



# E84 Handheld Tester GCI05001

## Users Manual

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## Introduction

The GCI Handheld Tester is an efficient tool for quickly testing, trouble-shooting, and resolving E84 problems. It is a self-contained, battery operated tool integrating the industry-leading automated load and unload routines provided in the **GCI E84 Emulator**. It incorporates a number of industry firsts to quickly locate answers to E84 problems:

- Voltage and current measurement of each E84 signal
- Automated optical transceiver test
- Real-time display of E84 communications using the **GCI E84 DLD** and **GCI RJ-11 Optical Transceiver**

Starting with Revision 3.0, the HHT provides a Secure Digital Flash card interface. Test results from all HHT provided tests can be stored onto an inserted SD Card. DLD Log files can also be stored on an SD Card.

The new SD Card interface provides a simple method of transferring test results to a PC for additional analysis. Test results are saved in binary format compatible with the **GCI E84 Analysis Application**. Additional test results and information are stored in a formatted ASCII text file.

For customers who do not allow devices with SD Card interfaces in their facility, the HHT can also be ordered with an internal, non-removable, SD Card for test results storage. For this version, the HHT comes with a separate PC application and a null-modem cable to facilitate uploading test results to a PC via a communications port.

## Making Rear Panel Connections

The rear panel provides Passive and Active E84 ports and a COM (RS-232) port.

### Passive E84 Port

DB-25 socket housing (female) with 4-40 threaded jack screw locks. Pin assignments per E84 passive equipment side. Provides the interface for an external transceiver to perform load and unload tests and transceiver functional verification.

### Active E84 Port

DB-25 pin housing (male) with 4-40 threaded jack screw locks. Pin assignments per E84 active equipment side. Provides the interface to directly connect to a load port to perform load and unload tests and electrical tests.

### COM Port

DB-9 socket housing (female) configured as Data Terminal Equipment (DTE). Interfaces to GCI E84 Data Logging Device (DLD) and RJ-11 Transceiver using a 9-pin straight-through male-to-female cable for DLD log uploads, and live display mode. May also interface to a PC for test results upload.

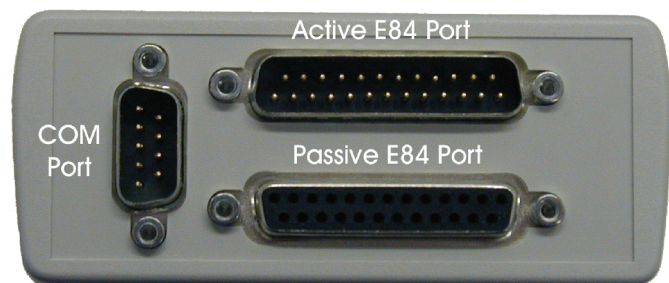


Figure 1 - HHT Rear Panel

### Navigating The E84 HHT Menus

Text and graphics menus provide the user interface to perform functions provided by the E84 HHT. Navigate the menus using the soft keys, arrow keys, and **Enter** key.

### Using The Soft Keys

The E84 HHT keypad provides eight soft keys in a two row by four column configuration. Each soft key has an associated ICON on the lower portion of the LCD. Use the soft keys to navigate the menus and select options.

For example, from the Test Menu, press the upper right soft key to advance to the Manual Mode Control menu. Note that there is not a function for the lower right soft key as indicated by a blank ICON.

In menus that display only the bottom row of soft key ICONs, use the bottom row of soft keys to make selections.

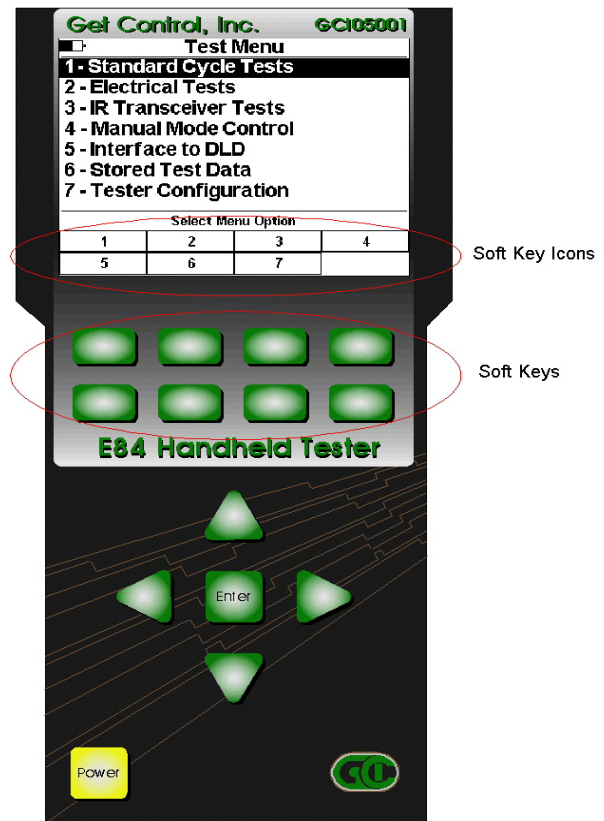


Figure 2 - Soft Keys and Icons

### Paperless Storage System (PSS)

Test results data can be saved in the HHT's Paperless Storage System (PSS). The PSS provides a convenient method of documenting E84 troubleshooting activities. Data stored in the PSS can be transferred to a computer for detailed analysis, reporting or archival purposes.

The HHT displays a **Save** soft key in each test screen that supports the PSS. The format of data saved depends on the HHT test in progress. Specific data formats are described in individual test sections below.

### SD Card Interface

Starting with Version 3.00, the HHT provides an SD Card interface for the PSS. Previous versions relied on internal non-volatile flash memory for data storage. This resulted in time-consuming uploads of test results when additional analysis was needed on a PC.

With the new SD Card interface, transferring test results to a PC becomes trivial. Simply remove the SD Card from the HHT, and insert it into an SD Card reader connected to a PC. All HHT test result are then available directly as files on the SD Card.

The HHT provides an SD Card slot in the front panel. SD Cards can be inserted only in one orientation. Slide the SD Card into the slot with the SD Card label facing up. Press the card fully into the slot until you hear a small 'click'. The SD Card slot is spring loaded. To remove the card, press in gently, which will cause the spring to release, allowing the card to be removed.

### Internal SD Card

For customers who prohibit removable SD Cards in their facility, the HHT can be ordered with an internal SD Card. The HHT's front panel does not have a card slot, and the SD Card is mounted inside the case, and cannot be removed. To upload stored test results, connect the HHT's

COM port to a PC's COM port using a null-modem cable. Run the separate PC HHT\_Upload application to upload stored test results. This process is described in detail in the Stored Test Data section later in this manual.

### **SD Card Format**

All HHT's are shipped with a pre-formatted SD Card. The HHT is compatible with any SD Card that has been formatted with the FAT16 file system. FAT16 is fully supported by all versions of Microsoft Windows®. Before using a new SD Card, format it for FAT16 using Windows Explorer®. Warning: formatting the SD Card will erase the card, resulting in the loss of any data stored on it.

### **File Organization**

HHT Test results files are organized by Tool ID. Each E84 interface in the FAB is associated with an EFEM (Equipment Front End Module) on a specific Tool. When testing a specific EFEM, it is convenient to organize all stored test results together.

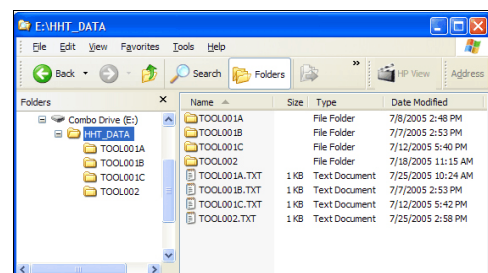
### **Tool ID**

The HHT stores all test results in a folder on the SD Card called HHT\_DATA. Within the HHT\_DATA folder, a series of Tool ID text files define the Tools being tested. The Tool ID files can be created using a text editor (Notepad) on the PC, or on the HHT using the Stored Test Data option. See below for the file format to use when creating Tool ID files on the PC. A description on creating new Tool ID's on the HHT can be found below.

The Tool ID file contains the Tool's ID (max. 8-character name), it's Location (max 20-characters), and a description of the Tool (max. 100-characters). The ID file also contains a breakdown of the types of tests stored by the HHT for that Tool.

When the HHT stores data to a specific Tool, a sub-folder is created within the HHT\_DATA folder. The Tool ID is used as the name for this new folder. All test results stored for this Tool is placed within this sub-folder. This folder is created automatically by the HHT. There is no need to create the folder manually.

Figure 3 shows an example of the SD Card file organization. The Combo Drive E: is the Windows Explorer tag for the SD Card. The root folder of the SD Card has a single folder in it called *HHT\_DATA*. Inside this folder, a series of sub-folders and text files are displayed. The text files (TOOL001A.TXT, TOOL001B.TXT, TOOL001C.TXT and TOOL002.TXT) are Tool ID files. Each Tool ID file is associated with a sub-folder (of the same name, minus the .TXT extension). All test results for a given tool are stored within the associated sub-folder.

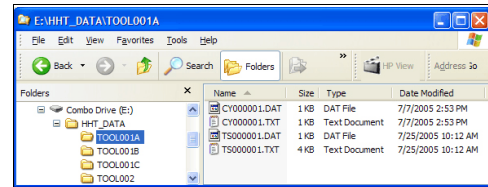


**Figure 3 - Example SD Card File System**

### **Test Results File Name**

The HHT automatically names stored test results files based on the test type. The HHT keeps index counters for each type of test. When results from a specific test type are stored, the HHT creates a filename in the format XXNNNNNN.DAT where XX is a two character test type code, and NNNNNN is a six digit index number. The first file saved for a specific test type is given index number 1. The index number is incremented for each subsequent results file saved.

Figure 4 shows test results stored for Tool ID *TOOL001A*. The folder for *TOOL001A* contains two different test results, one from a Cycle Test, the other from an Emulator Test Suite test.



**Figure 4 - Stored Test Results Files**

The filename for the Cycle test is CY000001.DAT, which indicates it is the first CYCLE test saved for *TOOL001A*. The .DAT extension indicates it is a binary file that is formatted for use with the **GCI E84 Analysis Application**.

A second file of the same name, with a .TXT extension, contains additional test details in a formatted ASCII report. This file can be viewed with any text editor.

The filename for the Emulator Test Suite is TS000001.DAT, which indicates it is the first Test Suite test saved for *TOOL001A*.

If another Cycle or Test Suite test was saved, the index number would be incremented. The file time-stamp indicates when the test results were stored, and can be used as a method of determining the desired file when viewing on the PC.

### **Tool ID File Format**

Tool ID files can be created using a text editor (Notepad) on the PC. Simply create a file with the following format, and save it to the HHT\_DATA folder on a SD Card. If the SD Card has not been used previously with an HHT, you must first create the HHT\_DATA folder.

**Figure 5** shows the Tool ID File Format. The file should contain 9 lines of text. Each line contains a specific piece of information about the Tool, and is terminated with a carriage return.

Line 1: Tool Name - maximum of 8 characters. This will also be the name of the file, with a .TXT extension. The Tool Name is used as the filename, and the name of the folder where test results will be stored, therefore the name cannot contain the following characters:  
 \/:\*?"<>|.

Line 2: Tool Location - maximum 20 characters. This is a free format text string that can be used to define the location of the Tool in the FAB (i.e. bay number, EFEM number).

Line 3: Tool Details - maximum 100 characters. This is a free format text string that can be used to describe the Tool. This can include Tool manufacturer, tool type, etc.

Line 4: Number of Cycle Test Results stored (set to zero for newly created Tool ID files).

Line 5: Number of Electrical Test Results stored (set to zero for newly created Tool ID files).

Line 6: Number of IR Transceiver Test Results stored (set to zero for newly created Tool ID files).

Line 7: Number of Strip Chart (manual) Results stored (set to zero for newly created Tool ID files).

Line 8: Number of DLD Log Files stored (set to zero for newly created Tool ID files).

Line 9: Number of Emulator Test Suite Results stored (set to zero for newly created Tool ID files).

```
Name <cr>
Location <cr>
Details <cr>
0<cr>
0<cr>
0<cr>
0<cr>
0<cr>
0<cr>
0<cr>
```

**Figure 5 - Tool ID File Format**

Save the file to the HHT\_DATA folder on the SD Card. The filename should be the same as the Name string (line 1), with a .TXT extension.

### **Saving Test Results**

Pressing the **Save** soft key (displayed on each screen where test results can be saved) brings up the Save Test Results screen. A list of Tool ID's is displayed on the left side of the screen. Information on the currently selected Tool ID is displayed on the right side of the screen.

Use the **Up** and **Down Arrow** keys, along with the **Top**, **Bottom**, **Prev**, and **Next** soft keys to move the Tool selection cursor to the desired Tool (in Figure 6, *TOOL001A* is selected).

The **Up** and **Down Arrow** keys move the cursor up and down one Tool ID. The **Top** soft key moves the cursor to the first Tool ID in the list. The **Bottom** soft key moves to the last Tool ID in the list. The **Prev** and **Next** soft keys page up and down (respectively) by 11 Tools.

The **Edit** soft key can be used to edit the Tool ID record of the selected Tool. To create a new Tool ID record, select the *New Tool* entry, and press the **Edit** soft key. See Editing Tool Details below for more information on creating and editing Tool ID records.

After selecting the desired Tool ID, press the **Enter** key to save the test results. The HHT creates two files inside the sub-folder for the selected Tool ID. The file name is auto-generated based on the test type. The HHT remembers the last Tool ID selected (until the SD Card is removed, or the unit is powered OFF).

### Editing Tool Details

When editing or creating Tool ID records, the Edit Tool Details screen is displayed. The Tool ID, Location and Details fields are displayed, showing their current values. When creating a new Tool ID record, the Tool ID field is blank, and must be set to the desired Tool ID name. When editing a Tool ID record, the Tool ID field can not be modified on the HHT.

The Edit Tool Details screen has three pages of soft keys. Switch between soft key pages using the **Up** and **Down Arrow** keys.

The first soft key page contains the Latin alphabet (upper case), as well as the characters "( ) - \_" (parentheses, square brackets, dash, and underscore). The second soft key page contains the Latin alphabet (lower case), as well as the characters "! @ # % & \*" (exclamation point, at sign, pound sign, ampersand, and asterisk). The third page contains Arabic numerals, as well as a space character, and the "+" character (plus). Five additional editing soft keys are available on the third page.

The soft keys are operated similar to the keys on a cellular phone. Press the soft key once for the first displayed character, twice for the second, etc.

Save Test Results			
Tools		Tool Information	
TOOL001A	Tool ID: TOOL001A		
TOOL001B	Location: METROLOGY BAY C		
TOOL001C	Details: WAFER SORTER - LOAD PORT 1		
TOOL002	Select Tool ID and press Enter to save test results. Edit the New Tool entry to create a new Tool ID before saving.		
XYZ			
New Tool			
Top	Prev		
Bottom	Next	Edit	Exit

Figure 6 - Save Test Results Screen

Edit Tool Details			
Tool ID: TOOL001A			
Location: METROLOGY BAY C			
Details: WAFER SORTER - LOAD PORT 1			
ABC (	DEF )	GHI [	JKL ]
MNO -	PQRS	TUV _	WXYZ

Figure 7 - Edit Tool Details Screen

Edit Tool Details			
Tool ID: TOOL001A			
Location: METROLOGY BAY C			
Details: WAFER SORTER - LOAD PORT 1			
1 2 3 sp	4 5 6 ~	7 8 9 0	Cancel
Clear	Del	Ins	Done

Figure 8 - Edit Tool Details Screen (2)

A rectangle is drawn around the current field being modified. A vertical bar is displayed at the location of the character cursor.

Use the Enter key to select the desired field. Each time the Enter key is pressed, the rectangle is advanced to the next field.

Use the **Ins** soft key to switch between insert mode, and overstrike mode. Insert mode is enabled by default. In overstrike mode, characters to the right of the cursor are overwritten by new characters.

The **Del** soft key will delete the character to the left of the cursor. The cursor will back up one character. If no characters have been entered, the **Del** soft key has no affect.

The **Clear** soft key will clear the current field, and place the cursor at the beginning of the field.

Use the **Cancel** soft key to cancel your Edit session, and return to the previous screen. Changes made will be lost.

Use the **Done** soft key to end the editing session, and save all changes.

Press the **Right Arrow** key to move to the next character in the current field. If the cursor is at the end of the field, the **Right Arrow** key will insert a space character.

Press the **Left Arrow** key to move the cursor to the left.

### Main Test Menu

The Main Test Menu is displayed when the HHT is first powered up. This menu provides access to each supported HHT test type, as well as Stored Test Data and HHT Configuration.

Menu options are numbered, and can be selected using the numbered soft keys. Menu options can also be selected using the **Up** and **Down Arrow** keys. The currently selected option is highlighted. Press the **Enter** key to select the current option.

A battery fuel gauge is displayed in the upper left corner of the LCD. This fuel gauge shows approximate remaining battery life based on usage. Average current drawn from the batteries fluctuates based on specific HHT operations. Actual measured current draw is used to estimate remaining battery life.

The battery fuel gauge is displayed in all HHT screens. The fuel gauge is updated to show 3/4, 1/2, and 1/4 full based on usage.

### Active Mode Load and Unload Cycles

\Standard Load and Unload Cycle Tests are available using Test Menu Option 1.

The Standard Cycle Test Menu provides options for

Test Menu			
<b>1 - Standard Cycle Tests</b>			
<b>2 - Electrical Tests</b>			
<b>3 - IR Transceiver Tests</b>			
<b>4 - Manual Mode Control</b>			
<b>5 - Interface to DLD</b>			
<b>6 - Stored Test Data</b>			
<b>7 - Tester Configuration</b>			
Select Menu Option			
1	2	3	4
5	6	7	

Figure 9 - Main Test Menu

Standard Cycle Test Menu			
<b>1 - Active Mode Load Test</b>			
<b>2 - Active Mode Unload Test</b>			
<b>3 - Passive Mode Load Test</b>			
<b>4 - Passive Mode Unload Test</b>			
<b>5 - Emulator Test Suite</b>			
<b>6 - Continue Emulator Test</b>			
Select Menu Option			
1	2	3	4
5	6		Main

Figure 10 - Standard Cycle Test Menu

running Load and Unload cycle tests in both Active and Passive modes.

