

**X-RAY PROGRAM PACKAGE**  
**OPERATING PROCEDURE**  
**"DIMENSION®" "PRELUDE\*" PBX**

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1. GENERAL

1.01 The DIMENSION PRELUDE PBX X-ray program package consists of the X-ray mini-cassette tape (TP1E733) and the LC569 circuit pack. The X-ray program package is a series of software programs used to test the hardware of the DIMENSION PRELUDE PBX. The X-ray program package is used at the time of installation and may be used when troubleshooting chronic, intermittent, or multiple faults (ie, when service can be interrupted).

1.02 Whenever this section is reissued, the reasons for reissue are listed in this paragraph.

1.03 The X-ray program package is mainly a first or second tier maintenance tool. The first and second tiers are for hardware maintenance only. The first tier is basically installation and circuit pack replacement, and the second tier is basically logic probe and back plane wiring troubleshooting. Normally the Administration and Maintenance (A and M) manuals or the Task Oriented Practice (TOP) documents point to the hardware at fault. These are:

- 500-677 System Administration and Maintenance Procedure (with Addendum 700-383) A and M Manual (Volume 1)
- 500-393 Maintenance Support Information (with Addendum 700-389) A and M Manual (Volume 2)
- 554-102-330 TOP—Installation, Replacement, and Test
- 554-102-332 TOP—Feature Translations, Traffic Translations, and Search Procedures
- 554-102-334 TOP—Trouble Analysis.

1.04 However, if these methods are not successful, X-ray should be used. If X-ray is unsuccessful

in locating/correcting the problem, it is very likely a software problem. The third tier of maintenance specializes in software troubleshooting. Parts 3 and 5 of this Section and Table A may be especially useful for software troubleshooting.

**1.05** The following paragraphs present a general X-ray description.

**1.06** During call processing, the processor controls all system activities by executing high-level instructions read from the generic program memory. The generic program memory resides on the LC555/ZLC14 (or ZLC16 for expanded systems) which is an Erasable Programmable Read Only Memory (EPROM). The translation tape contains feature data. These translations are stored in the LC556 (or LC594 for an expanded system) Random Access Memory (RAM). The translations are cleared from RAM when the X-ray tape is loaded.

**1.07** The software programs (and associated high-level instructions) used by X-ray to test the DIMENSION PRELUDE PBX reside on the LC569 EPROM circuit pack. The memory load capability of the X-ray program memory (LC569) is used to load the X-ray tape data into RAM. The X-ray tape is inserted into the DIMENSION PRELUDE tape unit which is shown in Fig. 1. When the X-ray program memory (LC569) is properly installed, call processing is disabled and all in-progress calls are dropped. The processor transfers program control from the generic program memory (ie, LC555/ZLC14 for single cabinet, or ZLC16 for multi-cabinet systems) to the X-ray program memory on the LC569. Once the tape is loaded, X-ray determines what the system configuration is and stores this information in RAM. The X-ray tape contains test data mostly in the form of tables.

**1.08** The X-ray programs residing on the LC569 consist of a series of specific tests (octally numbered from 00 to 47) which may be selected and started at the Maintenance and Administration Panel (MAAP) (see Fig. 2).

**1.09** When an X-ray test is selected, the system searches a table in RAM for this test and this test indexes programs in EPROM which index required test data from RAM. The system then tests the appropriate hardware.

**1.10** When an X-ray test finds a fault in the system, the fault code is displayed on the MAAP

and the alarm panel. Other pertinent information may also be displayed on the MAAP. The fault code is used to identify and correct the fault. The basic procedure to run an X-ray test is shown in Fig. 3.

**1.11** This document is designed in a step-by-step procedural format. Parts 1 through 4 describe the preliminary requirements, how to load X-ray, how to select and run a test, and how to repair the system if a fault occurs during a test. When a PBX is installed, the system should be tested by all applicable X-ray tests. However, after installation, a chronic intermittent or multiple fault may occur. The tester need not run all the X-ray tests (ie, sequentially 00 through 47) to identify the fault in the system if the tester knows the system function that is failing. Part 5 of this document provides a description of each X-ray program. These programs describe the system functions that they test. Each program description also lists the X-ray tests that should be selected to test these system functions. The recommended X-ray test(s) can then be run and the system fault identified and corrected using Parts 1 through 4.

**1.12** ***Danger: The CSS201 processor carrier has both 117 volt ac and ringing voltages and may be fatal. Thus, caution should always be observed in probing and handling parts of the system.***

**1.13** ***Caution: When making hardware changes to any circuit pack (ie, soldering terminals, wires, etc), make sure the ac power is unplugged. Turning off the system does not remove the ringing voltage (approximately 100 volts ac) fed from the ringing generator across each line and trunk carrier to feed each circuit.***

**1.14** ***Warning: Authorized grounded wrist strap must be worn in contact with the skin when handling circuit packs to prevent electrostatic damage to circuit packs.***



*Table A provides a reference of each test, the circuit packs tested by each test, the flow chart that shows the test procedure and other test information. Table B should be used throughout this document to determine the name of a DIMENSION PRELUDE PBX circuit pack. Circuit*

TABLE A

## X-RAY TESTS, IDENTIFICATION AND DESCRIPTION

TEST NO.	TEST NAME AND TEST TIME (APPROX)	FUNCTIONAL AREA (PROGRAM)	CIRCUIT PACK TESTED	FLOWCHART FIG. NO.	DISPLAY FORMAT
00	Alarm Panel Test (1 Sec)	Alarm Panel (ALARMS).  High Level Instruction Decoding (INIT B).  Processor RM Memory (MEMXRY).  RAM Memory (MEMTST)  Data Set Initialization (T1SUBR — Test 00 Transfers to Test 01 After One Pass.)	LC557  LC22  LC20  LC556, LC594, and LC557	—	—
01	Control Section Test (30 Sec)	Real Time Clock Interrupts (INITPI)  Microinterrupts (INTRUP)  Instruction Set (INSTRC) Maps Jumbo  Processor RM Memory (MEMXRY)  RAM Memory (MEMTST)  Main Store Memory Test (EPRM — TST)  Serial Data Links (DLXRAY — This Test is Improved By Use Of Loopback Test Fixtures)	LC22 and LC53  LC53, LC22, and LC560  LC20, LC21, LC22, LC560, LC52, and LC53  LC20  LC556, LC594, and LC557  LC557, LC555, and LC595  LC554 and LC44	13	F1 THEN FC*

See footnotes at end of table.

TABLE A (Contd)

## X-RAY TESTS, IDENTIFICATION AND DESCRIPTION

TEST NO.	TEST NAME AND TEST TIME (APPROX)	FUNCTIONAL AREA (PROGRAM)	CIRCUIT PACK TESTED	FLOWCHART FIG. NO.	DISPLAY FORMAT
01 (Contd)	Control Section Test (Contd)	Attendant Console (ATTXRY)  MAAP Test (MP Test – MAAP Tests Must Be Selected Manually.)  RMATS  Alarm Panel Exerciser (AP_LED)	LC554  LC44  LC570* and LC597  LC557		
02 §	System Test (2-15 Min)	Real-Time Clock Interrupts (INITPI)  Microinterrupts (INTRUP)  Instruction Set (INSTRC) Maps Jumbo  Processor (RM) Memory (MEMXRY)  RAM Memory (MEMTST)  Main Store Memory Test (EPRM_TST)  Serial Data Links (DLXRAY – This Test is Improved By Use Of Loopback Test Fixtures.)  Attendant Console (ATTXRY)  Scanner/Distributor (SCNXRY)	LC22 and LC53  LC22, LC560 and LC53  LC20, LC21, LC22, LC560, LC52, and LC53  LC20  LC556, LC594, and LC597  LC557, LC555, and LC595  LC544 and LC44  LC544  LC46, LC49, and LC50	14	FA

See footnotes at end of table.

TABLE A (Contd)

## X-RAY TESTS, IDENTIFICATION AND DESCRIPTION

TEST NO.	TEST NAME AND TEST TIME (APPROX)	FUNCTIONAL AREA (PROGRAM)	CIRCUIT PACK TESTED	FLOWCHART FIG. NO.	DISPLAY FORMAT
02 (Contd) §	System Test (Contd)	Time Division Network Control (NETWRK)  RMATS  Tones (PAMXRY)  MAAP (MP Test — MAAP Test 1 Starts After 4 Minutes. MAAP Test 3 Must Be Manually Requested.)  Alarm Panel Exerciser (AP_LED)  Station Message Detail Recording (SMDR)  Lines and Trunks (LINRAY — This test is Not Effective Unless Lines And/Or Trunks Loop-Around Fixtures Are Used.)	LC02C, LC08, LC09, LC10, LC11, LC13, LC47, LC49, LC588  LC570*, LC597  LC204, LC17, LC48 and LC50  LC44, MAAP  LC557  SMDR Circuit Packs; LC38, LC39, LC62, LC63, LC64, LC65, LC66, and LC67  LC02C, LC588 LC06, LC12, LC08, LC145 LC09, LC10, LC11, LC278 LC13, LC279 LC45, LC293, LC145, and LC361	14	FA
03	Scanner/Distributor Test (2 Sec)	(SCNXRY) Test NTWK	LC46, LC49, and LC50	13	F1
04	Network Shift Register Test (5-15 Sec)	SCNXRY, and Network NTWK	LC46, LC49, LC50, LC47, LC02C, LC08, LC09, LC10, LC11, LC13, and LC588	13	F1 THEN FA*

See footnotes at end of table.

TABLE A (Contd)

## X-RAY TESTS, IDENTIFICATION AND DESCRIPTION

TEST NO.	TEST NAME AND TEST TIME (APPROX)	FUNCTIONAL AREA (PROGRAM)	CIRCUIT PACK TESTED	FLOWCHART FIG. NO.	DISPLAY FORMAT
05	PAM Test (90-300 Sec)	SCNXRY, Network and PAMXRY	LC46, LC49, LC50, LC47, LC49, LC204, LC08, LC09, LC10, LC11, LC13, LC02C, LC588, LC17, LC48 and LC50	13	F1 THEN FA*
06	Emergency Transfer (20 Sec)	EMXFER	LC557	15	—
13	Attendant Console Test (Indefinite)	ATTXRY	Console	16	—
14	Memory (RAM) Test (25 Sec)	MEMTEST	LC556, LC594, and LC557	13	FC
15	SMDR Test (Indefinite)	Station Message Detail Recording	SMDR Circuit Packs; LC38, LC39, LC62, LC63, LC64, LC65, LC66, and LC67	—	F3
16 †	High-Speed Data (3 Sec)	SMDR port	LC570, LC597	—	—
17 §	Line Test (15 Sec to 5 Min)	Linray	LC02C, LC588 LC45, LC17, LC145, and LC293	13	FA
21	TOUCH-TONE Calling REC, REG. Test (Indefinite)	TOUCH-TONE Calling Receiver-Register	LC553 or LC10D	18	FA THEN F9
31	Instruction Set Test (2 Sec)	Instruction Set (INSTRC), Maps Jumbo	LC560, LC20, LC21, LC22, LC52, and LC53	13	FU

See footnotes at end of table.

TABLE A (Contd)

## X-RAY TESTS, IDENTIFICATION AND DESCRIPTION

TEST NO.	TEST NAME AND TEST TIME (APPROX)	FUNCTIONAL AREA (PROGRAM)	CIRCUIT PACK TESTED	FLOWCHART FIG. NO.	DISPLAY FORMAT
32	Interrupt Test (2 Sec)	INTRUP  (To Stop This Test, Press Clear Entry Control Key For Several Seconds, Then Release.)	LC22, LC560 and LC53	13	—
33 †	LC14 — Contact Interface Test (2 Sec)	Contact Interface	LC14	—	—
35 §	LC570 (or 597) Test (2-10 Sec)	RMATS/Tape/SMDR Interface	LC570, and LC597	19	FC
42 ‡	Trunk Tests 40 Sec-5 Min)	LINRAY	LC06, LC08, LC09, LC10, LC11, LC12, LC13, and LC553	13	F1 THEN FA*
46	Port Per Slot Display Test (5 to 15 Sec)	NTWK	LC46, LC49, LC50, LC47, LC02C, LC588, LC06, LC08, LC09, LC10, LC11, LC13, LC12, LC280, LC285, LC361, and LC293	20	FV
47 §	LC145 Test (4 Min)	LC145 TST	LC02C, LC145, and LC588	13	F1 THEN FA*
	LC15 Display Interface Test	Used With Any Test Number (ie, except Test 00)	LC15	—	—

\* Displayed at successful completion of test.

† Factory test which requires the use of loop equipment.

‡ A thorough test requires the use of LC14 with trunk loop-around fixtures.

§ A thorough test requires loop-around fixtures.

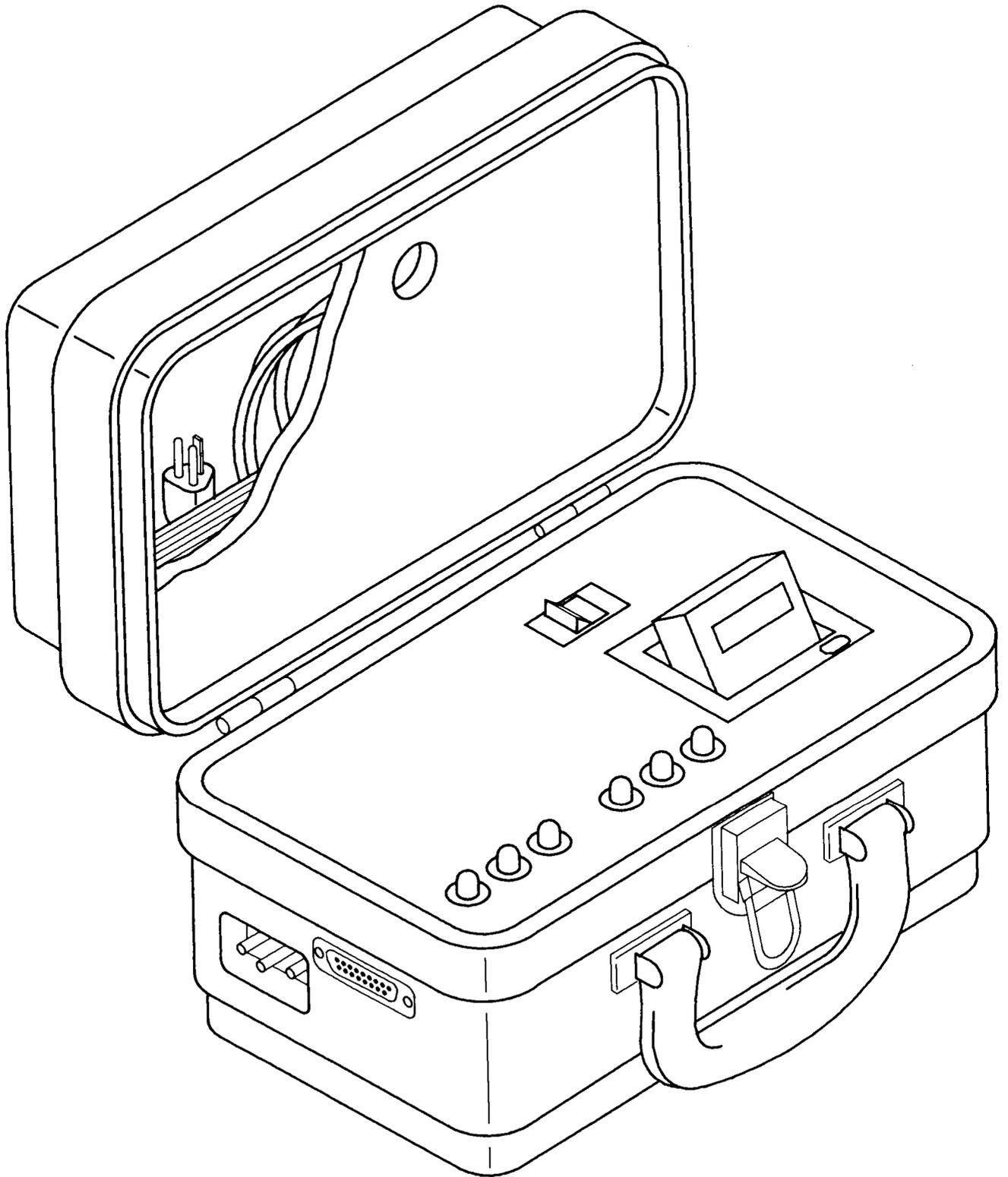


Fig. 1 — DIMENSION PRELUDE PBX Tape Unit

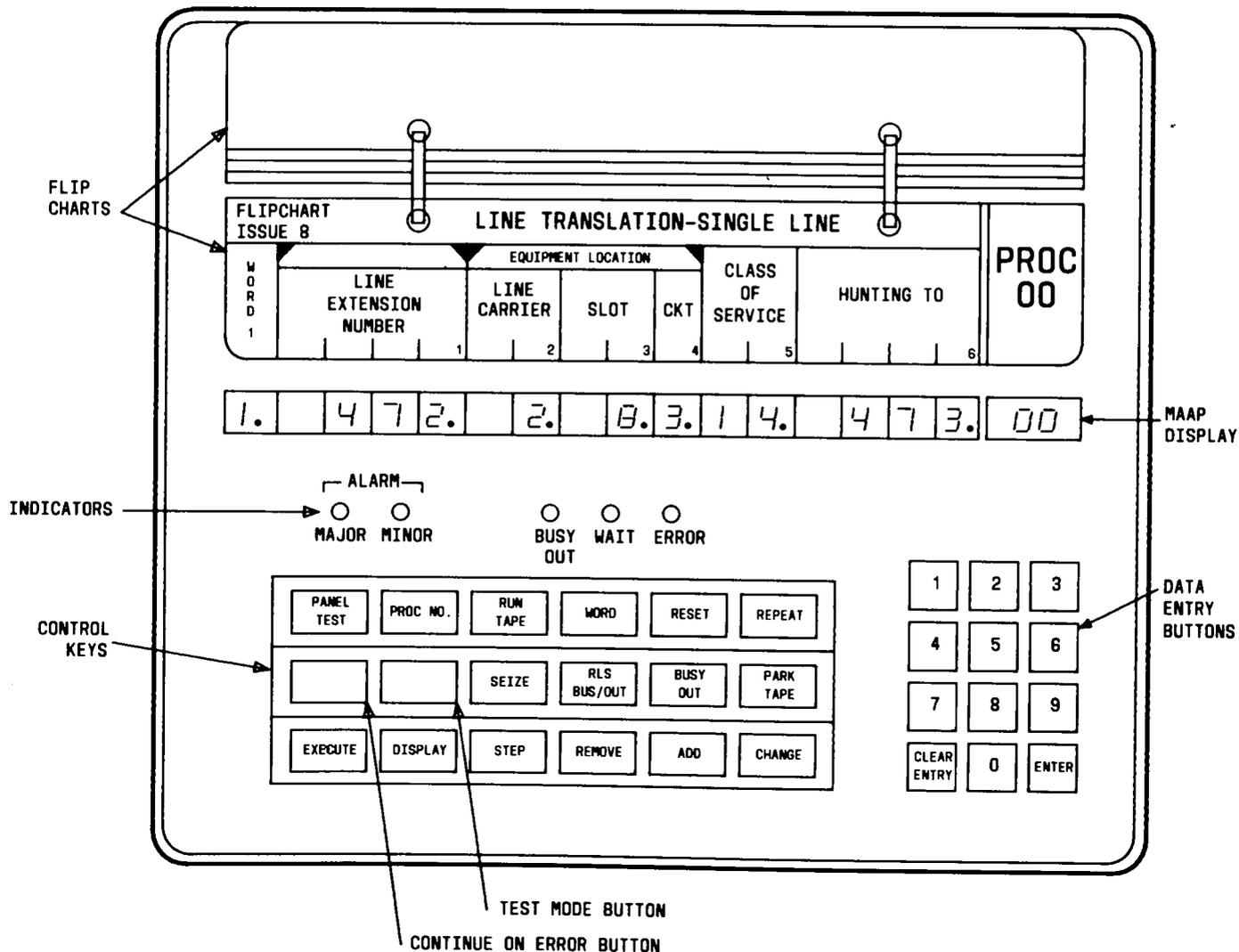


Fig. 2—Maintenance and Administration Panel (MAAP)

*pack suffixus in this document may not be applicable to the customer's system. Applicable circuit pack suffixus are found on each carrier via the circuit pack designation strip.*

1.15 The following sections are associated with DIMENSION PRELUDE PBX and may be used for additional information.

- 554-102-108 DIMENSION PRELUDE PBX—Central Processor—Maintenance Support Information
- 554-102-109 DIMENSION PRELUDE PBX—

Input/Output, Interface and Auxiliary Circuits—Maintenance Support Information

- The schematic diagram (SD) and the associated circuit description (CD) are combined for the DIMENSION PRELUDE PBX. This information is titled "DIMENSION 201 VSCR" and numbered SD1E498-D1/CD1E498-01.

## 2. X-RAY PRELIMINARY TEST REQUIREMENTS AND TAPE LOADING PROCEDURES

### MINIMUM EQUIPMENT CONFIGURATION

- 2.01 Table C shows the minimum circuit pack installation required per carrier to run all X-ray

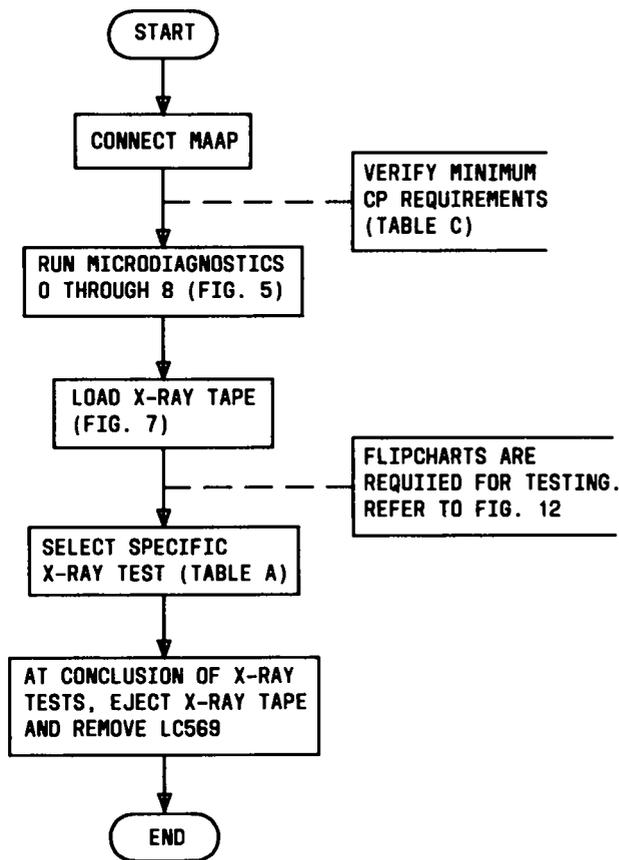


Fig. 3—X-Ray Tests Operating Procedure

tests. Some of the circuit packs have been modified to include new features. When a circuit pack is modified, an alpha suffix is added to the circuit pack number. The modified circuit pack can be used in place of the earlier version. However, the earlier version cannot be used in place of the modified version when the modified version is specified.



**Whenever a carrier designation strip calls for a specific code of circuit pack (eg, LC29B), a circuit pack with a succeeding suffix letter (eg, LC29C, LC29D, etc) is interchangeable with it. Reverse interchangeability, however, cannot be utilized.**

**2.02** The circuit pack requirements given in Table C denote the minimum system configuration for running an X-ray test. The system should not be stripped back to this configuration unless there is no

other way to get the test started. The test should first be tried using the fully equipped system.

## LOADING THE X-RAY TAPE

### A. General

**2.03** Before the X-ray tape is loaded into memory, microdiagnostic (MD) Tests 0 through 9 should be run to verify that the processor is in the proper condition to accept input from the X-ray tape. All machine instructions for the MD tests, including tape loading instructions, are on the LC560 (PROM). Test MD0 through MD8 should be run before the X-ray tape is inserted into the tape unit. However, the tape should be in place before the MD9 is run. The MD9 test initiates loading of the X-ray tape.

### B. Microdiagnostics

#### Running Microdiagnostics

**2.04** Each MD is intended to test a particular part of the processor. However, other parts of the processor must be used to perform the tests. Therefore, it is possible for an MD to fail because of a fault which is not in the particular part of the processor being tested. Each MD (except MD0) uses circuits tested by the previous MD. Starting with MD0 and progressing through MD9 eliminates some of the potential problems associated with isolating faulty circuits.

**2.05** The MDs are initiated from the alarm panel. Figure 4 shows the alarm panel which is positioned on the face of the LC557. Figure 5 is a flow diagram showing the procedure for running the MDs. To select an MD test, the TEST SELECT thumb-wheel switch is set to the test number desired (0 through 8). To initiate the test, perform the following operations:

- (1) Push the ALARM RETIRE button momentarily.
- (2) Push the ENABLE button momentarily.

The MDs 0 through 8 cycle repeatedly until a different MD or operation is initiated. See the description of MD9 for test procedures.

**2.06** For MD Test 0, a successful test is indicated when all software controlled alarm panel light-emitting diodes (LEDs) (ie, except XFER) are

TABLE B

## "DIMENSION" "PRELUDE" PBX CIRCUIT PACKS

CIRCUIT PACK NUMBER	CIRCUIT PACK NAME
LC02C	Line Ckt
LC06B	Attendant Conference Ckt
LC08D	Dual CO Trunk Ckt
LC09D	DID Trunk Ckt
LC10D	TOUCH-TONE Calling Register and Receiver
LC11B	Tie Trunk Ckt
LC12	TOUCH-TONE Calling Sender
LC13B	Auxiliary Trunk Interface
LC14	Contact Interface Ckt
LC15	Contact Interface B Ckt
LC17B	Tone Plant C
LC20	Processor Control
LC21B	Processor I/O Ckt
LC22B	Processor Timing Ckt
LC44	Extended I/O
LC45B	Attendant Interface
LC46	Scanner/Distributor
LC47B	Network Control
LC48	PAM Distribution Ckt
LC49C	Digital Network Buffer
LC50	Analog Buffer B
LC52	Processor Data Ckt
LC53	Processor Interrupt Ckt
LC145	Transmission Test Line
LC204	Tones Ckt
LC293	Multiport Conferencing Ckt
LC361	Loop Signaling Interface Trunk

TABLE B (Contd)

## "DIMENSION" "PRELUDE" PBX CIRCUIT PACKS

CIRCUIT PACK NUMBER	CIRCUIT PACK NAME
LC553	Quad TOUCH-TONE Calling Receiver/Register
LC554	Quad Low-Speed Data Channel
LC555B	88K EPROM Ckt
LC556	18K RAM Ckt
LC557	Memory Controller and Alarm Ckt
LC560	Processor Control Ckt
LC566	Data Interface (DI) Ckt
LC567B	Data Port Ckt
LC568	Voice Data Link
LC569	X-Ray Program Ckt
LC570	RMATS/Tape/SMDR Interface Ckt
LC570B*	RMATS/Tape/SMDR Interface Ckt
LC587	Scanner/Distributor Ckt
LC588	Line Ckt
LC594*	32K RAM Ckt
LC595*	88K EPROM Ckt
LC597	Dual RS232 Port Interface Ckt

\* Needed for an expanded DIMENSION PRELUDE PBX system.

flashing. These are LEDs 2 through 11 on the alarm panel shown in Fig. 4.

**2.07** For MD Tests 1 through 8, a successful test is indicated when the PASS LED lights on the alarm panel.

**2.08** For MD Test 9, a successful test is indicated when the following occur:

- (1) During MD9 memory test, the MEMORY and FAIL LEDs are on.
- (2) During tape load, LEDs MINOR through FAIL are on.

**2.09** For MD Test 0 through 8, an unsuccessful test is indicated by the FAIL lamp lighting. See the description of MD9 for the failure indications.

**Note:** An unsuccessful test for MD8 is also indicated on the MAAP.

**2.10** If the alarm panel LEDs are not proper for either the pass or fail indication, replace the LC557 circuit pack and repeat the test. If the LED display is unchanged, investigate the circuit pack (circuit pack) fingers for good contact with its terminal in the connector and restart test. If the display is still unchanged, check the back plane wiring for opens and/or shorts and restart test.

**2.11** Erratic, continuously changing symptoms of trouble on any MD test (or any other test) are

TABLE C

**MINIMUM CIRCUIT PACK CONFIGURATION TO RUN  
ALL X-RAY TESTS**

CARRIER	SLOT	CIRCUIT PACK
TRUNK CONTROL (J58891AA-1)	01	LC49
	10	LC50
	15	LC569
	16	LC555, LC595*
	17	LC556, LC594*
	18	LC557
	19	LC21B
	20	LC52
	21	LC20
	22	LC53
	23	LC22B
	24	LC560
	29	LC44
	32	LC570 or LC597, LC570B*
39	LC46	
40	LC47B	
LINE (J58891BA-1)	00	LC48
	01	LC50
	02	LC204
	10	LC49C
	11	LC588 (or LC02C)
	12	LC558 (or LC02C)

\* Needed for an expanded DIMENSION PRELUDE PBX system.

most likely caused by a circuit pack finger not making good contact with its terminal in the connector. The circuit packs involved should be carefully re-seated after checking the circuit pack land area (fingers) to make sure they are clean. If the erratic symptoms continue, one of the following problems could exist.

- (a) An intermittent open (broken conductor) on the back plane
- (b) An intermittent short (wire clipping, solder splash, bent terminal, etc) in the connector plane area.

A circuit pack device failure usually gives an unchanging trouble symptom.

**2.12** To replace a circuit pack in a carrier (see Fig. 6 for the flowchart), place the control switch (on the alarm panel) in the HALT position, replace the circuit pack, place the control switch in the GO position, and push the ALARM RETIRE button. When the replacement procedure is completed, all previously run MDs should be rerun. If more than one circuit pack is listed as the possible cause of a test failure, the term "replace in sequence" is used. "Replace in sequence" indicates the first circuit pack listed should be replaced and all of the MDs previously run should be repeated. If the same MD again fails, return the original circuit board, replace the second circuit board listed, and repeat all MDs previously run, etc. Section 554-102-108 (DIMENSION PRELUDE PBX—Central Processor—Maintenance Support Information) provides some additional information about MDs.

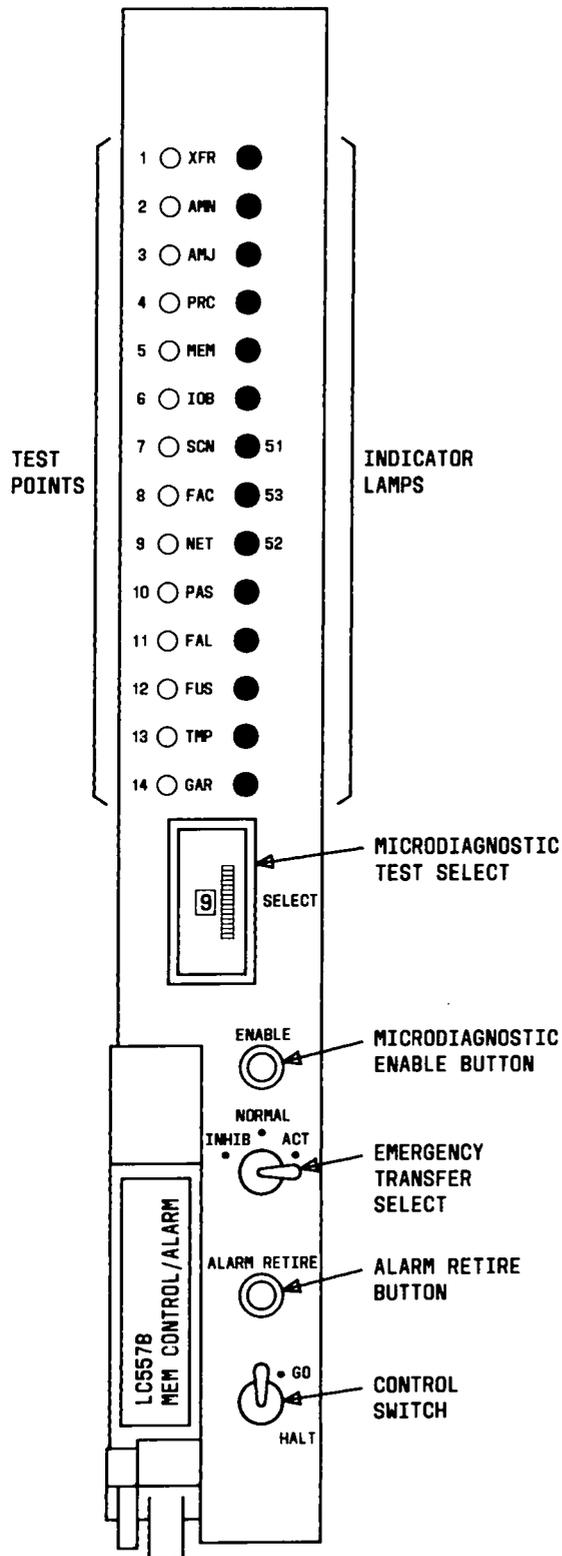


Fig. 4—Alarm Panel Faceplate for LC557 Memory Control/Alarm Circuit Pack

## Description of Microdiagnostics

### MD0

2.13 The purpose of MD0 is to test the condition flop (CF) and the initialization sanity check flop (ISC). It also tests the LC557 by lighting all alarm panel lamps. If MD0 fails, the PROC and FAIL alarm panel lamps light and an emergency transfer occurs. The MAJOR and XFER LEDs also light on the LC557 alarm panel. If MD0 fails, replace in sequence LC52, LC22, LC557, LC560, and repeat MD0.

