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Section 1

INTRODUCTION

Part III of the manual provides the software procedures required to operate, validate and troubleshoot the XL40 system. It also provides the recommended preventive maintenance routines designed to keep the system in optimum condition. These procedures are contained in the following sections.

Section 2 – Troubleshooting

Provides system flowcharts used to isolate faults to a PCBA.

Section 3 – Off-Line Diagnostic Tests

Contains the operating procedures, error codes, and the descriptions concerning the off-line diagnostic tests for both release 1.5 and 1.6 software.

Section 4 – On-Line Diagnostic Tests

Contains the operating procedures, error codes, and test descriptions concerning the on-line diagnostic tests.

Section 5 – Software Support

Contains information concerning system errors, software diagnostic operations, system generation procedures and system software patches.

Section 6 – Preventive Maintenance

Delineates the two-month and six-month preventive maintenance procedures to be performed on the XL40 system.

Section 2

TROUBLESHOOTING

2.1 INTRODUCTION

Troubleshooting the XL40 system is a learned art that entails the logical and proper use of panel displays, diagnostics, and test equipment to isolate a hardware fault down to the smallest replaceable assembly. To enable you to be successful at it (i.e., getting a "downed" system up and running in a minimum amount of time), a planned course of action procedure must be implemented for each service call to reduce running unnecessary tests, yet ensuring that no fault possibility is overlooked. The purpose of this section is to provide that procedure. Presented in two parts, shown in Figure 2-1 and 2-2, the XL40 troubleshooting procedure utilizes flow chart decision blocks to isolate a fault down to an MCU board or to a peripheral. If a faulty peripheral is indicated, the flowchart will then refer to the appropriate peripheral troubleshooting table to help pinpoint the problem to a defective subassembly or adjustment.

NOTE

Before leaving on a service call, be sure you are equipped with the following:

1) *Complete CE Tool Kit*
2) *Dual Trace Scope*
3) *DVM*
4) *Documentation*
5) *A spare of the part you suspect may be wrong – as a result of customer supplied information.*

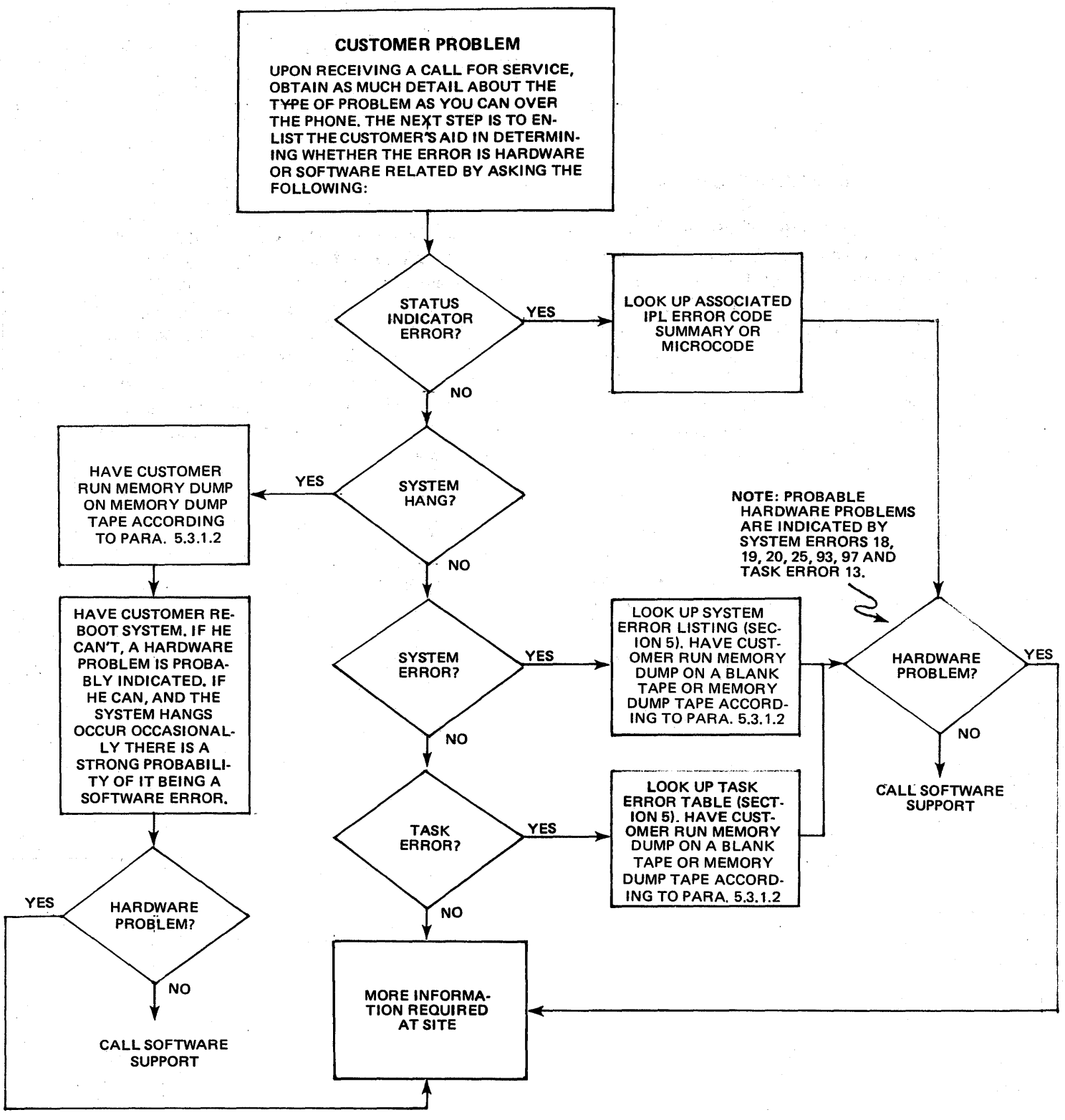


Figure 2-1. Preliminary Hardware/Software Fault Determination

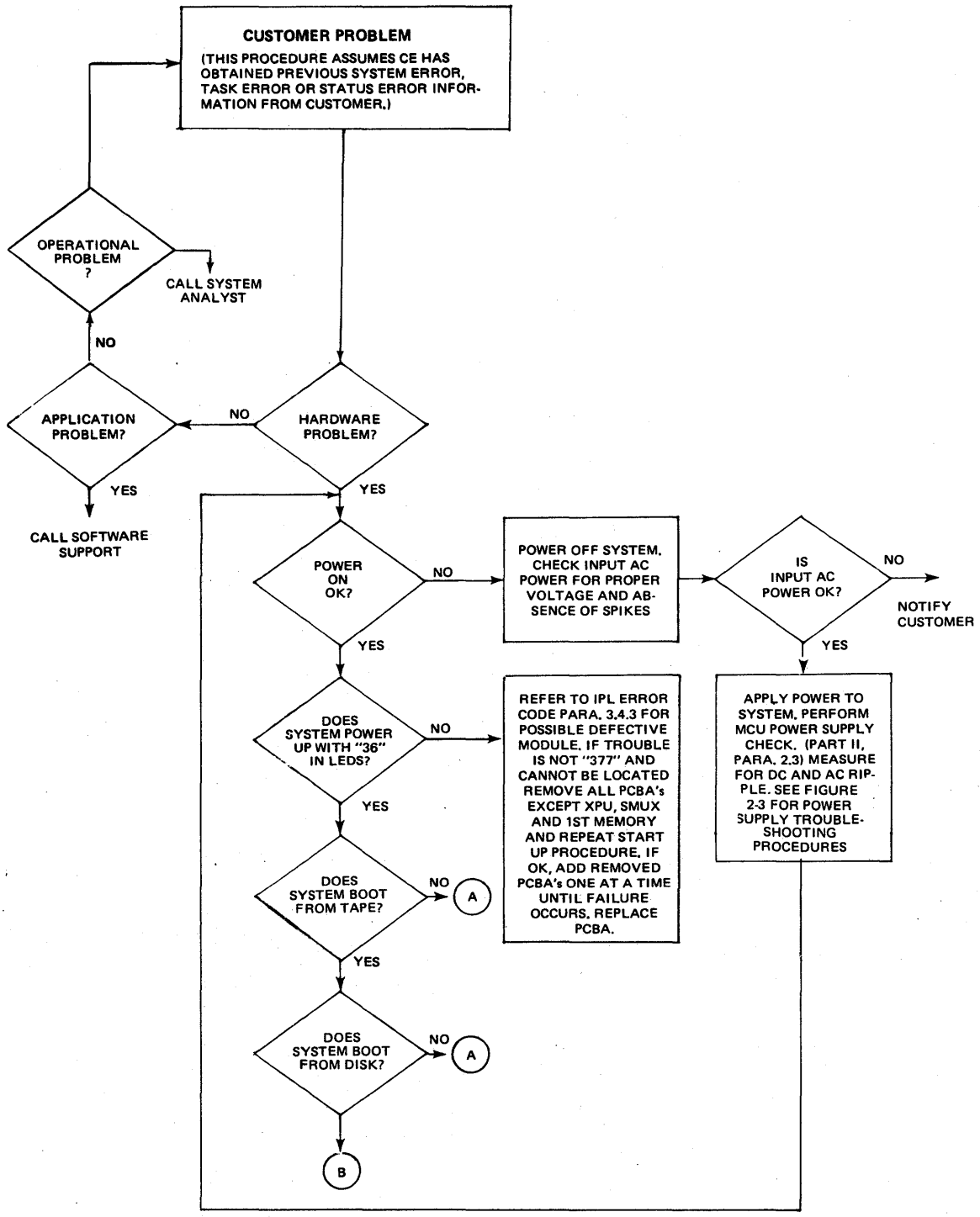


Figure 2-2. System Troubleshooting Procedure (Sheet 1)

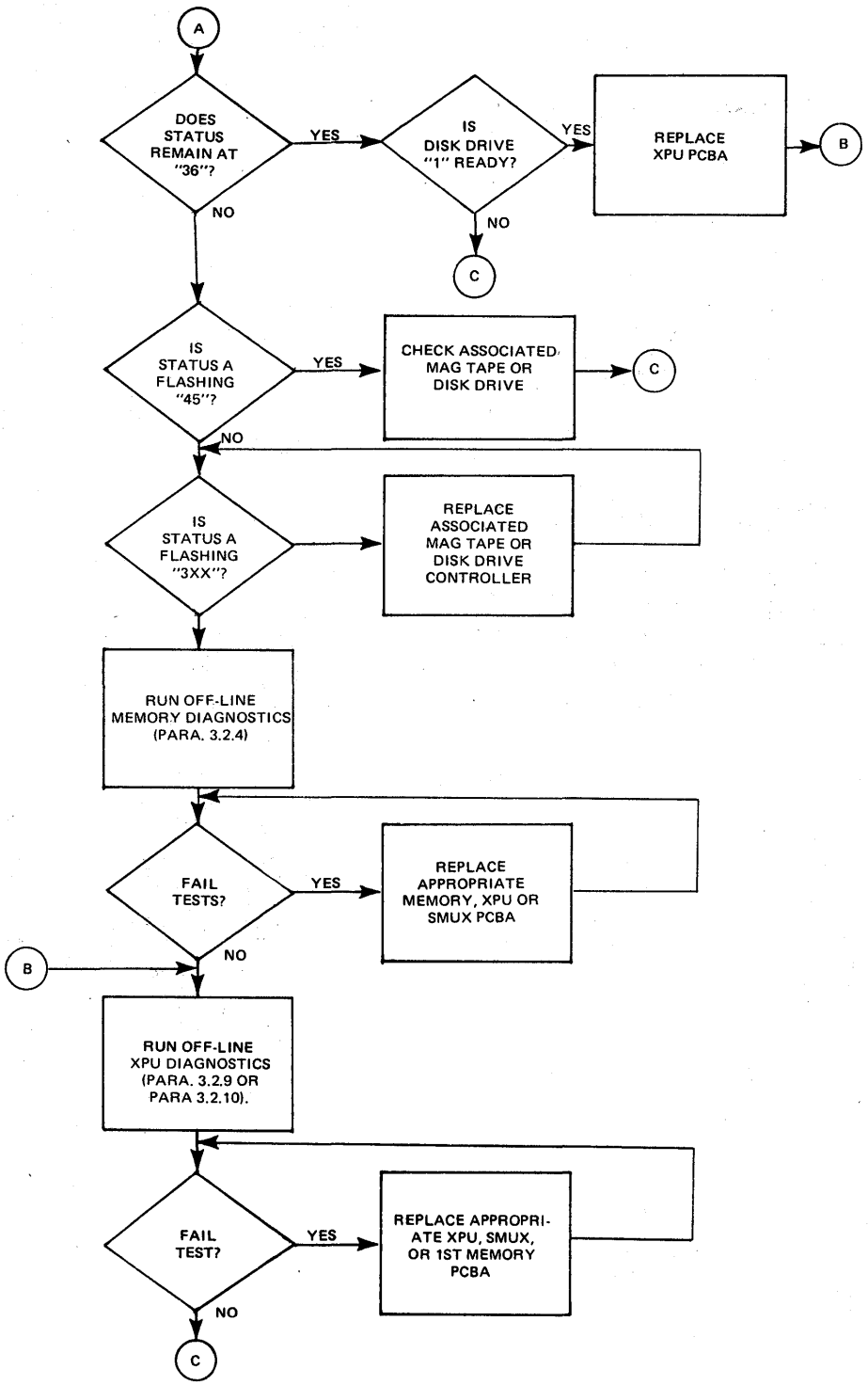


Figure 2-2. System Troubleshooting Procedure (Sheet 2)

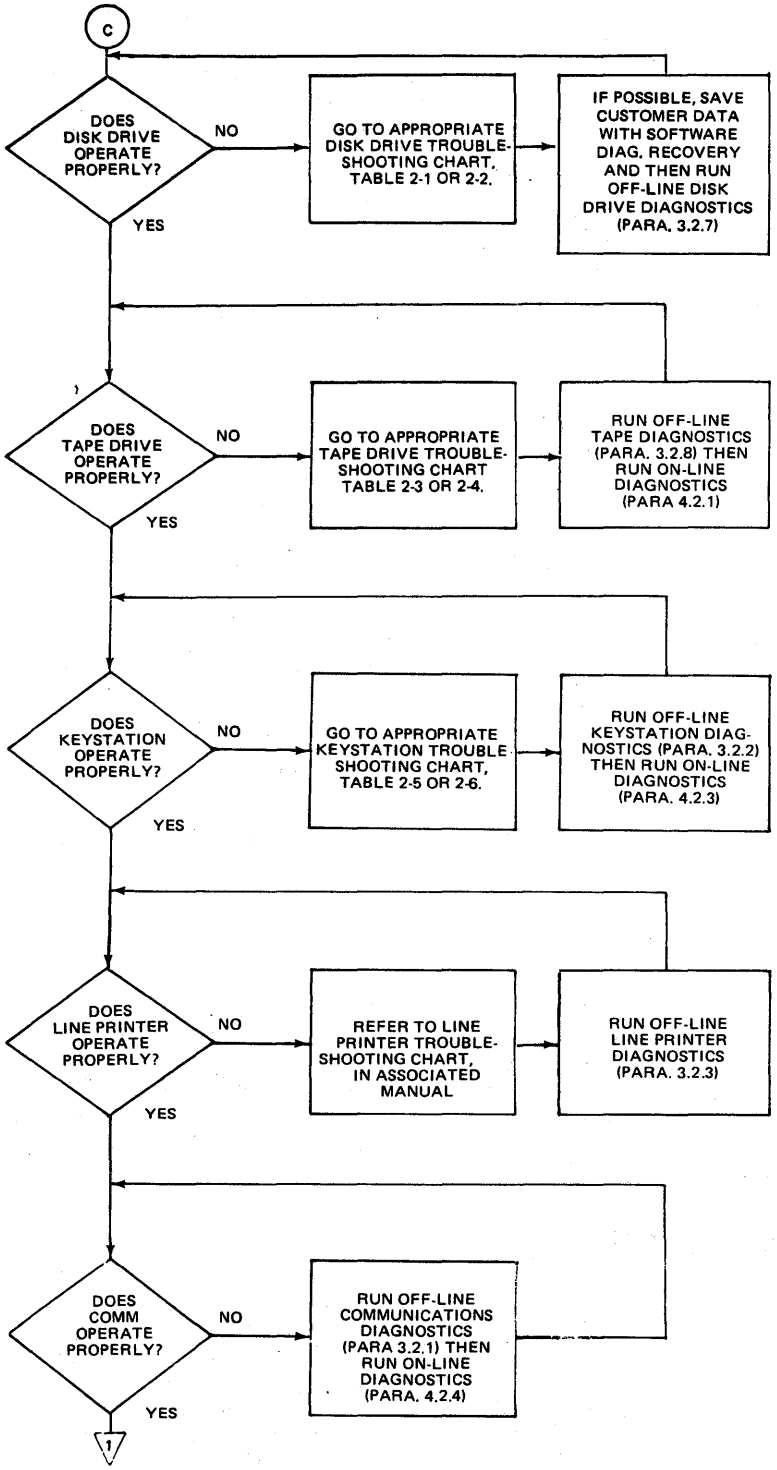


Figure 2-2. System Troubleshooting Procedure (Sheet 3)

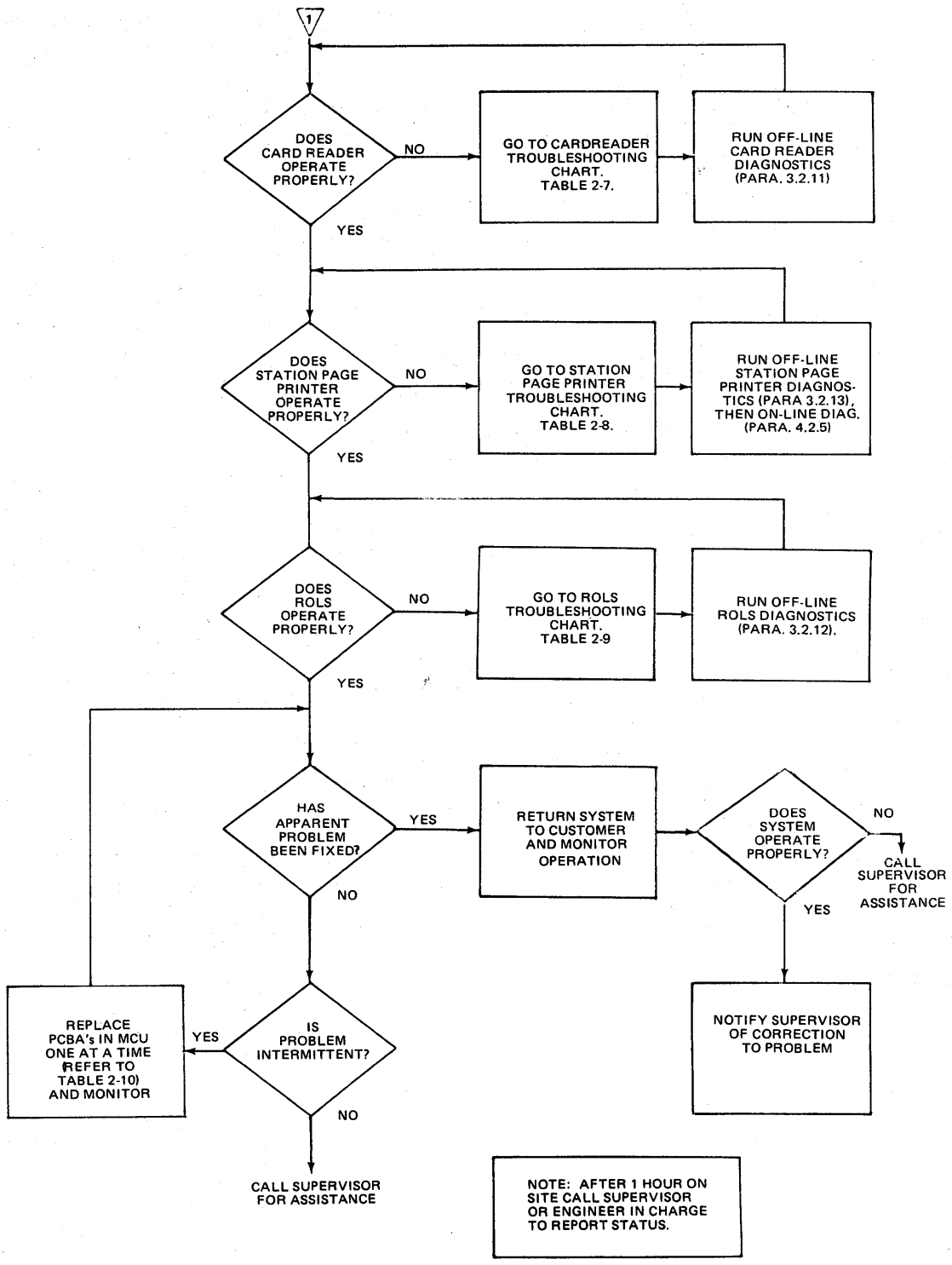


Figure 2-2. System Troubleshooting Procedure (Sheet 4)

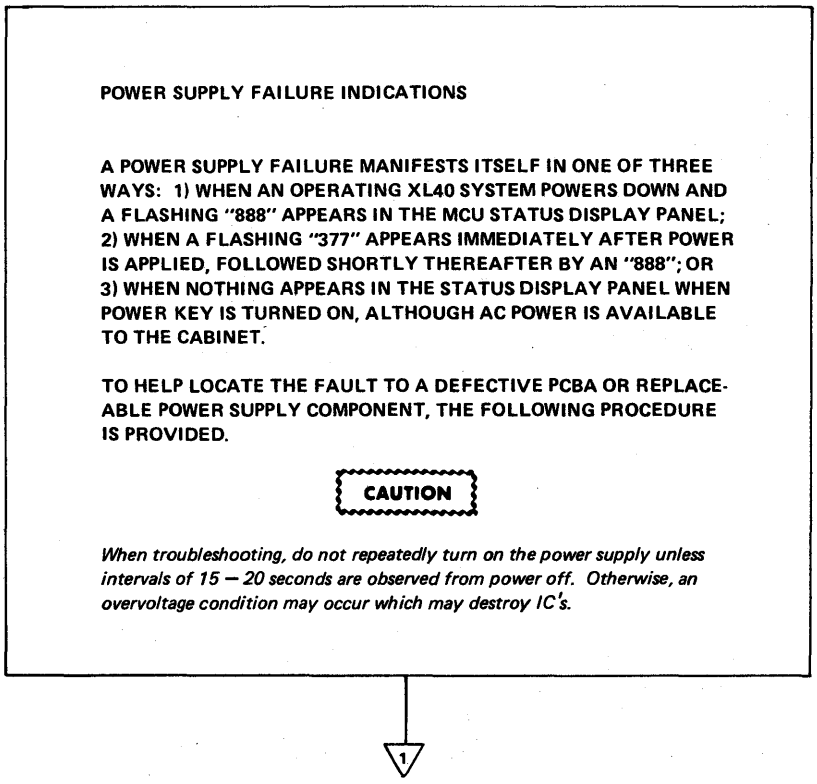


Figure 2-3. Linear Power Supply Troubleshooting Procedure (Sheet 1)

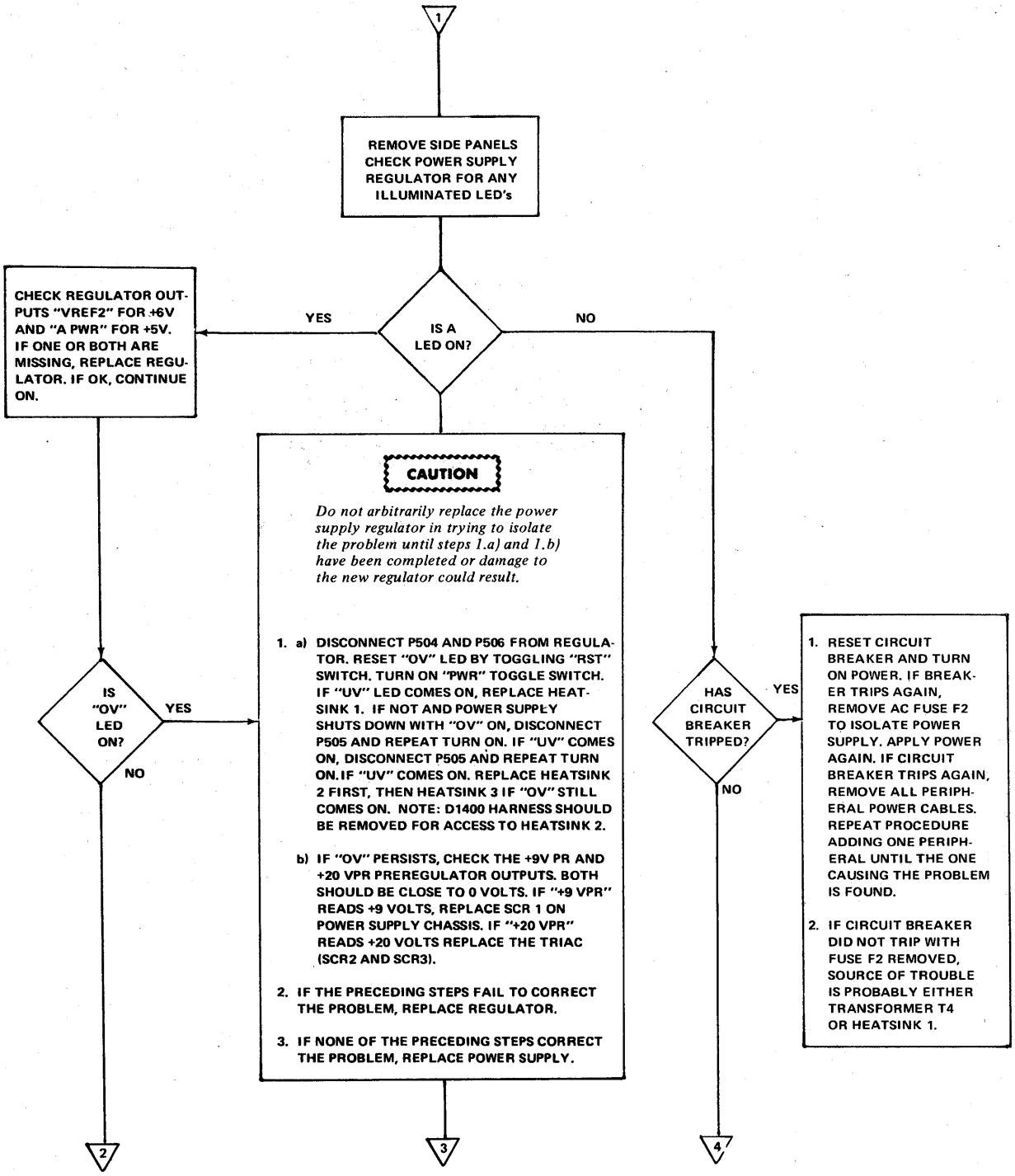


Figure 2-3. Linear Power Supply Troubleshooting Procedure (Sheet 2)

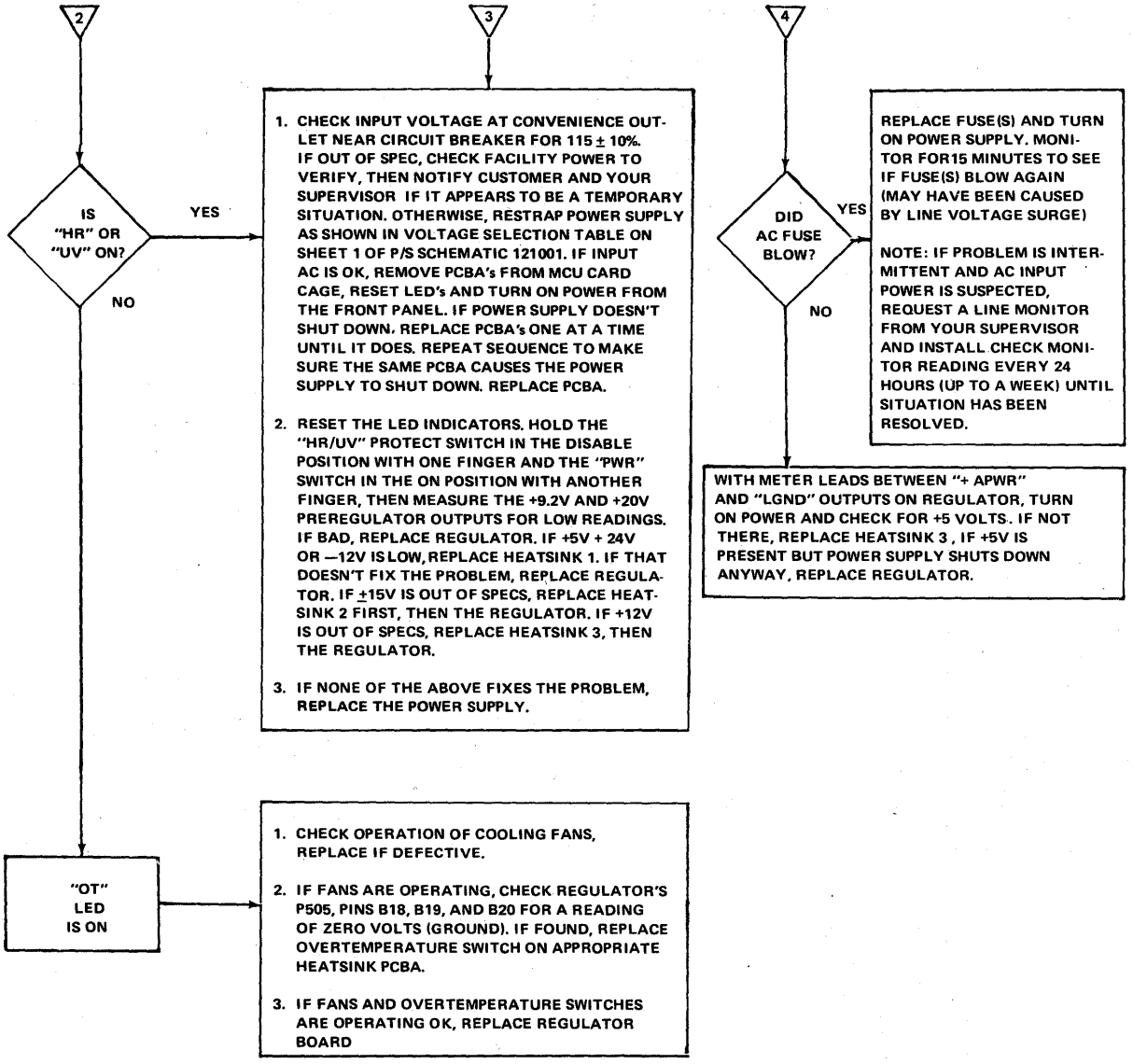


Figure 2-3. Linear Power Supply Troubleshooting Procedure (Sheet 3)

Table 2-1. 1460 Disk Drive Troubleshooting Chart

Symptom	Possible Cause	Remedy
1) Flashing "45" appears on MCU display during power up procedure. NOTE: This error is not applicable to disc drive no. 1 after restart has been pressed.	a) MCU power supply failure	a) Extend disk drive, raise cover, and on servo PCBA, check for +15 at TP1 and −15V at TP7. If one or both are missing, check output of associated regulators in MCU power supply. Etch fuses may be out.
	b) Emergency unload caused by disk start error.	b) Check J191 pin 6 of control PCBA for a +5V level (monitor start error). Replace motor generator PCBA if present.
	c) Positioner not all the way retracted.	c) With power off, physically move positioner up against stops, then retry power on sequence.
2) Drive is running properly with heads loaded but does not go into Ready state, i.e., IRXXD = true.	Ready logic in control PCBA defective.	Check J102-33 for a low level output. If high, replace Control PCBA. If low, check interface cable.
3) Motor hums excessively.	Defective motor control PCBA.	Replace first the motor control PCBA. If that does not stop the problem, replace motor.
4) Heads do not load after drive is started.	a) Positioner not adjusted properly.	a) Check and adjust positioner (reference Part II, paragraph 6.4.2.2.) Replace any failing item.
	b) Fault in position control logic.	b) Replace control PCBA.
	c) Emergency unload condition motor not up to speed or out of tolerance.	c) Verify speed error by checking J191 pin 6 for presence at a high logic level. If present, replace control PCBA.

Table 2-1. 1460 Disk Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
5) Operational drive shuts down.	Emergency unload caused by:	
	a) Blown fuse	a) At J191, check pins 9, 11, 5, 1, 6, 14, 16,13 and ground for presence of a +5V logic level. If none is present, check for +15V input at TP1 (+15V) and TP7 (−15V) to ground (TP11) on servo PCBA. If not present, check for blown fuses in ± 15V regulator on MCU power supply. If disk drive is in expansion cabinet, check fuses in 1416 power supply.
	b) Disk speed error	b) If disk speed error (CDSEG, pin 6 is high) is indicated, replace servo PCBA.
	c) Seek time error	c) If seek time error (CSTEG pin 2 is high) is indicated, replace control PCBA.
6) Heads move out at a maximum velocity to physical stops, then do an emergency unload.	a) No velocity feedback. b) Positioner transducer signals X + 0, X-90 missing.	Refer to Part II, paragraph 6.4.2.2 for checks and adjustment procedures. Replace any failing item.
7) Heads move out to load at track 00, then drift or unload.	No velocity feedback.	Refer to Part II, paragraph 6.4.2.2.6 for velocity check. If OK, replace control PCBA. If not, replace transducer.
8) Heads move all the way out to spindle	No positioner index signal.	Replace servo PCBA.
9) During head loading, heads move out at slow velocity until index limits are exceeded, then they unload.	Current address register defective.	Replace control PCBA
10) Disk will not seek.	Fault in position control logic.	A high logic level at E514 on the control PCBA indicates a fault in the positioner control logic which is holding the Busy flip-flop set. Therefore, the controller is not allowed to send new track information to the drive. Replace control PCBA.

Table 2-2. D34XX Disk Drive Troubleshooting Chart

Symptom	Possible Cause	Remedy
1) ON lamp does not light when power ON switch is pressed.	a) If SAFE light illuminates, probably a defective bulb. b) If SAFE light does not illuminate, a blown fuse or bad switch is indicated.	a) Replace bulb b) If fans are on at the rear of the expansion cabinet check first, that the disk power cable is connected securely to power distribution box, then extend drive and verify cooling fan is operating. If so, check outputs of power supply at J212 of servo PCBA. Replace fuses if bad. If OK, check outputs of regulators at J210. If bad, replace servo PCBA.
2) SAFE lamp does not light when power ON switch is pressed.	a) Depress RUN/STOP switch. If drive motor starts, a defective lamp or lamp driver is indicated. b) If READY light does not come on, one of the following may be true: • Positioner not all the way retracted. • Heads Retracted signal (SHRXG) on Servo PCBA did not go true. • Disk Rotation Detector Counter (NLDRXG) on logic PCBA did not go false to indicate no rotation. • I/O cable defective or MCU not on. • Brake Cycle Enable F-F on Logic PCBA not reset. • Positioner Transducer lamp is defective.	a) Replace or repair accordingly. b) • Physically move positioner to stop, then check for SAFE light. • Check action of heads retracted switch first, then refer to Part II, paragraph 7.4.2.5.4 for check and fault isolation. • Check U283-15 on Logic PCBA. If U283-15 is low when the disk has stopped rotating, and U284-2 is also low, replace the Logic PCBA. • Fix accordingly. • If U384-15 is low when U384-3 is high, replace Logic PCBA. • Replace lamp.

Table 2-2. D34XX Disk Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
	c) Power supply voltages not within tolerance (i.e., Power Clear signal on logic PCBA is true).	c) Check TP12 on logic PCBA for presence of a true LPCXG signal. If present, check output of power supply regulators on servo PCBA. (Reference Part II, paragraph 7.4.2.1.) If bad, replace servo PCBA. If OK, replace logic PCBA.
3) Pressing RUN/STOP pushbutton does not start motor.	a) Cartridge not inserted. b) Cartridge interlock switch is defective or other problem exists in interlock system. c) Unit not in SAFE mode. d) Emergency unload abort.	a) Insert cartridge. b) Check cartridge interlock switch and its adjustment. (Reference Part II, paragraph 7.4.2.10.) If OK, check logical level at J109-2 of logic PCBA. If low, replace logic PCBA. If high, replace RUN/STOP switch. c) Refer to problem 2. d) Check output of Emergency Unload flip-flop (U345) to see if it has been set (pin 14 high). If so, check output of U306, pin 8 for a high. If present, replace logic PCBA.
4) Motor creeps in SAFE mode.	Defective motor control PCBA.	Replace motor control PCBA.
5) Motor hums excessively.	Defective motor control PCBA or motor.	Replace motor control PCBA first, then motor.
6) Motor will not start when RUN switch is pressed although RUN indicator lights and SAFE indicator goes out.	a) Jammed cartridge. b) Jammed belt and pulley system. c) Defective motor control PCBA or motor. d) No motor enable signal (LDMEC) generated on logic PCBA.	a) Remove and reinsert. b) Repair. c) Replace motor control PCBA, then motor if necessary. d) Replace logic PCBA.

Table 2-2. D34XX Disk Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
7) Motor overspeeds.	a) Noisy AC line.	a) Using oscilloscope, check for glitches on AC line at J402 pins 1 and 3 on the motor. If present, check cabinet input power line. If glitches still there, notify customer.
	b) Defective motor control PCBA.	b) Replace.
	c) No lower transducer output.	c) Check TP1 on logic PCBA for index pulses at 25 ms.
8) Spindle speed does not change to purge cycle during start up.	a) Lower magnetic transducer misaligned.	a) NOTE: Purge cycle refers to a 10% increase in spindle speed within 25 seconds after start up. To see if disk drive goes into purge cycle, check the waveform at TP3 (Logic PCBA) with oscilloscope. 2400 rpm = 25 msec between pulses Purge cycle = 22.5 msec between pulses. (Spindle speed returns to normal after heads are loaded and before READY lamp lights.) If out of specs, refer to part II, paragraph 7.4.1.1 for adjustment procedure.
	b) Lower magnetic transducer output out of tolerance.	b) Check magnetic transducer voltage waveform on oscilloscope at U408-2 (Logic PCBA). Positive swing must be +600 mv or more positive. Negative swing must be -400 mv or more negative. If the output is out of tolerance (output too low), replace magnetic transducer assembly.
	c) Purge cycle flip-flop U344-15 on Logic PCBA stays low beyond 25 seconds.	c) If run flip-flop U364-15 (Logic PCBA) goes high and U344-15 stays low for more than 25 seconds, replace the Logic PCBA.

Table 2-2. D34XX Disk Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
9) *Emergency unload relay, K1, on Servo PCBA, does not engage. *NOTE: An emergency unload is caused whenever the following occurs: • Power failure • Motor speed out of tolerance • Heads not loading • Disk fails to seek	a. Emergency unload condition being activated prevents K1 relay from engaging during purge cycle.	a. Press RUN/STOP pushbutton. If logic level at U364-15 does not go high within 25 seconds, replace logic PCBA.
	b. Defective relay or defective relay engage circuit.	b. Replace relay K1 (Servo PCBA). If still not engaging, check logic level at J202-32. If low, relay driver circuit is defective; replace the Servo PCBA. If J202-32 is high and does not go low when going into purge cycle, replace the logic PCBA.
	c. -20V dc at J212-3 out tolerance.	c. Check the following: 1. Check fuses F1, F2, F3, and F4. 2. Use an oscilloscope or digital voltmeter to check voltages on Servo PCBA. Test Point — Voltages TP4 — +5V dc ± 0.25V dc TP12 — -5V dc ± 0.25V dc TP21 — +10V dc ± 0.8V dc TP25 — -10V dc ± 0.8V dc 3. If voltage at TP4 is incorrect, adjust R158. If voltage at TP12 is incorrect, adjust R167. 4. If any voltage cannot be correctly adjusted, check the input voltages at J212, as follows: J212-8 — +10V dc — -0.5 + 5V dc J212-11 — +20V dc — -3.0 + 5V dc K212-3 — -20V dc — -5.0 + 3V dc

Table 2-2. D34XX Disk Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
		5. If any voltage specified in step 4) is not present, replace the power supply; otherwise, go to next step. 6. If one of the voltages is not correct, disconnect all boards that are powered from the Servo PCBA. If voltages are correct after boards are disconnected, begin reconnecting boards one at a time until an incorrect voltage is measured. Replace board causing the problem. 7. If voltage at TP21 is incorrect, check Q26 on the heatsink. If Q26 is defective, replace it, If Q26 checks good, replace the Servo PCBA.
10) **Heads do not load properly after RUN switch is pressed.**	a) Positioner shipping restraint has not been removed. b) Positioner not adjusted properly. c) Emergency unload condition - motor not up to speed or out of tolerance. NOTE: In troubles causing an emergency unload, the source can be determined through use of an emergency unload test box indicator LED's.	a) Remove restraint. b) Check and adjust positioner. (Reference Part II, paragraph 7.4.2.4). c) Check J128-2 and J128-6 on logic PCBA. If either one is low, replace motor speed control PCBA (if drive belt is not binding).
11) Heads move all the way out to spindle then unload.	a) No positioner index signal.	a) With oscilloscope at TP27 of servo PCBA, verify that index signal SPTIG switches from +4 volts to -4 volts at point where heads load and maintains that level until positioner is moved to track 406. If signal-levels are

Table 2-2. D34XX Disk Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
		absent, recheck at J203-1. If present, replace servo PCBA. If not present, refer to Part II, paragraph 7.4.2.55 for index balance adjustment.
12) Heads move out at maximum velocity to physical stops, then do an emergency unload.	a) No velocity feedback. b) Positioner Transducer signal (X + 0, X + 90, SPRCG, SPQCB) missing. c) Shorted forward drive signal in servo PCBA.	Refer to Part II, paragraph 7.4.2.5 to check on transducer signals in servo PCBA. If present, replace servo PCBA.
13) Heads move out to load at track 00, then drift or unload.	No velocity feedback.	Replace servo PCBA.
14) Emergency unload caused by speed out-of-tolerance error.	a) Defective logic PCBA. b) Defective servo PCBA. c) Defective drive motor and/or motor PCBA.	a) If logic level at U47-5 is low, and logic level at logic level at U385-11 is high, replace logic PCBA. If logic level at U447-5 is low, and U385-11 is high, and TP24 is also high, replace logic PCBA. b) If U447-5 is low, U385-11 is high, TP24 is low, and TP22 is high, replace the servo PCBA. c) If U447-5 is low, U385-11 is high, TP24 and TP22 are low, and the drive belt is not binding, replace motor control PCBA. If problem persists, replace drive motor. If the drive belt binds, readjust it.
15) Emergency unload caused by head loading error.	a) Plug P205 on servo PCBA. b) Defective flex strip on positioner. c) Defective logic PCBA. d) Positioner binding.	a) Check if P205 is properly connected to J205. b) Replace flex strip c) Press RUN/STOP pushbutton. If logic level at U364-15 on logic PCBA is low, replace logic PCBA. If logic level at U364-15 does not go high within 25 seconds after pressing RUN/STOP pushbutton, replace logic PCBA. d) Free the binding positioner.

Table 2-2. D34XX Disk Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
16) During head loading, the heads move out at slow velocity then erratically drift until index limits are exceeded, they they unload.	Current address register inoperative	Replace logic PCBA.
17) No READY indication appears 2 minutes after RUN switch is pressed.	a) Defective lamp or lamp driver. b) Fault in load sequence circuit.	a) Replace lamp or logic PCBA. b) Sequence Control flip-flop (U384) should be set after load sequence. Check pin 11 for a high. If not present, replace logic PCBA. If present, check U404 pin 11 for presence of emergency unload signal (NLEFF low). If present, problem may be in motor control PCBA.
18) READY indicator is lit but CPU controller indicates unit is not ready.	a) Unit select switch not set to correct setting. b) I/O cable to MCU defective. c) Interface READY driver signal at J101-B1 on logic PCBA is false (high).	a) If only one drive, setting must be 1. Otherwise number must be in sequence. b) Replace cable if open is found. c) Repair circuit or replace logic PCBA.
19) Desk will not seek though READY light is on.	Busy logic circuit (Logic PCBA) does not go into non-busy state.	Check logic level at U69-3 (Logic PCBA). If low, the drive is constantly busy. Therefore, the CPU is not allowed to send new track information to the drive. This causes the positioner to stop seeking. Replace the Logic PCBA.
20) Positioner seeks to wrong track position.	a) Positioner improperly adjusted. b) Address logic on logic PCBA	a) Refer to Part II, paragraph 7.4.2.4 for check and adjustment.

Table 2-2. D34XX Disk Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
	c) Excessive overshoot on X + 10 adjustment on servo PCBA.	c) Refer to Part II, paragraph 7.4.2.6 for check and adjustment
	d) Scratch on scale assembly.	d) If a high level exists on TP27 (Servo PCBA) from tracks 0–406, replace scale.
	e) Reticle to scale spacing adjustment incorrect.	e) Refer to Part II, paragraph 7.4.2.6.
	f) Index to quad clock adjustment incorrect.	f) Refer to Part II, paragraph 7.4.2.6.
21) Emergency unload caused by disk speed error (after drive is in Ready mode).	AC motor speed out of tolerance.	Adjust ac motor speed control. Refer to Part II, paragraph 7.4.2.3.
22) Emergency unload when trying to seek.	a) Servo out of adjustment.	a) Check all servo adjustments. Reference Part II, paragraph 7.4.2.6. Replace servo if adjustments cannot be made.
	b) Voice coil shorted to magnet.	b) Replace voice coil.
23) Disk tries to write through two heads simultaneously.	Defective Read/Write PCBA or defective heads.	If a low logic level exists at U306-12, check heads for shorts or opens. If heads are good, replace the Read/Write PCBA.
24) Positioner takes longer than 200 msec to complete a seek to a new track	a) Foreign matter on voice coil and/or scale.	a) Remove foreign matter from voice coil and/or scale.
	b) Defective bearing on Positioner Assembly or defective Logic PCBA.	b) Check for any obstruction that would prevent free movement of carriage. If problem persists, replace Logic PCBA.

Table 2-2. D34XX Disk Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
25) Emergency unload caused by Position Transducer Lamp failure.	a) Defective transducer lamp. b) Defective transducer lamp failure circuit.	a) If transducer lamp is not lit check for +15V at J203-10. If present, replace lamp. b) If transducer lamp is on, replace servo PCBA.
26) Emergency unload when disk attempts to write.	More than one head selected.	Replace Read/Write PCBA.
27) Heads crash.	Dirty heads and/or dirty disk surfaces.	Clean heads and disk surfaces. (Refer to paragraph 6.1.4.2 and 6.1.4.3 respectively.) If heads cannot be cleaned, replace heads. If disk surfaces cannot be cleaned, replace disk.
28) Heads unload when trying to write.	Write emergency condition when going into Write mode.	Replace the head that is selected when drive unloads. If problem persists, replace the Read/Write PCBA.
29) Drive does not read data properly.	a) Defective circuit on Read/Write PCBA. b) Incorrect index and sectoring.	(See Figure 2-4) Replace Read/Write PCBA. Check for index indication and correct number of sectors. On Logic PCBA, check upper disk Index indication at TP7. Correct 2400 rpm indication is one pulse per 25 msec. Check sector count at TP8. Correct 2400 rpm sector count is* pulses per 25 msec. If the wrong number of sectors is observed, check output waveform of upper photoelectric transducer for possible *Number of pulses is the same as the sector count for the unit used.

Table 2-2. D34XX Disk Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
		out-of-tolerance output. Positive swing shall be +1.5v or more positive. Negative swing shall be -1.0v or more negative. If output is out of tolerance, replace transducer. If output is within tolerance but trouble persists, replace Logic PCBA.
30) Disk drive has incorrect sector count.	a) Upper magnetic transducer has incorrect output.	a) Check upper magnetic transducer output at U429-6. Positive swing shall be +1.5v or more positive. Negative swing shall be -1.0v or more negative. If output is out of tolerance, replace magnetic assembly.
	b) Sector electronics on Logic PCBA has malfunction.	b) Replace the Logic PCBA.
	c) Disk cartridge has defective sector ring.	c) If sector ring has scratches on outer edges, replace the disk cartridge.
	d) Lower magnetic transducer output out of tolerance.	d) Check the magnetic transducer voltage waveform on oscilloscope at U408-2. The positive swing must be +600 mv or more positive. Negative swing must be -400 mv or more negative. If the output is out of tolerance, replace magnetic transducer assembly.
	e) Defective sector phase lock loop (Logic PCBA).	e) Adjust phase lock loop as instructed in Part II, paragraph 7.4.2.8. If proper adjustment cannot be made, replace logic PCBA.

Table 2-2. D34XX Disk Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
31) Write or erase current is on but not enabled.	Defective Read/Write PCBA or defective heads.	Check heads for shorts or opens. If heads are good, replace the read/write PCBA.
32) Cannot read removable cartridge; fixed platter OK.	a) Defective upper transducer. b) Alignment incompatibility.	a) Refer to problem 27a. b) If cartridge has been used on another drive, reinitialization is required.
33) Data error, fixed platter OK.	Defective lower electronic sectoring logic on logic PCBA.	Replace logic PCBA.
34) Intermittent data errors, all surfaces.	a) Defective read/write PCBA. b) Defective static discharge eliminator. c) Jitter in electronic sectoring of logic PCBA. d) System noise.	a) Replace read/write PCBA if adjustments in Part II, paragraph 7.4.2.8 cannot be made. b) Replace static discharge eliminator. c) Replace logic PCBA. d) Check dc voltages for noise. If present, determine source.

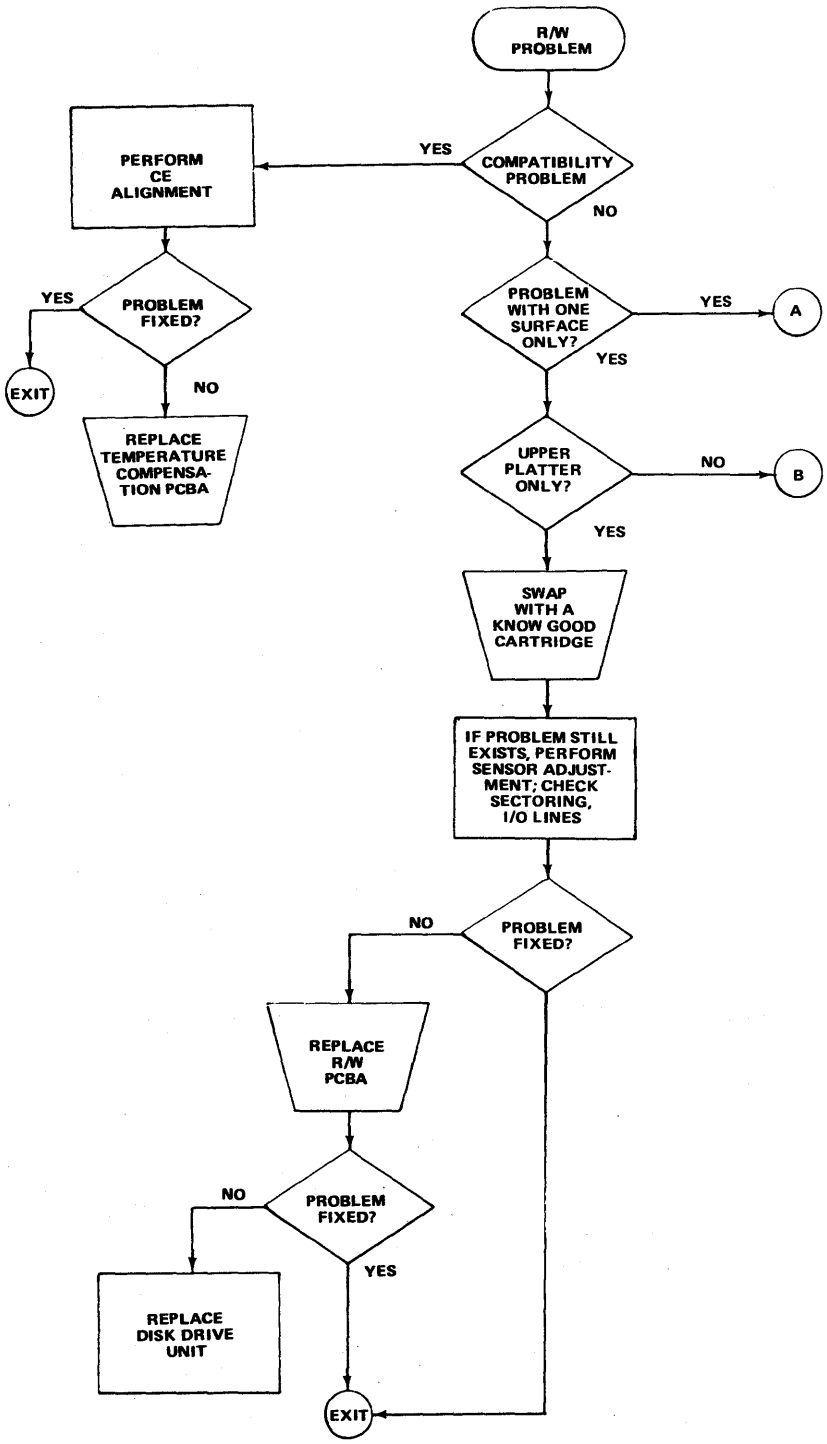


Figure 2-4. D34XX Read/Write Troubleshooting Flow Chart (Sheet 1)

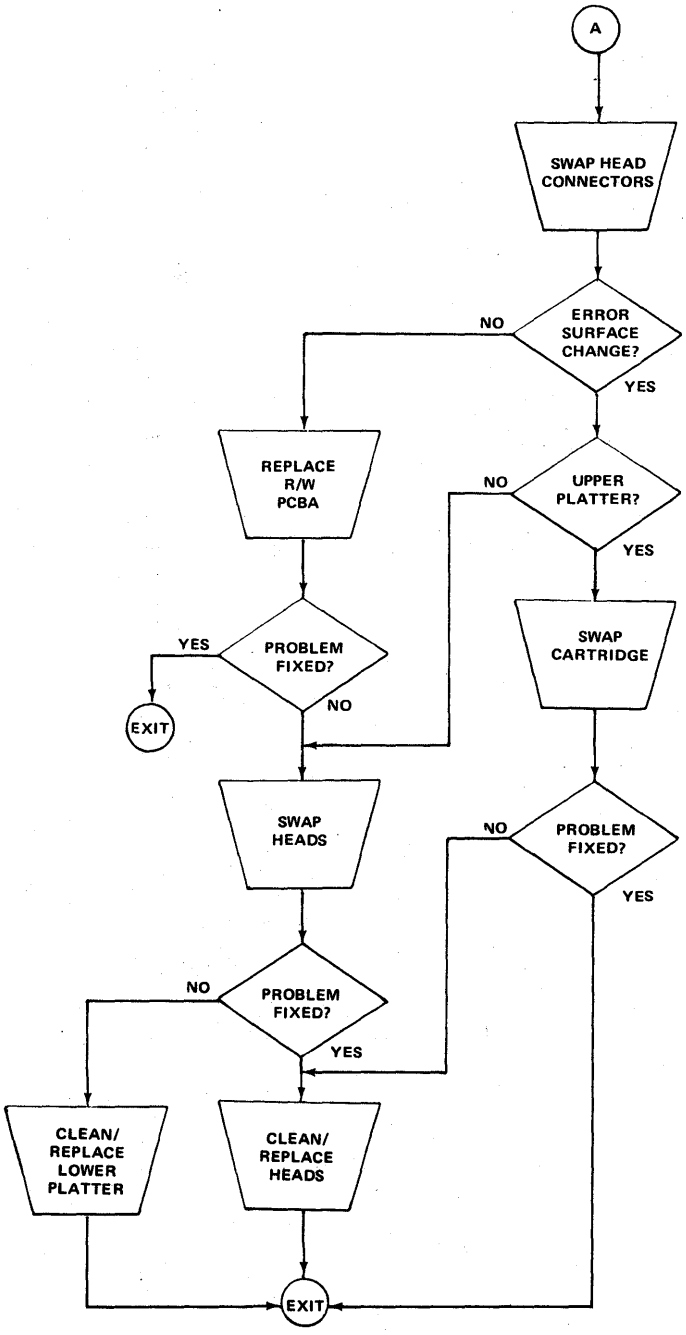


Figure 2-4. D34XX Read/Write Troubleshooting Flow Chart (Sheet 2)

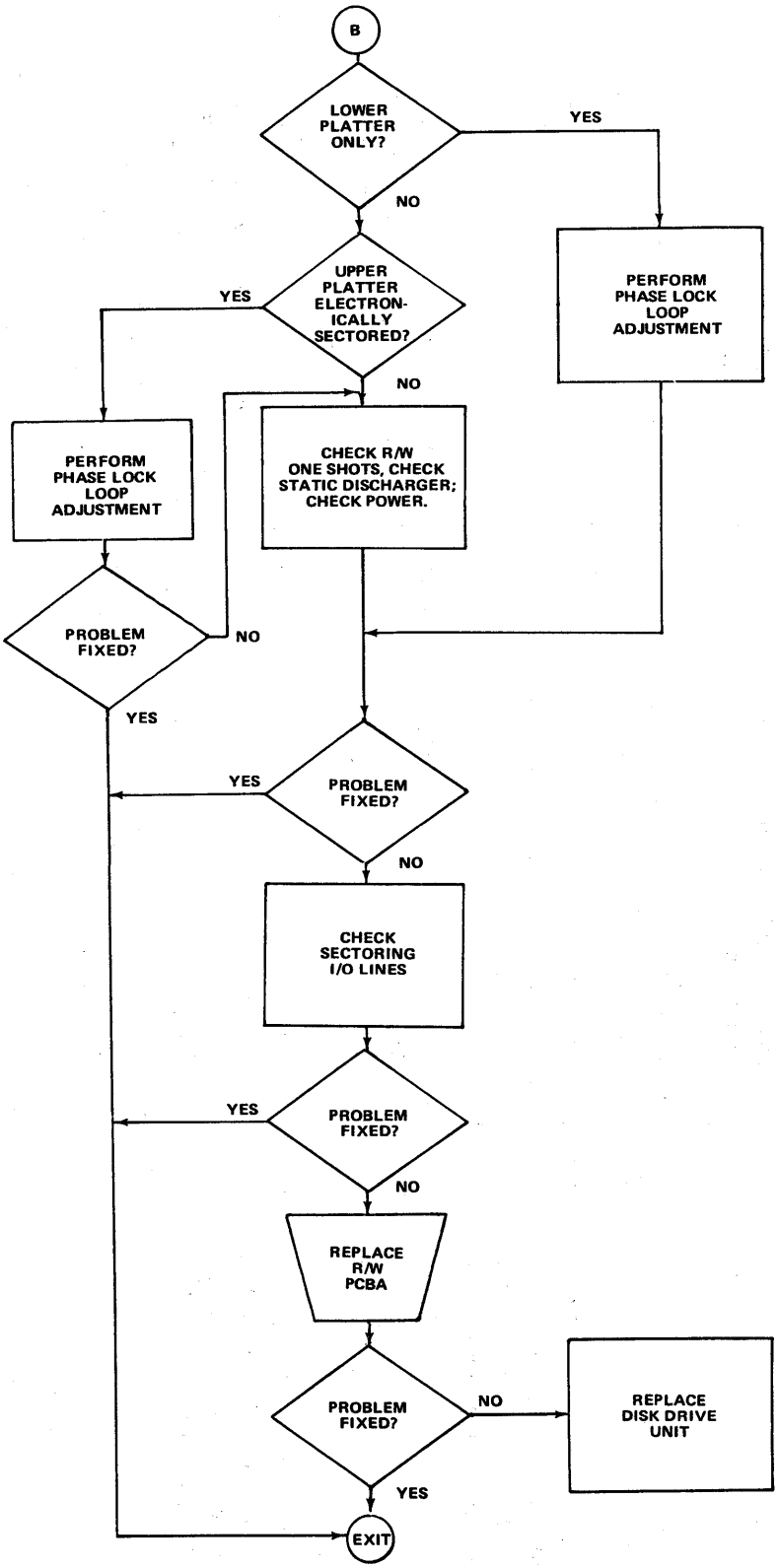


Figure 2-4. D34XX Read/Write Toubleshooting Flow Chart (Sheet 3)

Table 2-3. T7000 Tape Drive Troubleshooting Chart

Symptom	Possible Cause	Remedy
1) With power applied to the cabinet, FILE PROTECT lamp fails to illuminate.	a) Defective power supply or blown fuse in power supply. (If T7000 is in an expansion cabinet, it could also be a blown fuse in the power distribution circuit - indicated by fans not turning.)	a) Verify by checking power supply outputs at J10 for the following: pins 1, 4 15 VAC pin 2 -13V pin 3 +13V b) Replace defective fuse or module.
	b) Defective +5V -5V regulator.	Check for +5V at TP17 and for -5V at TP23 (on tape control PCBA). If not present, repair regulator or replace tape control PCBA.
2) With ac power applied to the unit, tension arms fail to move when LOAD switch is depressed for the first time.	a) LOAD switch or associated circuitry on tape control PCBA	a) Replace tape control PCBA.
	b) Interlock relay K1 either defective or not getting energized.	b) Visually check to see if contacts of relay close when LOAD switch is depressed. If not, verify that collector voltage of Q3 goes to less than +1 volt when LOAD switch is depressed. If not, replace either the relay driver component or tape control PCBA.
3) Tape is tensioned when the LOAD control is depressed, but tension is lost when control is released.	a) Bad contacts on relay K1	a) At TP25 on tape control, PCBA voltage should go to +5V when LOAD switch is depressed. If not, replace K1 or the tape control PCBA.
	b) Limit switch is inoperative.	b) Refer to Part II, paragraph 4.5.1.11 for check and adjustment procedure.
4) Tape unwinds or tension arm hits stop when the LOAD control is depressed for the first time.	a) +5or -5 volts missing from tension arm sensors.	a) Quick check it to see if tension arm sensor lights are on. If off, isolate problem and/or replace tape control PCBA. Refer to Part II, paragraph 4.5.1.13 or 4.5.1.14 if adjustment is required.
	b) Fault in reel servo amplifier.	b) Verify by seeing (without tape in transport) if movement of reels respond to tension arm position. Replace as required.

Table 2-3. T7000 Tape Driving Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
5) Tape "runs away" or rewinds when LOAD control is depressed for the second time.	Ramp generator or defective capstan motor assembly.	Check tape ramp adjustment, Part II, paragraph 4.5.1.3. If OK, replace capstan motor assembly. If not, repair or replace the tape control PC.
6) Tape runs past the BOT marker.	a) BOT tab dirty or tarnished.	a) Replace tab or increase sensitivity of photo sensor amplifier.
	b) Photo sensor amplifier defective or misadjusted.	b) With blank tape under sensor check for a reading of +3.25 to +4.5V at TP2 on tape control PCBA. Move tab under sensor and verify that voltage drops at least 0.8V. Refer to Part II, paragraph 4.5.14 for adjustment procedure. Replace BOT/EOT PCBA if bad.
	c) Load flip-flop does not reset.	c) Repair or replace tape control PCBA.
7) Transport responds to a write command but tape is not written upon.	a) Cable J1 disconnected. Write current not enabled.	a) Check at data or tape control PCBA. Check presence of write enable ring on supply reel. If OK, check WRT PWR level at TP16 of tape control PCBA Should be +5V when writing. (Write lockout assembly is probably bad if +5V is not present.) If correct, check that WRT POWER level on data PCBA at TP6 is +5V. If not, J8 pin 4 may be bent or broken.
	b) Write status (NWRT) or MOTION signal to data PCBA is not present.	b) Check write status at TP3 of data PCBA. Should be 0 volts during write. Check MOTION at TP2. Should be +5 volts. If present, check these outputs at J14 pins 9 and 6, respectively. Replace or repair the appropriate PCBA or connector cable.
	c) Write data or WRT PWR strobe missing.	c) Ensure that interface cable at J101 on data PCBA is firmly connected. Check WRT PWR at TP6 for +5V. If not, isolate trouble to tape control PCBA. If present, check TP8 for -5V level.
	d) Head not plugged in.	d) Check J2 and J3 on data PCBA.

Table 2-3. T7000 Tape Driving Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
8) Data incorrectly written.	a) Incorrect data format.	a) Use IBM Form A22-6589-3 (729 or 727 series) IBM Form A22-6866-3 (2400 series)
	b) If fault is restricted to one track, problem is probably in write amplifier.	b) Check outputs of associated write amplifier (TP101—TP901, TP102—TP902) during a write. If no output, repair amplifier or replace data PCBA if input signal is present.
	c) Intermittent write control signals or data.	c) Clean printed circuit contacts of J102 with pencil eraser. Monitor inputs of write control signals on data PCBA during a write. If intermittent, isolate to cable or tape control PCBA.
9) A known good tape cannot be read correctly.	a) Head and guides need cleaning.	a) Clean accordingly.
	b) Head not plugged in.	b) Check J3 on data PCBA.
	c) If single track, probably a bad transmitter.	c) Monitor output of associated channel (TP107—TP907). Repair transmitter or replace data PCBA.
	d) Tape cleaner full.	d) Remove tape cleaner; blow oxide and dirt from mesh, then clean with a cotton swab moistened with 91% isopropyl alcohol.
	e) Read amplifier(s) defective.	e) Refer to Part II, paragraph 4.5.15 for check and adjustment procedure.
	f) Faulty write amplifier causes current to be passed through write head during a read operation.	f) Monitor outputs (TP101—TP901 and TP102—TP902) of suspected amplifier during a read for verification. If present, repair circuit or replace data PCBA.
	g) If all tracks are not reading, faulty component in the read enable lines.	g) Check for a low at U31-B (MOTION) and the following threshold values at TP5 (data PCBA): Write Mode +4.30 maximum +3.90 minimum Read Mode (IRTH2 False) +1.40V maximum +1.00V minimum (IRTH2 True) +0.70V maximum +0.50V minimum

Table 2-4. T8000 Tape Drive Troubleshooting Chart

Symptom	Possible Cause	Remedy
1) Power on indicator does not illuminate when power ON switch is depressed.	a) Blown fuse in expansion cabinet power distribution cabinet.	a) Check to see if fans on rear door are operating. If not, replace fuse on power distribution cabinet.
	b) Defective power supply or blown fuse in power supply.	b) Replace accordingly.
	c) Defective voltage regulator.	c) On tape control PCBA, check TP33 for +10V, TP31 for -10V. On J28 check pin 4 for +.5V. If not present and inputs are OK, repair voltage regulator or replace tape control PCBA.
2) With power ON, tension arms do not move when LOAD switch is depressed for the first time.	a) LOAD switch or associated circuit circuitry on tape control PCBA defective.	a) Check for proper closure of LOAD switch. Replace if bad. Otherwise, replace tape control PCBA.
	b) Defective power supply or voltage regulator.	b) On tape control PCBA, check TP33 for +10V, TP31 for -10V. Check J28 pin 4 for +5V. If not present and inputs are OK, repair voltage regulator or replace tape control PCBA.
	c) Defective arm cocking motor circuit.	c) Check J30 and J31 for proper connection. If OK, replace tape control PCBA.
3) After the tension arms have moved down, tape is tensioned when the LOAD control is depressed, but tension is lost when control is released.	a) Bad contacts on interlock relay K1.	a) Check TP8 on tape control PCBA for +5V when LOAD switch is depressed. If not, replace K1.
		b) Interlock switch out of adjustment. Refer to Part II, paragraph 5.5.1.11 for check and adjustment procedure.
4) Actuator motors fail to deactivate.	Load limit switch malfunction.	Refer to Part II, paragraph 5.5.1.12 for check and adjustment procedure.
5) Tension arms travel downward but tape does not tension. Actuator motor does not deactivate.	Arm retract limit switch malfunction.	Refer to Part II, paragraph 5.5.1.13.

Table 2-4. T8000 Tape Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
6) Tape unwinds or tension arm hits stop when the LOAD control is depressed for the first time.	a) Tape improperly threaded. b) +5V or -5V is missing from respective tension sensors. c) Fault in reel servo amplifier.	a) Rethread tape. b) Move tension arm to mid point of travel and check TP19 and TP24 on tape control PCBA for readings of +0.6V. If off, refer to Part II, paragraph 5.5.1.14 for adjustment procedure. c) Without tape, check to see if movement of reels responds to tension arm position. If defect is noted, trouble may be isolated to the respective reel motor, read amplifier or Q42/Q43, Q48/Q49 power transistor pairs on the vertical heatsink.
7) Tape "runs away" or rewinds when the LOAD switch is depressed for second time.	a) General fault in the tape control PCBA. b) Defective capstan motor.	a) Replace tape control PCBA. b) If replacing tape control PCBA did not fix problem, replace capstan motor.
8) Tape runs past the BOT marker.	a) BOT tab dirty or tarnished. b) Photosensor or photosensor amplifier defective or maladjusted. c) Logic fault-load flip-flop does not reset.	a) Replace tab. b) Refer to Part II, paragraph 5.5.1.3 for check and adjustment procedure. c) Repair or replace tape control PCBA.
9) Transport does not move in response to SYNCHRONOUS FORWARD or SYNCHRONOUS REVERSE commands.	a) Interface cable or receiver. b) Faulty ramp generator.	a) Check signal output of cable. If OK, replace tape control PCBA. b) Check output at TP20 on tape control PCBA. Refer to Part II, paragraph 5.5.1.6 for adjustment procedure.

