

Core Module Test System

SW13-512

LCN Service - 3

Core Module Test System

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About This Publication

This reference manual documents the individual test programs that make up the Core Module Test System (Release 10.1). It is intended for use by Honeywell or customer service technicians who are responsible for the isolation of those TPS hardware failures that are not fully identified by the firmware and on-line software diagnostics. This publication is a reference manual for trained technicians and is intended to supplement TPS service training, not replace it.

To use this manual, you must first be familiar with the content of the *Test System Executive*. A list of other related publications is located at paragraph 1.3 of this publication.

Following is a summary of the contents of each section of this document:

Section 1—This section introduces you to the characteristics and uses of CMTS. It also provides a list of related publications and an overview of changes introduced at the current release.

Sections 2 through 10 provide specific information on the individual test and exerciser programs.

This publication supports **TotalPlant** Solution (TPS) System network Release 510 and earlier R500 software releases. TPS is the evolution of TDC 3000^X.

Change bars are used to indicate paragraphs, tables, or illustrations containing changes that have been made by an update to the previous software release.

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INTRODUCTION Section 1

This section introduces you to the characteristics and uses of the Core Module Test System.

1.1 WHAT CMTS IS AND HOW IT WORKS

The Core Module Test System (CMTS) is a collection of test programs that work under the Test System Executive and are used to verify the correct operation of the "kernel" electronics of one or more nodes on a **TotalPlant** Solution (TPS) System Local Control Network. It replaces two free-standing tests, the MCPUC Board Test and the Memory Board Test.

The pieces that make up a node's kernel electronics are its

- Power supply
- Processor board
- Memory boards
- Local Control Network Interface board
- Paddle boards associated with the above board types

Most of the test programs are unique to CMTS, but two (the Clock Subsystem Tests and the Local Control Network Exerciser) are also found in HVTS. Table 1-1 lists the CMTS test programs by the 4-character names accepted by the Test System Executive (EXEC).

Table 1-1 — CMTS Test Program Names

AMRT	—	Application Module Redundancy Tests
CLKS	—	Clock Subsystem Tests
CMEM	—	Common Memory Test Program
KMBT	—	K2LCN/K4LCN Module Bus Test Program
LCNS	—	Common LCN Subsystem Tests
LCNX	—	Local Control Network Exerciser
PCIF	—	LCNP Power PC Bus Test Program
MMPU	—	Multi-Microprocessor Test Program
MPWV	—	Memory Protect and Watch Variable Test Program

You control the operation of CMTS by keyboard entry of commands that specify the hardware to be tested and the number and sequence of tests to be run.

CMTS test programs are packaged with the Test System Executive (EXEC) on floppy diskette number 51150354, or on cartridge disk number 51152049. Follow the loading and test system setup instructions found in the *Test System Executive*.

1.2 USES OF CMTS

CMTS is useful during both system installation and initial hardware validation, and, in a limited sense, for troubleshooting during on-line system operation. System validation is accomplished before loading operational software and, in that instance, CMTS can have unconstrained use of the system hardware. If CMTS is to be used for troubleshooting during normal operation, the selected TOCS and the nodes to be tested must be removed from service before CMTS can be loaded. Other test program-specific restrictions exist and are noted in the test program writeups.

1.3 REFERENCES

The following are other TPS 3000 publications that will be of use during installation and maintenance of TPS 3000 systems.

Publication Title	Publication Number	Binder Title	Binder Number
<i>Maintenance Test Operations</i>	SW11-502	LCN Service - 1	TPS 3060-1
<i>Test System Executive</i>	SW13-510	LCN Service - 3	TPS 3060-3
<i>Core Module Test System</i>	SW13-512	LCN Service - 3	TPS 3060-3
<i>LCNI Network Communications Test</i>	SW13-513	LCN Service - 3	TPS 3060-3
<i>Universal Station Service</i>	US13-500	LCN Service - 1	TPS 3060-1
<i>History Module Service</i>	HM13-501	LCN Service - 2	TPS 3060-2
<i>Five/Ten-Slot Module Service</i>	LC13-500	LCN Service - 2	TPS 3060-2
<i>Dual Node Module Service</i>	LC13-510	LCN Service - 2	TPS 3060-2
<i>LCN System Checkout</i>	SW20-510	LCN Installation	TPS 3025
<i>Universal Work Station Installation, Operation & Service</i>	UW02-500	LCN Service - 2	TPS 3060-2

1.4 CMTS RELEASE CHANGES

The major changes to CMTS at Release 10.1 are

- Update to include K4LCN processor board.
- MMPU (Section 6) tests nonvolatile memory.
- MMPU (Section 6) adds tests 9 and 10.

CLOCK SUBSYSTEM TESTS (CLKS) Section 2

2.1 CLOCK SUBSYSTEM TEST ELEMENTS

The Clock Subsystem Test elements consist of one or more LCN modules. One of the following "normal" network topologies is expected:

- Both A and B clock sources and one or more 12.5 kHz listeners (a nonenhanced network).
- Both A and B clock sources, one or more 12.5 kHz listeners, a K2LCN/K4LCN node acting as a 12.5 kHz to LCN translator, and one or more K2LCN/K4LCN listeners (a hybrid network).
- A K2LCN/K4LCN LCN clock master and one or more K2LCN/K4LCN listeners (an enhanced network).

2.2 USE INFORMATION

CLKS uses stimulus/response test methodology wherever possible. Proper behavior of the clock subsystem is modeled by CLKS and compared to the actual clock subsystem response. CLKS operates in a master/slave relationship with copies of itself in the other LCN nodes. (All copies of CLKS in the network must be set up to reflect the capabilities of the clock subsystem in that individual LCN node.)

Whenever CLKS is started or restarted, the copy running in the TOCS is designated as master. Alarms can come from either the master or slave(s). If a breakdown in LCN communications is detected, the master copy CLKS prints an alarm. To restart a dropped node, all nodes must be stopped and restarted.

A check is made by each test for resources required. If the resources are not present, the test is removed from the test list and the operator is notified.

CLKS executes two types of tests, Local and Network. Local testing checks clock operation within the individual nodes. Network testing checks clock subsystem communication through the LCN, and is coordinated by the TOCS.

CAUTION

Do not run CLKS in Network operating scope on an LCN with operating RNOS nodes. CLKS in Network operating scope interferes with RNOS time keeping. This causes the time displayed at Universal Stations to change randomly and will upset journal event time tags. Operations performed in Local operating scope do not involve network clock activity and can be safely performed in the presence of operating RNOS nodes.