### MD1

2.14 The purpose of MD1 is to test the priority encoder, no zero detect (NZD) flip-flop. If MD1 fails, replace in sequence LC53, LC22, LC21, and LC557, repeating MD0 and MD1 with each replacement.

### MD2

2.15 The purpose of MD2 is to test the register memory (RM). If MD2 fails, replace in sequence LC20, LC22, LC52, and LC557, repeating MD0 through MD2 with each replacement.

### MD3

2.16 The purpose of MD3 is to test the software interrupts and the real time clock (RTC). If MD3 fails, replace in sequence LC53 and LC557, repeating MD0 through MD3 with each replacement.

### MD4

2.17 The purpose of MD4 is to test the constant memory at address 0 for all 1s and at address 63 for all 0s. If MD4 fails, replace in sequence LC20 and LC557, repeating MD0 through MD4 with each replacement.

### MD5

2.18 The purpose of MD5 is to make a shift test. If MD5 fails, replace in sequence LC52, LC20, and LC557, repeating MD0 through MD5 for each replacement.

### MD6

2.19 The purpose of MD6 is to test the temporary memory (TM). If MD6 fails, replace in se-

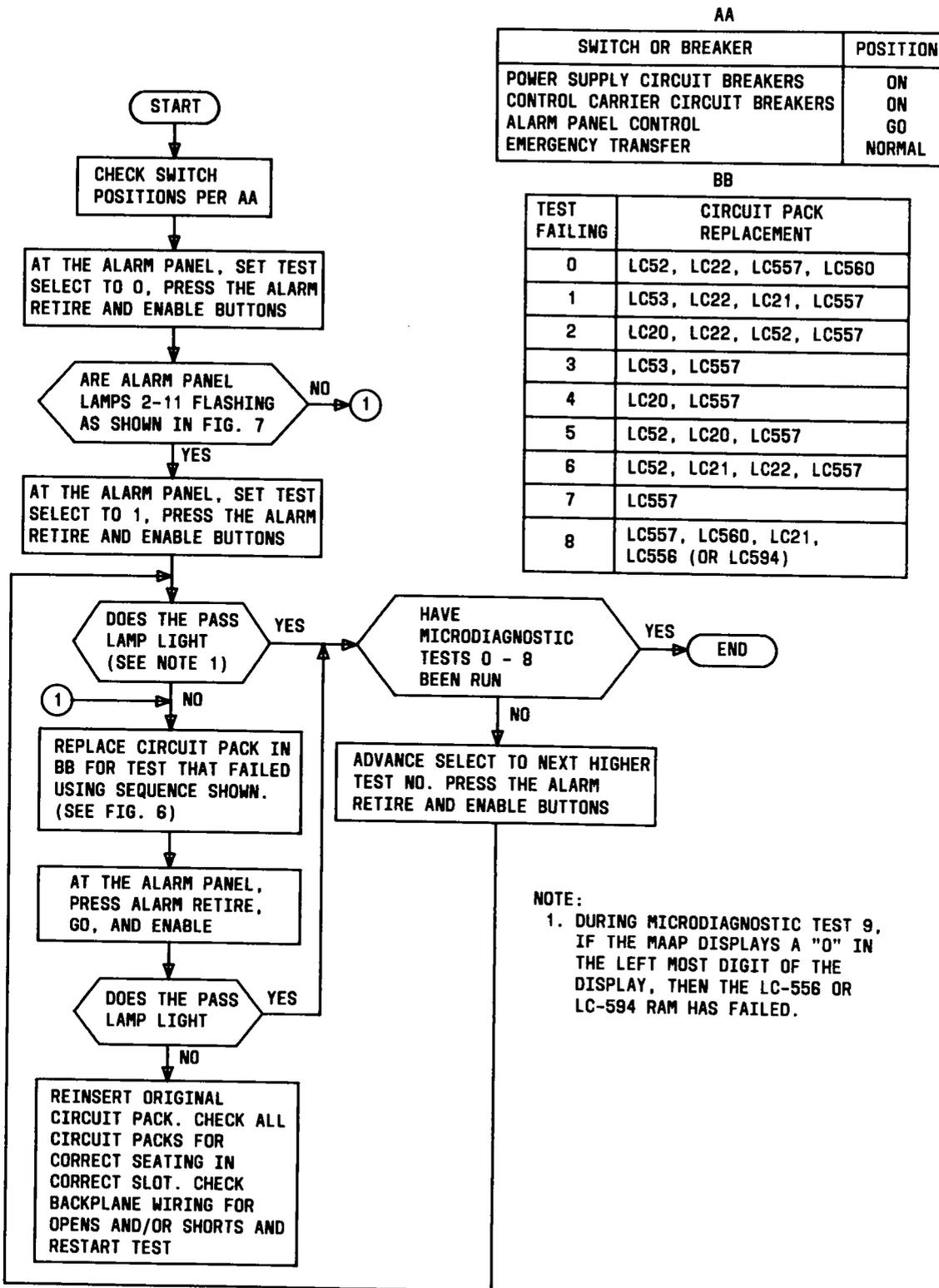


Fig. 5—Microdiagnostic Tests 0 Through 8

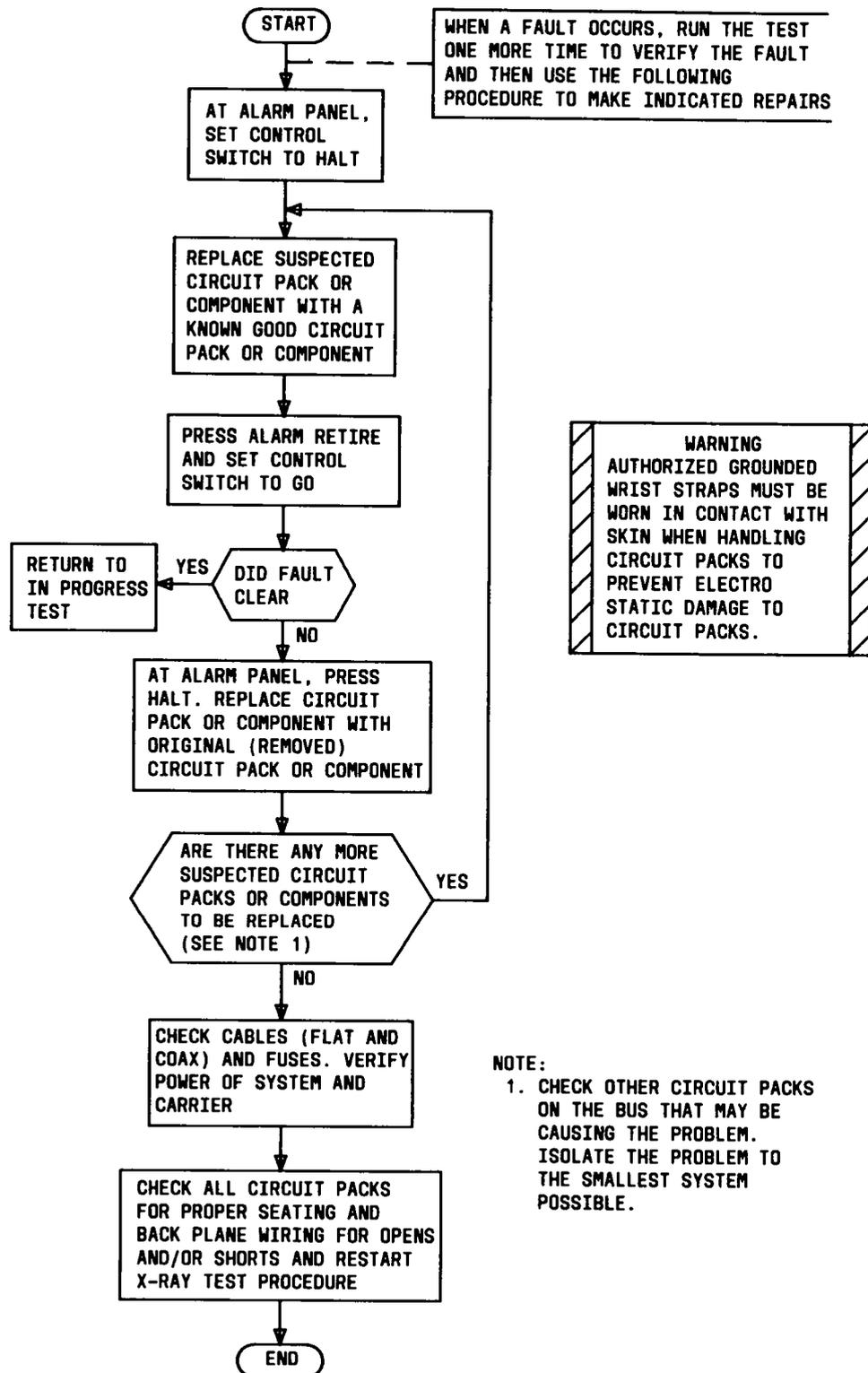


Fig. 6—Procedure for Replacing Circuit Packs or Components

quence LC52, LC22, and LC557, repeating MD0 through MD6 for each replacement.

### MD7

2.20 There is no test performed for MD7. The pass lamp is lit when the ENABLE button is pressed. Proceed to next test.

### MD8

2.21 The purpose of MD8 is to test the RAM (ie, LC556 or LC594) for addressing, data bits, controls, and parity. The LC555/ZLC14 (or ZLC16) EPROM is not checked in this MD test. The total time required to complete MD8 varies, depending on the RAM circuit pack being tested. The processor, upon a translation tape load, knows the size of the RAM [ie, LC556 (18K bytes) or LC594 (32K bytes)] by looking at a word stored in EPROM. If MD8 fails, replace in sequence LC557, LC560, LC20, and LC556 (or LC594) repeating MD0 through MD8 for each replacement.

**Note:** The MAAP should be plugged in during this test. If the MAAP displays a "0" in the left-most digit of the display, then the LC556 or LC594 RAM has failed.

### MD9

2.22 **Warning: Whenever a circuit pack is inserted or removed, the control switch must be set to the HALT position or have the system powered down to avoid hazardous voltages.**

2.23 The purpose of MD9 is to run a short version of MD0 through MD8 and then initiate the loading of the X-ray tape. The MD9 does not cycle repeatedly as do MD0 through MD8 (with the exception of MD7). Executing MD9 causes the call processing information in RAM (LC556 or LC594) to be cleared. The X-ray tape contains test data. Loading the X-ray tape causes this data to be read into RAM (LC556 or LC594). The procedure used to execute MD9 is as follows:

- (1) Set the control switch on the alarm panel (see Fig. 4) to the HALT position.
- (2) Set the emergency transfer switch to NORMAL.
- (3) Insert the LC569 (which is the X-ray program circuit pack).

(4) Insert the X-ray mini-cassette tape into the tape unit.

(5) Press the ALARM RETIRE button to reset the alarm panel alarms. The GUARD alarm should be the only alarm on. If not, try pressing this button several more times since there may be a poor contact. If this does not work, replace the LC557 and try pressing the ALARM RETIRE button several times again. If still no success, replace the LC21, LC53, or LC20 and re-try pressing the ALARM RETIRE button several times for each replacement.

(6) Plug in the MAAP.

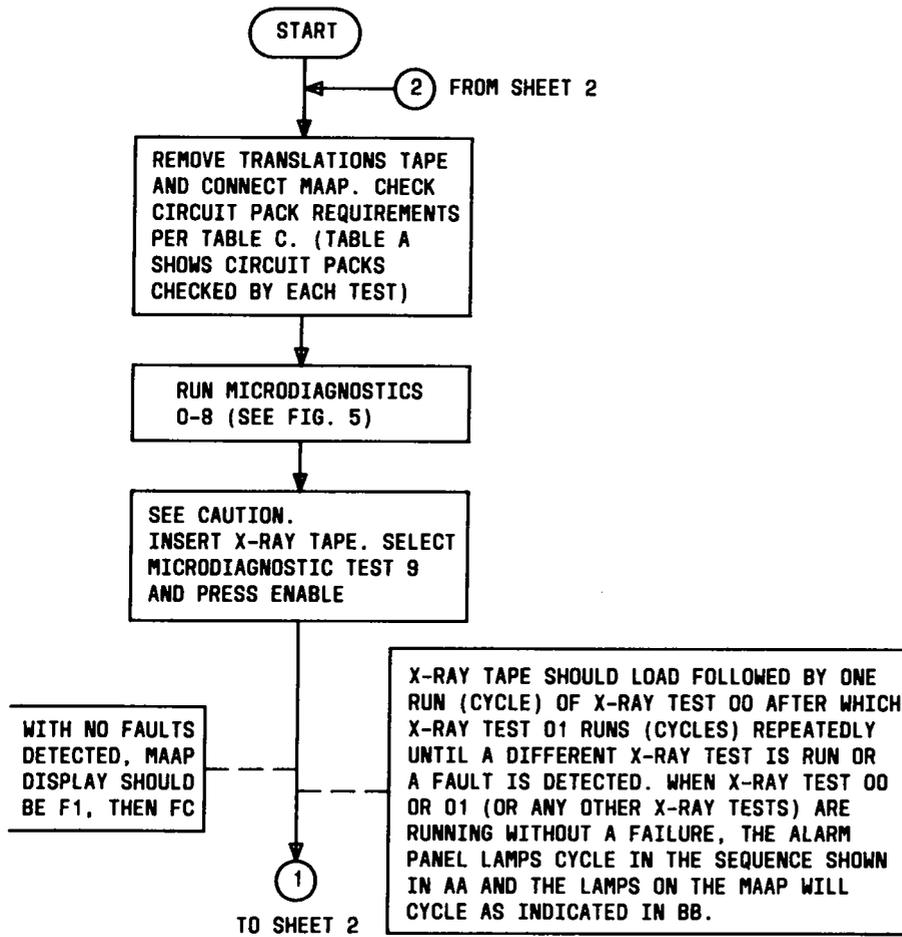
(7) Set the MD test select switch to position 9.

(8) Set the control switch to GO, and press the ENABLE button and start the tape load sequence shown in Fig. 7.

(9) The tape should start loading about 5 seconds after pressing the ENABLE button. If an alarm comes on, use MD0 through MD8 to find the bad board. If the alarm panel display is correct but there is no tape motion, the LC570 (or LC597), LC569, or the tape unit is suspect. Repeat MD0 through MD9 for each replacement.

(10) When the X-ray data is loaded, observe that all alarm panel LEDs extinguish and then the following alarm panel LEDs come on for approximately 0.2 seconds in the following order.

- MINOR
- MAJOR
- PROC
- MEM
- IOB
- SCAN
- FACILITY
- NETWORK
- PASS
- FAIL.



AA (NOTES 1 AND 2)

ALARM PANEL LAMPS	SEQUENCE OF ONE LAMP CYCLE									
	1ST	2ND	3RD	4TH	5TH	6TH	7TH	8TH	9TH	10TH
1. TRANSFER	○	○	○	○	○	○	○	○	○	○
2. MINOR	◇	○	○	○	○	○	○	○	○	○
3. MAJOR	○	◇	○	○	○	○	○	○	○	○
4. PROC	○	○	◇	○	○	○	○	○	○	○
5. MEM	○	○	○	◇	○	○	○	○	○	○
6. I/O BUS	○	○	○	○	◇	○	○	○	○	○
7. SCAN	○	○	○	○	○	◇	○	○	○	○
8. FACILITY	○	○	○	○	○	○	◇	○	○	○
9. NETWORK	○	○	○	○	○	○	○	◇	○	○
10. PASS	○	○	○	○	○	○	○	○	◇	○
11. FAIL	○	○	○	○	○	○	○	○	○	◇
12. FUSE	○	○	○	○	○	○	○	○	○	○
13. TEMP	○	○	○	○	○	○	○	○	○	○
14. GUARD	○	○	○	○	○	○	○	○	○	○

FLASHING SEQUENCE OF ALARM PANEL LAMPS (0.2 SEC FLASH)

NOTES:

1. The symbol "◇" represents a lighted lamp.
2. The PASS lamp flashes every other cycle of a test.

BB

BUSY OUT	WAIT	ERROR	
○	○	○	1ST CYCLE 0.4 SEC
◇	○	○	2ND CYCLE 0.4 SEC
◇	◇	○	3RD CYCLE 0.4 SEC
◇	◇	◇	4TH CYCLE 0.4 SEC

FLASHING SEQUENCE OF MAAP INDICATOR LAMPS (0.4 SEC FLASH)

CAUTION:  
NOTIFY ATTENDANT  
THAT X-RAY TESTS  
WILL INTERRUPT  
SERVICE.

Fig. 7—Tape Loading Procedure (Sheet 1 of 2)



**Note:** Each of these alarm indicator lamps light for 0.2 seconds when the tape is loaded and X-ray Test 00 is completed. A failure to load the tape is indicated by either the alarm panel lamps not lighting in order, the FAIL lamp not lighting, or possibly a fault code will be displayed.

- (11) The system starts running Test 01 approximately 5 seconds after the FAIL lamp comes on. The tester has MAAP control after Test 00 is completed.

### MAAP Test (Panel Tests 1, 2, and 3)

**2.24** After the X-ray tape has been loaded and Test 01 has run a successful pass, the manual MAAP X-ray panel tests (1, 2, and 3) should be performed. These manual tests are necessary to check functions that cannot be checked via a selected X-ray test (00 through 47). The MAAP Test 1 is run automatically during test 02. The MAAP tests can be performed while any selected X-ray test is running without affecting the selected test.

**Note:** These manual tests can also be used to test the Customer Administration Panel (CAP).

**2.25** The procedure to run MAAP Test 1 is shown in Fig. 8 and 9. The MAAP Test 1 stops automatically after 1 minute in any test except Test 01. If run during Test 01, MAAP Test 1 can be stopped by pressing the MAAP TEST button and the digit 2.

**2.26** The MAAP Test 2 is the clock check routine. It can be started by pressing the PANEL TEST button and the digit 2. This should clear the MAAP display except for the clock.

**2.27** The procedure to run MAAP Test 3 is shown in Fig. 10.

## 3. X-RAY TESTS

### GENERAL

**3.01** X-ray is a test program designed to test the hardware operation of the system. The test program consists of a series of tests (octally numbered 00 through 47) which are stored on the LC569. The test program instructs the equipment to perform a specific operation and then compares the results. If the results of the operation are improper, a fault code

is generated. Different hardware failures cause different fault codes. Table D provides specific information for each fault code. Part 4 of this document describes how faults are displayed and corrected.

**3.02** Microdiagnostics 0 through 9 are run manually at the alarm panel before X-ray is run. When MD9 is run, it initiates loading of the X-ray tape. Once the tape is loaded, Test 00 is run automatically. Test 00 does not cycle, it runs only once and if it passes, Test 01 is run automatically. With no manual intervention, Test 01 continues to cycle indefinitely unless a fault is detected or the test is manually interrupted at the alarm panel or MAAP. When detecting a fault, the test stops, a fault code is displayed on the alarm panel, and a fault code is also displayed on the MAAP (if the MAAP is operative). The MAAP is not operative during an automatically run Test 00 nor during the first pass of an automatically run Test 01. When Test 01 (or any other test) is cycling, the alarm panel indicator lamps 2 through 9 and 11 each turn on for 0.2 seconds as shown in Fig. 7-AA. These lamps cycle on until a fault occurs or the test is stopped. Each lamp cycle is 2.4 seconds long and thus is not synchronized with any test cycling. The cycling of these lamps indicate a test is running. However, the PASS lamp (ie, lamp 10) changes state each time a successful pass (cycle) of a test is completed (ie, on one cycle and off one cycle). The PASS lamp does not cycle in sequence with the other lamps. While a test is running, the MAAP lamps also cycle as shown in Fig. 7-BB.

**3.03** While an X-ray test is running successfully, the left-most seven digits on the MAAP displays the accumulated time since tape load. What occurs when a fault is detected is dependent on the mode the test was selected by.

### SELECTING X-RAY TESTS

**3.04** If no MAAP is connected to the system, testing is limited to the automatic X-ray Tests 00 and 01. Using the MAAP, any of the available tests can be manually selected. Table A provides the name of each X-ray test, the circuit packs tested, the X-ray programs used per test and the flowchart figure number.

**3.05** Two modes of testing are available for selection when selecting tests at the MAAP. They are the execute and repeat modes. Any selected test in either mode can be stopped by pressing the

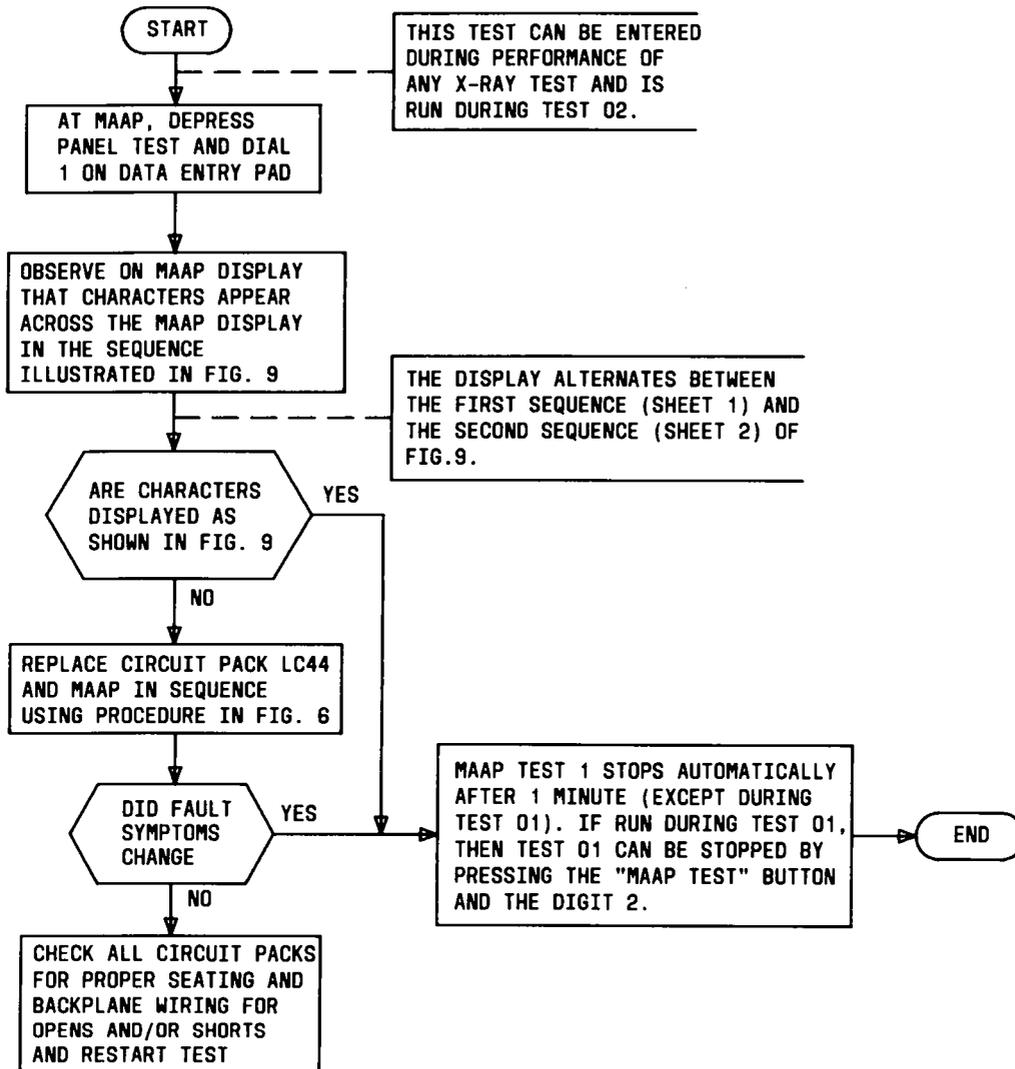


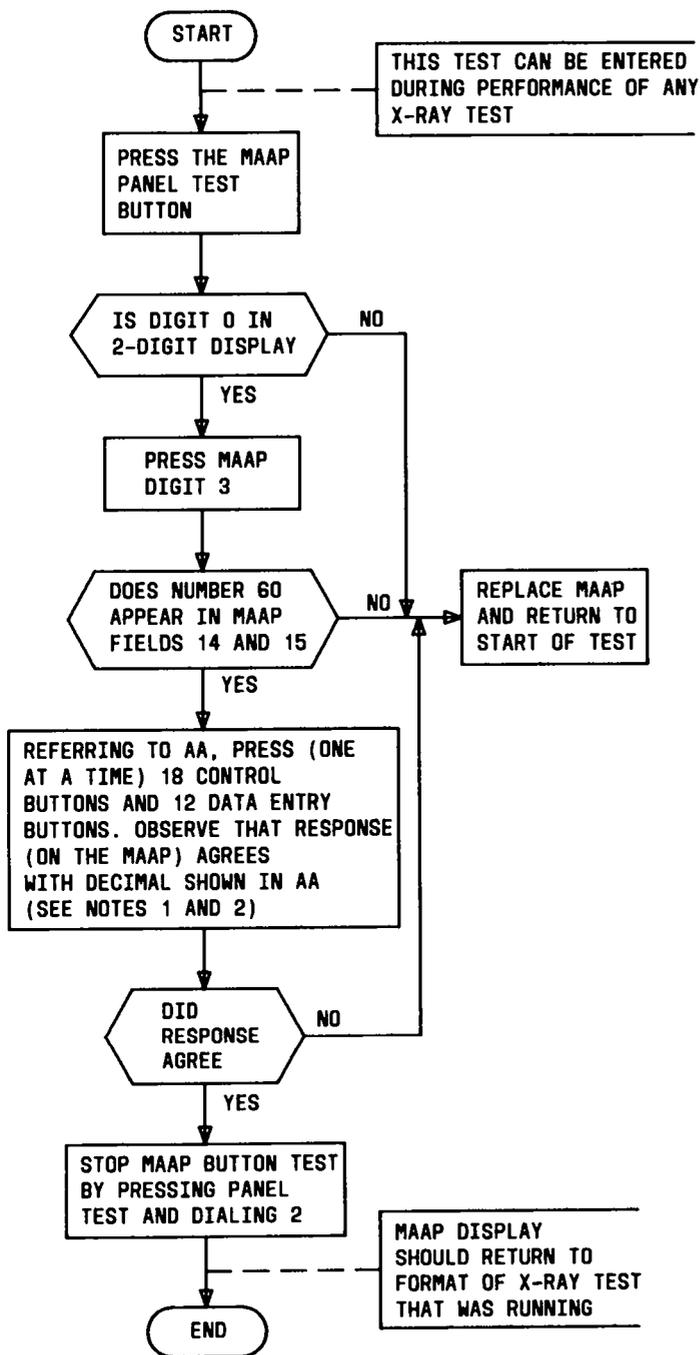
Fig. 8—Procedure to Run MAAP Test (MAAP Test 1)

STEP	CHARACTER DISPLAY																	
1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
3	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
4	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
5	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
6	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
7	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
8	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
9	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
10	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.	9.
11	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.	⊠.
12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
21	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
22	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
23	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
24	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
25	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
26	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
27	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠
28																		
29																		
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31																		
32																		

Fig. 9—MAAP Display Stepping Across 16-Digit Display (Sheet 1 of 2)

STEP	CHARACTER DISPLAY																		
	0.																		
1	0.																		
2	1.	0.																	
3	2.	1.	0.																
4	3.	2.	1.	0.															
5	4.	3.	2.	1.	0.														
6	5.	4.	3.	2.	1.	0.													
7	6.	5.	4.	3.	2.	1.	0.												
8	7.	6.	5.	4.	3.	2.	1.	0.											
9	8.	7.	6.	5.	4.	3.	2.	1.	0.										
10	9.	8.	7.	6.	5.	4.	3.	2.	1.	0.									
11	⊠.	9.	8.	7.	6.	5.	4.	3.	2.	1.	0.								
12	.	⊠.	9.	8.	7.	6.	5.	4.	3.	2.	1.	0.							
13	.	.	⊠.	9.	8.	7.	6.	5.	4.	3.	2.	1.	0.						
14	-.	.	.	⊠.	9.	8.	7.	6.	5.	4.	3.	2.	1.	0.					
15	.	-.	.	.	⊠.	9.	8.	7.	6.	5.	4.	3.	2.	1.	0.				
16	.	.	-.	.	.	⊠.	9.	8.	7.	6.	5.	4.	3.	2.	1.	0.			
17	0	.	.	.	.	.	⊠.	9.	8.	7.	6.	5.	4.	3.	2.	1.		0.	
18	1	0	.	.	-.	.	.	⊠.	9.	8.	7.	6.	5.	4.	3.	2.		1.	0.
19	2	1	0	.	.	-.	.	.	⊠.	9.	8.	7.	6.	5.	4.	3.		2.	1.
20	3	2	1	0	.	.	-.	.	.	⊠.	9.	8.	7.	6.	5.	4.		3.	2.
21	4	3	2	1	0	.	.	-.	.	.	⊠.	9.	8.	7.	6.	5.		4.	3.
22	5	4	3	2	1	0	.	.	-.	.	.	⊠.	9.	8.	7.	6.		5.	4.
23	6	5	4	3	2	1	0	.	.	-.	.	.	⊠.	9.	8.	7.		6.	5.
24	7	6	5	4	3	2	1	0	.	.	-.	.	.	⊠.	9.	8.		7.	6.
25	8	7	6	5	4	3	2	1	0	.	.	-.	.	.	⊠.	9.		8.	7.
26	9	8	7	6	5	4	3	2	1	0	.	.	-.	.	.	⊠.		9.	8.
27	⊠	9	8	7	6	5	4	3	2	1	0	.	.	-.	.	.		⊠.	9.
28		⊠	9	8	7	6	5	4	3	2	1	0	.	.	-.	.		.	⊠
29			⊠	9	8	7	6	5	4	3	2	1	0	.	.	-.		.	.
30	-			⊠	9	8	7	6	5	4	3	2	1	0	.	.		-.	.
31		-			⊠	9	8	7	6	5	4	3	2	1	0	.		.	-.
32			-			⊠	9	8	7	6	5	4	3	2	1	0		.	.

Fig. 9—MAAP Display Stepping Across 16-Digit Display (Sheet 2 of 2)



AA	
KEYS	DECIMAL DISPLAY
PANEL TEST	0.
PROC NO.	1.
RUN TAPE	2.
WORD	3.
RESET	4.
REPEAT	5.
BLANK	10.
BLANK	11.
SEIZE	12.
RLS BUS/OUT	13.
BUSY OUT	14.
PARK TAPE	15.
EXECUTE	20.
DISPLAY	21.
STEP	22.
REMOVE	23.
ADD	24.
CHANGE	25.
1	40.
2	50.
3	60.
4	41.
5	51.
6	61.
7	42.
8	52.
9	62.
CLEAR ENTRY	43.
0	53.
ENTER	63.
"BAD BUTTON CODE"	64.

NOTES:

1. An incorrect display implies a defective MAAP. The MAAP is scanned by the processor to insure the buttons are released - this takes 2 seconds.
2. If the ERROR lamp is flashing during MAAP test, the system is not error free and the current X-ray test has not run successfully, a prerequisite to MAAP testing. The MAAP test must be run during another running test (such as Test 01 successfully) to be checked. Otherwise, another detected fault will stop the MAAP test and flash the MAAP ERROR lamp.

