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# Service Guide

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## 80000 Series Infiniium Oscilloscopes

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## The Agilent Technologies Infiniium Oscilloscope at a Glance

### Ease of use with high performance

The Agilent Technologies Infiniium oscilloscopes combine unprecedented ease-of-use with high-performance digitizing oscilloscope functionality to simplify your design and analysis measurement tasks.

- Traditional oscilloscope front-panel interface provides direct access to the controls needed for most troubleshooting tasks.
- Graphical user interface with menus, windows, dialogs, and toolbars provides easy access to dozens of configuration and analysis tools, ensuring you can set up and make the most complex measurements.
- All models offer 20 GSa/s sampling rate on all four channels, or 40 GSa/s sampling rate in two-channel mode.
- Models with bandwidths from 2 GHz to 13 GHz.

### Display shows waveforms and graphical user interface

- Graphical interface allows direct interaction with waveforms, including drag-and-drop positioning and instant waveform zoom.
- Touchscreen display allows oscilloscope operation without an external pointing device.
- Waveforms displayed in color, making correlation easy.
- Current configuration parameters displayed near the waveform display and are color-coded to make identification easy.
- Graphical interface menus and toolbars simplify complex measurement setups.

### Horizontal controls set sweep speed and position

- Main sweep speeds from 5 ps/div to 20 s/div.
- Delayed sweep speeds from 1 ps/div to main time base setting.
- Intensified waveforms on main sweep window make it easy to see what will appear in delayed sweep window.

### Acquisition and general controls start and stop the scope and do basic setup

- Run and stop controls for continuous or single-shot acquisitions.
- Clear display before one or more acquisitions.
- Default setup and Autoscale set initial configuration.

### Hard disk drive and USB 2.0 port for saving and restoring setups and measurement results

- Store measurement displays for inclusion in reports and test setup guides.
- Store oscilloscope setups to repeat tests another time.
- Hard disk stores oscilloscope operating system.

### Trigger setup controls set mode and basic parameters

- Select Edge, Glitch, or Advanced Modes.
- Choose input source and slope.
- Use graphical user interface to simplify configuration of pattern, state, delay, and violation trigger modes.
- Use auxiliary trigger to increase triggering flexibility.

### Vertical controls set attenuation, and position

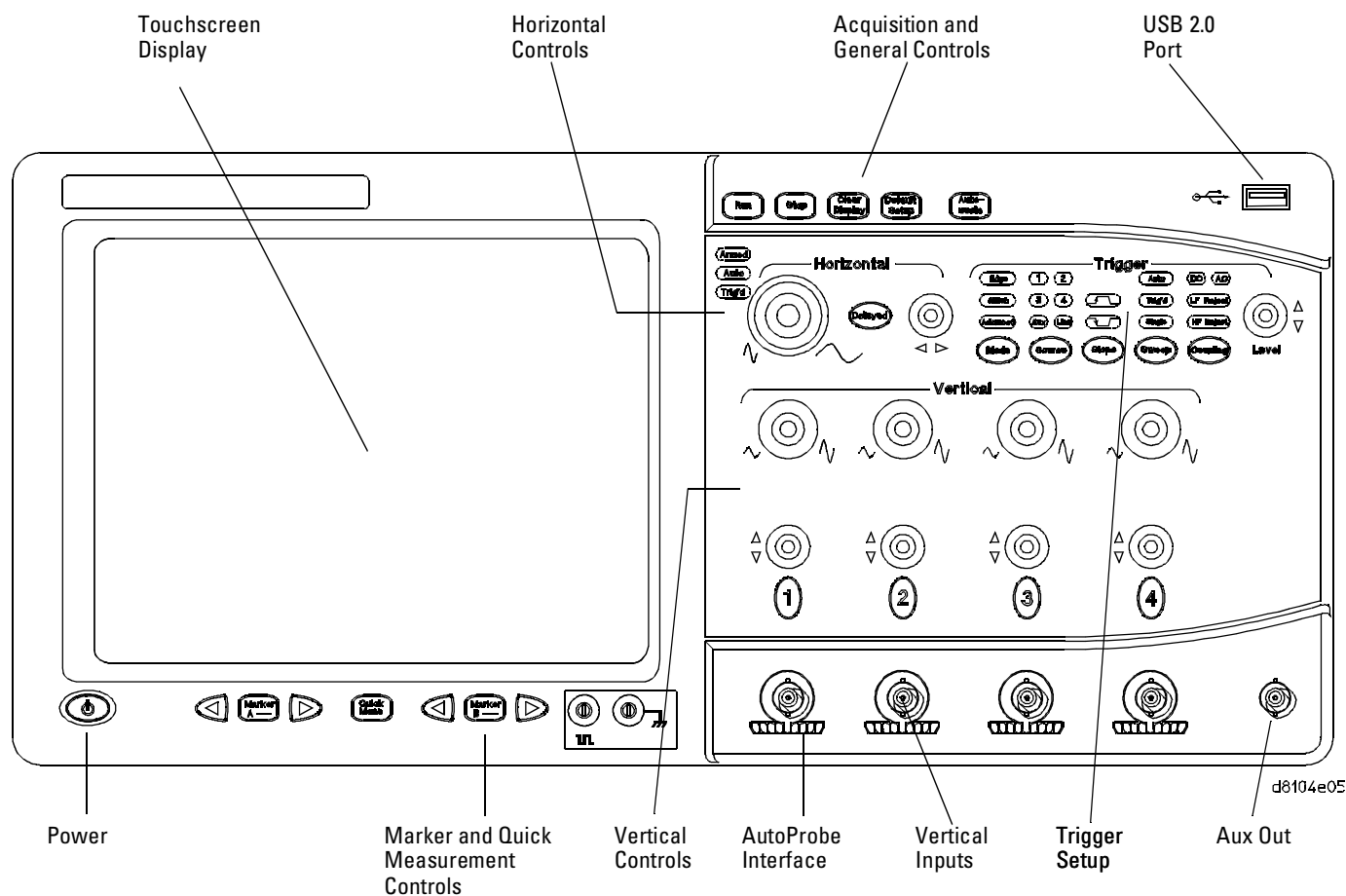
- Input attenuation adjustable from 1 mV/div to 1 V/div.
- Color-coded knobs make it easy to find the controls that affect each waveform.

