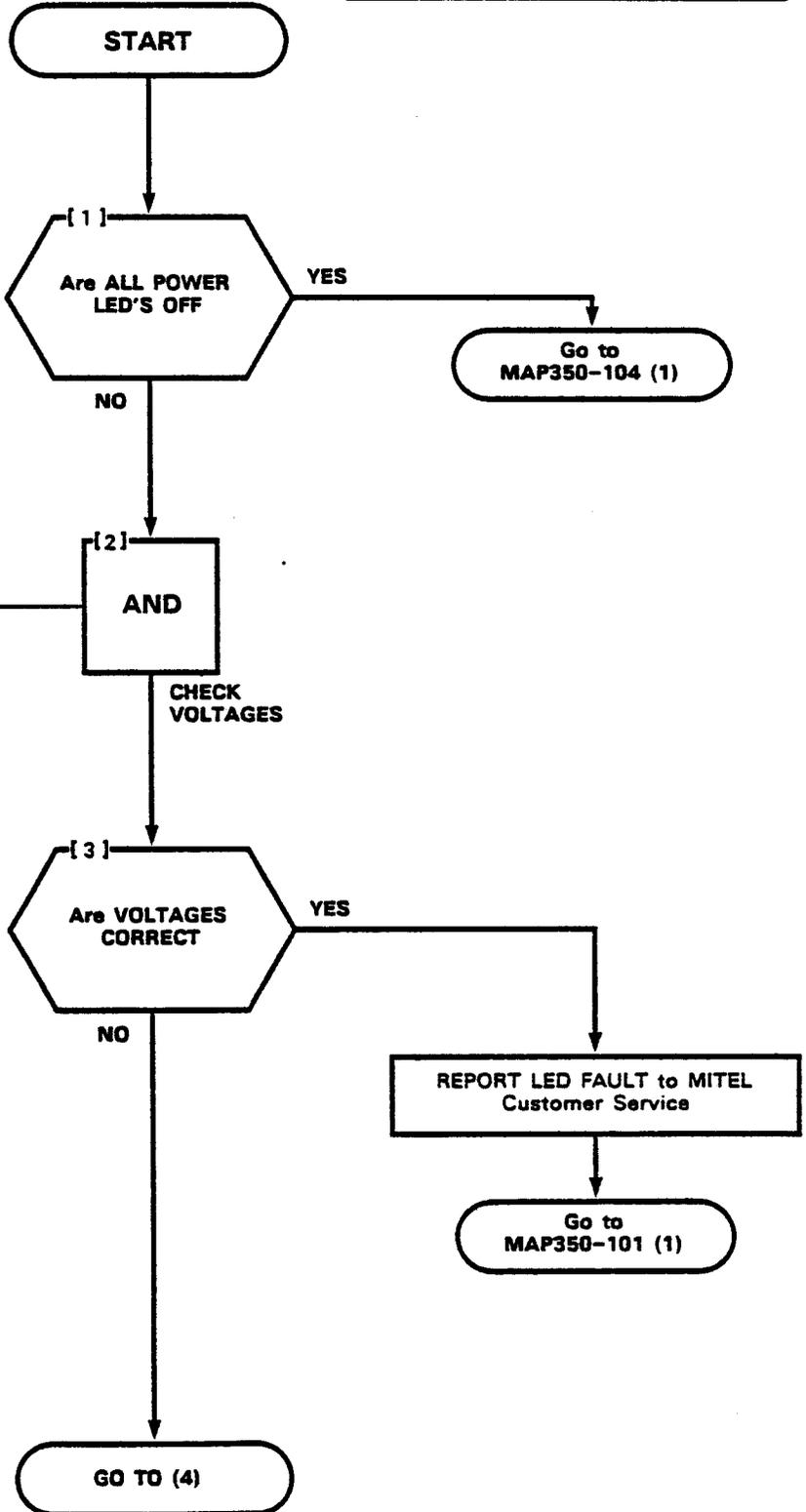
FEATURE FAULT
MAP350- 102
Issue 1, May 1982
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POWER FAULT
MAP350- 103
Issue 1, May 1982
Sheet 1 of 4

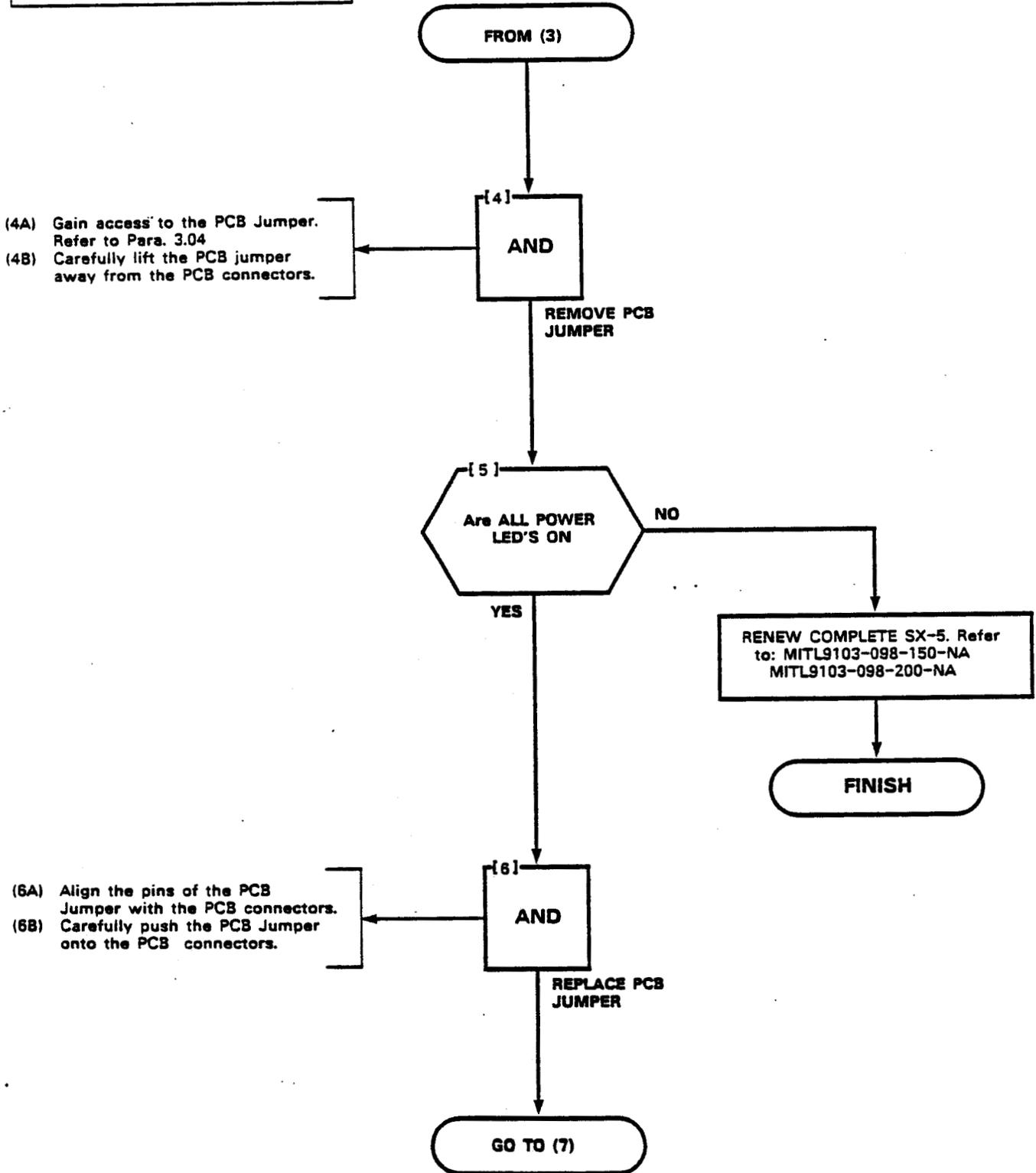
CAUTION:
ACTIONS WHICH REQUIRE LEVEL 2 ENTRY MUST ONLY BE PERFORMED BY A SKILLED TECHNICIAN.

- (2A) Set multimeter to a suitable DC volt range
- (2B) Connect multimeter as shown in Fig. 6-2
- (2C) Read voltage.

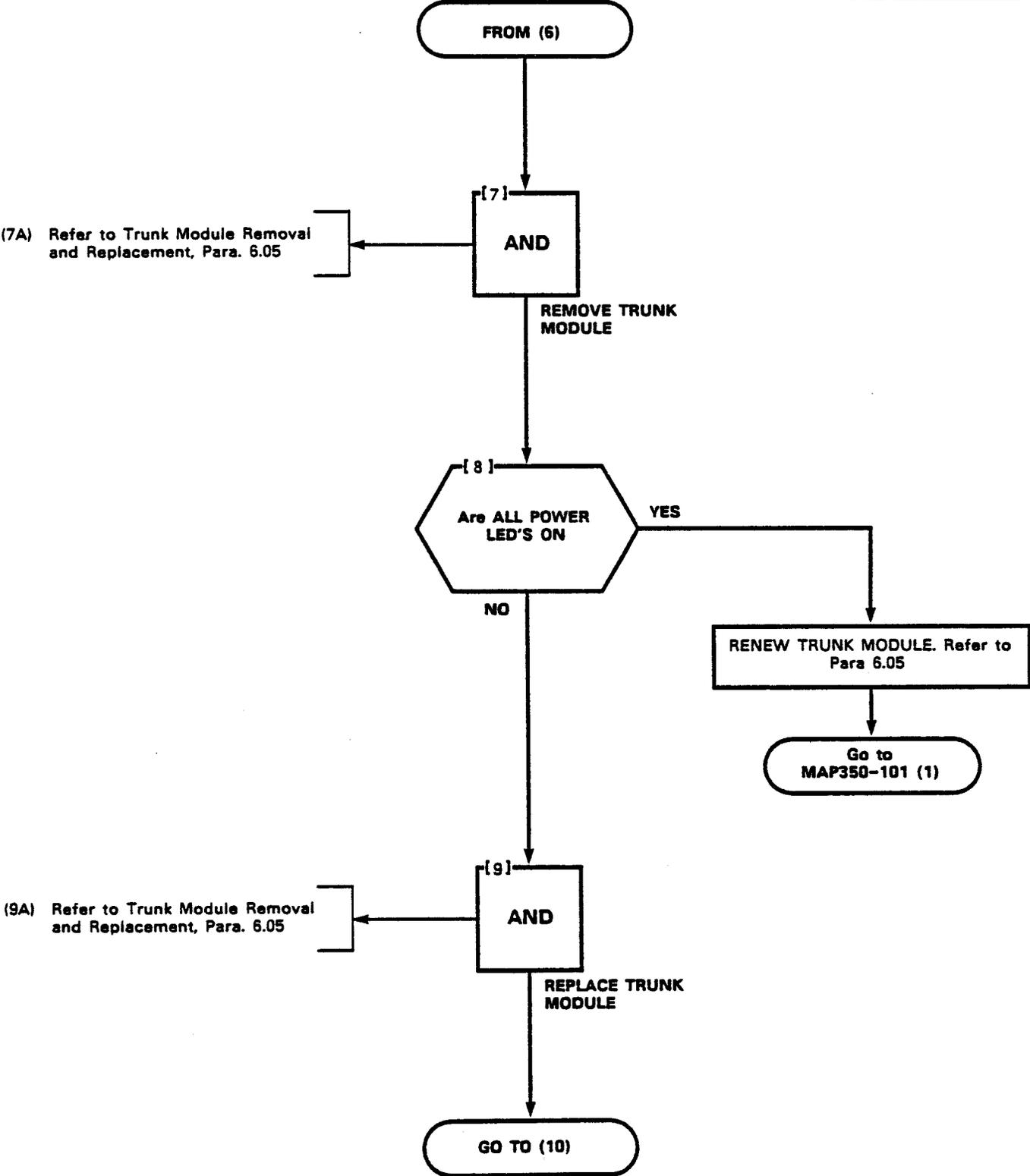


SECTION MITL9103-098-350-NA

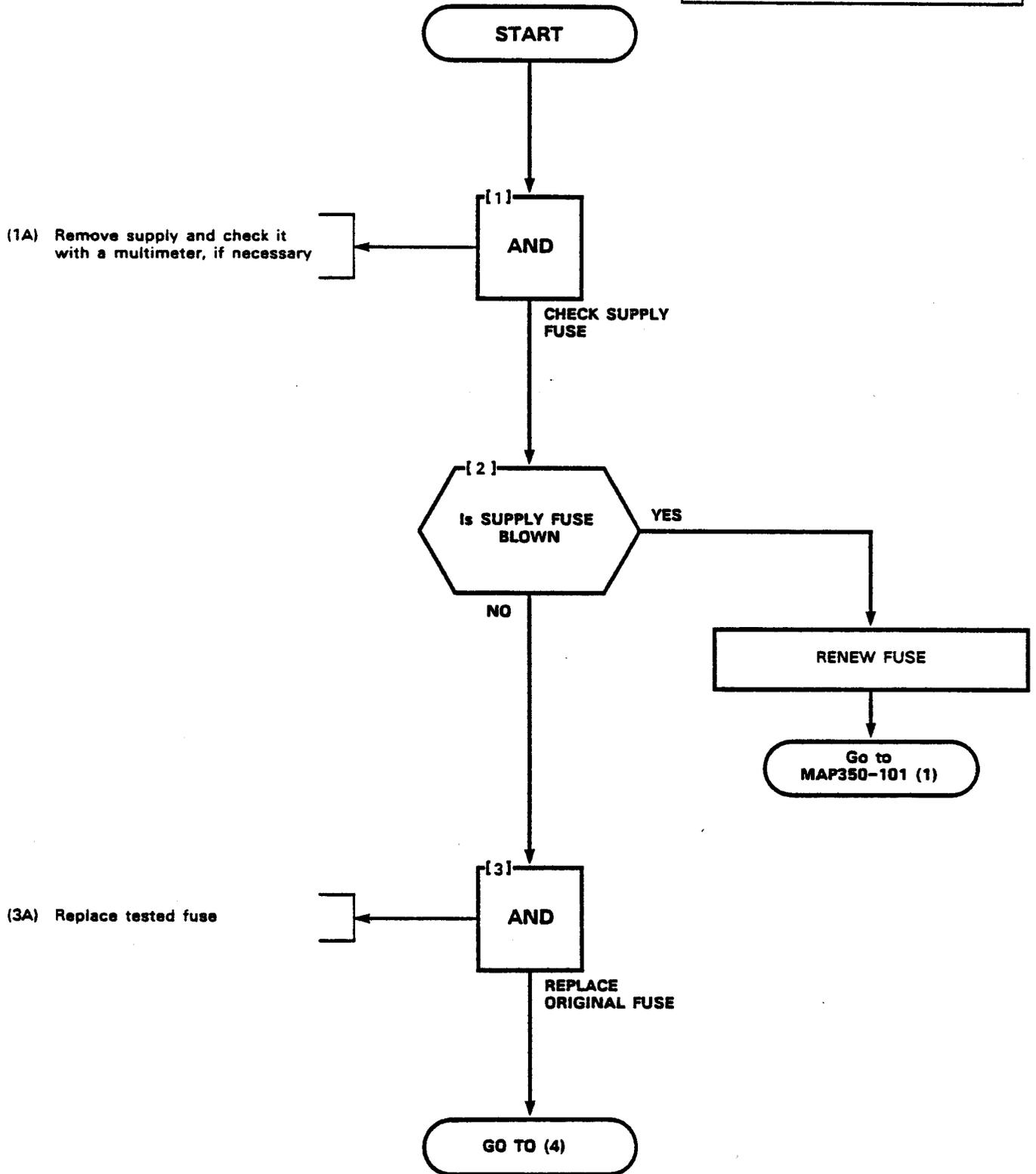
POWER FAULT
MAP350- 103
Issue 1, May 1982
Sheet 2 of 4



