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In addition, it is our sincere intent that the transition from Hewlett Packard to Agilent Technologies should have no impact on your warranties, service levels, or purchase volume credits.

For more information about this transition, please visit our website at: http://www.agilent.com, or contact your local sales representative. It has been our pleasure to work with you for the past 60 years as part of Hewlett-Packard. We look forward to continuing to serve you as Agilent Technologies for years to come.

Installation Instructions

for

HP E2460CS

Oscilloscope Upgrade Kit

HP 1660-Series Logic Analyzers

This kit upgrades either the HP 1660C, HP 1661C, HP 1662C, or the HP 1663C logic analyzer to an analyzer that contains the 1 GSa/s oscilloscope.

The following table lists how the kit upgrades your analyzer.

The E2460CS Kit	upgrades this analyzer	to this analyzer.
	HP 1660C	HP 1660CS
	HP 1661C	HP 1661CS
	HP 1662C	HP 1662CS
	HP 1663C	HP 1663CS

Note *Your logic analyzer and this upgrade kit must be shipped together to a Hewlett-Packard service center*. The service center will install the upgrade and verify performance of the upgraded logic analyzer.
Contact your Hewlett-Packard sales office for the location of the nearest HP service center.

TOOLS REQUIRED:

- T10 TORX screwdriver
- T15 TORX screwdriver
- #1 pozidrive screwdriver
- 9/32-inch hex nut driver
- 3/16-inch hex nut driver
- 5/8-inch deep-well nut driver
- Utility knife

May 1997 HP Part Number E2460-92006

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1900 Garden of the Gods Road, Colorado Springs, Colorado U.S.A.

PARTS SUPPLIED

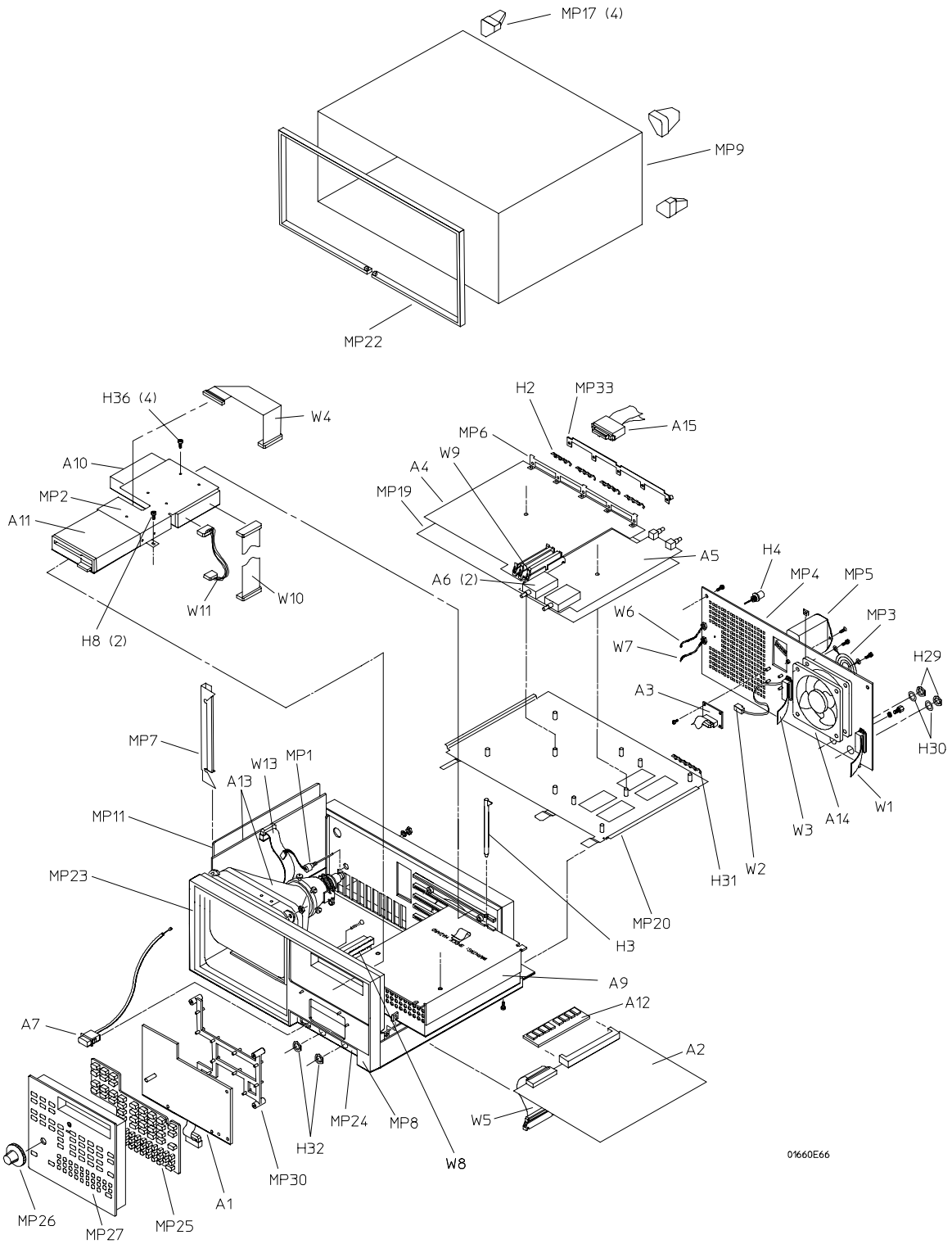
Most parts are not labeled. Refer to figure used in the instructions for easy identification.

