

**SYSTEM CENTURY®
CENTRALIZED OR LOCAL
AUTOMATIC MESSAGE ACCOUNTING
SUBSYSTEM**

MAINTENANCE

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2.03	Related Publications	2	
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2.	Internal and External AMA Frame Cabling	4	A Sales and Instructional Literature Index of latest available publications can be obtained from your Stromberg-Carlson sales representative or from Publications Services, Stromberg-Carlson Corporation, P.O. Box 1698, Sanford, Florida 32771.
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			*23-YYY-97	System Operators Manual
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28-005-02 CAMA/LAMA Subsystem,
General Description

2.03 Related Publications.

For preventive or corrective maintenance procedures for the tape drive unit, refer to the vendors manual that accompanies the specific tape drive unit supplied.

2.04 Related Drawings.

The schematic diagram and description of each circuit listed below is recommended for use with this document. Each circuit is identified by a six-digit base number. A circuit schematic diagram or circuit description is identified by prefixing a base number with S- or DS- respectively.

<u>BASE NUMBER</u>	<u>NAME</u>
814052	Data Link
814288	Tape Diagnostic
814289	Tape Bus Interface
814290	Tape Interface Buffer
814291	Tape Motion Control
814298	Tape Buffer
814470	Maintenance Bus Interface
814551	Line Calendar Clock

3. PREVENTIVE MAINTENANCE

3.01 Cleaning the Tape Path.

CAUTION. Do not use methyl or ethyl alcohol, toluene, methyl ethyl ketone (MEK), acetone, or trichloroethylene as cleaning solvents on the tape drive unit. Any of these can damage the magnetic tape or elements in the tape path.

The tape path in each tape drive unit should be cleaned daily during a time of low traffic and each time a reel of tape is changed. Items to be cleaned include the

capstan, roller guides, magnetic heads, tape cleaner, and face of the beginning-of-tape/end-of-tape (BOT/EOT) sensor. First brush away any loose particles on the tape drive front panel. Then use a lint-free cloth and nonsolvent degreaser such as Freon* Type TF degreaser to clean the capstan. Use another lint-free cloth moistened with isopropyl alcohol to clean the other items in the tape path. An alcohol-moistened cotton swab may be used to clean the inside of the tape cleaner, but be sure that cotton lint is not deposited on the cleaner or in the holes. These deposits may contaminate the tape path. When cleaning the head, do not allow the hinged head shield to snap back against the head.

3.02 Other Preventive Maintenance.

For other preventive maintenance details, refer to the vendors manual for the specific tape drive unit supplied.

4. CORRECTIVE MAINTENANCE

4.01 General.

Corrective maintenance for the CAMA/LAMA subsystem generally involves only replacing printed wiring board assemblies (PWBA), fuses, and lamps. Failures are reported by built-in hardware and software fault detectors. Then the specific locations and types of failures are identified by error-handling and diagnostic software. If a more serious problem should occur, Stromberg-Carlson Assistance Team (SCATSM) service is available to assist in troubleshooting the CAMA/LAMA subsystem and isolating the fault. For information about how to obtain this service, refer to the section titled *Product Support Procedures*, referenced in paragraph 2.02. As an aid in troubleshooting the CAMA/LAMA subsystem, figures 1 and 2 illustrate the power and signal cabling, respectively, in the AMA frame (AMAF).

4.02 Test Equipment Needed.

No test equipment is needed so long as the corrective actions indicated by diagnostic software clear the error. However, if further troubleshooting is necessary, the following equipment, or equivalent, may be needed:

*Freon is a registered trademark of E.I. DuPont de Nemours Company, Inc.