POWER FAULT
MAP350- 103
Issue 1, May 1982
Sheet 3 of 4

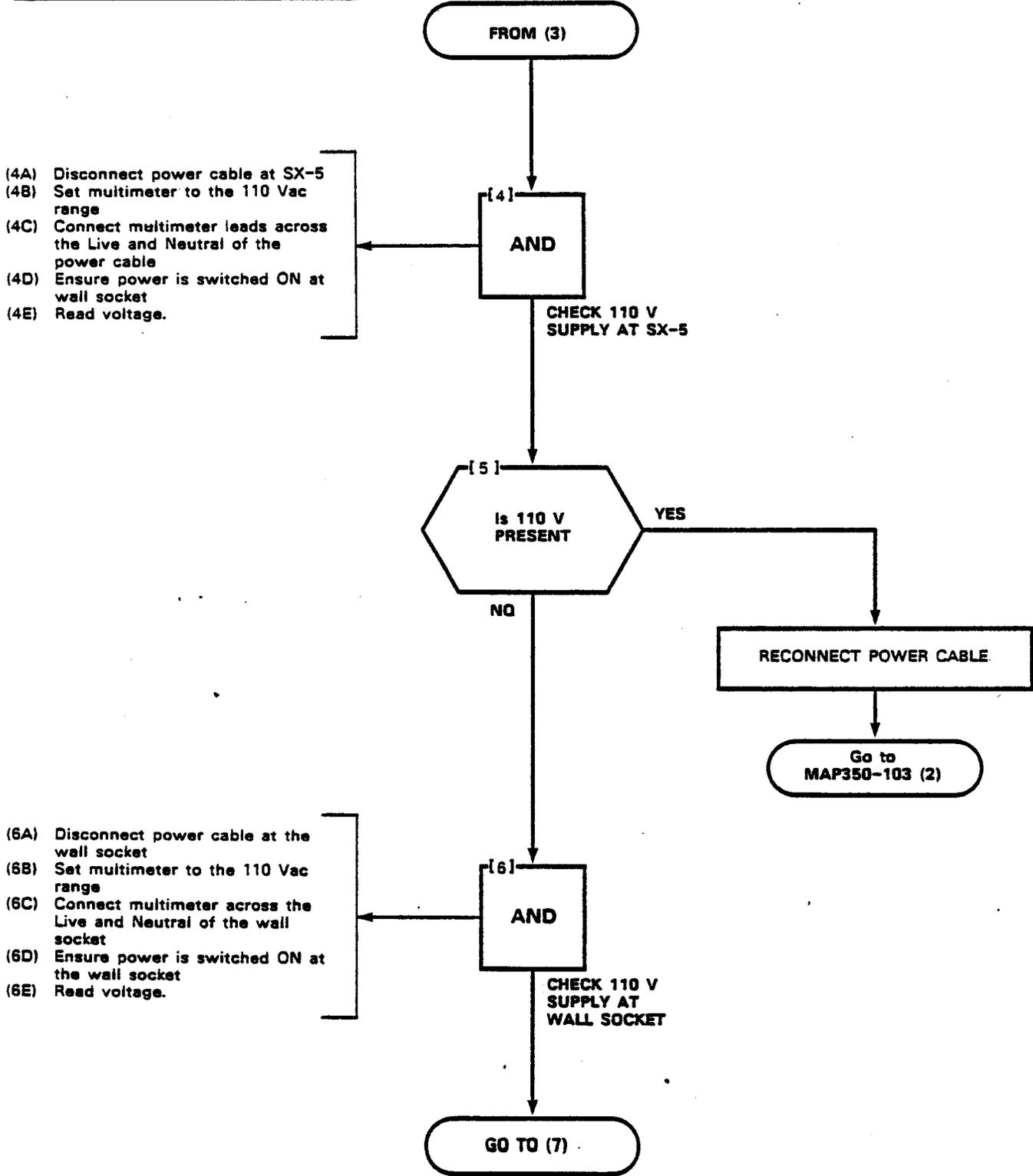


SYSTEM DEAD
MAP350-104
Issue 1, May 1982
Sheet 1 of 4

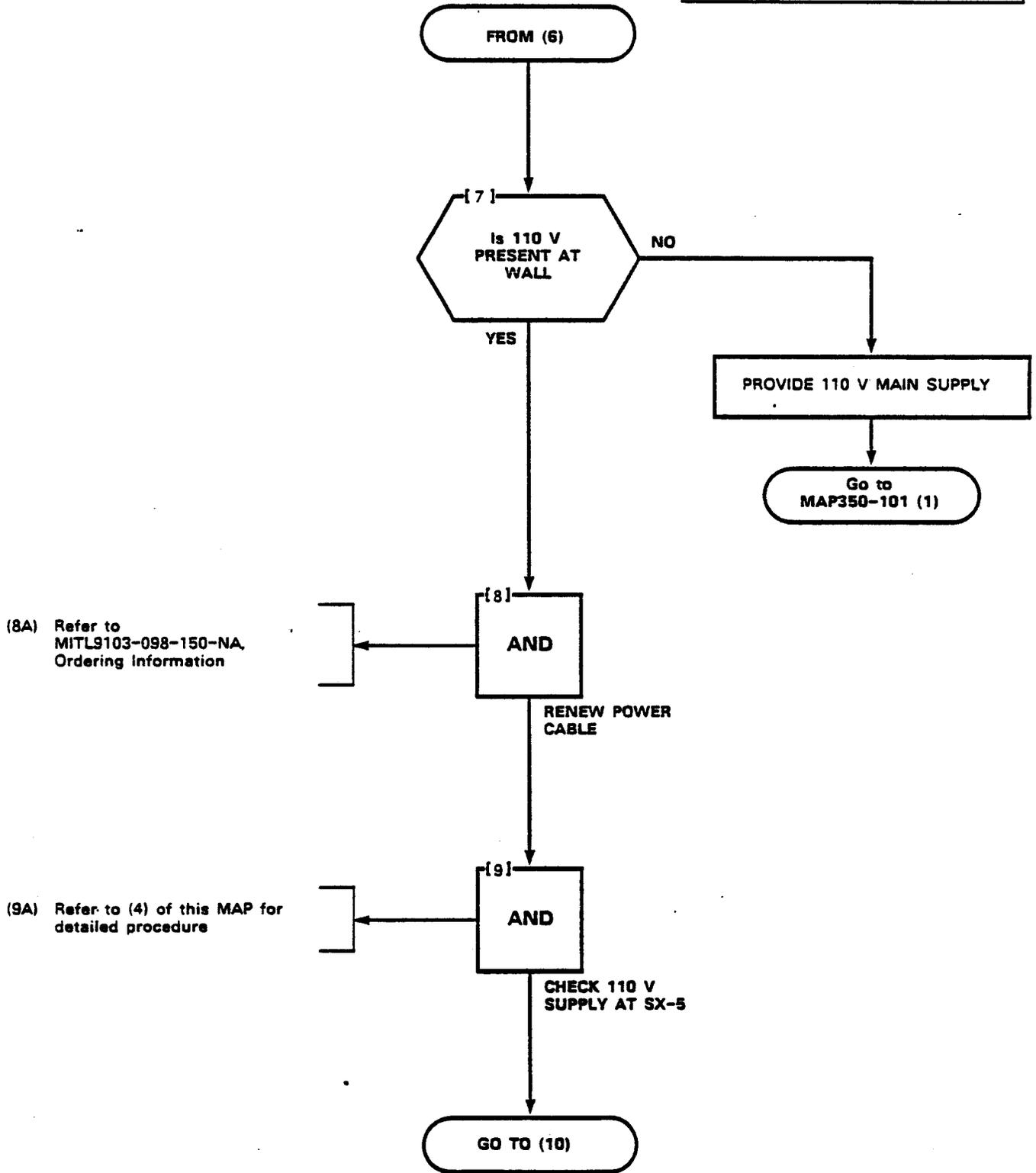


SECTION MITL9103-098-350-NA

SYSTEM DEAD
MAP350- 104
Issue 1, May 1982
Sheet 2 of 4

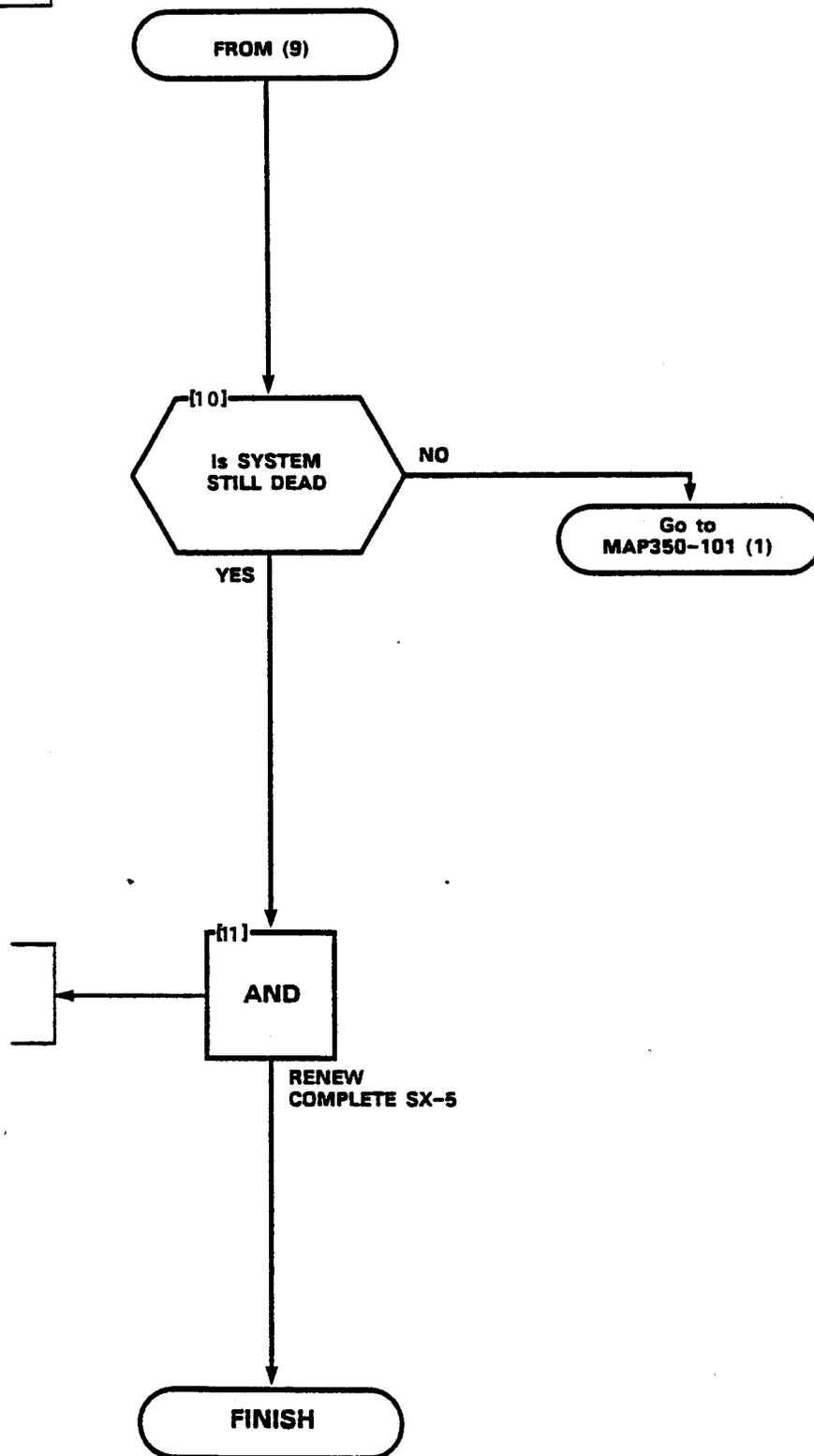


SYSTEM DEAD
MAP350-104
Issue 1, May 1982
Sheet 3 of 4



SECTION MITL9103-098-350-NA

SYSTEM DEAD
MAP350- 104
Issue 1, May 1982
Sheet 4 of 4

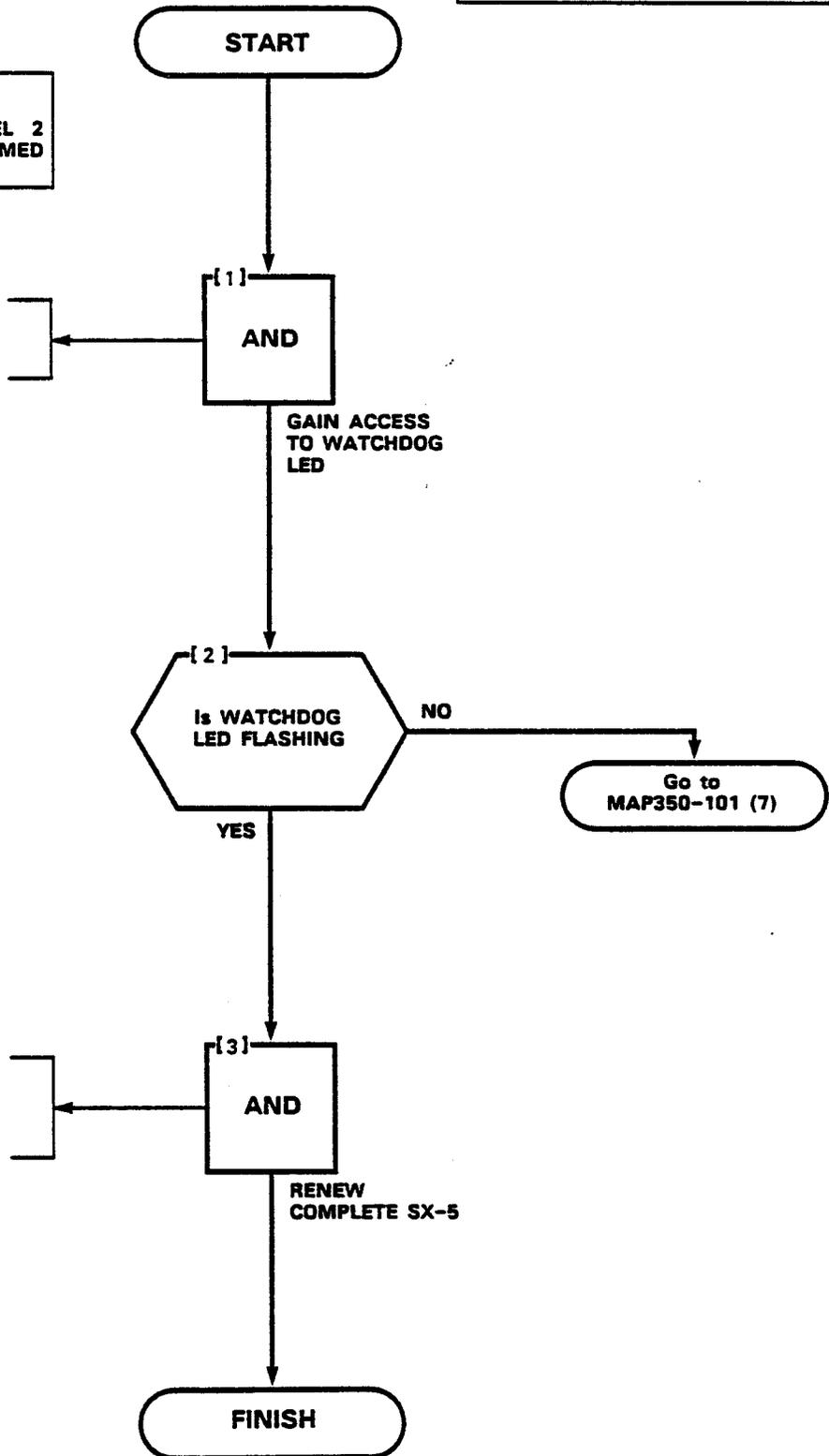


(11A) Refer to MITL9103-098-150-NA and MITL9103-098-200-NA

SYSTEM CONTROL DEAD
MAP350- 105
Issue 1, May 1982
Sheet 1 of 1

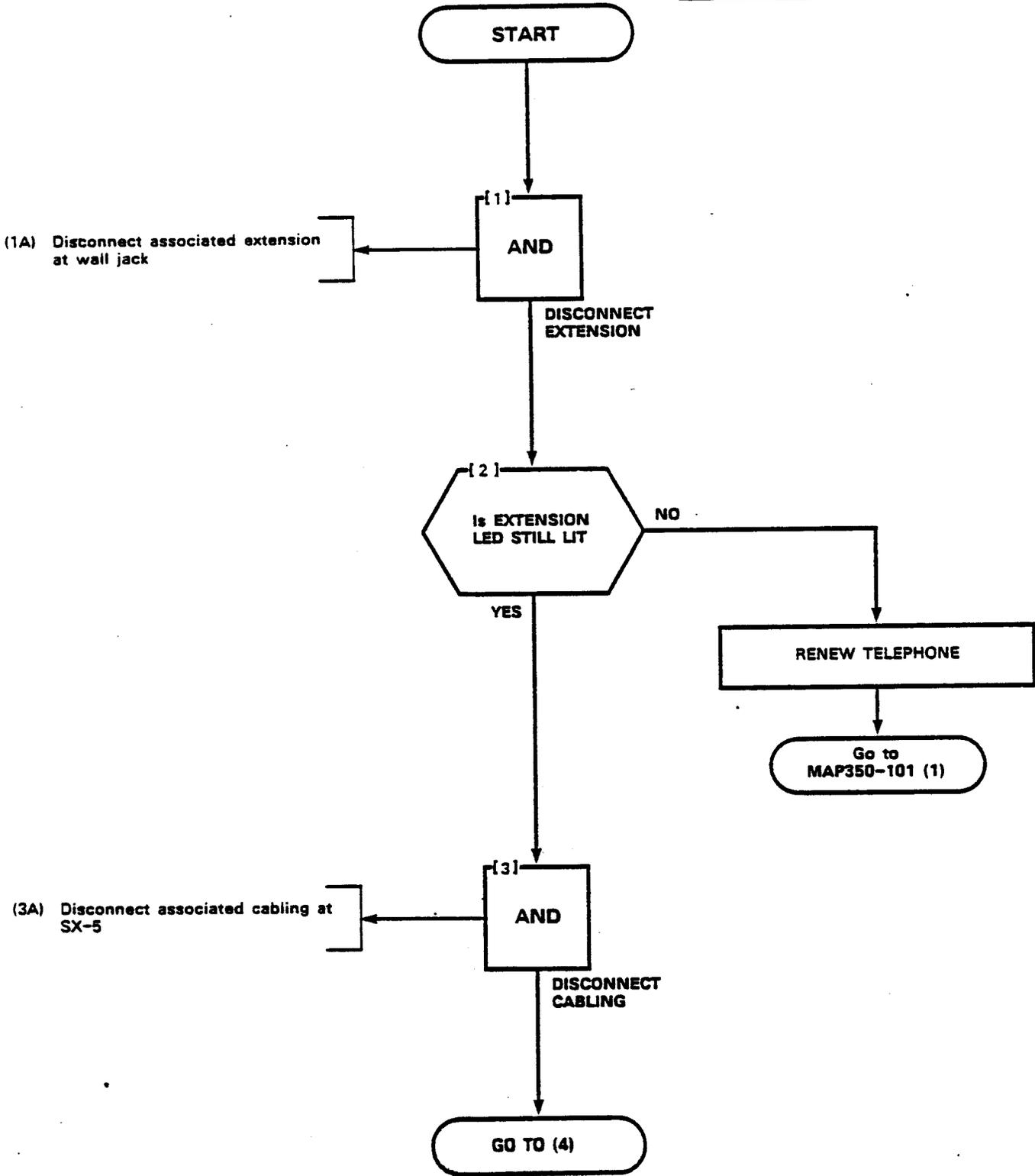
CAUTION:
ACTIONS WHICH REQUIRE LEVEL 2
ENTRY MUST ONLY BE PERFORMED
BY A SKILLED TECHNICIAN.

