HSC5O
Maintenance
Guide

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UDA50	MASSBUS	RA80
HSC50	RA60	RA81

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1 INTRODUCTION

1.1 INTRODUCTION
This chapter includes general information about the HSC50 Mass-Storage Controller, a block diagram of system functions and a list of related documentation.

1.2 GENERAL INFORMATION
The HSC50 is a disk and/or tape subsystem that can interface to multiple hosts on the Computer Interconnect (CI) bus. Two CI buses are normally configured with the system to accommodate the possibility of failure on one bus. The HSC50 can presently support up to 24 Standard Interconnect (SI) disk drives or 24 tape formatters that conform to the Standard Tape Interconnect (STI) bus.

1.2.1 Packaging
The HSC50 logic and power systems are housed in a modified H9642 cross-products cabinet. A standard cabinet key is used to gain access to the front of the HSC50 while a 5/32 inch hex wrench is used for the rear door. The cabinet keys are part of the cabinet lock assembly (part number 12-14664-00).

1.3 HSC50 BLOCK DIAGRAM
Figure 1-1 shows the HSC50 in a block diagram representation. Each major block is a module unless otherwise specified. Figure 1-2 shows the module utilization for the HSC50.

CX–007A
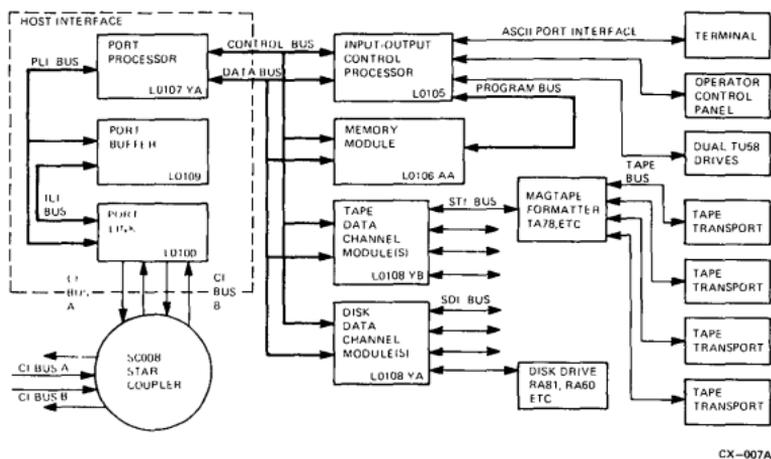
Figure 1-1   HSC50 Block Diagram

CZ 0948

Figure 1-2   HSC50 Module Utilization Label

1.4   HSC50 RELATED DOCUMENTATION

The HSC50 manuals are available under the following part numbers:

- *HSC50 Controller User Guide* (EK-HSC50-UG)

- *HSC50 Controller Installation Manual* (EK-HSC50-IN)

- *HSC50 Service Manual* (EK-HSC50-SV)

- *HSC50 Maintenance Documentation Kit* (QP906-GZ)

- *Maintenance Guide Loose-leaf Binder* (AV-L980A-TK)

- *HSC50 Illustrated Parts Breakdown* (EK-HSC50-IP)

- *HSC50 Inline Diagnostics User Documentation* (EK-IHSC5-UG)

- *HSC50 Offline Diagnostics User Documentation* (EK-OHSC5-UG)

- *HSC50 Field Maintenance Print Set* (MP01422)

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2 HSC50 CONTROLS/INDICATORS

2.1 INTRODUCTION

This chapter describes the controls and indicators presently available on the HSC50. The controls and indicators are located in five areas of the HSC50:

- Operator control panel
- Inside front door
- Maintenance access panel
- Modules
- Power controller

2.2 OPERATOR CONTROL PANEL (OCP)

Figure 2-1 shows the switches/indicators available on the OCP. For a more detailed description of these switches/indicators refer to the *HSC50 User Guide* or the *HSC50 Service Manual*.

CX—008A
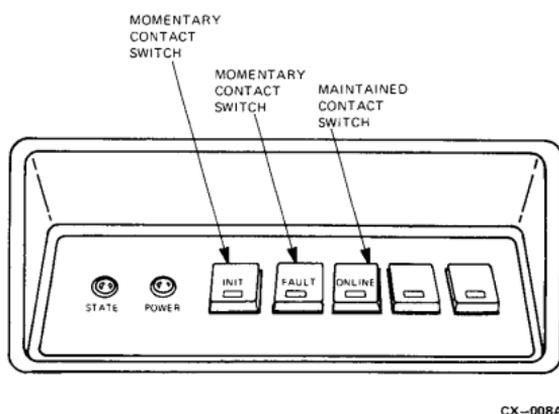
Figure 2-1   Operator Control Panel

2.2.1 State and Init Indicators

Under normal conditions, the Init indicator is off while the State indicator is pulsing. At time of initialization, these indicators change to reflect the initialization phase the HSC50 is going through.

2.2.2 Init Switch

Pushing the Init indicator activates a switch causing the HSC50 to start its initialization routine. The Secure/Enable switch must be in the enable position for this switch to be operational.

2.2.3 Power Indicator

The power indicator is normally on but goes out when one or more of the dc voltages in the HSC50 fail.

2.2.4 Fault Indicator and Switch

The fault indicator comes on when the HSC50 logic detects a fault.

Pushing and holding the fault indicator causes all the operator control panel (OCP) lamps to come on and functions as a lamp test. These indicators go off when the switch is released.

The lamp test may be executed even if the fault indicator is already on before the switch is pushed. When the switch is released, however, the entire OCP functions as an error display. Appendix A shows the error codes associated with the OCP error display.

2.2.5 Online Indicator

When the online indicator is on, the HSC50 has established a virtual circuit with a host CPU. When the indicator is off, all virtual circuits are broken.

2.2.6 Online Switch

When the online indicator is pushed to the in position, the HSC50 logic is put in the available state. This allows a host to establish a virtual circuit with the HSC50. When the switch is released to the out position, no virtual circuits can be made and the indicator goes off when the last virtual circuit is broken. The HSC50 is then in an offline state (online switch out and indicator off).

2.2.7 Two Blank Indicators

The two blank indicators form a part of the fault display to make up a five-bit fault code.

2.3 INSIDE FRONT DOOR CONTROLS/INDICATORS

Figure 2-2 shows the controls and indicators made available to you once the front door is opened.
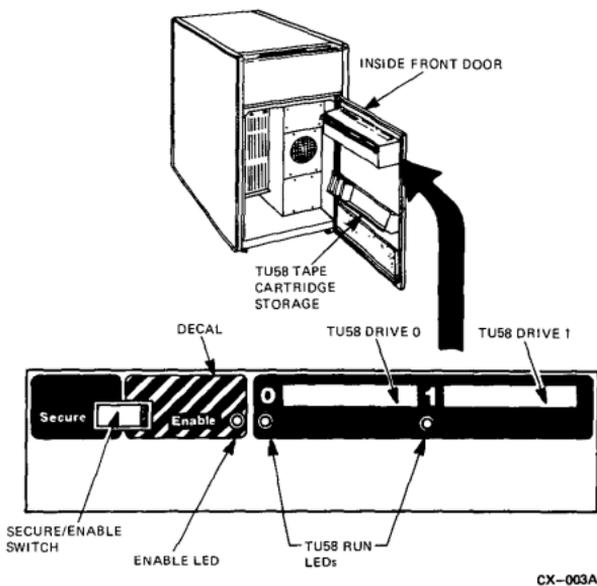
Figure 2-2   Inside Control/Indicators

2.3.1 Secure/Enable Switch

With the Secure/Enable switch in the secure position, the Init switch is disabled from the operator control panel. Also, some utility programs called in from an auxiliary terminal may not be used. With the Secure/Enable switch in the enable position, the Init switch and the utility programs may be used.

The Show utility may be used with the Secure/Enable switch in either position.

2.3.2 Enable Indicator

An illuminated enable indicator means the Secure/Enable switch is in the enable position (Init and Online switches may be used). When the enable indicator is off the OCP is secure.

2.3.3 TU58 Run Indicators

When a TU58 Run indicator is on, the TU58 is presently moving tape. Tape is not in motion when the indicator is off.

2.3.4 TU58 Self-Test Indicator

The TU58 Self-Test indicator is found on the TU58 controller module (see Figure 2-3). The controller module is located inside the TU58 housing with the drive mechanics. The Self-Test indicator may be seen by looking down through the TU58 housing vents. This indicator should normally be on indicating that the TU58 controller has passed its self-diagnostics.

SELF—TEST
INDICATOR
(VIEWED FROM TOP)

CX–010A
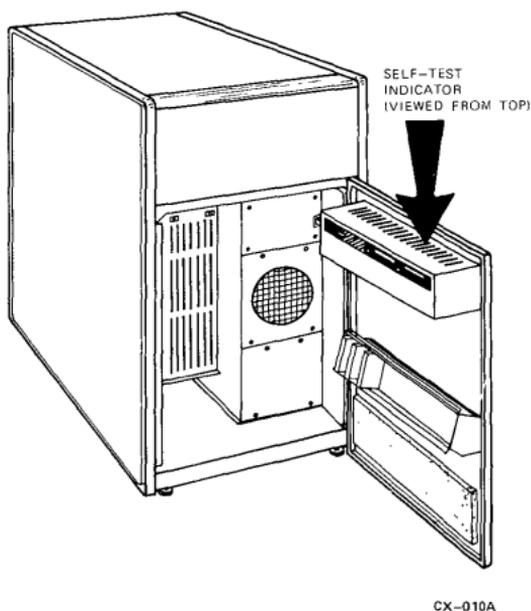
Figure 2-3   TU58 Self-Test Indicator

2.4 MAINTENANCE ACCESS PANEL CONTROLS AND CONNECTORS

Loosening the maintenance access panel screws and swinging the door open reveals a switch and several connectors (Figure 2-4) available for maintenance of the HSC50.
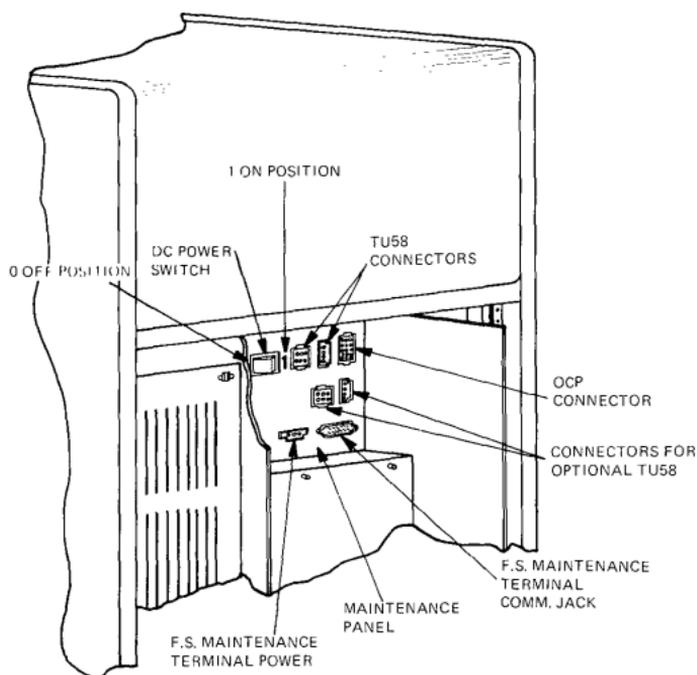
CX—014A

Figure 2-4   Maintenance Access Panel

2.4.1 DC Power Switch

The DC Power switch removes the dc power from the HSC50 when the switch is in the "0" position. Moving the switch to the "1" position restores dc power.

2.4.2 Maintenance Terminal Connectors

Two connectors in the maintenance access panel are used to connect the maintenance terminal to the HSC50. One connector is used to supply power to the maintenance terminal while the other is the signal connector.

2.5 MODULE INDICATORS

Most modules have at least one LED to indicate board status (Figure 2-5). During normal operations, the green LED should always be on. The exception is during an initialization routine when the red LED comes on during the testing of the module. The red LED normally indicates a bad module.
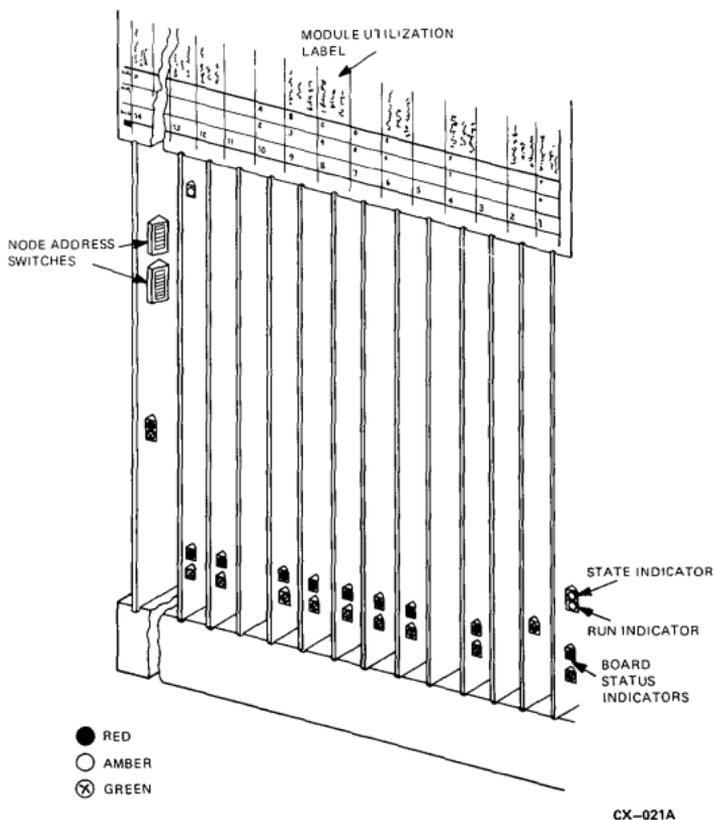
Figure 2-5   Module LED Indicators

The memory module has a single green LED to indicate that memory cycles are taking place.

The I/O control processor module has an additional two amber LEDs. The top amber LED mirrors the state indicator on the OCP. The second LED from the top pulses at a rate equal to the on-board microprocessor run rate.

2.5.1   Module Switches/Jumpers

Figure 2-5 shows the location of the CI node address switches mounted on the L0100 Port Link Module. Both sets of switches must be set identically to avoid CI addressing errors. The address chosen must not exceed the current maximum of 15 (decimal). Addresses higher than 15 cause Port Link Module faults on the Operator Control Panel (Error code of 25 octal).