This menu also provides options for running Emulator Test Suite tests. Please see the Emulator Test Suite Addendum for details.

During Active Mode tests, the HHT simulates the active side (AMHS) of the E84 handoff. This mode is used when testing a load port.

During Passive Mode tests, the HHT simulates the passive side (EFEM) of the E84 handoff. This mode is used when testing a delivery vehicle.

Use the numbered soft keys to select the desired test mode.



Press the **CS\_0** and **CS\_1** soft keys to toggle the CS\_0 and CS\_1 output states prior to handoff.

CS\_0 is set exclusively for a single load port per E84 port configuration (HHT default). CS\_0 and CS\_1 select left and right load port respectively in a one E84 port per two load ports configuration.

Use the soft keys to select the type of connection between the HHT and the Load Port: **Internal IR**, **External IR**, or **Direct**. The status window displays a graphic depicting the physical configuration of the interface between the HHT and load port (Figures 11 - 13).

Press the **Start** soft key to initiate the Active Mode Load Cycle Test.

Press the **Exit** soft key to return to the Main Menu.

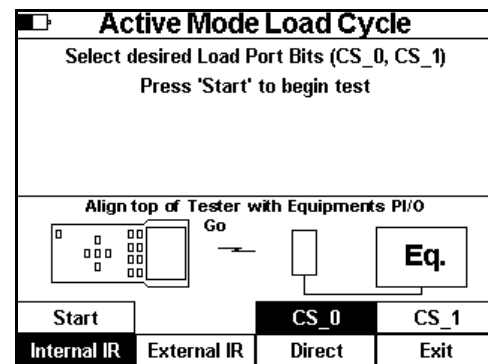


Figure 11 - Active Mode Load Cycle - Internal IR

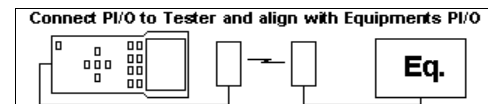


Figure 12 - External IR Connection



Figure 13 - Direct Connection

The real-time graph window displays the states of all E84 signals during Active Mode Load and Unload Cycles.

The HHT prompts the operator when intervention is required to place (load) or remove (unload) a FOUP at the load port. It displays a countdown timer to indicate the time remaining before a timeout error will occur.

Press the **Abort** soft key to abort the current load or unload cycle.

Successful cycles are reported in the status window. The HHT detects and reports any errors in the same status window.

After a test completes, successfully or with an error, a new set of soft key icons is displayed. Press the **Re-Test** soft key to re-run the current cycle test.

Press the **Save** soft key to save the Cycle Test results data (see Paperless Storage System above). Cycle Tests results data saved in the PSS include signal state change history (real-time graph), cycle completion status and E84 Timeout settings. Cycle Test results transferred to a computer can be analyzed using the GCI E84 Analysis Application. The ASCII report generated for Cycle Tests include the number of events recorded, along with E84 Timeout settings, cycle type (Load / Unload) and completion status (error code and message).

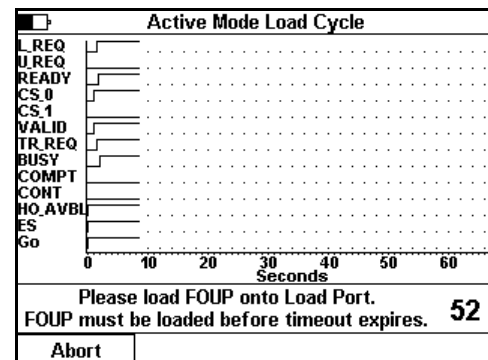


Figure 14 - Load Cycle Graph Window

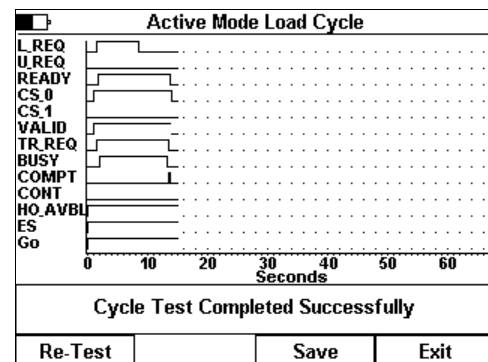


Figure 15 - Load Cycle Complete

Press the **Exit** soft key to close the real time graph window, and return to the Standard Cycle Test Menu.

### Electrical Tests

Electrical Tests are available using Test Menu Option 2.

#### Power Supply Voltage Test

Use the power supply voltage test to verify that the load port supplies the required power for a transceiver. The Power Supply Voltage Test is only available in the direct connect configuration.

The E84 Specification states that the passive equipment (load port) must supply voltage on Pin 23 of the female DB-25 connector. It further specifies that the passive equipment should leave pin 22 unconnected. The active equipment supplies voltage on pin 22. The E84 Specification further states that the voltage level must remain with +18 VDC and +30 VDC under both no-load and full-load conditions.

The HHT measures the voltage level on both pins, under no-load and full-load conditions. The voltage measurements are displayed on the screen. To be compliant, all four measurements must remain within the voltage limits.

Press the **Next** soft key to advance to the next screen.

Press the **Exit** soft key to return to the Main Test Menu.

#### Displaying Signal Voltage and Current Levels

The E84 HHT displays voltage and current levels for E84 signals for Active or Passive entities in the direct connect configuration. Measurements are displayed by output number, DB-25 pin number, E84 signal name, and voltage or current.

Press the **Voltage** and **Current** soft keys to switch the signal display between voltage and current.

Active Signal Levels			
Outputs		Inputs	
OutPin	Signal	In Pin	Signal
	Current		Current
1	14 VALID	1	1 L_REQ
2	15 CS_0	2	2 U_REQ
3	16 CS_1	3	3 VA
4	17 AM_AVBL	4	4 READY
5	18 TR_REQ	5	5 VS_0
6	19 BUSY	6	6 VS_1
7	20 COMPT	7	7 HO_AVBL
8	21 CONT	8	8 ES
	12 Go	10	Select
		11	Mode

Voltage	Active	Previous	Save
Current	Passive	Manual	Exit

**Figure 18 - Active Signal Levels - Current**

Press the **Active** and **Passive** soft keys to switch the signal display between Active and Passive entities. When set for Active display, the HHT should be connected to a passive entity (load port).

Press the **Previous** soft key to return to the Power Supply Voltage Test screen.

Press the **Save** soft key to save Electrical Test results data (see Paperless Storage System above).

Electrical Test data saved in the PSS include measurements for all input, output, and control signals. The most recent measurements are saved in the PSS, including measurements affected by setting HHT outputs using Manual Mode below. The ASCII report generated provides a formatted table of voltage and current levels for all signals.

Power Supply Voltage Test			
Passive Eq. should supply +24 VDC on Pin 23 Handheld Tester supplies +24 VDC on Pin 22 Voltage levels must be between +18 and +30 VDC			
	No Load	Full Load (100 mA)	
Pin 22:	24.19 VDC	24.23 VDC	
Pin 23:	27.96 VDC	24.94 VDC	

Connect Tester to Equipment using straight through cable

Next	Exit
------	------

**Figure 16 - Power Supply Voltage Test**

Active Signal Levels			
Outputs		Inputs	
OutPin	Signal	In Pin	Signal
	Voltage		Voltage
1	14 VALID	1	1 L_REQ
2	15 CS_0	2	2 U_REQ
3	16 CS_1	3	3 VA
4	17 AM_AVBL	4	4 READY
5	18 TR_REQ	5	5 VS_0
6	19 BUSY	6	6 VS_1
7	20 COMPT	7	7 HO_AVBL
8	21 CONT	8	8 ES
	12 Go	10	Select
		11	Mode

Voltage	Active	Previous	Save
Current	Passive	Manual	Exit

**Figure 17 - Active Signal Levels Screen - Voltage**

Use the Electrical Test screens to verify that an E84 interface is electrically compliant. Input and output signals must match the voltage and current levels defined in the E84 Specification. For signals in the OFF state, voltage levels must remain above 1.8 VDC, with current levels less than 200  $\mu$ A. Signals in the ON state must have voltage levels less than 1.8 VDC, with current levels greater than 200  $\mu$ A (typically in the mA range).

Press the **Exit** soft key to close the Electrical Test screen, and return to the Main Test Menu.

### Electrical Test Manual Mode

Press the **Manual** soft key to enter Electrical Test Manual mode.

Two soft key pages are provided. The first page shows HHT output signal names based on the current settings of the **Active** and **Passive** soft keys shown above. In Figure 19, Active output signals are shown.

The second soft key page shows Active (passive) control signals, and Exit.

Set HHT outputs by pressing the associated soft key. When an output has been turned ON, its associated soft key is highlighted. Turn OFF outputs by pressing the associated soft key again.

Voltage and current measurements cannot be saved while running in Manual Mode. To save measurements of outputs set using Manual Mode, return to the Electrical Test Signal Level screen.

Press the **Exit** soft key to close Manual Mode, and return to the Electrical Test Signal Level screen.

### IR Transceiver Test

The E84 HHT IR Transceiver Test, Test Menu Option 3, performs a complete end-to-end functional test on E84 compatible optical transceivers.

Plug the IR Transceiver (UUT) into the passive DB-25 on the rear panel of the HHT. Align the front of the HHT with the transceiver's IR window (Figure 21). The GO signal on the transceiver should light and a Go indicator for the HHT and transceiver should appear on the HHT's LCD. While maintaining IR alignment, press the **Auto Test** soft key to begin the test.

If there is no alignment indicator displayed on the HHT, the **Auto Test** option will be disabled. For the Auto Test to start, the HHT must be receiving an IR signal from the UUT.

Press the **Manual** soft key to enter IR Manual Mode.

Press the **Burn-In** soft key to repeat the auto test continuously. The IR Transceiver Auto Test Screen is displayed, and the test pattern is repeated indefinitely.

Active Signal Levels							
Outputs				Inputs			
OutPin	Signal	Voltage		In Pin	Signal	Voltage	
1	14	VALID	0.7 V	1	1	L_REQ	24.1 V
2	15	CS_0	0.8 V	2	2	U_REQ	1.2 V
3	16	CS_1	26.6 V	3	3	VA	24.2 V
4	17	AM_AVBL	26.7 V	4	4	READY	24.0 V
5	18	TR_REQ	26.6 V	5	5	VS_0	24.1 V
6	19	BUSY	26.6 V	6	6	VS_1	24.1 V
7	20	COMPT	26.6 V	7	7	HO_AVBL	
8	21	CONT	26.6 V	8	8	ES	
	12	Go		10	10	Select	
				11	11	Mode	
		<b>VALID</b>	<b>CS_0</b>		<b>CS_1</b>	<b>AM_AVBL</b>	
		<b>TR_REQ</b>	<b>BUSY</b>		<b>COMPT</b>	<b>CONT</b>	
↓ ↑							
Go				Exit			

Figure 19 - Electrical Test - Manual Mode

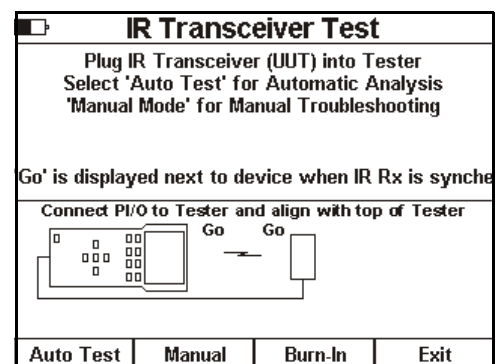


Figure 20 - IR Transceiver Test



Figure 21 - IR Transceiver Test Alignment

Press the **Abort** soft key to terminate the burn-in test.

Press the **Exit** soft key to return to the Main Test Menu.

### IR Transceiver Auto Test Screen

The IR Transceiver Auto Test changes the state of each Output and Input on the transceiver and performs verification. Voltage levels are recorded for each signal, in both the ON and OFF states. The screen displays the current state of each output and input. IR alignment must be maintained during the entire test.

IR Transceiver Auto Test	
Please Wait	
IR Loopback Test in Progress	
Outputs	Inputs
→ 1	1
→ 2	2
3	3
4	4
5	5
6	6
7	7
8	8
Abort	

Figure 23 - IR Auto Test with Errors

### IR Test Summary Screen

When the IR Transceiver Test completes, the HHT displays the IR Test Summary Screen showing the statistical results of the test.

IR Test completion status is displayed near the top of the screen. If the transceiver fails at least one test, an error message is displayed.

Press the **Save** soft key to save IR test results data (see Paperless Storage System above). IR test results saved in the PSS include voltage measurements for all input, output, and control signals in both the ON and OFF state. The ASCII report generated provides a formatted table of voltage and current levels for all signals.

If the test failed, press the **Err Detail** soft key to display specific details of each error detected.

Press the **ON State** or **OFF State** soft keys to display voltage and current measurements taken during the IR test.

Press the **Exit** soft key to close the IR Transceiver Test and return to the Main Test Menu.

IR Transceiver Auto Test	
Please Wait	
IR Loopback Test in Progress	
Outputs	Inputs
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
Abort	

Figure 22 - IR Auto Test Active

Errors detected during the IR Auto Test are marked on screen as they occur. Arrows are displayed next to the input / output signal that failed.

Press the **Abort** soft key to abort the IR Transceiver Test.

IR Transceiver Test Summary			
The UUT has passed all IR Loopback tests. The UUT appears to fully comply with published E84 specifications.			
IR Test Breakdown			
	Pass	Fail	
16 Output Patterns	16	0	
16 Input Patterns	16	0	
3 Control Tests	3	0	
	ON State	Save	
Re-Test	Manual	OFF State	Exit

Figure 24 - IR Transceiver Test Summary Screen

## IR Error Detail Screen

The IR Test Error Details screen displays specific details about each error that the IR Transceiver test detected. It reports opens circuits, shorts circuits, and unexpected patterns.

Figures 25 and 26 show example IR Test Error Detail Screens.

IR Test Error Details			
Total Errors:	20	Current Error: 8	↑ ↓
UUT failed the Select Bit Functionality test. The Select bit (pin 10) should disable transmission and reception operations when set. The UUT failed to halt transmission when the Select Bit was Set. This could mean pin 10 is not wired properly.			
			Summary

Figure 26 - IR Error Detail Screen

## IR Test Manual Mode

Press the **Manual** soft key to enter IR Manual Mode.

IR Manual Mode shows HHT input and output voltage levels, and provides two soft key pages used to set internal and extern IR inputs.

Soft key page one displays transceiver input signal names. Soft key page two displays transceiver control signal names, **Ext. IR**, **Int. IR** and **Exit** soft keys.

Press the **Ext. IR** soft key to select the attached IR Transceiver. When the external IR is selected, page one soft keys can be used to set the attached IR Transceiver's input signals.

Press the **Int. IR** soft key to select the HHT's internal IR Transceiver. When the internal IR is selected, page one soft keys can be used to set the HHT's IR Transceiver's input signals.

Press the **Exit** soft key to return to the IR Test Summary Screen.

IR Test Error Details			
Total Errors:	20	Current Error: 1	↑ ↓
HHT detected a probable open circuit on UUT Output 1. UUT pin 14 appears to be open.			
			Summary

Figure 25 - IR Error Detail Screen

Use the **Up** and **Down Arrow** keys to scroll through the error list.

Press the **Summary** soft key to return to the Summary screen.

IR Signal Levels			
Outputs		Inputs	
OutPin	Signal Voltage	In Pin	Signal Voltage
1	1 L_REQ 23.0 V	1	14 VALID 23.7 V
2	2 U_REQ 23.0 V	2	15 CS_0 23.7 V
3	3 VA 22.9 V	3	16 CS_1 23.7 V
4	4 READY 23.0 V	4	17 AM_AVBI 23.7 V
5	5 VS_0 22.9 V	5	18 TR_REQ 23.7 V
6	6 VS_1 23.0 V	6	19 BUSY 23.7 V
7	7 HO_AVBL 22.9 V	7	20 COMPT 23.7 V
8	8 ES_ 23.1 V	8	21 CONT 23.7 V
	10 Select 23.2 V	12	Go 0.0 V
	11 Mode 22.9 V		
L_REQ	U_REQ	VA	READY
VS_0	VS_1	HO_AVBL	ES
↓ ↑			
Select	Mode	Ext. IR	
		Int. IR	Exit

Figure 27 - IR Test Manul Mode

## IR On / OFF State Levels

This screen shows voltage and current measurements taken during the IR Transceiver Test.

Press the **Voltage** soft key to display voltage measurements.

Press the **Current** soft key to display current measurements.

Press the **ON State** soft key to display the voltage or current of the inputs and outputs as measured in their ON state.

Press the **OFF State** soft key to display the voltage or current of the inputs and outputs as measured in their OFF state.

Press the **Summary** soft key to return to the IR Test Summary Screen.

IR Test Measurements					
Outputs			Inputs		
OutPin	Signal	Voltage	In Pin	Signal	Voltage
1	L_REQ	0.9 V	1	14_VALID	0.1 V
2	U_REQ	0.9 V	2	15_CS_0	0.1 V
3	VA	1.0 V	3	16_CS_1	0.1 V
4	READY	1.0 V	4	17_AM_AVBL	0.1 V
5	VS_0	0.9 V	5	18_TR_REQ	0.1 V
6	VS_1	1.0 V	6	19_BUSY	0.0 V
7	HO_AVBL	0.9 V	7	20_COMPT	0.1 V
8	ES	0.9 V	8	21_CONT	0.1 V
10	Select	0.9 V	12	Go	0.1 V
11	Mode	0.9 V	E84 Spec: In: Max 1.8 VDC Out: Max 1.8 VDC		

Voltage ON State  
 Current OFF State  
 Summary

**Figure 28 - IR Test 'On' Measurements**

## Manual Mode Control

Manual Mode Control is available using Test Menu Option 4.