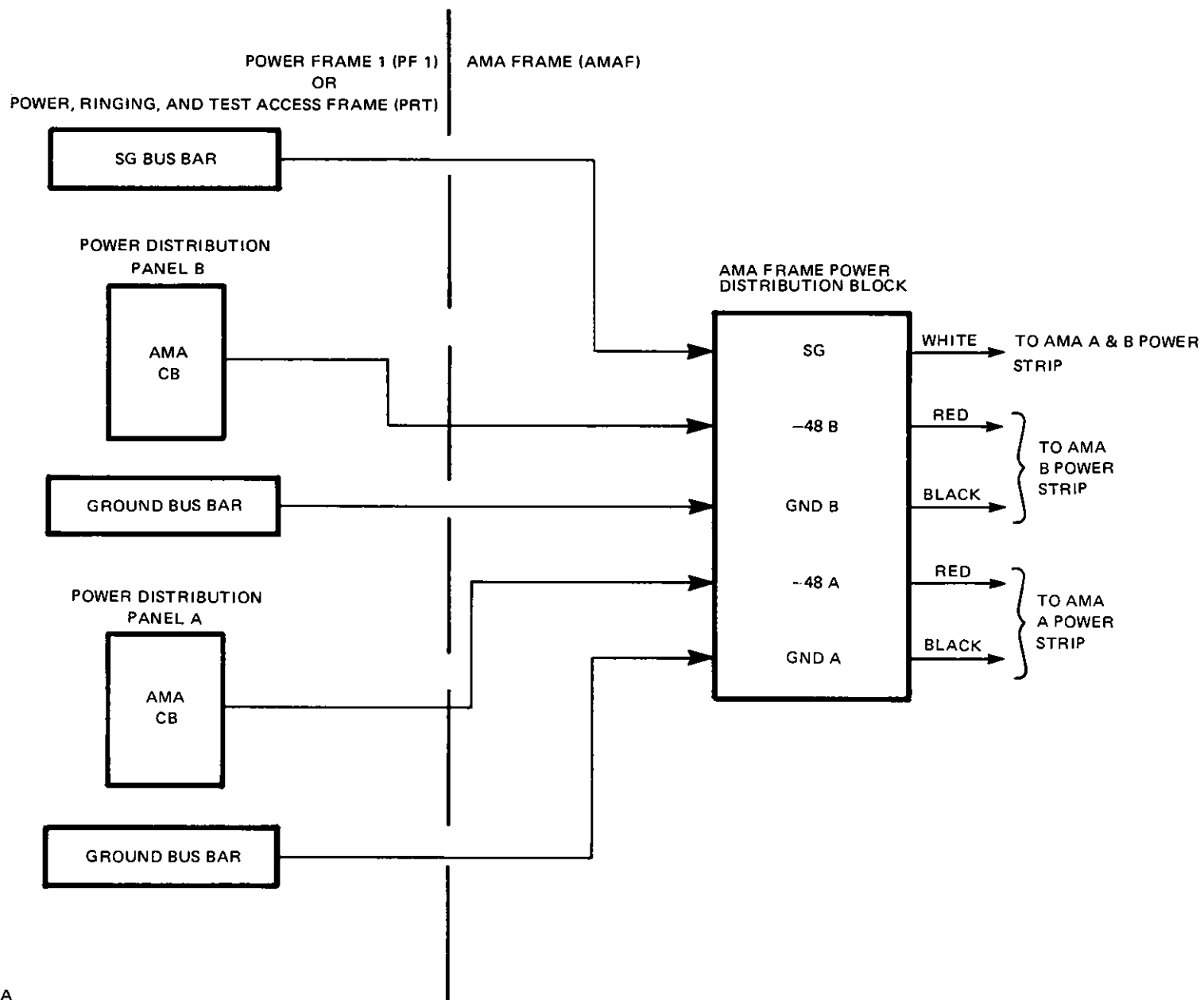
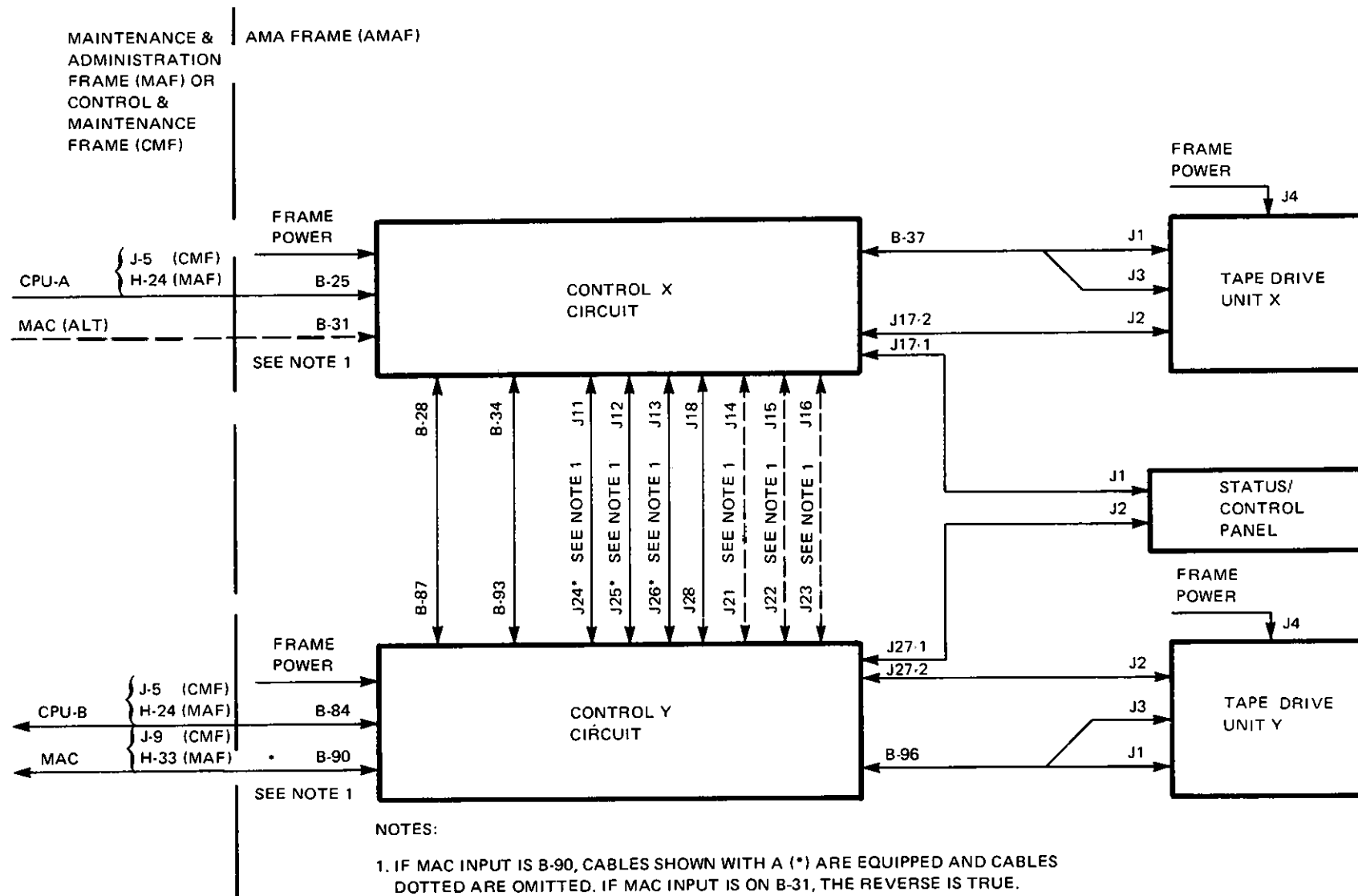