Fig. 10—Procedure to Run MAAP Button Test (MAAP Test 3)

**TABLE D**  
**FAULT CODES**

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
3	00,01	None	Bad parity found in memory after power failure.	Program will automatically rest without displaying the fault code. If the fault is displayed, replace in sequence LC21 and LC20B.
5	00,01	AP*	Forward branch instruction failed.	Perform microdiagnostic test and replace in sequence circuit packs LC560, LC52 and LC20B.
6	00,01	AP*	Improper jump to location X(400).	Perform microdiagnostic test and replace in sequence LC20B, LC560, LC52, and LC53.
7	00,01	AP*	RM register bit stuck.	Perform microdiagnostic test and replace LC20B.
11	00,01	AP*	Data dependent RM register fault.	Perform microdiagnostic test and replace in sequence LC20B and LC52.
12	00	AP*	Branch-back instruction failed.	Perform microdiagnostic test and replace in sequence LC560, LC52, and LC20B.
13	00	AP*	An exclusive OR operation improperly set condition flop.	Perform microdiagnostic test and replace in sequence LC52, LC22B, LC560 and LC20B.
14, 15, 16	00	AP*	Failure of an instruction to set condition flop or failure of a conditional branch instruction.	Perform microdiagnostic test and replace in sequence LC560, LC52, and LC20B.
17	00	AP*	Sixteen bits of immediate data were loaded and read; word read failed the comparison with word loaded test.	Perform microdiagnostic test and replace in sequence LC52, LC560, and LC20B.
21	00	AP*	RM3 has a bit stuck at zero.	Perform microdiagnostic test and replace in sequence LC20B and LC52.

\* This display format indicates no fault codes will be displayed at the MAAP. To determine the fault code, observe the indicator lights on the alarm panel. Add the assigned value of these indicators to get the fault code number (refer to Fig. 7).

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
22	00	AP*	A data comparison was made that failed to zero condition flop.	Perform microdiagnostic test and replace in sequence LC22B, LC52, and LC560.
23	00	F3	No subroutine enabled.	Replace in sequence LC560, LC52, and LC20B.
24	00	AP*	Failure of an attempt to load one register with data from another.	Perform microdiagnostic test and replace in sequence LC20B, LC52, LC22B, and LC560.
25	00	AP*	The register to be loaded has a bit stuck at 1 or same as fault code 24.	Perform microdiagnostic test and replace in sequence LC20B, LC52, LC22B, and LC560.
26	00	AP*	An attempt was made to add 1 to contents of a register and attempt failed.	Perform microdiagnostic test and replace in sequence LC20B, LC52, LC22B, and LC560.
27	00,01	F3	Wrong program address in RM1 while testing hardware interrupt.	Perform microdiagnostic test and replace in sequence LC20B, LC52, LC22B, and LC53.
30, 31	00	AP*	Sixteen bits of data were added to a register and condition flop failed to reset or condition flop was not set to indicate overflow.	Perform microdiganostic test and replace in sequence LC52 and LC20B.
32	00	AP*	A rotate left operation of data in a register failed.	Perform microdiagnostic test and replace in sequence LC52, LC20B, and LC560.
33	00	AP*	Same as fault code 32.	Same as fault code 32.
35	00	AP*	Condition flop was not correctly set to 0 by a register comparison operation.	Perform microdiagnostic test and replace in sequence LC52, LC20B, and LC22B.
36, 37	00	AP*	A load register operation failed or condition flop was not correctly set to 1 by a register comparison operation.	Perform microdiagnostic test and replace in sequence LC52 and LC20B.

\* This display format indicates no fault codes will be displayed at the MAAP. To determine the fault code, observe the indicator lights on the alarm panel. Add the assigned value of these indicators to get the fault code number (refer to Fig. 7).

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
41	00	AP*	Complement of data operation failed.	Perform microdiagnostic test and replace LC52.
42	00	AP*	A register load operation failed.	Perform microdiagnostic test and replace in sequence LC20B, LC22B, and LC52.
43	00	AP*	A register load with a word from memory failed.	Perform microdiagnostic test and replace in sequence LC557, LC20B, LC21, LC52, and LC22B.
44	00	AP*	Branched to incorrect location.	Perform microdiagnostic test and replace in sequence LC557 and LC52.
45	00	AP*	Branch complete, but register did not increment.	Perform microdiagnostic test and replace in sequence LC20B and LC52.
46	00	AP*	Branched to wrong address.	Perform microdiagnostic test and replace in sequence LC20B, LC52, LC557.
47, 50	00	AP*	Data into or out of hold get counter failed or the hold get counter was not reset after a branch to a saved address.	Perform microdiagnostic test and replace in sequence LC52, LC20B, and LC22B.
51	00	AP*	Branch instruction was ignored.	Perform microdiagnostic test and replace LC52.
52	00	AP*	Branched, but lost return address.	Perform microdiagnostic test and replace in sequence LC20B and LC52.
53	00	F3	A set bit instruction failed to set correct bit.	Replace in sequence LC20B and LC22B.
54	00	F3	After a test bit operation, condition flop was in wrong state.	Replace LC52.
55	00	AP*	A bit is stuck at 1 in RM4.	Replace LC20B.
56	00	AP*	Branched to a wrong program address.	Replace in sequence LC21, LC557, and LC20B.
57	00	AP*	A performed addition is incorrect.	Replace LC52.

\* This display format indicates no fault codes will be displayed at the MAAP. To determine the fault code, observe the indicator lights on the alarm panel. Add the assigned value of these indicators to get the fault code number (refer to Fig. 7).

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
61	00	F3	Cannot zero real time clock or cannot load real time clock into a register.	Replace LC53.
62	00	F3	The processor is running at least 25 percent too fast or real time clock is too slow.	Replace in sequence LC53 and LC22B.
63	00	F3	Cannot load item vector table base register with 1s.	Replace LC52.
64	00	F3	Cannot load 0s into transfer vector table base register.	Replace LC52.
65	00	F3	Cannot load 0s into item vector table register.	Replace LC52.
66	00	F3	Cannot load transfer vector table register with 1s.	Replace LC52.
67	00	F3	Cannot load item vector table base address.	Replace LC52.
70	00	F3	Cannot load transfer vector table base address.	Replace LC52.
71	00	F3	The processor is running at least 25 percent too fast or real time clock is running too slow.	Replace in sequence LC53, LC22B, LC557, and LC52.
72	00	F3	A 25-ms interrupt never occurred.	Replace in sequence LC53 and LC22B.
73	00	F3	A 10-ms program interrupt is occurring when it should be masked out.	Replace in sequence LC20B, LC22B, and LC53.
75	00	F3	Failure of test for 0 bit in RM4.	Replace LC20B.
76	00	AP*	A 25-ms program interrupt occurred only once. Probably program interrupt and instruction not working.	Replace in sequence LC22B and LC53.

\* This display format indicates no fault codes will be displayed at the MAAP. To determine the fault code, observe the indicator lights on the alarm panel. Add the assigned value of these indicators to get the fault code number (refer to Fig. 7).

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
101, 102	00	F3	A 10-ms program interrupt never occurred or took longer than 11-ms.	Replace in sequence LC22B, LC53, and LC20B.
103	00	F3	The 10-ms interrupt rate is wrong.	Replace in sequence LC22B and LC20B.
104	00	F3	The 25-ms program interrupt rate is wrong when 10-ms program interrupt is on.	Replace in sequence LC22B, LC20B, and LC53.
105	00	F3	Instruction to disable program interrupt failed.	Replace LC22B.
106, 107	00	F3	Data from RM0 or RM1 was put into memory and read from memory into RM3. This operation failed.	Replace in sequence LC20B and LC52.
110	00	F3	Illegal OP code interrupt failed to occur for an OP code of 0 (illegal code).	Replace in sequence LC52, LC22B, and LC560.
113	00,01	F3	Microparity interrupt failed to occur.	Replace in sequence LC560, LC22B, LC21, and LC53.
114	00,01	F3	Branch-allow interrupt failed, branched to an instruction where branch-allow bit was 0.	Replace in sequence LC52, LC22B, LC560.
115	00,01	F3	A branch-to-address instruction acted similarly to a no-OP instruction.	Replace in sequence LC52 and LC560.
116	00,01	F3	Program sanity interrupt occurred too soon.	Replace in sequence LC22B and LC52.
117	00,01	F3	RM3 data was compared to RM4 data and failed.	Replace in sequence LC20B and LC52.
120	00,01	F3	Program sanity failed to occur in 450 ms.	Replace in sequence LC22B and LC53.
121	00,01	F3	Test of the initialization sanity check flip-flop did not set condition flip-flop or instruction to set initialization sanity check flip-flop failed.	Replace in sequence LC22B and LC52.

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
122	00,01	F3	Test of initialization sanity check flip-flop did not reset condition flip-flop.	Replace in sequence LC22B and LC52.
123	00,01	F3	Branch occurred without correct condition.	Replace LC52.
124	00	F5	An unexpected hardware interrupt occurred.	Replace in sequence LC53, LC22B, LC560, LC48, LC52, and LC21.
125	00	F5	Interrupt occurred a right time, but was wrong type interrupt.	Replace in sequence LC53 and LC22B.
126	06	F3	Emergency transfer failed or took longer than 20 seconds.	Replace in sequence LC557 and LC52.
127	00,01	F5	Expected interrupt occurred, but no return code was found.	Replace LC52.
130	00,01	F3	Failed a bit test of RM4 after data was loaded from memory.	Replace in sequence LC20B and LC557.
131, 132	00,01	F3	The 25-ms program interrupt failed to decrement hold get register or failed to load proper return address in hold get area.	Replace in sequence LC22B, LC52, and LC53.
133, 134	00,01	F3	The 10-ms program interrupt failed to decrement hold get register or failed to load proper return address in hold get area.	Replace in sequence LC22B, LC52, and LC53.
135	31	F3	RM 0 has a bit stuck at 0.	Replace in sequence LC20B and LC52.
136	31	F3	Load-a-register instruction failed.	Replace in sequence LC20B, LC52, and LC560.
137, 140	31	F3	A register bit is stuck.	Replace LC20B.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
141, 142	31	F3	An exclusive OR operation failed to reset condition flop or modified data in the wrong register.	Replace in sequence LC52 and LC20B.
143	31	F3	An exclusive OR operation failed to set condition flop.	Replace in sequence LC52 and LC20B.
144	31	F3	An exclusive OR operation failed to zero correct register.	Replace in sequence LC20B and LC52.
145, 146	31	F3	Insert bit operation failed.	Replace LC20B.
147	31	F3	A branch on not-condition branched when condition flop was 1.	Replace LC52.
150	31	F3	A branch on not-condition did not branch when condition flop was 0.	Replace in sequence LC52 and LC560.
151	31	F3	Branched long when condition flop was 0.	Replace in sequence LC52 and LC560.
152	31	F3	Did not branch long when condition flop was 1.	Replace in sequence LC52 and LC560.
153	31	F3	Branched long on not-condition when condition flop was 1.	Replace in sequence LC52 and LC560.
154, 155	31	F3	Did not branch long on not-condition when condition flop was 0 or backware failure.	Replace in sequence LC52 and LC560.
156, 157	31	F3	Register operation failed.	Replace in sequence LC20B, LC557, LC52, LC21, and LC560.
160	31	F3	Store contents of a register into another register failed.	Replace in sequence LC20B, LC52, LC560.

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
161, 162	31	F3	Load data from memory into a register failed or failure to store data from a register at an address from another register.	Replace in sequence LC20B, LC52, LC557, LC21, and LC560.
163	31	F3	Failure to load memory data into a register.	Replace in sequence LC20B, LC52, LC21, LC557, and LC560.
164, 165	31	F3	Data stored or loaded has improper value.	Replace in sequence LC20B, LC560.
166, 167	31	F3	RM13 or RM15 was not updated by a store or load instruction.	Replace in sequence LC20B and LC52.
170	31	F3	A store at location instruction failed to store proper value.	Replace in sequence LC20B and LC52.
171	31	F3	A load at location instruction failed to load proper value.	Replace in sequence LC20B and LC52.
172, 173	31	F3	A store at location or a load at location instruction failed to load register address 0 or 1.	Replace in sequence LC52 and LC20B.
174	31	F3	A store at address instruction failed to store correctly.	Replace in sequence LC20B and LC52.
175	31	F3	A load at address instruction failed to load correctly.	Replace in sequence LC20B and LC52.
176	31	F3	A store or load, at address instruction, updated register address 0 incorrectly.	Replace in sequence LC52 and LC20B.
201	31	F3	Inserting data under a mask into a register failed.	Replace in sequence LC53, LC20B, LC52 and LC560.

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
202	31	F3	Inserting data under a mask into memory failed.	Replace in sequence LC53, LC20B, LC52 and LC21.
203	31	F3	Data input into memory under a mask was read out into a register. Readout value was incorrect.	Replace in sequence LC557, LC20B, LC52, and LC53.
204	31	F3	Data input into a register under a variable mask has incorrect value.	Replace in sequence LC53, LC20B, and LC52.
205	31	F3	Cannot load a register with data under variable masking.	Replace in sequence LC560, LC20B, LC52, and LC53.
206, 207	31	F3	Cannot zero a register or cannot exchange data between two registers.	Replace in sequence LC20B, LC52, LC560,
210	31	F3	A register content was not correctly updated after a store or load operation.	Replace in sequence LC20B and LC52.
211	31	F3	A register load under a mask failed.	Replace in sequence LC53, LC52, LC20B and LC560.
212, 213	31	F3	An AND operation failed.	Replace in sequence LC52 and LC560.
214, 215 216, 217	31	F3	An inclusive OR operation failed.	Replace in sequence LC52 and LC560.
220	31	F3	An exclusive OR operation did not reset condition flop.	Replace in sequence LC52 and LC560.
221, 223	31	F3	A complement operation did not set or reset condition flop.	Replace in sequence LC52 and LC560.
222	31	F3	A complement operation failed.	Replace in sequence LC52 and LC560.
224	31	F3	A compare operation did not reset condition flop.	Replace in sequence LC52 and LC560.

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
225	31	F3	A compare operation changed register content.	Replace in sequence LC52, LC20B, and LC560.
226	31	F3	A compare operation did not set condition flop.	Replace in sequence LC52 and LC560.
227	31	F3	A compare operation under mask did not reset condition flop.	Replace in sequence LC53, LC52, LC560.
230	31	F3	A compare operation under mask changed a register content.	Replace in sequence LC53, LC20B, LC52, and LC560.
231	31	F3	A compare operation under mask did not set condition flop.	Replace in sequence LC53, LC52, and LC560.
232, 235, 240	31	F3	An add operation did not reset condition flop.	Replace in sequence LC52, LC20B, and LC560.
233, 236, 241	31	F3	An add operation did not set condition flop.	Replace in sequence LC52 ad LC560.
234, 237, 242	31	F3	An add operation gave incorrect answer.	Replace in sequence LC52 and LC560.
243		F3	An add 1 to memory operation failed to reset condition flop.	Replace in sequence LC52 and LC560.
244	31	F3	An add 1 to memory operation failed to increment memory.	Replace in sequence LC52, LC557, LC21, and LC560.
245	31	F3	An add 1 to memory operation failed to set condition flop.	Replace in sequence LC52 and LC560.
246, 253, 255	31	F3	A subtract operation failed to set condition flop.	Replace in sequence LC52 and LC560.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
247, 252, 256	31	F3	A subtract operation gave wrong answer.	Replace in sequence LC52 and LC560.
250, 251, 254	31	F3	A subtract operation failed to reset condition flop.	Replace in sequence LC560 and LC52.
257	31	F3	A load register operation failed.	Replace in sequence LC20B, LC52, and LC560.
260, 261	31	F3	A set bit or 0 bit in register operation failed.	Replace in sequence LC20B, LC52, and LC560.
262, 263, 264	31	F3	A test bit or 0 bit in register operation failed.	Replace in sequence LC20B, LC52, and LC560.
265	31	F3	A set bit in register operation failed.	Replace in sequence LC20B, LC52, and LC560.
266	31	F3	A 0 bit in memory operation failed.	Replace in sequence LC52, LC21, LC557, and LC560.
267	31	F3	A test bit in memory operation failed.	Replace in sequence LC52, LC21, LC557, and LC560.
270	31	F3	A set bit in memory operation failed.	Replace in sequence LC52, LC21, LC557, LC560.
271, 273	31	F3	A rotate data to right operation failed.	Replace in sequence LC22B, LC20B, LC52, and LC560.
272, 274	31	F3	A rotate data to left operation failed.	Replace in sequence LC22B, LC20B, LC52, and LC560.
275	31	F3	A test for all 0s operation failed to set condition flop.	Replace in sequence LC52, LC20B, and LC560.
276	31	F3	A test for all 0s operation failed to reset condition flop.	Replace in sequence LC52 and LC20B.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
277	31	F3	A compare and rotate under mask operation failed to set condition flop.	Replace in sequence LC53, LC20B, LC52, and LC560.
300	31	F3	A compare and rotate under mask operation failed to reset condition flop on a mismatch.	Replace in sequence LC52, LC53, LC20B, and LC560.
301	31	F3	A compare and rotate under an all 1s mask operation failed to set condition flop.	Replace in sequence LC53, LC52, LC20B, and LC560.
302	31	F3	A compare and rotate under mask operation failed to set condition flop.	Replace in sequence LC53, LC20B, LC52, and LC560.
303	31	F3	A find low 0 operation failed to set condition flop.	Replace in sequence LC52, LC21, and LC560.
304	31	F3	A find low 0 operation identified wrong bit as the first 0.	Replace in sequence LC52, LC21, and LC560.
305	31	F3	A find low 0 operation failed to set low 0 to 1.	Replace in sequence LC52 and LC560.
306	31	F3	A find low 0 operation failed to reset condition flop.	Replace in sequence LC52 and LC560.
307	31	F3	A find low 0 operation changed a register contents when no 0 was found.	Replace in sequence LC52 and LC560.
310*	05	F3	Status of LC204 (or LC30) incorrect.	Replace LC204 (or LC430).
311*	05	F3	Status of LC204 (or LC430) incorrect.	Replace LC204 (or LC430).

\* These fault codes are unique conditions, rarely encountered. Codes 310 and 311 are generated by a test operation that is dependent upon some portions of the LC02Bs working correctly. After applying the repair procedures, if the fault still exists, unplug all LC02Bs except the first one in line carrier 0 and run test 5. If the test now finds no faults, plug in the LC02Bs one at a time until the packs or pack causing the fault is located. Replace the faulty LC02Bs. A missing or poorly connecting fuse for LC02Bs could also cause this code. With all but one LC02B unplugged, if the fault still exists, replace the LC02B and verify the power connections to its connection.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
312*	05	FB	At least one tone failed and: If tone which failed is No. 10 or less.  If tone which failed is No. 200 or less.  If tones which failed are No. 377 (all tones).  If tone which failed is between 400 — 4000.	Replace in sequence LC204 (or LC430) and LC45 (or 433).  Replace in sequence LC204 (or LC430) and LC45 (or 433).  Replace in sequence LC204 (or LC430) and LC48 and all LC50's (one at a time).  LC02B or fusing to LC02B; solder or wrong value of resistor on carrier backplane; flat cable; replace LC17B.
313	04	F3	No acknowledgement of send input/output message to scanner.	Replace LC46.
314	04	F3	No acknowledgement of send input/output message to network control.	Replace LC47B (minimum of one LC45 (or 433) and two or three LC558s).
315	04	F3	No acknowledgement of take input/output message to network control.	Replace LC46.
316-326		None	(Not used).	
327	03	F3	No acknowledgement of take input/output message to scanner.	Replace in sequence LC46, LC47B (minimum of three LC02Bs or one LC45 (or 433) and two LC02Bs required in basic line carrier 0).

\* These fault codes are unique conditions, rarely encountered. Codes 310 and 311 are generated by a test operation that is dependent upon some portions of the LC02Bs working correctly. After applying the repair procedures, if the fault still exists, unplug all LC02Bs except the first one in line carrier 0 and run test 5. If the test now finds no faults, plug in the LC02Bs one at a time until the packs or pack causing the fault is located. Replace the faulty LC02Bs. A missing or poorly connecting fuse for LC02Bs could also cause this code. With all but one LC02B unplugged, if the fault still exists, replace the LC02B and verify the power connections to its connection.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
330	03	F6	Scanner solid fault.	Replace in sequence LC46, LC47B.
331	03	F6	Scanner solid fault.	Replace in sequence LC46, LC47B.
332-345	03	F6	Scanner solid fault.	Unplug all LC49C (or LC41B) circuit packs, except the one in carrier 0. Run test 5. If test passes, plug in LC49C (or LC41B) circuit packs, one at a time. Replace any one which causes a failure. If test failed with the LC49C (or LC41B) circuit packs out, replace in sequence LC46 and LC49C (or LC41B) in carrier 0; then plug in the LC49C (or LC41B) circuit packs per previous instruction.
346	03	F6	Scanner solid fault. First trunk carrier (trunk carrier 0 = system carrier No. 8).	Replace LC50 in first trunk carrier. If fault still exists, replace original LC50 and unplug all other circuit packs in carrier, except LC50 and LC49C or LC41B. If fault still exists, replace LC46. Plug in (one at a time) all circuit packs in first trunk carrier, replacing only the one that causes the fault to reoccur. Use test 5.
347	03	F6	Scanner solid fault. Second carrier (trunk carrier 1 = system carrier No. 7).	Same as procedure for fault code 346, except substitute trunk carrier 1 for trunk carrier 0. Use test 5.
350	03	F6	Scanner solid fault (system carrier No. 6 is either trunk carrier 2 — third trunk carrier — or line carrier 6).	Same as procedure for fault code 346, except substitute either trunk carrier 2 or line carrier 6 for trunk carrier 0. Use test 5.
351	03	F6	Scanner solid fault. System carrier No. 5 (either trunk carrier 3 or line carrier 5).	Follow same repair procedure as for fault code 346, except substitute trunk carrier 3 or line carrier 5 for trunk carrier 0. Use test 5.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
352	03	F6	Scanner solid fault. Line carrier 4.	Follow same repair procedure as for fault code 346, except substitute line carrier 4 or line carrier 5 for trunk carrier 0. Use test 5.
353	03	F6	Scanner solid fault. Line carrier 3.	Follow same repair procedure as for fault code 346, except substitute line carrier 3 for trunk carrier 0. Use test 5.
354	03	F6	Scanner solid fault. Line carrier 2.	Follow same repair procedure as for fault code 346, except substitute line carrier 2 for trunk carrier 0. Use test 5.
355	03	F6	Scanner solid fault. Line carrier 1.	Follow same repair procedure as for fault code 346, except substitute line carrier 1 for trunk carrier 0. Use test 5.
356	03	F6	Scanner solid fault. Line carrier 0.	Follow same repair procedure as for fault code 346, except substitute line carrier 0 for trunk carrier 0. Use test 5. (Do not unplug LC204 or LC430.) Finally, replace LC44.
357	03	F6	Same as fault code 330, except failure is intermittent rather than solid.	Replace in sequence LC46 and LC47B.
360	03	F6	Same as fault code 331, except failure is intermittent rather than solid.	Replace in sequence LC46 and LC47B.
361-374	03	F6	Same as fault code 332, except failure is intermittent rather than solid.	Follow same repair procedure as for fault code 332.
375	03	F6	Same as fault code 346, except failure is intermittent rather than solid.	Follow same repair procedure as for fault code 346.
376	03	F6	Same as fault code 346, except failure is intermittent rather than solid.	Follow same repair procedure as for fault code 346, substituting carrier 7.

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
377	03	F6	Same as fault code 350, except failure is intermittent rather than solid.	Follow same repair procedure as for fault code 346, substituting carrier 6.
400	03	F6	Same as fault code 351, except failure is intermittent rather than solid.	Use same repair procedure as for fault code 346, substituting carrier 5.
401	03	F6	Same as fault code 352, except failure is intermittent rather than solid.	Follow same repair procedure as for fault code 346, substituting carrier 4.
402	03	F6	Same as fault code 353, except failure is intermittent rather than solid.	Follow same repair procedure as for fault code 346, substituting carrier 3.
403	03	F6	Same as fault code 354, except failure is intermittent rather than solid.	Follow same repair procedure as for fault code 346, substituting carrier 2.
404	03	F6	Same as fault code 355, except failure is intermittent rather than solid.	Follow same repair procedure as for fault code 346, substituting carrier 1. If this fails, replace LC47B.
405	03	F6	Same as fault code 356, except failure is intermittent rather than solid.	Follow same repair procedure as for fault code 346, substituting carrier 0.
406	04	F7	Maximum time to execute a network command has been exceeded.	Replace LC47B.
407	04	F3	At least 599 network ports could not be cleared.	Replace LC47B.
410	04	F9	Bad board found on carrier 0 during network verification (line carrier 0).	Replace in sequence LC50 (carrier 0) and LC47B, check cabling.
411	04	F9	Bad board found in carrier 1 during network verification (line carrier 1).	Replace in sequence indicated bad board and LC41B or LC49C on same carrier or LC45 (or 433) and check cabling.

## TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
412	04	F9	Bad board found on carrier 2 during network verification (line carrier 2).	Replace in sequence indicated bad board and LC41B or LC49C on same carrier or LC45 (or 433) and check cabling.
413	04	F9	Bad board found on carrier 3 during network verification (line carrier 3).	Replace in sequence indicated bad board and LC41B or LC49C on same carrier or LC45 (or 433) and check cabling.
414	04	F9	Bad board found on carrier 4 during network verification (line carrier 4).	Replace in sequence indicated bad board and LC41B or LC49C on same carrier or LC45 (or 433) and check cabling.
415	04	F9	Bad board found on carrier 5 during network verification (line carrier 5 or trunk carrier 3).	Replace in sequence indicated bad board and LC41B or LC49C on same carrier or LC45 (or 433) and check cabling.
416	04	F9	Bad board found on carrier 6 during network verification (line carrier 6 or trunk carrier 2).	Replace in sequence indicated bad board and LC41B or LC49C on same carrier or LC45 (or 433) and check cabling.
417	04	F9	Bad board found on trunk carrier 1 during network verification.	Replace in sequence indicated bad board and LC49C (or LC41B) on same carrier or LC45 (or 433); check cabling.
420	04	F9	Bad board found on trunk carrier 0 during network verification.	Replace in sequence indicated bad board and LC49C (or LC41B) on same carrier or LC45 (or 433); check cabling.
421		None	(Not used).	No procedure required.
422	04	F9	Multiple bad boards in carrier.	Replace LC49C or LC41B in same carrier.

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
423	04	F9	More than one carrier found which has bad boards during network clear test.	Replace in sequence indicated bad boards, LC41B or LC49C on indicated carrier and LC47B on indicated carrier. If this fails for 2-cabinet system, power down (momentarily) and restart test.
424	04	F8	Response invalid on verification of assigned time slot.	Replace LC47B. If this fails, determine failing carrier by unplugging the LC49C (or LC41B) and LC50 circuit packs in each carrier (one at a time) until test passes. When failed carrier is determined, unplug all port circuits in that carrier, plug in the LC49C (or LC41B) and LC50 circuit packs for that carrier and then reinsert the remaining circuit packs (one at a time), replacing any circuit pack that caused the failure to reoccur. If this fails, replace LC45 (or 433).
425	04	F9	Bad network port found.	Replace indicated board or LC45 (or 433) LC47B, in sequence. If this fails, for 2-cabinet system, power down (momentarily) and restart test.
426	04	F9	Board select bit is stuck at active.	<ol style="list-style-type: none"> <li>1. Replace in sequence LC49C (or LC41B) in indicated carrier. If this fails, unplug all circuit packs except LC49C (or LC41B) and LC50 in indicated carrier. Reinstall each circuit pack (one at a time) until fault reoccurs. Replace circuit pack causing reoccurrence of fault. If this fails, replace LC50 in indicated carrier.</li> <li>2. Replace LC204 (or 430).</li> </ol>
427	04	F9	Port select bit stuck or busy-idle bit stuck.	Follow same repair procedure as for fault code 426.
430	04	F9	Command to remove specified time slot from port failed.	Replace LC47B.

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
431	04	F9	Time slot 0 assignment fails intermittently. Port number is displayed.	Replace circuit pack in displayed port location.
432	04	F9	Port select bit 0 stuck at active on this carrier.	Replace LC49C (or LC41B) in indicated carrier.
433	04	F3	Network control slot addressing problem.	Replace in sequence LC47B, LC49C (or LC41B), and check cabling.
434	04	F9	Network control always reads and writes the same time slot.	Replace in sequence LC47B, LC45 (or 433), LC49C (or LC41B), and check cabling.
435	04	F9	Removes time slot command and clears more than one time slot.	Replace in sequence LC47B, LC49C (or LC41B), and check cabling.
436	04	F9	Removes time slot command and fails intermittently or noise-enabled a time slot on this port.	Replace indicated circuit pack.
437	04	F9	Network trunk port faulty.	Replace indicated trunk circuit pack.
440	04	F9	Line circuit port faulty.	Replace indicated line circuit pack, LC204 (or 430).
441	04	F9	Intermittent network failure or noise.	Replace in sequence indicated port circuit pack, LC47B, each LC49C (or LC41B), LC46, each LC50, and LC204 (or 430), and check cabling.
442	04	F9	Board select bit is stuck at active.	Replace LC49C (or LC41B) in indicated carrier, and check cabling.
443	04	F3	No network ports found to be equipped.	Determine that all circuit packs are properly inserted and if problem persists, replace LC47B, and check cabling.
444	04	F9	RMV3 (remove 3-dB pad). Command fails to clear specified port.	Replace LC47B.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
445	04	F9	ADD 3 (add 3-dB pad). Command fails to establish a good connection.	Replace LC47B.
446	04	F9	RMV_SLT_3 (remove time slot associated with 3-dB pad). Command fails to clear port.	Replace LC47B.
447-453		None	(Not used).	None required.
454	31	F3	Hold get address register is incorrect.	Replace in sequence LC52, LC20B, and LC560.
455	31	F3	Return address saved in hold get area is incorrect.	Replace in sequence LC52 and LC560.
456	31	F3	Cannot hold register in hold get area.	Replace in sequence LC52, LC20B, LC560.
457	31	F3	Cannot get register information from hold get area.	Replace in sequence LC52, LC20B, and LC560.
460	31	F3	Content of register cannot be kept in hold get area.	Replace in sequence LC52, LC20B, and LC560.
461	31	F3	Cannot retrieve content of register that was put into hold get area.	Replace in sequence LC52, LC20B, LC560.
462	31	F3	Did not branch as directed by a register content.	Replace in sequence LC20B, LC52, LC557, LC21, and LC560.
463	31	F3	Branched, but did not decrement register.	Replace in sequence LC20B, LC52, LC557, LC21, and LC560.
464	31	F3	Failed on a branch as directed by a register content when register number was 0.	Replace in sequence LC20B, LC52, LC557, LC21, and LC560.
465	31	F3	Did not respond to a branch to program address instruction.	Replace in sequence LC52, LC20B, LC21, LC557, and LC560.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
466	31	F3	Branched to incorrect location.	Replace in sequence LC557, LC52, LC20B, LC21, and LC560.
467	31	F3	Failed to branch as instructed.	Replace in sequence LC560, LC52, and LC20B.
470	31	F3	Branched to incorrect location.	Replace in sequence LC560, LC52, and LC20B.
471	31	F3	Branch instruction was ignored.	Replace in sequence LC560, LC52, and LC20B.
472	31	F3	Branched to incorrect location.	Replace in sequence LC560, and LC52.
473	31	F3	Branch instruction with no address information did not set condition flop.	Replace in sequence LC52, LC560, and LC20B.
474	31	F3	Branch instruction was ignored.	Replace in sequence LC52, LC20B, and LC560.
475	31	F3	Branched, but lost return address.	Replace in sequence LC52, LC20B, and LC560.
476	31	F3	Returned to incorrect location on return from a branch.	Replace in sequence LC52, LC20B, and LC560.
477	31	F3	Returned to correct location, but did not reset condition flop.	Replace in sequence LC52 and LC560.
500	31	F3	Branched to incorrect location.	Replace in sequence LC52, LC20B, and LC560.
501	31	F3	Branched, but lost return address.	Replace in sequence LC52, LC20B, and LC560.
502	31	F3	Branched to saved address, but failed to set condition flop.	Replace in sequence LC52, LC20B, and LC560.
503	31	F3	Branched to incorrect location.	Replace in sequence LC52, LC20B, and LC560.