### Marker and quick measurements help measure waveform parameters

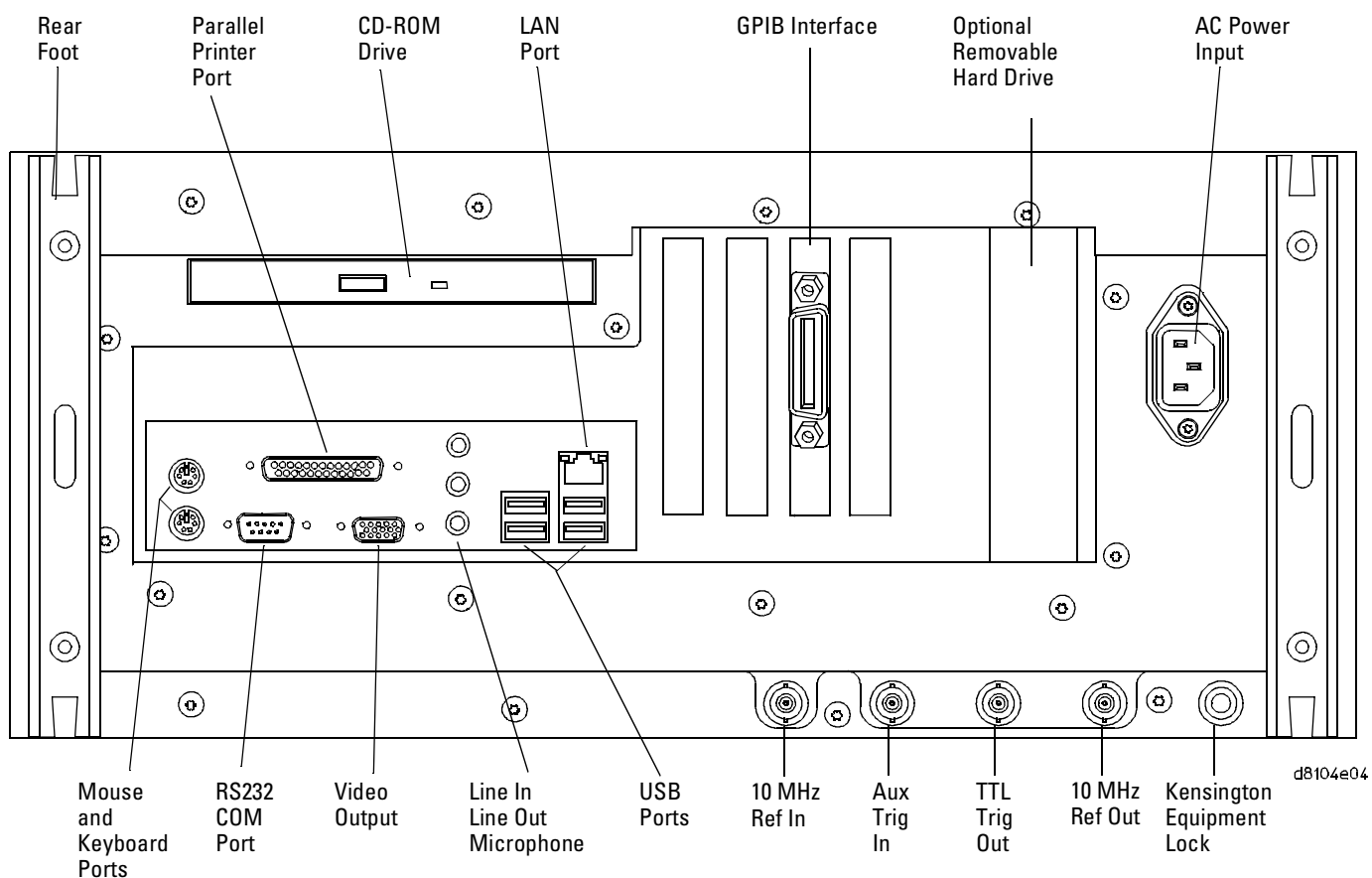
- Waveform markers A and B to check voltage or  $\Delta$ -time at any point on the displayed waveform.
- Quick Meas executes up to four predefined measurements instantly.