The L0105 module has a baud rate jumper to establish the proper communications rate between the HSC50 and the type of local terminal attached to the HSC50. Use of terminals such as an LA12 or a VT100 means the jumper should be in establishing a 9600 baud rate. The hand-held maintenance terminal only operates at 300 baud, so the jumper should be out. Figure 2-6 shows the location of the jumper.
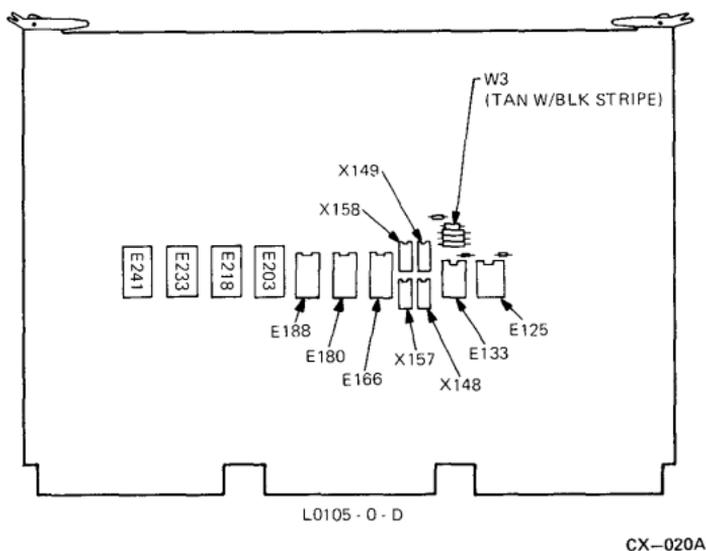
Figure 2-6   Baud Rate Jumper

   The L0107 and L0109 modules have DIP switches to indicate the revision level of the microcode. If field revisions are done to either of these modules, the switches must be changed to reflect the new revision status. Figure 2-7 shows the location of these DIP switches.
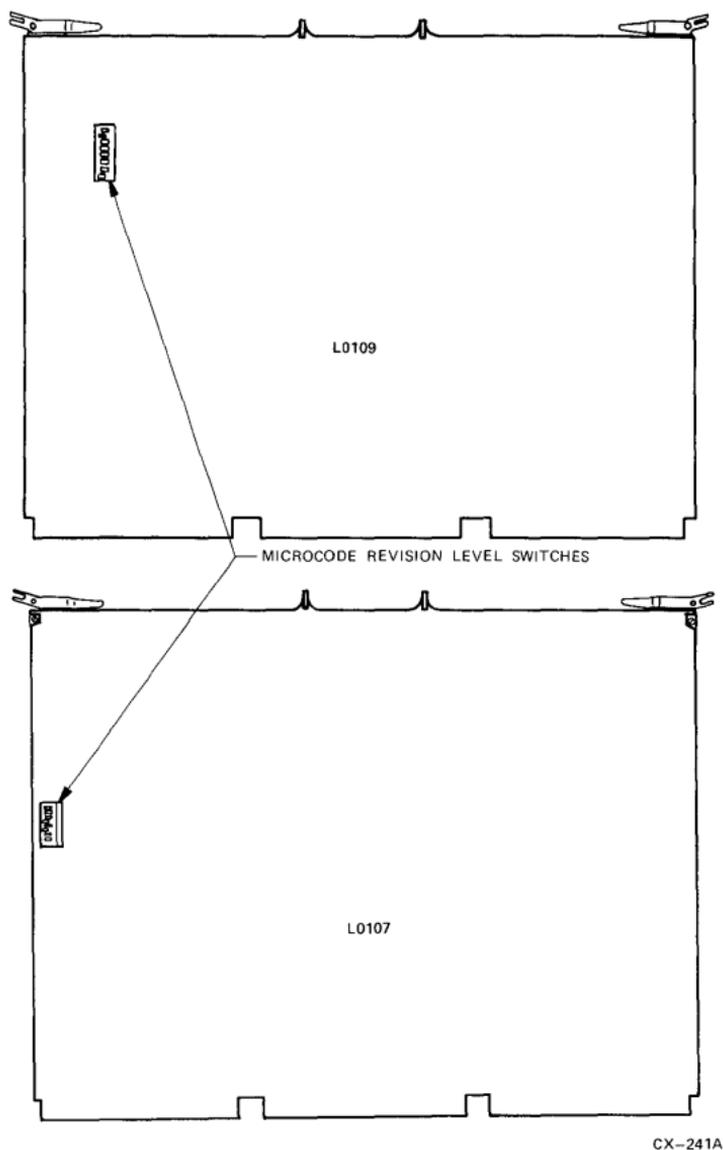
Figure 2-7   Revision Level Switches

2.6 POWER CONTROLLER SWITCHES AND INDICATORS

The Power Controller switches and indicators are shown in Figure 2-8.
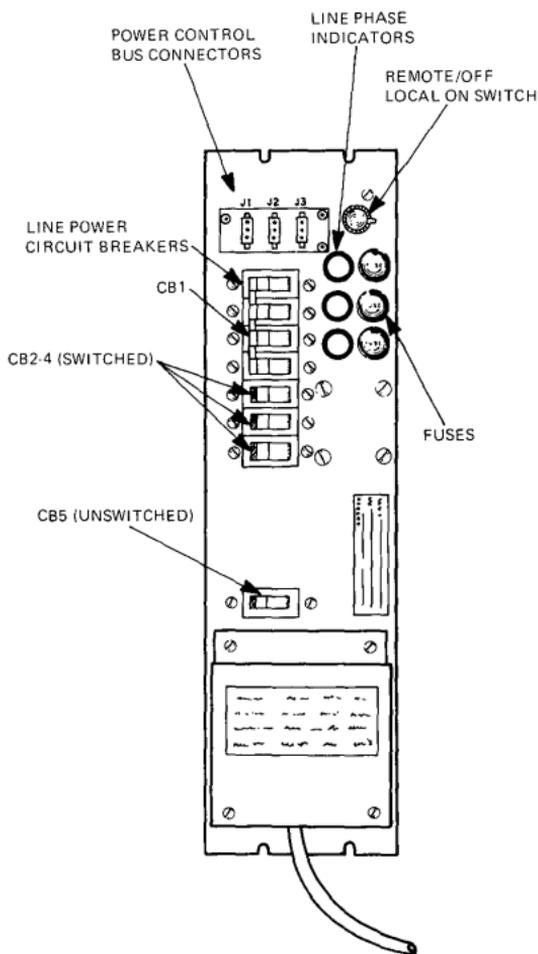
CX—013A

Figure 2-8   Power Controller

2.6.1   Line Phase Indicators
The three Line Phase Indicators display the status of the three phases of incoming line power. If any phase drops, the indicator for that phase goes out.

2.6.2   Fuses
The three line phases are fused to protect the circuitry in the HSC50. The three fuses are located beside the three Line Phase Indicators.

2.6.3   Remote/Off/Local On Switch
When this switch is in the off position, the power controller does not route ac line power to the switched/unswitched outlets.

When the switch is in the local on position, ac power is routed to the power controller switched/unswitched outlets (as long as CB1 is set).

When the switch is in the remote position, the routing of ac power is dependent upon the DEC power control bus signals (as long as CB1 is set).

2.6.4   Circuit Breakers
CB1 protects the power controller from incoming line surges.

CB2,3,4 protect the switched outlets found at the rear of the power controller as shown on Figure 2-9.

CB5 protects the unswitched outlets found at the rear of the power controller.
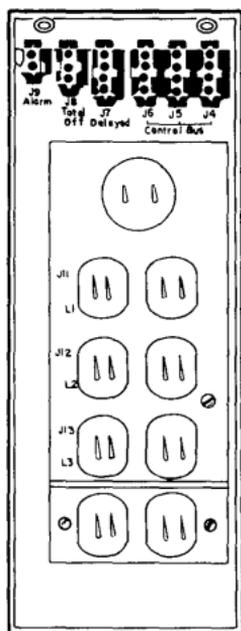
CZ–0964

Figure 2-9   Rear View of Power Controller

3 FRU REMOVAL AND REPLACEMENT

3.1 HSC50 REMOVAL AND REPLACEMENT PROCEDURES

This maintenance guide only provides general descriptions of removal and replacement procedures. Detailed procedures for removal of major FRUs are found in the *HSC50 Controller Service Manual*.

3.2 MODULE REMOVAL/REPLACEMENT

Open the front door with a cabinet key to access any of the modules in the card cage. Release the card cage cover locks (Figure 3-1) and remove the cover. Remove power to the HSC50 before removing the desired module(s).

Insert the new module in the location specified by the module utilization label found above the card cage (Figure 1-2).

NOTE
Use a Velostat antistatic kit during the removal/replacment of any module.

NYLON LATCHES

CARD CAGE
COVER

AIRFLOW
WARNING
LABEL

CX—019A
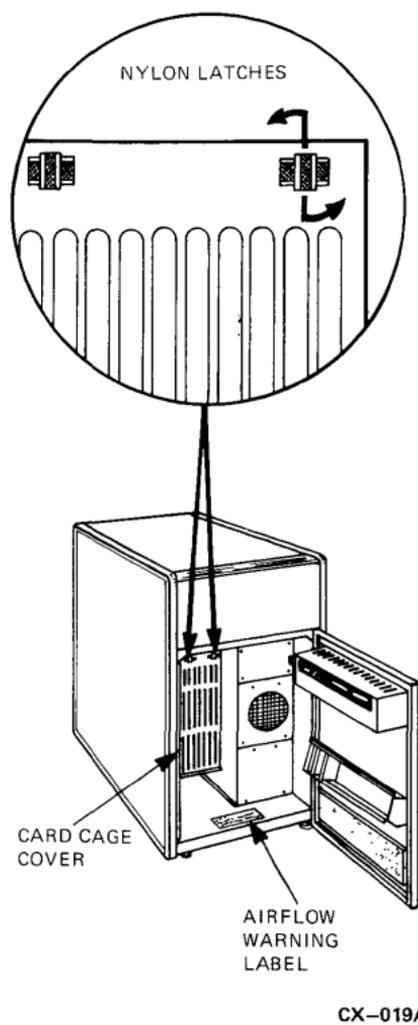
Figure 3-1   HSC50 Front Inside View

3.3   TU58 REMOVAL/REPLACEMENT

Open the front door with a cabinet key. After removing power from the HSC50, remove the two 11/32 inch nuts holding the TU58 housing to the door (Figure 3-2). Lift the TU58 off the support brackets (Figure 3-3).

11/32" NUT
DRIVER
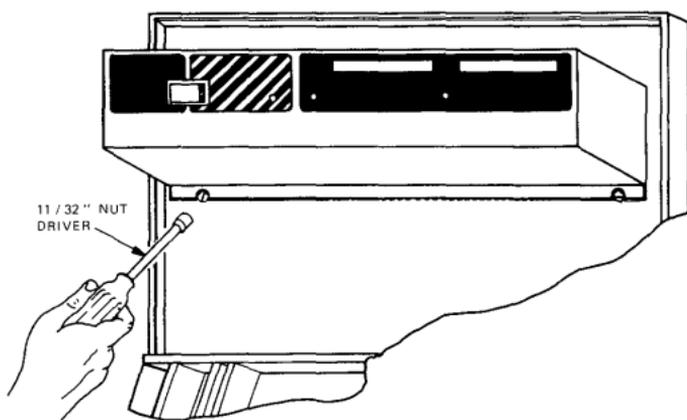
CX–016A

Figure 3-2   TU58 Removal

CX-018A
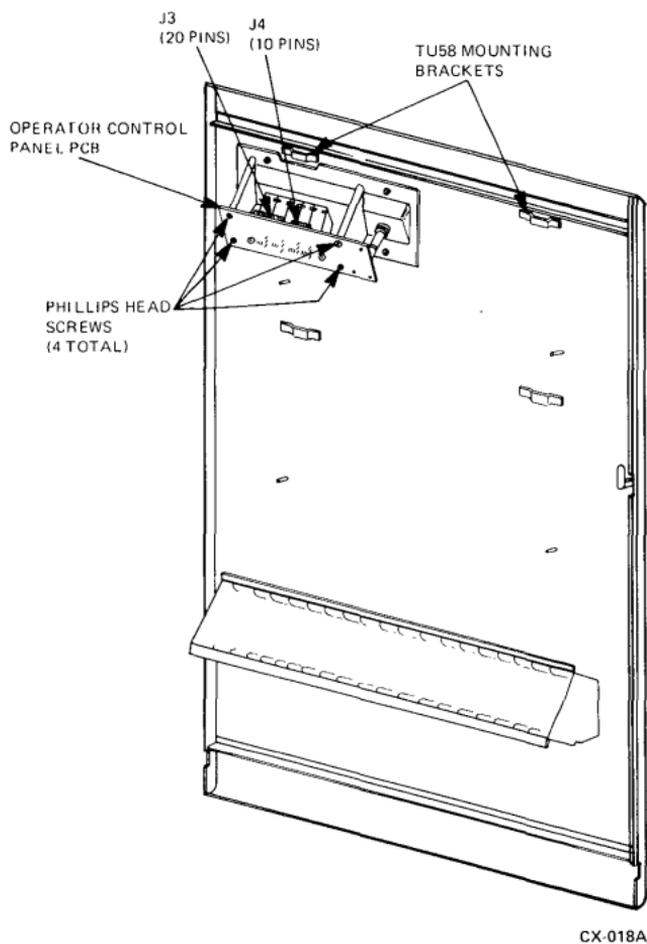
Figure 3-3   Inside View Of Front Door

Note the placement of the TU58 connectors before removing. Disconnect the cabling so the TU58 housing can be put down (Figure 3-4). After all the cabling is unplugged, remove the TU58 controller module from the housing. The controller module slides on tracks within the housing.

Remove any read/write head shrouds on the new TU58 before installing.

Caution

When re-installing the cabling, the power connector may be inserted backwards even though it is keyed. This can burn the controller module.
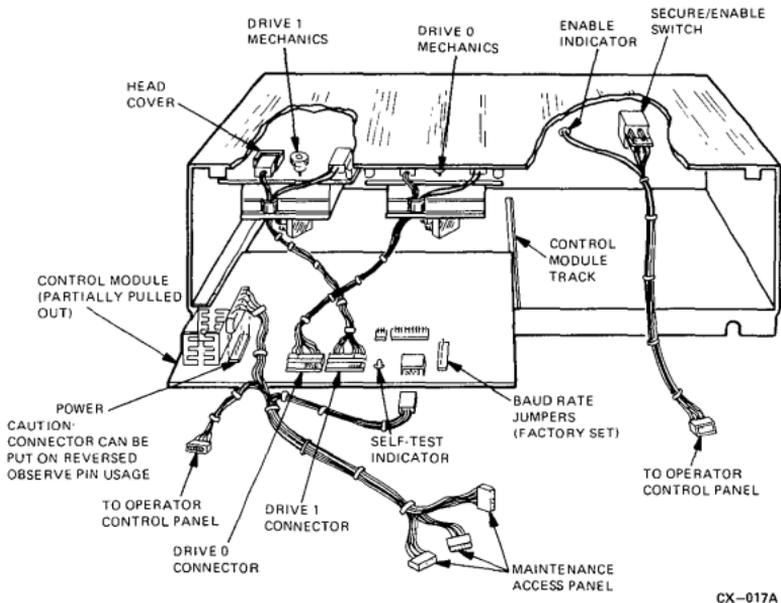
Figure 3-4   Inside Rear View Of TU58

3.4 OPERATOR CONTROL PANEL (OCP)

Remove the TU58 housing from the front door and then the four screws holding the OCP to the door (Figure 3-3). Again, note the placement of the cabling. Replace the entire OCP whenever a switch or indicator fails.

3.5 POWER CONTROLLER

Disconnect source line power to the HSC50 before proceeding. Open the rear cabinet door with a 5/32 inch hex wrench. Next, remove the two power control bus connectors (Figure 3-5) and the rear door latch. Remove the four screws securing the power controller to the chassis. Pull the power controller from the cabinet far enough to access the line cords and ground wire found on the rear of the controller.

COOLING BLOWER
LINE CORD

MAIN
POWER SUPPLY

MAIN POWER
SUPPLY
LINE CORD

AUXILIARY
POWER SUPPLY

CONNECTORS
J1   J2   J3

AUXILIARY
POWER SUPPLY
LINE CORD

POWER CONTROLLER
LINE CORD

POWER CONTROLLER
SCREW LOCATIONS

CX-024A
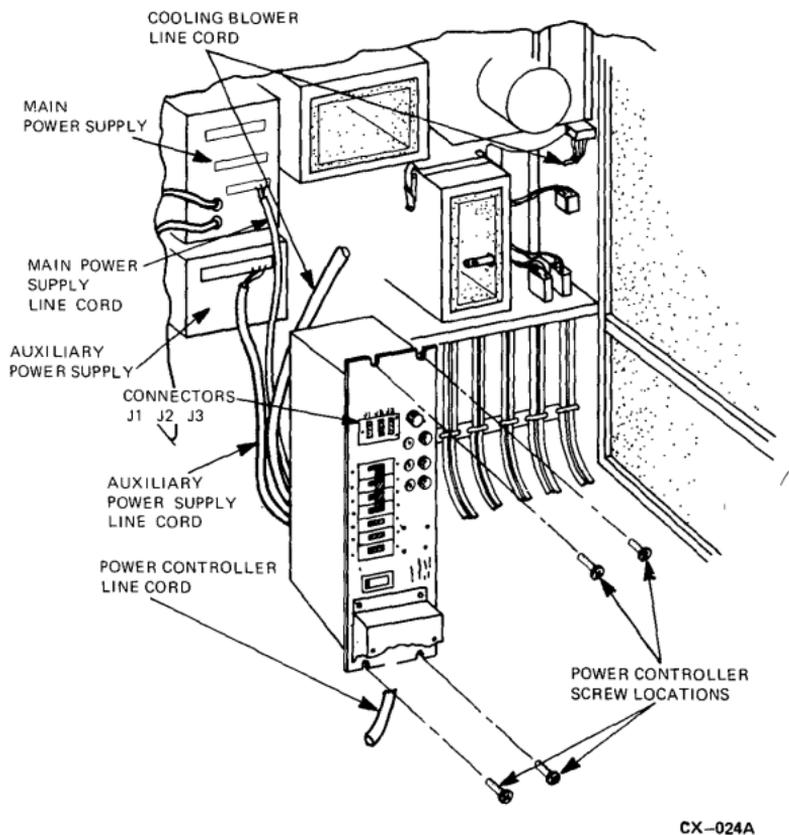
Figure 3-5   Power Controller Removal

3.6 MAIN POWER SUPPLY REMOVAL/REPLACEMENT

Remove the power controller in order to remove the power buses at the rear of the power supply (+ and − on Figure 3-5).