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
504	31	F3	Branched to saved address, but bad data entered into a register.	Replace in sequence LC52, LC20B, and LC560.
505	31	F3	Branched to saved address, but failed to set condition flop.	Replace in sequence LC20B, LC52, and LC560.
506	31	F3	Branched to saved address, but failed to restore register.	Replace in sequence LC52, LC20B, and LC560.
507	31	F3	Branched to incorrect location.	Replace in sequence LC52 and LC560.
510	31	F3	Branched to saved address, but failed to set condition flop.	Replace in sequence LC52 and LC560.
511	31	F3	Branched to saved address and loaded return code, but failed to restore registers.	Replace in sequence LC52, LC20B, and LC560.
512	31	F3	Branched to incorrect location.	Replace in sequence LC20B, LC52, and LC560.
513	31	F3	Branched correctly, but loaded incorrect return code.	Replace in sequence LC52, LC20B, and LC560.
514, 515, 516	31	F3	A register was loaded incorrectly.	Replace in sequence LC20B, LC52, and LC560.
517, 520	31	F3	Replaced register information incorrectly.	Replace in sequence LC52, LC20B, and LC560.
521, 522	31	F3	Did not zero correct item.	Replace in sequence LC52, LC20B, and LC560.
523, 524	31	F3	Correct item was not set to 1.	Replace in sequence LC52, LC20B, and LC560.
525, 526, 527	31	F3	A comparison test failed to reset condition flop.	Replace in sequence LC52 and LC560.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
530	31	F3	A comparison test failed to set condition flop.	Replace in sequence LC52 and LC560.
531, 532, 533, 534	31	F3	A test for 0 operation failed to set or reset condition flop.	Replace in sequence LC52 and LC560.
535, 536, 537, 540	31	F3	A test for all 1s operation failed to set or reset condition flop.	Replace in sequence LC52 and LC560.
541	32	F3	A processor error hardware interrupt occurred.	Replace in sequence LC53, LC22B, LC560 and LC21.
542	32	F3	An illegal OP code hardware interrupt occurred.	Replace in sequence LC53, LC22B, and LC560.
544	32	F3	A branch-allow hardware interrupt occurred.	Replace in sequence LC53, LC22B, LC52, and LC560.
545	32	F3	A parity hardware interrupt occurred.	Replace in sequence LC53, LC22B, and LC21.
546	32	F3	A program sanity hardware interrupt occurred.	Replace in sequence LC52, LC560, LC20B, LC53 and LC22B.
547	32	F3	A microsanity hardware interrupt occurred.	Replace in sequence LC53, LC22B, LC560, and LC52.
550	32	F3	A microparity hardware interrupt occurred.	Replace in sequence LC560, LC53, LC22B, and LC21.
551	32	F5	Interrupt return code is incorrect.	Replace LC22B.
552	32	F5	Illegal OP code appears as incorrect interrupt code.	Replace in sequence LC22B and LC53.
554	32	F5	Incorrect interrupt code appears, but should be branch-allow.	Replace in sequence LC22B and LC53.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
555	32	F5	Incorrect interrupt code appears, but should be program sanity.	Replace in sequence LC22B, LC53, and LC560.
556	32	F5	Incorrect interrupt code appears, but should be microparity.	Replace in sequence LC22B, LC53, LC560 and LC21.
557-572		None	(Not used).	None required.
577	00,01	F3	The X-ray subroutine is stuck in a loop.	Replace in sequence LC560, LC52, LC20B, and LC22B.
600-607	14	F3	Parity error encountered while testing RAM. Fault code is different for each 4K block.	Replace in sequence LC556 (or 594), LC21B.
610-617	14	F3	Error encountered while testing RAM used the "TLOC" instruction. Fault code is unique for each 4K block.	Replace in sequence LC556 (or 594), LC557.
620-627	14	F3	Error encountered during read-write test of RAM. Fault code is unique for each 4K block.	Replace LC556 (or 594).
630	14	F3	Parity error during test of Generic EPROM (parity generator fault).	Replace LC555/595/593/603.
631	14	F3	Parity error during test of A+M EPROM (parity generator fault).	Replace LC555 (or LC595 or LC593 or LC603).
650	14	F3	Program in paging buffer did not execute properly.	Replace in sequence LC557, LC556 (or 594).
651	14	F3	Generic checksum incorrect.	Replace in sequence LC555 (or 595 or 593 or LC603), LC557.
652	14	F3	No acknowledge on SIO or MCR.	Replace LC557.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
653	14	F3	Location x(408) in generic contains invalid data.	Replace in sequence LC555 (or 595 or 593 or 603), LC557.
654	Tape Load	AP*	Tape tried to load three times and failed.	Replace in sequence LC570 (or 597), tape drive.
660	14	F3	Bad parity found on testing TPAR instruction.	Replace LC21.
661	14	F3	TPAR fails to increment R13.	Replace in sequence LC21, LC52.
662	14	F3	TPAR modifies tested location.	Replace in sequence LC21 and LC557.
663	14	F3	Exclusive OR operation fails.	Replace in sequence LC52 and LC560.
664	14	F3	Stuck bit was encountered while testing TLOC instruction.	Run memory test 14, replace in sequence LC556 (or 594), LC557.
665	14	F3	TLOC instruction modifies the tested location.	Replace LC560.
720	—	F3	Inactive test was called up.	Key in a different test.
727	00,01	AP*	System insane. Repeated hardware interrupts.	Reload tape, replace in sequence LC22, LC53, LC52, LC20, LC560, LC21, LC557, LC555 (LC595, or 593, LC603).
731	32	F3	The 10-ms program interrupt stopped.	Replace in sequence LC53, LC22.
732	32	F3	Parity interrupt occurred, but bad location was not found.	Replace in sequence LC21, LC53, LC22.
740	14	AP	LC20 timing problem or fault. Data and register dependent.	Replace LC20.

\* This display format indicates no fault codes will be displayed at the MAAP. To determine the fault code, observe the indicator lights on the alarm panel. Add the assigned value of these indicators to get the fault code number (refer to Fig. 7).

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
742	14	AP	Program address register is at all 1's.	Replace LC52.
743	02	F3	MAAP unplugged during test 02, repeat mode.	None required.
1035	02	FG	No acknowledgement on data link input/output.	Replace in sequence indicated LC554 and LC44.
1036	02	FG	No data link response in maintenance mode.	Same as for fault code 1035.
1037	02	FG	Incorrect data link response in maintenance mode.	Replace in sequence LC554 (LC570), LC44.
1040	35	FG	Bad response to 8-bit data or no loop around.	Replace LC570.
1041	35	FG	Bad response to 7-bit data or overrun error.	Replace LC570.
1042	35	FG	Bad alarm.	Replace LC570.
1044	15	FG	No acknowledgement on input/output to ports 640 and 650.	Replace in sequence LC570 (slot 32) and LC22B.
1045	15	FG	Data link parity error.	Replace in sequence indicated LC554 and LC21.
1046	15	FG	Data link echo error appears on a high speed port.	Replace indicated LC570.
1047	15	FG	No response from high speed data set.	Replace LC570 associated with data set.
1050	15	F3	Indicates no SMDR is present.	If SMDR is present, repair or replace SMDR.
1051	24	F3	No hotel/motel memory board.	Install board if needed.
1052	25	F3	Hotel/motel battery backup not working.	Replace LC38.
1053	25	F3	LC38 and LC39 test good.	No procedure (action) required.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1054	25	F3	LC38 and LC40 test good.	No procedure (action) required.
1070	04 or 27	FG	Number or arrangement of high speed data links has changed since start of burn-in.	Restore system to original configuration or clear burn-in record.
1071	02	FG	Number or arrangement of low speed data links has changed since start of burn-in.	Same as for fault code 1070.
1073	02	F3	Number or arrangement of memory boards has changed since start of burn-in.	Same as for fault code 1070.
1075	02	F3	Number of line carriers no longer agrees with burn-in records.	Same as for fault code 1070.
1076	02	F3	Number of trunk carriers no longer agrees with burn-in records.	
1077	02	F3	Number of equipped line ports no longer agrees with burn-in records.	
1100	02	F3	Number of trunk ports no longer agrees with burn-in records.	
1101	02	F3	Number of equipped TOUCH TONE Calling register ports no longer agrees with burn-in records.	
1102	02	F3	Number of attendant interface ports no longer agrees with burn-in records.	
1103	02	F3	Carrier 0 board complement no longer agrees with burn-in records.	

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1104	02	F3	Carrier 1 board complement no longer agrees with burn-in records.	
1105	02	F3	Carrier 2 board complement no longer agrees with burn-in records.	
1106	02	F3	Carrier 3 board complement no longer agrees with burn-in records.	
1107	02	F3	Carrier 4 board complement no longer agrees with burn-in records.	
1110	02	F3	Carrier 5 board complement no longer agrees with burn-in records.	Same as for fault code 1070.
1111	02	F3	Carrier 6 board complement no longer agrees with burn-in records.	
1112	02	F3	Carrier 7 board complement no longer agrees with burn-in records.	
1113	02	F3	Carrier 8 board complement no longer agrees with burn-in records.	
1114	02	FG	Number of attendant consoles no longer agrees with burn-in records.	
1116	02	FG	Incorrect echo from attendant console.	Replace in sequence associated LC554 and attendant console.
1117	02	FG	Getting a good echo from an attendant console that is unequipped.	Same as for fault code 1070.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1120	07	F3	Data link loop-around differs from tape burn-in data.	Same as for fault code 1070.
1121	07	F3	Carrier loop-around differs from tape burn-in data.	
1123		F3	Serial number on tape fails to match the system serial number.	
1124-1125		None	(Not used.)	None required.
1127		None	(Not used.)	None required.
1300	42	FW	Trunk idle status incorrect. Correct idle status is X(F).	Replace indicated trunk and/or LC49.
1301	42	FW	Trunk idle status incorrect. Correct idle status is X(F).	Replace indicated trunk and/or LC49.
1302	42	FW	Trunk idle status incorrect. Correct idle status is X(F).	Replace indicated trunk and/or LC49.
1303	42	FW	Trunk idle status incorrect. Status should show trunk to be idle but reversed. Correct status is X(A).	Replace indicated trunk and/or LC49.
1304	42	FW	Trunk idle status incorrect. Correct idle status is X(F).	Replace indicated trunk and/or LC49.
1305	42	FW	Incorrect ground sensed status. Correct status for trunk 1 is X(8). Correct status for trunk 0 is X(2).	Replace indicated trunk and/or LC49.
1306	42	FW	Ground start status incorrect. Correct status is X(2) if only GS1 is operated and X(A) if both GS1 and GS0 are operated.	Replace indicated trunk and/or LC49.

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1316		F9	LC361 0.5-second timer failed to send on-hook signal.	Replace LC361, LC285, or LC279.
1317		F9	LC361 excessive 0.5-second on-hook time.	
1320		None	(Not used.)	
1321	21	F9	Two port originate/receive function failed on TOUCH-TONE calling receiver/register.	Replace indicated TOUCH-TONE calling receiver/register LC10C or LC553.
1322-1375		None	(Not used.)	
1376	17,42	F3	Button push not properly recognized on MAAP or CAP.	Replace MAAP (CAP), LC44.
1377	17,42	F3	Improper use of continue on error or test mode by trying to step out of bounds of lines or trunks.	None
1400*	17	F9	Line off-hook status incorrect.	Replace in sequence LC588 and LC49C (or LC41B), and check ring generator.
1401	17	F9	Two line did not go on-hook.	Replace in sequence LC588, LC49C (or LC41B), LC46, LC47B, and check cabling.
1402*	17	F9	Tone transmission failed.	Replace in sequence LC50, LC49C (or LC41B), LC204 or LC430, LC48, LC47B, LC45, LC554, Console. Rerun test 04; rerun test with minimum CP; Fusing; check terminating resistor on backplanes; Check cabling; Re-check processor, re-check power, re-check unit wiring and cabling.
1403	17	F9	Tone improperly present.	Replace in sequence CP containing indicated port and LC50, LC49C (or LC41B).

\* Fault Code displayed when loop-around fixtures are not used.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1404	17	F9	Attendant off-hook status incorrect.	Replace in sequence LC45, LC49C (or LC41B), and check TIP/RING cable from line to control carrier.
1405	17	F9	A ringing relay failed.	Replace in sequence LC02s, LC49C's (or LC41B's) LC46, LC47B, LC21, LC22B.
1406	42	FW	Trunk idle status incorrect. For LC11B trunks, status should be X(A). Status for all other boards should be X(F).	Replace indicated trunk and/or LC49.
1407	17	F9	Ground detector incorrectly active.	Replace in sequence LC08D and LC49C (or LC41B).
1410	17	F9	Loop or ground detector or loop current incorrect.	Repair indicated trunk and/or replace LC49C (or LC41B), LC14, LC46.
1411	42	FW	Incorrect ground sensed status. Correct status for trunk 1 is X(8). Correct status for trunk 0 is X(2).	Replace indicated trunk and/or LC49.
1412-1414	17	F9	Loop or ground detector or loop current incorrect.	Repair indicated trunk and/or replace LC49C (or LC41B), LC14, LC46.
1415, 1416	17	F9	Defective LC11B DX/E&M signal circuit or LC11B 2-dB pad circuits fail.	Replace in sequence LC11B, LC49C (or LC41B), LC14.
1417	17	F9	Defective end-of-announcement circuit.	Replace in sequence LC13B, LC49C (or LC41B), LC14.
1420, 1421	17	F9	No lines off-hook.	Replace in sequence LC02B or LC49C (or LC41B).
1422, 1423	17	F9	Unidentified trunk.	Repair indicated trunk and/or replace LC49C (or LC41B), LC14, -9V power supply.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1424	17	F3	TIP/RING resistance too low.	1. Replace in sequence LC08Ds and LC13Bs throughout system until defective board is located. Check +9V power supply. 2. For system with loop fixture: A. Operate each loop box switch from LC08D or LC13B or LC09D and retest — replace CP that just passed. B. Check cabling. C. Check LC14 switch setting.
1425	17	F3	LC14 not installed in trunk carrier 00, slot 09.	Install LC14.
1426*	17	F3	No port available on line carrier 00 for trunk test.	If 9th port is equipped, replace in sequence the LC02B containing the 9th port, LC49C (or LC41B), LC50, LC48.
1427*	17	F3	LC02B not available to access TOUCH-TONE service.	If there is at least one LC02B installed, replace receiver in sequence the first LC02B, LC49C (or LC41B), LC48.
1430*	17	F9	Fault port equipment number.	The number is faulty, it may not indicate the faulty CP. If an undefined format comes up, replace LC20B.
1431*	17	F9	Incorrect idle state of TOUCH-TONE calling receiver/register.	Replace in sequence LC10C or (LC553). LC49C (or LC41B).
1432	17	F9	An LC08D talk relay failed.	Replace in sequence LC08D, LC49C (or LC41B).
1433*- 1436*	17	F9	Analog switch stuck active.	Replace in sequence CP containing indicated port, LC50, and LC49C (or LC41B).
1437*	17	F9	LC06B busy flip-flop failed.	Replace in sequence LC06B and LC49C (or LC41B).
1440*	17	F9	Defective tone board.	Replace in sequence LC204 or LC430 and LC50.

\* Fault code displayed when loop-around fixtures are not used.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1441	02	F3	Relay or detector defective.	Replace LC17B.
1442	02	F3	LC17B ground start or busy/idle detector failed.	Replace LC17B (check LC02B/LC03C count).
1443	37	F3	No loop boxes.	Connect loop boxes when in burn-in mode.
1444	37	F3	Faulty LC41B idle status.	Replace in sequence LC41B and LC03C in slot 6 of the same carrier.
1445		F3	Faulty LC41B active status.	Replace in sequence LC41B and LC03C in slot 6 of the same carrier.
1446		F9	Defective LC285 PM dial relay control.	Replace LC285.
1447		F9	LC285 PM output improperly idle.	Replace LC285.
1450		F9	LC285 PM output improperly active.	Replace LC285.
1456, 1457	17,34	F9	A message register circuit (0-7) stuck active.	Replace in sequence LC16B, LC49C (or LC41B).
1460-1462	17,34	F9	Message register circuit 0, 1, or 2 stuck inactive.	Replace in sequence LC16B, LC49C (or LC41B).
1463	17,34	F9	Message register circuit 3 stuck inactive or -48V or LC14 missing.	Install LC14 and/or replace in sequence LC16B, LC49C (or LC41B), check -48V DC.
1464-1477	17,34	F9	A message register circuit (4-7) stuck inactive or 0-7 stuck active.	Replace in sequence LC16B, LC49C (or LC41B).
1500	17,33	F3	A contact drive, or drivers, stuck inactive or test plug missing.	Install test plug and/or replace in sequence LC14, LC49C (or LC41B).
1502-1511	17,33	F3	LC14 relay failed.	Replace in sequence LC14, LC49C (or LC41B).
1560	02,17	F9	Faulty inner loop current detector.	

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1561	02,17	F9	Dial "*" fails to disable trunk scan output.	Replace in sequence indicated CP and LC49C (or LC41B).
1562	02,17	F9	Excessive inner loop detector impedance (ckt 0).	} Replace in sequence indicated CP and LC49C (or LC41B).
1563	02,17	F9	Excessive inner loop detector impedance (ckt 1).	
1564	02,17	F9	GND* fails to inhibit trunk scan output.	} Replace in sequence indicated CP and LC49C (or LC41B).
1565	02,17	F9	Faulty outer loop current detector.	
1566	02,17	F9	Excessive outer loop detector impedance (ckt 0).	
1567	02,17	F9	Excessive outer loop detector impedance (ckt 1).	
1570	02,17	F9	Faulty 170 msec timer (ckt 0).	
1571	02,17	F9	Faulty 170 msec timer (ckt 1).	
1572	02,17	F9	Faulty ring detector.	
1573	02,17	F9	Ring detector fails to retrigger on steady ringing.	
1574	02,17	F9	Ring detector times out too soon.	
1575	02,17	F9	Ring detector times out too late.	
1576		F9	LC285 ring detector delay is too short.	Replace LC285.
1577		F9	LC279/LC285 5-second ring detector timer failed to reset.	Replace LC279/LC285.
1600		F9	TOUCH-TONE calling register output fails to agree with digit sent from LC12.	Replace in sequence LC12, LC10C or LC553.

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1601		F9	TOUCH-TONE calling receiver/register responded to a false combination from LC12.	Replace in sequence LC10C or LC553, LC12.
1602		F9	LC12 dial tone detector failed to detect 350 Hz signal.	Replace in sequence LC12 and LC204 (or 430).
1603		F9	Faulty response of LC12 dial tone detector to 440 Hz.	
1604		F9	LC12 dial tone detector fails to hold over tone break.	
1605		F9	Faulty LC12 TOUCH-TONE calling signal.	
1606	17	FS	Tone event occurred too soon.	
1607	17	FS	On-hook event occurred too soon.	Replace LC145.
1610	17	FS	Off-hook event occurred too soon.	Replace LC145.
1611	17	FS	Tone event failed to occur.	Replace in sequence LC145, LC204 (or LC430).
1612	17	FS	On-hook event failed to occur.	Replace LC145.
1613	17	FS	Off-hook event failed to occur.	Replace LC145.
1614	17	F9	LC145 Port A failed to remain on-hook after "Drop 400D" signal.	Replace LC145.
1615-1617		—	(Not used.)	

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1620	42	F9	Incorrect trunk idle status.	Replace indicated board.
1621	42	F9	Loop detector failed to detect a closed loop.	
1622	42	F9	Loop current improperly present.	
1623	42	F9	OG1 not operated or AO not sense loop.	
1624	42	F9	RVO not operated or REV1 not sensed.	
1625	42	F9	RVO not released or REV1 still sensed.	
1626	42	F9	DON1 not operated.	
1627	42	F9	RLS1 not operated.	
1630	42	F9	REV1 sensed reversal.	
1631	42	F9	RLS1 not released.	
1632	42	F9	DISC1 timer too early.	
1633	42	F9	RLS1 not operated.	
1634	42	F9	DON1 timer too early.	
1635	42	F9	DON1 timer too late.	
1636	42	F9	DON1 not operated.	
1637	42	F9	RLS1 not operated.	
1640	42	F9	REV1 not sensed or RVO not released.	
1641	42	F9	REV1 not sensed or RLS1 not released.	

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1642	42	F9	Scan memory wrong — ckt 1.	Replace indicated board.
1643	42	F9	DON1 or RLS1 timers too late.	
1644	42	F9	DON1 or RV0 not operated.	
1645	42	F9	DISC1 timer too late.	
1646	42	F9	RV0 not released or board not idle.	
1647	42	F9	OG0 not operated or A1 not sense loop.	
1650	42	F9	RV1 not operated or REV0 not sensed.	
1651	42	F9	RV1 not released or REV0 still sensed.	
1652	42	F9	DON0 not operated.	
1653	42	F9	RLS0 not operated.	
1654	42	F9	REV0 sensed reversal.	
1655	42	F9	RLS0 not released.	
1656	42	F9	DISC0 timer too early.	
1657	42	F9	RLS0 not operated.	
1660	42	F9	DON0 timer too early.	
1661	42	F9	DON0 timer too late.	
1662	42	F9	DON0 not operated.	
1663	42	F9	RLS0 not operated.	

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1664	42	F9	REV0 not sensed or RV0 not released.	Replace indicated board.
1665	42	F9	REV1 not sensed or RLS1 not released.	
1666	42	F9	Scan memory wrong — ckt 0.	
1667	42	F9	DON0 or RLS0 timers too late.	
1670	42	F9	DON0 or RV0 not operated.	
1671	42	F9	DISC0 timer too late.	
1672	42	F9	RV1 not release or board not idle.	
1673-1677		None	(Not used.)	
1700	42 02	F2	No loop equipment.	
1701	42 02	F2	Failed ring trip during silent interval.	
1702	42 02	F2	Wrong loop status and control on Ckt 1.	Replace indicated LC361.
1703	42 02	F2	Wrong loop status and control on Ckt 0.	
1704	42 02	F2	The 450-ms timer too early — Ckt 0.	
1705	42 02	F2	The 450-ms timer too early — Ckt 1.	

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1706	42 02	F2	The 450-ms timer too late — Ckt 0.	Replace indicated LC361.
1707	42 02	F2	The 450-ms timer too late — Ckt 1.	
1710	42 02	F2	Failed ring trip during ring interval.	
1711	42 02	F2	Ringback tone gone.	
1712	42 02	F2	Ring control status wrong.	
1713	42 02	F2	Circuit 1 failed ring lockout.	
1714	42 02	F2	Circuit 1 ring control status wrong.	
1715	42 02	F2	Circuit 1 failed ring lockout release.	
1716	42 02	F2	Ring control status wrong.	
1717	42 02	F2	Circuit 0 failed ring lockout.	
1720	42 02	F2	Circuit 0 ring control status wrong.	
1721	42 02	F2	Circuit 0 failed ring lockout release.	

TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1722	42 02	F2	Board did not go idle.	Replace indicated LC361.
1723	42 02	F2	Ringback tone improperly present.	
1724	42 02	F2	Ringback tone not found.	
1725	42 02	F2	Ring control off delay failed.	
1726	42 02	F2	Ring on time too short.	
1727	42 02	F2	Ring on time too long.	
1730	42 02	F2	Silent interval too short.	
1731	42 02	F2	Silent interval too long.	
1732	42 02	F2	Ring control failed to turn off ringing.	
1733	42 02	F2	The 60-ms timer late — Ckt 0.	
1734	42 02	F2	The 60-ms timer late — Ckt 1.	

## TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1735	42 02	F2	The 60-ms timer early — Ckt 0.	Replace indicated LC361.
1736	42 02	F2	The 60-ms timer early — Ckt 1.	
1737		None	(Not used.)	
1740	32	F3	MAPS jumbo instruction failed.	Replace microcode board LC560.
1741	31	F3	MAPS jumbo failed to return correct word pointer in R9.	Replace LC560.
1742	31	F3	MAPS jumbo failed to return correct bit position pointer in R6.	
1743	31	F3	MAPS jumbo failed to return correct complemented data in R8.	
1744	31	F3	Same as 1741.	
1745	31	F3	Same as 1742.	
1746	31	F3	Same as 1743.	
1747	31	F3	Same as 1741.	
1750	31	F3	Same as 1742.	
1751	31	F3	Same as 1743.	
1752	31	F3	Same as 1741.	
1753	31	F3	Same as 1742.	
1754	31	F3	Same as 1743.	

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
1755 -				
1777		None	(Not used.)	
2010	02	F3	New tests have been selected under Test 50 to run during burn-in without reinitializing burn-in.	Reinitialize burn-in.
2104 -				
2177		None	(Not used.)	
2200		F9	Conference off-hook status incorrect.	Replace in sequence LC293, LC49C (or LC41B).
2201		F9	Tone improperly present — Bridge 3 disconnected.	Replace indicated LC293.
2202		F9	Bad hook status — All ports should be on-hook.	
2203		F9	Tone improperly present — Bridge 0 disconnected.	
2204		F9	Bad hook status — All ports should be on-hook.	
2205		F9	Tone not present — Bridge on — Talk muted in reverse direction.	
2206		F9	Bad hook status.	Replace indicated LC293.
2207		F9	Tone improperly present — Talk muting is on from 0 to 3.	
2210		F9	Bad hook status — Muting talk path affected bridge.	
2211		F9	Tone not present — Bridge on — Talk muted in reverse direction.	

## TABLE D (Contd)

## FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
2212		F9	Bad hook status.	Replace indicated LC293.
2213		F9	Tone improperly present — Talk path muting is on from 3 to 0.	
2214		F9	Bad hook status.	
2215		F9	Tone improperly present — Bridge 0,3 are off.	
2216		F9	Bad hook status — All ports should be on-hook.	
2217		F9	Tone improperly present — Bridge 2 disconnected.	
2220		F9	Bad hook status — All ports should be on-hook.	
2221		F9	Tone improperly present — Bridge 1 disconnected.	
2222		F9	Bad hook status — All ports should be on-hook.	
2223		F9	Tone not present — Bridge on — Talk muted in reverse direction.	
2224		F9	Bad hook status.	
2225		F9	Tone improperly present — Talk muting is on from 1 to 2.	
2226		F9	Bad hook status — Muting talk path affected bridge.	
2227		F9	Tone not present — Bridge on — Talk muted in reverse direction.	
2230		F9	Bad hook status.	

TABLE D (Contd)

FAULT CODES

FAULT CODE	TEST NO.	DISPLAY FORMAT	DESCRIPTION OF FAULT	REPAIR PROCEDURE
2231		F9	Tone improperly present — Talk muting is on from 2 to 1.	Replace indicated LC293.
2232		F9	Bad hook status.	
2233		F9	Tone improperly present — Bridge 1, 2 are off.	
2234		F9	Bad hook status — All ports should be off-hook.	
2235		F9	Tone improperly present — Ports should have all been cleared.	
2236		F9	Bad hook status — All ports should be off-hook.	

CLEAR ENTRY button on the MAAP (on Test 32 press the CLEAR ENTRY button a few seconds). Decimal 720 is displayed on the MAAP and the BUSY OUT lamp flashes. Tests can also be stopped by starting another test.

(1) **Execute Mode:** A test is run in the execute mode by pressing the RESET and EXECUTE buttons on the MAAP and then a 2-digit test number (00, 01, etc). In the execute mode, the selected test is cycled continuously. If a fault occurs, the test stops, a fault code is displayed on the alarm panel, and on the MAAP. When a fault occurs, the fault should be repaired and the test rerun [unless the Continue on Error or Test Mode option is used (see TIME SAVING OPTIONS)]. The test should be manually restarted in the same manner as it was started initially (ie, EXECUTE, 2-digit test number).

(2) **Repeat Mode:** A test is run in the repeat mode by pressing the RESET and REPEAT buttons on the MAAP and then the 2-digit test number. In the repeat mode, the test cycles continuously as in the execute mode. However, on all tests (except Test 02) if a fault occurs in the repeat mode, the fault code, the time the fault occurred, the board that failed (if applicable), and the fault count is logged in memory and the test restarts automatically at the beginning of the test and continues to cycle. The fault count represents the order of occurrence. The faults logged in memory can be displayed and corrected at a later time (as described in paragraph 4.08). In the repeat mode, faults may be caused by heat or transient problems, thus, the problem should be solved when the stored faults are recalled from memory or else they may be lost until a later time. See Part 4 for the procedure to recall faults logged in memory. Figure 11 is a flow diagram for running tests in the repeat mode.

**Note:** When Test 02 is running in the repeat mode and a fault occurs, the test stops as it would in the execute mode.

**3.06** The execute mode is probably used most often. However, the repeat mode may be preferred for intermittent faults and/or when constant monitoring is not possible.

**Note:** For Tests 17 (line test), 42 (trunk test) and 02 (system test), it is recommended that the

test take advantage of the TIME SAVING OPTIONS (ie, the Continue on Error and Test Mode options).

### TIME SAVING OPTIONS

**3.07** The Continue on Error and Test Mode options are time savers for Tests 42 and 17 when in the EXECUTE mode of testing. The Continue on Error option can also be used on Test 02 when being run in the EXECUTE mode of testing. These two options are available only on the **first** pass of these tests. An attempt to use either of these options on any other test or during other than the first pass of the applicable test is ignored. These options are only applicable to the following circuit packs.

LC588/LC02C

LC08

LC09

LC10

LC11

LC293

LC361

**3.08** The Continue on Error option is a quick way of determining most of the faults in a system. The Test Mode option is a quick way of testing replaced circuit packs or suspected circuit packs.

#### A. Continue on Error

**3.09** The Continue on Error option allows testing of lines and trunks to be continued after an error (fault) has occurred, without starting the test over (ie, at the first circuit pack on the first carrier). Testing resumes at the board which normally would have been tested next, had the fault not occurred.

**3.10** When Test 42, 17, or 02 is running on its first pass and a fault is found in one of the applicable circuit packs, the test stops as usual and a fault code is displayed. The test number flashes on and off at the MAAP, indicating that the Continue on Error option is allowed. To continue on error, pull the faulty circuit pack back (but do not replace it) and push the COE button on the MAAP. The COE button is an

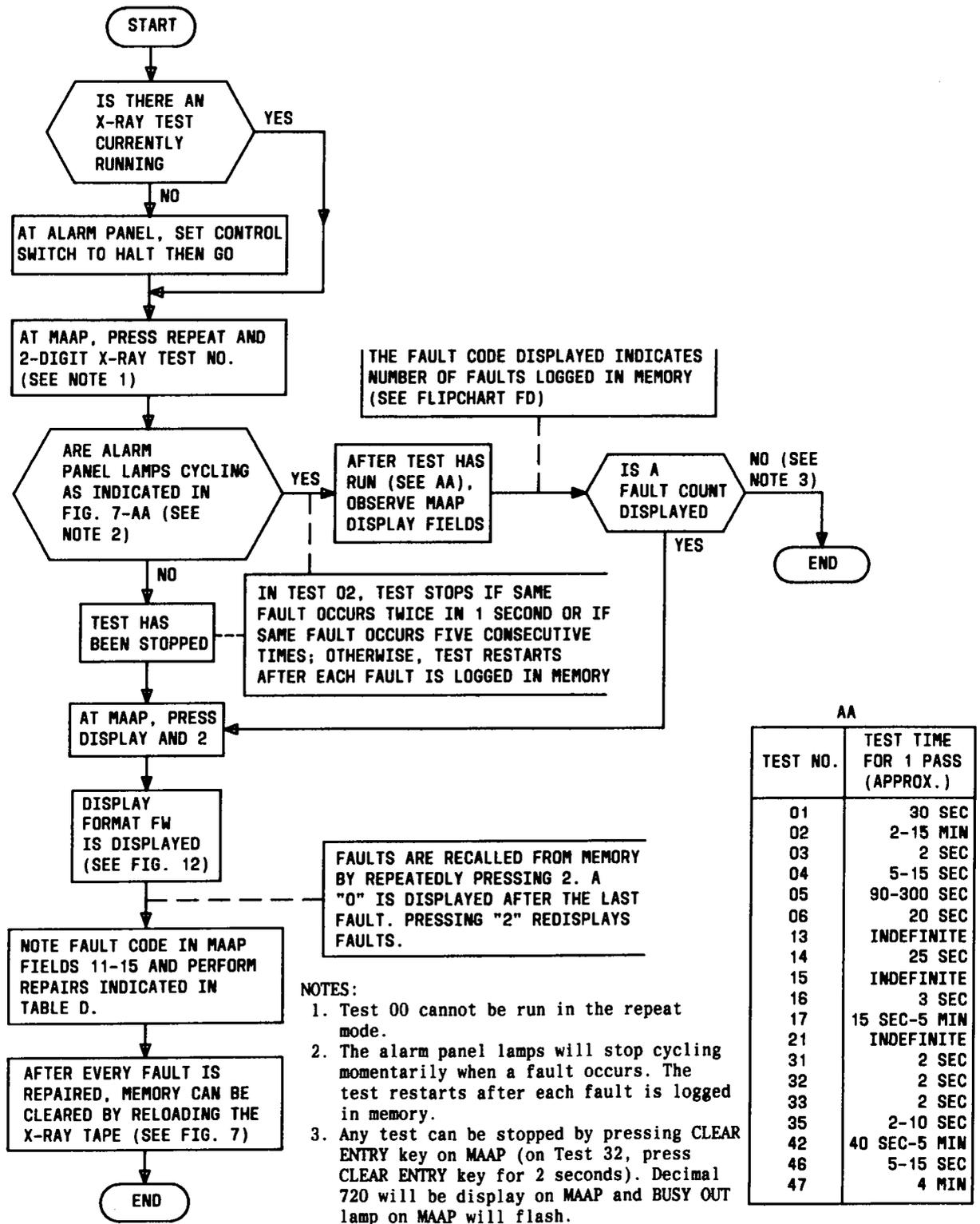


Fig. 11—Procedure to Run Tests in Repeat Mode

unlabeled button shown in Fig. 2. The test continues at the next circuit pack, allowing the remainder of the system to be checked without waiting for a retest of previously tested circuit packs. The test number on the MAAP continues to flash on and off after the COE button is pressed to indicate that the COE button is being used.

