Chapter 3

Diagnostic Testing

DIAGNOSTIC TESTING

INTRODUCTION

This chapter describes offline diagnostics and how to use them for troubleshooting control unit hardware and software problems. Diagnostic troubleshooting procedures for isolating typical control unit failures are provided at the end of this chapter. The diagnostic tests and error codes for each control unit series are described in Chapters 4, 5, 6, 7 and 8.

Offline diagnostics provide for comprehensive control unit testing from an on-site display terminal. Any 3270 coax terminal attached to the control unit may be used as the diagnostic monitor, or an ASCII terminal may be connected to the maintenance port, either locally or remotely.

Use offline tests to troubleshoot intermittent or non-fatal errors that allow basic system operation and loading.

Error data from offline testing is saved for later examination on the diagnostic monitor screen. The following error information is available:

- Total number passes for each series of tests completed
- Total number of errors reported for each test
- Data for the first 10 errors for each test

TERMINAL OPERATION

Offline diagnostics may be monitored from an on-site or remote (via modem) ASCII terminal attached to the remote maintenance port. Use a standard modem cable to attach the terminal (either remote or local) to the maintenance port. Directly-attached coax display stations also support offline testing.

NOTE: Only one terminal (coax or ASCII) may access offline diagnostics at a time. Use the following procedures:

ASCII DISPLAY TERMINAL

Determine the baud rate of your terminal. Offline diagnostics supports 9600, 2400, 1200, and 300 baud. The default baud rate is 1200. Press the Break key once for 2400, twice for 9600, three times for 300, and four times to return to 1200 baud.

Once communication at the correct baud rate is established, the message "ENTER TERMINAL TYPE" appears. Enter the 3 to 5 character code for your terminal according to the list below:

- ADM, ADM3 – LS ADM3A Terminal
- ADM11 – LS ADM11 Terminal
- HAZ, HAZ2 – Hazeltine 1400 Series Terminal
- DUMB – Any other terminal (special cursor control commands are not used in this mode)
- ANSI – ANSI 3.64 Compatible Terminals (e.g., VT100)

Refer to the output command for procedures to switch control from an ASCII terminal to a coax display.

COAX DISPLAY TERMINAL

Press the Alt, Left Shift, and tilde (~) keys simultaneously on the coax keyboard. To switch control to another coax terminal, use the same key sequence on the new coax keyboard. The status information appears when a blank prompt line is entered.

Refer to the Output command for procedures to switch control from a coax display to an ASCII terminal.

SCREEN FORMAT

Two types of diagnostic screen outputs are available: an enhanced mode for all coax terminals and selected ASCII terminals (see list above), and a simplified mode for Dumb ASCII terminal selection.

ENHANCED MODE

The enhanced display for all coax and selected ASCII terminals provides test status and error information.

```
DIAGNOSTIC MONITOR V2.4              000:00:33

BOARD    PASS    LAST COMPLETE    LAST FAILURE    # FAILURES
PROC     00000          0                0            00000
COAXA    00000          0                0            00000
ASYNC    00000          0                0            00000
HOST1    00000          0                0            00000

(C)LEAR (D)ISPLAY (G)O (M)ONITOR (O)UTPUT (S)ELECT (B)OARD (R)EVEAL
===> S *
```

Figure 3-1. Offline Diagnostics Screen Example

NOTE: The PCBs indicated in the Board column will vary, depending on control unit model and optional PCBs installed in the control unit.

The top portion contains status information that is updated at the beginning of each test. Commands are entered at the ===> prompt under the status display. The lower screen displays error data.

The top line identifies the version level of the diagnostic monitor. To the right of the version level is a time indicator which displays elapsed time in the format hr:min:sec. This timer is started when the diagnostics are loaded. All error records are time-stamped at the time of failure using the format hr:min.

The next screen area is the status field which maintains a table for each board in the system. The column entries are updated as each test completes.

The first column (Board) identifies the board(s) that are installed in the control unit. Each board is designated by an abbreviation of the board function: PROC, COAXA, CHAN, ASYNC, TRA, TRGATE, HOST1, and HOST2.