Table 2-4. T8000 Tape Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
10) Transport responds to SYNCHRONOUS FORWARD command, but tape is not written.	a) Write current not enabled.	a) Using diagnostic to write 1's on tape, check first that write enable ring is present on supply reel. At TP18 on tape control PCBA, check for presence of +5V WRT PWR level. If signal level is not present and the write enable ring is present replace the tape control PCBA. If WRT PWR is generated, check for its presence on Data PCBA at TP8. If not there, check J8 pin 4 and connector cable for an open.
	b) Write status or MOTION signal to data PCBA missing.	b) Check for +5V MOTION signal at TP1 on data PCBA and 0V NWRT signal at TP2. If either is missing and cable is OK, replace tape control PCBA.
	c) Heads not plugged in correctly.	c) Check J1 and J2 connections. (Read head, head nearest takeup reel, uses J2).
11) Data is incorrectly written.	a) Fault on track due to a failing write amplifier.	a) With diagnostic writing all 1's compare inputs and outputs of suspected bad write amplifier with adjacent ones. If the results do not compare, replace data PCBA.
	b) Intermittent WRT POWER, WRITE MOTION or NWRT signal.	b) With diagnostic writing all 1's, disconnect J8 from tape control PCBA and check for WRT PWR (+5V) MOTION (+5V) and NWRT (0V) and pins 4, 6 and 9 respectively. If any signal appears intermittent, replace tape control PCBA. If OK, reconnect cable and check outputs at other end of cable. If OK, replace data PCBA.
	c) Defective interface cable.	c) Disconnect cable from J102 and clean contacts with pencil eraser. Reconnect cable. If trouble still persists, replace cable.

Table 2-4. T8000 Tape Drive Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
12) Correct tape cannot be read.	a) Interface cable or transmitter fault.	a) Check out interface cable. If OK, replace data PCBA.
	b) Head not connected.	b) Check J2 for proper connection.
	c) Tape tracking on skew.	c) Readjust according to Part II, paragraph 5.5.1.15.
	d) Head guides and/or tape cleaner dirty.	d) Clean per directions in Part II, paragraph 6.1.3.2.
	e) Read amplifier output too low.	e) Refer to Part II, paragraph 5.5.1.8 for check and adjustment procedure.
	f) Defective write amplifier causes current to be passed through head while reading.	f) Check output of write amplifier on defective track during a read. If present, replace data PCBA.
	g) Envelope detector delays are incorrect.	g) Check TP106—TP906 on data PCBA to determine which channel has the incorrect on/off times. When found, check the associated TP104—TP904 for a 5V PP reading. If incorrect, adjust the associated R117—R917 potentiometer. If output cannot be adjusted, replace data PCBA.
	h) Threshold level incorrect.	h) During a diagnostic read check TP6 on the data PCBA for the following: 1) With IRTH2 false: • +3.00V maximum • +2.40V minimum 2) With IRTH true: • +1.60V maximum • +1.00V minimum If threshold levels are out of tolerance, replace data PCBA.
13) One tape has intermittent read errors. Other tapes are OK.	Old tape	Replace tape with a duplicate.

Table 2-5. Model 4141 Keystation Troubleshooting Table

Symptom	Possible Cause	Remedy
1) No 'BEEP' tone when power turned on.	a) TONE control not adjusted properly. b) Keyboard speaker not connected.	a) Adjust control. b) Check speaker connection at keyboard and KRD3.
2) No blinking cursor after power turned on.	a) "BRT" control not adjusted properly. b) Loose cable connection. c) Bad CRT. d) Defective cursor logic.	a) Adjust BRT control for proper intensity. b) Check all cable connections to all PCBA's and CRT. c) Replace CRT. d) Replace KSC4/5.
3) No 'BEEP' tone when power turned on and no blinking cursor.	a) Loose cable connection. b) Blown fuse. c) Missing regulated voltage. d) No control logic.	a) Check all cable connections to all PCBA's and CRT. Also check AC power cord and voltage plug (P017). b) Check input AC fuse(s). c) Perform voltage check on KRD3. If a voltage is missing or improper, replace KRD3. d) Check that KSC4/5 is properly seated.
4) Cursor is not aligned properly.	Misalignment of video control.	Perform keystation adjustment and alignment procedures (Reference Part II, paragraph 8.4)
5) Intermittant screen flashing.	a) Bad flyback transformer. b) Improper grounding.	a) Replace flyback transformer. b) Check all ground connections.
6) Keystation seems to be functioning properly but will not respond to system.	a) Failure in control logic. b) Break in coax line. c) Keystation is addressed wrong.	a) Replace control PCBA. b) Check coax cable to keystation and coax connection to KRD3. c) Check address switch on KSC4/5 for correct setting in address range.

Table 2-5. Model 4141 Keystation Troubleshooting Table (Continued)

Symptom	Possible Cause	Remedy
7) Characters appear, but have incorrect dots or segments.	a) Character font incorrectly loaded. b) Failure in character font RAM or character generator logic.	a) Turn off the keystation, then back on. Have system respond to keystation again. b) Replace KSC4/5 PCBA.
8) Keystation appears to be functioning properly, but no keyboard response.	a) Loose keyboard connector. b) Failure in keyboard encoding logic. c) Failure in keyboard interface logic.	a) Check keyboard cable connection. b) Replace keyboard. c) Replace KSC4/5 PCBA.
9) No "CLICK" when keyswitch is depressed, but correct character appears.	a) CLICK control not adjusted properly. b) Failure in keyboard control logic.	a) Adjust control. b) Replace KSC4/5 PCBA.
10) Double keystrokes or no key switch response when key is depressed.	Failure in keyswitch module.	Replace keyswitch.

Table 2-6. Model 4143 Keystation Troubleshooting Chart

Symptom	Possible Cause	Remedy
1) No BEEP tone when power is turned on.	a) TONE control not adjusted properly.	a) Adjust control.
	b) Keyboard speaker not attached.	b) Check speaker connection.
2) No blinking cursor after power is turned on.	a) "BRT" control not adjusted properly.	a) Adjust control.
	b) Loose cable connection.	b) Check all cable connections between display PCBA, defelection driver PCBA and CRT.
	c) Defective cursor logic on display	c) Depress switch 8 of the DIP switch on the coax interface PCBA to see if a test pattern appears. If not, and CRT filaments are on, replace the display logic PCBA.
	d) Bad CRT.	d) If CRT filaments are on, turn up BRT control to see if there is any raster. If there is or if only a dot appears replace deflection driver PCBA. If nothing appears replace CRT.
3) No "BEEP" when power is turned on and no blinking cursor appears. Keyboard appears dead.	a) No AC input.	a) Verify that facility power is present and that power cable to Keystation is connected.
	b) Blown fuse.	b) Check AC fuses at rear of power supply.
	c) Missing regulated voltage.	c) On power supply regulator PCBA, check for presence of +12 Volts at TP2; check for presence of +5 Volts at TP1. Replace PCBA if either is missing.

Table 2-6. Model 4143 Keystation Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
4) Cursor is not aligned.	a) Misalignment of video control.	a) Perform Keystation adjustment and alignment procedures (Reference Part II paragraph 9.4).
5) Intermittent screen flashing.	a) Bad flyback transformer.	a) Verify by checking transformer for audible or visual indications of arcing, then replace. Otherwise, check all cable and ground connections before replacing transformer. Also check out deflection drive for visable signs of component damage due to deflection driver.
	b) Improper grounding.	b) Check all ground leads for tight connections, particularly those on the CRT and power supply assembly and tighten.
6) Keystation appars to be functioning properly, but will not respond to system.	a) Open in coax line.	a) Check coaxial line from last working Keystation or from MCU-1 cabinet for a disconnected or damaged cable.
	b) Keystation is incorrectly addressed.	b) Check address switch on coax interface PCBA for correct setting. NOTE: 0 and 1 are invalid addresses; the first address should be 2.
	c) Failure in the coax interface PCBA.	c) Replace PCBA.
7) Screen will not get bright enough without overdriving BRT control.	a) Defective deflection driver	a) Replace PCBA.
8) Video jitters and/or rolls over.	a) 50HZ operation has been selected with a 60HZ power inout.	a) Set switch 7 on the coax interface DIP switch to on.

Table 2-6. Model 4143 Keystation Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
9) Vertical lines or garbage displayed on screen.	a) Defective display logic PCBA.	a) Replace PCBA.
10) Any problem concerned with sync, changing size of display, or ghosts.	a) Defective deflection driver PCBA.	a) Replace PCBA if test display is OK.
11) No characters can be typed in.	a) Keyboard not plugged into Keystation. b) Defective Keyboard interface PCBA.	a) Connect Keyboard. b) Replace PCBA.
12) Typing characters locks up system.	a) Defective Keyboard interface PCBA.	a) Replace PCBA.
13) Multiple characters displayed for one Keystroke.	a) If problem exists for only one Key, defective Keyswitch. b) Defective Keyboard interface PCBA.	a) Replace Keyswitch. b) Replace PCBA.

Table 2-7. Card Reader Troubleshooting Chart

Symptom	Possible Cause	Remedy
1) POWER indicator fails to light when POWER switch is turned on.	a) Power cord is not connected to reader or power source.	a) Connect power cord to reader and power source.
	b) Circuit breaker CB1 is not on.	b) Place circuit breaker CB1 to ON position.
	c) Fuse F1 is defective.	c) Replace F1.
	d) Lamp is burned out.	d) Replace lamp.
	e) +5 volt power regulator defective.	e) Replace +5 volt power regulator.
2) When LAMP TEST switch is activated, none of the lamps on the control panel will light. (POWER indicator excluded).	a) Defective lamp test switch.	a) Replace lamp test switch.
	b) Defective Error Card.	b) Replace Error Card.
3) HOPPER CHECK indicator does not light when hopper goes empty or stacker goes full. No other error indications.	a) Lamp is burned out.	a) Replace lamp.
	b) Defective Error Card.	b) Replace Error Card.
4) HOPPER CHECK indicator does light when hopper goes empty and PICK CHECK indicator is lit.	a) Hopper empty switch not adjusted properly.	a) Adjust hopper empty switch, Reference Part II, paragraph 14.4.1.5.
	b) Defective hopper empty switch.	

Table 2-7. Card Reader Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
5) HOPPER CHECK indicator does not light when stacker goes full.	a) Stacker full switch is adjusted properly. b) Defective stacker full switch.	a) Adjust stack full switch, Reference Part II, paragraph 14.4.1.6. b) Replace stacker full switch.
6) PICK CHECK indicator fails to light when reader makes six attempts and fails to pick a card.	a) Deffective Error Card.	a) Replace Error Card.
7) STACK CHECK indicator fails to light when there is a stack check condition.	a) Defective Error Card.	a) Replace Error Card.
8) PICK CHECK indicator lights regularly after making six pick attempts.	a) Dirty picker selector. b) Maladjustment of picker stops, vacuum plate, throat clearance, or solenoid coupling. c) Defective Sync Card. d) Defective Error Card. e) Defective Clock Card.	a) Clean picker selector with denatured alcohol. b) Readjust picker selector, Reference Part II, paragraph 14.4.1.7. c) Replace Sync Card. d) Replace Error Card. e) Replace Clock Card.
9) READ CHECK indicator fails to light when a dark check or light check condition occurs.	a) Column "0" output or Column "81" output is missing from the Clock Card. b) One light or one dark output missing from the Control Card. c) Defective Error Card.	a) Replace Clock Card. b) Replace Control Card. c) Replace Error Card.

Table 2-7. Card Reader Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
10) Reader picks three cards, and then stops with a PICK CHECK.	a) Good pick reset output is missing from Clock Card.	a) Replace Clock Card.
	b) Clear pick control is missing on the Sync Card.	b) Replace Sync Card.
	c) Pick attempt counter is not being cleared out properly.	c) Replace Sync Card.
11) Reader picks two to six cards and then stops with a PICK CHECK.	a) Pick attempt counter is not being reset at good pick reset time. Defective Sync Card.	a) Replace Sync Card.
12) Reader picks one card but the reader will not pick additional cards. Unable to stop the reader by pressing the STOP switch.	a) Column "84CR or CR' output is missing from the Clock Card.	a) Replace Clock Card.
	b) Column strobe phase "B" or phase "D" is missing from Sync Card.	b) Replace Sync Card.
	c) Clock phase "C" or phase "D" is missing from Clock Card.	c) Replace Clock Card.
	d) Clock phase "B" is missing from Clock Card.	d) Replace Clock Card.
13) Reader reads erroneous data.	a) Defective Clock Card.	a) Replace Clock Card.
	b) Defective Sync Card.	b) Replace Sync Card.
	c) Defective Control Card.	c) Replace Control Card.

Table 2-7. Card Reader Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
14) Sharp, metallic noise from picker sector while reading cards.	a) Picker sector maladjusted.	a) Adjust picker sector. Reference Part II. paragraph 14.4.1.7.
	b) Rubber roller worn.	b) Replace roller.
	c) Bearing bad.	c) Replace bearing.
	d) Belt too tight	d) Readjust belt.

Table 2-8. Station Page Printer Troubleshooting Chart

Symptom	Possible Cause	Remedy
1) POWER indicator does not light when power switch is turned on.	a) Power cord not connected to facility power. b) Line fuse blown.	a) Connect power cord to facility power. b) Replace line fuse.
2) Printer does not print when the SELECT lamp is lit.	a) Loose interface cable. b) Printed circuit boards not sealed.	a) Secure interface cable. b) Check for proper mating of all PCBA's.
3) Print head does not return to left margin when power is applicable.	a) RTP or EOP optical sensor switches loose or maladjusted.	a) Adjust RTP and/or EOP actuator arms. (Reference Part II, paragraph 13.8.4.)
4) Print head pin fire occurs during power-on or power-off cycle.	a) Logic PCBA defective.	a) Replace Logic PCBA.
5) Continuous print head motion occurs without printing or paper.	a) Logic PCBA defective.	a) Replace Logic PCBA.
6) Erratic carriage and/or paper motion occurs.	a) Blown fuses on Logic PCBA. b) Defective Logic PCBA.	a) Replace fuses. b) Replace Logic PCBA.
7) Erratic line to line spacing occurs.	a) Backstopper pawl on the platen drive assembly out of adjustment.	a) Backstopper Pawl Adjusment. • Rotate the backstopper pawl eccentric forward to a position where it will not engage after performing the top of forms, vertical tabs and single line feed functions. Perform these functions without paper installed in the printer. • Move the eccentric backward to a position where the pawl engages during the execution of the three functions.

Table 2-8. Station Page Printer Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
8) Malformed or missing dots in occur in printed characters.	a) Dirty timing fence.	a) Carefully clean both sides of timing fence with a clean soft cloth. **CAUTION** Do not use alcohol as a cleaning agent or the timing fence may be damaged.
	b) Video amplifier out of adjustment.	b) Adjust video amplifier PCBA (Reference Part II, paragraph 13.8.2).
	c) Blown PICO fuses on the Logic PCBA.	c) Check and replace if necessary.

Table 2-9. ROLS Troubleshooting Chart

Symptom	Possible Cause	Remedy
NOTE: BECAUSE OF THE MANY POSSIBLE CONFIGURATIONS OF THE ROLS SYSTEM, PRE-DIAGNOSTIC TROUBLESHOOTING IS RESTRICTED TO DETERMINING PROPER INPUT POWER TO THE CARS OR RSC, CHECKING THE PCBA'S BASIC OPERATION BY INITIATING A SWITCH SELECTED TEST, VERIFYING DATA LINK IS OPERATIONAL AND THAT ADDRESS SWITCH SETTINGS MATCH.		
1) Power indicator does not illuminate when LCU/RCU power switch is turned on.	Blown fuse.	Check LED display at bottom of the CARS or RSC RCBA. If Run LED (2nd from left) is on, input power is available and only replacement of power indicator bulb is necessary. If Run is off also, check input power connections and fuses. Fix accordingly.
2) Power on indicator illuminated but Run LED is not.	a) Missing DC power.	a) Rotate Mode switch to 8 to initiate self test initiate self test of the PCBA. If the LED display does not turn on, measure for the following DC voltages at J006. Pins 1 & 2 +5VDC Pin 3 +12VDC Pin 4 −12VDC Pins 5 & 6 ground If any voltage is missing, check the same pin connections on J004 of power supply regulator. If symptoms are the same, replace regulator.

Table 2-9. ROLS Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
		NOTE: If the CARS PCBA is mounted in the MCU, the foregoing procedure would be done as follows: Set the J005 switch augat position 8 ON and initiate self-test. If LED's don't light, check P100 for the following: Pins A04, B04, A05, B05 +12VDC Pins A44, B44 A49, B49 −12VDC Pins A49, B49 A50, B50 +5VDC If inputs are OK, check printed circuit fuse F1 to see if it has blown. Replace with a jumper of similar gauge wire.
	b) Defective CARS or RSC PCBA.	b) Replace PCBA if DC input power checks OK but board fails self-test.
3) Keystations at remote site cannot communicate with XL40. ON LINE indicator on LCU/RCU, however, is on.	a) Incorrect switch settings.	a) At remote site, have someone set the mode switch to position 8 (TEST). Verify that the TEST and ON LINE indicators blink on and off alternately and that a test pattern is flashed on key-stations along with an alert tone. Replace RSC if it fails test. If RSC's check out OK repeat test for LCU. REplace CARS PCBA if it fails test.

Table 2-9. ROLS Troubleshooting Chart (Continued)

Symptom	Possible Cause	Remedy
	b) Bad modem or phone lines	With RSC mode switches set in position 1, place LCU mode switch to position 8 (TEST). Have people at all remote sites interfacing with LCU verify if TEST ON LINEindicators are blinking on and off alternately. If all but the affected site report in the affirmative, switch modem cables (if identical) at the local site and see if trouble "moves." If it does, replace defective modem. If it doesn't, replace modem at "downed" site.
4) Keystations at remote site cannot communicate with XL40. ON LINE indicator on LCU is off.	a) Bad modem or phone lines.	a) If possible, switch two identical modems at the local site to see if trouble "moves." If so, replace modem. If not, replace modem at remote site. b) Check and repair accordingly.
5) All remote sites interfacing with LCU down, yet ON LINE indicator on LCU is on.	a) Bad CARS PCBA.	a) Verify by positioning mode switch to TEST. If TEST indicator remains on, replace PCBA. Since the self test will not check out the coax interface, it may be more expedient to change the PCBA only. However, if time permits or a spare board is not immediately available, run off line diagnostics to check out MCU to CARS coax interface.

Table 2-9. ROLS Troubleshooting Chart (Continued)

CAUTION

When replacing CARS or RSC PCBA, ensure that switch settings are correct. See chart below for reference. Set LCU and RCU switches as follows:

1. Switch	LCU	RCU
7D	See chart	All OFF
9D	1-7 OFF, 8 ON	All OFF

Switch 7D Position Assignments for LCU

Switch Position 1	2	3	Remote Address Range	Switch Position 4	5	6	Maximum Station Address	Switch Position 7	8
ON	ON	ON	00-07	ON	ON	ON	0	OFF	ON
ON	ON	OFF	08-15	ON	ON	ON	1	OFF	ON
ON	OFF	ON	16-23	ON	OFF	ON	2	OFF	ON
OFF	ON	ON	32-39	OFF	ON	ON	4	OFF	ON
OFF	ON	OFF	40-47	OFF	ON	OFF	5	OFF	ON
OFF	OFF	ON	48-55	OFF	OFF	ON	6	OFF	ON
OFF	OFF	OFF	56-63	OFF	OFF	OFF	7	OFF	ON

Table 2-9. ROLS Troubleshooting Chart (Continued)

2. LCU/RCU Modem Clock Rate Switch Settings

Switch Number		Asynchronous Modems or Direct Connection Only							All Sync Modems
XMIT	RCVE	75 BPS	150 BPS	300 BPS	600 BPS	1200 BPS	2400 BPS	4800 BPS	1200 to 9600 BPS
3	6	OFF	OFF	OFF	OFF	ON	ON	ON	ON
2	5	OFF	OFF	ON	ON	OFF	OFF	ON	ON
1	4	OFF	ON	OFF	ON	OFF	ON	OFF	ON
7		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
8		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Switch Pack Position	Comm Port Connector	Application
17G	J101	LCU & RCU
18F	J102	LCU only
19F	J103	LCU only
20G	J104	LCU only

Table 2-10. General Troubleshooting Notes Concerning PCBA's

a) Always check a removed PCBA for dull or dirty contacts. Clean by rubbing with a pink pencil earser.

CAUTION

Do not use any other type of eraser or
the contacts may be damaged.

b) Check for dirt buildup between IC pins and clean with soft brush.

c) Check for proper seating of ROMS, RAMS and plug-in chips.

d) If a PCBA had been reworked, check for cold solder joints, loose wires or solder splash. Correct accordingly.

e) Check all plugs for loose or bent pins.

f) When replacing a PCBA, ensure that it is seated properly and that any cable connections are tight.

Section 3

OFF-LINE DIAGNOSTIC TESTS

3.1 INTRODUCTION

This section contains functional and procedural descriptions of the off-line diagnostic tests contained in Release 4.0 of the XL40 diagnostic tape. Although similar in function and operation to earlier versions, Release 4.0 features a number of improvements. These include:

- General standardization of prompts in all diagnostics
- Standardized execution of commands, defaults and displays through exclusive use of the FIELD REL key.
- Incorporating a single diagnostic to test both 32K byte and 128K byte memory boards.
- Addition of a system exerciser diagnostic that permits the testing of selected groups of peripherals under a simulated system operation environment.

System diagnostic testing is accomplished using a coordinated set of diagnostic test programs on tape that exercise the system functions. The functions tested progress toward greater complexity. This facilitates the isolation of equipment faults to a particular hardware module within the system. In addition to isolating system faults these diagnostic programs may also be used following system installation or after maintenance and repair procedures to insure proper operation before the system is returned to the normal operating software. While separate tests are required for the XPU and XPU2 processors, the term XPU is used in this section describing functions performed by both. The term XPU2 is used when describing functions performed only by that processor.

3.1.1 DIAGNOSTIC PROGRAM ORGANIZATION

The off-line diagnostic software is composed basically of two major components. The first consists of the controlling programs which are the XPU microcode firmware selftest, the initial program load (IPL), the support control system (SCS), the input/output control program (IOCTL), and the diagnostic executive (DX). The second component consists of the specific diagnostic test programs which include the various diagnostic tests that are to be executed.

3.1.1.1 Controlling Programs

Each controlling program below is briefly described in the order in which they are executed starting at power-up.

The XPU microcode firmware selftest is a ROM resident program used by the XPU microprocessor to check the following hardware:

- XPU firmware ROM parity.
- SMUX memory error logic.
- XPU registers (PSW, P, A, B and X).
- First bootstrap buffer memory location (012B).

The XPU microcode firmware selftest is executed immediately upon power-up and after a LOAD or RESTART is depressed for a tape or disk bootstrap. If an error occurs during this test, a blinking octal error code will be displayed in the diagnostic display indicators located on the MCU-1 system control panel. The error codes range from 1_8 – 53_8 and are explained in paragraph 3.4.1, XPU Microcode Firmware Selftest Error Codes. Error codes for the XPU2 also range from 1_8 – 53_8 and are explained in paragraph 3.4.2.

The initial program load (IPL) is originally resident on the diagnostic tape and is executed after a bootstrap load. The IPL is a mandatory diagnostic program which generally checks the execution of various XPU instructions, main memory and certain SMUX functions. If an error occurs during the IPL, a blinking octal error code will be displayed in the diagnostic display indicators. The error codes range from 60_8 - 278_8 and are explained in paragraph 3.4.3, IPL Error Codes. After the IPL is successfully completed, the diagnostic display will show only decimal points.

Diagnostic tapes may be made which do not have the IPL at the beginning of them. This is occasionally done for expediency as the IPL execution time is approximately 30 seconds plus 10 seconds for each 16K of main memory within the system.

The support control system (SCS) program executes in conjunction with the input/output control (IOCTL) program. The IOCTL program is used by SCS to interface with the various peripherals connected to the system. IOCTL can detect intolerable conditions or peripheral errors. The IOCTL error codes are explained in paragraph 3.4.6, IOCTL Error Codes.

The diagnostic executive (DX) program performs the following basic functions in relation to the off-line diagnostic testing:

- provides test program execution control mechanisms to the operator through IOCTL,
- provides operator communication routines through IOCTL to the test programs,
- provides IOCTL communication information to test programs,
- provides test program fetching through SCS and IOCTL,
- provides a DX/test program and test program/test program communication interface,
- provides commonly needed utility routines to test programs.

If an unexpected interrupt occurs, DX will handle the interrupt and display an error message. The unexpected interrupt error codes are explained in paragraph 3.4.7, Unexpected Interrupts.

3.1.1.2 Test Programs

There are several diagnostic test programs available, which are called into main memory and executed by the diagnostic executive (DX), by the entry of a specific two character mnemonic. The diagnostic test programs and their mnemonics are shown in Table 3-1.

Table 3-1. Diagnostic Test Programs

Test Program	Mnemonic	Paragraph
Communications Controller	CD	3.2.1
Keystation, U.S.	KS	3.2.2
Keystation, Japanese	KJ	3.2.2
Keystation, Nordic	KN	3.2.2
Keystation, Turkish	KT	3.2.2
Line Printer	LP	3.2.3
Main Memory (XPU & XPU2)	MD	3.2.4
System Exerciser	SX	3.2.5
Test Panel	PD	3.2.6
Rigid Disk	RD	3.2.7
Magnetic Tape	TD	3.2.8
Executive Processor Unit	XP	3.2.9
Executive Processor Unit 2	XQ	3.2.10
Card Reader	CR	3.2.11
RSS–(ROLS)	RS	3.2.12
Station Page Printer	SP	3.2.13
Flexible Disk	FD	3.2.14

3.2 DIAGNOSTIC OPERATING PROCEDURE

Paragraph 3.2 contains the following information concerning the off-line diagnostic tests:

- Step-by-step procedures describing the mechanics and details of running the diagnostic tests.

- Standard diagnostic test error codes with brief descriptions and possible failing hardware modules.
- Functional description of all diagnostic tests.

Before running the diagnostics, note that several other errors can occur. These are XPU microcode firmware selftest errors, IPL errors, tape and disk bootstrap errors, IOCTL errors and unexpected interrupts. These are listed and described in paragraph 3.4.

CAUTION

IF THE RIGID DISK DIAGNOSTIC TESTS ARE TO BE RUN, ASK THE SUPERVISOR TO SAVE THE DATA THAT IS ON DISK BEFORE EXECUTING THE OFF-LINE DIAGNOSTICS.

The execution procedure of the diagnostics, is presented below. For display prompts which include information within parenthesis, the values within the parentheses are the default conditions, which can be selected by simply depressing the FIELD REL key. To begin executing the off-line diagnostic, follow the procedure below.

NOTE

All command entries must end with a FIELD REL for execution to occur.

	Display	Operator Action
a)	(No display)	Mount the diagnostic tape and bring it to the load point and depress READY on the drive.
b)	(No display)	Wait for the octal diagnostic display indicator to reach 36 and then depress LOAD and IPL release (blank push button) on the system control panel simultaneously. Do not depress any keys on any keystations until prompted. If the display remains flashing on a number less than 42, XPU or XPU2 Microcode Selftest Error has occurred. Refer to respective paragraphs 3.4.1 or 3.4.2 for the meanings of these error codes. Note: If the diagnostic tape contains the IPL (Initial Program Load) mandatory diagnostics, these tests are initiated by the above action and their performances are indicated by a series of sequentially changing octal numbers in the diagnostic display indicator on the system control panel. An error detected during these tests will be

	Display	Operator Action
		indicated by a flashing error code. Refer to paragraph 3.4.3 for definitions of these error codes. If it is desired to bypass the IPL, simply depress LOAD and IPL release (blank push button) several times. When the status indicator has reached 260, the screen and error tones for all keystations will flash and sound. Upon successful completion of the IPL, the diagnostic display indicator will display only decimal points and the supervisor's keystation will display the following message:
c)	RESIDENT UNIT = (REL = MT1)	FIELD REL selects the tape drive as the resident device for loading the diagnostic tests. DK1 then FIELD REL selects the disk as the resident device.
		CAUTION **IF THE DISK IS TO BE SELECTED AS THE RESIDENT DEVICE, ALL IMPORTANT DATA ON THE DISK MUST HAVE PREVIOUSLY BEEN SAVED.**
		If DK1 was selected the following prompt will be displayed:
d)	INITIALIZE DISK? (Y = YES, REL = NO)	Y then FIELD REL to initialize disk (this takes 1.5 minutes). FIELD REL not to initialize disk.
e)	SUPPORT CONTROL SYSTEM V ( ) DATE =	Enter 3- to 5-digit Julian date (yyddd, where yy is the year and ddd is the date) then FIELD REL.
f)	SUPPORT CONTROL SYSTEM V ( ) DATE = yydd TIME = hhmm	Enter the time in military form (hhmm, where hh is 0–23 hours and mm is 0–59 minutes), then FIELD REL.
g)	ENTER SCS COMMAND	EX, DX then FIELD REL loads the Diagnostic Executive program.
h)	DX---DIAGNOSTIC EXECUTIVE V ( ) ---GENERAL INFORMATION--- ---FIELD REL TERMINATES INPUTS---	Depress FIELD REL.

	Display	Operator Action
i)	THE AVAILABLE TESTS ARE: CD – COMM CR – CARD READER KJ – KEYSTN JAPANESE KS – KEYSTN U.S.A. LP – LINE PRINTER PD – TEST PANEL RS – ROLS SP STATION PRINTER XP XPU PROCESSOR *CM – MULTIPORT COMM FD – FLOPPY DISK KN – KEYSTN NORDIC KT – KEYSTN TURKISH MD – MEMORY RD – RIGID DISK TD – TAPE DRIVE SX – SYSTEM EXERCISER XQ – XPU2 PROCESSOR	Depress FIELD REL.
j)	RESIDENT DIRECTIVES. CL – CLEAR CO – CONTROL OPTIONS EX – EXECUTE TR – TIMER RESTE /* – EXIT TO SCS MU – MENU OF DIAGNOSTIC MODULES LAST MEMORY ADDRESS = XXXXX DX DIRECTIVE =	CO, then FIELD REL allows control options to be selected.
k)	LOG UNIT ADDRESS (0000) =	FIELD REL prohibits logging of responses and errors on a line printer. Enter the decimal line printer unit address (10 for ASCII, 11 for EBCDIC) or tape transport address (1–4) then FIELD REL for responses and errors to be logged.
l)	TEST AIDS (Y)?	FIELD REL will cause a list of commands and tests to be displayed when the specific diagnostic test is loaded. N then FIELD REL deselects the test aids.
m)	EXECUTE ALL TESTS (1) TIMES?	FIELD REL will cause the tests specified to be executed once for each "EX". Enter the number of desired executions, then FIELD REL for multiple executions.

* Not implemented

	Display	Operator Action
n)	DISPLAY ERROR AND PROGRESS INFO (Y)	FIELD REL to display error information on screen. N, then FIELD REL deselects error display to the screen. Use of this option will cause the error messages to roll on the display screen.
o)	BEEP ON ERROR (N)	FIELD REL to cause no beep signals at key-station for each error. Y, then FIELD REL to cause beep signals at keystation for each error occurance.
p)	AWAIT OPER RESPONSE ON ERROR (Y)?	FIELD REL to cause the execution to wait for the operator to respond by pressing any non-control key before execution can continue when an error occurs. N, then FIELD REL to cause the execution to continue when an error occurs. Use of this option will cause the error messages to roll on the display screen.
q)	CONTINUE TESTING ON ERROR (Y)?	FIELD REL to cause the normal testing sequence to continue after an error has occurred. N, then FIELD REL to terminate the execution of the selected test after encountering one error.
r)	MAX ERROR COUNT (20) =	Select the number of errors that can occur before terminating the selected test, then FIELD REL. FIELD REL if the maximum error count should be 20.
s)	RETRY COUNT (0) =	Enter the number of retries that will be attempted before an error message appears, then FIELD REL. FIELD REL if no retries are to be attempted.
t)	INTERRUPTS ENABLED (Y)?	FIELD REL permits the diagnostic programs to enable interrupts. N, then FIELD REL disables interrupts.
u)	RANDOM NUMBER SEED (0000)	Enter the starting number of the random number generator, then FIELD REL. FIELD REL if starting number is to be 0000.
v)	DX DIRECTIVE =	CD to run communications controller diagnostics (paragraph 3.2.1). KS to run keystation diagnostics (paragraph 3.2.2). LP to run line printer diagnostics (paragraph 3.2.3). MD to run XPU or XPU2 memory diagnostics (paragraph 3.2.4). SX to run system exerciser diagnostics (paragraph 3.2.5).

Display	Operator Action
	PD to run test panel diagnostics (paragraph 3.2.6). RD to run rigid disk diagnostics (paragraph 3.2.7). TD to run magnetic tape diagnostics (paragraph 3.2.8). XP to run executive processor diagnostics (paragraph 3.2.9). XQ to run executive processor unit 2 (XPU2) diagnostics (paragraph 3.2.10). CR to run card reader diagnostics (paragraph 3.2.11). RS to run remote station subsystem diagnostics (paragraph 3.2.12). SP to run station page printer diagnostics (paragraph 3.2.13). FD to run flexible disk diagnostics (paragraph 3.2.14).

Note that a CTRL/BYPASS depressed simultaneously at any time will return the program to DX DIRECTIVE =. This may be done if more than one set of diagnostic test programs are to be executed.

There will be a pause at this time while the program fetches the proper diagnostic program from tape or disk.

3.2.1 COMMUNICATIONS CONTROLLER DIAGNOSTICS (CD)

Paragraph 3.2.1 contains the following information concerning the communications controller diagnostics (CD):

- Step-by-step procedures of execution.
- Test error codes.
- Functional test descriptions.

If a specific function on the communications controller is to be tested, refer to paragraph 3.2.1.5, Communications Controller Diagnostic Test Descriptions in order to select the proper test(s) to run.

3.2.1.1 Communications Controller Diagnostic Test Procedure

At this point, CD has been selected in the Diagnostic Operating Procedure, paragraph 3.2v. To execute the communications controller diagnostics, follow the procedure below:

	Display	Keyboard Response
a)	COMM DIAGNOSTICS V ( ) DATE PRESS FIELD REL TO CONTINUE	Depress FIELD REL
b)	——COMMUNICATION CONTROLLER DIAG COMMANDS—— DR – DEFINE CONTROLLER OPTIONS TS – TEST SELECTIONS RT – RETURN TO DIAGNOSTIC CONTROL ST – STANDARD TEST SET SELECTION	Depress FIELD REL

	Display	Keyboard Response
	DM – DISPLAY TEST DESCRIPTION MENU CL – CLEAR TEST SELECTIONS PRESS FIELD REL TO CONTINUE	
c)	COMM CONTROLLER TESTS TEST 0* . . BASIC CONTROLLER TEST TEST 1* . . IMMEDIATE INSTRUCTION TEST TEST 2* . . REGISTER INSTRUCTION TEST TEST 3* . . INDIRECT INSTRUCTION TEST TEST 4* . . RAM TEST TEST 5* . . INPUT TEST TEST 6* . . OUTPUT TEST * = STANDARD TESTS PRESS FIELD REL TO CONTINUE	Depress FIELD REL.
d)	COMM CONTROLLER DIAGNOSTIC TEST 7* . . INPUT/OUTPUT TEST TEST 8* . . MISCELLANEOUS TEST TEST 9. . . PLUG TEST TEST 10 . . . MODEM TEST TEST 11 . . . TRANSMIT/RECEIVE TEST * = STANDARD TESTS PRESS FIELD REL TO CONTINUE	Depress FIELD REL
e)	TESTS 0–8 TEST ONLY THE CONTROLLER CD COMMAND =	DR then FIELD REL
f)	CONTROLLER (1) =	Select controller to be tested (1–4), then FIELD REL.
g)	INTERNAL CLOCK REQUIRED (Y)?	FIELD REL should be selected when in the loopback mode or when two systems are connected back to back without modems. N, then FIELD REL should be selected when using a modem.
h)	CD COMMAND =	ST then FIELD REL to run standard tests. TS then FIELD REL to run test selections. Go to paragraph 3.2.1.2.
i)	THE STANDARD TEST SET (0–8) HAS BEEN SELECTED	
j)	CD COMMAND =	RT, then FIELD REL.

	Display	Keyboard Response
k)	DX DIRECTIVE =	EX, then FIELD REL
l)	COMM CONTROLLER TEST IN PROGRESS TEST (number and title) COUNT (number) PROGRESS (number)	At this time the specifc or standard tests will be executed. If there is an error, refer to paragraph 3.2.1.4. If no errors occur the following prompt will be displayed:
m)	TOTAL ERRORS = 0 DX DIRECTIVE =	EX will repeat the execution of the tests selected. Go to paragraph 3.2.1.1l above. CL will clear all selected tests from memory and the operator may begin testing another logical unit. Go to paragraph 3.2t. CO to redefine the DX control options. Go to paragraph 3.2i.

3.2.1.2 Communications Controller Diagnostic Test Selection Procedure

At this time TS has been selected in the Communications Controller Diagnostic Test Procedure, paragraph 3.2.1.1g.

Note that in order to run tests 9—10, a special loopback plug (P/N 211303) must be installed or the modem used should have a loopback feature.

To execute specifc communications controller diagnostic test(s), follow the procedure below:

	Display	Keyboard Response
a)	TEST (0) =	Select test number to be run (0—11) then FIELD REL.
b)	COUNT (1) =	Select iteration count (0—32,767) (0 will cause the test to be skipped), then FIELD REL. If test 10 is to be run, go to paragraph 3.2.1.3.
c)	ANYMORE TESTS (Y)?	If N, then FIELD REL is selected return to paragraph 3.2.1.1h. If FIELD REL is selected return to paragraph 3.2.1.2a above. Note that the TEST prompt in paragraph 3.2.1.2a above will have the test number selected incremented by one as the new default value.

3.2.1.3 Communications Controller Diagnostic Test 10 Procedure

At this time, test 10 (modem test) has been selected in the Communications Controller Diagnostic Specifc Test Procedure, paragraph 3.2.1.2a. Before executing test 10, see the test 10 description in paragraph 3.2.1.5 for an explanation of the prompts displayed below.

Note that if the following parameters have been previously selected and a DX DIRECTIVE = CL has not been performed, then some of the following default values will be those that were previously selected.

To execute the communications controller diagnostic test 10, follow the procedure below:

	Display	Keyboard Response
a)	SYNC CHAR (32)?	Select 0—FF, then FIELD REL.
b)	NBR OF CHARS (512)?	Select 0—32,767, then FIELD REL.
c)	FIRST CHAR (FF)?	Select 0—FF, then FIELD REL. However, the first character cannot be the same as the sync character.
d)	FUNCTION CODE (0)?	Selects a logarithm used for generation of each character received or transmitted: 0 selects no change, 1 selects increment, 2 selects decrement, 3 selects complement. Then depress FIELD REL.
e)	INPUT (Y)?	Choose if you want test to run in the receive mode (Y or N), then FIELD REL.
f)	OUTPUT (Y)?	Choose if you want test to run in the transmit mode (Y or N), then FIELD REL. Note that the test can run in both receive and transmit modes.
g)	NBR OF SYNCS (3)?	Will be displayed only if Y was selected in paragraph 3.2.1.3f above. Select the number of sync characters transmitted (1—7) prior to the specified first character, then FIELD REL.
h)	MODEM IN LOOPBACK MODE (N)?	Will be displayed only if Y was selected in paragraph 3.2.1.3f above.

Display	Keyboard Response
	If Y then FIELD REL is selected the DSR (data set ready) indicator should be ignored. Return to paragraph 3.2.1.2c.

3.2.1.4 Communications Controller Diagnostic Test Error Codes

Table 3-2 below lists the communications controller diagnostic test error codes, the test numbers failed, brief error descriptions and possible failing hardware modules.

Table 3-2. Communications Controller Diagnostic Test Error Code Summary

Error Code	Test No.	Brief Description	Possible Failure
7000	XX	Occurrence of an extra interrupt.	CC (Communications Controller)
7001	00	Basic controller test failure.	CC
7002	XX	No MACK response when CC memory address is accessed.	CC
7003	XX	Bus error.	CC
7004	00	RAM data error.	CC
7005	XX	RAM load error.	CC
7006	XX	CC failure to set interrupt request bit during an interrupt.	CC
7007	XX	Timeout due to inability of CC to interrupt and start diagnostic program.	CC
7008	00	Accumulator test failure.	CC
7009	00	Unconditional jump test failure.	CC
700A	00	Compare/branch test failure.	CC
700B	01	Immediate instruction failure.	CC

Table 3-2 (Continued)

Error Code	Test No.	Brief Description	Possible Failure
700C	02	Register instruction failure.	CC
700D	03	Indirect instruction failure.	CC
700E	03	Branch indirect instruction failure.	CC
700F	04	Load RAM test failure.	CC
7010	04	RAM test failure.	CC
7011	05	Main memory read test failure	CC or main memory
7012	08	Failure to perform branches on output instructions associated with the programmable flag, interrupt request, command flag, and the interval timer.	CC
7013	08	No response from the interval timer.	CC
7014	09	Modem interface signal test failure (loopback plug must be installed).	CC, loopback plug or cable
7015	09	Failure to perform branches on modem interface signals (loopback plug must be installed).	CC, loopback plug or cable
7016	09	Failure to perform data transmit and receive operations (loopback plug must be installed).	CC, loopback plug or cable
7017	10/11	Command timeout error (data transfer/ modem test)	Modem if test 9 passes
7018	10/11	Selection status error (data transfer/modem test).	Modem if test 9 passes
7019	10/11	Completion status error (data transfer/ modem test).	Modem if test 9 passes

Table 3-2 (Continued)

Error Code	Test No.	Brief Description	Possible Failure
701A	10	Transmission compare error (modem test).	Modem if test 9 passes.
701B	06/11	Main memory write test failure.	CC, modem or main memory
701C	XX	Bus data error when CC was master.	CC
701D	XX	Unable to disable CC bus drivers.	CC

3.2.1.5 Communications Controller Diagnostic Test Descriptions

The following information provides a brief description of each test of the communications controller diagnostics. These tests are explained below on a functional level only. Standard tests are indicated by asterisks.

* Test 0: Basic Controller Test

  This test verifies the proper functioning of the CC bus drivers and the local RAM's by filling them with data patterns and reading them back. The CC status bits are checked. Three microprograms are loaded in to test the accumulator, the ability to execute forward and backward jumps and the ability to set and clear the carry and zero condition codes and detect these codes with the execution of the branch-on-true and branch on false microinstructions.

* Test 1: Immediate Instruction Test

  This test verifies that the seven immediate microinstructions and the rotate-right-through-carry microinstructions execute properly using 14 data patterns and all combinations of the carry and zero condition codes.

* Test 2: Register Instruction Test

  This test checks that the nine register reference microinstructions exeucte properly, using 14 data patterns, all combinations of the condition codes and the 15 general registers.

* Test 3: Indirect Instruction Test

  This test checks the proper execution of the load indirect, the store indirect, the long branch (inter-page branching) and the branch indirect microinstructions.

* Test 4: RAM Test

This test loads the local RAM's with a data pattern and then checks them for proper data. It also executes a galloping ones and zeros test and a data toggle (complement) test.

* Test 5: Input Test

This test verifies that the CC can read from main memory properly by filling a buffer in main memory with an incrementing byte data pattern and then reading each byte of the buffer to insure that the correct data is received.

* Test 6: Output Test

This test verifies that the CC can write to main memory properly by filling a buffer in main memory with an incrementing byte data pattern and then checks the data.

* Test 7: Input/Output Test

This test checks that the CC can read from and write to main memory properly. This is accomplished by loading various data patterns from the main memory output buffer and storing them into the main memory input buffer. The input buffer is then compared to the current data pattern for errors.

* Test 8: Miscellaneous Test

This test checks the ability of the CC to perform branches on output instructions associated with the programmable flag, interrupt request, command flag and the interval timer. Test 8 also checks the accuracy of the interval timer.

Test 9: Plug Test

This test verifies the modem interface on the CC by looping back various output signals to their corresponding input signals. Test 9 also verifies the ability of the CC to perform branches on signals associated with the RS-232 interface for transmitting and receiving data, and checks the ability to perform data bit transmit to the receive circuits checking for status or data error conditions. Note that a loopback plug (P/N 211303) must be installed to execute this test.

Test 10: Modem Test

This test verifies that the CC can communicate with another system through a modem, or communicate with itself using the loopback feature of a modem or a loopback plug (P/N 211303) in place of the modem. This test can check the transmit and/or receive modes simultaneously. The transmit mode program sends a number of sync characters (determined by the operator) followed by a number of data characters. The sequence and number of these characters are determined by the operator by specifying the first character and a function code which determines an algorithm for computing the next character to be transmitted. The receive mode

program waits for the first non-sync character and compares this one to the one expected. This expected character is computed in the same manner as the character on the transmit side. If the loopback plug is used or if the modem is in the loopback mode, the operator should select identical parameters for both the input and output side. If another system is used, it is possible to run either one side or both sides independently with the complementing parameters entered on the other system's communications controller (CD) diagnostic program.

Test 11: Transmit/Receive Test Through Modems

This test checks that the CC can read a block of data from main memory, transfer it to a modem, receive it from a modem, and write it back to main memory.

3.2.2 KEYSTATION DIAGNOSTICS (KS)

Paragraph 3.2.2 contains the following information concerning the keystation diagnostics (KS):

- Step-by-step procedures of execution.
- Test error codes.
- Functional test descriptions.

If a specific function of the keystation/SMUX is to be tested, refer to paragraph 3.2.2.4, Keystation Diagnostic Test Descriptions in order to select the proper test(s) to run.

3.2.2.1 Keystation Diagnostic Test Procedure

At this point, KS has been selected in the Diagnostic Operating Procedure, paragraph 3.2v. To execute the keystation diagnostics, follow the procedure below:

	Display	Keyboard Response
a)	KEYSTATION DIAG COMMANDS DM DISPLAY MENU DR KEYSTATION TS TEST SELECTION RT RETURN TO DX ST STANDARD TEST CL CLEAR TESTS AND DR SELECTIONS PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL to continue.
b)	KEYSTATION TESTS T0* SMUX RESET REG TEST T1* MEMORY ADDR REG TEST T2* BLK LEN REG TEST T3* MOD REG TEST T4* POLLING CONTROL REG TEST T5* MEMORY ADDR REG INCREMENT T6* BLOCK LENGTH REG INCREMENT * = STANDARD PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL to continue.

	Display	Keyboard Response
c)	——KEYSTATION TESTS—— T7* POLL CNTL REG, POLL ADDR INCR T8* REAL TIME CLOCK CHECK T9* MEM REFRESH COUNTER CHECK T10* COAX DATA LOOPBACK T11* STATION RESPONSE REG SHIFT T12* VERIFY SELECTION RESP TIMEOUT T13* SELECTION RESP PARITY ERROR * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE.	Depress FIELD REL
d)	T14* VERIFY NORMAL SELECTION RESP T15* NORMAL KEYBOARD POLLING RESP T16* CHAR GENERATION RAM PATT TEST 1 T17* CHAR GENERATION RAM PATT TST 2 T18* DISPLAY DATA RAM PATTERN TST 1 T19* DISPLAY DATA RAM PATTERN TST 2 T20 CHAR GEN & DISPL DATA RAM ADR * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	
e)	——KEYSTATION TESTS—— T21* FIELD IDENT/ERASE T22* CURSOR T23* KEY SEQ T24* KEY ECHO T25* LARGE SCREEN * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL
f)	TESTS 0–12 TEST ONLY THE SMUX KS COMMAND =	
g)	KEYSTATION (0) =	Find the address of the keystation to be tested by checking the setting of the address selection switches on the station control PCBA if a Model 4141 keystation is to be tested (reference Model 4141 Keystation Technical Manual, 651249-100 or on the coax interface PCBA if a Model 4143 Keystation Technical Manual, 651258-100). Enter the decimal address and then FIELD REL. Note that the default value will be incremented if more than one keystation is to be tested.

h)

```
KEYBOARD TYPE CODES:
0 =  9 IN DETACH US STD KP
1 =  9 IN DETACH US KP/ADD
2 =  9 IN DETACH US TYPWRT
3 =  2000 CHAR, US STD KP
4 =  2000 CHAR, US KP/ADD
5 =  2000 CHAR, US TYPWRT
6 =  FXD STD KP
7 =  FXD KP/ADD
8 =  FXD TYP
TYPE 0 =
```

The following refers to the keystations to be tested:

- Types 0–2 refer to standard screen detachable keyboard keystations
- Types 3–5 refer to large screen detachable keyboard keystations
- Types 6–8 refer to keystations with fixed keyboards
- Types 0, 3 and 6 (standard keypunch) do not have a numeric pad to the right of the FIELD REL key. They do have a U key to the right and below the INSERT/DUP key.
- Types 1, 4 and 7 (keypunch/adding machine have the 0 key to the right of the space bar.
- Types 2, 5 and 8 (typewriter/numeric pad) have a numeric pad to the right of the FIELD REL key.

Enter the code number for the keyboard type, then FIELD REL.

i)

```
IS KEYSTATION REMOTE THRU
ROLS(N)?
```

Y then FIELD REL should be selected if keystation to be tested is located at a remote site through ROLS. FIELD REL should be depressed if keystation is connected directly to the XL40 system.

j)

```
ANY MORE KEYSTATIONS (N)?
```

Y then FIELD REL should be selected if more keystations are to be tested. A FIELD REL should be depressed if no more keystations are to be tested. Return to paragraph 3.2.21g above.

ST then FIELD REL to run standard tests.
TS then FIELD REL to run test selections. Go to paragraph 3.2.2.2.

k)

```
THE STANDARD TEST SET (0–19,
21–25) HAS BEEN SELECTED
KS COMMAND =
```

RT then FIELD REL. It is imperative that the operator read the Keystation Diagnostic Test Descriptions, paragraph 3.2.2.5, on these tests before execution as they require visual verification by the operator and no error codes will be displayed.

l)	DX DIRECTIVE =	EX, then FIELD REL.
m)	TEST XX (TITLE OF TEST) COUNT 1	At this time the specific or standard tests will be executed. If the standard tests were selected or if test 23 was specified operator assistance will be required. At test 23 execution, the operator must depress the keys asked for by the display, starting with the DISPLAY key and progressing from left to right and top to bottom throughout the keyboard. Test 24 (one of the standard tests) also requires operator assistance. The operator may key in any information for sight verification. Then, depress CTRL and BYPASS keys simultaneously to terminate test 24 on each keyboard. If there is an error, refer to paragraph 3.2.2.3. If no errors occur, the following prompt will be displayed:
n)	TOTAL ERRORS = 0 DX DIRECTIVE =	EX will repeat the tests selected. Go to paragraph 3.2.2.1l above. CL will clear all selected tests from memory and the operator may begin testing another logical unit. Go to paragraph 3.2v. CO to redefine the DX control options. Go to paragraph 3.2.i.

3.2.2.2 Keystation Diagnostic Test Selection Procedure

At this time TS has been selected in the Keystation Diagnostic Standard Load Procedure, paragraph 3.2.2.1j. To execute specific keystation diagnostic test(s), follow the procedure below:

	Display	Keyboard Response
a)	TEST (0) =	Select test number to be run, then FIELD REL.
b)	COUNT (1) =	Select iteration count (0—32,767) (0 will cause the test to be skipped), then FIELD REL.

	Display	Keyboard Response
c)	ANY MORE TESTS (N)?	If FIELD REL is selected, return to paragraph 3.2.2.1k. If N then FIELD REL is selected return to paragraph 3.2.2.2a above. Note that the TEST prompt in paragraph 3.2.2.2a above will have the test number selected incremented by one as the new default value.

3.2.2.3 Keystation Diagnostic Test Error Codes

Table 3-3 below lists the keystation diagnostic test error codes, the test numbers failed, brief error descriptions and possible failing hardware modules.

Table 3-3. Keystation Diagnostic Test Error Code Summary

Error Code	Test No.	Brief Description	Possible Failure
2001	00	Occurrence of a memory error interrupt during a reset and disable operation.	SMUX (Station multiplexer)
2002	00	No occurrence of a memory error interrupt when reading the memory address register (FF71) following a reset and disable operation.	SMUX
2003	00	Occurrence of a memory error interrupt during a reset and enable operation.	SMUX
2004	00	Occurrence of a memory error interrupt when reading the memory address register (FF71) following a reset and enable operation.	SMUX
2005	01–03	Memory address register (FF71), block length register (FF73), or mode register (FF74) write/read data compare error.	SMUX
2006	XX	No reset of the busy bit in the status register (FF77) at the start of an operation.	SMUX

Table 3-3 (Continued)

Error Code	Test No.	Brief Description	Possible Failure
2007	01,02,04	Memory address register (FF71), block length register (FF73), or polling control register (FF75) increment test error occurrence.	SMUX
2010	09	No setting of the MSB of the memory refresh counter.	SMUX
2011	09	The MSB of the memory refresh counter did not reset at least twice in ten reads of the register.	SMUX
2012	10	Loopback (coax) data compare error.	SMUX or keystation
2013	10–11	Failure of data loopback transmission to terminate within one second.	SMUX or keystation
2014	11	Failure of the station response register (FF7F) to shift correctly.	SMUX
2015	XX	SMUX status error.	SMUX or keystation
2101	08	Occurrence of a real time clock interrupt while the clock was disabled.	SMUX
2102	08	No occurrence of a real time clock interrupt while the clock was enabled.	SMUX

3.2.2.4 Keystation Status Errors

During the KS diagnostic program status errors may be generated which utilize mnemonics to report various hardware malfunctions. This paragraph lists and explains the error conditions and mnemonics for the keystation.

A keystation status error results when any of the following conditions occur:

- One or more of the bits of the SMUX status register (FF77) or the line printer status register (FF7E) were not in the condition expected following an operation.

- The block length register (FF73) failed to increment to zero.
- The polling control register (FF75) contained an incorrect keystation address.
- The station response register (FF7F) contained an incorrect response.

An SMUX status error is identified as an off-line diagnostic error 2015 (reference paragraph 3.2.2.3). The following messages are displayed which contain mnemonics that are explained below.

If an SMUX status register (FF77) error occurred, the following message will be displayed:

SMUX STATUS (XXXX) YYY . . . . Y

XXX is the hexadecimal contents of the register and YYY . . . Y is the mnemonic(s) that describes the error. Table 3-4 below lists these mnemonics and their meanings.

Table 3-4. KS SMUX Status Register Error Mnemonics

Mnemonic	Definition
SBSY	SMUX busy bit set when not expected.
N-SBSY	SMUX busy bit not set when expected.
CBSY	SMUX coax busy bit set when not expected.
N-CBSY	SMUX coax busy bit not set when expected.
POLINT	An SMUX polling interrupt occurred when not expected.
N-POLINT	An SMUX polling interrupt failed to occur when expected.
SELINT	An SMUX selection interrupt occurred when not expected.
N-SELINT	An SMUX selection interrupt failed to occur when expected.
SELTO	An SMUX selection timeout occurred when not expected.
N-SELTO	An SMUX selection timeout failed to occur when expected.
LPINT	A line printer interrupt occurred when not expected.
PARE	An SMUX coax parity error occurred when not expected.
N-PARE	An SMUX coax parity error failed to occur when expected.
BUSE	A universal bus error occurred.

If a line printer status register (FF7E) error occurs, the following message will be displayed:

LP STATUS (XXXX) YY . . . Y

XXXX is the hexadecimal contents of the register and YYY . . . Y is the mnemonic(s) that describes the error. Table 3-5 lists these mnemonics and their meanings.

If an incorrect polled keystation number was found, the following message will be displayed:

POLL KS # (XXXX) EXP YYYY ACT ZZZZ

Table 3-5. KS Line Printer Status Register Error Mnemonics

Mnemonic	Definition
EODINT	A line printer end of data transfer interrupt occurred.
EOPINT	A line printer end of operation interrupt occurred.

XXXX is the hexadecimal contents of the polling control register (FF75) when the polling interrupt occurred. YYYY is the expected hexadecimal keystation number and ZZZZ is the actual keystation number.

If an incorrect polling response was found, the following message will be displayed:

```
POLL RESP (XXXX) EXP YYYY ACT ZZZZ
```

XXXX is the hexadecimal contents of the station response register (FF7F) when the polling interrupt occurred. YYYY is the expected hexadecimal register contents and ZZZZ is the actual register contents.

If an incorrect selection response was found, the following message will be displayed:

```
SEL RESP (XXXX) EXP YYYY ACT ZZZZ
```

XXXX is the hexadecimal contents of the station response register (FF7F) when the selection interrupt occurred. YYYY is the expected hexadecimal register contents and ZZZZ is the actual register contents.

If the block length register (FF73) failed to increment to zero during a coax selection operation, the following message will be displayed:

```
BLK LEN (XXXX) EXP YYYY ACT ZZZZ
```

XXXX is the hexadecimal contents of this register. YYYY is the expected hexadecimal register contents and ZZZZ is the remaining byte count.

3.2.2.5 Keystation Diagnostic Test Descriptions

The following information provides a brief description of each test of the keystation diagnostics. These tests are explained below on a functional level only. Standard tests are indicated by asterisks.

* Test 00: SMUX Reset Register Test

This test verifies the reset function (write to main memory location FF70).

* Test 01: Memory Address Register Test

  This test checks the memory address register (location FF71, bits 0–15).

* Test 02: Block Length Register Test

  This test checks the block length register (location FF73, bits 4–15).

* Test 03: Mode Register Test

  This test checks the mode register (location FF74, bits 12–15).

* Test 04: Polling Control Register Test

  This test checks the polling control register (location FF75, bits 9 and 11–15).

* Test 05: Memory Address Register Increment Test

  This test verifies that the memory address register (location FF71, bits 0–15) can properly increment.

* Test 06: Block Length Register Increment Test

  This test verifies that the block length register (location FF73, bits 4–15) can properly increment.

* Test 07: Polling Control Register, Polling Address Increment Test

  This test verifies that the polling control register (location FF75, bits 11–15) can properly increment.

* Test 08: Real Time Clock Check

  This test checks that the real time clock functions and can be controlled by the real time clock register (location FFF8, bit 15).

* Test 09: Memory Refresh Counter Check

  This test verifies that the MSB of the memory refresh counter (location FF7D) is producing the desired square wave.

* Test 10: SMUX Coax Data Loopback Test

  This test checks the SMUX coax data path.

* Test 11: Station Response Register Shift Test

This test verifies that the station response register (location FF7F) shifts correctly.

* Test 12: Verify Selection Response Timeout

This test verifies the operation of the SMUX when there is no response to a selection message (timeout).

* Test 13: Verify Selection Response Parity Error

This test checks the operation of the SMUX when a keystation selection response message contains a parity error.

* Test 14: Verify Normal Selection Response

This test verifies the operation of the SMUX and keystations during a normal selection operation.

* Test 15: Verify Normal Keyboard Polling Response

This test checks the operation of the SMUX, keystations and keyboards during a keystroke simulation operation.

* Test 16: Character Generation RAM Pattern Test 1

This test checks the character generation RAM in each keystation. Verification is visual since the program cannot read the character generation RAM. Note that the screen should be blank except for the cursor in the upper left hand corner.

* Test 17: Character Generation RAM Pattern Test 2

This test checks the character generation RAM in each keystation. Verification is visual since the program cannot read the character generation RAM. Note that the screen will display a checkerboard pattern where the odd characters display in slices 5—12 and the even characters display in slices 0—7. The cursor will be in the upper left hand corner.

* Test 18: Display Data RAM Pattern Test 1

This test loads an all zeros pattern into the display data RAM in each keystation. Verification is visual since the program cannot read the display data RAM. Note that the screen will be blank except for the cursor in the upper left hand corner.

* Test 19: Display Data RAM Pattern Test 2

This test loads an all ones pattern into the display data RAM in each keystation. Verification is visual since the program cannot read the display data RAM. Note that the screen will display a checkerboard pattern (slices 0—7 only).

Test 20: Character Generation and Display Data RAM Addressing

This test verifies that both the character generation RAM and the display data RAM may be correctly addressed. Verification is visual since the program cannot read the keystations RAM's. The screen display consists of three prompts, each separately displayed for 10—30 seconds. They are described in Table 3-6 below.

Table 3-6. Keystation Diagnostics Test 20 Displays

Display	Title	First Line Character	Slices	Time Displayed
1	Incrementing Address Check	1	none (cursor)	10 sec.
		2	0	
		3	1	
		4	0 and 1	
		5	2	
		6	0 and 2	
		7	0, 1 and 2	
		8	3	
2	Character Generation RAM Pattern Inversion Check	1	0—7 (cursor)	10 sec.
		2	1—7	
		3	0 and 2—7	
		4	2—7	
		5	0—1 and 3—7	
		6	1 and 3—7	
		7	3—8	
		8	0—2 and 4—7	
3	Display Data RAM Pattern Inversion Check	1	7 (cursor)	30 sec.
		2	0 and 7	
		3	1 and 7	
		4	0—1 and 7	
		5	2 and 7	
		6	0, 2 and 7	
		7	0—2 and 7	
		8	3 and 7	

* Test 21: Field Identifier/Display Erase Function Check

This test verifies the operation of the field identifier codes and display erase function. Verification is visual since the program cannot read the keystation's RAM.

First, the field identifier codes (underline, flash, and high intensity) are checked. The first character position of each display line contains a field identifier code and is displayed as a blank (the cursor is in the upper left hand corner). The following patterns (left to right, top to bottom) will be dispalyed:

1) 128 character set underlined.
2) 128 character set flashing.
3) 128 character set with high intensity.
4) normal 128 character set which fills the rest of the screen.

This is displayed for 30 seconds to allow for visual verification.

Next, the erase functions are checked. The following checks will be performed and each will be displayed for 15 seconds:

1) erase display line 12.
2) display "ERASE CHECK" at the beginning of line 10 and erase the rest of the screen.
3) completely erase the screen.

* Test 22: Cursor Position Test

This test verifies the ability to position the cursor at any display position on the screen. Verification is visual since the program cannot read the keystation's cursor position. The H character will be displayed in all positions on the screen. The cursor will move diagonally from the upper left to the bottom right of the screen until all 40 character columns have been checked.

* Test 23: Keyboard Keycode Input Test

This test checks all keyboard keycodes (row and column numbers) that the keyboard can generate. The operator must depress the keys asked for by the display starting with the DISPLAY key and progressing from left to right and top to bottom throughout the keyboard. After all keys have properly been input on each keystation END OF TEST will be displayed on that keystation. Testing continues until all keyboards have been tested.

* Test 24: Keyboard Echo Test

This test checks all keyboard keycodes by echoing the characters input on the keystation display. Verification is visual since the program does not know the expected key sequence.

If the keyboard being tested is keypunch style, ALPHA will be displayed; if the keyboard is typewriter style LOWER will be displayed. Characters are then to be keyed in and checked against the display.

If a shift key is depressed when a character is input, the keyboard shift is changed to that shift mode and the shift display at the left of the first line is updated as follows:

1) Keypunch style keyboards:

   a) If no shift key is depressed, the shift mode is not changed.
   b) If the NUMERIC shift key is depressed, the numeric shift mode is set and NUMERIC is displayed.
   c) If the ALPHA shift key is depressed, the alpha shift mode is set and ALPHA is displayed.
   d) If the LCA key is depressed, the additional character shift mode is set and ADDL CHAR is displayed.

2) Typewriter style keyboards:

   a) If no shift key is depressed, the lower case shift mode is set and LOWER is displayed.
   b) If the SHIFT key is depressed, the upper case shift mode is set and UPPER is displayed.
   c) If the LCA key is depressed, the additional character shift mode is set and ADDL CHAR is displayed.

If CTRL and BYPASS are depressed simultaneously, test 24 is terminated on the respective keyboard.

Test 25: Large Screen Test

This test runs only on selected 2000 character keystations. If there are none to test, this test will terminate. Verification is visual, since the program cannot read the keystation's RAM. Three messages are displayed which are unique to the large screen keystations.

- FID BLIND test message
  "THE REST OF THIS LINE SHOULD BE BLANK"
  After the K in "BLANK" is an FID BLIND character followed by 34"X" which should not be visable to the operator.
- FID GRAPHICS message
  Displays a message in graphics (GRAPHICS MODE!)
- Character generator half bit shift message displays a row of vertical lines whose alternate top and bottom halves are shifted by half bits.

3.2.3 LINE PRINTER DIAGNOSTICS (LP)

Paragraph 3.2.3 contains the following information concerning the line printer diagnostics (LP):

- Step-by-step procedures of execution.
- Test error codes.
- Line printer status errors.
- Functional test descriptions.

If a specific function of the line printer/SMUX is to be tested, refer to paragraph 3.2.3.5, Line Printer Diagnostic Test Descriptions in order to select the proper test(s) to run.

3.2.3.1 Line Printer Diagnostic Test Procedure

At this point, LP has been selected in the Diagnostic Operating Procedure, paragraph 3.2v. To execute the line printer diagnostics, follow the procedure below:

	Display	Keyboard Response
a)	--LINE PRINTER DIAG V( ) DATE PRESS FIELD REL TO CONTINUE	Depress FIELD REL
b)	LINE PRINTER DIAG DM DISPLAY MENU DR PRINTER OPTIONS TS TEST SELECT UD USER DATA RT RETURN TO DX ST STANDARD TESTS CL CLEAR TEST SELECTIONS PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL.
c)	LINE PRINTER TESTS TEST 0* RESET REG TEST 1* MEM ADDR REG TEST 2* BLK LEN REG TEST 3* MOD REG TEST 4* RTC TEST 5* INTERRUPT TEST 6* SLIDING PATT * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL
d)	LINE PRINTER TESTS TEST 7* DIAMOND PATT TEST 8* USER DATA BROADSIDE TEST 9* TXT CONT CHARS TEST 10* FORMAT SPACE TEST 11* VFU FORMAT SKIP TEST 12* LINE BROADSIDE PATT TEST 13* RIPPLE PATT * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL.
e)	LINE PRINTER TESTS TEST 14* SPEED TEST 15* NOISE * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL.
f)	TESTS 0–4 TEST ONLY THE CONTROLLER LP COMMAND =	DR, then FIELD REL

	Display	Keyboard Response
g)	PRINTER TYPE CODES ST STD INTERFACE LP TYPE (ST) =	Type ST, then FIELD REL
h)	CHARACTER SET (96) =	FIELD REL to select a 96 character
i)	NO FORMAT CHAN (12) =	FIELD REL to test the 12 channel VFU on the Printronix printer. Enter the number of format channels and then FIELD REL otherwise.
j)	NO LINES TO SKIP (15) =	FIELD REL (for the Printronix printer) will select 15 as the maximum number of lines that can be skipped for each line space command. Otherwise enter the maximum number of lines that can be skipped and the n FIELD REL.
k)	LP COMMAND =	ST then FIELD REL to run standard tests. TS then FIELD REL to run test selections. Go to paragraph 2.3.3.2. UD to select specified character in test 8, single character broadside pattern test. Go to paragraph 3.2.3.3.
l)	THE STANDARD TESTS SET (0–15, ALL OF THE TESTS) HAS BEEN SELECTED LP COMMAND =	If the standard tests or any of the specific tests 6–15 are selected, it is imperative that the operator read the Line Printer Diagnostic Test Descriptions (paragraph 3.2.3.5) on these tests before execution, as they require visual verification by the operator and no error codes will be displayed. RT, then FIELD REL
m)	DX DIRECTIVE =	EX, then FIELD REL
n)	LINE PRINTER DIAG VXXX (date) IN PROGRESS TEST (number and title) COUNT (number) PROGRESS (numbered)	At this time the specific or standard test(s) will be executed. If there is an error, refer to paragraph 3.2.3.4. If no errors occur, the following prompt will be displayed:
o)	TOTAL ERRORS = 0 DX DIRECTIVE =	EX will repeat the tests selected. Go to paragraph 3.2.3.1m above. CL will clear all selected tests from memory and the operator may begin testing another logical unit. Go to paragraph 3.2v.

	Display	Keyboard Response
		CO to redefine the DX control options. Go to paragraph 3.2i.