### Service Policy

The service policy of this instrument requires replacing defective assemblies. Some assemblies can be replaced on an exchange basis.



**80000 Series Oscilloscope Front Panel**



## 80000 Series Oscilloscope Rear Panel

Note: Your instrument's rear panel configuration may differ from this diagram.

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## In This Book

This book provides the service documentation for the Agilent Technologies 80000 Series oscilloscopes. It is divided into eight chapters.

Chapter 1, "General Information," provides information about which oscilloscopes are covered by this manual, environmental requirements, and oscilloscope dimensions.

Chapter 2, "Setting Up the Oscilloscope," explains how to prepare the oscilloscope for use.

Chapter 4, "Testing Performance," provides information about testing the oscilloscope to verify that it performs according to specifications.

Chapter 3, "Calibration," explains how and when you should run the user calibration procedure.

Chapter 5, "Troubleshooting," provides information about how to identify defective assemblies.

Chapter 6, "Replacing Assemblies," gives the procedures and techniques for replacing defective parts.

Chapter 7, "Replaceable Parts," includes a list of exchange assemblies and other replaceable parts, part ordering information, and shipping information.

Chapter 8, "Theory of Operation," briefly describes the internal operation of the oscilloscope.

At the back of the book you will find safety notices.



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## General Information

This chapter of the *Agilent Technologies Infiniium Oscilloscope Service Guide* gives you general information about the oscilloscope. The following topics are covered in this chapter.

- Instruments covered by this guide
- How to determine whether the instrument is under warranty
- Accessories
- Where to find the oscilloscope's specifications
- Environmental conditions and measurement category
- Oscilloscope dimensions

## Instruments covered by this service guide

Oscilloscopes manufactured after the date this manual was released may be different from those described in this manual. The release date of this manual is shown on the title page. This manual will be revised when necessary.

If you have an oscilloscope that was manufactured after the release of this manual, please check the Agilent Technologies website at [www.agilent.com](http://www.agilent.com) to see whether a newer version of this manual is available. You can perform a search for your oscilloscope's model number, go to its product page, and select Library.

You can determine the year the oscilloscope was manufactured by examining the serial number label that is affixed to the rear panel of the oscilloscope. The serial number is composed of two parts. The first part contains two letters and two numbers that signify the oscilloscope's county of origin and year date code. A year date code of "05" indicates that the oscilloscope was manufactured in 2005. The second part of the serial number contains a rolling number that is different for each oscilloscope.

The following 80000-Series oscilloscopes are covered in this guide. These four-channel digitizing oscilloscopes feature 40 GSa/s sample rate in 2-channel mode, and 20 GSa/s sample rate in 4-channel mode.

**Table 1 -1**

**Oscilloscopes Covered by this Service Guide**

Model	Bandwidth
DSO81304B	13 GHz bandwidth
DSO81204B	12 GHz bandwidth
DSO81004B	10 GHz bandwidth.
DSO80804B	8 GHz bandwidth
DSO80604B	6 GHz bandwidth
DSO80404B	4 GHz bandwidth
DSO80304B	3 GHz bandwidth.
DSO80204B	2 GHz bandwidth

The oscilloscope can be identified by the product number on the front or rear panel.

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## To determine whether the oscilloscope is under warranty

You can check your instrument's warranty status at [www.agilent.com](http://www.agilent.com). All you need is access to the world wide web and the instrument's model and serial numbers.

At the time this manual was published, the following steps brought you to the "Check Warranty Status" web page on [www.agilent.com](http://www.agilent.com).