Remove the two-gauge power buses from the plus and minus V2 studs (Figure 3-6). Then disconnect all remaining power plugs.
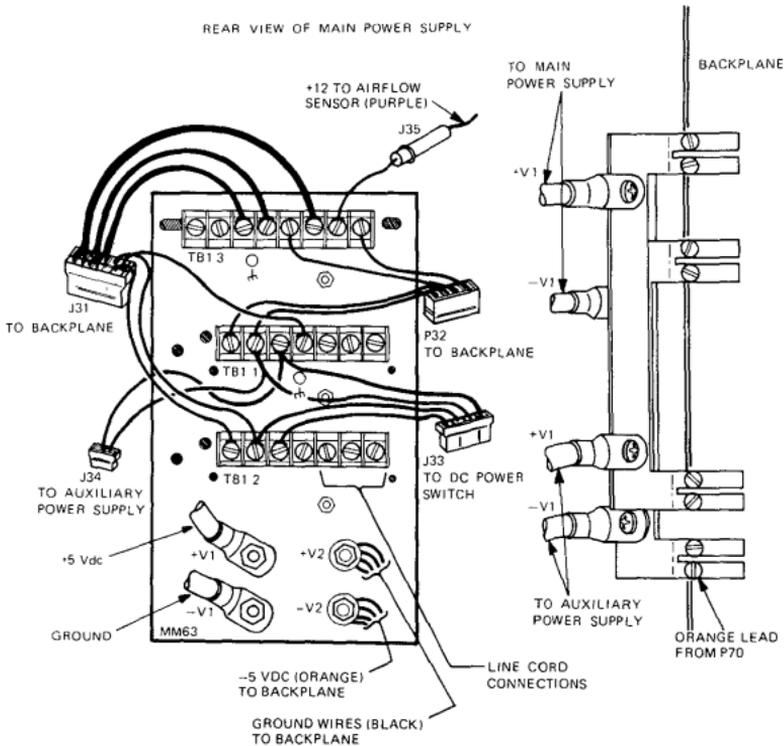
Figure 3-6   Main Power Supply Detail

Remove the front door in order to obtain the clearance necessary to pull the power supply out through the front of the cabinet. Next loosen the four captive retaining screws on the front of the HSC50 (Figure 3-7) and pull the power supply out.

CAPTIVE
SCREWS

CX–026A
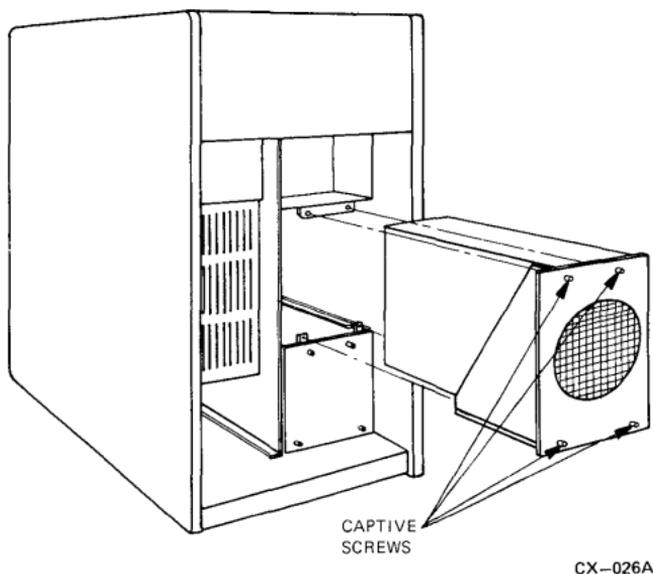
Figure 3-7   Removal Of Main Power Supply

3.7 AUXILIARY POWER SUPPLY REMOVAL

Remove the power controller in order to remove the power buses on the rear of the auxiliary power supply (+ and – on Figure 3-8).

NOTE
Auxiliary power supplies are required in those HSC50s having nine or more logic modules.
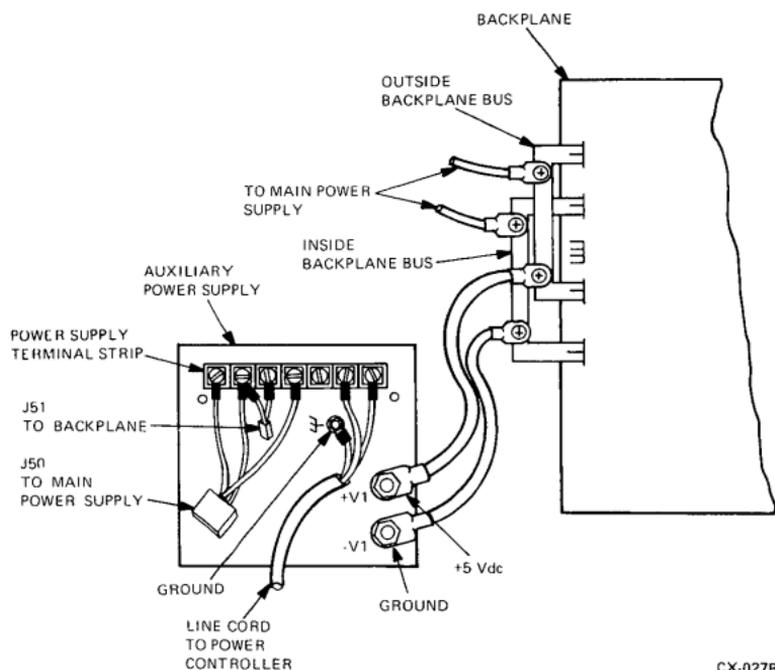
Figure 3-8   Auxiliary Power Supply Detail

Remove all connectors on the auxiliary supply before loosening the four captive screws on the front of the auxiliary power supply (Figure 3-9). Remove the front door in order to obtain the clearance to pull the power supply out.

MAIN POWER
SUPPLY

AUXILIARY POWER
SUPPLY GUIDANCE
TRACK

AUXILIARY POWER
SUPPLY

CAPTIVE
SCREWS

CX—028A
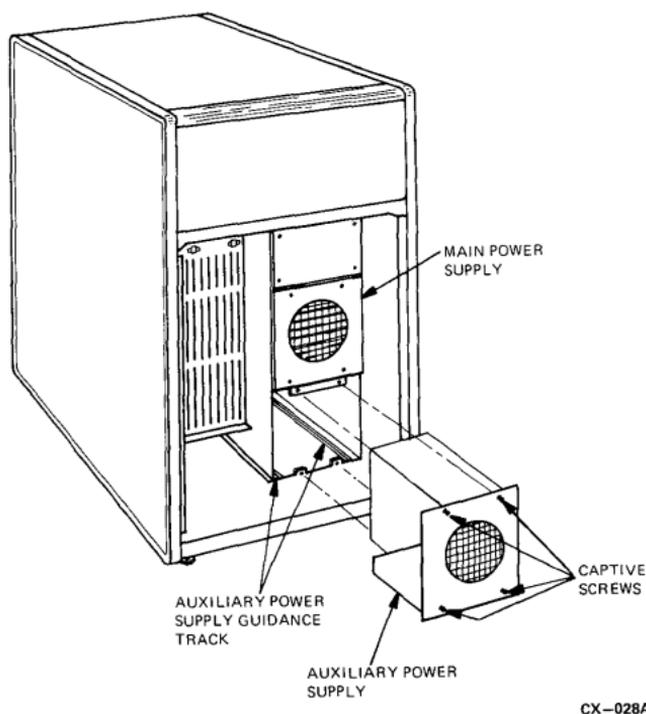
Figure 3-9   Removal Of Auxiliary Power Supply

3.8   MAIN COOLING BLOWER

   Disconnect the airflow sensor connector and release
the catches on the exhaust duct (Figure 3-10). Pull the
duct and airflow sensor out of the cabinet. Unplug the
blower connector and then loosen the three screws holding
the blower plate to the cabinet. Lift the blower assembly
out of the cabinet.

3 PHILLIPS HEAD SCREWS

REMOVABLE
EXHAUST DUCT

QUICK RELEASE
LATCHES

COOLING BLOWER
POWER CONNECTOR

AIRFLOW SENSOR
POWER CONNECTOR
(J70)

AIRFLOW
SENSOR

CX—022A
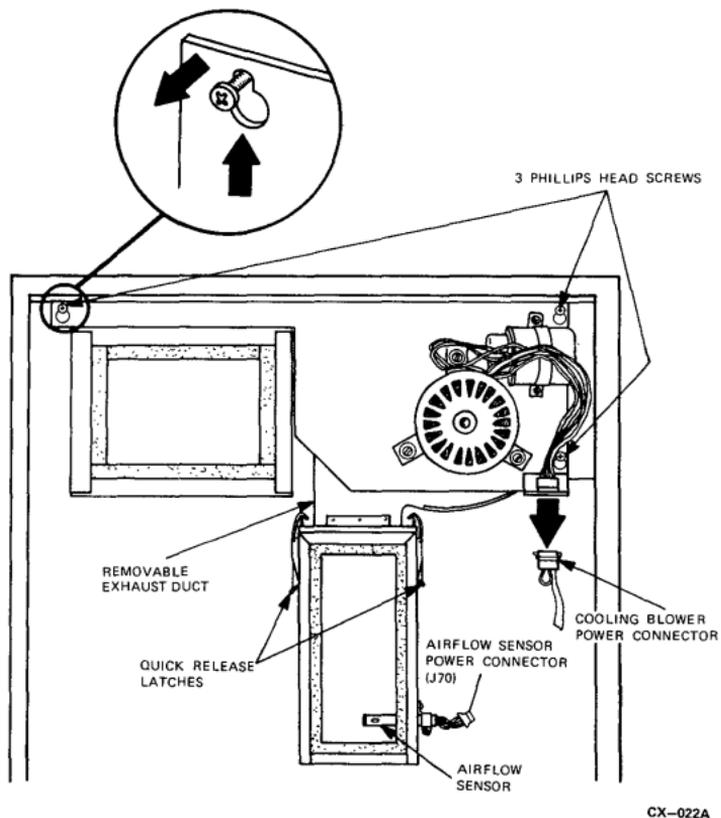
Figure 3-10   Removal Of Main Cooling Blower

4 DIAGNOSTICS AND UTILITIES

4.1 DIAGNOSTICS

HSC50 diagnostics can be categorized under the following headings:

- Power-up bootstrap diagnostics
- Inline diagnostics
- Offline diagnostics
- Periodic diagnostics

4.1.1 Power-up Bootstrap Diagnostics

The initialization diagnostics are executed each time the subsystem is powered up or the Init switch is pushed with the Secure/Enable switch in the enable position. The tests execute in four minutes or less.

The hardcore subset of the initialization diagnostics are ROM resident or PROM resident. The rest are stored on the HSC50 system tape or offline diagnostic tape.

Figure 4-1 is a flowchart showing the events that take place during the boot process.

Figure 4-1   P.ioc ROM Bootstrap Flowchart (1 of 4)

IF SYSTEM TAPE

(A)

TURN INIT IND. OFF
TURN STATE IND. ON (SOLID) ✳

OUTPUT TO TERMINAL
"INIPIO-I BOOTING"
LOAD REST OF INITPIOC

RUN INITPIOC   FAIL   S=1 I=0 F=1 FC=XX
INIT KS TO TEST   ──────▶   NOTE THAT NO TEST
AND GET STATUS FROM KS   NUMBER INFO. IS
                                            AVAILABLE AS IN
                                            THE BOOTSTRAP
LOAD OPERATING SOFTWARE   SEE FC CODE CHART
WHILE TESTING MEMORY BY K

TURN ON P.IOC GREEN LED

START OPERATING SOFTWARE   FAIL   S=✳ I=0 F=1 FC=XX
BLINK STATE INDICATOR   ──────▶   STATE SOLID ON OR OFF
OPERATING SOFTWARE HERALD   SEE FC CODE CHART

OPER S/W WILL NOT PROMPT
UNTIL REQUESTED BY ^Y
THE PROMPT IS: FAULT CODE CHART
HSC50>   01 = K.PLI UCODE REV
                                02 = K.SDI UCODE REV
                                03 = K.STI UCODE REV
                                21 = P.IOC
                                22 = M.STD
                                23 = BOOT DEVICE
                                25 = LINK SWITCH SET HIGHER THAN HEX 0F
                                26 = MISSING REQUIRED FILE ON BOOT MEDIA
                                30 = NO Ks IN SYSTEM
                                31 = REBOOT BEFORE PREVIOUS BOOT COMPLETED
                                32 = S/W DETECTED INCONSISTENCY

✳ STARTING WITH V110, THIS WILL BE A FAST BLINK

CX-041A
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Figure 4-1   P.ioc ROM Bootstrap Flowchart (2 of 4)
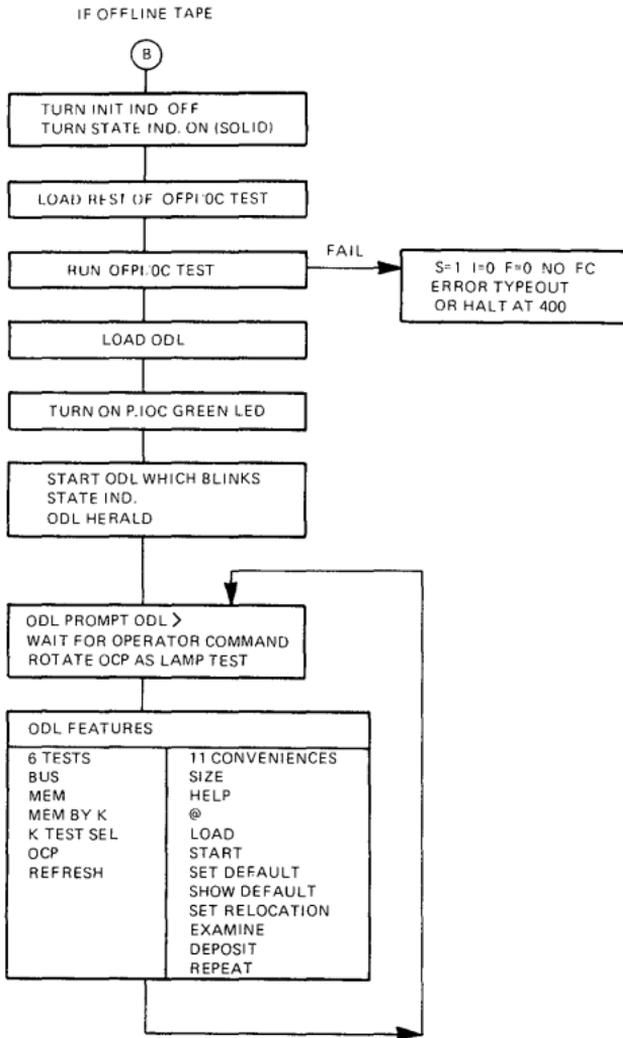
CX-041A
Sheet 3 of 4

Figure 4-1   P.ioc ROM Bootstrap Flowchart (3 of 4)

NOTES ON PIOC ROM INIT TEST - BOOTSTRAP

During the Bootstrap, if the FAULT indicator lights, more information is available. Use F-11 ODT to look at this info. BREAK and examine 172340. It contains the failing test number.

If Test 4 discovered any TU58 faults, the error information is available. Use ODT to examine 400 thru 412. See below.

    400 = Error code for TU58 controller 0 CSR=177520 unit 0
    402 = Error code for TU58 controller 0 CSR=177520 unit 1
    404 = Error code for TU58 controller 1 CSR=177530 unit 0
    406 = Error code for TU58 controller 1 CSR=177530 unit 1
    410 = Error code for $SSL0 (normally terminal)
    412 = Error code for $SSL0 (normally not used)

The low byte contains the error code assigned by the bootstrap and the high byte contains the error code contained in the End Packet sent by the TU58 controller. See below.

    Lo byte:

    0 = No error
    1 = NXM accessing CSR
    2 = TU58 sync sequence failed
    3 = TU58 failed self test
    4 = Drive did not contain bootable image
    5 = Checksum Error in received packet
    6 = Timeout on Transmitter Ready bit
    7 = Timeout on Receiver Done bit
    10 = Overrun or Framing Error
    11 = Unknown packet type received

    Hi byte:

    1774xx = Self Test failed
    1770xx = End of Tape
    1750xx = Hard Read Error
    1740xx = Bad Unit Number Given
    1734xx = No Cassette Mounted
    1724xx = Write Protected
    1674xx = Data Check Error
    1600xx = Seek Error
    1574xx = Motor Stopped
    1500xx = Bad Op Code
    1444xx = Bad Block Number Given

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Figure 4-1   P.ioc ROM Bootstrap Flowchart (4 of 4)

4.1.1.1 Init P.ioc Diagnostic − This completes the testing begun by the ROM bootstrap. This diagnostic is loaded each time the the HSC50 System Tape is booted. If the Offline Diagnostic Tape is loaded, the Offline P.ioc Test is executed in place of the Init P.ioc Diagnostic.

The following sections of logic are tested with the Init P.ioc Diagnostic:

- **I/O Control Processor** − The complete instruction set, interrupts, traps, memory management and the control memory lock-cycle circuitry are included. Failures detected result in the display of an error code on the OCP.

- **Memory** − The program memory is tested from the I/O control processor, but the control and data memories are tested by the highest numbered requestor available under control of the I/O control processor. Failures detected result in an error code display on the OCP.