HP Part Number	Description	QTY.
01650-29101	Ground Spring	1
01660-41902	Elastomeric Keypad	1
01660-61604	Cable, 60 Conductor (Analyzer Board to Scope Board)	1
01660-66523	2 Chan., 1GSa/s Digital Oscilloscope Board Assy.	1
01660-687xx	SW Disk Pouch (Latest Version)	1
01660-94307	Label-Line Switch	1
01660-94309	Label, Cal Output	1
01660-99018	DA-1660C/CS-Series Service Guide (Optional)	0
01660-99019	DA-1660CS-Series User's Guide	1
9320-5776	Manual-Digitizing Scopes	1
01660-94313	Label-CRT-1660CS	1
01661-94304	Label-CRT-1661CS	1
01662-94304	Label-CRT-1662CS	1
01663-94304	Label-CRT-1663CS	1
0515-0431	Machine Screw	1
10430-60001	10430A Probe Assy.	2
1250-1454	Connector-BNC PLG "BNC Connector"	1
2190-0068	Washer, Lock 0.505 0.630 0.02	2
2950-0054	Nut, Hex 1/2-28 0.125	2
54503-25701	Nut, Hex, Tapered	2
5090-4383	Serial Number Tag	1
E2450-17504	SW, Logic Analyzer Symbol Utility	1
E2450-97002	Manual, Symbol Utility User's Guide	1

INTRODUCTION

Refer to figure 1, HP 166xC/CS Logic Analyzer Exploded View, when performing this upgrade. Note that A5 is the scope card.

Figure 1 (Tear out and use as reference)



HP 166xC/CS Logic Analyzer Exploded View

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REMOVAL PROCEDURES

WARNING **Hazardous voltages exist on the power supply, the CRT, and the CRT driver board. To avoid electrical shock, disconnect the power from the instrument before performing the following procedures. After disconnecting the power, wait at least three minutes for the capacitors on the power supply board and the CRT driver board to discharge before servicing the instrument.**

CAUTION **Electrostatic discharge can damage electronic components. Use grounded wrist straps and mats when performing any service to the logic analyzer.**

CAUTION **Do not remove or replace any circuit assemblies in this instrument while power is applied. The assemblies contain components which may be damaged if the assembly is removed or replaced while the instrument is powered.**

Remove the Probe Mounting Plate and the Probe Cables (See Figure 1)

1. Turn off the power and unplug the logic analyzer.
2. Using a #1 pozidrive screwdriver, loosen the five screws and remove the probe mounting plate (MP33).
3. Remove the probe cables (A15) by pulling them out of their connectors on the rear panel.

Remove the Cover Assembly (See Figure 1)

1. Using a T10 TORX screwdriver, remove the seven screws holding the trim strip (MP22) and the cover assembly (MP9) to the cabinet assembly (MP8). Remove MP22.
2. Using a T10 TORX screwdriver, remove the four screws to remove the four rear feet (MP17).
3. Using a T15 TORX screwdriver, remove the two screws and remove the handle assembly.
4. To remove the cover assembly (MP9) , set the instrument facing toward you. Prepare to remove the cover by using a T10 TORX to turn back three revolutions each the 4 screws fastening the equipment pouch to MP9. Slide the chassis toward the front, out of the cover. Set the instrument on a static-safe work area.

Remove the Disk Drive (See Figures 1)

1. Disconnect the flexible disk drive cable (W4) from the rear of the flexible disk drive (A11). Disconnect the hard disk drive power cable (W11) and the hard disk drive data cable (W10).

2 . Remove the two screws holding the disk drive bracket (MP2, figure 1) to the power supply (A9).

3 . Slide the disk drive bracket assembly toward the rear of the instrument, then lift it up and out.

Remove the Power Supply (See Figures 1 and 2)