**3.11** At the successful conclusion of the first pass, fault code 720 is displayed on the MAAP (and on the alarm panel) and the ERROR lamp flashes at the MAAP. Most faulty circuit packs are pulled out and the system should respond as usual to any command.

#### B. Test Mode

**3.12** The Test Mode option allows the tester to step either forward (left to right) or backward through a carrier after a fault has occurred. This option minimizes the time it takes to test a replaced circuit pack. This option also saves time by only testing the desired circuit packs or carrier. For example, when a fault occurs and a circuit pack is replaced, the tester can immediately verify the replaced circuit pack by stepping backward one place and restarting the current test. The test starts at this board and continues through the system until manually stopped or a fault detected. Likewise, a carrier could be skipped by stepping forward through the carrier until positioned at the desired carrier/circuit pack to be tested.

**3.13** When Test 17 or 42 is running on its first pass and a fault is found in one of the applicable circuit packs, the test stops as usual and a fault code is displayed. The test number and ERROR lamp flashes on and off at the MAAP.

**3.14** To step forward through a carrier, press the TEST MODE button on the MAAP. This is an unlabeled button shown in Fig. 2. The test number on the MAAP continues to flash on and off after the TEST MODE button is pressed indicating that the Test Mode option is being used. Next press the STEP button the desired number of times. A number of circuit packs equal to the number of times the STEP button was pressed are skipped in the forward direction. Pressing the ENTER button causes testing to resume at the location equal to the faulty circuit pack plus the number of times the STEP button was pressed.

**3.15** More useful is the capability to step backward through a carrier. In order to step backward

through a carrier after a faulty circuit pack is detected (fault code displayed with ERROR lamp and test number flashing), the TEST MODE and REMOVE buttons are pressed on the MAAP and then STEP is pressed the desired number of times. A number of circuit packs equal to the number of times the STEP button was pressed are skipped in the reverse direction. Pressing the ENTER button which causes testing to resume at a location equal to the faulty circuit pack minus the number of times the STEP button was pressed.

**3.16** At the successful conclusion of the first pass, fault code 720 is displayed on the MAAP (and on the alarm panel) and the ERROR lamp flashes at the MAAP. The faults in the system should all be corrected.

#### RUNNING X-RAY TESTS

**3.17** For manual startup of any of the tests, the following stimulus-response exchange occurs at the MAAP.

- (1) Press EXECUTE (the digits "12" are displayed in the far right two character display).
- (2) Press the two digits of the test number (once the digits are displayed in the far right display, the test has started). For example, if test number one is desired to be run, press the digits "0" and "1".

As soon as the test number (XY) is seen in the rightmost two digits of the MAAP display, the test is running.

**3.18** The following paragraphs describe each X-ray test. These descriptions should help the tester understand what is being tested. For a more thorough understanding of each test, read the descriptions of the programs in Part 5 for the test desired. Table A lists the programs used for each test. Each test has a reference to a flow diagram which depicts the test procedure. The MAAP display formats referenced to in these descriptions are shown in Fig. 12. See Table A for a quick reference of the circuit packs tested, the display format(s) used, the time for one pass, the system function (program) tested, and the flowchart used for each test.

**Note:** While running any X-ray test, the tester should verify that the LEDs on the appro-

F1																X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)																
HOURS	MIN.		SEC.													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

F2																X-RAY TEST NO.	
BURN-IN CLOCK (DECIMAL)													MAAP BUTTON HWWARE CODE (OCT)				
HOURS	MIN.		SEC.														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		

F3																X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)															FAULT CODE (OCTAL) OR SPECIAL CODE MIN VALUE 3 MAX VALUE 3777	
HOURS	MIN.		SEC.													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

(ACCESSED BY DEPRESSING DISPLAY AND 2 - SEE NOTE)																X-RAY TEST NO.
RAM ADDRESS (OCTAL)						ADDRESS CONTENT (OCTAL)										
MIN. VALUE 0 MAX. VALUE 17777						MIN. VALUE 0 MAX. VALUE 17777 (TABLE F)										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

NOTE: USE F4 TO RECALL SOFT MEMORY FAULTS WHEN MEMORY X-RAY (TESTS 01, 02, 14) IS RUNNING IN THE REPEAT MODE.

Fig. 12—MAAP Display Formats (Flipcharts) (Sheet 1 of 7)

F5															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						HARDWARE INTERRUPT TYPE (OCTAL) (FIGURE 22)				FAULT CODE (OCTAL)					
HOURS	MIN.		SEC.												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

F6															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						FAULTY SCAN/DIST RESPONSE OR I/O CHANNEL NO. (OCTAL) (TABLE G)		NO. OF SCAN/ DIST TESTS TO FAIL OUT OF 27 (OCT)		FAULT CODE (OCTAL)					
HOURS	MIN.		SEC.												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

F7															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						TIME DIVISION NETWORK COMMAND (OCTAL)				FAULT CODE (OCTAL)					
HOURS	MIN.		SEC.												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

F8															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						RESPONSE TO A NETWORK VERIFICATON REQUEST (OCTAL) (TABLE H)				FAULT CODE (OCTAL)					
HOURS	MIN.		SEC.												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Fig. 12—MAAP Display Formats (Flipcharts) (Sheet 2 of 7)

(SEE FIG. 23) <b>F9</b>															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						HI ADR.	CARR. (DEC)	BOARD (DEC)	PORT	FAULT CODE (OCTAL)					
HOURS	MIN.		SEC.												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

<b>F10</b>															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						BUTTON (SEE NOTE 1)				FAULT CODE (OCTAL)					
HOURS	MIN.		SEC.			ROW (OCTAL)		COLUMN (OCTAL)							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

X-RAY TEST 02 REPEAT MODE <b>F11</b>															X-RAY TEST NO.	
BURN-IN CLOCK (DECIMAL)						CARRIER NUMBER (OCTAL)			BOARD NUMBER (OCTAL)		FAULT CODE (OCTAL)					
HOURS	MIN.		SEC.													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

<b>FA</b>															X-RAY TEST NO.				
BURN-IN CLOCK (DECIMAL)						NO. OF LINE PORTS EQUIP.  (DEC)			NO. OF TRK PORTS EQUIP.  (DEC)		NO. OF LINE CARR. EQUIP.  (DEC)		NO. OF TRK CARR. EQUIP.  (DEC)			NO. OF "TOUCH- TONE" CALLING REG PORTS EQUIP. {TABLE I} (DEC)		NO. OF ATTND INTF. PORTS EQUIP.  (DEC)	
HOURS	MIN.		SEC.																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16				

NOTE:

- To determine the defective lots use the following:  
(Where the slot number is electrical board / carrier slot).

		BUTTON COLUMN					
BUTTON		0	1	2	3	4	5
ROW	5	3/5	3/5	3/5	3/5	3/5	3/5
	4	4/6	4/6	4/6	4/6	3/5	3/5
	3	5/7	5/7	4/6	4/6	4/6	4/6
	2	5/7	5/7	5/7	5/7	5/7	5/7
	1	6/8	6/8	6/8	6/8	6/8	6/8
	0	7/9	7/9	7/9	7/9	6/8	6/8

Fig. 12—MAAP Display Formats (Flipcharts) (Sheet 3 of 7)

<b>FB</b>															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						TONES WHICH FAILED TEST (OCTAL) (TABLE J)				FAULT CODE (OCTAL)					
HOURS	MIN.	SEC.													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

<b>FC</b>															X-RAY TEST NO.	
BURN-IN CLOCK (DECIMAL)						NO. OF 2K RAM MEMORY BLOCKS (DECIMAL)			NO. OF HIGH SPEED DATA PORTS (DEC)		NO. OF LOW SPEED DATA PORTS (DEC)		NO. OF SERIAL DATA LINK LOOPS (DEC)			(SEE NOTE 1) (DEC)
HOURS	MIN.	SEC.														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

<b>FD</b>															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						FAULT COUNT SINCE START OF TEST (DECIMAL)				FAULT CODE (OCTAL) [DEPRESS DISPLAY AND 2 TO RECALL EARLIEST TO LATEST FAULTS]					
HOURS	MIN.	SEC.													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

<b>FF</b>															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						FAULTY SCAN/ DIST. RESPONSE OR I/O CHANNEL NO. (OCTAL) (TABLE G)				FAULT CODE (OCTAL)					
HOURS	MIN.	SEC.													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

<b>FG</b>															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						DATA CHANNEL ADDRESS (OCTAL) (TABLE K)				FAULT CODE (OCTAL)					
HOURS	MIN.	SEC.													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

NOTE:

1. RMATS board type: 0=LC570, 1=LC570B, 2=LC597.

Fig. 12—MAAP Display Formats (Flipcharts) (Sheet 4 of 7)

<input type="radio"/> (ACCESSED BY DEPRESSING DISPLAY AND 1) <b style="font-size: 1.2em;">FH</b> <input type="radio"/>															X-RAY TEST NO.
CSS MEMORY ADDRESS (OCTAL) THE ADDRESS (WHEN NON-ZERO) OF THE LAST HARDWARE INTERRUPT. THIS DISPLAY IS ACCESSED BY DEPRESSING DISPLAY AND 1 AT THE MAAP															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

<input type="radio"/> (ACCESSED BY DEPRESSING DISPLAY AND 0) <b style="font-size: 1.2em;">FM</b> <input type="radio"/>															X-RAY TEST NO.
NO. OF MEMORY BLOCKS (DEC)	NO. OF HIGH SPEED DATA LINKS (DEC)	NO. OF LOW SPEED DATA LINKS (DEC)	NO. OF ATTND COM-SOLE (DEC)	NO. OF CARRIERS LOOPED-AROUND	ANI PRS (DEC)	NO. OF LINE PORTS EQUIPPED, (DEC) INCLUDING TONE PORTS	NO. OF LINE TRK PORTS EQUIPPED (DEC)	NO. OF LINE CARRS (DEC)	NO. OF TRK CARRS (DEC)	NO. OF "TOUCH-TONE" CALLING REC PORTS (DEC) (TABLE I)	NO. OF ATTND INTF PORTS (DEC)				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

<input type="radio"/> (ACCESSED BY DEPRESSING DISPLAY AND 3) <b style="font-size: 1.2em;">FN</b> <input type="radio"/>															X-RAY TEST NO.
SYSTEM SERIAL NUMBER					DATA I/O CHANNELS					TAPE DRIVE SERIAL NUMBER					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

<input type="radio"/> LC145 FAULTS (LINE CARRIER 0) <b style="font-size: 1.2em;">FS</b> <input type="radio"/>															X-RAY TEST NO.
HOURS			MIN.		SEC.		BOARD (DEC.)	PORT	SCAN STATE (DEC.)		FAULT CODE				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Fig. 12—MAAP Display Formats (Flipcharts) (Sheet 5 of 7)

<input type="radio"/> LC361 RING CYCLE FAULTS <b>FT</b> <input type="radio"/>															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						BOARD (DEC)	PORT	SCAN STATE (DEC)	FAULT CODE (OCTAL)						
HOURS	MIN.	SEC.													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

<input type="radio"/> (ACCESSED BY DEPRESSING DISPLAY AND 4) <b>FU</b> <input type="radio"/>															X-RAY TEST NO.
TAPE ISSUE				MICRO- CODE VERSION											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

<input type="radio"/> <b>FV</b> <input type="radio"/>															CARRIER NUMBER	
BOARD #	BOARD 1	BOARD 2	BOARD 3	BOARD 4	BOARD 5	BOARD 6	BOARD 7	BOARD 8	BOARD 9	BOARD 10	BOARD 11	BOARD 12	BOARD 13	BOARD 14		BOARD 15
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		16

<input type="radio"/> (SEE NOTE 2) <b>FW</b> <input type="radio"/>															X-RAY TEST NO.	
BURN-IN CLOCK (DECIMAL)						CARRIER (DEC.)	BOARD (DEC.)	HI ADDRESS AND STATUS (OCTAL)	FAULT CODE (OCTAL)							
HOURS	MIN.	SEC.														
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

NOTE:  
2. For format FW the HI address and status is arranged as follows:

MAAP FIELDS				
10		11		
HI ADR.	SS3*	SS2*	SS1*	SS0*
4	3	2	1	0

Fig. 12—MAAP Display Formats (Flipcharts) (Sheet 6 of 7)

○ (ACCESSED BY PRESSING DISPLAY AND 2) <b>FX</b> ○															X-RAY TEST NO.
BURN-IN CLOCK (DECIMAL)						PORT ADDRESS OF BOARD THAT FAILED OR OTHER DATA RELATING TO FAULT				FAULT CODE (OCTAL)					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

○ <b>FZ</b> ○															
TEST NUMBER 1	TEST NUMBER 2	TEST NUMBER 3	TEST NUMBER 4	TEST NUMBER 5	TEST NUMBER 6	TEST NUMBER 7	TEST NUMBER 8	TEST NUMBER 9	TEST NUMBER 10	TEST NUMBER 11	TEST NUMBER 12	TEST NUMBER 13	TEST NUMBER 14	TEST NUMBER 15	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Fig. 12—MAAP Display Formats (Flipcharts) (Sheet 7 of 7)

appropriate circuit packs light properly. Check the buffer boards and processor boards for proper indications also.

## DESCRIPTION OF X-RAY TESTS

### A. Test 00 (Alarm Panel Test) (Fig. 13)

**3.19** Test 00 is run to verify basic processor sanity and to initialize X-ray status (data sets, tables, etc). This test is run automatically immediately after store, instruction fetch, and register memory which occur immediately after the X-ray tape load is completed. Test 00 makes one pass in about 1 second, then automatically transfers control to Test 01. This test cannot be manually started via the MAAP button sequence EXECUTE, 0, 0 without a fault code being displayed.

### B. Test 01 (Control Section Test) (Fig. 13)

**3.20** Test 01 runs the following tests in the order given.

- (1) Memory (Test 14)
- (2) Interrupt (Test 32)
- (3) Instruction Set (Test 31)
- (4) LC570 (or LC597) Test (Test 35).

**3.21** Display format FC is displayed during this test. The tester should verify that the correct number of data links and memory blocks are displayed. See each individual test description for more detailed information. The time for one pass is 30 seconds.

### C. Test 02 (System Test) (Fig. 14)

**3.22** Test 02 runs the following tests in the order given.

- (1) Memory (Test 14)
- (2) Interrupt (Test 32)
- (3) Instruction Set (Test 31)
- (4) Scanner/Distributor (Test 03)
- (5) Network Shift Register (Test 04)
- (6) PAM test (Test 05)

(7) LINRAY (line and trunk) (Test 17 and 42)

(8) LC570 (or LC597) Test (Test 35).

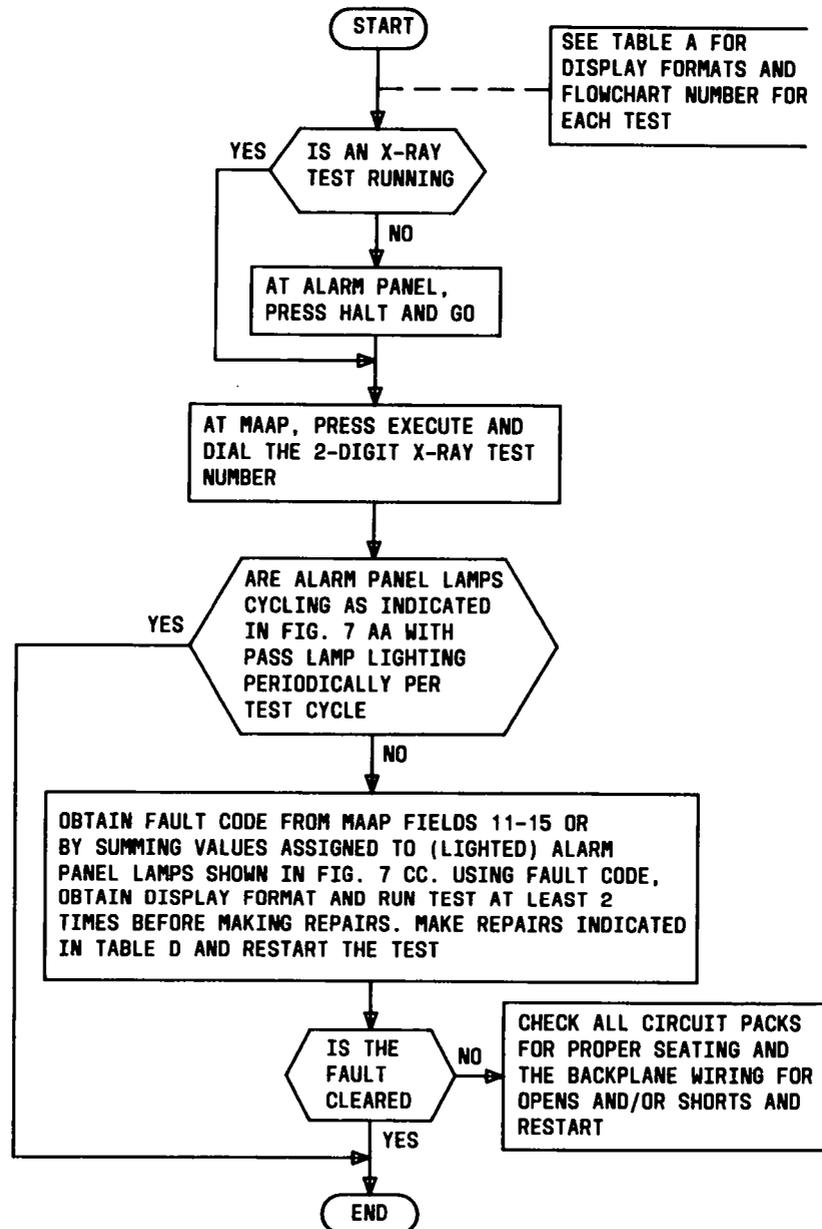
**3.23** Test 02 should be used when a test of the entire system needs to be continuously run. See individual test instructions for more detailed information. The MAAP Test 1 is run during this test (See Fig. 14). The time to run one pass of Test 02 varies from 2 to 15 minutes depending on the size of the system.

### D. Test 03 (Scanner/Distributor Test) (Fig. 13)

**3.24** Test 03 performs a test of the LC46. This test is accomplished by sending special data patterns to the board which causes an internal loop-around condition. Data is sent through this loop in the circuitry and is expected to come back to the processor identical to the way it was sent. If the data is not the same, then a stuck at (SA) fault has been found and an appropriate fault code is displayed on the MAAP via format F1. The time for one pass is 2 seconds.

### E. Test 04 (Network Shift Register Test) (Fig. 13)

**3.25** Test 04 runs in order Test 03 (scanner/distributor test) and the Network Shift Register test. Test 04 performs a test of each shift register on each ported pack in the system and then builds a table where each entry contains the address of each shift register. First, the test clears this network table so that it is initialized. Next, the test clears the shift register at every possible shift register address in the system. Then a check is made to insure that all shift register addresses indicate that either no time slot is assigned or that there is no shift register. A single time slot is assigned to each port and it is checked to see that it is the proper time slot and that no other slots have been inadvertently assigned. If this is correct, then that port's address is entered into the network table. If no response is received in the attempt to assign a single time slot, then it is assumed that no shift register is at that address and no entry is made in the table. Next a complete test is made of each shift register by assigning each of the possible 64 time slots and insuring that the correct one is indeed active and that it can be cleared properly. After all shift registers have been tested in this manner, format FA is displayed on the MAAP. The time for one pass is 5 to 15 seconds.



## NOTE:

1. THE CLEAR ENTRY BUTTON ON THE MAAP MUST BE PRESSED AND HELD APPROX 3 SECONDS TO TERMINATE TEST 32.

Fig. 13—Procedure to Run Tests 00, 01, 03, 04, 05, 14, 17, 31, 32, 42, and 47 in the Execute Mode

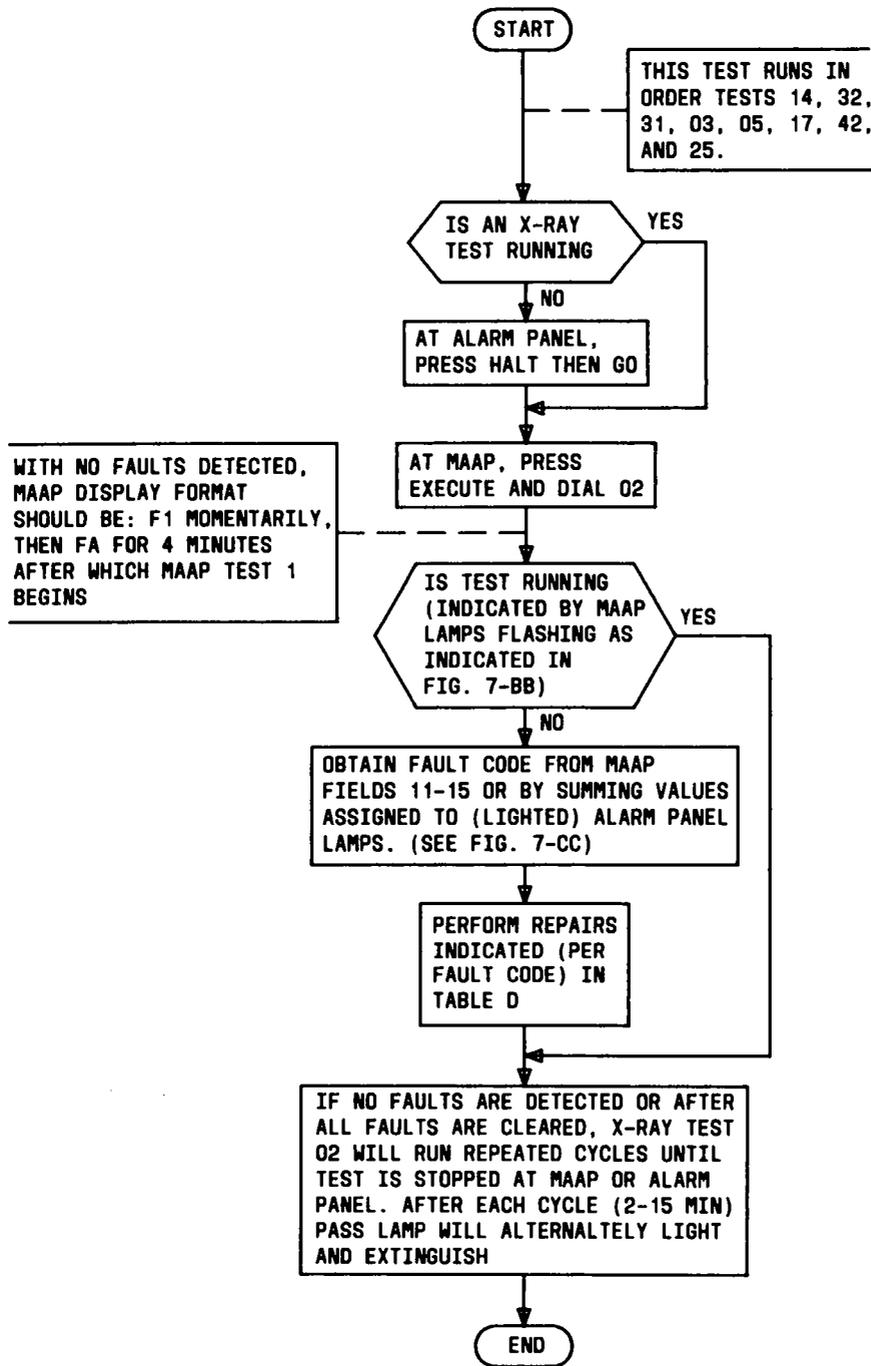


Fig. 14—Procedure to Run Test 02 (System Test) in the Execute Mode

**F. Test 05 (PAM Test) (Fig. 13)**

**3.26** Test 05 runs the following test in the order given.

- (1) Scanner/Distributor (Test 03)
- (2) Network Shift Register test (Test 04)
- (3) PAM test.

**3.27** Test 05 verifies the tone plants in the system. The tone plants are the LC204 and the LC17 (optional). Dial tone may be heard by plugging a handset into port 0 of any of the first six boards in a line carrier. The top LED on each LC50 in each carrier should be on during Test 05. If this is not the case, then something is wrong with tone transmission to the carrier with the LC50 (ie, the one with the LED that did not light). Check PAM cabling and flat cables. Format FA displays the ports that are found in the system. The time for one pass of this test is 90 to 300 seconds.

**G. Test 06 (Emergency Transfer Test) (Fig. 15)**

**3.28** The emergency transfer function allows the customer designated telephones to be automatically connected to central office trunks in the event of a system breakdown (eg, a processor failure). This test involves not only executing Test 06 and verifying that the proper sequence of events occurs, but also involves verifying certain events happen when the emergency transfer switch on the alarm panel is operated. The time for this test is 20 seconds.

**H. Test 13 (Attendant Console Test) (Fig. 16)**

**3.29** Test 13 runs in one of two possible modes:

- (1) Automatic LED cyler
- (2) Manual button pushes.

The automatic mode exercises the lamps, alphanumeric, and audibles on up to four attendant consoles by stepping them through a periodic sequence. The manual test, performed while running Test 13, allows any one, or all, consoles to be tested for circuit continuity by pressing the desired buttons. After the first button on any attendant console is pressed, all LEDs on all consoles go out. For any button pressed thereafter on any console, the associated

LED is turned on and remains on until another button on the console is pressed. If no button is pressed within 30 seconds, the test returns to the automatic mode.

**3.30** For most buttons, the associated LED is adjacent to the button. The following buttons and their displays are exceptions:

- TOUCH-TONE dialing buttons 0 through 9, #, and \* are displayed as the left-most alphanumeric on the attendant console display.
- The HOLD button is associated with the PR LED.
- The CANC button is associated with the CW LED.
- The START and ANSWER (ANS) buttons are associated with the two left-most ANS field LEDs, respectively.

**I. Test 14 (Memory Test) (Fig. 13)**

**3.31** The memory test tests only the RAM portion of memory. Data patterns are shifted through nonprogram areas of memory in order to check for data dependent faults. Areas of memory that contain data or status are tested with data patterns using the swap instruction called TLOC. Format FC displays the number of 2K memory blocks in the system. All the RAM is located on the LC556 (or LC594) board. Parity is also tested at every location. This test requires 25 seconds for one pass.

**3.32** The generic EPROM board (LC555/ZLC14 or ZLC16) is tested continuously during the 25 millisecond interrupt when Tests 01 and 02 are run. The only tests performed are checksum tests and parity generator tests. The checksum test requires 2 minutes, 20 seconds to complete one pass.

**J. Test 15 (SMDR Test)**

**3.33** Test 15 gives the user control of that part of the X-ray program which controls the SMDR tests.

**3.34** This test is unusual because rather than running an X-ray test it allows the user to select other SMDR tests. These tests verify SMDR equipment operation. The SMDR equipment is connected

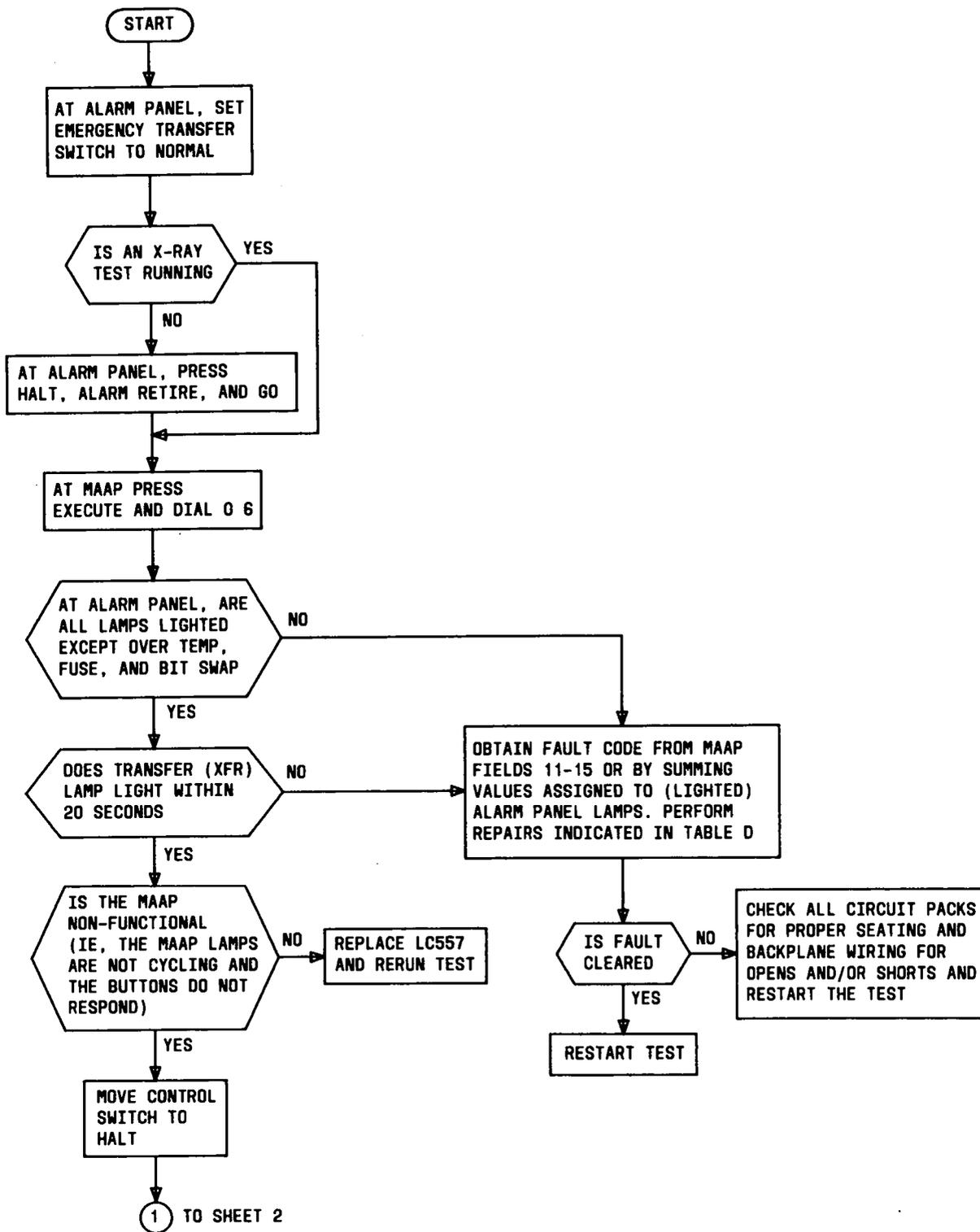


Fig. 15—Procedure to Run Test 06 (Emergency Transfer) (Sheet 1 of 2)