- **Host Interface and Data Channels** − Module status is collected and placed in a table for the HSC50 control program init process. When each module is enabled, it automatically executes internal microdiagnostics. The internal diagnostics perform the following tests:

  - ROM (sequencer, checksum, parity, etc.)

  - Special logic unique to that particular module

Upon completion of diagnostics for each module, a status code is passed to the I/O control processor. If the module diagnostics pass, the status code represents the type of module. If the diagnostics fail, the status code indicates the type of error detected. Appendix B shows the status codes for the various modules. Failures detected also result in that module's red LED coming on. Failures in the Host Interface (K.ci) also report on the auxiliary terminal.

Fault isolation in the Init P.ioc diagnostic is to the module level. The operator control panel (OCP) fault code identifies the module most likely causing the failure. The Init P.ioc diagnostic is initiated by the following:

1. The system tape is inserted into TU58 unit 0.

2. The HSC50 is powered on, or the Init switch is depressed and released with the Secure/Enable switch in the enable position.

3. The TU58 Run indicator lights within ten seconds indicating the bootstrap is loading the Init P.ioc diagnostic.

4. The TU58 Run indicator blinks indicating that the control program software is being read from the tape to program memory.

5. The State lamp blinks on and off when the Init P.ioc test initiates the HSC50 control program.

6. After about four minutes, the control program indicates it has loaded properly by displaying its name and version on the auxiliary terminal (if installed):

   HSC50 Version nnnn DD-MMM-YYYY tt:tt:tt

The HSC50 is now capable of being put online to the system and executing any of the available inline diagnostics. Brief descriptions of the inline diagnostics are found in Appendix G. A complete description of each diagnostic is found in the *HSC50 Inline User Documentation* (EK-IHSC5-UG).

4.1.2   Offline Bootstrap

The P.ioc ROM bootstrap program described earlier and shown in Figure 4-1 is executed each time the offline tape is loaded. The P.ioc ROM bootstrap program then loads the Offline P.ioc test.

When the Offline P.ioc test begins to execute, most F-11 chip set logic has been tested and is assumed to be working. Likewise, the memory occupied by the test and the TU58 used to load the test are also assumed to be tested and working.

4.1.3   Offline P.ioc Test

This program tests all I/O control processor logic not tested by the bootstrap program. The test runs in a stand-alone environment and provides specific error messages aiding in the isolation of I/O control processor module failures. If the entire test runs with no errors, the offline diagnostic loader is read to memory from the TU58 and started. The following steps boot the offline loader:

1. The HSC50 Offline Diagnostic tape is inserted into TU58 unit 0.

2. The HSC50 may be powered on, or the Init switch on the HSC50 OCP is depressed and released with the Secure/Enable switch in the enable position.

3. The TU58 Run indicator lights within ten seconds indicating that the bootstrap is loading the offline diagnostic loader into program memory.

4. After about 60 seconds, the offline diagnostic loader indicates it has loaded properly by displaying the following report:

HSC50 OFL DIAGNOSTIC LOADER
RADIX = OCTAL, DATA LENGTH = WORD, RELOC = 00000000
ODL >

The offline loader is now ready to accept any of the following commands:

- **HELP** – This command provides an abbreviated list of all commands that the loader recognizes. In response to the help command, the loader reads the file **OFLLDR.HLP** from the TU58 and displays the contents of this file on the auxiliary terminal.

- **LOAD** – This command allows a program to be loaded into HSC50 program memory without being started. The format of the command is **LOAD <filename>** where **<filename>** is the name of any file on the HSC50 Offline Diagnostic tape. The loader program finds the specified file and loads it into program memory. The program can be initiated via the start command, as described in the following section.

- **START** – This command directs the loader to initiate the program currently loaded in program memory. The START command can be used in conjunction with the LOAD command (see preceding section), or it may be used to reinitiate the last offline diagnostic. This saves the time required to reload the program from the TU58.

- **EXAMINE** – This command displays the contents of any location in HSC50 program, data, or control memories. The format of the command is **EXAMINE <address>** where **<address>** can be a string of digits in the current (default) radix, but certain symbolic addresses are also permitted.

  EXAMPLE:

  ODL > E 14017776 <CR>
  (D) 14017776 125252

  In the example, a command to examine the contents of location 14017776 was entered. The EXAMINE command was abbreviated to a single E in the example. When the loader displays the contents of location 14017776, the address is preceded by a (D) to indicate that the location is within HSC50 data memory. The display indicates the location contains the value 125252.

- **DEPOSIT** – This command modifies the contents of any location in HSC50 program, control, or data memories. The format of the command is **DEPOSIT <address> <data>** where **<address>** can be a string of digits in the current (default) radix, but certain symbolic addresses are also permitted (see next section).

  EXAMPLE:

  ODL > E 14017776 <CR>

  In the example above, a command to store the value 123456 into the contents of address 14017776 was entered. The previous contents of this data memory location is replaced with the value specified in the DEPOSIT command (123456).

- **SIZE** − This command invokes the Offline System Sizer program. The program determines the sizes of the three HSC50 memories and the type of module in each HSC50 requestor number. The HSC50 requestor number refers to the priority of a particular module on the data and control memory buses. It does not necessarily correspond to the numbering of module slots.

- **TEST** − This command invokes the various offline diagnostics available. Appendix H contains a brief description of each Offline diagnostic. For a complete description refer to the *HSC50 Offline Diagnostic User Documentation*(EK-OHSC5-UG).

4.1.4 Periodically Scheduled Diagnostics

Periodically scheduled diagnostics are tests that run when the subsystem has little or no I/O to perform. These tests run very quickly (in terms of tens of milliseconds) avoiding throughput impact.

Normally HSC50 periodic diagnostics are enabled by default with a time interval of one minute. To verify that periodic diagnostics are enabled, use the SETSHOW utility command **SHO SYSTEM**.

The **SET PERIODIC__DIAGNOSTICS [time-interval]** command enables the periodic diagnostics to run. Currently there are three periodic diagnostics:

1. **PRKSDI** − K.SDI Diagnostic
2. **PRKSTI** − K.STI Diagnostic
3. **PRMEMY** − Memory Diagnostic

PRKSDI and **PRKSTI** cause a particular microdiagnostic to be run on each of the K.sdi and K.sti modules available. A different diagnostic is run on successive calls to this routine.

PRMEMY tests the following:

- Control bus transceivers
- Data bus transceivers
- Memory parity checking circuits.

Examples of error messages are found in Appendix C, Software Crash Definitions.

4.2 UTILITY PROGRAMS

HSC50 utility programs are stored on the System Tape. A ∧ Y (control Y) must be keyed in on the local terminal to obtain the command prompt. Any of the available utility programs may be executed by typing the word RUN preceding the program name.

Brief descriptions of the utility programs are found in Appendix I. Detailed descriptions are found in the *HSC50 Service Manual* and the *HSC50 Disk Controller User Guide*.

4.3 HOST-EXECUTED DIAGNOSTICS

There are no HSC50-specific programs that execute in a host CPU.

4.4 CONNECTING AN AUXILIARY
        TERMINAL

Figure 4-2 shows the placement of the two ASCII ports on the HSC50. The auxiliary terminal connects to the rear ASCII port while the front port is normally used for the field service maintenance terminal. Both may not be connected at the same time. Either terminal should be connected with HSC50 power off. If power must be left on while connecting the terminal, the following procedure must be followed:

- Ensure the Secure/Enable switch is in secure position.
- Change terminal state (e.g. plug in, remove power etc.).
- Type three space characters on terminal keyboard.
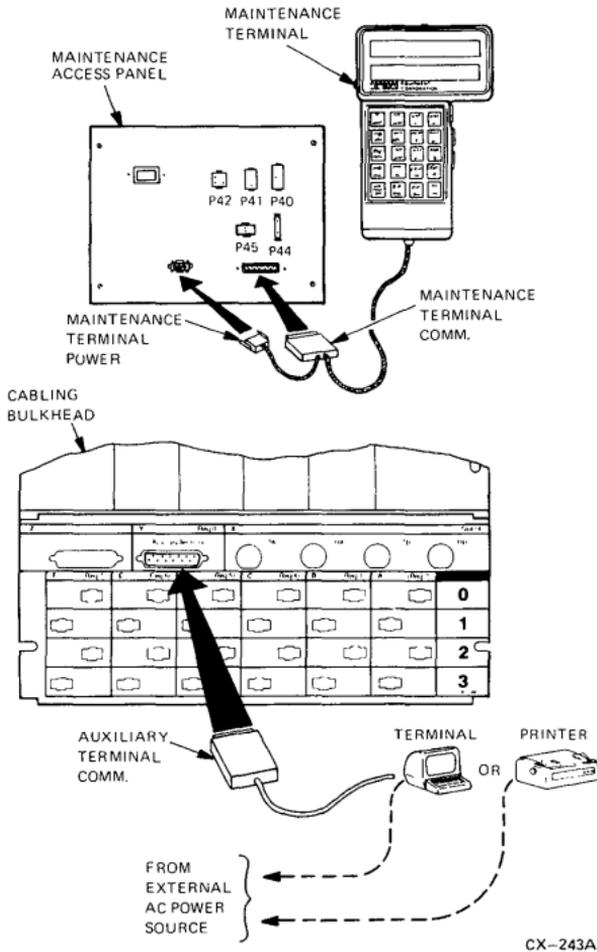
Figure 4-2   Connecting a Local Terminal

If this procedure is not followed, then micro-ODT mode may be entered. The prompt displayed on the terminal is an @ signifying micro-ODT mode. Typing a **P** (proceed) should exit micro-ODT mode. In certain cicumstances however, this will not work and the HSC50 will have to be re-initialized.

Another microprocessor mode of operation may be entered by mistake. This mode is called HSC50 ODT. The prompt that shows up on the auxiliary terminal is an * when this mode is entered. Typing a; **P** and performing a **SET** command will obtain the normal diagnostic mode prompt (**HSC50**).

Once in the normal diagnostic mode, the user has about four minutes to input a command from the terminal or a timer expires and the diagnostic mode is exited. Typing a control Y (∧**Y**) re-enters diagnostic mode.

4.4.1   LA12 Setup
If an LA12 is used as an auxiliary terminal, the following parameters must be established on the LA12 before it can be used with the HSC50:

1. **Communications**

   - Auto − Ansbk = no
   - Buffer = 1024
   - Comm Port = EIA
   - Disk − HDX = none
   - Echo − Local = no
   - Fault = none
   - G − HDX Start Mode = Rcv
   - H − Hi Speed (bps) = 9600
   - L − Lo Speed (bps) = 300

- M − Line Prot = FDX − Data Leads
- O − Rcv Error Ovride = no
- Parity = 7/M
- Q − SRTS Polarity = lo
- Restraint = Xon/Xoff
- S − Speed Select = hi
- Turn Char = none
- U − Power Up = line
- V − Frequency = bell 103

2. **Keyboard**

- Auto − Linefeed = no
- Break = yes
- C − Keyclick = no
- Keypad = normal
- Language = USA
- Repeat = yes

3. **Printer**

- A − G0 Char Set = USA
- B − G1 Char Set = USA
- C − G2 Char Set = USA
- D − G3 Char Set = USA
- End-of-line = wrap
- Form Length = 264

- G – Print Cntrl Chars
- Horiz Pitch (CPI) = 10
- Newline Char = none
- Print Force = hi
- Vertical Pitch (LPI) = 6

5   TROUBLESHOOTING

5.1 TROUBLESHOOTING

The HSC50 troubleshooting flowchart is presently under revision. The next edition of the Maintenance Guide should have the updated troubleshooting information.

A   OPERATOR CONTROL PANEL FAULT CODE CHART

	INIT	FAULT	ONLINE			OCTAL VALUE
K.PLI FAILURE	OFF	OFF	OFF	OFF	ON	1
K.SDI FAILURE	OFF	OFF	OFF	ON	OFF	2
K.STI FAILURE	OFF	OFF	OFF	ON	ON	3
P.IOC MODULE FAILURE	ON	OFF	OFF	OFF	ON	21
MEMORY MODULE FAILURE	ON	OFF	OFF	ON	OFF	22
TU58 FAILURE	ON	OFF	OFF	ON	ON	23
LINK MODULE FAILURE	ON	OFF	ON	OFF	ON	25
MISSING FILES	ON	OFF	ON	ON	OFF	26
NO Ks IN SYSTEM	ON	ON	OFF	OFF	OFF	30
REBOOT WHILE BOOTING	ON	ON	OFF	OFF	ON	31
SW INCONSISTENCY	ON	ON	OFF	ON	OFF	32

CX-029B

Figure A-1   Operator Control Panel (OCP) Failure Codes

A.1   FAULT CODE CHART ERROR INTERPRETATION

1. OCP codes of 1,2,3 indicate the module contains out of revision microcode. Check the revision matrix (RM) Document (Appendix F) for the correct revision levels.

2. OCP error code of 21 (octal) indicates a bad L0105 module. Replace the L0105 and use the following as a guide:

    • Establish the baud rate considering the local terminal to be used.

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- • Jumper W3 in for 9600 baud (auxiliary terminal).

- • Jumper W3 out for 300 baud (maintenance terminal).

- • Run Bus Interaction Offline diagnostic (TEST BUS) verifying the new module.

3. OCP error code of 22 (octal) indicates a bad memory module (L0106). Use the following as a guide:

- • Replace the suspect memory module with new one.

- • Execute the SHO MEM utility.

- • If any memory locations appear in the suspect or disabled memory locations lists, perform the following:

  - • Set Secure/Enable switch to enable.

  - • Execute SET MEM ENABLE/ALL utility.

  - • Run Offline Memory diagnostic (TEST MEM) for about 30 minutes.

  - • Run Bus Interaction Offline diagnostic (TEST BUS) verifying the new module.

- • If no memory locations appear in the suspect or disabled memory locations lists, perform the following:

  - • Run Offline Memory diagnostic (TEST MEM) for about 30 minutes.

  - • Run Bus Interaction Offline diagnostic (TEST BUS).

4. OCP code of 23 (octal) indicates a TU58 problem. Use the following as a guide to isolate a cartridge/drive/controller problem:

   • Ensure the TU58 controller self-test LED is on. A bad controller module is indicated if the LED is off.

   • Insert backup tape from same HSC50 into same drive.

   • Re-initialize HSC50. A bad tape cartridge is indicated if the initialization diagnostics pass.

   • Place backup tape into other drive.

   • Re-initialize HSC50.

     • If initialization diagnostics pass, a bad TU58 drive is indicated.

     • If initialization diagnostics fail, a bad TU58 controller module is indicated.

5. OCP code of 25 (octal) indicates the node address switches on the L0100 module are set at a value greater than F (Hex).

6. OCP code of 26 (octal) indicates some of the required files could not be found on the System Tape. This could mean a bad TU58. Refer to the procedures outlined for an OCP code of 23 (octal).

7. OCP code of 30 (octal) indicates there are not enough working requestors in the HSC50. Use the following as a guide:

   • Replace any module with a red LED on.

   • Compare the module utilization label on the HSC50 with actual module compliment. Check for missing requestors and replace.

- Restore any module in the wrong location to its proper place.

8. OCP code of 31 (octal) indicates a crash occurred while attempting to load and initialize the HSC50 control program. Use the following as guide:

  - Depress **Break** key on terminal.
  - Key in **177576/**.
  - Analyze bits 8 to 11 of 16-bit message displayed:

    - X XXX XXX 1XX XXX XXX = NXM Trap. Probable causes are:
      - I/O control processor module
      - Memory module
      - Software problem

    - X XXX XX1 0XX XXX XXX = Illegal instruction. Probable causes are:
      - I/O control processor module
      - Memory module
      - Software problem

    - X XXX XX1 1XX XXX XXX = Parity trap. Probable causes are:
      - Memory module
      - I/O control processor module

    - X XXX X10 0XX XXX XXX = Level seven interrupt. Refer to Appendix B for module status interpretation.

- **X XXX X10 1XX XXX XXX** = MMu trap. Probable causes are:
  - I/O control processor module
  - Software problem

- **X XXX X11 0XX XXX XXX** = Software caused crash.

- **X XXX 111 XXX XXX XXX** = Host Interface (K.ci) host reset.

- **X XXX 100 0XX XXX XXX** = User requested a reboot of HSC50.

9. OCP code of 32 (octal) indicates an inconsistency in the software and generally means the System Tape is bad. This error occurs during initilization process. Use the following as a guide:

- Try booting with the backup System Tape.

- If this error occurs while attempting to install a newer revision software drop back to the original revision software.

B MODULE STATUS CODES

B.1 STATUS BYTE INTERPRETATION

Status bytes displayed on the auxiliary terminal may be interpreted as follows:

- **Bit 7** is the parity bit. Odd parity is used by the software. An odd status byte in bits 0-6 generates a clear parity bit. An even status byte generates a set parity bit.

