

WATERS CORPORATION
ENGINEERING TEST SPECIFICATION AND PROCEDURE
COMPANY CONFIDENTIAL

SYSTEM/ASSEMBLY NAME: **DETECTOR FRONT-END ASSEMBLIES**

PART NUMBER AFFECTED: **WAT081318, 210000147, 210000161, 210000159**

TEST EQUIPMENT NAME: **UNIVERSAL FRONT-END TESTER**

TEST EQUIPMENT NUMBER: **TE82720-1, TE82720-2**

TEST EQUIPMENT LOCATION: **TE82720-1: FLEXTRONICS, SINGAPORE**

TE82720-2: GES ELTECH, MAYLASIA

DOCUMENT NUMBER: **735000522**

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EQUIPMENT REQUIRED

Quantity	Part Number	Description
1	TE82717	2414 Front-End Board Fixture.
1	TE82718	2487 Front-End Board Fixture
1	TE82719	2475 Front-End Board Fixture
1	TE82754	2488 Front End Board Fixture
1	TE82720	Universal Front-End Board Test Platform

REFERENCE DOCUMENTATION

Document Number	Description
735000521	Calibration Procedure, Universal Front End Tester
735000408	Test Procedure 2414 Preamp Fixture
735000515	Test Procedure 2475 Preamp Fixture
735000171	Test Procedure 2487 Preamp Fixture
735000516	Test Procedure 2488 Preamp Fixture

TABLE OF CONTENTS

- 1. Hardware.....4
 - 1.1. Chassis4
 - 1.2. Receiver4
 - 1.3. Fixtures5
- 2. System operation7
 - 2.1. Menu Navigation7
 - 2.2. Operational Controls7
- 3. Functional Description8
 - 3.1. Main menu8
 - 3.2. Automatic Testing9
 - 3.3. Troubleshooting10
 - 3.4. System Configuration11
 - 3.5. System Diagnostics17
- 4. Procedures20
 - 4.1. System Start Up20
 - 4.2. System Shut Down.....20
 - 4.3. Installing Fixtures20
 - 4.4. Removing Fixtures20
 - 4.5. Loading Printer with Paper20
 - 4.6. Replacing Print Cartridges21
 - 4.7. Cleaning PC Air Filter 21

1. HARDWARE

Read this section to familiarize yourself with the physical layout of the test system and general nomenclature of its components. Refer to Figure 1.

The Front-End Tester is a PC based, floor standing, portable, test system designed specifically for detector Front-End Boards. The system consists of three main assemblies:

1.1. Chassis

The Chassis is a standard 19" floor standing instrument rack on wheels. The Chassis contains the following components/instruments:

- 1.1.1. Rackmount Keyboard drawer - Standard Windows keyboard with integrated trackball for point and click operations.
- 1.1.2. Rackmount Printer – Hewlett Packard Deskjet model 612C mounted on a sliding shelf. This printer accepts any standard 8.5" x 11" printer paper.
- 1.1.3. Rackmount PC – The Rackmount PC provides all the functionality of a standard desktop PC with the following additions:
 - a) GPIB Interface Card – The PCI-GPIB interface card provides instrument communications.
 - b) National Instruments 6025E Multifunction I/O Card – The multifunction I/O card provides both analog and digital I/O resources for the tester.
- 1.1.4. Two Keithley model 236 Source Measure Units – The Source Measure Units (SMU's) provide current input stimulus for the Front-End Boards. One SMU is designated Channel A or Sample and is configured with a GPIB address of 4. The second SMU designated Channel B or Reference is configured with a GPIB address of 5.
- 1.1.5. Rackmount power entry strip.
- 1.1.6. Rackmount power line strip w/fuse and illuminated on/off switch.
- 1.1.7. 17" hi-resolution color monitor – The monitor is strapped to a pedestal, which is bolted to the top of the Chassis. The monitor is powered from the rackmount, power entry strip. A standard 15-pin "D" video connector is also provided on the power entry strip.

1.2. Receiver

The Receiver is a sloped metal enclosure bolted to the top of the Chassis. The Receiver interfaces Chassis resources to the Fixtures and contains the following components:

- 1.2.1. Fixture Power – Triple output linear power supply rated at:
 - Output #1 5V @ 3A
 - Output #2 +12V - +15V @ 1A (adjustable)
 - Output #3 -12 - -15V @ 1A (adjustable)
- 1.2.2. Relay Board – 16 dry contact relays controlled by National Instruments 6025E Multifunction I/O Card, located in the PC.
- 1.2.3. Fixture Interface Board – Custom breadboard used to interface Fixture resources to the National Instruments 6025E Multifunction I/O Card, located in the PC.

- 1.2.4. Power Control Relay – 4 form C contacts used to switch fixture power.
- 1.2.5. Operator Control Pushbuttons – Heavy duty, color-coded, momentary pushbutton switches for convenient operator interface to the system.
- 1.2.6. Hypertronics high reliability Rack and Panel Interface connector with 180° jackscrew receptacle.