The Manual Control menu provides options to run Active or Passive Mode Manual Control.

Press the **1** soft key to run Manual Control in Active Mode (HHT as delivery vehicle).

Press the **2** soft key to run Manual Control in Passive Mode (HHT as load port).

Use the soft keys to select the type of connection between the HHT and the equipment being tested: **Internal IR**, **External IR**, **Direct**. The status window displays a graphic depicting the physical configuration of the interface between the HHT and the equipment.

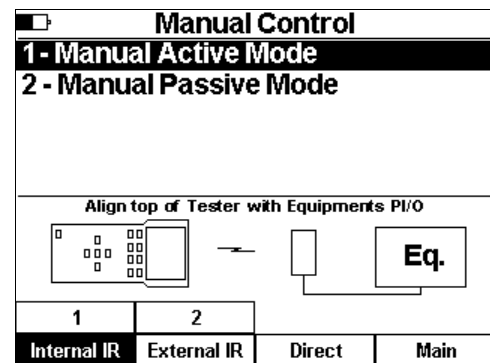
Press the **Main** soft key to return to the Main Test menu.

## Manual Control Screen

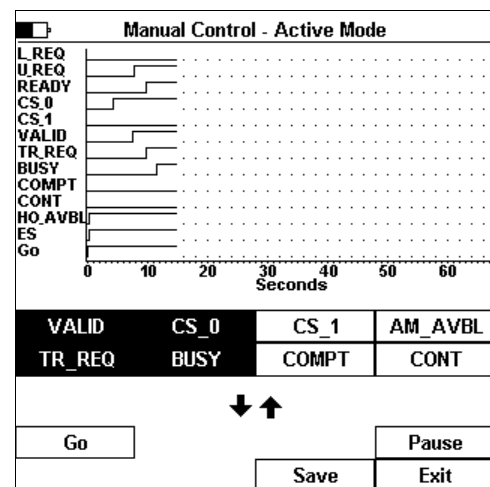
Manual Mode control displays the current state of all E84 inputs and outputs in a real-time graph window. Two pages of soft keys are provided.

Page one contains soft keys for all E84 outputs. E84 output soft keys are 'toggle' keys. Turn ON an E84 output by pressing the associated soft key. Soft key icons are displayed white-on-black for those E84 outputs that are turned ON.

Turn OFF an E84 output by pressing the associated soft



**Figure 29 - Manual Control Menu**



**Figure 30 - Manual Control - Active Mode**

key again. Soft key icons are displayed black-on-white for those E84 outputs that are turned OFF.

Page two contains soft keys for E84 control outputs, along with **Pause**, **Save** and **Exit** soft keys.

Figure 30 shows the Active Mode Manual Control Screen after several seconds. Four E84 outputs have been turned ON.

Press the **Pause** soft key once to pause the Manual Control real-time graph window. The **Pause** soft key is a toggle switch, remaining ON until pressed a second time. The HHT does not update the real-time graph when the **Pause** soft key is selected. The HHT continues to scan E84 inputs, and maintain E84 outputs during the Pause. Changes to E84 inputs are not displayed.

Press the **Pause** soft key to re-enable real-time graph updates.

Press the **Save** soft key to save Manual Control timing data (see Paperless Storage System above). Manual Control timing data saved in the PSS include the time stamp and signal state of the last 100 signal change events. Each time either an input or output changes state, the HHT records a timestamp, along with the state of all E84 inputs and outputs. Manual Control timing data transferred to a computer can be analyzed using the GCI E84 Analysis Application. The ASCII report generated for Manual Control tests include the mode (Manual Active or Manual Passive), along with the current E84 timeout settings, and the number of signal change events.

Manual Control storage is limited to the last 100 signal change events.

Press the **Exit** soft key to close the Manual Control Screen and return to the Main Test Menu. The **Enter** key can also be used to exit the Manual Control Screen.

### Interface to DLD

The HHT can interface with an attached GCI DLD or RJ11 Transceiver (with built in DLD) using Test Menu Option 5.

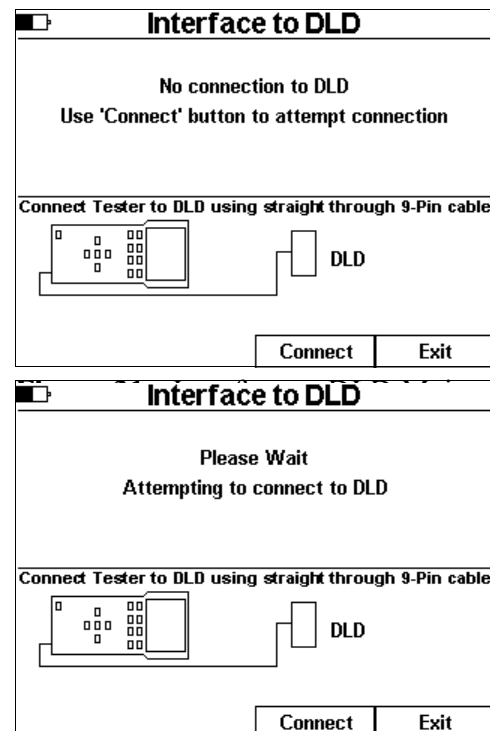
The GCI DLD captures and writes E84 handshake timing details into non-volatile memory. Internal memory provides the capacity to store over 50 FOUP handoffs.

Using the HHT's DLD Interface capabilities provides access to DLD's configuration, log file upload, and live display mode features.

The Interface to DLD Screen shows a graphic depicting the proper connection between the HHT and the DLD. Typically, the DLD would be installed between the Process Equipment and its PI/O Transceiver. Alternately, the DLD can be plugged directly into the HHT's Passive E84 Port.

The HHT connects to the DLD using a straight through 9-pin male-to-female cable.

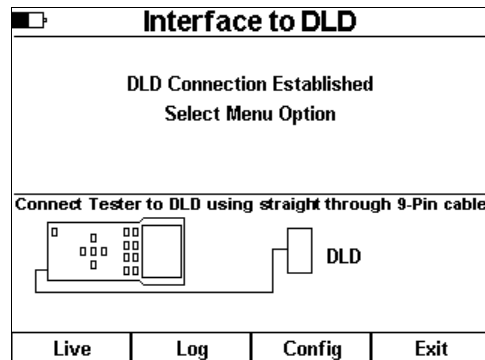
Press the **Connect** soft key to attempt to establish communications with the DLD.



**Figure 32 - Interface to DLD - Attempting to Connect**



A status message is displayed while the HHT searches for an attached DLD. The DLD periodically checks the status of its COM port to see if an HHT is connected. Connection may take up to 5 seconds. If no DLD is found within 5 seconds, the HHT terminates the attempt and displays an error message.



**Figure 33 - Interface to DLD - Contact Established**

Once contact is established, the HHT adds additional soft key options to the Interface to DLD Screen.

Press the **Live** soft key to enter the DLD Live Mode.

Press the **Log** soft key to upload the DLD's log file.

Press the **Config** soft key to modify DLD configuration settings.

Press the **Exit** soft key to return to the Main Test Menu.

### **DLD Live Mode**

During DLD Live Mode, the HHT continuously updates a real-time graph window with data received from the attached DLD.

Press the **Pause** soft key to pause real-time graph updates. The HHT continuously receives data from the DLD while paused. Received data is not added to the real-time graph.

Press the **Pause** soft key again to re-enable real-time graph updates.

Press the **Exit** soft key to terminate DLD Live Mode and return to the Interface to DLD Screen. There is currently no Save option during DLD Live mode.

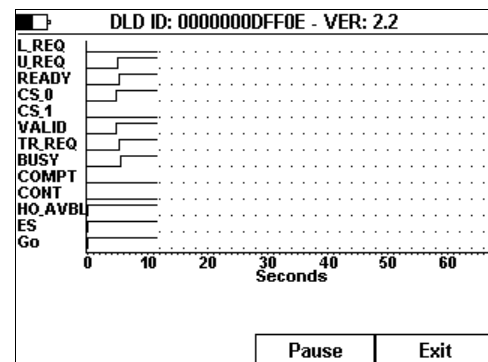
### **DLD Log File**

The HHT stores the DLD Log file in the PSS. Before starting the upload process, the HHT needs to know where to store the Log file. The Save Test Results screen is displayed when the **Log** soft key is pressed. Select a Tool ID to save the DLD Log file to (see Saving Test Results Files above for details on selecting the Tool ID). DLD Logs transferred to a computer can be analyzed using the GCI E84 Analysis Application (Version 2.70 or newer).

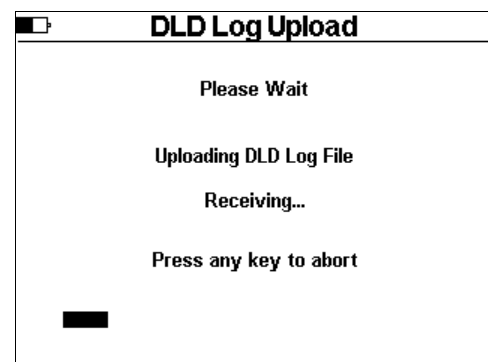
After selecting the Tool ID, the DLD Log Upload Screen will be displayed.

During the DLD Log Upload, the HHT displays a Please Wait prompt, along with a status bar showing progress of the upload.

Press any HHT key to abort the DLD Log Upload.



**Figure 34 - DLD Live Mode Display**



**Figure 35 - DLD Log File Upload Screen**

When the upload is completed, a status message is displayed showing the number of DLD records received.

Press the **Exit** soft key to return to the Interface to DLD Screen.

### HOWTO: Download the DLD Log - Step by Step Instructions

1. If the DLD is not connected to a tool, plug the DLD's male DB25 connector into the HHT's Passive E84 Port. The HHT will supply power to the DLD through this interface. If the DLD is already connected to a tool or other E84 interface, its DB25 connector does not need to be plugged into the HHT.
2. Use the DLD Comm Cable, GCI P/N 9101-22-122 (or a male-to-female DB9 straight-through cable) to connect the DLD to the HHT's COM port.
3. Select Test Menu Option 5 (Interface to DLD) from the HHT's main menu.
4. Press the **Connect** soft key to connect to the DLD.

If the HHT is unable to connect to the DLD, make sure that the DLD is firmly plugged into its power source. If it still can not connect, and the HHT is not the DLD's power supplier, try disconnecting the DLD from the E84 interface to which it is connected, and connect it to the HHT instead.

5. After a connection has been established, press the **Log** soft key.
6. Select the proper Tool ID, and press the **Enter** key to continue.
7. Monitor the download status displayed by the HHT.
8. When the download completes, press the Exit soft key to close the DLD Log Upload Screen and return to the Interface to DLD Screen.

### DLD Configuration Screen

The DLD Configuration Screen provides a method of viewing and modifying current DLD settings.

Current DLD settings are displayed near the top of the screen. Settings displayed include the DLD's internal Date and Time, its firmware Version Number and unique DLD ID.

If the DLD firmware supports statistics gathering, a series of counters are also displayed.

Two configurable options are supported by the DLD; Error Trapping and Idle Noise. *Error Trapping* limits the DLD to record only failed E84 transactions. *Idle Noise* limits the special *Error Trapping* mode to record only those errors that occur during an E84 transaction.

The current state of the two configurable options are shown below the statistics counters. When the option is enabled, an arrow is displayed to the left of the option text. In Figure 37, both *Error Trapping* and *Idle Noise* options are enabled.

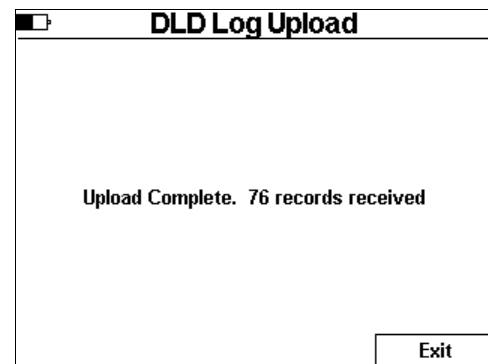


Figure 36 - DLD Log Upload Completed

DLD Configuration Screen			
Current Settings			
		Counters (since last clear)	
Date	10/17/2004	Power Cycles	0
Time	19:48:43	Good Loads	0
DL Savings	Disabled	Good Unloads	0
Version	2.2	Failed Loads	0
ID	000000DFF0E	Failed Unloads	0
		Failed Unknown	0
Sync Clock		→ Error Trap	
Clear RAM		→ Idle Noise	
Clear Cntrs			
Sync Clock	Clear RAM	Clear Cntrs	Update DLD
Error Trap	Idle Noise	Get Current	Exit

Figure 37 - DLD Configuration Screen

## Update DLD Configuration

There are five DLD configuration options that can be selected using the soft keys. To select an option, press the associated soft key. An arrow is displayed to the left of the selected option text. To de-select an option, press the associated soft key again. The arrow will be removed. Figure 38 shows all five options selected, and the DLD update in progress.

GCI recommends synchronizing the DLD's clock, and clearing its RAM each time the DLD is installed on a new tool.

Press the **Sync Clock** soft key to synchronize the DLD's clock with the HHT's clock.

Press the **Clear RAM** soft key to clear the DLD's internal RAM buffer.

Press the **Clear Cntrs** soft key to clear the statistics counters.

Press the **Error Trap** soft key to enable error trapping mode.

Press the **Idle Noise** soft key to enable Idle Noise mode.

Press the **Update DLD** soft key to send the selected options to the DLD. The **Update DLD** soft key will remain selected until the update is completed. The DLD settings display is refreshed following the DLD update.

Press the **Exit** soft key to close the DLD Configuration Screen and return to the Interface to DLD Screen.

## Stored Test Data

Data stored in the Paperless Storage System (PSS) can be accessed using Test Menu Option 6.

The Stored Test Data Menu provides a list of available Tool ID's, along with details on the type and number of the Tools' stored data files.

The left side of the screen shows the list of Tool ID's found on the installed SD Card. Use the **Up** and **Down Arrow** keys, along with the **Top**, **Bottom**, **Prev**, and **Next** soft keys to select the desired Tool ID.

The right side of the screen shows details on the selected Tool ID, along with the number of stored test results for each test type supported by the HHT.

An example of the Stored Test Data Menu is shown above. The currently selected Tool ID is *ABC*. There are three results files stored for *ABC*, including one Electrical Test, and two DLD Log Files.

Use the **Edit** soft key to edit the Tool ID details (see Editing Tool Details above).

DLD Configuration Screen			
Current Settings			
Date	10/18/2004	Counters (since last clear)	
Time	12:48:56	Power Cycles	7
DL Savings	Disabled	Good Loads	0
Version	2.2	Good Unloads	0
ID	0000000DFF0E	Failed Loads	0
		Failed Unloads	1
		Failed Unknown	13
↔ Sync Clock		↔ Error Trap	
↔ Clear RAM		↔ Idle Noise	
↔ Clear Cntrs			
Sync Clock	Clear RAM	Clear Cntrs	Update DLD
Error Trap	Idle Noise	Get Current	Exit

Figure 38 - Update DLD Configuration

Stored Test Data Menu			
Tools		Tool Information	
SAMPLE		Tool ID: ABC	
ABC		Location: Test	
New Tool		Details: Just a test	
		Test Results for ABC include:	
		0 Cycle Tests	1 Elect. Tests
		0 IR Trans. Tests	2 DLD Log Files
		0 Manual Tests	0 Emulator Tests
Top	Prev	Delete	View
Bottom	Next	Edit	Exit

Figure 39 - Stored Test Data Menu

**Warning! Selected Tool Directory (SAMPLE) will be removed, along with all associated test results. Press 'Delete' to continue, any other key to cancel.**

Figure 40 - Delete Tool Warning

Use the **Delete** soft key to delete the selected Tool ID, including all of the associated test data. A warning message is displayed asking for confirmation of the delete operation. Pressing the **Delete** soft key again will permanently delete the Tool ID folder and all associated test data files.

In general, the Delete operation on the HHT should only be used on HHT's with internal, non-removable SD Cards. For removable SD Cards, use Windows Explorer for tool and test data deletion.

Use the **View** soft key to view the list of files saved for the selected Tool ID.

### Stored Test Data File List

The File List screen is displayed when the **View** soft key is pressed on the Stored Test Data Menu. The left side of the screen shows details on the selected Tool ID.

The right side of the screen shows a File List of stored test results files for the selected Tool. Each entry in the File List contains the type of test results saved, along with the test date. The File List is sorted by test date.

The **Top**, **Bottom**, **Prev**, and **Next** soft keys can be used to scroll through the File List.

Use the **Delete** soft key to delete the selected test results file. A warning message is displayed asking for confirmation of the delete operation. Pressing the **Delete** soft key again will permanently delete the selected test results file.

In general, the Delete operation on the HHT should only be used on HHT's with internal, non-removable SD Cards. For removable SD Cards, use Windows Explorer for tool and test data deletion.

The **View** soft key will display the selected test results Status File. The Status File is a formatted text file containing information about the test results.

For some tests, the Status File contains a formatted report of all of the test results stored by the HHT. The Status Files for both Electrical and IR tests contain all of the voltage and current measurements taken during the test. For the remaining test types, the Status File contains details about the number of test records saved (for DLD Log File and Cycle and Manual Control tests), and final test pass / fail status (Cycle tests). The associated binary file must be displayed using the E84 Analysis Application on a PC after the data files have been moved to a PC.

Use the **Upload** soft key to upload the selected data file using the HHT\_Upload application. This application (available from [support@getcontrol.com](mailto:support@getcontrol.com)) must be running before the **Upload** soft key is pressed.

Connect a null-modem cable (female-to-female 9-pin cable) between the HHT's COM port and an available PC COM port. Run the HHT\_Upload application. It will prompt for the COM port connected to the HHT. After selecting the connected COM port, the PC application waits for an upload command from the HHT. The application can be closed at any time by pressing a key on the PC.