- **Bit 6** indicates a microdiagnostic failure occurred With this bit set, bits 0-5 of the status byte indicate the test number of the failed microdiagnostic. With bit 6 clear, bits 0-5 indicate the module type reporting the message.

- **377** (all ones) in the status field represents no requestor present in that slot.

B.2 MODULE TYPE CODES

When the module successfully passes all microdiagnostics, bit six of the status byte remains clear. Bits 0-5 of the status byte then have the following codes to define the module type:

- **Code 001** represents a host interface (K.CI) module set. Using odd parity, the code is reported as 001.

- **Code 002** represents a disk data channel (K.sdi) module. Using odd parity, the code is reported as 002.

- **Code 003** represents a tape data channel (K.sti) module. Using odd parity, the code is reported as 203.

Following is a an example HSC50 error message following a reboot caused by a Level 7 K Interrupt. This same information may be obtained by executing the SHOW EXCEPTION command after the reboot. The SHOW EXCEPTION command causes the last exception reason to be read from the system tape.

SINI-E Error sequence 1. at 03-Nov-1983 09:12:16.60
         Last soft init caused by Level 7 K interrupt
         (Trap thru 134)
         From process DISK
         PC 046410
         Status of requestors 1-4: 001 377 203 002
                                 5-7: 140 377 377

The status shown in the example indicates the following:

- Requestor slot 1 contains a K.ci.
- Requestor slot 3 contains a K.sti.
- Requestor slot 4 contains a K.sdi.
- Requestor slots 2,6,7 are empty.

The requestor in slot 5 generated the interrupt. The status code of 140 indicates a control bus error was detected (see Appendix C).

C SOFTWARE CRASH INTERPRETATIONS

C.1 INTRODUCTION

The operating software contains numerous consistency checks. When one of these checks fails, the HSC50 performs a soft init sequence which causes it to crash and reboot. This sequence is similar to the operating system on a CPU crashing due to a STOPCODE, or BUGHLT.

Whenever the HSC50 executes the soft init sequence, a message describing the reason is displayed on the auxiliary terminal when the operating software comes back up. The same message is written on the system tape where it can be examined by a SHOW EXCEPTION command.

The following paragaphs describe some of the software crash interrupts that can occur on the HSC50.

C.2 LEVEL 7 K INTERRUPT (TRAP THROUGH 134)

The Level 7 K Interrupt is one of the exception errors that cause the HSC50 to crash and reboot. This can occur when one or more requestors detect a fatal error condition while executing functional code. The requestor detecting the error generates the Level 7 Interrupt to the P.ioc. The P.ioc then traps through location 134 causing a reboot.

The error conditions detected by the requestor may be either hardware or microcode detected. Microcode detected errors causing the interrupt are the result of a microcode consistency check failing.

K.sdi hardware detected errors are the result of errors detected on the control bus.

K.ci hardware detected errors are the result of the following errors:

- Control bus errors
- Scratchpad RAM parity errors
- Data bus parity errors
- Nonexistant memory (NXM) errors not related to a data transfer operation.

Replacing a module after the first occurrence of this type of failure is not recommended. This is due to the fact that intermittent control memory, data memory, control bus and data bus problems can all cause a requestor to generate a Level 7 K Interrupt.

It should be determined if the same requestor always causes the failure. If other requestors also fail, the problem may be any of the modules on the control or data buses.

C.2.1 Control Bus Error Conditions

The following is a list of control bus errors that cause Level 7 Interrupts:

- **Control bus error** is detected when the requestor is executing a control bus cycle and the P.ioc is issuing **CERR L** to the requestor. CERR L indicates an illegal control bus cycle type on the CCYCLE 0-2 lines.

- **Control bus NXM** is detected when the requestor attempts to reference control memory and does not receive an acknowledgement (CACK L) within the timeout period.

- **Control bus parity error** is detected when the requestor senses bad parity on the data being read from the control bus.

C.2.2   Level 7 Interrupt Reports

Whenever a Level 7 K Interrupt occurs, the status of each requestor slot is printed on the HSC50 auxiliary terminal after the reboot and saved on the System tape. Examining this status identifies the requestor generating the interrupt. Refer to Appendix B for an example error message and description of the module status codes.

The following is a list of K.ci and K.sdi exception codes that may be displayed in the requestor status byte (bits 0-5) of a failing requestor. The hardware detected exception codes are the result of control bus errors. Any microcode detected exception codes are the result of microcode consistency check failing. The left-most two bits are not shown as they have no useful meaning.

- **K.ci**

  - Hardware detected errors: 15, 20, 23, 31, 33-37, 40-47, 50, 51, 53-57, 60-67, 70-75.

  - Microcode detected errors: 14, 16, 17, 21, 22, 24-27, 30, 32, 52, 76, 77.

- **K.sdi**

  - Hardware detected errors: 14, 16, 17, 20-27, 30, 32-34, 36, 37, 40-42, 44, 46, 47, 50-55, 75, 76.

  - Microcode detected errors: 15, 26, 31, 35, 43, 45, 77.

C.3 REQUESTOR DETECTED DATA MEMORY ERRORS

If one of the requestors detects a parity error or NXM error while referencing data memory the following measures are taken:

- The buffer causing the error is set offline.
- The data transfer is retried using another buffer.
- The inline memory diagnostic is scheduled to test the offline buffer.

Buffers failing the memory test are sent to the Disabled Memory queue not to be used again. Buffers passing the memory test are returned to the Free Memory queue and are again available for use. The address of buffers not failing ILMEMY are saved on a list in HSC50 memory. This list is used to determine if a buffer has been sent a second time for testing by ILMEMY. If the buffer has been tested previously, the buffer is added to the Disabled Memory queue.

An MSCP error message with an event code of 012A is sent to the host to be logged in the system error log when one of these errors occur. An error message and output from the inline memory test are also printed on the auxiliary terminal. An example follows showing the error message and ILMEMY output printed on the auxiliary terminal when an error referencing data memory is detected. In this example the inline memory test did not detect the failure when testing the buffer.

ERROR-E Data memory error (NXM or parity) at 2-Feb-1984 11:01:57.37

Command Ref	EFA9000F
RA81 unit	7.
Err Seq	1.
Error Flags	01
Event	012A
Recovery level	0.
Recovery count	1.
LBN	380.
Orig err flags	000040
Recovery flags	000002
Lvl A retry cnt	0.
Lvl B retry cnt	0.
Buffer addr	140644
Source Req.	3.
Detecting Req.	3.

ERROR-I End of error

ILMEMYA11:03 Execution Starting

ILMEMYA11:03 T 001 E 001
ILMEMYAReturned Buffer to Free Buffer Queue
ILMEMYAFRU1-M.std FRU2-
ILMEMYABuffer Starting Address (physical) = 14064400
ILMEMYABuffer Ending Address (physical) = 14065476
ILMEMYA11:03 Execution Complete

The contents of the Disabled Memory queue are not saved on the HSC50 system tapes; therefore, the addresses of those buffers put in the queue are not saved through power fails and reboots. Those buffers passing the initialization diagnostics but failing intermittently under heavy system I/O may generate one or two parity errors after every reboot.

C.4   SOFTWARE INCONSISTENCY ERRORS

The following paragraphs describe software inconsistency errors caused by requestors timing out and periodic diagnostic failures.

C.4.1   Requestors Timing Out

Requestors can be timed out by the operating software if one of the clocks on the module stops due to the detection of certain errors. A message is displayed on the auxiliary terminal when the reboot is complete. This message is also written on the system tape where it may be examined by using the SHOW EXCEPTION command. Examination of this message determines if the software inconsistency was caused by a requestor being timed out.

The process active at the time of the software inconsistency indicates which type of requestor may have been timed out by the software. The first word on the stack dump indicates whether a requestor timed out or not. Table C-1 shows the process, the stack word and requestor type and is used to interpret requestor time-out problems.

Table C-1   Requestor Time-out

Active Requestor Process	Software Version	First Word on Stack	Type
Poller	V100	000007	k.ci
Poller	V110	000007	k.ci
Disk	V100	030025	k.sdi
SDI	V110	030025	k.sdi

NOTE
All other codes in the first word on the stack indicate the software inconsistency was not caused by a requestor timing out.

If the software inconsistency is caused by a K.sdi being timed out, then the second word on the stack should be examined. The contents of the second word is broken down as follows: Low byte equals the requestor slot number and the high byte equals the active port number.

C.4.1.1   Time-out Error Message Examples – Following are message examples displayed when a time-out occurs:

SINI-E Error sequence 1. at 17-Nov-1983 00:00:16.80
  Last soft init caused by software inconsistency
  From process POLLER
  PC 004054
  PSW 140001
  Stack Dump: 000007 052525 052525

The active process indicated in the message is POLLER and 000007 is the first word on the stack. Table C-1 is used to determine if the cause of the inconsistency is the K.ci timing out. The most likely FRU is the L0107 module.

SINI-E Error sequence 1. at 17-Nov-1983 00:00:16.80
  Last soft init caused by software inconsistency
  From process SDI
  PC 041202
  PSW 140001
  Stack Dump: 030025 000405 000000

The active process indicated in the message is SDI and 030025 is the first word on the stack. Table C-1 is used to determine if the cause of the software inconsistency is a K.SDi timing out. The low byte of the second word on the stack indicates that the L0108-YA (K.SDI) module in slot 5 is the most likely cause of the failure.

C.4.2 Periodic Diagnostic Failures

Periodic diagnostics are scheduled to run in the HSC50 under the operating software during periods of low activity. Additional information is found in Chapter Four of this guide.

The following is an example of the printout of a periodic diagnostic detecting a failure in the K.sdi module found in requestor slot 2.

> **PRKSDIP15:04 T#007 E#001**
> **PRKSDIPK Failed During Diagnostic**
> **PRKSDIPRequestor 2, Status = 307**
> **PRKSDIPMicro Diagnostic   07**

T# equals the ROM-resident microdiagnostic that failed. The following is a list of the K.sdi/K.sti microdiagnostic tests:

- Test 00 indicates the Sequencer Test.
- Test 01 indicates the ALU Test.
- Test 02 indicates the Data Bus Test.
- Test 03 indicates the Control Bus Test.
- Test 04 indicates the PROM Parity Test.
- Test 05 indicates the Memory Test.
- Test 06 indicates the RAM Test.
- Test 07 indicates the SERDES/RSGEN Test.
- Test 10 indicates the Partial SDI Interface Test.

The following test numbers apply for the PRMEMY diagnostic:

- Test 01 indicates the Data Memory Transceiver test.
- Test 02 indicates the Control Memory Transceiver test.
- Test 03 indicates a parity error can be forced.

E# equals one of the following errors:

- **Error 0** indicates a failure in the periodic control and data memory test
- **Error 1** indicates the K.SDI/K.STI did not finish the microdiagnostic to be performed. An error is declared when the diagnostic takes longer than 5 seconds to complete.
- **Error 2** indicates the K.SDI/K.STI microcode did not return the dialog control block (DCB). The DCB is used to command the K.SDI/K.STI microcode to perform the diagnostic. A possible cause might be a control bus NXM error was detected while attempting to return the DCB.

Failures in the periodic diagnostics generate an exception error causing the HSC50 to re-initialize. The exception reason is printed on the auxiliary terminal after the re-initialization. It is also stored on the System tape where it may be displayed using the SHO EXC command.

Following is an example of an exception reason displayed after a re-initialization:

SINI-E   Error sequence 1. at 17-Nov-1858 00:00:02.80
Last soft init caused by software inconsistency
From procss PDEMON
PC 113606
PSW 140000
Stack Dump: 000004 104030 140310

The diagnostic message indicates that PDEMON is the process running, and the stack dump display contains no useful information. The periodic diagnostic failure printout must be examined to determine which requestor failed. Following is an example of a message displayed when a K.sdi also failed on the reboot:

SINI-E   Error sequence 2. at 17-Nov-1858 00:00:02.80
Requestor 2 failed INIT diags, status = 107

D MSCP EVENT CODES

D.1 INTRODUCTION

This appendix describes the status and event codes displayed as a result of a subsystem problem and may be used to interpret these codes during the analysis of the problem.

D.1.1 Appendix Notes

- The combination of a status or event code with a subcode are expressed (assuming 16-bit symbols) as:

  (SUBCODE*ST.SUB)+CODE

- The standard subcode values (Table D-2) are only returned as status codes in end messages. They are never returned as event codes in error log messages.

- The nonstandard subcode values (Tables D-3 through D-7) may be returned as both status codes and event codes. In those tables, an asterisk in the EV column indicates the code and subcode may be returned as an event code. An asterisk in the ST column indicates the code and subcode may be returned as a status code.

- The letters to the right of the subcode tables indicate which controller implement that subcode. The letter U indicates UDA50A and the letter H indicates the HSC50. An upper case letter indicates the controller fully implements the subcode. A lower case letter indicates that the controller partially implements the subcode.

Table D-1 Status and Event Codes

Dec.	Value Oct.	Hex.	Status or Event Code
31	37	1F	Status/event code mask
32	40	20	Subcode multiplier
0	0	0	Success
1	1	1	Invalid command
2	2	2	Command aborted
3	3	3	Unit offline
4	4	4	Unit available
5	5	5	Media format error
6	6	6	Write protected
7	7	7	Compare error `
8	10	8	Data error
9	11	9	Host buffer access error
10	12	A	Controller error
11	13	B	Drive error
31	37	1F	Message from an internal diagnostic

Table D-2 Standard Status Subcode Values

Sub-code	Code + Subcode Dec.	Oct.	Hex.	Status Subcode	
Success subcode values:					
0	0	0	0	Normal	UH
1	32	40	20	Spin-down ignored	UH
2	64	100	40	Still connected	UH
4	128	200	80	Duplicate unit number	UH
8	256	400	100	Already online	UH
16	512	1000	200	Still online	H

Table D-2 Standard Status Subcode Values (continued)

Sub-code	Code + Subcode Dec.	Oct.	Hex.	Status Subcode	
Invalid Command Subcode Values:					
0	1	1	1	Invalid message length	UH
many				Other invalid command subcode values should be referenced as follows. Note, this is combined with the status code.	UH
				offset*256.+code	
				Offset is the command message offset symbol for the field in error and code is the symbol for the Invalid Command status code.	
Command Aborted subcode values:					
0	2	2	2	Subcodes are not used.	UH
Unit Offline subcode values:					
0	3	3	3	Unit unknown or online to another controller.	UH
1	35	43	23	No volume mounted or drive disabled via RUN/STOP switch (unit is in known substate).	UH
2	67	103	43	Unit is inoperative. For SI drives, the controller has marked the drive inopera-tive due to an unrecoverable error in a previous level 2 exchange, the drive C1 flag is set, or the drive has a duplicate unit identifier.	UH

Table D-2 Standard Status Subcode Values (continued)

Sub-code	Code + Subcode Dec.	Oct.	Hex.	Status Subcode	
4	131	203	83	Duplicate unit number	UH
8	259	403	103	Unit disabled by field service or diagnostic. For SI drives, the drive DD flag is set.	UH

Unit Available subcode values:

0	4	4	4	Subcodes are not used.	UH
					UH

Media Format Error subcode values − see Table D-3.

Write Protected subcode values:

256	8198	20006	2006	Unit is hardware write protected.	UH
128	4102	10006	1006	Unit is software write protected.	U

Compare Error subcode values:

0	7	7	7	Subcodes are not used.

Data Error subcode values − see also Table D-4

0	8	10	8	Sector was written with Force Error modifier.	UH

Host Buffer Access Error subcode values − see Table D-5.

Controller Error subcode values − see also Table D-6.

0	10	12	A	Reserved for host-command timeout expired.

Drive Error subcode values − see Table D-7.

Table D-3   Media Format Error Subcode Values

Sub-code	Code + Subcode Dec.	Oct.	Hex.	E V	S T	Status Subcode	
many				*	*	Data Error accessing RCT or FCT.	UH

For every Data Error subcode that may be reported as a status code, the exact same subcode value may be returned as a Media Format Error subcode value. Each subcode listed in Table D-4 that has an asterisk in the ST column indicates a transfer to the unit FCT or RCT. The subcode reports the error that occurred on the last copy of the multicopy structure. For example, the subcode value 7 (combined code and subcode value 229 decimal) indicates the FCT or RCT is unreadable due to an Uncorrectable ECC Error.