3.2.3.2 Line Printer Diagnostic Test Selection Procedure

At this time TS has been selected in the Line Printer Diagnostic Test Procedure, paragraph 3.2.3.1k. To execute specific line printer diagnostic test(s) follow the procedure below:

	Display	Keyboard Response
a)	TEST (0) =	Select test number to be run, then FIELD REL.
b)	COUNT (1) =	Select iteration count (0–32,767) (0 will cause the test to be skipped). Then FIELD REL.
c)	END OF TESTS (Y)?	If N then FIELD REL is selected, return to paragraph 3.2.3.1k. If FIELD REL is selected return to paragraph 3.2.3.2a above. Note that the TEST prompt in paragraph 3.2.3.2a above will have the test number selected incremented by one as the new default value.

3.2.3.3 Line Printer Diagnostic User Data Specification Procedure

At this time UD has been selected in the Line Printer Diagnostic Test Procedure paragraph 3.2.3.1k. To specify the user data parameters, follow the procedure below:

	Display	Keyboard Response
a)	CHAR (H) =	Enter the print character to be used in the broadside print test (08), then FIELD REL. The character entered will be printed in all selected columns of 60 print lines.
b)	START COL (1) =	Enter the starting print column number (1–132) to be used in test 08, then FIELD REL.

	Display	Keyboard Response
c)	END COL (132) =	Enter the last print column number (up to 132) to be used in test 08, then FIELD REL. Return to paragraph 3.2.3.1k. Now standard or specifc tests can be run with the above user data input for test 08.

3.2.3.4 Line Printer Diagnostic Test Error Codes

Table 3-7 below lists the line printer diagnostic test error codes, the test numbers failed, brief error descriptions and possible failing hardware modules.

Table 3-7. Line Printer Diagnostic Test Error Code Summary

Error Code	Test No.	Brief Description	Possible Failure
2001	00	Occurrence of a memory error interrupt during a reset and disable operation.	SMUX (Station multiplexer)
2002	00	No occurrence of a memory error interrupt when reading the memory address register (FF71), following a reset and a disable operation.	SMUX
2003	00	Occurrence of a memory error interrupt during a reset and enable operation.	SMUX
2004	00	Occurrence of a memory error interrupt when reading the memory address register (FF71) following a reset and enable operation.	SMUX
2005	01,03	Memory address register (FF71) block length register (FF73), or mode register (FF74) write/read data compare error.	SMUX
2006	XX	No reset of the busy bit in the status register (FF77) at the start of an operation.	SMUX
2101	04	Occurrence of a real time clock interrupt while the clock was disabled.	SMUX

Table 3-7 (Continued)

Error Code	Test No.	Brief Description	Possible Failure
2102	04	No occurrence of a real time clock interrupt while the clock was enabled.	SMUX
2201	XX	The line printer connected bit in the status register (FF7E) was not set at the start of an operation.	Line printer cable
2202	XX	The line printer ready bit in the status register (FF73) was not set at the start of an operation.	Line printer
2203	XX	The line printer on-line bit in the status register (FF73) was not set at the start of an operation.	Line printer
2204	05	The SMUX busy bit in the SMUX status register (FF77) is set following a reset and enable operation when the line printer was busy.	SMUX
2205	05	The line printer ready bit in the line printer status register (FF7E) is set following a reset and enable operation when the line printer was busy.	SMUX or line printer
2206	05	Occurrence of a line printer interrupt following a reset and enable operation when the line printer was busy.	SMUX
2207	05	End of data transfer interrupt timeout.	SMUX or line printer
2208	05	End of operation interrupt timeout.	SMUX or line printer
2209	XX	Occurrence of a line printer interrupt without either the end of data transfer or end of operation interrupt bits set.	Line printer
2210	XX	Occurrence of a non-line printer SMUX interrupt.	SMUX or device

Table 3-7 (Continued)

Error Code	Test No.	Brief Description	Possible Failure
2211	XX	Simultaneous occurrence of both the end of data transfer and end of operation interrupts.	Line printer
2212	XX	Line printer status error	SMUX or line printer
2213	08	Failure to translate the user's EBCDIC character into the line printer's ASCII character set.	SMUX

3.2.3.5 Line Printer Status Errors

During the LP diagnostic program, status errors may be generated which utilize mnemonics to report various hardware malfunctions. This paragraph lists and explains the error conditions and mnemonics for the line printer.

A line printer status error results when any of the following conditions occur:

- One or more of the bits of the SMUX status register (FF77) or the line printer status register (FF7E) were not in the condition expected following an operation.
- The block length register (FF75) failed to increment to zero.

A line printer status error is identified as an off-line diagnostic error 2212 (reference paragraph 3.2.3.4). The following messages are displayed which contain mnemonics that are explained below.

If an SMUX status register (FF77) error occurred, the following message will be displayed:

SMUX STATUS (XXXX) YYY . . . Y

XXXX is the hexadecimal contents of the register and YYY . . . Y is the mnemonic(s) that describes the error. Table 3-8 lists these mnemonics and their meanings.

If a line printer status register (FF7E) status error occurred, the following message will be displayed:

LP STATUS (XXXX) YYY . . . Y

XXXX is the hexadecimal contents of the register and YYY . . . Y is the mnemonic(s) that describes the error. Table 3-9 lists these mnemonics and their meanings.

Table 3-8. LP SMUX Status Register Error Mnemonics

Mnemonic	Definition
SBSY	SMUX busy bit set when not expected.
N-SBSY	SMUX busy bit not set when expected.
CBSY	SMUX coax output busy bit set when not expected.
POLINT	An SMUX polling interrupt occurred when not expected.
SELINT	An SMUX selection interrupt occurred when not expected.
LPINT	A line printer interrupt occurred when not expected.
N-LPINT	A line printer interrupt failed to occur when expected.
PARE	An SMUX coax parity error occurred when not expected.
BUSE	A universal bus error occurred.

Table 3-9. LP Line Printer Status Register Error Mnemonics

Mnemonic	Definition
EODINT	A line printer end of data transfer interrupt occurred when not expected.
N-EODINT	A line printer end of data transfer interrupt failed to occur when expected.
EOPINT	A line printer end of operation interrupt occurred when not expected.
N-EOPINT	A line printer end of operation interrupt failed to occur when expected.
DEMAND	The line printer demand bit was set when not expected.
N-DEMAND	The line printer demand bit was not set when expected.
ONL	The line printer on-line bit was set when not expected.
N-ONL	The line printer on-line bit was not set when expected.
RDY	The line printer ready bit was set when not expected.
N-RDY	The line printer ready bit was not set when expected.
CONNECT	The line printer connected bit was set when not expected.
N-CONNECT	The line printer connected bit was not set when expected.

If the block length register (FF73) failed to increment to zero during the operation the following will be displayed:

```
LENGTH NOT ZERO (XXXX)
```

XXXX is the remaining byte count.

3.2.3.6 Line Printer Diagnostic Test Descriptions

The following information provides a brief description of each test of the line printer diagnostics. These tests are explained below on a functional level only. Standard tests are indicated by asterisks.

* Test 00: SMUX Reset Register Test

This test verifies the reset functions (write to main memory location FF70).

* Test 01: Memory Address Register Test

This test checks the memory address register (location FF71, bits 0—15).

* Test 02: Block Length Register Test

This test checks the block length register (location FF73, bits 4—15).

* Test 03: Mode Register Test

This test checks the mode register (location FF74, bits 12—15).

* Test 04: Real Time Clock Check

This test verifies that the real time clock functions and can be controlled by the real time clock register (location FFF8, bit 15).

* Test 05: Line Printer Interrupt Test

This test verifies that the line printer interrupt logic functions correctly.

* Test 06: Single Character Sliding Pattern Test

This test verifies the ability of the line printer to print a partial print line and to print a specific character in a specific print column. A total of 132 lines are printed of the character E once in each column.

* Test 07: Diamond Pattern Test

This test displays a pattern designed to verify that the printer places print characters in the correct columns and can handle any starting or ending column. A total of 263 lines are printed of the character E in a diamond pattern.

* Test 08: Single Character Broadside Pattern Test

This test prints 60 lines using the user's specified character in all user's specified print columns.

* Test 09: Verify Imbedded (Textual) Control Characters

This test verifies the operation of the textual control characters. If this test is selected and the line printer does not have any textual control characters, the following message will be displayed: NO IMBEDDED CONTROLS – TEST SKIPPED.

If the line printer does have imbedded (textual) control character capability, the program will then check if the printer has an electronic VFU. If it does, it will be loaded and ELEC VFU LOAD will be printed. Next, the following control functions will be performed followed by the printing of the name of the function:

1) Perform a form feed, then print FORM FEED.
2) Perform a line feed/carriage return, then print LINE FEED/CARRIAGE RETURN.
3) Perform a vertical tab, then print VERTICAL TAB.
4) Perform a bell ring, then print BELL three times.

If the printer does not have one of the above functions, that test will be skipped.

* Test 10: Verify Format Control Unit Spacing

This test checks the line printer's ability to space all possible number of lines, as controlled by the format control unit. If the printer does not have format spacing capability, the following message will be displayed: NO VFU SPACE – TEST SKIPPED.

If the printer does have format spacing capability, LP SPACING TEST will be printed. The printer will print SPACE 0 LINES if it has space zero lines capability and then space 0 lines. Next, SPACE 1 LINES will be printed and executed. The operation will continue in this manner until the maximum number of lines that can be spaced has been tested.

* Test 11: Verify Format Control Unit Skip to Channel

This test checks the line printer's ability to skip to a channel under control of the format control unit. If the printer does not have a formatted skip to channel capability, the following message will be displayed: NO VFU SKIP – TEST SKIPPED.

If the printer has an electronic VFU, it will be loaded and ELEC VFU LOAD will be printed.

The printer will print SKIP TO CHANNEL 0 and then skip to channel 0. Next SKIP TO CHANNEL 1 will be printed and executed. The operation will continue in this manner until all channels have been tested.

* Test 12: All Characters, Line Broadside Pattern Test

This test checks the line printer's ability to print all characters in all print positions, and may also be used to verify horizontal and vertical alignment as well as hammer loading. Each character is printed across one complete line.

* Test 13: All Characters, Ripple Pattern Test

This test checks the line printer's ability to print all characters on the same line. The pattern begins with the first printable character in the character set which is placed in column one of line one. Each succeeding column is filled with the next character in sequence until the end of the character set is reached.

* Test 14: Printer Speed Test

This test checks the rate at which the line printer can print full lines and the ability of the SMUX to print multiple lines in a single operation.

If the data buffer is at least 4096 bytes long, two 30 line ripple data patterns will be printed and USING 30 LINES/PRINT will be displayed. If the data buffer is less than 4096 bytes long, 60 single line ripple data patterns will be printed and USING SINGLE LINE/PRINT will be displayed. Next the print rate will be output: PRINTER SPEED = XXXX.X LINES/MIN.

* Test 15: Data Noise Pattern Test

This test checks the ability of the line printer and cable to correctly handle characters when the data lines are alternated from zeros to ones and back to zeros. Sixty identical lines of the "noise" pattern are generated.

3.2.4 MAIN MEMORY DIAGNOSTICS (MD)

Paragraph 3.2.4 contains the following information concerning the main memory diagnostics (MD): (MD):

- Step-by-step procedures of execution.
- Test errors codes.
- Functional test descriptions.

If a specific function of main memory is to be tested, refer to paragraph 3.2.4.5, Main Memory Diagnostic Test Descriptions in order to select the proper test(s) to run.

3.2.4.1 Main Memory Diagnostic Test Procedures

At this point MD has been selected in the Diagnostic Operating Procedure, paragraph 3.2v to execute the main memory diagnostics follow the procedure below. (Note: the message MD WILL EXECUTE ON EITHER AN XPU OR XPU2 will be displayed.)

	Display	Keyboard Response
a)	MD COMMANDS CL CLEAR TEST SELECTIONS DM DISPLAY MENU EL DEFINE ERROR LIMIT MR DEFINE MEMORY RANGE ST STANDARD TESTS TS TEST SELECTION RT RETURN TO DX PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.
b)	MEMORY TESTS TEST 0* ONES AND ZEROS TEST 1* ALTERNATING ONES AND ZEROS TEST 2* UNIQUENESS TEST 3* TOGGLE TEST 4* SWAP TEST 5* EXECUTION TEST 6* MEMORY ERROR INT * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.
c)	MEMORY TESTS TEST 7* RAM MEMORY REFRESH TEST 8* WALKING ONES AND ZEROS TEST 9* WALKING COLUMN TEST 10* MOVING INVERSIONS TEST 11* DECREMENT MEMORY TEST * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	
d)	MD COMMAND =	MR, then FIELD REL
e)	LO 4K BLK ADR (04)?	Enter the starting 4K test block address (03–F), then FIELD REL.

	Display	Keyboard Response
f)	HI 4K BLK ADR (END OF MEMORY)?	Enter the ending 4K test block address (03–3F), then FIELD REL. Note that this value cannot be lower than the LO 4K BLK ADR selected above. The default value is the end of memory block address. When testing the 128K byte PCBA the diagnostic automatically tests the memory 16K word (32K byte) blocks. If any portion of the 16K block is selected, the whole block is tested. With 128K byte PCBA's testing of low core is allowed since block 3 is part of the first 16K block. While testing this area, errors are reported only through the error indicator display. For 32K byte boards only: Since the diagnostics reside on memory board 0, all of memory cannot be tested at one time. To test board 0, swap the address selection switch settings on boards 0 and 1, reload the memory and the operator may begin testing another logical unit; go to paragraph 3.2 step v. CO to redefine the DX control options; go to paragraph 3.2 step i.
g)	128K BYTE MEMORY PCBA? (Y)	This entry defines the type of memory board and memory chip size which, in turn, defines the block size tested (1 memory chip boundary) Y, then FIELD REL indicates a 128K byte PCBA is to be tested. N, then FIELD REL indicates 32K memory PCBA is to be tested.
h)	MD COMMAND =	ST, then FIELD REL to run standard tests. TS, then FIELD REL to run test selections. Go to paragraph 3.2.4.2.
i)	THE STANDARD SET OF TESTS (0–7, 9, 10) HAS BEEN SELECTED MD COMMAND	EL, then FIELD REL to select the maximum number of errors which may be output for a single test of one memory block. Go to paragraph 3.2.4.3.
j)	ERR LIM (16) =	Depress FIELD REL

	Display	Keyboard Response
k)	MD COMMAND =	RT, then FIELD REL
l)	DX DIRECTIVE =	EX, then FIELD REL
m)	XX000 to XXEFF R TEST n CNTc	At this time, the specific or standard tests will be executed. "XX000 to XXEFF" indicates the boundaries of the block under test. If "R" is present, the code to execute the test is relocated to reside at the top of the block being tested. "TESTn" indicates the current test being executed. "CNTc" indicates the current test count as it is decremented toward 0. If there is an error, refer to paragraph 3.2.4.4. If no errors occur, the following prompt will be displayed:
n)	TOTAL ERRORS = 0 DX DIRECTIVE =	EX will repeat the tests selected. Go to paragraph 3.2.4.e above. CL will clear all selected tests from memory and the operator may begin testing another logical unit. Go to paragraph 3.2 step i. CO to redefine the DX control options. Go to paragraph 3.2 step v.
o)	TEST TERMINATED BECAUSE OF MERR	Will be displayed only if an unrecoverable memory error occurs during test execution.
p)	MD TEST CAN'T BE RUN	Will be displayed only if the diagnostic test program resides in the area that was to be tested.

NOTE

During testing of 128K Byte memory boards, the test will allow testing of low core locations by moving all the programs in low core into upper memory locations. Since this involves removing all the message display programs, reporting of errors is limited to the error display register on the front of the machine. Just prior to going into this test mode, the following message is output.

WATCH THE SYSTEM STATUS DISPLAY FOR ERROR INDICATIONS DURING THIS PORTION OF THE TESTING.

The status display will indicate the number sequence "10", "30", "40" twice. If an error is detected in low core, the display will be flashing with one of these numbers.

3.2.4.2 Main Memory Diagnostic Test Selection Procedure

At this point TS has been selected in the Main Memory Diagnostic Standard Load Procedure, paragraph 3.2.4.1h. To execute specific main memory test(s) follow the procedure below:

	Display	Keyboard Response
a)	TEST (0) =	Select test number to run, then FIELD REL.
b)	COUNT (1) =	Select iteration count (0–32,767) (0 will cause the test to be skipped), then FIELD REL.
c)	ANYMORE TESTS (Y)?	If N then FIELD REL is selected, return to paragraph 3.2.4.1j. If FIELD REL is selected, return to paragraph 3.2.4.2a above. Note that the TEST prompt in paragraph 3.2.4.2a above will have the test number selected incremented by one as the new default value.

3.2.4.3 Main Memory Diagnostic Error Output Limit Specification Procedure

At this point EL has been selected in the Main Memory Diagnostic Test Procedure, paragraph 3.2.4.1h. To specify the error output limit, follow the procedure below;

	Display	Keyboard Response
a)	ERR LIM (16) =	Enter the maximum number of errors which may be output for a single test of one memory block, then FIELD REL. Return to paragraph 3.2.4.1h. Now standard or specific tests can be run with the above error output limit specified.

3.2.4.4 Main Memory Diagnostic Test Error Codes

Table 3-10 below lists the main memory diagnostic test error codes, the test numbers failed, brief error descriptions and possible failing hardware modules.

Table 3-10. Main Memory Diagnostic Test Error Code Summary

Error Code	Test No.	Brief Description	Possible Failure
1000	XX	Data compare error due to RAM failure.	Main memory
1001	XX	Unexpected memory error interrupt error.	Main memory or XPU

3.2.4.5 Main Memory Diagnostic Test Descriptions

The following information provides a brief description of each test of the main memory diagnostics. These tests are explained below on a functional level only. Standard tests are indicated by asterisks.

* Test 0: Ones and Zeros Test

The entire test block (X000–XFFF) is written with the tests patterns, 0000, 5555, AAAA, and FFFF separately and then read back and verified. This test is executed in two directions, from X000 to XFFF and from XFFF to X000.

* Test 1: Alternating Ones and Zeros Test

The entire test block (X000–XFFF) is written with the test pattern 0000, FFFF, 0000, ... and then read back and verified. This test is executed in two directions, from X000 to XFFF and from XFFF to X000.

* Test 2: Uniqueness Test

The entire test block (X000–XFFF) is written with its own address. Each location is read back and verified. Each address read back is then complemented and written back into its respective location. Next, the complemented addresses are read back and verified. Once more the addresses are complemented back to the original values and verified. This test is executed in two directions, from X000 to XFFF and from XFFF to X000.

* Test 3: Toggle Test

This test checks the ability of main memory to properly increment and decrement (instructions INM and DCM). The entire test block (X000–XFFF) is filled with the value FFFE. Each location is toggled (INM, DCM, INM, DCM . . . . .) 425 times, and then the entire test block is checked for FFFF. This procedure is repeated for FFFF and then the block is checked for 0000. Next, each location is toggled (DCM, INM, DCM, INM . . . . . .) 25 times and then the entire block is checked for FFFF. This test is executed in two directions from X000 to XFFF and from XFFF to X000.

* Test 4: Swap

This test verifies the ability of main memory to properly swap data with the A register (instruction SWA). The entire test block (X000–XFFF) is filled with the initial background pattern from the table below, and the initial test pattern is loaded into the A register. Each location is exercised by 425 SWA instructions and then verified for the correct background pattern. Each location in the test block is tested in the above manner for all swap values listed below in Table 3-11.

Table 3-11. Swap Values For Test 4

Background Value (memory)	Test Value (A register)
0001	FFFE
0002	FFFD
0004	FFFB
0008	FFF7
0010	FFEF
0020	FFDF
0040	FFBF
0080	FF7F
0100	FEFF
0200	FDFF
0400	FBFF
0800	F7FF
1000	EFFF
2000	DFFF
4000	BFFF
8000	7FFF

* Test 5: Execution Test

This test checks the ability to execute the following memory reference instructions:

1) Store A (STA)
2) Load A (LDA)
3) Unconditional Jump (JMP)
4) Effective Address to B (EAB)
5) Effective Address to X (EAX)

* Test 6: Memory Error Interrupt Test

This test verifies the proper functioning of the memory error interrupt logic.

* Test 7: RAM Refresh Test

This test verifies that RAM refresh circuitry is operating properly. It detects the following failure conditions:

1) The SMUX refresh register is not refreshing memory at the proper rate.
2) The RAM is marginal and needs to be refreshed at a higher rate.
3) Another PCB is stealing memory cycles.
4) The system clock is not running at the proper speed.

Test 8: Walking Ones and Zeros Test

The entire test block (X000—XFFF) is written with the initial background pattern from the table below. Next, the initial test pattern is written into the first location of the test block. The entire test block is read and verified. Each main memory location in the test block is tested in the above manner for all background and test patterns listed below in Table 3-12.

Table 3-12. Background and Test Patterns for Test 8

Background Pattern	Test Pattern
FFFF	0000
0000	FFFF
FFFE	0000
0000	FFFE

Test 9: Walking Column Test

The entire test block (X000—XFFF) is written with the initial background pattern from Table 3-12. Each row is read and verified to be the background data pattern. All columns in each row are written with the test data pattern, then read and verified. Each row and column in the test block is tested in the above manner for all background and test patterns listed in the table.

Test 10: Moving Inversions

Checks the test block using a moving inversions test pattern. A read/write/read operation inverts the data of each address sequentially.

Test 11: Decrement Memory

Initializes the test block to all FFFF. Next, each test cell is decremented around back to FFFF (64K decrements).

NOTE

On some boards (typically board 0 with stack operations) accessing one cell a high number of times may cause problems.

3.2.5 SYSTEM EXERCISER DIAGNOSTICS (SX)

The system exerciser diagnostic tests for interactions among working peripherals to achieve valid results, therefore, the following pretest conditions must be observed:

a. Each peripheral subsystem to be included in the system exerciser should have successfully completed all tests on its own diagnostic.

b. Each selected device must be ready and on-line.

c. All customers' disk files must be saved to tape; only scratch tapes should be used for the test. The disk drive must be preinitialized with RD diagnostics (Test 8).

d. Since SX runs a memory test in the background of all memory not used by DX or SX, no other storage device diagnostic such as tape (TD) disk (RD) or memory (MD) should be selected to run the same execution cycle as SX.

3.2.5.1 System Exerciser Diagnostic Test Procedure

At this point, SX has been selected in the Diagnostic Operating Procedure, paragraph 3.2.v. The diagnostic begins with the following display. To continue, perform "Keyboard Response" functions.

Display	Keyboard Response
SYSTEM EXERCISER V ( ) DATE ——SYSTEM EXERCISER COMMANDS—— DR SYSTEM EXERCISER TEST OPTIONS RT RETURN TO DX ST STANDARD TESTS CE CLEAR ERROR AND PASS COUNTS DE DISPLAY ERROR AND PASS COUNTS CF DISPLAY CONFIGURATION RE RECONFIGURE CONTROLLER SX COMMAND =	DR, then FIELD REL to select test options (paragraph 3.2.5.1.1) RT, then FIELD REL to return to diagnostic executive. ST, then FIELD REL for standard tests (paragraph 3.2.5.1.2). DE, then FIELD REL to display error and pass counts (paragraph 3.2.5.1.3). CE, then FIELD REL to clear error and pass counts. CF, then FIELD REL to display configuration (paragraph 3.2.5.1.4). RE, then FIELD REL to reconfigure controller (paragraph 3.2.5.1.5).

3.2.5.1.1 DR -- System Exerciser Test Options — Entering this command allows the operator to define the system exerciser test options. This procedure selects device parameters as follows:

NOTE

After DR, do NOT select ST or test options will be set to defaults.

	Display	Keyboard Response
a)	RUN TIME IN MINUTES (900) =	Select execution time (1–32,767), then FIELD REL. NOTE: Execution time will be 1/3 slower if VERIFY DATA = Y is selected for each of the following controllers.
b)	HALT AT THE END OF SX EXECUTION (Y)?	FIELD REL if execution is to start after each "CO" (Control Options) loop count. Select N, then FIELD REL to continue testing until "CO" count equals 1.
c)	**EXERCISE MAG TAPE (N)?	FIELD REL to bypass mag tape testing. Select Y, then FIELD REL to test mag tape.
d)	TAPE DRIVE (1) =	Select address of tape drive (1–4) to be tested. Then FIELD REL. Only one drive can be tested.
e)	VERIFY DATA (Y)?	FIELD REL to verify data, otherwise, select N, then FIELD REL.
f)	PATTERN 1 (0000) =	Select data pattern 1, then FIELD REL. Complement of this value will also be used during the test.
g)	PATTERN 2 (A55A) =	Select data pattern 2, then FIELD REL. The complement of this value will also be used during the test.
h)	BUFFER ADR (470D)	Change buffer address if desired, then FIELD REL. Otherwise use default value (FIELD REL only).
i)	BUFFER SIZE (1000)	Change buffer size if desired, then FIELD REL. Otherwise use default value (FIELD REL only).
j)	**EXERCISE LINE PRINTER (N)?	Depress FIELD REL to bypass line printer testing. Select Y, then FIELD REL to test line printer.

	Display	Keyboard Response
k)	DELETE TEST IF OFF-LINE (Y)?	If during testing, the line printer goes off-line (e.g. paper-out, paper-jam, etc.) the line printer can be deleted from further system exerciser testing. Depress FIELD REL to enable this delete option. Select N, then FIELD REL to disable the delete option.
l)	DATA ITERATION COUNT (10)	Select the number of iterations to be performed per pass, then FIELD REL. If default value is to be used, FIELD REL only.
m)	PATTERN 1 (3137) =	Select data pattern 1, then FIELD REL. If default value is to be used, FIELD REL only. Complement of this value will also be used during test.
n)	PATTERN 2 (0042) =	Select data pattern 2, then FIELD REL. If default value is to be used, FIELD REL only. Complement of this value will also be used during test.
o)	BUFFER ADR (5700) =	Change buffer address if desired, then FIELD REL. Otherwise use default value (FIELD REL only).
p)	BUFFER SIZE (0042) =	Change buffer size if desired, then FIELD REL. Otherwise use default value (FIELD REL only).
q)	XX EXERCISE KEYSTATION (N)?	Depress FIELD REL to bypass keystation testing. Select Y, then FIELD REL to test keystation. NOTE: This test will exercise only the diagnostic command console keystation.
r)	DATA ITERATION COUNT (100)	Select the number of iterations to be performed per pass (1–32,767), then FIELD REL. If default value is to be used, FIELD REL only.
s)	PATTERN 1 (E7E8) =	Select the first data pattern to be used, then FIELD REL. The complement of this value will also be used during the test.

	Display	Keyboard Response
t)	PATTERN 2 (C4C5) =	Select the second data pattern to be used, then FIELD REL. The complement of this value will also be used during the test.
u)	BUFFER ADR (574F) =	This indicates the starting address of the buffer allocated to the keystation. The default value is the computed value of the first available free space for the keystation buffer. Do not use any value less than the default value. Therefore, select the desired starting address, then FIELD REL. Otherwise, FIELD REL only.
v)	BUFFER SIZE (0064) =	This indicates the length, in words, of the buffer allocated to the keystation. Each word represents two characters. SX uses three words for control characters so an input of 4 would result in two characters appearing. If a longer buffer length is selected than the keystation can accommodate, the excess characters will be sent out on the coax, resulting in more DMA, but they will not appear on the screen. The larger the data iteration count and the larger the buffer, the longer the pattern will stay on the screen without changing. To indicate that the keystation is not "hung," SX toggles the second character on the screen after every write operation. With this information in mind select the desired data value (4—1000), then FIELD REL. For default value, FIELD REL only.
w)	**EXERCISE RIGID DISK (N)?	Depress FIELD REL to bypass rigid disk testing. Select Y, then FIELD REL to test the disk.
x)	DISK DRIVE NUMBER (1) =	Select the disk drive (1—4) to be tested, then FIELD REL (only one drive may be selected). FIELD REL only will select drive #1.

	Display	Keyboard Response
y)	START CYLINDER (405)	Select the start cylinder (0—405) for testing, then FIELD REL.
z)	END CYLINDER (405)	Select the end cylinder (0—405) for testing, then FIELD REL.
aa)	RUN THE TEST ON THE TOP PLATTER (Y)?	Depress FIELD REL to test the top platter. Select N, then FIELD REL to test bottom platter. The bottom surface is always used. This platter selection applies to either dual or quad platter drives.
ab)	VERIFY DATA (Y)?	FIELD REL to verify data. Otherwise select N, then FIELD REL.
ac)	DATA ITERATION COUNT (100) =	Select number of iterations to be performed per pass, then FIELD REL. If default value is to be used, FIELD REL only.
ad)	PATTERN 1 (1000) =	Select data pattern 1, then FIELD REL. The complement of this value will also be used in the test.
ae)	PATTERN 2 (A55A)	Select data pattern 2, then FIELD REL. The complement of this value will also be used in the test.
af)	BUFFER ADR (594F)	Change buffer address if desired, then FIELD REL. Otherwise use default value (FIELD REL only).
ag)	BUFFER SIZE (0A2C)	Change buffer size if desired, then FIELD REL (min 4, max A80). Otherwise use default value (FIELD REL only).
ah)	**EXERCISE COMM CONTROLLER (N)?	FIELD REL to bypass communications controller testing. Select Y, then FIELD REL to test the controller.
ai)	VERIFY DATA (Y)?	FIELD REL to verify data. Otherwise select N, then FIELD REL.

	Display	Keyboard Response
aj)	DATA ITERATION COUNT (100)	Select the number of iterations to be performed per pass, then FIELD REL. If default value is to be used FIELD REL only.
ak)	PATTERN 1 (0000) =	Select data pattern 1, then FIELD REL. Complement of this value will also be used in the test.
al)	PATTERN 2 (5555)	Select data pattern 2, then FIELD REL. Complement of this value will also be used in the test.
am)	BUFFER ADR (637B) =	Change buffer address, if desired, then FIELD REL. Otherwise use default value (FIELD REL only).
an)	BUFFER SIZE (1000) =	Change buffer size, if desired, then FIELD REL. Otherwise use default (FIELD REL only).
ao)	SX COMMAND =	RT, then FIELD REL to return to diagnostic executive.
ap)	DX DIRECTIVE =	EX, then FIELD REL. This will start the SX test. At the end of the test (run time) the system will pause and display the Error Summary (paragraph 3.2.5.1.3) for the devices tested. NOTE: Testing can be terminated at any time by depressing CTRL/BYPASS.

3.2.5.1.2 ST – Standard Tests – Entering this command selects all devices with standard defaults for testing. The following message will be displayed.

ALL AVAILABLE DEVICES HAVE BEEN SELECTED WITH DR DEFAULTS

a)	SX COMMAND =	RT, then FIELD REL to return to diagnostic executive

b) DX DIRECTIVE =

EX, then FIELD REL to start the ST test.

3.2.5.1.3 DE – Display Error and Pass Counts – Selection of this command will cause a summary of error and pass counts of DR or ST tests to be displayed as follows:

ERROR SUMMARY

	PASS COUNT	DATA ERRS	STAT ERRS	TIME-OUTS	OVER-RUNS
MAG TAPE	0	0	0	0	0
LINE PRN	0	0	0	0	0
KEYSTN	0	0	0	0	0
RGD DISK	0	0	0	0	0
COMM CTRL	0	0	0	0	0
MEMORY	0	0	0	0	0

NOTE

Select CE, then FIELD REL, if desired to clear error and pass counts.

3.2.5.1.4 CF – Display Configuration – Selection of this command will display the configuration selected under DR. An example follows:

Display	Keyboard Response
MAGNETIC TAPE DEVICE NUMBER: 0001 VERIFY DATA: YES ITERATION COUNT: 100 PATTERN 1: 0000 PATTERN 2: A55A BUFFER START: 470D BUFFER SIZE: 1000 PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL. The next device selected will be displayed.

3.2.5.1.5 RE – Reconfigure Controller – Selection of RE permits reconfiguration of any of the devices available for testing. The following prompt will appear:

	Display	Keyboard Response
a)	RECONFIGURE ONLY THE BUFFERS (N)?	Select Y, then FIELD REL to reconfigure only the buffers of each device. An example of the prompts that will appear is shown in b) below. Depress FIELD REL only to reconfigure any options of all devices. The prompt shown in c) will appear.
b)	MAGNETIC TAPE BUFFER ADR (71DF) = BUFFER SIZE (1000) =	
c)	DEVICE CODES: MT MAGNETIC TAPE LP LINE PRINTER KS KEYSTATION RD RIGID DISK CD COMMUNICATIONS CONTROLLER RECONFIGURE WHICH DEVICE?	Select the device code of the selected device, then FIELD REL to display the DR test options.
d)	SX COMMAND =	Select RT, then FIELD REL to return to DX
e)	DX DIRECTIVE =	Select EX, then FIELD REL to execute the system exerciser. At the end of the test (run time) the system will pause, then display the ERROR SUMMARY for the devices tested. NOTE: Testing can be terminated at any time by depressing CTRL/BYPASS.

3.2.6 TEST PANEL DIAGNOSTICS (PD)

Paragraph 3.2.6 contains the following information concerning the test panel diagnostics (PD):

- Step-by-step procedures of execution.
- Test error codes.
- Functional test descriptions.

If a specific function of the test panel/test panel controller is to be tested, refer to paragraph 3.2.6.4, Test Panel Diagnostic Test Descriptions in order to select the proper test(s) to run.

NOTE

PD Diagnostics will only function with the new test set designed to operate with both the XPU and XPU2.

3.2.6.1 Test Panel Diagnostic Test Procedure

At thia point PD has been selected in the Diagnostic Operating Procedure, paragraph 3.2v. To run the diagnostic tests, the panel must be correctly connected to the system and the PROG indicator should be on. If it is not, depress the PROG switch. To execute the test panel diagnostics, follow the procedure below:

	Display	Keyboard Response
a)	TEST SET DIAGNOSTIC COMMANDS DM DISPLAY TEST DESCRIPTION MENU TS TEST SELECTION ST STANDARD TEST SET SELECTION RT RETURN TO DIAGNOSTIC CONTROL CL CLEAR TEST SELECTIONS PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL.
b)	PANEL TESTS TEST 0* DISABLE/ENABLE TEST TEST 1* WRITE READ I/O REGISTERS TEST TEST 2* COMPARE REGISTER TEST TEST 3* COMPARE FUNCTION TEST TEST 4* ADDRESS REGISTER TEST TEST 5* DATA REGISTER TEST TEST 6* BUS HISTORY POINTER TEST * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL.
c)	PANEL TESTS TEST 7* BUS HISTORY RECORDER TEST TEST 8* BUS WRITE TEST TEST 9 HALT/STEP TEST TEST 10 MICROCODE SYNC ACTION TEST TEST 11 PSW INDICATOR EXERCISE TEST 12 DISPLAY EXERCISE TEST 13 SWITCH EXERCISE * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL.
d)	PANEL TESTS TEST 14 READ/WRITE WAVEFORMS TEST 15 DUTY CYCLE WAVEFORMS * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Depress FIELD REL.

	TESTS 0-8 DO NOT REQUIRE A DISPLAY PANEL TO BE ATTACHED	The operator may respond with any of the two letter commands shown in display (a) followed by FIELD REL.
e)	PD COMMAND =	ST, then FIELD REL to run standard tests (0-8)
f)	THE STANDARD SET OF TESTS (0-8) HAS BEEN SELECTED PD COMMAND =	TS, then FIELD REL to run test selection (paragraph 3.2.6.2) RT, then FIELD REL.
g)	DX DIRECTIVE =	EX, then FIELD REL.
h)	PANEL TEST IN PROGRESS TEST (number and title) COUNT (number) PROGRESS (number)	At this time the specific or standard tests will be executed. If there is an error, refer to paragraph 3.2.6.3.
i)	TOTAL ERRORS = 0 DX DIRECTIVE =	EX, then FIELD REL will repeat execution of the tests CL, then FIELD REL will clear all tests from memory, and testing of other units may begin (3.2v.)

3.2.6.2 Test Panel Diagnostic Test Selection Procedure

The selection of TS (paragraph 3.2.6.1a), allows the operator to select tests for execution and the iteration count for each test. The program starts by prompting for test 0 and continues prompting based on the operator's response. For more details on non-standard tests (9—15), reference should be made to paragraph 3.2.6.4.

	Display	Keyboard Response
a)	TEST (0) =	Select test number to be run (0-15), then FIELD REL.
b)	COUNT (1) =	Select iteration count (0-32, 767) (0 will cause the test to be skipped), then FIELD REL.
c)	ANYMORE TESTS (Y)?	If N, then FIELD REL is selected, return to paragraph 3.2.6.1 for new command selection. Depressing FIELD REL will cause prompting for the next test. After all tests have been selected, the responses to the following prompts will start executing the tests.

	Display	Keyboard Response
d)	PD COMMAND =	RT, then FIELD REL to return to DX.
e)	DX DIRECTIVE =	EX, then FIELD REL to execute.

3.2.6.3 Test Panel Diagnostic Test Error Codes

Table 3-13 lists the test panel diagnostic test error codes, the test numbers failed, brief interpretation of error messages and possible failing hardware chips.

Table 3-13. Test Panel Error Code Summary

Error Code	Test No.	Brief Description	Possible Failure
E000	0	Test set did not respond to any one of the memory addresses written to by the test	Memory
E001	0	Enabled test set cannot read back what was written into the Compare LS register.	Compare LS Register
E002	0	A '0000' data pattern is not what is read back after a 0123 data pattern is written to the Compare LS register of a disabled test set.	Compare LS Register
E003	1,2,5	Contents read from I/O register (XFR register) and exclusive ORed with a 16 bit mask do not compare with expected data	One of 12 possible I/O registers that would appear in the error message
E004		Not Used.	
E005	2	The Compare Register does not clear when test set is reset.	Compare Register
E006	2	The Compare Register fails to indicate proper value when incremented or decremented by the test.	Compare Register
E007	3	During a compare function either an interrupt occurred when values did not compare or an interrupt did not occur when values were equal.	One of 12 I/O registers (see error message)
E008	3	No time out sync condition interrupt generated as a result of a program forced bus timeout.	TSC

Table 3-13 (Continued)

Error Code	Test No.	Brief Description	Possible Failure
E009	4	Program simulated "ADDRESS LOAD" switch results in wrong data being retrieved.	Address Register LS
E00A	4	Program simulated "ADDRESS LOAD" switch results in wrong data being retrieved.	Address Register MS
E00B	4	Reset of test set doesn't clear Address Register LS	Address Register LS
E00C	4	Address Register LS, after being loaded with 0000 and then incremented FFFF times, does not contain FFFF.	Address Register LS
E00E		Address Register LS, after being loaded with FFFF and incremented 3 times, does not result in a 3 count in Address Register MS	Address register MS
E00F	4	Address Register LS fails a two part test in which: 1) it is loaded with 0000 and an address decremented is simulated by program (address reg. LS should contain FFFF) 2) register is loaded with FFFF and decremented FFFF times address register LS should contain 0000)	Address Register LS
E010	4	Address Register MS fails the same test described for E00F above.	Address Register MS
E011	5	Resetting of the test set fails to clear the Data Register MS	Data Register MS
E012	6	Bus History Pointer fails one of the five-part test 6 as indicated in the appropriate error message.	Bus History Pointer
E013	8	Data written into a memory location via tsc switch simulation does not compare to the data read out.	Memory
E014	7	Error in a two part test where message 1 indicates that a particular bit within the Bus History Register pointed at by the Bus History Pointer could not be written to or	Bus History Register

Table 3-13 (Continued)

Error Code	Test No.	Brief Description	Possible Failure
		read from. Message 2 indicates that the Bus History Register pointed to by the Bus History Pointer did not copy the proper bus address provided during test.	
E015	13	Error in a three part test involving: 1) the WRITE swtich, 2) the WRITE INCREMENT switch and the ADDRESS LOAD switch due to a mis-compare between data written into memory and data read from memory.	Memory or message indicated switches

3.2.6.4 Test Panel Diagnostic Test Description

The following paragraphs provide brief functional descriptions of the 15 tests provided in the test panel diagnostic. Standard tests are indicated by asterisks.

* Test 0: Disable/Enable

This test verifies that all test set controller slave addresses, FFE0-FFFF, can be accessed whether the controller is enabled or disabled.

* Test 1: Write/Read I/O Registers

This test checks the following TSC functions:

1) Unique addressing for compare, address, and data registers with respect to other I/O registers.

2) Unique addressing amongst the compare, address and data registers.

3) Bit independence for the compare, address and data registers.

* Test 2: Compare Register

This test is structured as follows:

1) The Compare Register is loaded with all ones via a store to Compare Register bus addresses FFE1/FFE2. These addresses are read and verified for correct data.

2) After a reset command to the TSC, the Compare Register addresses are again read and checked for all zeros.

3) The Compare Register is incremented from zero to its maximum count via simulation of the ADDR INCR switch and checked for the correct value after each increment.

4) The Compare Register is decremented from its maximum count via simulation of the ADDR DECR switch and checked for the correct value after each decrement.

* Test 3: Compare Function

This is a two part test in which first, a one is shifted through the least significant 16 address bits in the compare logic, while a check is made for the correct occurrence of panel sync interrupts. Next, the various address agree, store address agree and bus time-out sync conditions are checked for proper operation via appropriate switch simulations.

* Test 4: Address Register

This test functions of the Address Register not checked by previous tests. In general, this consists of simulating the ADDR LOAD, ADDR INCR and ADDR DECR switches to load, increment and decrement the LS and MS sections of the Address Register while verifying for correct data after each step.

* Test 5: Data Register

This test checks the ability of the Data Register to be loaded via a DMA read and for the ability to reset the Data Register. It starts by setting a value in 'XFR PATTERN' and then moving the data selector to the bus position. The program waits 20 milliseconds to allow for a DMA cycle then examines the Data Register contents. The second part of the tests involves loading all one's in the Data Register, then issuing a reset to the test set controller. The MS portion of the register is checked for all zeros. Note: While the LS portion of the Data Register also gets reset, it cannot be verified by the program.

* Test 6: Bus History Pointer

This test verifies correct operation of the Bus History Pointer, with its up/down counter and increment/decrement logic and the Bus History Enable Flip-flop. Once activated, the test goes through the following sequence:

1) It increments the Bus History Pointer from its initial value through all of its 64 states while checking for the correct pointer value after each increment. The same is done for the decrement function.

2) A short program is initiated which, when the Bus History Pointer is enabled, will advance the pointer hex '34' steps for each of the following conditions:

- Bus History is enabled upon entry to the test program and disabled upon exit. The pointer should advance.
- Bus History is not enabled upon entry to the test program. The pointer should not advance.
- Bus History is enabled by Clear Switch simulation upon entry to the test program and disabled upon exit. The pointer should advance.

* Test 7: Bus History Recorder

In this, the Bus History Recorder is tested to verify that each of the 64 locations are unique and that each bit of each location is independent. Uniqueness is verified by a subroutine which enables bus history recording and then executes a series of instructions whose addresses will be copied by the Bus History Recorder. Each address copied will be unique. At the end of the subroutine, the Bus History Recorder is disabled and the contents checked against the addresses in the subroutine. Bit independence is verified by shifting a one on a background of zeros through each of the 64 locations of the Bus History Recorder. Each location is checked for the correct value after each shift.

* Test 8: Bus Write

Test 8 verifies operation of TSC DMA logic and a portion of the switch simulate logic. This is done first for the write function by storing 16 data values into a memory location via simulation of the WRT switch and checking for the correct value in memory after each store operation. Next, the write increment function is tested via simulation of the WRT/INCR switch. For this part of the test, a block of 16 sonsecutive addresses is written (with a different data value for each location) and checked for correct data after each write.

Test 9: Halt/Step

This test allows verification of the halt/step features in both the clock step and instruction step modes. Operator assistance is required. The test is conducted as follows:

a) Operator is given clock mode prompt.

b) Test begins by putting TSC in a clock halt mode. If a TSC to processor interface cable is installed, the operator can observe the microcode address advance by depressing the HALT/STEP switch.

c) Depressing the RUN button causes the instruction halt mode prompt to be issued.

d) Upon operator initiation, TSC is put in instruction halt mode by the program.

e) Operator depresses RUN button again — test finishes.

Test 10: Sync Action Halt

This test allows verification of the microcode address agree logic. This requires both operator assistance and an interface cable from the TSC to processor to be installed. The test sequence is as follows:

a) The operator is prompted as to the required actions and results.

b) The program sets up microcode compare address.

c) Program sets up sync condition and sync action.

d) Program halts — operator verifies.

e) Operator depresses RUN button — test finishes.

Test 11: PSW Indications Exercise

This test allows verification of the panel PSW indicator LED's, the BUS TIMEOUT and DATA ERR indicator LED's, and the INTR indicator LED. Operator assistance is required. The test sequence is as follows:

a) The program prompts the operator and waits for a response.

b) The PSW indicator LED's are stepped across the panel display from left to right. Each LED is on for approximately one second.

NOTE

Because the program will be interrupted when the PSW T (trace) LED is on, the indicator LED 'on' time may be somewhat erratic. This should be considered normal.

c) Next, the BUS TIMEOUT indicator LED is turned on for approximately one second, then both the BUS TIMEOUT and DATA ERR indicator LED's turned on also for approximately one second. Each of these actions will cause the INTR indicator LED to come on also.

Test 12: Display Exercise

This test allows visual verification of the panel display selector indicator LED's, the hex DATA and ADDRESS displays and the ADX1/ADX2 indicator LED's. Operator assistance is required. The test sequence is as follows:

a) The program prompts the operator and waits for a response.

b) The display indicator LED's are checked via program simulation of the move right and move left switches, causing the indicator LED's to circulate from left to right twice and then right to left twice.

c) The DATA and ADDRESS displays are individually checked by first incrementing each hex digit in the display from zero to F, starting with the least significant digit. Then, each hex digit is decremented from F to zero, starting again with the least significant digit.

d) Next, the ADX1/ADX2 indicator LED's are checked by toggling each indicator on and off individually.

Test 13: Switch Exercise

This test directs the operator through a functional check of the test set panel switches. The program is structured as follows:

The program prompts the operator and waits for a response. The program issues a control switch test prompt, waits for a response, then begins to issue a series of prompts which instruct the operator as to which switches to push and which indicator LED's to verify. The operator is given approximately 5 seconds to complete each test before the next prompt is issued. The program issues a keyboard test prompt then waits for an operator response after he has completed the test. The test consists of depressing each keyboard switch, in order, and verify the display results.

The program issues an ADDR INCR switch test prompt and then waits for an operator response after the test has been completed.

The program issues an ADDR DECR switch test prompt and then waits for an operator response after the test has been completed.

The program issues a WRT INCR switch test prompt and waits for an operator response after the test has been completed. The program then verifies memory data written as a result of the WRT INCT switch action.

The program issues a WRT switch test prompt and waits for an operator response after the test has been completed. The program then verifies memory data written as a result of the WRT switch action.

The program issues an ADDR LOAD switch test prompt and waits for operator response after the test has been completed.

The program issues another WRT switch test prompt in order to verify the ADDR LOAD switch function by checking for correct memory data in the correct memory address.

The program issues a DISPLAY SELECTOR switch test prompt and then awaits operator response when the test is complete. The test consists of manually stepping the DISPLAY SELECTOR indicator LED's across the display by use of the move right and move left switches. The program issues a MPRT switch test prompt.

NOTE

If the MPRT switch test is performed the system will be reset and will have to be bootstrap loaded to continue with any testing.

Test 14: Read/Write Waveforms

This test provides a scope display of most of the read and all of the write signals from the read decoder and write decoder logic. The program sequentially reads each TSC address (except FFEE), then sequentially writes to each address including addresses FFFA, FFFB and FFFF. This program loop will continue until halted by the operator depressing the CNTRL/BYPASS keys on the keyboard.

Test 15: Duty Cycle Waveform

This test provides a scope test pattern which can be used to verify operation of the duty cycle test point feature. The test point is made to toggle at a frequency of approximately 1 Mhz. Once initiated, the test will continue until the operator depresses the CNTRL/BYPASS keys on the keyboard.

3.2.7 RIGID DISK DIAGNOSTICS (RD)

Paragraph 3.2.7 contains the following information concerning the rigid disk diagnostics (RD):

- Step-by-step procedures of execution.
- Test error codes.
- Rigid disk status errors.
- Functional test descriptions.

If a specific function of the rigid disk drive/disk controller is to be tested, refer to paragraph 3.2.7.5, Rigid Disk Diagnostic Test Descriptions in order to select the proper test(s) to run.

3.2.7.1 Rigid Disk Diagnostic Test Procedure

At this point RD has been selected in the Diagnostic Operating Procedure, paragraph 3.2v. Before executing the rigid disk diagnostics, be certain that all important customer data has been saved. To execute the rigid disk diagnostics, follow the procedure below:

	Display	Keyboard Response
a)	RIGID DISK DIAG (XXX) date RIGID DISK DIAGNOSTIC COMMANDS DR DEFINE DRIVE OPTIONS TS TEST SELECTION RT RETURN TO DX ST STANDARD TEST SET SELECTION	Press FIELD REL.

	Display	Keyboard Response
	DM DISPLAY TEST DESCRIPTION MENU CL CLEAR TEST AND DRIVE NBR SELECTIONS PRESS 'FIELD REL' TO CONTINUE	
b)	RIGID DISK TESTS TEST 0* EXTERNAL CONTROLLER TEST TEST 1* INTERNAL CONTROLLER TEST TEST 2* UNLOAD LOAD TEST TEST 3* BASIC CONTROLLER/DRIVE TEST (W) TEST 4* SEEK/STATUS ERROR TEST (W) TEST 5* WRITE/READ (W) TEST 6* RANDOM SEEK/READ (W) * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
c)	RIGID DISK TESTS TEST 7* RANDOM DATA WRITE/READ (W) TEST 8 INITIALIZE AND VERIFY (W) TEST 9 VERIFY DISK DATA TEST 10 OVERLAPPED SEEKS (W) TEST 11 REPETITIVE SEEK TEST 12 REPETITIVE RESTORE TEST 13 WRITE (W) * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
d)	RIGID DISK TESTS TEST 14 READ TEST 15 TROUBLESHOOTING AID * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
e)	TESTS 0 AND 1 TEST ONLY THE CONTROLLER PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
f)	THIS MODULE HAS ONE AUTOMATIC CALL TO DR, HERE WE GO PRESS 'FIELD REL' TO CONTINUE	This statement will appear after FIELD REL in step e is depressed the first time RD is used. Thereafter, DR, then FIELD REL, has to be entered in response to RD COMMAND = Press FIELD REL to continue.

	Display	Keyboard Response
g)	DRIVE (1) =	Enter the drive (1-4) to be tested, then FIELD REL.
h)	X READY X WRTPRT X 2200BPI X 200TPI X FIXED X 64SECT X 2400RPM X 2 PLAT X SAFE X 4 PLAT	The program now determines the type status of the drive selected in para. 3.2.7.1g above. The "X" before each status condition can either be an N for "no" or "not" or a blank for "yes". This status information should be checked to insure agreement with the type of drive selected and the switch settings on the rigid disk controller.
i)	UNABLE TO DETERMINE DEVICE TYPE	Will be displayed only if the program is unsuccessful in determining the drive type status due to a controller malfunction. The type status will be defaulted to the following values: READY N–WRTPRT 2200BPI 200TPI FIXED 64SECT 2400RPM N–2PLAT N–SAFE N–4PLAT
j)	PLATTER (N) TEST BOTTOM SURFACE (Y)?	Enter FIELD REL if you want to test the bottom surface of platter N. If the number of platters N specified in para. 3.2.7.h above was greater than 1, then return to 3.2.7.1j above. Note that the platter number N will be incremented for each iteration until N equals the number of platters specified.
k)	PLATTER (N) TEST TOP SURFACE (Y)?	Enter FIELD if you want to test the top surface of platter N.
l)	START CYLINDER (32) =	Select the first cylinder to be tested (0-202 for 100 TPI or 0-405 for 200 TPI), then FIELD REL.
m)	END CYLINDER (64) =	Select the last cylinder to be tested (0-202 for 100 TIP, or 0-405 for 200 TPI), then FIELD REL.
n)	START SECTOR (0) =	Select the first sector to be tested: (0-63) for 84 bytes/sector drive; (0-23) for 512 bytes/sector, 4400 bpi drive; (0-13) for 512 bytes/sector, 2200 bpi drive.
o)	END SECTOR (63) =	Select the first sector to be tested: (0-63) for 84 bytes/sector drive; (0-23) for 512 bytes/sector, 4400 bpi drive; (0-13) for 512 bytes/sector, 2200 bpi drive.
p)	DATA PATTERN 1 (5555) =	Select data pattern 1 (0000-FFFF), then FIELD REL.

	Display	Keyboard Response
q)	DATA PATTERN 2 (AAAA) =	Select data pattern 2 (0000–FFFF), then FIELD REL.
r)	SECTORS TRANSFERRED 64 =	Select the number of sectors to be transferred with each data command (1–64), then FIELD REL.
s)	RD COMMAND =	If this is not done for a new pack, errors will be displayed which are due to the lack of headers on the new pack. ST then FIELD REL to run standard tests. TS then FIELD REL to run test selections. Go to paragraph 3.2.7.2.
t)	DRIVE (1) =	Select the drive number (1–4) then FIELD REL that the standard tests are to be executed on. Note that if a drive is selected for which DR parameters have not been specified starting in paragraph 3.2.7.1h, then the default values will be used for prompts 3.2.7.1j through 3.2.7.1r, and CAUTION DRIVE PARAMETERS DEFAULTED! will be displayed. CAUTION **(W) AFTER THE TEST TITLE INDICATES THAT THE TEST WILL WRITE DATA TO THE DISK. BE CERTAIN TO SAVE THE USER'S DATA THAT IS ON DISK BEFORE EXECUTING THOSE TESTS.**
u)	ANY OTHER DRIVES TO BE TESTED (N)? THE STANDARD TEST SET (0, 1, 3–7) HAS BEEN SELECTED	If no other drives are to be tested, press FIELD REL. If more drives are to be tested, select Y and then FIELD REL. Now, parameters must be set for the other drives to be tested. Go to paragraph 3.2.7.1g.
v)	RD COMMAND =	RT, then FIELD REL.

	Display	Keyboard Response
w)	DX DIRECTIVE =	EX, then FIELD REL.
x)	RIGID DISK TEST IN PROGRESS TEST (number and title) COUNT (number) PROGRESS (number)	At this time, the specific or standard tests will be executed. If there is an error, refer to paragraph 3.2.7.4. If no errors occur, the following prompt will be displayed:
y)	TOTAL ERRORS = 0 DX DIRECTIVE =	EX, then FIELD REL will repeat the tests selected. CL, then FIELD REL will clear all selected tests from memory and the operator may begin testing another logical unit. Go to paragraph 3.2v. CO, then FIELD REL to redefine the DX control options. Go to paragraph 3.2j.

3.2.7.2 Rigid Disk Diagnostic Test Selection Procedure

At this time TS has been selected in the Rigid Disk Diagnostic Test Procedure, paragraph 3.2.7.1s. To execute specific rigid disk test(s) follow the procedure below:

	Display	Keyboard Response
a)	DRIVE (1) =	Select the drive number (1–4) that the specific tests are to be executed on, then FIELD REL. Note that if a drive is selected for which DR parameters have not been set starting in paragraph 3.2.71f above, then the default values will be used for prompts 3.2.7.1d through 3.2.7.1r above, and CAUTION DRIVE PARAMETERS DEFAULTED! will be displayed.
b)	TEST (0) =	Select test number (0–15) to be run, then FIELD REL. Note: If test 15 is selected, refer to paragraph 3.2.7.3 for directions.

	Display	Keyboard Response
c)	COUNT (1) =	Select iteration count then FIELD REL (0–32,767). 0 will cause the test to be skipped. If test 15 was selected in paragraph 3.2.7.2b above, go to paragraph 3.2.7.3.
d)	ANYMORE TESTS (Y)?	If N, then FIELD REL is selected, return to paragraph 3.2.7.1v. If FIELD REL is selected, return to paragraph 3.2.7.2b above. Note that the TEST prompt in paragraph 3.2.7.2b above will have the test number selected incremented by one as the new default value.

3.2.7.3 Rigid Disk Diagnostic Test 15 (Troubleshooting Aid) Procedure

At this time test 15 (troubleshooting aid) has been selected in the Rigid Disk Specified Test Procedure, paragraph 3.2.7.2b.

Note that if the following parameters have been previously selected and a DX DIRECTIVE = CL has not been performed, then some of the following default values will be those that were previously selected.

To execute test 15, follow the procedure below:

	Display	Keyboard Response
a)	TEST 15 TROUBLESHOOTING AID ONLY CMND (XXXX) =	Enter one of the following to specify the command: 0001 for a restore 0002 for a seek 0010 for a write 0011 for a read 0012 for a write zeros 0014 for a verify or read diagnostic 0015 for an initialize 0020 for a start/stop 0030 for a device status then depress FIELD REL command.
b)	DEVICE (XXXX) =	Enter one of the following to specify the device address: 0080: drive 1, bottom platter, bottom surface.

Display	Keyboard Response
	0081: drive 1, bottom platter, top surface. 0082: drive 1, top platter, bottom surface. 0083: drive 1, top platter, top surface. 0040: drive 2, bottom platter, bottom surface. 0041: drive 2, bottom platter, top surface. 0042: drive 2, top platter, bottom surface. 0043: drive 2, top platter, top surface. 0020: drive 3, bottom platter, bottom surface. 0021: drive 3, bottom platter, top surface. 0022: drive 3, top platter, bottom surface. 0023: drive 3, top platter, top surface. 0010: drive 4, bottom platter, bottom surface. 0011: drive 4, bottom platter, top surface. 0012: drive 4, top platter, bottom surface. 0013: drive 4, top platter, top surface. Then, depress FIELD REL.
c) CYLSEC (0000) =	Enter a 16-bit hex value for the cylinder and sector address in the following manner: the most significant 10 bits is the cylinder address (000 is the outer-most cylinder) and the least significant 6 bits is the sector address (000 is the first sector following the index pulse). Then, depress FIELD REL.
d) BLK LEN (0000) =	Enter the two's complement of the hex value of the block length, then depress FIELD REL.

	Display	Keyboard Response
e)	DATA PATTERN 1 (7272) =	Enter the hex value of the data pattern used to fill the data block used by the controller, then depress FIELD REL.
f)	EXP OP STATUS (0000) =	Enter a 16-bit hex value to reflect the expected operation status. Assemble this value in the following manner: • Set the MSB = 1 if one of the following commands will be successfully executed: write, write zeros, initialize, read, verify, read diagnostic (normal end). • Set the second MSB = 1 if the header-data-field read from the disk will not match the header data expected by the RDC (header error). • Set the third MSB = 1 if the CRC read from the disk will not match the generated code during a read or verify command (CRC error). • Set the fourth MSB = 1 if the RDC will not be able to gain access to the main memory in time to stay in sync with the disk (data late). • Set the fifth MSB = 1 if a sector pulse will occur prior to completion of the data operation for that sector (sector overrun). • Set the sixth MSB = 1 if one of the drives (whether selected or not) will detect a malfunction (drive malfunction). • Set the remaining 10 least significant bit equal to zero. Then depress FIELD REL.
g)	EXP DEV STATUS (0000) =	Enter a 16-bit hex value to reflect the expected device status. Assemble this value in the following manner: • Set the MSB = 1 if the drive will be ready. (drive ready). • Set the second MSB = 1 if the drive will be write protected (file protect).

	Display	Keyboard Response
		• Set the third MSB = 1 if the drive will be seeking to the designated cylinder (seeking). • Set the sixth MSB = 1 if the drive has two platters (dual platter). • Set the eighth MSB = 1 if the drive has 406 cylinder (dual track). • Set the remaining bits equal to zero. Then depress FIELD REL.
h)	VRFY OP STATUS (N)?	Enter Y then FIELD REL if you want to verify the operation status, by comparing the actual status with the expected operation status set up in paragraph 3.2.7.3f above. Enter N then FIELD REL if you do not want to verify the operation status.
i)	VEFY DEV STATUS (N)?	Enter Y then FIELD REL if you want to verify the device status by comparing the actual status with the expected device status set up in paragraph 3.2.7.3g above. Enter N then FIELD REL if you do not want to verify the device status.
j)	DELAY MS (0) =	Enter the delay in milliseconds which is to be used in each loop of the program, then depress FIELD REL.
k)	LOOP COUNT (0) =	Enter the decimal number of loops from 0 to 32,767 to be executed, then depress FIELD REL.
l)	TEST 15 TROUBLESHOOTING ONLY XXXX = PROGRAM START ADR XXXX = IOCB ADR XXXX = DATA BUFFER ADR PRESS ANY KEY 3 TIMES TO START	Depress any three keys.
m)	I/O CONTROL BLOCK CONTENTS (XXXX) = XXXX (XXXX) = XXXX (XXXX) = XXXX	This prompt will be displayed only if there was a device or operation status miscompare between the expected and actual status. The values in parentheses

Display	Keyboard Response
(XXXX) = XXXX (XXXX) = XXXX (XXXX) = XXXX (XXXX) = XXXX	are the main memory locations of the control block rungs. The values to the right are the actual contents of each control block rung. The I/O control block consists of eight contiguous memory locations (rungs) as follows: • CB+0: Command • CB+1: Device address • CB+2: Cylinder, sector address • CB+3: (Not used) • CB+4: Data block starting address • CB+5: Data block length • CB+6: Operation status • CB+7: Device status
n) CONTINUE Y/N?	Enter N then FIELD REL if you do not want the program to execute once more. Enter Y then FIELD REL if you do wish to continue. Return to paragraph 3.2.6.3a above. Depress CTRL/BYPASS if you want to terminate test 15. Return to paragraph 3.2 7.2.

3.2.7.4 Rigid Disk Diagnostic Test Error Codes

Table 3-14 below lists the rigid disk diagnostic test error codes, the test numbers failed, brief error descriptions and possible failing hardware modules. For a more detailed explanation of the error messages, see paragraph 3.2.7.5.

Table 3-14. Rigid Disk Diagnostic Test Error Code Summary

Error Code	Test No.	Brief Description	Possible Failure
4001	00	Failure to disable bus drivers.	RDC (rigid disk controller)
4002	00	Mailbox data compare error.	RDC
4003	XX	CRC compare error.	RDC or disk drive

Test 3-14. (Continued)

Error Code	Test No.	Brief Description	Possible Failure
4004	00	RDC status error.	RDC
4005	XX	RDC timeout error.	RDC
4006	XX	Command timeout error.	RDC
4007	XX	Bus timeout when accessing a RDC address.	RDC
4008	XX	Data compare error.	RDC or disk drive
4009	XX	Disk address compare error.	RDC or disk drive
400A	03	Incorrect RDC busy status bit setting.	RDC
400B	XX	Status compare error.	RDC or disk drive
400C	04	Maximum full disk seek time exceeded.	Disk drive
400D	03	Incorrect interrupt pending status bit setting.	RDC
400E	10	No seek complete interrupt.	Disk drive
400F	10	Unexpected seek complete interrupt.	Disk drive
4010	XX	Seeking status error.	Disk drive
4011	10	Must have two or more drives to execute test 10.	Disk drive
4012	01	Internal micro code diagnostic data miscompare.	RDC
4013	04	Surface selection test failure.	Disk drive

3.2.7.5 Rigid Disk (RD) Status Errors

Rigid disk status compare errors occur when the status of the operation does not compare to a predetermined status word. The expected and actual status will be reported in the off-line diagnostic test error message. If the status reported is not specified as controller, drive or operation status, then a general status word is displayed which consists of status bits concerning the disk drive, the controller and the disk operations. The format of this general rigid disk status word is described in Table 3-15.

3.2.7.6 Rigid Disk Diagnostic Test Descriptions

The following information provides a brief description of each test of the rigid disk diagnostics. These tests are explained below on a functional level only. Standard tests are indicated by asterisks.

CAUTION

Note that a "W" after the test title indicates that the test will write data to the disk. Be certain to save the user's data that is on disk before executing those tests.

* Test 0: External Controller Test

This test verifies that the bus drivers function properly, that all controller addresses are accessible, and that the mailbox register is operational.

* Test 1: Internal Controller Test

This test executes the rigid disk controller's internal diagnostic microprogram.

Test 2: Unload/Load Test

This test checks the execution of unload/load command.

* Test 3: Basic Controller/Drive Test (W)

This test verifies that each command executes correctly and that the busy and interrupt pending status bits are set correctly. It tests the controller's ability to set most of the bits of the address bus and tests for correct data transfer from one word to full cylinder word length. This test is executed using end cylinder value specified by the operator.

* Test 4: Seek/Status Error Check (W)

This test verifies that the header error, length check, and seek status bits function correctly. It checks seek timing on a maximum duration seek operation, seek status during a seek operation

Table 3-15. General Rigid Disk Status Word Format

Bit	Description	Reference
(MSB) 0	Drive ready	Drive
1	File protect	Drive
2	Seeking	Drive
3	Seek complete	Controller
4	Seek check	Controller
5	Multi-platter	Device
6	--	--
7	200 TPI	Device
8	Normal end	Operation
9	Header error	Operation
10	CRC error	Operation
11	Data late	Operation
12	Sector overrun	Operation
13	Drive malfunction	Operation
14	Drive address error	Operation
(LSB) 15	Universal bus data error	Controller

and performs a seek damping test. This test performs a full cylinder read/write and a partial sector read/write. It also performs a sequential seek, checks for proper first header data and performs a surface selection check.

Test 5: Seek/Write/Read Test (W)

This test performs sequential seek/write/read operations using operator specified parameters. It checks for correct status after each individual operation and, where application, compares the input and output buffers for data errors.

* Test 6: Random Seek/Read Test (W)

This test performs 1024 random seek reads within the range of the operator specified parameters with block length of one sector. This disk is first initialized with data patterns 1 and 2.

* Test 7: Random Seek/Write/Read Test (W)

This test performs 4096 random seek/write/read operations with random data within the range of the operator specified parameters.

Test 8: Initialize and Verify Test (W)

This test initializes the disk using the initialize with zero command with the range of the operator specified parameters. It then checks with a read diagnostic command for the proper header and data.

Test 9: Verify Disk Data Test

This test verifies that there are no header or CRC errors on the disk. It executes the verify command with a block length equal to a complete cylinder on all cylinders.

Test 10: Overlapped Seeks

This test issues seek and read commands to all drives that are ready. These commands are executed within the range of the parameters specified by the operator for each particular drive. If only one drive has been selected or is ready, the test will be cancelled and an error prompt will be displayed.

Test 11: Repetitive Seek Test

This test performs 1024 seeks between the start and end cylinder specified by the operator. After every 60 seeks an average seek time will be displayed:

```
SEEK OUT TIME = XXXX MS
SEEK BACK TIME = XXXX MS
```

Test 12: Repetitive Restore Test

This test performs 1024 restores.

Test 13: Write (W) Test

This test writes the data specified by the operator onto the disk over the cylinder and sector range specified by the operator.

Test 14: Read Test

This test reads and compares the data specified by the operator from the disk over the cylinder and sector range specified by the operator.

Test 15: Troubleshooting Aid

This test allows the operator to troubleshoot the controller or drive at a basic level. The operator sets up the control block except for the data block starting address rung. He also sets up a loop count and specifies whether he wants to verify the operation and/or the device status. The program is then executed with each loop having the delay selected, looping as many times as selected. While looping, the controller cannot be interrupted and will return control to the operator when the loop count has reached zero. If verification of status was selected and an error occurs the operator may gain control at the time of an error display. When the loop count has gone to zero it will again prompt for the operator to set up the control block. To exit this test CTRL/BYPASS should be entered at any point when the program is in the operator control mode.

3.2.8 MAGNETIC TAPE DIAGNOSTICS (TD)

Paragraph 3.2.8 contains the following information concerning the magnetic tape diagnostics (TD):

- Step-by-step procedures of execution.
- Test error codes.
- Magnetic tape status errors.
- Functional test descriptions.

If a specific function of the magnetic tape drive/tape controller is to be tested, refer to paragraph 3.2.8.7, Magnetic Tape Diagnostic Test Descriptions in order to select the proper test(s) to run.

3.2.8.1 Magnetic Tape Diagnostic Test Procedure

At this point TD has been selected in the Diagnostic Operating Procedure, paragraph 3.2t. To execute the magnetic tape diagnostics, follow the procedure below:

	Display	Keyboard Response
a)	——MAG TAPE DIAG COMMANDS—— DM DISPLAY MENU DR DEFINE DRIVE OPTIONS TS TEST SELECTION UD USER DATA	Press FIELD REL.