1.3. Fixtures

Each fixture is unique to each Front-End Board type. Each Fixture contains:

- 1.3.1. CPU Board or CPU/Personality boards – CPU or Personality boards are application specific. Each provides their Front-End Boards with analog power supplies and an RS232 to QSPI interface for PC to UUT communications.
- 1.3.2. Faraday Shield Box – Front-End Boards must be in a grounded enclosure to obtain clean reliable data. Each Faraday Shield Box is unique in respect to Front-End Board footprint and cable routing.
- 1.3.3. Rack and Panel Interface connector with 180° jackscrew plug.
- 1.3.4. Signal Interface Cables – Coaxial cables, SMA connectors on the fixture side and appropriate termination for the UUT on the other side.

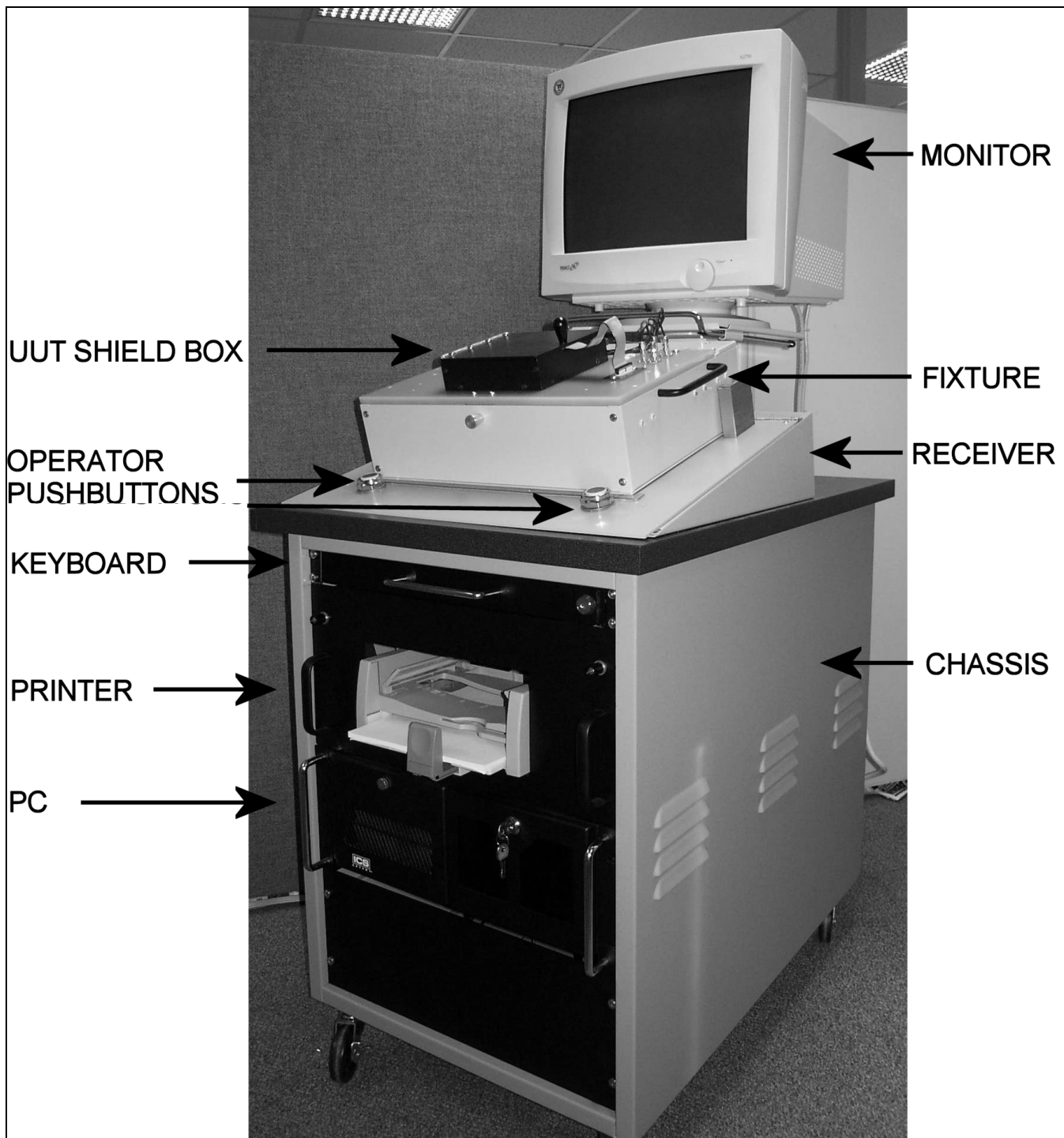


Figure 1

2. SYSTEM OPERATION

The Universal Front-End Tester is a menu driven, interactive, Labview application.

2.1. Menu Navigation

Each menu provides several options to the user/operator. Executing a menu item is performed by selecting or highlighting a menu item, followed by entering the selected menu item into the system. All of this can be performed by either of two methods:

2.1.1. Point and Click

Using the built-in trackball, move the Windows pointer to the item you wish to select and press the left trackball button (point and click). This will highlight your selection. To change your selection simply point and click on the desired item. This will deselect the previous selection and highlight the item at the current Windows pointer location. To execute the selected menu item, point and click on the "ENTER" key at the bottom of the menu.