Stored Test Data Menu			
Tool ID: ABC	Test Type	Time Stamp	
Location: Test	Electrical Test	10/22/10 11:02:24	
Details: Just a test	DLD Log File	10/22/10 11:04:06	
	DLD Log File	10/22/10 11:05:04	
Top	Prev	Delete	View
Bottom	Next	Upload	Exit

Figure 41 - Stored Test Data - Marked Records

Stored Test Data Menu			
Tool ID: ABC	Test Type	Time Stamp	
Location: Test	Electrical Test	10/22/10 11:02:24	
Details: Just a test	DLD Log File	10/22/10 11:04:06	
	DLD Log File	10/22/10 11:05:04	
Warning! Selected data set will be deleted. Press 'Delete' to continue, any other key to cancel.			
Top	Prev	Delete	View
Bottom	Next	Upload	Exit

Figure 42 - Delete File Warning

Select the desired data file (using the HHT's arrow keys and the **Top**, **Bottom**, **Prev**, and **Next** soft keys). Press the **Upload** soft key to start the upload process. The HHT displays a message indicating it is attempting to contact the PC. If the PC cannot be contacted (either because there is no physical connection or if the HHT\_Upload program is not running, or if the wrong PC COM port was selected) the HHT will time-out and display an error message. If the connection attempt succeeds, the HHT displays a message indicating that the PC was contacted, and to use the HHT\_Upload program for status of the upload progress.

When initially contacted, the HHT\_Upload program displays a message indicating the file name being uploaded:

```
Upload File Command received (\HHT_DATA\ABC\DL000001.dat)
```

Then, a status message is displayed showing the progress of the upload:

```
Receiving File Packets:.....
```

A period (.) is displayed, following the reception of each file packet. Finally, when the file upload completes, a:

```
File closed
```

message is displayed.

The HHT will then display a message indicating the upload was successful.

For each selected data file, two files are uploaded. First, the Status File is sent (formatted text file) then the binary data file is sent. Both files will have the same filename, with different file extensions (Status File - \*.TXT, binary file - \*.DAT).

Files are stored in the HHT\_Data folder under the HHT\_Upload Application's installation directory. Typically, this is:

```
C:\Program Files\Get Control, Inc\HHT
Upload\HHT_Data
```

Inside this folder, sub-folders are created for each Tool ID whose data has been uploaded. Sub-folders are named after the Tool ID. In the example shown in Figure 5, the DLD Log file upload would result in:

```
C:\Program Files\Get Control, Inc\HHT Upload\HHT_Data\ABC\DL000001.TXT
C:\Program Files\Get Control, Inc\HHT Upload\HHT_Data\ABC\DL000001.DAT
```

### File Management Options

For HHT's with a removable SD Card, file maintenance tasks (delete, copy) should be performed on a PC using Windows Explorer®. For HHT's with internal, non-removable SD Cards, this option is not available. Instead, use the HHT's **Delete** soft key to delete either the entire Tool ID (including all saved test results files) or individual test results files.

Tool ID files should not be modified on the PC once test results have been saved to them. Modifying the Tool ID file may affect PSS integrity, and could cause files to be overwritten during

Stored Test Data Menu			
Tool ID: ABC	Test Type Electrical Test	Time Stamp 10/22/10 11:02:24	
Location: Test	File Upload Complete. Press any key to return to the file list.		
Details: Just a test			
Top	Prev	Delete	View
Bottom	Next	Upload	Exit

**Figure 43** - Upload Complete Message

testing.

Tool ID files can be deleted when no longer required. The user should also remove the associated sub-folder, including all stored results files. The sub-folder has the same name as the Tool ID file, minus the .TXT extension.

## Configuring The Tester

Use the Tester Configuration Menu, Test Menu Option 7, to set the time and date, E84 timeouts, sleep and power timeouts, default E84 communications method, and LCD contrast. The firmware version and release date, along with the battery voltage are also displayed in the Tester Configuration Menu.

When adjusting any of the HHT configuration parameters, pressing and holding the **Up / Down** keys will cause the parameter to be continuously modified until the key is released.

### Setting Time & Date

Press the **Time/Date** soft key to set the time and date. The Time & Date section title is underlined to show that it is selected.

A rectangle is drawn around the hour to indicate it can be modified. Use the **Up** and **Down** arrow keys to increment and decrement the hour respectively. Use the **Left** and **Right** arrow keys to navigate the rectangle to the minute, second, month, day, and year. After modifying the time and date, press the **Update** soft key to write the new date and time to the internal real-time clock.

### Setting E84 Timeout Values

Press the **Timeouts** soft key to modify the E84 timeouts. The E84 Timeouts section title is underlined to show that it is selected.

A rectangle is drawn around TA1. Use the **Up** and **Down** arrow keys to increment and decrement TA1 respectively. Use the **Left** and **Right** arrow keys to navigate the rectangle to TA2, TA3, TP1, TP2, TP3, TP4, TP5, and TP6.

E84 Timeout settings are used by the HHT during Standard Cycle Tests and Emulator Test Suite tests. The current settings are stored with Cycle Test, Manual Control, and Test Suite test results when using the HHT's Paperless Storage System (PSS).

Tester Configuration Menu			
<u>Time &amp; Date</u>		E84 Timeouts	
19: 58: 25 07/ 29/ 05		TA1: 2 TA2: 2 TA3: 2 TP1: 2 TP2: 2 TP3: 60 TP4: 60 TP5: 2 TP6: 1	
Power Settings		E84 Comm Method	
Power : 60 Min Key Beep : On		1 - Internal IR Current 2 - External IR 1 3 - External Cable	
Ver: 3.04 - Jul 28 2005		Contrast	Battery
		↓ ↑	10.04 VDC
Time/Date	Timeouts	Power	Comm
Contrast	Charge	Update	Exit

Figure 44 - Tester Configuration - Time & Date

Tester Configuration Menu			
<u>Time &amp; Date</u>		E84 Timeouts	
19: 58: 39 07/ 29/ 05		TA1: 2 TA2: 2 TA3: 2 TP1: 2 TP2: 2 TP3: 60 TP4: 60 TP5: 2 TP6: 1	
Power Settings		E84 Comm Method	
Power : 60 Min Key Beep : On		1 - Internal IR Current 2 - External IR 1 3 - External Cable	
Ver: 3.04 - Jul 28 2005		Contrast	Battery
		↓ ↑	10.04 VDC
Time/Date	Timeouts	Power	Comm
Contrast	Charge	Update	Exit

Figure 45 - Tester Configuration - E84 Timeouts

## Setting Power Timeouts

Press the **Power** soft key to modify the E84 HHT Power timeouts. The Power Settings section title is underlined to show that it is selected.

A rectangle is drawn around the Power timeout. Use the **Up** and **Down** arrow keys to increment and decrement the Power timeout respectively. Use the **Left** and **Right** arrow keys to navigate the rectangle to the Power timeout.

The Power timeout determines the number of minutes of non-use that must pass before the E84 HHT powers itself off. The Power timeout is disabled during DLD Live Mode, and all Cycle, IR, Electrical and Manual Test Screens to allow for extended analysis.

When the Power timeout decrements to 30 seconds, a warning message (PD: ##) is displayed at the upper right hand corner of the screen. A warning beep accompanies the message. This warning message shows the number of seconds remaining before auto-power off. The warning message is updated at 20, 10, and 5-1 seconds, and is accompanied by a warning beep. Any keystroke will reset the Power timeout and clear the warning message.

The Power timeout can be disabled by setting it to its highest value (60). When set at 60, the HHT deactivates the timer.

The Key Beep option enables an audible beep whenever keys are pressed on the HHT's keypad. Set this option to OFF to turn off the audible beep.

## Setting Default Communications Method

Press the **Comm** soft key to set the default E84 communications method. The E84 Comm Method section title is underlined to show that it is selected.

A rectangle is drawn around the current configuration. Use the **Up** and **Down** arrow keys to increment and decrement the current configuration respectively.

The default E84 communications method is selected when entering Cycle and Manual tests. Alternate E84 communications methods can be selected during each test.

Tester Configuration Menu			
Time & Date 19: 59: 03 07/ 29/ 05		E84 Timeouts TA1: 2 TA2: 2 TA3: 2 TP1: 2 TP2: 2 TP3: 60 TP4: 60 TP5: 2 TP6: 1	
<u>Power Settings</u>		E84 Comm Method	
Power : 10 Min Key Beep : On		1 - Internal IR Current 2 - External IR 1 3 - External Cable	
Ver: 3.04 - Jul 28 2005		Contrast ↓ ↑	Battery 10.04 VDC
Time/Date	Timeouts	Power	Comm
Contrast	Charge	Update	Exit

**Figure 46** - Tester Configuration - Power Settings

Tester Configuration Menu			
Time & Date 19: 59: 19 10 / 17 / 04		E84 Timeouts TA1: 2 TA2: 2 TA3: 2 TP1: 2 TP2: 2 TP3: 60 TP4: 60 TP5: 2 TP6: 1	
<u>Power Settings</u>		E84 Comm Method	
Power : 10 Min Key Beep : On		1 - Internal IR Current 2 - External IR 1 3 - External Cable	
Ver: 3.04 - Jul 28 2005		Contrast ↓ ↑	Battery 10.04 VDC
Time/Date	Timeouts	Power	Comm
Contrast	Charge	Update	Exit

**Figure 47** - Tester Configuration - Comm Method



**Setting Screen Contrast**

Press the **Contrast** soft key to adjust the LCD contrast. The Contrast section title is underlined to show that it is selected.

A rectangle is drawn around the contrast arrow keys.

Use the **Up** and **Down** to increase and decrease the LCD contrast respectively.

**Storing Configuration Settings**

Press the **Exit** soft key to close the Tester Configuration Menu, save changed configuration settings, and return to the Main Test Menu. Changes to HHT configuration settings are saved into battery backed RAM prior to returning to the Main Test Menu.

Changes made to configuration settings are not saved until the Tester Configuration Menu is closed using the **Exit** soft key. If the HHT is powered OFF prior to returning to the Main Test Menu, any configuration changes will be lost.

Tester Configuration Menu			
Time & Date 19 : 59 : 33 07 / 29 / 05		E84 Timeouts TA1 : 2 TA2 : 2 TA3 : 2 TP1 : 2 TP2 : 2 TP3 : 60 TP4 : 60 TP5 : 2 TP6 : 1	
Power Settings Power : 10 Min Key Beep : On		E84 Comm Method 1 - Internal IR Current 2 - External IR 1 3 - External Cable	
Ver: 3.04 - Jul 28 2005		Contrast ↓ ↑	Battery 10.03 VDC
Time/Date	Timeouts	Power	Comm
Contrast	Charge	Update	Exit

**Figure 48 - Tester Configuration - Contrast**

## Charging the Rechargeable Battery Pack

At delivery, the batteries may be empty and should be charged. Charging time is 4 hours. When fully charged, the batteries provide 8 to 16 hours of use depending on the E84 HHT functions performed.

The useable battery range is 8 to 12 Volts. Battery voltage is displayed on the configuration menu for reference. When the battery voltage drops below 9 Volts, a Lo Bat (low-battery) indicator appears in the upper left corner of the LCD to indicate charging is required. If battery voltage drops below 8 Volts, the HHT automatically powers OFF.

If the HHT's battery level drops too low, the HHT will not power up properly. In this case, connect the wall transformer to the HHT, and allow the batteries to trickle charge for a short time (10 minutes or so). The HHT batteries should receive enough boost from the attached wall transformer to allow proper power up. Immediately enter the charge screen and begin a charge cycle.

The battery fuel gauge is reset to Full following a successful charge cycle.

Enter the Configuration screen using Option 7 from the Test Menu. Press the **Charge** soft key to display the Charge Battery Screen. This screen displays battery status information. This information is valid only when the 15 VDC wall supply is not connected. If connected, the 15 VDC supply will influence battery levels, and cause the HHT to improperly report that no charge is required.

Plug the 15 VDC wall supply to a 120 VAC source. Connect the wall supply into the front panel connector on the E84 HHT.

From the Charge Battery Screen, press the **Charge** soft key to begin charging. The Charging Batteries screen displays the current battery voltage, battery temperature, charge current, charge time, and maximum time to charge completion. After the batteries are fully charged, the E84 HHT terminates the charge cycle, and displays final charge statistics.

The Power timeout is disabled during the charge cycle. When the charge cycle completes, the Power timeout is reactivated. This allows for over-night re-charging. When the charge cycle completes, the charge statistics will be displayed. Following the Power timeout period, the HHT will auto-power down. Ensure that the Power timeout is not disabled (using a value of 60) when charging over-night.

### HHT Firmware Field Update

The HHT firmware is continuously being updated to add new features. When an update is released, it is placed on the GCI web-site at:



Figure 49 - Charging the HHT

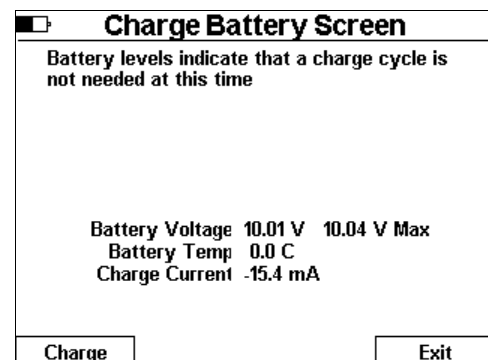


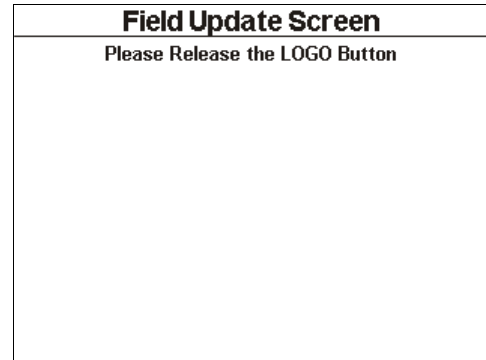
Figure 50 - Charge Battery Screen

[www.getcontrol.com/products/e84handheld\\_tester.html](http://www.getcontrol.com/products/e84handheld_tester.html)

To update the HHT firmware, download the update file from the GCI web-site. The update filename includes the version number of the update. When updating the HHT, the file must be renamed to HHTUPDAT.S19. Save the downloaded file onto an SD Card in the root directory as HHTUPDAT.S19.

Insert the SD Card into the HHT. Press and hold the **GCI Logo** key, which is at the lower right corner of the HHT's keypad. With the **Logo** key pressed, power on the HHT. The Field Update Screen will be displayed.

Figure 51 shows the Field Update Screen. Release the **Logo** key and follow the on-screen instructions to update the HHT's firmware.



**Figure 51** - Field Update Screen

### **Field Update Errors**

If any errors occur during the Field Update process, an error message is displayed. Figure 52 shows an example error message. This message is displayed if the Field Update Screen is entered with no SD Card inserted.

If an error occurs, the Field Update is terminated. Press the **Enter** key to boot the currently installed HHT firmware.



**Figure 52** - Field Update Error Screen

### **Field Update Details**

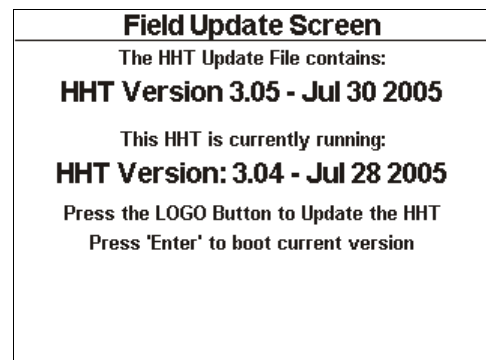
Figure 53 shows the Field Update Detail Screen. This screen is displayed after the user releases the **Logo** key.

The HHT searches the installed SD Card for the file HHTUPDAT.S19. If the file is found, the HHT opens it, and reads in the version number and release date. This information is displayed, along with the currently installed version number and release date.

The user should carefully examine the two version numbers / release dates to determine if the firmware should be updated.

If the firmware version and release date on the SD Card is older, or is not desired, press and release the **Enter** key to boot the current firmware. This will close the Field Update Screen, and display the HHT's Main Menu.

If the update is desired, press and release the **Logo** key to update the HHT's firmware with the



**Figure 53** - Field Update Detail Screen

update file located on the SD Card. The Confirm HHT Update Screen will be displayed.

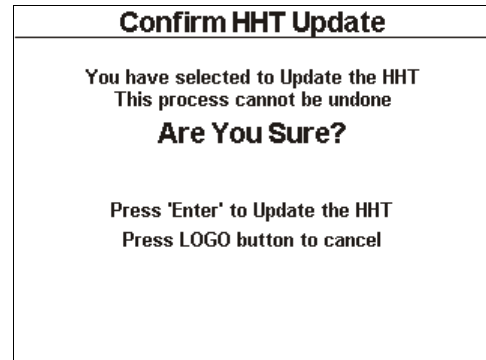
### Field Update Verification

The Confirm HHT Update screen is displayed to verify that the user desires to update the HHT's firmware.

A warning message is displayed indicating that the update process cannot be interrupted or undone.

To cancel the update, and return to the HHT's Main Menu, press and release the **Logo** key. The update process will terminate, and the HHT will boot the currently installed firmware.

Press and release the **Enter** key to begin the firmware update process.



**Figure 54 - Confirm HHT Update Screen**

### Field Update Progress

The HHT displays the HHT Update in Progress screen during the update process. The update process takes two stages. Progress through each stage is indicated on this screen. It is critical that the HHT remains powered ON during the update process. If the HHT is powered down during the update process, the HHT may become unstable. If the HHT does not function following a Field Update, it must be returned to the factory for repairs.

First, the HHT loads the firmware update from the SD Card into internal memory. During this loading stage, the HHT displays a message indicating that it is loading the HHT Update from the SD Card. A progress bar is displayed on the left side of the screen. As the update data is loaded, this progress bar fills up.



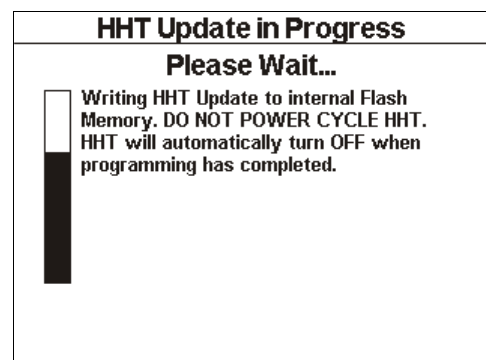
**Figure 55 - Loading HHT Update**

When all update data has been loaded, the progress bar is cleared, and a new message is displayed, indicating that the HHT is writing the update data to internal flash memory.

