

Agilent 16902B Logic Analysis System

Service Guide



Agilent Technologies

Notices

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CAUTION

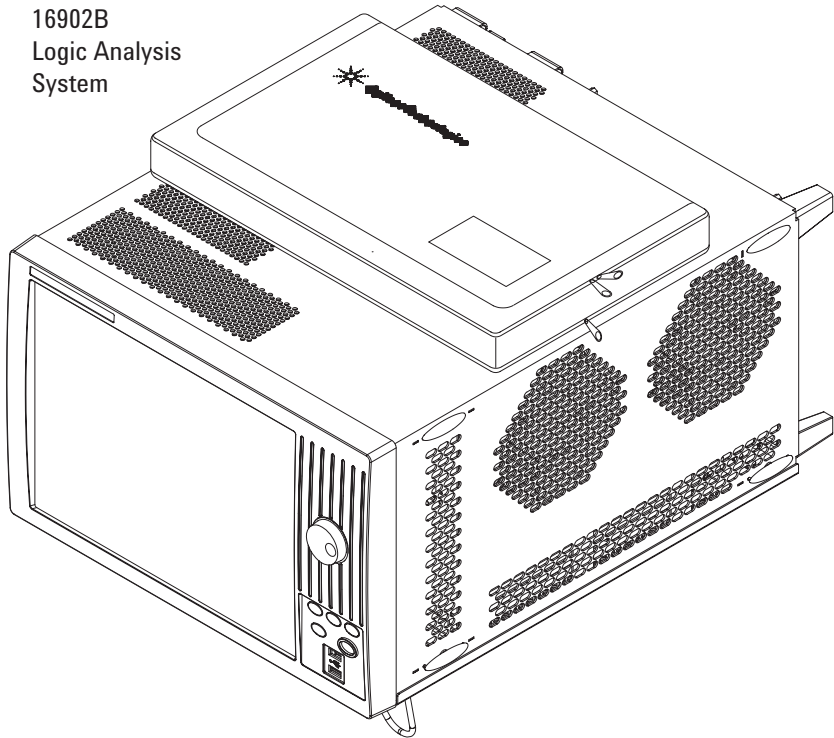
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WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

The Agilent 16902B Logic Analysis System—At a Glance

The Agilent Technologies 16902B logic analysis system is a modular system with slots for logic analyzer and other types of measurement modules.



Features

- Six slots for logic analyzers and other types of measurement modules.
- Multiframe Pro for making time-correlated measurements with a logic analysis system made up of multiple 16900A, 16901A, 16902A, and 16902B frames.
- Built-in 15 inch TFT color touch screen LCD display, 1,024 x 768 (XGA) resolution.
- 80 GB removable hard disk drive.
- 10/100/1000 Base-T LAN port.
- USB 2.0 ports (six total, two on front, four on back).
- One PCI expansion slot.
- Windows® XP Professional operating system.

- *Agilent Logic Analyzer* application which takes the complexity out of making logic analyzer measurements. You can perform all operations directly from one window.

Supplied Accessories

- PS2 mouse.
- PS2 keyboard.
- Accessory pouch and power cord.
- Ten-conductor flying lead cable for target control port.

Optional Accessories:

- Multiframe cable (E5861A).
- Probes.

Service Strategy

The service strategy for this instrument is the replacement of defective assemblies. This service guide contains information for finding a defective assembly by testing and servicing the 16902B logic analysis system.

This instrument can be returned to Agilent Technologies for all service work, including troubleshooting. Contact your nearest Agilent Technologies Sales Office for more details.

Contacting Agilent Technologies

To locate a sales or service office near you, go to <http://www.agilent.com/find/contactus>.

In This Service Guide

This book is the service guide for the 16902B logic analysis system and is divided into eight chapters.

[Chapter 1](#), “General Information” contains information about the instrument including accessories, specifications and characteristics, and a list of the equipment required for servicing the instrument.

[Chapter 2](#), “Preparing for Use” tells how to prepare the instrument for use.

[Chapter 3](#), “Testing Performance” gives instructions on how to test the performance of the instrument.

[Chapter 4](#), “Calibrating and Adjusting” contains calibration instructions for the instrument.

[Chapter 5](#), “Troubleshooting” contains self-tests and flowcharts for troubleshooting the instrument.

[Chapter 7](#), “Replaceable Parts” lists replaceable parts, shows exploded views, and gives ordering information.

[Chapter 6](#), “Replacing Assemblies” tells how to replace the instrument and assemblies of the instrument, and how to return them to Agilent Technologies.

[Chapter 8](#), “Theory of Operation” explains how the instrument works and what the self-tests are checking.

Revision History

Table 1 Revision History

Revision	Reason
16902-97000, December 2007	First edition.

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Electrical and Operating Environment Characteristics

The following operating characteristics are not specifications, but are typical operating characteristics for the Agilent 16902B logic analysis system.


Table 2 Electrical Characteristics

Power Requirements	100/240 Vac, 47-63Hz, 1300W Max The line voltage is autodetected by the instrument. CAT II (Line voltage in appliance and to wall outlet) Pollution degree 2
---------------------------	---


Table 3 Environmental Characteristics

	For indoor use only.
Temperature	0° to + 40° C (+32° to +104° F) Disk Media: 10° to + 40° C (+50° to +104° F) Probes/cables: 0° to + 65° C (+32° to +149° F) Reliability is enhanced when operating the instrument within a temperature of +20°C to +35°C (+68°F to +95°F).
Altitude	3,000 m (10,000 ft)
Humidity	Relative humidity 8% to 80% at 40° C (104° F). Avoid sudden, extreme temperature changes which could cause condensation on the circuit board. Reliability is enhanced when operating the instrument within a noncondensing humidity range of 20% to 80%. Condensation within the instrument can cause poor operation or malfunction. Provide protection against internal condensation.
Vibration	Operating: random vibration 0-500 Hz, 10 minutes per axis, 0.3 g (rms). Non-operating: random vibration 0-500 Hz, 10 minutes per axis, 2.41g (rms); and swept sine resonant search, 0-500 Hz, 0.75g, 5-minute resonant dwell at 4 resonances per axis.
Weight	Max Net: 19.6 kg (43.2 lbs) Max Shipping: 28.0 kg (61.7 lbs) The weight of modules ordered with mainframes will add 0.9 kg (2.0 lb) per module
Storage	Store or ship the instrument in environments within the following limits: Temperature -40°C to +75°C (-40°F to 167°F) Humidity up to 90% at 65° C (149°F) Altitude up to 3,000 meters (10,000 feet) Protect the system from temperature extremes which cause condensation on the instrument.

Trigger In

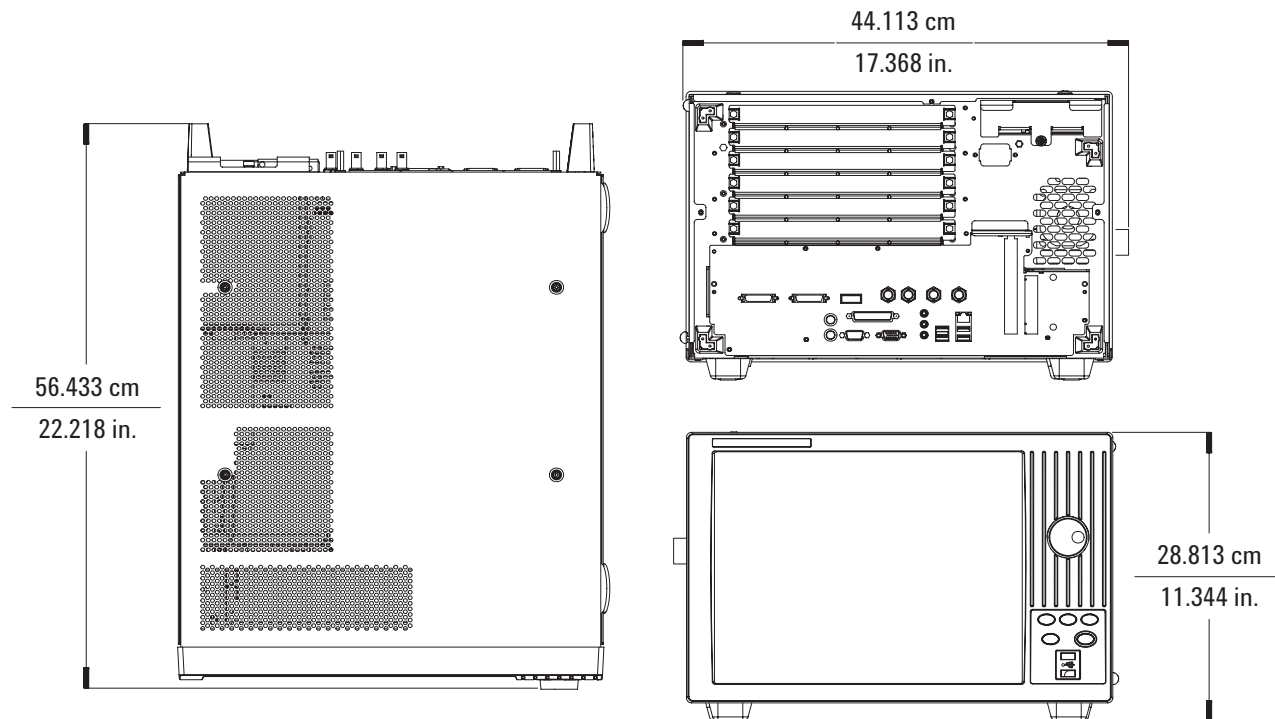
 The Trigger In connector is 5V Max pk and DC, CAT I (line isolated).

Clock In

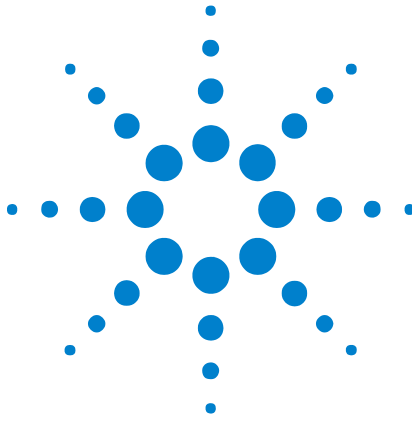
 The Clock In connector is 5.5V Max pk and DC, CAT I (line isolated).

Dimensions

The following figure provides dimensions for the 16902B logic analysis system mainframe in centimeters and inches.



1 General Information



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To inspect the logic analysis system

- 1 Inspect the shipping container for damage.

If the shipping container or cushioning material is damaged, keep them until you have checked the contents of the shipment and checked the instrument mechanically and electrically.

WARNING

Hazardous voltages exist in this instrument. To avoid electrical shock, do not apply power to a damaged instrument.

- 2 Check the supplied accessories.

Accessories supplied with the logic analysis system are listed on [page 4](#).

- 3 Inspect the product for physical damage.

Check the logic analysis system and the supplied accessories for obvious physical or mechanical defects. If you find any defects, contact your nearest Agilent Technologies Sales Office. Arrangements for repair or replacement are made, at Agilent Technologies' option, without waiting for a claim settlement. Contact information is located on [page 4](#).

To apply power

- 1 Connect the supplied power cord to the instrument and to the power source.

This instrument autodetects the line voltage from 100 VAC to 240 VAC. It is equipped with a three-wire power cable. When connected to an appropriate AC power outlet, this cable grounds the instrument cabinet. The type of power cable plug shipped with the instrument depends on the model ordered and the country of destination. The 16902B should only be used with the notched power cord provided due to the high power requirements of the instruments. Refer to [“Power Cables and Plug Configurations”](#) on page 85 more information on power cables.

- 2 Turn on the power switch located on the front panel.

For first-time power up considerations and setup steps, refer to the *Installation Guide* that came with your instrument. See “[To get the most up-to-date installation guide](#)” on page 17.

To connect multiple frames

If you need to make time-correlated measurements with more logic analysis channels than can be installed into a single logic analysis system frame, you can connect multiple 16900A, 16901A, 16902A, and 16902B frames together. Refer to the *Installation Guide* that came with your instrument for Multiframe Pro configurations. See “[To get the most up-to-date installation guide](#)” on page 17.

To install measurement modules

For general information on installing a measurement module into the mainframe refer to the *Installation Guide* that came with your instrument. See “[To get the most up-to-date installation guide](#)” on page 17.

To get the most up-to-date installation guide

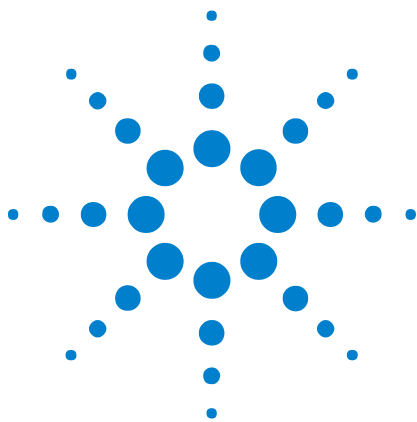
- Go to www.agilent.com.
- Search for 16902B Logic Analysis System.
- Look under Technical Support and then Manuals.

To clean the instrument

If the instrument requires cleaning:

- 1 Remove power from the instrument.
- 2 Clean the external surfaces of the instrument with a soft cloth dampened with a mixture of mild detergent and water.
- 3 Make sure that the instrument is completely dry before reconnecting it to a power source.

2 Preparing for Use



3 Testing Performance

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To ensure the logic analysis system is operating correctly, you can perform software tests (self-tests) on the system. Directions for performing the software tests are given in this chapter. Because there are no specifications for the 16902B logic analysis system, there are no performance verification tests.



Self-Tests

The self-tests listed in this chapter check the functional operation of the mainframe. Self-tests for the optional modules installed in the frames are listed in the individual module Service Guides.

There are two types of self-tests: self-tests that automatically run at powerup, and self-tests that you select on the screen. For descriptions of the tests, refer to [Chapter 8](#), “Theory of Operation.”

Perform the self-tests as an acceptance test when receiving the logic analysis system or when the logic analysis system is repaired.

If a test fails, refer to [Chapter 5](#), “Troubleshooting.”

Test Interval

There is no recommended test interval for the 16902B mainframes. However, each of the supported modules has performance verification tests and therefore require a periodic verification of specifications. Refer to the *Service Guides* of the individual modules for more information.

To perform the power-up tests

The logic analysis system automatically performs power-up tests when you apply power to the instrument. Any errors are reported in the boot dialogue. Serious errors will interrupt the boot process.

The power-up tests are designed to complement the instrument on-line Self-Tests. Tests that are performed during powerup are not repeated in the Self-Tests.

A keyboard and mouse must be connected to the mainframe to observe the results of the power-up tests.

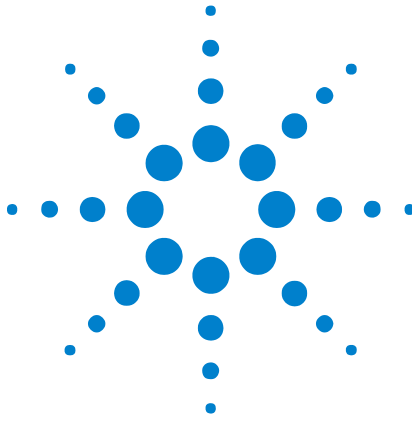
- 1 Exit all logic analysis sessions.
- 2 Press the power switch for about 1 second and release, wait for the the unit to power off.
- 3 After a few seconds, turn the power switch back on. Observe the boot dialogue for the following:
 - Ensure all of the installed memory is recognized
 - Any error messages
 - Interrupt of the boot process with or without error message

A complete transcript of the boot dialogue is in chapter 8, "Theory of Operation."

- 4 During initialization, check for any failures.

If an error or an interrupt occurs, refer to [Chapter 5](#), "Troubleshooting."

3 Testing Performance



4 Calibrating and Adjusting

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Calibrations and Adjustments for Modules 24

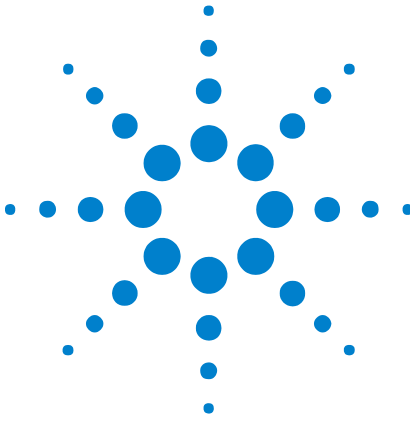


Calibration Strategy

The 16902B logic analysis system does not require operational accuracy calibration.

Calibrations and Adjustments for Modules

The individual modules that plug into the 16902B mainframes may require calibration, operational accuracy calibration, or adjustments. Refer to the “Testing Performance” chapter in the service manual for the module.



5 Troubleshooting

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This chapter helps qualified service personnel troubleshoot the logic analysis system to find defective assemblies. The troubleshooting consists of flowcharts, self-test instructions, and tests. This information is not intended for component-level repair.

If you suspect a problem, start at the top of the first flowchart. During the troubleshooting instructions, the flowcharts will direct you to perform other tests. The other tests are located in this chapter after the flowcharts.

The service strategy for this instrument is the replacement of defective assemblies. This instrument can be returned to Agilent Technologies for all service work, including troubleshooting. Contact your nearest Agilent Technologies Sales Office for more details.

CAUTION

Electrostatic discharge can damage electronic components. Use grounded wrist straps and mats when you perform any service to this instrument or to the cards in it.



To use the flowcharts

Flowcharts are the primary tool used to isolate defective assemblies. The flowcharts refer to other tests to help isolate the problem. The circled references on the charts indicate connections with the other flowcharts or other parts within the same flowchart. A circled alpha references connections within the flowchart. Start your troubleshooting at the top of the first flowchart ([Figure 1](#) on page 27).

