

Chapter 1

Power-On Testing

POWER-ON TESTING

INTRODUCTION

The first diagnostics level is basic system testing. This testing initiates when the control unit power is turned on. This chapter describes all of the power-on tests that are executed when the control unit is switched on.

Several methods of diagnostic monitoring are available. At the customer site any coax terminal or an ASCII terminal connected directly to the maintenance port can be used. For remote monitoring, a modem may be attached to the maintenance port and testing can be performed from an offsite ASCII terminal.

Basic 1374 module and interface functions are verified by EPROM-resident tests during power-on and system reset (IML). This initialization testing is the first level in the maintenance strategy to isolate faults to the module level.

TEST, SYNCHRONIZATION, AND PROGRAM LOAD - 0X, 4XR, AND 5XR

Power-on testing and initialization begins when the front power switch or IML switch is pressed. The main processor and the specialized processors in the option PCBs start testing their own functions at the same time. The normal test cycle is under six seconds. With additional memory installed in the processor, the test time will be significantly longer.

When the main processor completes testing and synchronization, the status of each specialized processor is read. If no errors are detected, the program load process from the diskette commences. Any failures during the test, synchronization, and load process cause an error code to appear continuously in the four LEDs on the 1374 front operator panel.

Specific error code descriptions and field replaceable unit (FRU) isolation for power-on test failures are listed later in this chapter.

FRONT PANEL DISPLAY CODES

The front panel 4-digit LED display may show four types of codes during testing, synchronization and disk loading. The first digit of the code indicates the type of failure:

- "P" messages are processor routine codes. If a code appears continuously, a test has failed.

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- "H" messages appear if channel adapter or other processor synchronization fails.
- "L" messages indicate the load process fails.
- "E" messages indicate system software failures that occur during testing or operation.
- A number (0-9) in the first digit indicates software faults.

If the first digit is P, H, L, or E, the second digit indicates in which slot the failing PCB is installed. The last two digits are a decimal code.

If a single digit, no digits, or an incomplete digit appears in the front panel, the processor has probably failed.

P MESSAGES

P messages indicate main processor power-on test routines. As each test routine is started, the test number briefly appears in the two right-hand digits. If all power-on tests complete successfully, the display is cleared (blank) and loading begins.

NOTE: Memory tests require significantly longer time to complete than other processor tests.

If a test fails, it is repeated until it passes. The LEDs indicate the number of the failing test. For example, if test routine 10 for the processor fails, Pn10 appears on the LEDs (where "n" indicates the slot number).

If a P message continuously appears, the processor has probably failed.

H MESSAGES

These messages indicate that the slave synchronization process failed, and are usually caused by the slave device attached to the processor. HnXX usually indicates a channel adapter (1L only) failure or a coax adapter failure.

L MESSAGES

These messages indicate an error during the software load process. The failure may be caused by the disk drive, by the drive circuitry on the processor, or by a missing or defective diskette.

E MESSAGES

These errors occur on unexpected interrupts or faults during testing or operation, and indicate either 1374 software or hardware problems. A software dump may be required. Contact your next level of support for assistance.

NUMERIC CODES

Most 1374 software faults which occur during testing or operation cause four decimal digits to appear in the front indicators. Software faults that are not associated with a specific numeric code cause an En01 message. A software fault usually requires a software dump analysis. Contact your next level of support for assistance.

**TEST, SYNCHRONIZATION, AND PROGRAM LOAD –
61R AND 7XR**

During power-on initialization, the controller runs tests residing in Processor EPROM to check the operation of the Coax Controller PCB logic. After the tests run successfully, routines verify basic coax interaction, and operational software is loaded from the diskette.

The testing sequence begins when the power-on switch on the front of the controller is switched on. The Status and Power indicators on the front panel light, then the Status indicator goes off as the tests run and then lights steadily when all tests are completed. If all tests pass, the power-on sequence executes within five seconds. The specific testing sequence is described in the following steps.

1. Power is turned on (Power and Status indicators light).
2. Chip selects are set and the processor circuitry is mapped into memory space.
3. EPROM processor checksum performed (Status indicator off).
4. Offset address written at each memory location (parity disabled).
5. Stack operation is verified.
6. Interval timer is tested.
7. DMA circuitry is checked.
8. Interrupts are tested.
9. Offset address is written at each memory location (parity enabled).
10. Initialize the serial maintenance port (Status indicator on).