For proper operation, do not add nodes, delete nodes, or change the TOCS node while CLKS is running. Additionally, CLKS should be started in all nodes simultaneously by using the “LF” key to initiate a Network-directed command. Stopping the master CLKS node also stops all slave node(s).

CLKS in the TOCS uses the EXEC's network communication facilities to coordinate the operation of CLKS in the other LCN nodes. This causes one major complication, a task that is halted on error cannot receive network messages. This cuts off communications to the CLKS in a remote node, causing the CLKS in the TOCS to print operator information messages. If this occurs during an overnight run, it wastes a lot of paper and, if the halted CLKS was the A or B cable clock source, causes the loss of the run. To prevent this, CLKS simulates halt on error by inhibiting error messages while otherwise continuing to operate as usual. This allows the A or B cable source to reach the “Halt on Error Limit” without invalidating the testing performed by the rest of the nodes.

If the system does not contain 12.5 kHz clock transmitters (Clock Source Repeaters—CSR boards), crossed cable connection testing must be performed using the Network Communications Test (LCNI). Please refer to the crossed-cable testing procedure documented in *LCNI Network Communications Test* in the *LCN Service* binder.

2.3 SETUP PARAMETERS

2.3.1 CLKS-Specific Parameters

OPERATING_SCOPE (Can be changed only with CLKS off) Allowed values are

- LOCAL = No actions are taken by CLKS that could disturb the proper operation of any RNOS-based nodes that may coexist on the network.
- NETWORK = CLKS can perform actions that will upset proper operation of RNOS-based nodes coexisting on the network. As a safeguard against accidental disturbance of RNOS nodes, the operator is required to set the PERMISSION parameter to "Y" before NETWORK scope is allowed.

LISTENER (Can be changed only with CLKS off) Allowed values are

- ENABLE = Indicates that this node has the ability to receive 12.5 kHz clock data.
- DISABLE = Indicates that this node cannot receive 12.5 kHz clock data.

- TRANSLATE** (Can be changed only with CLKS off) Allowed values are
- ENABLE = Indicates that this is a K2LCN/K4LCN node and can perform 12.5 kHz to 5 MHz translation if required by the test (the LISTENER value also must be ENABLE).
- DISABLE = Indicates that this node should not be used as the 12.5 kHz to 5 MHz translator.
- This parameter defaults to ENABLE in nodes that contain a K2LCN/K4LCN node and to DISABLE in nodes that do not.
- MASTER** (Can only be changed with CLKS off) Allowed values are
- ENABLE = Indicates that this is a K2LCN/K4LCN node and is available to be used as the 5 MHz master clock source.
- DISABLE = Indicates that this node will not be used as the 5 MHz master clock source.
- This parameter defaults to ENABLE in nodes that contain a K2LCN/K4LCN node and to DISABLE in nodes that do not.
- AC_LINE_SYNC** (Can be changed only with CLKS off) This parameter controls the use of the ac line reference signal. It affects all nodes in local mode, K2LCN/K4LCN nodes with MASTER enabled, and the A and B cable clock sources. Note that Test 3 ignores this parameter value and attempts to synchronize all non-K2LCN/K4LCN nodes to the power line. Allowed values are
- ENABLE = The ac reference signal will be used if it is an option in the current test.
- DISABLE = The ac reference signal will not be used.
- PROCESSOR_TYPE** (Display Only) Identifies the processor type present in this node.
- A_SOURCE** (Must be changed with CLKS off) Allowed values are
- = No cable A 12.5 kHz clock source is present
 - 0-127 = LCN address (decimal) of the cable A 12.5 kHz clock source
- B_SOURCE** (Must be changed with CLKS off) Allowed values are
- = No cable B 12.5 kHz clock source is present
 - 0-127 = LCN address (decimal) of the cable B 12.5 kHz clock source

- IDLE_TIME** (Can be changed at any time.) Allowed values are
 1-30 = Specifies the length (in minutes) of the exercise period in Test 8.
- PERMISSION** (Can be changed at any time) Allowed values are
 Y = Allow Network operating scope
 N = Do not allow Network operating scope
- Set by the program to N each time it starts with OPERATING_SCOPE set at NETWORK. The operator is then prompted to authenticate the network operating scope by changing this value to Y. This parameter will now accept any valid command processor abbreviation for YES or NO.
- CLOCK_STATUS** Display only, contains the current clock status-word value (in hex).
- DEBUG_COMMUNICATIONS** This parameter is used only for developer testing and must be left DISABLED.

2.3.2 General Parameters

- TESTS** Allowed values are 1 through 8
- ERROR_LIMIT** Allowed values are 1 through 32766 or "-"
- PASS_LIMIT** Allowed values are 1 through 32766 or "-"
- REPORT** Allowed values are PASSNUMBER, TESTNUMBER, LOG
- INHIBIT** Allowed values are PASSNUMBER, TESTNUMBER, LOG
- SCALE** Not used
- MINUTES_LIMIT** Allowed values are 0 through 32766 or "-"
- ABBREVIATION** Allowed values are 0 through 4
- AFTER_ERROR_LIMIT** Allowed values are ABORT or HALT

- Test 03 AC Power Line Synchronization SUB, MOD
Verifies the Clock Subsystem's ability to lock to the ac power line in local mode. (This test is performed only in nodes that do not contain a K2LCN/K4LCN.) If the required resources are available, all enabled non-K2LCN/K4LCN nodes are asked to print the test number, send an enable ac line synch command to the clock subsystem, set the final clock status, and perform a delayed clock status check. All non-K2LCN/K4LCN nodes are allowed to remain in synch for 10 seconds, then all that have AC_LINE_SYNCH = DISABLE are asked to unlock from the ac line and perform a delayed clock status check.
- Test 04 12.5 kHz Network Operations SUB, MOD
Verifies the Clock Subsystem's ability to transmit and receive 12.5 kHz data and its ability to detect and process network time sets. If AC_LINE_SYNCH is enabled at the A and B clock source nodes, it will be used. This test is performed only if OPERATING_SCOPE = NETWORK and both A and B clock sources are present. Nodes with LISTENER = ENABLE are instructed to listen to the A and B clock sources. On even-numbered passes, the A cable clock source is used as the master and the B cable clock source functions as the slave. On odd-numbered passes, the roles are reversed.
- Test 05 12.5 kHz Clock Source Failovers SUB, MOD
Verifies the Clock Subsystem's ability to perform 12.5 kHz clock source failovers (the slave clock source takes over clock master operations). If AC_LINE_SYNCH is enabled at the A and B clock source nodes, it will be used. This test is performed only if OPERATING_SCOPE = NETWORK and both A and B clock sources are present. Nodes with LISTENER = ENABLE are instructed to listen to the A and B clock sources. On even-numbered passes, the A cable clock source is used as the master and the B cable clock source functions as the slave. On odd-numbered passes, the roles are reversed.
- Test 06 LCN-Based Network Operations SUB, MOD
Verifies the Clock Subsystem's ability to transmit and receive 5 MHz data and its ability to detect and process network time sets. Also verifies the LCN ASIC's ability to detect and indicate the source of the clock data. If AC_LINE_SYNCH is enabled at the master clock source node, it will be used. This test is performed only if OPERATING_SCOPE = NETWORK, at least one node is present with MASTER enabled, and at least one additional K2LCN/K4LCN node is present.
- Test 07 12.5 kHz to LCN Based Translation SUB, MOD
Verifies the Clock Subsystem's ability to perform 12.5 kHz to 5 MHz translation and the detection/translation of time set events. Also verifies the LCN ASIC's ability to detect and indicate the source of the clock data. If AC_LINE_SYNCH is enabled at the A and B clock source nodes, it will be used. This test is performed only if OPERATING_SCOPE = NETWORK, both A and B clock sources are present, at least one node is present with both LISTENER and TRANSLATE enabled, and at least one additional K2LCN/K4LCN node is present. On even-numbered passes, the A cable clock source is used as the master and the B cable clock source functions as the slave. On odd-numbered passes, the roles are reversed.