- 1** Direct your web browser to [www.agilent.com](http://www.agilent.com).
- 2** Select the "Products & Services" heading.
- 3** Select "Test & Measurement Equipment."
- 4** Select "Repair, Calibration & Applications Services."
- 5** Select "Warranty & Service Agreements."
- 6** Select "Check Warranty Status."
- 7** Type in your oscilloscope's model number and serial number.
- 8** Select "Submit." The warranty status of your oscilloscope will be displayed.

If these navigation steps no longer work because of changes to the [www.agilent.com](http://www.agilent.com) website, then search for "warranty status" at [www.agilent.com](http://www.agilent.com) to find the "Check Warranty Status" web page.

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## Accessories supplied

The following accessories are supplied.

- Mouse, Agilent part number 1150-7913
- Stylus, Agilent part number 1150-7997
- Keyboard, Agilent part number 1150-7809
- Accessory Pouch, Agilent part number 54810-68701
- Front-panel Cover, Agilent part number 54810-42201
- Calibration Cable Assembly, Agilent part number 54855-61620
- Precision 3.5 mm Adapters (qty 2), Agilent part number 54855-67604
- Probe De-skew and Performance Verification Kit, Agilent E2655B
- Power Cord (see chapter 6, “Replaceable Parts,” for available power cords)
- *User's Quick Start Guide*

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## Options and Accessories Available

For a complete list of available options and accessories see Agilent Technologies publication number 5989-4604ENUS: *Infiniium 80000B Series Oscilloscopes Data Sheet*.

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## Specifications & characteristics

For complete specifications and characteristics, direct your web browser to [www.agilent.com](http://www.agilent.com) and perform a search for the oscilloscope's model number. Then select “Data Sheets” from the Library.

Specifications that are pertinent to each test are given in the "Testing Performance" chapter.

Specifications are valid after a 30 minute warm-up period, and within  $\pm 5^{\circ}\text{C}$  from the temperature at which the last self-calibration was performed.

## Environmental Conditions

### Overvoltage Category

This product is intended to be powered by MAINS that comply to Overvoltage Category II, which is typical of cord-and-plug connected equipment.

### Pollution Degree

The 80000 Series Oscilloscope may be operated in environments of Pollution Degree 2 (or Pollution Degree 1).

### Pollution Degree Definitions

Pollution Degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. Example: A clean room or climate controlled office environment.

Pollution Degree 2: Normally only dry non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation may occur. Example: General indoor environment.

Pollution Degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. Example: Sheltered outdoor environment.

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## Measurement Category



### Measurement Category

The 80000 Series oscilloscope is intended to be used for measurements in Measurement Category I.

### Measurement Category Definitions

Measurement category I is for measurements performed on circuits not directly connected to MAINS. Examples are measurements on circuits not derived from MAINS, and specially protected (internal) MAINS derived circuits. In the latter case, transient stresses are variable; for that reason, the transient withstand capability of the equipment is made known to the user.

Measurement category II is for measurements performed on circuits directly connected to the low voltage installation. Examples are measurements on household appliances, portable tools and similar equipment.

Measurement category III is for measurements performed in the building installation. Examples are measurements on distribution boards, circuit-breakers, wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and equipment for industrial use and some other equipment, for example, stationary motors with permanent connection to the fixed installation.

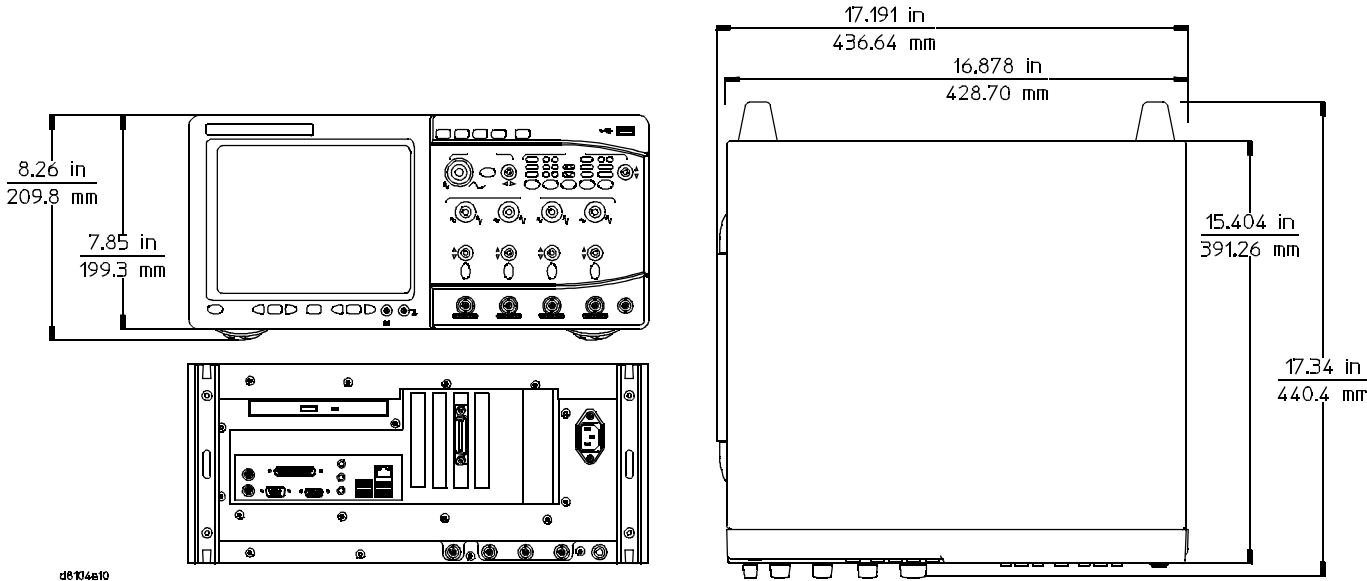
Measurement category IV is for measurements performed at the source of the low-voltage installation. Examples are electricity meters and measurements on primary overcurrent protection devices and ripple control units.