1. Lift the two PCB locking pins (H3 (2 pins)) from the front and rear of the power supply.

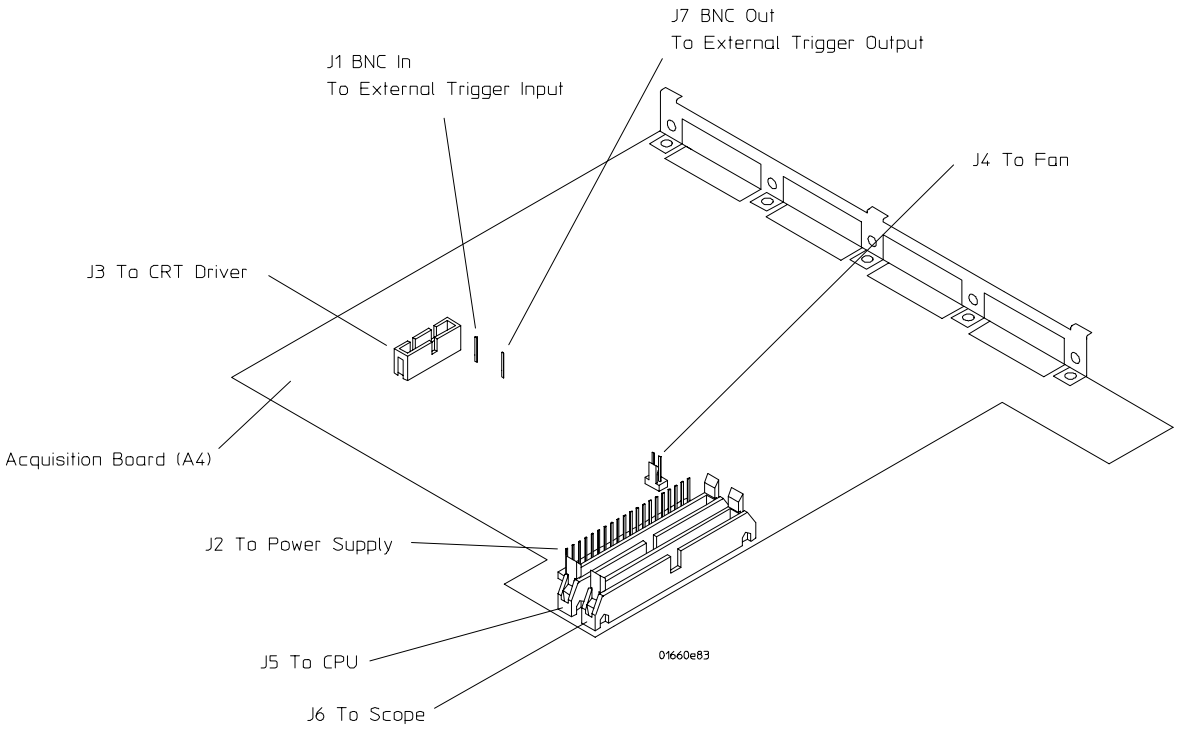
2. Slide the power supply out of the cabinet approximately 2.5 cm (1 in.).

3. Disconnect the J2 end of the power supply cable going from J2 (figure 2) on the acquisition board to the power supply assembly.

4. Disconnect the power supply end of the cable assembly going from the power supply to the line filter/cable assembly (MP5) located on the rear panel.

5. Slide the power supply the rest of the way out of the instrument.

Figure 2



Acquisition Board Connector Location Diagram

Remove the CPU Board (See Figure 1)

1. Disconnect all cables from the CPU board (A2). The CPU board is directly under the power supply. Note cable positions for later reference.

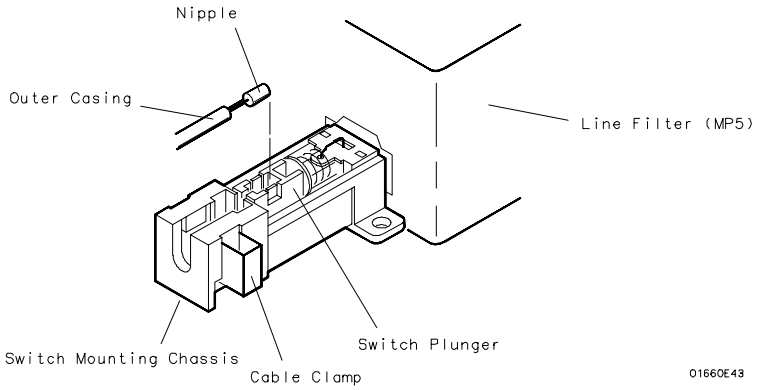
2. Slide the CPU board out of the cabinet.

Disconnect Line Filter/Cable Assembly Cable (See Figures 1 and 3)

Disconnect the cable attached to the switch actuator (A7) on the line filter/cable assembly (MP5) using the following steps:

- Slide the cable clamp up and off the outer casing far enough to release the switch actuator assembly (figure 3).
- Without bending the wire, pry the nipple out of the switch plunger.
- Lift the cable up and out of the slot in the switch assembly.

Figure 3



Line Filter/Cable Switch Assembly, Rotated 90°

Remove the Rear Panel Assembly (See Figures 1 and 2)

1. Disconnect both BNC trigger cables (W6 and W7) from the acquisition board (J1 and J7).
2. Disconnect the fan cable (W2) from the acquisition board (J4).
3. Using a T10 TORX screwdriver, remove the 6 screws from the rear panel assembly. Note how the cables are routed through the cabinet rear wall and where the cables are connected.
4. Remove the rear panel and set it aside; do not remove any components from the rear panel yet.

Remove the Acquisition Board (See Figures 1 and 2)

1. Disconnect the CRT drive cable (W13) from the acquisition board (J3).
2. At J5 on the acquisition board, disconnect the CPU-acquisition board cable (W5).
3. Slide the acquisition board and the attached mounting plate (MP20) out of the rear of the instrument; be careful not to break the locking tabs on J5 and J6.