Test 08 Exerciser Test

SUB, MOD, EXER

Operations performed in this test have already been performed in previous tests and are considered reliable at this point. The resources available are examined and a test setup is selected to use each node in the most useful manner. If OPERATING_SCOPE = LOCAL (local network) or a node does not fit into one of the normal topologies, it is placed in local operating mode and time sets will be performed and verified locally. If AC_LINE_SYNCH is enabled at the A clock source, the B clock source, the K2LCN/K4LCN clock source or non-K2LCN/K4LCN nodes operating in local mode (as applicable), it will be used. If the A and B cable clock sources are used on even-numbered passes, the A cable clock source is used as the master and the B cable clock source functions as the slave. On odd-numbered passes, the roles are reversed.

2.7 CLKS ALARM CATEGORIES

CLKS prints alarms in either of two formats:

- As relatively simple English language descriptions of the expected vs actual values.
- The standard HVTS alarm header line followed by additional information including
 - Description of the operation in progress
 - Starting random number (if a random number was in use)
 - Description of data area in error that includes the was and should be values, the mask used, and the differences (Exclusive OR of was and should be values ANDed with the mask).

LOCAL CONTROL NETWORK EXERCISER (LCNX) Section 3

3.1 LOCAL CONTROL NETWORK ELEMENTS

The Local Control Network Exerciser tests correct communication between LCNI boards in three or more individual nodes on the same network.

3.2 USE INFORMATION

LCNX consists of one test that instructs each listed node in the Test System network to talk to every other listed node in the network during each pass.

The TOCS node is the master; all other nodes in the network are slaves and are started and controlled by the TOCS. All error detection occurs at the TOCS node. It administers all transmissions and prints errors if the expected results do not occur.

The TOCS randomly picks two slave nodes and transmits messages between the three, noting results. This process continues until all nodes in the network are used two at a time. This procedure is random but orderly, so the LCNX for an n-node system requires the same execution time each time.

3.3 SETUP PARAMETERS

3.3.1 LCNX-Specific Parameters

NODE_LIST_MODE Allowed values and their meanings are

AUTO_MODE—LCNX uses the network node list
USER_MODE—LCNX uses a node list specified through
use of the command "USER_NODE_LIST".

NOTE

USER_NODE_LIST is an EXEC command that controls a node list used by only LCN test and exerciser programs. Whenever USER_NODE_LIST is used by a test or exerciser program, only the nodes that appear in **both** the list of LOADED nodes (as modified by use of the DEL and ADD commands), and the list controlled by the USER_NODE_LIST command are affected.

The initial value for USER_NODE_LIST is "-" (therefore, all loaded nodes). Changes to the list are invoked by the command—or command abbreviation—followed by a list of node numbers separated by commas or "-" (to signify a group of consecutive node numbers).

ERROR_TABLE_PRINT Allowed values and their meanings are

END_OF_TEST—Print the error table at test completion
 NO_PRINT—Do not print the error table at completion
 NOW—Print the error table at the end of the current pass
 (entered while LCNX is running). After the error table
 is printed, the value reverts to END_OF_TEST or
 NO_PRINT.

3.3.2 General Parameters

TESTS Allowed value is 1
ERROR_LIMIT Allowed values are 1 through 32767 or "-"
PASS_LIMIT Allowed values are 1 through 32767 or "-"
REPORT Allowed values are PASSNUMBER, TESTNUMBER, LOG
INHIBIT Allowed values are PASSNUMBER, TESTNUMBER, LOG
SCALE Allowed values are 0 through 999
MINUTES_LIMIT Allowed values are 0 through 32766 or "-"
ABBREVIATION Allowed values are 0 through 4
AFTER_ERROR_LIMIT Allowed values are ABORT or HALT

3.4 PRESET PARAMETER VALUES FOR LCNX

NODE_LIST_MODE = AUTO MODE
 ERROR_TABLE_PRINT = END OF TEST
 TESTS = 1
 ERROR_LIMIT = 5
 PASS_LIMIT = -
 REPORT = LOG
 INHIBIT = PASSNUMBER, TESTNUMBER
 SCALE = 100
 MINUTES_LIMIT = -
 ABBREVIATION = 4
 AFTER_ERROR_LIMIT = ABORT

3.5 MODE CHARACTERISTICS FOR LCNX

<u>System Mode</u>	<u>Programs Running</u>	<u>Tests Running</u>	<u>Delay Between Tests</u>
Subsystem	Only one	One	Zero
Module	One or more	One	Random
Exerciser	One or more	One	Random

3.6 INDIVIDUAL LCNX TESTS

(System Modes)

Test 01

SUB, MOD, EXER

3.7 LCNX ALARM MESSAGES

LCNX alarm numbers do not have meaning to the user. The alarm messages describe specific problems encountered in English text. Examples are

```
"*Startup Error* TOCS cannot communicate with Node 5"  
"Node 5 has been dropped from the node list"
```


COMMON MEMORY TEST PROGRAM (CMEM) Section 4

4.1 COMMON MEMORY SUBSYSTEM TEST ELEMENTS

The primary kernel element tested by this program is the memory board.

4.2 USE INFORMATION

CMEM is used to test all types of TPS memory boards (EDAC, Parity only, HMPU, EMPU), and runs only those tests that are appropriate to the board(s) being tested. Tests 3, 4, 6, and 7 apply to all memory types. The remaining tests apply to board types as stated in the individual test descriptions at paragraph 4.6.