	Display	Keyboard Response
	RT RETURN TO DX ST STANDARD TESTS CL CLEAR TEST AND DRIVE SELECTIONS PRESS 'FIELD REL' TO CONTINUE.	
b)	--TAPE TESTS-- TEST 0* CONT REGS TEST 1* INTERNAL DIAG TEST 2* LOOPBACK TEST 3* RESET FUNCTION TEST 4* BASIC OPERATIONS TEST 5* START ADDR/LENGTH TEST 6* CMD TEST 1 (W/R/RFW) * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.
c)	--TAPE TESTS-- TEST 7* CMD TST 2 TEST 8* USER DATA TEST 9* INCREMENTING DATA TEST 10* CHAR PARITY TEST 11* CRC/LRC TEST 12* OFF-LINE TEST 13* RANDOM EXER * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
d)	--TAPE TESTS-- TEST 14 WRITE REEL TEST 15 READ REEL TEST 16 READ USER TAPE TEST 17 CAPSTAN RAMP TEST 18 FLUX GATE TEST 19 HEX DUMP DISPLAY * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.
e)	TESTS 0–3 TEST ONLY THE CONTROLLER TD COMMAND =	DR, then FIELD REL

	Display	Keyboard Response
f)	DRIVE (1) =	At this time the diagnostic tape must be removed, and a scratch tape mounted and brought to the load point. The scratch tape must have a write ring installed. Depress FIELD REL.
g)	DRIVE BUSY – NOT ASSIGNED	Will be displayed only if the busy bit of the controller status register (FF33) is set.
h)	DRIVE STATUS TIMEOUT – NOT ASSIGNED	Will be displayed only if a status request operation fails to terminate within one second.
i)	DRIVE NOT RDY – NOT ASSIGNED	Will be displayed only if the tape drive is not ready. Bring the tape to BOT.
j)	DRIVE NOT ONL – NOT ASSIGNED	Will be displayed only if the tape drive is not on-line. Depress the READY button on the tape drive.
k)	DRIVE FPT	Will be displayed if the file protect bit is set.
l)	DRIVE NOT FPT	Will be displayed if the file protect bit is not set.
m)	7TR	Will be displayed if the data tracks bit is 7 tracks.
n)	9TR	Will be displayed if the data tracks bit is 9 tracks.
o)	NRZ PE	Will be displayed if the format bit is NRZ. Will be displayed if the format bit is PE.

	Display	Keyboard Response
p)	S HEAD D HEAD	Will be displayed if the head type bit is single stack (read or write). Will be displayed if the head type bit is dual stack (read after write).
q)	LO SPD HI SPD	Will be displayed if the drive speed bit is low speed (18.75 ips). Will be displayed if the drive speed bit is high speed (37.5 ips).
r)	ANY MORE DRIVES (Y)?	If yes, select FIELD REL. If no, select N, then FIELD REL and return to paragraph 3.2.8.1e above. Note that DRIVE (2) will be displayed and will be incremented for up to four drives.
s)	TD COMMAND =	ST, then FIELD REL, to run standard tests (0—11,13) TS, then FIELD REL, to run test selections. Go to paragraph 3.2.8.2.
t)	THE STANDARD SET OF TESTS (0—11,13) HAS BEEN SELECTED	UD to specify the data pattern and length to be used by the variable data pattern check (test 08). Go to paragraph 3.2.8.3.
u)	TD COMMAND =	RT, then FIELD REL.
v)	DX DIRECTIVE =	EX, then FIELD REL
w)	TEST 0 (Title of test) COUNT 1	At this time, the specific or standard test(s) will be executed. If there is an error, refer to paragraph 3.2.8.5. If no errors occur, the following prompt will be displayed.
x)	TOTAL ERRORS = 0 DX DIRECTIVE =	EX will repeat the tests selected. Go to paragraph 3.2.8.1w above. CL will clear all selected tests from memory and testing another logical unit can begin. Go to paragraph 3.2v. CO to redefine the DX control options. Go to paragraph 3.2j.

3.2.8.2 Magnetic Tape Diagnostic Test Selection Procedure

At this point TS has been selected in the Magnetic Tape Diagnostic TEst Procedure, paragraph 3.2.8.1s. To execute specific magnetic tape test(s) follow the procedure below:

	Display	Keyboard Response
a)	TEST (0) =	Select test number to be run, then FIELD REL. Note: If test 19 is selected, refer to paragraph 3.2.8.4 for procedure.
b)	COUNT (1) =	Select iteration count (0–32,767) (0 will cause the test to be skipped), then FIELD REL.
c)	END OF TESTS (Y)?	If FIELD REL is selected, return to paragraph 3.2.8.1q. If N then FIELD REL is selected, return to paragraph 3.2.8.2a above. Note that the TEST prompt in paragraph 3.2.8.2a above will have the test number selected incremented by one as the new default value.

3.2.8.3 Magnetic Tape Diagnostic User Data Specification Procedure

At this time UD has been selected in the Magnetic Tape Diagnostic Test Procedure, paragraph 3.2.8.1s. To speicfy user data, follow the procedure below:

	Display	Keyboard Response
a)	PATT WD 1 (FF00) =	Enter the data pattern word (0000–FFFF) to be used by the variable data pattern check (test 08) then FIELD REL.
b)	PATT WD 2 (AA55) =	Enter the data pattern word 2 (0000–FFFF) to be used by the variable data pattern check (test 08) then FIELD
c)	REC LEN (200) =	The hexadecimal entries of pattern words 1 and 2 are used as a repeating four byte data pattern. Enter the number of bytes of the record length to be used in test 08, then FIELD REL.

	Display	Keyboard Response
		Return to paragraph 3.2.8.1s. Now standard or specific tests can be run with the above user data input for test 08.

3.2.8.4 Magnetic Tape Diagnostic Test 19 Procedure

At this time test 19 has been selected in the Magnetic Tape Diagnostic Test Selection Procedure, paragraph 3.2.8.2a. To run this test, follow the procedure below:

	Display	Keyboard Response
a)	MAX BYTE CNT = XXXX	The maximum byte count to be used (0—4096), is diplayed.
b)	DENSITY HI (Y)?	Will be displayed if a 7-track drive is being used. Enter N then FIELD REL to specify 556 bpi density. Enter FIELD REL to specify 800 bpi density.
c)	PARITY ODD (Y)?	Will be displayed if a 7-track drive is used. Enter N then FIELD REL to specify even parity. Enter FIELD REL to specify odd parity.
d)	FM = XXXXX P = YYY D = ZZZ FMC = AAAAA LRC = BBBB	Will be displayed if an NRZI file mark is detected, where: XXXXX is the decimal file mark sequence number. YYY is the expected parity. ZZZ is the expected density. AAAAA is the file mark character read from tape. BBBB is the LRC character read from tape.
e)	FM = XXXXX P = ODD D = 1600	Will be displayed if a PE file mark is detected, where: XXXXX is the decimal file mark sequence number.

	Display	Keyboard Response
f)	REL = XXXXX P = YYY D = ZZZ CRC = ABB LRC = CDD REL LEN = EEEEE FGHHJKK FGHHJKK . . . . CRC = HHMNN LRC = HHPRP	Will be displayed when a NRZI data record is read, where : XXXXX is the decimal record number. YYY is the expected parity. ZZZ is the expected density in bpi. ABB is the CRC character calculated from the data record. CDD is the LRC character calculated from the data record. EEEEE is the decimal number of bytes (record length). FGHHJKK is the diagnostic word input for a data byte. KK is the hexadecimal data word read. HHMNN is the LRC word read from tape.
g)	REL = XXXXX P = ODD D = 1600 REL LEN = YYYYY ZZ ZZ ZZ . . .	Will be displayed when a PE data record is read, where: XXXXX is the decimal record number. YYYYY is the decimal number of bytes (record length) ZZ is the hexadecimal data word read.
h)	LOGICAL EOT	Will be displayed if two file marks are detected in a row.
i)	PHYSICAL EOT XXXXX RECORDS	Will be displayed if the end of the tape mark has been passed, where: XXXXX is the decimal record count in the current file.
j)	BLANK TAPE FOUND	Will be displayed if the diagnostic read command read the maximum byte count.

3.2.8.5 Magnetic Tape Diagnostic Test Error Codes

Table 3-16 below lists the magnetic tape diagnostic test error codes, the test numbers failed, brief error descriptions and possible failing hardware modules.

Table 3-16. Magnetic Tape Diagnostic Test Error Code Summary

Error Code	Test No.	Brief Description	Possible Failure
3001	XX	Operation start error caused by the busy bit in the MTC status register (FF33) set.	MTC (magnetic tape controller)
3002	XX	Operation start error caused by the ready bit in the device status (rung 7) not set.	MTC or tape drive
3003	XX	Operation start error caused by the on-line bit in the device status (rung 7) not set.	MTC or tape drive
3004	XX	Operation start error caused by a status request timeout.	MTC
3005	XX	Operation end error caused by an interrupt timeout.	Tape drive
3006	XX	Operation end error caused by an unexpected interrupt.	Tape drive
3007	XX	Tape status error (see paragraph 3.4.7.4 for more information).	MTC or tape drive
3008	XX	Read data compare error.	MTC or tape drive
3009	XX	Failure of the tape drive to rewind.	Tape drive
3010	00	Mailbox register error.	MTC
3011	03	Setting of the busy bit in the MTC status register (FF33) following a reset and enable operation.	MTC
3012	02	Occurrence of a controller loop back data compare error.	MTC

Table 3-16. (Continued)

Error Code	Test No.	Brief Description	Possible Failure
3013	03	Occurrence of a memory timeout error when performing a reset and enable operation or when reading an MTC register following the reset operation.	MTC
3014	03	No memory timeout error when performing a reset and disable operation or when reading an MTC register following the reset operation.	MTC
3015	07	Write edit error.	Tape drive
3016	07	Erase variable edit error.	Tape drive
3017	07	Erase variable error.	Tape drive
3018	07	Erase fixed error.	Tape drive
3019	XX	Hard error caused by tape operation and retry failure.	Tape drive
3020	XX	Soft error caused by current tape operation failure followed by a successful retry.	Tape drive or tape
3021	XX	Main memory size limitation for two 2048 data buffers.	Main memory size
3022	11	CRC check charcter error.	NRZI tape drive
3023	11	LRC check character error.	NRZI tape drive or magnetic tape
3026	11	File mark error.	MTC or tape drive

3.2.8.6 Magnetic Tape (TD) Status Errors

A magnetic tape status error results when any of the following conditions occur:

- One or more of the bits of the status register (FF33), operation status (rung 6) or device status (rung 7) were not in the condition expected following an operation.
- The ending block length was incorrect.

The format of the status word is described in Table 3-17.

Magnetic tape status errors are identified as an off-line diagnostic error 3007 (reference paragraph 3.2.8.5). The following messages are displayed which contain mnemonics that are explained below.

Table 3-17. Magnetic Tape Drive Status Errors

Bit	Description
(MSB) 0	Indicates that file mark was detected.
1	Indicates that an illegal command was given (e.g. rewind from BOT).
2	Indicates that a single track dropout occurred and was corrected.
3	Indicates a detected parity error or an incorrect file mark.
4	Indicates a detected CRC error (NRZI transport only).
5	Indicates a detected LRC error (NRZI transport only).
6	NRZI Gap Error: Indicates that 2 gaps (on 7-track transports) or 3 gaps (on 9-track transports) of more than 2½ characters were detected after 12 successive characters of proper spacing preceding the first gap. PE Format Error: Indicates any of the following conditions: Ones are detected during the 8-character times following lock on (preamble error, tested across all 9 tracks). • No ones are detected from 8 to 30 character times following lock on and a file mark is not detected (sync error tested across all 9 tracks). • More than one channel loses its envelope signal after lock on and a file mark is not detected.

Table 3-17. (Continued)

Bit	Description
	• More data skew is encountered than the deskewer circuit can accommodate (skew error). • Ones are detected in any track from 0 to 22 character times after the postamble start (postamble error). • Any envelopes are detected from 44 to 66 character times after the postamble start.
7	NRZI Internal Error: Indicates a gap of more than 2½ characters was detected after 12 successive characters of proper spacing preceding the gap. RE Internal Error: Indicates if any envelopes are detected for less than 22 character times prior to lock-on.
8	Indicates a detected character prior to the tape reaching operating speed (NRZI transports only).
9	Indicates that a DMA request is being made while the MTC is performing a DMA.
10	Indicates when a data character is received from the tape transport before the present data character has been processed.
11	Indicates when a data character has not been processed in time to output it to the tape transport.
12	Indicates when the initialization test has failed during the internal diagnostics.
13	Indicates when one of the tape characters for a file mark is incorrect (NZRI transports only).
14	Indicates when a PE ID burst is detected on the tape (PE transports only).

If a MT status error occurs the following message is displayed:

```
MT X STATUS ERROR, TEST YY, OPER ZZ
```

X denotes the drive number (1–4). YY is the diagnostic test number (00–19) where the status error was detected and ZZ is a mnemonic which represents the operation being executed. The operational mnemonics are listed below in Table 3-18.

Table 3-18. TD Operational Mnemonics

Mnemonic	Operation
EE	Erase variable edit
EF	Erase fixed
EV	Erase variable
ID	Internal diagnostic
LB	Data loopback
OF	Off-line
ON	On-line
RC	Read conversion
RD	Read diagnostic
RE	Read reverse edit
RF	Read forward
RW	Rewind
SR	Status request
WC	Write conversion
WE	Write edit
WF	Write forward
WM	Write file mark

If a controller status error (register FF33) occurred the following message will be displayed:

```
CONT (XXXX)  YYY . . . Y
```

XXXX is the hexadecimal contents of the status register (FF33) and YYY . . .Y is the mnemonic(s) that describes the error. Table 3-19 below lists these mnemonics and their meanings.

Table 3-19. TD Controller Status Register Error Mnemonics

Mnemonic	Definition
BSY	Controller was busy when not expected.
N-BSY	Controller not busy when expected.
INTER	An interrupt request was set when an interrupt was not expected.
N-INTER	An interrupt request was not set when an interrupt was expected.
UBUS	A universal bus error occurred.

If an operation status error (rung 6 of the control block) occurred, the following message will be displayed:

```
OPER (XXXX) YY . . . Y
```

XXXX is the hexadecimal contents of the operation status register (rung 6 of the control block) and YYY . . . Y is the mnemonic(s) that describes the error. Table 3-20 below lists these mnemonics and their meanings.

Table 3-20. TD Operation Status Register Error Mnemonics

Mnemonic	Definition
FM	A file mark was found when not expected.
N-FM	A file mark was not found when expected.
ILC	An illegal command was found when not expected.
N-ILC	An illegal command was not found when expected.
CER	A corrected data error occurred (PE drive) when not expected.
N-CER	A corrected data error did not occur (PE drive) when expected.
PER	A parity or file mark data error occurred when not expected.
N-PER	A parity or file mark data error did not occur when expected.
CRC	A CRC character error occurred when not expected.
N-CRC	A CRC character error did not occur when expected.
LRC	An LRC character error occurred when not expected.

Table 3-20. (Continued)

Mnemonic	Definition
N-LRC	An LRC character error did not occur when expected.
GAP	Gap error (NRZI drive) occurrence.
FORM	Format error (PE drive) occurrence.
INT	Internal data spacing error occurrence.
PRE	Pre-record error occurrence.
DMA	DMA overlap error occurrence.
RRE	Read rate error occurrence.
WRE	Write rate error occurrence.
INIT	Selt-test error occurrence.
BFM	Bad file mark error occurrence.
PEID	A PE ID burst was found when not expected.
N-PEID	A PE ID burst was not found when expected.

If a device status error (rung 7 of the control block) occurred, the following message will be displayed:

```
DEV (XXXX) YY . . . Y
```

XXXX is the hexadecimal contents of the device status register (rung 7 of the control block) and YYY . . . Y is the mnemonic(s) that describes the error. Table 3-21 below lists these mnemonics and their meanings.

Table 3-21. TD Device Status Register Error Mnemonics

Mnemonic	Definition
SGL	Drive indicates single stack head when a dual stack head is expected.
N-SGL	Drive indicates dual stack head when a single stack head is expected.
NRZ	Drive indicates NRZ format when PE format is expected.
N-NRZ	Drive indicates PE format when NRZ format is expected.

Table 3-21. (Continued)

Mnemonic	Definition
7TR	Drive indicates 7 track format when 9 track format is expected.
N-7TR	Drive indicates 9 track format when 7 track format is expected.
SPD	Drive indicates high speed when low speed is expected.
N-SPD	Drive indicates low speed when high speed is expected.
DDI	Drive indicates high density when low density is expected.
N-DDI	Drive indicates low density when high density is expected.
ONL	Drive indicates on-line when off-line is expected.
N-ONL	Drive indicates off-line when on-line is expected.
RWD	Drive indicates rewinding when not expected.
N-RWD	Drive does not indicate rewinding when expected.
FPT	Drive is file protected.
LDP	Tape is at load point when not expected.
N-LDP	Tape is not at load point when expected.
RDY	Drive is not ready when expected.
N-RDY	Drive is ready when not expected.
EOT	Tape is at end of tape when not expected.

If the data block length register (rung 5 of the control block) failed to increment correctly by the end of the operation, the following message will be displayed:

```
LENGTH (XXXX) EXP YYYY
```

XXXX is the hexadecimal ending data block length and YYYY is the expected data block length.

The decimal tape record number where the status error occurred is displayed as follows:

```
RECORD NO XXXXX
```

3.2.8.7 Magnetic Tape Diagnostic Test Description

The following information provides a brief description of each test of the magnetic tape diagnostics. These tests are explained below on a functional level only. Standard tests are indicated by asterisks.

* Test 0: Controller Register Test

  This test verifies that the mailbox register (FF31) functions correctly.

* Test 1: Controller Internal Diagnostic Test

  This test executes the magnetic tape controller's internal diagnostic microprogram.

* Test 2: Data Loop Back Test

  This test uses the MTC's data loop back operation to verify the controller's data path, character parity generation and DMA memory logic. Note that this function is internal to the MTC and that no drive actions are performed.

* Test 3: Reset Function Test

  This test verifies the reset function by a write to location FF30.

* Test 4: Basic Operations Test

  This test verifies the write, read forward, and rewind functions.

* Test 5: Data Block Starting Address/Data Block Length Test

  This test verifies the proper operation of the data block starting address (rung 5) location of the control block.

* Test 6: Command Test 1 — Write/Read/Rewind

  This test verifies the operation of the write, write file mark, read forward, read reverse, and rewind commands.

* Test 7: Command Test 2 — Erase/Edit

  This test verifies the operation of the write edit, read reverse edit, erase fixed, erase variable, and erase variable edit commands.

* Test 8: User Defined Data Test

  This test checks the data transfer capabilities of the MTC and tape drives by use of the user defined data (UD) parameters. Four bytes of the specified 8-bit pattern words 1 and 2 of the specified record length are written onto tape and then compared.

* Test 9: Incrementing Data Pattern Test

This test verifies the conversion mode of the MTC for all drives (high density 9-track drives and low density 7-track drives). The data pattern is initially 00 and is incremented by one through FF. The total record length is 257 bytes.

* Test 10: Character Parity Test

This test verifies the character parity generation and check circuitry by forcing all possible odd parity errors.

* Test 11: CRC/LRC Check Characters and File Mark Bit Patterns Test

This test uses the read diagnostic forward command to verify the CRC and LRC check character logic and the NRZI file mark bit pattern logic in the MTC. Both the CRC and LRC check characters are verified on 9-track NRZI drives. Only the LRC check character is verified on 7-track NRZI drives (these drives do not use a CRC). No check characters are employed in the 9-track PE format.

Test 12: Off-Line Test

This test checks the off-line command of the tape controller and drives. The message PLACE DRIVE ON-LINE will be displayed, and the operator must depress the ON-LINE push button on the tape drive.

* Test 13: Random Data Exerciser Test

This test verifies normal data transfer operations by simulation of system operation. Each operation is performed on all drives selected prior to the next operation being started.

Test 14: Write Compatibility Tape Test

This test writes a full reel of pseudorandom data which may be read by test 15 to insure compatibility between similar tape drives. Each operation is performed on all selected tape drives prior to the next operation being started.

Test 15: Read Compatibility Tape Test

This test reads forward a full reel of pseudorandom data which was written by test 14. This may be used to verify compatibility between similar tape drives. Each operation is performed on all selected tape drives prior to the next operation being started.

Test 16: Status Check Read Customer's Tape Test

This test reads forward to EOT or two file marks. A complete status check is performed after each read forward operation but the data is not verified. The number of records in each file is displayed.

Test 17: Capstan Ramp Adjustment Test

This test starts and stops the tape drive capstan motor to allow the technician to check and adjust the start/stop ramp generators. No errors are output for this test.

Test 18: Flux Gate Adjustment Test

This test is designed to allow mechanical adjustment of the tape head's flux gate with the tape mounted so as not to pass over the capstan wheel or the tape head.

Test 19: Hexadecimal (Read Diagnostic) Tape Display Test

This test reads any reel of magnetic tape and displays the data in a hexadecimal format. The Diagnostic Forward read command is used for NRZI tapes and the character spacing, character parity and record check characters (CRC and LRC) are checked and displayed. A normal read is used for PE tapes and a simple hexadecimal dump of each record is performed.

3.2.9 EXECUTIVE PROCESSOR UNIT DIAGNOSTICS (XP)

Paragraph 3.2.9 contains the following information concerning the executive processor unit diagnostics (XP):

- Step-by-step procedures of operation.
- Test Error Codes.
- Functional test descriptions.

If a specific function of the XPU is to be tested, refer to paragraph 3.2.9.4, Executive Processor Diagnostic Test Descriptions, in order to select the proper test(s) to run.

3.2.9.1 Executive Processor Unit Diagnostic Test Procedure

At this point, XP has been selected in the Diagnostic Operating Procedure, paragraph 3.2v. To execute the XPU diagnostics, follow the procedure below: Note: the message XP IS ONLY FOR TESTING THE XPU1 will appear on systems using XPU2.

	Display	Keyboard Response
a)	XPU DIAGNOSTICS V( ) DATE PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.
b)	TS TEST SELECTION ST STANDARD TEST SET SELECTION DM DISPLAY TEST DESCRIPTION MENU RT RETURN TO DIAGNOSTIC CONTROL CL CLEAR TEST SELECTIONS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
c)	TEST 0* GROUP 1 MEM REF SHORT FORM INST TEST 1* GROUP 1 MEM REF LONG FROM INST TEST 2* GROUP 2 MEM REF SHORT FORM INST TEST 3* GROUP 2 MEM REF LONG FORM INST TEST 4* GROUP 3 MEM REF INST TEST 5* CONDITIONAL BRANCH INSTRUCTIONS	Press FIELD REL.

	Display	Keyboard Response
	TEST 6* INTER-REGISTER INSTRUCTIONS * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	
d)	TEST 7* SHIFT INSTRUCTIONS TEST 8* OVERLAY INSTRUCTIONS TEST 9* CONTROL INSTRUCTIONS TEST 10* PSW/INTERRUPT TEST * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.
e)	XP COMMAND =	ST, then FIELD REL to run standard tests (0–10). TS, then FIELD REL to run test selections. Go to paragraph 3.2.9.2.
f)	THE STANDARD SET OF TESTS (1–10) HAS BEEN SELECTED	
g)	EXTENDED DATA TEST PATTERNS (Y)?	If FIELD REL is selected, the tests will be executed using 25 data test patterns. Note that this will cause the execution of the standard tests to run for approximately 15–18 minutes. If N, then FIELD REL is selected, the tests will be executed using the normal 10 data test patterns.
h)	XP COMMAND =	RT, then FIELD REL.
i)	DX DIRECTIVE =	EX, then FIELD REL. At this time the specific or standard test(s) will be executed. If there is an error, refer to paragraph 3.2.9.3. If no errors occur, the following prompt will be displayed:
j)	TOTAL ERRORS = 0 DX DIRECTIVE =	EX will repeat the tests selected. CL will clear all selected tests from memory and the operator may begin

	Display	Keyboard Response
		testing another logical unit. Go to paragraph 3.2v. CO to define the DX control options. Go to paragraph 3.2j.

3.2.9.2 Executive Processor Unit Test Selection Procedure

At this time TS has been selected in the Executive Processor Unit Diagnostic Test Procedure, paragraph 3.2.9.1e. To execute the specific XPU diagnostic test(s) follow the procedure below:

	Display	Keyboard Response
a)	TEST (0) =	Select test number to be run, then FIELD REL.
b)	COUNT (1) =	Select iteration count (0—32,767) (0 will cause the test to be skipped), then FIELD REL.
c)	EXTENDED DATA TEST PATTERNS (Y)?	If FIELD REL is selected, the tests will be executed using 25 data test patterns. If N, then FIELD REL is selected, the tests will be executed using the normal 10 data test patterns.
d)	ANYMORE TESTS (Y)?	If N then FIELD REL is selected, return to paragraph 3.2.9.1h. If FIELD REL is selected return to paragraph 3.2.9.2a above. Note that the TEST prompt in paragraph 3.2.9.2a above will have the test number incremented by one as the new default value.

3.2.9.3 Executive Processor Unit Diagnostic Test Error Codes

Table 3-21 below lists the XPU diagnostic test error codes, the test number failed, brief error descriptions and possible failing hardware modules.

Table 3-22. Executive Processor Unit Diagnostic Test Error Code Summary

Error Code	Test No.	Brief Description	Possible Failure
0000–000F	00	Group 1 memory reference short form instruction error.	XPU
0100–010F	01	Group 1 memory reference long form instruction error.	XPU
0200–020F	02	Group 2 memory reference short form instruction error.	XPU
0300–030F	03	Group 2 memory reference long form instruction error.	XPU
0400–0407	04	Group 3 memory reference instruction error.	XPU
0500–050F	05	Conditional branch instruction error.	XPU
0600–060F	06	Inter-register instruction error.	XPU
0700–070E	07	Shift instruction error.	XPU
0800–0805	08	Overlay instruction error.	XPU
0900–090F	09	Control instruction error.	XPU
0A00	10	PSW compare error.	XPU
0A01	10	No trace interrupt occurrence.	XPU
0A02	10	Trace PSW compare error.	XPU
0A03	10	Missing interrupt.	XPU
0A04	10	Unexpected interrupt.	XPU
0A05	10	Interrupt sequence error.	XPU
0A06	10	No reserved instruction interrupt.	XPU

3.2.9.4 Executive Processor Unit Diagnostic Test Descriptions

The following information provides a brief description of each test of the XPU diagnostics. These tests are explained below on a functional level only. Standard tests are indicated by asterisks.

* Test 0: Group 1 Memory Reference Short Form Instructions Test

This test executes and verifies the sixteen group 1 memory reference short form instructions.

* Test 1: Group 1 Memory Reference Long Form Instructions Test

This test executes and verifies the sixteen group 1 memory reference long form instructions.

* Test 2: Group 2 Memory Reference Short Form Instructions Test

This test executes and verifies the sixteen group 2 memory reference short form instructions.

* Test 3: Group 2 Memory Reference Long Form Instructions Test

This test executes and verifies the sixteen group 2 memory reference long form instructions.

* Test 4: Group 3 Memory Reference Instructions Test

This test executes and verifies the group 3 memory reference instructions.

* Test 5: Conditional Branch Instructions Test

This test executes and verifies the sixteen conditional branch instructions.

* Test 6: Inter-Register Instructions Test

This test executes and verifies the sixteen inter-register instructions.

* Test 7: Shift Instructions Test

This test executes and verifies the fourteen shift instructions.

* Test 8: Overlay Instructions Test

This test executes and verifies the six overlay instructions. The overlay service interrupt, stack service interrupt and the clock interrupt are also tested.

* Test 9: Control Instructions Test

This test executes and verifies the control instructions.

* Test 10: PSW/Interrupt Test

This test checks all the bit positions of the PSW. It also tests the trace function and the interrupt priority scheme with six different interrupt levels. This test also checks the reserved instructions to ensure that they cause a reserve instruction interrupt.

3.2.10 EXECUTIVE PROCESSOR UNIT 2 DIAGNOSTICS (XQ)

This paragraph provide the following executive processor unit 2 diagnostic (XQ) information:

- Step-by-step procedures of operation.
- Test error codes.
- Functional test descriptions.

If a specific function of the XPU2 is to be tested, refer to Executive Processor Unit 2 diagnostic test descriptions, paragraph 3.2.10.4, to select the proper tests.

3.2.10.1 XPU 2 Diagnostic Test Procedure

At this point XQ has been selected in the diagnostic operating procedure, paragraph 3.2v. Execute the XPU2 diagnostics as follows. Note: the message XQ IS ONLY FOR TESTING THE XPU2 will appear on systems using XPU1.

	Display	Keyboard Response
a)	XPU2 DIAGNOSTICS V( ) DATE PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
b)	TS TEST SELECTION ST STANDARD TEST SET SELECTION DM DISPLAY TEST DESCRIPTION MENU RT RETURN TO DX CL CLEAR TEST SELECTIONS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.
c)	TEST 0* GROUP 1 MEM REF SHORT FORM INSTR TEST 1* GROUP 1 MEM REF LONG FORM INSTR TEST 2* GROUP 2 MEM REF SHORT FORM INSTR	Press FIELD REL.

	Display	Keyboard Response
	TEST 3* GROUP 2 MEM REF SHORT FORM INSTR TEST 4* GROUP 3 MEM REF INSTR TEST 5* CONDITIONAL BRANCH INSTRUCTIONS TEST 6* INTER-REGISTER INSTRUCTIONS * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	
d)	TEST 7* SHIFT INSTRUCTIONS TEST 8* MAPPING TEST 9* CONTROL INSTRUCTIONS TEST 10* PSW/INTERRUPT TEST TEST 11* SWITCH POSITIONS * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.
e)	XQ COMMAND =	ST, then FIELD REL, to run standard tests (0–10) TS, then FIELD REL, to run test selection. (Go to paragraph 3.2.10.2.)
d)	THE STANDARD SET OF TESTS (0–10) HAS BEEN SELECTED	
e)	EXTENDED DATA TEST PATTERNS (Y)?	If FIELD REL is selected, the tests will be executed using 25 data test patterns. Note that this will cause the execution of the standard tests to run for approximately 15–18 minutes. If N, then FIELD REL is selected, the tests will be executed using the normal 7 data test patterns.
f)	XQ COMMAND =	RT, then FIELD REL.
g)	DX DIRECTIVE =	Ex, then FIELD REL. At this time the specific or standard tests will be executed. If there is an error, refer to paragraph 3.2.10.3. If

	Display	Keyboard Response
		no errors occur, the step j prompt will be displayed.
h)	TOTAL ERRORS = 0 DX DIRECTIVE =	EX will repeat the tests selected. CL will clear all selected tests from memory and the operator may begin testing another logical unit. Go to paragraph 3.2v. CO to redefine the DX control options; go to paragraph 3.2j.

3.2.10.2 XPU 2 Test Selection Procedure

At this time TS has been selected in the executive processor unit diagnsotic test procedure, paragraph 3.2.10.1e. Execute the specific XPU2 diagnostic tests as follows:

	Display	Operator Action
a)	TEST (0) =	Select test number to be run, then FIELD REL.
b)	COUNT (1) =	Select iteration count (0-32,767; 0 will cause the test to be skipped) then FIELD REL.
c)	EXTENDED DATA TEST PATTERNS (Y)?	If Y then FIELD REL is selected, the tests will be executed using 25 data test patterns. If N then FIELD REL is selected, the tests will be executed using the normal 7 data test patterns.
d)	ANYMORE TESTS (Y)?	If N then FIELD REL is selected, return to paragraph 3.2.10.1f. If FIELD REL is selected, return to step a of this procedure. Note that the TEST prompt will have the test number incremented by one as the new default value.

3.2.10.3 XPU2 Diagnostic Test Error Codes

Table 3-23 lists the XPU2 diagnostic test error codes, the test number failed, brief error descriptions and possible failing hardware modules.

3.2.10.4 XPU2 Diagnostic Test Descriptions

Following is a brief functional description of each XPU2 diagnostic test; standard tests are indicated by asterisks.

* Test 0: Group 1 Memory Reference Short Form Instructions Test – Executes and verifies the sixteen group 1 memory reference short form instructions.

* Test 1: Group 1 Memory Reference Long Form Instructions Test – Executes and verifies the sixteen group 1 memory reference long form instructions.

* Test 2: Group 2 Memory Reference Short Form Instructions Test – Executes and verifies the fifteen group 2 memory reference short form instructions.

* Test 3: Group 2 Memory Reference Long Form Instructions Test – Executes and verifies the fifteen group 2 memory reference long form instructions.

* Test 4: Group 3 Memory Reference Instructions Test – Executes and verifies the group 3 memory reference instructions.

* Test 5: Conditional Branch Instructions Test – Executes and verifies the sixteen conditional branch instructions.

* Test 6: Inter-Register Instructions Test – Executes and verifies the twenty-four inter-register instructions.

* Test 7: Shift Instructions Test – Executes and verifies the fourteen shift instructions.

* Test 8: Mapping Test – Executes and verifies all aspects of mapping including the mapping registers, fault interrupts and mapped MOVB instructions.

* Test 9: Control Instructions Test – Executes and verifies the control instructions.

* Test 10: PSW/Interrupt Test – Checks all the bits of the PSW. It also tests the trace function and the interrupt priority scheme with nine different interrupt levels. This test also checks the reserved and privileged instructions to insure that they cause reserve and privileged instruction interrupts.

Test 11: Switch Positions Test – Checks the COPA instruction and displays the setting of the sixteen switches.

Table 3-23. Executive Processor Unit 2 Diagnostic Test Error Code Summary

Error Code	Test No.	Brief Description	Possible Failure
0000–000F	00	Group 1 memory reference short form instruction error.	XPU2
0100–010F	01	Group 1 memory reference long form instruction error.	XPU2
0200–020E	02	Group 2 memory reference short form instruction error.	XPU2
0300–0310	03	Group 2 memory reference long form instruction error.	XPU2
0400–040D	04	Group 3 memory reference instruction error.	XPU2
0500–050F	05	Conditional branch instuction error.	XPU2
0600–0617	06	Inter-register instruction error.	XPU2
0700–070B	07	Shift instruction error.	XPU2
0800–080C	08	Mapping error.	XPU2 or memory
0900–0910	09	Control instruction error.	XPU2
0A00	10	PSW compare error.	XPU2
0A01	10	No trace interrupt occurrence.	XPU2
0A02	10	Trace PSW compare error.	XPU2
0A03	10	Missing interrupt.	XPU2
0A04	10	Unexpected interrupt.	XPU2
0A05	10	Interrupt sequence error.	XPU2
0A06	10	No reserved instruction interrupt.	XPU2
0A07	10	No privileged instruction interrupt.	XPU2
0B00	XX	Stack content error.	XPU2

3.2.11 CARD READER DIAGNOSTICS (CR)

Paragraph 3.2.11 contains the following information concerning the card reader diagnostics (CR):

- Step-bystep procedures of execution.
- Test deck descriptions.
- Test error codes.
- Functional test descriptions.

If a specific function of the card reader/CRDC is to be tested, refer to paragraph 3.2.11.5, Card Reader Diagnostic Test Descriptions in order to select the proper test(s) to run.

3.2.11.1 Card Reader Diagnostic Test Procedures

At this point, CR has been selected in the Diagnostic Operating Procedure, 3.2t. To execute the card reader diagnostics, follow the procedure below:

	Display	Keyboard Response
a)	CR DIAGNOSTIC V(XXX) date ——CR DIAGNOSTIC COMMANDS—— TS TEST SELECTION RT RETURN TO DX ST STANDARD TEST SET SELECTION DM DISPLAY TEST DESCRIPTION MENU CL CLEAR TEST SELECTIONS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.
b)	——CARD READER TESTS—— TEST 0* ENABLE, DISABLE BUS DRIVERS TEST 1* MEMORY ADDRESS TEST TEST 2* STATUS TEST TEST 3* BINARY SIMULATE TEST TEST 4* HOLLERITH SIMULATE TEST TEST 5* RESERVED COMMAND AND ILLEGAL CODE TEST TEST 6 STANDARD HOLLERITH CARD TEST (RDR) * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.

	Display	Keyboard Response
c)	CARD READER TESTS TEST 7 WORST CASE CARD TEST (RDR) TEST 8 TROUBLESHOOTING AID (RDR-OPT) TEST 9 ALIGNMENT AID (RDR) * = STANDARD TESTS PRESS 'FIELD REL' TO CONTINUE	
d)	TESTS 0-5 TEST ONLY THE THE CONTROLLER CR COMMAND =	Enter ST, then FIELD REL, to select the standard tests (0—5).
e)	THE STANDARD TEST SET (0—5) HAS BEEN SELECTED	Enter TS, then FIELD REL, to select specific tests. Go to paragraph 3.2.11.2.
f)	CR COMMAND =	Enter RT, then FIELD REL.
g)	DX DIRECTIVE =	Enter EX, then FIELD REL to begin test. If no errors occur, the following prompt will be displayed after completion of the test. If there is an error, refer to paragraph 3.2.11.6.
h)	TOTAL ERRORS = 0 DX DIRECTIVE =	Enter EX, then FIELD REL, to repeat the tests selected. Enter CL, then FIELD REL, to clear all selected tests from memory. The operator may begin testing another hardware unit. Go to paragraph 3.2v.

3.2.11.2 TS — Test Selection

At this time TS has been selected in the Card Reader Diagnostic Test Procedure, paragraph 3.2.11.1.d. To run this test, observe the following prompts and directives.

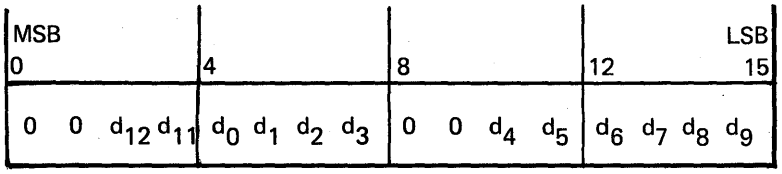
	Display	Keyboard Response
a)	TEST (0) =	Enter the test number to be run (0—9) then depress FIELD REL.

	Display	Keyboard Response
b)	COUNT (1) =	Enter the iteration count (0–32,767) then FIELD REL. Note that 0 will cause the test to be skipped.
c)	ANYMORE TESTS (Y)?	If there are more tests to be selected, depress FIELD REL and return to step a above. Note that this prompt will have the test number incremented by one as the new default value. If no more tests are to be selected, press FIELD REL. NOTE: Several of the non-standard tests (6–7) require subdecks of cards (P/N 600648-203-01) punched in a certain fashion. The description of these subdecks is in paragraph 3.2.11.4. The following lists the subdecks which are required in these tests: Test 6: subdecks 0–3 Test 7: subdecks 4–9 (subdeck 9 is optional) Subdecks are to be separated by a control separator card, which is also described in 3.2.11.4. If tests 6 or 7 are to be run, place the required subdecks in the card reader hopper. If tests 8 or 9 are to be run, refer to the following paragraphs for details.
d)	CR COMMAND =	Enter RT, then FIELD REL.
e)	DX DIRECTIVE =	Enter EX, then FIELD REL, to begin test. If no errors occur, the following prompt will appear after completion of tests. If there is an error, refer to paragraph 3.2.11.6.
f)	TOTAL ERRORS = 0	Enter EX, then FIELD REL to repeat tests. Enter CL, then FIELD REL.

3.2.11.3 Card Reader Diagnostic Test 8 (Troubleshooting Aid) Procedure

At this time test 8 (troubleshooting aid) has been selected in the Card Reader Test Selection Procedure, paragraph 3.2.11.2a. To execute this test, follow the procedure below:

	Display	Keyboard Response
a)	STARTING MEMORY ADR (XXXX) =	Enter the four-digit hexadecimal main memory address where the card reader controller is to begin storing the data, then FIELD REL. Note that the diagnostic program memory is protected and cannot be written into.
b)	DATA PATTERN (XXXX) =	Enter the initial binary data pattern to be used in the first column of the first card, then FIELD REL. The format of this 16-bit word:



where d_n is the data bit from card row n.

Note that if an illegal Hollerith data character is selected and the Hollerith mode is selected in (h) below, status and data errors will occur.

c)	INCR PATTERN (N)	Depress FIELD REL if the word selected in (b) above is not to be incremented. This should be selected if the word selected is to be read indefinitely. Enter Y then FIELD REL if the word specified in (b) above is to be the first word and each additional column is to be incremented from there. Note that if the Hollerith mode is selected in (h) below, only legal Hollerith patterns will be used.
d)	CARD SIZE (80) =	Enter the number of columns per card to be read or simulated (1–80) then FIELD REL.

	Display	Keyboard Response
		If all 80 columns of a standard IBM card are to be read, depress FIELD REL.
e)	COMPARE STATUS (Y)	Depress FIELD REL if verification of status is required. Otherwise enter N, then FIELD REL.
f)	COMPARE DATA (Y)	Depress FIELD REL if data verification is required. Otherwise, enter N, then FIELD REL.
g)	SIMULATE CARD READS (Y)	If card reads are to be simulated by the system, that is, the data pattern specified in steps (b) and (c) above are used in the simulation and are the expected values, then depress FIELD REL. If real cards are to be used, enter N then FIELD REL. Place the cards as specified above into the card reader hopper if real cards are to be used.
h)	READ BINARY (Y)	Depress FIELD REL if the binary mode is to be used. Enter N then FIELD REL if the Hollerith mode and EBCDIC translation is to be used. Return to paragraph 3.2.11.1g.

3.2.11.4 Card Reader Diagnostic Test 9 (Alignment Aid) Procedure

At this time test 9 (alignment aid) has been selected in the Card Reader Test Selection Procedure, paragraph 3.2.11.4a. To exeucte this test, follow the procedure below:

	Display	Keyboard Response
a)	THE FIRST CARD READ BECOMES THE EXPECTED VALUE, ALL FOLLOWING CARDS ARE COMPARED TO IT. IF A SEPARATOR CARD IS READ (PUNCH 11, 1 AND 9 IN COLUMN 15) THEN THE NEXT CARD BECOMES THE EXPECTED VALUE.	Depress FIELD REL.

	Display	Keyboard Response
b)	DELAY BETWEEN CARDS (N)	Depress FIELD REL if no delay is desired between card reads. Enter Y then FIELD REL if a delay is desired.
c)	DELAY COUNT (00000)	Enter the delay in milliseconds between card reads (0—32,767 ms) then depress FIELD REL.
d)	LOG CARDS (N)	Place the cards into the card reader hopper as explained in the test 9 description in paragraph 3.2.11.6. Depress FIELD REL if the expected column numbers and binary data values are not to be logged. Enter Y then FIELD REL if the expected column and binary data values are to be logged. Return to paragraph 3.2.11.1f.

3.2.11.5 Test Desk Description

If both tests 6 and 7 are to be run consecutively, the entire test deck (P/N 600648-203-01) must be placed in the card reader hopper. The test deck is composed of ten subdecks (0—9). Test 6 requires subdecks 0—3 and test 7 calls for subdecks 4—8 (9 is optional).

Subdecks 0—4 are groups of 99 identical cards. Subdeck 5 is composed of 10 subsubdecks with 9 identical cards each. Subdecks 6—9 are groups of 99 identical cards. Each subdeck or subsubdeck is preceded by a separator control card shown in Figure 3-21. Figure 3-1 shows the order of the subdecks and Figures 3-2 through 3-20 show the hole patterns for each subdeck and subsubdeck.

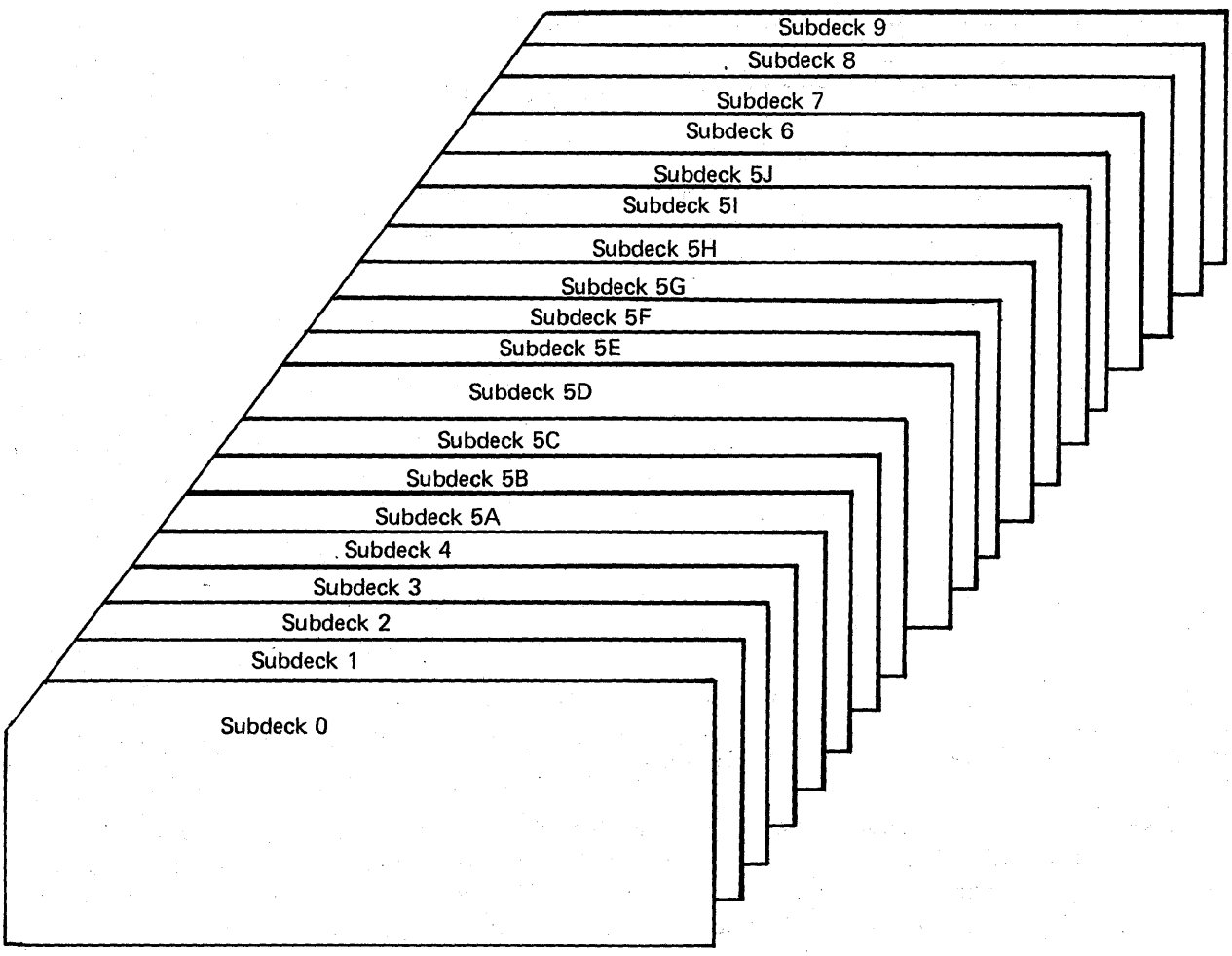


Figure 3-1. Entire Test Deck (tests 6–7)

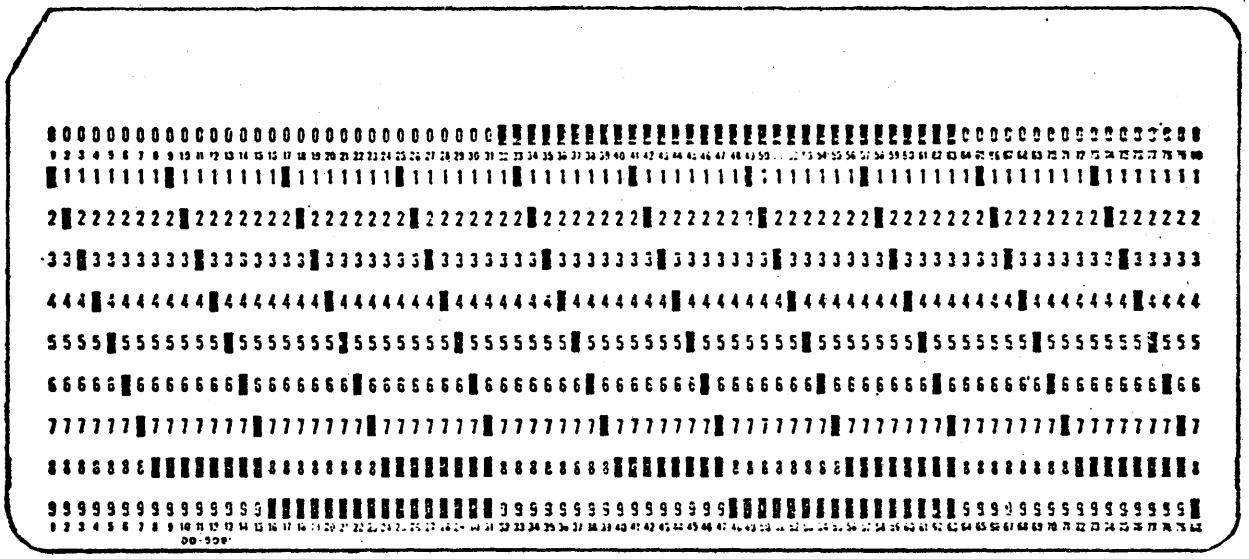


Figure 3-2. Subdeck 0 (test 6) — All valid Hollerith combinations with no holes punched in rows 11 and 12 (99 cards).

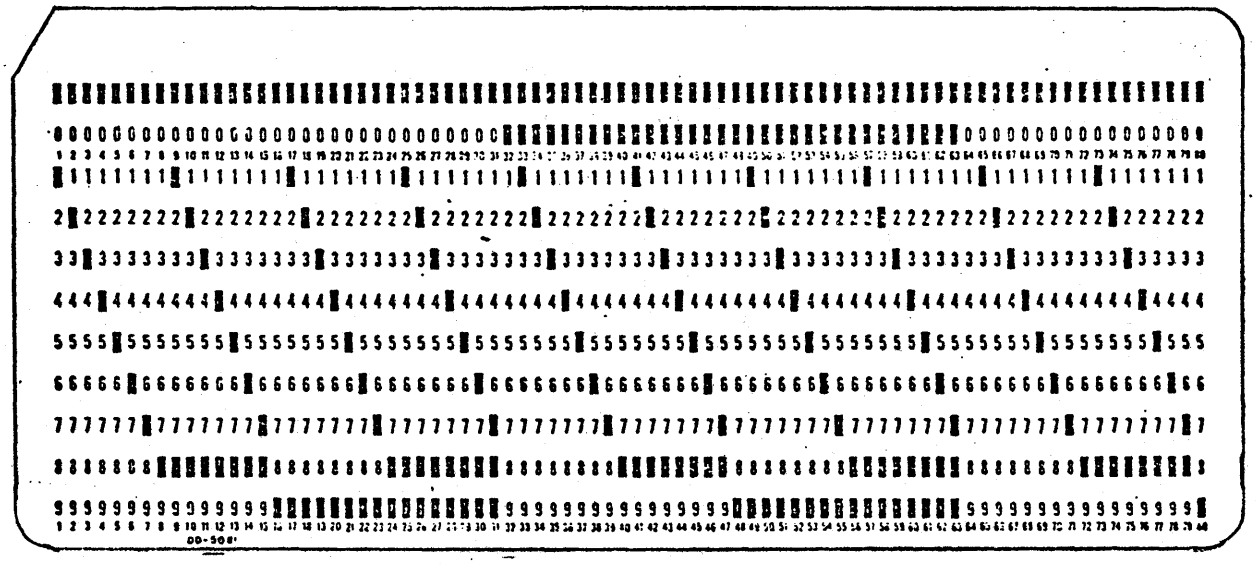


Figure 3-3. Subdeck 1 (test 6) — All valid Hollerith combinations with holes punched in row 11 but none in row 12 (99 cards).

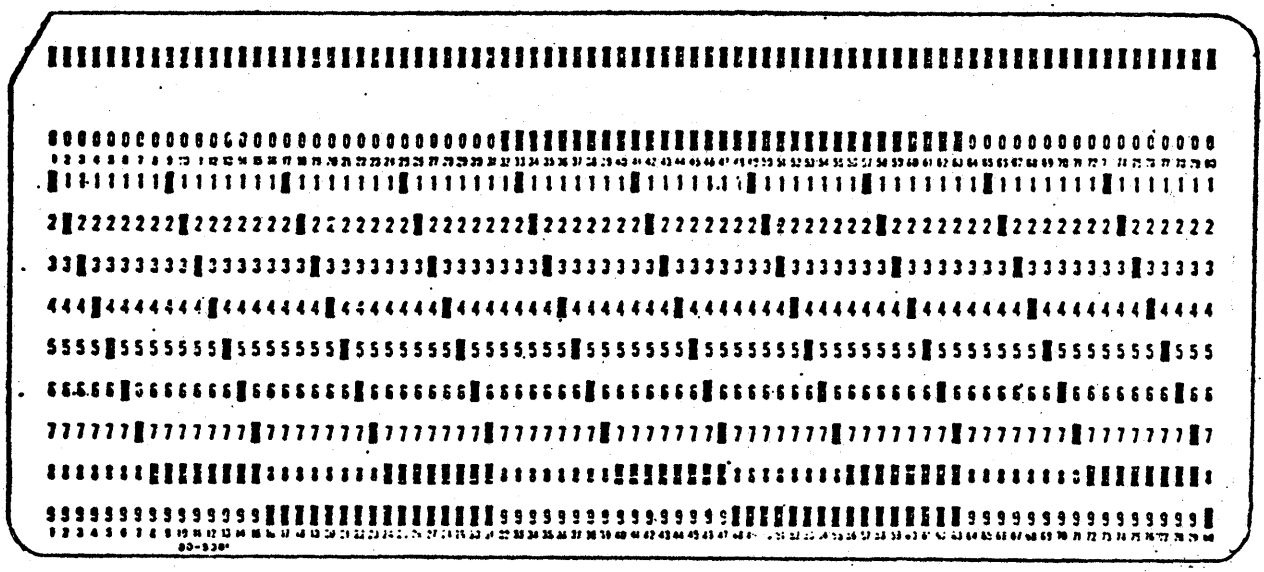


Figure 3-4. Subdeck 2 (test 6) — All valid Hollerith combinations with holes punched in row 12 but none in row 11 (99 cards).

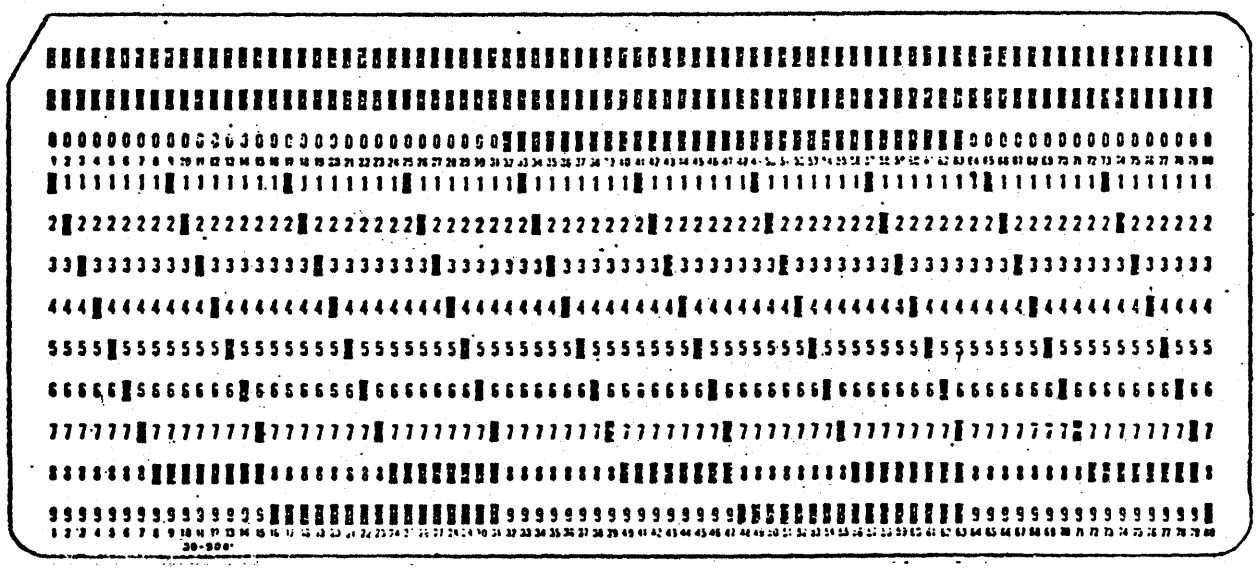


Figure 3-5. Subdeck 3 (test 6) — All valid Hollerith combinations with holes punched in rows 11 and 12 (99 cards).

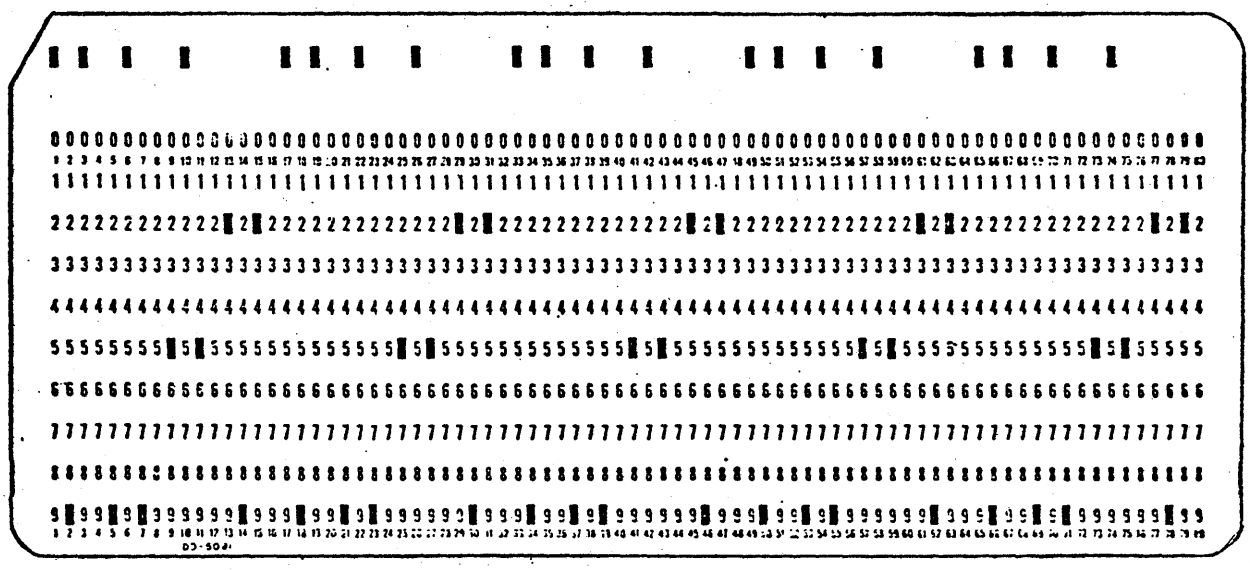


Figure 3-6. Subdeck 4 (test 7)
Worst case skew pattern (99 cards).

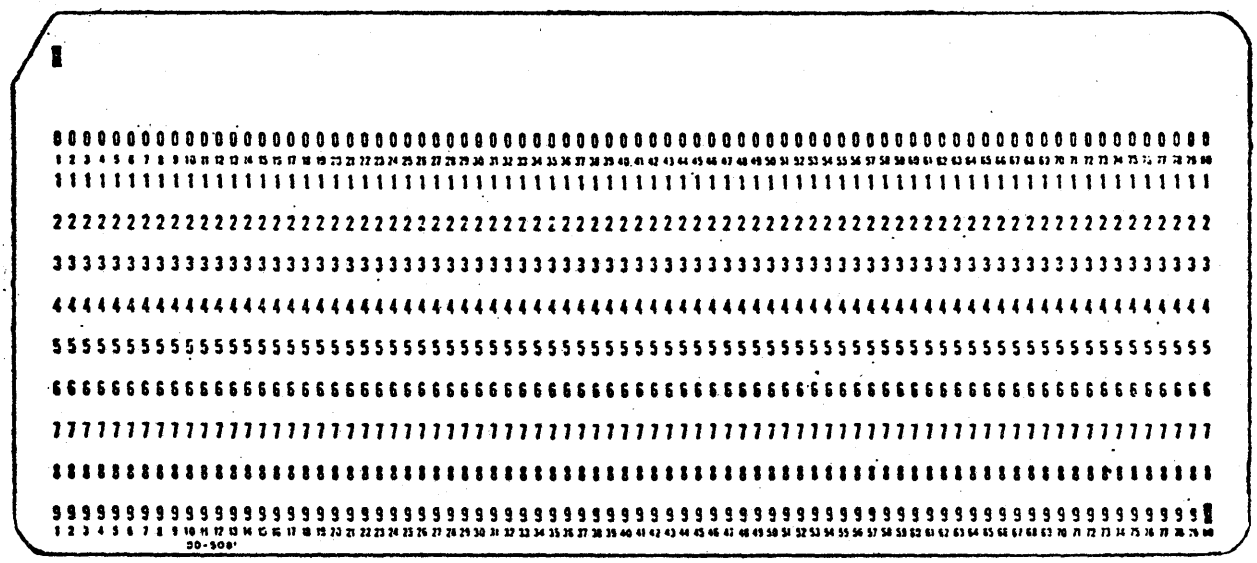


Figure 3-7. Subsubdeck 5A (test 7)
Worst case resync pattern (9 cards).

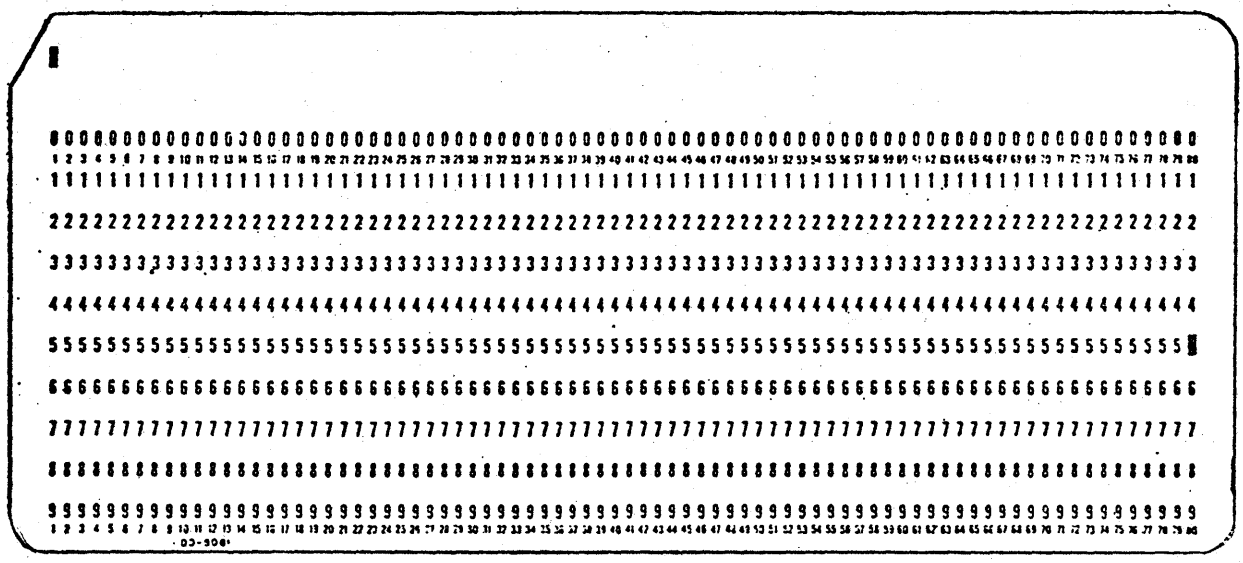


Figure 3-8. Subsubdeck 5B (test 7)
Worst case sync pattern (9 cards).

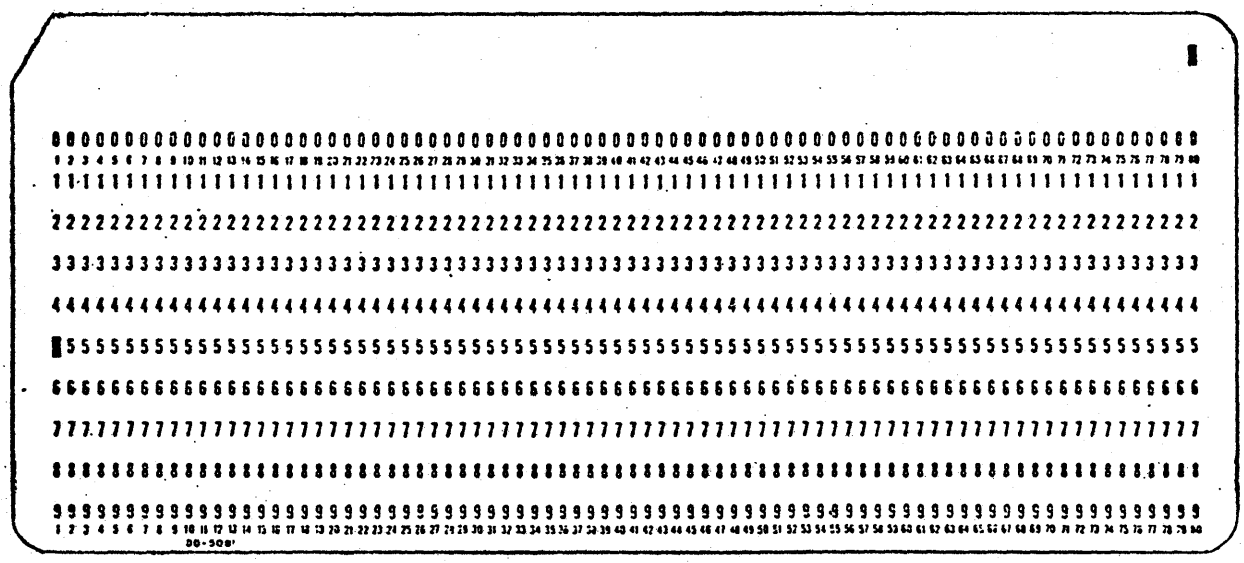


Figure 3-9. Subsubdeck 5C (test 7)
Worst case sync pattern (9 cards).

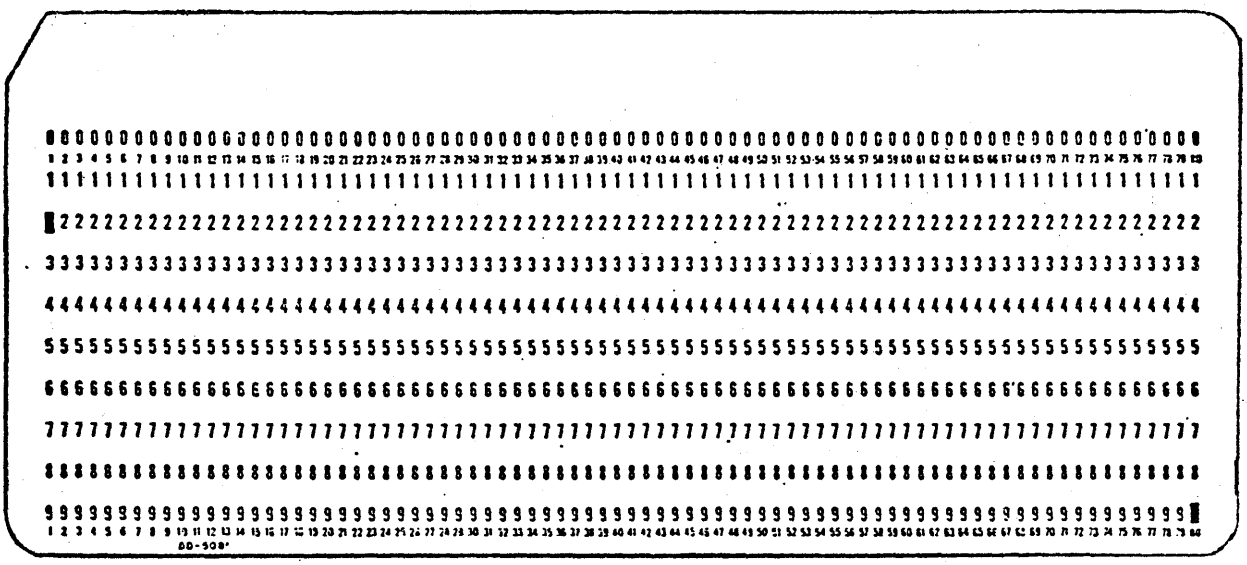


Figure 3-10. Subsubdeck 5D (test 7)
Worst case resync pattern (9 cards).