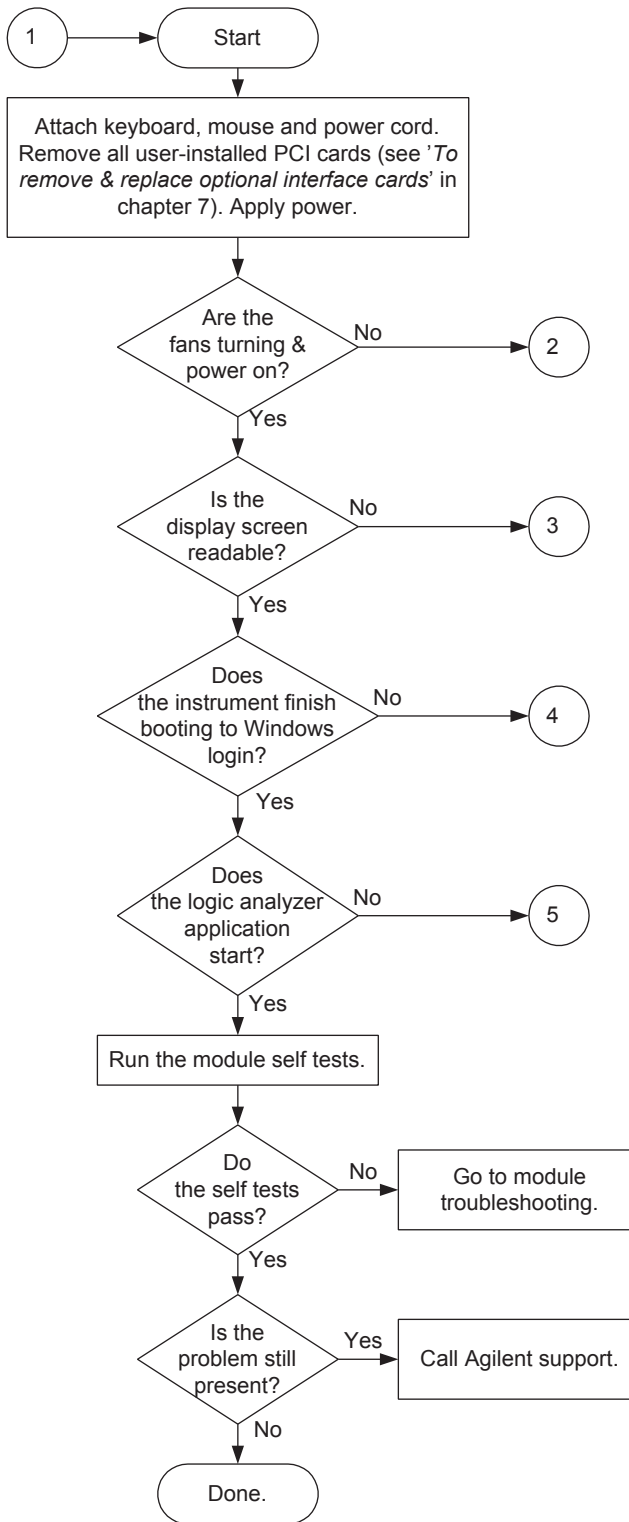


Figure 1 16902B Troubleshooting Flowchart

5 Troubleshooting

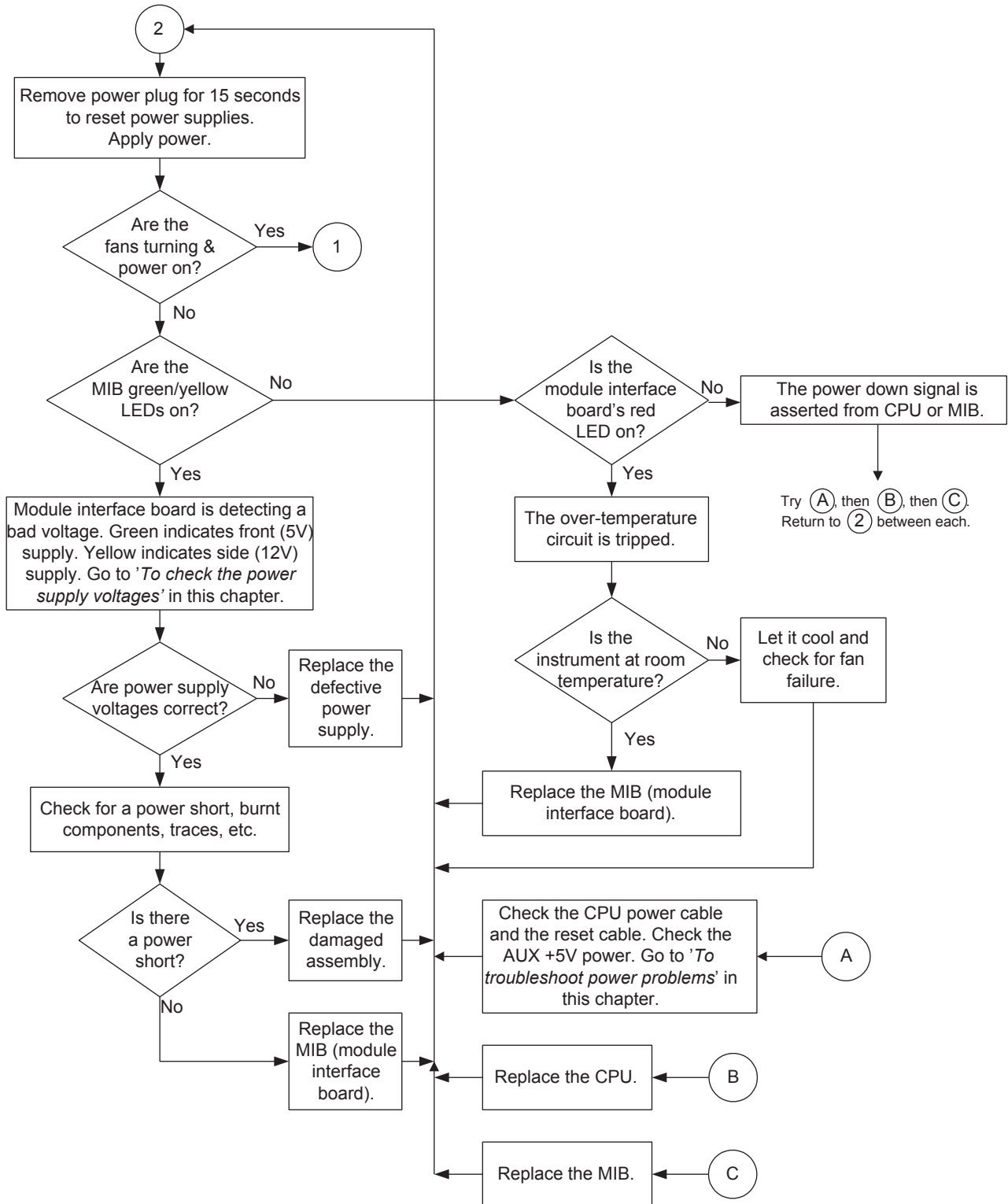


Figure 2 16902B Power Troubleshooting Flowchart

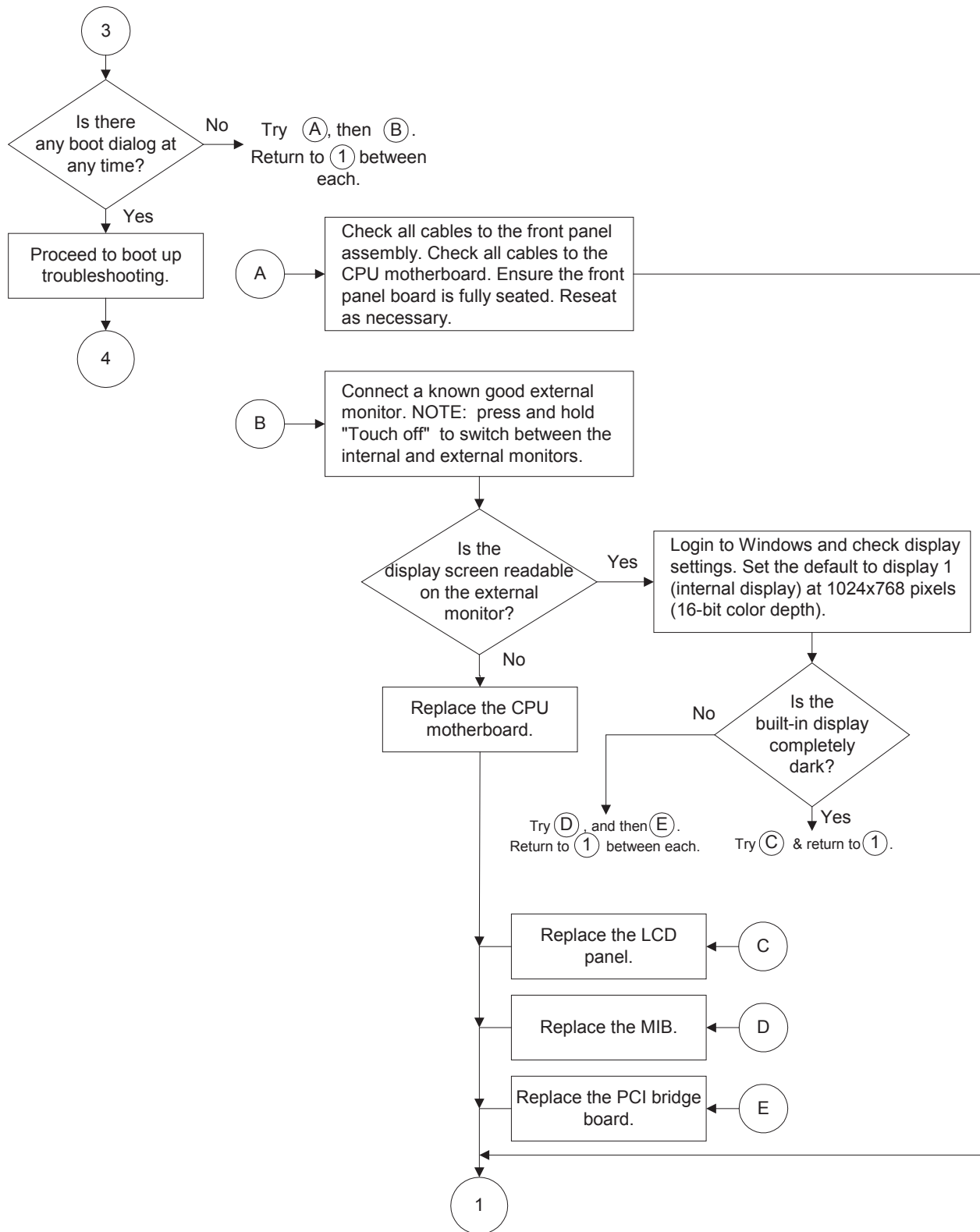


Figure 3 16902B Display Troubleshooting Flowchart

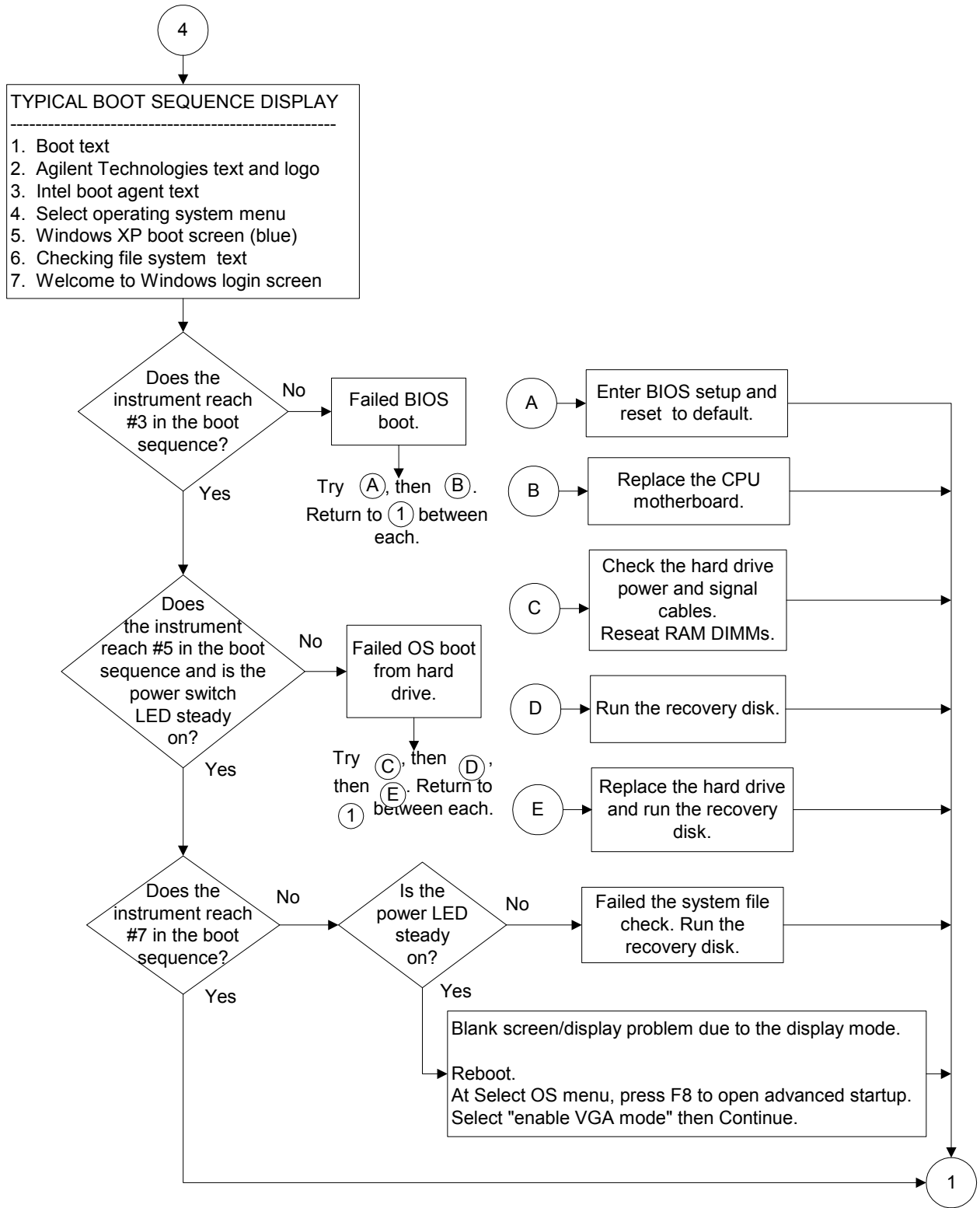


Figure 4 16902B Boot Up Troubleshooting Flowchart

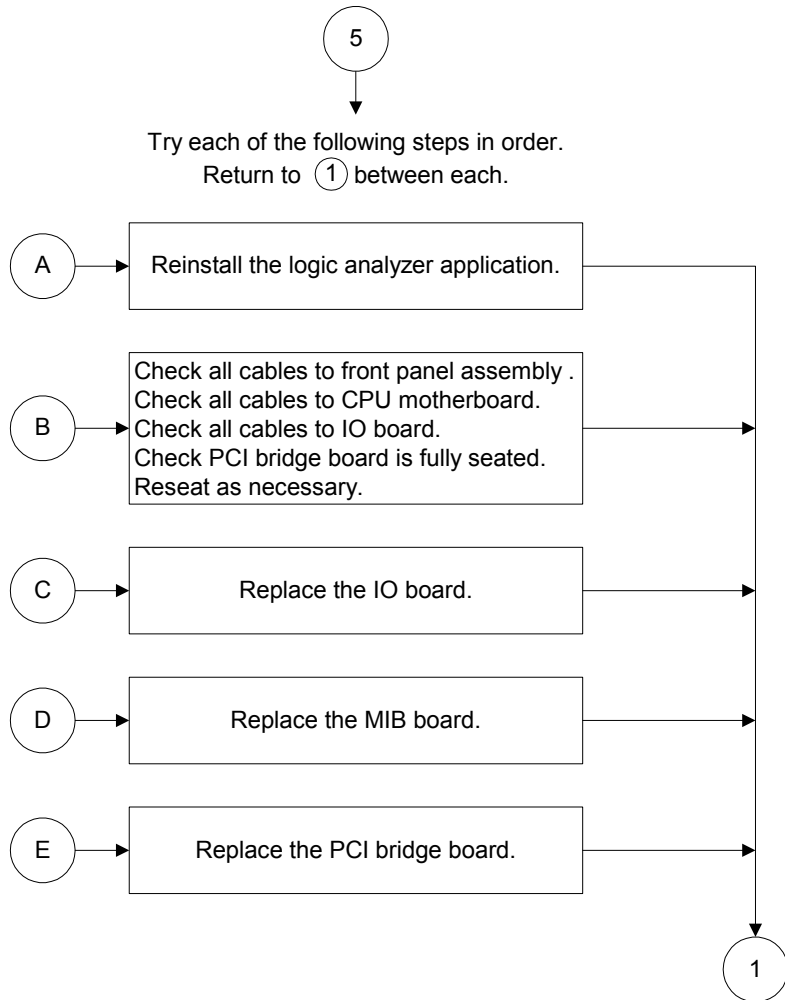
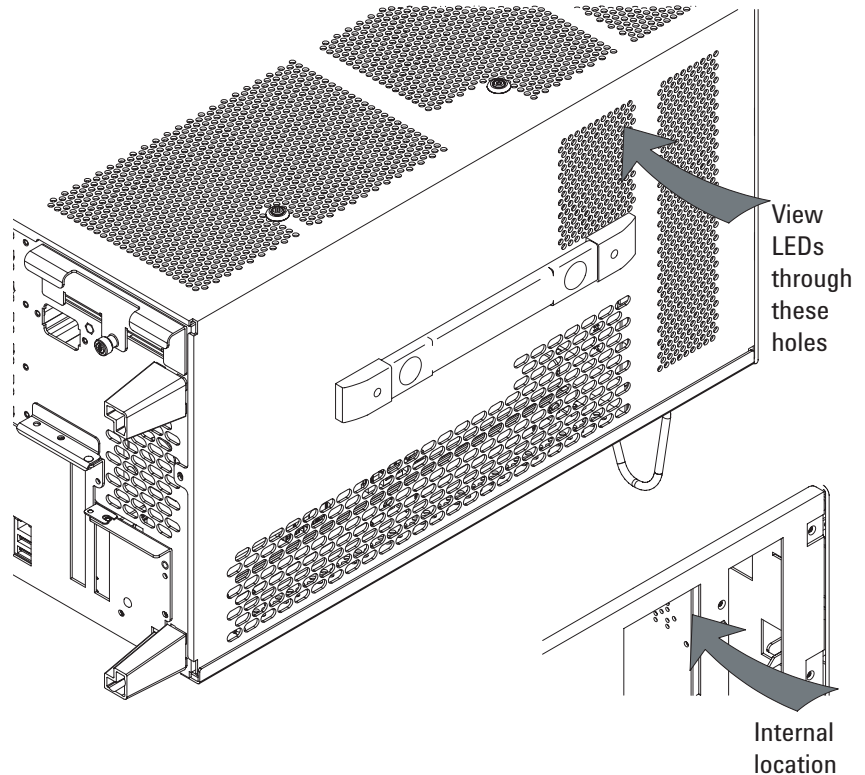


Figure 5 16902B Application Troubleshooting Flowchart

To troubleshoot power problems

The power LEDs on the frame help to figure out why a frame has powered itself down. For safety purposes, when any of these LEDs are lit the frame will not power back up until the power cord has been disconnected and then reconnected.



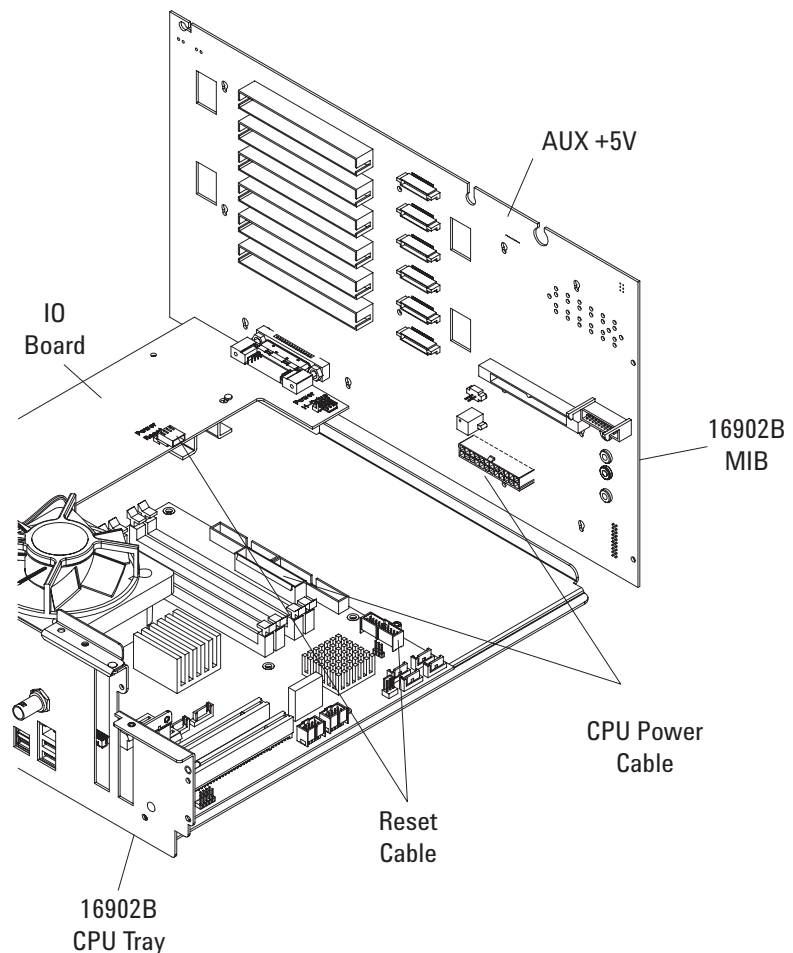
The colors indicate:

- Green – Front (5V) power supply failure.
- Yellow – Side (12V) power supply failure.
- Red – fan failure or 'overtemp'.

If the system warns you it is powering down before it powers down, it is a fan/overtemp problem. If it just powers down, it is a power supply problem

On the 16902B frame, if the lights do not come on and if the system powers up momentarily when you plug it in, make sure the power button hasn't become jammed or stuck in the pushed in position.

- 1 Turn off the instrument using one of the methods described in [“To power off the system”](#) on page 42
- 2 Disconnect the power cord, move the instrument to a static safe work environment, then remove the cover (instructions in [“To remove and replace the cover”](#) on page 48).
- 3 Ensure that the CPU power cable and reset cables are seated properly.



- 4 Using a voltmeter, ensure the AUX +5V power on the MIB measures +5V. If it does not, replace the power supply.
- 5 Apply power and return to [“16902B Power Troubleshooting Flowchart”](#) on page 28.

To check the power supply voltages

WARNING

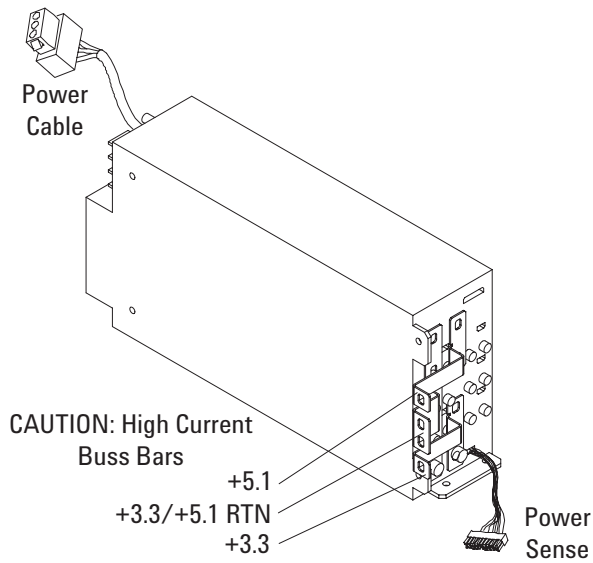
Hazardous voltages exist on the power supply. This procedure is to be performed by service-trained personnel aware of the hazards involved, such as fire and electrical shock.