(1A) Refer to Part 3, Entry into an
SX-5 Cabinet



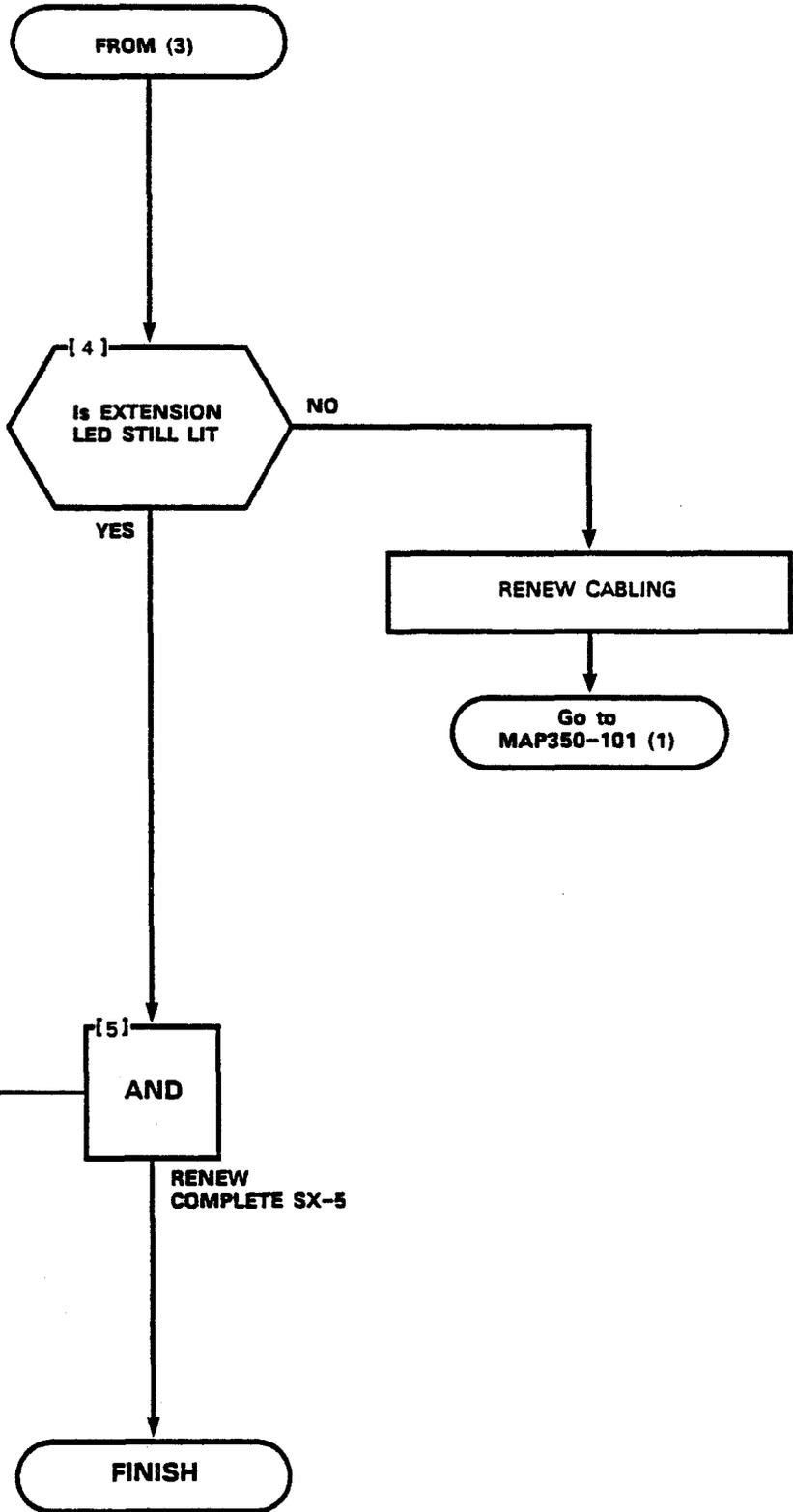
(3A) Refer to
MITL9103-098-150-NA and
MITL9103-098-200-NA

EXTENSION LED FAULT
MAP350-106
Issue 1, May 1982
Sheet 1 of 2



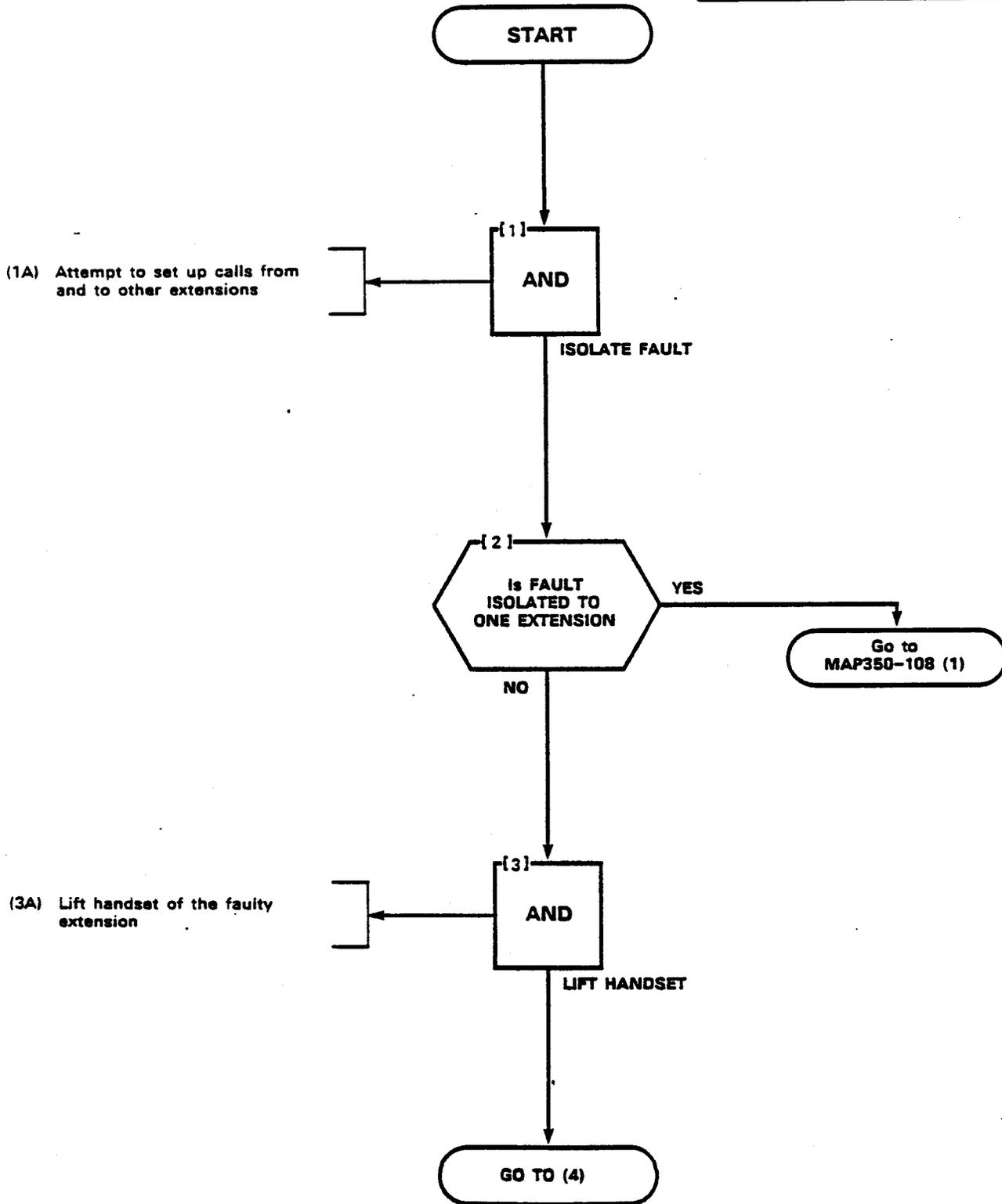
SECTION MITL9103-098-350-NA

EXTENSION LED FAULT
MAP350- 106
Issue 1, May 1982
Sheet 2 of 2



(5A) Refer to MITL9103-098-150-NA and MITL9103-098-200-NA

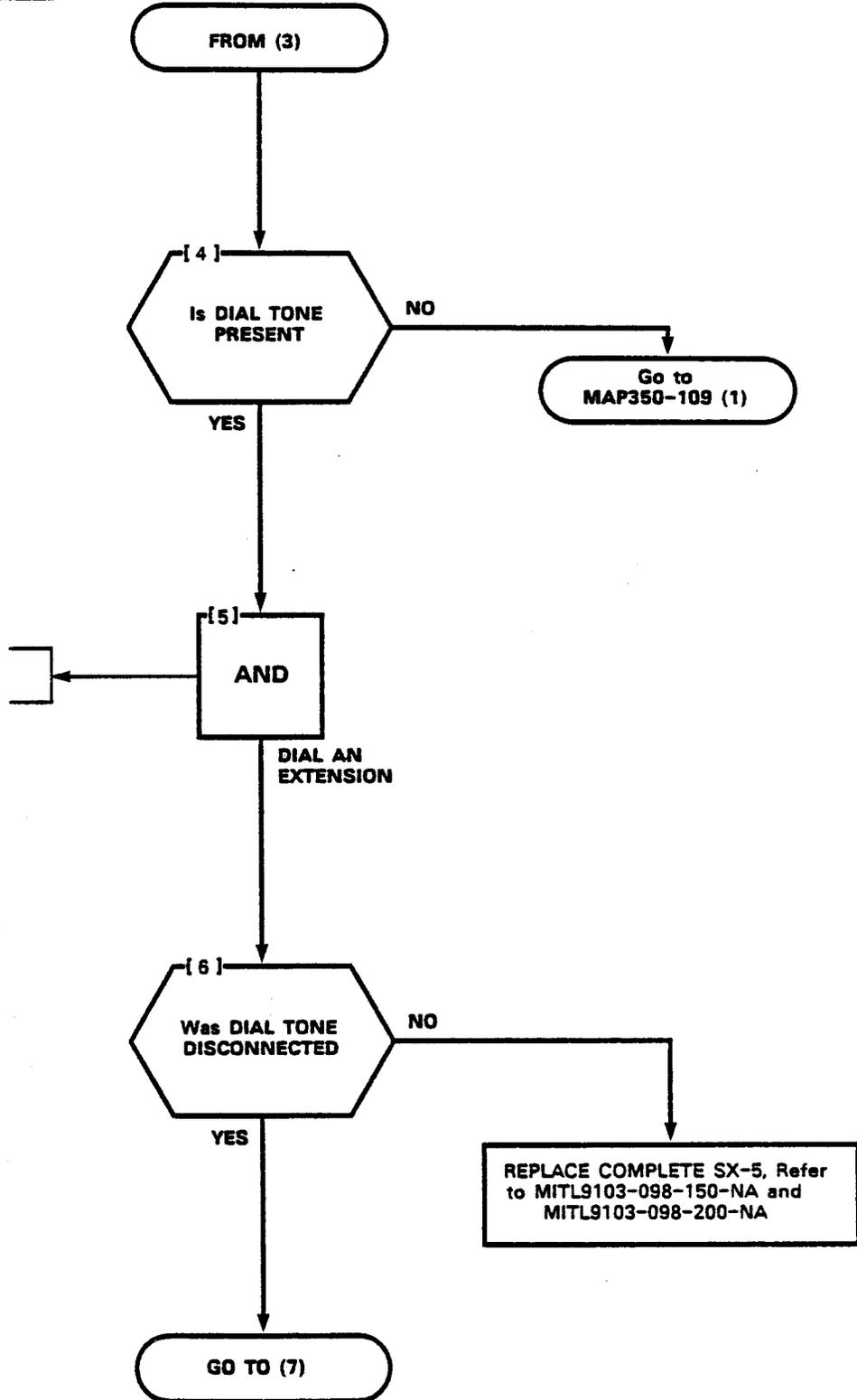
EXTENSION FAULT
MAP350-107
Issue 1, May 1982
Sheet 1 of 4