The second column (Pass) indicates the current number of test series completed.

The third column (Last Complete) lists the number of the last completed test. The fourth column (Last Failure) contains the test number of the last test failure. A value of zero indicates no failures. The last column (# Failures) lists the number of total board test failures.

The line below the status information lists the seven commands. Each command is selected by typing its first letter after the prompt on the next line. The remaining screen area is used for error information as explained in the command descriptions.

Whenever a blank prompt line is entered (by pressing Enter or Return), the top screen area is repainted. This action is useful if you switch from one coax terminal to another coax terminal.

NOTE: The Last Complete column may not be accurate when the screen is repainted by entering a blank prompt line.

SIMPLIFIED MODE

When Dumb is selected as the ASCII terminal type, the enhanced screen format is not used – the only messages that display during testing are error messages. Test status is updated, but not displayed as tests execute. The command prompt and format and the display command output are the same.

DIAGNOSTIC COMMANDS

Eight commands provide configuration information, test control, error displays, and access to Monitor. Tests may be run in any order, and test sequences may be repeated any number of times. Error data for the first 10 errors of each test is available.

To execute a command, type the mnemonic (upper or lower case) and any parameters at the prompt and press Enter or Return.

Command	Mnemonic	Description
BOARD	B	Displays information about the installed PCBs
CLEAR	C	Clears error data, resets counters, and tests selections
DISPLAY	D	Displays error data
GO	G	Begins selected tests
MONITOR	M	Initiates Monitor mode
OUTPUT	O	Transfers output
SELECT	S	Selects test sequences
REVEAL	R	Displays test and error code descriptions for all boards

Table 3-1. Offline Diagnostics Commands

Any syntax errors cause an "Illegal Command" message to appear. Space delimiters are required. Numbers used for command inputs and displays are decimal except for the hexadecimal words in the error displays. If an error occurs (e.g., Illegal Command), press Return to clear the error message and continue.

In the following descriptions, required parameters are enclosed in { }s, while optional parameters are enclosed in [ ]s. These braces and brackets are not command characters.

(B)OARD COMMAND

The Board command displays additional miscellaneous information (e.g., memory size) about the PCBs that are installed in the control unit. Use this command to verify that the optional PCBs or FRUs are recognized by the software.

(C)LEAR COMMAND USAGE: C {BOARD} {*}, C {BOARD} {TEST NUMBER}, OR C *

The Clear command clears error data buffers and resets the test counters to zero. The upper display is updated to reflect this action. The Clear command also clears any test selections that may been previously selected.

The board name is the abbreviation of the board, such as HCA for High-Speed Channel Adapter. The test number may be optionally selected. C * clears all data and registers for all boards.

ERROR MESSAGES

"PLEASE USE THE FORMAT: C {BOARD} {TEST NUMBER}" – (The board name parameter was omitted.)

"INVALID BOARD" – (The board name is not valid.)

"ILLEGAL TEST NUMBER" – (The test number is out of range.)

Press Return to clear the error message.

EXAMPLES

C PROC * – Clears all test data for PROC tests

C * – Clears all test data for all printed wiring boards

C PROC 10 – Clears PROC test 10 data

(D)ISPLAY COMMAND USAGE: D {BOARD NAME} [TEST NUMBER]

The Display command displays error data. The board name is the assigned abbreviation. The optional test number field may be an individual test number or the asterisk (*) to display all tests.

If a test number or * is not specified, the display will contain a chronological log of the first 10 errors for the specified board. In addition to the total number of passes and failures for the board, the display describes failure number, test number, error code and time for each failure.

When * is used as the test number parameter, cumulative pass and failure data for each of the tests is listed in the bottom screen area.

If a test number is specified, the bottom screen displays data for the first 10 test failures. In addition to the total passes and failures, the screen lists the error code, error words, and time for each pass number.