Tests 12, 13, and 16 require manual intervention and each runs only if it is the only test selected.

4.3 SETUP PARAMETERS

4.3.1 CMEM-Specific Parameters

SLOT_TO_TEST Used by Test 16 to determine on which EDAC memory board (not including the HMPU board) to set selected LEDs on and off. Allowed values are 0 through 15.

LED_SETTING Used by Test 16 to determine states of LEDs on the selected memory board. Allowed values and their meanings are

- SINGLE—The single-bit error LED is lit; all other memory board error LEDs are extinguished.
- MULTIPLE—The multiple-bit error LED is lit; all other memory board error LEDs are extinguished.
- PARITY—The parity error LED is lit; all other memory board error LEDs are extinguished.
- OFF—All memory-board error LEDs are extinguished.

4.3.2 General Parameters

TESTS	Allowed values are 1 through 17
ERROR_LIMIT	Allowed values are 1 through 32766 or "-"
PASS_LIMIT	Allowed values are 1 through 32766 or "-"
REPORT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
INHIBIT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
SCALE	Allowed values are 0 through 999
MINUTES_LIMIT	Allowed values are 0 through 32766 or "-"
ABBREVIATION	Allowed values are 0 through 4
AFTER_ERROR_LIMIT	Allowed values are ABORT or HALT

- Test 07 Random Data SUB, MOD
At each pass, verifies a small portion of "Beyond Pool" memory area (6000 hex long words) for random data. Starts at the beginning of "Beyond Pool" and continues to end of memory, then starts over.
- Test 08 68020/68040 Syndrome Memory Bits SUB, MOD
Verifies the ability of memory to store walking ones in the check bits of the 68020/68040 "Beyond Pool" memory area.
- Test 09 68020/68040 Border Operations SUB, MOD
Tests the ability of the 68020/68040 to store words and long words with a starting address on the 68020/68040 memory and ending in external memory. If no external memory exists, trap #2 is checked for.
- Test 10 68020 Border Operations w/ EDAC SUB, MOD
Tests the ability of the 68020 to detect double-bit errors in external memory on a read that starts on the 68020 board, but extends to external memory containing a double-bit error.
- Test 11 Walking Op-code Fetch SUB
Not currently implemented.
- Test 12 68020/68040 Memory Error Indicator SUB**
Verifies the ability of the 68020/68040 to turn on and off the single- and multiple-bit memory error LEDs. The program issues screen messages that allow you 10 seconds to see if the external error indicators are correct.
- Test 13 68020/68040 Fatal Double Bit Error SUB**
Verifies that the 68020/68040 processor executes a halt upon detection of a double-bit error when **not** in EDAC test mode. The program issues a screen message warning that a fatal multiple-bit error is expected, which forces the 68020/68040 processor into the halted state, thus requiring reset and reload of the node for testing to continue. If the processor does **not** halt, an error is reported.
- Test 14 External Memory EDAC SUB, MOD
Tests all single-bit and combinations of double-bit errors for each EDAC memory board in the node.
- Test 15 External Memory Syndrome Memory Bits SUB, MOD
Verifies the ability of memory to store walking ones in the check bits of the external EDAC memory's "Beyond Pool" area.
- Test 16 External Memory Error Indicators SUB**
Allows you to selectively light each of the error indicator LEDs on any selected external EDAC memory board. The program looks for a change in the SLOT_TO_TEST or LED_SETTING test-specific parameters to determine the memory board and LEDs to set on.
- Test 17 Scan Program Area for EDAC Errors SUB, MOD
Reads the program area of memory, from \$80000 through the end of heap, and looks for and displays "single-bit" errors as they are found (a multiple-bit error will crash the node with a bus error).

**Requires manual intervention; runs only if it is the only test selected.

4.7 CMEM ALARM MESSAGES

CMEM alarm messages describe, in English text, the specific problems encountered.

LCN SUBSYSTEM TEST (LCNS) Section 5

5.1 COMMON LCN SUBSYSTEM TEST ELEMENTS

The primary kernel elements tested by this program are the LCN portion of the K4LCN or retrofitted K2LCN processor boards. Also, the LCN cables are verified.

5.2 USE INFORMATION

Only nodes specified in the User_Node_List are tested. This list defaults to all nodes set, which allows testing of all nodes in the network; however, it may be restricted to fewer nodes through use of the command "USER_NODE_LIST" followed by a list of nodes separated by commas.

For Test 2, LCN cable switching must be active (SWITCH YES) and both cables must be running error-free before testing for crossed cables can be done.

5.3 SETUP PARAMETERS

5.3.1 LCNS-Specific Parameters

CROSSED_NODE Allowed values and their meanings are

- 1 No node with intentionally crossed cables specified (crossed-cable summary message printed after first and last pass, as well as any pass that finds one or more nodes with crossed cables).
- nn Node number with intentionally crossed cables (specifies factory environment. Crossed-cable summary message suppressed if this is the only node with crossed cables).

5.3.2 General Parameters

TESTS	Allowed values are 1 through 3
ERROR_LIMIT	Allowed values are 1 through 32766 or "-"
PASS_LIMIT	Allowed values are 1 through 32766 or "-"
REPORT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
INHIBIT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
SCALE	Allowed values are 0 through 999
MINUTES_LIMIT	Allowed values are 0 through 32766 or "-"
ABBREVIATION	Allowed values are 0 through 4
AFTER_ERROR_LIMIT	Allowed values are ABORT or HALT

In order to verify that the send message on single cable feature works, it is necessary to have one or more nodes in the network with crossed cables. Successful operation would report these nodes with crossed cables and all others with correct cables.

For the factory environment, the setup parameter "CROSSED_NODE" can be changed to indicate the node number with crossed cables. This parameter is defaulted to -1, which indicates nonfactory environment and the summary message is to be printed after the first and last passes, as well as any pass that finds one or more nodes with crossed cables. When a node number is specified, the crossed cable results are compared to this node and, if only this node indicates crossed cables and no other, the summary message is suppressed.

Test 02 Operator Messages

Wrong Processor Type Installed
 Wrong K2LCN Hardware Revision
 Wrong K2LCN Firmware Revision

Test 02 Alarm Messages

201 Error: Message Received From Wrong Node nn
 202 Error: Crossed Node nn Does Not Indicate Crossed Cables
 203 No Remote Nodes In Node List
 204 LCN Cable Switching Is Disabled

Test 02 Summary Message

LCN cables are correct in xx nodes: n-n
 LCN cables are crossed in yy nodes: n-n
 LCN cables indeterminate in zz nodes: n-n (This line is not printed if zz=0)

Test 02 Run Time Estimates:

Number of Nodes in Node List	Estimated Run Time in Minutes
2 - 12	2
13 - 24	4
25 - 36	6
37 - 48	8
48 - 60	10
61 - 64	12

Test 03 Diagnostic Commands Verification SUB**

Tests each node in the current network list for the ability to respond to LCN diagnostic commands. The TOCS as master is not verified by this test. The Network command type prompt is recommended for starting the testing.