- 1 Turn off the instrument using one of the methods described in [“To power off the system”](#) on page 42.
- 2 Disconnect the instrument’s power cord; move the instrument to a static safe work environment, then remove the cover (instructions in [“To remove and replace the cover”](#) on page 48).
- 3 Disconnect all cables/buss bars from the power supply except the power cable.
- 4 Reconnect the instrument’s power cord, and then apply power to the instrument.
- 5 Using a digital volt meter, measure the power supply dc voltages.
- 6 Referring to the graphics that follow, note problems with the power supply, then return to the flowchart.

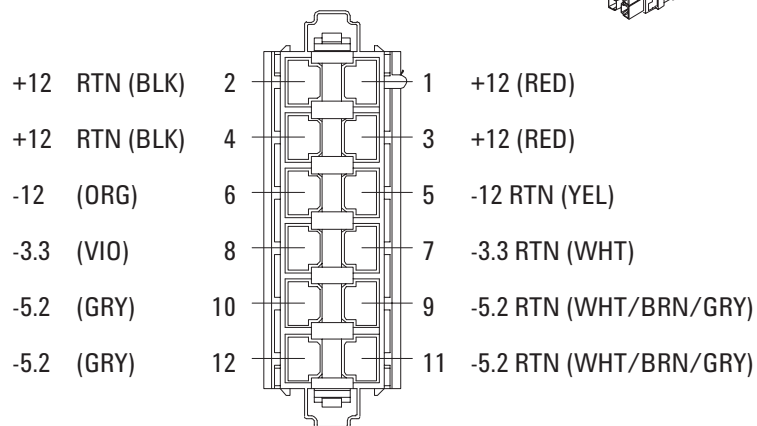
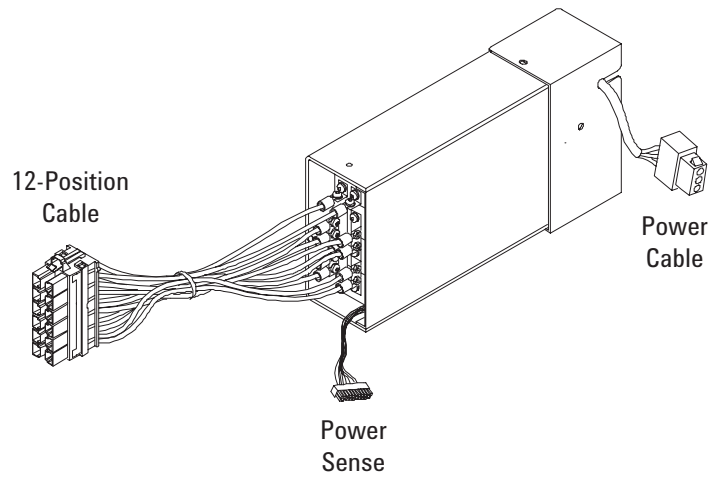
16902B power supplies

The 16902B system has two power supplies. Both are 650 watts. Use the following graphics when measuring the voltages.

Front (5V) power supply

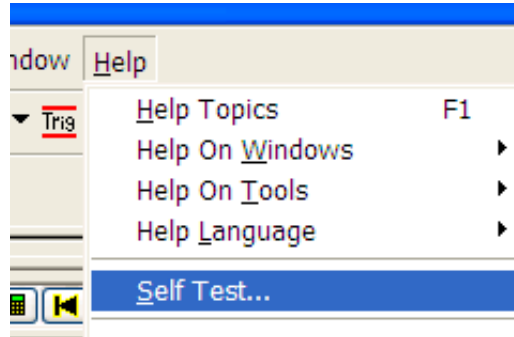


Side (12V) power supply

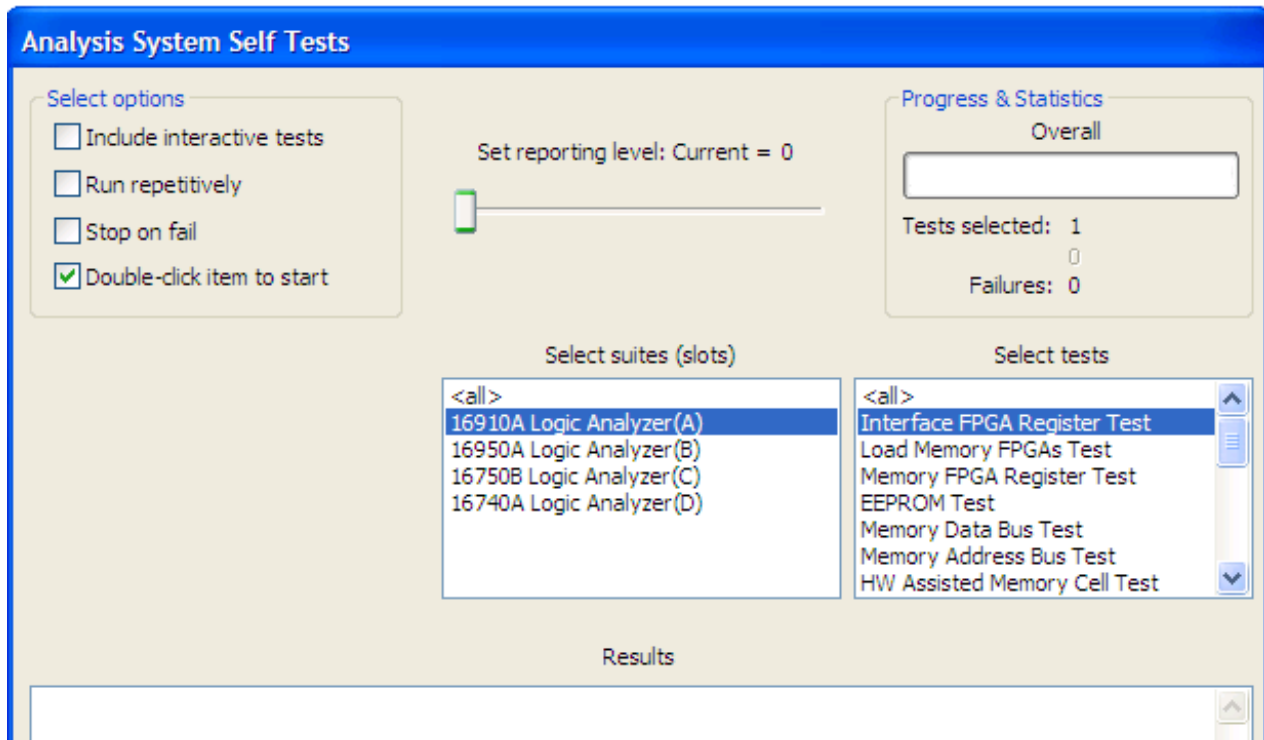


To run the self-tests

- 1 In the Agilent logic analyzer application, click Help>Self Test.



- 2 In the Analysis System Self Test dialog, double click on the test you want to run.



To reinstall the operating system

Restoring your system software might be necessary for the following reasons:

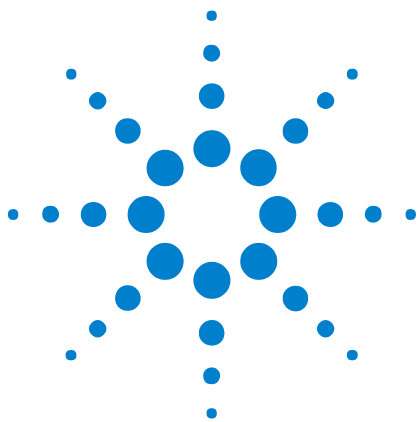
- Hard drive failure.
- Virus in the system or unstable system.
- Intentional disk clean – for example if you are passing the system to another team or returning it to a rental company and you do not want any data left on it.

You need to have a keyboard, mouse, and USB DVD-ROM drive connected. Follow the instructions provided with the recovery DVD to restore your system software.

CAUTION

Running the recovery disks will reformat your hard drive. All data files and programs will be overwritten. Save your license files and data to a USB flash drive or to another computer before performing this procedure.

5 Troubleshooting



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To remove and replace the motherboard	55
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To remove and replace the touch screen controller board	59
To remove and replace the front panel bracket assembly	60
To remove and replace the USB cables	61
To remove and replace the display assembly	62
To remove and replace the keypad and keypad board	64
To remove and replace the hard drive cage assembly	66
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NOTE

Part drawings in this chapter are representative. The actual parts may look different.



16902B Logic Analysis System Disassembly/Assembly

This chapter contains the instructions for removing and replacing the assemblies of the logic analyzer. Also in this chapter are instructions for returning assemblies.

WARNING

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

CAUTION

Damage can occur to electronic components if you remove or replace assemblies when the instrument is on or when the power cable is connected. Never attempt to remove or install any assembly with the instrument on or with the power cable connected.

Replacement Strategy

These replacement procedures are organized as though you are disassembling the complete instrument, from the first assembly to be removed to the last. Some procedures tell you to remove other assemblies of the instrument, but do not give complete instructions. In these cases, refer to the procedure for that specific assembly for the instructions.

CAUTION

Electrostatic discharge can damage electronic components. Use grounded wrist straps and mats when performing any service to this logic analysis system.

Tools Required

- T6, T10, T15, T20 TORX screwdrivers.
- #1 Pozidrive screwdriver.
- 1/8-inch screwdriver.
- 13/16-inch, deep-well nut driver.
- 1/4-inch hex socket.
- 3/16-inch nut driver.

To save the license file

Before doing any major repairs to the instrument, it is recommended that you back up any data and license files to a USB flash drive if possible. You will need a backup copy if you encounter any problems that require re-imaging the hard drive.

License files contain keys for licensed software features.

Node-locked license files are located in the “License” folder in the Agilent Logic Analyzer application’s install directory. For example, the default location is:

```
C:\Program Files\Agilent Technologies\Logic Analyzer\  
License\
```

Floating license files are located in the “License Files” folder in the license server’s install directory. For example, the default location is:

```
C:\Program Files\Agilent Technologies\License Server\  
License Files
```

If for some reason, you lose a license file, you can obtain new licenses from Agilent, given the licensing host ID.

To obtain the licensing host ID

From the *Agilent Logic Analyzer* application’s main menu, choose **Help>Software Licensing...** The Licensing Host ID is displayed in the Software Licensing dialog’s Activation tab.

To prepare the instrument for disassembly

Do this procedure before doing any disassembly procedure on the instrument.

- 1 Close the *Agilent Logic Analyzer* application software.
- 2 Power off the system using one of the methods explained below.
- 3 Remove the power cord.
- 4 Move the instrument to a static safe work environment.

WARNING

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

CAUTION

Damage can occur to electronic components if you remove or replace assemblies when the instrument is on or when the power cable is connected. Never attempt to remove or install any assembly with the instrument on or with the power cable connected.

To power off the system

There are several ways to power off the logic analysis system.

NOTE

When powering off the logic analysis system, wait until the fans stop turning (about 15 seconds) before turning the logic analysis system back on. This ensures that internal circuitry restarts in a known state.

Using the Windows Shutdown

On the logic analysis system desktop click **Start> Shut Down** or if you are running remote desktop, click **Start> Settings> Windows Security> Shut Down**. This software power off does the following:

- Closes all programs that are running.
- Writes all data to the disk.
- Turns off the power supply.

- If the system is unplugged while it is off and then plugged back in, the system will not power on until the power button is pressed.

Using a Short Press of the Power Button

Pressing the power button on a frame for a short time (less than 2 seconds or so):

- Closes all programs that are running.
- Writes all data to the disk.
- Turns off the power supply.

If the power button is depressed for a short time (less than 2 seconds or so) while another instrument has an open Remote Desktop connection to this instrument, a message on the logic analysis system screen (not on the remote desktop) will pop up asking if you really want to power down. Clicking the 'yes' button results in the above events. Clicking 'no' will prevent the shutdown and not answering the dialog box (neither clicking "Yes" or "No") will have no effect. Further short presses on the power button will have no effect.

Using a Long Press of the Power Button

Pressing the power button for more than 4 seconds will power the system down abruptly. Use this method only when other methods have not responded:

- Programs that are running will not be shut down. Any data that has not been written to the disk will be lost.
- Turns off the power supply.
- If the system is unplugged while it is off and then plugged back in, the system will not power on until the power button is pressed.
- If the system does not boot, the hard disk drive will need to be re-imaged.

Unplugging the Power Cord or Power Loss

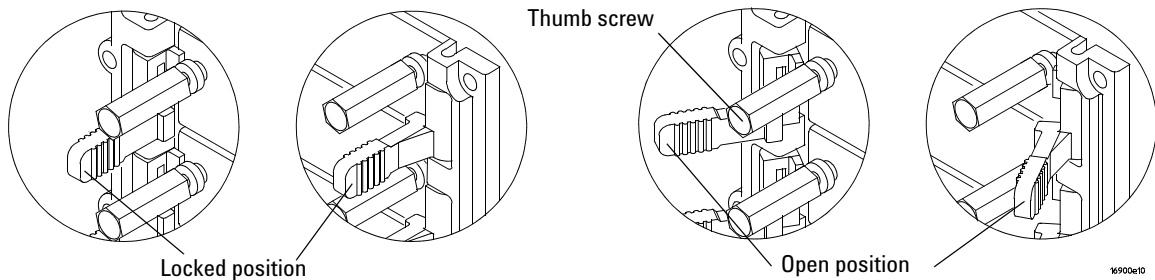
Unplugging power while the instrument is turned on or a power loss is similar to the long press of the power button with one exception:

- When the system is plugged back in, it will power up and boot into Windows.

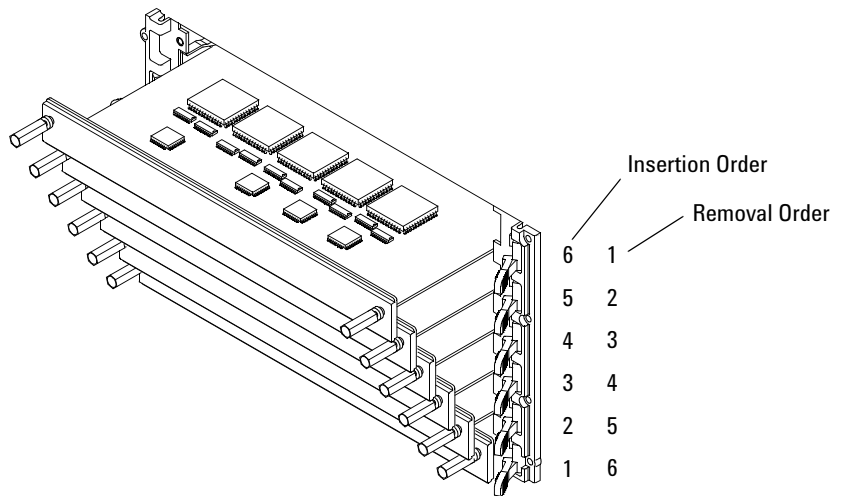
To remove and replace optional modules or filler panels

The following procedure guides you through installing, removing, or replacing measurement modules in the logic analysis system frame. Information on connecting specific multi-card measurement modules can be found in the *Installation Guide* that came with your frame. Measurement modules with different model numbers may not be connected together in multi-card (Master/Expander) modules unless stated otherwise. See also, the service guide that came with your measurement module.

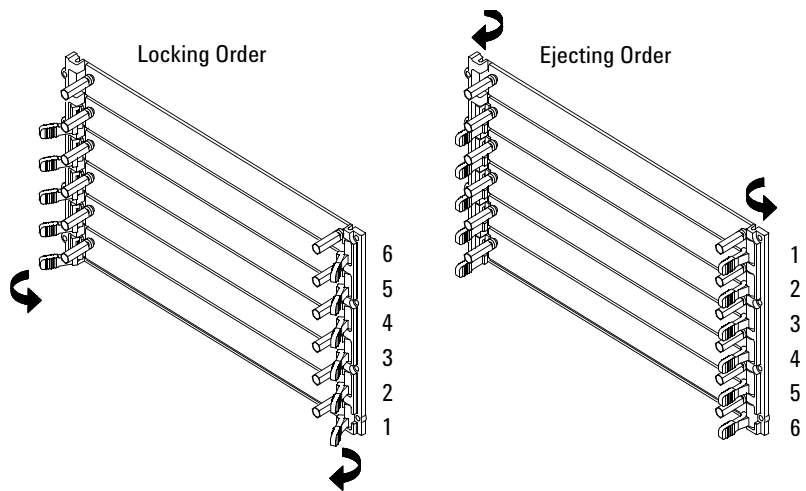
- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
- 2 Using a 1/4-inch hex socket, loosen the thumb screws on the modules or filler panels.
- 3 Rotate the ejector levers from the locked position to the open position.
- 4 Ensure all ejectors are fully open and out of the way.
- 5 Remove filler panels or slide the modules out of the logic analysis system frame.



The following figure shows a 6-card frame. The insertion/removal order would be the same for a 3-card frame. A single-module configuration can be installed in any available slot.



- When inserting, seat the modules then rotate the ejector tabs to the lock position. Repeat for all modules or filler panels.

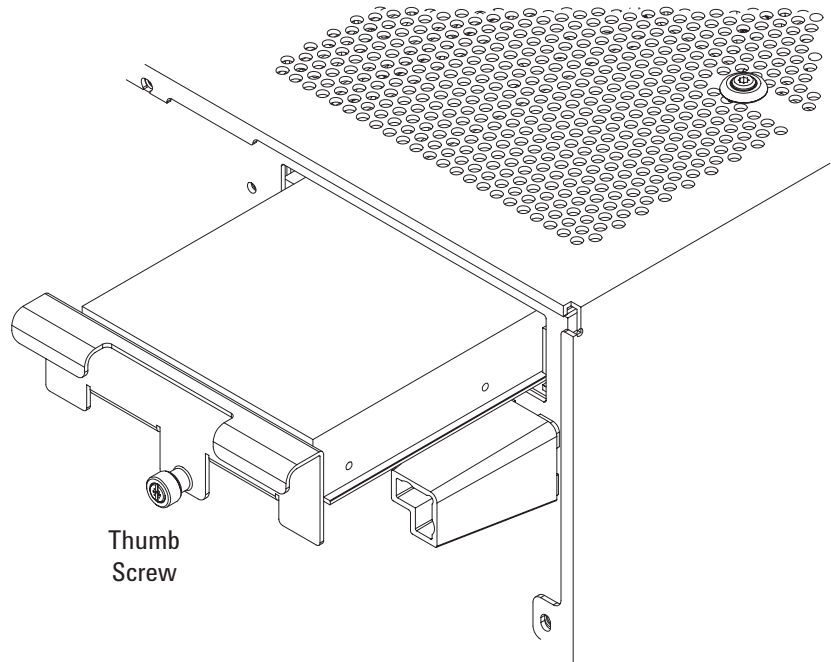


- Tighten the thumb screws until finger tight in the same order used in step 5 above. If using a hex socket or torque driver, avoid over tightening (2 in-lb maximum).
- For correct air circulation, install filler panels in all unused card slots. Correct air circulation keeps the instrument from overheating. Keep any extra filler panels for future use.

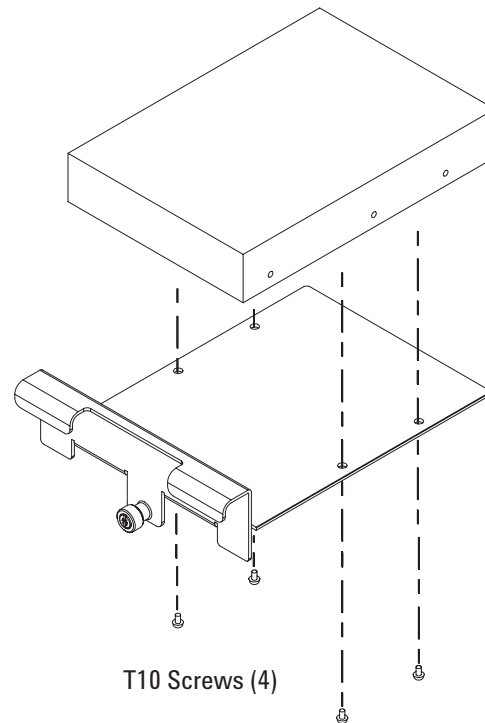
To remove and replace the hard disk drive

The 16902B logic analysis system has a removable hard disk drive. It can be removed and replaced without disassembling the instrument.

- 1 Perform previous procedures:
 - [“To prepare the instrument for disassembly”](#) on page 42.
- 2 Loosen the thumb screw that holds the hard disk drive in place.
- 3 Pull the drive tray out to remove the disk drive.