2.1.2. Select and Enter

Located at the front of the Receiver are two momentary pushbutton switches. When on a menu screen pressing the left (green) switch will scroll through the menu items by selecting (highlighting) them, in order, one after the other. When the desired item is selected, depressing the right (red) switch will enter (execute) the selected item.

2.2. Operational Controls

2.2.1. Test

When in Automatic Test mode, a green "TEST" button is displayed on the left side of the screen. To test a UUT, point and click the on screen button or push the left (green) Operator Pushbutton switch on the Receiver.

2.2.2. Abort

When in any screen that displays a red button "ABORT", "EXIT", or "STOP", point and click on the button to perform the task displayed. Depending on the screen or mode the tester is in, it may take some time to recognize the point and click operation. For an immediate response, depress the right (red) Operator Pushbutton switch on the Receiver. This pushbutton always assumes the function of the red button on the screen.

2.2.3. Keyboard

The keyboard will be required for entering a password to access system configuration, entering UUT serial numbers and entering test specifications.

2.2.4. Trackball

The trackball, used in place of a mouse, can be used for any point and click operations presented to the operator. Point and Click operations include toggling on/off buttons, opening pull-down menus, and selecting a text/data box to edit.

3. FUNCTIONAL DESCRIPTION

The Universal Front-End Pre-Amp Tester software is automatically started when the system is powered up. If, for any reason Tester software has been terminated, Windows should be showing its active desktop. To restart the Tester software, simply double-click the Front-End Tester icon from the desktop as you would with any Windows application.

3.1. Main menu

The Main Menu screen (Figure 2) is displayed at power-up and is the upper most level of the Tester software. The Main Menu presents the operator with basic system options, status, and configuration. At the bottom of the page, the Main Menu displays which fixture, if any, is installed and system status. The System Status line prompts the user for input, displays errors and/or current system activity. The Runtime Options box shows which Runtime Options are currently enabled.

When at the Main Menu screen, the tester continuously checks system status. If an error is encountered, the prompt "System Error! Go to System Diagnostics for details" is displayed in the System Status line at the bottom of the screen. If a calibration or maintenance item becomes due, a prompt is displayed to the right of the Main Menu box. When a calibration or maintenance item becomes due, refer to the appropriate Waters Calibration Procedure.

The screenshot shows the 'UNIVERSAL FRONT END PRE-AMP TESTER' main menu. It features a central column of buttons: 'AUTOMATIC TESTING', 'TROUBLESHOOTING', 'SYSTEM CONFIGURATION', 'SYSTEM DIAGNOSTICS', 'EXIT TO WINDOWS', and 'ENTER'. To the left is a 'Runtime Options' box with four items: 'Print on Pass' (checked), 'Print on Fail' (unchecked), 'Data Logging' (checked), and 'Exit on Fail' (unchecked). At the bottom, there are two input fields: 'Fixture Installed:' with the value '2475' and 'System Status:' with the text 'Select from Main Menu'. The bottom right corner contains the text 'WATERS CORPORATION' and 'TE #82720'.

UNIVERSAL FRONT END PRE-AMP TESTER

MAIN MENU

Runtime Options

Print on Pass ☒

Print on Fail ☐

Data Logging ☒

Exit on Fail ☐

AUTOMATIC TESTING

TROUBLESHOOTING

SYSTEM CONFIGURATION

SYSTEM DIAGNOSTICS

EXIT TO WINDOWS

ENTER

Fixture Installed: 2475

System Status: Select from Main Menu

WATERS CORPORATION
TE #82720

Figure 2

3.2. Automatic Testing

Automatic Testing (Figure 3) mode is invoked by the operator from the Main Menu. The Tester calls the appropriate test sequence based on the fixture installed. All Automatic Test Sequence screens are identical and operate the same way. Only the executed tests as displayed in the Test Sequence Listbox differ. Controls and Indicators on Automatic Test Sequence screens are described below. A detailed test procedure for each model Front-End board can be found in that boards test procedure as listed in the Reference Documentation section above.

3.2.1. # Boards Tested

This numerical indicator shows how many boards have been tested during that test session only. The test session starts when the Automatic Test Sequence begins and is always zero at that time.

3.2.2. Test Sequence Listbox

This text box displays each test step to be executed in top to bottom order. Each test step is highlighted while it is executing. When that test step is finished, a pass/fail (✓/X) symbol is inserted to the left of that line indicating that test step's status.

3.2.3. Status Banner

Just below the Test Sequence Listbox is the Status Banner. This indicator displays the current Tester/UUT status as follows in Table 1.

Tester/UUT State	Color	Display Text
Before first board is tested	Gray	IDLE
UUT being Initialized	White	Initializing
Testing	Yellow (blinking)	TESTING
UUT passed	Green	PASSED
UUT failed	Red	FAILED
Test sequence aborted	Red	ABORTED
System error	Red	ERROR

Table 1

3.2.4. Serial Number

This text box displays the UUT serial number, as entered by the operator.

3.2.5. TEST

This on-screen control is used to start an automatic test sequence on a UUT. The TEST button is emulated by the left (green) pushbutton switch on the Receiver. After a brief Initialization period, the operator is prompted to enter the UUT serial number. Type in the serial number followed by the keyboard Enter key and the test sequence will begin. See paragraph 2.2.1 above.