### Transient Withstand Capability

The maximum transient withstand capability of this instrument is not specified. Do not apply more than 5 volts rms at the oscilloscope's vertical input BNC connectors.

# Oscilloscope Dimensions

The following pictures shows the dimensions of the frame.







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# Setting Up the Oscilloscope

This chapter shows you how to set up your Infiniium oscilloscope, connect power and accessories, and verify general operation.

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## To inspect package contents

- ❑ Inspect the shipping container for damage.

Keep a damaged shipping container or cushioning material until you have inspected the contents of the shipment for completeness and have checked the oscilloscope mechanically and electrically.

- ❑ Verify that you received the following items in the Infiniium Oscilloscope packaging.

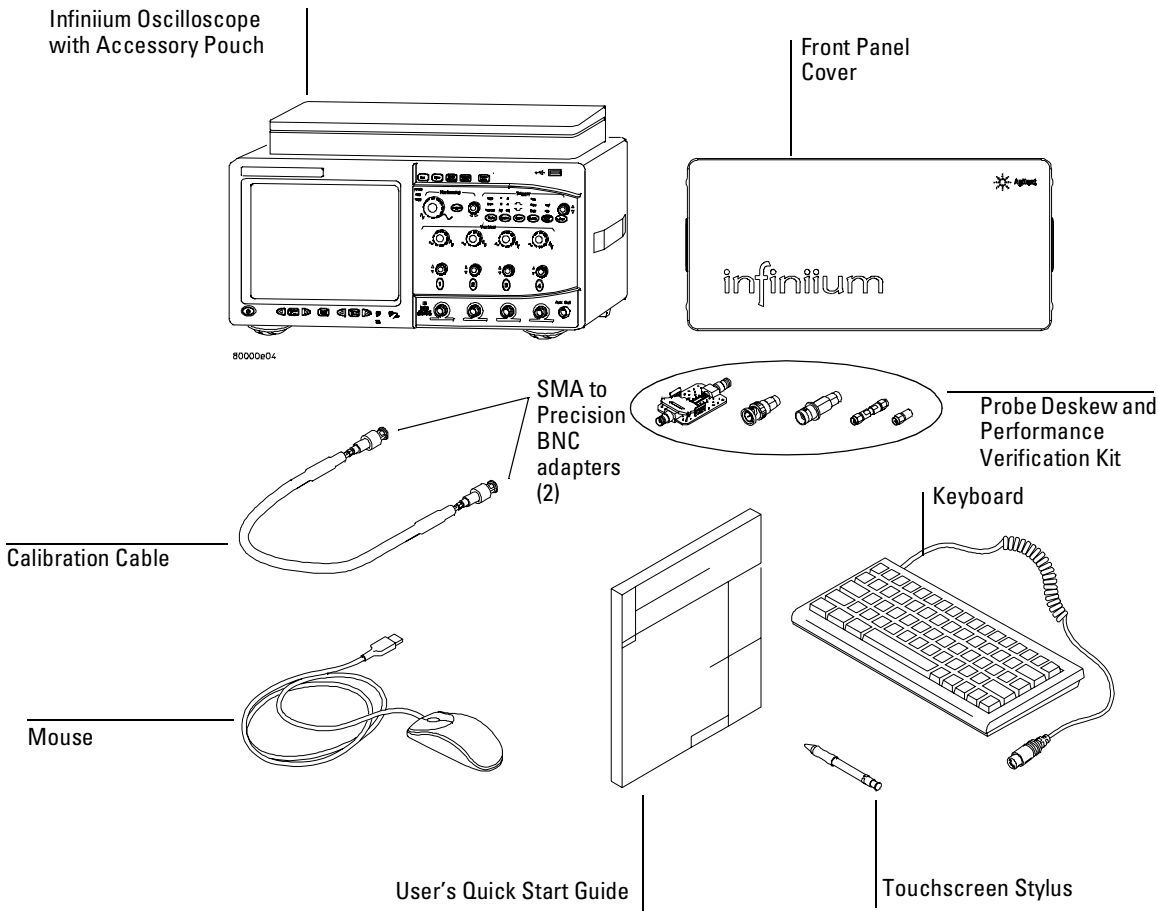
- Infiniium Oscilloscope
- Mouse, Agilent part number 1150-7913
- Stylus, Agilent part number 1150-7997
- Keyboard, Agilent part number 1150-7809
- Accessory Pouch, Agilent part number 54810-68701
- Front-panel Cover, Agilent part number 54810-42201
- Calibration Cable Assembly, Agilent part number 54855-61620
- Precision 3.5 mm Adapters (quantity 2), Agilent part number 54855-67604
- Probe De-skew and Performance Verification Kit, Agilent E2655B
- Power Cord (see chapter 6, “Replaceable Parts,” for available power cords)
- *User's Quick Start Guide*