Figure 1. Power Distribution for AMA Frame



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Figure 2. Internal and External AMA Frame Cabling

<u>DESCRIPTION</u>	<u>S-C STOCK NO.</u>	<u>QTY</u>
Oscilloscope, TEKTRONIX* Model 465	207245-492	1
Voltohmmeter, Triplett Model 601	207244-950	1

4.03 Fault-Isolation and Diagnostic Software.

Two levels of software assist in the isolating and diagnosing of errors in the CAMA/LAMA subsystem. These are the error handler task (LAMAER) in the CAMA/LAMA maintenance and administration (M&A) program and the CAMA/LAMA diagnostic task (AMATST) in the second-level system diagnostic program.

a. Error Handler Task.

The CAMA/LAMA error handler (LAMAER) automatically isolates most of the hardware- and software-detected faults that occur in the CAMA/LAMA subsystem. The handler identifies the source of the error and, if necessary, causes a changeover from the faulty tape unit to the operational tape unit to ensure that ticketing continues, if at all possible. The handler also causes an error vector and a repair list to be printed or displayed. The error vector summarizes the location and nature of the fault. The repair list presents the PWBA's that are most likely to have caused the fault in the descending order of likelihood of their being the source of the fault. These PWBA's then can be replaced, one by one in the order listed, until the fault is cleared.

b. CAMA/LAMA Diagnostic Task.