3.2.6. EXIT

This on-screen control has two purposes depending on the state of the tester. If the button displays “EXIT”, it is used to terminate Automatic Testing mode. If the button displays “ABORT”, it is used to terminate the test sequence in progress. The EXIT and ABORT buttons are emulated by the right (red) pushbutton switch on the Receiver. See paragraph 2.2.1 above.

3.2.7. Report

After the first UUT has been tested, a Report button becomes visible on screen. When activated (by a point and click operation) the tester displays the test report for the last UUT tested. The on-screen report contains the same information as the printed report does if enabled. This report is available to the user until the next test sequence is started.

3.2.8. System Error

This structure (Boolean, numeric, and text) is visible only if a system error occurs. Otherwise, it is not displayed on the screen. It is used to inform the user that a system error has occurred and to describe the error. Double click on the code field to display a pop-up window that describes the error.

The screenshot displays the tester's main interface. At the top, it shows 'MODEL 2414' and 'TEST SEQUENCE'. On the left, there is a label '# Boards Tested' followed by a text box containing the number '1'. In the center, a large white box lists the test results for the sequence. The results are as follows:

Test Item	Status
Channel A Offset, Measured	✗
Channel B Offset, Measured	✓
Channel A Offset, Interpolated	✓
Channel B Offset, Interpolated	✓
Channel A Noise Test	✓
Channel B Noise Test	✓
Channel A Leakage	✓
Channel B Leakage	✓
Channel A Integral Linearity	✗
Channel B Integral Linearity	✓
Channel A Differential Linearity	✗
Channel B Differential Linearity	✓

Below this list, a dark grey box with the word 'FAILED' in white capital letters indicates the overall result. To the left of the central box is a circular button labeled 'TEST'. To the right is a circular button labeled 'EXIT'. At the bottom of the screen, there is a 'Serial Number' label above a text input field. Below the input field are two buttons: 'Report' and 'View'.

Figure 3

3.3. Troubleshooting

Troubleshooting (Figure 4) mode is invoked by the operator from the Main Menu. The Tester calls the appropriate Debug Diagnostic page based on the fixture installed. All Debug Diagnostic screens are identical. Only the set of tests presented to the operator in the Debug

Menu differs. Troubleshooting mode allows the operator to execute any of the Automatic Test Sequence steps repeatedly and accumulate statistical data.

Controls and Indicators on Debug Diagnostic screens are described below. A more detailed description of the diagnostic tests available for each model Front-End board can be found in that boards test procedure as listed in Reference Documentation above.

3.3.1. Debug Menu

The Debug Menu presents to the operator the set of test routines available for the model Front-End board being tested. To execute simply select the desired function and hit ENTER.

3.3.2. ENTER

For a description of this item, see paragraph 2.1, Menu Navigation, above.