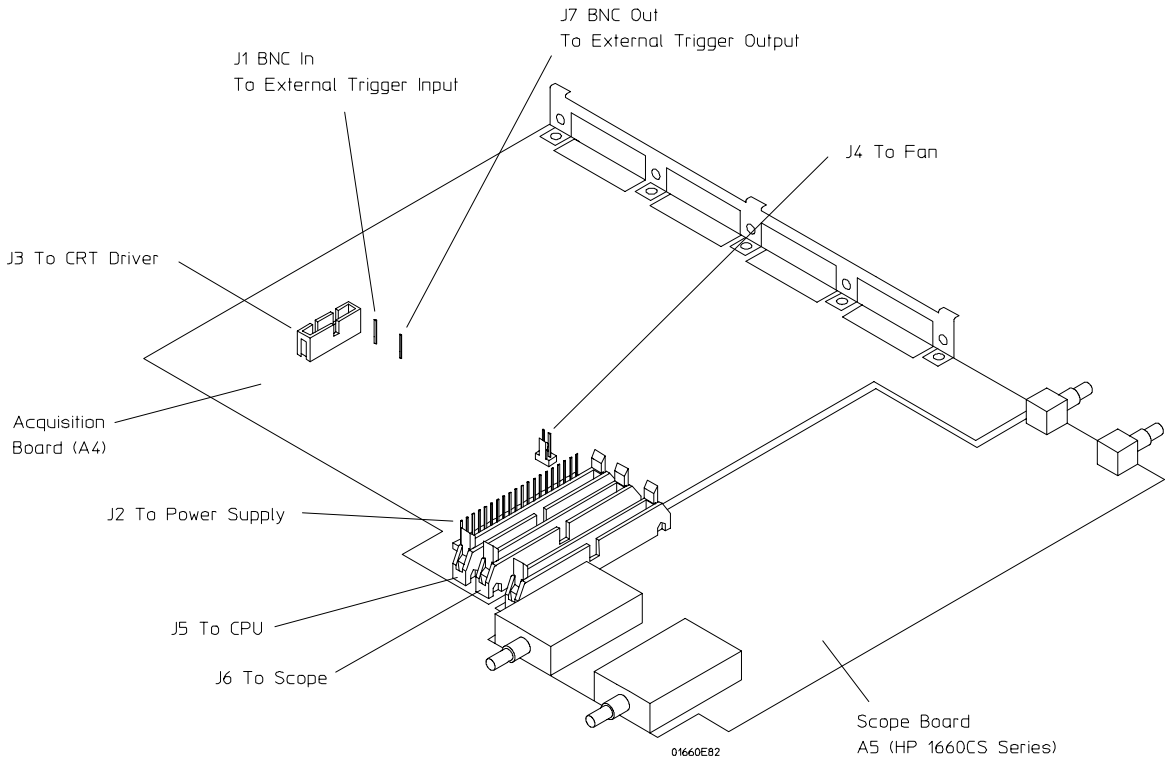
Mount the Oscilloscope Board (See Figures 1 and 4)

1. Place the supplied oscilloscope board assembly (01660-66523, A5 in figure 4) on the 4 studs on the circuit board mounting plate (MP20, figure 1) and slide the oscilloscope board assembly forward to lock it to the mounting plate.

2. Secure the oscilloscope board assembly to the mounting plate by placing the machine screw (0515-0431) in the hole in the center of the oscilloscope board assembly. Tighten with a T10 TORX.

3. Slide the ground spring (H31, figure 1) onto the edge of the mounting plate; it should extend up between the two BNC connectors on the back of the oscilloscope board.

Figure 4



Acquisition and Oscilloscope Board Connector Location Diagram

Install the Elastomeric Keypad (Figure 1)

1. Remove the 4 screws from the spacer (MP30) to remove the front panel keypad assembly from the front panel.

2. Remove the RPG knob (MP26) from the front panel assembly by pulling it straight out.

3. Remove the PC board (A1).

4. Remove the elastomeric keypad (MP25) and replace with the new elastomeric keypad (01660-41902)

5. Reassemble the front panel keypad assembly and secure to the front panel with the 4 existing screws.

REASSEMBLY PROCEDURE

Prefabricate the Front and Rear Panel Assemblies (See Figure 1)

1. Remove the two plastic plugs on the left rear side of the rear panel (MP4). Place the Oscilloscope Cal Output label (01660-94309) over the space that contained the two plastic plugs. Make sure you align the holes in the label with the holes in the rear panel.

2. Remove the line switch label (MP24) in the lower right corner of the front panel and place the new line switch label (01660-94307) in its place.

Install the Acquisition Board Assembly (See Figures 1 and 4)

1. Install the board assembly into the instrument by sliding it through the rear of the instrument. Tabs at the front of the mounting plate must align with slots at the front of the cabinet. The board assembly must also be flush with the rear of the cabinet.

2. Connect the 60-pin ribbon cable assembly (01660-61604) between the oscilloscope 60-pin connector and the acquisition board J6 connector (figure 4).

3. Reconnect the CRT drive cable (W13, figure 1) to the acquisition board (J3, figure 4). Secure the CRT drive cable to the acquisition board with the retainer clip; clearance is tight.

Position the Rear Panel Assembly

1. Place the rear panel assembly at the rear of the logic analyzer.

2. Feed the free ends of the cables through the cabinet rear wall. Ensure that the cables are routed the same as before. They must not block the fan.

3. After completing the cable routing, insert the rear panel onto the rear of the instrument.

Install the Rear Panel Assembly (See Figures 1 and 4)

1. Using a T10 TORX screwdriver, attach the rear panel to the chassis using the 6 existing screws.

2. Ensure that the rear panel is properly seated on the rear of the chassis. Tabs at the rear of the acquisition board mounting plate should fit into the slots in the rear panel.

3. Plug the BNC cables (W6 and W7) into the acquisition board (J1 and J7, figure 4) using the reference designators shown on the acquisition board.

4. Plug the fan cable (W2) into the acquisition board (J4, figure 4).

5. Using a 5/8-inch deep-well nut driver, attach a tapered hex nut (54503-25701) to each of the two BNC connectors on the front panel of the cabinet assembly. Use of tapered hex nut is only cosmetic.