The *Programmer's Guide* and this *Service Guide* are included on the oscilloscope's hard drive.

See Figure 2-1. (See table 2-4 for the power cord.) If anything is missing, contact your nearest Agilent Technologies Sales Office. If the shipment was damaged, contact the carrier, then contact the nearest Agilent Technologies Sales Office.

- ❑ Inspect the oscilloscope.
  - If there is mechanical damage or a defect, or if the oscilloscope does not operate properly or does not pass performance tests, notify your Agilent Technologies Sales Office.
  - If the shipping container is damaged, or the cushioning materials show signs of stress, notify the carrier and your Agilent Technologies Sales Office. Keep the shipping materials for the carrier's inspection. The Agilent Technologies Sales Office will arrange for repair or replacement at Agilent's option without waiting for claim settlement.
- ❑ Verify that you received the options and accessories you ordered and that they are not damaged.

Figure 2-1



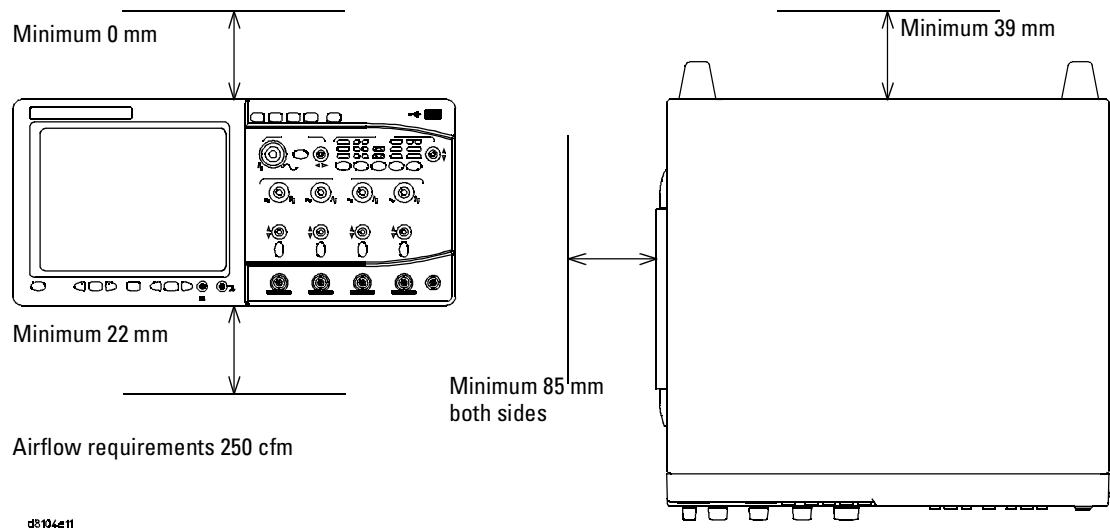
Package Contents for the Infiniium Oscilloscope

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## To connect power

- 1 Position the oscilloscope where it will have sufficient clearance for airflow around the top, back, and sides.
- 2 Position the oscilloscope so that it is not difficult to unplug the power cord.