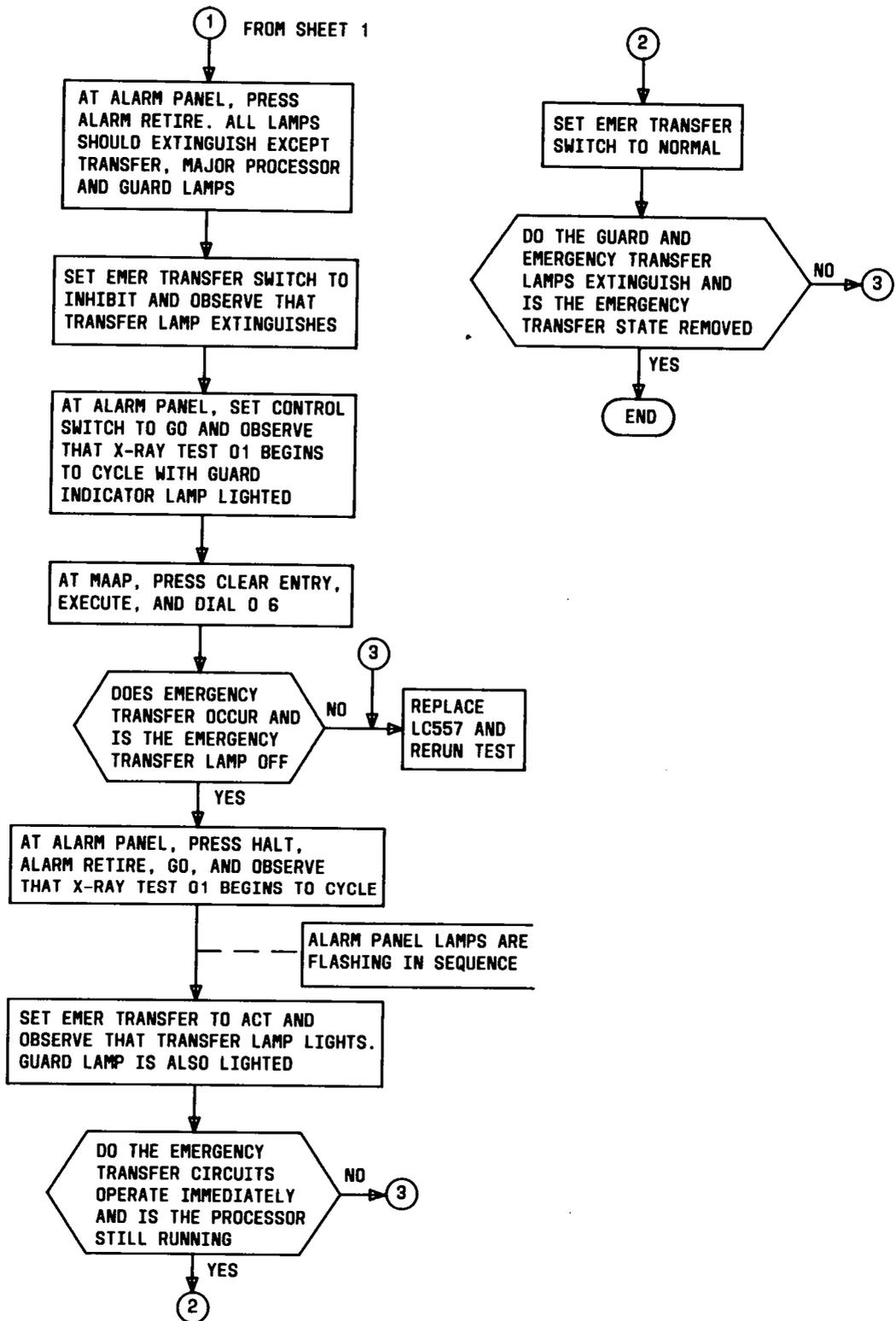


Fig. 15—Procedure to Run Test 06 (Emergency Transfer) (Sheet 2 of 2)

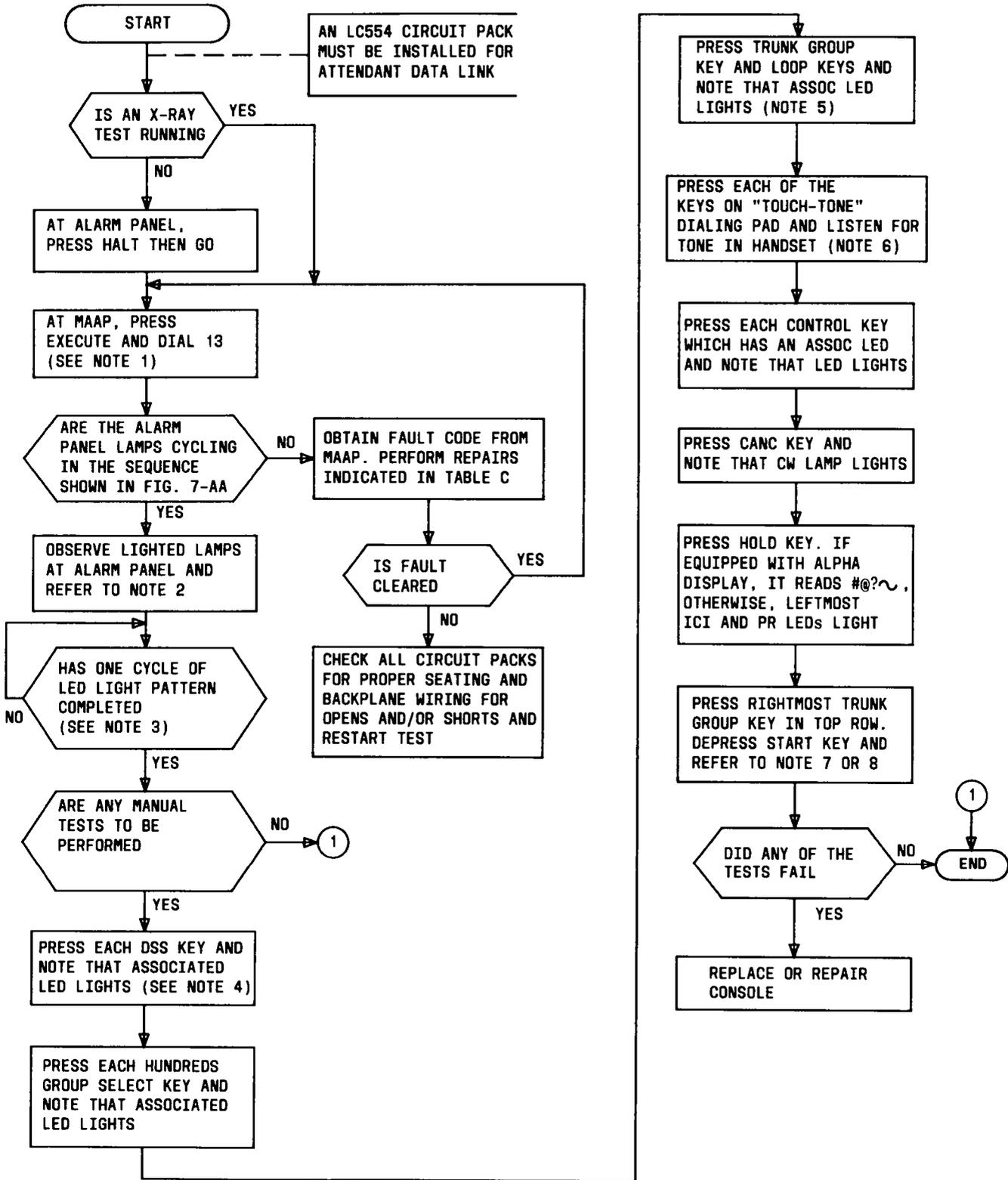


Fig. 16—Procedure to Run Test 13 (Attendant Console) (Sheet 1 of 2)

## NOTES:

1. TEST 13 WILL RUN AUTOMATICALLY WHEN SELECTED OR A MANUAL TEST CAN BE PERFORMED ANY TIME DURING THE AUTOMATIC CYCLES (ie, AFTER ONE SUCCESSFUL PASS).
2. THE ALARM PANEL INDICATES THE CONSOLE(S) WHICH THE X-RAY PROGRAM HAS FOUND AND WILL TEST. THE SCAN, NET, AND FACILITY LEDS INDICATE THE PRESENCE OF THE ASSOC CONSOLE. REFER TO TABLE AA.
3. ONE CYCLE OF THE AUTO. LED CONSOLE DISPLAY IS AS FOLLOWS: EACH BUSY LED IN TURN, EACH HUNDREDS GROUP IN TURN, ONE PULSE OF TONE RINGER, RIGHT SIDE OF LOWER PORTION OF CONSOLE LIGHTING EACH ROW OF LEDS LEFT TO RIGHT STARTING AT BOTTOM WORKING UP, CENTER PORTION (LOOPS) LEFT TO RIGHT, BOTTOM TO TOP, LEFT PORTION OF CONSOLE (TRUNK GROUPS) LEFT TO RIGHT, BOTTOM TO TOP, TONE RINGER SOUNDS WHILE ALPHANUMERIC IS BEING WRITTEN TO #@?~, 5 PULSES OF ALL LEDS WITH TONE RINGER. THE SPECIAL AUDIBLES (TIME REMINDER AND CALL WAITING) ARE ALSO TURNED ON AND OFF.
4. AFTER THE FIRST BUTTON PUSH, ALL LEDS ON ALL CONSOLES GO OUT. FOR SUBSEQUENT BUTTON PUSHES ON ANY CONSOLE, THE ASSOCIATED LED IS TURNED ON AND REMAINS ON UNTIL ANOTHER BUTTON ON THAT CONSOLE IS PUSHED. IF NO BUTTON IS PUSHED WITHIN 30 SECONDS. THE TEST RETURNS TO THE AUTOMATIC MODE.
5. TRUNK KEY OPERATION LIGHTS ONLY THE BUSY LED ROW, AND LOOP KEY OPERATION LIGHTS ONLY THE HOLD LED ROW.
6. THE TWO ROWS OF LEDS ABOVE THE LOWEST ROW OF TRUNK GROUP KEYS SHOULD LIGHT, ONE FOR EACH "TOUCH-TONE" DIALING BUTTON. "TOUCH-TONE" DIALING BUTTONS 0 THRU 9, # AND \* ARE DISPLAYED AS THE LEFT MOST ALPHANUMERIC.
7. EACH TIME THE START KEY IS DEPRESSED, ALL FOUR ALPHA CHARACTERS, ARE SIMULTANEOUSLY INCREMENTED IN THE FOLLOWING SEQUENCE: @ A B C D E F G H I J K L M N O P Q R S  
T U V W X Y Z [ ~ ] { } ! " # \$ % & ' ( ) \* + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ?  
WHEN THE ANSWER KEY IS DEPRESSED, ANY LIGHTED LED OR ALPHANUMERIC CHARACTER IS EXTINGUISHED.
8. THE START AND ANSWER BUTTONS ARE ASSOCIATED WITH THE TWO LEFT-MOST ANS FIELD LEDs, RESPECTIVELY.

AA

SCAN	NET	FACILITY	CONSOLE(S) FOUND
◆	◆	◆	NO CONSOLES
◆	◆	◆	CONSOLE 0
○	◆	◆	CONSOLES 0 AND 1
○	○	◆	CONSOLES 0, 1, AND 2
○	○	○	CONSOLES 0, 1, 2, AND 3

◆ = LIGHTED INDICATOR

Fig. 16—Procedure to Run Test 13 (Attendant Console) (Sheet 2 of 2)

to serial data channel (octal port address 3100) via connecting plug CX03. The data integrity of this channel and the SMDR printer are verified via the "SMDR Output to Printer" procedures. This data channel and other SMDR functions are verified using the "SMDR Output to 9-Track Tape" procedures. The printout can be verified for accuracy by comparing the printout with Fig. 17, Sheets 1 and 2. When the output is to a 9-track tape, the tape data must be read elsewhere for verification. Format F3 is used to display faults that occur during a SMDR test.

#### SMDR Output to Printer

**3.35** To output the SMDR test data to an SMDR printer, the following procedure is used at the MAAP:

- (1) Press EXECUTE.
- (2) Dial the digits 15 and wait for a blinking PASS lamp.
- (3) Press PROC NO.
- (4) Dial the digits 21.
- (5) Press ENTER.
  - (a) A 12-word message of 'NOP' commands is transmitted to the SMDR.
  - (b) If the data link is working, the WAIT LED lights.
- (6) Press STEP.
  - (a) Step (1) of the test is executed.
  - (b) The data shown in Fig. 17, Sheet 1, is automatically printed on the SMDR printer.
  - (c) If timing is correct, the WAIT LED lights immediately after the last line is printed.
- (7) Press STEP.
  - (a) Step (2) of the test is executed.
  - (b) The data shown in Fig. 17, Sheet 1, is automatically printed on the SMDR printer. The difference between Step (2) and Step (1) is the output in Step (2) is "retransmitted" and is interlaced with erroneous messages.

- (8) Press STEP.
  - (a) Step (3) of the test is executed.
  - (b) The data shown in Fig. 17, Sheet 2, is automatically printed on the SMDR printer.
  - (c) If timing is correct, the WAIT LED lights after the last line is printed.
- (9) Press STEP.
  - (a) Step (4) of the test is executed.
  - (b) The data shown in Fig. 17, Sheet 2, is automatically printed on the SMDR printer. The difference between Step (4) and Step (3) is the output data in Step (4) is all "retransmitted" and is interlaced with erroneous messages.
  - (c) If timing is correct, the WAIT LED lights immediately after the last line is printed.
  - (d) If the data link is working, the WAIT LED lights.
- (10) Press STEP. Step (5) of the SMDR test is executed after the STEP button is pressed. The result of Step (5) being executed is the continuous alternation between Step (2) and Step (4) every 5 minutes. This test provides "burn-in" for the SMDR. To exit Step (5) or if Step (5) is not desired, press the RLS BUS/OUT.
- (11) Press RLS BUS/OUT.
  - (a) A 720 error message is displayed.
  - (b) X-ray returns to standard operation.

#### SMDR Output to 9-Track Tape

**3.36** To output the SMDR test data to an SMDR 9-track tape, the following procedure is used.

**Note:** Steps (1) through (14) are done *at the SMDR*.

- (1) Power down the tape unit and SMDR carrier and mount tape reel.
- (2) Turn on power and load tape.
- (3) Set panel switch to ON.

XX:XX	0:00.0	@	000	000	00000-000-000-0000	0000	00000
XX:XX	1:11.1	A	111	111	11111-111-111-1111	1111	11111
XX:XX	2:22.2	B	222	222	22222-222-222-2222	2222	22222
XX:XX	3:33.3	C	333	333	33333-333-333-3333	3333	33333
XX:XX	4:44.4	D	444	444	44444-444-444-4444	4444	44444
XX:XX	5:55.5	E	555	555	55555-555-555-5555	5555	55555
XX:XX	6:66.6	F	666	666	66666-666-666-6666	6666	66666
XX:XX	7:77.7	G	777	777	77777-777-777-7777	7777	77777
XX:XX	8:88.8	H	888	888	88888-888-888-8888	8888	88888
XX:XX	9:99.9	I	999	999	99999-999-999-9999	9999	99999
XX:XX	:	.	.	.	.	.	.
XX:XX	<:<<<	L	<<<	<<<	<<<<<-<<<-<<<-<<<<	<<<<	<<<<<
XX:XX	=:==.	M	===	===	=====	=====	=====
XX:XX	>:>>.	N	>>>	>>>	>>>>>->>>->>>->>>>	>>>>	>>>>>
XX:XX	?:???	O	???	???	?????-???-???-????	????	?????
XX:XX	0:00.0	@	000	000	00000-000-000-0000	0000	00000
XX:XX	1:11.1	A	111	111	11111-111-111-1111	1111	11111
XX:XX	2:22.2	B	222	222	22222-222-222-2222	2222	22222
XX:XX	3:33.3	C	333	333	33333-333-333-3333	3333	33333
XX:XX	4:44.4	D	444	444	44444-444-444-4444	4444	44444
XX:XX	5:55.5	E	555	555	55555-555-555-5555	5555	55555
XX:XX	6:66.6	F	666	666	66666-666-666-6666	6666	66666
XX:XX	7:77.7	G	777	777	77777-777-777-7777	7777	77777
XX:XX	8:88.8	H	888	888	88888-888-888-8888	8888	88888
XX:XX	9:99.9	I	999	999	99999-999-999-9999	9999	99999
XX:XX	:	.	.	.	.	.	.
XX:XX	<:<<<	L	<<<	<<<	<<<<<-<<<-<<<-<<<<	<<<<	<<<<<
XX:XX	=:==.	M	===	===	=====	=====	=====
XX:XX	>:>>.	N	>>>	>>>	>>>>>->>>->>>->>>>	>>>>	>>>>>
XX:XX	?:???	O	???	???	?????-???-???-????	????	?????

NOTE: "XX:XX" REPRESENTS THE TIME AS SHOWN ON THE CLOCK DISPLAY.

Fig. 17—SMDR Verification Printout (Sheet 1 of 3)

```

XX:XX 0:12.3 D 567 89 <=>?-012-345-6789 <= >?012
XX:XX 1:23.4 E 678 9 <=>?0-123-456-789 <=> ?0123
XX:XX 2:34.5 F 789 <=>?01-234-567-89 <=>? 01234
XX:XX 3:45.6 G 89 <= >?012-345-678-9 <=>?0 12345
XX:XX 4:56.7 H 9 <=> ?0123-456-789- <= >?01 23456
XX:XX 5:67.8 I <=>? 01234-567-89 <=> ?012 34567
XX:XX 6:78.9 <= >?0 12345-678-9 <=>? 0123 45678
XX:XX 7:89. <=> ?01 23456-789- <=>?0 1234 56789
XX:XX 8:9 . L =>? 012 34567-89 <=> 01 2345 6789
XX:XX 9: .< M >?0 123 45678-9 <=>-? 12 3456 789
XX:XX :.= N ?01 234 56789- <=>?-0123 4567 89 <
XX:XX :<=> O 012 345 6789 <=>?0-1234 5678 9 <=
XX:XX <=>. ? @ 123 456 789 <=>-?01-2345 6789 <=>
XX:XX =>?.0 A 234 567 89 <=>?-012-3456 789 <=>?
XX:XX >:?.1 B 345 678 9 <=>?0-123-4567 89 =>?0
XX:XX ?:01.2 C 456 789 <=>-?01-234-5678 9 < >?012
XX:XX 0:12.3 D 567 89 <=>?-012-345-6789 <= >?012
XX:XX 1:23.4 E 678 9 <=>?0-123-456-789 <=> ?0123
XX:XX 2:34.5 F 789 <=>?01-234-567-89 <=>? 01234
XX:XX 3:45.6 G 89 <= >?012-345-678-9 <=>?0 12345
XX:XX 4:56.7 H 9 <=> ?0123-456-789- <= >?01 23456
XX:XX 5:67.8 I <=>? 01234-567-89 <=> ?012 34567
XX:XX 6:78.9 <= >?0 12345-678-9 <=>? 0123 45678
XX:XX 7:89. <=> ?01 23456-789- <=>?0 1234 56789
XX:XX 8:9 . L =>? 012 34567-89 <=> 01 2345 6789
XX:XX 9: .< M >?0 123 45678-9 <=>-? 12 3456 789
XX:XX :.= N ?01 234 56789- <=>?-0123 4567 89 <
XX:XX :<=> O 012 345 6789 <=>?0-1234 5678 9 <=
XX:XX <=>. ? @ 123 456 789 <=>-?01-2345 6789 <=>
XX:XX =>?.0 A 234 567 89 <=>?-012-3456 789 <=>?
XX:XX >:?.1 B 345 678 9 <=>?0-123-4567 89 =>?0
XX:XX ?:01.2 C 456 789 <=>-?01-234-5678 9 < >?012

```

NOTE: "XX:XX" REPRESENTS THE TIME AS SHOWN ON THE CLOCK DISPLAY.

Fig. 17—SMDR Verification Printout (Sheet 2 of 3)

001001001001001.....	(NOTE 1)
110110110110110.....	
222222222222222.....	
333333333333333.....	
444444444444444.....	
555555555555555.....	
666666666666666.....	
777777777777777.....	
888888888888888.....	
999999999999999.....	
BBBBBBBBBBBBBBBB.....	(NOTE 2)
BBBBBBBBBBBBBBBB.....	
BBBBBB0123456789	(NOTE 3)
BBBB0123456789B	
BBB0123456789BB	
BB0123456789BBB	
B0123456789BBBB	
0123456789BBBBB	
123456789BBBBB0	
23456789BBBBB01	
3456789BBBBB012	
456789BBBBB0123	
56789BBBBB01234	
6789BBBBB012345	
789BBBBB0123456	
89BBBBB01234567	
9BBBBB012345678	
BBBBB0123456789	

- NOTES:
1. PATTERNS MAY BE BROKEN UP.
  2. NOT ALL WINDOWS WILL BE BLANK.
  3. THIS PATTERN IS VISIBLE IN THE "DIALED NUMBER" WINDOW AND SHOULD MOVE ACROSS THE WINDOW FOR EVERY 6 BLOCKS OF DATA. THIS PATTERN IS ALSO VISIBLE IN OTHER WINDOWS BUT MAY BE BROKEN UP.

Fig. 17—SMDR Verification Printout (Sheet 3 of 3)

- (4) Set selector to EXTENSION NUMBER.
- (5) Dial the extension number 1111 using the thumb-wheel switched.
- (6) Press CLEAR DISPLAY.
- (7) Press LOAD. Verify that tape moves to load point.
- (8) Press ON LINE.
- (9) Press DUMP MEMORY five times.
- (10) Press ON LINE (indicator LED goes off).
- (11) Press REWIND.
- (12) Press CLEAR DISPLAY.
- (13) Press ON LINE (indicator LED goes on).
- (14) Ensure that READ STATUS and WRITE ENABLE LEDs are on.

**Note:** Steps (15) through (27) are used to verify that a certain pattern is written for every six blocks of data. The data pattern is displayed starting from the duration time block window, and may be broken up. Steps (15) through (22) are done **at the MAAP**.

- (15) Press EXECUTE.
- (16) Dial the digits 15.
- (17) Press PROC NO.
- (18) Dial the digits 45.
- (19) Press ENTER. A series of dashes should appear on the MAAP.
- (20) Dial the digit 1.
- (21) Press ENTER.
- (22) Press STEP (six blocks of data are written on the 9-track tape). The data can be verified by comparing the data pattern in Fig. 17, Sheet 3, with the data displayed in the SMDR tape unit windows.

**Note:** Steps (23) through (27) are done **at the SMDR tape unit**.

- (23) Press CLEAR DISPLAY (tape unit windows are cleared of data.)

- (24) Press REPEAT (six blocks of data are written to the SMDR tape and displayed in the SMDR tape unit windows). Again, the data can be verified using Fig. 17, Sheet 3.

**Note:** Each succeeding press of the CLEAR DISPLAY and REPEAT keys on the SMDR tape unit writes six blocks of data on the SMDR 9-track tape and display the data in the tape unit windows. This data can be verified using Fig. 17, Sheet 3. (Be sure the REPEAT key is **not** pressed after the last line of information in Fig. 17, Sheet 3 is displayed. If pressing the REPEAT key is continued, the displays are incorrect.)

- (25) Dial the following calling numbers using the thumb-wheel switches. Between each set of numbers, press CLEAR DISPLAY (at SMDR) and REPEAT (at the MAAP).

0123

1234

2345

3456

4567

5678

6789

7890

8901

9012

7747

Each set of numbers appears in the STA or ORIG TRUNK window of the SMDR tape unit.

- (26) Place the selector in AUTOMATIC.
- (27) Press CLEAR DISPLAY (on SMDR) and REPEAT (on MAAP).

- (a) The pattern 012345678901234567890— — — — is displayed across the entire LED display. The pattern may be broken up.

- (b) The digits 7890 are displayed in the STA or ORIG TRUNK window.

**3.37** At the SMDR tape unit, verify that the calendar clock display is functioning properly as follows:

- (1) Place TIME/DATE switch in the TIME position.
- (2) Press and hold down the SET MINUTES switch (minutes display cycles from 00 through 59 and back to 00).
- (3) Press and hold down SET HOURS switch (hours display cycles from 00 through 23 and back to 00).
- (4) Using SET HOURS and SET MINUTES switches, set the time to 23 hours and 59 minutes.

**Note:** When the time cycles from 23:59 to 00:00, the data changes and one block of data is written on the tape.

- (5) Place TIME/DATE switch in the DATE position.
- (6) Press and hold down the SET DATE switch.
- (7) Verify that the entire calendar year plus one day can be cycled. (There is not a 02/29 date.)
- (8) Reset the time and date to the correct reading.

**3.38** To terminate the SMDR test, proceed as follows:

- (1) Press TAPE UNLOAD.
- (2) When tape stops moving, press ON LINE. Indicator LED goes off.
- (3) Press REWIND.
- (4) Remove tape.
- (5) Press RLS BUS/OUT.
  - (a) A 720 error message is displayed.
  - (b) X-ray returns to standard operation.

#### K. Test 16 (High-Speed Data Test)

**3.39** Test 16 runs the high-speed data test on the LC570 (or LC597). This test is a factory test which requires loop-around equipment.

#### L. Test 17 (Line Test) (Fig. 13)

**3.40** Test 17 runs the following tests in the order given:

- (1) Scanner/distributor (Test 03)
- (2) Network shift register test (Test 04)
- (3) Line test.

**3.41** Test 17 verifies the operation of most line circuit packs. Display format FA is used to display the number of line ports found in the system.

**3.42** With no equipment connected to the LX and AX connectors, only a rudimentary test of line status is performed. The lines are simply checked to see that all ports on every pack are in an on-hook condition. A line status fault occurs if a port is stuck in an off-hook state. All LC588/LC02C status LEDs are on at the end of a pass of Test 17. The LEDs sequentially blink on all subsequent passes. This is because of a routine which tests for LC293s in the system by setting all of the ringing relays on each line circuit. This causes the LC588/LC02C status LED to go on.

#### M. Test 21 (TOUCH-TONE Calling Receiver/Register Test) (Fig. 18)

**3.43** Test 21 runs the following tests in the order given:

- (1) Scanner/distributor (Test 03)
- (2) Network shift register test (Test 04)
- (3) TOUCH-TONE calling test.

**3.44** Test 21 allows a test of each TOUCH-TONE calling receiver/register in the system as well as providing an audible test of all tone plants in the system. Test 21 requires that a TOUCH-TONE\* telephone be plugged into port 0 of the LC588/LC02C indicated by the test.

**3.45** Upon running this test, format FA is displayed for a few seconds. During this time all

\* Trademark of AT&T

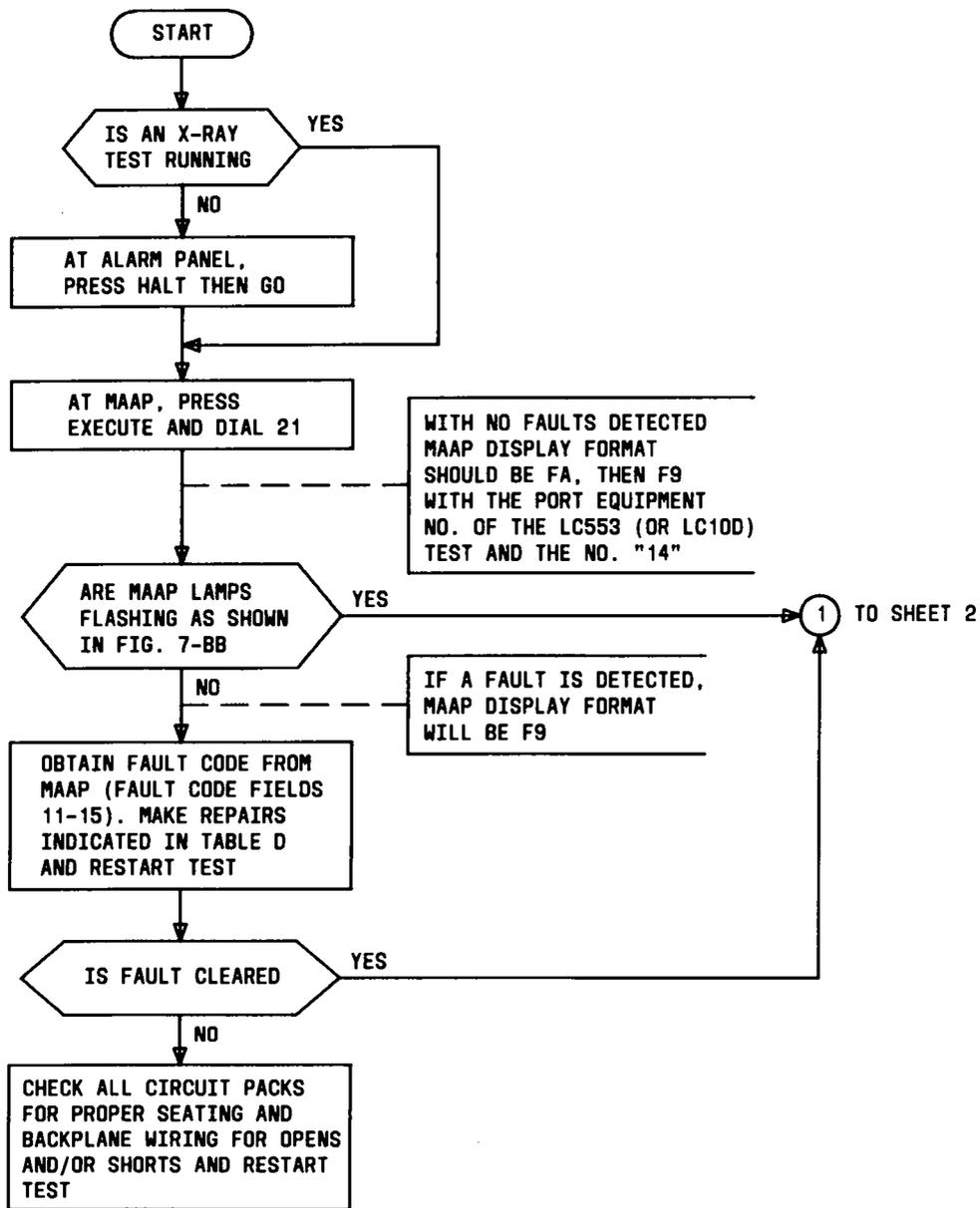
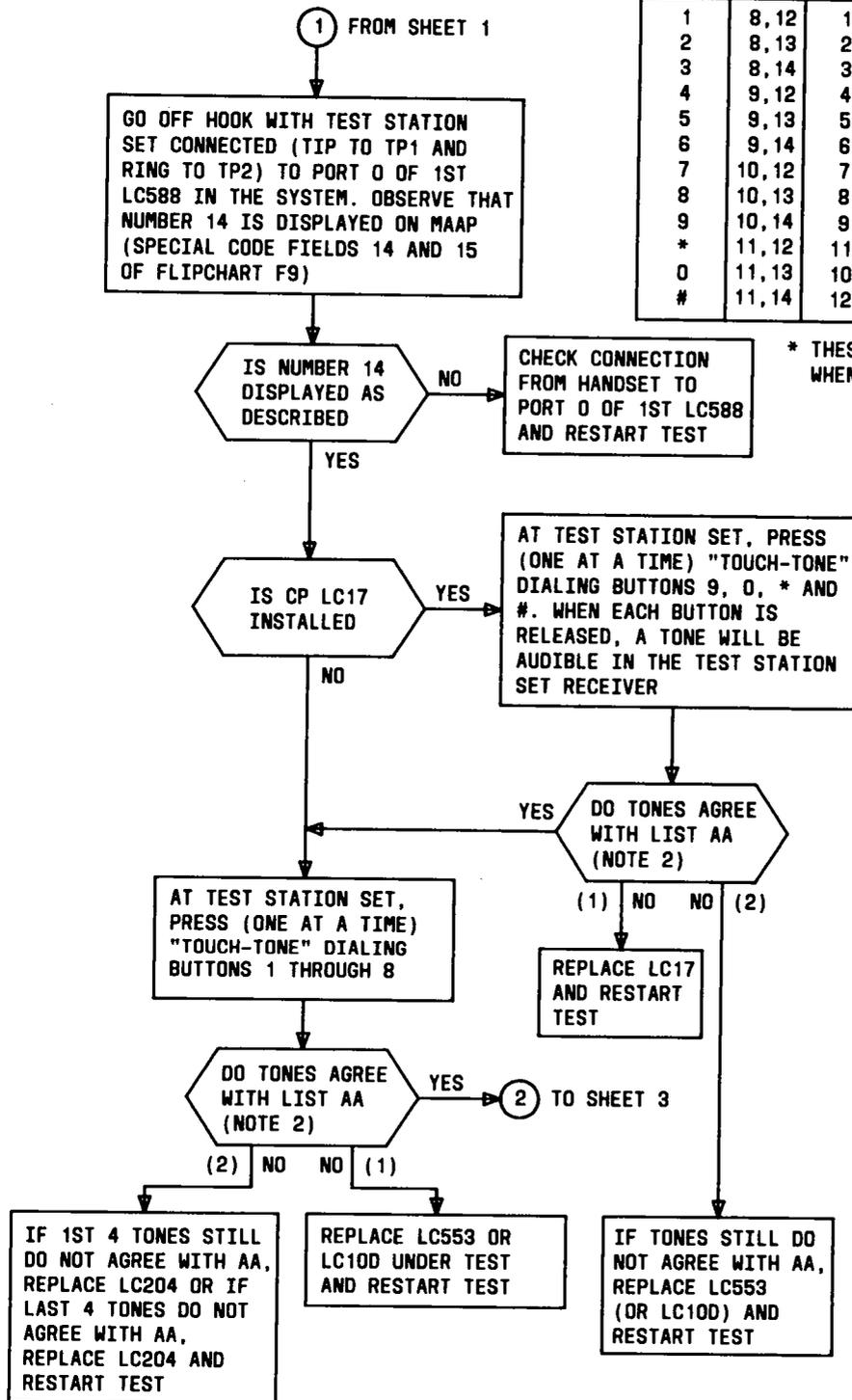


Fig. 18—Procedure to Run Test 21 (TOUCH-TONE Calling Receiver/Register Test)  
(Sheet 1 of 3)

AA

TT BUTTON	LED PAIR	MAAP DIGIT	AUDIBLE TONE (US)
1	8, 12	1	DIAL
2	8, 13	2	RECALL
3	8, 14	3	MISCELLANEOUS (440 HZ)
4	9, 12	4	INTERCEPT
5	9, 13	5	BUSY
6	9, 14	6	REORDER
7	10, 12	7	AUDIBLE RINGBACK
8	10, 13	8	SPECIAL AUD. RINGBACK
9	10, 14	9	IMMEDIATE RINGBACK*
*	11, 12	11	ZIP*
0	11, 13	10	480 HZ*
#	11, 14	12	CHIMES (1, THEN 2...7)*

\* THESE TONES ARE PRESENT ONLY WHEN LC17 IS INSTALLED.