For boards containing EPROMs, a version date code is displayed under the command line: BBBB EPROM VERSION YYDDD. BBBB is the board name and YYDDD indicates the year followed by the day (001-366) of the year (e.g., February 3, 1984 would be 84034).

```
DIAGNOSTIC MONITOR V2.4              000:00:33

BOARD    PASS    LAST COMPLETE    LAST FAILURE    # FAILURES
PROC     00000         0                0              00000
COAXA    00000         0                0              00000
ASYNC    00000         0                0              00000
HOST1    00000         0                0              00000

(C)LEAR (D)ISPLAY (G)O (M)ONITOR (O)UTPUT (S)ELECT (B)OARD (R)EVEAL
===> D PROC

TOTAL PASSES :00027                          TOTAL FAILURES: 00022
FAILURE #       TEST #       ERROR CODE       PASS #        TIME
   1              3               1           00018        000:33
   2              1               1           00019        000:34
   3              2               1           00019        000:34
   4              3               1           00019        000:34
   5              1               1           00020        000:34
   6              2               1           00020        000:34
   7              3               1           00020        000:34
   8              1               1           00021        000:34
   9              2               1           00021        000:34
   10             3               1           00021        000:34
```

Figure 3-2. Display Command – Example 1

```
===>D PROC *
PROC EPROM VERSION: 80000

TEST NUMBER          # OF PASSES          # OF FAILURES
     1                  00018                00000
     2                  00019                00000
     3                  00019                00000
     4                  00019                00000
     5                  00020                00000
     6                  00020                00004
     7                  00020                00000
     8                  00021                00000
     9                  00021                00000
     10                 00021                00000

10 of 11 Displayed: Type Any Key To Advance
```

Figure 3-3. Display Command – Example 2

```
===> D COAX 2

TEST NUMBER: 2     # OF PASSES: 00004        # OF FAILURES: 00004
PASS #     ERROR CODE     WORD 1     WORD 2     WORD 3     TIME
00000           5         0044H      0000H      0000H     000:36
00001           5         0054H      0000H      0000H     000:36
00002           5         0054H      0000H      0000H     000:37
00003           5         0054H      0000H      0000H     000:37

4 of 4 Displayed: Type Any Key To Advance
```

Figure 3-4. Display Command – Example 3

ERROR MESSAGES

"PLEASE USE THE FORMAT: D {BOARD NAME} [TEST NUMBER]" – (The board name parameter was omitted.)

"INVALID BOARD" – (The board name is not valid.)

"ILLEGAL TEST NUMBER" – (Test number is out of range.)

Press Return to clear the error message.

(G)O COMMAND USAGE: G [REPETITION COUNT]

The Go command begins execution of tests selected by the Select command. An optional command parameter provides the number of times the test sequence will be run. If a count is not specified, the sequence runs indefinitely.

Test execution may be halted at any time by pressing the space bar. Since error data is not cleared by this command, cumulative data may be collected.

ERROR MESSAGES

"PLEASE USE THE (S)ELECT COMMAND FOR TEST SELECTION" – (No tests have been selected.)

Press Return to clear the error message.

(M)ONITOR COMMAND USAGE: M

This command provides an exit to Basic Monitor. To return to diagnostics from Basic Monitor, type X Enter.

(O)UTPUT COMMAND USAGE: O {SPECIFIER}

The Output command switches diagnostics control from one terminal type to another.

To divert coax control to an ASCII terminal, use the specifier A. Issue the O A command from the coax terminal. The ASCII terminal will then request the terminal type.

To switch ASCII control to a coax terminal, use the specifier C. Issue the O C command from the ASCII terminal. Then press the Alt, Left Shift, and tilde (~) keys simultaneously on the coax keyboard, followed by pressing Enter (if the coax terminal has been switched from one port to another, toggle the Normal/Test switch on the coax terminal prior to entering the the Alt, Left Shift, and tilde (~) key sequence).

(S)ELECT COMMAND USAGE: S {BOARD NAME} {TEST SELECTION} OR S *

The Select command specifies the board test sequences. Both the board name and the desired test selection must be specified. S* is used to select all selectable tests on all boards, with the exception of those noted.

NOTE: Certain tests can not be selected with the * parameter. They must be selected individually, and are identified in the test descriptions.