**Requires manual intervention; runs only if it is the only test selected.

5.7 LCNS ALARM MESSAGES

LCNS alarm messages describe, in English text, the specific problems encountered.

MULTI-MICROPROCESSOR TEST PROGRAM (MMPU) Section 6

6.1 MMPU SUBSYSTEM ELEMENTS

The primary kernel element tested by this program is the microprocessor board.

6.2 USE INFORMATION

MMPU runs only those tests that are appropriate to the specific type of microprocessor board present in each node being tested.

Tests 6 and 7 require manual intervention. Neither will run unless it is the only test selected.

Test 8 requires the installation of an RS-232C loopback plug, drawing number 51304750. Note that this plug must NOT be installed during either a "power up" or a "reset" sequence on HMPU, HPK2, and K2LCN processor boards. This does not apply for the K4LCN board.

When the USE_CLOCK value = NO (which is the default value), Test 4 and Test 8 baud rate check are skipped.

If the ARCHIVE command is set to Y or R, 1-time write/read testing of a dedicated test location in nonvolatile memory is performed when any MMPU test is run on a K4LCN board.

6.3 SETUP PARAMETERS

6.3.1 MMPU-Specific Parameters

HEX_DISPLAY Allowed values are \$0 through \$3FF.

Value is used by the hex display test, Test 6.

USE_CLOCK Allowed values are YES or NO.

Controls use of the clock to measure timer interval in Test 4. Must be set to NO when running CLKS or when in a network with RNOS nodes.

OVERTEMP Controls the reporting of the LCNP over-temperature alarms. Allowed values and their meanings are

YES Report all LCNP over-temperature alarms

CHANGE Only report changes to the LCNP over-temperature alarm status

NO Do not report any LCNP over-temperature alarms

6.3.2 General Parameters

TESTS	Allowed values are 1 through 10
ERROR_LIMIT	Allowed values are 1 through 32766 or "-"
PASS_LIMIT	Allowed values are 1 through 32766 or "-"
REPORT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
INHIBIT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
SCALE	Allowed values are 0 through 999
MINUTES_LIMIT	Allowed values are 0 through 32766 or "-"
ABBREVIATION	Allowed values are 0 through 4
AFTER_ERROR_LIMIT	Allowed values are ABORT or HALT

6.4 PRESET PARAMETER VALUES FOR MMPU

HEX_DISPLAY = 0
 USE_CLOCK = NO
 OVERTEMP = YES
 TESTS = 1-10
 ERROR_LIMIT = 5
 PASS_LIMIT = -
 REPORT = LOG
 INHIBIT = PASSNUMBER,TESTNUMBER
 SCALE = 0
 MINUTES_LIMIT = -
 ABBREVIATION = 4
 AFTER_ERROR_LIMIT = ABORT

6.5 MODE CHARACTERISTICS FOR MMPU

<u>System Mode</u>	<u>Programs Running</u>	<u>Tests Running</u>	<u>Delay Between Tests</u>
Subsystem	Only one	One or more	None
Module	One or more	One or more	Random

6.6 INDIVIDUAL MMPU TESTS

(System Modes)

Test 01 Basic Registers Verification SUB, MOD

Verifies the contents of the status registers and the ability to read from Status Word No. 3 without error.

Test 02 Exception Handling SUB, MOD

Verifies detection and proper handling of the following exceptions: Illegal Instruction, Divide by Zero, Check Trap, Overflow, Privilege Violation, Line 1010, Bus Error.

Test 03 Read-Modify-Write Instructions SUB, MOD

Performs the TAS instruction (and the CAS and CAS2 instructions on HMPU, HPK2, and K2LCN) and verifies the processor responses.

Test 04 Timer Verification SUB, MOD

Checks the timers against the system clock. In MOD mode, when USE_CLOCK = YES runs through each of the modes supported by the HMPU, HPK2, K2LCN, and K4LCN timers and verifies the functionality.

Test 05 Floating Point Test SUB, MOD

Runs only on HMPU and K4LCN boards. Tests all interconnections between the microprocessor and floating point coprocessor on the HMPU board. Tests floating add, floating subtract, floating multiply and floating divide instructions on the K4LCN.

Test 06 Hex Display SUB

Each time you change the value of HEX_DISPLAY, this test changes the on/off state of the Data Comparison error light and loads the new value into the processor's hex display register. This program runs until it is issued either a STOP or ABORT command. The relationships of value entered and value displayed depend on the display register digit position or "window" as follows:

HEX VALUE	DISPLAY DIGITS			HEX VALUE	DISPLAY DIGITS		
	3	2	1		3	2	1
0	Δ	0	0	8		8	8
1	1	1	1	9		9	9
2	-1	2	2	A		A	A
3	-	3	3	B		-	-
4		4	4	C		C	C
5		5	5	D		Δ	Δ
6		6	6	E		E	E
7		7	7	F		F	F

(Where Δ represents a blank.)

For example, entry of '3BD' results in display of '--Δ'.

- Test 07 Address Error Exception Handling SUB
 Verifies detection and proper handling of the address error exception.
- Test 08 RS-232C Loopback Test SUB, MOD
 Tests the RS-232C port at 1200 baud and 9600 baud using a loopback connector. The modem lines are toggled on each pass to verify that they change correctly.
 This test is not performed when the processor board is an LCNP.
- Test 09 Display Nonvolatile Memory SUB, MOD, EXER
 Runs only on K4LCN boards. It is a utility test that runs one pass and displays the contents of the nonvolatile memory area where error messages (frames) are recorded.
- Test 10 EAMR Loopback Test SUB, MOD
 Runs only on K4LCN boards. This test performs a write/read test of the EAMR interface port on the K4LCN and requires a loopback plug (board assembly) installed when the test is run.

6.7 MMPU ALARM MESSAGES

MMPU alarm messages describe, in English text, the specific problems encountered.

MEMORY PROTECT AND WATCH VARIABLE TEST PROGRAM (MPWV) Section 7

7.1 MPWV SUBSYSTEM ELEMENTS

The kernel element tested by this program is the Hi-Per Processor board.