The CAMA/LAMA diagnostic task (AMATST) is called manually through the input/output console, in most cases, but automatically if a serious mismatch error occurs in the CAMA/LAMA subsystem. AMATST consists of 20 separate subtests, which are executed successively until the CAMA/LAMA subsystem either fails a subtest or successfully completes them all. When the CAMA/LAMA subsystem either passes or fails AMATST, a second-level diagnostic message to that effect is printed or displayed. The message is

accompanied by an error vector (EV) describing the fault (fig. 3 through 5), a vector extension (VX) defining the faulty side (fig. 6), and a fault code (FC) identifying the number of the subtest the CAMA/LAMA subsystem failed (fig. 7). Also printed or displayed is a list of PWBA's most likely to have caused the reported fault.

1. Prompted Manual Calling of AMATST.

Whenever an active, standby, or change command is entered through the input/output console, the question, "DO YOU WISH TO CERTIFY AMA (Y/N)," is printed or displayed. If "Y" (yes) is entered in response, a portion of AMATST is run to certify that toll tickets can be written to the tape unit selected in the command. If the command entered is the active or standby command, tests 01 through 03 and 18 of AMATST are executed as a result of entering "Y" after the query. If the command entered is the change command, responding to the query with a "Y" calls tests 01 through 08 and 16 through 18 of AMATST. Definitions of these tests are presented in table 1. If the selected tape unit passes these tests, the standard second-level diagnostic message, with the EV equal to zero, is printed or displayed. If the tape unit fails the tests, the EV, VX, and fault card list indicate the location and nature of the fault and which PWBA's to replace.

2. Arbitrary Manual Calling of AMATST.

Any or all of the AMATST diagnostic subtests may be selected arbitrarily by entering the normal second-level diagnostic commands. This provides a means for verifying and analyzing faults detected and reported by the error handler. More details about using the second-level diagnostic program can be found in the section titled *System Operators Manual*, referenced in paragraph 2.02.

3. Automatic Calling of AMATST by Error Handler (LAMAER).

In the event that four mismatch errors between X and Y tape units occur within a twelve-block segment of tape, the error handler automatically calls the AMATST

*TEKTRONIX is a registered trademark of Tektronix, Inc.

Table 1. CAMA/LAMA Second-Level Diagnostic (AMATST) Tests

TEST NO.	TEST DEFINITION
00	Displays the repair list for a fault located by the CAMA/LAMA error handler (LAMAER).
01	Proves that the CAMA/LAMA interrupt mask bit (bit 10) in the maintenance bus interface (MBI) mask register (164372) can be set and reset. Then sets bit 10 to mask CAMA/LAMA interrupts.
02	Verifies, on the tape diagnostic PWBA, the A/B select and on-line status bits in the off-line maintenance status register (164054 or 164056) and the error mask bits in the off-line maintenance mask register (164050 or 164052). Also verifies that the manual on-line select bit (tape motion control status register 164020 or 164022) is clear after resetting the tape motion control circuit.
03	Does preliminary setting up of the CAMA/LAMA subsystem that is required before further testing can take place. This includes: a. Saving the value in the block counters for the side under test. b. Resetting registers on all CAMA/LAMA boards, which clears any existing error status bits. c. Masking on the tape diagnostic PWBA of any error flags from the side not under test to avoid interference with testing in the side that is under test. (Any errors detected in the side not under test are displayed with an error vector and an "ERROR IGNORED" message.) d. Forcing of the side that is under test on-line.
04	Tests the power failure reporting circuitry (maintenance status register and maintenance mask register) on the tape diagnostic PWBA and the AMA interrupt bit in the MBI status register.
05	Assures that the side under test detects a forced motion control error.
06	Verifies that errors from the tape buffer can be masked and unmasked from the MBI by the tape diagnostic PWBA.
07	Exercises tape buffer functions not related to tape motion and tests the 4K RAM in the tape interface buffer.
08	Verifies commands to the tape motion control PWBA which do not actually move tape.
09	Verifies the ability of the tape motion control circuit to report a busy condition and an illegal command status, which reports a tape motion control error to the tape diagnostic PWBA.