The test selection field provides several variations. A series of test numbers may be specified, separated by spaces, such as 2 3 9. A range of tests may be specified using a number-dash-number, such as 1-5. The character * selects all selectable tests for the specified board.

ERROR MESSAGES

"PLEASE USE THE FORMAT: S {BOARD NAME} {TEST SEQUENCE}" – (Field parameter missing.)

"INVALID BOARD" – (Board name invalid.)

"ILLEGAL TEST NUMBER" – (Test number out of range.)

Press Return to clear the error message.

EXAMPLES

S PROC 1-8 – selects PROC tests 1-8

S * – all selects default tests

S COAX * – selects all default Coax Adapter tests

(R)EVEAL COMMAND USAGE: R {BOARD NAME} {TEST NUMBER} OR R {BOARD NAME}

he Reveal command specifies the board test and error descriptions for the specified board. Refer to the next three examples. A slash is used to indicate that the data word is to be interpreted as two separate. In example 3, if word one is 1234H, the failing port number is 12 and the test index is 34.

Type R COAX in response to the diagnostic prompt. A screen similar to the following appears:

```
Coax Controller (COAX) Board -

Test 1          -       Coax Port Loopback Test
Test 2          -       Coax Memory Test
Test 3          -       Coax PROM Checksum Test

Hit any key to return to Menu
```

Figure 3-5. Reveal Command – Example 1

Type R COAX 1 in response to the diagnostic prompt. A screen similar to the following appears:

```
Coax Controller (COAX) Board -

Test 1          -       Coax Port Loopback Test

This verifies the loopback capability of each port,
verifying the data patterns 55H and AAH

Hit any key to return to Menu
```

Figure 3-6. Reveal Command – Example 2

Type R COAX 1 3 in response to the diagnostic prompt. A screen similar to the following appears:

```
Coax Controller (COAX) Board -

Test 1          -       Coax Port Loopback Test

Error Code 3:           Loopback failed
        word 1:         Failing port / Test index
        word 2:         Data pattern
        word 3:         Contents of coax status register

Hit any key to return to Menu
```

Figure 3-7. Reveal Command – Example 3

DIAGNOSTIC TESTS

1374 Control Units provide a multilevel set of offline diagnostic tests to help the customer or field engineer troubleshoot intermittent or subtle failures.

A special diagnostics diskette is used to load these tests, which write over 1374 program software in controller memory. Normal control unit operation is terminated.

1374 oOffline diagnostics are more rigorous than the power-on tests that verify basic module and system functions during initialization. power-on test strategy must be followed before proceeding to offline testing.

To use diagnostics, insert the diagnostics diskette into the disk drive (with the label to the left – 0X, with the label up – all others) and press the power switch.

NOTE: If the power-on tests do not run, the offline diagnostics will not load.

The diagnostic tests for each board are run in numerical sequence, depending on the test numbers specified by the Select command. If S * is used, all boards are tested simultaneously. The test progress is displayed in the upper screen area and updated as each test passes. If a test fails, the entry # Failures for that PCB is updated. The number of the failing test is displayed in the Last Test Failed column for that PCB. The diagnostics continue to run.

This chapter contains the diagnostic tests for each 1374 Control Unit series.

The diagnostic tests and their associated error codes and error descriptions follow. Error data byte information is also included if used. The six error bytes are displayed as three hex words when a test number is specified in the diagnostic Display command. The following shows the words separated into six bytes:

PASS #	ERROR CODE	WORD1	WORD2	WORD3	TIME
00234	03	A461	CD45	173-B	13:05
Bytes==========>		1122	3344	5566	

Ignore words or bytes displayed on the diagnostic screen, but not listed in these tables.

USING DIAGNOSTICS

This section contains examples that show how to use the diagnostic tests to troubleshoot failures within the control unit. These examples show how to use the diagnostic tests to isolate a failure to a specific field replaceable unit (FRU).

NOTE: Depending upon the particular control unit series being used and the PCBs installed, the example screens that appear on your terminal may or may not be exactly the same as those shown in this discussion. These examples are for an 1374 Model 7XR.