The power-on tests are initiated only when the unit is turned on. To rerun the tests or re-initialize the control unit, reset the power switch – turn it off and then on.

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INITIALIZATION AND OPERATIONAL FAILURES

When a test fails, the Status indicator remains off. Most initialization failures are caused by the processing logic on the Coax Controller PCB. If the test eventually passes, the testing sequence continues. If a test does not pass, the Status indicator remains off.

After the tests have passed and normal operation commences, no other conditions cause the Status indicator to flash on and off. However, two types of internal faults cause the Status indicator to turn off and stay off: a memory parity error or a software fault. Following power-on testing, operational (or diagnostic) software from the diskette is loaded if the diskette is properly inserted (the label up on 4X, 5X, 61R, and 7X or to the left on 0X units).

EPROM CHECKSUM VERIFICATION

Before power-on testing begins, a checksum is performed on the diagnostic EPROM on the Coax Controller PCB. If this checksum fails, the Status indicator remains lit, but the rest of the power-on tests do not run. The control unit remains in a state where it appears Ready. If this condition exists, suspect a defective EPROM set on the Coax Controller PCB.

POWER-ON FUNCTIONAL TESTING

PROCESSOR (All Models)

Processor self-tests check the following microprocessor and support functions: DRAM memory, bus memory, timers and interrupts, bus time-out, stack push/pop and call, and DMA block move.

Power-on testing implicitly checks the utility interface. If tests complete and software loads from the diskette, the utility logic is operational. No specific utility tests are conducted during the power-on sequence.

ASYNCHRONOUS ADAPTER (0X, 4XR, and 5XR)

Asynchronous adapter internal self-tests check the following functions: 8530 serial controller, DRAM memory, timers and interrupts, bus time-out, stack push/pop and call, bus memory access, DMA block move, and serial port tests.

NOTE: The asynchronous adapter is the hardware portion of the optional Asynchronous Communications Support (ACS) feature.

COAX CONTROLLER (All Models)

The coax controller (coax adapter on 0X control units) tests its control processor registers, internal timer and stack push/pop functions. On-board DRAM and shared memory is also tested.

NOTE: The coax extender adapter has limited control logic and is not checked during power-on testing.

HIGH-SPEED CHANNEL ADAPTER (1L)

The high-speed channel adapter tests its control processor (2910A) registers, internal timer, bus arbitration, interrupts, and stack push/pop functions. On-board RAM and shared memory are also tested.

HOST SERIAL INTERFACE (All Models)

The host serial interface is not tested during power-on testing, but is tested by the processor. The 8530 transmitter/receiver operation is tested with loopback tests in both synchronous and asynchronous modes. The 8530 interrupts are also checked.

POWER-ON DIAGNOSTICS

Error codes for power-on tests and also for operational failures appear in the four LEDs on the operator's panel (0X, 4X, and 5X units). Offline diagnostic error codes appear on the screen of the diagnostic terminal.

The primary (1) and acondary (2) field replaceable unit (FRU) columns show the most likely defective component.

If replacement of the indicated component does not change the failure symptoms, one of the PCBs may be inhibiting signal flow. Try replacing the PCBs, one-by-one, to see if the problem can be resolved. If the cause of the failure cannot be resolved, contact your next level of support.

FRU Key

PROC = Processor PCB
CHAN = High-Speed Channel Adapter (Model 1L)
CA = Coax Adapter
DIST = Distribution PCB (0X series)

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POWER-ON DISPLAY CODES

These 4-digit error codes indicate failures during power-on testing, synchronization, and software loading. The "E" codes and numeric codes may also appear during operation if a system fault occurs.

NOTE: Numeric codes (without letters) in the LEDs indicate a software fault similar to En01. The same isolation procedures apply to both numeric and En01 codes.

If an error code appears that is not listed in the following table, a processor may be defective. Contact your next level of support for assistance.