As the update is written into internal flash memory, the progress bar will fill.

When the update has completed, the HHT will turn itself OFF.

Power ON the HHT, and select the Configuration Menu option to verify the firmware version number and release date.



**Figure 56 - Writing Update to Internal Flash**



E84 Handheld Tester  
GCI05001

***Emulator Test Suite Addendum***



---

## Overview

This document details the porting of the GCI E84 Emulator Test Suite into the GCI HHT.

Due to memory constraints, a subset of the E84 Emulator Test Suite is implemented. The HHT Test Suite is functionally equivalent to the E84 Emulator Test Suite, with the following limitations:

- Limited status messages
- No user comment entry
- No support for running TP tests using an Unload Cycle
- No Static Tests
- No Passive Test Mode under Emulator Test Suite
- No Continuous Test Mode under Emulator Test Suite

Pass / Fail test results, including failure codes, are maintained for each test in the HHT Test Suite. When the HHT Test Suite has completed, or when the operator exits the HHT Test Suite, the test results data structure can be saved into the HHT's Paperless Storage System (PSS).

It is suggested that a hard-copy Test Procedure be used during testing that provides operator fields for manual entry of test comments and UUT information. An example Test Procedure is included as an appendix to this document.

## HHT to UUT Connection

The HHT provides three connection methods for testing E84 interfaces:

1. direct           HHT is directly connected to the UUT's E84 interface using a straight through, 25-pin, male-to-female cable. E84 communications takes place through this connecting cable.
2. external IR       an IR Transceiver is connected to the HHT. This external IR Transceiver is aligned with the UUT's IR Transceiver. E84 communications takes place through the IR link between the two Transceivers.
3. internal IR       The HHT's internal IR Transceiver is aligned with the UUT's IR Transceiver. E84 communications takes place through the IR link between the HHT's internal Transceiver and the UUT's Transceiver.

Test B (Verify Full Load / No Load Voltage) requires a direct connection. All other tests in the HHT Test Suite can be performed using any of the available connection methods.



## Running the HHT Test Suite

Selecting the **Emulator Test Suite** option from the Standard Cycle Test Menu (Figure 57) will display the first test in the HHT Test Suite (Voltage Test).

Each test in the HHT Test Suite has an opening screen describing operator setup instructions. A **Start** option provided on each test screen will initiate the current test. The current test can be skipped by pressing the 'Right' arrow button. To return to the previous test, press the 'Left' arrow button.

At the conclusion of the current test, several options are provided: re-run the current test; advance to the next test in the HHT Test Suite; and exit the HHT Test Suite.

At the conclusion of all tests in the HHT Test Suite, or when the HHT Test Suite is exited by the operator, an option for saving the HHT Test Suite test results into the HHT's PSS is provided. See **Paperless Storage System** above for details on the HHT's PSS.

## Continuing an Emulator Test Suite

Selecting the **Continue Emulator Test** option from the Standard Cycle Menu brings up the Select EM Test Results screen (Figure 58). This screen shows a list of Tool ID's on the left side of the screen. Information on the currently selected Tool ID is displayed on the right side of the screen. Information displayed includes the number of Emulator Tests stored for the selected Tool ID.

The operator uses the **Up** and **Down** arrow keys, and the **Top**, **Bottom**, **Prev** and **Next** soft keys, to navigate to the desired Tool ID. Pressing the **View** soft key will display all Emulator Tests saved for the selected Tool ID (Figure 59).

The operator uses the **Up** and **Down** arrow keys, and the **Top**, **Bottom**, **Prev** and **Next** soft keys, to navigate to the desired Emulator Test Suite. To continue a previously saved test suite, position the screen cursor on the desired results entry, and press the **Enter** key.

The selected test results file will be read, and the HHT will advance to the first failed or untested test in the Test Suite, and the appropriate test screen will be displayed.

If all tests in the selected results file had passed, the HHT will advance to the first test in the Test Suite. Each test setup screen will show the status of the current test from the results file:

'Untested'	- Test did not run
'Failed'	- Test was not successful the last time it ran
'Passed'	- Test was successful the last time it ran

Standard Cycle Test Menu			
<b>1 - Active Mode Load Test</b>			
<b>2 - Active Mode Unload Test</b>			
<b>3 - Passive Mode Load Test</b>			
<b>4 - Passive Mode Unload Test</b>			
<b>5 - Emulator Test Suite</b>			
<b>6 - Continue Emulator Test</b>			
Select Menu Option			
1	2	3	4
5	6		Main

Figure 57 - Standard Cycle Test Menu

Select EM Test Results			
Tools		Tool Information	
SAMPLE	New Tool	Tool ID: SAMPLE Location: SAMPLE TOOL Details: This is a sample Tool ID Record Test Results for SAMPLE include: 0 Cycle Tests    0 Elect. Tests 3 IR Trans. Tests    1 DLD Log Files 0 Manual Tests    3 Emulator Tests	
Top	Prev		View
Bottom	Next	Edit	Exit

Figure 58 - Select EM Test Results Screen 1

Select EM Test Results			
Tool ID: SAMPLE		Emulator Test Suite 10/08/05 9:49:27	
Location: SAMPLE TOOL		Emulator Test Suite 10/08/05 9:57:23	
Details: This is a sample Tool ID Record		Emulator Test Suite 10/08/05 10:19:28	
Press 'Enter' to Select			
Top	Prev		
Bottom	Next		Exit

Figure 59 - Select EM Test Results Screen 2

## HHT Test Suite Help System

A **Details** soft key is displayed on the opening screen for each test. Pressing this **Details** soft key will bring up the help system for the current test. The HHT Test Suite Help System is based on a series of ASCII text files stored on the HHT's SD Card. If no SD Card is inserted, or if the system cannot locate the appropriate file, the help system will be disabled.

The help system files are stored on the SD Card in the folder \HHT\_HELP and include separate files for each supported HHT Test Suite Test. The files are named after the associated test. For example, the file EMTST\_B.TXT contains help information for Test B.

Help system files contain details on the specific test, including information on why the test is required. GCI recommended help file contents come pre-installed on supplied SD Cards. The files are formatted ASCII text, and can be modified by the end user to include company specific testing requirements or information.

If the end user modifies the help files, they should maintain the following format to ensure compatibility with the HHT Help System.

- Line 1: Help Section Title - maximum of 40 characters. The title is displayed in the header of the displayed help window.
- Line 2: Help Section Sub-Title - maximum 40 characters. The sub-title is displayed at the top of the scrolling help screen.
- Line 3: Section 1 Text - maximum 500 characters.
- Line 4: Section 2 Text - maximum 500 characters.
- Line 5: Section 3 Text - maximum 500 characters.
- Line 6: Section 4 Text - maximum 500 characters.
- Line 7: Section 5 Text - maximum 500 characters.
- Line 8: Section 6 Text - maximum 500 characters.
- Line 9: Section 7 Text - maximum 500 characters.
- Line 10: Section 8 Text - maximum 500 characters.
- Line 11: Section 9 Text - maximum 500 characters.
- Line 12: Section 10 Text - maximum 500 characters.

```
Title <cr>
Sub-Title <cr>
Section 1 Text <cr>
Section 2 Text <cr>
.
.
.
Section 10 Text <cr>
```

Figure 60 - Help File Format

Each line should be terminated with a carriage return character <cr>. A second carriage return character may be inserted between sections for clarity. There is a maximum of 10 sections, but less can be coded.

The following figure shows the Help System file for Test G. Notice that each section is terminated with a carriage return. The title for this Help File is *Active Mode Emulator Test G*. The sub-title is *Verify TP1 Timeout Error*. The remaining text consists of sections 1 through 4.

Active Mode Emulator Test G

Verify TP1 Timeout Error

Why we run this test:

The E84 Specification defines TP1 as the maximum time between L\_REQ / U\_REQ ON and TR\_REQ ON (Table 8). Section 6.3 specifies that equipment should inform the operator about handoff timeout errors. Additionally, in section A1-4.71 requires that the equipment display details about the timeout error including: Timer name, Timer Description and current Timer setting.

This test will force a TP1 timeout error by advancing the handoff up to the point where the equipment is expecting the TR\_REQ signal to turn ON. At this point, the HHT locks its outputs and displays a timeout dialog box. This timeout box counts down from the TP1 value set on the Configuration Screen. When the counter reaches zero, the timeout should have expired on the equipment.

The HHT requires the operator to visually inspect the equipments GUI to verify that an appropriate timeout error message has been displayed. After the operator passes, or fails the test based on the visual display of an error message, the HHT checks the HO\_AVBL signal. When the timeout occurs, the the HO\_AVBL signal should turn OFF. If the operator passes the test based on the display of an error message, but the equipment fails to turn OFF the HO\_AVBL signal, the HHT will fail the test.

**Figure 61** - Example Help System File

Navigate the displayed help information using the **Up** and **Down** arrow keys. Press the **Enter** key to close the help window.

## Active Mode Test Plan

In the following discussion, refer to the GCI E84 Emulator Application Users Manual for more details on Emulator test steps and operator prompts.

### Active Mode Static Tests

The three E84 Emulator Active Mode Static tests are not supported in this HHT Test Suite subset.

#### Active Mode Static Test A

##### Verify labeled DB-25 female E84 plug exists

Is a labeled DB-25 female E84 plug (as specified in ISO 4902) present for each Load Port on the equipment?

#### Active Mode Static Test B

##### Verify proper plug location

Are the plugs mounted in the correct location? Figure 1 defines the zone where the plug(s) can be located. The plug(s) can be mounted anywhere in this zone on the top or top edge of the equipment.

#### Active Mode Static Test C

##### Verify Documented Recovery Procedures Exist

Do documented E84 recovery procedures exist?

Not supported.

### Active Mode Functionality Tests

There are 17 Active Mode, Functionality tests. Each is supported as described below.

#### Active Mode Functionality Test A

##### Verify Configurable Passive Equipment Timers

Using the equipment user interface, verify that the passive equipment timers (TP1 through TP5) are configurable within the range specified in E84 (1 to 999) and make note of the default settings:

**Test A** is not directly supported on the HHT. The Operator should verify that the UUT's timers are configurable using the tools GUI, then manually enter the TP timer settings into the HHT's Configuration Screen (option 7 - Tester Configuration) prior to starting the Emulator Test Suite.

The HHT's TP Timers need to be configured prior to starting the Emulator Test Suite. The HHT uses the configured timeouts during all remaining Test Suite tests.

Tester Configuration Menu			
Time & Date		E84 Timeouts	
[21]: 01 : 15 10 / 01 / 04		TA1 : 2 TA2 : 2 TA3 : 2 TP1 : 2 TP2 : 2 TP3 : 60 TP4 : 60 TP5 : 2 TP6 : 1	
Power Settings		E84 Comm Method	
Sleep : 1 Min Power : 60 Min		1 - Internal IR Current 2 - External IR 3 3 - External Cable	
Ver: 2.41.2.16		Contrast ↓ ↑	Battery 10.35 VDC
Time/Date	Timeouts	Power	Comm
Contrast	Charge	Update	Exit

**Figure 62** - Tester Configuration Menu

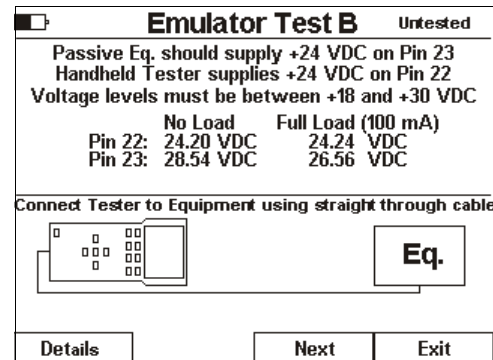
### Active Mode Functionality Test B Verify Full Load / No Load Voltage

Verify for hard wired implementation the voltage provided by the equipment under test is within the range specified in E84 under Full Load (100mA) and No Load (<2mA).

**Test B** is implemented using the Power Supply Voltage Test screen. The HHT must be directly connected to the UUT using a straight through, 25-Pin, male to female cable for this test.

The screen shows full and no load voltage readings for Pin 22 and Pin 23 of the E84 interface connector. Voltage on Pin 22 is supplied by the HHT. Voltage on Pin 23 is supplied by the UUT.

Verify that the voltage measured on Pin 23 falls within the published range of +18 to +30 VDC for both the No Load and Full Load conditions. The voltage measured on Pin 22 should also be verified to test for a mis-wired E84 interface.



**Figure 63** - Power Supply Voltage Test Screen

The HHT continuously monitors and displays voltage levels while the Power Supply Voltage Test screen is displayed. The HHT continuously:

- takes a No Load voltage measurement
- switches in the Load resistor
- allows the voltage to stabilize
- takes a Full Load voltage measurement
- switches out the Load resistor
- allows the voltage to stabilize

The current test status is displayed in the upper right corner of the screen. The test status is 'Untested' the first time through the test suite. If a test suite is continued, this status will be either 'Passed' or 'Failed' depending on the selected results file.

Press the **Next** button to continue on to Test C - Standard Load Cycle Test. The HHT logs the measured voltages, along with the Pass / Fail test results, then advances to the next test.

This is the first test displayed when the **Emulator Test Suite** option is selected. The **Start** option is removed, and the 'Left' and 'Right' arrow buttons have no affect. Use the 'Next' button to advance to the next test in the Test Suite.

### Active Mode Functionality Test C

#### Verify Single handoff sequence for Loading.

Verify single handoff sequence for Loading. See Figure 2 for example signal timing diagram.

**Test C** is implemented using the Active Mode Load Cycle screen. This screen runs a standard Load Cycle test using CS\_0 (default) or CS\_1. The operator should select the desired port selection signal. Typically, CS\_0 should be used.

Figure 64 shows the test setup screen for Test C. The connection method defaults to **Direct**. The operator should select the desired connection method. The test title is displayed in the middle of the screen.

When the Start option is selected, the Active Mode Load Cycle screen is displayed.

Figure 64 shows an example of a Failed test status. When 'Failed' is displayed at the upper right of the screen, the current test results indicate that this test had failed the last time it ran.

The operator is prompted to load a FOUP onto the UUT at the proper point in the E84 handoff. A TP3 timeout counter is displayed in the status window showing the operator how much time is available to load the FOUP.

Cycle status is displayed in the status window, including successful completion or error condition.

When the cycle has completed, either successfully or with an error, the operator has the option of re-running the current test, advancing to the next test in the HHT Test Suite, or exiting the HHT Test Suite.

At the end of the Cycle Test, the results code is added to the HHT Test Suite results data structure.

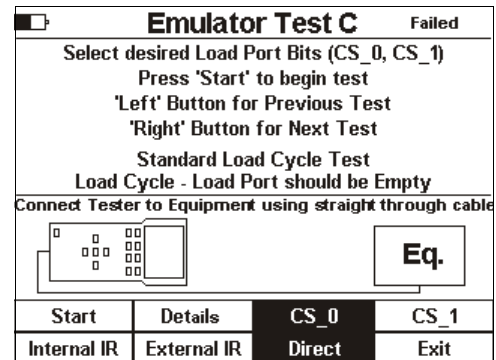


Figure 64 - Test C Setup Screen

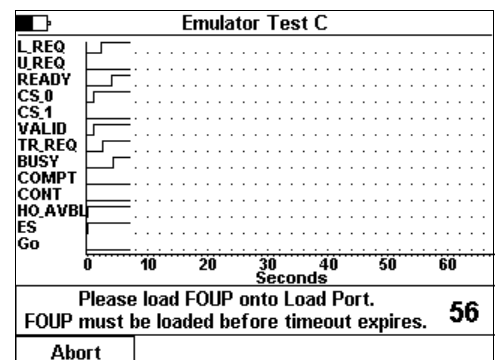


Figure 65 - Test C In Progress

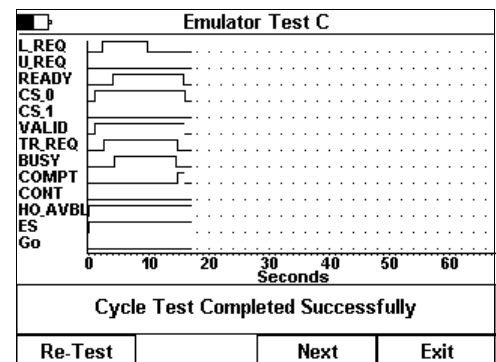


Figure 66 - Test C Completed

### Active Mode Functionality Test C - 2<sup>nd</sup> Run Verify Single Handoff Load Sequence 2

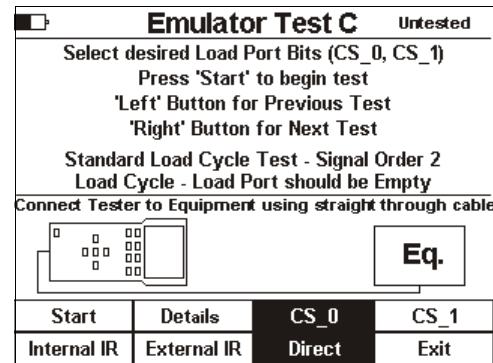
Verify single handoff sequence for Loading (signal order independency verification).  
See Figure 2 for example signal timing diagram.

The E84 Emulator's Load Sequence 2 test runs a standard Load Cycle, but re-arranges the sequence of signal state changes (see the E84 Emulator Users Guide for details).

The HHT displays the same title string (Emulator Test C) at the top of the setup screen. The test setup instructions shows that this is the second run for Test C, using Signal Order 2.

The test executes identically to the first run of Test C, using the same screens described above. Signal state change order is modified as described in the E84 Emulator Users Guide.

To return to the previous test, press the 'Left' arrow button. To skip the current test, and advance to the next test in the Test Suite, press the 'Right' arrow button.



**Figure 67 - Test C Second Run**

### Active Mode Functionality Test D

#### Verify Single Handoff Unload Sequence

Verify single handoff sequence for Unloading.  
See Figure 3 for example signal timing diagram.