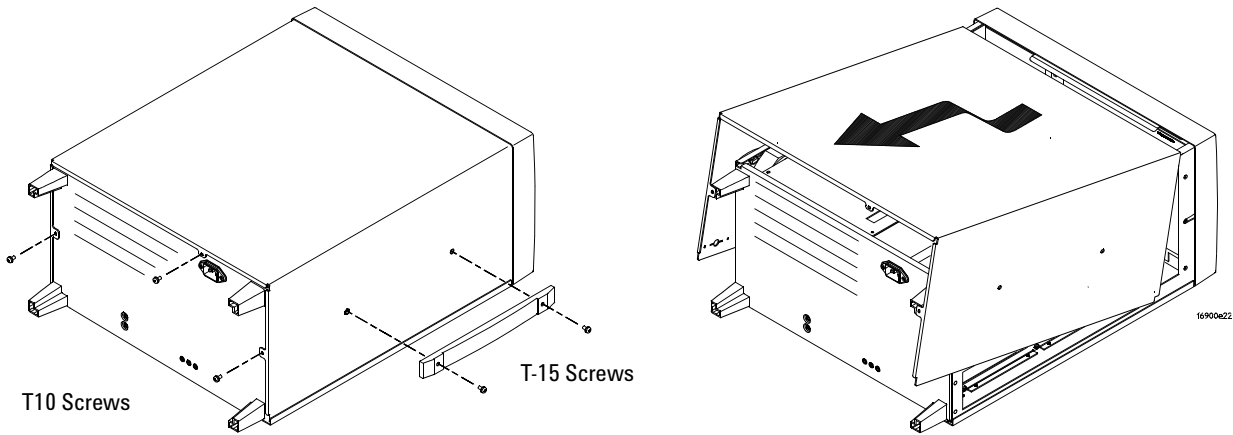
- 4 To remove the disk drive from the tray, use a Torx T10 screwdriver to remove the 4 screws that secure the hard drive to the hard tray.



- 5 Reverse this procedure to install the hard disk drive.
- 6 Follow the instructions on the recovery DVD to restore your system software.

To remove and replace the cover

- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
- 2 Using a Torx T15 screwdriver, remove the handle assembly.
- 3 Using a Torx T10 screwdriver, remove 3 screws that secure the cover to the chassis.
- 4 Slide the cover back and up to remove.



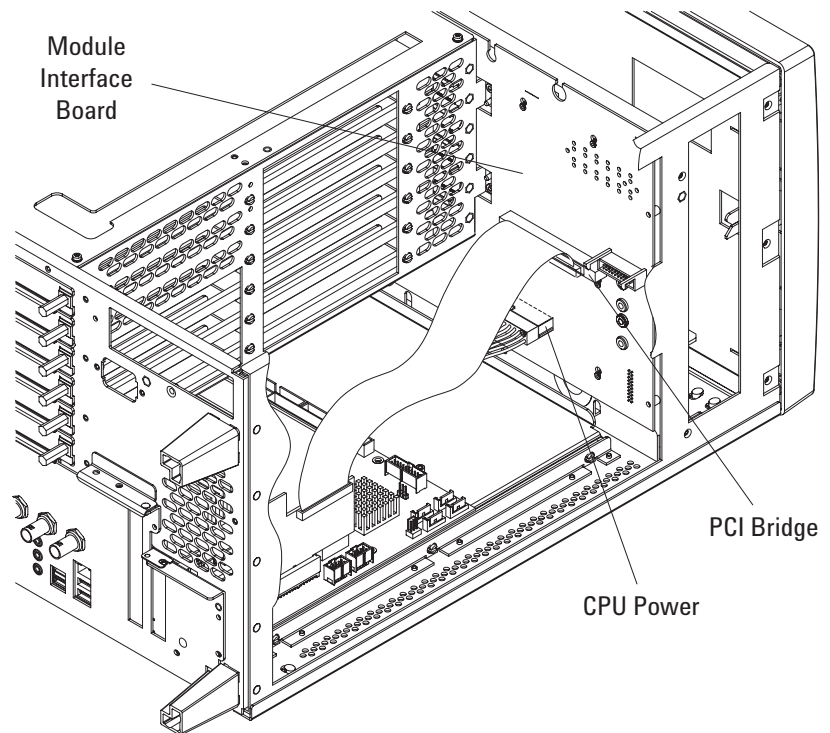
- 5 Reverse this procedure to replace the cover.

CAUTION

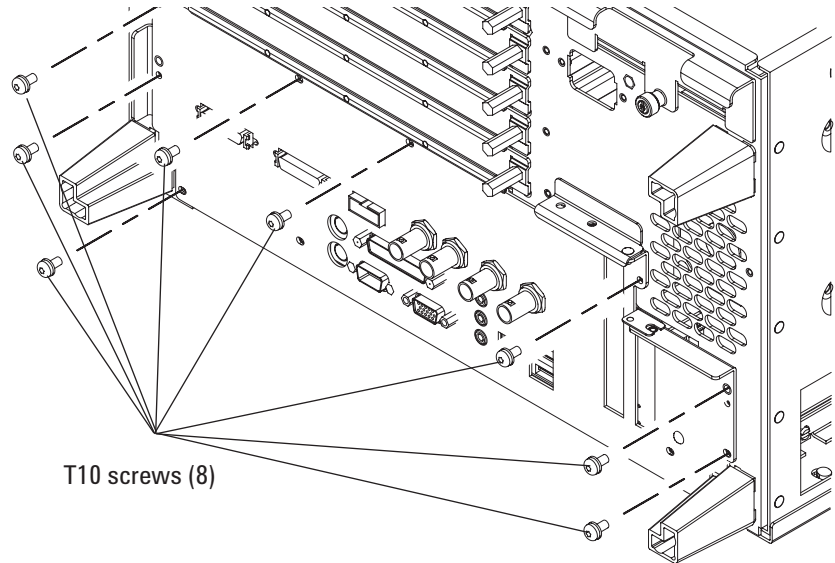
When reinstalling the handle assembly, ensure that the screws are torqued to 2.372 Newton meters (21 inch pounds) so that they do not work themselves loose.

To remove and replace the CPU tray

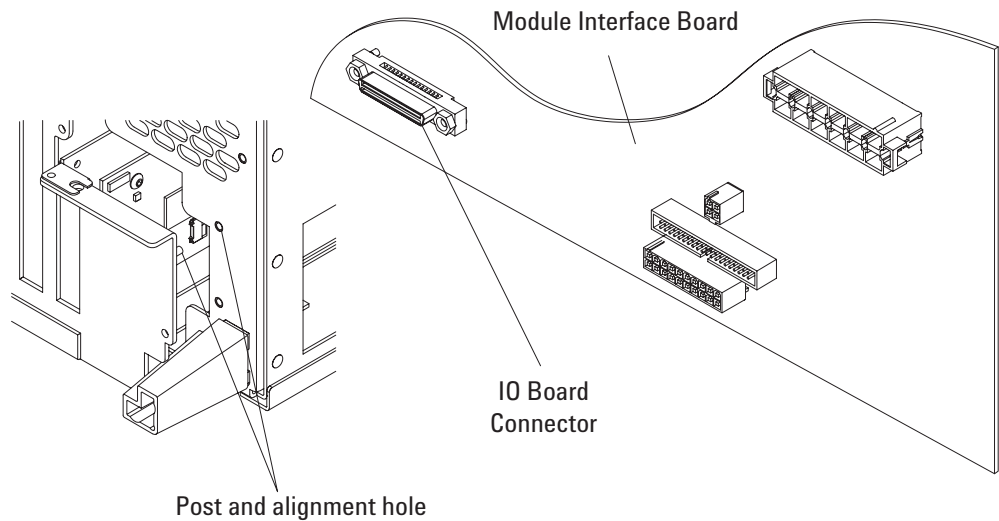
- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
- 2 Disconnect cables from the module interface board.



- 3 Remove 8 screws from the back of the CPU tray using a Torx T10 screwdriver.



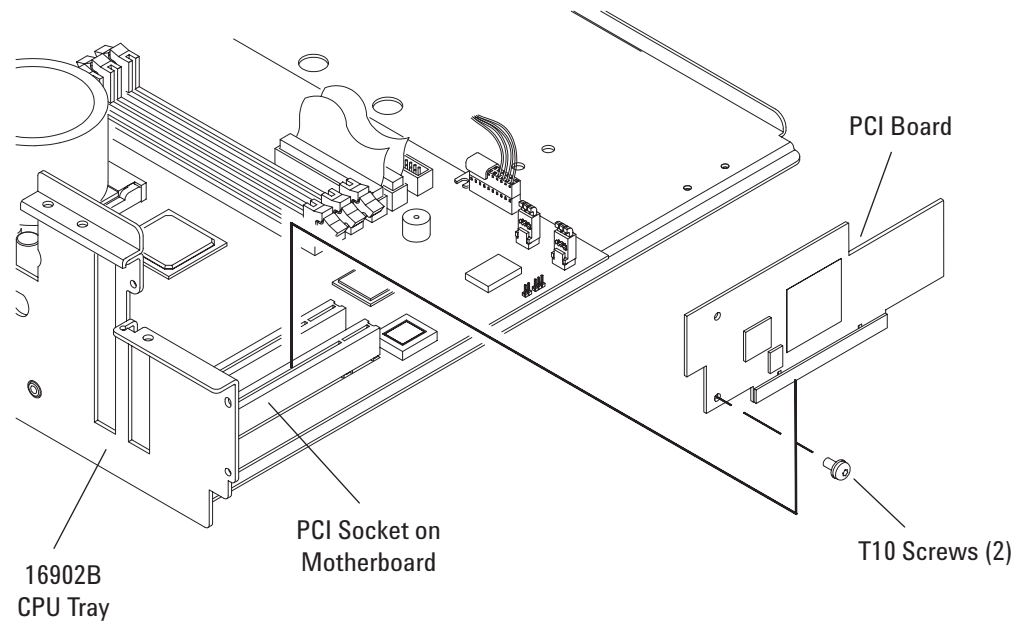
- 4 Slide the tray out being careful not to catch the loose cables on anything.



- 5 Reverse this procedure to install the CPU tray.

To remove and replace the PCI board

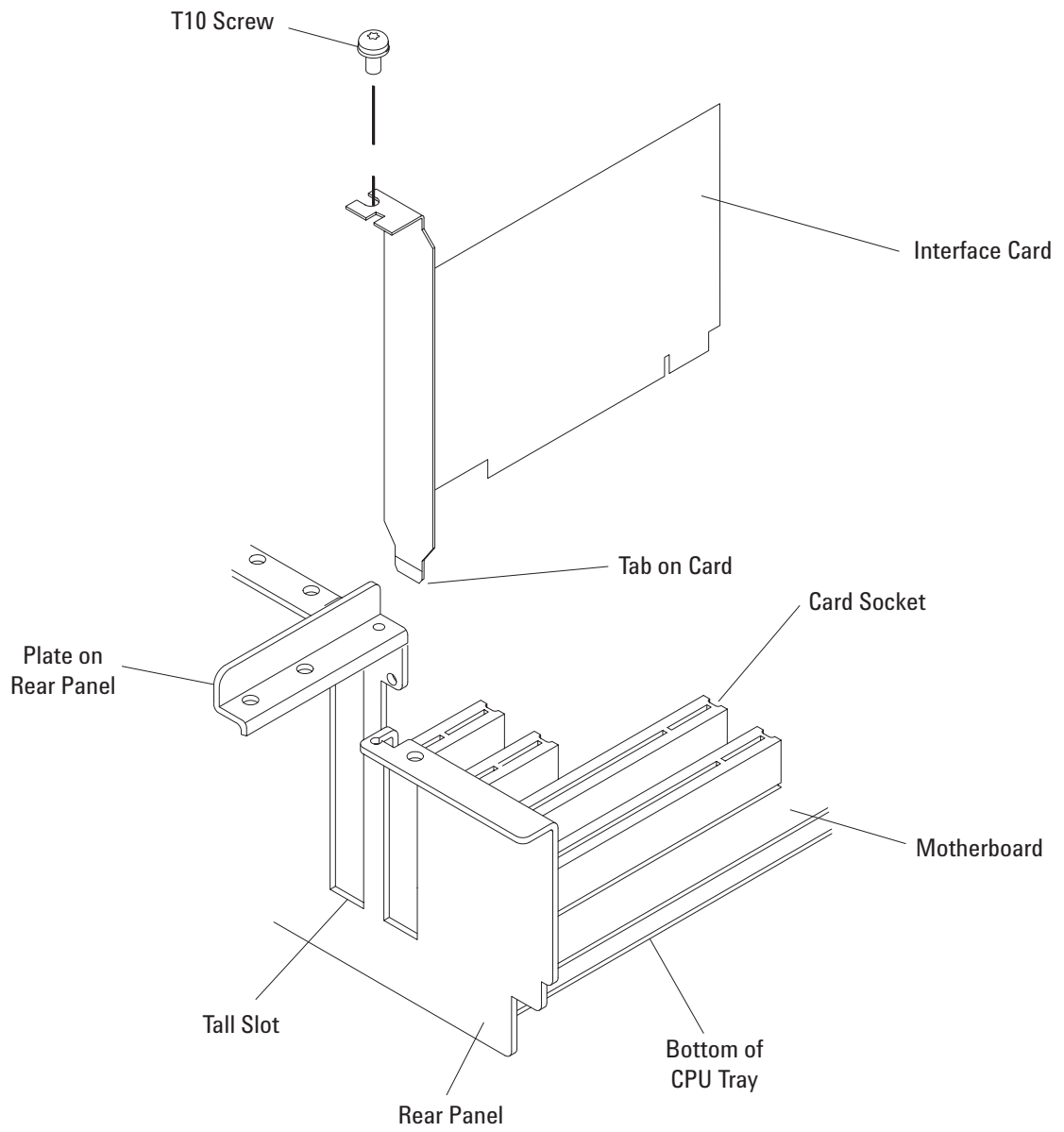
- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the CPU tray” on page 49.
- 2 Using a Torx T10 screwdriver, remove the 2 screws that secure the PCI board to the CPU tray.
- 3 Disconnect the cable to the MIB board.
- 4 Pull up the PCI board to disconnect it from the PCI socket on the motherboard.



- 5 Reverse this procedure to install the PCI board.

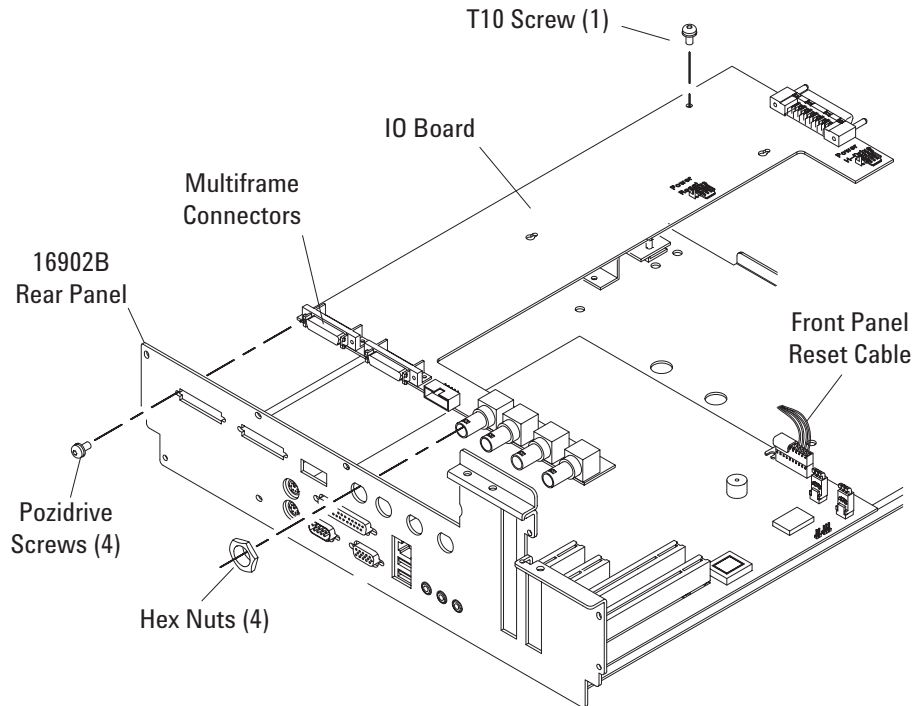
To remove and replace optional interface cards

- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the CPU tray” on page 49.
- 2 Using a T10 screwdriver, remove the screw securing the interface card to the rear panel of the CPU tray.
- 3 Swing the plate over the tall slot out of the way as shown in the following figure.
- 4 Lift the card out of the socket to remove.
- 5 To install a card, ensure that the tab at the bottom of the card is aligned with the slot in the bottom of the CPU tray between the motherboard and the rear panel.
- 6 Press the card securely into the socket on the motherboard.
- 7 For cards in the tall slot, swing the plate back into place.
- 8 Replace the screw.



To remove and replace the I/O board

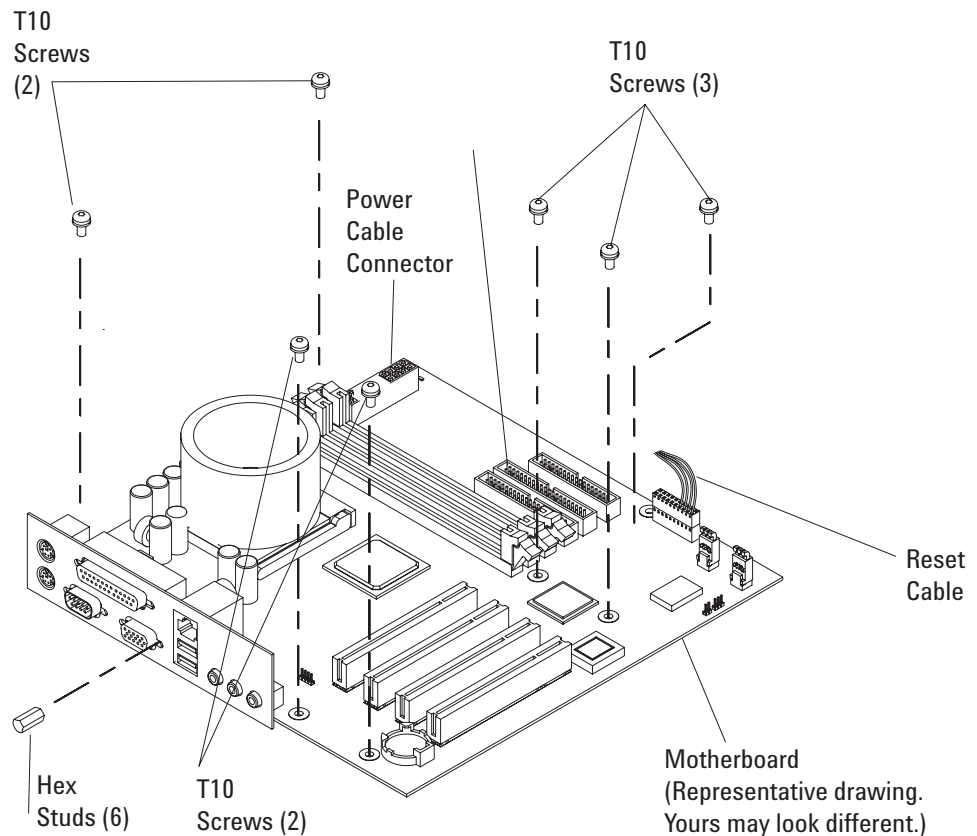
- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the CPU tray” on page 49.
- 2 Disconnect the front panel reset cable.
- 3 Using a deep-well 13/16-inch nut driver, remove the hex nuts that secure the BNC connectors to the rear panel.
- 4 Using a Pozidrive screwdriver, remove the 4 screws securing the multiframe input/output connectors to the rear panel.
- 5 Using a Torx T10 screwdriver, remove the screw securing the I/O board to the CPU tray.



- 6 Reverse this procedure to install the I/O board.

To remove and replace the motherboard

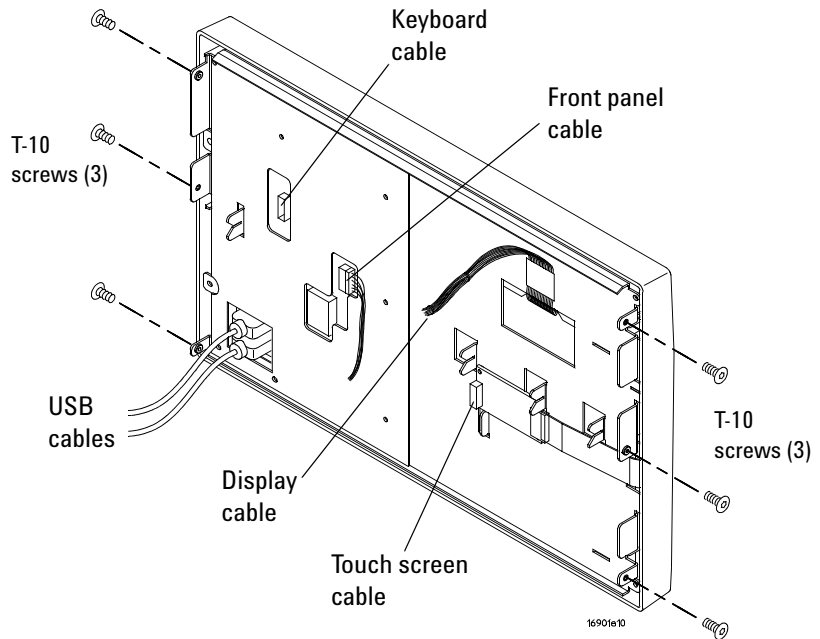
- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the CPU tray” on page 49.
- 2 Disconnect the following cables:
 - CPU power cables.
 - USB cables.
 - Hard drive SATA cable.
 - Front panel reset cable.
- 3 Remove the 6 Hex Studs securing the connectors to the rear panel of the CPU tray.
- 4 Using a Torx T10 screwdriver, remove the 7 screws that secure the motherboard to the bottom of the CPU tray.