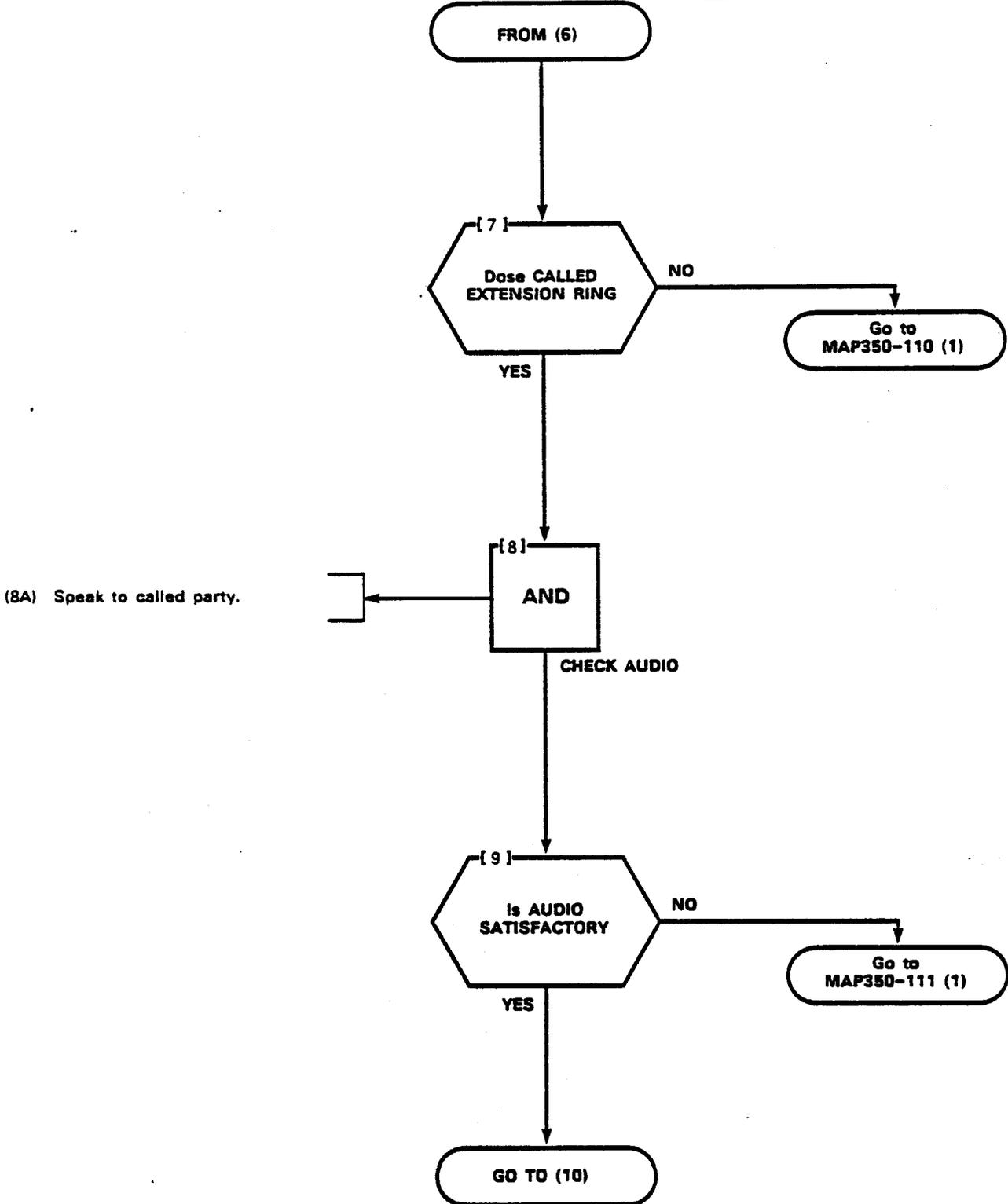
SECTION MITL9103-098-350-NA

EXTENSION FAULT
MAP350- 107
Issue 1, May 1982
Sheet 2 of 4

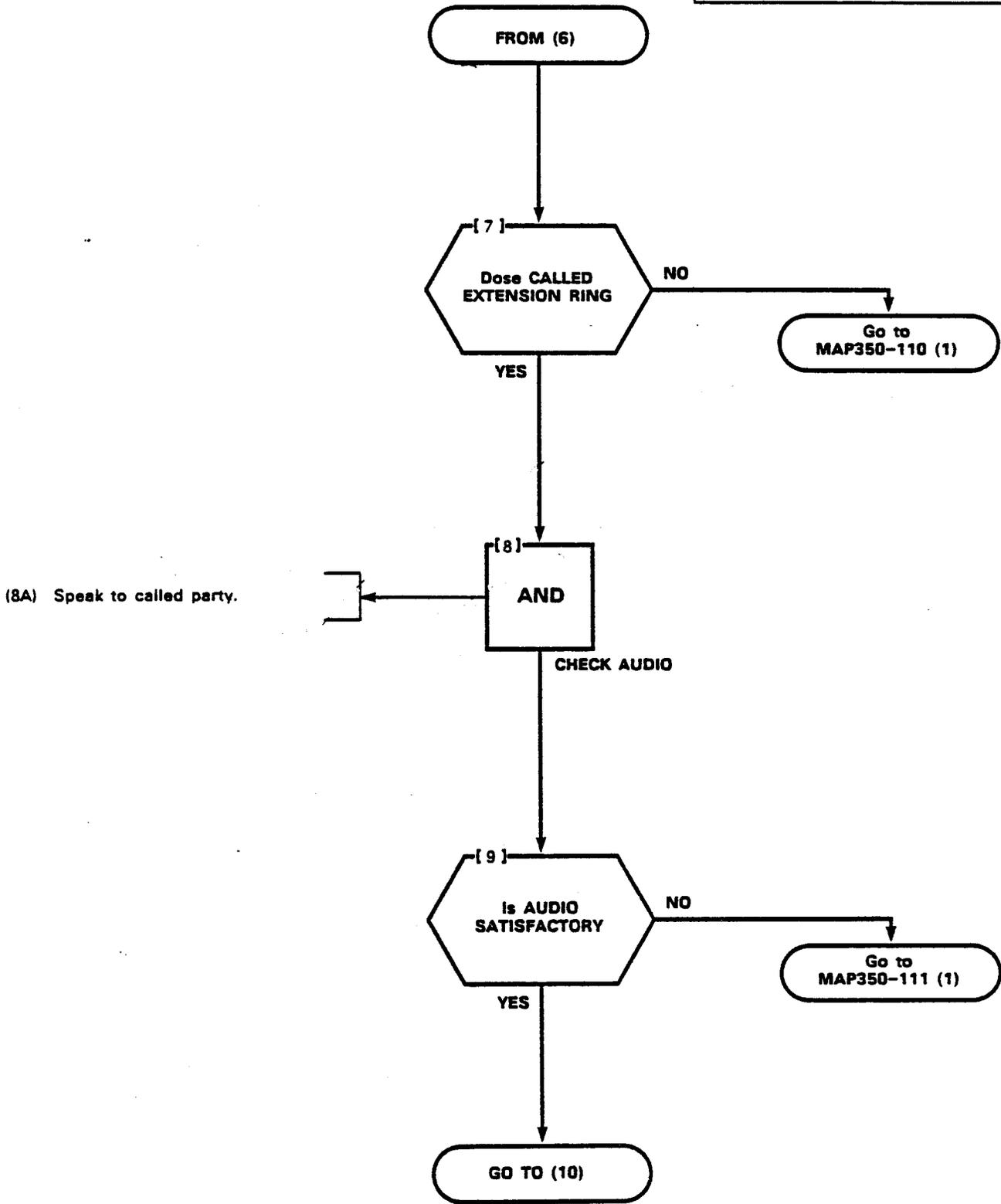
(5A) Dial any extension number



EXTENSION FAULT
MAP350-107
Issue 1, May 1982
Sheet 3 of 4



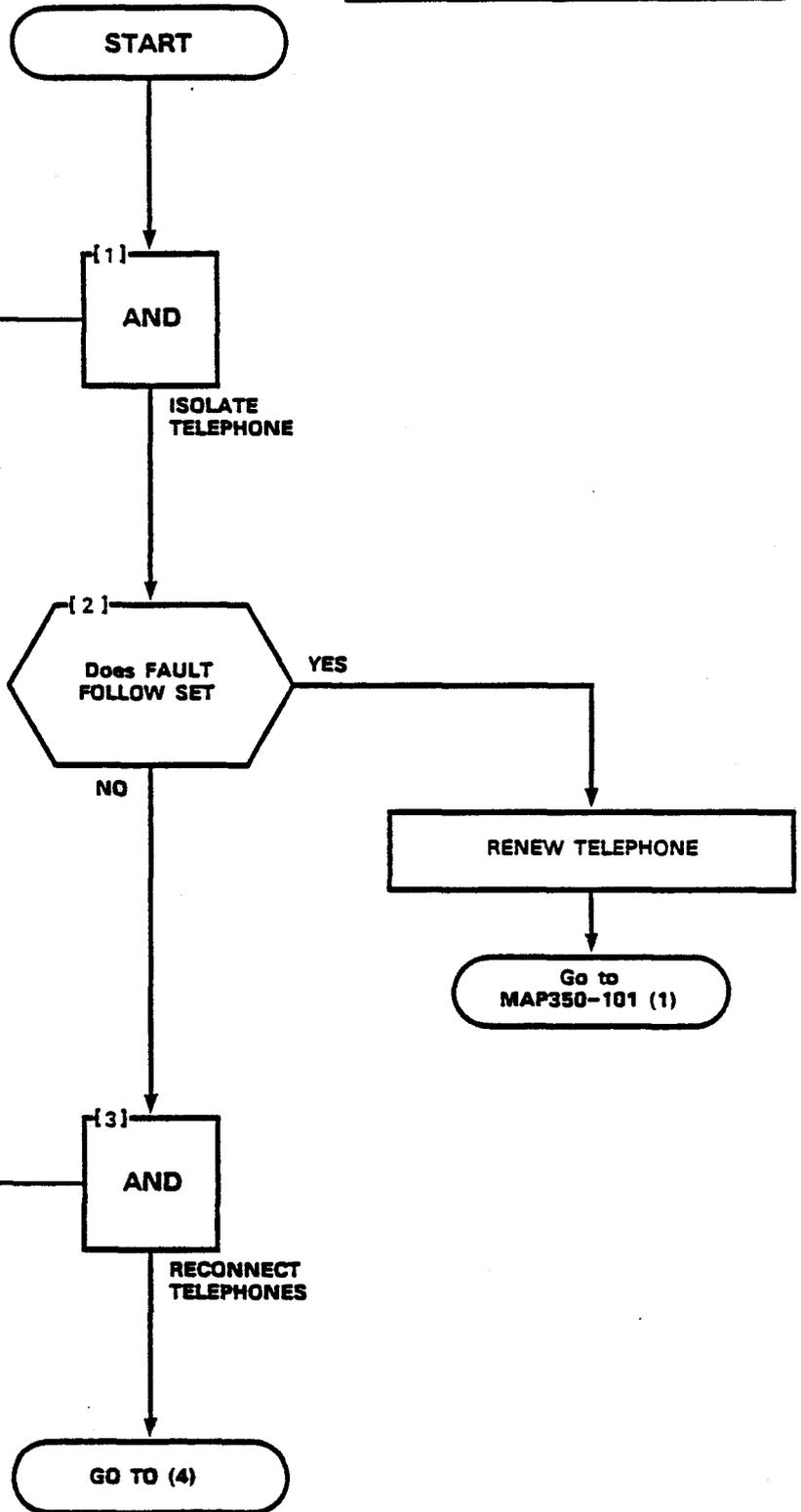
EXTENSION FAULT
MAP350- 107
Issue 1. May 1982
Sheet 3 of 4



SINGLE EXTENSION FAULT
MAP350-108
Issue 1, May 1982
Sheet 1 of 3

CAUTION:
ACTIONS WHICH REQUIRE LEVEL 2
ENTRY MUST ONLY BE PERFORMED
BY A SKILLED TECHNICIAN.

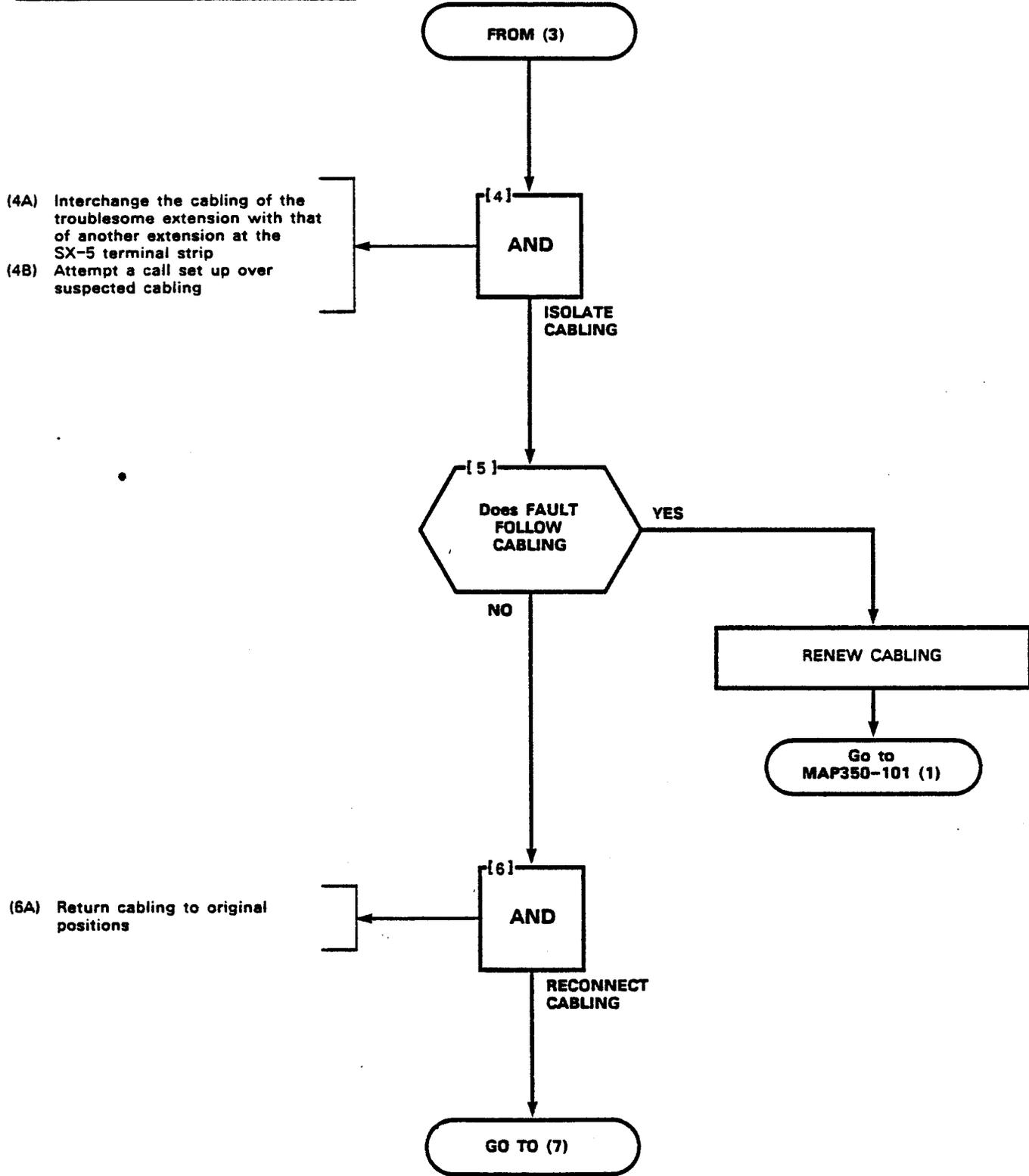
- (1A) Connect 'suspect' telephone to another wall jack
- (1B) Attempt a call set up using the 'suspect' telephone



- (3A) Return telephones to original wall jacks

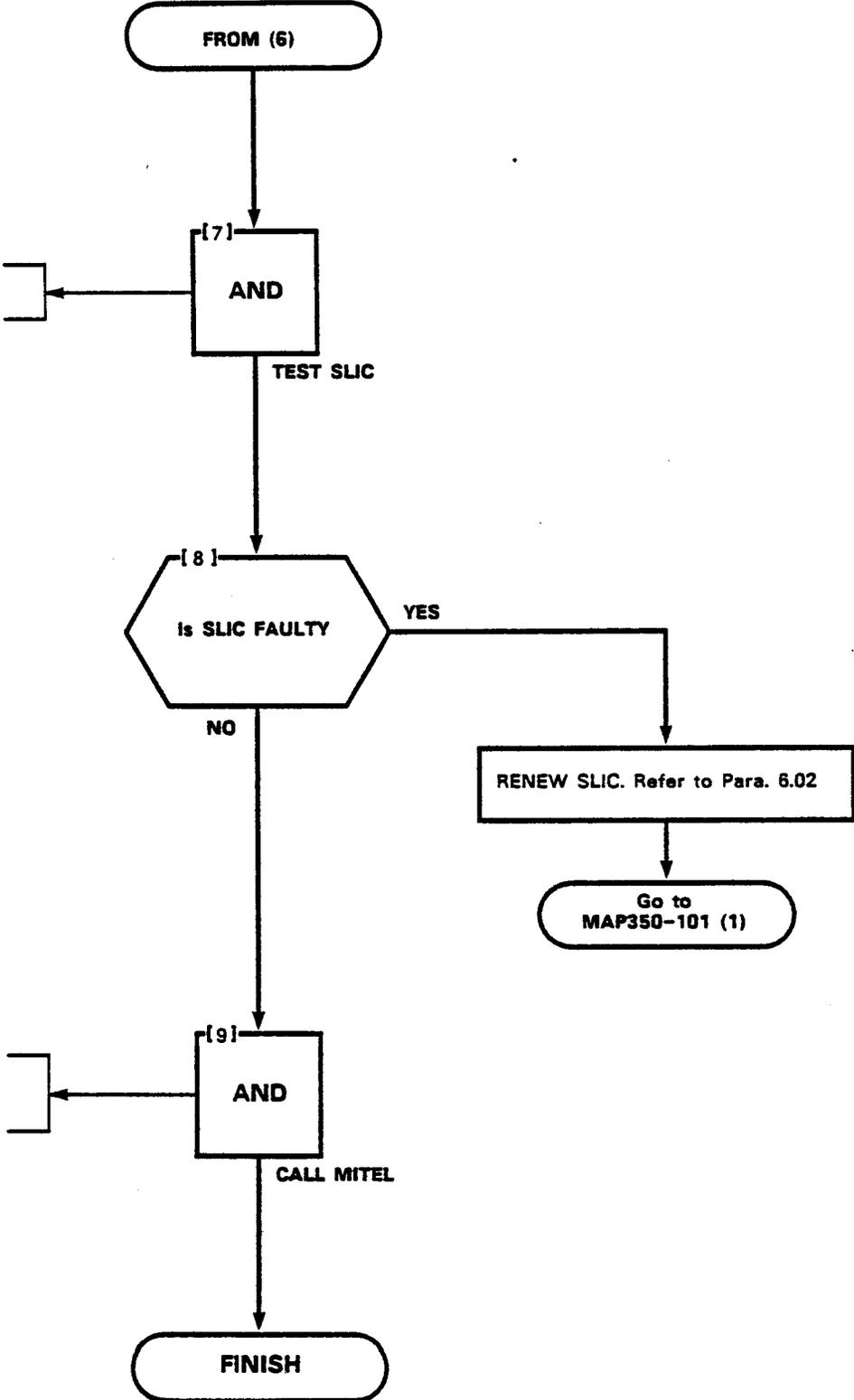
SECTION MITL9103-098-350-NA

SINGLE EXTENSION FAULT
MAP350- 108
Issue 1, May 1982
Sheet 2 of 3



SINGLE EXTENSION FAULT
MAP350- 108
Issue 1, May 1982
Sheet 3 of 3

(7A) Go to MAP350-112 (1)