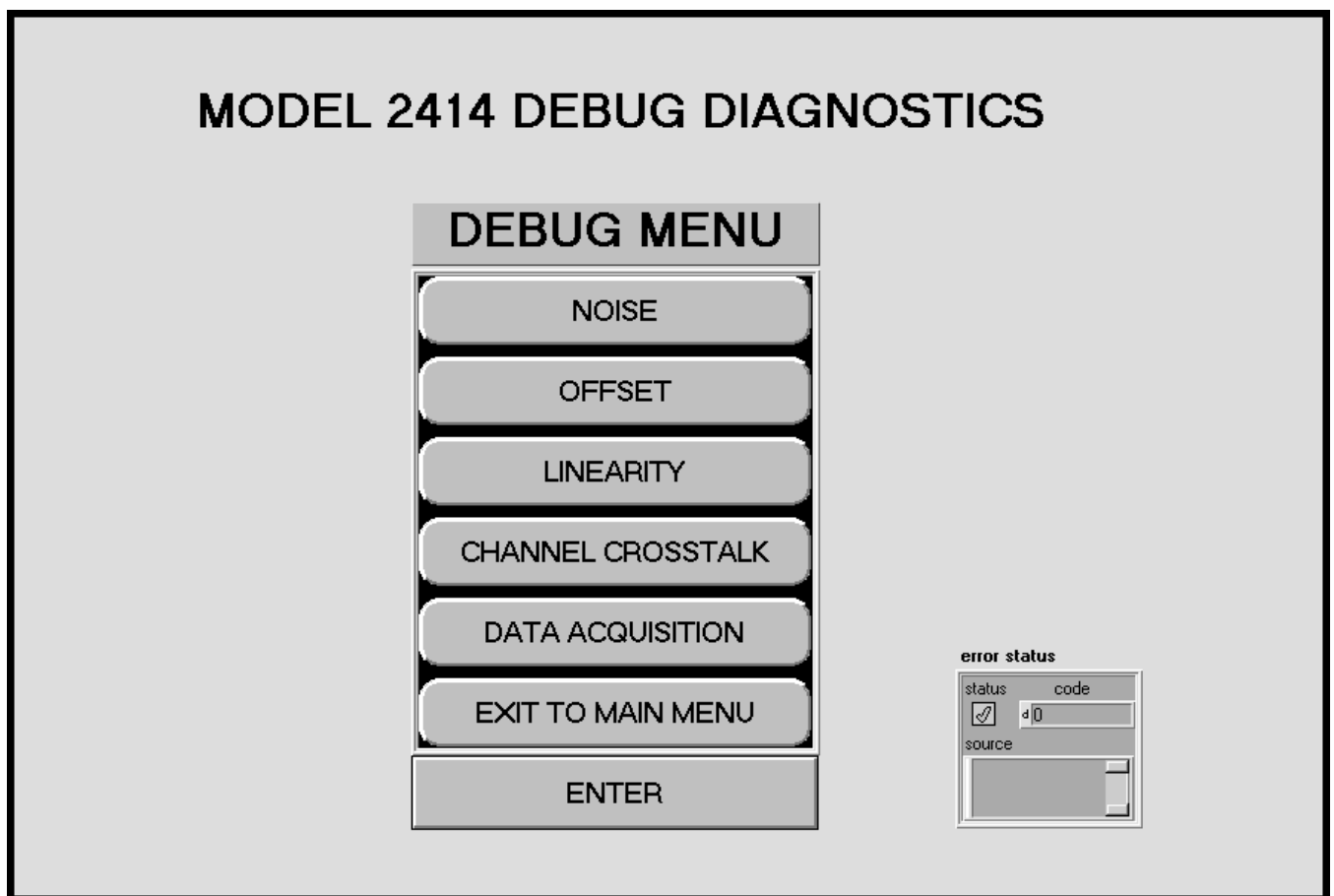


Figure 4

3.3.3. Error Status

This structure (Boolean, numeric, and text) is used to inform the user that a system error has occurred and to describe the error.

3.4. System Configuration

System Configuration (Figure 5) mode allows the user to customize some operational characteristics of the tester, edit PCB test specifications, and track calibration and periodic

maintenance due dates of the instruments and fixtures. System Configuration mode is intended for test managers only and is password protected. When invoked, the user is prompted to enter a password. Enter the password following with either the keyboard Enter key or point and click on "OK". If the correct password is entered, the Configuration Menu will be displayed.