6. Using a 5/8-inch deep-well nut driver, attach a lock washer (2190-0068) and hex nut (2950-0054) to each of the two BNC connectors on the rear panel of the cabinet assembly.

Reconnect the Power Switch (See Figure 3)

Insert the cable into the switch actuator assembly.

- Insert the nipple into the switch plunger.
- Depress the cable locking clamp to secure the outer casing.
- Test the power switch on the front panel to insure it catches.

Check Cable Installations (See Figures 1 and 4)

1. Verify that the CRT driver cable (W13, figure 1) is installed on acquisition board and retainers are in place.
2. Ensure that the BNC trigger cables (W6 and W7) are installed on acquisition board at J1 and J7 (figure 4).
3. Ensure that the power supply cable is installed on the acquisition board at J2 (figure 4).
4. Verify that the fan cable (W2) is installed on acquisition board at J4 (figure 4).
5. Verify that the cable is installed between acquisition board and oscilloscope board (J6, figure 4).
6. Verify that the HP-IB, RS-232-C, and I/O board cables are routed through rear of cabinet.
7. Verify that the keypad cable is routed through front of cabinet.

Install the CPU Board (See Figure 1)

1. Place the free ends of the RS-232-C and HP-IB cables in the bottom of the cabinet close to where the cables would connect to the CPU board.
2. Slide the CPU board (A2, figure 1) into the bottom slot of the cabinet.
3. Plug the existing CPU-acquisition board cable (W5) into the CPU board and into the acquisition board.
4. Plug both the HP-IB cable and the RS-232-C cable into the CPU board.
5. Plug the keypad cable into the CPU board.
6. Plug the I/O cable into the CPU board.

Install the Power Supply (See Figure 1)

1. Slide the power supply most of the way into the cabinet.
2. Connect the line filter cable to the power supply.
3. Connect the power supply cable (W8) to the acquisition board (J2).
4. Slide the power supply the rest of the way into the cabinet.
5. Secure the power supply in the cabinet using the two existing locking pins (H3 (2 pins)). Install the locking pins, one on the front and one on the rear of the power supply. The locking pins should go through the power supply and the CPU board.

Install the Disk Drive Assembly (See Figure 1)

1. Position the disk drive/bracket assembly so that the front of the flexible disk drive can be inserted in the corresponding hole in the front of the cabinet. Insert the flexible disk drive into the hole.

2. Insert the rear of the disk drive/bracket assembly so that the rear of the bracket can be inserted in the top slot in the rear of the cabinet. Position the bracket assembly so that the two screw holes in the bracket ears align with the screw holes in the top of the power supply.

3. Using a T10 TORX screwdriver, use 2 existing screws to secure the disk drive/bracket assembly to the top of the power supply. Ensure that the bracket is seated into a slot in back.

4. Connect the hard disk drive data cable (W10) to the CPU board.

5. Connect the hard drive power cable (W11) to the CPU board.

6. Connect the flexible disk drive cable (W4) to the CPU board.

7. Plug the flexible disk drive cable into the rear of the flexible disk drive. Plug the hard disk drive data cable and hard disk drive power cable into the rear of the hard disk drive. Flat cables should be folded and inserted into the ribbon cable holder to prevent interference when sliding on outer cover.

Install Cover (See Figure 1)

1. Slide the cabinet into the cover. Using a T10 TORX, re-tighten the 4 screws fastening the equipment pouch.

2. Using a T10 TORX screwdriver, attach the 4 existing rear feet to the rear panel of the logic analyzer.

3. Using a T10 TORX screwdriver, install the trim strip to the outside front of the logic analyzer (7 screws). Hold the strip in place when starting screws to avoid cross-threading.

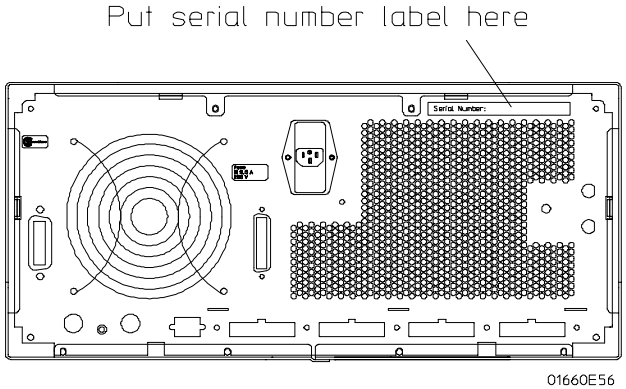
4. Using a T15 TORX screwdriver, install the handle assembly to the monitor side of the logic analyzer.

5. Connect the probe cables to the rear panel of the instrument. Using a #1 pozidrive screwdriver, install the probe mounting plate to the rear panel of the instrument.

Install the Serial Number Label (See Figure 5)

Place the serial number label in the location shown in figure 5.

Figure 5

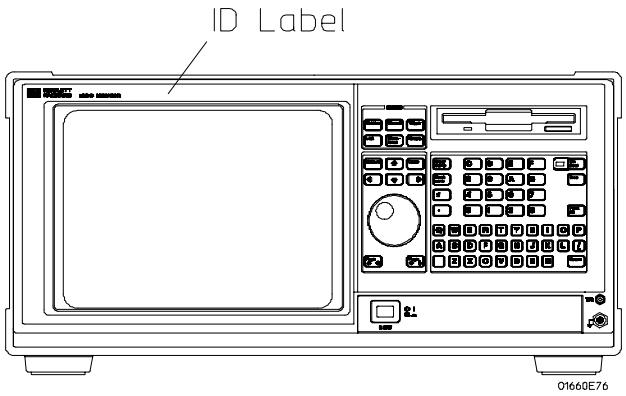


Serial Number Label Location

Install the ID Label (See Figure 6)

1. Peel off the old ID label; use a utility knife to raise a corner of the existing label.
2. Clean off existing label adhesive if needed.
3. Select the new ID label which corresponds to the upgraded logic analyzer
4. Attach the new ID label to the logic analyzer as seen in figure 6.