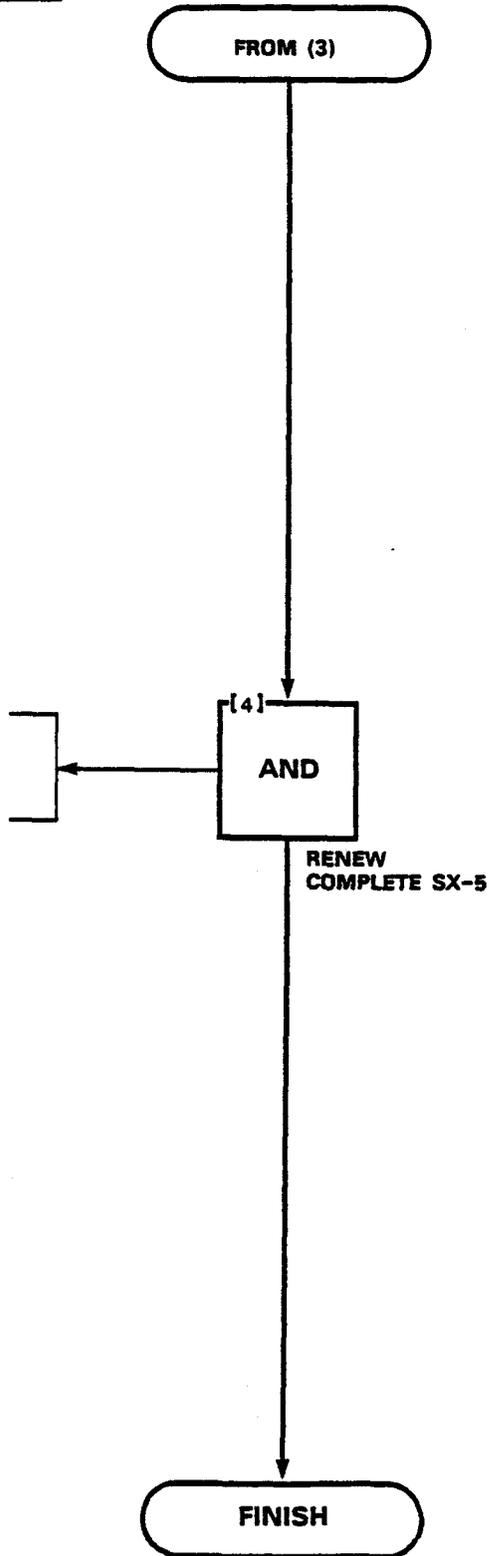


(9A) Seek advise from MITEL Customer Service

SECTION MITL9103-098-350-NA

NO DIAL TONE
MAP350- 109
Issue 1, May 1982
Sheet 2 of 2

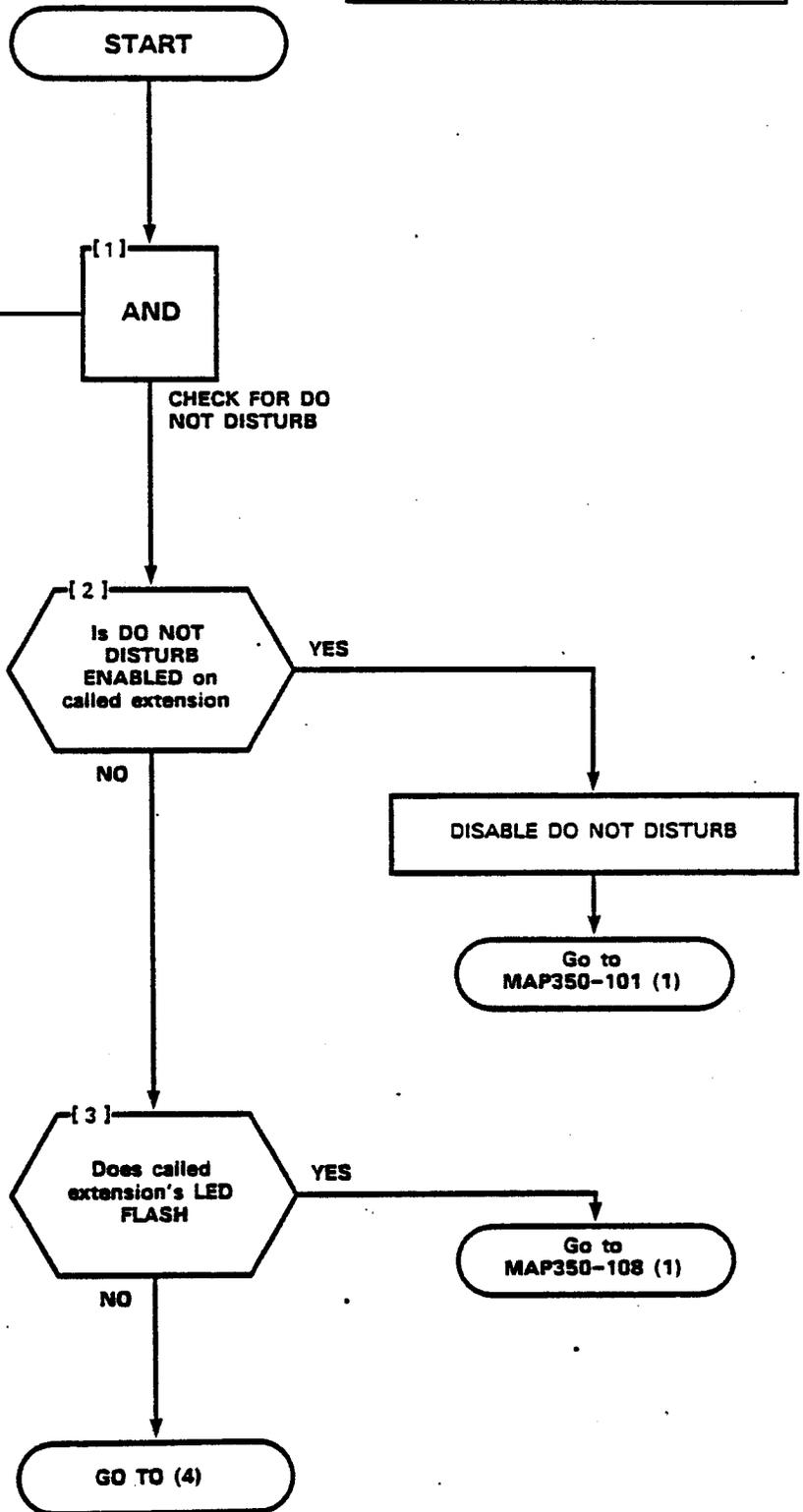
(4A) Refer to
MITL9103-098-150-NA and
MITL9103-098-200-NA



NO RINGING
MAP350-110
Issue 1, May 1982
Sheet 1 of 3

CAUTION:
ACTIONS WHICH REQUIRE LEVEL 2 ENTRY MUST ONLY BE PERFORMED BY A SKILLED TECHNICIAN.

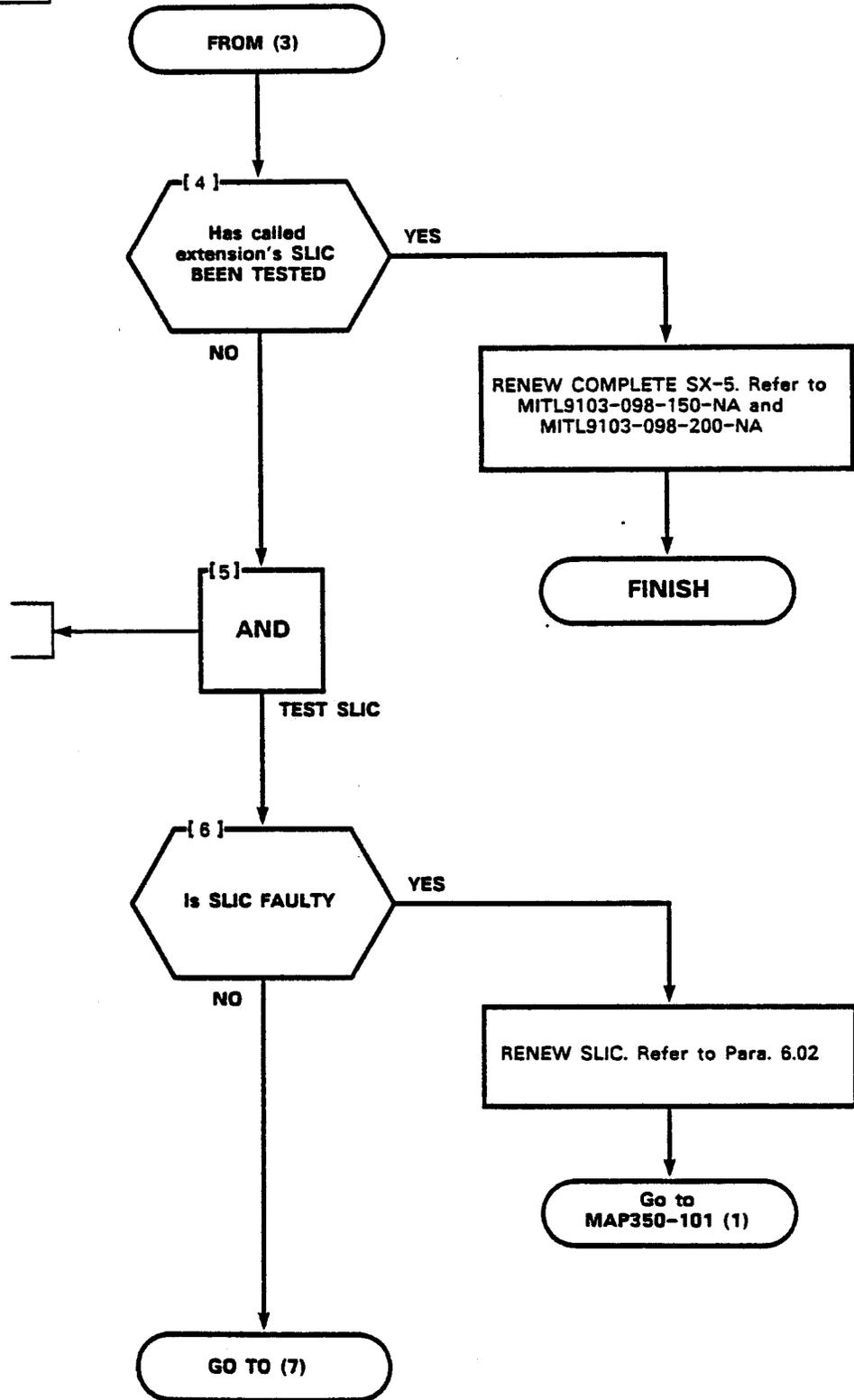
(1A) Check called extension to see if DO NOT DISTURB is enabled



SECTION MITL9103-098-350-NA

NO RINGING
MAP350- 110
Issue 1, May 1982
Sheet 2 of 3

(5A) Go to MAP350-112 (1)



NO RINGING
MAP350- 110
Issue 1, May 1982
Sheet 3 of 3

FROM (6)

[7]
AND



(7A) Refer to
MITL9103-098-150-NA and
MITL9103-098-200-NA

RENEW
COMPLETE SX-5

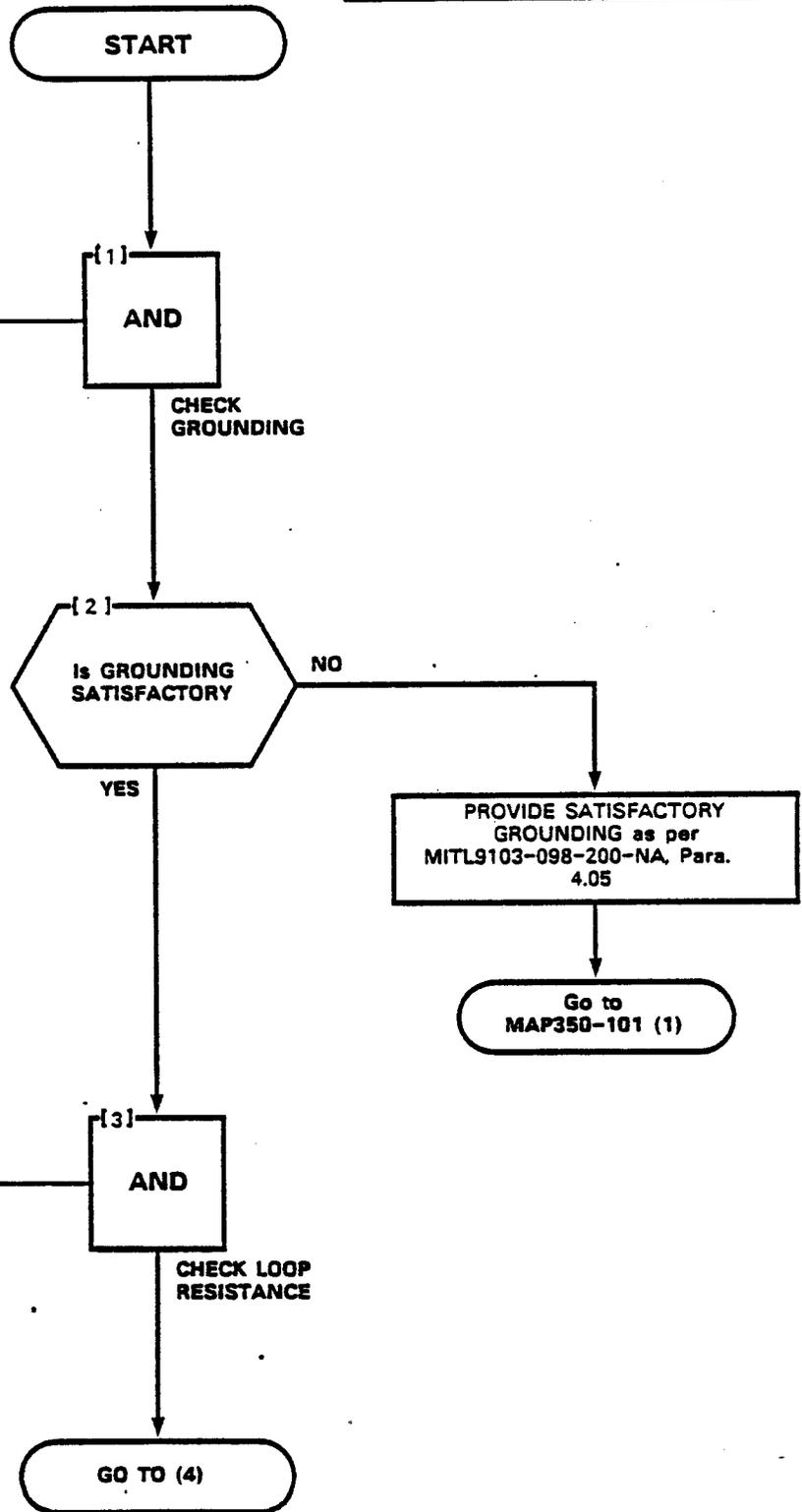
FINISH

EXTENSION AUDIO FAULT
MAP350- 111
Issue 1, May 1982
Sheet 1 of 3

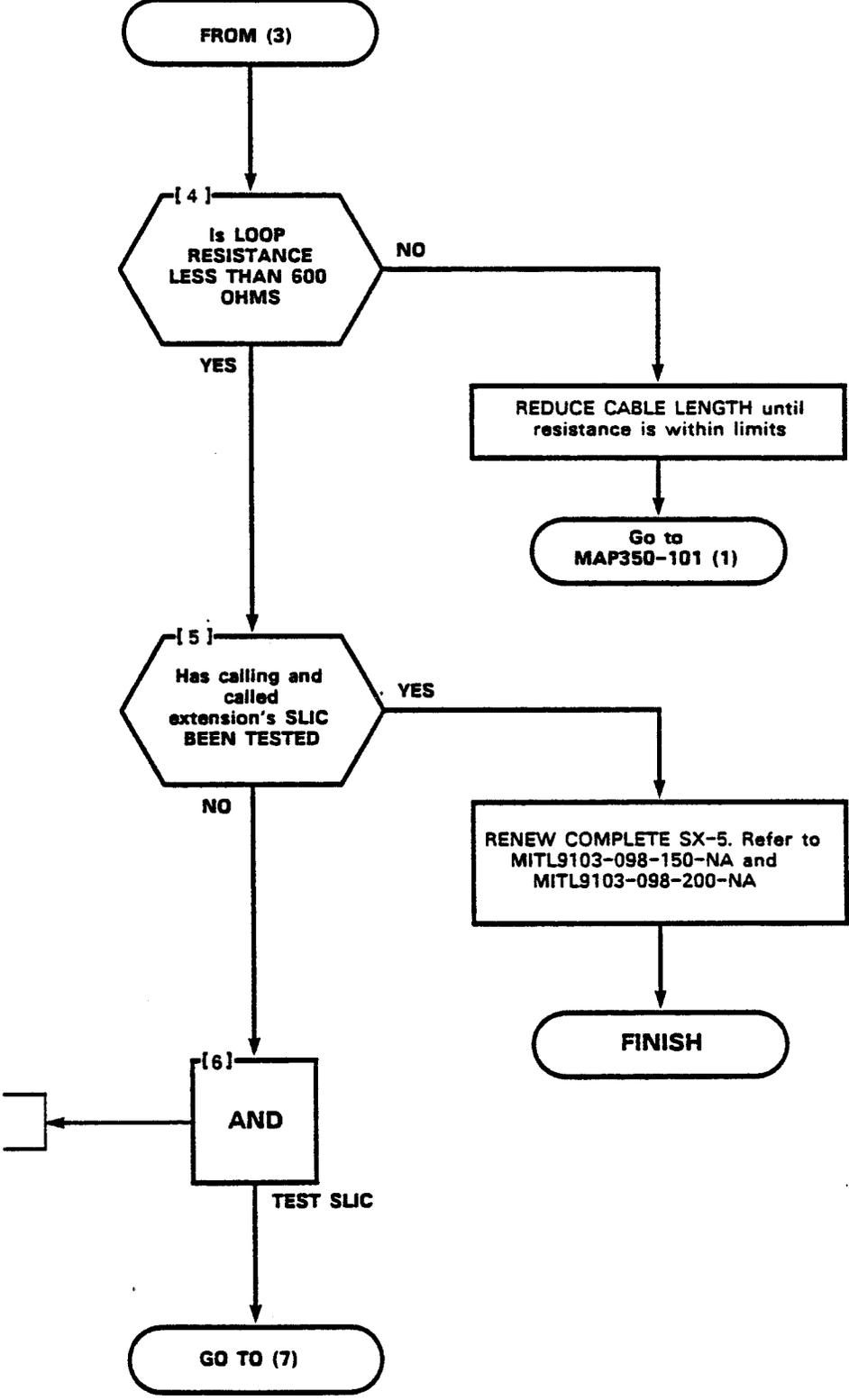
CAUTION:
ACTIONS WHICH REQUIRE LEVEL 2 ENTRY MUST ONLY BE PERFORMED BY A SKILLED TECHNICIAN.