NOTES:

1. TO FULLY TEST AN LC17, ATTACH A LOUPEAKER TO PIN 94 ON SLOT 7, CARRIER 0 ( OR 43 ON AX01) WITH GROUND CONNECTION TO PIN 93 ON SLOT 7 (OR 18 ON AX01). PRESS THE "#" "TOUCH-TONE" DIALING BUTTON AND VERIFY THAT ALL CHIME TONES CAN BE HEARD THROUGH SPEAKER.
2. IF THE TONES FAIL TO AGREE WITH THE LIST, PERFORM THE ACTION ASSOCIATED WITH THE FIRST "NO" (1). IF THIS DOES NOT CORRECT THE PROBLEM, PERFORM THE ACTION ASSOCIATED WITH THE SECOND "NO" (2).

Fig. 18—Procedure to Run Test 21 (TOUCH-TONE Calling Receiver/Register Test) (Sheet 2 of 3)

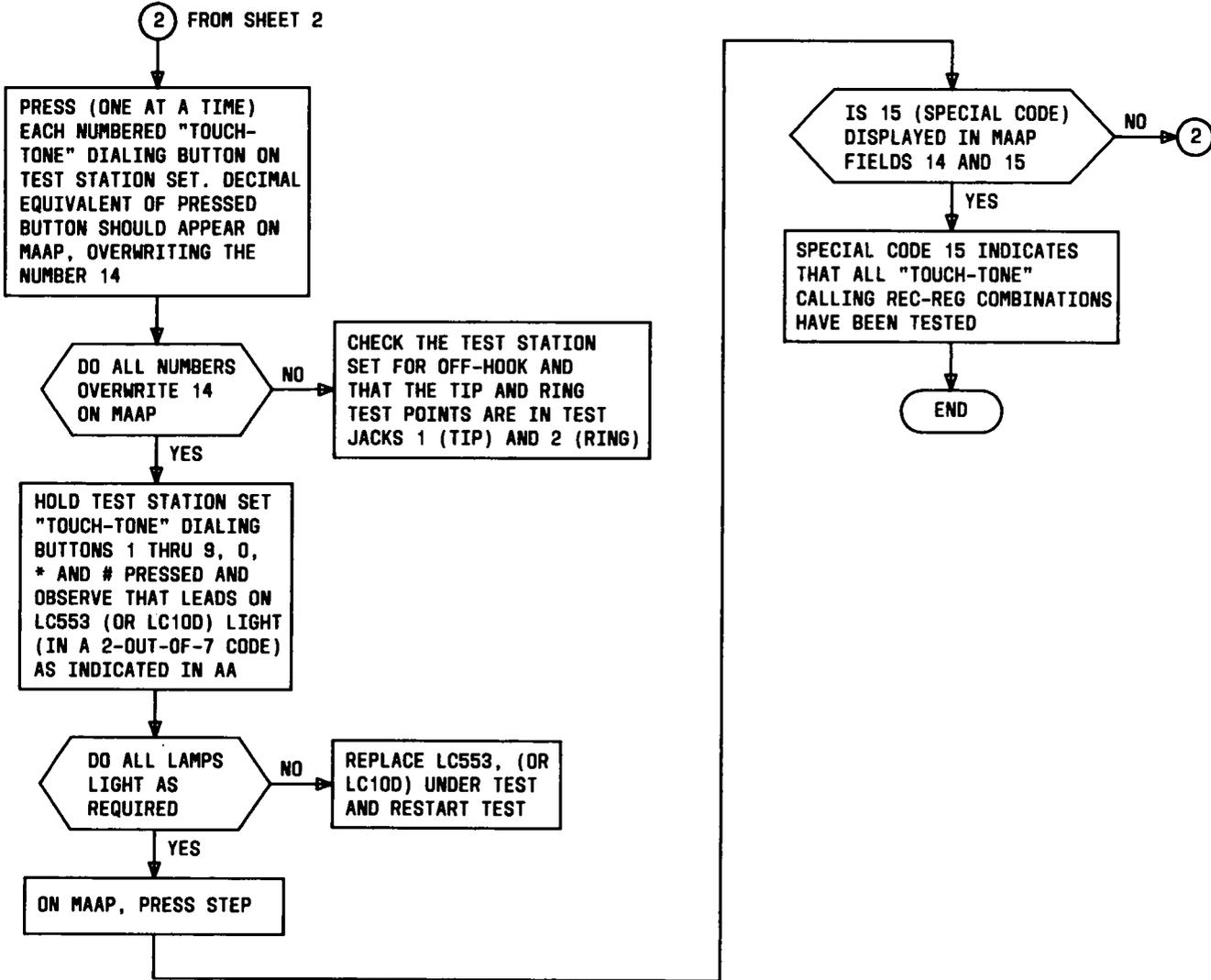


Fig. 18—Procedure to Run Test 21 (TOUCH-TONE Calling Receiver/Register Test)  
(Sheet 3 of 3)

TOUCH-TONE calling receivers/registers are identified and a tone transmission test is run on them. When this has passed, format F9 is displayed (ie, without the fault field). This displays the carrier, board, and port of the LC588/LC02C that is used for the test. The station set must be plugged into this LC588/LC02C port. Going off-hook with the station set displays a "14" in the fault field, the carrier, and board and port of the TOUCH-TONE calling register under test.

**3.46** Pressing a TOUCH-TONE dialing button on the station set causes its number to be displayed on the MAAP in the fault field and a pair of LEDs to be lighted on the TOUCH-TONE calling register under test. Upon releasing the button, a spurt of dial tone may be heard in the handset and is an indication that a function called two port originate/receive is being tested. After that spurt, a tone from one of the tone plants is connected depending on the button just pushed. See Fig. 18-AA for the displayed digits, LED pairs, and audible tones that correspond to each TOUCH-TONE calling digit.

**3.47** To advance to the next LC553 port (or LC10) TOUCH-TONE calling receiver, hit the STEP button on the MAAP. The next TOUCH-TONE calling receiver is displayed and a "14" appears in the fault field when the station set is off-hook. A "15" appears in the fault field when the last TOUCH-TONE calling receiver is tested and the STEP button is hit. The tester should verify that the proper LEDs, MAAP displays, and tones occur for each LC553 (or LC10) in the system.

**3.48** To fully test an LC17, attach a loudspeaker to pin 94 on slot 7, carrier 0 (or 43 on AX01) with ground connected to pin 93 on slot 7 (or 18 on AX01). Press the "#" TOUCH-TONE dialing button and verify that all chime tones can be heard through the speaker.

**Note:** Test 21 is used to test LC10s and two of the four ports on the LC553. The time for one pass is indefinite.

#### **N. Test 31 (Instruction Set Test) (Fig. 13)**

**3.49** Test 31 tests nearly all machine instructions in the 201S processor. Press the DISPLAY button on the MAAP and the digit 4 (see Format FU) in order to access this information. The time for one pass is 2 seconds.

#### **O. Test 32 (Interrupt Test) (Fig. 13)**

**3.50** Test 32 insures that all types of interrupts can occur and that the proper interrupt codes are generated. The interrupt types checked for are:

- Program sanity
- Main store parity
- Main store branch allow
- Illegal OP code.

**3.51** This routine spends 10 and 25 milliseconds with the program interrupts turned off which results in slow MAAP response. The best way to get out of this test is to press the CLEAR ENTRY button for a few seconds, release it, and wait for fault code 720 to be displayed. The MAAP now behaves as usual. The time for one pass is 2 seconds.

#### **P. Test 33 (LC14—Contact Interface Test)**

**3.52** This test is a factory test which requires loop-around equipment.

#### **Q. Test 35 [LC570 (or LC597) Test] (Fig. 19)**

**3.53** The LC570 (or LC597) is the interface between a DIMENSION PBX and a RMATS center. Via this board, the DIMENSION PBX can be monitored for traffic measurements and translations can be changed from a remote location.

**3.54** To run Test 35, an LC570 (or LC597) must be in slot 32/37 of the control carrier. Verify that the option switches on the LC570 (or LC597), and the LC554 are set in accordance with Table E. This test is enhanced by using a loop-plug for connector CX02. If not available, this loop-plug may be fabricated from a 50 pin male amphenol plug (as shown in Fig. 19-AA). With no loop plug attached, this test can run only rudimentary tests (see the RMATS program in Part 5).

**3.55** If the loop plug is available, plug the loop plug into CX02. Request Test 35. The MAAP should display 3120 and the digit 1. Within 5 seconds after the test is called, ground test point 8 (TP8) with a ground probe. If the test passes, the digit changes to 2 within 5 seconds after grounding the test point. If the test fails, the digit display changes to 4. After a

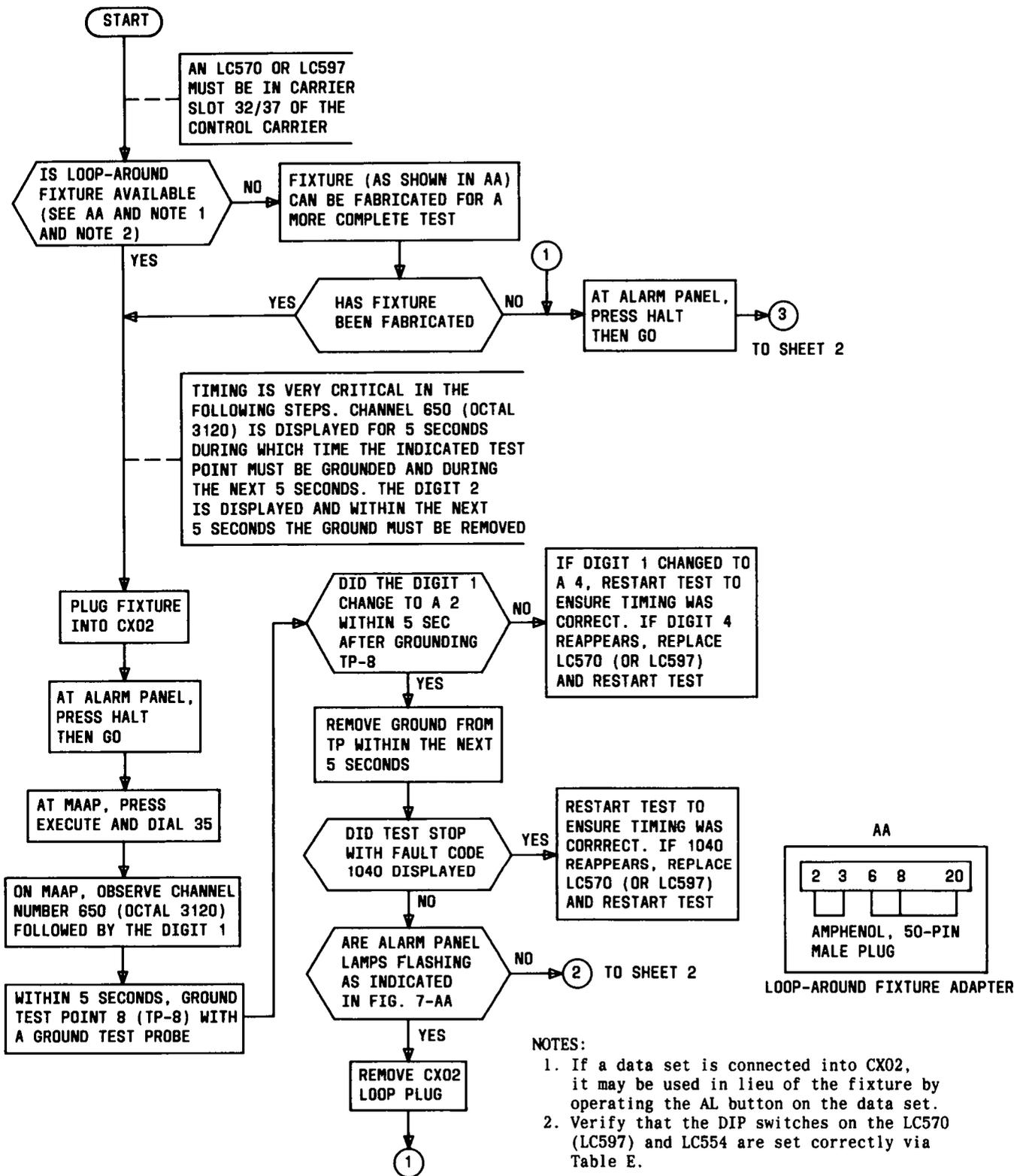


Fig. 19—Procedure to Run Test 35 [LC570 (or LC597) Test] (Sheet 1 of 2)

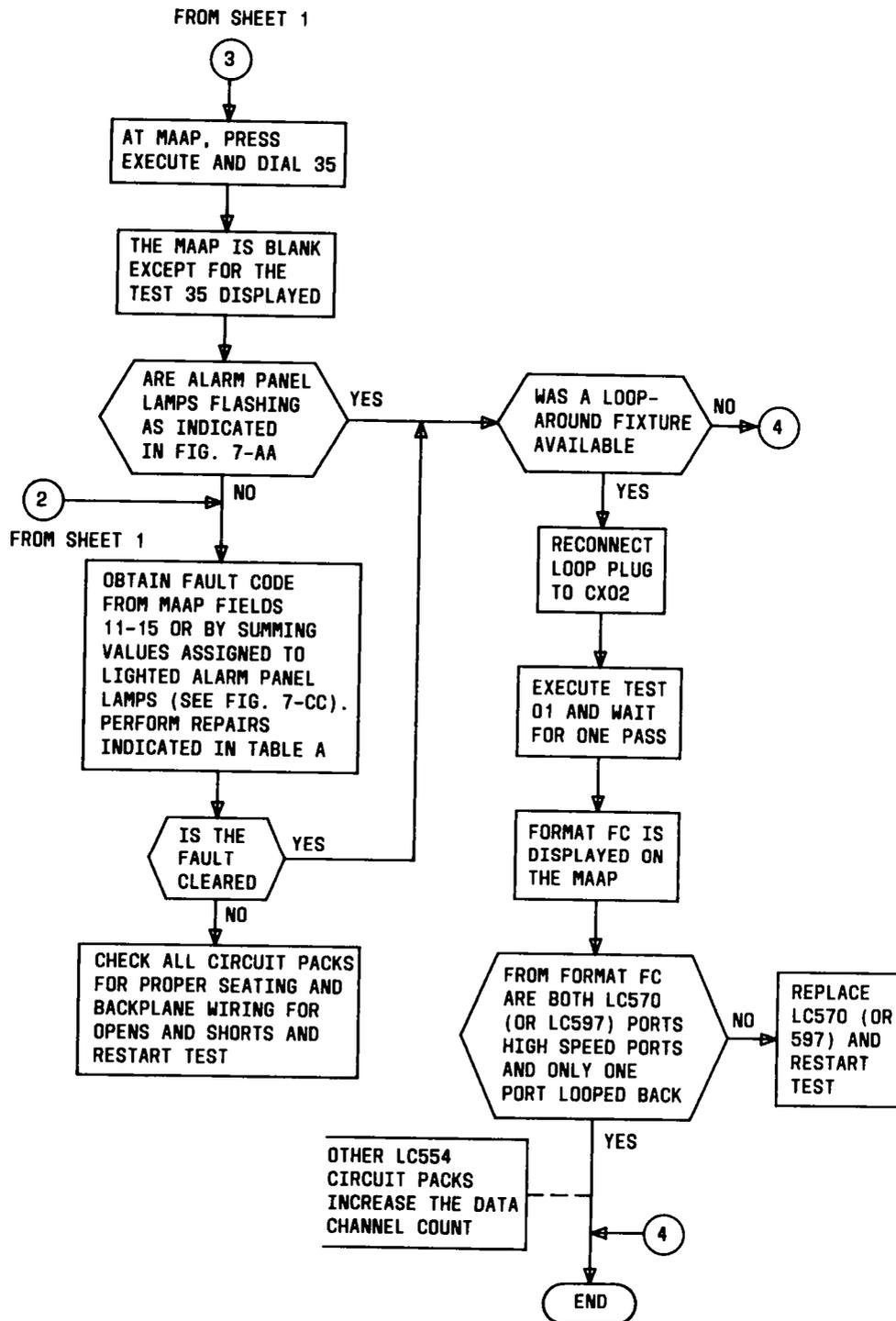


Fig. 19—Procedure to Run Test 35 [LC570 (or LC597) Test] (Sheet 2 of 2)

**TABLE E**  
**REQUIRED CIRCUIT PACK SETTINGS WHEN USING LOOP-AROUND**  
**EQUIPMENT**  
**(SEE NOTE)**

CIRCUIT PACK	SWITCH OR DIP	OPTION SETTING OR CONNECTION
LC11B	<u>SWITCH</u>	OPTION SETTING 1 2 3 4 5 6 7
	1.0	O C C O C O C
	1.1	O C C O C O C
	2.0	C C C C C C
LC13	1.0	O O C C O O
LC554	<u>DIP</u>	<u>CONNECTIONS</u>
	J1	PIN 5 TO PIN 12 PIN 6 TO PIN 11 PIN 7 TO PIN 10 PIN 8 TO PIN 9
LC570	J2	PIN 1 TO PIN 8
(LC597)	J1	PIN 1 TO PIN 8 PIN 2 TO PIN 7

**Note:** In this table, "O" represents open and "C" represents closed. To open a switch, press the end farthest from the switch number (black line appears near number). To close a switch, press end nearest to the switch number (black line appears away from number).

successful test and the digit changes to 2, remove the ground within 5 seconds or fault code "1040" is displayed. Remove the CX02 loop fixture and execute Test 35 again. The MAAP should not give a display and the PASS lamp should come on. Once again, put the loop plug back on CX02. Execute Test 01 and wait for one pass. At this point, the MAAP has format FC displayed. Verify that both LC570 (or LC597) ports are seen as high-speed ports but only one port as being looped. Other LC554 boards increase the data channel count. The loop plug should be connected during REPEAT 02. The time for one pass of this test is 2 to 10 seconds.

**R. Test 42 (Trunk Test) (Fig. 13)**

**3.56** Test 42 runs the following test in the order given.

- (1) Scanner/distributor (Test 03)
- (2) Network shift register test (Test 04)
- (3) Trunk test.

**3.57** Test 42 performs a test of most circuit packs that can be put into a trunk carrier. Format FA is used in this test to display the ports found.

**3.58** In this test a command is sent to idle all trunks and a check is made to see that all trunks are idle. Next, all TOUCH-TONE calling re-

ceiver/registers (LC10 or LC553) are checked for tone transmission via an internal loop-around arrangement. Then all trunk carriers are scanned for the presence of a TOUCH-TONE calling sender (LC12). If a TOUCH-TONE calling sender is not found, the test proceeds to check for LC06s. If a TOUCH-TONE calling sender is found, then it is checked by using the last TOUCH-TONE calling receiver/register in the system. The last board means the board in the lowest X-ray trunk number and the highest slot number in the carrier. Once both ports are tested on the TOUCH-TONE calling sender (including dial tone detection test) then any other TOUCH-TONE calling senders are identified and tested. When all senders have been tested using the last TOUCH-TONE calling receiver/registers, all TOUCH-TONE calling receiver/registers are tested using port 0 of the first TOUCH-TONE calling sender. The test starts testing with the first TOUCH-TONE calling receiver/register in the system and proceeds to the next to last receiver. The test sends not only valid TOUCH-TONE dialing combinations, but also checks to see that invalid tones and half tones are not decoded as valid TOUCH-TONE calling tones.

**3.59** The LC06 test is begun after the previous sequence. This test performs a tone transmission test on all circuits in the attendant conference board.

**3.60** An identification test is made on each pack in the system for each type of trunk pack. X-ray scans the trunk carriers for each pack type in the following order:

- (1) LC08
- (2) LC361
- (3) LC09
- (4) LC13
- (5) LC11.

**3.61** Because no loop-around equipment is attached, no trunks other than the previously discussed LC10 (or LC553), LC12, or LC06 are identified. The first pass is completed after all these identification procedures. The second pass takes less time because the tables of all the trunks have been completed.

**Note:** When running Test 42 and an LC361 is present, pin 80 of the LC361 slot must be tied to

ground or to pin 85 of the LC361 slot. This ensures that trunk testing operates properly.

#### **S. Test 46 (Ports Per Slot Display Test) (Fig. 20)**

**3.62** Test 46 runs the following tests in the order given:

- (1) Scanner/distributor (Test 03)
- (2) Network shift register test (Test 04)
- (3) Fault 720.

**3.63** Test 46 allows the number of ports per slot on a carrier to be displayed according to format FV. Test 46 runs one pass of NETWORK and stops on a 720. At this point, hitting the STEP button on the MAAP causes format FV to be displayed. The first time step is pressed, the ports per slot for carrier 0 are displayed. Successive stepping increments the carrier number and displays that carrier's ports. A STEP beyond carrier 8 causes carrier 0 to be displayed again.

**3.64** The 720 fault code need not appear in order to access the display. If a network error is found during Test 46, the display may still be accessed with the STEP button although not all of the carriers and ports are displayed correctly. This may help in troubleshooting which carriers or boards have problems. The time for one pass is 5 to 15 seconds.

#### **T. Test 47 (LC145 Test) (Fig. 13)**

**3.65** Test 47 runs the following tests in the order given:

- (1) Scanner/distributor (Test 03)
- (2) Network shift register test (Test 04)
- (3) LC145 Test.

**3.66** Test 47 verifies the operation of the tone transmission test line, the LC145. The LC145 is used in the field to monitor the quality of segments of the telephone network.

**3.67** In order to verify the tones, a station set may be plugged into port 0 of the first available LC588/LC02C in carrier 0. Upon starting the test, the following sequence of tones are heard.

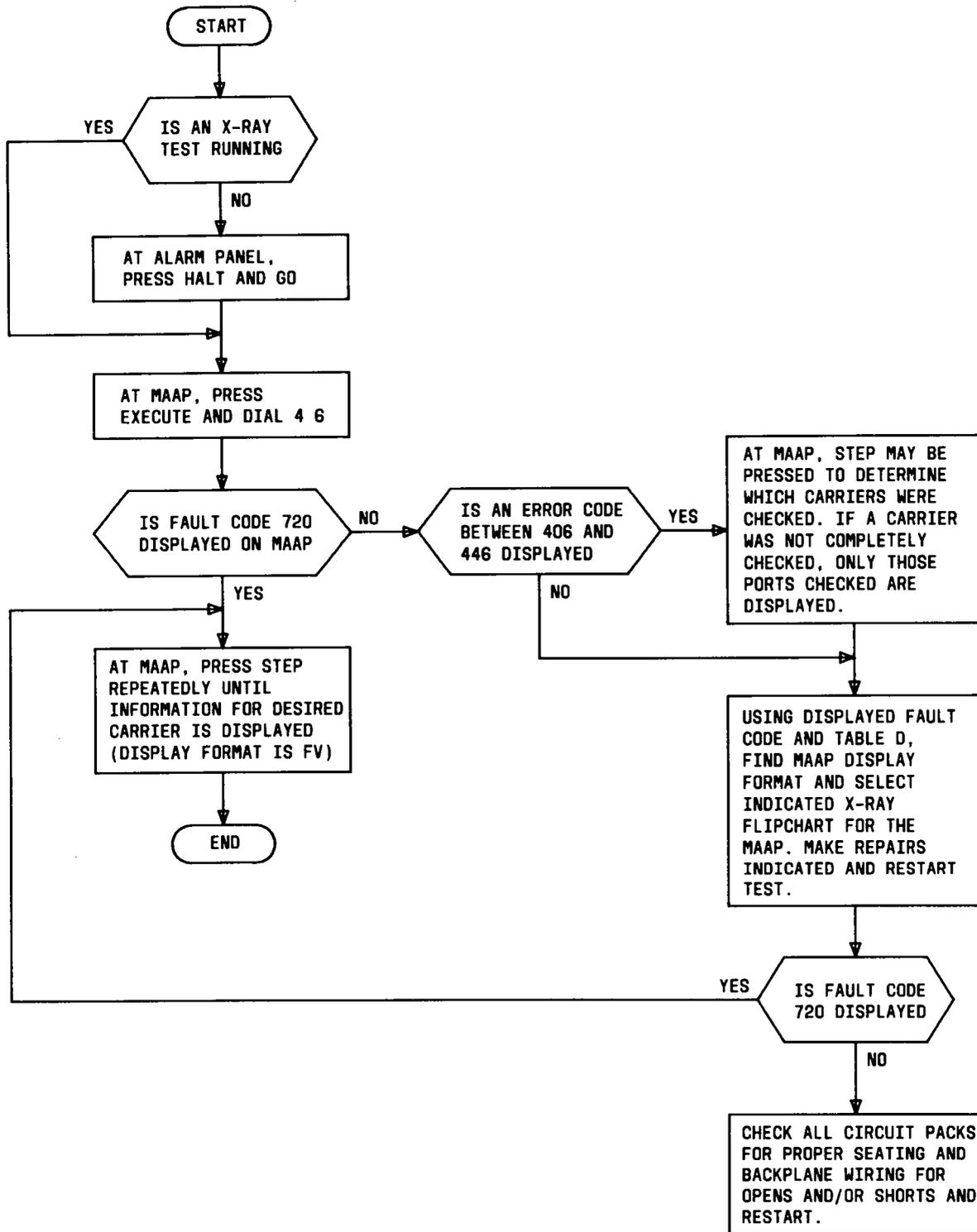


Fig. 20—Procedure to Run Test 46 (Ports Per Slot Display Test)

DURATION	tone
5 Seconds	Low Tone
10 Seconds	Medium Tone
10 Seconds	High Tone
30 Seconds	Silence
5 Seconds	3 Burst of Medium Tone
30–35 Seconds	Silence
90 Seconds	Low Tone
30 Seconds	Silence
5 Seconds	3 Burst of Medium Tone

**3.68** Care should be taken not to introduce sound into the transmitter during the test. This could cause a test failure. The time for one pass is 4 minutes per LC145.

**U. LC15/CAS System Status Indicator (SSI) Test (Fig. 21)**

**3.69** These instructions provide test of all LC15s and the SSI. The test runs continuously when the addresses are input after Test 00 has run. To cancel the test, request Test 00.

**Note:** After any reload, the addresses must be input again.

**3.70** For each LC15, there should be an SSI. The mini-clips should be connected to -48 volts and ground.

**3.71** **Warning:** *As a safety precaution, turn off dc power before connecting clips.*

**3.72** This test is to verify that each LED on an SSI flashes on the following order: top row—left to right; bottom row—left to right.

**3.73** **Warning:** *Each TX connector on the backplane that has an LC15 connected to it cannot have circuit packs of a different code connected to that TX connector. If not, it is possible that the adjacent trunk circuits may be damaged.*

## MANUALLY DISPLAYED FORMATS

**3.74** The following are the display formats that can be manually displayed. They are aids for the tester during system testing. These displays may be accessed by pushing the DISPLAY button on the MAAP followed by the appropriate digit. These formats are shown in Fig. 12.

- DISPLAY 1 (format FH) displays the memory location where the latest hardware interrupt took place.
- DISPLAY 2 (format FX) displays the faults logged in memory during a "Repeat" test. Press the digit "2" to display each fault logged in memory (maximum 42). A "0" is displayed after the last fault recorded. The digit "2" can be used to cycle through all the errors again.
- DISPLAY 4 (format FU) displays the X-ray program issue and the microcode version. The microcode displayed is "2" if the LC560 is in the system.

## 4. FAULT IDENTIFICATION AND CORRECTION

### GENERAL

**4.01** Faults in the system can be isolated by obtaining the fault code (octal number) via the alarm panel (LC557) or the MAAP.

**4.02** Normally the MAAP should be used to identify fault codes. However, during X-ray Test 00 and the first pass of Test 01 of the MD9 tape loading procedure, the MAAP is inoperative. The MAAP may also be rendered inoperative by a fault that occurs during a selected X-ray test. If the MAAP is inoperative, the fault code must be obtained by the alarm panel.

**4.03** The fault code (octal number) obtained via the MAAP or the alarm panel is used to find a repair procedure. Table D provides a list of fault codes, corresponding MAAP display formats, a description of the fault, and a repair procedure (if applicable). In some cases, the display format (Fig. 12) refers to a table or figure for interpretation of the MAAP display. The tables that are referenced by these displays are Tables F through K. Tables F, G, H, I, J, and K and the figures referenced by these displays are Fig. 22, 23, and 24.