Figure 68 shows the test setup screen for **Test D**. **Test D** is implemented using the standard Unload Cycle screens.

The Unload Cycle test prompts the operator to remove a FOUP from the UUT at the proper point in the E84 handoff. A Test completion message (pass or fail) is displayed, and recorded in the HHT Test Suite Test Results data structure.

When the **Start** button is selected, the Active Mode Unload Cycle screen is displayed.

To return to the previous test, press the 'Left' arrow button. To skip the current test, and advance to the next test in the Test Suite, press the 'Right' arrow button.

The operator is prompted to remove a FOUP from the UUT at the proper point in the E84 handoff. A TP3 timeout counter is displayed in the status window showing the operator how much time is available to remove the FOUP.

Final test completion status is displayed, and the operator is given options to re-run the current test, advance to the next test in the HHT Test Suite, or exit the HHT Test Suite.

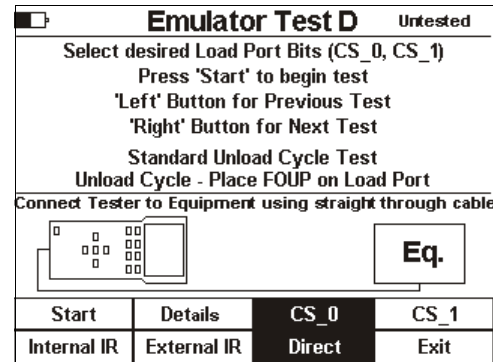


Figure 68 - Test D Setup Screen

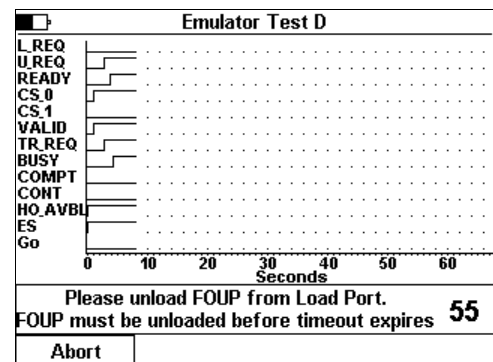


Figure 69 - Test D In Progress

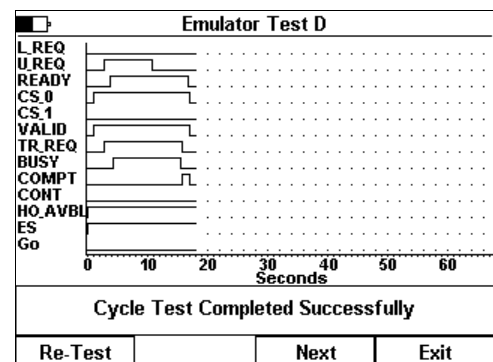


Figure 70 - Test D Completed



### Active Mode Functionality Test D - 2<sup>nd</sup> Run Verify Single Handoff Unload Sequence - 2

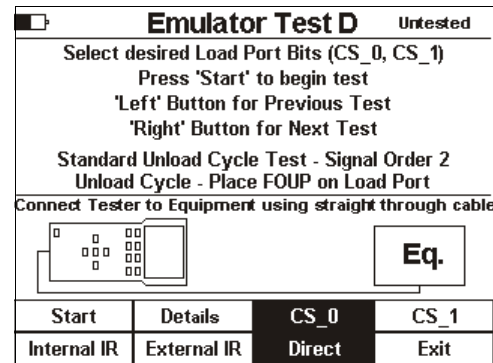
Verify single handoff sequence for Unloading (signal order independency verification).  
See Figure 3 for example signal timing diagram.

The E84 Emulator's Unload Sequence 2 test runs a standard Unload Cycle, but re-arranges the sequence of signal state changes (see the E84 Emulator Users Guide for details).

The HHT displays the same title string (Emulator Test D) at the top of the setup screen. The test setup instructions shows that this is the second run for Test D, using Signal Order 2.

The test executes identically to the first run of Test D, using the same screens described above. Signal state change order is modified as described in the E84 Emulator Users Guide.

To return to the previous test, press the 'Left' arrow button. To skip the current test, and advance to the next test in the Test Suite, press the 'Right' arrow button.



**Figure 71 - Test D Second Run**

**Active Mode Functionality Test E**  
**Verify Handoff Available Signal test for Load**  
 Handoff available signal test for load:

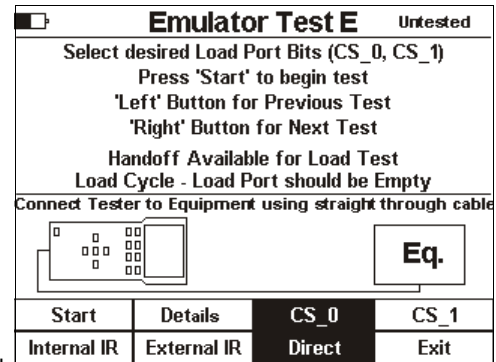
**Test E** verifies that the UUT does not request a FOUP delivery when the presence sensors are blocked.

When the **Start** button is selected, the standard Load Cycle test screen is displayed, and the CS\_0 signal is set.

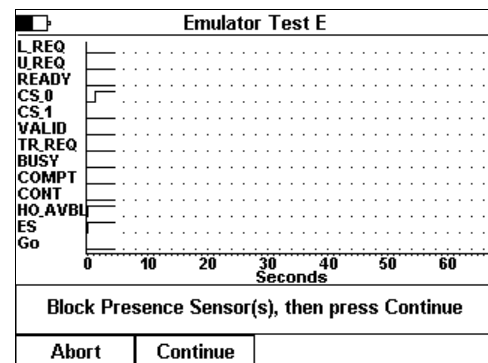
To return to the previous test, press the 'Left' arrow button. To skip the current test, and advance to the next test in the Test Suite, press the 'Right' arrow button.

The operator is prompted to activate the presence sensors only. A **Continue** option button will be displayed. The operator presses the **Continue** button after activating the presence sensor. This instructs the HHT to continue with the Load Cycle handoff.

The test completes when the UUT drops HO\_AVBL (indicating a load conflict), or a TA1 or TA2 timeout occurs. All three cases are Pass conditions. If the UUT advances the E84 handoff by setting the L\_REQ and READY signals, the test is halted with a failure.



**Figure 72 - Test E Setup**



**Figure 73 - Test E In Progress**

### Active Mode Functionality Test F Verify Handoff Available Signal

Note: This test uses a standard load cycle to verify the Handoff Available sequence. The Load Port under test must be empty prior to initiating the test. Verify handoff available sequence.

The setup screen for **Test F** instructs the operator to modify (on the UUT's GUI) the passive equipments TP1 timeout to at least 15 seconds. This is done to give the operator enough time to activate Manual Mode at the proper point in the test sequence.

At the end of Test F, the operator must remember to return the UUT's TP1 timeout to it's original setting.

To return to the previous test, press the 'Left' arrow button. To skip the current test, and advance to the next test in the Test Suite, press the 'Right' arrow button.

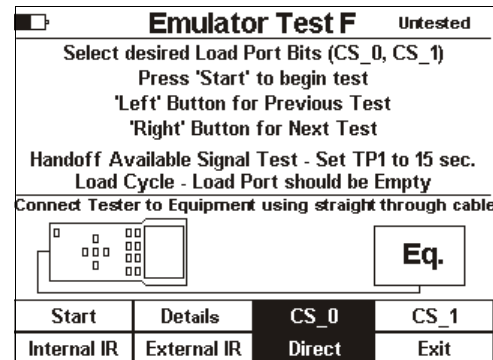


Figure 74 - Test F Setup Screen

The Load Cycle test screen will be displayed. The HHT sets CS\_0 and VALID, then displays a prompt asking the operator to switch the UUT to Manual Mode, along with a count down timer showing the available time to affect this switch. The operator can do any operation on the UUT that will cause the HO\_AVBL signal to turn OFF. The operator prompt will only mention the switch to Manual Mode for brevity.

If the UUT does not drop HO\_AVBL before the timeout occurs, the test will fail. If the operator does not complete the switch to Manual Mode in time, the UUT should issue a TP1 timeout error. The TP1 timeout error is normally accompanied by a drop in HO\_AVBL, which would be detected by the HHT as a pass condition.

After the HHT detects a successful drop in HO\_AVBL, it drops it's CS\_0 and VALID signals. The operator is prompted to switch the UUT back to Automatic Mode, which should cause the HO\_AVBL signal to turn back ON. There is no timeout associated with this step.

If the HHT detects the HO\_AVBL signal ON, the test Passes. If the HO\_AVBL signal does not turn back ON, the operator should select the **Fail** option, to mark the test as failed.

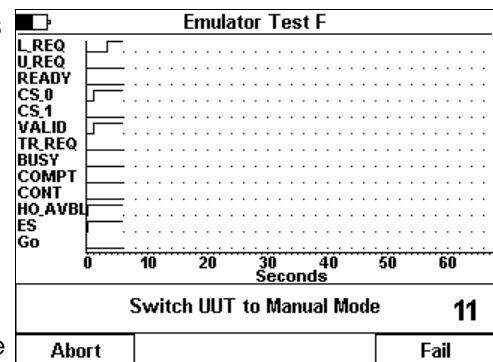


Figure 75 - Test F In Progress

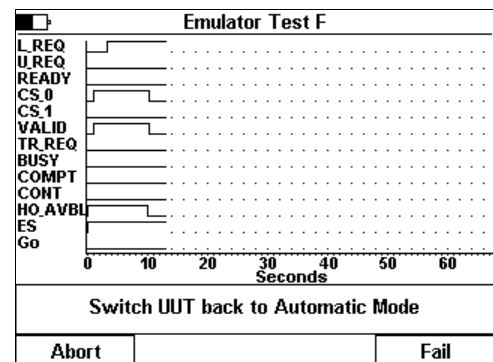


Figure 76 - Test F Step 2

### Active Mode Functionality Test G Verify TP1 Timeout Error

Verify TP1 timeout error.

**Test G** is implemented using a standard Load Cycle test. The Load Cycle screen is displayed, and the HHT advances the E84 handshake up to the point where the UUT sets it's L\_REQ signal.

At this point, the HHT locks it's outputs, and displays a status message indicating that the TP1 timeout should occur when the displayed count down timer expires.

The operator must press either the **Pass** or **Fail** option (newly displayed for TP timeout tests) to indicate if the UUT properly displayed the TP1 timeout error.

When the operator passes the test, the HHT will do one last verification of the UUT. At the point of the timeout error, the UUT should drop the HO\_AVBL signal to indicate the error condition. The HHT will verify that the HO\_AVBL signal is OFF. If it is still ON when the operator presses the **Pass** option, the HHT will fail the test.

The UUT must be reset following each TP timeout test.

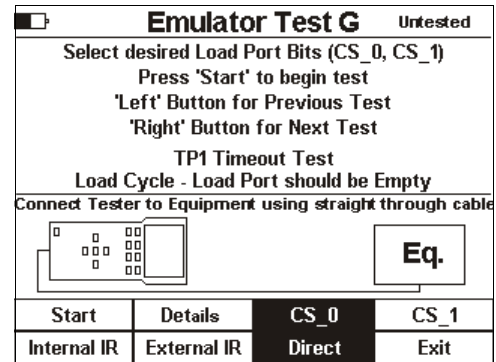


Figure 77 - Test G Setup Screen

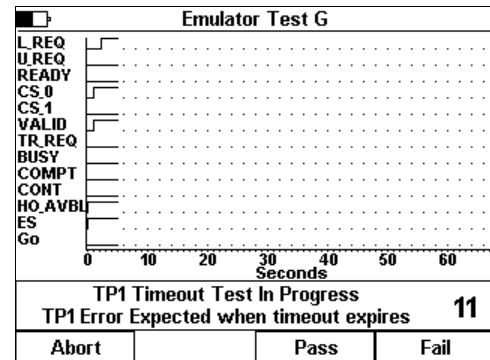


Figure 78 - Test G In Progress

### Active Mode Functionality Test H Verify TP2 Timeout Error

Verify TP2 timeout error.

**Test H** is implemented using a standard Load Cycle test. The Load Cycle screen is displayed, and the HHT advances the E84 handshake up to the point where the UUT sets it's READY signal.

At this point, the HHT locks it's outputs, and displays a status message indicating that the TP2 timeout should occur when the displayed count down timer expires.

The operator must press either the **Pass** or **Fail** option (newly displayed for TP timeout tests) to indicate if the UUT properly displayed the TP2 timeout error.

When the operator passes the test, the HHT will verify that the HO\_AVBL signal is OFF. If it is still ON when the operator presses the **Pass** option, the HHT will fail the test.

The UUT must be reset following each TP timeout test.

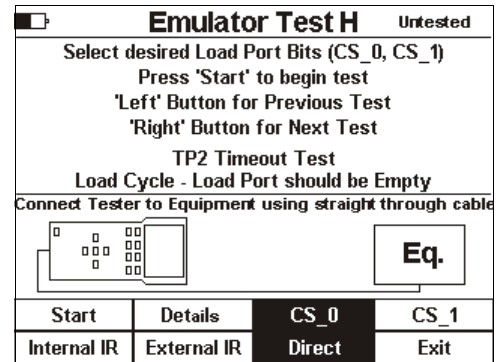


Figure 79 - Test H Setup Screen

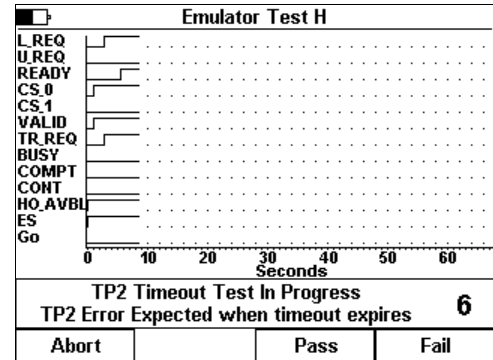


Figure 80 - Test H In Progress

### Active Mode Functionality Test I Verify TP3 Timeout Error

Verify TP3 timeout error.

**Test I** is implemented using a standard Load Cycle test. The Load Cycle screen is displayed, and the HHT advances the E84 handshake up to the point where the UUT is waiting for the delivery of a FOUP.

At this point, a normal Load Cycle would place the FOUP onto the UUT. Instead, the operator waits for the TP3 timeout to occur. The HHT displays a status message indicating that the TP3 timeout should occur when the displayed count down timer expires.

The operator must press either the **Pass** or **Fail** option (newly displayed for TP timeout tests) to indicate if the UUT properly displayed the TP3 timeout error.

When the operator passes the test, the HHT will verify that the HO\_AVBL signal is OFF. If it is still ON when the operator presses the **Pass** option, the HHT will fail the test.

The UUT must be reset following each TP timeout test.

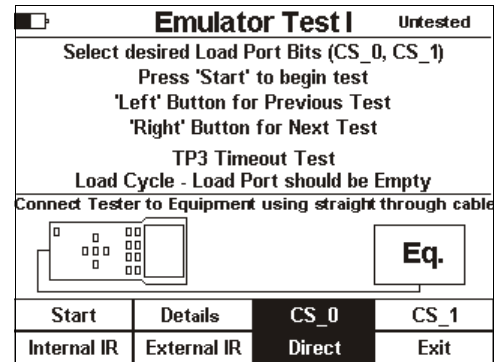


Figure 81 - Test I Setup Screen

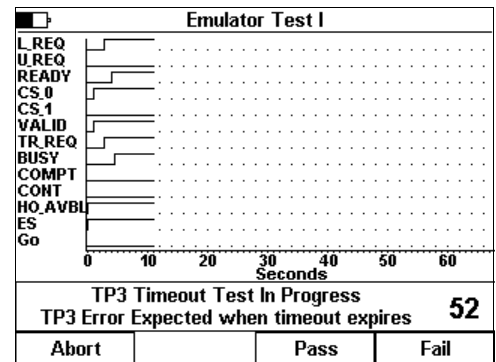


Figure 82 - Test I In Progress

### Active Mode Functionality Test J Verify TP4 Timeout Error

Verify TP4 timeout error.

**Test J** is implemented using a standard Load Cycle test. The Load Cycle screen is displayed, and the HHT advances the E84 handshake up to the point where the UUT drops it's L\_REQ signal following the successful delivery of a FOUP.

At this point, the HHT should set it's COMPT signal, and drop it's BUSY and TR\_REQ signals. Instead, the HHT locks it's outputs, and displays a status message indicating that the TP4 timeout should occur when the displayed count down timer expires.

The operator must press either the **Pass** or **Fail** option (newly displayed for TP timeout tests) to indicate if the UUT properly displayed the TP4 timeout error.

When the operator passes the test, the HHT will verify that the HO\_AVBL signal is OFF. If it is still ON when the operator presses the **Pass** option, the HHT will fail the test.

The UUT must be reset following each TP timeout test.

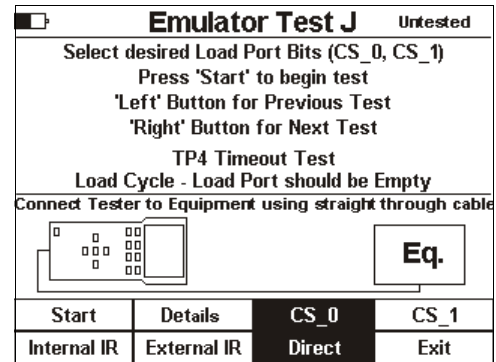


Figure 83 - Test J Setup Screen

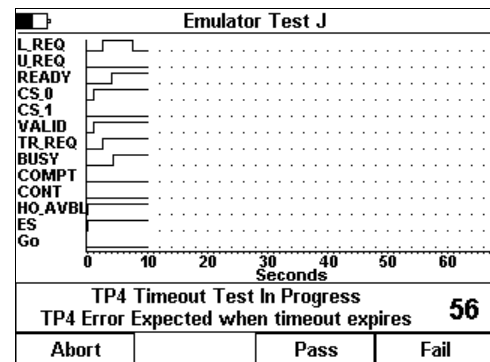


Figure 84 - Test J In Progress

### Active Mode Functionality Test K Verify TP5 Timeout Error

Verify TP5 timeout error.