(1A) Refer to Grounding Instructions, MITL9103-098-200-NA, Para. 4.05

(3A) Disconnect the relevant telephone cable from the SX-5 Terminal strip
 (3B) Set multimeter to the 1 k ohm range
 (3C) Place phone off-hook
 (3D) Connect multimeter across cable Tip and Ring
 (3E) Take resistance reading

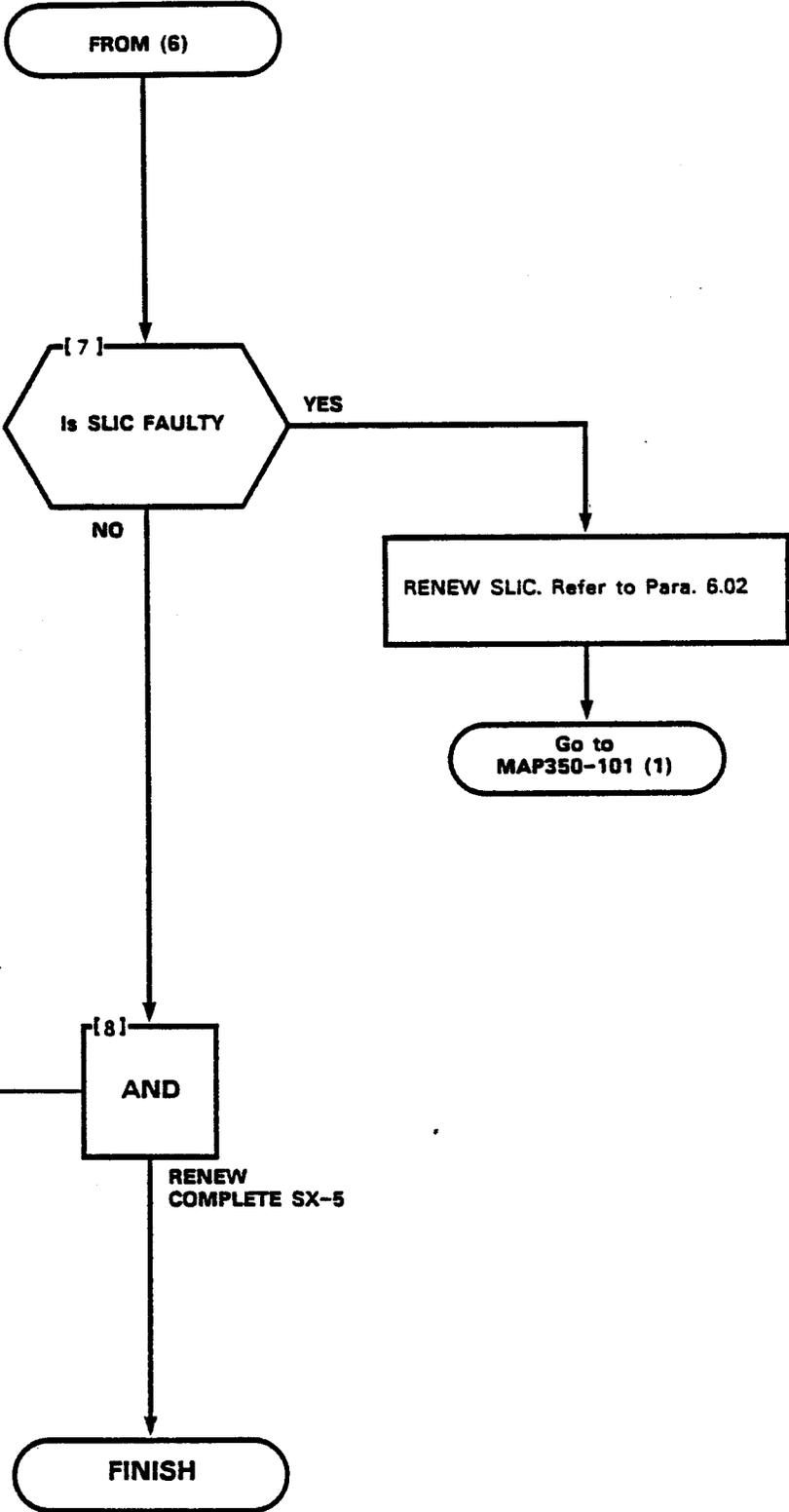


EXTENSION AUDIO FAULT
MAP350- 111
Issue 1, May 1982
Sheet 2 of 3



(6A) Go to MAP350-112 (1)

EXTENSION AUDIO FAULT
MAP350-111
Issue 1, May 1982
Sheet 3 of 3

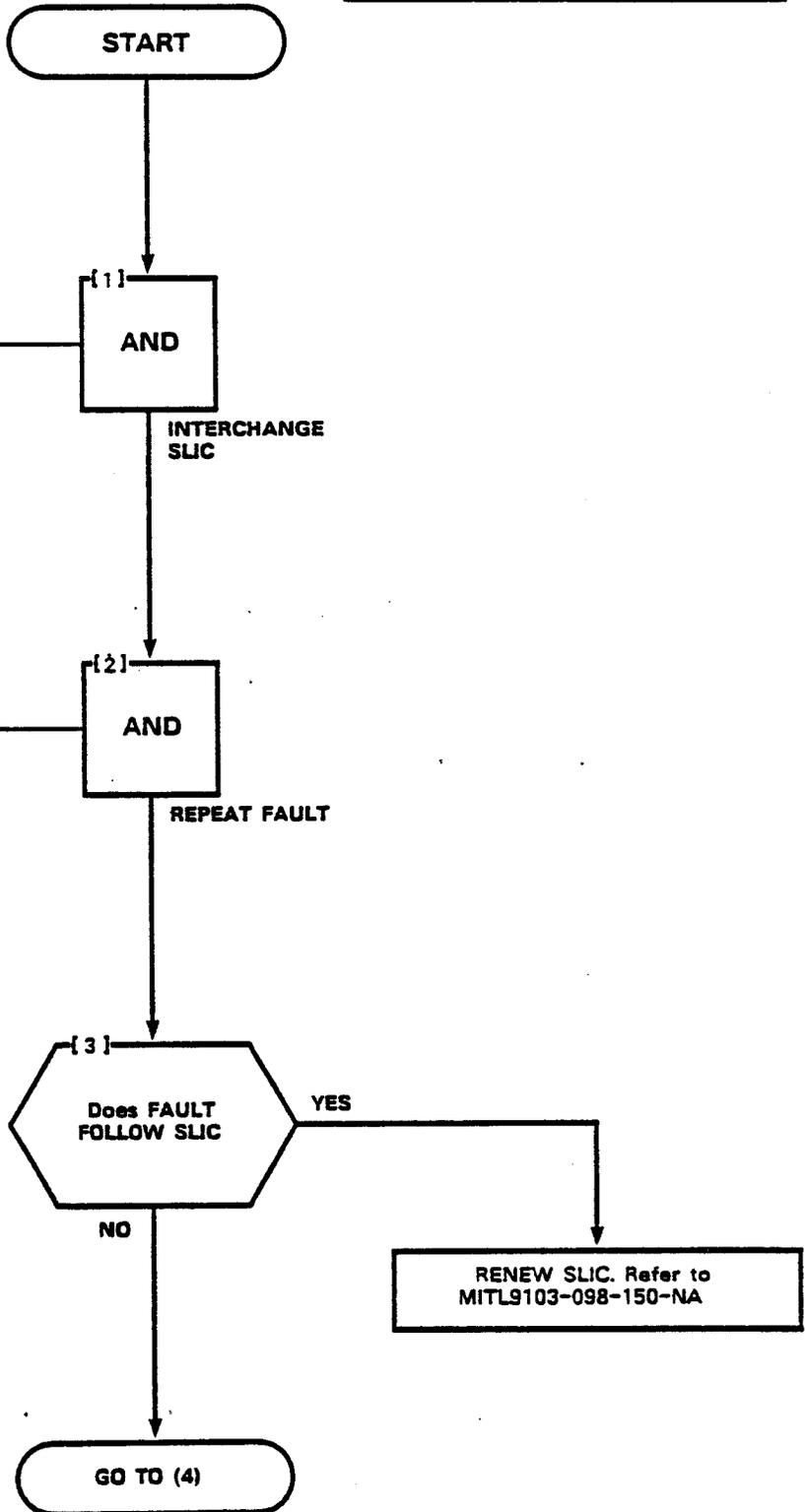


SLIC TEST
MAP350- 112
Issue 1, May 1982
Sheet 1 of 2

CAUTION:
ACTIONS WHICH REQUIRE LEVEL 2
ENTRY MUST ONLY BE PERFORMED
BY A SKILLED TECHNICIAN.

(1A) Refer to SLIC Removal and
Replacement, Para. 6.02

(2A) Repeat the call set-up using the
same extensions



SECTION MITL9103-098-350-NA

SLIC TEST
MAP350- 112
Issue 1, May 1982
Sheet 2 of 2

FROM (3)



{4}
AND



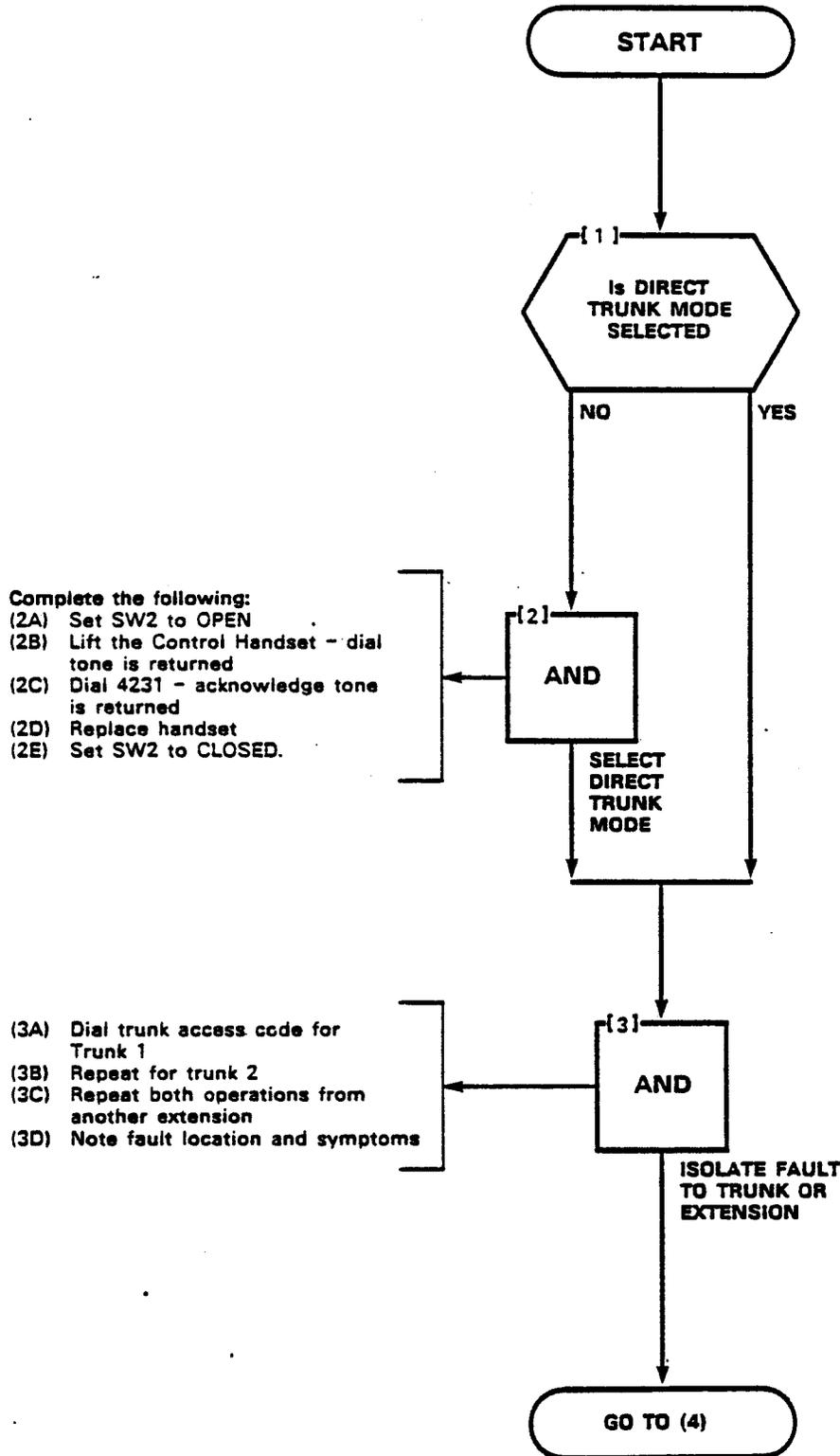
(4A) Return to the MAP which requests a SLIC Test and complete the procedures