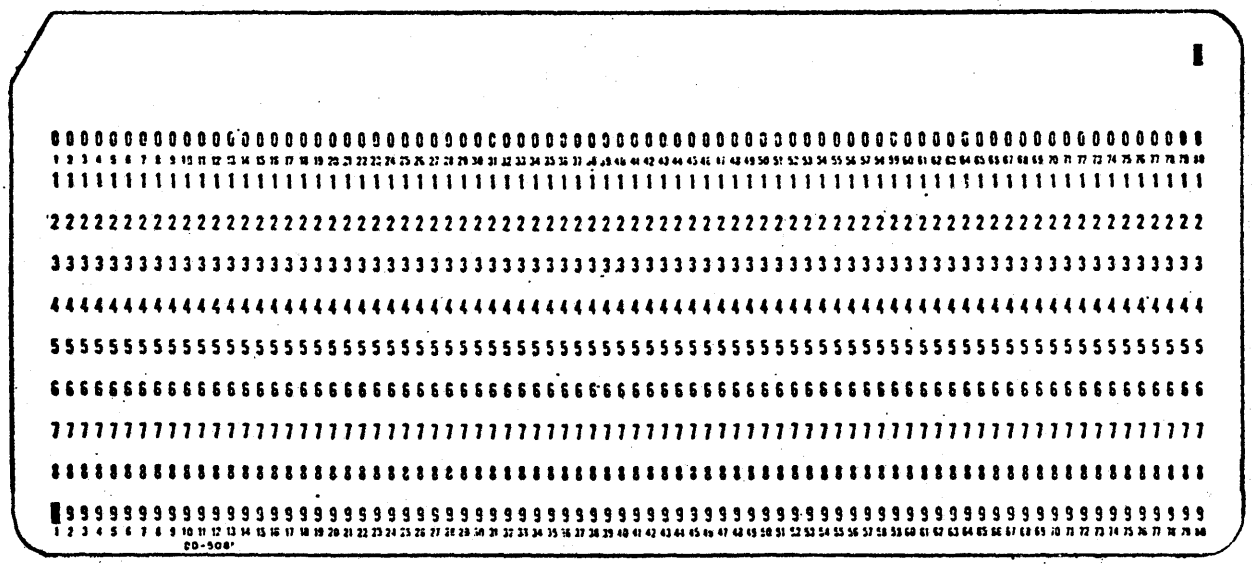


Figure 3-11. Subsubdeck 5E (test 7)
Worst case resync pattern (9 cards).

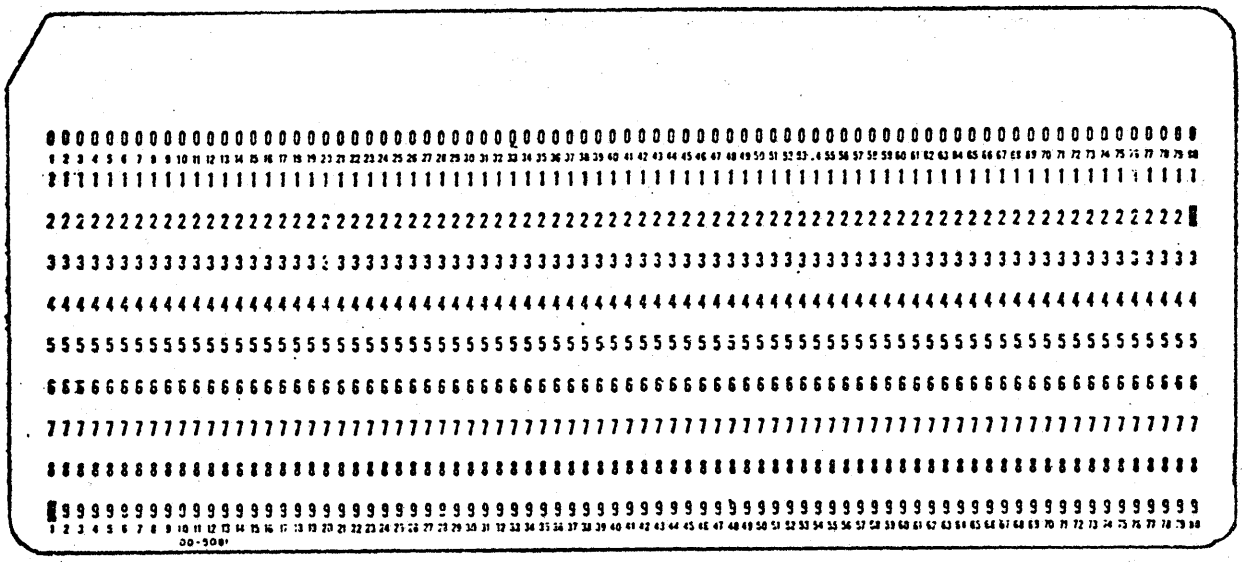


Figure 3-12. Subsubdeck 5F (test 7)
Worst case resync pattern (9 cards).

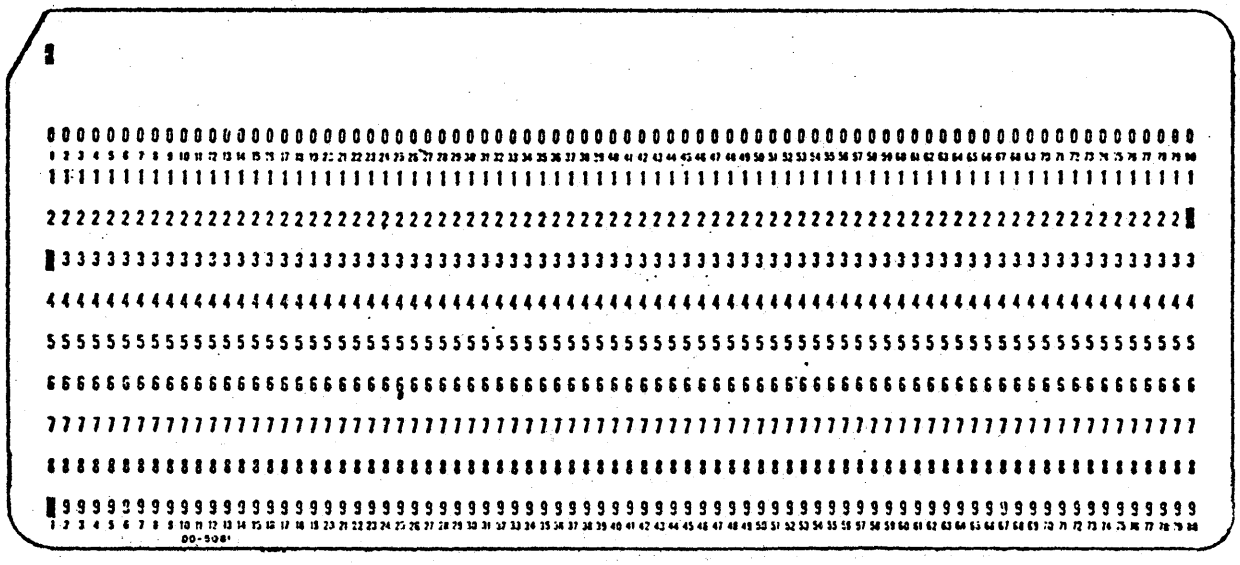


Figure 3-13. Subsubdeck 5G (test 7)
Worst case resync pattern (9 cards)

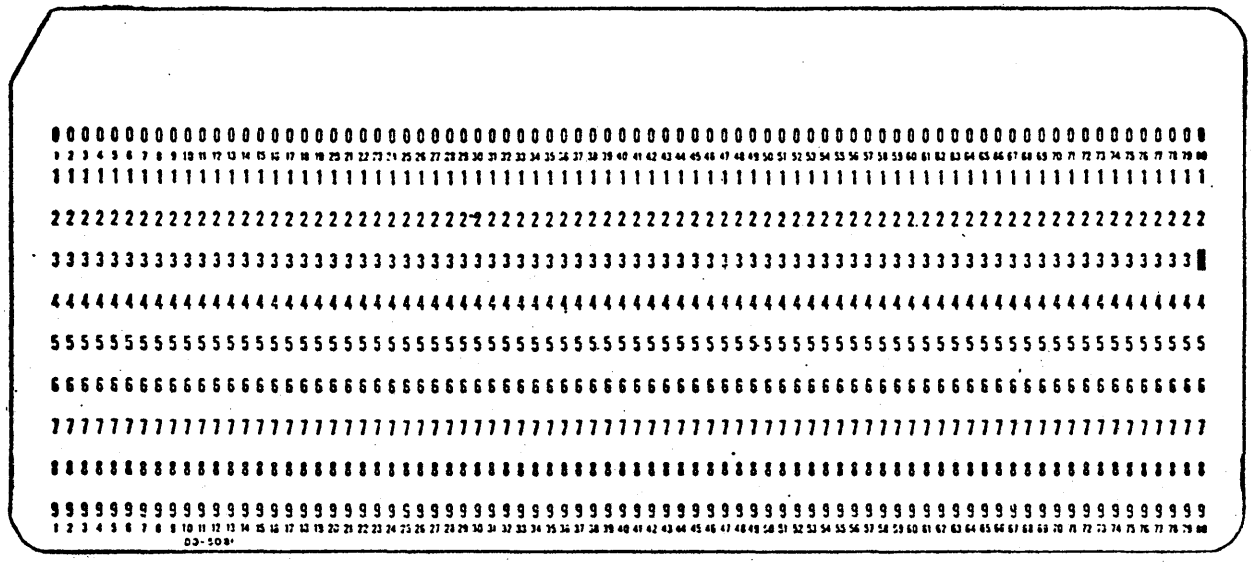


Figure 3-14. Subsubdeck 5H (test 7)
Worst case resync pattern (9 cards).

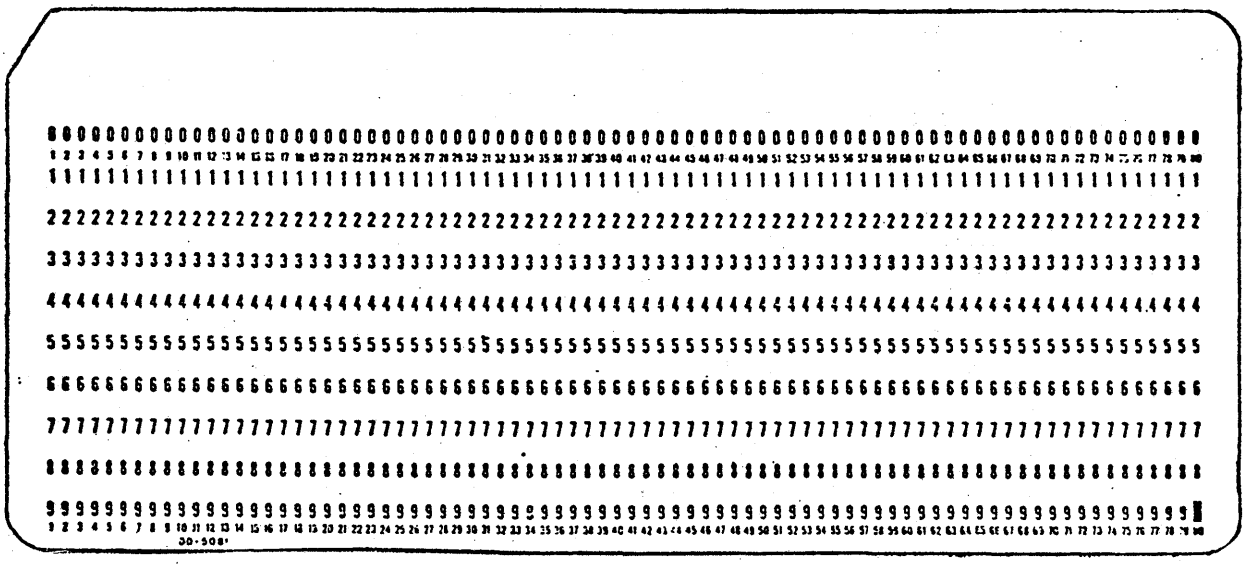


Figure 3-15. Subsubdeck 5I (test 7)
Worst case resync pattern (9 cards).

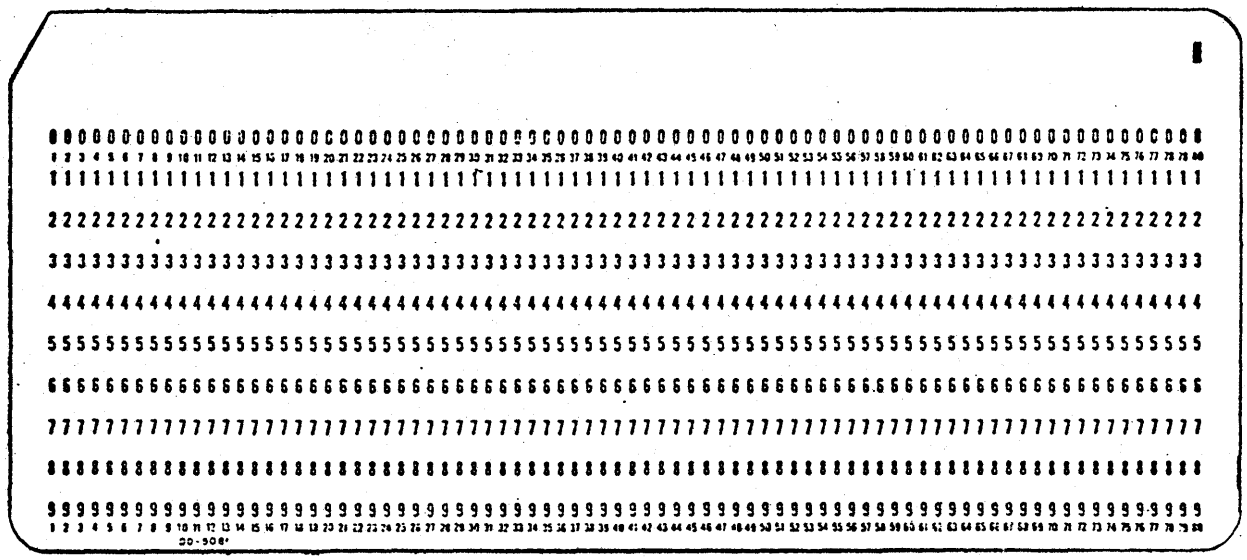


Figure 3-16. Subsubdeck 5J (test 7)
Worst case resync pattern (9 cards).

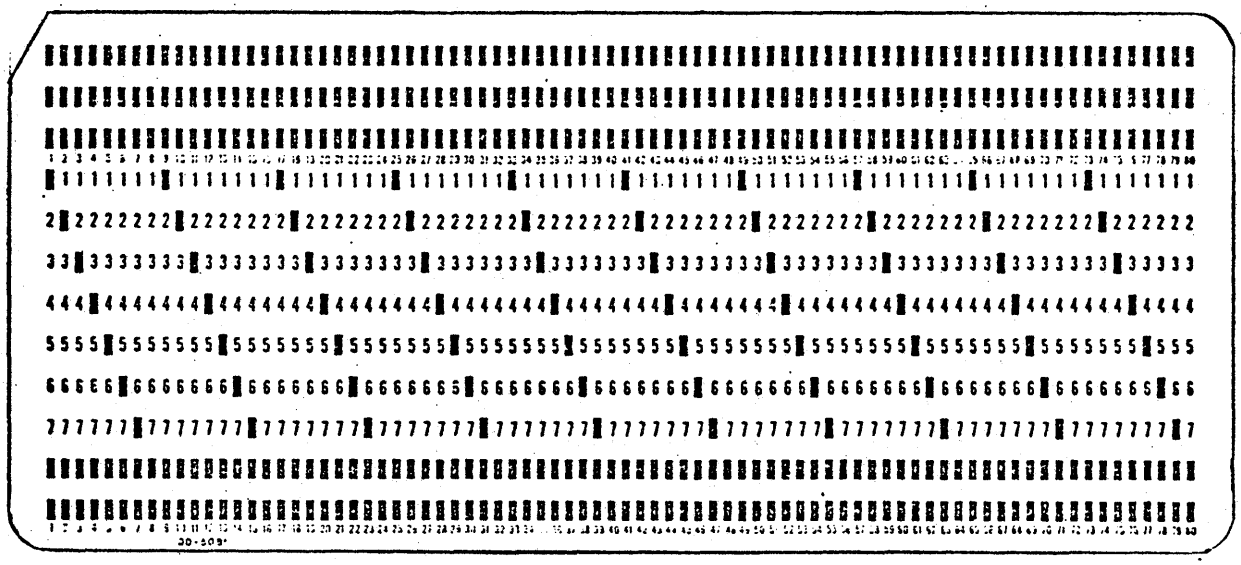


Figure 3-17. Subdeck 6 (test 7)
Maximum legal Hollerith punch pattern (99 cards).

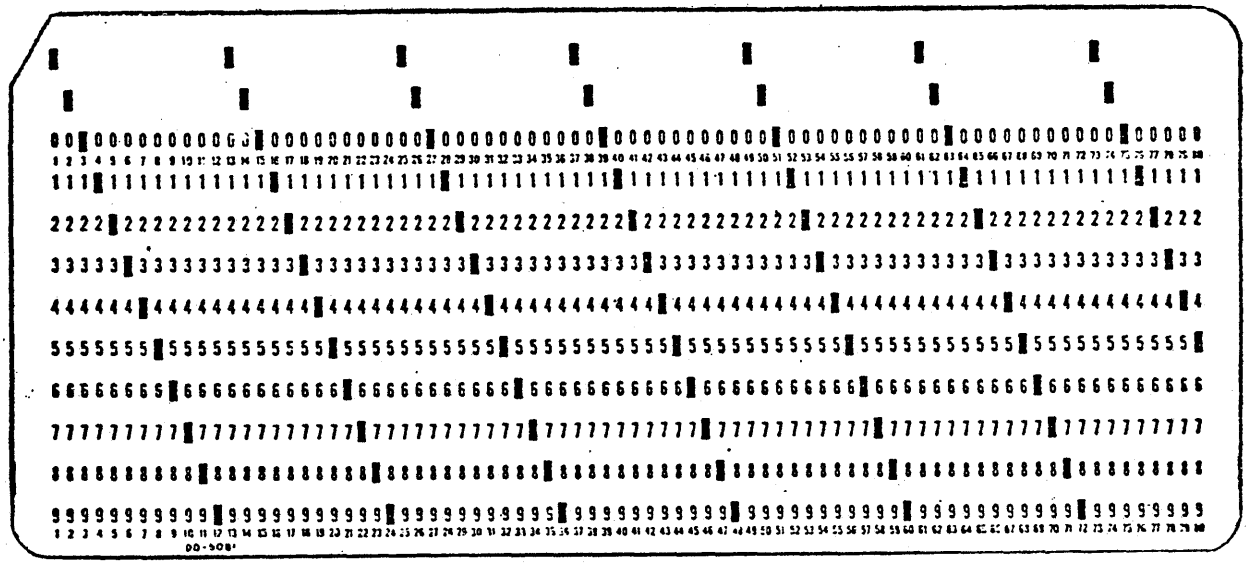


Figure 3-18. Subdeck 7 (test 7)
Timing (sliding) pattern (99 cards).

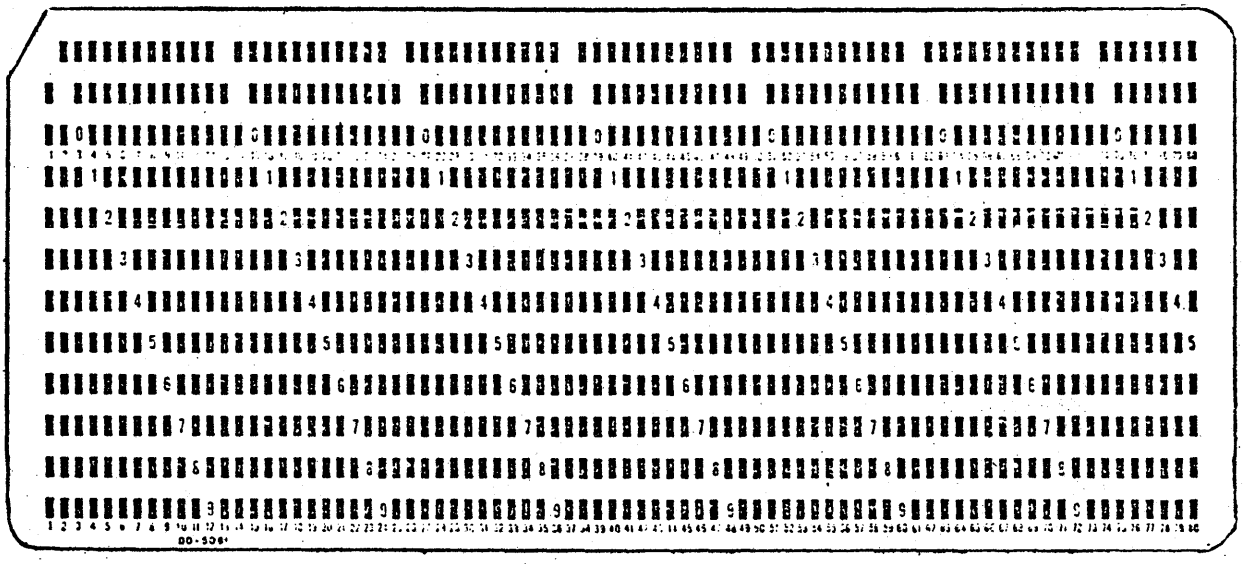


Figure 3-19. Subdeck 8 (test 7)
Inverted timing pattern (worst case binary)
(99 cards).

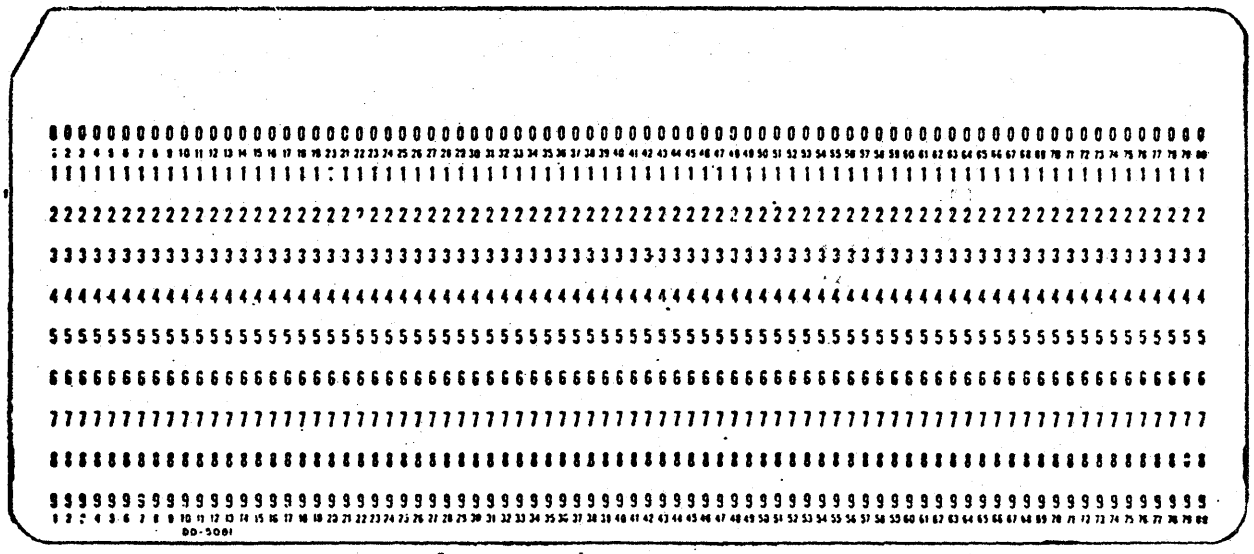


Figure 3-20. Subdeck 9 (test 7 optional)
No punches (99 cards).

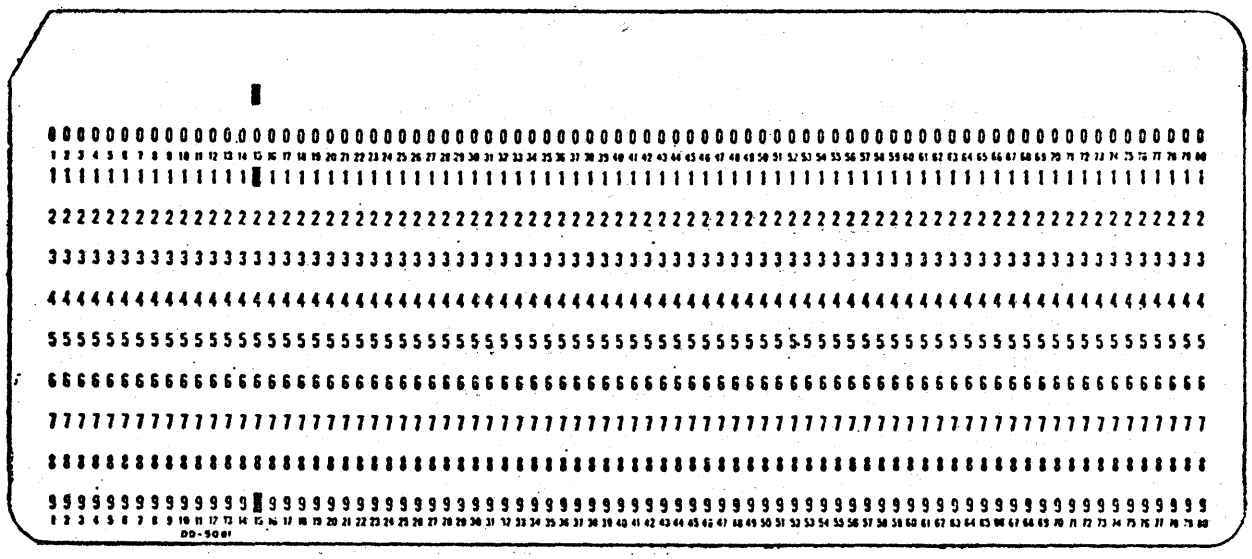


Figure 3-21. Separator Control Card.

3.2.11.6 Card Reader Diagnostic Test Error Codes

Table 3-24 below lists the card reader diagnostic test error codes, the test numbers failed, brief error descriptions and possible failing hardware modules.

Table 3-24. Card Reader Diagnostic Test Error Code Summary

Error Code	Test No.	Brief Description	Possible Failure
6000	8/9	Troubleshooting or alignment aid error.	CRDC or card reader
6001	0	Failure to disable CRDC bus drivers.	CRDC
6002	0	CRDC bus timeout.	CRDC
6003	1	Memory address register (FF21) error.	CRDC
6004	1/2	CRDC reset error.	CRDC
6005	1	Increment memory address register error.	CRDC
6006	2	Mode register (FF25) error.	CRDC
6007	2	Status interface error.	CRDC
6008	3	Binary simulate error.	CRDC
6009	3	Column counter error.	CRDC
600A	4	Hollerith simulate error.	CRDC or card reader
600B	4	Hollerith odd column error.	CRDC or card reader
600C	5	Reserved command error.	CRDC
600D	5	Hollerith check bit error.	CRDC
600E	6	Standard card read error.	CRDC or card reader
600F	7	Worst case card read error.	CRDC or card reader
6010	7	Slow power-up error.	CRDC or card reader
6011	7	Hopper status error.	CRDC or card reader

3.2.11.7 Card Reader Diagnostic Test Descriptions

The following information provides a brief description of each test of the card reader diagnostics. These tests are explained below on a functional level only. Standard tests are indicated by asterisks.

* Test 0: Enable, Disable Bus Drivers

This test verifies the ability to connect and disconnect the controller bus drivers, and to read all CRDC addresses.

* Test 1: Memory Address Test

This test verifies that the memory address register (FF21) can be written to and read from with all possible data patterns. It also verifies that this register can be reset from all ones to all zeros by writing 0001 to FF20. This test also verifies that the memory address register can be incremented through all combinations by using the increment memory address register command (0001 written to FF26).

* Test 2: Status Test

This test checks the data path from the mode register (FF25) and the control diagnostic register (FF24) to the status register (FF27).

* Test 3: Binary Simulate Test

This test simulates reading binary cards to test the following:

- The data path from the row diagnostic register (FF24) through the input data register (FF22) and the transceivers onto the universal bus and into main memory.
- The proper functioning of the address drivers.
- The ability to do DMA's and interrupts.
- The setting of the excessive column count bit (bit 3 of the status register, FF27) upon attempting to read 81 simulated columns and that DMA's are inhibited while this bit is set.

* Test 4: Hollerith Simulate Test

This test checks the ability of the controller to translate all possible Hollerith codes.

* Test 5: Reserved Command and Illegal Code Test

This test verifies that all the reserved commands written into the command register (FF26) have no effect on the controller.

Test 6: Standard Hollerith Card Test

This test is used to check the card reader and assumes that the controller is working properly (except for the line drivers and receivers to and from the card reader). It does binary reads of legal Hollerith cards from a standard test deck comparing each card read against expected values. The test deck used in this test consists of subdecks 0—3 (see

paragraph 3.2.11.1) separated by separator control cards. If a control card is sensed before it is expected, the program assumes that an abridged is being used; this will not cause an error, but it is assumed that the next subdeck is about to begin.

Test 7: Worst Case Card Test

This test is a continuation of the card reader test (test 6) and reads in the second part of the test deck. If subdeck 9 (optional) is used four tests are performed:

- The reader speed check reads cards at full speed for 5 seconds, counting as it reads. The card reader speed (cards per minute) is displayed.
- This test asks the operator to verify that the reader motor stops after 30 seconds when no card read commands are issued.
- This test verifies that the reader reads a card within seven seconds after a read command is issued with the card reader motors stopped.
- This test reads cards and tests for the expected hopper check on the last card read.

Test 8: Troubleshooting Aid

This test reads cards or simulates reading cards as selected by the operator. The operator selects the data, card size, data mode (binary or Hollerith) and whether data and/or status is to be verified. If verification is selected, the program compares the data selected by the operator with the actual data and reports any errors.

Test 9: Alignment Aid

This test is used for alignment or troubleshooting. It reads the first card of a deck and expects all the following cards to be the same. If a separator card is read, it treats the next card as the first card of a deck and expects all of the following to be the same. For troubleshooting purposes, one can select a delay (0—3.2 seconds) between card reads.

3.2.12 ROLS (REMOTE STATION SUBSYSTEM DIAGNOSTIC (RS)

This program is designed to verify the correct operation of the selected address ports. The program assumes the CPU (XPU or XPU2), memory, SMUX and operator communications device are functioning properly. Error information is provided which, in most cases, may be sufficient to isolate a fault to the CARS, RSC, modems, telephone lines or SMUX.

Information on the ROLS diagnostic is presented in the following sequence:

- Step-by-step procedures of execution
- Functional test descriptions
- Test error codes
- ROLS status errors

3.2.12.1 ROLS (RSS) Diagnostic Test Procedure

At this point RS has been selected in the Diagnostic Operating Procedure. (Reference paragraph 3.2v.) The test begins with the following display on the CRT.

	Display	Keyboard Response
a)	ROLS DIAGNOSTIC V( ) DATE PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
b)	-- ROLS DIAGNOSTIC COMMANDS -- SL STANDARD LOCAL (CARS) TESTS SR STANDARD REMOTE (RSC) TESTS ST STANDARD TEST (BOTH) TS TEST SELECT CL CLEAR TESTS AND DEVICES DR DEFINE DEVICES AND OPTIONS DM DISPLAY MENU OF TESTS RT RETURN TO DX CONTROL PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
c)	ROLS TESTS TEST 0* SELECTION RESPONSE TEST TEST 1* ILLEGAL COAX PARITY TEST TEST 2* SHORT SELECTION MESSAGE TEST TEST 3* CARD LEGAL LENGTH SMSG TEST TEST 4* LONG BLOCK LENGTH TEST TEST 5* ILLEGAL COAX MESSAGE TEST	Press FIELD REL.

	Display	Keyboard Response
	TEST 6* CARS POLL RESPONSE TEST * = STANDARD LOCAL: + = STANDARD REMOTE PRESS 'FIELD REL' TO CONTINUE	
d)	ROLS TESTS TEST 7 CARS LED TEST TEST 8 DUMP CARD PROM TEST 9 CARS EXTERNAL SWITCHES TEST 10 CARS INTERNAL SWITCHES TEST 11 CARS CONFIGURATION SWITCHES TEST 12 CARD SYNCHRONOUS MODEM SWITCHES TEST 13+ RSC SHORT MESSAGE TEST * = STANDARD LOCAL + = STANDARD REMOTE PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.
e)	ROLS TESTS TEST 14+ RSC POLL RESPONSE TEST TEST 15+ RSC LONG BLK KSIM TEST TEST 16+ DEVICES EXERCISED SERIALLY TEST 17+ DEVICES EXERCISED CONCURRENTLY TEST 18+ CARS RSC & DEV CONCURRENT TEST TEST 19 RSC LED TEST TEST 20 DUMP RSC ROM * = STANDARD LOCAL + = STANADRD REMOTE PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
f)	ROLS TESTS TEST 21 RSC EXTERNAL SWITCHES TEST 22 RSC INTERNAL SWITCHES TEST 23 RSC CONFIGURATION SWITCHES TEST 24 RSC SYNCHRONOUS MODEM SWITCH TEST 25 COAX DEVICE CONFIGURATION TEST 26 CARS DATA SET READY TEST * = STANDARD LOCAL + = STANDARD REMOTE PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.

	Display	Keyboard Response
g)	THIS MODULE HAS ONE AUTOMATIC CALL TO DR HERE WE GO PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL. This prompt appears on the first pass of RS. Thereafter, DR, then FIELD REL must be selected. Note: DR allows the selection of the coax address ports the program is to test. Once an address is selected, the only way to deselect it is through the use of the CL command.
h)	RSS ADDRESS / COAX ADDRESSES / RSS NUMBER / COAX ADDRESSES 0 00-07 4 32-39 1 08-15 5 40-47 2 16-23 6 48-55 3 24-31 7 56-63 SELECT RSS NUMBER (0) =	Enter RSS address number and FIELD REL. The program then displays the CARS address range within the selected RSS number.
i)	SELECTED CARS ADDRESS RANGE IS X-X	Press FIELD REL.

NOTE

When the XL40 was first released, its SMUX had the capability of polling only the first 32 coax addresses, i.e., 0-31. Subsequent design and field changes allow the SMUX to poll 64 coax addresses (i.e., 0-63). If the RSS number selected is 4 through 7, the program checks that the SMUX can poll the higher coax address (i.e., 32-63). If it can't, the following prompt is displayed.

	Display	Keyboard Response
j)	THE UNMODIFIED SMUX IN THIS SYSTEM CAN'T POLL ANY ADDRESS ABOVE 31 (I.E. 32 THROUGH 63).	

The program now sends the following selection message to the first coax address listed in the CARS range display (step h).

CS 36 04 00 3F

	Display	Keyboard Response
	If there is a polling response, the following is displayed. If there is no polling response, the display is bypassed.	
k)	THE CARS INDICATES THAT THE TESTABLE COAX IS XX–XX	
	At this point, the program determines which coax addresses in the previously indicated range acknowledged by the CARS.	

NOTE

The RSC must be attached with some keystations, station page printer, or other coax devices on-line in order for CARS to respond. This is the only way in which the program will fully test the ROLS.

The on-line addresses for the CARS are then listed as shown:

	Display	Keyboard Response
l)	THE CARS RESPONDS FOR THE FOLLOWING COAX ADDRESSES: X X	Up to eight addresses can be listed in this display. If none are listed however, it is likely that errors have occurred because the CARS does not have any coax addresses on-line, and/or it does not respond. In such a case, it might be well to select any arbitrary address and run test 25 to determine the coax configuration. If addresses are listed, the program then prompts with the following display:
m)	WHICH COAX ADR IS TO BE TESTED (00)?	Key in any part in the range indicated in the CARS indicated range display, then FIELD REL. If default address (00) is to be used, FIELD REL only. At this point the program queries the coax port selected to see if it should be considered on-line or off-line for testing purposes.

	Display	Keyboard Response
n)	IS THE COAX PORT ON-LINE (N)?	FIELD REL if not on-line. Only the local tests will be beneficial. Y, then FIELD REL if on-line.
o)	ARE THERE ANY MORE ADDRESSES TO TEST (N)?	If there are any more addresses to test, a Y, FIELD REL, will cycle the prompting sequence back to step m. FIELD REL only will terminate the DR command and the program will return to the RS command prompt.
p)	RS COMMAND =	Key in the appropriate 2 characters of the command to be run; and FIELD REL. Go to the paragraph covering the selected command (see below). SL – Standard Local (CARS) Tests, paragraph 3.2.12.2 SR – Standard remove (RSC) Tests, paragraph 3.2.12.3 ST – Standard Test (Both), paragraph 3.2.12.4 TS – Test Select, paragraph 3.2.12.1.4 CL – Clear Tests and Devices, paragraph 3.2.12.1.5 DM – Display Menu of Tests, paragraph 3.2.12.1.6 RT – Return to DX Control paragraph 3.2.12.1.7 Note: If a 2 character name, not in the command display, is keyed, the following error will be displayed and control will pass back to step p of this paragraph.
	* – INPUT ERROR, PLEASE REKEY –*	

NOTE

Under normal circumstances, it is expected that you execute the SL (Standard Local) tests on all coax addresses in the DR CARS INDICATED RANGE display. If successfully completed, CL (clear) out RS and then execute the SR (Standard Remote) tests on all addresses indicated in the DR Coax Display.

3.2.12.1.1 SL – Standard Local (CARS) Tests – SL selects the standard set of tests designed to exercise the CARS. Note that at least one remote coax device must be on-line through the CARS in order to thoroughly test the board. With SL keyed in, the automatically selected tests are displayed as shown. For a description of the functions performed by each test, refer to paragraph 3.2.12.2.

	Display	Keyboard Response
a)	THE STANDARD SET OF LOCAL TESTS (0–6) HAS BEEN SELECTED. RS COMMAND =	RT, then FIELD REL.
	DX DIRECTIVE =	EX, then FIELD REL to begin tests. If there is an error, refer to paragraph 3.2.12.3. If no error exists, the following will be displayed.
	TOTAL ERRORS = 0 DX DIRECTIVE =	EX, then FIELD REL to repeat tests CL, then FIELD REL to terminate tests.

3.2.12.1.2 SR – Standard Remote (RSC) Tests. – This command will select the standard set of tests designed primarily to exercise the RSC. It is important to note however, that at least one remote coax device must be on-line through the CARS or the RSC cannot be exercised. When SR is keyed in response to the RS command prompt (paragraph 3.2.12.1p), the following is displayed. For a description of the functions performed, refer to paragraph 3.2.12.2.

	Display	Keyboard Response
a)	THE STANDARD SET OF REMOTE TESTS (13–18) HAS BEEN SELECTED RS COMMAND =	RT, then FIELD REL.
b)	DX DIRECTIVE =	EX, then FIELD REL to begin tests. If there is an error, refer to paragraph 3.2.12.3. If no error exists, the following will be displayed.
	TOTAL ERRORS = 0 DX DIRECTIVE =	EX, then FIELD REL will repeat execution of the tests. CL, then FIELD REL will clear all tests from memory and testing of other units may begin (paragraph 3.2.v).

3.2.12.1.3 ST – Standard Test (Both) – Keying "ST" in response to the RS command prompt causes standard tests for CARS and for RSC to be executed. The following will be displayed.

	Display	Keyboard Response
a)	THE STANDARD SET OF LOCAL AND REMOTE TESTS (0–6; 13–18) HAS BEEN SELECTED PRESS 'FIELD REL' TO CONTINUE	RT, then FIELD REL
b)	DX DIRECTIVE =	EX, then FIELD REL to begin tests. If there is an error, refer to paragraph 3.2.12.3. If no error exists, the following will be displayed.
c)	TOTAL ERRORS = 0 DX DIRECTIVE	EX, then FIELD REL will repeat tests CL, then FIELD REL will clear all tests from memory and testing of other units may begin.

3.2.12.1.4 TS – Test Select – TS permits the entry of an iteration count for each test. When the tests are in execution, the selected test will be executed. The selected number of times for each coax address before the next coax address is tested.

	Display	Keyboard Response
a)	RS COMMAND = TS TEST (0) =	The program will prompt for the decimal number of the test to be selected (0–26). Count 0 will cause the test to be skipped.
b)	COUNT (0) =	Enter decimal number for the number of iterations of the selected test is to be made (0–32,767), then FIELD REL.
	ANYMORE TESTS (N)?	Enter Y, then FIELD REL if the TS prompting sequence is to be automatically called again. The test number will automatically increment if "Y" is selected. N, then FIELD REL returns program to RS command prompt.

3.2.12.1.5 CL – Clear Tests and Devices – The CL command permits the operator to deselect all previously selected tests and devices.

3.2.12.1.6 DM – Display Menu of Tests – The DM command permits the viewing of the menu of tests. When keyed, displays shown in paragraph 3.2.12.1cf are presented.

3.2.12.1.7 RT – Return to DX Control – The RT command will return control to the diagnostic executive module DX. Any further prompts will be a function of DX.

3.2.12.2 ROLS (RSS) Diagnostic Test Description

The following provides a brief functional description of each test in the ROLS diagnostic.

Test 0: Selection Response Test

This test sends 1000 selection messages with a false RAM address to the CARS port under test. Each selection message is of the form:

CX 34 0000 3F

The CARS should treat each message as a "NOP" (No Operation, dummy message). If the CARS is on-line, a "Busy" selection response and a "Busy Complete" polling response should be received. If the CARS is off-line, only a selection timeout should be received.

Test 1: Illegal Coax Parity Test

During this test, 1000 selection messages with inverted parity are sent to the selected CARS port. Each selection message is of the form:

CX 34 nn nn 3F

where nn is 03E7 for the first message, 03E6 for the second etc., until nn nn is 00 00 for the last message.

Because of incorrect parity, each message should be rejected by the CARS. Should any be accepted they should be treated as "NOP's". Whether on-line or off-line, the CARS coax ports should always detect the parity error and not respond - causing a selection timeout.

Test 2: Short Selection Message Test

During this test a series of eight different imcomplete selection messages are sent to the designated CARS port, to check if the CARS treats them as NOP's. Each selection message is one of the following:

CX	3F	3F	3F
CX	34	00	00
CX	34	00	
CX	3F	3F	
CX	34	3F	
CX	3F		
CX	3F		
CX	34	3F	3F

If the CARS port is on-line, a "Busy" selection response and a "Busy Complete" polling response should be received. If the CARS port is off-line, only a selection timeout should be received.

3.2.12.3 ROLS Test Error Codes

Table 3-25 lists the ROLS diagnostic test error codes. Displayed with the error code to aid the CE, would be elapsed minutes, error exit address, listing address, the test number in which the error occurred and a description of the problem.

Table 3-25. ROLS Diagnostic Test Error Codes

Error Code	Test No.	Brief Description	Possible Fault
8000	—	Can't determine if the SMUX can poll all 64 coax addresses or just the first 32.	SMUX
8001	XX	SMUX was unexpectedly busy when a selection message transmission was to be initiated coax address	SMUX
8002	17	SMUX went busy but never issued an interrupt	SMUX
8003	XX	An Interrupt of unknown type (not poll or selection) occurred for the SMUX	SMUX
8004	XX	Unexpected selection message interrupt for coax address	SMUX
8005	1	Illegal coax parity test. The CARS was sent a selection message with parity of each byte reversed. Unexpected selection response was received.	CARS
8006	XX	Selection response status error	CARS
8007	XX	Selection timeout was expected but an unexpected selection response was received	CARS
8008	XX	Selection message timeout occurred	CARS
8009	5	Unexpected selection message interrupt	CARS
800A	3	Unexpected selection message timeout	CARS
800B	4	CARS responded to an illegally long selection message	CARS

Table 3-25. (Continued)

Error Code	Test No.	Brief Description	Possible Fault
800C	17,18	Expected selection response interrupt was not received.	SMUX
800D	XX	Unexpected busy complete interrupt received from CARS	CARS
800E	17,18	Expected busy complete interrupt not received from CARS upon receipt of legal selection message.	CARS
800F	XX	Unexpected polling response interrupt returned from an address not selected for testing NOTE This error is usually the result of someone turning on a keystation or depressing a key at a keystation not under test.	—
8010	XX	Unexpected polling response interrupt occurred while the address was selected for testing	ROLS or someone depressing key at key-station under test
8011	XX	Unexpected device error occurred	device
8012	17,18	Expected polling response interrupt not received	ROLS or device
8013	16	There was some kind of hang while waiting for the response(s) to a selection message	ROLS or device

3.2.13 STATION PAGE PRINTER DIAGNOSTICS (SP)

The following paragraphs contain information concerning the station page printer diagnostic procedures, including:

- Step-by-step procedures of exectution
- Functional test descriptions
- Test error codes

If a specific function of the station page printer is to be performed, refer to paragraph 3.2.13.2 Station Page Printer Diagnostic Test Descriptions, in order to select the proper test(s) to run.

3.2.13.1 Station Page Printer Diagnostic Test Procedure

At this point SP has been selected in the Diagnostic Operating Procedure. Reference paragraph 3.2t. To execute the station page printer diagnostic, observe the following procedure.

	Display	Keyboard Response
a)	STATION PRINTER V(X.XXX) Date —— SP DIAGNOSTIC COMMANDS —— DR DEFINE DEVICE OPTIONS TS TEST SELECTION ST STANDARD TEST SELECTION RT RETURN TO DIAGNOSTIC CONTROL UD USER DATA SELECTION DM DISPLAY TEST MENU CL CLEAR TEST SELECTIONS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.
b)	—— STATION PRINTER TESTS —— TEST 0 OPERATOR CONTROLS TEST 1 INTERNAL PRINTER CHECK TEST 2 ERROR CONDITIONS CHECK TEST 3 SELECTION/POLL RESPONSE CHECK TEST 4 ALERT TONE CHECK TEST 5 FONT CHECK TEST 6 ASCII FONT LOAD N' CHECK TEST 7 IMBEDDED CONTROL CHARACTERS TEST 8 ELECTRONIC FORM CONTROL (EFC) PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.

	Display	Keyboard Response
c)	—— STATION PRINTER TESTS —— TEST 9 SLIDING "E" PATTERN TEST 10 DIAMOND PATTERN TEST 11 PRINTER SPEED TEST 12 PAPER LINE ADVANCE (PLA) TEST 13 RIPPLE PATTERN TEST 14 BROADSIDE PATTERN TEST 15 USER DATA TEST 16 SELECTION LOGIC CHECK-OUT TEST 17 POLLING LOGIC CHECK-OUT	Depress space bar
d)	FD COMMAND =	Select command entry from the following: DR - Define Device Options (paragraph 3.2.13.1.1) TS - Test Selection (paragraph 3.2.13.1.2) ST - Standard Test Selection (paragraph 3.2.13.1.3) RT - Return to Diagnostic Control (paragraph 3.2.13.1.4) UD - User Data Selection (paragraph 3.2.13.1.5) DM - Display Test Menu (paragraph 3.2.13.1.6) CL - Clear Test Selections (paragraph 3.2.13.1.7)

3.2.13.1.1 DR — Station Page Printer Diagnostic Device Definition Procedure — DR permits selection of the printer to be tested and the parameters used during testing. Prompts displayed for this procedure are shown as follows:

	Display	Keyboard Response
a)	PRINTER NUMBER (10) =	Enter device number (0—31 or 63 depending on the type of SMUX), then FIELD REL
b)	IS PRINTER REMOTE (N)?	FIELD REL if not remote. Type Y, then FIELD REL if remote

	Display	Keyboard Response
c)	CHARACTERS/LINE (132) =	Enter number of characters per line that will be used in testing then FIELD REL. FIELD REL if the standard 132 characters per line is to be used
d)	LINES/PAGE (66)	Enter number of lines per page to be used in testing and FIELD REL. FIELD REL only for standard 66 lines.

3.2.13.1.2 TS – Station Page Printer Diagnostic Test Selection Procedure – TS permits the selection of a specific test and the iteration count for that test. (Refer to paragraph 3.2.13.2 for a description of each test available.) Prompts displayed for this procedure are as follows:

	Display	Keyboard Response
a)	TEST (0) =	Enter test number, then FIELD REL
b)	COUNT (1) =	Enter iteration count (0-32767) and FIELD REL. NOTE: A count of zero causes the test to be skipped.
	ANYMORE TESTS (Y)?	If N, then FIELD REL is selected, return to paragraph 3.2.13.1.a. If FIELD REL, return to step a. Note that the TEST prompt will have the test number incremented by one as the new default value.

3.2.13.1.3 ST – Station Printer Diagnostic Standard Test Selection Procedure – ST permits selection of standard set of tests that can be executed in less than six minutes for a local printer (non-remote). The program displays the following information:

THE STANDARD SET OF TESTS CONSISTS OF 2, 3, 4, 6 THRU 14	(No parameter entry is required. The test selections are done by the program which will immediately return to the command entry prompt.)

3.2.13.1.4 RT – Station Page Printer Diagnostic Return to Diagnostic Control – RT returns control to the Diagnostic Executive (DX).

3.2.13.1.5 UD – Station Page Printer User Data Selection – UD permits parameters used in test 15. The procedure is as follows:

	Display	Keyboard Response
a)	START COLUMN (1) =	Enter desired start column (1-132). FIELD REL.
b)	END COLUMN (132) =	Enter desired end column number (1-132) and FIELD REL. Note: If the END COLUMN number selected is less than the START COLUMN number, they are exchanged.
c)	ASCII CHARACTER 1 (41) =	Enter the hex value of the first ASCII character (01-FF) used in filling the print buffer and FIELD REL.
d)	ASCII CHARACTER 2 (42) =	Enter hex value of the second ASCII character used in filling the print buffer (01-FF), then FIELD REL. Note: Refer to paragraph 3.2.13.2, test 15, for an explanation of how these parameters are used.

3.2.13.1.6 Station Page Printer Diagnostic Display Test Menu – At this point DM has been selected at Station Page Printer Test Procedure, paragraph 3.2.13.1d. DM permits the operator to review the test menu shown in paragraph 3.2.13.1.b and c.

3.2.13.2 Station Page Printer Diagnostic Test Descriptions

The following provides a brief functional description of each test in the station page printer diagnostic. Standard tests are indicated by asterisks.

Test 0: Operator Controls

This test verifies that the station page printer is checked for correct initialization at power up and that printer status (paper load, ready, selected, EFC loaded) is correctly reported in the selection response. These status conditions are forced by operator activity at the printer.

Test 1: Internal Printer Check

This test verifies the correct operation of the write RAM, read RAM, and read print line buffer command modes. It also exercises the printer's self test capability by repeatedly setting the initialize command mode.

* Test 2: Error Conditions Check

This test checks the station page printer's ability to recognize selection message format errors. The format errors tested are: 1) messages that are too long or too short, 2) messages not ending

with an EOM character and 3) messages having incorrect parity. It also checks the printer's response to messages received when it is still busy with the previous message.

* Test 3: Selection/Poll Response Check

This test verifies that the station page printer responds to all lengths of selection messages within the minimum maximum ranges (5 through 206 bytes). It also tests the keystroke simulate function (a carryover from the keystations) for a correct response.

* Test 4: Alert Tone Check

This test verifies operation of the alert tone.

Test 5: Font Check

The font check verifies the ability to load and print fonts of different sizes. It prints patterns which can be used to determine hammer failures. It verifies that a full 127 characters can be loaded and printed. It also checks both the printing and executing of the control characters (LF, FF, CR, VT).

* Test 6: ASCII Font Load N' Check

This test loads the standard ASCII 96 character font, then reads back each slice of the font to ensure it loaded correctly. The test also verifies that the station page printer's copy of the font header is correct. The final portion of the test sends two print lines to the printer.

* Test 7: Imbedded Control Characters

This test verifies the ability of the station page printer's ability to identify and execute control characters imbedded in a string of print characters. This is accomplished by sending a single message in which an individual check is made for each control character (FF, CR, LF, VT). These checks consist of print characters describing the control character followed by the control character itself.

* Test 8: Electronic Form Control (EFC)

This test verifies the station page printer's capability to load the electronic form control and to recognize and execute EFC (VFU) control characters imbedded in messages. The form size is determined by the "DR" parameter LINES/PAGE with a maximum form size of 66 lines per page. The station page printer's maximum form size is 132 lines but the program loads two copies of the form into the EFC so that the maximum form size for this program is set at one half of 132 or 66.

* Test 9: Sliding "E" Pattern

The sliding "E" pattern test is designed to check the print head registration under worst case conditions. A line of E's are printed from left to right one character at a time. Then a line feed is issued and a second line will be printed from right to left. There should be no noticeable misalignment in the horizontal direction between the two lines.

* Test 10: Diamond Pattern

This test is designed to check the print head registration and interline spacing. The size of the diamond pattern is determined by the number of characters per line value set by the "DR" command. Upon examination of the printout, there should be no inconsistencies in vertical character alignment or horizontal spacing.

* Test 11: Printer Speed

This test will calculate the print speed in lines per minute. Speed is determined by counting the number of lines printed in one minute. Different line lengths will result in different speeds. (The length is operator selectable by the "DR" command.) The speed is displayed on the operator console and is also logged on the station page printer.

* Test 12: Paper Line Advance (PLA)

This test checks all of the Paper Line Advance (PLA) characters (Y'90-X9F). A separate message is sent for each PLA character, followed by printed data and a carriage return.

* Test 13: Ripple Pattern

This test prints 96 lines of data. The data consists of an incrementing pattern of ASCII characters which is repeated every 96 characters. The pattern shifts to the left with each new line so that upon completion, all 96 ASCII characters will be in column one.

* Test 14: Broadside Pattern

This test prints 96 lines of data with each line being a different ASCII character. The number of times the character is repeated on a particular line is defined by the "DR" command parameter characters per line.

Test 15: User Data

This test prints 30 lines of data using the parameters defined in the "UD" (User Data) command.

Test 16: Selection Logic Checkout

The selection logic checkout test is designed to assist in the troubleshooting of the station page printer selection message input and response logic. A five byte selection message is sent every four

milliseconds with a break every five seconds to check for operator cancel request (control/bypass) and to update the progress count. The operator cancel request is the only way to end the test. Since the object of this test is to aid in the troubleshooting of a known problem, no errors are reported. This test can be used in conjunction with diagnostic switch 4 (selection and poll response test) on the station page printer processor board.

Test 17: Polling Logic Check-Out

This test is designed to assist in the troubleshooting of the station page printer polling message input and response logic. When initiated, SMUX is disabled and a single byte identical to the SMUX poll message is sent to the station page printer every four milliseconds. This stream of polls is interrupted every five seconds to check for an operator cancel request (control/bypass) and to update the progress count. The operator cancel request is the only way to end the test. Since the objective of the test is to aid in the troubleshooting of a known problem, no errors are reported. This test can be used in conjunction with diagnostic switch 4 (poll selection and poll response test) on the station page printer processor board.

3.2.13.3 Station Page Printer Test Error Codes

Table 3-26 lists the station page printer diagnsotic test error codes. Displayed with the error codes would be the elapsed time, the error exit address and the listing address. In some cases, the error codes will be preceeded by a message describing the purpose of the test.

Table 3-26. Station Page Printer Test Error Codes

Error Code	Test No.	Brief Description	Possible Fault
9001	1	The data read from the RAM on the station page printer's processor board was incorrect	Printer
9002	1	The data read from the print line buffer or the station page printer was incorrect	Printer
9003	8	The data read from EFC RAM on the station page printer was incorrect	Printer

Table 3-26. (Continued)

Error Code	Test No.	Brief Description	Possible Fault
9004	XX	The data read from the font RAM on the station page printer was incorrect	Printer
9005	XX	A polling interrupt occurred from a device other than the station page printer. NOTE This error usually happens because someone turns on or presses a key at a keystation or station page printer not under test	Printer
9006	XX	A polling response that does not have the busy complete bit true was received at a time when none should occur	Printer
9007	XX	Unable to send a selection message due to the SMUX hanging busy for more than 5 seconds	SMUX
9008	XX	Sent a selection message but received no selection interrupt	Printer
9009	XX	Received a selection response with the device busy bit true but did not receive a polling response with the busy complete bit set true within 5 seconds (30 seconds if remote)	Printer
900A	XX	Expected a polling response, other than a polling response with busy complete bit true, but it did not occur within 5 seconds (30 seconds, if remote)	Printer

Table 3-26. (Continued)

Error Code	Test No.	Brief Description	Possible Fault
900B	XX	Did not receive a polling response after power on or with SELECT on	Printer
900C	XX	The SMUX status register contents did not agree with what was expected	SMUX
900D	XX	The selection response status did not agree with what was expected	Printer
900E	XX	The selection response status (station page printer status) did not agree with what was expected	Printer
900F	XX	The status of the busy complete polling response contains an error	Printer
9010	XX	The busy complete polling response did not compare with the expected value	Printer
9011	XX	The status of the polling response contained an error	Printer
9012	XX	The polling response data did not compare with the expected value	Printer

3.2.13.4 Station Page Printer Status Errors

During the station page printer diagnsotic program, status errors may be generated which utilize memonics to report various hardware malfunctions. These are identical to the keystation status errors (reference paragraph 3.2.2.4).

3.2.14 FLEXIBLE DISK DIAGNOSTICS

This paragraph provides the following flexible disk diagnostics (FD) information:

- Step-by-step procedures of execution.
- Test error codes.
- Functional test descriptions.

If a specified function of the flexible disk drive/disk/disk controller is to be tested, refer to the flexible disk diagnostic test descriptions in paragraph 3.2.14.5 to select the proper tests.

3.2.14.1 Flexible Disk Diagnostic Test Procedure

At this point FD has been selected in the diagnostic operating procedure, paragraph 3.2, step u. Before executing the flexible disk diagnostics, be certain that all important customer data diskettes have been removed. Execute the flexible disk diagnostics as follows:

	Display	Keyboard Response
a)	FLOPPY DISK DIAG V (01.000) 09/15/78 DR – DEFINE DRIVE OPTIONS TS – DISK TEST SELECTION ST – STANDARD TEST SET SELECTION RT – RETURN TO DIAGNOSTIC CONTROL DM – DISPLAY TEST DESCRIPTION MENU CL – CLEAR TEST SELECTIONS CB – DISPLAY CURRENT CONTROL BLOCK PRESS SPACE BAR TO CONTINUE	Depress space bar.
b)	FLOPPY DISK TESTS TEST 0 – BASIC CONTROLLER TEST TEST 1 – COMMAND TEST TEST 2 – ERROR CONDITIONS TEST TEST 3 – CONTROLLER/DRIVER TEST TEST 4 – WRITE TEST TEST 5 – READ TEST TEST 6 – RANDOM DATA/WRITE/READ TEST 7 – MULTIPLE DRIVE CONCURRENCY TEST PRESS SPACE BAR TO CONTINUE	Depress space bar.
c)	FLOPPY DISK TESTS TEST 8 – INITIALIZE TEST 9 – VERIFY TEST 10 – TROUBLESHOOTING AID TEST 11 – VERIFY TRACK IDS TEST 12 – DUMP DISKETTE DATA TEST 13 – ALIGNMENT AIDS TEST 14 – INTEGRITY TEST TEST 15 – WRITE TRACK PRESS SPACE BAR TO CONTINUE	Depress space bar.

	Display	Keyboard Response
d)	FD COMMAND =	DR
e)	DRIVE (1) =	Enter the drive (1–2) to be tested, then FIELD REL.
f)	DOUBLE SIDED DISKETTE (Y) ?	Enter FIELD REL for double sided diskette (2D type) or enter N for single sided diskette (1D type).
g)	SIDE 0 (Y)?	Enter FIELD REL if side 0 is to be tested or else enter N. If N is entered, side 1 is automatically selected. Go to step 1.
h)	SIDE 1 (Y)?	Enter FIELD REL if side 1 is to be tested or else enter N.
i)	TYPE 1 = 26 SECTORS/TRK TYPE 2 = 15 SECTORS/TRK TYPE 3 = 8 SECTORS/TRK TYPE 4 = 6 SECTORS/TRK TYPE (1) =	Enter the sector type (1–4) to be tested, then FIELD REL.
j)	DOUBLE DENSITY (Y)?	Enter FIELD REL for double density testing or enter N for single density testing.
k)	START TRACK (0) =	Select the first track to be tested, then FIELD REL.
l)	END TRACK (76) =	Select the last track to be tested, then FIELD REL.
m)	NBR SECTORS XFRD (26)	Select the number of sectors to be transferred with each data command (6–26), then FIELD REL.
n)	DATA PATTERN 1 (5555) =	Select data pattern 1 (0000–FFFF), then FIELD REL.
o)	DATA PATTERN 2 (AAAA) =	Select data pattern 2 (0000–FFFF), then FIELD REL.

	Display	Keyboard Response
p)	FD COMMAND =	Note: If a new diskette is in the drive and it has not yet been initialized, it is necessary to run FD test 8 in order to initialize the diskette; then the standard or specific tests can be run. If this is not done for a diskette, errors will be displayed which are due to the lack of headers on the diskette. ST to run standard tests. TS to run test selections. Go to paragraph 3.2.14.2.
q)	STANDARD SET OF FLOPPY DIAGNOSTIC TESTS CONSISTS OF TEST 0 THRU 6 DRIVE (1) =	Select the drive number (1–2) then FIELD REL that the standard tests are to be executed on. Note that if a drive is selected for which DR parameters have not been specified, starting in step f of this procedure, then the default values will be used for step f through o prompts and CAUTION DRIVE PARAMETERS DEFAULTED! will be displayed. If more drives are to be tested, select ST standard tests again for those drives. Parameters must be set for the other drives to be tested; return to step f of this procedure.
r)	FD COMMAND =	RT
s)	DX DIRECTIVE =	EX
t)	FLOPPY DISK TEST DRIVE (number) COUNT (number) PROGRESS (number)	At this time, the specific or standard tests will be executed. If there is an error, refer to paragraph 3.2.14.4. If no errors occur, the step u prompt will be displayed.
u)	0 SOFT & 0 HARD ERRORS ON DRIVE (no.) TOTAL ERRORS = 0 DX DIRECTIVE =	EX will repeat the tests selected. Return to step t of this procedure. CL will clear all selected tests from memory and the operator may begin testing another logical unit; go to paragraph 3.2 step v. CO to redefine the DX control options; go to paragraph 3.2, step j.

3.2.14.2 Flexible Disk Diagnostic Test Selection Procedure

At this time TS has been selected in the flexible disk diagnostic test procedure, paragraph 3.2.14.1, step p. Execute specific flexible disk tests as follows:

	Display	Keyboard Response
a)	DRIVE (1)	Select the drive number (1–2) that the specific tests are to be executed on, then FIELD REL. Note that if a drive is selected for which DR parameters have not been set, starting in paragraph 3.2.14.3, step f, then the default values for those prompts will be used, and CAUTION DRIVE PARAMETERS DEFAULTED! will be displayed.
b)	TEST (0) =	Select test number (0–15) to be run, then FIELD REL.
c)	COUNT (1) =	Select iteration count then FIELD REL (0–32,767). 0 will cause the test to be skipped. If test 10 was selected in step b, go to paragraph 3.2.14.3.
d)	ANYMORE TESTS (Y)?	If N then FIELD REL is selected, return to paragraph 3.2.14.1, step r. If FIELD REL is selected, return to step b of this procedure. Note that the TEST prompt in step b will have the test number incremented by one as the new default value.

3.2.14.3 Flexible Disk Diagnostic Test 10 (Troubleshooting Aid) Procedure

At this time test 10 (troubleshooting aid) has been selected in the flexible disk specific test procedure, paragraph 3.2.14.2, step. c.

Note that if the following parameters have been previously selected and a DX DIRECTIVE = CL has not been performed, then some of the following default values will be those that were previously selected.

Execute test 10 as follows:

	Display	Keyboard Response
a)	TEST 10 – TROUBLESHOOTING AID CMND/TRK (XXXX) =	CMND/TRK is structured as shown: X X XX ↓ ↓ ↓ Command Unit No. Track No. Enter one of the following to specify the command: 0 for seek/restore 1 for test unit ready 2 for test unit ready & interrupt 3 for test speed 4 for read 5 for verify 6 for read track ID 7 for read track data 8 for write 9 for initialize A for delete track B for write FDC C for read FDC Enter one for the following to specify the unit number: 0 for unit 1 1 for unit 2 Enter the track number in the range 00 to 76. Then depress FIELD REL.
b)	HEAD/SECTOR (XXXX)	HEAD/SECTOR is structured as shown: XX XX ↓ ↓ Head Sector Enter the head of either 00 or 01. Enter the sector number of the first sector to be accessed when reading or writing.
c)	SEC CODE/ADR MARK (XXXX)	SEC CODE/ADR MARK is structured as shown: X XX X ↓ ↓ ↓ Density sector/trk Data address mark value

	Display	Keyboard Response
		Enter the number of sectors/track as follows: 0 for 26 1 for 15 2 for 8 3 for 6 Enter the data address mark of FB. Deleted data will be FB. Then depress FIELD REL.
d)	WORD COUNT (XXXX) =	Enter the value of the word count, then depress FIELD REL.
e)	DATA PATTERN 1 (XXXX) =	Enter the hex value of the data pattern used to fill the data block used by the controller, then depress FIELD REL.
f)	EXP CNTLR STATUS (XXXX) =	Enter a 16-bit hex value to reflect the expected controller status. Assemble this value as follows: MSB 0 – 1 controller busy 1 – 1 interrupt request 2, 3 – not used 4 – 1 unit 1 5 – 1 unit 2 (4, 5 – operation complete) 6 – not used 7 – not used 8 – 1 busy seeking 9 – 1 control block error 10 – 1 write protected 11 – 1 unit ready 12, 13, 14 – not used LSB 15 – 1 data bus error Then depress FIELD REL.
g)	VRFY CNTLR STATUS (X)?	Enter Y then FIELD REL to verify the device status by comparing the actual status with the expected controller status setup in step f.

	Display	Keyboard Response
h)	EXP OP STATUS (XXXX) =	Enter a 16-bit hex value to reflect the expected operation status. Assemble this value as follows: MSB 0 – 1 normal end 1 – 1 write or write protect 2 – not used 3 – 1 CRC error 4 – 1 data overrun 5 – 1 track timeout 6 – 1 unexpected data address mark 7 – 1 control block error 8 } 9 } 10 } 11 } data address mark 12 } of FB 13 } 14 } 15 } Then depress FIELD REL.
i)	VRFY OP STATUS (X) ?	Enter Y then FIELD REL to verify the operation status, by comparing the actaul status with the expected operation status setup in step h. Enter N then FIELD REL if you do not want to verify the operation status.
j)	DELAY MS (XXXXX)	Set the delay to 200 milliseconds which will be used in each loop of the program, then depress FIELD REL.
k)	LOOP COUNT (XXXXX)	Enter the decimal number of loops from 1 to 32,767 to be executed, then depress FIELD REL.
l)	TEST 10 – TROUBLESHOOTING AID XXXX = PROGRAM START ADR XXXX = IOCB ADR XXXX = DATA BUFFER ADR START EXECUTION Y/N? EXECUTING TROUBLESHOOTING AID PROGRAM	Enter Y to start execution of troubleshooting test; enter N to return to step a of this procedure.

	Display	Keyboard Response
m)	I/O CONTROL BLOCK CONTENTS (XXXX) – XXXX (XXXX) – XXXX (XXXX) – XXXX (XXXX) – XXXX (XXXX) – XXXX (XXXX) – XXXX (XXXX) – XXXX CNTLR STATUS – XXXX	This prompt will be displayed only if there was a controller or operation status miscompare between the expected and actual status. The values in parentheses are the main memory locations of the control block rungs. The values to the right are the actual contents of each control block rung. The I/O control block consists of eight contiguous memory locations (rungs) as follows: CB+0: Command/Track CB+1: Head/Sector CB+2: Sec code/Data address CB+3: Word count CB+4: Data block starting address CB+5: (not used) CB+6: Operation status CB+7: Final word count
n)	CONTINUE Y/N?	Enter N then FIELD REL if you do not want the program to execute once more. Enter Y then FIELD REL if you do wish to continue; return to step a of this procedure. Depress CTRL/BYPASS if you want to terminate test 10. Return to FD specific test procedure, paragraph 3.2.14.2, step d.

3.2.14.4 Flexible Disk Diagnostic Test Error Codes

Table 3-27 lists the flexible disk diagnostic test error codes, the test numbers failed, brief error descriptions and possible failing hardware modules.