Figure 6



ID Label Location

LOADING THE SYSTEM SOFTWARE

You must load the system software to be able to run the instrument. Optionally, you may wish to load the Symbol Utility SW; it enables the instrument to download symbols created by other programs.

1. Apply power to the instrument.
2. Insert the Operating System Software disk 1 of 2 into the disk drive on the front of the instrument.
3. Press the System key in the MENU keys.
4. Using the arrow keys, Done key, and Select key, highlight the second field from the left and press Select. Arrow down and select Select Utilities from the pop-up menu.
5. Using the arrow keys, highlight the Update FLASH ROM field, press the Select key. Select Continue from the pop-up menu. Press the Done key and wait for the disk to complete. Insert disk 2 of 2 and press Done.
6. When your system software is done loading, remove the Operating System Software disk and put the disks in a safe place.
7. If desirable, load the Symbol Utility SW. Insert the disk into the analyzer and cycle power. The program loads automatically but takes more than a minute. Symbol Utility can be found under the System menu.

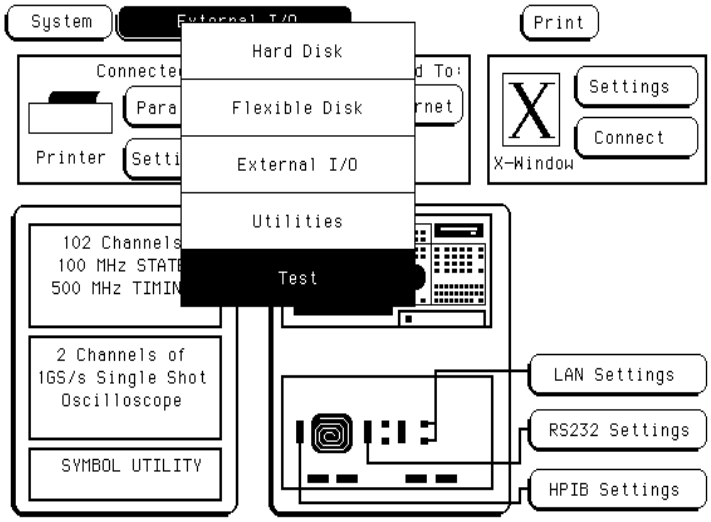
LOGIC ANALYZER TESTING

Self-Tests

The performance verification (PV) self-tests consist of system PV tests, analyzer PV tests, and oscilloscope PV tests.

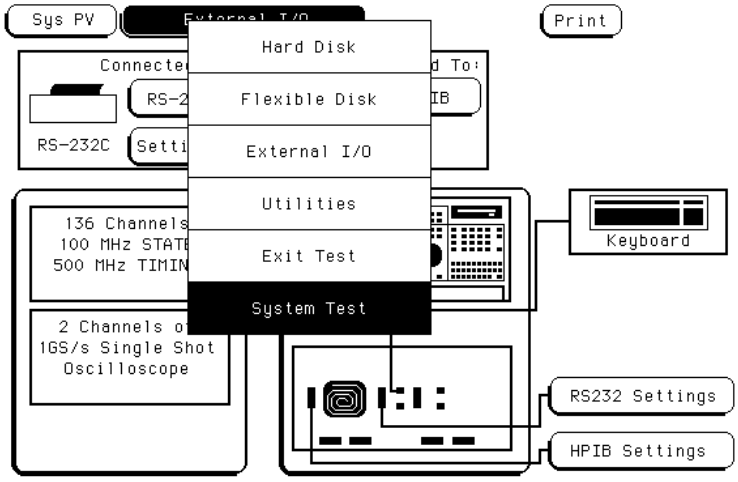
1. Disconnect all inputs, then turn on the power switch. Wait until the power-up tests are complete.

2. Press the System key. Select the field next to System, then select Test in the pop-up menu.



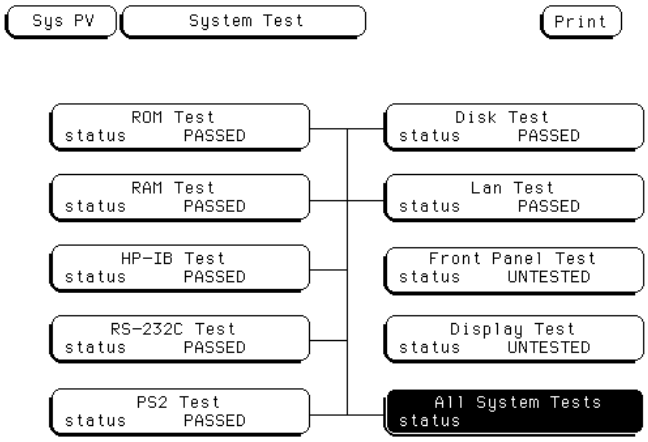
3. Insert the disk containing the PV self-tests into the disk drive. Select the box labeled Load Test System, then select Continue.