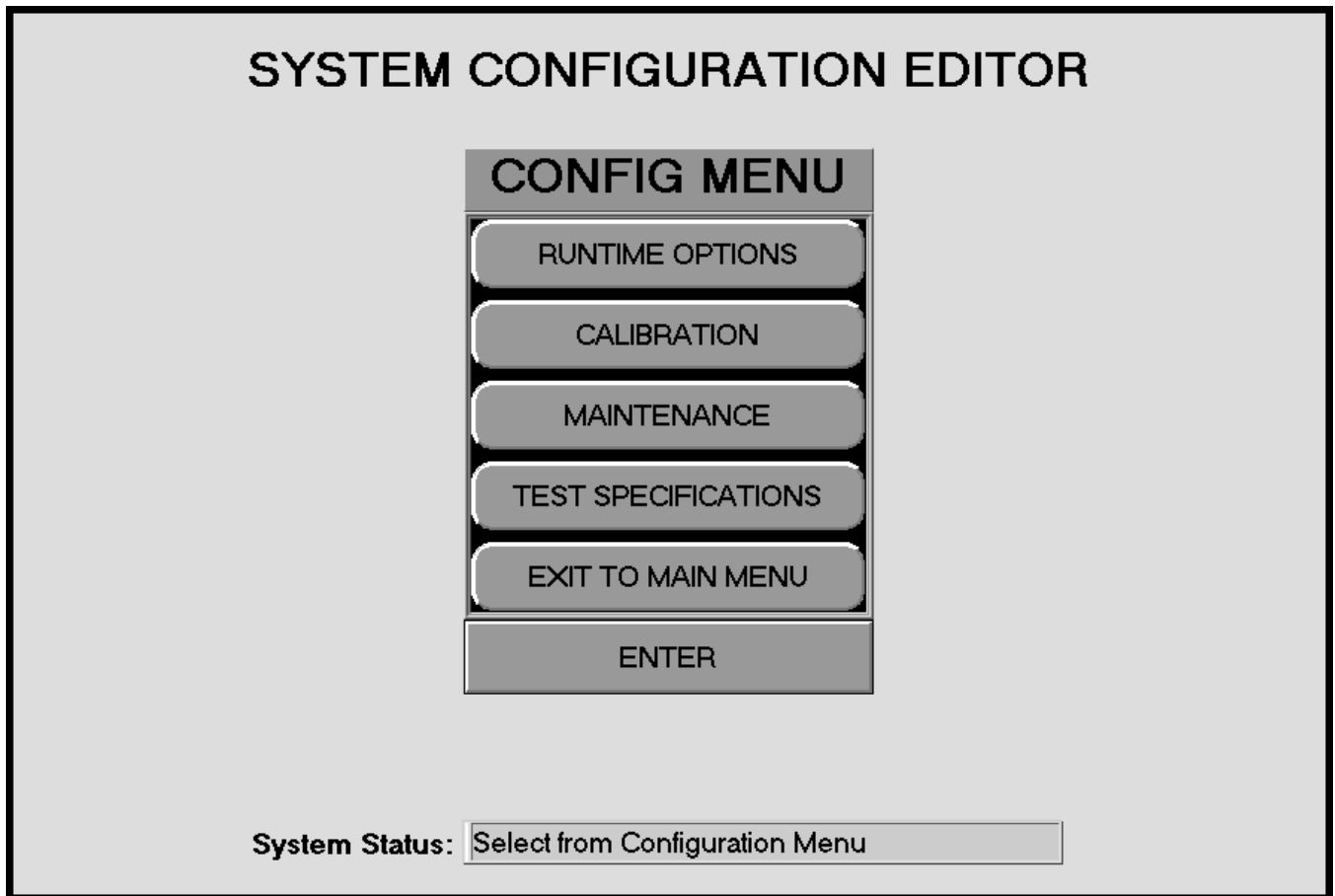


Figure 5

3.4.1. Runtime Options

Runtime Options (Figure 6) are used to configure some of the operational characteristics of the Tester and the Automatic Test Sequencer. Any combination of options may be enabled at any time. To toggle Runtime Option buttons simply point and click on the item.

1. Print on Pass – When ON the tester will print a report for each UUT that passes Automatic Testing. This button is highlighted green when ON.
2. Print on Fail – When ON the tester will print a report for each UUT that fails Automatic Testing. This button is highlighted green when ON.
3. Data Logging – When ON the tester will append to a file the report generated after Automatic Testing, for each UUT, regardless of pass/fail status. This button is highlighted green when ON.
4. Exit on Fail – When ON the Automatic Test Sequence will halt when the first failure is encountered. A report is generated using whatever amount of data is available followed by a "Exit on Fail" line. This button is highlighted green when ON.

5. Change Password – Point and click on this button to change the system administrators password. A popup window will prompt the user for new password and to confirm the new password.
6. PC Com Port – The PC's com port, used to interface to the UUT, is displayed in this textbox. To change either point and click on the arrows to the left of the textbox, which will automatically switch to the next available com port or point and click in the textbox which will pull down a list of available ports.
7. Save – Point and click this button to exit and save the Runtime Options window.
8. Cancel – Point and click this button to exit without saving Runtime Options. Previously saved options will be restored, including a password.

RUNTIME OPTIONS

Password
password

Change Password?
YES

Print on Pass
OFF

Print on Fail
OFF

Data Logging
ON

Exit on Fail
ON

PC Com Port
COM 1

SAVE CANCEL

Figure 6

3.4.2. Calibration

The Instrument Calibration (Figure 7) page presents to the user a group of items related to instrument calibration. When at the Main Menu, these items are checked and if an item becomes due, a text field appears, denoting which items are due calibration. At this time however, it is just a reminder and the Tester will function normally. The calibration items in this window are:

- National Instruments PCI-6025E – The PCI-6025E is embedded in the PC. This item requires annual calibration. Calibration is simple and can be performed without removing the board from the Tester.

- Keithley Instruments model 236 SMU Channel A – Channel A SMU is also called Sample Side SMU and requires a GPIB address of four to function properly. This item is on a yearly calibration cycle and must be sent out.
- Keithley Instruments model 236 SMU Channel B – Channel B SMU is also called Reference Side SMU and requires a GPIB address of 5 to function properly. This item is on a yearly calibration cycle.

Each item on the Calibration window provides a Month, Day of the Month, and Year text field.

1. MONTH - To edit the Month field, either point and click the up or down arrows adjacent to the field, to scroll to the next or previous month, or point and click in the field and then point and click on the month in the pop up list of months which will temporarily replace the field.
2. DAY - To edit the Day of the Month field, either point and click the up or down arrows adjacent to the field, to increment or decrement the day, or point and click in the field and then point and click on the day in the pop up list of days which will temporarily replace the field.
3. YEAR - To edit the Year field, point and click the up or down arrows adjacent to the Year field to scroll to the next or previous Year or double click in the text box to highlight the text and then type in the new year.
4. CALIBRATE – This button switches to a calibration window for the PCI-6025E Multifunction I/O Board. If calibration is successful the calibration due date is automatically changed to one year from the current date.
5. SAVE - To exit and save changes point and click on the Save button at the bottom of the window.
6. CANCEL - To exit without saving changes point and click on the Cancel button on the bottom of the window. Previously stored dates will be restored.

EDIT INSTRUMENT CALIBRATION DATES

CHANNEL A SMU CALIBRATION DATE

APRIL / 1 / 2001

CHANNEL B SMU CALIBRATION DATE

APRIL / 1 / 2001

PCI-6025E CALIBRATION DATE

APRIL / 27 / 2002 Calibrate

SAVE CANCEL

Figure 7

3.4.3. Maintenance

Each model Front End Board has maintenance items that require periodic attention and/or replacement. Refer to the appropriate Calibration Procedure for maintenance instructions. When at the Main Menu, the maintenance items associated with whichever fixture is installed are checked and if an item becomes due, a text field appears, denoting which items require maintenance. At this time however, it is just a reminder and the Tester will function normally (Figure 8).

Presently, the only items requiring periodic maintenance are signal cables. The Signal Cable Maintenance window displays the maximum number of insertions allowed and the current number of insertions (equals boards tested since last cleared) for each fixture.