7.2 USE INFORMATION

None

7.3 SETUP PARAMETERS

7.3.1 MPWV-Specific Parameters

RND_NUM_SPECIFIED Not for field use. Leave set to default value of \$FFFF.

ADRS_SPECIFIED Not for field use. Leave set to default value of \$FFFFFFFF.

7.3.2 General Parameters

TESTS	Allowed values are 1 through 16
ERROR_LIMIT	Allowed values are 1 through 32766 or "-"
PASS_LIMIT	Allowed values are 1 through 32766 or "-"
REPORT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
INHIBIT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
SCALE	Allowed values are 0 through 999
MINUTES_LIMIT	Allowed values are 0 through 32766 or "-"
ABBREVIATION	Allowed values are 0 through 4
AFTER_ERROR_LIMIT	Allowed values are ABORT or HALT

7.4 PRESET PARAMETER VALUES FOR MPWV

RND_NUM_SPECIFIED = FFFF
ADRS_SPECIFIED = FFFFFFFFFF
TESTS = 1-4
ERROR_LIMIT = 5
PASS_LIMIT = -
REPORT = LOG
INHIBIT = PASSNUMBER, TESTNUMBER
SCALE = 0
MINUTES LIMIT = -
ABBREVIATION = 3
AFTER_ERROR_LIMIT = ABORT

7.5 MODE CHARACTERISTICS FOR MPWV

<u>System Mode</u>	<u>Programs Running</u>	<u>Tests Running</u>	<u>Delay Between Tests</u>
Subsystem	Only one	One or more	None
Module	One or more	One or more	Random

7.6 INDIVIDUAL MPWV TESTS

(System Modes)

- Test 01 Basic MPWV Registers and Mapping RAM Checks SUB, MOD
Tests the basic ability to communicate with the Memory Protect register, Watch Variable register and the mapping RAM.
- Test 02 Check of Memory Protect Without DMA SUB, MOD
At each pass, tests one 64-byte block of "beyond pool" and one 64-byte block of HEAP for all combinations of current access class, memory protect mapping (0-6), write and read. Steps sequentially at each pass until upper limits are reached, then starts over.
- Test 03 Check MP Boundary—HMPU and Optional Memory SUB, MOD
Tests last 64-byte block of beyond pool, if optional memory is available, for all combinations of current access class, memory protect mapping (0-6), write and read.
- Test 04 Check of Watch Variable Without DMA SUB, MOD
At each pass, tests one 64-byte block of "beyond pool" and one 64-byte block of HEAP for all combinations of watch variable qualifier, watch variable byte address, write and read. Steps sequentially at each pass until upper limits are reached, then starts over.
- Test 05 Check of WV Boundary—HMPU and Optional Memory SUB, MOD
Do not use; future addition
- Test 06 Check of Memory Protect with DMA SUB, MOD
Do not use; future addition
- Test 07 Check of Watch Variable with DMA SUB, MOD
Do not use; future addition

7.7 MPWV ALARM MESSAGES

MPWV alarm messages describe, in English text, the specific problems encountered.

APPLICATION MODULE REDUNDANCY TESTS (AMRT) Section 8

8.1 AM REDUNDANCY ELEMENTS

The normal Application Module Redundancy Subsystem includes two Application Modules that are cable-connected through AMR or EAMR boards. Limited testing can be done on a single AM with an AMR board.

The Application Module(s) must contain either an HMPU processor board with an AMR or EAMR board, or a K4LCN processor board with an EAMR board.

8.2 USE INFORMATION

AMRT tests can be used with the following hardware configurations.

Processor AMR/EAMR Function	AMRT Tests
HMPU AMR Single	1 through 7
HMPU EAMR Single	1 through 7
K4LCN AMR	Not supported
K4LCN EAMR	1-3, 5-7, and 13
HMPU AMR Master/HMPU AMR Slave	1 through 12
HMPU AMR Master/HMPU EAMR Slave	1 through 12
HMPU EAMR Master/HMPU AMR Slave	1 through 12
HMPU EAMR Master/HMPU EAMR Slave	1 through 12
K4LCN AMR Master/K4LCN AMR Slave	Not supported
K4LCN AMR Master/K4LCN EAMR Slave	Not supported
K4LCN EAMR Master/K4LCN AMR Slave	Not supported
K4LCN EAMR Master/K4LCN EAMR Slave	1-3 and 5-15
HMPU/K4LCN (Redundancy with mixed processor types)	Not supported

Tests 8, 9, 10, 11, and 12 can be used for dual-board configurations only.

The AMRT-specific parameters are required because AMRT is normally a 2-node test program and cannot be set up without knowledge of whether the "other node" exists.

When performing master/slave tests, tests to be run can be specified in only the master node. The slave node will follow whatever is specified in the master. The roles of master and slave can be reversed when all no tests are being performed.

When performing master/slave tests, the tests must be started with the NETWORK command (see the Test System Executive) or timeouts will occur.

8.3 SETUP PARAMETERS

8.3.1 AMRT-Specific Parameters

O_NODE	Identifies the "other node's" address. If there is no backpanel connector to another node, use the node number for this node. Allowed values are 0-127. Note that the range of implemented node addresses is a subset of this value range.
O_SLOT	Identifies the slot number of the other node's AMR or EAMR that the backpanel is connected to. If there is no backpanel connector to another node, use the slot number of this node's AMR or EAMR. Allowed values are 1-15.
ROLE	Specifies the role type. When there is a backpanel connector to another node, one of the nodes must be the MASTER and the other the SLAVE. If there is no backpanel connector to another node, the role must be SINGLE. Allowed values are MASTER, SLAVE, SINGLE.

8.3.2 General Parameters

TESTS	Allowed values are 1 through 15
ERROR_LIMIT	Allowed values are 1 through 32767 or "-"
PASS_LIMIT	Allowed values are 1 through 32767 or "-"
REPORT	Allowed values are PASSNUMBER, TESTNUMBER, LOG, SUSPENDED
INHIBIT	Allowed values are PASSNUMBER, TESTNUMBER, LOG, SUSPENDED
SCALE	Allowed values are 0 through 999
MINUTES_LIMIT	Allowed values are 1 through 32767 or "--"
ABBREVIATION	Allowed values are 0 through 4

8.4 PRESET PARAMETER VALUES FOR AMRT

O_NODE = 1
O_SLOT = (the slot number of the AMRT's AMR/EAMR is used as an initial value)
ROLE = UNKNOWN
TESTS = 1-15
ERROR_LIMIT = 5
PASS_LIMIT = -
REPORT = LOG
INHIBIT = PASSNUMBER, TESTNUMBER, SUSPENDED
SCALE = 0
MINUTES_LIMIT = -
ABBREVIATION = 3

8.7 AMRT ALARM CATEGORIES

The AMRT tests are designed to verify correct operation of the AMR or EAMR board, and the majority of alarms produced indicate a failure of either the master or slave board. Other failure messages indicate discrepancies between operator-entered information and set up data gathered by the test program.