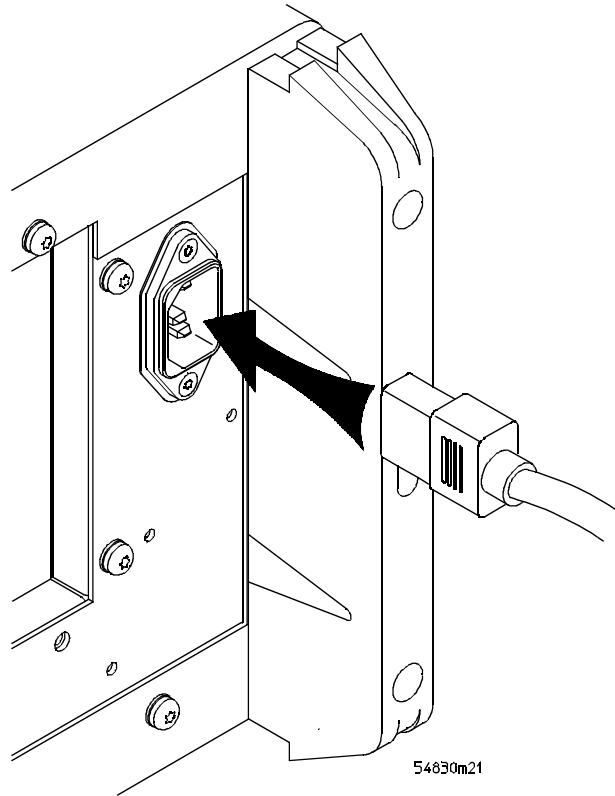
**Figure 2-2**



### Positioning the Infiniium Oscilloscope with Sufficient Clearance

- 3 Connect the power cord to the rear of the oscilloscope, then to a suitable AC voltage source (100 to 240 VAC  $\pm 10\%$ , 47 to 63 Hz).  
Maximum power dissipation: 550 W.

**Figure 2-3**





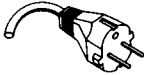


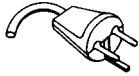


#### **Infiniium Oscilloscope Power Cord Connection**

The oscilloscope power supply automatically adjusts for line input voltages in the range 100 to 240 VAC. Therefore, you do not need to adjust an input line voltage setting. The line cord provided is matched by Agilent Technologies to the country of origin of the order.

- 4** Ensure that you have the correct line cord. See table 2-4.

Chapter 2: Setting Up the Oscilloscope  
To connect power

Table 2-4

Power Cords						
	Plug Type	Cable Part No.	Plug Description	Length (in/cm)	Color	Country
250V		8120-1351	Straight *BS1363A	90/228	Gray	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore
		8120-1703	90°	90/228	Mint Gray	
250V		8120-1369	Straight *NZSS198/ASC	79/200	Gray	Australia, New Zealand
		8120-0696	90°	87/221	Mint Gray	
250V		8120-1689	Straight *CEE7-Y11	79/200	Mint Gray	East and West Europe, Saudi Arabia, So. Africa, India (unpolarized in many nations)
		8120-1692	90°	79/200	Mint Gray	
		8120-2857	Straight (Shielded)	79/200	Coco Brown	
125V		8120-1378	Straight *NEMA5-15P	90/228	Jade Gray	United States, Canada, Mexico, Philippines, Taiwan
		8120-1521	90°	90/228	Jade Gray	
		8120-1992	Straight (Medical) UL544	96/244	Black	
250V		8120-2104	Straight *SEV1011	79/200	Mint Gray	Switzerland
		8120-2296	1959-24507	79/200	Mint Gray	
220V		8120-2956	Straight *DHCK107	79/200	Mint Gray	Denmark
		8120-2957	90°	79/200	Mint Gray	
250V		8120-4211	Straight SABS164	79/200	Jade Gray	Republic of South Africa India
		8120-4600	90°	79/200		
100V		8120-4753	Straight MITI	90/230	Dark Gray	Japan
		8120-4754	90°	90/230		

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

## To connect the mouse, keyboard, LAN, printer, and GPIB cable

Mouse. Plug the mouse into the mouse connector on the rear panel of the oscilloscope.

While you can operate many oscilloscope functions using only the front-panel keys and knobs, you will need the mouse to access advanced oscilloscope functions through the graphical interface, or to find out more about the oscilloscope through the built-in information system.

Keyboard. Plug the keyboard cable into the keyboard connector on the rear panel of the oscilloscope.

A keyboard must be plugged into the oscilloscope before the Windows operating system has started booting.

LAN Cable. Connect your LAN cable to the RJ-45 connector on the rear panel of the oscilloscope.