Table 1. CAMA/LAMA Second-Level Diagnostic (AMATST) Tests (Cont)

TEST NO.	TEST DEFINITION
10	Tests the ability to control the advance and rewind functions with commands issued through the tape motion control PWBA.
11	Tests the backspace function of the tape drive as controlled by the tape motion control PWBA.
12	Verifies write and read commands issued through the tape motion control PWBA. Writes all 1's (377 ₈ bytes) on tape, clears by writing all 0's, then rewrites all 1's and two end-of-file (EOF) characters.
13	Verifies the erase command issued through the tape motion control PWBA.
14	Tests the write and read commands issued through the tape motion control PWBA. If the test terminates without failure, two EOF characters are written after the final block of the incrementing test pattern that is written on tape.
15	Tests the write EOF command and verifies the IRG (inter-record gap) length via the tape motion control PWBA.
16	Verifies reporting of an illegal command by the tape motion control and exercises the following six tape functions via the tape buffer PWBA: write, read, backspace, erase, rewind, and EOF tape mark. The IRG, erase length, and block counters also are verified through the tape buffer PWBA.
17	Verifies that absence of timer disable and watchdog-timer reset commands results in setting of the busy timeout and busy status bits on the tape motion control PWBA when an illegal command is issued through the tape buffer PWBA.
18	Verifies that test data can be written from the call processor through the tape bus interface PWBA, the 4K RAM on the tape interface buffer PWBA, and the tape buffer PWBA, and then onto the tape in the side under test. If the other tape unit is active, it also records the test data.
19 (Executed only in state 2)	Tests the reporting of simulated errors on the off-line tape bus interface PWBA. These errors are reported to the MBI via the tape diagnostic and switchover control PWBAs.
20 (Executed only in state 2)	Verifies the operation of the 256 x 9-bit local buffer on the off-line tape bus interface PWBA and the universal asynchronous receiver/transmitters (UAR/Ts) on the tape bus interface and the tape interface buffer PWBAs.

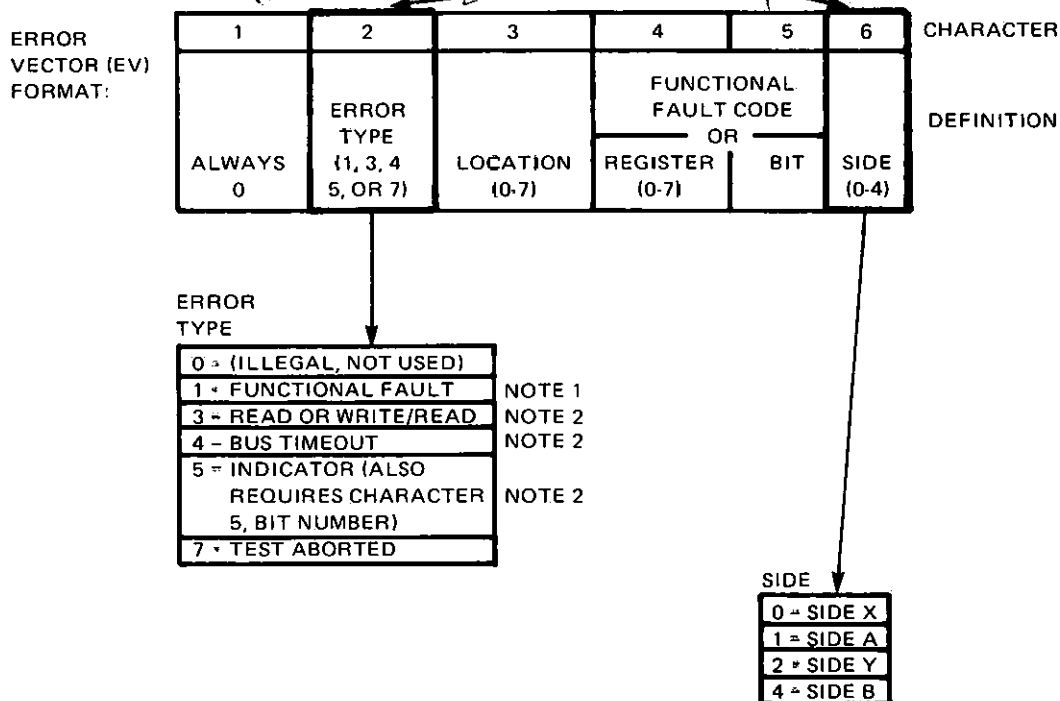
diagnostic task. The AMATST subtests are run on the standby tape unit to determine if it is the source of the mismatch. If so, the standby unit is placed in the maintenance-out-of-service (MOS) state. If no fault is found in the standby unit, the active unit is assumed to be the source of the fault and is placed in the lockout state. In either case, the input/output console prints or displays

the second-level diagnostic report of the fault and the repair list.