Two general types of test messages are produced. Operator Alert messages contain text explanations of the detected problems, while Alarm messages are formatted as described at heading 2.8.2 of the *Test System Executive* manual. Please note that the message text that accompanies some numbered Alarm messages can vary. Careful analysis of Alarm messages is required to determine which AMR or EAMR board has failed, because both master and slave boards often issue messages associated with the same error.

AMRT Operator Alert Messages

SLAVE DID NOT RESPOND TO TEST NUMBER CALL—Master node lost communication with slave node.

MASTER HAS NOT COMMUNICATED FOR 1 MINUTE—Slave node lost communication with master node.

INVALID TEST NUMBER—Operator has specified an invalid test number.

OTHER NODE ABORTED THIS NODE VIA MAIL

INVALID NODE AND/OR SLOT NUMBER FOR SINGLE NODE TESTING—See explanation for parameters O_NODE and O_SLOT.

INVALID NODE AND/OR SLOT NUMBER FOR TWO NODE TESTING—Each node must point to the other's node and slot number.

NODE AND/OR SLOT NUMBER OUT OF RANGE—Acceptable node range is 0–127 and slot range is 1–15.

UNEXPECTED MAIL RECEIVED FROM MASTER—Occurred while waiting to become the primary.

DID NOT BECOME PRIMARY WITHIN ONE MINUTE—Occurred while waiting to become the primary.

MASTER/SLAVE/SINGLE MUST BE SPECIFIED—See explanation for parameter role.

INITIAL SETUP FAILED—AMRT detected a parameter error or a hardware configuration that is not supported.

INITIAL ENVIRONMENT CONF. INCORRECTLY—AMRT detected a communications error between the nodes or a hardware configuration that is not supported.

INVALID TEST MODE—None of the tests selected are valid for the system mode.

ILLEGAL COMMAND DETECTED—AMRT software error.

SOFTWARE ERROR – MEMORY ALREADY RESERVED—AMRT software error.

SOFTWARE ERROR – BUFFER SIZE WRONG—AMRT software error.

HARDWARE CONFIGURATION NOT SUPPORTED—See subsection 8.2 (Use Information).

SOFTWARE ERROR – NO PACKETS SPECIFIED—AMRT software error.

SOFTWARE ERROR – MORE THAN 3 PACKETS—AMRT software error.

MIXED KERNEL PAIR NOT SUPPORTED—See subsection 8.2 (Use Information).

K2LCN/K4LCN MODULE BUS TEST (KMBT) Section 9

9.1 COMMON K2LCN/K4LCN MODULE BUS TEST ELEMENTS

The primary kernel elements tested by this program are the K2LCN/K4LCN board and the memory bus in either a single-node or dual-node 5-slot chassis.

9.2 USE INFORMATION

KMBT is used to verify correct operation of these module bus functions:

- Basic read and write operations into the module bus address space
- DMA operations
- Interrupt service
- Detection of references to nonexistent memory
- Detection of multiple-bit memory errors

KMBT uploads a custom set of primitives into an EPDG to perform operations as requested by the test program. Proper behavior is modeled by KMBT and is compared to actual behavior. Note that the EPDG is assumed to be known good and is not tested.

9.3 SETUP PARAMETERS

9.3.1 KMBT-Specific Parameters

STARTING_RANDOM (Can be changed only when KMBT is off.) When nonzero, this parameter sets the starting random number to be used by the current test (in Hex notation). Allowed values are \$0 through \$FFFF. If a test uses random numbers, this number is printed as part of any alarm message (to allow for faster replication of the error).

TRANSFER_LENGTH Controls the maximum length of the DMA transfers. Long-word transfers use this value unmodified, word-wide transfers use this value doubled, and byte-wide transfers use this value quadrupled. Allowed values are 1 to 512.

RANDOM_TRANSFERS Controls the use of randomly sized transfer lengths. Allowed values are

ENABLE = Transfers of 1 to TRANSFER_LENGTH are performed

DISABLE = Transfers are all of the size defined by TRANSFER_LENGTH.

9.3.2 General Parameters

TESTS	Allowed values are 1 through 7
ERROR_LIMIT	Allowed values are 1 through 32766 or "-"
PASS_LIMIT	Allowed values are 1 through 32766 or "-"
REPORT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
INHIBIT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
SCALE	Allowed values are 0 through 999
MINUTES_LIMIT	Allowed values are 0 through 32766 or "-"
ABBREVIATION	Allowed values are 0 through 4
AFTER_ERROR_LIMIT	Allowed values are ABORT or HALT

9.4 PRESET PARAMETER VALUES FOR KMBT

STARTING_RANDOM = 0
 TRANSFER_LENGTH = 512
 RANDOM_TRANSFERS = ENABLED
 TESTS = 1-7
 ERROR_LIMIT = 5
 PASS_LIMIT = -
 REPORT = LOG
 INHIBIT = PASSNUMBER, TESTNUMBER
 SCALE = 0
 MINUTES_LIMIT = -
 ABBREVIATION = 4
 AFTER_ERROR_LIMIT = ABORT

9.5 MODE CHARACTERISTICS FOR KMBT

<u>System Mode</u>	<u>Programs Running</u>	<u>Tests Running</u>	<u>Delay Between Tests</u>
Subsystem	Only one	One or more	None
Module	One or more	One or more	Random

9.6 INDIVIDUAL KMBT TESTS

(System Modes)

Test 01	Read/Write	SUB, MOD
	Tests the basic module bus read/write capabilities.	
Test 02	Interrupt Vectoring	SUB, MOD
	Verifies the module bus interrupt vectoring capabilities.	
Test 03	Byte-wide DMA	SUB, MOD
	Verifies the byte-wide DMA capabilities of the module bus.	
Test 04	Word-wide DMA	SUB, MOD
	Verifies the word-wide DMA capabilities of the module bus.	
Test 05	Longword-wide DMA	SUB, MOD
	Verifies the longword-wide DMA capabilities of the module bus.	
Test 06	Nonexistent Memory Detection	SUB, MOD
	Verifies the module bus capabilities of detecting references to nonexistent memory. This test is not performed if KMBT detects the presence of a full eight megawords of memory.	
Test 07	Memory Error Detection	SUB, MOD
	Verifies the multiple-bit memory error detection and indication capabilities of the module bus.	