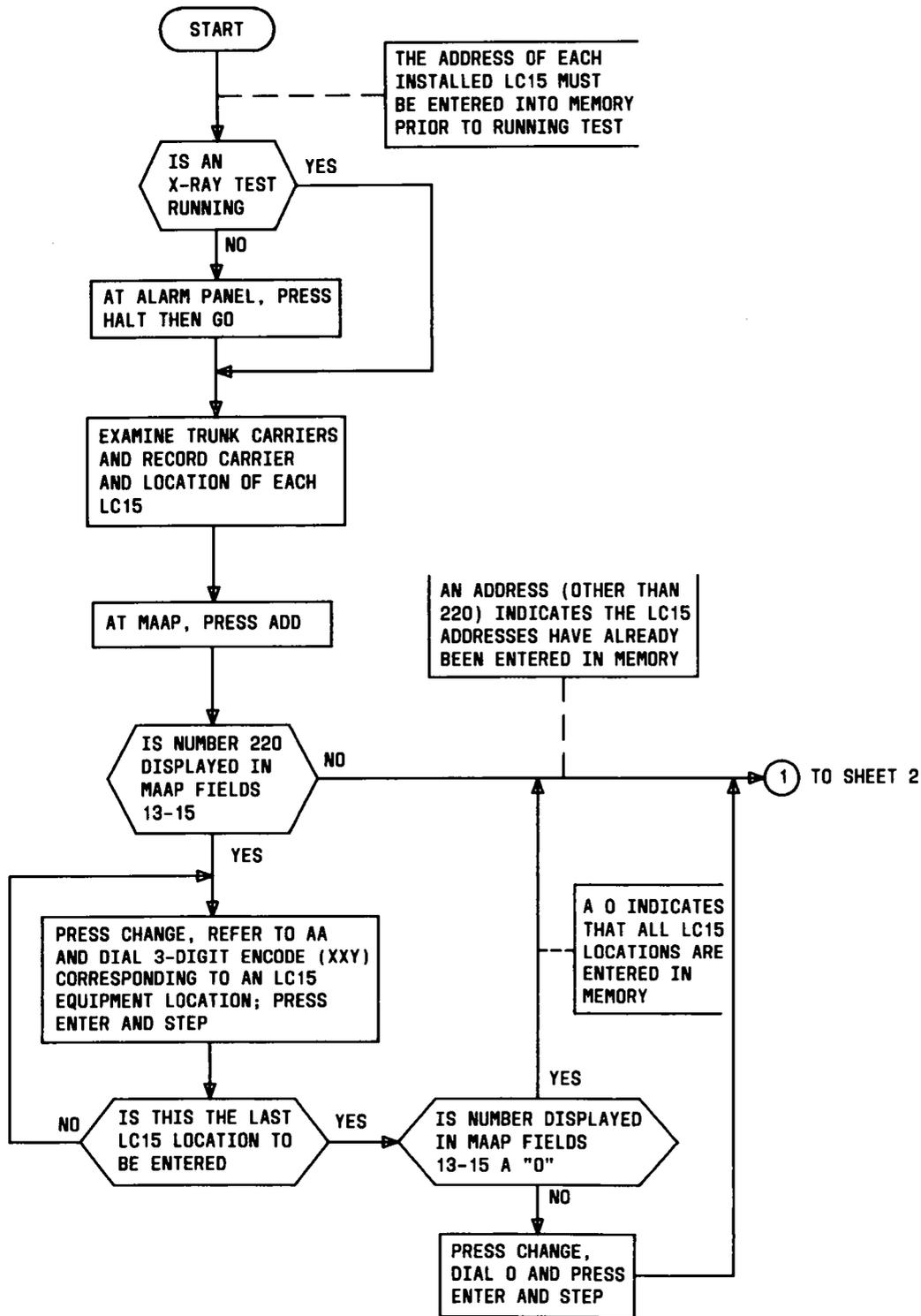
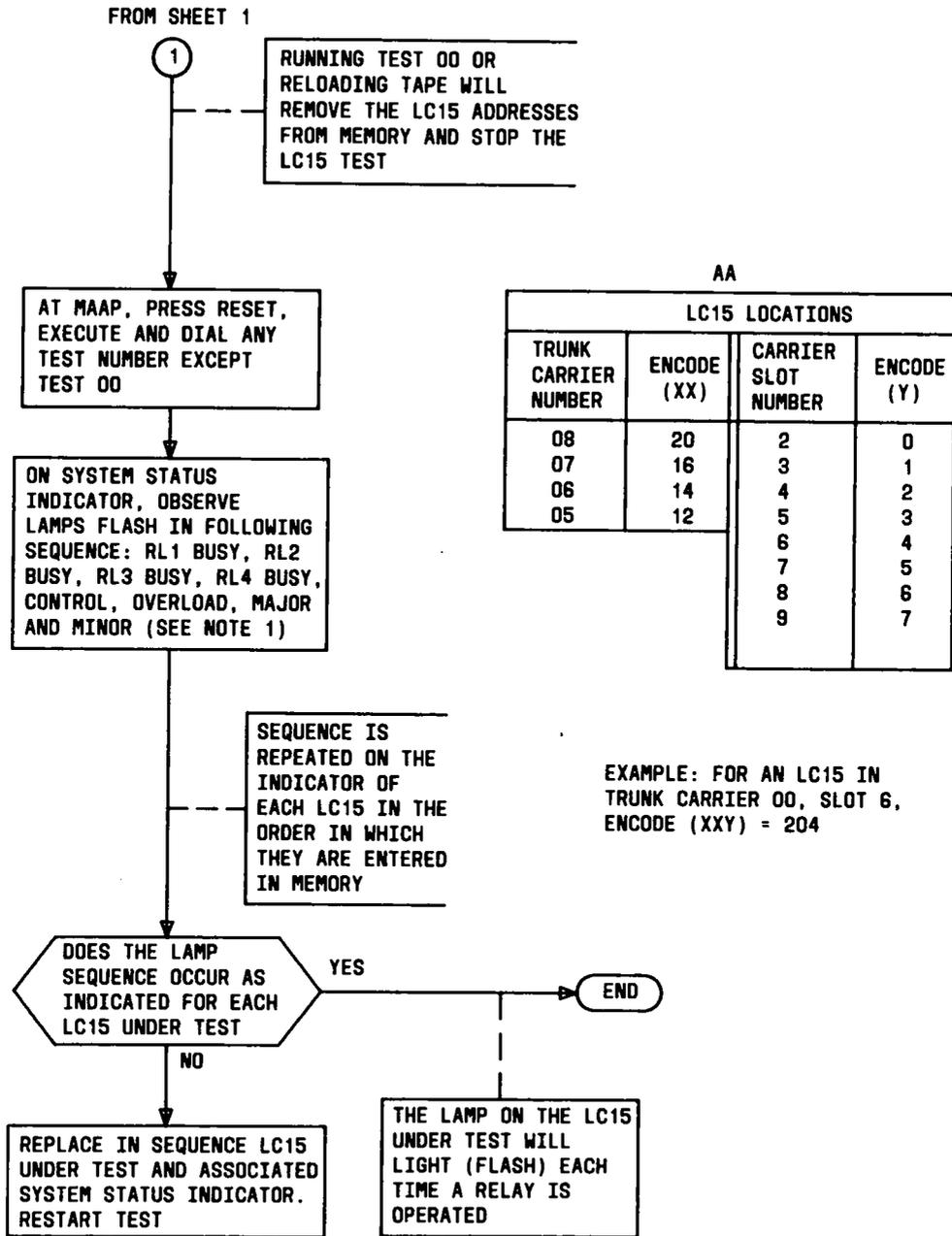


Fig. 21—Procedure to Run LC15/CAS System Status Indicator Test (Sheet 1 of 2)



NOTE:

1. When the system status indicators are cross-connected to an installed PBX, the major and minor SSI indicators are controlled from the PBX alarm circuit and will be lit when the corresponding alarm panel LEDs are lit.

Fig. 21—Procedure to Run LC15/CAS System Status Indicator Test (Sheet 2 of 2)

**TABLE F**  
**TRANSMITTED/RECEIVED MESSAGES**  
**(DISPLAY FORMATS FI AND F4)**

FIELD DISPLAYED (OCTAL)	10 (0 THRU 7 OCTAL)	11 (0 THRU 7 OCTAL)	12 (0 THRU 7 OCTAL)	13 (0 THRU 7 OCTAL)	14 (0 THRU 7 OCTAL)	15 (0 THRU 7 OCTAL)
<b>MESSAGE BINARY BIT POSITION</b>	15	14 13 12	11 10 9	8 7 6	5 4 3	2 1 0

**4.04** If more than one display format is listed for a fault code in Table D, the first refers to the display associated with the indicated test number. The second display format indicates additional information that may be recalled from memory.

**4.05** The repair procedure given in this table may offer a quick solution. All possible problems are not listed. The procedure for replacing circuit packs is shown in Fig. 6. "Replace in sequence" means to replace the designated components (circuit packs, etc) in the order listed. For example, "replace in sequence LC47B, LC45" should be interpreted as follows: Replace LC47B and rerun the test which was running when the fault was detected. If the fault symptoms remain unchanged, return the original LC47B to the correct slot, replace LC45, and rerun the test which was running when the fault was detected. If the fault symptoms remain unchanged, return the original LC45 to the correct slot etc.

**4.06** If microdiagnostics (MDs) are called for in the repair procedure portion of Table D, rerun MD0 through MD8 and repair as indicated in Part 2 of this document. If the fault code is not listed in Table D, run MD0 through MD8 to identify and correct the processor fault.

#### MAAP FAULT IDENTIFICATION PROCEDURE

**4.07** If a fault is detected while X-ray is running in the *execute mode*, the test stops and the following events occur:

- The ERROR lamp on the MAAP begins to flash.
- The lamps on the alarm panel stop cycling.
- The indicator lamps on the MAAP stop cycling.

- A fault code is displayed on the alarm panel.
- The MAAP displays the appropriate display format for the fault detected.
- A fault code is displayed on the MAAP. The general format is: "HHH.MM.SS.DDDD.FFFFF". Where "HHH.MM.SS" is the time since tape load, "DDDD" is the subfiled containing details of fault codes, and "FFFFFF" is subfield containing the fault code.

**4.08** If a fault is detected while X-ray is running a test in the *repeat mode*, the test resets and begins again. The following events occur when a fault is detected in the repeat mode.

- The fault code is stored in RAM memory (up to 42).
- The fault code of the last fault to occur is displayed on the MAAP using display format FD.
- The fault count of the last fault to occur is displayed to the left of the fault code using format FD.

**4.09** Each fault has the time the fault occurred, the board that failed if applicable, the fault code, and the fault count logged in memory. The fault count signifies the order of occurrence. To display the fault information stored in memory, press the DISPLAY button, then the digit 2 button on the MAAP. The present fault count is initially displayed. If the fault count is above 0, press the digit 2 to display the fault information of the first fault occurrence (the format used to display this information is FX). This

TABLE G

**FAULTY SCAN/DISTRIBUTOR RESPONSE (I/O CHANNEL NO.)  
(DISPLAY FORMAT F6 AND FF)**

FAULT CODE	FAULTY SCAN/ DIST RESPONSE (I/O CHANNEL NO.)	ASSOCIATED LEAD OR LEADS	STUCK AT 0 OR 1	FAULT CODE	FAULTY SCAN/ DIST RESPONSE (I/O CHANNEL NO.)	ASSOCIATED LEAD OR LEADS	STUCK AT 0 OR 1
330	Disregard	MD00*	1	347	1	BB70*/SS0*	0
		MD01*	1		2	BB71*/SS1*	0
		MD02*	1		4	BB72*/SS2*	0
		MD03*	1		10	BB73*/SS3*	0
331	Disregard	MD00*	0		COMB.	COMB./COMB.	0
		MD01*	0	350	1	BB60*/SS0*	0
		MD02*	0		2	BB61*/SS1*	0
		MD03*	0		4	BB62*/SS2*	0
332	10	SAD10	0		10	BB63*/SS3*	0
333	1	SCEN8*	0		COMB.	COMB./COMB.	0
	2	SDA1*	0	351	1	BB50*/SS0*	0
	4	SDA2*	0		2	BB51*/SS1*	0
	10	SAD10	0		4	BB52*/SS2*	0
	COMB. †	COMB.	0		10	BB53*/SS3*	0
334	1	SCEN4*	0		COMB.	COMB./COMB.	0
	2	SCEN5*	0	352	1	BB40*/SS0*	0
	4	SCEN6*	0		2	BB41*/SS1*	0
	10	SCEN7*	0		4	BB42*/SS2*	0
	COMB.	COMB.	0		10	BB43*/SS3*	0
335	1	SCEN0*	0		COMB.	COMB./COMB.	0
	2	SCEN1*	0	353	1	BB30*/SS0*	0
	4	SCEN2*	0		2	BB31*/SS1*	0
	10	SCEN3*	0		4	BB32*/SS2*	0
	COMB.	COMB.	0		10	BB33*/SS3*	0
336	Disregard	SAD05*	1		COMB.	COMB./COMB.	0
337	Disregard	SAD04*	1	354	1	BB20*/SS0*	0
340	1	SAD04*	0		2	BB21*/SS1*	0
	2	SAD05*	0		4	BB22*/SS2*	0
	4	SPTEN*	0		10	BB23*/SS3*	0
	10	SCLK*	0		COMB.	COMB./COMB.	0
	COMB.	COMB.	0	355	1	BB10*/SS0*	0
341	Disregard	SAD03*	1		2	BB11*/SS1*	0
342	Disregard	SAD02*	1		4	BB12*/SS2*	0
343	Disregard	SAD01*	1		10	BB13*/SS3*	0
344	Disregard	SAD00*	1		COMB.	COMB./COMB.	0
345	1	SAD00*	0	356	1	BB00*/SS0*	0
	2	SAD02*	0		2	BB01*/SS1*	0
	4	SAD01*	0		4	BB02*/SS2*	0
	10	SAD03*	0		10	BB03*/SS3*	0
	COMB.	COMB.	0		COMB.	COMB./COMB.	0
346	1	BB80*/SS0*	0		COMB.	COMB./COMB.	0
	2	BB81*/SS1*	0				
	4	BB82*/SS2*	0				
	10	BB83*/SS3*	0				
	COMB.	COMB./COMB.	0				

\* Indicates the lead is active in the low state.

† Displayed value can be a combination of 1, 2, 4 and 10, which indicates more than one fault.  
Decode the combination to determine specific faults.

TABLE H

**RESPONSE TO NETWORK VERIFICATION REQUEST  
(OCTAL) (DISPLAY FORMAT F8)**

RESPONSE TO NETWORK VERIFICATION REQUEST	DEFINITION
0	Port Unequipped
400	Invalid Network Connection
600	Valid Network Connection

TABLE I

**QUANTITY OF "TOUCH-TONE" CALLING REGISTER PORTS (FIELD 14) (DISPLAY FORMATS FA AND FM)**

DISPLAYED NO. DECIMAL	QUANTITY OF "TOUCH-TONE" CALLING REGISTERS
0	0 or 5 or 10 or 15
2	1 or 6 or 11 or 16
4	2 or 7 or 12
6	3 or 8 or 13
8	4 or 9 or 14

is the first fault since memory was last cleared (the RAM memory is cleared during a tape reload). Each fault code is chronologically displayed with press of the digit 2 until all desired fault codes and fault information are displayed. The DISPLAY 2 format (FX) can be displayed while the test is running in the repeat mode. The MAAP is reset to format FD by pressing the RESET button.

**ALARM PANEL FAULT IDENTIFICATION PROCEDURE**

**4.10** When a fault is detected during a test procedure which is running in the execute mode, the alarm panel lamps stop cycling and displays a pattern which can be translated into a fault code. However, in the repeat mode, this pattern is only displayed for approximately 2 seconds, then the test is restarted.

**4.11** The alarm panel lamp pattern is translated into the fault code using the following procedure.

TABLE J

**TONE THAT FAILED TEST—FIELDS 7 THRU 10  
(DISPLAY FORMAT FB)**

DISPLAYED NUMBER	TONE WHICH FAILED
1	Dial
2	Recall Dial
4	Miscellaneous
10	Intercept
20	Busy
40	Reorder
100	Audible Ring
200	Special Audible Ring
377	All Tones Failed
17	All Tones from LC04 (or LC204)
360	All Tones from LC05B (or LC204)
400	Immediate Ringback
1000	480 Hz
2000	Zip
4000	Chime
7400	All Tones from LC17

TABLE K

**DATA CHANNELS — OCTAL (DISPLAY FORMAT FG)**

DL ADDRESS	CONTROL CARRIER SLOT NO.	CONTROL CARRIER CONN. DESIG
3000	30	CA01
3020	30	CA02
3040	33	CX01
3060	33	CX01
3100	32	CX03
3120	32	CX04
3140	31	CA03
3160	31	CA04
3200	34	CX01
3220	34	CX01
3240	35	CX01
3260	35	CX01

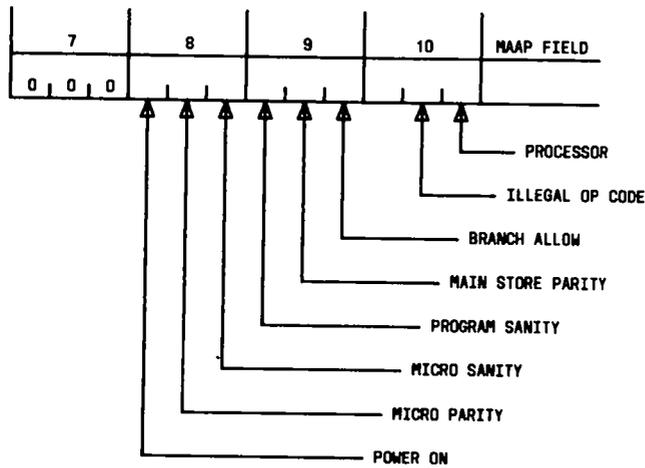


Fig. 22—Hardware Interrupt Type (Format F5)

- (a) Interpret each lighted alarm panel indicator lamp as a number using the list of alarm panel lamp values in Fig. 7-CC.
- (b) Determine the fault code by adding the (octal) numbers. The octal sum of the numbers is equal to the fault code.

**Note:** The fault code displayed on the LC557 is not necessarily the correct fault code as explained in Note 5 of Fig. 7.

## 5. X-RAY PROGRAM DESCRIPTION

**5.01** This part contains a description of the X-ray programs which are structured into Tests 00 through 47. The description of the programs may be helpful to determine which tests to use in analyzing intermittent or multiple faults. The tests and associated programs are listed in Table D.

### XREXEC (X-RAY EXECUTIVE ROUTINE, TEST 00)

**5.02** The XREXEC initializes the processor and cycles the X-ray tests (excluding microtests) that have been chosen (selected) via the MAAP. The cyclor portion of the routine runs the X-ray test selected. If one of the programs detects a fault, the cycle stops and an error subroutine (ERROR) is called.

**5.03** When a fault is detected, a fault code is displayed on the alarm panel and on the MAAP. The program then enters a wait loop or a trap. The

XREXEC also keeps a continuous count of the X-ray subroutines. This count is monitored by the 25-millisecond clock interrupt program to determine if any X-ray program is stuck (hung-up) in a loop. The XREXEC toggles the alarm panel PASS lamp at the end of each successful X-ray test pass. The PASS lamp on the alarm panel is alternately off, then on for successive passes of an X-ray test. Therefore, the PASS lamp can be used to determine how long each test runs.

### INITPI (PROGRAM INTERRUPT INITIALIZATION, TEST 00)

**5.04** During the startup of each test, the program interrupt initialization subroutine (INITPI) is called by the X-ray executive routine (XREXEC). This subroutine initiates the 25-millisecond and 10-millisecond program interrupts and verifies that these interrupts occur at the proper rate. A collection of line-dependent parameters used by many of the other programs is initialized.

### ALARMS (ALARM PANEL INDICATORS, TEST 00)

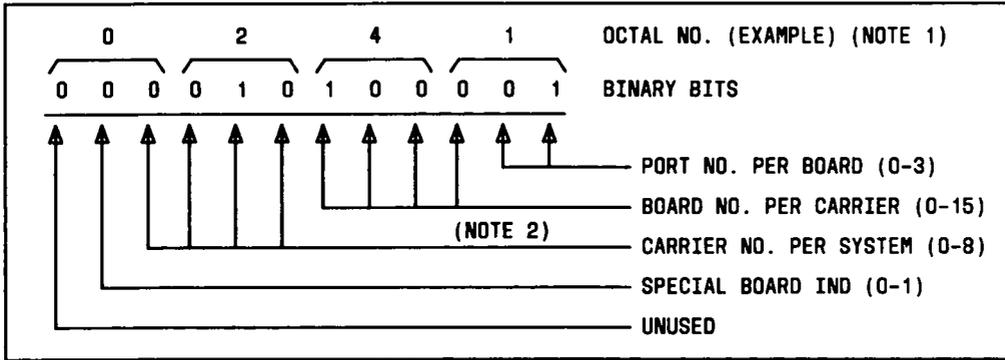
**5.05** ALARMS is performed at the beginning of the XREXEC routine. This test runs only once. Each software-controlled alarm indicator lamp on the alarm panel (MAJOR, MINOR, I/O BUS, PROC, MEM, SCAN, NET, FACILITY, PASS, FAIL) is activated in a top-to-bottom sequence. Each alarm lamp is activated for approximately 0.2 seconds. A visual verification may be obtained by observing that all software-controlled alarms can be activated and that correlation with the alarm panel register is correct. Hardware faults are displayed on the alarm panel in octal code.

**5.06** Program instructions used in the ALARMS program have not been tested because ALARMS precedes the program instruction set test program (INSTRC). Consequently, each program instruction used in the ALARMS program is tested prior to the actual alarm indicator test. If a failure occurs in an instruction (used to provide the 0.2-second alarm activation interval), the program attempts to display a fault code on the alarm panel.

### INIT B (TAPE LOAD, TEST 00)

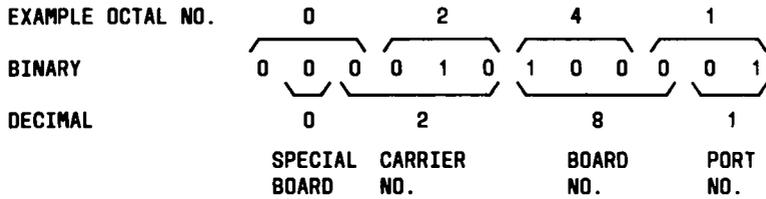
**5.07** This routine is used to indicate that control has been transferred from microcode to the program in main store. This routine checks the following functions:

- Loads X-ray data tape



**NOTES:**

1. THE OCTAL NUMBERS DISPLAYED IN MAAP FIELDS 7-10 MUST BE CONVERTED TO



**2. CARRIER IDENTIFICATION**

- 0 = LINE 0
- 1 = LINE 1
- 2 = LINE 2
- 3 = LINE 3
- 4 = LINE 4
- 5 = LINE 5 OR TRUNK 3
- 6 = LINE 6 OR TRUNK 2
- 7 = TRUNK 1
- 8 = TRUNK 0

DEC	BINARY
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

**Fig. 23—Port Number Associated With Detected Fault (Display Format F9)**

- Ability to transfer control from the micro-code to a program in the main store
- Ability to fetch, decode, and execute a high level instruction from the main store
- Operation of the program instruction load immediate (LI), load alarm panel register (AP), and branch long (BL)
- Operation of the alarm indicators corresponding to bits 0 through 10 of the alarm word.

#### **T1SUBR (SUBROUTINE CALL, TEST 00)**

**5.08** This program, the last to run in test 00, tests the operation of the processor on a subroutine call and initializes all status memory following tape load. At the end of the program, T1SUBR transfers control to test 01.

#### **MEMXRY (PROCESSOR REGISTER MEMORY [RM], TESTS 00, 01, 02)**

**5.09** MEMXRY performs the processor register memory (RM) test. The registers are checked first for stuck bits by passing all 1s and then all 0s through the registers (except RM3) 15 times.

#### **MEMTST (MEMORY, TESTS 00, 01, 02, 14)**

**5.10** The memory test (MEMTST) follows the processor register memory (RM) test (MEMXRY). The following are the major functions checked:

- Word parity
- Alternate FFFF and 0000 (not done in Test 00)
- Alternate 0000 and FFFF (not done in Test 00)
- Parity bit set to 1
- Parity bit set to 0
- Address location into location (not done in Test 00).

These tests are run on memory not containing the X-ray program. For areas of memory that contain X-ray programming, the following tests are performed.

- Word parity
- All 1s in each word using special program instruction TLOC (test memory location)
- All 0s in each word using special program instruction TLOC
- Parity bit set to 1
- Parity bit set to 0.

If a fault is detected during the memory test run, a code is displayed on the alarm panel and the MAAP, enabling the observer to determine the defective board.

#### **DLXRAY (SERIAL DATA LINK, TEST 01, 02)**

**5.11** This subroutine checks every data channel three times per second. The checks are performed when the channels are idle, except for the attendant console channels which are constantly checked. A low-speed channel is tested using message 0E57 and a high-speed channel is test with message F0F0 and channels supplied with attendant consoles are checked for correct echo using the message (0E57).

#### **MPTST (MAAP TEST, TESTS 01, 02)**

**5.12** This subroutine checks the MAAP lamps and provides a coded display for each button keyed.

#### **AP LED (ALARM PANEL EXERCISER, TESTS 01, 02)**

**5.13** This program exercises the alarm panel by stepping the lamps in a repetitive pattern. The state of the PASS lamp is set as defined by the base level program cycler.

#### **INTRUP (HARDWARE INTERRUPT VERIFICATION, TESTS 01, 02, 32)**

**5.14** This program forces the following interrupts.

- Illegal OP code
- Branch-allow
- Program sanity
- Microparity.

**INSTRC (INSTRUCTION SET VERIFICATION, TESTS 01, 02, 31)**

**5.15** This subroutine verifies every instruction possible without interfering with the requirement that program interrupts run concurrently. Each instruction is used to verify that the processor performs as intended. This subroutine (INSTRC) is called by the executive routine (XREXEC) during startup of every test and is also cycled with other programs in tests 01, 02, and 31.

**ATTXRY (ATTENDANT CONSOLE, TESTS 01, 02, 13)**

**5.16** This subroutine exercises the lamps on up to four attendant consoles by stepping them through a periodic sequence. Hotel-motel display units are included in the exercise. After one pass through the lamp sequence, the program accepts button inputs from the consoles and provides a positive indication that the button input was received. In most cases, the lamp associated with the button is turned on and all other lamps are turned off.

**RMATS (TESTS, 01, 02, 35)**

**5.17** In the DIMENSION PRELUDE PBX, the RMATS X-ray program tests the LC570 (or LC570B) circuit pack. With no loop plug, the correct response to a read I/O command is checked and then the correct response to major and minor alarm signals is checked. If the loop plug is connected, an additional test is performed to check for correct response to an 8-bit data word and to a 7-bit data word with overrun error. In X-ray test 35 only, an optional manual test is available for a traffic data request to an LC570 (or LC570B) circuit pack. A loop plug is required for the LC570 (or LC570B) and a test point on the LC570 (or LC570B) is grounded by the operator to simulate a traffic data request. Special codes are displayed to indicate a pass or fail condition.

**SCNXRY (SCANNER/DISTRIBUTOR, TESTS 02, 03, 04, 05)**

**5.18** This subroutine runs a group of 23 tests to identify faults internal to the LC46 scanner/distributor circuit pack. The SCNXRY also checks the scanner interface in conjunction with the line and trunk carriers. These tests detect stuck bit "k" faults on the status buses; on the port, board, or carrier select lead; and on auxiliary signaling leads.

**5.19** The X-ray tests have been arranged to allow fault diagnosis and repair procedures to be based on the first test to fail and the number of tests

to fail. The block of 23 tests is run 10 times, each time the subroutine SCNXRY is called. If the same fault is detected on each of the ten runs of the test, the fault is determined to be a hard fault; otherwise, the fault is considered an intermittent fault.

**NETWRK (DIGITAL NETWORK, TESTS 02, 04, 05)**

**5.20** This subroutine verifies the time-division network control (LC47), the digital portions of the buffer board, the time-division network, and the shift registers on all equipped line and trunk circuits. Stuck-active board and port selects are detected. If no faults are detected, the number of lines, trunks, TOUCH-TONE calling registers, and attendant interface shift register circuits are displayed. The eight shift registers on the tone board (LC204) are included in the line count.

**PAMXRY (TONE TEST, TESTS 02, 05)**

**5.21** This subroutine (PAMXRY) verifies a portion of the analog network consisting of the carrier 0 PAM network, the PAM bus amplifiers (LC48), the carrier 0 LC50 network's buffer circuit pack, and the tone generator board (LC204). The test connects each tone to the tone monitor circuit and verifies that the tone monitor is correct.

**5.22** The first tone checked is dial tone (on port equipment number 0). The tone monitor does not have a port equipment number, but can be enabled via a scanner/distributor address. When the tone monitor is enabled, any network commands to any port equipment number are also provided to the monitor. The tone monitor is enabled throughout the tone test. The sequence of events for checking each tone is as follows:

- (1) Clear the port equipment number of tones to be tested (this also clears the tone monitor).
- (2) Assign the next time slot to the tone port equipment number (the same time slot is assigned to the monitor).
- (3) Check the monitor output after it stabilizes. The paths taken by each tone are as follows:
  - (a) Tone port
  - (b) Carrier 0 transmit bus [circuit 0, LC50, has second light-emitting diode (LED) on when the tone is present]

- (c) PAM bus amplifier (LC48 has both LEDs on when the tone is present)
- (d) Carrier receive bus (carrier 0, LC50, has the top LED on when the tone is present)
- (e) Tone monitor (LC204).

**5.23** At the beginning of the tone test, no time slots are assigned. As the test progresses, tones are left assigned to time slots and ports. Dial tone is connected to the first six available time-division shift registers on every carrier. The last available time slot is assigned first. During the tone test, dial tone is audible at every attendant console handset. A test station plugged into the first six lines on any carrier receives dial tone. Dial tone is routed to every carrier over the PAM bus and lights the top LED on every LC50 buffer board. Approximately 66 seconds after the tone test begins, the network is cleared, all the above mentioned LEDs related to the time-division network analog path are extinguished, and the test continues if no tone has failed.

#### **SMDR (STATION MESSAGE DETAIL RECORDING, TEST 02, 15)**

**5.24** This program verifies the SMDR equipment and printer operation. The description of this X-ray program is given under the description of X-ray test 15.

#### **LINRAY (LINE AND TRUNK TEST, TESTS 02, 17, 42)**

**5.25** This program exercises the tests each line, trunk, and attendant port circuit. Each port is tested for tone transmission, and each relay is operated and released. The principal functions of the test are:

- Disconnect group ringing on the line carriers.
- Verify switchhook status, analog transmission paths, and relay operation on all lines and attendant ports.
- Locate and test trunks in the order of LC12 (see LC12 TST, paragraph 5.33), LC10, LC06, LC08, LC361, LC09, LC13, and LC11.
- When running test 42 or 02 and an LC361 is present, pin 80 of the LC361 slot must be tied to ground or to pin 85 of the LC361 slot.

**5.26** Though there is normally only one LC145 per system, however, up to 11 LC145s can be tested. Each LC145 is tested, beginning with the highest number slot position. The test on each LC145 lasts approximately 4 minutes. The LC145 tones appear at port 0 of the first LC02C/LC588 installed in line carrier 0, slots 4 through 6. The tones can be monitored with a station set attached to this port. Care should be taken not to introduce sound into the transmitter, since such sounds could cause an error. The tones monitored at the LC02C/LC588 consist of the following:

- Medium pitch tone—10 seconds
- Low pitch tone—10 seconds
- High pitch tone—10 seconds
- Wait (not tone)—30 seconds
- Three short bursts of medium tone—5 seconds
- Wait (no tone)—30 to 35 seconds
- Low pitch tone—1 minute, 30 seconds
- Wait (no tone)—30 seconds
- Three short bursts of medium tone—5 seconds.

**5.27** In this test, the LED on each LC588 or LC02 lights when a circuit pack is tested. At the end of Test 17, the LEDs on all LC02Cs and LC588s are lighted.

#### **LC145TST (LC145 TEST, TESTS REPEAT 02, 47)**

**5.28** This test makes a search for LC145s, and if found, the LC145 is tested as described in paragraph 3.65. The stipulation in Test 17 that LC145s must be in slots 7 through 9 and/or 11 through 18 does not apply for this test.

#### **LC293TST (LC293 TEST, TEST REPEAT 02, 17)**

**5.29** This subroutine is used to test the LC293 Line Circuit Conference Bridge. The LC293 allows up to 40 parties to participate in a conference call. A software controlled switch enables or disables a party from participating in the conference. The LC293TST tests the ports on the LC293 by using tone

tests. If a port is found to be operating improperly, the appropriate error code is displayed on the MAAP and alarm panel.

**EMXFER (EMERGENCY TRANSFER VERIFICATION TEST)**

**5.30** This program turns on all software-controlled LEDs on the alarm panel (including the emergency transfer lamp), stops program interrupt activity, and enters a 20-second time-out program loop. If the processor enters emergency transfer and stops, the alarm panel LEDs will remain on and there will be no activity on the MAAP. If the processor fails to enter emergency transfer within 20 seconds, a special code will appear on the MAAP and the ERROR lamp will flash.

**TTRECREG ("TOUCH-TONE" CALLING RECEIVER-REGISTER, TEST 21)**

**5.31** This subroutine tests the receiver-register board packs under manual control from a test station and the MAAP (the MAAP is used to access each register). This subroutine performs the following:

- (a) Automatically checks analog circuits associated with TOUCH-TONE calling registers.
- (b) Verifies that all TOUCH-TONE dialing digits are received and decoded correctly.
- (c) Verifies that the 2-out-of-7 TOUCH-TONE calling code is visible in the lamp field on the LC10C/D circuit pack (not visible on LC553).
- (d) Verifies, on the test station handset, the eight call progress tones for LC204 circuit pack, and the four tones from LC17, tone plant circuit pack, if present.
- (e) Test 21 verifies the two port originating/receiving functions on the LC10 and LC553.

**LC14TST (CONTACT INTERFACE, TEST 33)**

**5.32** This subroutine verifies the operation of the contact interface LC14 circuit pack.

**LC12TST ("TOUCH-TONE" DIALING SENDER, TESTS 02, 42)**

**5.33** The LC10s ( or LC553s) can be tested in any trunk carrier and are not required to be in a special slot. When LC12s are in the system, the LC12s are tested during the first part of test 42. The LC12s are tested using an LC10 or LC553. The dial tone detector circuit in the LC12 is tested and TOUCH-TONE dialing combinations (1 through 12) are tested for recognition in the receivers. Each of the 16 TOUCH-TONE dialing frequencies is tested singly and checked for recognition. The 33 false TOUCH-TONE dialing combinations with half-tone frequencies are sent and checked for no recognition in the receiver. After all LC12s are tested, one LC12 is used to test all LC10s and LC553s.

**NTWK (PORT COUNT DISPLAY TEST, TESTS 46, 03, 04)**

**5.34** This program tests the carriers and then displays, on display format FV, the ports found for each carrier. A port is counted when it has a working time slot shift register. When test 46 is initiated, error code 720 should be displayed. By repeatedly depressing the STEP button on the MAAP, the port information for the desired carrier can be displayed on the MAAP. If an error code in the range 406 through 446 is displayed rather than error code 720, the STEP button may still be used to determine which carriers were checked. If only a portion of a carrier is checked before a fault occurs, only those ports checked will be displayed.