1. To reset a maintenance item, “point and click” on the CLEAR button next to the item, the Current # of Insertions will zero, and the Main Menu prompt will be removed from the Main Menu.
2. To change the “# of Insertions Allowed” point and double click on the text to highlight the field then type in the new number.
3. To exit and save point and click on the “SAVE” button at the bottom of the window.
4. To exit and discard changes point and click on the “CANCEL” button at the bottom of the window. Previously stored dates will be restored.

SIGNAL CABLE MAINTENANCE

of Insertions Allowed on 2487

300 Max 301 Current Clear

of Insertions Allowed on 2414

300 Max 305 Current Clear

of Insertions Allowed on 2475

1000 Max 4 Current Clear

SAVE CANCEL

Figure 8

3.4.4. Test Specifications

Each model Front End Board has a set of test specifications that can be edited from this page (Figure 9). Each item within a board group is labeled with title and units, and are self explanatory. These specifications are used in automatic testing to determine whether a UUT passes or fails. The test specifications on this page are not to be changed without proper authorization from Waters Corporation.

1. To change a test specification, point and double click inside the specifications text box. This will highlight the current specification, then type in the new specification, or point and click on the up or down arrow adjacent to the text box to increment or decrement the specification.
2. To exit and save, point and click on the "SAVE" button at the bottom of the window.
3. To exit and discard changes, point and click on the "CANCEL" button at the bottom of the window. Previously stored data will be restored.

PCB TEST SPECIFICATIONS

2487 TEST SPECIFICATIONS

Linearity Spec
▲ 0.50 ▼ %FS

Noise Spec
▲ 750 ▼ ADC Counts

Droop Spec
▲ 3500000 ▼ ADC Counts

2414 TEST SPECIFICATIONS

Integral Linearity Spec
▲ 0.50 ▼ %

Differential Linearity Spec
▲ 5.00 ▼ %

Leakage Spec
▲ 50 ▼ ADC Counts

Noise Spec
▲ 200 ▼ ADC Counts

Offset Spec
▲ 400 ▼ ADC Counts

2475 TEST SPECIFICATIONS

Integral Linearity Spec
▲ 0.25 ▼ %

Differential Linearity Spec
▲ 5.00 ▼ %

Leakage Spec
▲ 100 ▼ ADC Counts

Noise Spec
▲ 200 ▼ ADC Counts

Offset Spec
▲ 300 ▼ ADC Counts

Figure 9

3.5. System Diagnostics

System Diagnostics (Figure 10) are provided as a means of system troubleshooting in the event a system error should occur. Diagnostic windows allow the user to monitor and manipulate system resources.

Caution: Do not attempt to manipulate or acquire data from a UUT using System Diagnostic utilities.

3.5.1. System Status

The System Status box is a group of indicators that show the status of system resources as the system tries to initialize them. Green indicates the item is ready and initialized without errors, and Red indicates an error. If an item should fail, detailed information and troubleshooting tools can be selected from the Diagnostics Menu.

3.5.2. Fixture Installed

The Tester searches for and displays in this text box the identification of the fixture installed. Identification is based on jumpers installed on the Hypertronics Rack and Panel connector in each fixture.

3.5.3. Diagnostics Menu

The Diagnostic Menu presents to the user a set of tools to be used in diagnosing system errors. To execute a menu item, see paragraph 2.1 above.

3.5.4. Menu Items

1. GPIB/6025E – This menu button invokes National Instruments Measurement & Automation Explorer. The Measurement and Automation Explorer allow the operator to test, troubleshoot, and configure system hardware. Troubleshooting and configuration wizards are available to help guide the user.
2. Channel A (Sample Side) SMU – This Diagnostic window allows the operator to manipulate the Keithley 236 Source Measure Unit (SMU) designated Channel A. Channel A is also called Sample Side, which is determined by a GPIB address of 4. The GPIB address is set manually using the instruments front panel controls.
3. Channel B (Reference Side) SMU – This Diagnostic window allows the operator to manipulate the Keithley 236 Source Measure Unit (SMU) designated Channel B. Channel B is also called Reference Side, which is determined by a GPIB address of 5. The GPIB address is set manually using the instruments front panel controls.
4. CPU Serial Interface – This Diagnostic page allows the user to manually communicate with the CPU in a fixture via the serial port. Serial port settings are automatically set, and are determined by the fixture installed.
5. Power Supplies – This Diagnostic window measures and displays all the power supplies in the system. Power supplies are divided into two groups, System and UUT. System power comes from the System Power Supply, reference paragraph 1.2.1 above. UUT power comes from the CPU or Personality board, which is located in the fixtures.
6. ER16 Relays – This Diagnostic control panel reads and writes to each of the 16 relays on the National Instruments ER16 Relay Board, reference paragraph 1.2.2 above. By default, relay #16 is on, as is required to power up and initialize the CPU or Personality board in the fixtures. Relay definitions are provided for signal tracing. To toggle a relay on or off, point and click on the toggle switch in the relay box. When on the status LED will be green, when off the status LED will be gray.
7. Fixture DIO – This Diagnostic window monitors and displays fixture Digital I/O. The following are checked:
 - Fixture ID – determined by jumpers in the fixtures.
 - Fixture Status – Reads the micro switch in the Faraday shield box. Displays OPEN or CLOSED.
 - CPU Status – Sends CR to the CPU or Personality Board and expects a prompt in return (displays ONLINE or OFFLINE).
 - TEST – Shows the state of the Test (green) Operator Pushbutton Switch.
 - ABORT – Shows the state of the Abort (red) Operator Pushbutton Switch.