4. Press the System key. Select the field next to Sys PV, then select System Test in the pop-up menu.



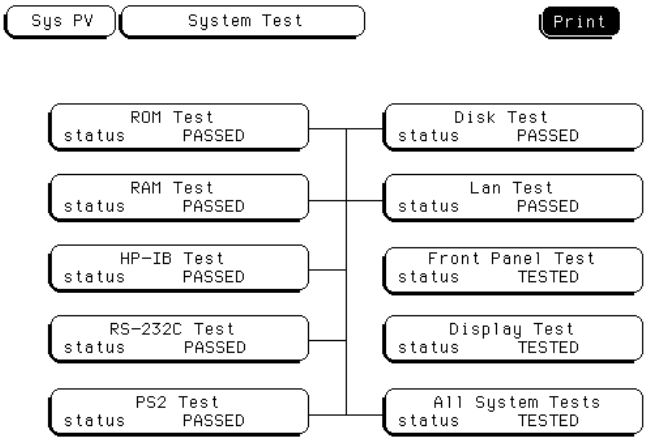
5. Install a formatted disk that is not write protected into the disk drive. Connect an RS-232-C loop back connector onto the RS-232-C port. The RS-232-C connector is supplied with the logic analyzer.

6. Select All System Tests. You can run all tests at one time, except for the Front Panel Test and Display Test, by running All System Tests. To see more details about each test when trouble shooting failures, you can run each test individually. When the tests finish, the status for each test shows PASSED or FAILED, and the status for the All System Tests changes from UNTESTED to TESTED. Note that the Front Panel Test and Display Test remain UNTESTED.

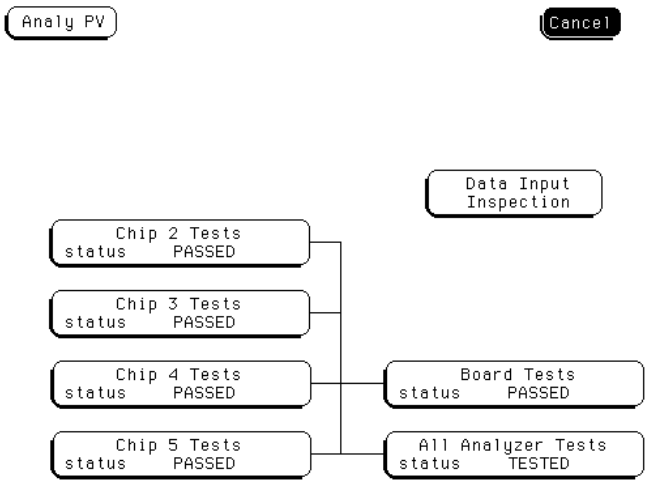


7. Select the Front Panel Test. A screen duplicating the front panel appears. Press each key on the front panel and the corresponding key on the screen will change from a light to a dark color. Test the knob by turning it in both directions. Note any failures, then press the Done key to exit the Front Panel Test. The status of the test changes from UNTESTED to TESTED.

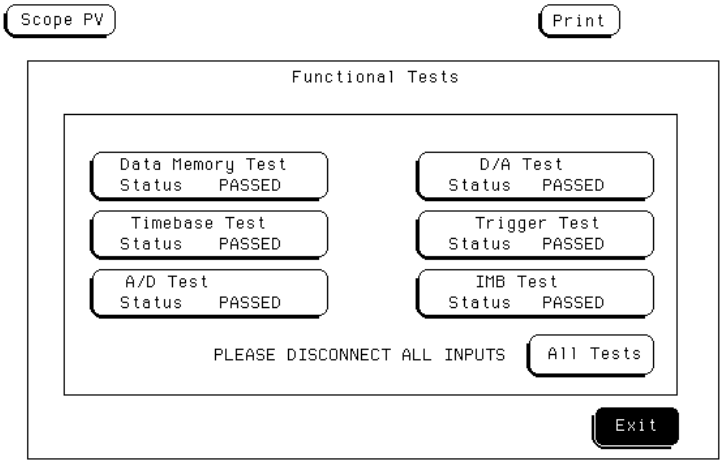
8. Select the Display Test. A white grid pattern is displayed. Refer to chapter 4, "Calibrating and Adjusting" of the Service Guide for display adjustments. Select Continue and the screen changes to full bright. Select Continue and the screen changes to half bright. Select Continue and the test screen shows the Display Test status changed to TESTED.



9. Select Sys PV, then select Analy PV in the pop-up menu. In the Analy PV menu, select All Analyzer Tests. You can run all tests at one time, except for the Data Input Inspection, by running All Analyzer Tests. To see more details about each test when trouble shooting failures, you can run each test individually. When the tests finish, the status for each test shows PASSED or FAILED, and the status for the All Analyzer Tests changes from UNTESTED to TESTED.



10. Select Analy PV , then select Scope PV in the pop-up menu. In the Scope PV menu, select Functional Tests then select All Tests. To see more details about each test when trouble shooting failures, you can run each test individually. When the tests finish, the status for each test shows PASSED or FAILED. Select Exit.



11. To exit the test system, use the arrow keys to select Scope PV. Select Sys PV, press the System key, then select Exit Test in the pop-up menu. Remove the disk containing the Performance Verification test, then select Exit Test System.
12. The HP 1660C/CS Logic Analyzer Service Guide should be ordered if trouble shooting is deemed necessary.