4.04 Removing and Replacing PWBAs, Fuses, and Lamps.

For instructions on removing and replacing PWBAs, fuses, and lamps, refer to the section titled *Equipment Removal and Replacement Procedures*, referenced in paragraph 2.02.

SAMPLE PRINTOUT: ***HH:MM:SS DIAG2 AMATST EV = 054442 VX = 2 FC = TEST16



- NOTES. 1. FOR ERROR TYPE 1 (FUNCTIONAL FAULT), CHARACTER 3 SPECIFIES THE SUBSYSTEM LOCATION OF THE FAULT; CHARACTERS 4 AND 5, TOGETHER, IDENTIFY THE NATURE OF THE FAULT. (SEE FIGURE 4.)
2. FOR ERROR TYPE 3, 4, OR 5, CHARACTER 3 SPECIFIES THE SUBSYSTEM LOCATION OF THE ERROR; CHARACTER 4 IDENTIFIES THE REGISTER THROUGH WHICH THE ERROR IS REPORTED; CHARACTER 5 IDENTIFIES THE BIT THAT IS SET IN THE REPORTING REGISTER. (SEE FIGURE 5.)

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Figure 3. Error Vector: "Error Type" and "Side"

SAMPLE PRINTOUT: ***HH:MM:SS DIAG2 AMATST EV = 054442 VX = 2 FC = TEST16

ERROR VECTOR
(EV FORMAT):

1	2	3	4	5	6
	ERROR TYPE (1)	LOCATION	FUNCTIONAL FAULT CODE		SIDE

CHARACTER

DEFINITION

LOCATION

FUNCTIONAL FAULT CODE

SIDE

0 = LINK	01 = LINK ERROR DETECTED 02 = LINK BUSY 03 = NO RESPONSE FROM CALL PROCESSOR 04 = INVALID RESPONSE FROM CALL PROCESSOR 05 = NO UNSOLICITED RESPONSE FROM CP 06 = BUS TIMEOUT IN EXTENDED TRANSFER 07 = INTERRUPT TO C.P. NEVER STARTED TEST 10 = TEST IN C.P. NEVER COMPLETED	
0 = CP → TAPE DRIVE UNIT	17 = CP-A BLOCK WRITE, NO CTR CHG 17 = CP-A BLOCK WRITE, NO CTR CHG 37 = CP-B BLOCK WRITE, NO CTR CHG 37 = CP-B BLOCK WRITE, NO CTR CHG	0 = SIDE X 2 = SIDE Y 0 = SIDE X 2 = SIDE Y
1 = MAINTENANCE BUS INTERFACE (MBI)	01 = MBI MASK BIT IS NOT MASKING 02 = MBI STATUS ERROR, TEST ABORTED 03 = MBI ERROR NOT GETTING TO HANDLER 04 = ERROR REMOVED BUT STATUS NOT CLEARED	
1 = FLOPPY DRIVE UNIT (FDU)	05 = DIRECTORY SEARCH OR TASK READ ERROR	
2 = TAPE DIAGNOSTIC BOARD (TDIA)	01 = NO MOTION CONTROL ERROR TO MBI 02 = NO TAPE BUFFER ERROR TO MBI 03 = NO TAPE BUFFER MISMATCH ERROR TO MBI 04 = NO POWER FAIL ERROR TO MBI 05 = NO A/B BUS INTERFACE ERROR TO MBI 06 = TAPE BUFFER MASK(S) NOT MASKING	

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Figure 4. Error Vector: Error Type 1, "Locations", "Functional Fault Codes", and "Side" (Sheet 1 of 2)