RETURN TO PREVIOUS MAP



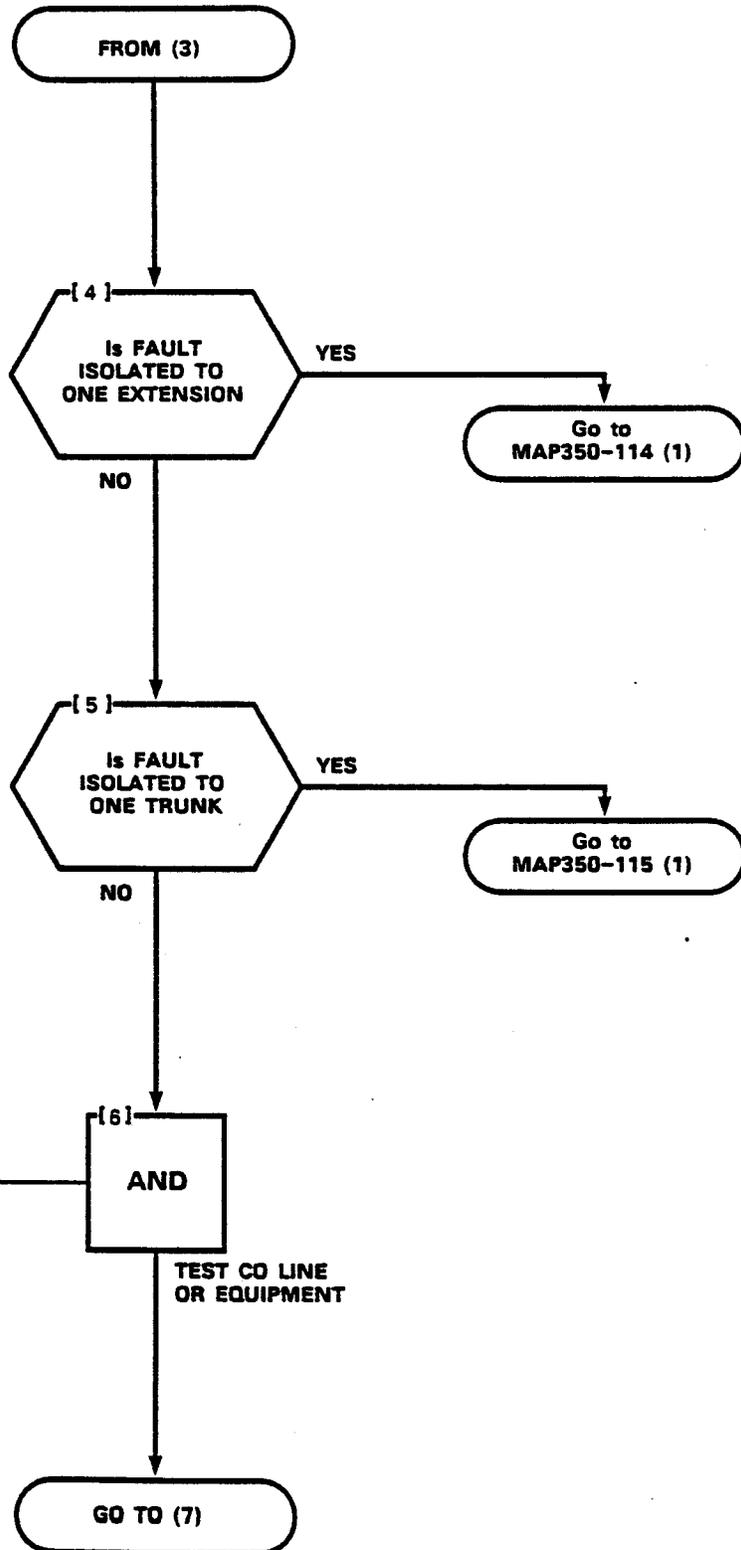
FINISH

TRUNK FAULT
MAP350- 113
Issue 1, May 1982
Sheet 1 of 5



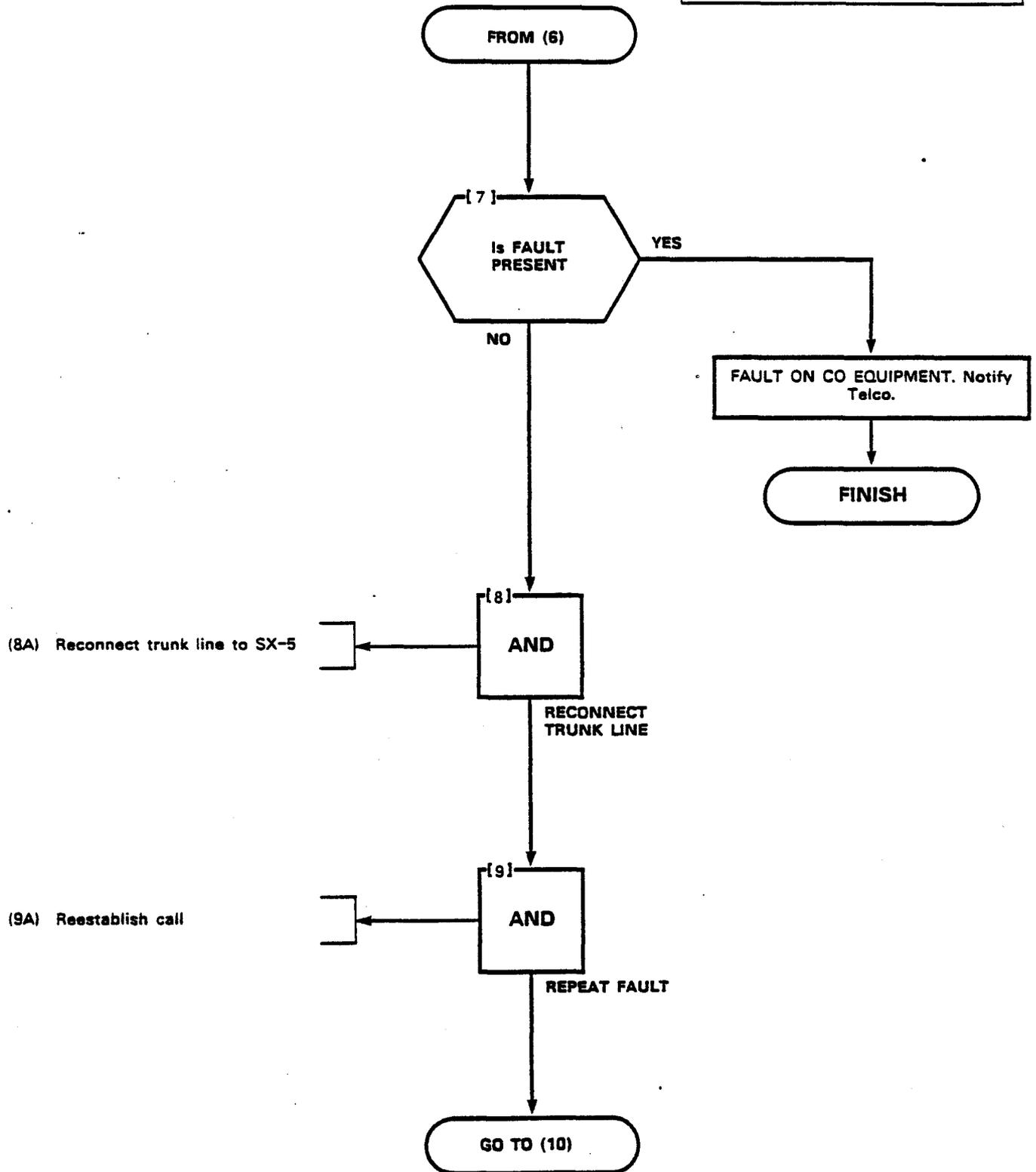
SECTION MITL9103-098-350-NA

TRUNK FAULT
MAP350- 113
Issue 1, May 1982
Sheet 2 of 5



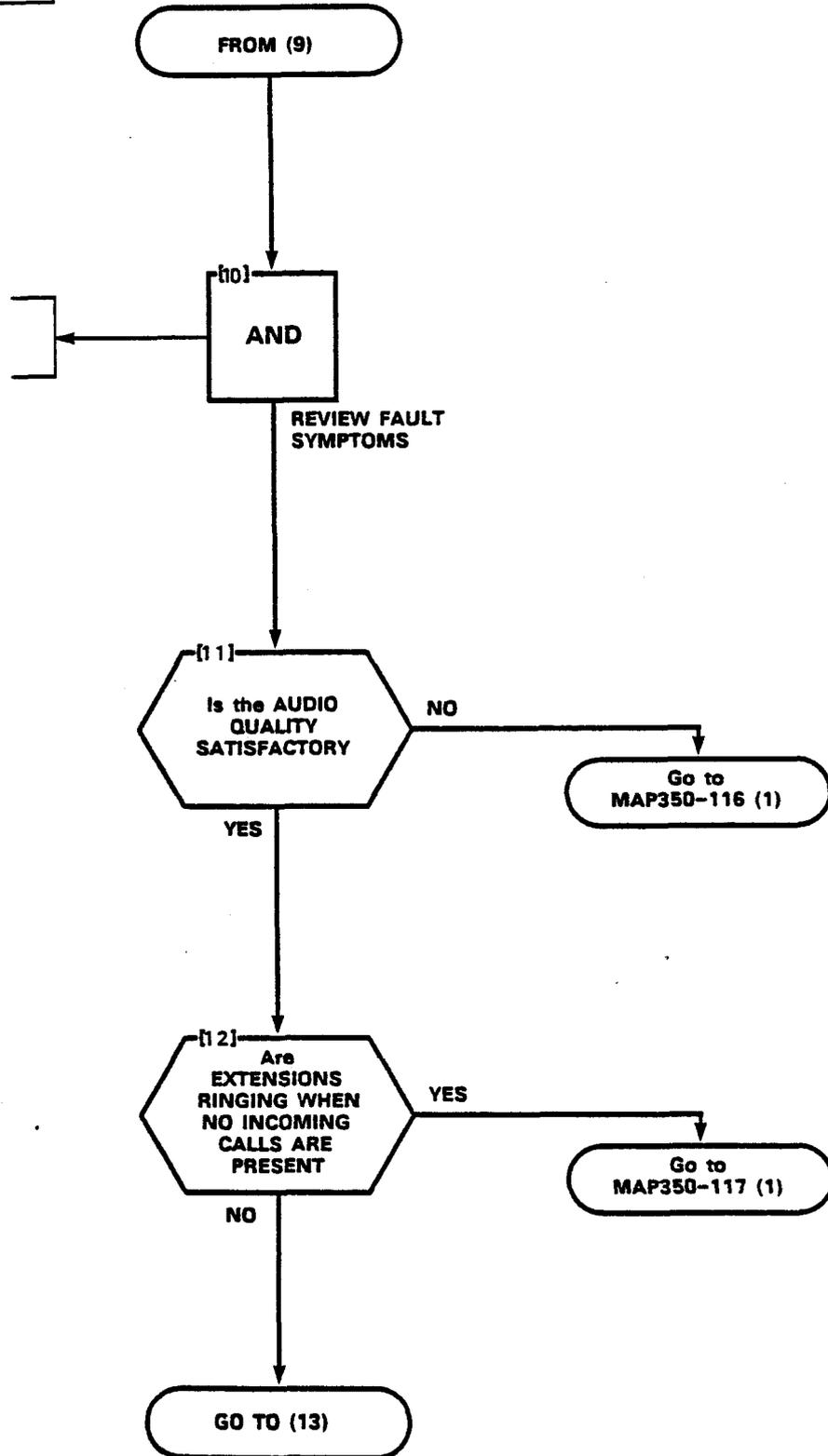
- (6A) Disconnect a trunk line from the SX-5
- (6B) Connect a telephone directly to the CO line
- (6C) Attempt to set up a call
- (6D) Note: If the trunk is a ground start, the extension must be equipped with a Ground Start Button, or a Ground Start or Loop Start Converter