Table 3-27. Flexible Disk Diagnostic Test Error Code Summary

Error Code	Test No.	Brief Description	Possible Failure
5001	12	Failure to disable bus drivers	FDC (Flexible disk controller)
5002	00	Bus error at controller address FF5X	FDC
5003	XX	Bus error	FDC
5004	00	Mail box data error	FDC

Table 3-27. Flexible Disk Diagnostic Test Error Code Summary (Continued)

Error Code	Test No.	Brief Description	Possible Failure
5005	00	Reset busy status bit error	FDC
5006	00	Incorrect FDC busy status bit setting	FDC
5007	00	Internal data loopback error	FDC
5008	00	Incorrect interrupt request status bit setting	FDC
5009	00	Internal timer error	FDC
500A	00	Internal register data compare error	FDC
500B	XX	FDC timeout error	FDC or diskette drive
500C	XX	Command timeout error	FDC or diskette drive
500D	XX	Operation status compare error	FDC or diskette drive
500E	XX	Controller status compare error	FDC
500F	XX	Data compare error	FDC or diskette drive
5010	XX	Index address mark error	Diskette drive
5011	XX	ID address mark error	Diskette drive
5012	XX	Data address mark error	Diskette drive
5013	XX	ID block compare error	Diskette drive
5014	XX	CRC compare error	FDC or diskette drive
5015	XX	Data compare error	Diskette drive
5016	03	Rotation time error	Diskette drive
5017	XX	Track address compare error	Diskette drive
5018	XX	Final word/CRC error count miscompare	FDC or diskette drive
5019	03	Head load time error	Diskette drive

Table 3-27. Flexible Disk Diagnostic Test Error Code Summary (Continued)

Error Code	Test No.	Brief Description	Possible Failure
501A	03	Unexpected head load	Diskette drive
501B	XX	Background data compare error	FDC or diskette drive
501C	03	Mailbox data error	FDC
501D	07	Must have two or more drives to execute test 7	Diskette drive

3.2.14.5 Flexible Disk Diagnostic Test Descriptions

Following is a brief functional description of each flexible disk diagnostic test; standard tests are indicated by asterisks.

Test 0: Basic Controller Test – verifies that the bus drivers function properly, that all controller addresses are accessible and that the mailbox register is operational.

Test 1: Command Test – verifies that each command executes correctly and that the busy and interrupt pending status bits are set correctly. It also tests the controller's ability to set most of the bits of the address bus and tests for correct data transfer. This test is executed using device options specified by the operator.

Test 2: Error Condition – verifies that the data bus error, control blank error, CRC error and track timeout status bits function correctly.

*Test 3: Controller/Drive Test – checks the diskette drive rotation speed and the head load time. It also checks the ability of the drive to seek through the full range of track and to perform random track seeks. It tests the controller's ability to transfer data blocks of different sizes.

Test 4: Write Test – performs sequential seek/write operations using operator specified parameters. It also checks for correct status after each individual operation.

Test 5: Read Test – performs sequential seek/read operations using operator specified parameters. It checks for correct status after each individual operation and, where applicable, compares the input and output buffers for data errors.

Test 6: Random Data/Write/Read Test – performs 256 random seek/write/read with random data within the range of the operator specified parameters.

*Test 7: Multiple Device Concurrency Test – checks the ability of the controller to do concurrent operations on two, three or four flexible disk drives.

Test 8: Initialize Test – initializes the diskette using the initialize with zero command with the sector format of the operator specified parameters.

Test 9: Verify Test – verifies that there are no header or CRC errors on the diskette. It executes the verify command with the sector format of the operator specified parameters.

Test 10: Troubleshooting Aid – allows the operator to troubleshoot the controller or drive at a basic level. The operator sets up the control block except for the data block starting address rung. He also sets up a loop count and specifies whether he wants to verify the operation and/or the device status. The program is then executed with each loop having the delay selected, looping as many times as selected. While looping, the controller cannot be interrupted and will return control to the operator when the loop count has reached zero. If verification of status was selected and an error occurs, the operator may gain control at the time of an error display. When the loop count has gone to zero, it will again prompt the operator to set up the control block. To exit this test CTRL/BYPASS should be entered at any point when the program is in the operator control mode.

Test 11: Verify Track IDS – verifies that the diskette tracks are properly initialized with the address marks and ID headers.

Test 12: Dump Diskette Data – will read the data from the diskette a track at a time and output it to the log device. If the line printer is to be the log device, this will be set up in the DX control options (CO).

Test 13: Alignment Aids – will perform repetitive seeks between the start and end tracks indefinitely until CNTRL/BYPASS is keyed.

Test 14: Integrity Test – determines the data integrity of the flexible disk subsystem by calculating the bit error rate. The formula for bit error rate is CRC errors/total bits read.

Test 15: Write Track – writes the entire track with no sector formatting using the data patterns specified in the operator specified parameters.

3.2.15 LARGE DISK EXERCISER DIAGNOSTICS (LD)

Paragraph 3.2.15 Contains the following information concerning the large disk exerciser diagnostics (LD):

- Step-by-step procedures for execution.
- Test error codes.
- Functional test descriptions.

If a specific function of the large capacity disk drive is to be tested, refer to paragraph 3.2.15.4, Large Disk Exerciser Diagnostics Test Descriptions, in order to select the proper test(s) to be run.

3.2.15.1 Large Disk Exerciser Diagnostics Test Procedure

At this point LD has been selected in the Diagnostic Operating Procedure, paragraph 3.2v. To execute the large disk exerciser diagnostic, follow the procedure below:

	Display	Keyboard Response
a)	-- LD DIAGNOSTIC COMMANDS -- DM- DISPLAY TEST MENU TS- TEST SELECTION DR- DEFINE REQUIREMENTS ST- SELECT STANDARD TESTS RT- RETURN TO DX CL- CLEAR TEST AND DR SELECTIONS PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
b)	-- LARGE DISK EXERCISER TESTS -- TEST 0* CONTROLLER SELF TEST TEST 1* PSEUDO WRITE AND READ TEST 2* NOPC COMMAND TEST 3* CLEAR DEVICE TEST 4* DRIVE TIMING TEST 5* FORMAT DIAGNOSTIC TRACKS TEST 6* SEEK TEST * = STANDARD TEST PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL

	Display	Keyboard Response
c)	-- LARGE DISK EXERCISER TESTS -- TEST 7* WRITE READ PARTIAL SECTORS TEST 8* DATA CHAINING TEST 9* ERROR CORRECTION CODE CHECK TEST 10* RANDOM WRITE READ TEST 11* WRITE WORST CASE DATA TEST 12* VERIFY SURFACE TEST 13* HEAD CHECK * = STANDARD TEST PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
d)	-- LARGE DISK EXERCISER TESTS -- TEST 14* INITIALIZE CMND TEST 15* VERIFY HEADERS TEST 16 USER'S CHANNEL PROGRAM * = STANDARD TEST 10, 11 WRITE SELECTED TRACKS IF MODE 2 5, 7, 8, 9, 14 USE DIAG TRACKS ONLY 12, 13, 15 USE SELECTED TRACKS ONLY ALL TESTS REQUIRE A DRIVE LD COMMAND =	DR then FIELD REL
e)	DRIVE TYPE: 1 = MMD, 2 = ISS, 3 = KENNEDY (3) =	Press FIELD REL
f)	CONTROLLER ADDRESS RANGES 1 = FF18 – FF1F 2 = FF10 – FF17 CONTROLLER NBR (1) =	Select the controller address range to be tested (1 or 2), the FIELD REL.
g)	DRIVE NBR (1) =	Select drive number to be tested (1-4).
h)	START CYLINDER (0) = END CYLINDER (699) =	Select the start cylinder, the FIELD REL. Select the end cylinder, the FIELD REL.
i)	START SURFACE (1) = END SURFACE (5) =	Select the surface(s) to be tested, then FIELD REL.

	Display	Keyboard Response
j)	DIAGNOSTIC MODES: 1. TEST DIAG TRACKS ONLY TO PRESERVE SYSTEM SOFTWARE AND DATA. 2. TEST SYSTEM SOFTWARE AND DATA SECTORS. ENTER DIAGNOSTIC TEST MODE (1).	Select 1 or 2 as appropriate. If 1 is selected go to step l.
k)	DESTROY SYSTEM SOFTWARE AND (YES/NO)	If 2 was selected in step 1, a YES must be entered to continue. Any other response will return to step h.
l)	ANYMORE DRIVES (N)	Y to test another drive, go to step e. FIELD REL to continue.
m)	TEST DATA PATTERN 1 - DB6D, B6DB, 6DB6 FOR MAXIMUM PEAK SHIFT 2 - FFFF, FFFF, FFFF FOR MAXIMUM FREQUENCY 3 - 0000, 0000, 0000 FOR MAXIMUM FREQUENCY 4 - AAAA, AAAA, AAAA FOR MINIMUM FREQUENCY 5 - AAA0, 00AA, A000 FOR FREQUENCY SHIFTING 6 - USER SUPPLIED 3 WORD DATA PATTERN DATA TYPE NUMBER (1) =	Select the data pattern the FIELD REL.
n)	MAX NBR OF DATA ERRORS REPORTED PER OPERATION (18)?	Press FIELD REL
o)	DISPLAY ALL INTERRUPT INFO (N)?	Press FIELD REL
p)	DISPLAY ALL REGISTERS ON ERRORS (N)?	Press FIELD REL
q)	LD COMMAND =	ST then FIELD REL to run standard tests. TS then FIELD REL to run test selections. Go to paragraph 3.2.15.2.
r)	THE STANDARD SET OF TESTS (0-15) HAS BEEN SELECTED	(No response)
s)	LD COMMAND	RT then FIELD REL.
t)	DX DIRECTIVE =	EX then FIELD REL.

	Display	Keyboard Response
u)	LD TEST IN PROGRESS TEST (number and title) PROGRESS (number)	At this time the specific or standard tests will be executed. If there is an error, refer to paragraph 3.2.15.3. If no errors occur the following prompt will be displayed.
v)	TOTAL ERRORS = 0 DX PASS COUNT = 1 DX DIRECTIVE =	EX will repeat the execution of the selected tests. CL will clear the selected tests and testing of another unit may begin CO to redefine DX control options.

3.2.15.2 Large Disk Exerciser Diagnostic Test Selection Procedure

At this time TS has been selected in the Large Disk Exerciser. Diagnostic Test Procedure, paragraph 3.2.15.1r.

To execute specific large disk exerciser diagnostic test(s) follow the procedure below:

	Display	Keyboard Response
a)	TEST (0) =	Select the test number to be run (0-16) then FIELD REL.
b)	COUNT (1) =	Select the iteration count (0-32767), (0 will cause the test to be skipped), then FIELD REL.
c)	ANYMORE TESTS (Y)?	If N then FIELD REL is selected, return to paragraph 3.2.15.1r. If FIELD REL is selected, return to paragraph 3.2.15.2a. The test number default will be incremented by one.

3.2.15.3 Large Disk Exerciser Diagnostic Test Descriptions

The following information provides a brief description of each test of the large disk exerciser diagnostics. The tests are explained on a functional level only. Standard tests are indicated by an asterisk.

* Test 0: Controller Self Test

This test checks the reset operation of the LCDC controller by writing a zero to the reset register to cause the controller to disconnect from the universal bus. This is verified, and a 0001 is written to the reset register and verified.

* Test 1: Pseudo Write and Read

This test issues read and write commands to drives number six and seven, then drives number four and five. These drive numbers cause the LCDC to read from the write to its own data RAM. Drives number six and seven use the LCDC's internal clock and drives number four and five use the disk drive's servo track clock (PLO).

* Test 2: NOPC Command

This test checks the ability of the controller to switch from LCDC commands to LCD commands and to properly count through any legal number of LCD commands following a Fetch command (FCHI) by issuing an FCHI followed by from one to 128 NOPC commands.

* Test 3: Clear Device Command

This test issues a clear device command to each selected drive and verifies proper status.

* Test 4: Drive Timing

This test verifies drive timing calculating and displaying single track seek time, maximum track seek time, and rotation speed of the drive.

* Test 5: Format Diagnostic Tracks

This test executes only on the diagnostic cylinders. It also formats the diagnostic tracks for Tests 6 through 13. This is accomplished by formatting the diagnostic tracks, then issuing a Header Lock command. A Header Rewrite command is then issued and the expected error verified.

* Test 6: Seek Test

This test requires Test 5 to be performed first.

The test causes the drive to seek through several different sequences, then verifies the heads are where they should be.

* Test 7: Write Read Partial Sectors

This test requires Test 5 to be performed first.

The test writes data to the diagnostic track with a length of less than one sector. It then reads the sector and verifies the remainder of the sector has been padded with zeros.

* Test 8: Data Chaining

  This test requires Test 5 to be performed first.

  The test verifies the ability of the controller to chain data from more than one main memory buffer into a single write operation, as if the data came from one large buffer.

* Test 9: Error Correction Code Check

  This test requires Test 5 to be performed first.

  The test simulates from one to 11 dropped bits and verifies that auto error recovery can recover the dropped data.

* Test 10: Random Write Test

  This test requires Test 5 to be performed first.

  The test randomly exercises the selected drive(s) for 500 write/read operations, or the test is bypassed.

* Test 11: Write Worst Case Data

  This test requires Test 5 to be performed first.

  The test writes the selected data pattern (worst case default) to all of the diagnostic sectors and all sectors of the diagnostic tracks. If Mode 2 is selected, the data is also written to the system sectors.

* Test 12: Verify Surface

  This test requires Test 5 to be performed first.

  The test verifies each track of the specified cylinders, first from minimum to maximum, then from maximum to minimum cylinders.

* Test 13: Head Check

  This test requires Test 5 to be performed first.

  The test seeks to the diagnostic cylinder, then cycles through all of the heads, performing a write/read of the selected data pattern.

* Test 14: Initialize Command

To be supplied

* Test 15: Verify Headers

To be supplied

* Test 16: Verify Users Channel

To be supplied

3.2.15.4 Large Disk Exerciser Diagnostic Test Error Codes

Table 3-28 lists the large disk exerciser diagnostic error codes, the test number failed, brief error descriptions, and possible failing hardware.

Table 3-28. Large Disk Exerciser Diagnostic Test Error Codes

Error Code	Test No.	Brief Description	Possible Failure
4800	–	NBR disable error	–
4801	–	NBR bus timeout	–
4802	–	Unexpected memory error	–
4803	–	Unexpected controller interrupt	–
4804	–	Failure of mailbox busy bit	–
4805	–	Reset failure	–
4806	–	Missing interrupt	–
4807	–	Command failure	–
4808	–	Failure of users program	–
4809	–	Channel program status error	–
480A	–	Psuedo-write failure	–
480B	–	Psuedo-read failure	–
480C	–	NOPC failure	–
480D	–	Drive timing error	LCD
480E	–	Format error	LCD
480F	–	Damping seek error	LCD
4810	–	Partial sectors error	LCD
4811	–	Data chaining error	LCD
4812	–	NBR clear device error	–
4813	–	ECC check error	–
4814	–	Write/read error	–

Table 3-28. Large Disk Exerciser Diagnostic Test Error Codes - continued

Error Code	Test No.	Brief Description	Possible Failure
4815	–	Standard write error	–
4816	–	Standard read error	–
4817	–	Standard seek error	LCD
4818	–	Standard verify track error	–
4819	–	Standard initialize track error	–
481A	–	Verify error	–
481B	–	Initialize command error	–
481C	–	Read track format error	–
481D	–	PDFM checksum error	–
481E	–	TTFM checksum error	–
481F	–	Standard Test I/O error	–

3.2.16 LARGE CAPACITY DISK DIAGNOSTICS (LC)

Paragraph 3.2.16 contains the following information concerning the large capacity disk controller diagnostics (LC):

- Step-by-step procedures for execution.
- Test error codes.
- Functional Test Descriptions.

If a specific function of the large capacity disk system is to be tested, refer to paragraph 3.2.16.3, Large Capacity Disk Diagnostic Test Descriptions, in order to select the proper test(s) to be run.

3.2.16.1 Large Capacity Disk Diagnostic Test Procedure.

At this point LC has been selected in the Diagnostic Operating Procedure, paragraph 3.2v. To execute the large capacity disk diagnostic, follow the procedure below:

	Display	Keyboard Response
a)	–– LC DIAGNOSTIC COMMANDS –– CL- CLEAR TEST SELECTIONS DM- DISPLAY TEST DESCRIPTION MENUS DR- DEFINE LC OPTIONS LS- LOOP ON SUBTEST SELECTION RT- RETURN TO DX ST- STANDARD TEST SET SELECTION TS- TEST SELECTION PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL.

	Display	Keyboard Response
b)	-- LARGE CAPACITY DISK CONTROLLER TESTS -- TEST 0* LCDC RESET/STATUS EXAMINATION TEST 1* U-BUS INTERFACE REGISTERS TEST 2* DISK DRIVE ACCESS/ADDRESS TEST 3* DMA TO SYSTEM MEMORY TEST 4* LCDC COMMANDS TEST 5* LCDC COMMANDS/INSTRUCTIONS TEST 6* WRITE/READ PSEUDO DRIVE * = STANDARD TEST PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
c)	-- LARGE CAPACITY DISK CONTROLLER TEST -- TEST 7* LCDC INSTRUCTIONS/LCD COMMANDS TEST 8 LCDC OPTION SWITCH SETTINGS TEST 9 BUILD CHANNEL PROG UTILITY TEST 10 LDCC MEMORY I/O UTILITY * = STANDARD TEST TEST 7 REQUIRES THAT A DRIVE BE PRESENT PRESS 'FIELD REL' TO CONTINUE	Press FIELD REL
d)	LC COMMAND =	DR then FIELD REL.
e)	DRIVE TYPE 1 = KENNEDY 5300 2 = ISS717 SELECT TYPE (1) =	Select the type of drive to be tested.
f)	CONTROLLER ADDRESS RANGES 1 = FF10 – FF17 2 = FF18 – FF1F CONTROLLER (1) =	Select the controller number.
g)	SELECT DRIVE: 0 MEANS TEST NO DRIVE DRIVE (0) =	Select the number of the drive to be tested (1-4) then FIELD REL.
h)	TEST OTHER CONTROLLER/DRIVES (N)?	If testing of another drive or controller is desired enter Y, if not FIELD REL.

	Display	Keyboard Response
i)	CLEAR DEVICE AFTER ERROR (N)?	If clear of controller after an error is desired enter Y, if not FIELD REL.
j)	LC COMMAND =	ST then FIELD REL to run standard tests. TS then FIELD REL to run test selections. Go to paragraph 3.2.16.2.
k)	THE STANDARD SET OF TESTS (0-7) HAS BEEN SELECTED.	(No response)
l)	LC COMMAND =	RT then FIELD REL.
m)	DX DIRECTIVE =	EX then FIELD REL.
n)	LC TEST IN PROGRESS TEST (number and title) COUNT (number) PROGRESS (number)	At this time the specific or standard tests will be run. If there is an error, see paragraph 3.2.16.3. If no errors occur the following will be displayed.
o)	TOTAL ERRORS = 0 DX PASS COUNT = 1 DX DIRECTIVE =	EX to repeat the execution of the selected tests. CL to clear the selected tests and testing of another unit may begin. CO to redefine the DX control options.

3.2.16.2 Large Capacity Disk Diagnostic Test Selection Procedure

At this time TS has been selected in the Large Capacity Disk Diagnostic Test Procedure, paragraph 3.2.16.1i.

To execute specific large capacity disk diagnostic test(s) follow the procedure below:

	Display	Keyboard Response
a)	TEST (0) =	Select the test number to be run (0-10) then FIELD REL.
b)	COUNT (1) =	Select the iteration count (0-32767), (0 will cause the test to be skipped), the FIELD REL.
c)	ANYMORE TESTS ? (Y) =	If N then FIELD REL is selected, return to paragraph 3.2.16.1k. If FIELD REL is selected, return to step a. The test number default will be incremented by one.

3.2.16.3 Large Capacity Disk Diagnostic Test Descriptions

The following information provides a brief description of each test of the large capacity disk diagnostics. The tests are explained on a functional level only. Standard tests are indicated by an asterisk.

* Test 0: LCDC Reset/Status Examination

This test verifies that each selected controller is attached to the universal bus. If the controller is present, a reset command is issued.

* Test 1: U-Bus Interface Registers

This test examines the universal bus following a reset, looking for expected values. The attention register is given a valid command, then an invalid command and correct interrupt responses and error statuses are verified.

* Test 2: Disk Drive Access/Address

This test accesses the selected controller's disk drive(s) and compares the drive's status to the expected value. Entire status for all drives is presented.

* Test 3: DMA To System Memory

This test moves a block of words from system memory to the LCDC data RAM and back into system memory. It is repeated several times with different word counts and addresses. The data is verified as being correctly transferred.

* Test 4: LCDC Commands

This test verifies operation of LCDC commands: HIO, CLD, TIO, NOP and to a lesser extent S10. No drive is needed for this test.

* Test 5: LCDC Commands/Instructions

This test verifies operation of LCDC that do not rely on data transfers. Channel programs are used more extensively. No drive is needed for this test.

* Test 6: Write/Read Pseudo Drive

This test exercises the read/write capabilities of the controller and should be run after tests four or five to ensure correct operation of the channel programs. Data of varying types are used. The ability of the LCDC to handle small buffers, both individually and chained, is also tested. Memory error processing is tested.

* Test 7: LCDC Instructions/LCD Commands

This test is the most exhaustive tests of LCDC commands, LCDC instructions, and LCD commands. This test requires the selection of a disk drive. If no drive is selected, the test is bypassed.

Test 8: LCDC Switches

This test displays the current configuration of the Feature Select, Address/Capacity, and Self Test switches on the LCDC PCBA.

Test 9: Build Channel Programs Utility

This is not properly a diagnostic test, but a utility program to build channel programs. The manual mode assumes detailed knowledge of channel program constructs. The utility is menu driven and self-prompting.

Test 10: LCDC Memory I/O Utility

This is not properly a diagnostic test, but a utility program to enable interface with one of the LCDC self-test routines. With switch 6 of the self-test switch set to "ON", LCDC address space may be written to or read from.

The format of the LCDC memory data report is as follows:

NNNN MM MM MM MM MM MM MM MM

NNNN = The LCDC memory address of the first byte on each line.

MM = The contents of each byte.

3.2.16.4 Large Capacity Disk Diagnostic Test Error Codes

Table 3-29 lists the large capacity disk diagnostic error codes, the test number failed, brief error descriptions, and possible failing hardware.

Table 3-29. Large Capacity Disk Diagnostic Test Error Codes

Error Code	Test No.	Brief Description	Possible Failure
4400	XX	An invalid memory error interrupt occurred	LCDC
4401	XX	The error address reported after a memory error was incorrect	LCDC

Table 3-29. Large Capacity Disk Diagnostic Test Error Codes - continued

Error Code	Test No.	Brief Description	Possible Failure
4402	XX	An attempt to disable the universal bus drivers for the LCDC failed	LCDC
4403	XX	Reading the universal bus register while the bus drivers were disabled caused a timeout with an invalid status	LCDC
4404	XX	LCDC reset with E-bit ON results in a timeout	LCDC CONTROL
4405	XX	A timeout occurred when the bus drivers should have been enabled	LCDC
4406	XX	Self-test did not complete after three seconds	Self-test switch
4407	XX	Error in self-test	LCDC
4408	XX	Error in fetching file. The file may not exist	–
4409	XX	A conflict exists between the channel program and the data buffer	–
440A	XX	Invalid register content following self-test	LCDC
440B	XX	Invalid register contents after executing a NOP command	LCDC
440D	XX	Invalid register content after executing a NOPI command	LCDC
440E	XX	Mailbox busy not set after initiating an LCDC command	LCDC
440F	XX	The expected number of interrupts did not occur	LCDC
4410	XX	Invalid status after a DMC command	LCDC
4411	XX	Data miscompare after a loopback operation	LCDC
4412	XX	Invalid status after an IRC command	LCDC
4413	XX	Data miscompare after a loopback operation	LCDC
4414	XX	Insufficient buffer space	–

Table 3-29. Large Capacity Disk Diagnostic Test Error Codes - continued

Error Code	Test No.	Brief Description	Possible Failure
4415	XX	Invalid status after an illegal command	LCDC
4416	XX	An invalid entry in the channel program was not processed correctly	LCDC
4417	XX	A simple channel program could not be executed successfully	LCDC
4418	XX	An HIO command was improperly executed	LCDC
441A	XX	Data differed from one TIO execution to the next	LCDC
441B	XX	Invalid status after TIO command	LCDC
441C	XX	Invalid status after SIO command	LCDC
441D	XX	Invalid status after CLD command	LCDC
441E	XX	Invalid status after NOP command	LCDC
441F	XX	Incorrect residual byte count	LCDC
4420	XX	An LCDC interrupt occurred at an unexpected time	LCDC
4421	XX	An interrupt bit in the operation status register was not set	LCDC
4422	XX	Data returned to memory did not match data sent	LCDC
4423	XX	Data returned to memory did not match data sent	LCDC
4424	XX	Data was moved to the wrong place in memory	LCDC
4426	XX	Invalid contents in the channel program header	LCDC
4427	XX	Invalid contents in the channel program header	LCDC
4428	XX	Invalid contents in the channel program header	LCDC
442A	6	An expected memory error did not occur	LCDC
442C	XX	SMUX memory error and LCDC memory error do not match	LCDC or XPU2

3.3 OFF-LINE DIAGNOSTIC TAPE COPY PROCEDURE

The utility program of the Support Control System (SCS) is used to copy off-line diagnostic tapes. To copy a diagnostic tape follow the procedure below:

CAUTION

BE SURE TO SAVE ALL CUSTOMER DATA THAT IS ON DISK BEFORE EXECUTING THE FOLLOWING PROCEDURE.

	Display	Operator Action
a)		Mount the diagnostic tape to be copied and bring it to the load point reflector and depress READY on the drive.
b)		Wait for the diagnostic display indicator to reach 36 and then depress LOAD and IPL release (blank push button) on the system control panel simultaneously. Wait 30–60 seconds for the completion of the IPL. Upon successful completion the diagnostic display indicator will show only decimal points.
		CAUTION **BE SURE THAT ALL CUSTOMER DATA HAS BEEN SAVED.**
c)	RESIDENT UNIT = (REL = MT1)	Enter DK1 then FIELD REL which places the diagnostics on disk.
d)	INITIALIZE DISK? (Y = YES, REL = NO)	Depress FIELD REL. Y then FIELD REL will initialize the disk.
e)		Rewind tape and mount tape to be copied onto, with a write ring in place. Bring tape to load point and depress READY on the tape drive.
f)	SUPPORT CONTROL SYSTEM V DATE =	Enter 3–5 digit Julian date (yyddd, where yy is the year and ddd is the date) then FIELD REL.

	Display	Operator Action
g)	SUPPORT CONTROL SYSTEM V DATE = yyddd TIME = hhmm	Enter the time in military form (hhmm, where hh is 0-23 hours and mm is 0-59 minutes, then FIELD REL.
h)	ENTER SCS COMMAND	Enter EX, UTILITY then FIELD REL.
i)	UTILITY PROGRAM (10) KEY COMMAND	Enter DIAGNOSTIC, CO then FIELD REL to generate an off-line diagnostic tape preceded by the IPL mandatory diagnostics. Enter SAVE, CO then FIELD REL to generate an off-line diagnostic tape with no IPL mandatory diagnostics. Enter /* then FIELD REL to return to paragraph 3.3g above (cancels utility program). After this tape has been copied, rewind it and remove the write ring.

3.4 MISCELLANEOUS ERROR CODES

Paragraph 3.4 contains explanations of the following miscellaneous types of errors which may result when running the off-line diagnostics:

- XPU or XPU2 microcode firmware selftest errors.
- IPL mandatory diagnostics errors.
- Rigid disk bootstrap errors.
- Magnetic tape bootstrap errors.
- IOCTL errors.
- Unexpected interrupts.
- Status errors.

3.4.1 XPU MICROCODE FIRMWARE SELFTEST ERROR CODES

Table 3-30 below lists the XPU selftest error codes (seen in the diagnostic display), brief error descriptions and possible failing hardware module.

Table 3-30. XPU Microcode Firmware Selftest Error Code Summary

Octal Error Code	Brief Description	Possible Failure
001	Disable RAM0 (main memory locations 0000–3FFF) and SMUX, clear memory error registers (FFF9 and FFFA) and read address 0001.	Main memory (RAM0)
002	Enable SMUX, and read memory error status register (FFF9) to detect a timeout.	SMUX
004	Read memory error address register (FFFA), to verify its contents to be 0001.	SMUX
005	Clear memory error registers and read memory error status register (FFF9) to verify no memory error.	SMUX
007	Clear memory error registers and read address 0001.	Main memory (RAM0)
010	Enable SMUX and read memory error status register (FFF9) to detect a timeout.	SMUX
012	Read memory error address register (FFFA) to verify its contents to be 0001.	SMUX

Table 3-30. (Continued)

Octal Error Code	Brief Description	Possible Failure
013	Clear memory error registers and read memory error status register (FFF9) to verify no memory error.	SMUX
015	Enable RAM0 (main memory locations 0000–3FFF) and read memory error status register (FFF9) to verify no memory error.	Main memory (RAM0)
017	Check bootstrap buffer starting address to verify no memory error.	XPU or main memory (RAM0)
020	Check value read from bootstrap buffer starting address.	XPU or main memory (RAM0)
021	Check PSW save buffer location to verify no memory error.	XPU or main memory (RAM0)
022	Check value read from PSW save buffer.	XPU or main memory (RAM0)
023	Check P register save buffer location to verify no memory error.	XPU or main memory (RAM0)
024	Check value read from P register save buffer.	XPU or main memory (RAM0)
025	Check A register save buffer location to verify no memory error.	XPU or main memory (RAM0)
026	Check value read from A register save buffer.	XPU or main memory (RAM0)
027	Check B register save buffer location to verify no memory error.	XPU or main memory (RAM0)
030	Check value read from B register save buffer.	XPU or main memory (RAM0)
031	Check X register save buffer location to verify no memory error.	XPU or main memory (RAM0)

Table 3-30. (Continued)

Octal Error Code	Brief Description	Possible Failure
032	Check value read from X register save buffer.	XPU or main memory (RAM0)
033	Check carry-out-of P register.	XPU
034	Check carry-out-of A register.	XPU
035	Check carry-out-of B register.	XPU
036	Will be displayed when the system has powered up and is waiting for the operator to depress TAPE LOAD and IPL release or RESTART and IPL release. It will also be displayed if RESTART and IPL release are depressed and the disk is not ready.	—
037	Read bootstrap buffer starting address.	—
040	Read memory error status register (FFF9) to verify no memory error.	SMUX
042	Will be displayed after a successful bootstrap; software is ready to be loaded.	XPU
045	Read controller status.	MTC or RDC
050	Check trace interrupt.	XPU
051	Check memory error interrupt.	XPU, SMUX or main memory
052	Check reserve instruction interrupt.	XPU
053	Check stack error interrupt.	XPU
377	Will be displayed flashing immediately after power on, a master protect or when an XPU microcode parity error is detected.	XPU or power supply
888	Will be displayed if no +5V is supplied to the XPU.	Power supply

3.4.2 XPU2 MICROCODE FIRMWARE SELFTEST ERROR CODES

Table 3-31 lists the XPU2 selftest error codes seen in the diagnostic display, brief error descriptions and possible failing hardware modules.

Table 3-31. XPU2 Microcode Firmware Selftest Error Code Summary

Octal Error Code	Brief Description	Possible Failure
001-007	Reserved.	
010	Verify the XPU2 microcode and register operations.	XPU2
011	Enable SMUX and first 16K memory. Verify no memory error occurs.	SMUX
012	Write PSW, P, A, B, X and XFFFF at unmapped memory address X126 through X12B. Verify no memory errors occur.	Main memory (RAM 0)
013	Write ones complement of P, A, B and X. Verify data readback is correct and no memory errors occur.	Main memory (RAM 0)
014	Write ones and zeros to XPU2 registers MP, IR, TMP, PSW and MAR. Verify data readback is correct.	XPU2
015	Write ones and zeros to XPU2 registers NS, S and Q. Verify data readback is correct.	XPU2
016-031	Reserved.	
032	Enable the SMUX and disable first 16K of memory. Read memory cell addressed by X7F. Verify the expected SMUX memory timeout error and memory error interrupt request status bits are set.	SMUX
033	Enable first 16K of memory and write X1FFF, X0000 and XE000 at unmapped memory addresses X3FFF through X0000. Verify no memory errors occur.	Main memory (RAM 0)
034	Read unmapped memory address X1FFF through X0000. Verify no memory errors occur.	Main memory

Table 3-31. (Continued)

Octal Error Code	Brief Description	Possible Failure
035	Verify data readback is correct.	Main memory (RAM 0)
036	Will be displayed when the system has powered up and is waiting for the operator to depress LOAD and IPL release.	------
037	Read bootstrap buffer starting address.	------
040	Read memory error status register (FFF9) to verify no memory error.	SMUX
042	Will be displayed after a successful bootstrap; software is ready to be loaded.	XPU2
045	Read controller status.	FDC
047	Check page fault trap.	XPU2
050	Check trace interrupt.	XPU2
051	Check memory error interrupt.	XPU2, SMUX or main memory
052	Check reserve instruction interrupt.	XPU2
053	Check stack error interrupt.	XPU2
377	Will be displayed flashing immediately after power on, a master protect or when an XPU2 microcode error is detected.	XPU2 or power supply
888	Will be displayed if no +5V is supplied to the XPU2	Power supply

3.4.3 IPL DIAGNOSTIC ERROR CODES

Table 3-32 lists the possible IPL error codes, together with associated error description and possible failing hardware, contained in Release 4.0 of the XL40 Diagnostic Tape. All errors ranging from $060_8 - 272_8$ are signaled by flashing of the three octal indicators on the system status display panel and are applicable to both XPU or XPU2 equipped systems unless noted otherwise. If error codes appear that are not listed, the XPU or diagnostic display panel may be at fault.

Table 3-32. IPL Error Code Summary

Octal Error Code	Error Description	Possible Failure
060—066	Error occurred while trying to load next IPL module	Magnetic tape
067	A checksum error has been found	XPU memory or magnetic tape
070	Error occurred before any tests	—
071	BMI-BPL test failed	XPU
072	BEQ-BNE test failed	XPU
073	BOC-BNC test failed	XPU
074	BOV-BNV test failed	XPU
075	LDA test failed	XPU
076	ADD test failed	XPU
077	AND test failed	XPU
100	IOR test failed	XPU
104	Failure to initialize memory field 1	Main memory
105	COM test failed	XPU
106	NEG test failed	XPU
107	CMP test failed	XPU
110	Unexpected data com interrupt	COMM controller or XPU
111	Unexpected SMUX interrupt	SMUX or XPU
112	Unexpected tape controller interrupt	Mag tape controller or XPU

Table 3-32. (Continued)

Octal Error Code	Error Description	Possible Failure
113	Unexpected card reader interrupt	Card Read controller or XPU
114	Unexpected level B interrupt	XPU
115	Unexpected floppy disk controller interrupt	Floppy disk controller or XPU
116	Unexpected disk controller interrupt	Disk controller or XPU
117	Unexpected CCD memory 1 interrupt	CCD memory 1 or XPU
120	Unexpected CCD memory 2 interrupt	CCD memory 2 or XPU
121	Unexpected interrupt from real time clock	SMUX or XPU
122	Unexpected interrupt from temperature alarm	Power supply or XPU
123	Memory error interrupt	Memory or XPU
*124	Unexpected privileged instruction interrupt	XPU
*125	Unexpected supervisor call interrupt	XPU
*126	Spare 1 interrupt	XPU
*127	Spare 2 interrupt	XPU
130	Unexpected stack service interrupt	XPU
131	Page fault interrupt	XPU
132	Unexpected overlay interrupt	XPU
133	Unexpected test panel interrupt	XPU
134	XOR test failed	XPU
135	CAX-CXA test failed	XPU
136	EAX test failed	XPU

Table 3-32. (Continued)

Octal Error Code	Error Description	Possible Failure
140	PSW test failed	XPU
141	BXE test failed	XPU
142	BXN test failed	XPU
143	CAB-CBA test failed	XPU
144	EAB test failed	XPU
145	Based vs indexed addressing mode test failed	XPU
146	Short form absolute addressing mode test failed	XPU
147	LDA-ADD test failed	XPU
150	Long form indexed addressing mode test failed	XPU
151	Short form indexed addressing mode test failed	XPU
152	RAM (1st 16K) parity initialization - verification failed	XPU
153	Long form indirect addressing mode test failed	XPU
154	Short form indirect addressing mode test failed	XPU
155	Long form indirect indexed mode test failed	XPU
156	Short form indirect indexed mode test failed	XPU
157	BLS-BHI test failed	XPU
160	BGE-BLT test failed	XPU
161	BLE-BGT test failed	XPU
162	NABL-DSBL test failed	XPU
164	LDAL-STAL-ADDL-CMPL test failed	XPU
*166	CAN-CNA test failed	XPU
*167	CAM-CMA test failed	XPU
170	CBX-STB test failed	XPU
171	CXB test failed	XPU

Table 3-32. (Continued)

Octal Error Code	Error Description	Possible Failure
172	XAB-XAX-XBX test failed	XPU
173	INM-DCM test failed	XPU
174	ADM test failed	XPU
175	CAT-CTA test failed	XPU
176	CBT-CTB test failed	XPU
177	CXT-CTX test failed	XPU
200	XAT-XBT-XXT test failed	XPU
201	LDAA test failed	XPU
204	PSHA-PSHX-CMPT test failed	XPU
205	POPA-POPX-POPM test failed	XPU
206	RTI test failed	XPU
210	JSR test failed	XPU
211	RTS test failed	XPU
*212	POPR-PSHR test failed	XPU
*213	CAC-CCA test failed	XPU
214	SVC test failed	XPU
*215	LTR test failed	XPU
*220	LTO test failed	XPU
221	MOVB test failed	XPU
224	ASR test failed	XPU
225	ASRD test failed	XPU
226	ASL test failed	XPU
227	ASLD test failed	XPU
230	LSR test failed	XPU

Table 3-32. (Continued)

Octal Error Code	Error Description	Possible Failure
231	LSRD test failed	XPU
232	LSL test failed	XPU
233	LSLD test failed	XPU
234	ROR test failed	XPU
235	RORD test failed	XPU
236	ROL test failed	XPU
237	ROLD test failed	XPU
*240	BIS-BIR-TSTB test failed	XPU
*241	NEXT test failed	XPU
**242	RCR test failed	XPU
**243	RCL test failed	XPU
244	Initialize and determine memory size test failed	Main memory
245	Memory address uniqueness test failed	Main memory
246	Memory address data patterns test failed	Main memory or XPU
247	Memory data swap test failed	Main memory or XPU
250	SMUX reset test failed	SMUX
251	SMUX block address register test failed	SMUX
252	SMUX block address register increment test failed	SMUX
253	SMUX block length register test failed	SMUX
254	SMUX block length increment test failed	SMUX
255	SMUX polling control register increment test failed	SMUX
256	SMUX automatic polling address increment test failed	SMUX

Table 3-32. (Continued)

Octal Error Code	Error Description	Possible Failure
257	SMUX diagnostic polling address increment test failed	SMUX
260	SMUX coax data loopback test failed	SMUX
*264	Map register RAM test failed	Main memory or XPU
*265	LDMAP-STMAP instruction test failed	XPU
*266	User state test failed	XPU
*267	Mapping test failed	XPU
*270	Write protected mapping test failed	XPU
271	SKPWRD instruction test failed	XPU
272	Error occurred between the exit stage of IPLA and the start of the attempt to get SCS.	—

* = XPU2 only
** = XPU only

Note: Error indicators 110 through 133 are interrupt handlers.

3.4.4 RIGID DISK BOOTSTRAP ERROR CODES

One of the following octal error codes will be displayed on the diagnostic display if the disk controller detects a bootstrap error after RESTART has been depressed.

Five error conditions can occur:

- Drive malfunction — indicates that one of the drives (whether selected or not) detected a malfunction.
- Sector overrun — indicates that a sector pulse occurred prior to completion of the data operation for that sector.
- Data late — indicates that the RDC was not able to gain access to the main memory in time to stay in sync with the disk.
- CRC error — indicates that the CRC read from the disk did not match the generated code during a read or verify command.
- Header error — indicates that the header-data-field read from the disk does not match the header data expected by the RDC.

Table 3-33 below lists all possible error codes, the error conditions and the possible malfunctioning hardware module. Error codes range from octal 300 to 337, which may be an octal combination of 300_8 and the two least significant bits of the error code.

Table 3-33. Rigid Disk Bootstrap Error Code Summary

Octal Error Code	Brief Description	Possible Failure
301	Drive malfunction.	Disk drive
302	Sector overrun.	Disk drive
304	Data late.	RDC
310	CRC error.	Disk drive or RDC
320	Header error.	Disk drive or RDC

3.4.5 MAGNETIC TAPE BOOTSTRAP ERROR CODES

One of the following octal error codes will be displayed on the diagnostic diaplay if the magnetic tape controller detects a bootstrap error after LOAD has been depressed.

Five error conditions can occur:

1. File mark detected.
2. CRC, LRC or parity error.
3. Gap/format error – if this error occurs on an NRZI transport (gap error), this indicates that 2 gaps (on 7-track transports) or 3 gaps (on 9-track transports) of more than 2½ characters were detected after 12 successive characters of proper spacing preceding the first gap.

   If this error occurs on a DE transport (format error), this indicates any of the following conditions:

   - Ones are detected during the 8 character times following lock on (preamble error, tested across all 9 tracks).
   - No ones are detected from 8 to 30 character times following lock on and a file mark is not detected (sync error tested across all 9 tracks).
   - More than one channel loses its envelope signal after lock on and a file mark is not detected.
   - More data skew is encountered than the deskewer circuit can accommodate (skew error).
   - Ones are detected in any track from 0 to 22 character times after the postamble start (postamble error). Any envelopes are detected from 44 to 66 character times after the postamble start.

4. Data handling errors can be due to:

   - Read late – indicates when a data character is received from the tape transport before the present data character has been processed.
   - Write late – indicates when a data character has not been processed in time to output it to the transport.
   - DMA overlap – indicates that a DMA request is being made while the MTC is performing a DMA.

5. Internal diagnostic initialization test failure.

Table 3-34 lists the error codes and the possible malfunctioning hardware module.

Table 3-34. Magnetic Tape Bootstrap Error Code Summary

Octal Error Code	Brief Description	Possible Failure
372	File detected.	Tape drive or magnetic tape
373	CRC, LRC or parity error.	MTC, tape drive or magnetic tape
374	Gap/format error.	Tape drive
375	Data handling error (read late, write late, DMA overlap)	MTC
376	Internal diagnostic initialization test failure.	MTC

3.4.6 FLEXIBLE DISK BOOTSTRAP ERROR CODES

Octal error codes will be displayed on the diagnostic display if the flexible disk controller detects a bootstrap error after LOAD has been depressed. Four error conditions can occur:

- Unexpected data address mark — indicates that a read of the track data address mark does not agree with control block data address mark.
- Track timeout — indicates that an index pulse occurred prior to completion of the search for ID track 1 header.
- Data overrun — indicates that the FDC was not able to gain access to the main memory in time to stay in sync with the disk.
- CRC error — indicates that the CRC read from the disk did not match the generated code during a read or verify command.

Table 3-35 lists all possible error codes, the error conditions and the possible failing hardware module. Error codes range from octal 340 to 357, which may be an octal combination of 300_8 and the two least significant bits of the error code.

Table 3-35. Flexible Disk Bootstrap Error Code Summary

Octal Error Code	Brief Description	Possible Failure
341	Unexpected data address mark.	Diskette drive or FDC
342	Track timeout.	Diskette drive
344	Data overrun.	FDC
350	CRC error.	Diskette drive or FDC

3.4.7 IOCTL ERROR CODES

If an IOCTL error occurs, the following message will be displayed:

IO ERROR: U = XXXX F = YYYY S = ZZZZ

Table 3-36 lists the codings and meanings of these values.

Table 3-36. IOCTL Error Coding

U = XXXX (unit number)	F = YYYY (function)	S = ZZZZ (status)
0001: MTC 0, tape drive 1 0002: MTC 0, tape drive 2 0003: MTC 0, tape drive 3 0004: MTC 0, tape drive 4 See note below.	0003: read 0004: write 0005: rewind 0006: write filemark 000B: read status 000C: backspace record 000D: backspace file 000E: read without transfer 000F: skip file	0100: non-existent unit error occurs if the specified unit is not present in the present hardware configuration (software malfunction). 0200: unresolvable request errors occurs if the user program specifies a unit number which is not defined (software malfunction). 0400: unrecoverable error occurs if an operation results in an error and ten retries could not solve the problem.
0006: keystation	0001: input one character 0002: output one character 0003: input character string 0004: output character string	

Table 3-36. IOCTL Error Coding (Continued)

U = XXXX (unit number)	F = YYYY (function)	S = ZZZZ (status)
0007: RDC 0, disk drive 0, bottom platter 0008: RDC 0, disk drive 0, top platter 0009: RDC 0, disk drive 1, bottom platter 000A: RDC 0, disk drive 1, top platter 000B: RDC 1, disk drive 0, bottom platter 000C: RDC 1, disk drive 0, top platter 000D: RDC 1, disk drive 0, bottom platter 000E: RDC 1, disk drive 1, top platter	0003: read 0004: write 0005: restore 0006: initialize 000E: read without transfer	0800: unit not ready error occurs if the specified unit is not ready or if the write ring is not installed to perform a tape write. After a chacracter is entered the program will attempt the operation again.
0010: ASCII line printer 0011: EBCDIC line printer	0004: output	
0012: FDC0, drive 1 0013: FDC0, drive 2 0014: FDC0, drive 3 0015: FDC0, drive 4	0003: read 0004: write 0005: restore 0006: initialize 000B: read status 000E: read without transfer	

NOTE: The following unit modification bits are added to the tape unit numbers to further describe the tape unit.

0800: even parity, 7 track
1000: even parity, 7 track
2000: no conversion mode, 7 track
4000: phase-encoded read adapter is used
8000: read after write drive

3.4.8 UNEXPECTED INTERRUPTS

If an unexpected interrupt occurs, the following prompt will be displayed:

```
UNEXPECTED INTERRUPT
VECT        P          A          B          X          PSW
 aaaa       bbbb       cccc       dddd       eeee       ffff
(nnnn) = vvvv     (value of register)
   .        .
   .        .
   .        .
(nnnn) = vvvv
```

The value of aaaa above is the interrupt vector address in main memory identifying the interrupt and therefore the source of the unexpected interrupt. Table 3-37 below lists these vector addresses and the source of interruption.

The contents of various XPU registers when the interrupt occurred are displayed. The value of the P register is displayed below P (bbbb). Likewise for the A, B, X registers and the PSW.

The contents of related device controller registers when the interrupt occurred, are also displayed in a column below the interrupt vector location. These locations and their contents are different for different interrupts.

Table 3-37. Interrupt Vector and Processor Trap Memory Locations

Location	Description
0102	Communications controller
0104	SMUX/line printer
0106	Magnetic tape controller
0108	Card reader controller
010A	Flexible disk controller 1
010C	Rigid disk controller or flexible disk controller 2
010E	(not used)
0110	(not used)
0118	Trace (PSW bit 3)
011A	Memory/bus error (timeout or uncorrected error)
011C	Reserved instruction
011E	Stack error (overflow or underflow)
0120	Stack service
0122	Overlay service
0124	Test panel

3.5 OFFLINE DIAGNOSTIC DISKETTE COPY PROCEDURE

The utility program of the support control system (SCS) is used to copy offline diagnostic diskettes. This procedure will only copy diskettes which are of the same type (single sided or dual sided) as the source diskette. Copy a diagnostic diskette as follows:

CAUTION

Be sure to remove all customer diskettes before executing this procedure.

	Display	Keyboard Response
a)	(no display)	Mount the diagnostic diskette to be copied in flexible disk drive 1.
b)	(no display)	Wait for the diagnostic display indicator to reach 36 and then press LOAD and IPL release (blank pushbutton) on the system control panel simultaneously. Upon successful completion, the diagnostic display indicator will show only decimal points.
c)	(no display)	Mount a blank diskette in flexible disk drive 2.
d)	SUPPORT CONTROL SYSTEM V DATE =	Enter 3–5 digit Julian date (yyddd, where yy is the year and ddd is the date) then FIELD REL.
e)	SUPPORT CONTROL SYSTEM V DATE = yyddd TIME =	Enter the time in military form (hhmm, where hh is 0–23 hours and mm is 0–59 minutes).
f)	DATE = yyddd TIME = hhmm ENTER SCS COMMAND	Enter EX, FD MENU then FIELD REL.
g)	FD MENU V(8) XX/XX/XX 0 DISK INITIALIZE 1 FD MOUNT 2 FD VERIFY 3 FD COPY 4 SIM TAPE FUNCTIONS 5 TERMINATE SELECT OPTION	Enter 0 then FIELD REL to select diskette initialize.

	Display	Keyboard Response
h)	FD INIT SELECTED ENTER UNIT NUMBER	Enter 2 for flexible disk drive 2 then FIELD REL.
i)	ENTER UNIT TYPE	Enter 1 then FIELD REL.
j)	ENTER SECTOR SEQUENCE VALUE	Enter 1 then FIELD REL.
k)	ENTER SECTOR OFFSET VALUE	Enter 0 then FIELD REL.
l)	ENTER OWNER ID	Enter FIELD REL.
m)	ENTER ACCESS VALUE	Enter FIELD REL. The diskette will be initialized on a track-by-track basis in extended format.
n)	NO BAD TRACK PRESS REL TO CONTINUE	If no bad tracks are found, this display will be shown at the end of initialize. Enter FIELD REL of initialize. Enter FIELD REL will return to the FD MENU.
o)	FD MENU V(8) XX/XX/XX 0 DISK INITIALIZE 1 FD MOUNT 2 FD VERIFY 3 FD COPY 4 SIM TAPE FUNCTIONS 5 TERMINATE SELECT OPTIONS	Enter 3, then FIELD REL to select diskette copy.
p)	FD COPY SELECTED ENTER FROM UNIT	Enter 1 for master unit, then FIELD REL.
q)	ENTER TO UNIT	Enter 2 for copy unit, then FIELD REL.
r)	ENTER OWNER ID	Enter FIELD REL.
s)	ENTER ACCESS VALUE	Enter FIELD REL. The copy process will begin starting at track 0 through 76.

	Display	Keyboard Response
t)	PRESS REL TO CONTINUE	Copy complete. Enter FIELD REL will return to the FD MENU. Enter CNTRL BYPASS will return to DX DIRECTIVE.

Section 4

ON-LINE DIAGNOSTIC TESTS

4.1 INTRODUCTION

The on-line diagnostics are used to test the proper functioning of the system's hardware and to isolate a defective device or group of devices while the system is operating in the normal on-line fashion. Because of this functional aspect of the on-line diagnostics, the tests and their ability to isolate hardware problems are limited compared to the off-line diagnostics (see Section 3 of this manual).

The on-line diagnostics are used to test the following hardware devices:

- Magnetic tape drive and controller (MTC).
- Line printer and station multiplexer (SMUX).
- Keystation and station multiplexer (SMUX).
- Communications controller (CC).

Note that the executive processor unit (XPU), main memory, rigid disk drive and controller (RDC) are not tested by the on-line diagnostics.

The on-line diagnostic tests are resident on the operating system (on disk) and are called into main memory as commanded by the operator. Operationally, the on-line diagnostic tests are accessed when the system is in the supervisor mode by the TEST command (reference System User manual, 690015-001, Section 10 for information concerning the supervisor mode).

Paragraph 4.2 of this manual contains the procedures for using the on-line diagnostics as well as test descriptions of the test to be selected from. Paragraph 4.2 also contains information concerning errors that may occur during the execution of the on-line diagnostics.

4.2 ON-LINE DIAGNOSTIC OPERATING PROCEDURE

Paragraph 4.2 contains the following information concerning the on-line diagnostic tests:

- Step-by-step procedure describing the mechanics and details of running the tests.
- Functional description of all diagnostic tests.

Before running these tests, note that several auxiliary errors can occur. These are listed below in Table 4-1 along with the paragraph number where these errors and coding are described.

System and task as well as on-line diagnostic test errors may occur while running the tests. The other errors listed may occur only during software loading.

After each on-line diagnostic test has been executed, the program reports to the operator how many errors have occurred during that test. There are error codes that correspond to these errors (e.g.,

Table 4-1. On-Line Diagnostic Auxiliary Errors

Error Type	Reference Paragraph
XPU microcode firmware self test errors	3.4.1
Disk bootstrap errors	3.4.3
Tape bootstrap errors	3.4.4
IOCTL errors	3.4.5
Unexpected interrupts	3.4.6
SYSGEN errors	5.2.4
System errors	5.3.1
Task errors	5.3.2

error 4020 for the keystation input test) but these have no significance and should be ignored by the operator. These error numbers do not correspond to those of the off-line diagnostic tests.

The diagnostic execution procedure is presented below. To select the default value displayed on the screen, simply depress the FIELD REL key. To select a value different than the default value, enter the value and then depress the CTRL and PASS keys simultaneously. To return to on-line testing at this point, depress the CRTL and CMND keys simultaneously, then enter SU (supervisor), depress FIELD REL, enter the password and then depress FIELD REL again. At this point, page one of the command menu will be displayed. Depress FIELD REL to display page two of the menu where the TEST command is displayed. Then enter TEST and depress FIELD REL. To execute the on-line diagnostic tests at this point follow the procedure outlined below.

	Display	Operation Action
a)	ON-LINE DIAGNOSTICS TEST = SELECT TESTS DEFAULT = NO MORE CONTROL EXECUTE MAG TAPE KEY STA LP CC	This prompt will be displayed after the TEST command has been selected on page two of the supervisor command menu. Enter CONTROL then depress FIELD REL to define the control options concerning the execution of the tests.

	Display		Operation Action
b)	DISPLAY ERRORS =	CONTROL DEFAULT = YES YES NO	If error information is to be displayed as each error is detected, depress FIELD REL. If no error information is to be displayed, enter NO then FIELD REL.
c)	DISPLAY TOTAL =	CONTROL DEFAULT = YES YES NO	If the total number of errors detected during a test sequence is to be displayed, depress FIELD REL. If this is not to be displayed, enter NO then FIELD REL.
d)	REPEAT ON ERROR =	CONTROL DEFAULT = NO YES NO	If a test is not to be repeated if an error occurs, depress FIELD REL. If a test is to be repeated, enter YES then FIELD REL.
e)	SUSPEND ON ERROR =	CONTROL DEFAULT = YES YES NO	If the testing is to stop upon detection of an error depress FIELD REL. If the testing is not to stop enter NO then FIELD REL.
f)	LOOP =	CONTROL DEFAULT = NO YES NO	If the testing is not to loop indefinitely, depress FIELD REL. If the testing is to loop indefinitely, enter YES then FIELD REL. Skip to step (h).
g)	COUNT =	CONTROL DEFAULT = 1	If the test sequence is to be run only once, depress FIELD REL. Otherwise enter the number of times the sequence is to be run (1–32,767) then depress FIELD REL.
h)	ON-LINE DIAGNOSTICS TEST =	SELECT TESTS DEFAULT = NO MORE CONTROL EXECUTE MAG TAPE KEY STA LP CC	The operator may now select which set of tests are to be run: Enter MAG TAPE then FIELD REL to test the magnetic tape drive and controller. Go to paragraph 4.2.1.

	Display	Operation Action
		Enter LP then FIELD REL to test the line printer and station multiplexer. Go to paragraph 4.2.2.
		Enter KEY STA then FIELD REL to test a key station and station multiplexer. Then, go to paragraph 4.2.3.
		Enter CC then FIELD REL to test the communications controller. Go to paragraph 4.2.4.
		If no more tests are to be executed, depress FIELD REL.

4.2.1 MAGNETIC TAPE DIAGNOSTIC (MAG TAPE)

Paragraph 4.2.1 contains the following information concerning the magnetic tape diagnostics (MAG TAPE):

- Step-by-step procedures of execution.
- Functional test descriptions.

If a specific function of the tape drive or controller is to be tested, refer to paragraph 4.2.1.2, Magnetic Tape Diagnostic Test Descriptions in order to select the proper test(s) to run.

4.2.1.1 Magnetic Tape Diagnostic Test Procedure

At this point MAG TAPE has been selected in the On-Line Diagnostic Operating Procedure, paragraph 4.2h. To execute the magnetic tape diagnostics, follow the procedure below:

		Display	Operation Action
a)			Mount a scratch tape with a write ring on the drive to be tested. Bring the tape to BOT and place the drive on-line.
b)	TAPE NUM =	MAG TAPE DIAG DEFAULT = 1	If the logical unit number of the drive to be tested is 1, depress FIELD REL. Otherwise, enter the correct logical unit number (1—4).
c)	REC LEN =	RECORD LENGTH DEFAULT = 86	This prompt selects the length (in bytes) of the records to be written and read during the Write and Read tests.

	Display		Operator Action
			If an 86-byte length is desired, depress FIELD REL. Otherwise, enter the correct length (15–512), then depress FIELD REL.
d)	DATA PATTERN 1 =	DEFAULT = F0F0	The next two prompts apply to the Read and Write tests. The first word written in every record is its sequence number. This is followed by an alternation of two one-word data patterns, which are specified by the operator. If F0F0 is to be the first data pattern, depress FIELD REL. Otherwise, enter the four-digit hexadecimal word (0000–FFFF) to be used as the first data pattern.
e)	DATA PATTERN 2 =	DEFAULT = F0F0	If F0F0 is to be the second data pattern, depress FIELD REL. Otherwise, enter the four-digit hexadecimal word (0000–FFFF) to be used as the second data pattern.
f)	M.T. TEST =	M.T. TEST SELECT DEFAULT = NO MORE REGISTER POSITION COMMAND VAR REL SPACE WRITE READ SEVEN TRK NO MORE	See paragraph 4.2.1.2 for descriptions of the tests. Select the test(s) desired by entering the name of the test and then depressing FIELD REL. Any number of the tests may be entered in this fashion at one time. If no more tests are to be entered, depress FIELD REL an additional time.
g)	LONG FORM =	DEFAULT = NO YES NO	This prompt will be displayed only if Variable Record test was selected in step (f) above. If this test is to be run once depress FIELD REL. If it is to be run six times, enter YES then FIELD REL. Return to Step (f) above.

	Display	Operator Action
h)	ON-LINE DIAGNOSTICS TEST = SELECT TESTS DEFAULT = NO MORE CONTROL EXECUTE MAG TAPE KEY STA LP CC	Enter EXECUTE then depress FIELD REL to run the tests selected.
i)	MAG TAPE DIAGNOSTICS TEST X – (TEST NAME) CONTROLLER = Y DRIVE = Z	At this time the tests are being executed. X is the test number (see paragraph 4.2.1.2). Y is the number of controller errors. Z is the number of drive errors. Return to paragraph 4.2(h).

4.2.1.2 Magnetic Tape Diagnostic Test Description

The following information provides a brief description of each test of the magnetic tape on-line diagnostics. Each test is identified by a number which is displayed when the test is running. In parentheses after each test mnemonic is the alternate test name displayed when the test is being executed.

Test 1: RGISTER Test (Channel Exercise)

This test checks the reliability of the controller's mailbox register. The register is accessed and three small records of varying lengths are written and then read.

Test 2: POSITION Test (Device Status)

This test is designed to check the device's ability to write and to verify a file mark, and to detect an end-of-tape mark. The test begins by the issuance of write commands and continues until the end-of-tape mark is sensed. The tape is then rewound. A second run through verifies that the file marks have been properly written.

Test 3: COMMAND Test (Command Exercise)

Three records are written onto the tape and read in reverse. The same three records are then used to check the read reverse edit command and the fixed erase command.

Test 4: VAR REC Test (Variable Record Size)

In this test 100 records are written onto the tape; the first record consists of 15 characters and each successive record is 5 characters longer than the previous one. After a file mark is written, the tape is rewound. A second run through verifies the length of each record. This

test will be repeated five more times if the operator responds positively to the Long Form prompt (step 4.2.1.1g).

Test 5: SPACE Test (Random Record Read)

Twenty-five record numbers are selected at random and the contents of each of the specified records are compared with the data expected in these records. This test must be preceded by the VAR REC test.

Test 6: WRITE Test (Fixed Length Write)

Records whose length was determined by the operator's response to the Record Length prompt (step 4.2.1.1c) and whose contents are determined by the responses to the Data Patterns 1 and 2 prompts (steps 4.2.1.1d—e) are written onto the tape until the drive senses the end-of-tape mark.

Test 7: READ Test (Fixed Length Read)

This test must be preceded by the WRITE test since it consists of reading the records written at that time.

Test 8: SEVEN TRK Test

The various parity and density options are checked by writing 10 records with set data patterns, reading them and verifying the patterns, as well as by generating and detecting file marks. This test will not be run on nine-track drives.

4.2.2 LINE PRINTER DIAGNOSTICS (LP)

Paragraph 4.2.2 contains the following information concerning the line printer diagnostics (LP):

- Step-by-step procedures of execution.
- Functional test descriptions.

If a specific function of the line printer or station multiplexer is to be tested, refer to paragraph 4.2.2.2, Line Printer Diagnostic Test Descriptions in order to select the proper test(s) to run.

4.2.2.1 Line Printer Diagnostic Test Procedure

At this point LP has been selected in the On-Line Diagnostic Operating Procedure, paragraph 4.2(h). To execute the line printer diagnostics, follow the procedure below:

		Display	Operator Action
a)	LP NUM =	PRINTER NUMBER DEFAULT = 1	If the logical unit number of the drive to be tested is 1, depress FIELD REL. Otherwise, enter the correct logical unit number.

		Display	Operator Action
b)	REL LEN =	RECORD LENGTH DEFAULT = 132	This prompt selects the length (in characters) of the records to be written during the Command, Fixed Block and Worst Case tests. If a 132-character length is desired, depress FIELD REL. Otherwise, enter the correct length (1—500), then depress FIELD REL.
c)	LP TEST =	LP TEST SELECT DEFAULT = NO MORE COMMANDS IMBED CTL VAR BLK FIXED BLK SLEW VFU WORST CSE NO MORE	See paragraph 4.2.2.2 for descriptions of the tests. Select the test(s) desired by entering the name of the test and then depressing FIELD REL. Any number of the tests may be entered in this fashion at one time. If no more tests are to be entered, depress FIELD REL an additional time.
d)	SLEW 1 =	FIRST SLEW DEFAULT = 5	The next two prompts will be displayed only if the Slew test was selected in step (c) above. If the number of lines of slew to be generated for the first slew command is 5, depress FIELD REL. Otherwise, enter the desired number of slew lines (0—15), then depress FIELD REL.
e)	SLEW 2 =	SECOND SLEW DEFAULT = 15	If the number of lines of slew to be generated for the second slew command is 15, depress FIELD REL. Otherwise, enter the desired number of slew lines (0—15), then depress FIELD REL.
f)	VFU 1 =	FIRST VFU DEFAULT = 1	The next four prompts will be displayed only if the VFU test was selected in step (c) above. If the first VFU command used in this test is to be a VFU Channel 1 depress FIELD REL. Otherwise enter the desired channel number (1—12) then depress FIELD REL.

		Display	Operator Action
g)	VFU 2 =	SECOND VFU DEFAULT = 2	If the second VFU command used in this test is to be a VFU Channel 2, depress FIELD REL. Otherwise, enter the desired channel number (1—12), then depress FIELD REL.
h)	VFU 3 =	THIRD VFU DEFAULT = 3	If the third VFU command used in this test is to be a VFU Channel 3, depress FIELD REL. Otherwise, enter the desired channel number (1—12), then depress FIELD REL.
i)	VFU 4 =	FOURTH VFU DEFAULT = 4	If the fourth VFU command used in this test is to be a VFU Channel 4, depress FIELD REL. Otherwise, enter the desired channel number (1—12) then depress FIELD REL.
j)	DATA PATTERN 1 =	DEFAULT = 4142	The next two prompts will be displayed only if the Worst Case test was selected in step (c) above. If the first data pattern used in this test is to be 4142, depress FIELD REL. Otherwise, enter the desired four-digit hexadecimal ASCII character, then depress FIELD REL.
k)	DATA PATTERN 2 =	DEFAULT = 4344	If the second data pattern used in this test is to be 4344, depress FIELD REL. Otherwise, enter the desired four-digit hexadecimal ASCII character, then depress FIELD REL.
l)			Return to step (c) above.
m)	ON-LINE DIAGNOSTICS TEST =	SELECT TESTS DEFAULT = NO MORE CONTROL EXECUTE MAG TAPE KEY STA LP CC	Enter EXECUTE, then depress FIELD REL to run the tests selected.
n)	PRINT TEST X - - (TEST NAME)		At this time, the tests are being executed. X is the test number (see paragraph 4.2.2.2). Return to paragraph 4.2(h).

4.2.2.2 Line Printer Diagnostic Test Description

The following information provides a brief description of each test of the line printer on-line diagnostics. Each test is identified by a number which is displayed when the test is running.

Test 1: COMMANDS Test

This test consists of sending three lines (whose length is determined by the operator's response to the Record Length prompt, step 4.2.2.1b) to the line printer. The first is ended by a line-feed character; the second, by carriage-return and line-feed characters; and the last, by another line-feed.

Test 2: IMBED CTL Test

A message containing imbedded control characters (carriage-return line-feed and top-of-form) is sent to the line printer.

Test 3: VAR BLK Test

In this test, the printer is commanded to print 20 all-character blocks of variable lengths. The first block contains 10 characters; each successive block is 10 characters longer than the previous one.

Test 4: FIX BLK Test

The printer is commanded to print 40 all-character blocks of the length given in response to the Record Length prompt (step 4.2.2.1b).

Test 5: SLEW Test

The line printer is sent two slew (line ejection) codes, each of which is followed by a message indicating the number of lines of slew. These values are as specified by the operator in response to the First and Second Slew prompts (steps 4.2.2.1d–e)

Test 6: VFU Test

A sequence of four vertical format unit (VFU) commands, as specified by the operator in the VFU prompts (steps 4.2.2.1f–i) are sent to the line printer. A VFU command specifies the VFU channel (1–12) and causes the line printer to search for that channel, thereby providing the correct spacing for a form.

Test 7: WORST CSE Test

In this test, 40 lines are sent to the printer. Each line consists of the characters selected by the operator in response to the Data Pattern prompts (steps 4.2.2.1j–k) repeated to the length specified in response to Record Length prompt (step 4.2.2.1b). This test does not check the validity of the data.

4.2.3 KEYSTATION DIAGNOSTICS (KEY STA)

Paragraph 4.2.3 contains the following information concerning the keystation diagnostics (KEY STA):

- Step-by-step procedures of execution.
- Functional test descriptions.

If a specific function of the keystation or station multiplexer is to be tested, refer to paragraph 4.2.3.2, Keystation Diagnostic Test Descriptions in order to select the proper test(s) to run.

4.2.3.1 Keystation Diagnostic Test Procedure

At this point KEY STA has been selected in the On-Line Diagnostic Operating Procedure, paragraph 4.2(h). To execute the keystation diagnostics, follow the procedure below:

		Display	Operator Action
a)	KEY STA NUM =	KEY STATION DIAG DEFAULT = 2	If the address of the keystation to be tested is 2, depress FIELD REL. Otherwise, enter the correct address, then FIELD REL. Note that the supervisor keystation cannot be tested. If that keystation is to be tested, place it in the ready mode by depressing CTRL and PASS simultaneously. Then, place another keystation in the supervisor mode and select the TEST command. If the keystation is not in the ready mode the program will indicate KEYSTATION BUSY.
b)	KEY TEST =	KEY STATION DIAG DEFAULT = NO MORE OUTPUT INPUT NO MORE	See paragraph 4.2.3.2 for descriptions of these tests. Select the test(s) desired by entering the name of the test and then depressing FIELD REL. Any number of the tests may be entered in this fashion at one time. If no more tests are to be entered, depress FIELD REL an additional time.
c)	KEY TYPE =	KEYSTATION TYPE DEFAULT = 1	This prompt is displayed only if the Input test was selected in step (b) above.