LOCATION	FUNCTIONAL FAULT CODE	SIDE
3 - TAPE INTERFACE BUFFER (TIB) BOARD	00 = PATTERN FAILURE IN 4K RAM 01 = CHECKERBOARD PATTERN FAILURE 02 = INCREMENTING PATTERN FAILURE 03 = DECREMENT READ MODE FAILURE 04 = ADDRESS FREEZE FAILURE	
4 - TAPE BUFFER BOARD (TBUF)	00 = ILLEGAL COMMAND FAILURE 01 = REWIND TAPE FAILURE 02 = BACKSPACE TAPE FAILURE 03 = READ OR WRITE TO TAPE FAILURE 04 = EOF TAPE MARK FAILURE 05 = INTER-RECORD-GAP (IRG) FAILURE 06 = ERASE FAILURE	
5 = TAPE MOTION CONTROL BOARD (TMC)	01 = SIDE MANUALLY SELECTED, CANNOT TEST 02 = SIDE ACTIVE, CANNOT TEST 03 = CANNOT FORCE AN ERROR TO TAPE D/AG. 04 = BLOCK COUNT DECREMENT FAILURE 05 = BLOCK COUNTER RESET FAILURE 06 = NON WRITE CMD AFFECTED BLOCK COUNT 07 = INCORRECT BLOCK COUNT AFTER WRITE 10 = ILLEGAL COMMAND FAILURE 11 = REWIND TAPE FAILURE 12 = BACKSPACE TAPE FAILURE 13 = READ OR WRITE TO TAPE FAILURE 14 = EOF TAPE MARK FAILURE 15 = INTER-RECORD-GAP (IRG) FAILURE 16 = ERASE FAILURE	
6 = TAPE BUS INTERFACE BOARD (TBI)	01 = A/B ERROR DETECTED 02 = TRANSMIT ERROR DETECTED 03 = TEST TICKET PATTERN FAILURE 04 = CHECKERBOARD PATTERN FAILED 05 = COMPLEMENTED CHECKERBOARD FAILED 06 = SHORT LOOP INCREMENT PATTERN FAILED 07 = LONG LOOP INCREMENT PATTERN FAILED	
6 = (TBI) -> SWC)	10 = ERROR STATUS FAILS @ SWITCHOVER CTRL	

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Figure 4. Error Vector: Error Type 1, "Locations", "Functional Fault Codes", and "Side" (Sheet 2 of 2)

this determines which chart

SAMPLE PRINTOUT: ***HH:MM:SS DIAG2 AMATST EV = 054442 VX = 2 FC = TEST16

ERROR VECTOR
(EV) FORMAT:

1	2	3	4	5	6
	ERROR TYPE (3, 4, OR 5)	LOCATION	REGISTER	BIT	

CHARACTER

DEFINITION

LOCATION

REGISTER

BIT

0 = LINK	0 = NO REGISTER	NUMBER OF BIT SET IN REGISTER INDICATED IN CHARACTER 4 (SEE PARAGRAPH 11.03 OF SECTION TITLED <i>CAMA/LAMA</i> <i>SUBSYSTEM</i> , <i>GENERAL DESCIP-</i> <i>TION</i> , REFERENCED IN PARAGRAPH 2.02 OF THIS SECTION)
1 = MAINTENANCE BUS INTERFACE (MBI)	1 = 164372 - MASK REGISTER-16 BITS 2 = 164374 - 1ST FAULT REGISTER-16 BITS 3 = 164376 - STATUS REGISTER-16 BITS	
1 = SWITCHOVER CONTROL (SWC)	4 = 164142 - SWC DEVICE SELECT ADDRESS 5 = 164020/024 - OFF-LINE STATUS REGISTER 6 = 164022/026 - OFF-LINE MASK REGISTER	
2 = TAPE DIAGNOSTIC BOARD (TDIA)	1 = 164050 - TDMMR1 (MASK #1) 2 = 164052 - TDMMR2 (MASK #2) 3 = 164054 - TDMSR1 (STATUS #1) 4 = 164056 - TDMSR2 (STATUS #2) 5 = 164164 - TDMSR3 (STATUS #3)	
3 = TAPE INTERFACE BUFFER (TIB) BOARD	0 = NO REGISTERS	
4 = TAPE BUFFER BOARD (TBUF)	0 = 164100/102 - TBRR0 (MP DATA) 1 = 164104/106 - TBRR1 (MP COMMAND) 2 = 164110/112 - TBRR2 (MOTION CTRL BUF) 3 = 164114/116 - TBRR3 (FORMATTER BUF) 4 = 164120/122 - TBRR4 (STATUS) 5 = 164124/126 - TBRR5 (DATA) 6 = 164130/132 - TBRR6 (COMMAND) 7 = 164134/136 - TBRR7 (BUFFER COMMAND)	