The following subcode values also exist:

Sub-code	Dec.	Oct.	Hex.	E V	S T	Status Subcode	
5	165	245	A5	*		Disk not formatted with 512 byte sectors. The disk FCT indicates it is formatted with 576 byte sectors yet either the controller or the drive only supports 512 byte sectors.	UH
6	197	305	C5	*		Disk not formatted or FCT corrupted. The disk FCT indicates the disk is not formatted in either 512 or 576 byte mode.	UH
8	261	405	105	*	*	RCT corrupted. The RCT search algorithm encountered an invalid RCT entry. The subcode may be returned under the following conditions: during replacement of a block, revectoring a bad block, and when a unit is brought online.	H

Table D-3   Media Format Error Subcode Values (continued)

Sub-code	Code + Subcode Dec.	Oct.	Hex.	E V	S T	Status Subcode	
9	293	445	125	*		No replacement block available. Replacement was attempted for a bad block, but a replacement block could not be allocated (the RCT is full). This subcode may be returned during actual replacement and when an interrupted replacement is completed as part of bringing a unit online.	H

Table D-4   Data Error Subcode Values

Sub-code	Code + Subcode Dec.	Oct.	Hex.	E V	S T	Status Subcode	
0	8	10	8		*	Sector was written with Force Error modifier	UH
2	72	110	48	*	*	Invalid header The subsystem read an invalid or inconsistent header for the requested sector. For recoverable errors, this code implies a retry of the transfer read a valid header. For unrecoverable errors, this code implies the subsystem attempted tertiary revectoring and determined the requested sector is not revectored. Causes of an invalid header include header mis-sync, header sync time out, and an unreadable header.	UH
3	104	150	68	*	*	Data Sync not found (Data Sync timeout).	UH

Table D-4   Data Error Subcode Values (continued)

Sub-code	Code + Subcode Dec.	Oct.	Hex.	E V	S T	Status Subcode	
4	136	210	88	*		Correctable error in ECC field. A transfer encountered a correctable error where only the ECC field was affected. All data bits were correct but a portion of the ECC field was incorrect. The severity of the error (the number of symbols in error) is unknown. If the number of symbols in error is known, an n Symbol ECC Error subcode should be returned instead.	
7	232	350	E8	*	*	Uncorrectable ECC Error A transfer without the Suppress Error Correction modifier encountered an ECC error that exceeds the correction capability of the subsystem error correction algorithms, or a transfer with the Suppress Error Correction modifier encountered an ECC error of any severity.	UH
8	264	410	108	*		One Symbol ECC Error.	UH
9	296	450	128	*		Two Symbol ECC Error.	UH
10	328	510	148	*		Three Symbol ECC Error.	UH
11	360	550	168	*		Four Symbol ECC Error.	UH
12	392	610	188	*		Five Symbol ECC Error.	UH
13	424	650	1A8	*		Six Symbol ECC Error.	UH

Table D-4   Data Error Subcode Values (continued)

Sub-code	Code + Subcode Dec.	Oct.	Hex.	E V	S T	Status Subcode	
14	456	710	1C8	*		Seven Symbol ECC Error.	UH
15	488	750	1E8	*		Eight Symbol ECC Error. A transfer encountered a correctable ECC error with the specified number of ECC symbols in error.The number of symbols in errorroughly corresponds to the severity of the error.	UH

Table D-5   Host Buffer Access Error Subcode Values

Sub-code	Code + Subcode Dec.	Oct.	Hex.	E V	S T	Status Subcode	
0	9	11	9	*		Host buffer access error; cause not available. The controller was unable to access a host buffer to perform a transfer, but has no visibility into the cause of the error.	H
1	41	51	29	*		Odd transfer address.	U
2	73	111	49	*		Odd byte count.	U
3	105	151	69	*		Nonexistent memory error.	U
4	137	211	89	*		Host memory parity error.	U

Table D-6   Controller Error Subcode Values

Sub-code	Code + Subcode			E V	S T	Status Subcode	
	Dec.	Oct.	Hex.				
0	10	12	A	*	*	Reserved for host-command timeout expired.	
1	42	52	2A	*	*	SERDES overrun or underrun error. Either the drive is too fast for the controller, or a controller hardware fault has prevented controller microcode from keeping up with data transfer to or from the drive.	UH
2	74	112	4A	*	*	EDC Error The sector was read with correct or correctable ECC and an invalid EDC. There is most likely a fault in the ECC logic of either this controller or the controller that last wrote the sector.	UH
3	106	152	6A	*	*	Inconsistent internal control structure Some high level check detected an inconsistent data structure. For example, a reserved field contained a nonzero value or the value in a field was outside its valid range. This error almost always implies the existence of a microcode bug.	UH

Table D-6   Controller Error Subcode Values (continued)

Sub-code	Code + Subcode Dec.	Oct.	Hex.	E V	S T	Status Subcode	
4	138	212	8A	*	*	Internal EDC error Some low level check detected an inconsistent data structure. For example, a microcode implemented checksum or vertical parity (hardware parity is horizontal) associated with internal sector data was inconsistent. This error usually implies a fault in the memory addressing logic of one or more of the controller processing elements. It may also result from a double bit error or other error that exceeds the error detection capability of the controller hardware memory checking circuitry.	H
8	266	412	10A	*	*	Controller overrun or underrun The controller attempted to perform too many concurrent transfers, causing one or more of them to fail due to a data overrun or underrun.	H

Table D-6   Controller Error Subcode Values (continued)

Sub-code	Code + Subcode Dec.	Oct.	Hex.	E V	S T	Status Subcode	
9	298	452	12A	*	*	Controller memory error The controller detected an error in an internal memory, such as a parity error or nonresponding address. This subcode only applies to errors not affecting the controller's ability to properly generate end and error log messages. Errors affecting end and error log messages are not reported via MSCP. For most controllers, this subcode will only be returned for controller memory errors in data or buffer memory and noncritical control structures. If the controller has several such memories, the specific memory involved is reported as part of the error address in the error log message.	H
10	330	512	14A	*		PLI reception buffer parity error	H
11	362	552	16A	*		PLI transmission buffer parity error	H

Table D-7 Drive Error Subcode Values

Sub-code	Code + Subcode Dec.	Oct.	Hex.	E V	S T	Status Subcode	
1	43	53	2B	*	*	Drive command time out For SI drives, the controller timeout expired for either a level 2 exchange or the assertion of Read/Write Ready after an Initiate seek.	UH
2	75	113	4B	*	*	Controller detected transmission error. For SI drives, the controller detected an invalid framing code or a checksum error in a level 2 response from the drive. The and UDA50A also returns this subcode for controller detected protocol errors. All other SI controllers return subcode 9 for protocol errors.	UH
3	107	153	6B	*	*	Positioner error (misseek) The drive reported that a seek operation was successful, but the controller determined the drive had positioned itself to an incorrect cylinder.	UH
4	139	213	8B	*	*	Lost Read/Write Ready during or between transfers. For SI drives, Read/Write Ready drops when the controller attempts to initiate a transfer, or at the completion of a transfer with Read/Write ready previously asserted. This usually results from a drive detected transfer error, where additional error log message may be generated containing the drive detected error subcode.	UH

Table D-7   Drive Error Subcode Values (continued)

Sub-code	Dec.	Oct.	Hex.	E V	S T	Status Subcode	
5	171	253	AB	*	*	Drive clock dropout For SI drives, either data or state clock was missing. This is usually detected by means of a timeout.	UH
6	203	313	CB	*	*	Lost receiver ready for transfer For SI drives, Receiver Ready was negated when the controller attempted to initiate a transfer or did not assert at the completion of a transfer. This includes all cases of the controller timeout expiring for a transfer operation (level 1 real-time command).	UH
7	235	353	EB	*	*	Drive-detected error For SI drives, the controller received a Get Status or unsuccessful response with EL set, or the controller received a reponse with the DR flag set and it does not support automatic diagnosis for that drive type.	UH
8	267	413	10B	*	*	Controller-detected pulse or state parity error For SI drives, the controller detected a pulse error on either the state or data line, or the controller detected a parity error in a state frame.	UH
9	299	453		12B		Drive-requested error log (EL bit set)	H

Table D-7   Drive Error Subcode Values (continued)

Sub-code	Code + Subcode Dec.	Oct.	Hex.	E V	S T	Status Subcode	
10	331	513	14B	*	*	Controller-detected protocol error. For SI drives, a level 2 response from the drive had correct framing codes and checksum, but was not a valid response within the constraints of the SI protocol. The response had an invalid opcode, was an improper length, or was not a possible response in the context of the exchange.	H
11	363	553	16B	*	*	Drive failed initialization. For SI drives, the drive clock did not resume following a controller attempt to initialize the drive. This implies the drive encountered a fatal initialization error.	H
12	395	613	18B	*	*	Drive ignored initialization. For SI drives, the drive clock did not cease following a controller attempt to initialize the drive. This implies the drive did not recognize the initialization attempt.	H
13	427	653	1AB	*	*	Receiver Ready collision For SI drives, the controller attempted to assert its Receiver Ready and the drive's Receiver Ready was still asserted.	H
14	459	713	1CB	*		Response overflow A drive sent back more frames than the reception buffer could hold. This can be caused by a hung drive microdiagnostic or a malfunctioning K.sdi.	H

E POWER SUPPLY TEST POINTS

E.1 INTRODUCTION

The following illustrations show the locations of HSC50 voltage test points.
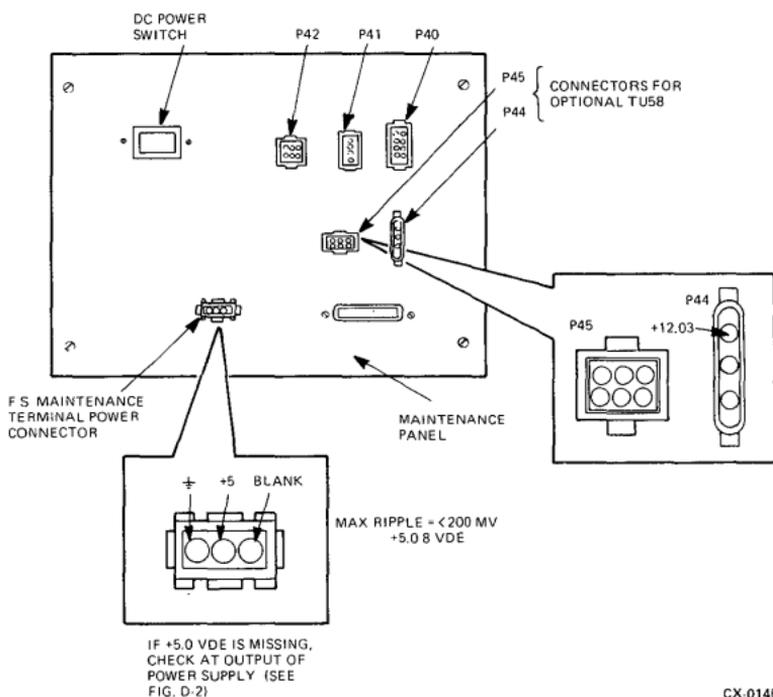
Figure E-1   Maintenance Access Panel Test Points
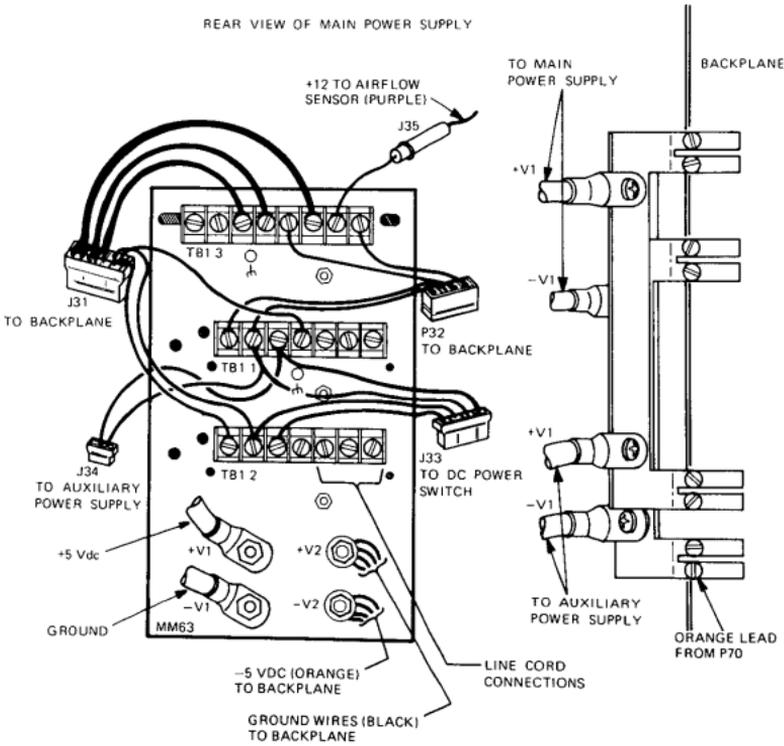
Figure E-2   Main Power Supply Test Points
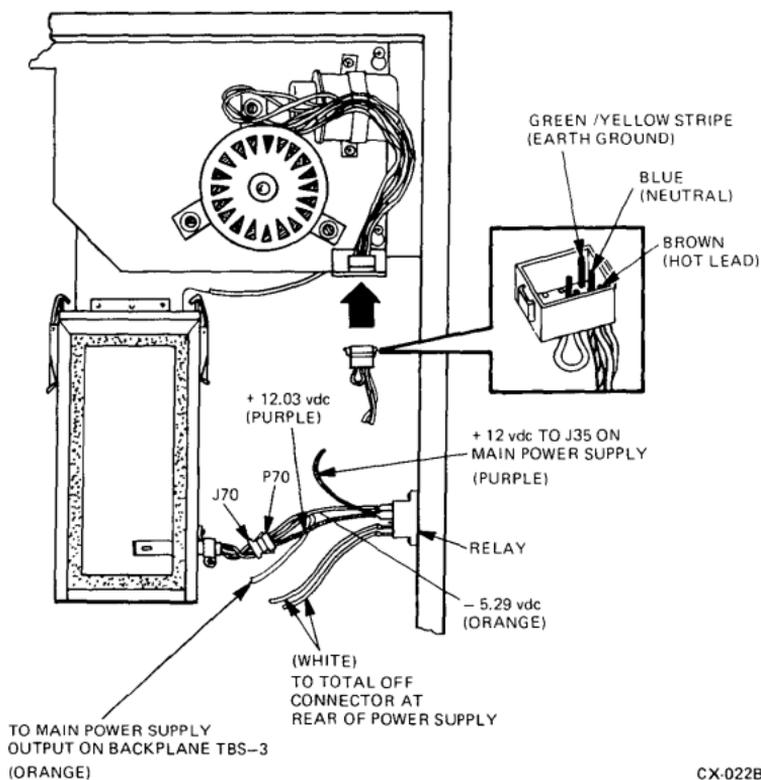
Figure E-3   Airflow Sensor Test Points
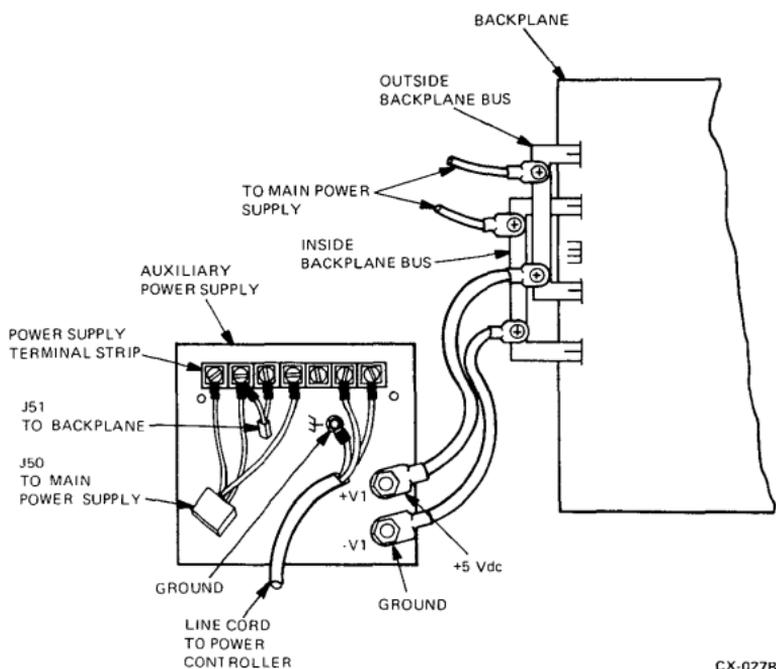
Figure E-4   Auxiliary Power Supply Test Points

F HSC50 REVISION MATRIX CHART

F.1 INTRODUCTION

This chart shows the revision status of all applicable HSC50 FRUs. An A1 HSC50 must have all the FRUs at a particular revision level in order to be a supported device.