OSCILLOSCOPE TESTING

Oscilloscope Calibration

Turn on the logic analyzer. Let it warm up for 30 minutes if you have not already done so.

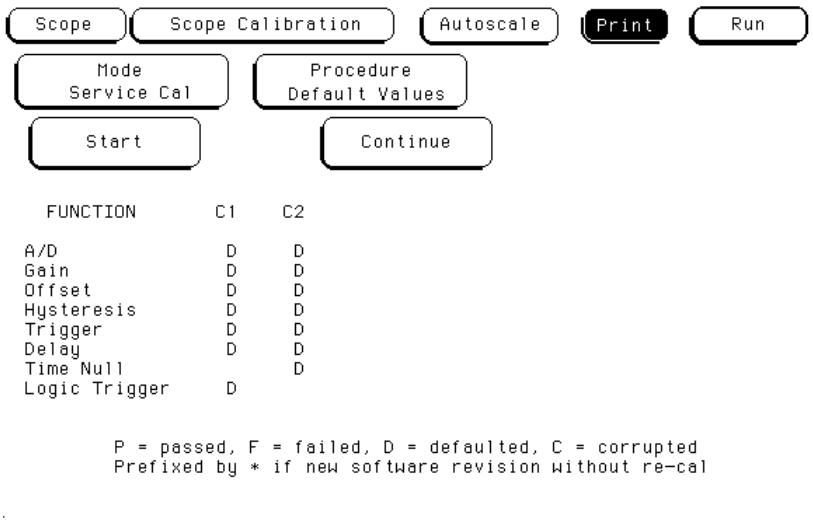
Equipment Required

Equipment	Critical Specification	Recommended Model/Part	Qty.
Cable	BNC, 9-inch (equal length)	HP 10502A	2
Cable	BNC, at least 1 meter	HP 10503A	1
Adapter	BNC tee (m)(f)(f)	HP 1250-0781	1
Adapter	BNC (f)(f) (ug-914/u)	HP 1250-0080	1

Default Calibration Factors

Note that once the default calibration factors are loaded, all calibrations must be done. This includes all of the calibrations in the Self Cal menu. The calibration must be performed in the exact sequence listed below.

1. Press the System key. Select System, then select Scope.
2. Select the menu field (top row, second from the left), then select Scope Calibration from the pop-up menu.
3. Select the Mode field, then select Service Cal from the pop-up menu.
4. Select the Procedure field, then select Default Values from the pop-up menu.
5. Select the Start field and follow the instructions on the display.



After you select the Start field, you can abort the calibration procedure by selecting either the Mode or Procedure fields if the Continue field is still displayed on the screen.

Self Cal menu calibrations

Messages will be displayed as each calibration routine is completed to indicate calibration has passed or failed. The resulting calibration factors are automatically stored to non-volatile RAM at the conclusion of each calibration routine. The Self Cal menu lets you optimize vertical sensitivity (Vert Cal) for channels 1 and 2 individually or both channels on a board simultaneously. Also, the Self Cal menu lets you optimize delay (Delay) for channel 1 and 2 separately, then Time Null for channel 2 and the Logic Trigger.

1. Optimize Vert Cal of the Self Cal.
   a. Connect two BNC 50-Ω, 9-inch cables to the BNC tee adapter. Connect the BNC 50Ω (f)(f) adapter to the BNC tee adapter, and connect the 48-inch BNC cable to the BNC 50Ω (f)(f) adapter. Once you select Start, the instrument will prompt you to connect the cables to the appropriate locations on the rear panel of the instrument.
   b. Select the Mode field, then select Self Cal from the pop-up menu.
   c. Select the Procedure field, then select Vert Cal from the pop-up menu.
   d. Select the Channel field, then select a channel choice from the pop-up menu.
   e. Select the Start field and follow the instructions on the display.
   f. After completion of Vertical Calibration, remove the cables from the instrument.
2. Optimize Delay of the Self Cal.
   a. Obtain a BNC 50-Ω, 48-inch cable. Once you select Start, the instrument will prompt you to connect the cable to the appropriate location on the rear panel of the instrument.
   b. Select the Procedure field, then select Delay from the pop-up menu.
   c. Select the Channel field, then select C1.
   d. Select the Start field and follow the instructions on the display.
   e. Repeat steps c and d for channel 2.
   f. After completing all of the channel delay calibrations, remove the cable from the oscilloscope.
3. Optimize the Time Null of the Self Cal.
   a. Connect two BNC 50-Ω, 9-inch cables to the BNC tee adapter. Connect the BNC 50Ω (f)(f) adapter to the BNC tee adapter, and connect the 48-inch BNC cable to the BNC 50Ω (f)(f) adapter. Once you select Start, the instrument will prompt you to connect the cables to the appropriate locations on the rear panel of the instrument.
   b. Select the Procedure field, then select Time Null from the pop-up menu.
   c. Select the Start field and follow the instructions on the display.
   d. After completion of the Time Null calibration, remove the cables from the instrument.
4. Calibrate the Logic Trigger of the Self Cal.
   a. Obtain a BNC 50-Ω, 48-inch cable.
   b. Select Start. The instrument will prompt you to connect the cable to the appropriate location on the rear . panel of the instrument.
   c. Select the Procedure field, then select Logic Trigger from the pop-up menu.
   d. Select the Start field and follow the instructions on the display.
   e. After completion of the Logic Trigger calibration, remove the cable from the instrument.