- 5 Reverse this procedure to install the CPU tray.

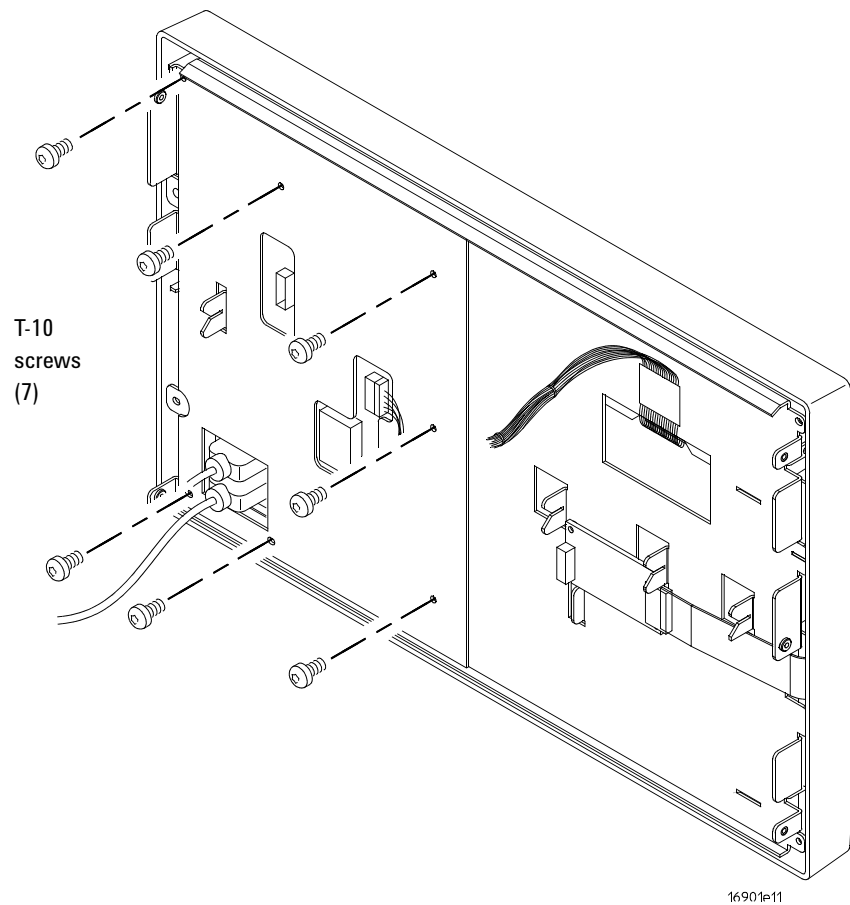
To remove and replace the front panel assembly

- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
- 2 Reverse this procedure to install the front panel assembly.
- 3 Disconnect the following cables:
 - USB cables from the motherboard.
 - Display cable from the motherboard (use care when disconnecting to avoid damage).
 - Touch screen cable from the touch screen controller board.
 - Keyboard cable from the keypad board.
 - Front panel cable from the backlight inverter board.
- 4 Using a Torx T10 screwdriver, remove 6 screws that secure the front panel to the chassis.
- 5 Remove the front panel assembly.
- 6 Reverse this procedure to install the front panel assembly.

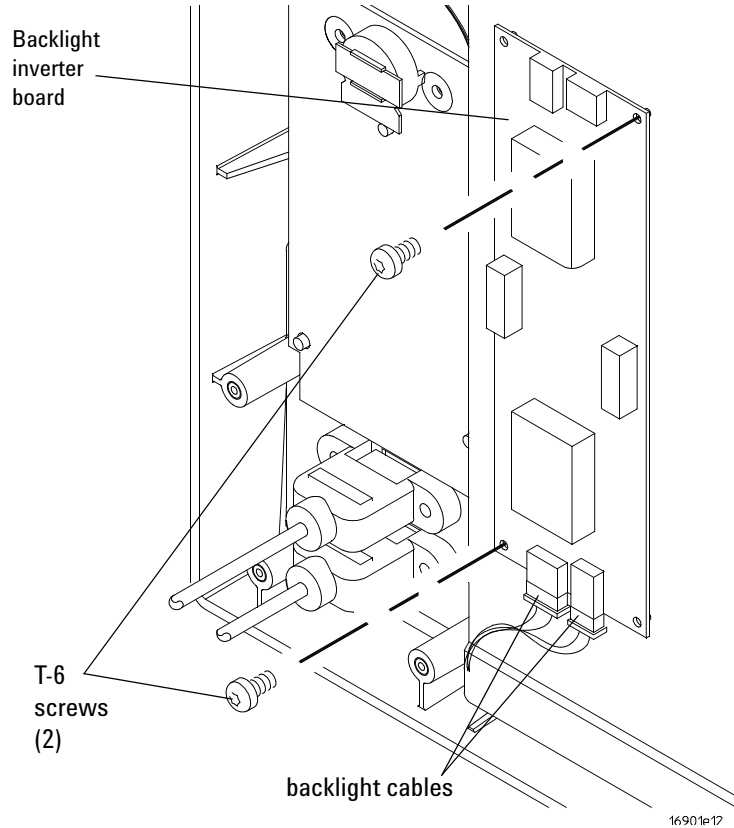


To remove and replace the backlight inverter board

- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the front panel assembly” on page 56.
- 2 Using a Torx T10 screwdriver, remove the 7 screws securing the front panel plate to the front panel.

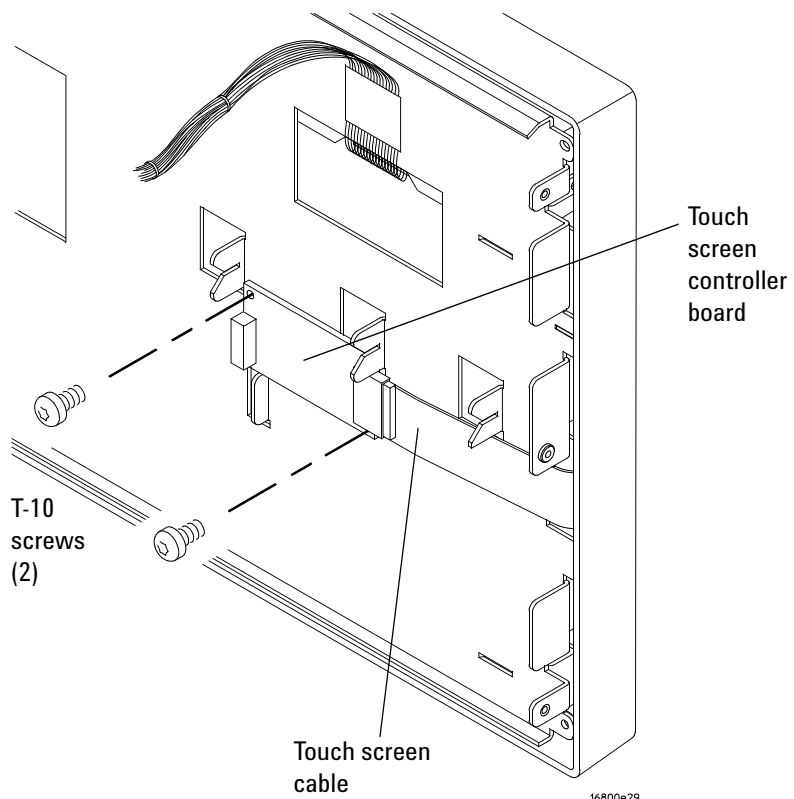


- 3** Disconnect the backlight cables from the inverter board.
- 4** Using a Torx T6 screwdriver, remove the 2 screws securing the board to the front panel.
- 5** Remove the board.
- 6** Reverse this procedure to install the backlight inverter board.



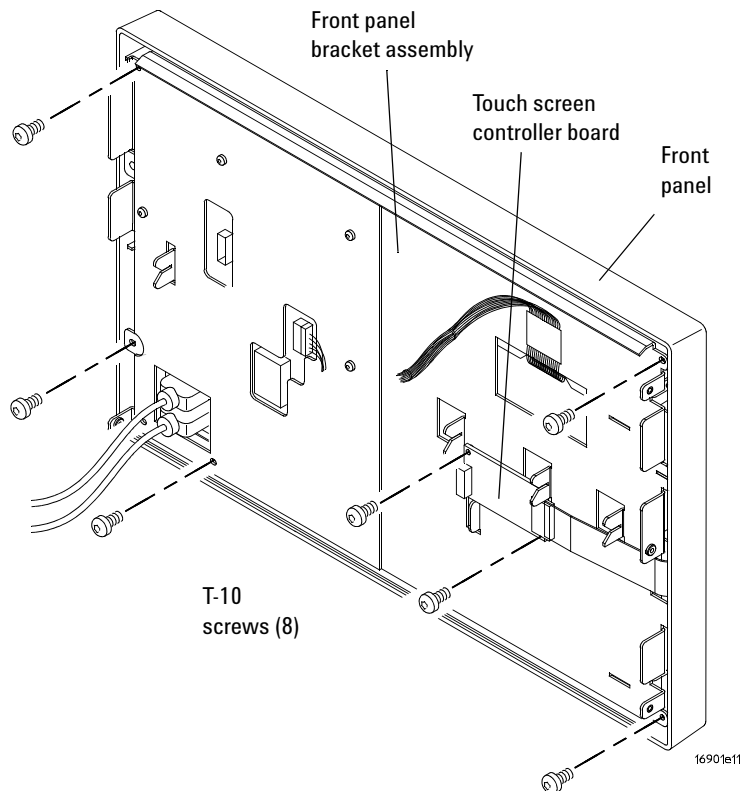
To remove and replace the touch screen controller board

- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the front panel assembly” on page 56.
- 2 Disconnect the touch screen cable from the touch screen controller board.
- 3 Using a Torx T10 screwdriver, remove the 2 screws securing the board to the front panel board.
- 4 Reverse this procedure to install the touch screen controller board.



To remove and replace the front panel bracket assembly

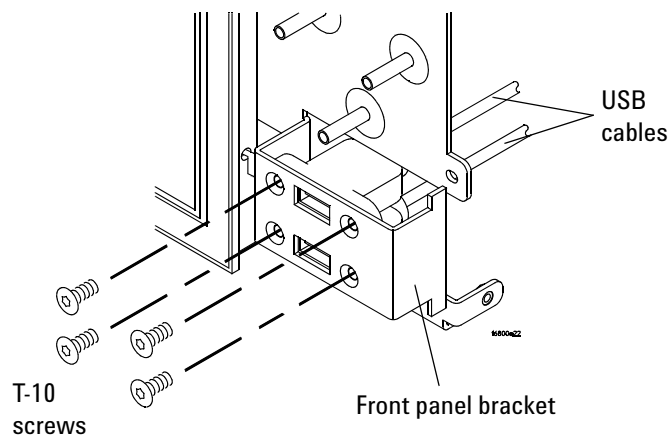
- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the front panel assembly” on page 56.
- 2 Using a Torx T10 screwdriver, remove the 2 screws securing the touch screen controller board to the front panel bracket assembly.
- 3 Using a Torx T10 screwdriver, remove the 6 screws securing the front panel bracket assembly to the front panel.
- 4 Remove the bracket assembly.



- 5 Reverse this procedure to replace the front panel bracket assembly.

To remove and replace the USB cables

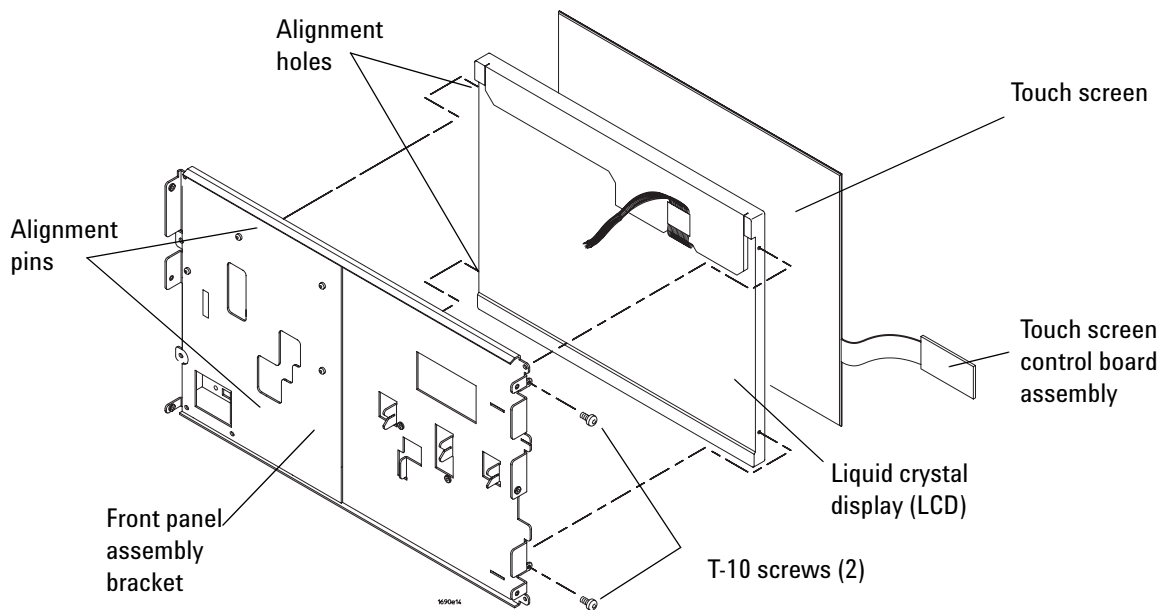
- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the front panel assembly” on page 56.
 - “To remove and replace the front panel bracket assembly” on page 60.
- 2 Using a Torx T10 screwdriver, remove the 4 screws securing the USB cables to the front panel bracket assembly.



- 3 Reverse this procedure to replace the USB cables.

To remove and replace the display assembly

- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the front panel assembly” on page 56.
 - “To remove and replace the backlight inverter board” on page 57.
 - “To remove and replace the front panel bracket assembly” on page 60.
- 2 Using a Torx T10 screwdriver, remove the 2 screws securing the display assembly to the front panel bracket assembly.
- 3 Remove the alignment pins on the bracket from the holes on LCD.



CAUTION

Handle the touch screen and LCD display by the edges only. If necessary, clean with alcohol and a lint-free wipe or remove any airborne contamination with ionized air.

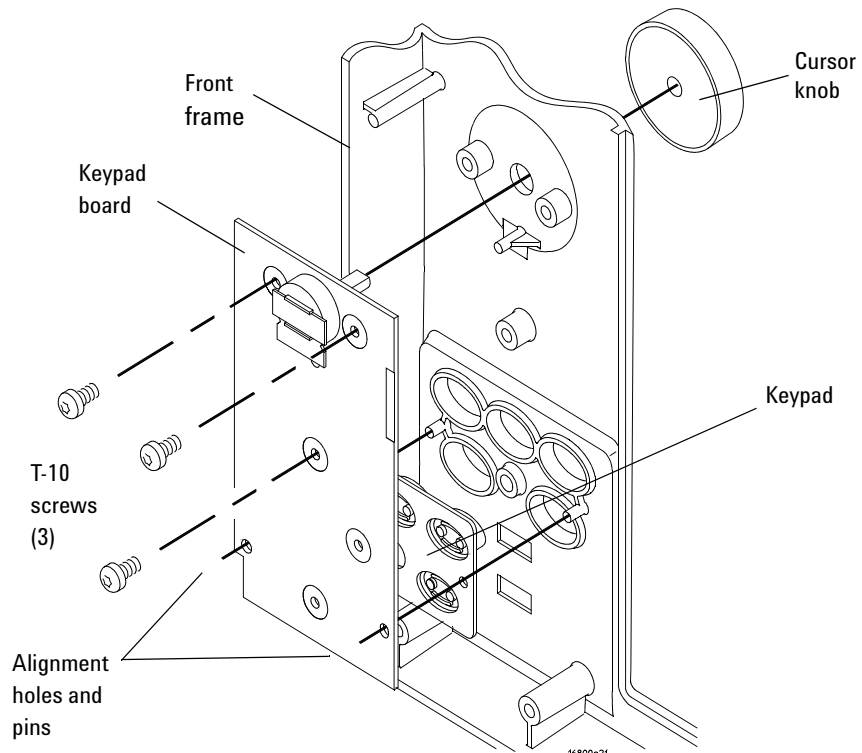
- 4 Gently pry the touch screen from the LCD. It is held on with double-sided tape.
- 5 Reverse this procedure to replace the display assembly.

To remove and replace the keypad and keypad board

- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the front panel assembly” on page 56.
- 2 Pull to remove the cursor knob from the front of the frame.
- 3 Using a Torx T10 screwdriver, remove the 3 screws securing the keypad board to the front frame.
- 4 Remove the keypad board and keypad from the frame.

CAUTION

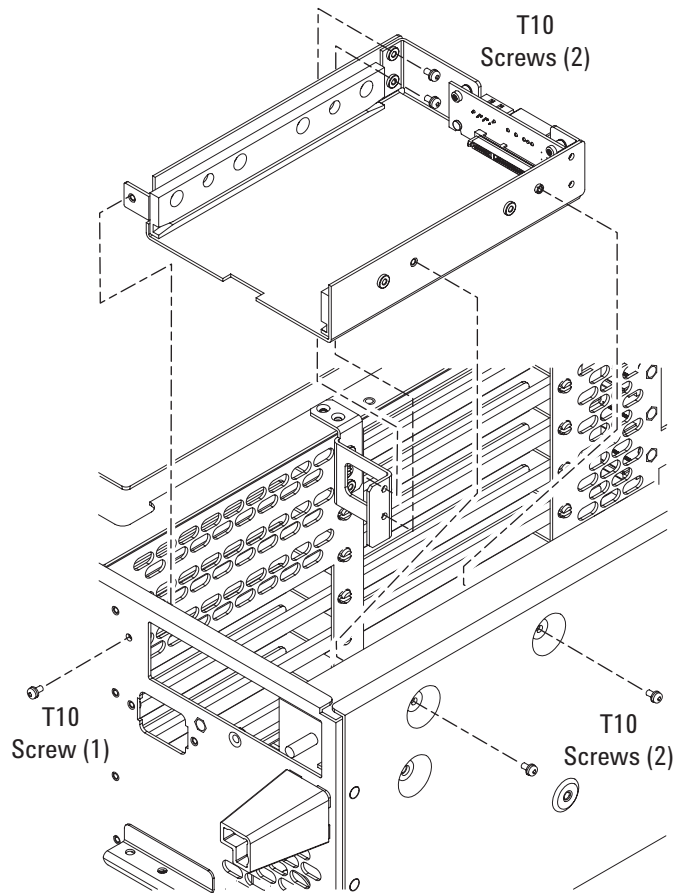
Wear ESD finger cots or use care not to touch the black pads on keypad and on the keypad board. Finger oils can impair contact. If necessary, carefully clean the contacts using alcohol and lint-free swabs or wipes.



- 5 Reverse this procedure to install the keypad and keypad board. Note the alignment pins on the frame and the holes in the board.

To remove and replace the hard drive cage assembly

- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the front panel assembly” on page 56.
 - “To remove and replace the hard disk drive” on page 46.
- 2 Disconnect the hard drive power cable and the SATA cable from the hard drive cage assembly:
- 3 Using a Torx T10 screwdriver, remove the 5 screws that secure the hard drive cage assembly to the chassis.



- 4 Reverse this procedure to replace.