	Display	Operator Action
		The three valid responses are: 1 for keypunch 2 for keypunch/adding machine 3 for typewriter with numeric pad If the keystation is of the keypunch configuration depress FIELD REL. Otherwise enter the correct code (1-3) corresponding to the type of keystation to be tested, then FIELD REL. Note that only keystations with detachable keyboards of the three types above can be tested with the Input test.
d)		Return to step (b) above.
e)	ON-LINE SELECT TESTS TEST = DEFAULT = NO MORE CONTROL EXECUTE MAG TAPE KEY STA LP CC	Enter EXECUTE, then depress FIELD REL to run the tests selected. If only the Input test was selected in step (b) above, go to step (k) below.
f)	KEYSTATION OUTPUT TEST PROGRAM WAITS 10 SECONDS BETWEEN OUTPUT MESSAGES. TO STOP TEST FOR LONGER VIEW TIME, DEPRESS ANY KEY. TO CONTINUE TEST, DEPRESS ANY KEY. SCREEN SHOULD BE BLANK FILLED FROM HERE.	This prompt will be displayed on the keystation being tested only if the Output test was selected is step (b) above. If this prompt does not appear as expected on the keystation being tested, depress one of the keys on the keyboard.
g)	ALL CHARACTER MSG . . . 80–FF _abcdefg . . . (DISPLAYS ALL CHARACTERS) . . . '=" TONE TEST	This prompt will be displayed only if the Output test was selected. A tone should be heard at this time.
h)	FIELD IDENTIFIER TEST **THIS LINE SHOULD BE INTENSIFIED** THIS LINE SHOULD BE UNDERLINED THIS LINE SHOULD FLASH	This prompt will be displayed only if the Output test was selected

	Display	Operator Action
i)	012345678901 . . . . . 3456789 012345678891 . . . . . 3456789 . . . . 012345678901 3456789	This prompt will be displayed only if the Output test was selected. The entire screen should be filled as shown.
j)	ABCDEFGHI¢ABC . . . . . EFGHI¢ ABCDEFGHI¢ABC . . . . . EFGHI¢ . . . . ABCDEFGHI¢ABC . . . . . EFGHI¢	This prompt will be displayed only if the Output test was selected. The entire screen should be filled as shown. If only the Output test was selected in step (b) go to paragraph 4.2(h).
k)	KEYSTATION INPUT TEST REPEAT KEY TEST PRESS REPEAT KEY AND ANY OTHER KEY	This prompt will be displayed only if the Input test was selected in step (b) above. Press the repeat key and any other key.
l)	KEY CLICK TEST INPUT FIVE CHARACTERS SHOULD HAVE AUDIBLE CLICK ON EACH INPUT	This prompt will be displayed only if the Input test was selected. Input five characters and check for audible clicks.
m)	KEY NO-CLICK TEST INPUT FIVE CHARACTERS NO AUDIBLE CLICK SHOULD BE HEARD ON EACH INPUT.	This prompt will be displayed only if the Input test was selected. Input five characters and check for no audible clicks.
n)	KEYBOARD INPUT TEST PRESS/RELEASE EACH KEY STARTING WITH KEY AT TOP LEFT. COMPLETE TOP ROW BEFORE INPUT OF LEFTMOST KEY IN SECOND ROW NO CRT RESPONSE IS MADE IF NO ERRORS ARE DETECTED.	This prompt will be displayed only if the Input test was selected. Input all keys as described.
o)	ERROR 4020 CHAR INPUT WAS XXXX CHAR SHOULD BE YYYY	This prompt will be displayed only if an error occurred while running the keyboard input test initiated in step (n) above. XXXX is the hexadecimal row-column keyboard address of the incorrect key that was entered.

	Display	Operator Action
		YYYY is the address of the key that was expected.
p)	PRESS NUM KEY AND ANY OTHER KEY	This prompt will be displayed only if the Input test was selected. Press the NUMERIC and any other key, simultaneously. If a typewriter keyboard is being tested, press the SHIFT and any other key simultaneously.
q)	PRESS CTRL KEY AND ANY OTHER KEY	This prompt will be displayed only if the Input test was selected. Press the CTRL and any other key simultaneously.
r)	PRESS ALPHA KEY AND ANY OTHER KEY	This prompt will be displayed only if the Input test was selected and if the keystation type is keypunch (1) or keypunch/adding machine (2) (reference step c). Press the ALPHA and any other key simultaneously.
s)	PRESS LCA KEY AND ANY OTHER KEY	This prompt will be displayed only if the Input test was selected. Press the LCA and any other key simultaneously.
t)		Return to paragraph 4.2(h).

4.2.3.2 Keystation Diagnostic Test Descriptions

The following information provides a brief description of the keystation on-line diagnostic tests.

OUTPUT Test

This test consists of sending various messages to the specified keystation for visual inspection. The subtests within the output test sequence are as follows.

- Erase test
- Tone test
- Field identifier test
- All-character test

INPUT Test

For the input test sequence the system prompts the operator for certain keyboard operations. The subtests within the input test sequence are as follows:

- Repeat key test
- Key click test
- Keyboard input test
- Numeric key test
- Control key test
- Alpha key test
- Lower case alpha (LCA) key test

4.2.4 COMMUNICATIONS CONTROLLER DIAGNOSTICS (CC)

Paragraph 4.2.4 contains the following information concerning the communications controller diagnostics (CC):

- Step-by-step procedures of execution.
- Functional test descriptions.

If a specific function of the communications controller is to be tested, refer to paragraph 4.2.4.2, Communications Controller Diagnostic Test Descriptions in order to select the proper test(s) to run.

4.2.4.1 Communications Controller Diagnostic Test Procedure

At this point CC has been selected in the On-Line Diagnostic Operating Procedure, paragraph 4.2(h). To execute the communications controller diagnostics, follow the procedure below:

		Display	Operator Action
a)	CONTROLLER =	CC CONTROLLER DEFAULT = 1	If the communications controller 1 is to be tested, depress FIELD REL. Otherwise, enter the controller number (1-4) that is to be tested then FIELD REL.
b)	INT CLOCK REQD =	DEFAULT = NO YES NO	If the 9600 bps internal clock is not required (if the controller is connected to a modem with a clock) depress FIELD REL. If the internal clock is required (if two systems are back-to-back or if a loop-back plug is being used), enter YES then FIELD REL.

		Display	Operator Action
c)	CC TEST =	COM CTRL TEST DEFAULT = NO MORE BASIC IMMEDIATE REGISTER INDIRECT RAM READ WRITE RD/WR MISC PLUG MODEM COMPLETE	See paragraph 4.2.4.2 for descirptions of these tests. Select the test(s) desired by entering the name of the test and then depressing FIELD REL. Any number of the tests may be entered in this fashion at one time. Note that if the PLUG test is selected, a special loopback plug must be installed, which loops certain outputs of the controller back to the inputs. If no more tests are to be entered, depress FIELD REL an additional time. If the Modem test was not selected, go to step (k).
d)	BLOCK LENGTH =	BLOCK LENGTH DEFAULT = 500	Prompts (d) through (j) will be displayed only if the Modem test was selected in step (c) above. If the number of data characters to be transmitted or received in this test is to be 500, depress FIELD REL. Otherwise, enter the desired number of characters (1–32,767), then FIELD REL.
e)	FIRST CHAR =	DEFAULT = C1	If the first hexadecimal two-digit data character that is to follow the synchronization character(s) is to be the value C1 then depress FIELD REL. Otherwise, enter the desired value (00–FF) then FIELD REL.
f)	FUNCTION CODE =	DEFAULT = 0	There are four possible algorithms used to define the data characters. 0: The character is repeated (C1 C1 C1 . . .) 1: The first character is incremented by one for each successive character (C1 C2 C3 . . .)

	Display		Operator Action
			2: The first character is decremented by one for each successive character (C1 C0 BF . . .) 3: The character alternates with its one's complement (C1 3E C1 . . .) If the character is to be repeated, depress FIELD REL. Otherwise, enter one of the other codes (0–3) representing the desired algorithm, then FIELD REL.
g)	SYNC CHAR =	DEFAULT = 32	If 32 is the hexadecimal number that is to be used as the synchronization character, depress FIELD REL. Otherwise, enter the two-digit hexadecimal number (00–FF) that is desired, then FIELD REL.
h)	INPUT =	DEFAULT = NO YES NO	If the Modem test is not to be run in the reception mode, depress FIELD REL. Otherwise, enter YES then FIELD REL.
i)	OUTPUT =	DEFAULT = NO YES NO	If the Modem test is not to be run in the transmission mode, depress FIELD REL. Otherwise, enter YES then FIELD REL.
j)	NBR SYNC CHARS =	DEFAULT = 3	This prompt will be displayed only if this test is to be run in the transmission mode as specified by a YES response to prompt (i) above. If the number at synchronization characters that are to precede the first data character is 3, depress FIELD REL. Otherwise, enter the desired number (0–7) then depress FIELD REL.
k)			Return to step (c) above.

	Display	Operator Action
l)	ON-LINE DIAGNOSTICS SELECT TESTS DEFAULT = NO MORE CONTROL EXECUTE MAG TAPE KEY STA LP CC	Enter EXECUTE, then depress FIELD REL to run the tests selected.
m)	CC TEST IN PROGRESS TEST X - - (TEST NAME)	At this time the test(s) will be executed. X is the test number in progress. Return to paragraph 4.2(h).

4.2.4.2 Communications Controller Diagnostic Test Descriptions

The following information provides a brief description of the communications controller on-line diagnostic tests. The test numbers are those that appear while the test is being executed.

Test 0: BASIC Test

In this test, the system checks to ensure that the controller responds to all controller addresses. Other verifications are that the controller RAM can be loaded, that the accumulator can be set to various values, that the condition codes can be set and reset, and that the branch-on-condition instructions function properly.

Test 1: IMMEDIATE Test

The LI, ANAI, EORI, ORI, SI, AI, CI and RRC immediate instructions are tested with all condition codes and a variety of data patterns.

Test 2: RGISTER Test

The L, ANS, EOR, OR, S, A, C, INC, and ST register instructions are functionally tested to ensure that all the registers can be accessed independently.

Test 3: INDIRECT Test

This test verifies the execution of the L*, ST*, B* and long branch indirect instructions.

Test 4: RAM Test

This test verifies that all 1048 bytes of the controller RAM can be addressed and also checks the integrity of the RAM.

Test 5: READ Test

The ability of the controller to read data directly from main memory is checked.

Test 6: WRITE Test

The ability of the controller to write data directly to main memory is checked.

Test 7: RD/WR Test

This test checks the ability of the controller to alternate in reading and writing data from and to main memory.

Test 8: MISC Test

The branches and output instruction areas (programmable flag, interrupt request, command flag and internal timer) are verified.

Test 9: PLUG Test

The modem interface within the controller is verified using a special loopback plug which ties the various output signals to their corresponding input signals (for example, DTR is connected to DSR and RTS is connected to CTS). The input and output instructions are checked by sending out all signal combinations and then verifying the input signals.

Test 10: MODEM Test

In this test, the ability of the controller to communicate with a modem is checked. The characters used in this test, as well as whether testing is to be in the transmission or reception mode, or both, is specified by the operation.

Test 11: COMPLETE Test

This test verifies the ability of the controller to read a block of data from main memory, transfer it to a modem, receive it from a modem, and write it back into main memory.

Section 5

SOFTWARE SUPPORT

5.1 INTRODUCTION

This section provides the necessary information that links the hardware with the system software on a level that can be utilized by customer engineers. The information concerning the software is presented in a simplified, functional form that can aid in servicing the system. For a more detailed explanation of the software, refer to the System Analyst Manual (686019) or the System Reference Manual (690015-001).

This section includes information on the following software-related areas:

- System Generation procedure and errors.
- System and Task Error messages and the cause and action for each error.
- Software Diagnostic operation which includes off-line recovery, off-line memory dump tape generation and dump tape listing.
- System Patch procedure.
- System Master Binary Tape copy procedure.

5.2 SYSTEM GENERATION

System Generation is accomplished by using the SYSGEN support program. The System Generation function is one of several functions of the SYSGEN program. Paragraph 5.2.1 below briefly describes the general functions and uses of the SYSGEN support program. Paragraph 5.2.2 defines the SYSGEN commands used in the procedure for generating an Operating System Tape. Paragraph 5.2.3 provides the procedure for generating an Operating System Tape. Paragraph 5.2.4 lists the SYSTEM errors. The IOCTL errors which may also appear during SYSGEN are listed in Paragraph 5.2.5.

5.2.1 SYSGEN SUPPORT PROGRAM

SYSGEN is a support program which provides a means of generating, loading and maintaining operational software systems for field installations. The generation process requires a System Master Binary (SMB) Tape for input and produces an Operating System Tape for output. The SMB contains a copy of SYSGEN and all of the product software. The SMB is identical for all field installations. The Operating System Tape is a configured software system for a specific field installation which contains all of the software required to load the installation initially and to initiate and support production work.

SYSGEN is used mainly by Customer Engineers to generate and maintain software systems in field installations. A CE may operate SYSGEN by a simple series of directive commands and responses

to the prompts issued by SYSGEN. The prompts require the CE to select system options, set parameters, define table values, and specify the hardware elements in the installation. This procedure causes the generation of a software system which has the desired operational characteristics and which will function on the defined hardware installation.

SYSGEN serves three basic functions for field installations. First, it provides the CE with a means of generating an operational software system. Secondly, it furnishes the mechanism for loading the software system and initiating production work. Finally, it provides the CE with the capability to perform field maintenance on the software. The functions are briefly defined in the following paragraphs.

5.2.1.1 Initial System Configuration (ISC)

SYSGEN will operate on a field installation system to produce operational software for that system. This process is referred to as initial system configuration (ISC). At ISC time, the various system parameters, options, and hardware elements are defined, and a specific set of product software modules are selected, parameterized, and configured for the installation system. A complete software system, which provides initial system loading, production work initiation and support is prepared for use on the installation system. The generated software is produced on a reel of magnetic tape which then becomes the Operating System Tape.

5.2.1.2 Initial Program Load (IPL)

SYSGEN provides a software loading function, referred to as the initial program load (IPL). The IPL provides the mechanism for loading the SMB Tape onto the disk. This loading process may occur immediately after ISC or whenever it is necessary to restore the disk copy of the system software. Further, SYSGEN provides a means of loading the resident portion of the software from disk to main memory, and also of performing a cold start tape load from the Operating System Tape.

5.2.1.3 Field Maintenance

SYSGEN contains a number of features which may be used by a field engineer for purposes of software field maintenance. The primary function of these features is to provide a means of keeping the SMB existing Operating System Tapes updated to reflect the update or system software patch. For this purpose, SYSGEN includes the ability to duplicate the SMB, add patch corrections for product software modules and update the product software modules.

5.2.2 SYSGEN COMMANDS

The following paragraph describes the function of those SYSGEN commands that are utilized in the Initial System Configuration (ISC) Procedure outlined in Paragraph 5.2.3.

The only two primary commands used in the ISC Procedure are:

- GDS – Generate Disk System.
- WTS – Write Tape System.

These commands are briefly described below.

5.2.2.1 GDS (Generate Disk System)

This command is used by the Customer Engineer to initiate an operator/SYSGEN dialog which results in the generation of the operating system according to the operator supplied parameters which is then placed onto disk. The disk drive is used to store the generated system software. The tape drive is used to read the System Master Binary (SMB) Tape.

5.2.2.2 WTS (Write Tape System)

This command causes SYSGEN to copy the operating software from disk to magnetic tape which becomes the Operating System Tape.

5.2.3 SYSGEN INITIAL SYSTEM CONFIGURATION (ISC) PROCEDURE

The SYSGEN tape should be created on the system that the tape is to be used on.

CAUTION

THIS PROCEDURE WILL DESTROY THE DATA ON THE DISK. BE SURE TO SAVE ANY CUSTOMER DATA THAT IS ON THE DISK.

	Display	Operator Action
1.		Mount the System Master Binary (SMB) Tape on the primary tape drive. Depress IPL Release (blank white push-button) and LOAD on the system control panel simultaneously.
2.	***MASTER VERSION NO XX.XX.XX*** INITIALIZE SYSTEM DISK? Y=YES, REL=NO	Depress Y, then FIELD REL.
3.	DELETE ALL DISK INFO? Y=YES, REL=NO	Depress Y, then FIELD REL.
4.	LOAD SYSGEN OVERLAYS TO DISK NO NAME VERSN TYP ID STATUS 001 S BLD LC X.X 014 001 LOAD 002 S GEN LC X.X 014 001 LOAD 003 S BLD MSG X.X 014 001 LOAD 004 S LD TELS X.X 014 003 LOAD 005 S P BUF1 X.X 014 001 LOAD END OF FILE TO SELECT MODS, TYPE: Y=YES, REL=NO	Depress FIELD REL.

	Display	Operator Action
5.	NO NAME VERSN TYP ID STATUS 001 S BLD LC X.X 014 001 LOAD . . . . 005 S P BUF1 X.X 014 001 LOAD *** SYSGEN VERSION NO. XX.XX.XX *** TYPE SYSGEN COMMAND	This prompt takes several minutes to be displayed. Enter ALU = 16 then FIELD REL to output the modules to the line printer.
6.	ALU = N SET ALTERNATE LIST UNIT = N TYPE SYSGEN COMMAND	Enter LC = 1 then FIELD REL to print all commands entered during SYSGEN.
7.	LC = N SET LIST COMMAND FLAG = N TYPE SYSGEN COMMAND	Enter GDS then FIELD REL.
8.	GDS GENERATE DISK SYSTEM NO NAME VERSN TYP ID STATUS 001 S BLD LC 1.7 014 001 LOAD XXX XXXXXXXX X.XX XXX XXX XXXX . . . . XXX XXXXXXXX X.XX XXX XXX XXXX END OF FILE TO SELECT MODS, TYPE: Y = YES, REL = NO	Depress Y then FIELD REL. All system modules will be displayed.
9.	TO REVERSE LOAD STATUS. TYPE: Y = YES, REL = NO, T = TERMINATE	Determine the model numbers of the keystations that will be used on the system. Depress FIELD REL repeatedly until the following prompt is displayed:
10.	015 XL KEYPCH X.X 000 254 XXXX	If model 4141-1 or 4143-1 keystations are to be used in the system and the module is listed with a LOAD status, depress FIELD REL. If the module is listed with a SKIP status enter Y then FIELD REL. If model 4141-1 keystations are not to be used, reverse the above procedure. Depress FIELD REL repeatedly until the following prompt is displayed:
11.	024 XL ADMCH X.X 000 254 XXXX	If model 4141-9 or 4143-9 keystations are to be used in the system and the module is listed with a LOAD status, depress FIELD REL. If

	Display	Operator Action
		the module is listed with a SKIP status, enter Y then FIELD REL. If model 4141-3 or 4143-3 keystations are not to be used, reverse the above procedure. Depress FIELD REL to display the following prompt:
12.	028 XL TYWRT X.X 000 254 XXXX	If model 4141-2 or 4143-2 keystations are to be used in the system and the module is listed with a LOAD status, depress FIELD REL. If the module is listed with a SKIP status, enter Y then FIELD REL. If model 4141-2 or 4143-2 keystations are not to be used, reverse the above procedure. Now, depress T, then FIELD REL.
13.	STD EQUIPMENT AND PARAMETERS? REL = YES, N = NO	Depress N, then FIELD REL.
14.	TABLES : REL =STANDARD, 1 =MINIMUM 2 =DATA COM 3 =CURRENT	Enter 3 then FIELD REL.
15.	ACCEPT CONFIGURATION? REL = YES, N = NO	Enter N, then FIELD REL.
16.	PARAMETER DEFINITIONS ARE: CMND = COMMAND (A, D, R, OH H) LUN = LOGICAL UNIT NUMBER (1, 16) CONT = CONTROLLER NUMBER (0, 3) DEV = DEVICE NUMBER (1, 4) SPL = DEVICE ALLOW SPOOLING (Y,N) T = NUMBER OF TRACKS (7 OR 9) FMTR = FORMATTER ADDRESS (0 OR 1) DEN = TAPE DENSITY (HIGH OR LOW) = DISK DENSITY (100 OR 200 TPI) PRTY = TAPE PARITY (ODD OR EVEN)	Depress the DISPLAY key.
17.	MDL = MODEL (TT OR DCT) OR = MODEL (2770, 2780, 3780, HASP) COMMANDS ARE: A = ADD NEXT DEVICE D = DELETE EXISTING DEVICE R = REPLACE EXISTING DEVICE H = HELP, DISPLAY DEFINITIONS PRESS REL KEY TO CONTINUE	Depress FIELD REL.

	Display	Operator Action
18.	TYPE LUN CONT DEV SPL TRKS DEN PRTY MT 01 00 01 NO 9T 00 9T FORM = COMND, LUN, CONT, DEV, 9T, FMTR 7T FORM = CMND, LUND, CONT, DEV, 7T, DEN, PAR TYPE: INPUT OR REL FOR NEXT DEV TYPE	Determine the model number of the tape drive that will be used on the system. If the drive is a 4342 or 4352 (9 track, 800 bpi) depress FIELD REL; this accepts the standard assignment displayed. If the drive is a 4341 or 4351 (7 track, 800 bpi) enter R, 01, 00, 01, 7T, HI, OD then FIELD REL. If the drive is a 4343 or 4353 (9 track, 1600 bpi) enter R, 01, 00, 01, 9T, 01 then FIELD REL. If there is more than one tape drive, determine the model numbers of the other drives from the sales order. The logical unit number (LUN) and the device number (DEV) should be incremented for each additional drive. Now, use the add (A) command, with the updated LUN and DEV numbers and the parameters specified above to enter the information for each additional drive (e.g. A, 02, 00, 02 . . .). This prompt will be displayed again but updated reflecting the changes made. If no more changes are to be made, depress FIELD REL.
19.	TYPE LUN CONT DEV SPL DEN DK 01 00 01 NO 200 DK FORM = CMND, LUN, CONT, DEV, DEN TYPE: INPUT OR REL FOR NEXT DEV TYPE	Determine the model number of the disk drive(s) that will be used on the system. If the drive(s) is to be 4241 (D1000 Series) depress FIELD REL to generate a single platter. Each additional platter is assigned a different logical unit and device number. To add additional platters, enter the following then FIELD REL: Drive 1, platter 2: A, 02, 00, 02, 200 Drive 2, platter 1: A, 03, 00, 05, 200 platter 2: A, 04, 00, 06, 200 Drive 3, platter 1: A, 05, 00, 09, 200 platter 2: A, 06, 00, 10, 200 Drive 4, platter 1: A, 07, 00, 13, 200 platter 2: A, 08, 00, 14, 200 If the drive(s) is to be 4243 (D3000 Series) depress FIELD REL to generate a single

	Display	Operator Action
		platter. To add additional platters, enter the following then FIELD REL: Drive 1, platter 2: A, 02, 00, 02, 200 platter 3: A, 03, 00, 03, 200 platter 4: A, 04, 00, 04, 200 Drive 2, platter 1: A, 05, 00, 05, 200 platter 2: A, 06, 00, 06, 200 platter 3: A, 07, 00, 07, 200 platter 4: A, 08, 00, 08, 200 Drive 3, platter 1: A, 09, 00, 09, 200 platter 2: A, 10, 00, 10, 200 platter 3: A, 11, 00, 11, 200 platter 4: A, 12, 00, 12, 200 Drive 4, platter 1: A, 13, 00, 13, 200 platter 2: A, 14, 00, 14, 200 platter 3: A, 15, 00, 15, 200 platter 4: A, 16, 00, 16, 200 This prompt will be displayed again but updated reflecting the changes made. If no more changes are to be made, depress FIELD REL.
20.	TYPE LUN CONT DEV SPL KS 01 00 01 YES KS FORM = NO INPUT REQUIRED TYPE: INPUT OR REL FOR NEXT DEV TYPE	Depress FIELD REL.
21.	TYPE LUN CONT DEV SPL MDL LD (NONE) LD FORM=CMND,LUN,CONT,DEV,SP,MDL TYPE: INPUT OR REL FOR NEXT DEV TYPE	Depress FIELD REL.
22.	TYPE LUN CONT DEV SPL LP 01 00 01 YES LP FORM=CMND,LUN,CONT,DEV,SPL TYPE: INPUT OR REL FOR NEXT DEV TYPE	If the system is to have a line printer, depress FIELD REL. If no line printer is to be used, enter D, 01, 00, 01 then FIELD REL. This prompt will be displayed again but updated reflecting the changes made. If no more changes are to be made, depress FIELD REL.
23.	TYPE LUN CONT DEV SPL CR (NONE) CR FORM = CMND,LUN,CONT, DEV TYPE: INPUT OR REL FOR NEXT DEV TYPE	If no card reader is to be used, depress FIELD REL, and go to step 25. If a card reader is to be added, enter A, 01, 00, 01 then FIELD REL.

	Display	Operator Action
		This prompt will be displayed again but updated reflecting the changes made. If no more changes are to be made, depress FIELD REL.
24.	NR OF CR BUFFERS = 2 TYPE NEW ASSIGNMENT OR REL = ACCEPT	Depress FIELD REL for double card reader buffers.
25.	TYPE LUN CONT DEV SPL MDL DC (NONE) DC FORM =CMND,LUN,CONT,DEV,MDL TYPE: INPUT OR REL FOR NEXT DEV TYPE	If data communications are not to be installed on this system, depress FIELD REL and then go to step 43. The following data communications SYSGEN parameters are defined in the System Reference Manual (680205). If 2770 protocol is to be used enter A, 01, 00, 01, 2770 then FIELD REL. If 2780 protocol is to be used enter A, 01, 00, 01, 2780 then FIELD REL. If 3780 protocol is to be used, enter A, 01, 00, 01, 3780 then FIELD REL. If HASP protocol is to be used, enter A, 01, 00, 01, HASP then FIELD REL. This prompt will be displayed again but updated reflecting the changes made. If no more changes are to be made, depress FIELD REL.
26.	DEFAULT DATA COM CONTROLS? REL = YES, N = NO	If yes, depress FIELD REL and go to step 39. If no, enter N then FIELD REL.
27.	DISABLE 9600 BAUD CLOCK? REL = YES, N = NO	If yes, depress FIELD REL. If no, enter N then FIELD REL.
28.	DATA SET RATE HIGH? REL = HIGH, L = LOW	If high, depress FIELD REL. If low, enter L then FIELD REL.
29.	SUPPRESS PRINT CONTROL? REL = NO, Y = YES Y	If no, depress FIELD REL. If yes, enter Y then FIELD REL.
30.	MULTI-POINT? REL = NO, Y = YES	If no, depress FIELD REL and go to step 32. If yes, enter Y then FIELD REL. Note that multipoint is available on 2770, 2780 and 3780 protocols only.
31.	POLLING ADDRESS (ALPHA CHARACTER)'	Enter the alpha polling address for multi-point operation. Then depress FIELD REL.
32.	BUFFER EXPANSION? REL = NO, Y = YES	If no, depress FIELD REL. If yes, enter Y then FIELD REL. Note that buffer expansion is available on 2770, 2780 and HASP protocols only

	Display	Operator Action
33.	ADDITIONAL EXPANSION? REL = NO, Y = YES	If no, depress FIELD REL. If yes, enter Y then FIELD REL. Note that additional expansion is available on 2770, 2780 and HASP protocols only.
34.	ASCII TRANSLATION? N REL = NO, Y = YES	If no, depress FIELD REL. If yes, enter Y then FIELD REL. Note that ASCII translation is available on 2770, 2780 and 3780 protocols only.
35.	EBCDIC TRANSPARENCY? Y REL = NO, Y = YES	If no, depress FIELD REL. If yes, enter Y then FIELD REL.
36.	SPACE COMPRESSION ON? N REL = NO, Y = YES	If no, depress FIELD REL. If yes, enter Y then FIELD REL. Note that space compression is available on 2770 and 3780 protocols only.
37.	MULTIRECORD? REL = NO, Y = YES N	If no, depress FIELD REL. If yes, enter Y then FIELD REL. Note that the multirecord option is available on 2780 protocol only.
38.	DELETE TRAILING BLANKS? REL = NO, Y = YES N	If yes, depress FIELD REL. If no, enter N then FIELD REL. Note that the deletion of trailing blanks is available on 2770 and 2780 protocols only.
39.	TYPE LUN CONT DEV SPL MDL DC XX XX XX XX XXXX . . . . DC XX XX XX XX XXXX DC FORM = CMND, LUN, CONT, DEV, MDL TYPE: INPUT RO REL FOR NEXT DEV TYPE	The data communications ports that have been specified up to this point are displayed. If an additional port is required, add the next device type (e.g. A, 02, 00, 02, –), then return to step 25. If no more communications ports are required, depress FIELD REL.
40.	NUMBER OF COMM BUFS = 2 TYPE NEW ASSIGNMENT OR REL = ACCEPT	If there are to be double communications buffers, depress FIELD REL. Otherwise enter the number of buffers then FIELD REL.
41.	MAXIMUM NO XMT BUFS = 2 TYPE NEW ASSIGNMENT OR REL = ACCEPT	If the maximum number of transmit buffers is to be 2, depress FIELD REL. Otherwise, enter the desired number. then FIELD REL.

	Display	Operator Action
42.	MAX NO RCV BUFS = 2 TYPE NEW ASSIGNMENT OR REL = ACCEPT	If the maximum number of receive buffers is to be 2, depress FIELD REL. Otherwise, enter the desired number, then FIELD REL.
43	CURRENT CONFIGURATION IS: TYPE LUN CONT DEV SPL TRKS DEN PRTY XX XX XX XX XX XX XX XX . . . . XX XX XX XX X XX XX XX	The first portion of the configuration will be displayed. Depress the DISPLAY key. The remaining portion of the configuration will be displayed.
44.	ACCEPT CONFIGURATION? REL = YES, N = NO	Depress FIELD REL if the assignments are accepted. Enter N then FIELD REL if the assignments are not correct; return to step 13, enter FIELD REL to each correct assignment; enter the corrections to each incorrect assignment.
45.	CURRENT I/O ASSIGNMENTS ARE: LOG DEV (TYPE, LUN, SPL) = XX, XX, X INPUT DEN (TYPE, LUN) = XX, XX 01 OUTPUT (TYPE, LUN, SPL) = XX, XX, X 02 OUTPUT (TYPE, LUN, SPL) = XX, XX,X D1 DCOM1 (TYPE, LUN, SPL) = XX, XX, X D2 DCOM2 (TYPE, LUN, SPL) = XX, XX, X D3 DCOM3 (TYPE, LUN, SPL) = XX, XX, X D4 DCOM4 (TYPE, LUN, SPL) = XX, XX, X ACCEPT ASSIGNMENTS? REL = YES, N = NO	The following SYSGEN parameters are described in the Section 5 of System Reference Manual (680205). Depress FIELD REL to accept assignments as shown and go to step 55. Enter N, then FIELD REL to enter different assignments.
46.	LOG DEV (TYPE,LUN,SPL) = KS, 01, N	If the supervisor's keystation is to receive output from the autolog function, depress FIELD REL. If another assignment is required, enter the type (LP, KS or MT), the logical unit number, and if spooling to be performed (Y or N) then FIELD REL.
47.	INPUT DEV (TYPE,LUN) = MT, 01	If the input device is to be the primary tape transport, depress FIELD REL. If another assignment is required, enter the type and the logical unit number, then FIELD REL.

	Display	Operator Action
48.	01 OUTPUT (TYPE,LUN,SPL) = MT, 01, N	If the 01 output device is to be the primary tape transport, depress FIELD REL. If another assignment is required, enter the type (KS, LP, MT), the logical unit number, and if spooling is to be performed (Y or N), then FIELD REL.
49.	02 OUTPUT (TYPE,LUN,SPL) = MT, 01, N	If the 02 output device is to be the primary tape transport, depress FIELD REL. If another assignment is required, enter the type (KS, LP, MT), the logical unit number, and if spooling is to be performed (Y or N), then FIELD REL.
50.	D1 DCOM1 (TYPE,LUN,SPL) = DK, 01, N	If the primary disk drive is to receive output from data communications device #1, depress FIELD REL. If another assignment is required, enter the type (DK, LP, MT), the logical unit number, and if spooling is to be performed (Y or N) then FIELD REL.
51.	D2 DCOM2 (TYPE,LUN,SPL) = DK, 01, N	If the primary disk drive is to receive output from data communications device #2, depress FIELD REL. If another assignment is required, enter the type (DK, LP, MT), the logical unit number, and if spooling is to be performing (Y or N) then FIELD REL.
52.	D3 DCOM3 (TYPE,LUN,SPL) = DK, 01, N	If the primary disk drive is to receive output from data communications device #3, depress FIELD REL. If another assignment is required, enter the type (DK, LP, MT), the logical unit number, and if spooling is to be performing (Y or N) then FIELD REL.
53.	D4 DCOM4 (TYPE,LUN,SPL) = DK, 01, N	If the primary disk drive is to receive output from data communications device #4, depress FIELD REL. If another assignment is required, enter the type (DK, LP, MT), the logical unit number, and if spooling is to be performed (Y or N) then FIELD REL.

	Display	Operator Action
54.	CURRENT I/O ASSIGNMENTS ARE: LOG DEV (TYPE, LUN, SPL) = XX, XX, X INPUT DEV (TYPE, LUN) = XX, XX 01 OUTPUT (TYPE, LUN, SPL) = XX, XX, X 02 OUTPUT (TYPE, LUN, SPL) = XX, XX, X D1 DCOM1 (TYPE, LUN, SPL) = XX, XX, X D2 DCOM2 (TYPE, LUN, SPL) = XX, XX, X D3 DCOM3 (TYPE, LUN, SPL) = XX, XX, X D4 DCOM 4 (TYPE, LUN, SPL) = XX, XX, X ACCEPT ASSIGNMENTS? REL = YES, N = NO	Depress FIELD REL to accept assignments. Enter N, then FIELD REL if the assignments are not correct. Return to step 46; depress FIELD REL in response to each correct assignment; enter the correct assignment in response to each incorrect assignment.
55.	PASSWORD (8 CHARS) = TYPE NEW ASSIGNMENT OR REL = ACCEPT	Note: The following SYSGEN parameters are to be obtained from the Customer Education Center. If no change is desired in the displayed password, depress FIELD REL. Key in up to 8 alphanumeric characters to form the desired password, then FIELD REL.
56.	FIELD SEPARATER CHAR = TYPE NEW ASSIGNMENT OR REL = ACCEPT	If no change is desired in the field separator character, if one is displayed, depress FIELD REL. Otherwise, enter the key of the desired separator character (except N) then depress FIELD REL. If no field separator character is required, enter N then FIELD REL.
57.	COMMAND ID COUNT (2,6) = 02 TYPE NEW ASSIGNMENT OR REL = ACCEPT	If 2 characters are required to identify a command, depress FIELD REL. Enter the desired number (02 through 06) of characters required to identify a command, then FIELD REL.
58.	MAX COAX ADDRESS (2, 33) = 08 TYPE NEW ASSIGNMENT OR REL = ACCEPT	If 8 is the highest terminal address to be used in the system, depress FIELD REL. Enter a number, 2–33, to indicate the highest terminal address to be allocated in the system, then FIELD REL.
59.	RESPONSES ARE: P = PARTIAL C = COMPLETE	These responses refer to the displays generated by a Y response to the AUTO SAVE prompt, in step 68.

	Display	Operator Action
	A = ALL Y = YES N = NO TYPE = MT LUN = 1–4 OPS-STATS (Y, N) = N TYPE NEW ASSIGNMENT OR REL = ACCEPT	If no op-stats are to be set to open automatically during start-up, depress FIELD REL. Note that the supervisor may open op-stats whenever desired with the OP-STAT command. If op-stats are to be set to open automatically during start-up, depress Y then FIELD REL.
60.	TONE AT RCD END (Y, N) = Y TYPE NEW ASSIGNMENT OR REL = ACCEPT	If a tone is to be inserted at the end of a record, depress FIELD REL. If no tone is required, enter N then FIELD REL.
61.	OPTIONAL FEATURES (Y, N) = N TYPE NEW ASSIGNMENT OR REL = ACCEPT	If optional features are not desired, depress FIELD REL. If optional features are desired, depress Y then FIELD REL. Note that this causes the miscellaneous I/O and work initialization overlays to become resident. Also, the twenty most recently used system messages are retained in memory in a fixed buffer. This will improve system response time but will require more memory.
62.	FAST REPLAY (Y, N) = N TYPE NEW ASSIGNMENT OR REL = ACCEPT	If fast replay is not required, depress FIELD REL. If fast replay is required, enter Y then FIELD REL. Note that this causes duplicate registers to be allocated in each TWA (terminal work area) for storing the register contents of the previous record. Thus, any changes to a register in the current record can be made based on the prior record and will not cause a replay from the check point.
63.	DBL BUF MT WRITE (Y, N) = Y TYPE NEW ASSIGNMENT OR REL = ACCEPT	If double buffers for tape write operations are to be used whenever adequate memory is available, depress FIELD REL.

	Display	Operator Action
		If only a single buffer for tape write operations are to be used, enter N then FIELD REL.
64.	LOG OPTIONS (Y, N) = N TYPE NEW ASSIGNMENT OR REL = ACCEPT	If log options are not to be selected, depress FIELD REL then go to step 68. If log options are to be selected, enter Y then FIELD REL.
65.	LOG SV ERRORS (Y, N) = N TYPE NEW ASSIGNMENT OR REL = ACCEPT	If supervisor errors are not to be logged, depress FIELD REL. If supervisor errors are to be logged enter Y then FIELD REL.
66.	LOG BK MESSAGES (Y, N) = N TYPE NEW ASSIGNMENT OR REL = ACCEPT	If background messages are not to be logged, depress FIELD REL. If background messages are to be logged, enter Y then FIELD REL.
67.	LOG AUTO MESSAGES (Y, N) = N TYPE NEW ASSIGNMENT OR REL = ACCEPT	If autolog messages are not to be logged, depress FIELD REL. If autolog messages are to be logged, enter Y then FIELD REL.
68.	AUTO SAVE (Y, N) = N TYPE NEW ASSIGNMENT OR REL = ACCEPT	If AUTO SAVE is not required depress FIELD REL. If it is required, enter Y then FIELD REL.
69.	BK TWA POOL CNTRL (2, 8) = 02 TYPE NEW ASSIGNMENT OR REL = ACCEPT	If 2 terminals are required to use the background command manager simultaneously, depress FIELD REL. If 3 through 8 is the maximum number of command managers which can be used simultaneously, enter the number (3–8) then depress FIELD REL.
70.	EXTENDED MEMORY (Y, N) = N TYPE NEW ASSIGNMENT OR REL=ACCEPT	A FIELD REL = NO B 'Y' - implements extended memory if two, three or four 128K Byte memory PCBA's are present in system.
71.	ACCEPT ALL DEFINITIONS? Y = YES, N = NO	Enter Y then FIELD REL to generate the system. Enter N then FIELD REL if the definitions are not correct (i.e., if a mistake has been made in entering the definition). Return to step 55.

	Display	Operator Action
72.	LOAD SELECTED MODULES TO DISK NO NAME VERSN TYP ID STATUS 001 S BLD LC 1.7 014 001 SKIPPED XXX XXXXXXXX X.XX XXX XXX XXXXXXX . . . . XXX XXXXXXXX X.XX XXX XXX XXXXXXX LOAD TABLES FROM TAPE? Y = YES, REL = NO	All software modules and patches will be output. This will take several minutes. At this point user created tables may be loaded. These tables are the special user defined data type and translation tables which may be specified for use in format programs. These tables must have been previously prepared on tape using the table preparation format programs in the user library (DATATYPE and TRANSLAT). Depress FIELD REL if tables are not to be loaded from tape. Enter Y then FIELD REL if tables are to be loaded from tape, and load the tape on the primary tape transport.
73.	FILE INQUIRY SYSTEM? Y = YES, N = NO	If file inquiry is not desired, enter N then FIELD REL, and go to step 81. Enter Y then FIELD REL to define the file inquiry parameters in steps 74 through 80 below.
74.	NR OF RDC BUFS (2, 16) = 3	The number of record buffers is generally one more than the number of page buffers, or two more than the number of rigid disk controllers. If 3 record buffers are required, depress FIELD REL. If another number of record buffers are required (2 through 16), enter the number, then FIELD REL.
75.	RCD BUF LTH IN WORDS (2, 500) = 64	If a 64-word record buffer length is desired, depress FIELD REL. If another record buffer length is desired, enter the number in words (2 through 500) then FIELD REL.
76.	NR OF KEY BUFS (2, 16) = 3	The number of key buffers should be equal to the number of record buffers which is generally one more than the number of page buffers, or two more than the number of rigid disk controllers. If 3 key buffers are desired, depress FIELD REL.

	Display	Operator Action
		If another number of key buffers are required (2 through 16), enter the number, then FIELD REL.
77.	KEY BUF LTH IN WORDS (4, 164) = 16	If a 16-word key buffer length is desired, depress FIELD REL. If another key buffer length is desired, enter the number in words (4 through 164) then FIELD REL.
78.	NR OF PAGE BUFS (1, 16) = 2	The number of page buffers shoudl generally be one more than the number of rigid disk controllers. If 2 page buffers are desired, depress FIELD REL. If another number of page buffers are required (1 through 16), enter the number, then FIELD REL.
79.	NR OF WORK BUFS (2, 16) = 4	The number of work buffers should generally be two more than the number of page buffers, or three more than the number of rigid disk controllers. If 4 work buffers are desired, depress FIELD REL. If another number of work buffers are required (2 through 16), enter the number, then FIELD REL.
80.	ACCEPT FILE INQUIRY PARMS? Y = YES, N = NO	If the parameters entered above are acceptable enter Y then FIELD REL. If the parameters are not acceptable (i.e., if a mistake has been made in entering the parameters), then enter N then FIELD REL. Return to step 74 to update the parameters. Note that the default values will now reflect the parameters entered previously.
81.	TYPE SYSGEN COMMAND	Enter CDM then FIELD REL. In the following steps main memory size is selected.
82.	CDM CORRECT DISK MODULE TYPE MODULE NAME	Enter LC then FIELD REL.

Note: If patches do not need to be added, proceed to step 86.

	Display	Operator Action
83.	ENTER CORRECTIONS R = XXXX B = XXXX U = XXXX L = XXXX D = XXXX	Enter one of the following patches for the amount of memory desired. (The actual amount of memory available to the system must be greater than or equal to the amount specified.) The code below should be entered exactly as shown, one line then a FIELD REL and a period at the end of the patch. Enter L8R for 64K bytes. 7FFF. Enter L8R for 72K bytes. 8FFF. Enter L8R for 80K bytes. 9FFF. Enter L8R for 88K bytes. AFFF. Enter L8R for 96K bytes. BFFF. Enter L8R for 104K bytes. CFFF. Enter L8R for 112K bytes. DFFF. Enter L8R for 120K bytes. EFFF. Enter L8R for 128K bytes. 0. Now enter G, then FIELD REL.
84.	G/X R = XXXX B = XXXX U = XXXX L = XXXX D = XXXX TYPE MODULE NAME	Depress FIELD REL if no additional patches are to be entered at this time to the system tape being created; go to step 86. If another module is to be patched, enter the module name.
85.	ENTER CORRECTIONS R = XXXX B = XXXX U = XXXX L = XXXX D = XXXX	Comments, patch numbers, and cross reference problems may be entered by keying an * in the first position followed by the comment in formation. Refer to the Patch Transmittal Form for the comments. Correction code must be entered exactly as specified on the Patch Transmittal Form. All spaces, including those preceding actual

Display	Operator Action
	code, must be keyed. Attention must be given to entering periods (.) which occur in the code. Do not enter the slash (/) and check digit at the end of each line of code. Depress FIELD REL. The system will display a check digit and should be sight verified with the one on the Patch Transmittal Form. After each line of code is entered, the system will display a series of hexadecimal values. After all patches for the above module name have been entered, enter G then FIELD REL. Return to step 84.
86. TYPE SYSGEN COMMAND	Mount the scratch tape to become the operating system tape with a write ring on the primary tape drive. Enter WTS then FIELD REL. Repeat if more operating system tapes are to be created.

5.2.4 SYSGEN ERRORS

When SYSGEN detects a critical error condition, a message will be displayed which consists of the words "SYSGEN ERROR" followed by a decimal number which can be used as an index for the error codes explained in this paragraph.

Whenever a SYSGEN error occurs, the process being attempted at the time of the error will be stopped. The operator will not be able to cause SYSGEN to resume processing at the point of interruption. If the interrupted task is to be completed, it must be restarted.

The following paragraphs below briefly describe the error codes that may occur during SYSGEN, cause and in some cases, suggestions for resolving or avoiding the associated error.

5.2.4.1 SYSGEN Error 01

This error message informs the operator that SYSGEN is unable to obtain an allocation unit (AU) of disk storage. This error can be caused by a full disk or an inaccuraae disk map. An ISD (Initialize System Disk) command can be used both to purge data from a filled disk and to build a new disk map.

5.2.4.2 SYSGEN Error 02

This error message informs the operator that SYSGEN is unable to read the disk. IOCTL (I/O Control Program) which was called by SYSGEN to perform the disk reading operation, has detected

a problem which prevented it from reading the disk. IOCTL has informed SYSGEN of the problem by returning to SYSGEN with the condition code set false.

5.2.4.3 SYSGEN Error 03

This error informs the operator that SYSGEN is unable to read tape. IOCTL (I/O Control Program), which was called by SYSGEN to perform the tape reading operation, has detected a problem which prevented it from reading the tape. IOCTL has informed SYSGEN of the problem by returning to SYSGEN with the condition code set false.

5.2.4.4 SYSGEN Error 04

This error message informs the operator that SYSGEN is unable to write on the disk. IOCTL (I/O Control Program), which was called by SYSGEN to perform the disk writing operation, detected a problem which prevented it from writing on the disk. IOCTL has informed SYSGEN of the problem by returning to SYSGEN with the condition code set false.

5.2.4.5 SYSGEN Error 05

This error message informs the operator that the relocatable binary loader was unable to load one of the overlay modules.

This error can be caused by any of the following three conditions:

- The overlay module contains a checksum error, often due to a defective tape drive or controller.
- The loader has been requested to load the module into memory addresses which do not exist.
- The binary overlay module contains loader control codes with which the loader is not familiar.

5.2.4.6 SYSGEN Error 13

This error message informs the operator that SYSGEN is unable to write to a magnetic tape. IOCTL (I/O Control Program), which was called by SYSGEN to perform the tape writing operation, has detected a problem which prevented it from writing on the tape. IOCTL has informed SYSGEN of the problem by returning to SYSGEN with the condition code set false.

5.2.4.7 SYSGEN Error 14

This error message is used to inform the operator of a checksum error detected while reading tape. This error message is displayed when SYSGEN reads a tape record with a nonzero checksum under either of the following circumstances:

- Modules are being copied from a System Tape to the disk.

- The correction file of the SMB Tape is being read during a GDS (Generate Disk System), GTS (Generate Tape System), or CMT (Correct Master Tape) command.

5.2.4.8 SYSGEN Error 16

This error message informs the operator that SYSGEN is unable to find the disk volume label in the last three allocation units on the system disk. Starting at the last allocation unit on the disk, SYSGEN examines at most three allocation units to determine which contains the disk volume label. When the volume label is found, it is assumed that the associated allocation unit contains the disk maps and other disk control information. If none of the three allocation units contains the disk volume label, it is assumed that the disk control information is lost, and the SYSGEN error is issued.

5.2.4.9 SYSGEN Error 17

This error message indicates that the tape mounted on the tape load unit is not of the correct format for a system tape or an SMB tape. This message is displayed shortly after a tape is loaded if an end-of-file mark is not found at the end of SYSGEN.

5.2.4.10 SYSGEN Error 19

This error message is used to inform the operator that at least one requested SYSGEN overlay cannot be found on the disk. SYSGEN software has both memory-resident code and disk-resident code. When the disk-resident code is needed, it is fetched by the memory-resident code. Part of the fetching process is to determine whether or not the desired SYSGEN overlay is resident on the disk. If the requested overlay is not on the disk, it cannot be loaded and the task for which it was requested cannot continue. This SYSGEN error message is issued to advise the operator that the requested task cannot be completed because a required SYSGEN overlay cannot be found on the disk.

5.2.4.11 SYSGEN Error 20

This error informs the operator that either the Disk Volume Table of Contents (VTOC) or the MAX FIXED BUF OVLY ID has been destroyed. This error can occur only during the GDS or GTS processing. The problem is detected when SYSGEN attempts to write a Fixed Buffer Overlay to disk, but finds that no room has been reserved for the overlay.

5.2.4.12 SYSGEN Error 204

This error message informs the operator that SYSGEN is unable to write on the disk. During the execution of S BLD MSG (the SYSGEN overlay which builds the system message disk file), SYSGEN calls IOCTL in an attempt to write to disk. If IOCTL detects a problem that prevents it from writing to disk, it returns to SYSGEN with the condition code set false. This error can occur only during a GTS (Generate Tape System) command or a GDS (Generate Disk System) command.

5.2.5 IOCTL ERRORS

Besides SYSGEN errors, IOCTL errors can occur during SYSGEN. These errors are hardware-related and are detected by the I/O Control Program. If an IOCTL error occurs, the following message will be displayed.

IO ERROR U = XXXX F = YYYY S = ZZZZ

Table 5-1 below lists the IOCTL codings and the meanings of these values.

5.3 OPERATING ERRORS

When the system is in its normal mode of operation (using the operating system software), basically two types of errors can occur:

- System Errors
- Task Errors

These errors are explained in the following paragraphs.

5.3.1 SYSTEM ERRORS

System errors occur because of either software anomalies or hardware failures that cause the software to malfunction. When a system error occurs, the system is halted and can be restarted only by initiating a warm or cold start. Before the warm or cold start is performed, however, it is advisable to obtain an on-line memory dump and, in some instances, a disk dump, which can later be examined for a possible cause of the problem. (See Paragraph 5.3.1.2 for how to perform these dumps).

Detailed information related to the system functions at the time of the system error should be obtained for the isolation of the cause. Corrective action should be pursued relative to hardware malfunctions prior to the investigation of software anomalies. Duplication of system functions and operations at the time of the system error should reproduce the software problem. A detailed Software Problem Report (SPR) should then be filled out.

Table 5-1. IOCTL Error Coding

U = XXXX (unit number)	F = YYYY (function)	S = ZZZZ (status)
0001: MTC 0, tape drive 1 0002: MTC 0, tape drive 2 0003: MTC 0, tape drive 3 0004: MTC 0, tape drive 4 See note below.	0003: read 0004: write 0005: rewind 0006: write filemark 000B: read status 000C: backspace record 000D: backspace file 000E: read without transfer 000F: skip file	0100: non-existent unit error occurs if the specified unit is not present in the present hardware configuration (software malfunction). 0200: unresolvable request errors occurs if the user program specifies a unit number which is not defined (software malfunction). 0400: unrecoverable error occurs if an operation results in an error and ten retries could not solve the problem. 0800: unit not ready error occurs if the specified unit is not ready or if the write ring is not installed to perform a tape write. After a character is entered the program will attempt the operation again.
0006: keystation	0001: input one character 0002: output one character 0003: input character string 0004: output character string	
0007: RDC 0, disk drive 0, bottom platter 0008: RDC 0, disk drive 0, top platter 0009: RDC 0, disk drive 1, bottom platter 000A: RDC 0, disk drive 1, top platter 000B: RDC0, disk drive 2, bottom platter 000C: RDC0, disk drive 2, top platter 000D: RDC0, disk drive 3, bottom platter 000E: RDC0, disk drive 3, top platter	0003: read 0004: write 0005: restore 0006: initialize 000E: read without transfer	
0010: ASCII line printer 0011: EBCDIC line printer	0004: output	

NOTE: The following unit modification bits are added to the tape unit numbers to further describe the tape unit:

0800: even parity, 7 track
1000: even parity, 7 track
2000: no conversion mode, 7 track
4000: phase-encoded read adapter is used
8000: read after write drive

5.3.1.1 System Error Listing (1.6 Software)

The following is a list of system errors associated with 1.6 software with a brief description of the cause and recovery procedure for each. Unless otherwise indicated, all errors are software related.

NOTE

Any error displayed not defined below is probably caused by a defective XPU or memory board.

System Error 02:	System Control List (SCL) overflowed
Module Called From:	EXECUTIVE
Cause:	An attempt has been made to place another entry into a list already full.
Response:	Take a memory dump. Warm start the system.
System Error 03:	Invalid I/O Request
Module Called From:	PHY 10
Cause:	I/O request made using an I/O control Block (IOCB) that currently has I/O in progress. Hardware is not responding properly to messages issued by Physical I/O.
Response:	Take a memory dump. Warm start the system.
System Error 04:	I/O request for an invalid device
Module Called From:	PHY 10
Cause:	I/O issued for a device not supported by software release 1.6.
Response:	Take a memory dump. Warm start the system.
System Error 05:	Diagnostic error
Module Called From:	PHY 10
Cause:	Attempt was made to get the Device Control Block (DCB) address of an invalid device.
Response:	Take a memory dump. Warm start the system.
System Error 06:	Problem in low level queueing
Module Called From:	PHY 10
Cause:	Bad IOCB pointer on the DBC queue
Response:	Take a memory dump. Warm start the system.
System Error 07:	Problem in low level queueing
Module Called From:	PHY 10
Cause:	Similar to system 06, indicates a bad IOCB pointer on the Channel Control Block (CCB) queue.
Response:	Take a memory dump. Warm start the system.
System Error 10:	Tenant Table Index (TTI) missing
Module Called From:	FILE CTRL
Cause:	TTI, on return to a resident module, is missing.
Response:	Take a memory dump. Warm start the system.

System Error 11:	Overlay segment not in memory
Module Called From:	FILE CTRL
Cause:	A link to an overlay cannot be made because source overlay is not in memory.
Response:	Take a memory dump. Warm start the system.

System Error 12:	Overlay erroneously removed from memory
Module Called From:	FILE CTRL
Cause:	Some task has released the overlay currently in execution and it has been removed from memory.
Response:	Take a memory dump. Warm start the system.

System Error 13:	Return to a nonexistent overlay
Module Called From:	FILE CTRL
Cause:	A link from an overlay, having been performed, attempts to return control to an overlay segment not currently in memory.
Response:	Take a memory dump. Warm start the system.

System Error 14:	Return to a nonexistent overlay
Module Called From:	FILE CTRL
Cause:	A Release and Link (RAL) to a overlay not currently in memory was attempted.
Response:	Take a memory dump. Warm start the system.

System Error 15:	Transfer to a nonexistent overlay
Module Called From:	FILE CTRL
Cause:	An attempt was made to transfer control to an overlay not currently in memory.
Response:	Take a memory dump. Warm start the system.

NOTE

The following error can be caused by two different sources

System Error 16:	Link to nonexistent overlay
Module Called From:	FILE CTRL
Cause:	An attempt was made to link to a special overlay not in memory.
Response:	Take a memory dump. Warm start the system.

System Error 16:	Overlay not in memory
Module Called From:	SYS SUBRS
Cause:	Overlay used in a cancel operation was not in memory
Response:	Take a memory dump. Warm start the system.

System Error 17:	Link to a nonexistent cancel overlay
Module Called From:	FILE CTRL
Cause:	Similar to the second part of system error 16, it is issued as an attempt is made to link to a cancel overlay which is not in memory.
Response:	Take a memory dump. Warm start the system.

System Error 18:	Unrecoverable disk access failure
Module Called From:	STARTUP, FILE CTRL, or SYS SUBRS
Cause	This is a hardware error caused by disk drive or controller failure during a disk access.
Response:	Take both a memory and disk dump. A subsequent attempt to do a warm start may resolve the problem, otherwise special recovery procedures and a cold start may be required.
System Error 19:	Disk software error
Module Called From:	STARTUP
Cause:	Unidentifiable disk error.
Response:	Take a memory and disk dump. Warm start the system.
System Error 20:	VTOC unreadable
Module Called From:	IDX FILES or DISK LOAD.
Cause:	An attempt to read, write or initialize a portion of the VTOC (Volume Table of Contents) failed. This is probably a hardware problem.
Response:	Take a memory and disk dump. An attempt to do a warm start may resolve the problem, otherwise special data recovery procedures and a cold start may be required.
System Error 21:	VTOC unreadable
Module Called From:	DELETE FIL
Cause:	Similar to Error No. 20.
Response:	Same as Error No. 20.
System Error 25:	Unknown disk error
Module Called From:	CHKPOINT
Cause:	Unspecified error has occurred on disk.
Response:	Take a memory and disk dump. Warm start the system.
System Error 40:	TTI range invalid
Module Called From:	EM MGR, EXECUTIVE or FORMAT Loader 2
Cause:	Tenant Table Index (TTI) referenced was outside the range of valid TTI's.
Response:	Take a memory dump. Warm start the system.
System Error 46:	Return to a nonexistent overlay
Module Called From:	FILE CTRL
Cause:	Indicates an attempt was made to return to an overlay that is no longer in memory.
Response:	Take a memory dump. Warm start the system.
System Error 47:	Invalid return to an overlay
Module Called From:	FILE CTRL
Cause:	Indicates an attempt has been made to return to an overlay whose frequency count has gone to zero.
Response:	Take a memory dump. Warm start the system.

System Error 47:	Inavlid return to an overlay
Module Called From:	FILE CTRL
Cause:	Indicates an attempt has been made to return to an overlay whose frequency count has gone to zero.
Response:	Take a memory dump. Warm start the system.
System Error 51:	Bad pointer address
Module Called From:	L10 or PHY 10
Cause:	A bad pointer was used in trying to compute the address of an IOCB.
Response:	Take a memory dump. Warm start the system.
System Error 52:	Illegal post priority argument
Module Called From:	EXECUTIVE
Cause:	This error is generated if an illegal post priority is found.
Response:	Take a memory dump. Warm start the system.
System Error 70:	Buffer pool not allocated
Module Called From:	SYS SUBRS
Cause:	An attempt was made to fetch a buffer from a pool which was not allocated.
Response:	Take a memory dump. Warm start the system.
System Error 8X:	Task queue overflow
Module Called From:	EXECUTIVE
Cause:	The task queue was full when an attempt to enqueue another task was being made. The "X" indicates the priority of the queue and may be 0,1, 2 or 3.
Response:	Take a memory dump. Warm start the system.
System Error 89:	CRT update table capacity exceeded
Module Called From:	EXECUTIVE
Cause:	This error may be hardware-related. There may be more key-stations than the system was configured for, or a SMUX failure may have occurred.
Response:	Take a memory dump. Warm start the system.

NOTE

System errors 91 through 99 occur in response to interrupts. Some of the errors are hardware related, but most are software errors which have been detected by hardware.

System Error 91:	Temperature alarm
Module Called From:	EXECUTIVE
Cause:	An interrupt was received from hardware indicating that an overtemperature condition had been sensed.
Response:	Check the MCU cabinet for proper ventiliation.
System Error 92:	Processor or Status Word (PSW) error
Module Called From:	EXECUTIVE
Cause:	Software error in PSW.
Response:	Take a memory dump. Warm start the system.
System Error 93:	Bus error (software out of memory)
Module Called From:	EXECUTIVE
Cause:	The system was attempting to address out of the range of existent memory. This is usually a software problem, but can be caused by a hardware malfunction such as a failure in the XPU or an undetected data error.
Response:	Take a memory dump. Warm start the system.
System Error 94:	Stack underflow or overflow
Module Called From:	EXECUTIVE
Cause:	An interrupt was caused by the XPU when a pop operation was attempted beyond the bottom of the stack (underflow) or when a push operation was attempted beyond a segment boundary when no additional segments were available (overflow).
Response:	Take a memory dump. Warm start the system.
System Error 95:	Stack Overflow
Module Called From:	EXECUTIVE
Cause:	Similar to the overflow portion of system error 94.
Response:	Take a memory dump. Warm start the system.
System Error 96:	Reserved instruction
Module Called From:	EXECUTIVE
Cause:	An attempt was made to execute a reserved instruction.
Response:	Take a memory dump. Warm start the system.
System Error 97:	Memory/bus error
Module Called From:	EXECUTIVE
Cause:	A hardware interrupt was generated by the XPU indicating a bus timeout or a memory parity error occurred. The bad parity is probably caused by a defective memory location.
Response:	Take a memory dump. Note particularly the bus location on the screen. This is the address of the memory location which caused the memory error. Warm start the system. Replace the bad memory board.

System Error 98:	Page Fault
Module Called From:	EXECUTIVE
Cause:	A page fault interrupt was initiated by the XPU2 when access was requested to a nonresident page. (On an XPU, this error indicates an overlay service error).
Response:	Take a memory dump. Warm start the system.

System Error 99:	Miscellaneous error
Module Called From:	EXECUTIVE
Cause:	A miscellaneous error cache for priviledged instruction supervisor call, trace bit or test panel interrupts.
Response:	Take a memory dump. Warm start the system.

5.3.1.2 Dump Procedures

The following information describes the procedures for performing a memory and disk dump if it is found that the cause of the problem is software-related.

Before restarting and while the system error message is still displayed on the keystation, mount a scratch tape with a write-enable ring on the primary tape drive. Depress LCA, CTRL and DISPLAY simultaneously on keypunch or adding machine keystations. On typewriter keystations, depress LCA, CTRL and the number 1 key in the upper left-hand corner. The contents of various memory locations will be displayed on the screen. Record these hex numbers on the Software Problem Report. Enter Y in response to the MEMORY DUMP? prompt. When the tape has stopped moving, the DISK DUMP? prompt will be displayed. If one is required, key Y and the contents of the system platter will be saved on tape. Otherwise, depress FIELD REL.

Key the appropriate response to the START OPTION prompt (COLD or WARM). Remove the tape from the tape drive and label it. This tape must accompany the Software Problem Report.

Occasionally the above procedure will not work if part of the dump routine was destroyed by the cause of the system error. In this case, a memory dump tape which was previously prepared using the Software Diagnostic program must be used. (See Paragraph 5.4 for this procedure.)

While the system error message is still displayed on the keystation, mount a memory dump tape with a write-enable ring on the master tape drive. Depress LOAD and IPL Release (white push-button) on the MCU control panel and wait approximately 5 seconds for cessation of tape movement. Remove the tape from the tape drive and apply an appropriate label. If a disk dump is not required, depress RESTART and IPL Release (white pushbutton) and do a warm or cold start.

If a disk dump is required, mount the Software Diagnostic tape and depress LOAD and IPL Release. After the tape is loaded and the ENTER command prompt is displayed, remove the Diagnostic tape and mount a scratch tape. Key SAVE = 20. Then Key N in response to the CONTINUATION TAPE? prompt. The contents of the system platter will be saved on tape. Other platters may be saved in the above manner by using SAVE = XX, where XX is the drive and platter number as described in paragraph 5.4.3.

In all cases, the tapes must be clearly labeled and submitted with a Software Problem Report.

5.3.2 TASK ERRORS

In order to reduce some operational inconveniences created when a hard system error occurs a soft error can happen. Unlike the hard shut-down encountered with a system error, the task error (soft error) will usually permit recovery by an orderly close and warm start procedure.

This is possible because a task error generally affects a single task and not the entire system. Usually a task error will lock a specific task, and a single terminal. However, because of possible software instability following a task error, it is recommended that all terminals close and recovery procedures be initiated as soon as possible.

Occasionally, a task error may hang the system, forcing a warm start without the benefit of an orderly close.

An off-line memory dump should be taken prior to the warm start, regardless of whether an orderly close was permitted or not.

When a task error occurs, the task error message will appear at all terminals as follows:

TASK ERROR XX

The two-digit number 'XX' represents a specific task error and indicates the software module which called the error.

5.3.2.1 Task Entry Listing (1.6 Software)

The following is a list of the task errors associated with software release 1.6. Unless otherwise noted all errors are software related. Task errors having more than one meaning are marked with an asterisk (*).

Task Error 2:	Illegal wait post ID
Module Called From:	EXECUTIVE
Cause:	Wait post identifier is greater than 7.
Task Error 3:	Illegal IOCB number
Module Called From:	EXECUTIVE
Cause:	Illegal Input/Output Control Block number.
Task Error 10:	DCB not found
Module Called From:	LOGICAL 10, L102780 or HI L10.
Cause:	The system was not configured for the device or the input/output control block is defective.
Task Error 11:	Device handler not found
Module Called From:	LOGICAL 10.
Cause:	The device number rung of the input/output control block pointer is not set up properly.
*Task Error 12:	Illegal magnetic tape command issued
Module Called From:	MT CMND
Cause:	Illegal magnetic tape command issued.
*Task Error 12:	Receive file not open
Module Called From:	HASP L10
Cause:	Data communications received command issued before the receive file was opened or after it was closed.
*Task Error 12:	Console out file not open
Module Called From:	HASP L10
Cause:	Data communications output command issued before the console out file was opened.
*Task Error 12:	Device not open
Module Called From:	L10 2780
Cause:	Data Communications trying to output to or input from a device which is not open.
*Task Error 12:	Receive file not open
Module Called From:	L10 3770
Cause:	SDLC receive command issued before the transmit file was opened or after it was closed.

*Task Error 12:	Transmit file not open
Module Called From:	L10 3770
Cause:	SDLC transmit command issued before the transmit file was opened or after it closed.
*Task Error 12:	Console out file not open
Module Called From:	L10 3770
Cause:	SDLC output command issued before the console out file was open.
*Task Error 12:	SDLC not initialized
Module Called From:	L10 3770
Cause:	Any SDLC command, except open console, issued before the completion of the SLDC initialization.
Task Error 13:	Unknown disk error
Module Called From:	DISK L10
Cause:	This is an unspecified disk error because the error bits are not set correctly to indicate the kind of error. If a hardware error, the disk drive or controller may be malfunctioning.
Task Error 14:	File not open
Module Called From:	DISK L10
Cause:	System tried to input to or output from a disk file which is not open.
*Task Error 15:	Illegal IOCB allocation
Module Called From:	GET IOCBS
Cause:	The system tried to allocate an existing input/output control block.
*Task Error 15:	Duplicate IOCB
Module Called From:	GET IOCBS
Cause:	The same IOCB appears twice in the user's IOCB table in the TWA.
*Task Error 15:	Nonexistent IOCB
Module Called From:	GET IOCBS
Cause:	An attempt was made to initialize an IOCB which does not exist.
Task Error 16:	Incorrect logical function
Module Called From:	MT RCD or MT SPECL
Cause:	Either the function code rung of the input;output control block is not correct, or the input;output control block pointer is bad.

*Task Error 20	Overlay appendate not in memory
Module Called From:	FILE CTRL
Cause:	An attempt was made to link to an overlay appendage which is not in memory.
Task Error 21:	Illegal section identifier
Module Called From:	MSG HDLR 2
Cause:	The parameter being passed to this module, to indicate which section to execute, is illegal.
Task Error 22:	No overlay on disk
Module Called From:	FILE CTRL
Cause:	One of the following: 1) The overlay identifier is bad, 2) the overlay does not exist, 3) the input;output control block is bad, or 4) the volume table of contents is bad.
Task Error 23:	SEGS FETCHED table overflow
Module Called From:	FILE CTRL
Cause:	The SEGS FETCHED table in the user's TWA has overflowed and the requested overlay cannot be fetched.
Task Error 23:	RUNTIME roll error
Module Called From:	RUNTIME
Cause:	A parameter for one of the RUNTIME function jump tables is out of range.
Task Error 31:	Incorrect TWA ID
Module Called From:	INIT TWA 2
Cause:	Incorrect terminal work area identifier.
*Task Error 31:	Shutdown error
Module Called From:	HASP L10
Cause:	Attempted termination of communications while data stream was active.
Task Error 32:	Incorrect TWA ID
Module Called From:	INIT TWA
Cause:	Incorrect terminal work area identifier.
Task Error 33	DCB already active
Module Called From:	HASP L10 or L10 3770
Cause:	An attempt was made to use a device control block which was already activated.
Task Error 34:	Buffer pool not allocated
Module Called From:	HASP L10 or L10 3770
Cause:	Buffer pool not allocated prior to use.

*Task Error 35:	Transmit buffer count negative
Module Called From:	HASP LIO
Cause:	Transmit buffer count has gone negative.
*Task Error 35:	Illegal logical function
Module Called From:	CONSOLE
Cause:	The function requested was greater than the maximum logical function supported.
Task Error 61:	Illegal overlay index into SCA appendate
Module Called From:	SCA ERR
Cause:	The overlay index sent to the error appendage for the synchronous adapter is bad.
Task Error 62:	DCB not found
Module Called From:	SCLA LDR, HASP LIO, SCA ERR or LIO 3770
Cause:	The system was not configured for the device during SYSGEN, or the device control block pointer is bad.
Task Error 63:	Buffer left before SCA closed
Module Called From:	SCA ERR
Cause:	The system did not deallocate all of the data communications buffers before attempting to close.
Task Error 64:	SCA not loaded
Module Called From:	SCA ERR
Cause:	The data communications software was not downloaded to the communications controller from the system.
Task Error 65:	Bad SCA logical input/output entry
Cause:	A bad function code rung in the input/output control block or a bad input/output control block pointer at the synchronous communications adapter level.
*Task Error 66:	No DCB linkage
Module Called From:	SCA PHY ID
Cause:	No device control block linkage established.
*Task Error 66:	Logical Host Interactivity error
Module Called From:	HI LIO
Cause:	Error cache for HI logical errors.
Task Error 67:	Bad SCA physical input/output entry
Module Called From:	SCA PHY IO
Cause:	A bad function code rung in the input/output control block or a bad input/output control block pointer at the SCA physical input/output level.

Task Error 68:
Module Called From:
Cause:

Incorrect magnetic tape record length
PHY IO 2
The record length requested on magnetic tape output was less than 14 characters.

Task Error 68:
Module Called From:
Cause:

No SCA buffer pool
SCA PHY IO
Could not allocate the background buffer pool area.

Task Error 70:
Module Called From:
Cause:

Send message queue empty
SYS SUBRS
The system attempted to send a message and there were no messages in the queue. The system control list may be defective.