**Test K** is implemented using a standard Load Cycle test. The Load Cycle screen is displayed, and the HHT advances the E84 handshake up to the point where the UUT drops it's READY signal following the successful delivery of a FOUP.

At this point, the HHT should drop it's COMPT, VALID and CS\_0 signals. Instead, the HHT locks it's outputs, and displays a status message indicating that the TP5 timeout should occur when the displayed count down timer expires.

The operator must press either the **Pass** or **Fail** option (newly displayed for TP timeout tests) to indicate if the UUT properly displayed the TP5 timeout error.

When the operator passes the test, the HHT will verify that the HO\_AVBL signal is OFF. If it is still ON when the operator presses the **Pass** option, the HHT will fail the test.

The UUT must be reset following each TP timeout test.

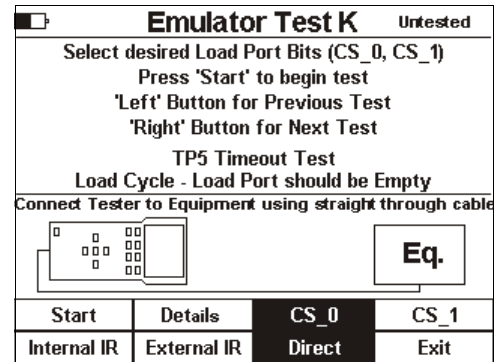


Figure 85 - Test K Setup Screen

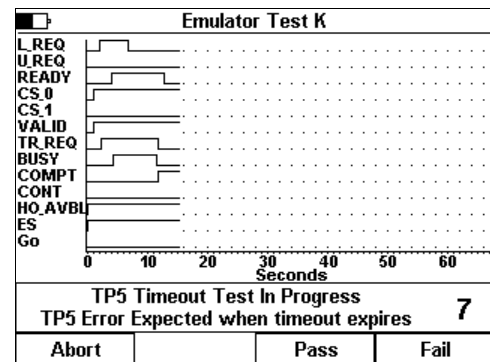


Figure 86 - Test K In Progress



### Active Mode Functionality Test L

#### Verify Access Mode Selection

Verify access mode selection.

**Test L** is implemented using the Load Cycle screen. No E84 handoff is used. The HHT verifies that the HO\_AVBL signal is ON to start the test.

The operator is prompted to switch the UUT to Manual Mode. If the HO\_AVBL signal fails to turn OFF, the operator must abort the test to indicate a failure.

When the HHT has verified that the HO\_AVBL signal has turned OFF, it prompts the operator to return the UUT to Automatic Mode.

If the HO\_AVBL signal does not turn back ON following the switch into Automatic Mode, the operator should select the **Fail** option to indicate that the test failed.

If the HHT detects that the HO\_AVBL signal has turned ON, it marks the test as Passed.

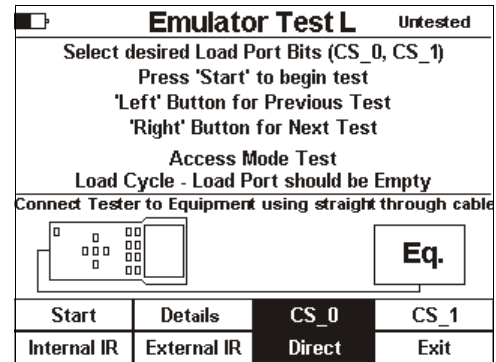


Figure 87 - Test L Setup Screen

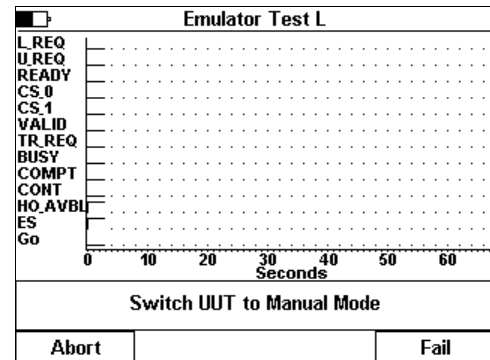


Figure 88 - Test L In Progress

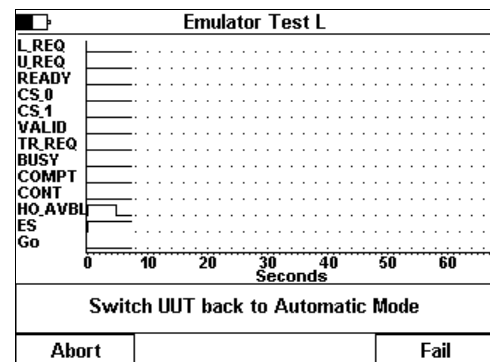


Figure 89 - Test L Step 2

### Active Mode Functionality Test M

#### Verify Port Sensors - Part 1

Verify Port Sensors tied to E84 signals - Part 1  
(Placement sensor(s) activated during Load, but  
Presence sensor(s) is not).

**Test M** is implemented using a standard Load Cycle test. The Load Cycle screen is displayed, and the HHT advances the E84 handshake up to the point where the UUT is waiting for the delivery of a FOUP.

At this point, the HHT prompts the operator to activate the Placement sensor(s) only. The Placement sensors must remain activated until the displayed count down timer expires. At that point, the UUT should issue a TP3 timeout error.

If the UUT drops it's L\_REQ signal following the Placement sensor activation, the HHT will fail the test. This indicates that the UUT is accepting a mis-aligned FOUP delivery as a valid handoff.

If the TP3 timeout occurs without the L\_REQ signal dropping, the HHT marks the test as passed.

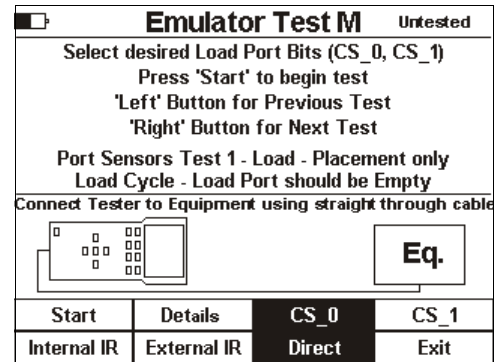


Figure 90 - Test M Setup Screen

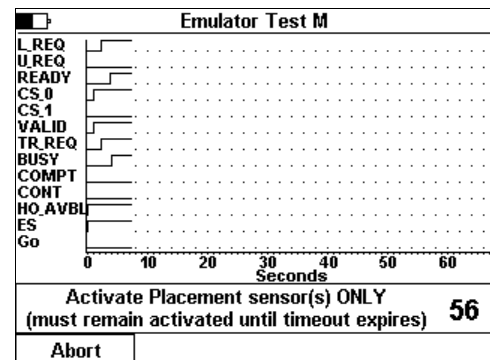


Figure 91 - Test M In Progress

### Active Mode Functionality Test N

#### Verify Port Sensors - Part 2

Verify Port Sensors tied to E84 signals - Part 2  
(Presence sensor(s) activated during Load, but Placement sensor(s) is not).

**Test N** is implemented using a standard Load Cycle test. The Load Cycle screen is displayed, and the HHT advances the E84 handshake up to the point where the UUT is waiting for the delivery of a FOUP.

At this point, the HHT prompts the operator to activate the Presence sensor(s) only. The Presence sensors must remain activated until the displayed count down timer expires. At that point, the UUT should issue a TP3 timeout error.

If the UUT drops its L\_REQ signal following the Presence sensor activation, the HHT will fail the test. This indicates that the UUT is accepting a mis-aligned FOUP delivery as a valid handoff.

If the TP3 timeout occurs without the L\_REQ signal dropping, the HHT marks the test as passed.

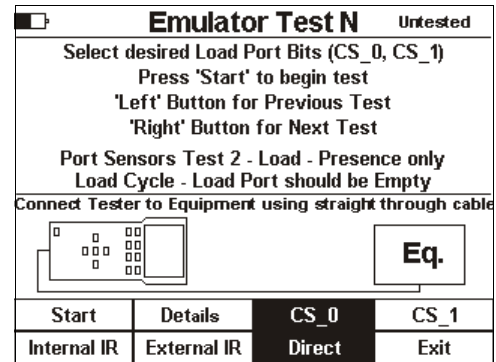


Figure 92 - Test N Setup Screen

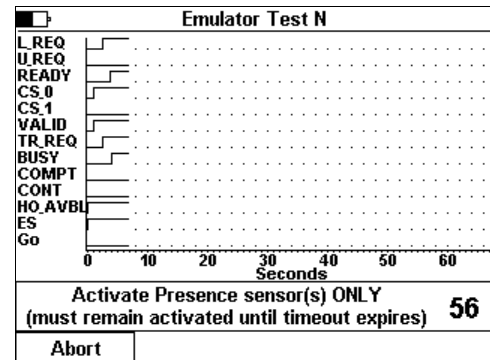


Figure 93 - Test N In Progress

### Active Mode Functionality Test O Verify Port Sensors - Part 3

Verify Port Sensors tied to E84 signals - Part 3 (Placement sensor(s) deactivated during Unload, but Presence sensor(s) is not).

The setup screen for **Test O** instructs the operator to activate all Placement and Presence sensors on the UUT. The operator should make sure all sensors are activated prior to starting the test.

**Test O** is implemented using a standard Unload Cycle test. The Unload Cycle screen is displayed, and the HHT advances the E84 handshake up to the point where the UUT is waiting for the removal of the FOUP.

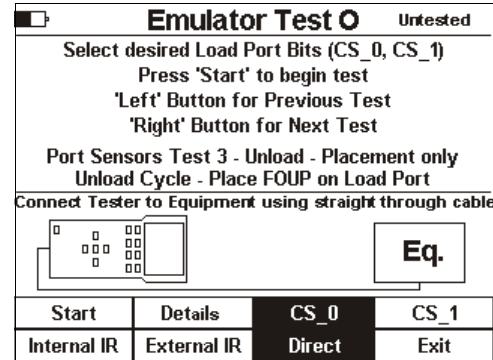


Figure 94 - Test O Setup Screen

At this point, the HHT prompts the operator to deactivate the Placement sensor(s) only. The **Presence** sensors must remain activated until the displayed count down timer expires. At that point, the UUT should issue a TP3 timeout error.

If the UUT drops its U\_REQ signal following the Placement sensor deactivation, the HHT will fail the test. This indicates that the UUT believes the FOUP has been properly removed when the Presence sensor(s) is still activated.

If the TP3 timeout occurs without the U\_REQ signal dropping, the HHT marks the test as passed.

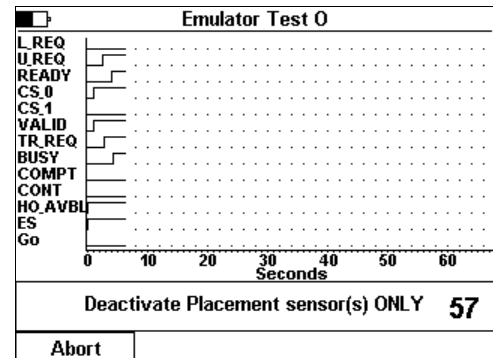


Figure 95 - Test O In Progress

### Active Mode Functionality Test P Verify Port Sensors - Part 4

Verify Port Sensors tied to E84 signals - Part 4 (Presence sensor(s) deactivated during Unload, but Placement sensor(s) is not).

The setup screen for **Test P** instructs the operator to activate all Placement and Presence sensors on the UUT. The operator should make sure all sensors are activated prior to starting the test.

**Test P** is implemented using a standard Unload Cycle test. The Unload Cycle screen is displayed, and the HHT advances the E84 handshake up to the point where the UUT is waiting for the removal of the FOUP.

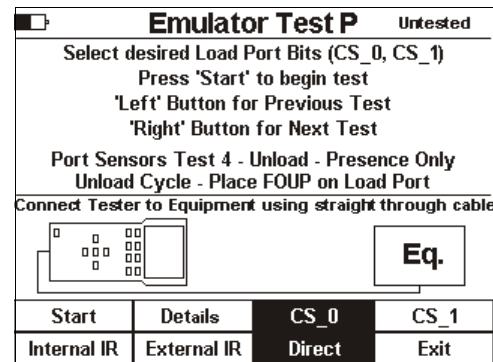


Figure 96 - Test P Setup Screen

At this point, the HHT prompts the operator to deactivate the Presence sensor(s) only. The **Placement** sensors must remain activated until the displayed count down timer expires. At that point, the UUT should issue a TP3 timeout error.

If the UUT drops its U\_REQ signal following the Presence sensor deactivation, the HHT will fail the test. This indicates that the UUT believes the FOUP has been properly removed when the Placement sensor(s) is still activated.

If the TP3 timeout occurs without the U\_REQ signal dropping, the HHT marks the test as passed.

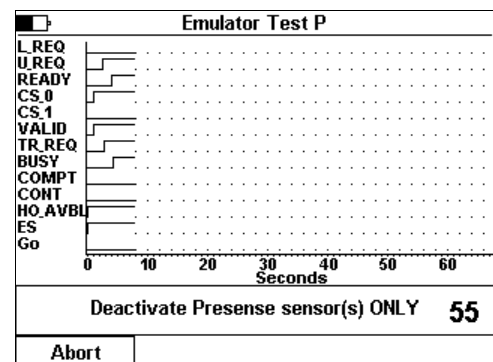


Figure 97 - Test P In Progress

### Active Mode Functionality Test Q

#### Verify Emergency Stop

Verify Emergency Stop operation.

**Test Q** is implemented using a standard Unload Cycle. The operator should make sure a FOUP is properly placed on the UUT prior to starting the test.

The Unload Cycle screen is displayed, and the HHT advances the E84 handshake up to the point where the UUT is waiting for the removal of the FOUP.

At this point, the HHT prompts the operator to press the UUT's Emergency Stop (EMO) button. The EMO button must be pressed before the displayed count down timer expires.

The UUT should drop it's ES signal.

If the UUT does not drop it's ES signal before the displayed count down timer expires, the test fails. The UUT will issue a TP3 timeout error at this point.

When the HHT detects a drop in the ES signal, it drops all of it's signals (BUSY, TR\_REQ, VALID, CS\_0). The HHT then prompts the operator to clear the E-Stop condition (release the EMO button). The UUT should turn it's ES signal back ON.

If the HHT detects the ES signal turning ON, it will mark the test as passed. If the ES signal fails to turn back ON, the operator should select the **Fail** option to indicate the failure.

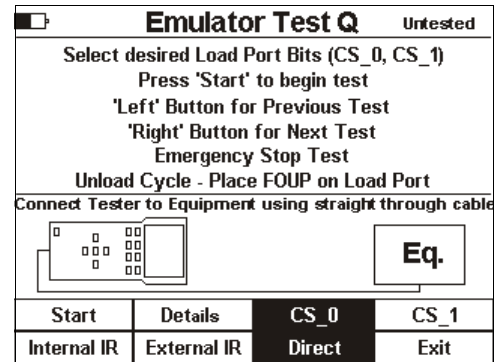


Figure 98 - Test Q Setup Screen

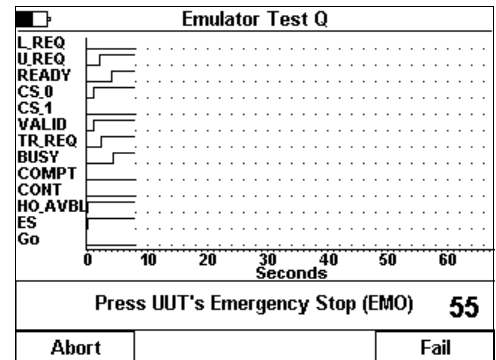


Figure 99 - Test Q In Progress

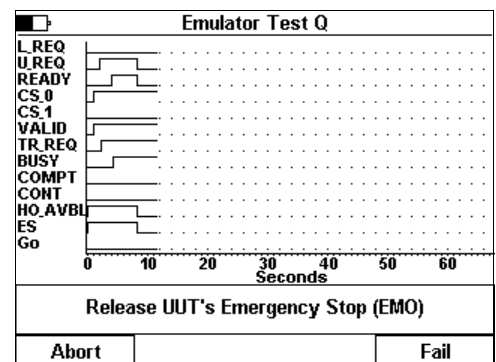


Figure 100 - Test Q Step 2

### HHT Test Suite Results

After all HHT Test Suite test have completed, or when the operator has aborted the HHT Test Suite, an option is displayed to save the HHT Test Suite results into the PSS. The test suite results is stored as a formatted ASCII text file.

This text file will show a title for each test in the HHT Test Suite, along with Pass / Fail results. For some tests, failure codes will be added indicating the type of failure if applicable.

Save Test Results			
Tools		Tool Information	
TOOL001A		Tool ID: TOOL001A	
TOOL001B		Location: METROLOGY BAY C	
TOOL001C		Details: WAFER SORTER - LOAD	
TOOL002		PORT 1	
XYZ		Select Tool ID and press Enter to	
New Tool		save test results. Edit the New	
		Tool entry to create a new Tool ID	
		before saving.	
Top	Prev		
Bottom	Next	Edit	Exit

**Figure 101** - Save HHT Test Suite Results



E84 Handheld Tester  
GCI05001

***Emulator Test Suite Worksheet***





## **HHT Test Suite Worksheet**

This section provides a test worksheet for use while running HHT Test Suite tests. It includes details for each test in the HHT Test Suite, along with user comment fields. The HHT does not provide a method of entering test related comments. This worksheet is intended to be used during HHT Test Suite testing, and provides a manual method for recording test related comments.

Instrumentation, Tools, Other

- 1 person (3 hrs)
- tape measure
- metric scale
- E84 HHT
- this HHT Test Suite Worksheet

Setup Procedure

The unit under test (UUT) must be fully assembled as for normal operation with power applied. The E84 HHT must be set to run the Emulator Test Suite (select option **1 - Standard Cycle Test** from Main Test Menu, then option **5 - Emulator Test Suite**).

### **Active Mode Static Tests**

Ensure that E84 parallel I/O interface plug(s) are mounted on the top of the equipment per SEMI\* E84. Ensure 1 plug is provided for each equipment load port. Ensure that documented recovery procedures exist per SEMI\* E84.