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Figure 5. Error Vector: Error Type 3, 4, or 5 "Locations", "Register" Codes, and "Bit" Number (Sheet 1 of 2)

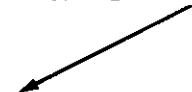
LOCATION	REGISTER	BIT
5 = TAPE MOTION CONTROL BOARD (TMC)	1 = 164000/002 - MCMCR (COMMAND) 2 = 164004/006 - MCBCR1 (BLOCK CNT - LOW) 3 = 164010/012 - MCBCR2 (BLOCK CNT - HI) 4 = 164014/016 - MCSR1 (STATUS #1) 5 = 164020/022 - MCSR2 (STATUS #2) 6 = 164024/026 - MCPAR (PROM ADDRESS) 7 = 164030/032 - MCSR3 (STATUS #3)	(SEE SHEET 1)
6 = TAPE BUS INTERFACE BOARD (TBI)	0 = 167000 (LOW) - COMMAND/STATUS 1 = 167000 (HIGH) - COMMAND/STATUS 2 = 167002 (LOW) - DATA 3 = 167002 (HIGH) - DATA 4 = 167004 (LOW) - MP COMMAND/STATUS 5 = 167004 (HIGH) - MP COMMAND/STATUS	
7 = TAPE DRIVE UNIT (TDU)	0 = NO REGISTER AVAILABLE	

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Figure 5. Error Vector: Error Type 3, 4, or 5 "Locations", "Register" Codes, and "Bit" Number (Sheet 2 of 2)

SAMPLE PRINTOUT: ***HH-MM-SS DIAG2 AMATST EV = 054442 VX = 2 FC = TEST16

VECTOR EXTENSION
(VX) DEFINITIONS:



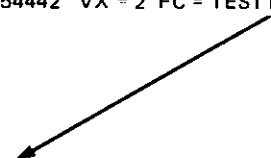
0 - SIDE X
1 - SIDE A
2 - SIDE Y
3 - SIDE B

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Figure 6. Vector Extension

SAMPLE PRINTOUT: ***HH-MM-SS DIAG2 AMATST EV = 054442 VX = 2 FC = TEST16

FAULT CODE
(FC) DEFINITIONS:



000000	= NO FAULTS
TEST00	= ERROR NOTED BEFORE STARTING TEST
TEST01	= MBI MASK (BIT 10) TEST
TEST02	= OFF-LINE STATUS AND ERROR MASK TEST
TEST03	= OTHER SIDE SETUP TEST
TEST04	= POWER FAIL TEST
TEST05	= FORCED MOTION CONTROL ERROR TEST
TEST06	= TAPE BUFFER ERROR MASK TEST
TEST07	= NONMOTION CONTROL TAPE BUFFER AND 4K RAM TEST
TEST08	= MOTION CONTROL, STATIC TEST
TEST09	= MOTION CONTROL, ILLEGAL COMMAND TEST
TEST10	= MOTION CONTROL, FORWARD/REWIND TEST
TEST11	= MOTION CONTROL, FORWARD/BACKSPACE TEST
TEST12	= MOTION CONTROL, WRITE 1'S, 0'S, and 1'S BLOCK TEST
TEST13	= MOTION CONTROL, ERASE TEST
TEST14	= MOTION CONTROL, WRITE INCREMENT PATTERN TEST
TEST15	= MOTION CONTROL, EOF/IRG TEST
TEST16	= TAPE BUFFER MOTION CONTROL TEST
TEST17	= BUSY AND WATCHDOG TIMEOUT TEST
TEST18	= ON-LINE CP/OFF-LINE TICKET TEST
TEST19	= TAPE BUS INTERFACE ERROR TEST (STATE 2 ONLY)
TEST20	= TAPE BUS INTERFACE RAM/LOOP TEST (STATE 2 ONLY)

NOTE. FOR DESCRIPTIONS OF AMATST TESTS 00 THROUGH 20,
REFER TO TABLE 1 OF THIS SECTION.

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Figure 7. Fault Code