PROBLEM INDICATION – EXAMPLE 1

This example shows how to use the diagnostic tests to troubleshoot a problem with a coax device.

A terminal operator reports that one particular terminal does not function; however, all others connected to that controller function normally.

Before beginning the fault isolation procedures, determine whether a coax terminal already connected to the controller is to be used as the diagnostic terminal or if an ASCII terminal connected to the maintenance port is to be used (refer to the instructions for these terminals at the beginning of this chapter).

DIAGNOSTIC PROCEDURE

STEP 1: The purpose of this step is to load the diagnostics and to determine whether a PCB may be failing. Install the diagnostic diskette into the control unit diskette drive and re-IML the control unit. When the control unit has completed the IML, press the Alt, Left Shift, and tilde (~) keys simultaneously. A Diagnostic Menu screen similar to the following appears:

```
      7XR DIAGNOSTIC MONITOR V2.4                        000:00:03

BOARD      PASS      LAST COMPLETE      LAST FAILURE      # FAILURES
PROC       00000           0                  0            00000
COAX       00000           0                  0            00000

(C)LEAR (D)ISPLAY (G)O (M)ONITOR (O)UTPUT (S)ELECT (B)OARD (R)EVEAL
===> _
```

Figure 3-8. Offline Diagnostics Menu

STEP 2: Since no failures were detected during load, the offline diagnostics tests must be run. These tests can be run selectively on each PCB (and, if applicable, the diskette drive and installed options). Refer to the diagnostic tests in Chapter 8 for additional details. To run all of the default diagnostic tests, type S * at the prompt and press Enter. Then type G. A screen similar to the following appears:

```
      7XR DIAGNOSTIC MONITOR V2.4                    000:00:03

BOARD      PASS      LAST COMPLETE      LAST FAILURE      # FAILURES
PROC       00000           2                  0            00000
COAX       00000           1                  1            00001

(C)LEAR (D)ISPLAY (G)O (M)ONITOR (O)UTPUT (S)ELECT (B)OARD (R)EVEAL
===> _
```

Figure 3-9. Offline Diagnostics Test Screen

STEP 3: This screen indicates that a coax failure has been detected. Checking the coax test results will show which coax test failed. To display the coax test results, type D COAX * at the prompt. A screen similar to the following appears:

```
===> D COAX *

TEST NUMBER       # OF PASSES       # FAILURES
1                 00001            00001
2                 00000            00000

===> _
```

Figure 3-10. Coax Test Results Screen

STEP 4: This screen indicates that coax test 1 failed. Coax test 1 test results can be checked to determine which coax test failed. To display coax test 1 results, type D COAX 1 at the prompt. A screen similar to the following appears:

```
===> D COAX 1

    TEST NUMBER 1     # OF PASSES: 00001     # FAILURES: 00001

PASS #     ERROR CODE     WORD 1     WORD 2     WORD 3      TIME
00000           2         0000H      0000H      0018H      000:00

===> _
```

Figure 3-11. Coax Test 1 Test Results Screen

STEP 5: While viewing at this screen, refer to Coax Controller diagnostic tests in Chapter 8. Error code 2 for coax test 1 describes the failure "Did not get data available", with word 2 indicating the hexadecimal value (0000H) for the port number (0).

STEP 6: This same error information can be obtained by using the Reveal command. Type R COAX 1 2 to request an online description of the error code and test.

The information provided by the diagnostic tests indicate that there is a problem with coax port 0. The terminal connected to port 0 may have failed, the coax cable connected to port 0 may be defective, or there may be an internal problem in the Coax Controller PCB.

STEP 7: Disconnect the coax cable connected to port 0 and rerun the tests. If the tests run without failing, either the coax cable or the terminal is defective. If the test still fails, the Coax Controller PCB is defective.

STEP 8: Isolate and replace the defective component and rerun the diagnostic tests to verify that the failure has been corrected.

PROBLEM INDICATION – EXAMPLE 2

This example shows how to use the diagnostic tests to troubleshoot a problem with the remote host link.