Error Code	F 1	R 2	U	Description
Numeric codes				See E101 and E201
Pn00	PROC		-	Mapping RAM test failed
Pn20	PROC		-	No ready T/O NMI in FF register
Pn21	PROC		-	Timer 0 did not expire
Pn22	PROC		-	Timer 0 not cleared
Pn23	PROC		-	FF register not cleared
Pn30	PROC		-	First quick memory test failed
Pn31	PROC		-	DIB quick memory test failed
Pn40	PROC		-	Data not preserved through PUSH/POP
Pn41	PROC		-	Data not PUSHed to correct address
Pn42,43	PROC		-	POR not PUSHed correctly
Pn50,52	PROC		-	Block DMA operation did not take precedence over CPU bus cycles
Pn51	PROC		-	Data error on DMA transfer (word)
Pn52	PROC		-	Data error on DMA transfer (byte)
Pn60	PROC		-	Internal PIC/Timer Interrupt failed
Pn70	PROC		-	IPI did not occur
Pn71	PROC		-	FF register not cleared
Pn72	PROC		-	IPI via multibus failed
Pn80	PROC		-	Memory read/write failed
Pn81	PROC		-	DIB memory read/write failed
Pn90-96	PROC		-	Slave test failed
Pn97	PROC		-	FF register selftest bit not cleared
Pn99	PROC		-	Failed to synchronize with processor in slot n
Hn00	CA	HCA		Invalid DMA buffer from channel
Hn01	CA	HCA		Invalid controller type
Hn02	CA	HCA		Data not accepted by controller
Hn03	CA	HCA		Data not correct
Hn04	CA	HCA		Too many bytes sent by controller

n = Slot number of PCB being tested

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Error Code	F	R	U	Description
	1	2		
Hn05	CA	HCA		Control register 0 incorrect on FIFO
Hn06	CA	HCA		Cannot sync controller
Hn10	CA	HCA		Divide Error
Ln05*	PROC	DIST		Disk error (Door probably open, bad diskette, or not properly seated)
Ln06*	PROC	DIST		File not found
Ln07*	PROC	DIST		Bad Object File
Ln08*	PROC	DIST		Loader not found on disk
Ln09	PROC	-		Remote processor error
En00	PROC	-		Unexpected Interrupt
E101**	PROC	CA		Software has faulted
E201**	PROC	CHAN		Software has faulted
E102	PROC	-		Ready Time-out
E202	PROC	-		Ready Time-out
E103	PROC	-		Hardware Memory Error
E203	PROC	-		Hardware Memory Error

n = Slot number of PCB being tested

* Examine diskette or drive causes before replacing PCBs.

** Examine software causes before replacing hardware components. Some software faults may be resolved by re-IMLing. If not, complete dump routine to capture fault information. Contact your next level of support for assistance.

DUMP COMPLETION CODES

Another group of display codes may also appear in the LED display. These codes, prefixed with EE to identify them, are the "Dump Completion" codes, and are displayed to indicate the status of the dump operation, as described in the following table:

Code	Meaning
EE00	Dump successfully completed
EE01	No dump control table
EE02	Dump disk full
EE03	Not used
EE04	Error writing to disk
EE05	Unknown PROM ID
EE06	Bad CPU parameter area
EE07	NMI occurred during dump operation

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When an error occurs during a dump operation, the LED display alters between the Dump Completion code and the Fault code. This is provided to assist in troubleshooting dump completion problems. The control unit remains in this state until a space character is entered from the monitor terminal.

CHANNEL ADAPTER LEDES (1L Only)

The channel adapter has a ten-position switch and eight LED indicator for selecting and displaying channel status information. The LEDs are defined as CR1 (bottom) through CR8 (top). The switch settings and status information are shown next:

Switch	LED	Description
0, 4, 8	CR8	Select In
	CR7	Op In
	CR6	Address Out
	CR5	Address In
	CR4	Command Out
	CR3	Status In
	CR2	Service In
	CR1	Service Out
1, 5, 9	CR8	Op Out
	CR7	Suppress Out
	CR6	Request In
	CR5	Interface Enabled
	CR4	Data In
	CR3	Data Out
	CR2	Microinstruction parity error
	CR1	Microclock Enabled
2, 6	All	Bus In 0-7 (CR8-CR1)
3, 7	All	Bus Out 0-7 (CR8-CR1)