HSC50 REVISION NUMBER			A1	B1	B2	
FRU NAME	SLOT NO	ETCH REV.	MR/PR	MR/PR	MR/PR	
L0100	14	C	D1			
L0105	1	D	D1			
L0106-AH	2	C	C			
L0107-YA	12	C				
L0108-YA (HSC5X-BA)	4, 6, 7, 8, 9, 10	C	C2, C3, C4, C5		C6	
		D	C2, C3, C4		C5	
L0109	13	E	E1			
TU58-XA			OPTION REV F			
TU58-XB (54-13489)		E F	F1, F2, H, J, L			
OCP (54-15286)		B	B1			
BACKPLANE		E	E			
MAIN POWER SUPPLY (70-20033) 60 Hz = 01 50 Hz = 02			L			
AUXILIARY POWER SUPPLY (70-20184) 60 Hz = 01 50 Hz = 02			J			
POWER CNTRLR (70-19122) 60 Hz = 00 50 Hz = 01			B			
SYSTEM TAPE (BET492 * - **			V 100	V110 * = (C-DE)		
DIAG TAPE (BET493 * - **			V01-01	V110 * = (C-DE)		
TAPE KIT (00-ZD300-CG)			V 100	V 100		

* MR/PR = MODULE REVISION OR PART REVISION.

NOTE. THE 50 Hz VERSION OF THE HSC50 IS AVAILABLE STARTING
    WITH REVISION B1. BOTH THE HSC50 - AA (60 Hz) AND
    HSC50 - AB (50 Hz) ARE AT REVISION B1.

CX-242A

Figure F-1   HSC50 Revision Matrix Chart

G INLINE DIAGNOSTICS

G.1 ILDISK

ILDISK is known by the name IDDD on the older revision tapes such as V100. ILDISK (IDDD) tests any disk drive connected to the HSC50. ILDISK (IDDD) runs concurrently with other HSC50 software processes using disk functional code subroutines to test disk drives. The SDI interface and the drive read/write electronics are tested in addition to the execution of the drive diagnostics.

ILDISK can be used to diagnose and isolate drive failures to a field replaceable unit (FRU). This FRU may be the disk data channel module connected to the drive, the SDI cable, or the drive itself.

G.1.1 Starting The Diagnostic

Perform the following steps to initiate ILDISK:

1. Type ∧Y (control Y). The HSC50 will respond with an HSC50 > prompt.

2. Type RUN ILDISK. ILDISK now prompts the user for parameters necessary.

When ILDISK completes all tests requested and has reported any errors found, it concludes with the following message:

ILDISK >D> EXECUTION COMPLETE

G.1.2 Test Summaries

- **Test 0** fetches the parameters to execute the diagnostic.

- **Test 1** commands the disk data channel to execute the partial SDI microdiagnostic and the SERDES/RSGEN microdiagnostic. If the microcode is not at the proper revision, the microdiagnostics are not executed.

- **Test 2** issues a GET LINE STATUS command to the disk data channel module resulting in a check of the drive's real-time status.

- **Test 3** issues a DRIVE INITIALIZE command to the disk data channel module. The drive and the controller real-time state line on the SDI bus is checked.

- **Test 4** issues a frame to the drive and waits for the drive to echo the frame back to the controller. The integrity of the WRITE/CMD DATA and the READ/RES DATA lines of the SDI bus is checked.

- **Test 5** directs the drive to run internal microdiagnostics.

- **Test 6** sends a DISCONNECT command to the drive and issues a GET LINE STATUS command to the diak data channel. The drive will be in the AVAILABLE state with RECEIVER READY and ATTENTION set and READ/WRITE READY not set.

- **Test 7** issues a GET STATUS command to the drive to check if any error bits are set. Any error found is reported and a DRIVE CLEAR is issued clearing the error conditions. Errors that do not clear are reported.

- **Test 8** issues a GET LINE STATUS command to the drive checking for the AVAILABLE state. A DRIVE INITIALIZE command is then issued.

- **Test 9** issues an ONLINE command to the drive followed by a GET LINE STATUS command checking for the ONLINE state.

- **Test 10** issues a RECALIBRATE command to the drive. Then a SEEK command is issued while checking the drive's real-time status for the absence of an ATTENTION condition.

- **Test 11** is identical to Test 6.

- **Test 12** brings the drive to the ONLINE state. If successful, the diagnostic continues with Test 13. if not, the diagnostic goes to Test 17 (Termination).

- **Test 13** ensures that all Read/Write heads in the drive can seek and properly locate a sector on each track. It also attempts to read data on at least one sector on every track of the DBN space. The next step is to seek to the LBN space and read the LBN.

- **Test 14** formats a disk in 576-byte mode.

- **Test 15** formats a disk in 512-byte mode.

- **Test 16** ensures the drive can successfully write a pattern and read it back from at least one sector on every track in the Read/Write DBN area.

- **Test 17** terminates the diagnostic.

G.1.3 Error Messages

- **Error 01** indicates the HSC50 diagnostic interface could not be initialized.

- **Error 02** indicates response to the unit number prompt was not correct.

- **Error 03** indicates the selected disk drive is not available.

- **Error 04** indicates an unknown status code resulted when a call was made to the diagnostic interface.

- **Error 05** indicates the disk drive is unknown to the HSC50 functional software.

- **Error 06** indicates the requestor number or port number given was not in the proper range.

- **Error 07** indicates the requestor specified was not a disk data channel.

- **Error 08** indicates the requestor or port specified contains a known drive to the HSC50 functional software.

- **Error 09** indicates the drive cannot be brought online.

- **Error 10** indicates the disk data channel under test is of the wrong microcode revision level and cannot execute the microdiagnostic.

- **Error 11** indicates the CHANGE MODE command failed.

- **Error 12** indicates the DRIVE DISABLED status bit was set upon issuing a GET STATUS command.

- **Error 13** indicates a failure occurred during the SDI verification test.

- **Error 14** indicates the write operation failed when executing a write to a sector of the DBN space.

- **Error 15** indicates the drive is online without the Read/Write Ready bit set.

- **Error 16** indicates the diagnostic could not release the drive from testing.

- **Error 17** indicates the SDI verification test could not be executed due to insufficient control memory space.

- **Error 18** indicates the selected data channel module did not complete its microdiagnostic within the allotted time.

- **Error 19** indicates the selected data channel module completed its microdiagnostic with a failure.

- **Error 20** indicates the selected data channel module completed its microdiagnostic without an error message but did not return the dialog control block (DCB) to the P.ioc.

- **Error 21** indicates the selected data channel module completed its microdiagnostic without an error message. The returned DCB however, reported an error.

- **Error 22** indicates the selected data channel module completed its microdiagnostic without an error message. The returned DCB also did not contain an error message, but an unexpected condition was indicated in the drive service queue.

- **Error 23** indicates the drive failed to re-acquire after releasing. The drive must be released to allow the drive to leave the online state. The drive must then be re-acquired to provide for diagnostic looping.

- **Error 24** indicates the status returned from a GET LINE STATUS command contained no state clock to the data channel.

- **Error 25** indicates a failure occurred when attempting a disk data read or write operation.

- **Error 26** indicates the state clock did not momentarily stop following a SDI INITIALIZE command to the drive.

- **Error 27** indicates the state clock stopped following a SDI INITIALIZE command but did not start back up.

- **Error 28** indicates the diagnostic was notified there is no longer any I/O operation in progress while waiting for a disk read or write operation to complete.

- **Error 29** indicates the SDI ECHO command to the drive completed but the wrong response was returned by the drive.

- **Error 30** indicates the drive spontaneously went offline.

- **Error 31** indicates the diagnostic cannot find the drive control area after acquiring the drive.
- **Error 32** indicates the diagnostic cannot find the requestor control area.
- **Error 33** indicates the diagnostic cannot read any sector on any track.
- **Error 34** indicates a drive diagnostic detected an error, but the error is not serious enough to remove the drive from service.
- **Error 35** indicates a drive diagnostic detected an error serious enough to remove the drive from service.
- **Error 36** indicates the drive returned an error bit in the SDI GET STATUS command while under test.
- **Error 37** indicates a SEEK command was issued to the drive and that the seek completed with an unexpected attention condition.
- **Error 38** indicates the drive did not return an available status during a GET LINE STATUS command.
- **Error 39** indicates the drive did not return an attention status during a GET LINE STATUS command.
- **Error 40** indicates the drive did not return the receiver ready status during a GET LINE STATUS command.
- **Error 41** indicates the drive returned both available and Read/Write Ready status during a GET LINE STATUS command.
- **Error 42** indicates the drive returned an available status when an ONLINE command was issued.
- **Error 43** indicates the drive returned an attention status when an ONLINE command was issued.
- **Error 44** indicates a DRIVE CLEAR command failed to clear the drive error bits noted in the Get Status response.
- **Error 45** indicates the diagnostic could not read the drive LBN properly.
- **Error 46** indicates the upper byte of the framing code of an SDI ECHO command response is wrong.

- **Error 47** indicates the disk data channel module under test has microcode not at the proper level. As a result, the SDI ECHO command could not be executed.

G.2   ILTAPE

ILTAPE tests a specific tape formatter dedicated to the test. The diagnostic consists of initiating all formatter-resident diagnostics and executing a series of I/O operations on the transport(s) (positioning, reads, and writes) connected to this formatter. This diagnostic provides 80% fault isolation between the formatter, the STI interconnect, and the transport. The error detection capabilities within the drive are strictly limited by the self-test diagnostics contained within the transport. ILTAPE will become available as an inline diagnostic at a later date.

G.3   ILTCOM

ILTCOM is an inline tape compatibility test. It will become available on a later version system tape.

G.4   ILEXER

ILEXER exercises up to ten disk or tape drives simultaneously. The exercise contains random drive sequences, data patterns, and operation sequences. Operations and errors are counted for statistical reporting. Full subsystem error handling and correcting features are employed. This exerciser does not provide for fault isolation. This test is known as OMDEXR on the older revision tapes and may only be initiated by user request (demand initiation).

G.4.1   Starting The Diagnostic

Perform the following steps to initiate ILEXER:

1. Type ∧Y (control Y). The HSC50 will respond with an HSC50 > prompt.

2. Type **RUN ILEXER** (or OMDEXR).

   The system loads the program from the TU58 tape system. This takes approximately one minute to complete. While the load is in progress, the HSC50 does not respond to control Y. When the program is successfully loaded, the following message is displayed:

   ILEXER>D>EXECUTION STARTING

   ILEXER now prompts for the parameters necessary. A description of the parameters is found in Chapter Four in the *HSC50 Service Manual*.

3. After all prompts have been answered, the execution of the diagnostic proceeds. Error reports and performance summaries are returned from ILEXER.

4. When ILEXER completes all requested tests and reports a final performance summary, the following message is displayed:

   ILEXER>D>EXECUTION COMPLETE

G.5   ILTU58

ILTU58 tests any TU58 drive attached to the HSC50. This test runs concurrently with other HSC50 control program processes and uses the services of HSC50 control program and the diagnostic execution monitor (DEMON). This test can be initiated by an operator using the local terminal with just the system tape installed.

ILTU58 performs only minimal testing because the HSC50 control program tests the TU58 each time it is used. Several writes and reads are performed to test the internal data paths and Read/Write electronics of the TU58. It is not necessary to use a scratch tape when running this test.

ILTU58 tests only the TU58 and the serial data path between the I/O control processor and the TU58. All other system hardware is assumed to be working.

G.5.1 Starting The Diagnostic
Perform the following steps to initiate ILTU58:

- Type $\wedge Y$ (control Y) to get the attention of the HSC50 control program keyboard monitor. The prompt HSC50> is displayed.

- Type RUN ILTU58<CR> initiating the inline TU58 diagnostic.

G.5.2 Test Summaries

- **Test 001** initiates the TU58 controller self-test.

- **Test 002** verifies data can be written to the tape and read back correctly.

G.5.3 Error Message Codes

- **Error 000** indicates a read or write operation failed on the first attempt but succeeded on one of the subsequent retries.

- **Error 001** indicates the TU58 did not reply to the control program TU58 driver aborting the operation.

- **Error 002** indicates the cartridge mounted in the TU58 is write protected when a write operation was attempted.

- **Error 003** indicates there is no cartridge mounted in the drive being tested.

- **Error 004** indicates the control program detected a hard error in the TU58 controller module.

- **Error 005** indicates the TU58 detected a request to read a record on the tape outside the range of legal block numbers.

- **Error 006** indicates the TU58 detected an illegal opcode in the radial serial protocol packet.

- **Error 007** indicates the TU58 has not detected an interrecord mark 400 milliseconds following the start of tape motion.

- **Error 008** indicates the TU58 attempted to find a tape record and failed all the retries.

- **Error 009** indicates the TU58 detected an illegal unit number in the radial serial protocol packet.

- **Error 010** indicates the TU58 failed self-test.

- **Error 011** indicates the TU58 detected the end of the tape while performing a read or write operation.

- **Error 013** indicates the diagnostic received a status code unknown from the TU58.

- **Error 014** indicates the data read from the tape does not agree with the data written.

- **Error 015** indicates the user specified an illegal device name when inputting the parameters for this diagnostic.

G.6 CI RESPONDER DIAGNOSTIC (RS)

CI Responder simulates traffic on the CI bus. There are no user input prompts or any error messages from the test directly sent to the user. This program only responds to commands from the CI NODE TESTER (CINT) or CI EXERCISER (CIE). CINT and CIE are based in a host CPU. Once the diagnostic is loaded, it simply responds to its counterparts on the CI cluster (i.e., CINT and CIE).

Normally HSC50s running V110 firmware (or higher) are shipped with the responder ready to load and execute automatically. Perform the following:

1. Type ∧**Y** (control Y). The HSC50 responds with an **HSC50>** prompt.

2. Type **SHOW LOAD**. The system loads the SETSHOW program from the TU58 tape system taking approximately one minute to complete. While the load is in progress, the HSC50 does not respond to control Y. When the program is loaded, the diagnostic flags and intervals are displayed among the HSC50 system data. The CI Responder is enabled if the following line appears:

CI RESPONDER

If the CI Responder is not loaded, the user may load it by performing the following:

- Type ∧Y (control Y). The HSC50 responds with an **HSC50>** prompt.
- Type **SET LOAD RS**. The SETSHOW program insists that the HSC50 be rebooted for this command to take effect.
- Answer **Y** to the following prompt:

REBOOTING HSC; Y TO CONTINUE, ∧Y TO ABORT:

A Y causes the HSC50 to reboot and load the CI Responder.

G.7 INLINE MEMORY DIAGNOSTIC

Inline memory tests data buffers previously producing parity errors while being used by the HSC50 control program. Failing buffers are placed in a queue, and the inline memory diagnostic is initiated automatically. The diagnostic checks to see if the same buffer was previously tested. If so, the buffer is sent to a queue of bad buffers and is retired from service. If not previously tested, the buffer is tested. If the test passes, the buffer is put back in service for further use by the control program. If the buffer fails, it is sent to a queue of bad buffers and is retired from service. This diagnostic is typically run only in an automatic mode by the HSC50 software.

G.7.1 Error Message Codes

- **Error 000** indicates a buffer failed twice during use by the control program but passed this diagnostic twice. This indicates an intermittent problem.

- **Error 001** indicates a buffer failed during use by the control program but passed this diagnostic once and was sent to the free buffer queue.

- **Error 002** indicates a parity error was detected during the testing of a buffer and the buffer is sent to the disabled buffer queue.

- **Error 003** indicates the wrong data was read while testing a buffer and the buffer is sent to the disabled buffer queue.

- **Error 004** indicates a nonexistent memory (NXM) trap occurred when accessing buffers for Read/Write tests.

H OFFLINE DIAGNOSTICS

H.1 INTRODUCTION

This appendix describes the offline diagnostic selection for the HSC50. Offline diagnostics are found on the Offline Diagnostic Tape.

H.2 TEST MEM

TEST MEM exercises the control, data, or program memory by operator selection. Three memory testing algorithms are used: the quick verify algorithm, the moving inversions algorithm, and the walking ones algorithm. The algorithms are designed to stress the memories in an effort to detect transient errors caused by bus and memory timing problems. Errors are reported on the local terminal as they occur. After reporting a data error, testing continues. After reporting a parity or nonexistent memory (NXM) error, testing is restarted from the beginning.

H.2.1 Starting The Diagnostic

After receiving the **ODL>** prompt, type in **T ME** or **TEST MEMORY** . When the diagnostic starts, the following report is displayed:

HSC50 OFL MEMORY TEST

H.2.2 Error Message Codes

- **Error 000** through **Error 010** indicate the tested memory location did not contain the expected data. The only difference between these errors is the exact step in the testing algorithm where they are detected.

- **Error 011** indicates a parity trap occurred in the testing.

- **Error 012** indicates a NXM trap occurred during the testing.

H.3   TEST MEM BY K

TEST MEM BY K uses one of the data channel requestors or the port processor requestor to test the data or control memory. This diagnostic runs faster than the offline memory diagnostic. Program memory cannot be tested using this test since the requestors do not have an interface to the program memory bus.

The test algorithm used is designed to stress the memories in an effort to detect transient errors caused by bus and memory timing problems. Errors are reported on the console terminal as they occur.