9.7 KMBT ALARM MESSAGES

KMBT alarm messages start with the standard HVTS alarm header line followed by additional information including

- Description of the operation in progress
- Starting random number (if a random number was in use)
- Description of data area in error including was and should be values, the mask used, and the differences (exclusive OR of was and should be values ANDed with the mask).

LCNP PCI BUS TEST (PCIF) Section 10

10.1 LCNP PCI BUS TEST ELEMENTS

The LCNP board provides the functionality of a K2CLN-8 board to a host PowerPC through its PCI bus. Emulation software that is running on the Power PC provides three emulated slots for the WSI2, SCSI, and PDG.

The primary elements tested by the PCIF test program are the LCNP board and the PCI bus.

The PowerPC must have the following hardware.

- | | | |
|-------------------------------------|------------------|-------|
| • PowerPC 603 Processor | Minimum Revision | |
| • PowerPC Firmware | Minimum Revision | 2.06A |
| • PowerPC Riser Card | Minimum Revision | D |
| • LCNP Board Hardware ** | Minimum Revision | B |
| • LCNP Kernel Firmware ** | Minimum Revision | B |
| • LCNP PCI Gate Array (Serial PROM) | Minimum Revision | A |

** The LCNP hardware and firmware are always the same revision level.

The PowerPC must have the following support software running.

- | | | | | |
|-----------------------------------|------------------|------|-------|------|
| • Windows NT Operating System | Minimum Revision | 3.51 | Build | 1057 |
| • Windows NT Operating System HAL | Minimum Revision | 2.35 | | |
| • PowerPC BIOS | Minimum Revision | | | |
| • TDCA Driver | Minimum Revision | | | |
| • Common Board Response | Minimum Revision | | | |
| • Factory Test Emulators | Minimum Revision | 1.00 | | |

10.2 USE INFORMATION

The PCIF test program is designed to run on each of the three emulated slots (slots 2-4) on an LCNP board with one copy of PCIF per slot. The PCIF program is used to verify correct operation of the following PCI bus functions.

- Basic read and write operations into slot address space RAM (registers)
Memory area \$0-\$F is the normal register set for the emulated slot.
- Basic read and write operations into slot address space 4 KB RAM memory
Memory area \$10-\$FFF follows the register set for the emulated slot.
- DMA operations
- Interrupt service
- Host PC access slot address registers
- Detection of references to nonexistent memory
- Detection of multiple-bit memory errors
- Serial port operations

10.3 SETUP PARAMETERS

10.3.1 PCIF-Specific Parameters

STARTING_RANDOM (Can be changed only when PCIF is off.) When nonzero, this parameter sets the starting random number to be used by the current test (in Hex notation). Allowed values are \$0 through \$FFFF. If a test uses random numbers, this number is printed as part of any alarm message to allow for faster replication of the error.

TRANSFER_LENGTH Controls the maximum length of the DMA transfers. Long-word transfers use this value unmodified, word-wide transfers use this value doubled, and byte-wide transfers use this value quadrupled. Allowed values are 1 to 512.

RANDOM_TRANSFERS Controls the use of randomly sized transfer lengths. Allowed values are:

ENABLE = Transfers of 1 to TRANSFER_LENGTH are performed

DISABLE = All transfers are the size defined by TRANSFER_LENGTH.

10.3.2 General Parameters

TESTS	Allowed values are 1 through 11
ERROR_LIMIT	Allowed values are 1 through 32766 or "-"
PASS_LIMIT	Allowed values are 1 through 32766 or "-"
REPORT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
INHIBIT	Allowed values are PASSNUMBER, TESTNUMBER, LOG
SCALE	Allowed values are 0 through 999
MINUTES_LIMIT	Allowed values are 0 through 32766 or "-"
ABBREVIATION	Allowed values are 0 through 4

10.4 PRESET PARAMETER VALUES FOR PCIF

STARTING_RANDOM = 0
 TRANSFER_LENGTH = 512
 RANDOM_TRANSFERS = ENABLED
 TESTS = 1-11
 ERROR_LIMIT = 5
 PASS_LIMIT = -
 REPORT = LOG
 INHIBIT = TESTNUMBER, LOG
 SCALE = 0
 MINUTES_LIMIT = -
 ABBREVIATION = 4

10.5 MODE CHARACTERISTICS FOR PCIF

<u>System Mode</u>	<u>Programs Running</u>	<u>Tests Running</u>	<u>Delay Between Tests</u>
Subsystem	Only one	One or more	None
Module	One or more	One or more	Random
Exerciser	One or more	Only one	Random

10.6 INDIVIDUAL PCIF TESTS

(System Modes)

Test 01	LCNP Access Slot Registers	SUB, MOD
	Tests the LCNP basic write and read capabilities into the slot address space in RAM (registers).	
Test 02	LCNP Slot RAM Memory	SUB, MOD
	Tests the LCNP RAM memory in slot address space (4 KB memory) with writes and reads from the LCNP.	
Test 03	Interrupt Service	SUB, MOD
	Tests the interrupt vectoring capabilities of the PCI bus with interrupts to the LCNP triggered from the PC side.	
Test 04	Interrupt Service	SUB, MOD
	Tests the interrupt vectoring capabilities of the PCI bus with interrupts to the PC triggered from the LCNP side.	
Test 05	Word-Wide DMA	SUB, MOD, EXER
	Verifies the word-wide DMA capabilities of the PCI bus.	
Test 06	Long Word-Wide DMA	SUB, MOD
	Verifies the long word-wide DMA capabilities of the PCI bus.	
Test 07	Byte-Wide DMA	SUB, MOD
	Verifies the byte-wide DMA capabilities of the PCI bus.	
Test 08	Host PC Access Slot Address Registers	SUB, MOD
	Verifies the host PC write and read operations into slot address space in RAM (registers).	
Test 09	Host PC Access Nonexistent Memory Detection	SUB
	Verifies the ability to detect a reference to nonexistent memory from the host PC side and return the proper indication to a temporary bus master. This is a fatal test and must be the only test selected.	

Test 10 Host PC Access Multiple Bit Memory Error SUB

Verifies the ability to detect a multiple bit memory error from the host PC side and return the proper indication to a temporary bus master. This is a fatal test and must be the only test selected.

Test 11 Serial Port SUB, MOD

Verifies the Serial Port register and the resulting interrupts to the PC or LCNP. This test runs only in the first LCNP emulated slot (usually slot 4).

10.7 PCIF ALARM MESSAGES

The PCIF alarm messages start with the standard HVTS alarm header line followed by additional information including

- Description of the operation in progress
- Starting random number (if a random number was in use)
- Description of data area in error that includes the was and should be values, the mask used, and the differences (exclusive OR of was and should be values ANDed with the mask).

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