Task Error 71:
Module Called From:
Cause:

Write to operator with reply
SYS SUBRS.
No reply in the reply queue. System control list may be wrong.

*Task Error 90:
Module Called From:
Cause:

IOCB number is out of range
DCOM RCV
1. An input/output control block number was passed which exceeds the maximum number allocated.

2. An attempt was made to start a subtask when there were no subtasks waiting to be started.

*Task Error 90:
Module Called From:
Cause:

Receive Error
UH RCV
Error cache for the following UH RCV errors:

a. UH RCV active task count invalid.
b. Open input failed.
c. Open output failed.

5.3.2.2 Dump Procedures

The following information describes the procedure for performing a memory dump if it is found that the cause of the problem is software-related.

Before restarting, and while the task error message is still displayed on the keystation, mount a previously prepared memory dump tape (see paragraph 5.4, Software Diagnostic) with a write-enable ring on the master tape drive. Depress LOAD and IPL Release (white pushbutton) on the MCU control panel and wait approximately 5 seconds for the cessation of tape movement. Remove the tape from the tape drive and apply an appropriate label.

In all cases, the tapes must be clearly labeled and submitted with a detailed Software Problem Report.

5.4 SOFTWARE DIAGNOSTIC OPERATIONS

The Software Diagnostic Program (SW DIAG) is explained in the following paragraph for use by the Customer Engineer. Only those commands and procedures which will be used to support the system software are explained. For more detailed information concerning SW DIAG, refer to the System Analyst Manual (111512).

5.4.1 SOFTWARE DIAGNOSTIC USES

The Software Diagnostic Program can be used by the C.E. to perform the following functions:

- Generation of off-line memory dump tapes.
- Generation of off-line disk dump tapes.
- Off-line recovery.
- Generation of dump tape listings.
- General manipulation of files and records from one storage media to another.

5.4.2 SOFTWARE DIAGNOSTIC PROCEDURE

This paragraph describes the general procedural information for using the Software Diagnostic Program.

1. Mount the SW DIAG tape on the primary tape drive.
2. Perform a tape load by depressing the LOAD and IPL Release (white pushbutton) on the MCU system control panel simultaneiously. SW DIAG is loaded to main memory.
3. The first prompt displayed is:

   SFTW DIAG DWG. NO. VERSION NO. ENTER COMMAND

4. Enter the command desired (see Paragraph 5.4.3) from the keystation. Note that commands, equal signs and arguments are to be keyed without any imbedded spaces. For ease of readability, all command examples in this document have inserted spaces.

5. After the successful completion of each command, a DONE message is displayed followed by another ENTER COMMAND prompt.

6. To return control to the operating system after SW DIAG functions are complete, a system tape load should be performed. A disk load (RESTART), at this point should not be performed because of the possible loss of software integrity through the use of SW DIAG.

7. Failure to specify the appropriate prior command(s) may result in a hang-type error condition. For example, if no OUTPUT command is in effect when a SAVE command is issued, a hang will occur. Depressing the CTRL and BYPASS keys simultaneously, followed by keying "G300.", followed by depressing the FIELD REL key will usually provide a recovery from the hang and return control to SW DIAG. If not, a reloading of the Software Diagnostic tape is required.

5.4.3 SOFTWARE DIAGNOSTIC COMMANDS

This paragraph includes explanations and procedures on how to implement some of the 26 SW DIAG commands that the Customer Engineer uses to perform dumps and listings. Device Codes used in the software diagnostic program are shown in Table 5-2.

Table 5-2. Device Codes

Number	Physical Device
1	Magnetic Tape Transport 1
2	Magnetic Tape Transport 2
3	Magnetic Tape Transport 3
4	Magnetic Tape Transport 4
6	Keystation
10	ASCII Line Printer
20	Disk Drive 1, Platter 1 — D1
21	Disk Drive 1, Platter 2 — D1
22	Disk Drive 1, Platter 3 — D3
23	Disk Drive 1, Platter 4 — D3
24	Disk Drive 2, Platter 1 — D1
25	Disk Drive 2, Platter 2 — D1
26	Disk Drive 2, Platter 3 — D3
27	Disk Drive 2, Platter 4 — D3
28	Disk Drive 3, Platter 1 — D1
29	Disk Drive 3, Platter 2 — D1
2A	Disk Drive 3, Platter 3 — D3
2B	Disk Drive 3, Platter 4 — D3
2C	Disk Drive 4, Platter 1 — D1
2D	Disk Drive 4, Platter 2 — D1
2E	Disk Drive 4, Platter 3 — D3
2F	Disk Drive 4, Platter 4 — D3

D1 = D1462
D3 = D3462 or D3482

5.4.3.1 INPUT, OUTPUT Commands

These commands, INPUT and OUTPUT, define the input or output magnetic tape logical unit numbers prior to the execution of certain other SW DIAG commands. Input, output assignments stay in effect until changed by new commands, or until the SW DIAG tape is reloaded.

The syntax for these commands are as follows:

INPUT = tape number (1 argument)
OUTPUT = tape number (1 argument)

Refer to Table 5-2 for the device codes to be used.

5.4.3.2 LIST Command

This command, LIST, defines an alternate list device, other than the keystation. Such devices can be the magnetic tape drives (1—4) and the line printer. This command lists all prompts, commands and outputs of the command DUMPM. The LIST command stays in effect until changed by a new command, or until the SW DIAG tape is reloaded.

The system for this command is as follows:

LIST = device number (1 argument)

A device number of 0 terminates the list function, writes an end-of-file mark and rewinds the tape if the tape drive is the list device. Refer to Table 5-2 for the device number to be used.

Listing to a magnetic tape drive causes additional prompts to be displayed. Table 5-3 below shows these prompts and the operator responses.

Table 5-3. LIST to a Magnetic Tape Drive Prompts

Display	Response
PACKED? TYPE Y FOR YES, REL = NO	Depress FIELD REL.
ASA PRINT CONTROL — EBDCIC? TYPE Y FOR YES, REL = NO	Depress FIELD REL.
CONTINUATION TAPE? TYPE Y FOR YES, REL = NO	Depress FIELD REL if the tape does not have any other data on it.

5.4.3.3 Tape Positioning Commands

Five commands are available for tape positioning:

- SKF skips one file on all tapes in the argument list.
- BSF backspaces one file on all tapes in the argument list.
- BSR backspaces one record on all tapes in the argument list.
- EOF writes an end-of-file mark on all tapes in the argument list.
- REW rewinds all tapes in the argument list.

The syntax for these commands are as follows:

```
SKF  = tape number 1, . . . , tape number 4 (1—4 arguments)
BSF  = tape number 1, . . . , tape number 4 (1—4 arguments)
BSR  = tape number 1, . . . , tape number 4 (1—4 arguments)
EOF  = tape number 1, . . . , tape number 4 (1—4 arguments)
RWD  = tape number 1, . . . , tape number 4 (1—4 arguments)
```

5.4.3.4 COPY Command

The COPY command copies files (including end-of-file marks) from an input device to an output device. The number of files and records to be copied are specified by the command. File number, record number and record length information may optionally be listed to the alternate list device.

The syntax of this command is as follows:

```
COPY  = arg 1, arg 2 (0—2 arguments)
arg 1 = number of files to be copied in hexadecimal (default value is 1)
arg 2 = maximum number of records to be copied in any one file. COPY terminates if
        arg 2 is exceeded in any file (default value is all records).
```

Refer to Table 5-2 for the device number to be used.

The following sample program copies 50 records, from the first file on tape 2 to tape 1, with a listing to the keystation. Since a partial file is copied, an end-of-file mark must be generated using the EOF command.

```
LIST   = 6
INPUT  = 2
OUTPUT = 1
COPY   = 1, 32
EOF    = 1
REW    = 1, 2
```

Note that the COPY command does not automatically rewind tapes; the REW command may be used.

5.4.3.5 SAVE Command

This command saves the entire contents of a disk platter and an end-of-file mark to a specified tape drive (disk dump). The output tape from the SAVE command may only be processed by the SW DIAG RESTORE command. Following a RESTORE, the information from the SAVE tape may be listed by using the VTOC and/or the DV commands.

The syntax of the SAVE command is as follows:

SAVE = disk number (1 argument)

Refer to Table 5-2 for the device number to be used.

The following table shows how to use the SAVE command to save the system platter (RDC 0, drive 0, bottom platter) to tape drive 1.

Table 5-4. Program to Save the System Platter

Display	Response
ENTER COMMAND	Enter OUTPUT = 1, then FIELD REL.
ENTER COMMAND	Enter SAVE = 20, then FIELD REL.
CONTINUATION TAPE? TYPE Y FOR YES, REL = NO	Depress FIELD REL if the tape does not have any other data on it.

Note that one disk platter with 1344 byte record length can be saved on a 600 foot reel (800 BPI) of tape.

5.4.3.6 RESTORE Command

This command restores a Software Diagnostic generated SAVE tape (see Paragraph 5.4.3.5) to a specified disk platter. Hard errors which occurred during the SAVE command will be reported (disk address and error status) during the RESTORE. The operator may then either continue or abort the RESTORE.

CAUTION

THE RESTORE COMMANDS DESTROY ALL CURRENT DATA ON THE PLATTER.

The syntax for the RESTORE command is as follows:

RESTORE = disk number

Refer to Table 5-2 for the device number to be used.

Table 5-5 shows the steps for restoring a SW DIAG SAVE tape from tape drive 1 to disk platter 1.

Table 5-5. Program to Restore SAVE Tape to System Platter

Display	Response
ENTER COMMAND	Enter INPUT = 1 then FIELD REL.
ENTER COMMAND	Enter RESTORE = 20, then FIELD REL.
DESTROY CURRENT DISK CONTENTS? TYPE Y FOR YES, REL = NO	Enter Y then FIELD REL. **CAUTION** **THIS ACTION WILL DESTROY CURRENT DISK DATA.**

5.4.3.7 RECOVER Command

This command recovers all data batches from a specified disk platter. It is used when a hardware or software problem precludes normal batch access. Note that no software or compiles are recovered. The tape generated by RECOVER may later be restored to disk via the supervisor RESTORE command (not the SW DIAG RESTORE). RECOVER can also be used to list a report of recovered batches.

The syntax for the RECOVER command is as follows:

RECOVER = disk number, save flag

Refer to Table 5-2 for the device number to be used. If the save flag is nonzero, an output tape is created. If the save flag is zero, an output tape is not created, but the batch report may be used.

Table 5-6 below describes a program that can be used to recover all data batches to tape drive 1 from disk platter1 and list a report of the recovered batches to the line printer.

Table 5-6. Program to Recover Batches to Tape and List the Report to the Line Printer

Display	Response
ENTER COMMAND	Enter LIST = 10 then FIELD REL.
ASA PRINT CONTROL – EBCDIC? TYPE Y FOR YES, REL = NO	Depress FIELD REL.
ENTER COMMAND	Enter OUTPUT = 1 then FIELD REL.
ENTER COMMAND	Enter RECOVER = 20, 1 then FIELD REL.

5.4.3.8 MAKEMD Command

This command creates a magnetic (Quit) tape which contains a memory dump routine. These dump tapes can be later used when certain system problems occur (e.g., system hangs).

The syntax for the MAKEMD command is as follows:

MAKEMD = tape number 1, . . . , tape number 4 (1–4 arguments)

Refer to Table 5-2 for the device numbers to be used.

Once the Quit tape is created by using the MAKEMD command, a memory dump can be executed by mounting the Quit tape and then depressing the LOAD and IPL Release simultaneously. The dump takes approximately ten seconds. The dump tapes are reusable, as the dump routine at the front end of the tape is not overlaid during the memory dump.

5.4.3.9 DUMPM Command

DUMPM converts a memory dump tape to EBCDIC and lists the contents to an alternate list device. Optionally software modules may be identified in the listing and terminal work area cells named (TWA's unwound).

The syntax for the DUMPM command is as follows:

DUMPM = arg 1, arg 2, arg 3 (0–3 arguments).
arg 1 = logical tape drive containing the dump (default value is 3).
arg 2 = dummy argument; can be anything (default value is 0).
arg 3 = module recognition flag. If arg 3 is zero all modules will be named and separated on the listing. If arg 3 is nonzero, the memory contents will be dumped as one module. The default value is zero.

Refer to Table 5-2 for the device number to be used.

Table 5-7 shows a program using DUMPM to list a dump tape from tape from tape drive 1 to the line printer with module recognition and with TWA unwinding.

Table 5-7. Program to List a Dump Tape to Line Printer

Display	Response
ENTER COMMAND	Enter LIST = 10 then FIELD REL.
ASA PRINT CONTROL – EBCDIC? TYPE Y FOR YES, REL = NO	Depress FIELD REL.
ENTER COMMAND	Enter DUMPM = 1, 0, 0 then FIELD REL.
OUTPUT FOR WIDE PAPER? TYPE Y FOR YES, REL = NO	Enter Y then FIELD REL.
UNWIND TWA'S? TYPE Y FOR YES, REL = NO	Enter Y then FIELD REL.

5.4.4 SOFTWARE DIAGNOSTIC TAPE DUPLICATION

The following procedure outlines how to copy Software Diagnostic tapes.

	Display	Operator Action
1.		Mount the Software Diagnostic tape on the primary tape drive. Depress LOAD and IPL Release simultaneously.
2.	SFTW DIAG DWG. NO. VERSION NO. ENTER COMMAND	Remove the Software Diagnostic tape, and mount the scratch tape to be copied onto the primary tape drive. Depress the RESET key, then depress the CTRL and BYPASS keys simultaneously. Now, enter Q, then depress FIELD REL.

5.5 SOFTWARE PATCHING

This paragraph includes the patching procedures as well as a listing of any errors that might occur during the patching.

The process of patching facilities the corrections of software modules on the System Master Binary (SMB) Tape and the Operating System Tape. This process is performed mainly by the SYSGEN program. Two basic SYSGEN commands can be used for this:

- CMT – Correct Master Tape
- CDM – Correct Disk Module

The procedures for performing both types of patching are outlined below.

5.5.1 CMT PATCHING AND CORRECTIONS

The SYSGEN command CMT creates a new SMB tape from an old SMB tape and incorporates patches entered from the keystation. The procedure for CMT patching is as follows:

THIS PROCEDURE WILL DESTROY THE DATA ON THE DISK. BE SURE TO SAVE ANY CUSTOMER DATA THAT IS ON THE DISK.

	Display	Operator Action
1.		Mount the old SMB on the primary tape drive. Depress LOAD and IPL Release (blank white pushbutton) on the system control panel on the MCU. The system will load tape and respond with the following prompts:
2.	***MASTER VERSION NO XX.XX.XX*** INITIALIZE SYSTEM DISK? Y = YES, REL = NO	Enter Y then FIELD REL.
3.	DELETE ALL DISK INFO? Y = YES, REL = NO	Enter Y then FIELD REL.
4.	LOAD SYSTEM OVERLAYS TO DISK NO NAME VERSN TYP ID STATUS 001 S DLD LC X.X 014 001 LOAD 002 S GEN LC X.X 014 001 LOAD 003 S BLD MSG X.X 014 002 LOAD 004 S LD TBLS X.X 014 003 LOAD 005 S P BUF 1 X.X 0 014 001 LOAD END OF FILE TO SELECT MODS, TYPE: Y = YES, REL = NO	Depress FIELD REL.

	Display	Operator Action
5.	NO NAME VERSN TYP ID STATUS 001 S BLD LC X.X 014 001 LOADED . . . . 005 S P BUF 1 X.X 014 001 LOADED *** SYSGEN VERSION NO. XX.XX.XX *** TYPE SYSGEN COMMAND	This prompt takes several minutes to be displayed. Enter ALU = 16 then FIELD REL to output the modules to the line printer.
6.	ALU = N SET ALTERNATE LIST UNIT = N TYPE SYSGEN COMMAND	Enter LC = 1 then FIELD REL to print all commands.
7.	LC = N SET LIST COMMAND FLAG = N TYPE SYSGEN COMMAND	Enter CMT then FIELD REL.
8.	CMT CORRECT MASTER TAPE NO NAME VERSN TYP ID STATUS 001 S BLD LC X.X 014 001 LOAD . . . . END OF FILE REVIEW AND CORRECT MASTER CORRECTIONS TYPE: Y = YES, REL = NO	At this time all of the software modules are listed. This takes several minutes. Depress FIELD REL if patches are only to be added to the SMB tape. Go to step 14. Depress Y then FIELD REL if patches are to be corrected or deleted.
9.	REVIEW SUB COMMANDS ARE: REL DISPLAY NEXT LINE D DELETE CURRENT LINE T TERMINATE CURRENT MODULE R RECYCLE CURRENT MODULE TYPE MODULE NAME:	Enter the module name which is to be reviewed, then depress FIELD REL.
10.	TYPE VERSION: FORM IS XX.XX	The version number of the module to be reviewed must be entered, followed by a FIELD REL. Significant digits may be entered with or without spaces as fill characters. Zero (0) fill characters are not allowed.
11.	** XX–XXX**XX.XX.XX**PATCH NO. XXXXX	Depress FIELD REL to review each line of the patches for that module. If a line is to be deleted, display the line, then enter D then FIELD REL. If the module is to be reviewed again, enter R then FIELD REL.

Display	Operator Action
	If the module is not to be reviewed any longer, enter T then FIELD REL.
12. END OF CORRECTIONS FOR THIS MODULE TYPE MODULE NAME	If patches are to be deleted from another module, enter the module name then depress FIELD REL. If no more modules are to be reviewed, enter XXX then FIELD REL.
13. ENTER NEW CORRECTIONS? TYPE: Y = YES, REL = NO	If new patches are to be added, type Y then FIELD REL. If no new patches are to be added, depress FIELD REL and go to step 17.
14. TYPE MODULE NAME	Enter the module name than a FIELD REL. If no more modules are to be corrected, enter XXX then FIELD REL, and go to step 17.
15. TYPE VERSION: FORM IS XX.XX	Enter the version number of the module to be patched then a FIELD REL. Note that significant digits may be entered with or without spaces as fill characters. Zero (0) fill characters are not allowed.
16. TYPE CORRECTION LINES	Comments, patch numbers, and cross reference problem numbers may be entered by keying an asterisk (*) in the first position of each comment line followed by the comment information. Refer to the Patch Transmittal Form for the comments. Correction code must be entered exactly as specified on the Patch Transmittal Form. All spaces, including those preceding actual code, must be keyed. Attention must be given to entering any periods (.) and spaces which occur in the code. A slash (/) and a check digit must be entered at the end of each line of code. After the last line of code is entered for a particular patch, a G is keyed to terminate that particular patch. Go to step 14.

Display	Operator Action
17. MOUNT TAPE: REL = READY, A = ABORT	Remove the old SMB tape from the primary tape transport. Mount a write-enabled tape which is to become the new SMB tape. Depress FIELD REL.
18. CHANGE XX.XX.XX TO XX.XX.XX? TYPE VERSION NUMBER OR REL TO ACCEPT	If the new version number is correct, depress FIELD REL. If the new version number is not correct, enter the correct new version number then depress FIELD REL. Now the new SMB tape will be written. This will take several minutes.

5.5.2 CDM PATCHING

The CDM command provides a method of correcting disk-resident modules under the control of SYSGEN. In turn, a new Operating System Tape may be created from the modified disk-resident operating system.

5.5.2.1 CDM Patching Procedure

CAUTION

THIS PROCEDURE WILL DESTROY THE DATA ON THE DISK. BE SURE TO SAVE ANY CUSTOMER DATA THAT IS ON THE DESK.

	Display	Operator Action
1.		Take all SAVES (Job, Compile, Directory) and FILES (under File Inquiry). Mount the existing System Tape on the primary tape drive. Depress LOAD and IPL Release (white pushbutton) on the MCU System Control Panel simultaneously.
2.	*** SYSTEM VERSION NO. XX.XX.XX *** INITIALIZE SYSTEM DISK? Y = YES, REL = NO	Enter Y then FIELD REL.
3.	DELETE ALL DISK INFO? Y = YES, REL = NO	Enter Y then FIELD REL.

	Display	Operator Action
4.	START OPTION – COLD	Enter SYS then FIELD REL. This enters the SYSGEN program.
5.	*** SYSGEN VERSION NO XX.XX.XX *** TYPE SYSGEN COMMAND	If a line printer is available on the system, enter ALU = 16 then FIELD REL. Then the system will respond with "TYPE SYSGEN COMMAND" again. Enter CDM then FIELD REL.
6.	CDM CORRECT DISK MODULE TYPE MODULE NAME	Enter the module name from the Patch Transmittal Form then depress FIELD REL.
7.	ENTER CORRECTIONS R=XXXX B=XXXX U=XXXX L=XXXX D=XXXX	At this time SYSGEN passes control to PERDEBUG for the entering of the patches. Comments, patch numbers, and cross reference problems may be entered by keying an * in the first position followed by the comment information. Refer to the Patch Transmittal Form for the comments. Correction code must be entered exactly as specified on the Patch Transmittal Form. All spaces, including those preceding actual code, must be keyed. Attention must be given to entering periods (.) which occur in the code. Do not enter the slash (/) and check digit at the end of each line of code. Depress FIELD REL. The system will display a check digit and should be sight verified with the one shown on the Patch Transmittal Form. After each line of code is entered, the system will display a series of hexadecimal values. After all patches for the above module name have been entered, enter G then FIELD REL.
8.	G/X R=XXXX B=XXXX U=XXXX L=XXXX D=XXXX TYPE MODULE NAME	If another module is to be patched enter the module name and then go to Step (7). If no other modules are to be patched, depress FIELD REL.

	Display	Operator Action
9.	TYPE SYSGEN COMMAND	Mount the scratch tape (with a write ring) which is to become the new Operating System Tape on the primary tape drive. Enter WTS then FIELD REL. The system will then write the new corrected System Tape.

5.5.3 PATCHING ERRORS

Since the software patching procedures utilize the SYSGEN program, the errors generated during patching are those that are generated during the Initial System Configuration procedure of SYSGEN. These are namely, SYSGEN and IOCTL errors. Refer to Paragraph 5.2.4 and 5.2.5 for a listing of these errors.

5.6 SYSTEM MASTER BINARY (SMB) TAPE DUPLICATION

This paragraph includes the copying procedure as well as a listing of any errors that might occur during the copying.

This copying function is facilitated by use of the SYSGEN program. The SYSGEN command used for this is DMT (Duplicate Master Tape). The duplication procedure is outlined below.

5.6.1 SMB DUPLICATION PROCEDURE

CAUTION

THIS PROCEDURE WILL DESTROY THE DATA ON THE DISK. BE SURE TO SAVE ANY CUSTOMER DATA THAT IS ON THE DISK.

	Display	Operator Action
1.		Mount the SMB tape to be copied on the primary tape drive. Depress LOAD and IPL Release (white pushbutton) on the MCU System Control Panel simultaneously.
2.	**MASTER VERSION NO. XX.XX.XX** INITIALIZED SYSTEM DISK? Y = YES, REL = NO	Enter Y then FIELD REL.
3.	DELETE ALL DISK INFO?	Enter Y then FIELD REL. Wait approximately 5 minutes.

	Display	Operator Action
4.	LOAD SYSTEM OVERLAYS TO DISK NO NAME VERSN TYP ID STATUS 001 S DLD LC X.X 014 001 LOAD 002 S GEN LC X.X 014 001 LOAD 003 S BLD MSG X.X 014 002 LOAD 004 S LD TBLS X.X 014 003 LOAD XXX X XX XXXX X.X XXX XXX XXXX END OF FILES TO SELECT MODS, TYPE: Y = YES, REL = NO	Depress FIELD REL.
5.	(Repeats SYSGEN overlay modules) ***SYSGEN VERSION NO XX.XX.XX*** TYPE SYSGEN COMMAND	Enter DMT then FIELD REL.
6.	DMT DUPLICATE MASTER TAPE TAPE TO DISK TO TAPE	The system reads in all of the SMB.
7.	MOUNT TAPE: REL=READY, A=ABORT	Remove the old SMB from the primary tape drive. Mount a write-enabled tape which is to become the new SMB tape. Depress FIELD REL. The system will now generate the new SMB tape.

5.6.2 SMB DUPLICATION ERRORS

Since the SMB duplication procedure utilizes the SYSGEN program, the errors generated during the duplication are those that are generated during the Initial System Configuration procedure of SYSGEN. These are namely, SYSGEN and IOCTL errors. Refer to Paragraph 5.2.4 and 5.2.5 for a listing of these errors.

Section 6

PREVENTIVE MAINTENANCE

6.1 GENERAL

This section provides the necessary information concerning scheduled preventive maintenance of the system. The preventive maintenance is partitioned into two- and six-month programs. These programs are outlined below.

6.1.1 TWO-MONTH PREVENTIVE MAINTENANCE PROGRAM

The following preventive maintenance should be performed every two months in the order given.

6.1.1.1 Magnetic Tape Transport Two-Month Preventive Maintenance

The following procedure applies to both the T7000 series and the T8000 series tape transports.

a. Perform the transport cleaning (paragraph 6.3.1.1).

b. Clean the tape cleaner on the tape transport (paragraph 6.3.1.2).

c. Clean the take-up hub on the tape transport (paragraph 6.3.1.3).

d. Save all of the customer's jobs, compiles, directories and index files onto tape.

CAUTION

Failure to perform this save will result in the loss of the customer's data.

e. Perform the magnetic tape off-line diagnostic (TD) standard tests.

6.1.1.2 Rigid Disk Drive Two-Month Preventive Maintenance

This paragraph includes procedures for both the fixed (Pertec D1460 series) and the removable (Pertec D3482) disk drives. Perform the preventive maintenance corresponding to the type of drive used in the system.

D1460 Disk Drive Two-Month Preventive Maintenance

a. Clean the disk drive pre-filter (paragraph 6.1.4.1).

b. Clean the disk drive heads (paragraph 6.1.4.1).

c. Inspect the disk platter and clean if necessary (paragraph 6.1.4.1).

d. Clean and inspect the disk drive chassis (paragraph 6.1.4.1).

e. Perform the rigid disk off-line diagnostic (RD) standard tests (reference Section 3).

D3482 Disk Drive Two-Month Preventive Maintenance

a. Clean the disk drive heads (paragraph 6.1.4.2).

b. Inspect the disk drive platter and clean if necessary.

6.1.1.3 Line Printer Two-Month Preventive Maintenance

This paragraph includes procedures for the low speed (Tally Model 1602), medium speed (Printronix 300) and the high speed (Dataproducts 2260 and 2290) line printers. Perform the preventive maintenance corresponding to the type of printer used in the system.

Tally Model 1602 Line Printer Two-Month Preventive Maintenance

a. Clean print head carriage rods and rollers that ride on them (paragraph 6.1.6.1).

b. Inspect and replace broken or cracked plastic rollers.

Printronix 300 Line Printer Two-Month Preventive Maintenance

a. Clean the interior of the printer (paragraph 6.1.5.1).

b. Clean the printer's hammer bank (paragraph 6.1.5.1).

c. Clean the printer's air filter (paragraph 6.1.5.1).

d. Lubricate the printer's cam (paragraph 6.1.5.1).

e. Lubricate the printer's counterbalance (paragraph 6.1.5.1).

f. Lubricate the printer's anti-rotation arm (paragraph 6.1.5.1).

g. Perform the line printer off-line diagnostic (LP) standard tests (reference Section 3).

Dataproducts 2260/2290 Line Printer Two-Month Preventive Maintenance

The following procedures refer to both the Dataproducts 2260 and 2290 line printers.

a. Verify the general cleanliness of the printer.

b. Verify that the input voltage is within ±10% of its nominal value.

c. Verify that the cooling fan is operational.

d. Check the power supply regulator voltage (paragraph 6.1.5.2).

e. Perform the servo system checkout procedure (paragraph 6.1.5.2).

f. Perform the character drum drive belt tension check in paragraph 6.1.5.2.

g. Perform the line printer off-line diagnostic (LP) standard tests (reference Section 3). Verify vertical line registration when the sliding pattern of E's is printed in test 6.

Verify hroizontal line registration when the single character broadside pattern of H's is printed in test 8.

6.1.1.4 Card Reader Two-Month Preventive Maintenance

The following procedure refers to the Documation M300L card reader.

a. Clean the picker sector (paragraph 6.1.6.1).

b. Clean the card track (paragraph 6.1.6.2).

c. Clean the cooling fan (paragraph 6.1.6.3).

d. Clean the exterior of the card reader (paragraph 6.1.6.4).

e. Perform the card reader off-line diagnostic (CR) standard tests (reference Section 3).

6.1.1.5 Two-Month Preventive Maintenance System Check

Reload the operating system from the operating system tape and restore all jobs, compiles, index files and directories on the save tape. Ensure that the customer's system is operating properly.

6.1.2 SIX-MONTH PREVENTIVE MAINTENANCE PROGRAM

The following preventive maintenance should be performed every six months in the order given in this paragraph.

6.1.2.1 Magnetic Tape Transport Six-Month Preventive Maintenance

The following procedure applies to both the T7000 series and the T8000 series tape transports.

a. Perform the transport cleaning (paragraph 6.1.3.1).

b. Clean the tape cleaner on the tape transport (paragraph 6.1.3.2).

c. Clean the take-up hub on the tape transport (paragraph 6.1.3.3).

d. Check the tape head wear and replace if necessary (paragraph 6.1.3.4).

e. Check the tape drive skew and adjust if necessary (paragraph 6.1.3.6).

f. Check the tape transport speed (paragraph 6.1.3.5).

g. Check the read and write skew (paragraphs 6.1.3.6 and 6.1.3.7).

h. Save all of the customer's jobs, compiles, directories and index files onto tape.

CAUTION

Failure to perform this save will result in the loss of the customer's data.

i. Perform the magnetic tape off-line diagnostic (TD) standard tests (reference Section 3).

6.1.2.2 Rigid Disk Drive Six-Month Preventive Maintenance

This paragraph includes procedures for both the fixed D1460 and the removable D3482 disk drives. Perform the preventive maintenance corresponding to the type of drive used in the system.

D1460 Disk Drive Six-Month Preventive Maintenance

a. Clean the disk drive pre-filter (paragraph 6.1.4.1).

b. Replace the main air filter.

c. Clean the disk drive heads (paragraph 6.1.4.1).

d. Inspect the disk platter and clean if necessary (paragraph 6.1.4.1).

e. Clean and inspect the disk drive chassis (paragraph 6.1.4.1).

f. Clean the positioner scale (paragraph 6.1.4.1).

g. Perform the rigid disk off-line diagnostic (RD) tests (reference Section 3).

D3482 Disk Drive Six-Month Preventive Maintenance

a. Clean the pre-filter (paragraph 6.1.4.2).

b. Replace the absolute air filter.

c. Clean the disk drive heads (paragraph 6.1.4.2).

d. Inspect the fixed disk platter and clean if necessary (paragraph 6.1.4.2).

e. Check the belt and the static discharge contact for wear (paragraph 6.1.4.2).

f. Clean the spindle magnetic chuck and cone (paragraph 6.1.4.2).

g. Clean the positioner (paragraph 6.1.4.2).

h. Check the CE alignment (reference Part II, paragraph 7.4.2.9).

i. Clean the base castings and the dust cover and inspect the machine (paragraph 6.1.4.2).

j. Perform the rigid disk off-line diagnostic (RD) standard tests (reference Section 3).

6.1.2.3 Line Printer Six-Month Preventive Maintenance

This paragraph includes procedures for the Tally 1602, Printronix 300, and the Dataproducts 2260 and 2290 line printers. It also includes the six-month procedures required for the Centronics 702 station page printer. Perform the preventive maintenance corresponding to the type of printer used in the system.

Tally Model 1602 Line Printer Six-Month Preventive Maintenance

The Tally Model 1602 line printer does not require any six-month preventive maintenance.

Printronix 300 Line Printer Six-Month Preventive Maintenance

a. Clean the interior of the printer (paragraph 6.1.5.1).

b. Clean the printer's hammer bank (paragraph 6.1.5.1).

c. Clean the printer's air filter (paragraph 6.1.5.1).

d. Lubricate the printer's cam (paragraph 6.1.5.1).

e. Lubricate the printer's counterbalance (paragraph 6.1.5.1).

f. Lubricate the printer's anti-rotation arm (paragraph 6.1.5.1).

g. Lubricate the older style shuttle motor (paragraph 6.1.5.1).

h. Lubricate the printer's O-rings (paragraph 6.1.5.1).

i. Perform the line printer off-line diagnostic (LP) standard test (reference Section 3).

Dataproducts 2260/2290 Line Printer Six-Month Preventive Maintenance

The following procedures refer to both the Dataproducts 2260 and 2290 line printers.

a. Physically inspect the printer.

- Verify that all connectors are secure.
- Inspect for damaged parts and components.
- Verify that all hardware is secure.
- Inspect for worn or loose wires.
- Insure that the fan intake is free of any obstructions.
- Insure that the character drum is clean.
- Verify the general cleanliness of the printer.

b. Verify that the input voltage is within ±10% of its nominal value.

c. Insure that the cooling fan is operational.

d. Check the power supply regulator voltages (paragraph 6.1.5.2).

e. Verify the correct drum-to-hammer bank alignment (reference character drum-to-hammer bank alignment procedure). Perform the adjustments only if required.

f. Perform the paper feed system/character drum check (paragraph 6.1.5.2).

g. With the printer power off, perform the character drum drive belt tension check.

h. Perform the data and print quality check (paragraph 6.1.5.2).

i. Perform the line printer off-line diagnostic (LP) standard tests (reference Section 3).

Centronics 702 Station Page Printer Six-Month Preventive Maintenance

a. Clean all cover assemblies with mild detergent and a clean cloth.

b. Clean both sides of timing fence with liquid freon and a soft, clean cloth.

CAUTION

Do not use organic solvents, such as alcohol, or damage to the timing fence may occur.

c. Manually move the ribbon cartridge assembly and verify proper ribbon tracking. Check ribbon pinch rollers for proper pressure.

d. Dust the upper and lower carriage guide bars with a soft, clean cloth.

e. Inspect the stepper motor assembly and carriage drive belt for wear and verify proper tension.

f. Clean the platter assembly with a mild detergent.

6.1.2.4 Card Reader Six-Month Preventive Maintenance

The following procedure refers to both the Documation M300L and M600L card readers.

a. Clean the picker sector (paragraph 6.1.6.1).

b. Clean the card track (paragraph 6.1.6.2).

c. Clean the cooling fan (paragraph 6.1.6.3).

d. Clean the card reader exterior (paragraph 6.1.6.4).

e. Lubricate the rotary solenoid rollers (paragraph 6.1.6.5).

f. Perform the card reader off-line diagnostic (CR) standard tests (reference Section 3).

6.1.2.5 Six-Month Preventive Maintenance System Check

Perform associated XPU (XP), XPU2 (XQ), main memory (MD) and communications controller (CD) off-line diagnostic standard tests (reference Section 3).

Reload the operating system for the operating system tape and restore all jobs, compiles, index files and directories on the save tape (reference System Reference Manual, 690015-006). Ensure that the customer's system is operating properly.

6.1.3.1 Transport Cleaning

The transport requires cleaning in five major areas: heads and associated guides, capstan, roller guides, tape cleaner and take-up hub. Refer to Figure 6-1 for the locations of these parts on the mini transport or Figure 6-2 for the maxi transport.

a. Clean the heads, guides and capstan with a cotton swab moistened with isopropyl alcohol or DuPont Freon TF. Be sure not to soak the swab with excessive solvent.

CAUTION

Rough or abrasive cloths or carbon tetrachloride must not be used to clean the tape transport.

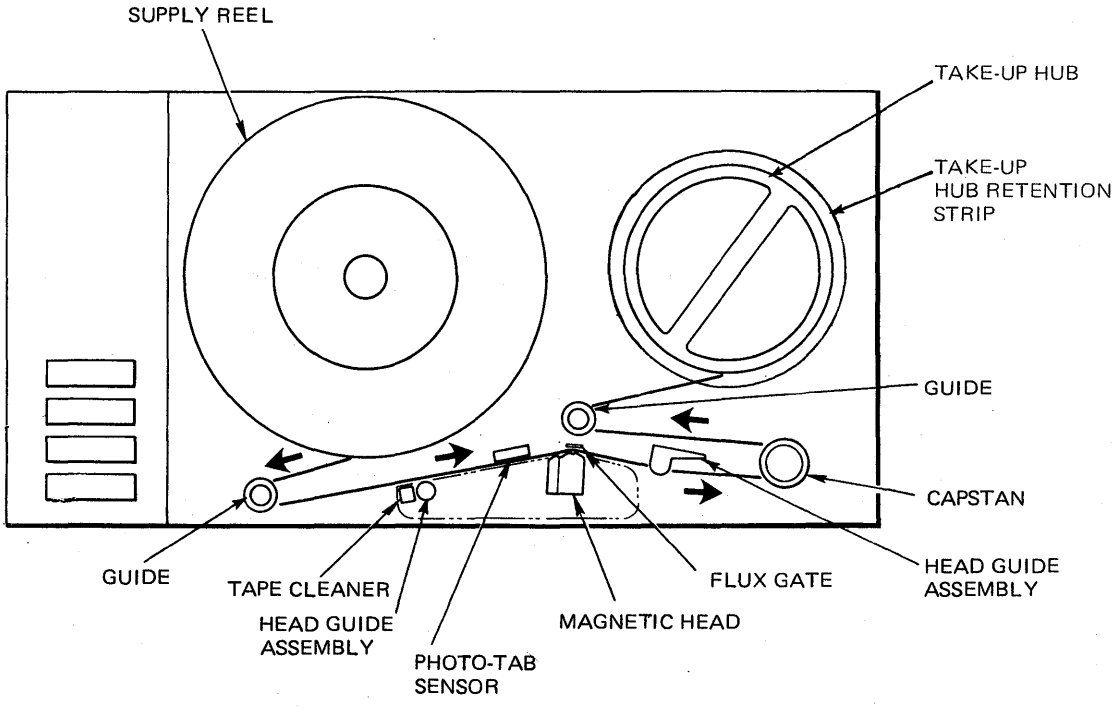


Figure 6-1. T7000 Series Tape Transport

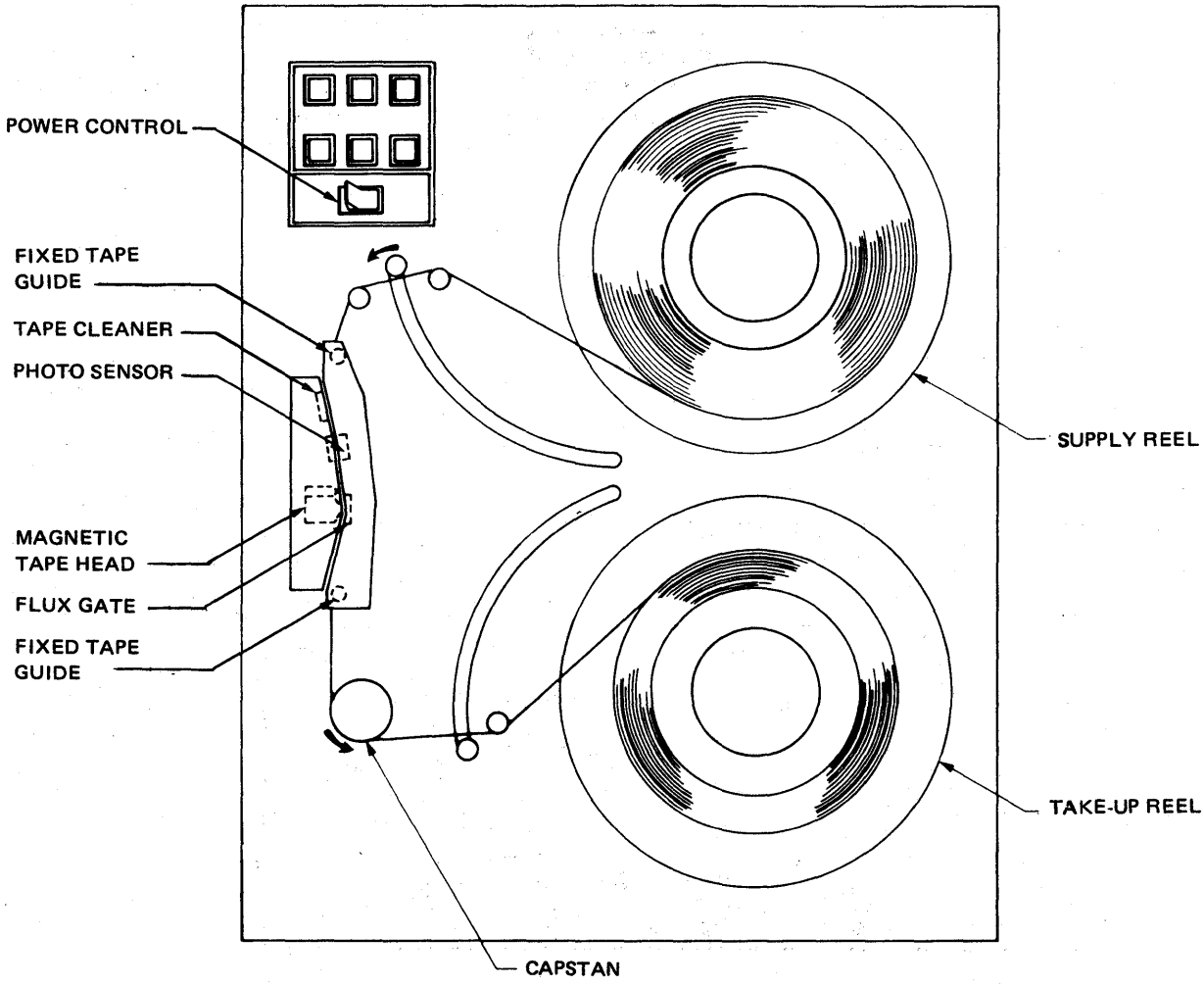


Figure 6-2. T8000 Series Tape Transport

6.1.3.2 Tape Cleaner Cleaning

The tape cleaner must be removed from the transport for proper cleaning:

a. Remove the head cover.

b. Remove the Allen head screw which holds the cleaner to the deck.

c. Loosen the two screws which hold the cleaner to the deck.

d. Remove the tape cleaner by removing the perforated mesh from the housing and blow the accumulated oxide and dirt from the housing.

e. Clean the perforated mesh and housing with a cotton swab moistened with isopropyl alcohol or DuPont Freon TF. Care should be taken to ensure that fibers from the cotton swab do not adhere to the mesh.

f. Relocate the mesh on the housing and tighten the retaining screws.

g. Carefully install the tape cleaner as located by the dowel pin. Secure in place and tighten the Allen head screw. Be certain that the perforated mesh surface is parallel to the tape and that the tape is wrapped symmetrically around the tape cleaner.

6.1.3.3 Take-Up Hub Cleaning

The take-up hub retention strip is cleaned by using a cotton swab moistened with isopropyl alcohol. Do not use excessive solvent when cleaning the retention strip.

6.1.3.4 Head Inspection

The head may require replacement because of internal faults, faulty cabling or from wear. Internal faults can be detected by checking the read skew (reference paragraph 6.1.3.5); wear can be checked by measuring the depth of the wear on the head crown with 0.010 inch shims. Place the shim in the worn area of the head crown with one side butted against the worn step. When the upper surface of the shim is below the unworn surface of the head (i.e., the head wear is greater than 0.010 inch) the head should be replaced (reference Part II, paragraph 4.6.1.3 for T7000 Series transports or paragraph 5.6.19 for T8000 Series transports).

6.1.3.5 Tape Speed Check

This paragraph contains procedures for both the T7000 Series and the T8000 Series tape transports. Perform the procedure(s) corresponding to the type(s) of transport(s) used in the system.

T7000 Series Tape Transport Tape Speed Check

a. Place the transport in the service position.

b. Mount and load an 800-cpi master skew tape on the transport.

c. Using any oscilloscope, monitor the following test points on the data PCBA:

- TP206 on MRZI transports (reference Part II, Figures 4-3 and 4-4).
- TP207 on PE transports (reference Part II, Figure 4-1).

Sync the oscilloscope internally.

d. Ground TP8 on the tape control PCBA (reference Figure 4-2). This will cause the tape to move forward.

e. Verify that the period between the leading edges of the two adjacent pulses is 66.7 ±1.3 (±2%) μsecs.

NOTE

Since the oscilloscope display will contain jitter when making this measurement, the pulse period should be measured at the approximate center of the jitter.

f. If the period is not within the above tolerance, perform the tape speed adjustment in Part II, paragraph 4.5.1.2 for NRZI transports or paragraph 4.5.2.2 for the PE transports.

g. Ground TP5 on the tape control PCBA. This will cause the tape to move backward.

CAUTION

Do not rewind the master skew tape.

T8000 Series Tape Transport Tape Speed Check

a. Place the transport in the service position.

b. Mount and load an 800-cpi master skew tape on the transport.

c. Using an oscilloscope, monitor the following test points on the data PCBA:

- TP206 on NRZI transports (reference Part II, Figures 5-5 or 5-6).
- TP207 on PE transports (reference Part II, Figure 5-13).

Sync the oscilloscope internally.

d. Cause the transport to move tape forward (SFC) with the maintenance switch on the tape control PCBA (reference Part II, Figure 5-3).

e. Verify that the period between the leading edges of the two adjacent pulses is as follows:

- 66.7 ±1.3 (±2%) μsecs for 18.75 ips.
- 33.3 ±0.7 (±2%) μsecs for 37.5 ips.

NOTE

Since the oscilloscope display will contain jitter when making this measurement, the pulse period should be measured at the approximate center of the jitter.

f. If the period is not within the above tolerance, perform the tape speed adjustment in Part II, paragraph 5.5.1.5 for NRZI transports or paragraph 5.5.2.5 for the PE transports transports.

g. Ground TP11 on the tape control PCBA. This will cause the tape to move backward.

NOTE

Do not rewind the master skew tape.

6.1.3.6 Read Skew Check

This paragraph contains procedures for both the T7000 Series and the T8000 Series tape transports. Perform the procedure(s) corresponding to the type(s) of transport(s) used in the system.

T7000 Series Tape Transport Read Skew Check

a. Place the transport in the service position.

b. Using an oscilloscope, monitor the following test points on the data PCBA:

- TP15 on NRZI transports (reference Part II, Figures 4-3 or 4-4).
- TP10 on PE transports (reference Part II, Figure 4-11).

Sync the oscilloscope internal negative.

c. Mount and load an 800-cpi master skew tape on the transport.

d. Ground TP8 on the tape control PCBA (reference Part II, Figure 4-2). This will cause the tape to move forward.

e. Observe the waveform and adjust the horizontal sweep rate to display one complete cycle over the entire display. A good skew waveform looks like the display in Part II, Figure 5-11.

f. Verify that the maximum fall time of the waveform is as follows:

- 7.8 μsecs for NRZI transports.
- 10.7 μsecs for PE transports.

g. If the fall time is not less than those specified above, perform the read skew check and adjustment in Part II, paragraph 4.5.1.8 for NRZI transports or paragraph 4.5.2.3. for PE transports.

h. Ground TP5 on the tape control PCBA (reference Part II, Figure 4-2). This will cause tape to move backward.

CAUTION

Do not rewind the master skew tape.

T8000 Series Tape Transport Read Skew Check

a. Place the transport in the service position.

b. Mount and load an 800-cpi master skew tape on the transport.

c. Using an oscilloscope, monitor the following test points on the data PCBA:

- TP2 on NRZI transports (reference Part II, Figures 5-5 or 5-6).
- TP10 on PE transports (reference Part II, Figure 5-13).

Sync the oscilloscope internal negative.

d. Cause the transport to move tape forward (SFC) with the maintenance switch on the tape control PCBA (reference Figure 5-3).

e. Observe the waveform and adjust the horizontal sweep rate to display one complete cycle over the entire display. A good skew waveform looks like the display in Part II, Figure 5-11.

f. Verify that the maximum fall time of the waveform is as follows:

- 7.8 μsecs for NRZI transports at 18.75 ips.
- 3.9 μsecs for NRZI transports at 37.5 ips.
- 10.7 μsecs for PE transports at 18.75 ips.
- 5.3 μsecs for PE transports at 37.5 ips.

g. If the fall time is not less than those specified above, perform the read skew check and adjustment in Part II, paragraph 5.5.1.15 for NRZI transports or paragraph 5.5.2.11 for PE transports.

h. Ground TP11 on the tape control PCBA. This will cause the tape to move backward.

CAUTION

Do not rewind the master skew tape.

6.1.3.7 Write Skew Check

This paragraph contains procedures for both the T7000 series and the T8000 series tape transports. Perform the procedure(s) corresponding to the type(s) of the transport(s) used in the system.

T7000 Series Tape Transport Write Skew Check

a. Place the transport in the service position.

b. Load the off-line magnetic tape diagnostics (TD) resident on disk and select user data patterns 1 and 2 to be FFFF to be used in test 8 (reference Section 3).

c. Mount a good quality scratch tape.

d. Using an oscilloscope, monitor the following test points on the data PCBA:

- TP15 on NRZI transports (reference Part II, Figures 4-3 or 4-4).
- TP10 on PE transports (reference Part II, Figure 4-11).

Sync the oscilloscope internal negative.

e. Execute test 8. This will cause the transport to write all ones and then read them.

f. While the transport is writing, adjust the horizontal sweep to display one complete cycle.

g. Verify that the maximum fall time of the waveform is as follows:

- 11.7 μsecs for NRZI transports.
- 21.3 μsecs for PE transports.

h. If the fall time is not less than those specified above, perform the write skew check and adjustment in Part II, paragraph 4.5.1.9 for NRZI transports or paragraph 4.5.2.4 for PE transports.

T8000 Series Tape Transport Write Skew Check

a. Place the transport in the service position.

b. Using an oscilloscope, monitor the following test points on the data PCBA:

- TP2 on NRZI transports (reference Part II, Figures 5-5 or 5-6).
- TP10 on PE transports (reference Part II, Figure 5-13).

Sync the oscilloscope internal negative.

c. Load the off-line magnetic tape diagnostics (TD) resident on disk and select user data patterns 1 and 2 to be FFFF to be used in test 8 (reference Section 3).

d. Mount a good quality scratch tape.

e. Execute test 8. This will cause the transport to write all ones and then read them.

f. While the transport is writing, adjust the horizontal sweep to display one complete cycle.

g. Verify that the maximum fall time of the waveform is as follows:

- 11.7 μsecs for NRZI transports at 18.75 ips.
- 5.8 μsecs for NRZI transports at 37.5 ips.
- 21.3 μsecs for PE transports at 18.75 ips.
- 10.7 μsecs for PE transports at 37.5 ips.

h. If the fall time is not less than those specified above perform the write skew check and adjustment in Part II, paragraph 5.5.1.15 for the NRZI transports or paragraph 5.5.2.12 for PE transports.

6.1.4 RIGID DISK DRIVE PREVENTIVE MAINTENANCE

The following paragraphs provide the information for the two- and six-month preventive maintenance procedures for the fixed D1460 and the removable D3482 disk drives. Whenever a preventive maintenance procedure is performed, visually inspect the disk drive for loose electrical connections, dirt, cracks, binding, excessive wear and loose hardware.

CAUTION

The following general precautions should be adhered to when performing maintenance functions on the disk drives:

- *There should be no power applied to the drive unless otherwise stated.*
- *Keep all ferrous materials (tools, wrist watches, rings, etc.) away from the positioner.*
- *Avoid placing hands near the carriage assembly or linear motor magnet assembly when the drive is operating.*
- *Avoid smoking in the immediate vicinity when servicing the drive.*
- *Avoid operating the drive with the front (fixed) cover removed unless maintenance cannot be performed otherwise.*

6.1.4.1 D1460 Disk Drive Preventive Maintenance

Pre-Filter Cleaning

a. Place the disk drive in the service position.

b. Remove the pre-filter by lifting one corner of the meshed material then gently pulling it away from the front surface of the main filter.

c. The pre-filter may be washed with soap and water and may be reused. The pre-filter must be absolutely dry and clean from any cleaning residue.

d. If the main filter is not to be replaced (i.e., the two-month preventive maintenance program is being performed) reinstall the pre-filter on the front of the main filter assembly.

Head Cleaning

a. Raise the rear (pivoting) cover and lock it in the open position.

b. Remove the front (fixed) cover and locate the read/write head(s) (Figure 6-3).

c. Prepare two cleaning wands (PCC Pertec P/N 623-0002) as follows:

- Insert a lint-free wiper into the barbed slot of the wand.
- Rotate the wand counterclockwise thereby wrapping the wiper completely around the wand. Be sure not to contaminate the wiper.

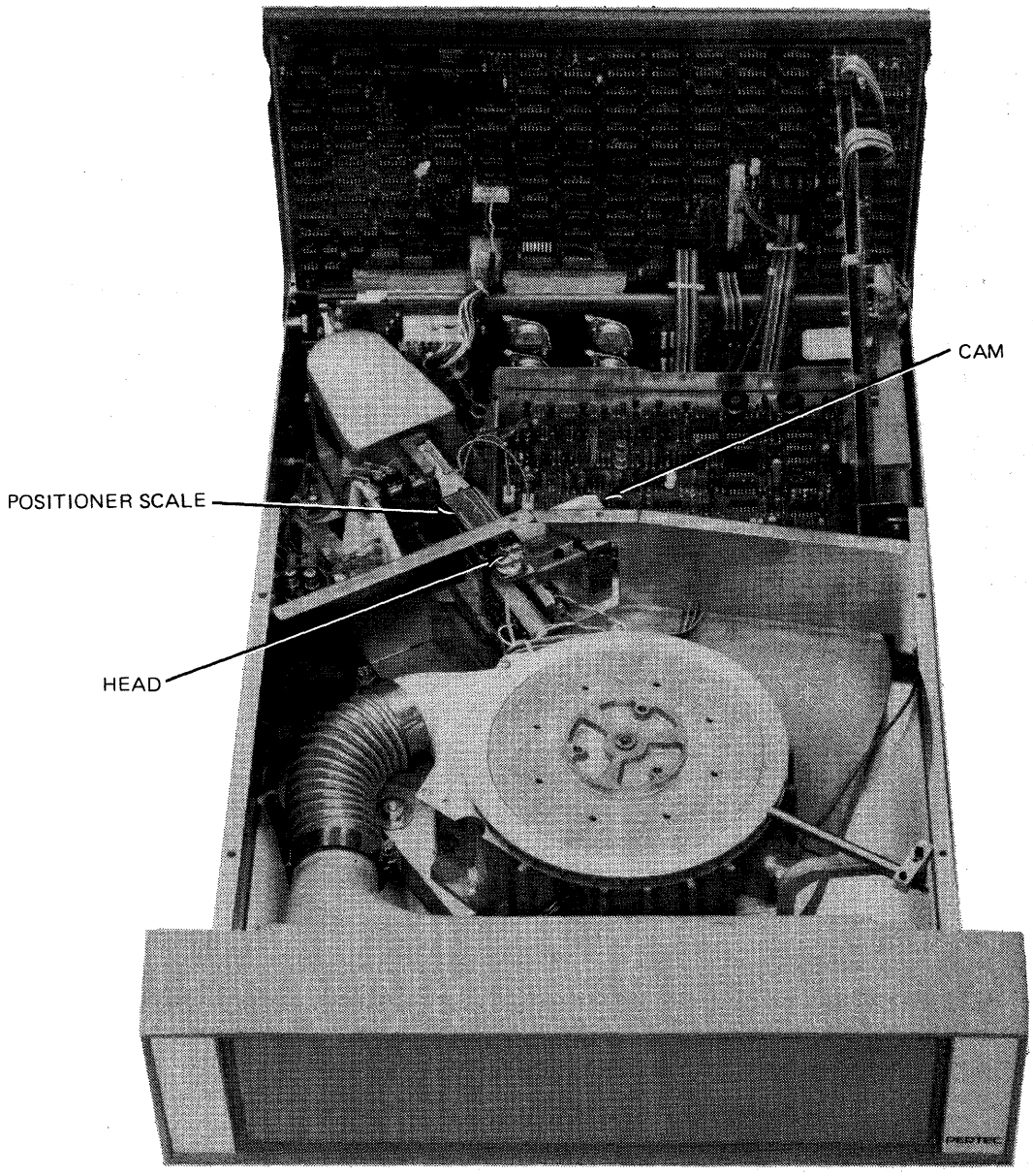


Figure 6-3. D1460 Series Disk Drive (Top View, Disk Removed)

d. Dampen the wiper with 91% isopropyl alcohol.

CAUTION

Do not touch the face of the heads with fingers. Do not leave any alcohol residue on the heads. Do not blow on the heads.

e. Gently raise the head arm with fingers thereby increasing the distance between the head and the disk.

f. Carefully insert the dampened wiper between the disk and the head. Slide the wiper across the head. Do not apply pressure to the head as this may cause overstressing of the gimbal spring or the load spring of the head assembly.

g. Wipe the slider face dry using the second cleaning wand; this must be done before the alcohol has evaporated.

h. Use a dental mirror to inspect head after cleaning. It is essential that all debris be removed from the head. Figure 6-4 shows examples of head assemblies which require cleaning and those which must be replaced. If replacement is required, refer to Part II, paragraph 6.5.1.1.

i. If replacement is not necessary, remove the shim from between the head and the cam.

j. Perform steps c through i for each additional head.

(A) Head Contamination (requires cleaning)

(B) Slider Defects (requires replacement)

Figure 6-4. Head Contamination and Slider Defects

Disk Platter Inspection and Cleaning

a. Visually inpsect all disk platter surfaces (use a dental mirror for bottom surfaces) for dirt. Perform the following cleaning procedure only if the platter surfaces appear dirty.

b. Prepare two cleaning wands as follows:

- Insert a lint-free wiper into the barbed slot of the wand.
- Rotate the wand counterclockwise thereby wrapping the wiper completely around the wand. Be sure not to contaminate the wiper.

c. Dampen a wiper isopropyl alcohol.

d. Do not touch the disk surface with your hands. Rotate the spindle counterclosewise, inserting the wand parallel to the disk, pointing directly at the spindle. The wand should remain flat and stationary opposing the rotation of the disk, thereby removing all foreign matter. Do not apply excessive wand pressure to the disk surface.

e. Using the procedure in step d, wipe the disk surface dry using the second cleaning wand. This must be done before the alcohol has evaporated from the disk surface. Do not allow alcohol to dry on the disk surface.

f. Perform steps a through e for each additional surface.

Base Chassis and Cover Cleaning

The base casting and other associated areas, including the chassis, covers and the interior of the cabinet should be cleaned using a vacuum cleaner or a damp lint-free cloth. Do not use compressed air as this will blow dirt into the disk chambers and the air system.

Positioner Scale Cleaning

a. Clean the positioner scale with a lint-free wiper slightly moistened with isopropyl alcohol (reference Figure 6-3). The positioner shaft and ways can be cleaned in the same manner. Carefully wipe the surfaces to remove any accumulated matter.

b. Reinstall the disk drive back into the cabinet.

6.1.4.2 D3482 Series Disk Drive Preventive Maintenance

Pre-Filter Cleaning

a. Place the disk drive in the service position.

b. Remove the pre-filter by lifting one corner of the meshed material then gently pulling it away from the front surface of the absolute filter.

c. The pre-filter may be washed with soap and water and may be reused. The pre-filter must be absolutely dry and clean from any cleaning residue.

Head Cleaning

a. Remove the cover from the disk drive and raise the logic PCBA to the extended position. In dual disk models, the read/write PCBA should be removed also.

b. Prepare two cleaning wands (PCC Pertec P/N 623-0002) as follows:

- Insert a lint-free wiper into the barbed slot of the wand.
- Rotate the wand counterclockwise thereby wrapping the wiper completely around the wand. Be sure not to contaminate wiper.

c. Dampen a wiper with 91% isopropyl alcohol.

CAUTION

Do not touch the face of the heads with fingers. Do not leave any alcohol residue on the heads. Do not blow on the heads.

d. Locate the heads (reference Figure 6-3) and carefully wipe the slider face of the head assembly with the dampened wiper. Be sure not to overstress the gimbal spring or the load spring on the head assembly.

e. Wipe the slider face dry using the second cleaning wand; this must be done before the alcohol has evaporated.

f. Use a dental mirror to inspect the head after cleaning. It is essential that all debris be removed from the head. Figure 6-4 shows examples of head assemblies which require cleaning and those which must be replaced. If replacement is required, refer to Part II, paragraph 7.5.1.1.

g. Perform steps b through f for each additional head.

Belt and Static Discharge Contact Inspection

a. Remove the belt guard (reference Part II, paragraph 7.5.1.7).

b. Inspect the belt and the static discharge contact (located on the belt guard) for wear.

c. If the belt shows excessive wear, replace it.

d. If the static discharge contact shows excessive wear from the pointed end of the spindle shaft, replace the belt guard.

e. Reinstall the belt guard.

Spindle Cleaning

a. Remove the removable disk and the cover from the disk drive.

b. Wipe the spindle cone and the magnetic chuck with a dry lint-free wiper. Metal particles that have become attracted to the magnetic chuck may be removed using masking tape.

Positioner Cleaning

The positioner shafts on the 100 tpi models can be cleaned with a lint-free wiper slightly moistened with 91% isopropyl alcohol; the scale on the 200 tpi models can be cleaned in the same manner. Carefully wipe the surfaces to remove any accumulated matter.

Base Casting and Dust Cover Cleaning

The base casting and associated areas, including the dust cover, should be cleaned using a vacuum cleaner or a damp lint-free cloth. Do not use compressed air as this will blow dirt into the disk chambers and air system.

6.1.5 LINE PRINTER PREVENTIVE MAINTENANCE

The following paragraphs provide the information for the two- and six-month preventive maintenance procedures for the medium speed (Printronix 300) and the high speed (Dataproducts 2260 and 2290) line printers.

6.1.5.1 Printronix 300 Line Printer Preventive Maintenance

Printer Interior Cleaning

a. Open the front cover and remove the paper from the printer.

b. Remove the ribbon assembly by performing ribbon assembly removal procedure (reference Part II, paragraph 11.5.1.6) and set it aside.

c. Use a soft brush and vacuum to dislodge and remove paper dust and ribbon lint. Remove from paper tractors, from the area of the hammer bank, and from the base pan.

d. If the hammer bank is to be cleaned, or the air filter cleaned or replaced, perform those procedures, then replace the ribbon assembly and restore the printer to operation.

e. If paper dust has been built up on the platen by impact at the print station, rotate the platen approximately 90 degrees from the printing position, then remove the line of paper dust and ink using alcohol and a clean cloth.

Hammer Bank Cleaning

a. Turn off AC power.

b. Set forms thickness adjustment lever to load position (fully raised).

c. Remove the ribbon assembly by performing the ribbon assembly removal procedure (reference Part II, paragraph 11.5.1.6), leaving the external cables connected if convenient.

d. Remove the two hex-head screws from the anti-rotation arm (Figure 6-5), disengage the anti-rotation arm from the anti-rotation spring, and remove the arm. Be careful to protect the lubricated area from dirt and debris.

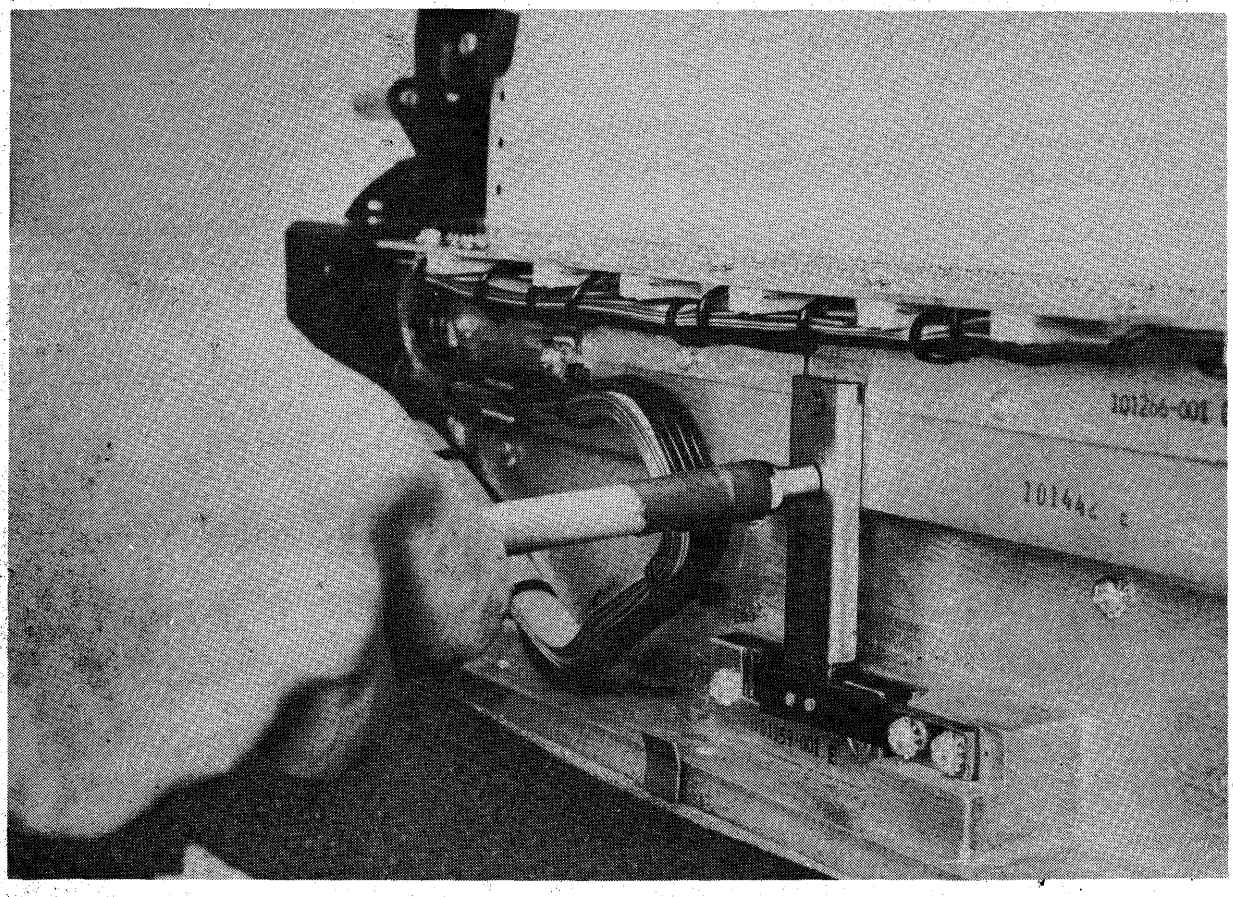


Figure 6-5. Anti-Rotation Arm Removal

e. Grasp the hammer bank PCBA and pivot the hammer bank upwards, 90 degrees away from the platen (see Figure 6-6).

f. Carefully remove the hammer bank front cover by first lifting two lower corners from the roll pins, then lifting the cover out. The front cover is magnetic and will tend to stick to the hammer bank assembly.

g. Using a dry, stiff bristle brush, clean around the hammer tips to remove accumulated ribbon lint and paper dust.

h. Clean up loosened material on a dry cotton swab, wiping the hammer tips clean.

i. Wipe the ink and ribbon debris from both sides of the hammer bank front cover, then replace the cover by placing it on the roll pins.

j. Be sure that the tape side of the front cover is against the support pins and that the hammer tips are centered in the cover holes, then pivot the hammer bank back into the operating position. Reinstall the anti-rotation arm, with the arm held between the Oilon rear bearing and the anti-rotation spring. Torque the screws to 12—14 inch-pounds.

k. Replace the ribbon assembly.

Air Filter Cleaning

a. Remove the ribbon assembly by performing the ribbon assembly removal procedure (reference Part II, paragraph 11.5.1.6), then lift out the filter holder and remove the filter (Figure 6-7).

b. Clean the filter with a vacuum cleaner. If this does not clean the filter sufficiently, clean it in detergent and warm water, then dry before replacing it in the printer. If the filter is very dirty, replace it with a new one.

Cam Lubrication

a. Remove the cam top cover and gasket, then check for oil film on the cam surface (reference Part II, Figure 11-7).

b. Press a pen or a narrow tool down into the wick between the hammer bank cam follower and the end of the yoke. If the tool does not pick up some oil from the wick or oil does not appear on the surface of the wick, slowly apply medium-weight oil (SAE 20 or equivalent) until the wick is saturated. Do not apply more oil than is needed to just saturate the wick.

Counterbalance Lubrication

a. With the top cam cover removed, pull out the plastic plugs from the oil ports in the counterbalance (reference Part II, Figure 11-7).

b. Pour a few drops of medium-weight motor oil (SAE 20 or equivalent) on each wick, adding oil until each wick is saturated. Replace the plastic plugs in the oil ports.

Figure 6-6. Hammer Bank Assembly in Open Position for Cleaning