H.3.1   Starting The Diagnostic

After receiving the ODL> prompt, type in T ME B K or TEST MEMORY BY K or TEST MEM BY K. When the test starts, the following report is displayed:

HSC50 OFL K/P MEMORY TEST

H.3.2   Test Summaries

- **Test 000** detects data and addressing problems in the K control area by use of the moving inversions algorithm. The K control area is used to pass memory test parameters to the requestor (K) and to return the results of the memory tests to the P.ioc.

- **Test 001** detects data and addressing problems in the requestor microcode by using the moving inversions algorithm.

H.3.3   Error Message Codes

- **Error 000** through **Error 007** are control memory errors detected by the P.ioc. The differences between these errors is the step in the memory test where they failed.

- **Error 008** indicates the requestor did not initialize properly.
- **Error 009** indicates a control or data memory error was detected by the requestor.
- **Error 010** indicates a parity trap occurred during the testing.
- **Error 011** indicates a NXM trap occurred during the testing.
- **Error 012** indicates no working control memory could be found for this test.

H.4   TEST K

TEST K executes from the I/O control processor and uses the HSC50 K control area to instruct one of the subsystem modules to test itself. The operator selects the module to be used and the number of the microdiagnostic test to be executed (Tables H-1, H-2, H-3). Errors are reported on the console terminal as they occur.

H.4.1   Starting The Diagnostic

After receiving the **ODL**> prompt, type in **T K** or **TEST K** to start the test. When the test starts, the following report is displayed:

HSC50 OFL K TEST SELECTOR

H.4.2   Test Summaries

- **Test 000** checks the K control area is used to pass memory test parameters to the requestor (K) and to return the results of the memory tests to the P.ioc. This test is used to detect data and addressing problems.

- **Test 001** through **Test 011** call upon each requestor to run its own set of tests for its microprocessor. Tables H-1 through H-3 list the test names for the different K types.

Table H-1   K.CI Microdiagnostics

Test Number	Name
000	Sequencer test
001	ALU test
002	Data bus test
003	Control bus test
004	PROM parity test
005	Memory test (not available on demand)
006	RAM test
007	PLI interface test
010	Packet buffer test
011	Link test

Table H-2   K.SDI Microdiagnostics

Test Number	Name
000	Sequencer test
001	ALU test
002	Data bus test
003	Control bus test
004	PROM parity test
005	Memory test (not available on demand)
006	RAM test
007	SERDES/RSGEN test
010	Partial SDI interface test

Table H-3   K.STI Microdiagnostics

Test Number	Name
000	Sequencer test
001	ALU test
002	Data bus test
003.	Control bus test
004	PROM parity test
005	Memory test (not available on demand)
006	RAM test
007	SERDES test
010	Partial STI interface test

H.4.3   Error Message Codes

- **Error 000** through **Error 007** indicate control memory errors detected by the P.ioc. The difference between these errors is the exact step in the memory test where the error occurred.

- **Error 008** indicates the selected requestor (K) did not complete its initialization sequence properly.

- **Error 009** indicates the selected requestor (K) failed its microdiagnostic. The contents of the K status register are displayed with the error report. Refer to the following paragraphs for information on the test that failed. Also refer to Appendix B for a definition of the module status codes.

- **Error 010** indicates the P.ioc detected a parity trap. The 22-bit address of the location causing the trap is displayed as **MA** data in the error report.

- **Error 011** indicates a NXM trap. The NXM error is caused when no memory responds to a particular address. The MA data in the error report indicates the address producing the NXM trap.

- **Error 012** indicates no working control memory could be found for a K control area. The control memory must be repaired before the K Test Selector can be used to test a K. The Offline Test Memory command is used to test the control memory.

H.5   TEST BUS

The HSC50 Offline Bus Interaction test (TEST BUS) is an HSC50 system exerciser designed to simulate intermittent faults that may not be detected by the other offline tests. The bus interaction test creates control and data bus contention among the requestors in the HSC50. The contention is generated by simultaneously testing different portions of the same memory from different requestors. In the process of testing the memories, the various requestors in the subsystem contend with each other for the use of the control and data memory.

While the requestors are generating bus contention, the I/O control processor is exercising the OCP, TU58, and all three HSC50 memories.

This test requires a minimum of two working requestors in order to operate, and uses a maximum of seven requestors if they are available. The more requestors available for use, the greater the amount of bus contention. The run time of this test increases linearly as the number of requestors is increased. A larger number of requestors make it easier to isolate problems to a particular source. Errors are reported on the local terminal as they occur.

H.5.1   Starting The Diagnostic

After receiving the **ODL>** prompt, type in **T B** or **TEST BUS** to start the diagnostic. When the test starts, the following report is displayed:

HSC50 OFL BUS INTERACTION TEST

H.5.2   Test Summaries

The test numbers displayed in error reports fall into the following categories:

- **Test 010** through **Test 017** are control bus contention tests.

- **Test 020** through **Test 027** are data bus contention tests.

- **Test 030** through **Test 037** are combined control and data bus contention tests.

In addition to the numbered tests, the P.ioc may be directed to perform vatious interaction tests while the requestors are generating bus contention. The following is a list of these tests:

- P.ioc program memory interaction test
- P.ioc control memory interaction test
- P.ioc data memory interaction test
- P.ioc OCP interaction test
- P.ioc TU58 interaction test

H.5.3   Error Message Codes

- **Error 000** indicates one of the requestors detected a control or data memory error.

- **Error 001** indicates one of the requestors failed to complete its initialization sequence in the time allowed. This error usually means one or more microdiagnostic has failed.

- **Error 002** indicates the requestor under test has failed to complete its memory test within the expected time.

- **Error 003** indicates a parity error was detected by the P.ioc. The error report displays the 22-bit address of the error location.

- **Error 004** indicates a NXM trap error has been detected by the P.ioc.

- **Error 005** indicates an error was detected by the P.ioc while testing program memory.

- **Error 006** indicates the TU58 failed to synchronize with the P.ioc.

- **Error 007** indicates the P.ioc UART detected either a framing error or a parity error.

- **Error 008** indicates the P.ioc detected a command or data packet checksum error from the TU58.

- **Error 009** indicates the TU58 detected an error in the command packet. The third line of the error report describes the type of error.

H.6   TEST OCP

TEST OCP checks the operation of the HSC50 lamps and switches including the five OCP lamps and switches, the State LED, the Secure/Enable switch and ENABLE LED.

H.6.1   Starting The Diagnostic

After receiving the ODL> prompt, type in **T O** or **TEST OCP** to start the test. When the test starts, the following report is displayed:

HSC50 OFL OPERATOR CONTROL PANEL TEST

H.6.2   Test Summaries

- **Test 000** uses the operator to check the enable and state LEDs for proper operation.

- **Test 001** uses the operator to check the operation of the OCP indicators by pushing the Fault indicator.
- **Test 002** checks for all indicators to be in the off state.
- **Test 003** checks for proper operation of the Fault indicator/switch.
- **Test 004** checks for proper operation of the Online indicator/switch.
- **Test 005** checks for proper operation of the first blank indicator/switch.
- **Test 006** checks for proper operation of the second blank indicator/switch.
- **Test 007** checks for proper operation of the Secure/Enable switch and indicator.
- **Test 008** ensures the Init switch does not operate when the Secure/Enable switch is in the secure mode.
- **Test 009** ensures the auxiliary terminal Break key has no effect while the Secure/Enable switch is in the secure mode.

H.6.3   Error Message Codes

- **Error 000** indicates the test detected the wrong switch bit set in the P.ioc switch/display register.
- **Error 001** indicates the operator pressed the Init switch causing a bit to set in the P.ioc switch/display register or some switch other than the Init was pressed.

H.7   TEST REFRESH

TEST REFRESH finds memory problems related to refresh capabilities. Patterns are written to memory and checked after waiting one minute. Three separate patterns are used to test each memory bit (including parity bits) in both the one and zero states. The three HSC50 memories are tested although only the program and control memories require refreshing. Tests of data memory are included because some static RAM failures resemble refresh problems.

The refresh test can find problems in the memories that are not detected by the normal memory tests. The refresh test is not intended to be run on memories which fail the normal memory tests. Each pass of the refresh test requires three minutes.

H.7.1   Starting The Diagnostic

After receiving the ODL> prompt, type in T R or TEST REFRESH to start the test. When the test starts, the following report is displayed:

HSC50 OFL MEMORY REFRESH TEST

H.7.2   Test Summaries

- **Test 001** fills the memories with an all ones data pattern and then reads each location for the pattern.

- **Test 002** fills the memories with an all zeroes data pattern and then reads each location for the pattern.

- **Test 003** fills the memories with an 100001 data pattern and then reads each location for the pattern.

H.7.3   Error Message Codes

- **Error 001** indicates a parity error was detected by the test.

- **Error 002** indicates a data compare error.

- **Error 003** indicates a parity error deteted by the P.ioc.

- **Error 004** indicates a NXM trap detected by the P.ioc.

I UTILITY PROGRAMS

I.1 FORMAT

This program reformats the specified disk unit destroying all previously written files. The disk to be reformatted must be dedicated to this program and the disk files backed up on another media before using. The format program replaces all bad sectors found. Version V.100 software requires a password in order to format the user data area. Without the password only the DBN space is formatted. This is not required in version V110.

I.2 VERIFY

This program is used to verify the integrity of the disk following the reformatting of a disk. All discrepancies and bad blocks are reported. Information on revectoring and bad block replacements is printed in a summary.

I.3 TPATCH

This utility allows the patching of the programs found on the TU58 tapes. Each software patch released will be accompanied by step-by-step directions.

I.4 TUCOPY

This program allows TU58 tapes to be duplicated. At least one backup tape of each kind should be on hand at all times.

I.5 SET/SHOW

This program allows the modification or display of any subsystem parameter. The following are the valid SET/SHOW utility commands:

- **SET (desired parameter)** allows parameter to be changed.

- **SHOW (desired parameter)** allows parameter to be displayed.

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- **HELP SET** displays all of the valid SET commands.
- **HELP SHOW** displays all of the valid SHOW commands.
- **HELP** displays all of the valid SET or SHOW commands.
- **Control Z (∧Z)** takes default values for as many consecutive optional parameters as possible; then prompts for non-defaultable parameters (if any).
- **EXIT** exits the SET/SHOW process after updating the system configuration table (SCT) on the TU58, if necessary. The command issues the following prompt if the changes made warrant a reboot of the system:

  REBOOTING HSC; Y TO CONTINUE, ∧Y TO ABORT:

- **Control C (∧C) or Control Y (∧Y)** exits the SET-SHO utility without any changes being made to the HSC50 system configuration table.

I.5.1   SET Command List And Options
The following list shows the names and abbreviations for all of the Set/Show commands. Detailed descriptions of these commands are found in the *HSC50 User Guide* and Appendix C in the *HSC50 Service Manual*.

- Set Allocate__Disk nnn **(SET ALL DIS n)**
- Set Allocate__Tape nnn **(SET ALL TAP n)**
- Set Automatic__Diagnostics Enable **(SET AUT ENA)**
- Set Automatic__Diagnostics Disable **(SET AUT DIS)**
- Set CI nn **(SET CI nn)**
- Set CI All **(SET CI ALL)**

- Set Control__Blocks nnn **(SET CON nnn)**
- Set Date and Time **(SET DA nn-nnn-nnnn:n:nn:nn)**
- Set Dump Co **(SET DUM nn)**
- Set Nodump Co **(SET NODUM nn)**
- Set Dump TU58 **(SET DUM TU58)**
- Set NoDump TU58 **(SET NODUM TU58)**
- Set Disk Dnnn Host__Access **(SET Dnnn HOS)**
- Set Disk Dnnn Nohost__Access **(SET Dnnn NOHOS)**
- Set Error error-level **(SET ERR nnnnnnn)**
- Set Error error-level/PER **(SET ERR nnnnnnn/PER)**

    - **Error Level Definitions**

        1. **SUCCESS** displays all messages.
        2. **INFO** displays informational, warning, and fatal messages.
        3. **WARNING** displays warning, error, and fatal messages.
        4. **ERROR** displays error and fatal messages.
        5. **FATAL** displays fatal messages.

- Set Host Enable nnn **(SET HOS ENA nnn)**
- Set Host Disable nnn **(SET HOS DIS nnn)**
- Set Host Enable/ALL **(SET HOS ENA/ALL)**
- Set Host Disable/ALL **(SET HOS DIS/ALL)**
- Set ID__%Xnnnnnnn **(SET ID__%Xnnnnnnn)**
- Set Load module option **(SET LOA nnnn)**
- Set Noload module option **(SET NOLOA nnnn)**

- Module Option Definitions

  1. **CI** – CI manager or CI emulator
  2. **DF** – Disk functional code and DFECC
  3. **DM** – DEMON
  4. **EL** – Central error logging
  5. **MR** – Mirror
  6. **TF** – Tape functional code
  7. **RS** – CI responder

- Set Max__Formatter nnn **(SET MAX__F nnn)**
- Set Max__Tape nnn **(SET MAX__T nnn)**
- Set Memory Enable/All **(SET MEM ENABLE/ALL)**
- Set Memory Enable address-id **(SET MEM ENA nnn)**
- Set Memory Disable address-id **(SET MEM DIS nnn)**
- Set Name nnnnnn **(SET NAM nnnnnn)**
- Set ODT nnnnnnn **(SET ODT nnnnnn)**
- Set NOODT nnnnnnn **(SET NOODT nnnnnn)**

  - ODT Parameters

    1. **ODT** allows ODT to be enabled in the HSC50.
    2. **NOODT** does not allow ODT to be enabled.
    3. **ODT INI** enables ODT to be entered during HSC50 initialization.
    4. **NOODT INI** does not allow ODT to be entered during HSC50 initialization.

5. **ODT DUMP** enables ODT to be entered after an exception dump.

6. **NOODT DUMP** does not allow ODT to be entered after an exception dump.

- Set Periodic__Diagnostics nn **(SET PER nn)**
- Set Noperiodic__Diagnostics nn **(SET NOPER nn)**
- Set Requestor nn Enable **(SET REQ nn ENA)**
- Set Requestor nn Disable **(SET REQ nn DIS)**
- Set Restart Warm **(SET RES WAR)**
- Set Restart Cold **(SET RES COL)**
- Set Restart Clear **(SET RES CLE)**
- Set Scope ASCII-ID **(SET nnn)**
- Set Scope ASCII-ID/Per **(SET nnn/PER)**

  - **Scope Options**

    1. **SET SCO** sets the serial line for a video terminal.

    2. **SET NOSCO** sets the serial line for a hardcopy terminal.

    3. **SET SCOPE/PER** sets the serial line for a video terminal whenever the HSC50 is initialized.

    4. **SET NOSCOPE/PER** sets the serial line for a hardcopy terminal whenever the HSC50 is initialized.

- Set SCT Clear **(SET SCT CLE)**
- Set Sector__Size 512 **(SET SEC 512)**
- Set Sector__576 **(SET SEC 576)**

- Set Short__Lifetime__Control__Blocks nnnn **(SET SH nnnn)**
- Set WCS nnn **(SET WCS nnn)**

I.5.2 SHOW Command List And Options

The following list shows the HSC50 SHOW commands and their abbreviations. Detailed information about these commands can be found in the *HSC50 User Guide* or Appendix C of the *HSC50 Service Manual*.

- Show All **(SHO ALL)**

    - Exceptions to All command

        1. Show Exception
        2. Show Disk-id

- Show CI **(SHO CI)**
- Show Control__Blocks **(SHO CON)**
- Show Disks **(SHO DIS)**
- Show Disk-id **(SHO Dnnn)**
- Show Error **(SHO ERR)**

    - **Error Messages**

        1. **SUCCESS** displays all messages.
        2. **INFO** displays informational, warning, error, and fatal error messages.
        3. **WARNING** displays warning, error, and fatal error messages.
        4. **ERROR** displays error and fatal error messages.
        5. **FATAL** displays fatal messages.

- Show Exception **(SHO EXC)**
- Show Hosts **(SHO HOS)**
- Show Lines **(SHO LIN)**
- Show Load **(SHO LOA)**
- Show Memory **(SHO MEM)**
- Show Max__Formatter **(SHO MAX__F)**
- Show Max__Tape **(SHO MAX__T)**
- Show ODT **(SHO ODT)**
- Show Pool **(SHO POO)**
- Show Requestors **(SHO REQ)**
- Show System **(SHO SYS)**

  - **System Parameters Shown**

    1. Date
    2. Uptime
    3. System version number
    4. System id
    5. System name
    6. Restart setting
    7. Sector size
    8. Front panel key status
    9. Diagnostic flags and intervals
    10. Settings of the automatic core dump flags

- Show Tapes **(SHO T)**
- Show Tape__ID **(SHO T nnn)**
- Show Virtual__Circuits **(SHO VIR)**

READER'S COMMENTS

HSC50 Maintenance Guide
AA-P672A-TK

This Pocket Service Guide is intended for *Field Service Technicians*. Your comments and suggestions will help us in our continuous effort to improve its quality and usefulness.

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