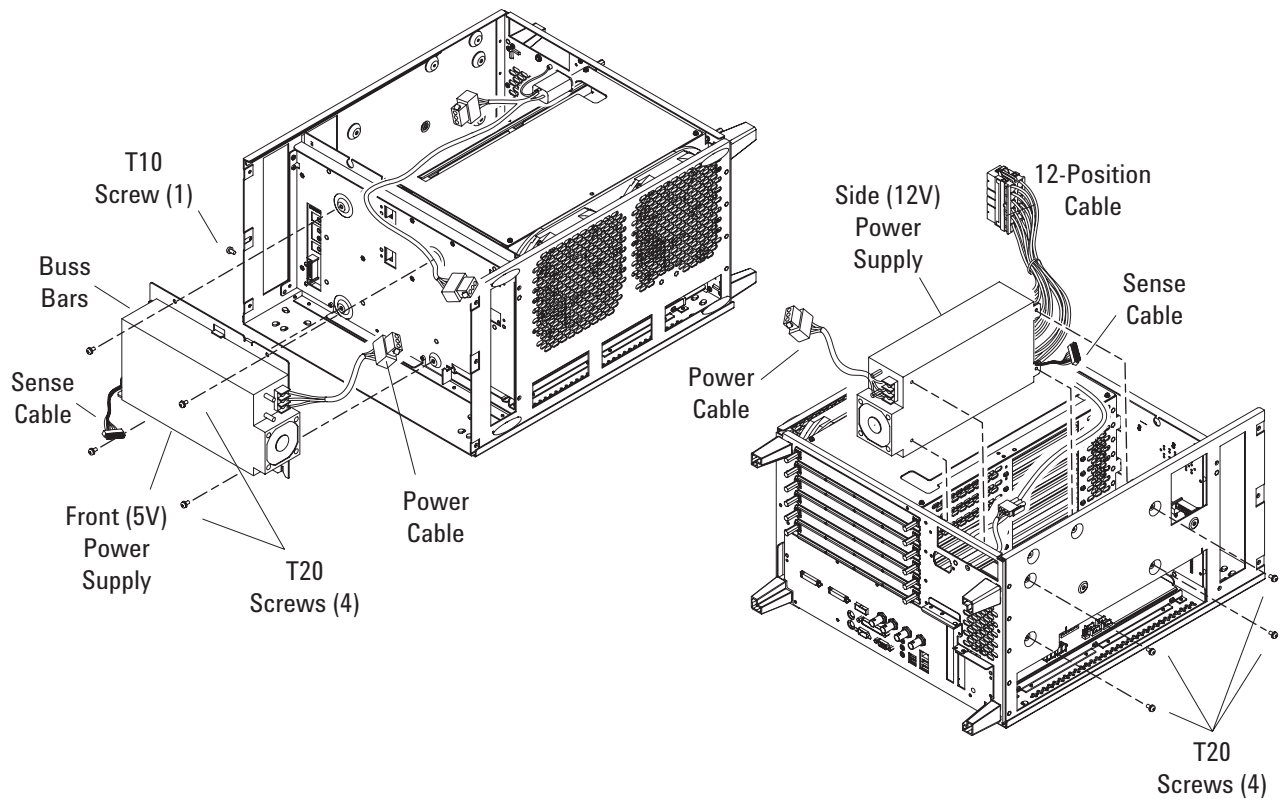
To remove and replace the power supplies

WARNING

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

- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the front panel assembly” on page 56.
 - “To remove and replace the hard disk drive” on page 46.
 - “To remove and replace the hard drive cage assembly” on page 66.
- 2 Disconnect the following cables and buss bars on the power supplies:
 - Power Cable.
 - Sense Cable.
 - 12-Position Cable.
 - Buss bars from the front (5V) power supply to the module interface board.

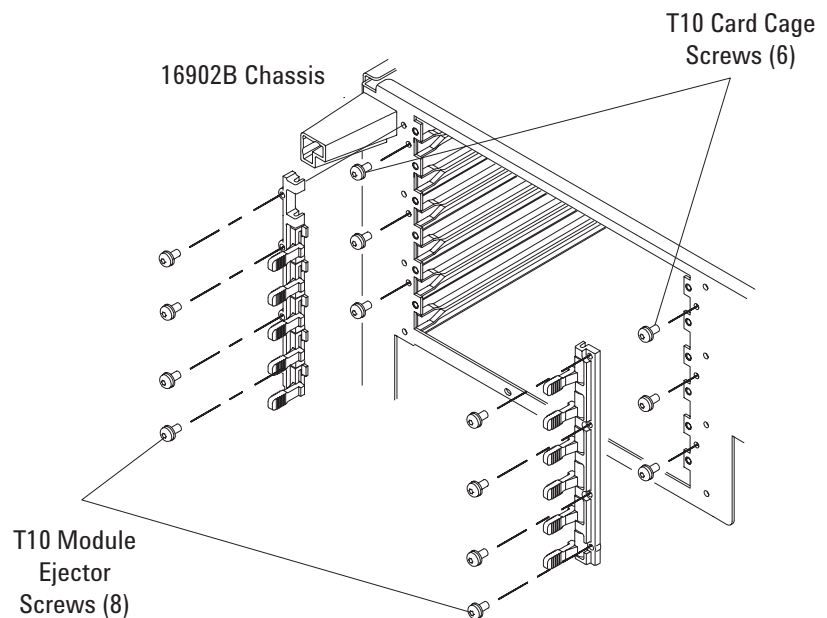
6 Replacing Assemblies



- 3 Using Torx T20 and T10 screwdrivers, remove the 5 screws that secure the front (5V) power supply to the chassis.
- 4 Using a Torx T20 screwdriver, remove the 4 screws that secure the upper and lower brackets to the front (5V) power supply.
- 5 Using a Torx T20 screwdriver, remove the 4 screws that secure the side (12V) power supply to the chassis.
- 6 Reverse this procedure to replace.

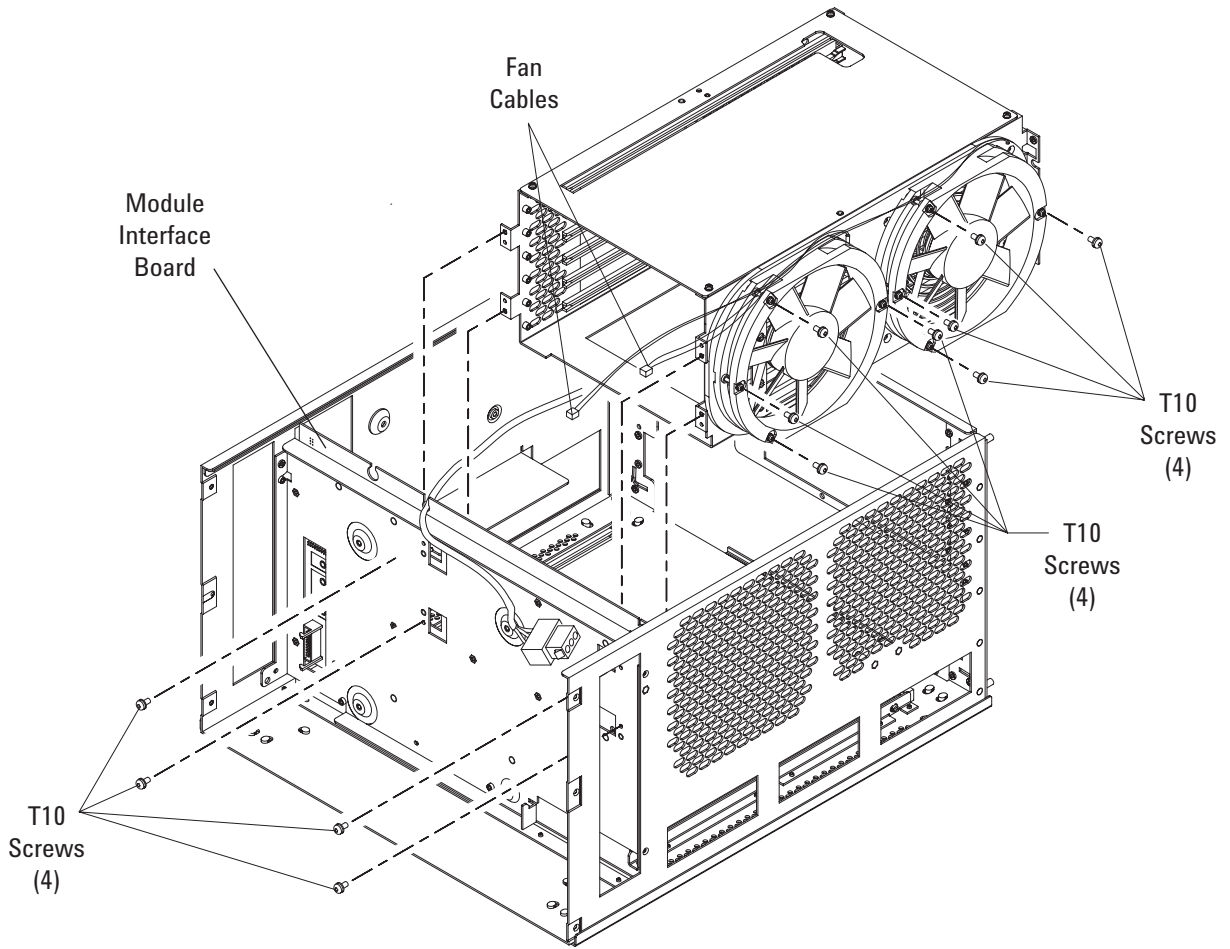
To remove and replace the card cage and fans

- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the CPU tray” on page 49.
- 2 Using a Torx T10 screwdriver, remove the screws holding the module ejectors to the rear of the chassis.
- 3 Using a Torx T10 screwdriver, remove the 6 screws holding the card cage assembly to the rear of the chassis.



- 4 Disconnect the fan cables from the module interface board.
- 5 Using a Torx T10 screwdriver, remove the 4 screws securing the card cage to the chassis.
- 6 Using a Torx T10 screwdriver, remove the 4 screws securing the fan from the card cage.

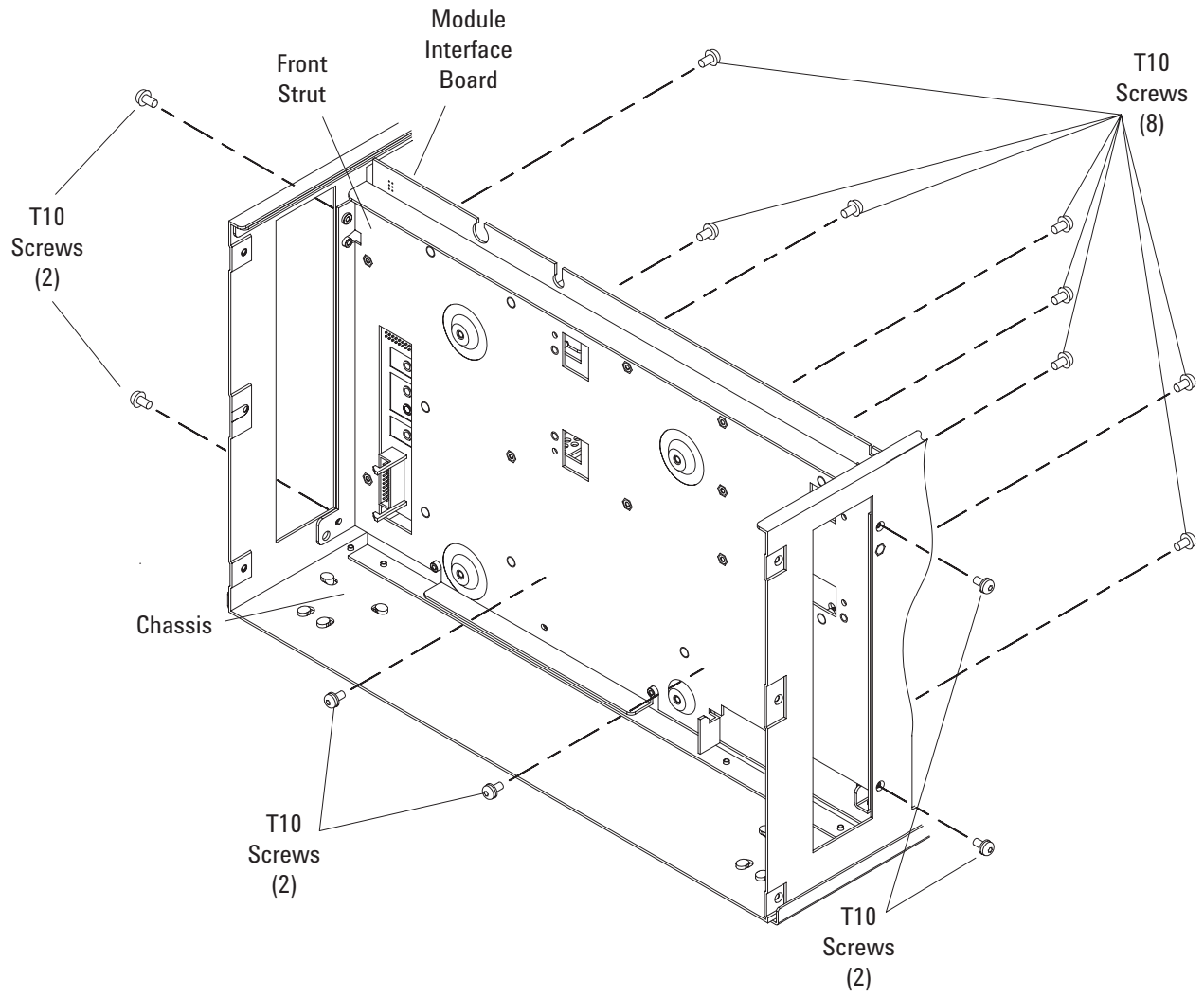
6 Replacing Assemblies



To remove and replace the module interface board

- 1 Perform previous procedures:
 - “To prepare the instrument for disassembly” on page 42.
 - “To remove and replace the cover” on page 48.
 - “To remove and replace the CPU tray” on page 49.
 - “To remove and replace the front panel assembly” on page 56.
 - “To remove and replace the power supplies” on page 67.
 - “To remove and replace the card cage and fans” on page 69.
- 2 Ensure that all cables are disconnected from the module interface board.
- 3 Using a Torx T10 screwdriver, remove the 6 screws securing the front strut to the chassis.
- 4 Using a Torx T10 screwdriver, remove the 8 screws securing the module interface board to the front strut.

6 Replacing Assemblies

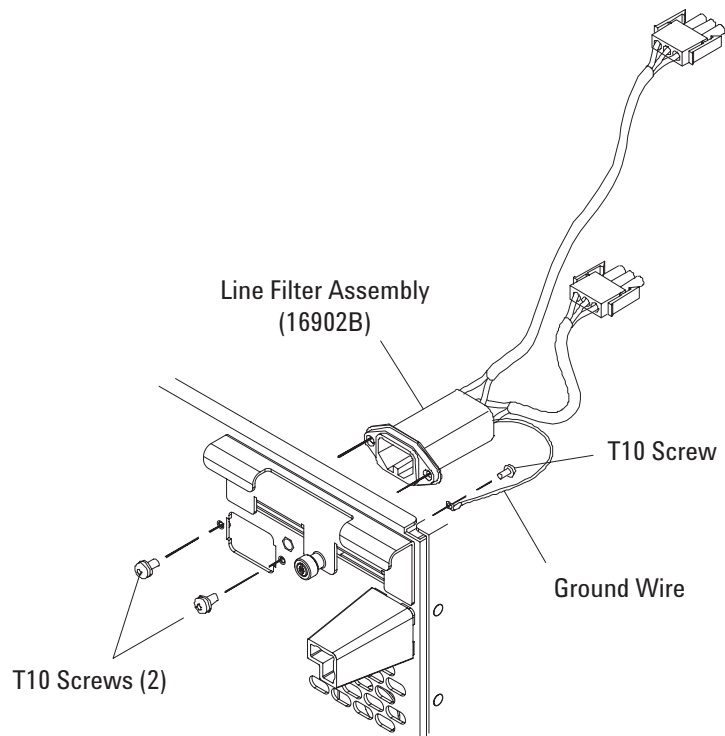


To remove and replace the line filter assembly

Perform previous procedures:

- “To prepare the instrument for disassembly” on page 42.
- “To remove and replace the cover” on page 48.

- 1 Disconnect the power cable from the power supply.
- 2 Using a Torx T10 screwdriver, remove the 2 screws securing the power socket to the frame and the 1 screw to the ground wire.
- 3 Reverse this procedure to replace.



Returning Assemblies

Before shipping the logic analysis system or assemblies to Agilent Technologies, contact your nearest Agilent Technologies Sales Office for additional details. To locate the sales or service office near you, go to <http://www.agilent.com/find/contactus>.

- 1 Write the following information on a tag and attach it to the part to be returned.
 - Name and address of owner.
 - Model number.
 - Serial number.
 - Description of service required or failure indications.

- 2 Remove accessories from the logic analysis system.

Only return accessories to Agilent Technologies if they are associated with the failure symptoms.

- 3 Package the logic analysis system or assemblies.

You can use either the original shipping containers, or order materials from an Sales Office.

CAUTION

For protection against electrostatic discharge, package the logic analysis system in electrostatic material.

- 4 Seal the shipping container securely, and mark it FRAGILE.



7 Replaceable Parts

Replaceable Parts Ordering 76

Cover Assembly 78

Front Panel Assembly 79

Frame 81

Power Cables and Plug Configurations 85

Replaceable Parts Ordering

Parts Listed

To order a part on the list of replaceable parts, quote the Agilent Technologies part number, indicate the quantity desired, and address the order to the nearest Agilent Technologies Sales Office. To locate a sales office near you, go to <http://www.agilent.com/find/contactus>.

Parts Not Listed

To order a part that is not on the list of replaceable parts, include the model number and serial number of the module, a description of the part (including its function), and the number of parts required. Address the order to your nearest Agilent Technologies Sales Office. To locate a sales office near you, go to <http://www.agilent.com/find/contactus>.

Direct Mail Order System

Within the USA, Agilent Technologies can supply parts through a direct mail order system. The advantages to the system are direct ordering and shipment from the Agilent Technologies Part Center. There is no maximum or minimum on any mail order. (There is a minimum amount for parts ordered through a local Agilent Technologies Sales Office when the orders require billing and invoicing.) Transportation costs are prepaid (there is a small handling charge for each order) and there are no invoices.

In order for Agilent Technologies to provide these advantages, a check or money order must accompany each order. Mail order forms and specific ordering information are available through your local Agilent Technologies Sales Office. To locate a sales office near you, go to <http://www.agilent.com/find/contactus>.

Exchange Assemblies

Some assemblies are part of an exchange program with Agilent Technologies. The exchange program allows you to exchange a faulty assembly with one that has been repaired and performance verified by Agilent Technologies.

After you receive the exchange assembly, return the defective assembly to Agilent Technologies. A United States customer has 30 days to return the defective assembly. If you do not return the defective assembly within the 30 days, Agilent Technologies will charge you an additional amount. This amount is the difference in price between a new assembly and that of the exchange assembly. For orders not originating in the United States, contact your nearest Agilent Technologies Sales Office for information. To locate a sales office near you, go to <http://www.agilent.com/find/contactus>. For more information on returning assemblies go to "Returning Assemblies" on page 74.

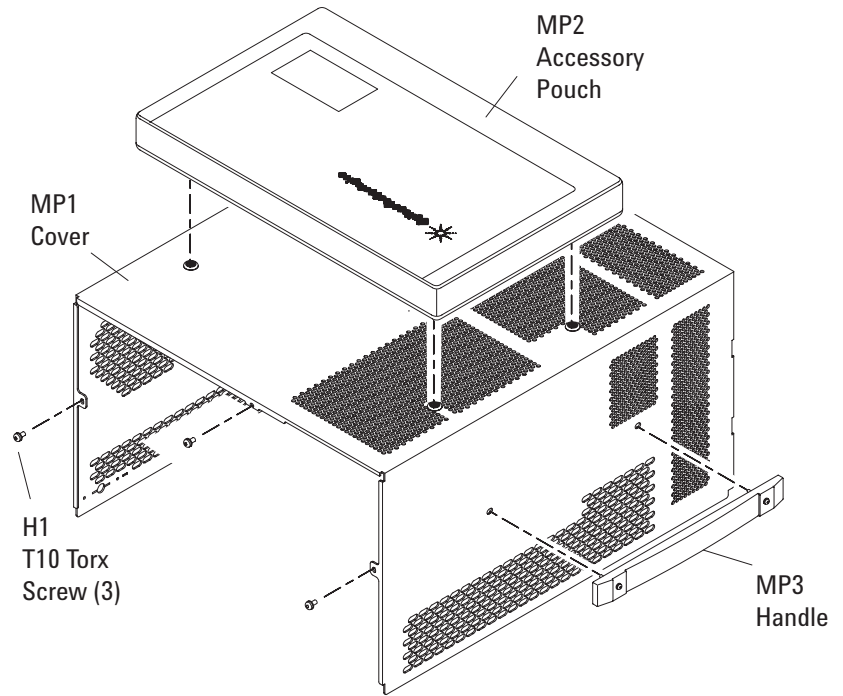
Replaceable Parts List Description

The replaceable parts lists in this chapter are organized by reference designation. The exploded views do not show all of the parts in the replaceable parts lists.