Note: This is the only window that will not exit when the Red Operator Pushbutton switch is activated. To exit this screen, use the trackball to point and click on the EXIT switch.
8. Printer Services – The Printer Services button opens the HP Deskjet 610C Toolbox. From this window the operator can display “How Do I?” instructions, Troubleshooting procedures, and select built in printer maintenance routines.

SYSTEM DIAGNOSTICS

MENU	
GPIB/6025E	Fixture Installed 2475
CHANNEL A SMU	
CHANNEL B SMU	
CPU SERIAL INTERFACE	
POWER SUPPLIES	
ER16 RELAYS	
FIXTURE DIO	
PRINTER SERVICES	
QUIT TO MAIN MENU	
ENTER	

System Status
MIO 6025E
CHANNEL A SMU
CHANNEL B SMU
FIXTURE ID
SERIAL PORT
FIXTURE POWER
UUT POWER
CPU STATUS

Figure 10

4. PROCEDURES

4.1. System Start Up

- 4.1.1. Connect Universal Front End Tester to an AC line using the line cord provided.
- 4.1.2. Toggle the AC line switch on the rear panel of the tester to on. Switch will illuminate when on.
- 4.1.3. Open disk drive bay door on PC. Depress round, black power button. Green LED will illuminate when power is on. **Note:** Key is required to open disk drive bay door.
- 4.1.4. Logon to system and tester boots automatically.

Tester must be allowed to warm up for a period of 1 hour before testing.

4.2. System Shut Down

- 4.2.1. Select "Exit to Windows" from the main menu and Enter. See paragraph 2.1 above.
- 4.2.2. Point and click on Start in the lower left corner of the windows desktop.
- 4.2.3. Point and click on Shut Down from the start menu.
- 4.2.4. Select "Shut down the computer" from the pop-up menu then point and click on the Yes button.
- 4.2.5. Wait for windows to display the dialog box "It is now safe to turn off your computer", then toggle the Tester's main power switch on the rear power distribution panel.

4.3. Installing Fixtures

- 4.3.1. Navigate to the Main Menu.
- 4.3.2. Holding fixture by handles on sides place lower front edge of fixture on guide bar just above Operator Pushbutton Switches on Receiver.
- 4.3.3. Lower Fixture so that guide pins fall into guide blocks.
- 4.3.4. Release fixture handles, rotate jackscrew handle 180° clockwise.
- 4.3.5. Fixture is secure and ready if while rotating the jackscrew handle the fixture was pulled into the Receiver.

4.4. Removing Fixtures

- 4.4.1. Navigate to the Main Menu.
- 4.4.2. Rotate jackscrew handle 180° counter-clockwise.
- 4.4.3. Using the handles on the sides of the fixture pull the back-end of the fixture out of the guide blocks.
- 4.4.4. Remove fixture.

4.5. Loading Printer with Paper

- 4.5.1. Select System Diagnostics from the Main Menu.
- 4.5.2. Select Printer Services from the System Diagnostics Menu.
- 4.5.3. Select the How Do I? Folder from the HP Deskjet 610C Toolbox window.
- 4.5.4. Select the button next to Load Paper in the Learn How To... menu.

4.5.5. Follow instructions.

4.5.6. Close the HP DeskJet 610C Toolbox.

4.5.7. Select Quit to Main Menu from the System Diagnostics Menu.

4.6. Replacing Print Cartridges

4.6.1. Select System Diagnostics from the Main Menu.

4.6.2. Select Printer Services from the System Diagnostics Menu.

4.6.3. Select the How Do I? Folder from the HP Deskjet 610C Toolbox window.

4.6.4. Select the button next to Replace print cartridges in the Learn How To... menu.

4.6.5. Disengage printer rackmount locks, located on printer front panel. Rotate the left side lock counter-clockwise $\frac{1}{2}$ turn and the right side lock clockwise $\frac{1}{2}$ turn.

4.6.6. Using the handles provided on the front printer rackmount panel, slide printer out of Chassis until locks in the slides click in place.

4.6.7. Follow instructions.

4.6.8. Close the HP DeskJet 610C Toolbox.

4.6.9. Double click the Universal Front End Tester icon located on the desktop.

4.6.10. Disengage slide locks with fingers and slide printer in slowly approx. $\frac{1}{2}$ inch.

Note: Be careful not to pinch fingertips.

4.6.11. Remove fingers from slides and push printer back in place.

4.6.12. Engage printer rackmount locks. Rotate left side lock clockwise and right side lock counter-clockwise.

4.6.13. Select Quit to Main Menu from the System Diagnostics Menu.

4.7. Cleaning PC Air Filter

4.7.1. Open air filter service door, located on front of PC, by turning thumbscrew counterclockwise, and dropping door down.

4.7.2. Remove foam filter by pinching near the middle and pulling out.

4.7.3. Filter can be cleaned by blowing with compressed air or washing with water and mild soap. If washed, allow to dry before reinstalling.

4.7.4. Position filter in original location.

4.7.5. Lift and secure air filter service door with thumbscrew.