All terminals connected to the controller function are locked up. Line 25 on each terminal displays a performance connection message (columns 25 through 35). In addition, the modem connected to the host port is not functioning.

Before beginning the fault isolation procedures, determine if a coax terminal already connected to the controller is to be used as the diagnostic terminal or if an ASCII terminal connected to the Maintenance Port is to be used.

DIAGNOSTIC PROCEDURE

STEP 1: The purpose of this step is to load the diagnostics and to determine whether a PCB may be failing. Install the diagnostic diskette into the control unit diskette drive and re-IML the control unit. When the control unit has completed the IML, press the Alt, Left Shift, and tilde (~) keys simultaneously. A Diagnostic Menu screen similar to the following appears:

```
      7XR DIAGNOSTIC MONITOR V2.4                    000:00:03

BOARD      PASS      LAST COMPLETE      LAST FAILURE      # FAILURES
PROC       00000           0                 0            00000
COAX       00000           0                 0            00000

(C)LEAR (D)ISPLAY (G)O (M)ONITOR (O)UTPUT (S)ELECT (B)OARD (R)EVEAL
===> _
```

Figure 3-12. Offline Diagnostics Menu

STEP 2: Since no failures were detected during load, the offline diagnostics tests must be run. These tests can be run selectively on each PCB (and, if applicable, the diskette drive and installed options). Refer to the diagnostic tests in Chapter 8 for additional details. To run all of the default diagnostic tests, type S * at the prompt and press Enter. Then type G. A screen similar to the following appears:

```
      7XR DIAGNOSTIC MONITOR V2.4                    000:00:03

BOARD      PASS      LAST COMPLETE      LAST FAILURE      # FAILURES
PROC       00000           1                 0            00000
COAX       00000           1                 0            00000

(C)LEAR (D)ISPLAY (G)O (M)ONITOR (O)UTPUT (S)ELECT (B)OARD (R)EVEAL
===> _
```

Figure 3-13. Offline Diagnostics Test Screen

STEP 3: This screen indicates that no failures were detected. Since some of the diagnostic tests are not selected with the * specifier, it will be necessary to select those tests individually (refer to Chapter 8 for additional information).

The failure symptoms indicate that the problem could be in the host link. Running a loopback test (processor test number 10) on the host interface will show if the problem is external to the control unit. Test 10 requires the host interface cable to be removed and a loopback connector be installed. To run processor test 10, type S PROC 10 at the prompt and press Enter. Then type G. A screen similar to the following appears:

```
===> S PROC 10

      7XR DIAGNOSTIC MONITOR V2.4.0                          000:01

BOARD      PASS      LAST COMPLETE      LAST FAILURE      # FAILURES
PROC       00001          10                 10            00001

(C)LEAR (D)ISPLAY (G)O (M)ONITOR (O)UTPUT (S)ELECT (B)OARD (R)EVEAL
===> _
```

Figure 3-14. Processor Test Results Screen

STEP 4: This screen indicates that processor test 10 failed. Processor test 10 test results can be checked to determine the cause of the failure. To display the test results for processor test 10, type D PROC 10 at the prompt. A screen similar to the following appears:

```
===> D PROC 10

    TEST NUMBER 10     # OF PASSES: 00001     # FAILURES: 00001

PASS #     ERROR CODE     WORD 1     WORD 2     WORD 3       TIME
00000           4         0074H      0000H      0000H      000:12

===> _
```

Figure 3-15. Processor Test 10 Test Results Screen

STEP 5: While viewing at this screen, refer to Coax Controller diagnostic tests in Chapter 8. Error code 4 for processor test 10 describes the failure as "DCD not detected". The information provided by the diagnostic tests indicate that the processor function of the Coax Controller PCB is failing.

STEP 6. This same error information can be obtained by using the Reveal command. Type R PROC 10 4 to request an online description of the error code and test.

STEP 7: Remove the loopback plug and replace the Coax Controller PCB in the control unit. Refer to the appropriate FRU Removal and Replacement chapter in the *1374 Product Service Manual.*

STEP 8: Rerun the diagnostic tests to verify that the failure has been corrected.