Information included for each part in the list consists of the following:

- Reference designator
 - A – Assembly
 - H – Hardware
 - MP – Mechanical Part
 - W – Cable
- Agilent Technologies part number
- Total quantity included with the instrument (Qty)
- Description of the part

Cover Assembly



Front Panel Assembly

The 16902B has a built-in color touch screen display and also supports external displays.

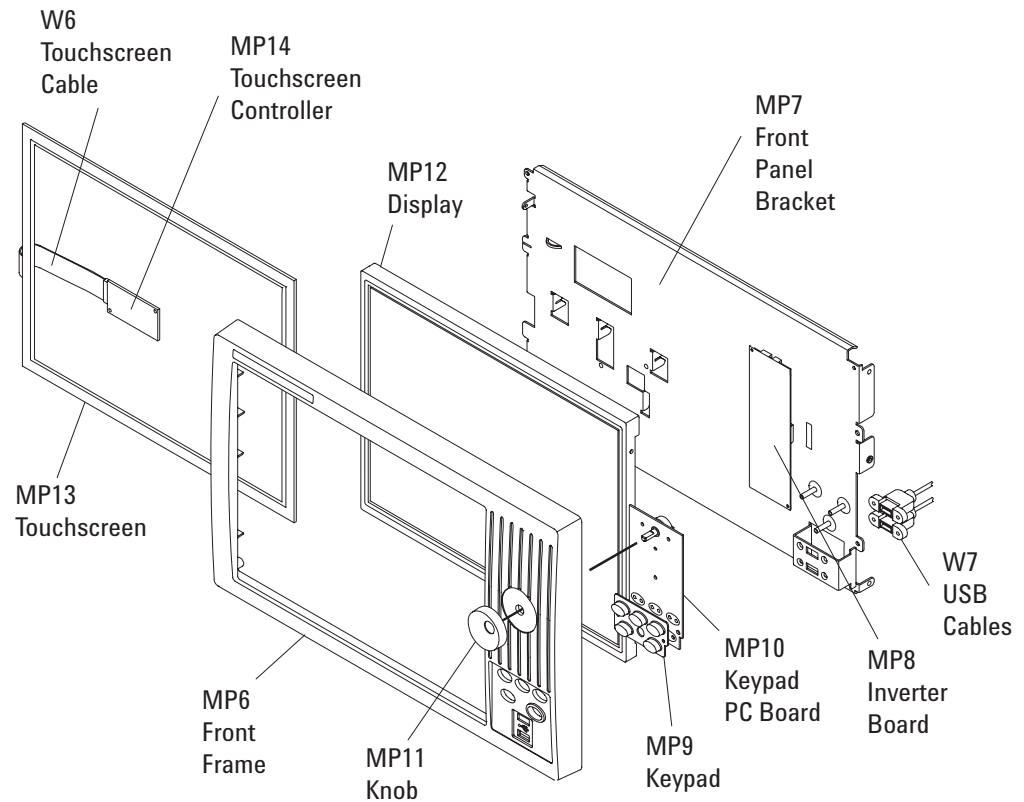


Table 4 Replaceable parts for the cover and front panel assemblies

Ref. Des.	Agilent Technologies Part Number	Qty	Description
A1	16800-68701	1	Font panel with 15 inch display and touchscreen
H1	0515-0372		Screw
H2	0515-0658		Screw
H3	0515-1246		Screw
H4	0515-0365		Machine screw
H5	16900-22401		Shoulder screw

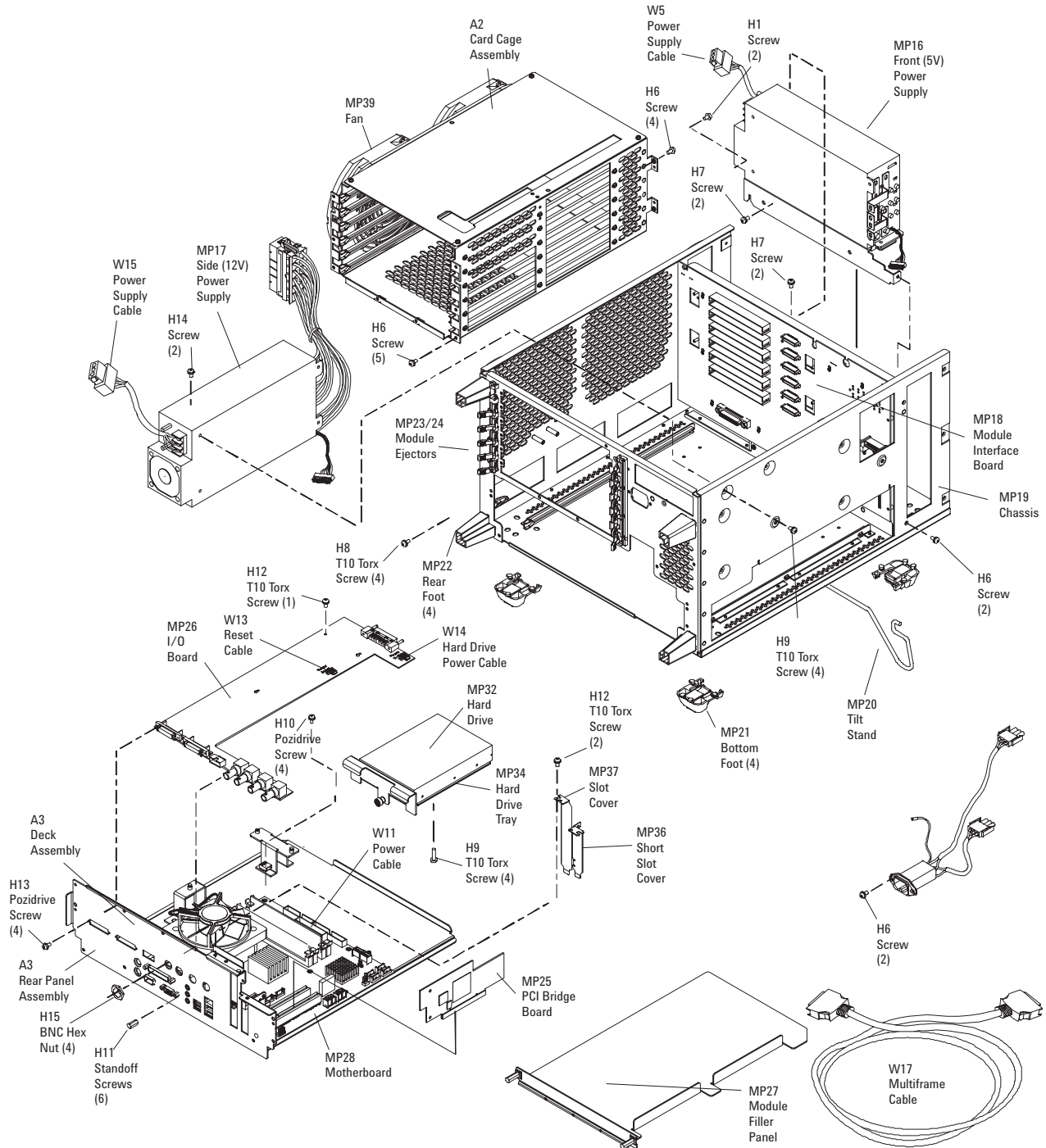
7 Replaceable Parts

Table 4 Replaceable parts for the cover and front panel assemblies (continued)

Ref. Des.	Agilent Technologies Part Number	Qty	Description
MP1	16902-04101	1	Cover (includes grommets for pouch)
MP2	01680-68702	1	Accessory pouch
MP3	16600-68707	1	Handle (includes screws)
MP2	01680-41002	4	Side foot (not shown)
MP5	16902-94303	1	ID label 16902B
MP6	16800-40201	1	Front frame
MP7	16901-01204	1	Front panel bracket
MP8	0950-4805	1	Inverter - DC-AC 8W dual output w/dimming function
MP9	16800-47402	1	Keypad - touchscreen
MP10	16800-66403	1	Keypad PC board assembly
MP11	16702-47402	1	Knob - cursor
MP12	2090-0939	1	LCD (Liquid Crystal Display) 15 inch TFT color
MP13	0960-2576	1	Touch screen
MP14	0960-2535	1	Touch screen controller board
W1	16800-61615	1	Front panel cable (not shown)
W2	16900-61609	1	Display cable (not shown)
W3	16801-61604	1	Inverter cable (not shown)
W4	16902-61602	1	Keypad cable (not shown)
W5	16901-61609	1	LCD cable
W6	16901-61603	1	Touch screen cable
W7	16901-61602	1	USB cable (dual)

Frame

The 16902B logic analysis system is modular with slots for 6 measurement modules.



7 Replaceable Parts

Table 5 Replaceable parts

Ref. Des.	Agilent Technologies Part Number	Qty	Description
	see page 85	1	Power cords
A2	16900-60011	1	Card cage assembly
A3	16902-60201	1	Rear panel assembly
A4	16902-60101	1	Deck assembly
H1	0515-0372		Screw - round head
H6	0515-2032		Screw
H7	0515-2143		Screw - M4 X 0.7 6MM-LG PAN-HD ; Torx T20
H8	0515-1349		Screw - rear foot
H9	2360-0462		Screw with washer
H10	3030-1245		Screw - shoulder 6-32 THD 0.20-IN-LG
H11	0380-1858		Standoff - hex .312-IN-LG 4-40-THD
H12	0515-0430		Screw - T10 Torx
H13	0515-4768		Screw - panel M2.5 X 0.45 8MM-LG
H14	0515-1403		Screw - special M4 X 0.7 6MM-LG 90-DEG-FLH-HD
H15	1250-2075		Nut - RF connector 9/16 inch hex; 1/2-28
MP16	16902-62602	1	Front (5V) power supply assembly - 650 W, 2 outputs
MP17	16902-62601	1	Side (12V) power supply assembly - 650 W, 4 outputs
MP18	16900-66507	1	Module interface board (MIB)
MP19	16902-00101	1	Chassis
MP20	54810-03702	1	Tilt stand
MP21	54810-61001	4	Foot - bottom
MP22	54110-40502	4	Foot - rear
MP23	16900-45002	1	Module ejector/lever assembly (left)
MP24	16900-45003	1	Module ejector/lever assembly (right)
MP25	16903-66404	1	PCI board

Table 5 Replaceable parts (continued)

Ref. Des.	Agilent Technologies Part Number	Qty	Description
MP26	16900-66503	1	I/O board
MP27	16901-00201	0-6	Module filler panel
MP28	16902-68701	1	CPU board assembly
MP29	0960-2689	1	Motherboard 945G Micro-ATX 352 Celeron D
MP30	3160-4243	1	CPU fan with heatsink
MP31	16902-01201	1	Card cage/front strut
MP32	16902-68704	1	Removeable hard disk drive (RHDD) assembly
MP33	0950-4970	1	Hard drive 80 GB SATA 3Gb/s
MP34	16902-01207	1	Hard drive tray
MP35	16903-41201	1	Retainer - PC board (not shown)
MP36	1600-1707	1	Short slot cover
MP37	1400-2120	1	Tall slot cover
MP38	16902-29101	1	Ground spring (not shown)
MP39	16900-68501	1	Fan
MP40	8160-1642	1	EMI gasket all mesh sgl rd strip psa (not shown)
MP41	8160-1641	1	EMI gasket all mesh strip aluminum (not shown)
MP42	8160-1545	1	RFI gasket nylon/urethane ni pl 4-mm-wd (not shown)
MP43	8160-1649	1	RFI gasket fingerstock be-cu 18.75-in lg (not shown)
MP44	0460-2961	1	Tape-elec 18-mm-w 0.007-inch-t PVC (not shown)
W11	16800-61609	1	Cable - CPU power
W12	54826-61606	1	Cable - acquisition signal (not shown)
W13	16901-61601	1	Motherboard switch cable
W14	16902-61608	1	Cable - hard drive power
W15	16700-61602	2	Power supply cable - for 5V and 12V supplies

7 Replaceable Parts

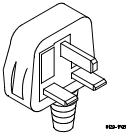
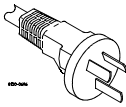
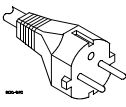
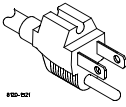
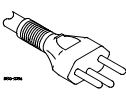
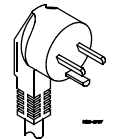
Table 5 Replaceable parts (continued)

Ref. Des.	Agilent Technologies Part Number	Qty	Description
W16	16902-61607	1	Cable assembly power 12V (not shown)
W17	E5861A	1	Multiframe Pro cable

Power Cables and Plug Configurations

This instrument is equipped with a three-wire power cable. The type of power cable plug shipped with the instrument depends on the instrument model number country of destination.

Table 6 Power Cables and Plug Configurations

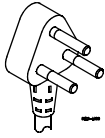
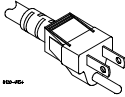
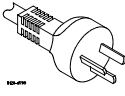
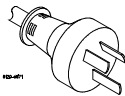
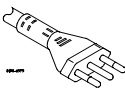
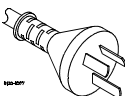
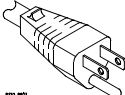
Plug Type (male connector)	Cable Part No.	Plug Orientation* (female connector)	Cable Length	Cable Color	Country
16902B-Opt 900 250V 	8120-5392	IEC 320-1 C15 (90°)	2.5 meters	Black	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore, Malaysia
16902B-Opt 901 250V 	8120-5393	IEC 320-1 C15 (90°)	2.5 meters	Black	Australia, New Zealand
16902B-Opt 902 250V 	8120-5394	IEC 320-1 C15 (90°)	2.5 meters	Black	East and West Europe, Saudi Arabia, (unpolarized in many nations)
16902B-Opt 903** 125V 	8120-5395	IEC 320-1 C15 (90°)	2.5 meters	Black	United States, Canada, Mexico, Philippines, Taiwan
16902B-Opt 906 250V 	8120-5397	IEC 320-1 C15 (90°)	2.5 meters	Black	Switzerland
16902B-Opt 912 250V 	8120-5398	IEC 320-1 C15 (90°)	2.5 meters	Black	Denmark

* Part number shown for plug is industry identifier for plug only. Number shown for cable is Agilent Technologies part number for complete cable including plug.

** These cords are included in the CSA certification approval of the equipment.

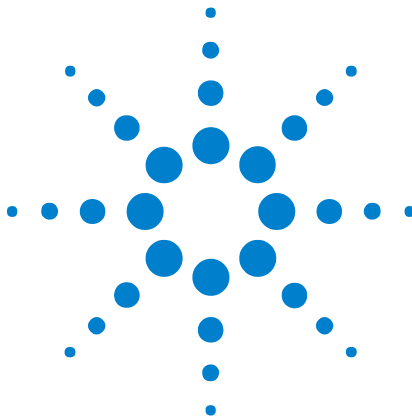
7 Replaceable Parts

Table 6 Power Cables and Plug Configurations (continued)

Plug Type (male connector)	Cable Part No.	Plug Orientation* (female connector)	Cable Length	Cable Color	Country
16902B-Opt 917 250V 	8120-5399	IEC 320-1 C15 (90°)	2.5 meters	Black	Republic of South Africa, India
16902B-Opt 918 100V 	8120-5400	IEC 320-1 C15 (90°)	2.5 meters	Black	Japan
16902B-Opt 919 250V 	8121-0955	IEC 320-1 C15 (90°)	2.5 meters	Black	Israel
16902B-Opt 920 250V 	8121-8390	IEC 320-1 C15 (Straight)	2.5 meters	Black	Argentina
16902B-Opt 921 	8120-8389	IEC 60320-1 C15 (Straight)	2.5 meters	Black	Chile
16902B-Opt 922 	8120-0953	IEC 320-1 C15 (90°)	2.5 meters	Black	People's Republic of China
16902B-Opt 927 	8121-0671	IEC 60320-1 C15 (Straight)	2.5 meters	Black	Brazil, Thailand

* Part number shown for plug is industry identifier for plug only. Number shown for cable is Agilent Technologies part number for complete cable including plug.

** These cords are included in the CSA certification approval of the equipment.



8 Theory of Operation

Block-Level Theory 88

This chapter describes the theory of operation for the 16902B logic analysis system.

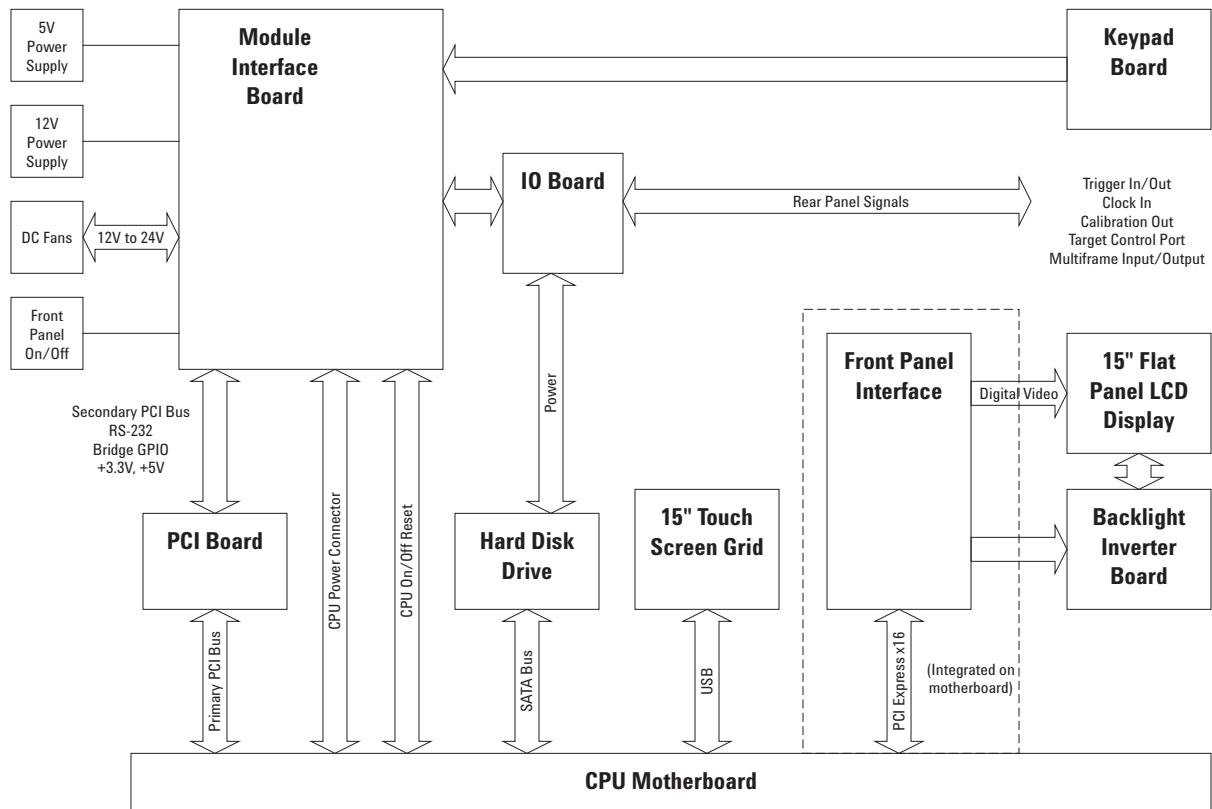
The information in this chapter is to help you understand how the logic analysis system operates. This information is not intended for component-level repair.



Block-Level Theory

The block-level theory includes the theory of operation of the logic analysis system in terms of the major subsystems including:

- CPU subsystem.
- PCI board.
- MIB (module interface board).
- I/O (input/output) board.
- Front panel assembly.



CPU Subsystem

The CPU subsystem includes the following.

- CPU board (more on [page 93](#)).
- Removable hard disk drive (more on [page 93](#)).
- Power supply (more on [page 93](#)).

PCI Board

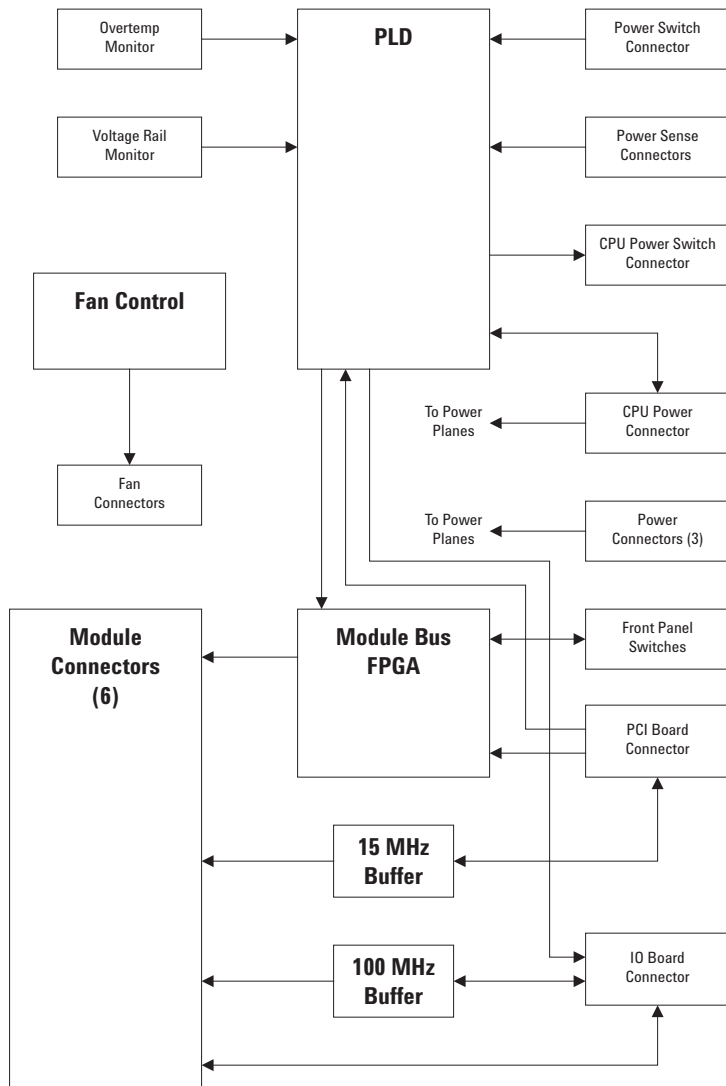
For more information on the PCI board go to [page 94](#).