TRUNK FAULT
MAP350-113
Issue 1, May 1982
Sheet 3 of 5

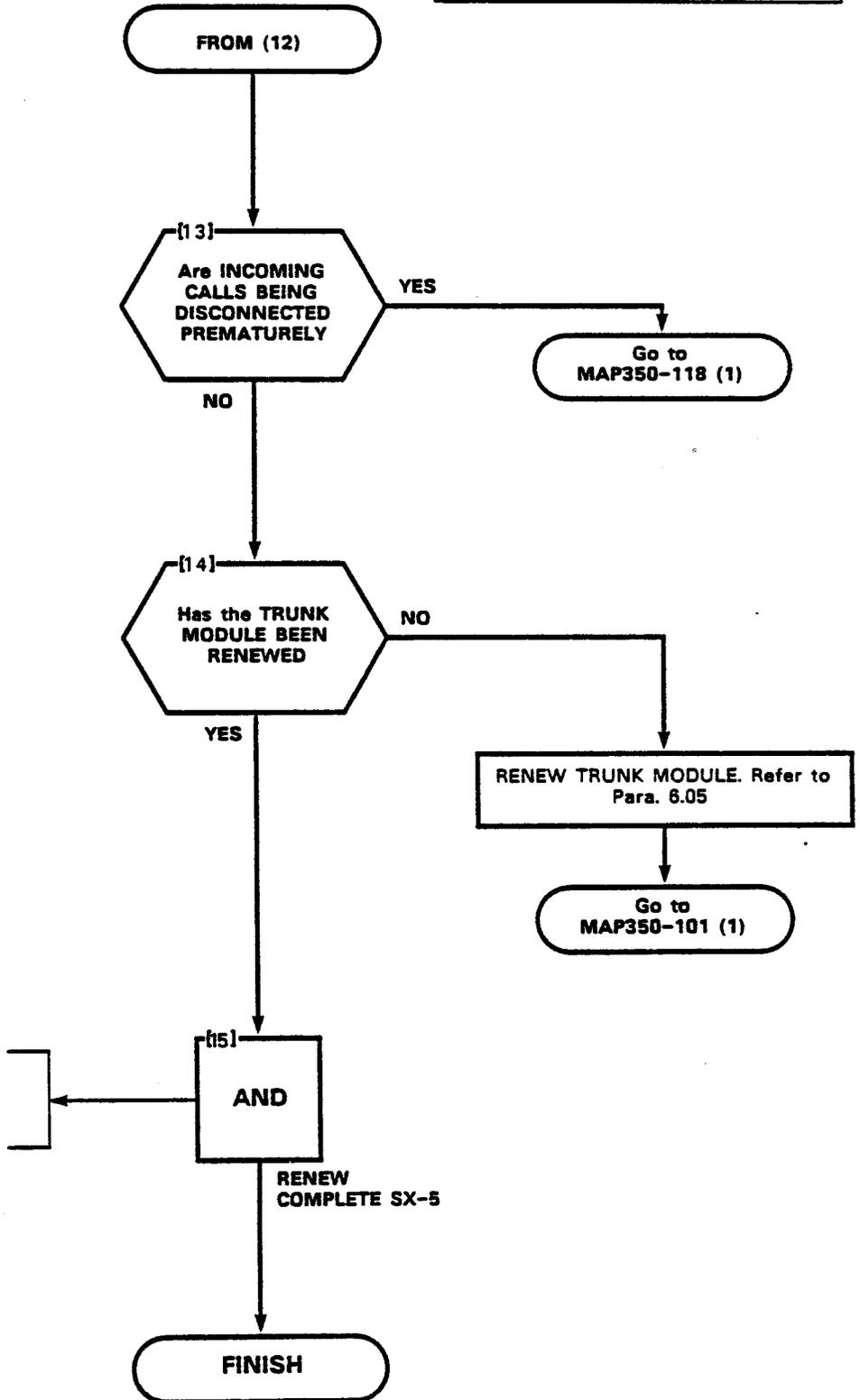


TRUNK FAULT
MAP350- 113
Issue 1, May 1982
Sheet 4 of 5

(10A) Study all fault-related information and proceed

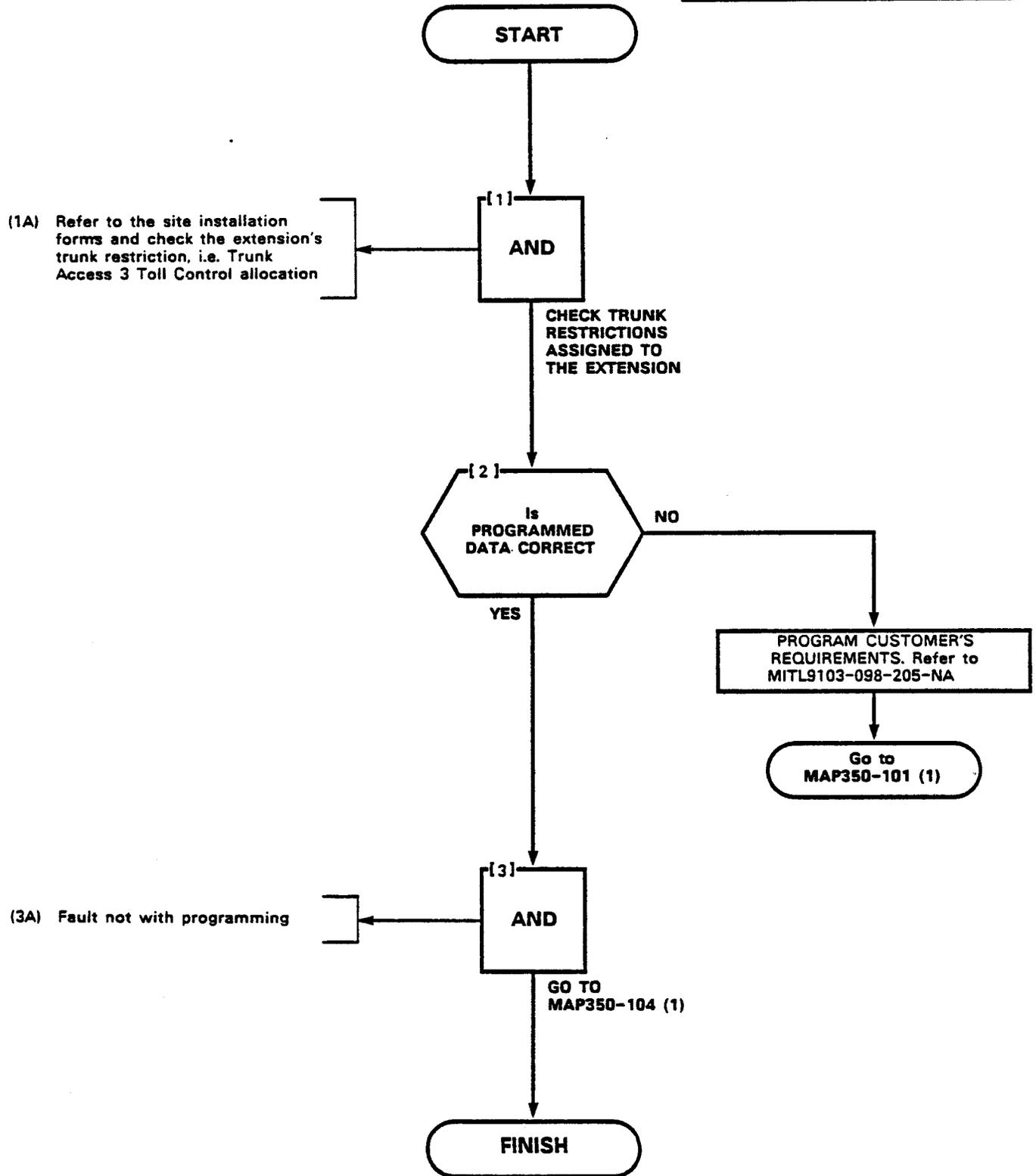


TRUNK FAULT
MAP350- 113
Issue 1, May 1982
Sheet 5 of 5

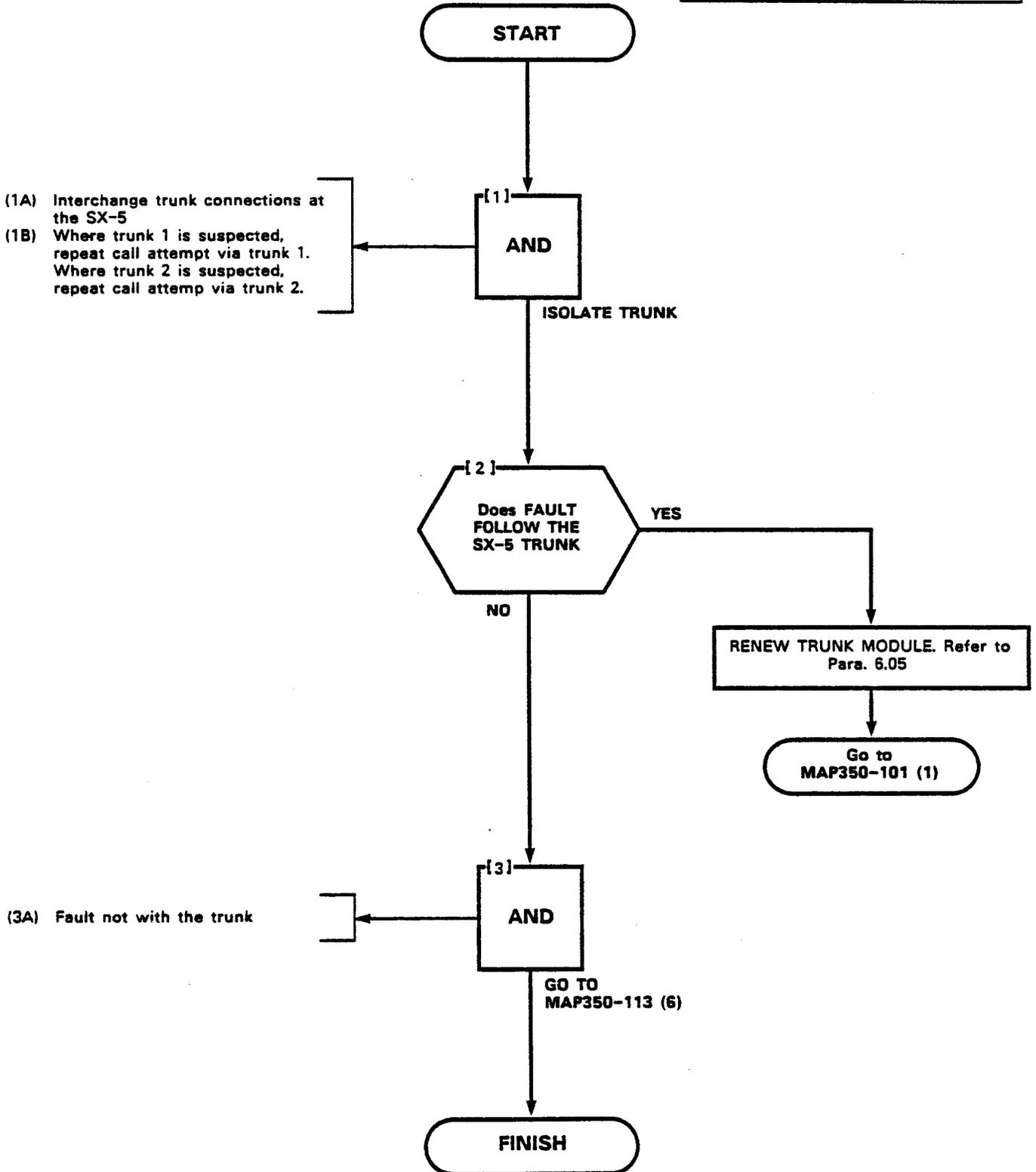


(15A) Refer to MITL9103-098-150-NA and MITL9103-098-200-NA

SINGLE EQUIPMENT FAULT
MAP350- 114
Issue 1, May 1982
Sheet 1 of 1



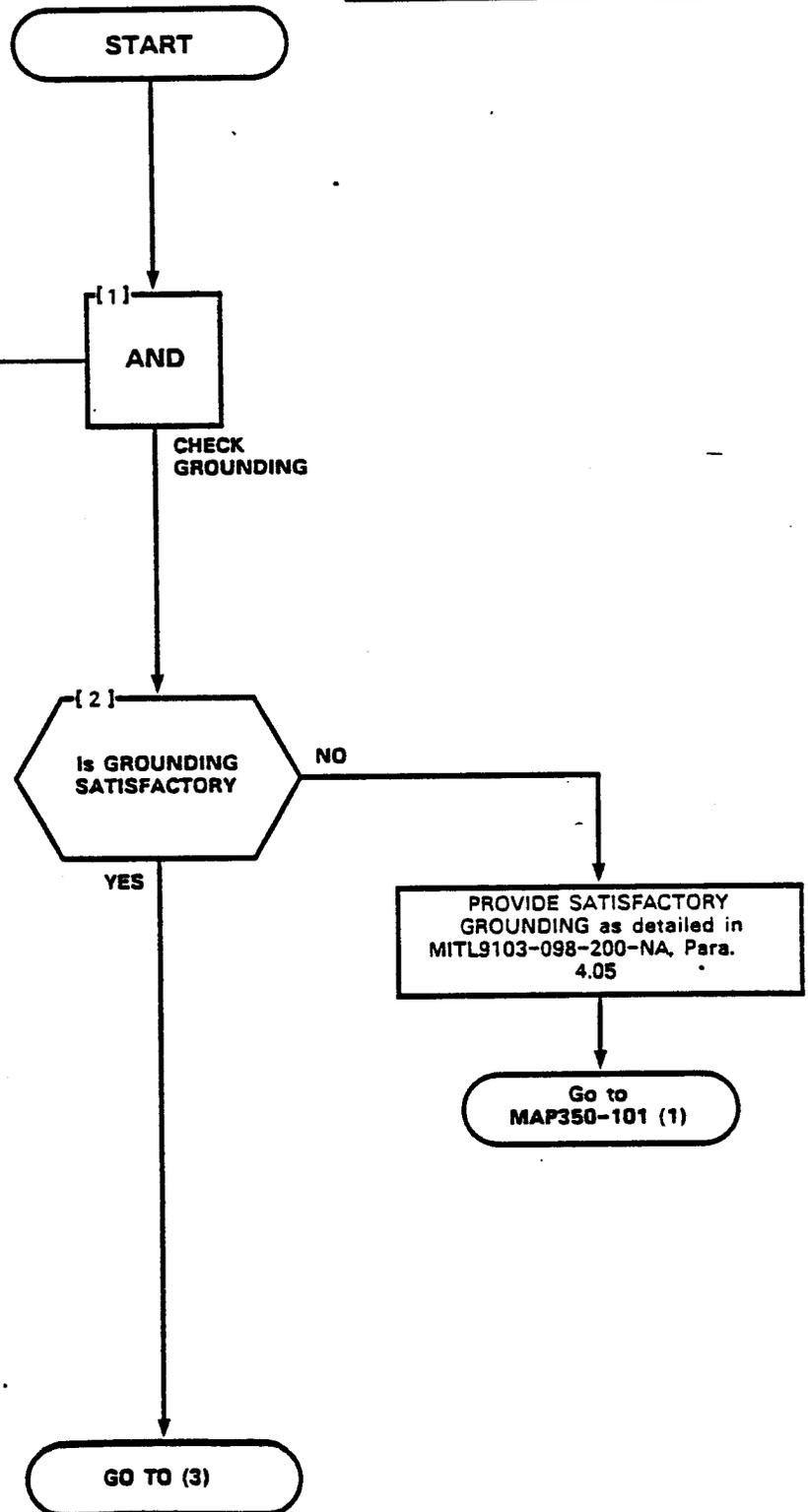
SINGLE TRUNK FAULT
MAP350- 115
Issue 1, May 1982
Sheet 1 of 1



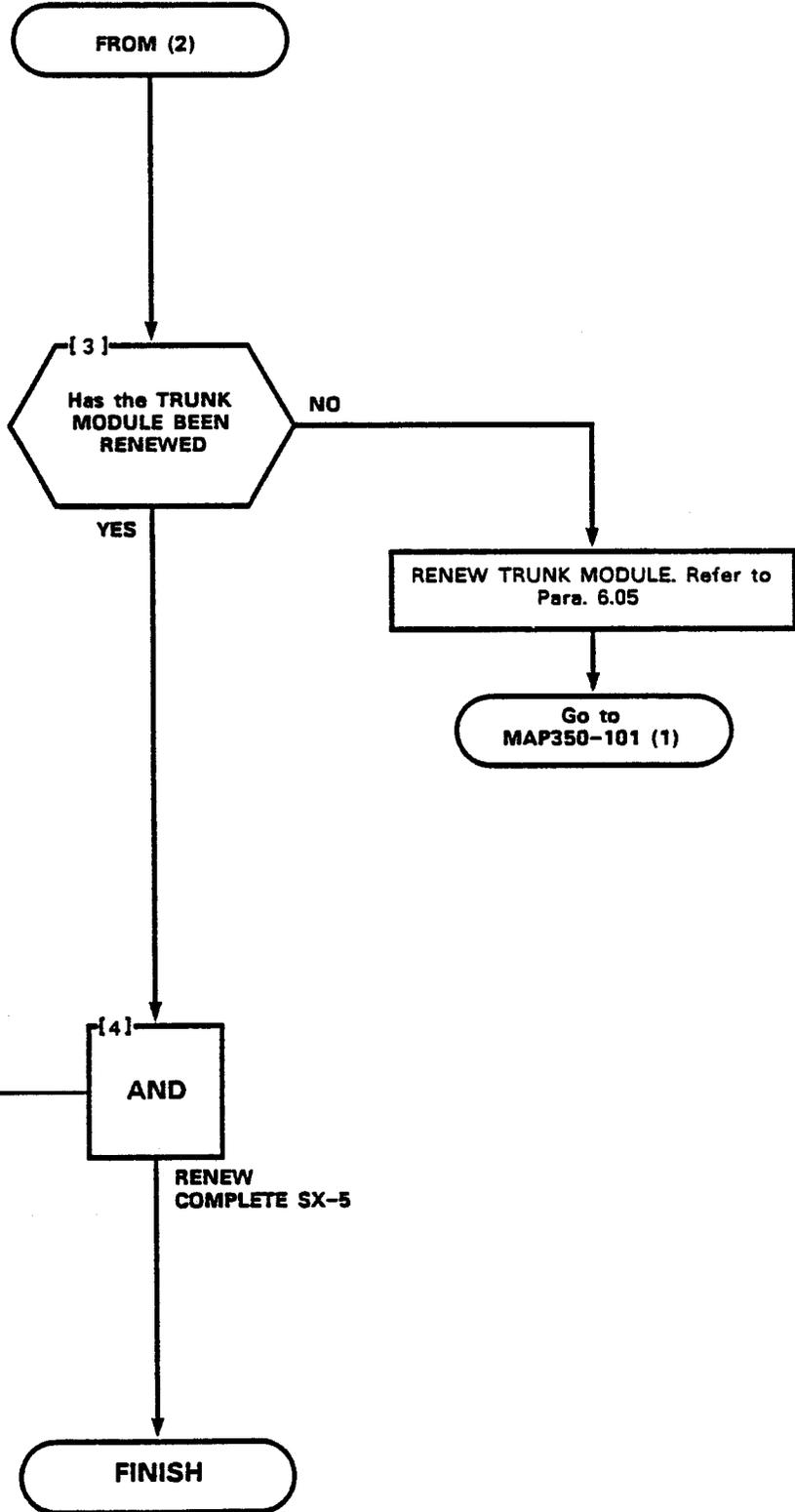
SECTION MITL9103-098-350-NA

TRUNK AUDIO FAULT
MAP350-116
Issue 1, May 1982
Sheet 1 of 2

(1A) Refer to Grounding Instructions in MITL9103-098-200-NA, Para. 4.05

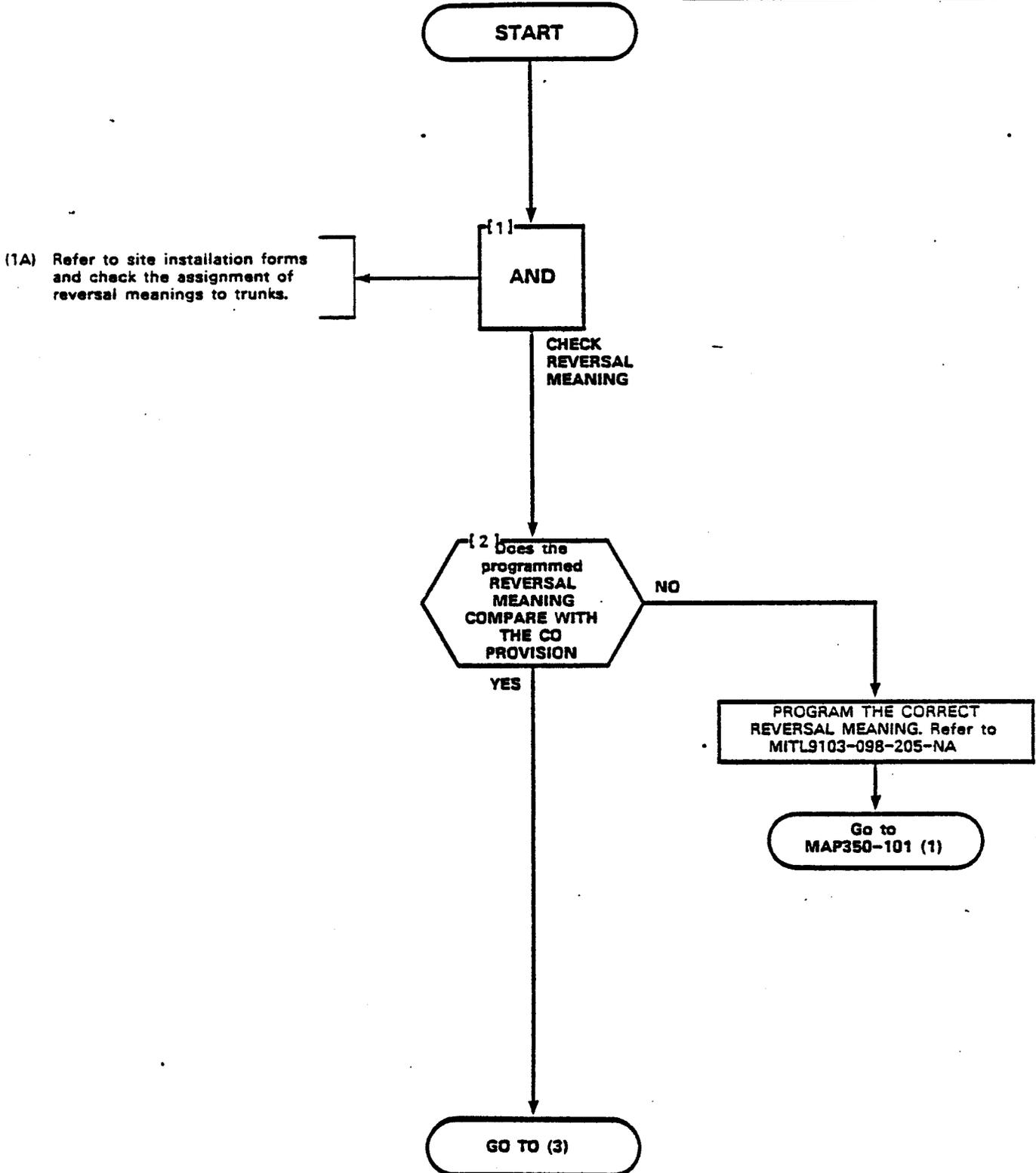


TRUNK AUDIO FAULT
MAP350- 116
Issue 1, May 1982
Sheet 2 of 2

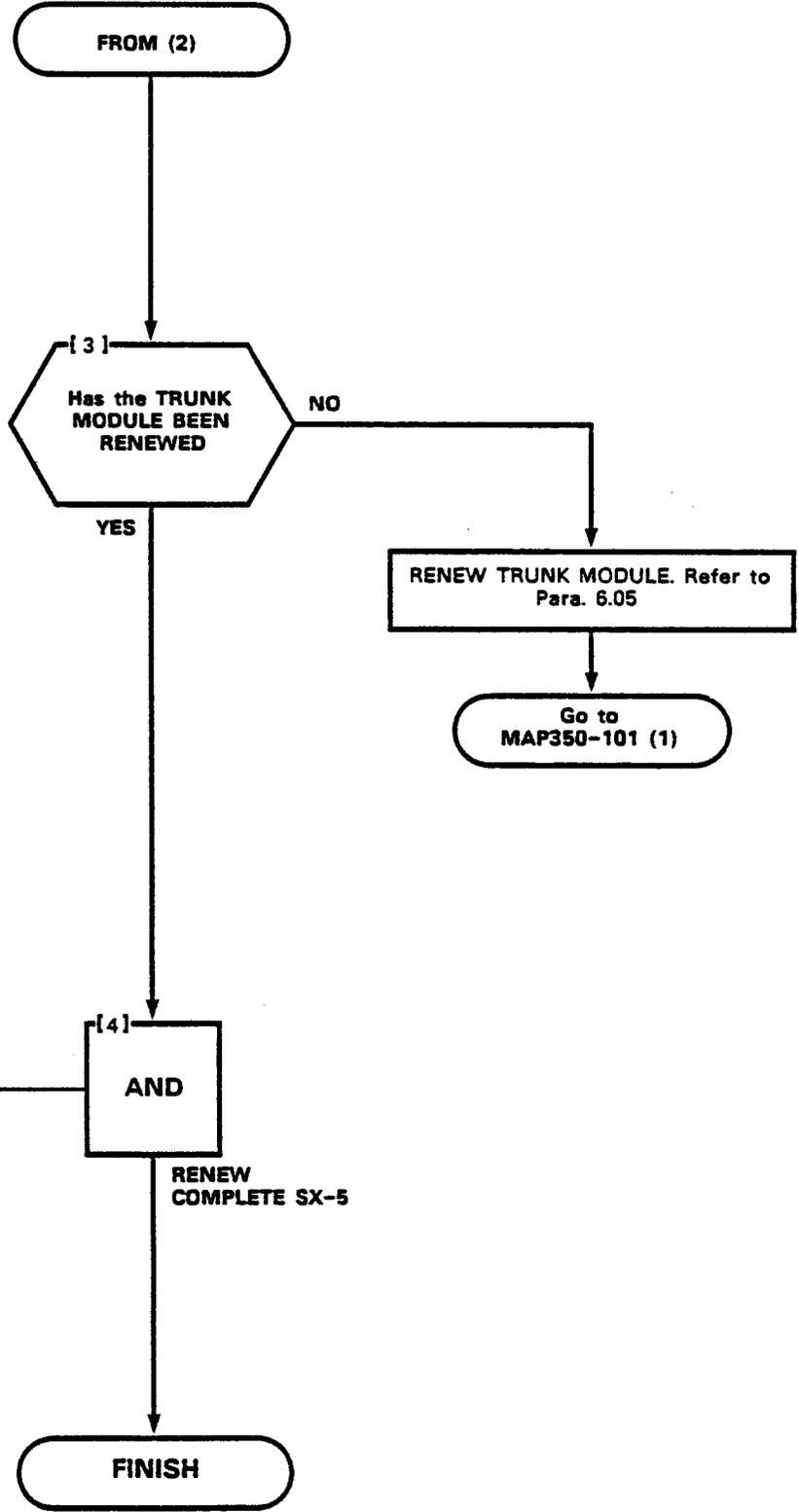


(4A) Refer to MITL9103-098-150-NA and MITL9103-098-200-NA

PHANTOM RINGING
MAP350-117
Issue 1, May 1982
Sheet 1 of 2



PHANTOM RINGING
MAP350- 117
Issue 1, May 1982
Sheet 2 of 2



(4A) Refer to MITL9103-098-150-NA and MITL9103-098-200-NA

DROPPED CALLS
MAP350-118
Issue 1, May 1982
Sheet 1 of 2