### **Active Mode Functionality Tests**

Ensure functionality of the E84 interface device per the SEMI\* E84 standard.

Tests C and D will be tested twice to verify the equipment does not require a specific order of signals at the transfer complete and release of CS sequences of the E84 handoff.

When loading a FOUP during Test C, the FOUP should be loaded such that the placement sensor is blocked approximately 5 seconds after the presence sensor (where possible).

When unloading a FOUP during Test D, the FOUP should be unloaded such that the presence sensor is unblocked approximately 5 seconds after the placement sensor (where possible).

- (P) (F) A.** Using the equipment user interface, verify that the passive equipment timers (TP1 through TP5) are configurable within the range specified in E84 (1 to 999) and make note of the default settings. (E84 Specification defines default settings of: 2, 2, 60, 60, 2).

Use the HHT's Tester Configuration (option 7 of Main Test Menu) to enter the passive equipment timers into the HHT:

TP1 \_\_\_\_\_seconds

TP2 \_\_\_\_\_seconds

TP3 \_\_\_\_\_seconds

TP4 \_\_\_\_\_seconds

TP5 \_\_\_\_\_seconds

Notes:

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- (P) (F) B.** Verify for hard wired implementation the voltage provided by the unit under test (UUT) is within the range specified in E84 under Full Load (100mA) and No Load (<2mA). Both measurements must be within the published range to pass.

UUT supplies voltage on Pin 23 of the E84 Interface.

1. Voltage at Full Load is in the range of 18VDC to 30VDC
2. Voltage at No Load is in the range of 18VDC to 30VDC

Also note voltage measured on Pin 22. This voltage should also fall within the published range. A voltage measurement on Pin 22 that is less than 18 VDC implies an improperly wired E84 interface.

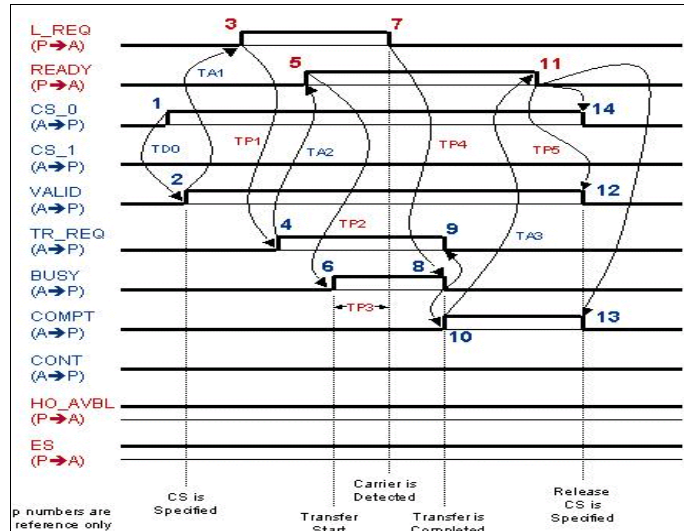
Notes:

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**(P) (F) C. Single handoff sequence for Loading:** All steps must occur in the prescribed order to pass:

1. Verify that the HO\_AVBL signal is ON on the equipment
2. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
3. Set the VALID signal ON on the E84 HHT
4. Verify that the equipment turns the L\_REQ signal ON
5. Set the TR\_REQ signal ON on the E84 HHT
6. Verify that the equipment turns the READY signal ON
7. Set the BUSY signal ON on the E84 HHT and place the FOUP on the loadport associated with the E84 interface being tested
8. Verify that the equipment turns the L\_REQ signal OFF
9. Set the BUSY signal OFF, TR\_REQ signal OFF and COMPT signal ON on the E84 HHT
10. Verify that the equipment turns the READY signal OFF
11. Set the COMPT, VALID and CS\_0 signals OFF on the E84 HHT



**Figure 102 - Single Handoff - Load**

Notes: \_\_\_\_\_

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**(P) (F) C. Single handoff sequence for Loading - 2<sup>nd</sup> Run:** All steps must occur in the prescribed order to pass:

1. Verify that the HO\_AVBL signal is ON on the equipment
2. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
3. Set the VALID signal ON on the E84 HHT
4. Verify that the equipment turns the L\_REQ signal ON
5. Set the TR\_REQ signal ON on the E84 HHT
6. Verify that the equipment turns the READY signal ON
7. Set the BUSY signal ON on the E84 HHT and place the FOUP on the loadport associated with the E84 interface being tested
8. Verify that the equipment turns the L\_REQ signal OFF
9. Set the TR\_REQ signal OFF, BUSY signal OFF and COMPT signal ON on the E84 HHT
10. Verify that the equipment turns the READY signal OFF
11. Set the VALID, COMPT, and CS\_0 signals OFF on the E84 HHT

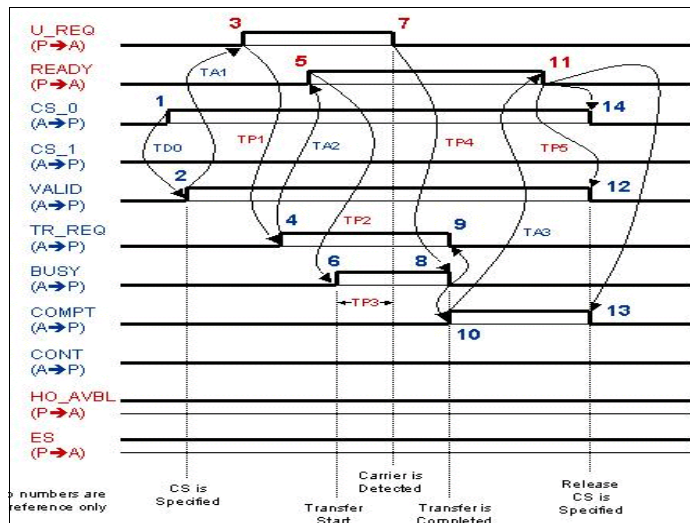
Notes: \_\_\_\_\_

\_\_\_\_\_

**(P) (F) D. Single handoff sequence for**

**Unloading:** All steps must occur in the prescribed order to pass:

1. Place a FOUP on the loadport associated with the E84 interface being tested
2. Verify that the HO\_AVBL signal is ON on the equipment
3. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
4. Set the VALID signal ON on the E84 HHT
5. Verify that the equipment turns the U\_REQ signal ON
6. Set the TR\_REQ signal ON on the E84 HHT
7. Verify that the equipment turns the READY signal ON
8. Set the BUSY signal ON on the E84 HHT and remove the FOUP from the loadport associated with the E84 interface being tested
9. Verify that the equipment turns the U\_REQ signal OFF
10. Set the BUSY signal OFF, TR\_REQ signal OFF and COMPT signal ON on the E84 HHT
11. Verify that the equipment turns the READY signal OFF
12. Set the COMPT, VALID and CS\_0 signals OFF on the E84 HHT



**Figure 103 - Single Handoff - Unload**

Notes: \_\_\_\_\_

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**(P) (F) D. Single handoff sequence for Unloading - 2<sup>nd</sup> Run:** All steps must occur in the prescribed order to pass:

1. Place a FOUP on the loadport associated with the E84 interface being tested
2. Verify that the HO\_AVBL signal is ON on the equipment
3. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
4. Set the VALID signal ON on the E84 HHT
5. Verify that the equipment turns the U\_REQ signal ON
6. Set the TR\_REQ signal ON on the E84 HHT
7. Verify that the equipment turns the READY signal ON
8. Set the BUSY signal ON on the E84 HHT and remove the FOUP from the loadport associated with the E84 interface being tested
9. Verify that the equipment turns the U\_REQ signal OFF
10. Set the TR\_REQ signal OFF, BUSY signal OFF and COMPT signal ON on the E84 HHT
11. Verify that the equipment turns the READY signal OFF
12. Set the COMPT, CS\_0 and VALID signals OFF on the E84 HHT

Notes: \_\_\_\_\_

\_\_\_\_\_

**(P) (F) E. Handoff available signal test for load:** All steps must occur in the prescribed order to pass:

1. Verify that the HO\_AVBL signal is ON on the equipment
2. Activate the presence sensor(s) on the loadport associated with the E84 interface being tested
3. Verify that the equipment does not allow for the delivery of a FOUP. The three acceptable communication scenarios include:
  - the equipment turns the HO\_AVBL signal OFF immediately
  - the equipment does not turn the L\_REQ signal ON after the tester turns the VALID signal ON
  - the equipment does not turn the READY signal ON after the tester turns the TR\_REQ signal ON.

One of these three scenarios must occur for this test to pass.

Notes:

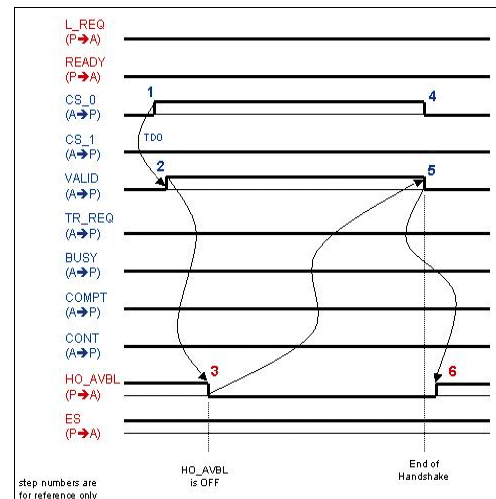
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**(P) (F) F. Handoff available sequence:** All steps must occur in the prescribed order to pass:

1. For this test only, set the TP1 setting to 15 seconds
2. Verify that the HO\_AVBL signal is ON on the equipment
3. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
4. Set the VALID signal ON on the E84 HHT
5. Manually induce a condition on the equipment that causes the HO\_AVBL signal to go OFF. This may be done by loading an unexpected FOUP on the loadport, or possibly switching the equipment to manual mode. Note the test person must cause the condition in a time less than 15 seconds.
6. Verify that the equipment turns the HO\_AVBL signal OFF
7. Set the CS\_0 signal OFF and the VALID signal OFF on the E84 HHT
8. Fix the error condition that was induced in Step 4
9. Verify that the equipment turns the HO\_AVBL signal ON again
10. Change the TP1 setting back to the original default setting



**Figure 104 - HO\_AVBL Signal Example**

Notes:

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**(P) (F) G. TP1 timeout error:** All steps must occur in the prescribed order to pass:

1. Verify that the HO\_AVBL signal is ON on the equipment
2. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
3. Set the VALID signal ON on the E84 HHT
4. Verify that the equipment turns the L\_REQ signal ON
5. Do nothing for a time exceeding TP1
6. Verify that the equipment indicates a TP1 timeout error on the User Interface

Notes:

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- (P) (F) H. **TP2 timeout error:** All steps must occur in the prescribed order to pass:
1. Verify that the HO\_AVBL signal is ON on the equipment
  2. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
  3. Set the VALID signal ON on the E84 HHT
  4. Verify that the equipment turns the L\_REQ signal ON
  5. Set the TR\_REQ signal ON on the E84 HHT
  6. Verify that the equipment turns the READY signal ON
  7. Do nothing for a time exceeding TP2
  8. Verify that the equipment indicates a TP2 timeout error on the User Interface

Notes:

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- (P) (F) I. **TP3 timeout error:** All steps must occur in the prescribed order to pass:
1. Verify that the HO\_AVBL signal is ON on the equipment
  2. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
  3. Set the VALID signal ON on the E84 HHT
  4. Verify that the equipment turns the L\_REQ signal ON
  5. Set the TR\_REQ signal ON on the E84 HHT
  6. Verify that the equipment turns the READY signal ON
  7. Set the BUSY signal ON on the E84 HHT but DO NOT place the FOUP on the loadport for a time exceeding TP3
  8. Verify that the equipment indicates a TP3 timeout error on the User Interface

Notes:

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- (P) (F) J. **TP4 timeout error:** All steps must occur in the prescribed order to pass:
1. Verify that the HO\_AVBL signal is ON on the equipment
  2. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
  3. Set the VALID signal ON on the E84 HHT
  4. Verify that the equipment turns the L\_REQ signal ON
  5. Set the TR\_REQ signal ON on the E84 HHT
  6. Verify that the equipment turns the READY signal ON
  7. Set the BUSY signal ON on the E84 HHT and place the FOUP on the loadport associated with the E84 interface being tested
  8. Verify that the equipment turns the L\_REQ signal OFF
  9. Do nothing for a time exceeding TP4
  10. Verify that the equipment indicates a TP4 timeout error on the User Interface

Notes:

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- (P) (F) K. **TP5 timeout error:** All steps must occur in the prescribed order to pass:
1. Verify that the HO\_AVBL signal is ON on the equipment
  2. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
  3. Set the VALID signal ON on the E84 HHT
  4. Verify that the equipment turns the L\_REQ signal ON
  5. Set the TR\_REQ signal ON on the E84 HHT
  6. Verify that the equipment turns the READY signal ON
  7. Set the BUSY signal ON on the E84 HHT and place the FOUP on the loadport associated with the E84 interface being tested
  8. Verify that the equipment turns the L\_REQ signal OFF
  9. Set the BUSY signal OFF, TR\_REQ signal OFF and COMPT signal ON on the E84 HHT
  10. Verify that the equipment turns the READY signal OFF
  11. Do nothing for a time exceeding TP5
  12. Verify that the equipment indicates a TP5 timeout error on the User Interface

Notes:

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- (P) (F) L. **Access mode test:** All steps must occur in the prescribed order to pass:
1. Verify that the HO\_AVBL signal is ON on the equipment
  2. Place the equipment into manual access mode using the equipment user interface. Note: the equipment should also have this functionality using the host instead of the user interface, but this is not part of the test plan.
  3. Verify that the HO\_AVBL signal is OFF
  4. Place the equipment into automated access mode using the equipment user interface.
  5. Verify that the HO\_AVBL signal is ON

Notes:

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- (P) (F) M. **Port sensors tied into E84 signals part 1 - Placement sensor(s) activated during Load, but presence sensor(s) is not:** All steps must occur in the prescribed order to pass:
1. Verify that the HO\_AVBL signal is ON on the equipment
  2. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
  3. Set the VALID signal ON on the E84 HHT
  4. Verify that the equipment turns the L\_REQ signal ON
  5. Set the TR\_REQ signal ON on the E84 HHT
  6. Verify that the equipment turns the READY signal ON
  7. Set the BUSY signal ON on the E84 HHT and activate all of the placement sensor(s) only on the loadport associated with the E84 interface being tested
  8. Verify that the equipment does NOT turn the L\_REQ signal OFF
  9. After exceeding the TP3 time, verify that the equipment indicates a TP3 timeout error on the User Interface

Notes:

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**(P) (F) N. Port sensors tied into E84 signals 2 - Presence sensor(s) activated during Load, but placement sensor(s) is not:** All steps must occur in the prescribed order to pass:

1. Verify that the HO\_AVBL signal is ON on the equipment
2. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
3. Set the VALID signal ON on the E84 HHT
4. Verify that the equipment turns the L\_REQ signal ON
5. Set the TR\_REQ signal ON on the E84 HHT
6. Verify that the equipment turns the READY signal ON
7. Set the BUSY signal ON on the E84 HHT and activate the presence sensor(s) only on the loadport associated with the E84 interface being tested
8. Verify that the equipment does NOT turn the L\_REQ signal OFF
9. After exceeding the TP3 time, verify that the equipment indicates a TP3 timeout error on the User Interface

Notes:

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**(P) (F) O. Port sensors tied into E84 signals 3 - Placement sensor(s) deactivated during Unload, but presence sensor(s) is not:** All steps must occur in the prescribed order to pass:

1. Activate both the placement and presence sensors on the loadport associated with the E84 interface being tested
2. Verify that the HO\_AVBL signal is ON on the equipment
3. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
4. Set the VALID signal ON on the E84 HHT
5. Verify that the equipment turns the U\_REQ signal ON
6. Set the TR\_REQ signal ON on the E84 HHT
7. Verify that the equipment turns the READY signal ON
8. Set the BUSY signal ON on the E84 HHT and deactivate the placement sensor(s) only from the loadport associated with the E84 interface being tested
9. Verify that the equipment does NOT turn the U\_REQ signal OFF
10. After exceeding the TP3 time, verify that the equipment indicates a TP3 timeout error on the User Interface

Notes:

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**(P) (F) P. Port sensors tied into E84 signals 4 - Presence sensor(s) deactivated during Unload, but placement sensor(s) is not:** All steps must occur in the prescribed order to pass:

1. Activate both the placement and presence sensors on the loadport associated with the E84 interface being tested
2. Verify that the HO\_AVBL signal is ON on the equipment
3. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
4. Set the VALID signal ON on the E84 HHT
5. Verify that the equipment turns the U\_REQ signal ON
6. Set the TR\_REQ signal ON on the E84 HHT
7. Verify that the equipment turns the READY signal ON
8. Set the BUSY signal ON on the E84 HHT and deactivate the presence sensor(s) only from the loadport associated with the E84 interface being tested
9. Verify that the equipment does NOT turn the U\_REQ signal OFF
10. After exceeding the TP3 time, verify that the equipment indicates a TP3 timeout error on the User Interface

Notes:

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- (P) (F) Q. Emergency Stop:** All steps must occur in the prescribed order to pass:
1. Place a FOUP on the loadport associated with the E84 interface being tested
  2. Verify that the HO\_AVBL signal is ON on the equipment
  3. Set the CS\_0 signal ON and CS\_1 signal OFF on the E84 HHT
  4. Set the VALID signal ON on the E84 HHT
  5. Verify that the equipment turns the U\_REQ signal ON
  6. Set the TR\_REQ signal ON on the E84 HHT
  7. Verify that the equipment turns the READY signal ON
  8. Set the BUSY signal ON on the E84 HHT
  9. Press the Emergency Stop (E-Stop) button on the equipment
  10. Verify that the equipment turns the ES signal OFF
  11. Set BUSY, TR\_REQ, VALID and CS\_0 signals OFF on the E84 HHT.
  12. Clear the E-Stop condition and verify that the equipment turns the ES signal ON

Notes:

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