Module Interface Board (MIB)

The following MIB subsystem block diagram includes:

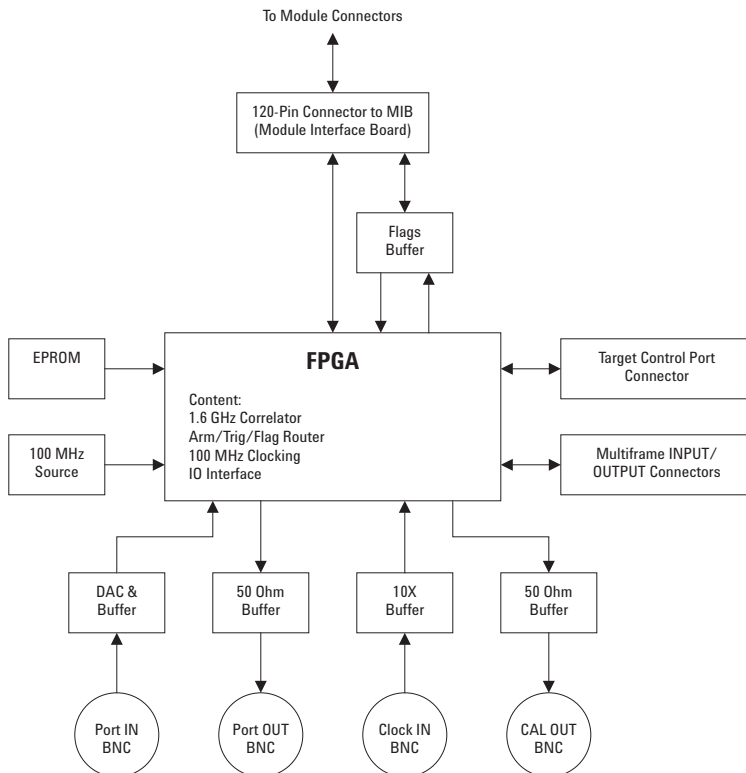
- Module bus FPGA (more on [page 94](#)).
- PLD (more on [page 94](#)).
- Voltage rail monitor (more on [page 95](#)).
- Overtemp monitor (more on [page 95](#)).
- Fan control (more on [page 95](#)).



I/O Board

The following I/O (input/output) board subsystem block diagram includes:

- FPGA (more on [page 96](#)).
- Multiframe input/output (more on [page 96](#)).
- Target control port (more on [page 97](#)).
- Trigger IN/OUT (more on [page 97](#)).
- Clock IN (more on [page 97](#)).
- Calibration OUT (more on [page 97](#)).

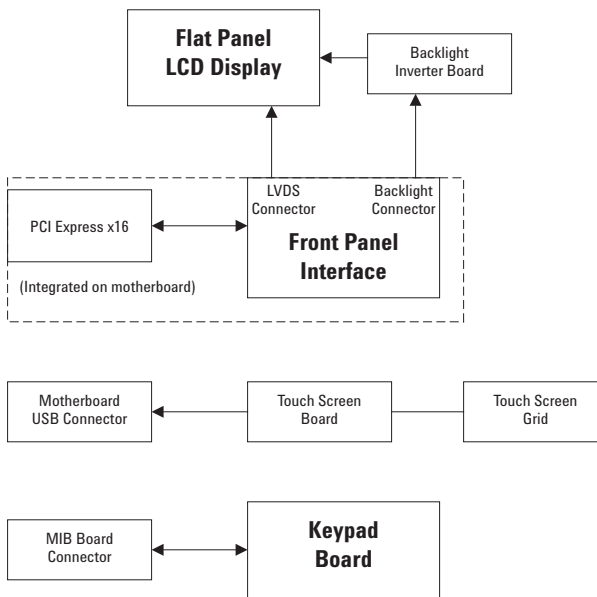


Front Panel Assembly

The front panel assembly block diagram shown here includes:

- LCD display.
- Touch screen board and grid.
- Keypad board.

For more information on the front panel assembly go to [page 98](#).



CPU Subsystem

CPU Board

The CPU motherboard is a standard microATX configuration with 1 GB of system RAM. The exact CPU and speed grade will vary over the life of the product. Standard I/Os built into the ATX board are PS/2, serial port, parallel port, USB 2.0, 10/100/1000 Mbit LAN, and VGA Video. One additional PCI slot is available for added I/O.

Removeable Hard Disk Drive

The frame contains a SATA hard drive. It is logically controlled directly from the CPU motherboard.

Power

The frame uses two modular power supplies to provide enough current for the six DC voltage rails: -12 V, +12 V, -5 V, +5 V, -3.3 V, +3.3 V. These rails use remote sensing to maintain 0.01% load regulation. The module slots are limited to 100 W each and the instrument as a whole to 900 W. This translates to 1300 W maximum draw from the outlet. Note that the instrument is shipped with a special notched power cord for the notched input receptical which prevents the use of lower current rated cords.

The frame has a "soft" power on/off algorithm. Pressing the power switch notifies the CPU to either wake up or power down. The CPU then in turn drives the signal line which actually turns the supplies on or off. A PLD monitors this process and will force a power down after approximately two minutes if the CPU does not respond. The small portion of circuitry involved in this process is powered from an auxiliary +5 V which is always present as long as the instrument is plugged in. Additional logic monitors the voltage levels on the six rails and will also cause an immediate power down if any one drops below about 90% of regulation. Power down can also be caused by an over temperature sense circuit. In this case, the PLD notifies the CPU, the user receives a warning window, and a soft power down is started. Again the PLD will force a power down if the CPU does not soft power down in about two minutes.

PCI Board

The PCI Board plugs into a CPU motherboard PCI slot, providing the interface between the CPU motherboard and the logic analyzer.

On the PCI board is a PCI bridge chip used to provide an electrical interface between the CPU PCI slot bus and the PCI device located on the Module Interface Board. A TI2050A PCI bridge chip is used to connect to the primary PCI bus on the CPU motherboard connector and provides a secondary PCI bus, which is connected via an 80-pin high-density cable from this PCI board to the Module Interface Board.

MIB (Module Interface Board)

Top Level Function

The MIB is primarily an interconnect and power distribution board. It performs some low level system monitoring and control functions such as power ON/OFF.

The MIB contains all of the logic analyzer frame specific hardware. This includes all circuits necessary to interface with measurement modules, front panel knob and keys, monitor frame functions, and interface to CPU motherboard via the PCI Board. It also performs power distribution and provides numerous interconnects.

Module Bus FPGA

The Xilinx XC3S500E FPGA is the primary bridge between the CPU and the measurement modules. It effectively performs a translation from PCI slot to the proprietary module interface bus.

PLD

The PLD is the low level system control element powered from the AUX+5V rail and continuously ON. It logically controls the soft power ON/OFF through signal lines to the CPU and power switch monitoring. It physically turns power ON/OFF via power on/off signals on the power supply sense cables. In addition to the power switch starting a power down sequence, two additional monitoring circuits (overtemp and voltage rail) may cause the PLD to initiate power down.

Both of these conditions are “latched” faults and require removing the power cord for 15 seconds to clear the condition.

Voltage Rail Monitor

All six voltage rails are continuously monitored for an under voltage fault condition. This could be caused by such things as a failed power supply or a short circuit within the instrument. When detected, both power supplies are immediately shut down. At power up, there is a one second time delay to allow the power to stabilize before the monitoring circuit is enabled.

Overtemp Monitor

A temperature monitoring circuit protects the instrument from thermal damage due to things such as failed fans or blocked frame vents. The circuit first notifies the CPU of a problem which then prompts the user with a warning message and initiates a soft power down. If the soft power down fails, a forced power down is initiated after about two minutes.

Fan Control

The instrument uses a pair of 24 V fans driven from a DC/DC boost converter circuit. This circuit creates a linear voltage ramp from 12 V to 24 V across the operating temperature range. The purpose of this circuit is to increase air flow as needed while maintaining the lowest possible fan noise.

Input/Output Board

Top Level Function

The input/output (I/O) board bridges between the frame rear panel connectors and the MIB (module interface board) from which it receives power and system interface signals.

The board has three basic purposes:

- 1 Interface hardware for the following system frame connectors:
 - Multiframe input/output.
 - Target control port.
 - Trigger in/out.

- Clock in.
 - Calibration out.
- 2 System clock generation and synchronization.
 - 3 System level functions for the module slots. Specifically:
 - Correlation.
 - Trig/arm/flag routing.

FPGA Function

The Xilinx XC2V250 FPGA is the heart of the I/O board and contains almost all of the functional logic for this module. The system interfaces directly to this part in the same way it talks to the six module slots, via a 16 bit multiplexed general purpose bus. The FPGA is loaded from an on board EPROM at power up. The EPROM contents can be changed (updated) through the system software via a JTAG port.

A major function of this FPGA component is system correlation: time alignment of the six modules and possible other modules connected through the multiframe port or trigger-in connector. This is done with eight 52-bit counters running at 1.6 GHz allowing relative time alignment of eight separate events. A 100 MHz clock is also selected from three possible sources (internal, multiframe, external) and a synchronizing signal is generated for time alignment across multiframe.

A second major function of the FPGA is the logical combination and routing of the module arm and trigger lines: ARM, TRIG, FLAG. These signals are used by the modules to start and stop each other in addition to supplying the signals for real time correlation.

The other FPGA functions include a system interface to control the input and output ports, a serial DAC programmer, and UARTs for multiframe.

Multiframe Input/Output

Multiframe is a proprietary bus used to connect multiple 16900A, 16901A, 16902A, and 16902B frames. It physically consists of two connectors (input, output) which cable frames together in a daisy chain configuration. It logically allows two or more frames to appear and operate as one large frame. A LAN connection between frames is used in addition to the multiframe cable for fast data transfer.

The bus is physically 18 LVDS differential pairs plus ground. The signals are 100 MHz clock, SYNC, START, eight flags, RUN, UARTS (receive and transmit), and "cable on" detection. They route from FPGA to FPGA across frames with no other hardware other than termination resistors.

The UARTS allow frames to communicate at a low level to identify themselves and pass IP addressing information. The "cable on" detection lets the system know when a frame has been added or removed via power up/down or cable changes. Together, these functions allow a multiframe setup to completely self-configure itself and appear as one integrated measurement system.

Target Control Port

The target control port consists of eight bi-directional LVTTTL lines driven from the FPGA through 51 Ω series dampening resistors. These lines are configured by the user as either READ or WRITE lines and are used for basic system monitoring and control. For example when driving a target system reset line or monitoring system power on.

Trigger IN/OUT

These two BNCs function as an external trigger out and arm in signaling between frames or other test equipment. The TRIGGER OUT is a simple three-state LVTTTL 50 Ω line drive circuit. TRIGGER IN (ARM) is complicated by the need to handle variable threshold levels. The circuit consists of a programmable 12-bit DAC and comparator. This combined with a level shift and divide circuit allows for a ± 5 V input range, 200 mV minimum swing, and 50 mV threshold steps.

Clock IN

This BNC input is specifically for a 10 MHz clock signal from an oscilloscope or other source. The signal is AC coupled and passed through a 10X multiplier part (low jitter) and then fed to the FPGA as one of the 100 MHz clock source choices. Using this input allows two measurement instruments to run on the same time base and maintain correct time alignment over long acquisitions.

Calibration OUT

This BNC output is a low frequency, 49 KHz, signal driven from a LVTTTL 50 Ω line driver. It is used by an external Time Correlation Fixture to simultaneously trigger multiple

frames and oscilloscopes. This is then used with a software averaging program to closely correlate the trigger point across instruments.

Front Panel Assembly

The front panel assembly is composed of three independently operating sub-systems:

- Front panel keypad board.
- Front panel interface.
- Front panel touch screen.

Front Panel Keypad Board

The front panel switches consist of five buttons and one digital encoder, the knob. When a button is pressed and released, or the knob turned, a series of codes are sent back to the module FPGA. When the module FPGA receives a front panel code, an interrupt is sent to the system CPU. The resulting ISR will read the code and act on it.

The module FPGA was used as a convenient place to put this logic. This logic operates independently of the module backplane logic also within the module FPGA.

Front Panel Interface

The front panel interface provides a connection point for flat-panel display communication.

With some motherboards, the front panel interface is integrated on the motherboard.

The front panel interface provides two connectors which are connected to a Mitsubishi 15" XGA AA150XN01 TFT-LCD 1024x768 display:

- LVDS video signals connector (CN10 on Adlink M-880 motherboard) – provides the data path back to the motherboard's graphics controller.
- Backlight inverter control connector (CN9 on Adlink M-880 motherboard) – controls the high-voltage needed to light the display backlight. This high-voltage is generated using a power inverter board, which is mounted on the front panel. This power inverter board is a TDK CXA-0384 DC-AC Inverter Unit.

Front Panel Touch Screen

Attached to the front panel assembly is a Touch Screen Control module used to implement the touch screen. The touch screen controller board is a 3M SC801U. Mounted in front of the flat panel display is a touch screen grid connected directly to the touch screen controller. The controller interprets touch presses and communicates with the host CPU via USB.

Power Up Routine

The power up routing includes the following:

- Boot sequence (more on [page 99](#)).
- Product install (more on [page 102](#)).
- Software recovery methods (more on [page 102](#)).
- Self test (more on [page 103](#)).

Boot Sequence

The 16902B logic analysis system ships with the Windows XP Professional operating system. After power is applied to the frame, the basic input/output system (BIOS) is the first thing to run. Among other things, the BIOS is responsible for enumerating plug-and-play (PnP) devices in the system and doing a "power on self test" (POST). All of the CPU (motherboard) RAM is checked during POST; however, subtle memory problems may not be detected by this simple test. If any hardware that the BIOS detects is malfunctioning at a fundamental level, then the BIOS reports an error to the display (if available) If things are OK control is turned over to the operating system.

The BIOS startup screen will be displayed on the LCD panel.

During startup, the Agilent logo is displayed by the system BIOS, then a few other messages, and finally the preliminary Windows XP startup screens.

During the first phase of the Windows startup, the kernel is loaded along with various system drivers. Prior to the video drivers loading, video is only displayed to the same video device as the BIOS startup screen. Once the video drivers load, the resolution will switch and eventually a logon screen will be presented. The logon screen will appear on whichever video adapter (LCD or external VGA) was displaying the Windows desktop when the system was last shut down.

It is possible to get a blue rectangle with an Agilent logo in it that says the current display is not active. In this situation, you can press and hold the "Touch Off" button on the front panel to switch to the other display. At any time either the LCD panel or the external monitor will have the Windows desktop displayed to it. It is also possible, but not typical, for the Windows desktop to be stretched across both the LCD and external monitor. The "Touch Off" front panel button can be pressed and held to force the desktop to use either the LCD or external monitor exclusively.

By the time Windows has presented the Windows logon screen to the user, two critical pieces of Agilent-specific software should already be running:

- Logic analyzer device drivers.
- Logic analyzer service.

The remaining critical piece of Agilent software (the GUI application itself) does not run until a user has logged onto the machine and started the application by clicking on the shortcut on the Windows desktop and/or the Windows start menu. The GUI application may auto-run when a user logs onto the machine.

The logic analyzer device drivers communicate directly with all of the hardware. This includes the frame hardware and all modules plugged into the frame. All other Agilent software in the system communicates with the drivers in order to access the hardware. Therefore, missing drivers look like missing hardware to the Agilent software. The frame power button LED will flash when the frame is first powered on and become steady once the frame drivers have loaded. A flashing power button LED should indicate:

- 1 The frame is in the middle of a power up or power down sequence.
- 2 The frame hardware was not recognized by the PnP system.
- 3 The frame drivers are missing.

Once the Windows kernel and the system drivers are loaded, a variety of Windows services (background processes) are started automatically by the system. These services are like UNIX/Linux daemons. They run silently in the background in order to provide system services. They run before any user has logged onto the system. If the logic analyzer product is installed on the system, a logic analyzer service called "Agilent Logic Analysis" should be running.

The logic analyzer service carries the following general responsibilities:

- System manager for the local frame.
- Communicates with local GUI application software.
- Listens for connection requests across the LAN (remote connect from other systems).
- Initialization of all local frame hardware including modules. This initialization includes loading of all FPGAs that are not loaded directly by boot-EEPROMs when power is first applied to the system.
- Hardware monitoring.
- Control over the "Touch Off" and "Keyboard" front panel buttons (if applicable).

The logic analyzer service must be started and fully initialized before the application software will be allowed to run. The logic analyzer drivers are not required for the application software to run – however the software will not be able to go online with the local hardware until the drivers are installed/running. In addition, other machines will not be able to remote connect to the machine and use its hardware if the drivers are not installed and running.

Because the service should always be running regardless of whether any user is logged onto the system, the logic analyzer should always be responsive to remote connection requests from other machines. The Touch Off and Keyboard buttons should also always function.

When the GUI application is launched by a logged on user, the application (by default) will attempt to connect to local hardware and go "online". If the service is not started, the application should either wait for the service to start (newer software revisions) or generate a message box indicating the service needs to be started (older software revisions). If the drivers are not loaded, the GUI application will start in offline mode.

Once the GUI application is running, the user can go online with local hardware or the hardware in any other Agilent 168x/169x/1690x/168xx logic analyzer running the same version of the logic analyzer software. The remote machine must be available on the network.

Product Install

The product install (SetupLAXxxx.exe) performs the following:

- Install the logic analyzer-specific files to the local hard drive.
- Register the application with the operating system (various registry settings are applied including COM registration).
- Create start menu/desktop shortcuts.
- Install device drivers.
- Install and start the service.
- Check frame boot-EEPROMs (non-volatile ROMs) and verify they are up-to-date. Reloads the boot-EEPROMs if necessary.

Software Recovery Methods

1 Logic analyzer product re-installation

Re-installing the logic analyzer product requires running the setup executable file – typically named SetupLAXxxx.exe. For example, the 03.70 software release file will be called SetupLA0370.exe.

During the installation of the product, older versions are automatically removed and replaced with the newer version. However, if you need to install an older version of the software over a newer version you must first uninstall the newer version. To uninstall the software, go to Windows **Start>Control Panel>Add or Remove Programs**. Select the logic analyzer software from the list of installed programs and select uninstall.

This recovery mechanism is used to fix problems with the logic analyzer software including application crash problems or problems with hardware recognition.

2 Full hard drive (system-level) recovery:

This is done by placing the appropriate recovery DVD into an external USB DVD-ROM drive and rebooting the analyzer. When the system begins booting after shutting down, the recovery sequence will begin. After addressing the introduction screens, the recovery DVD will erase all data on the hard drive and image the disk back to the state it was in when the customer received it. After a full

hard drive recovery, the logic analyzer software may or may not already be installed (depending on the version of the recovery DVD used).

This recovery mechanism is used to fix system-level problems – including damage done by viruses or previously-installed software, problems with operating system bugchecks (blue screen), etc.

Self Test

The logic analyzer does very little self test unless it is explicitly run by the user. As previously mentioned, the system BIOS does some hardware self test before turning control over to the operating system.

Once a user logs into the system and runs the logic analyzer GUI application software, self tests can be run by clicking on the "Help" menu within the application and then selecting "Self Test".

All self tests are consolidated into a single self test dialog.

The self test dialog contains a pane which allows the user to select the "test suite" and a pane which allows the user to select a specific test within that suite – or all of the tests. The tests can be run once or repetitively. Each card will have its own suite of tests. The frame hardware itself has a suite called "System".

At the bottom of the self test dialog is a results pane. The reporting level (how verbose the tests are) can be controlled using a slider bar at the top of the dialog. At the very least, each test should report that it is running and what the final status of each test was (pass or fail). Increasing the reporting level and re-running certain tests may help isolate a specific hardware failure in the event that a test fails.

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