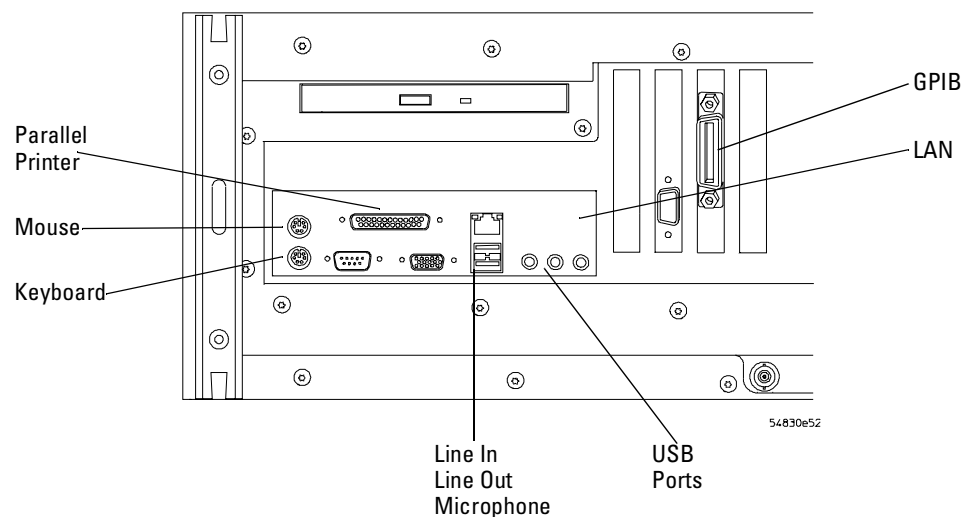
Depending on your building's LAN configuration, you may need to set up the oscilloscope's network configuration after connecting the LAN cable to the oscilloscope. If your building's network uses DHCP, many parameters will already be compatible. Before you set up the network configuration, you should exit the oscilloscope application. If you do not know how to setup the network, see your network administrator or use the Windows XP on-line help.

Printer Cable. If you have a USB printer, you will need to connect its cable to one of the four USB ports on the rear panel, or to the USB port on the front panel.

If you have a parallel printer, you will need to connect its parallel printer cable to the Parallel Printer connector on the oscilloscope.

GPIB Cable. If you will be controlling the oscilloscope through the GPIB, attach your GPIB cable to the GPIB connector on the rear of the oscilloscope.

Figure 2-5



### Rear Panel

Note: Your instrument's rear panel configuration may differ from this diagram. Connect the cables based on your instrument's configuration.

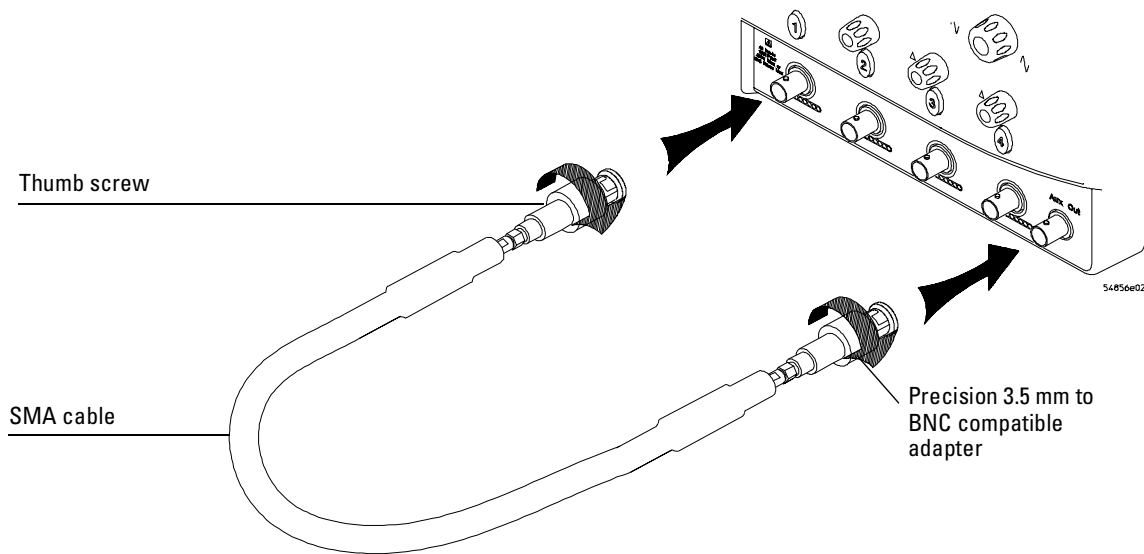
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## To connect SMA Cables

You can connect an SMA cable to the Infiniium oscilloscope using precision 3.5 mm to BNC compatible adapters.

- 1 Attach the two precision 3.5 mm to BNC compatible adapters to the ends of an SMA cable.
- 2 Push the precision 3.5 mm to BNC compatible adapters onto the oscilloscope BNC connectors.
- 3 Tighten the thumbscrews until they are snug.

**Figure 2-6**



**Connecting SMA to BNC adapters**

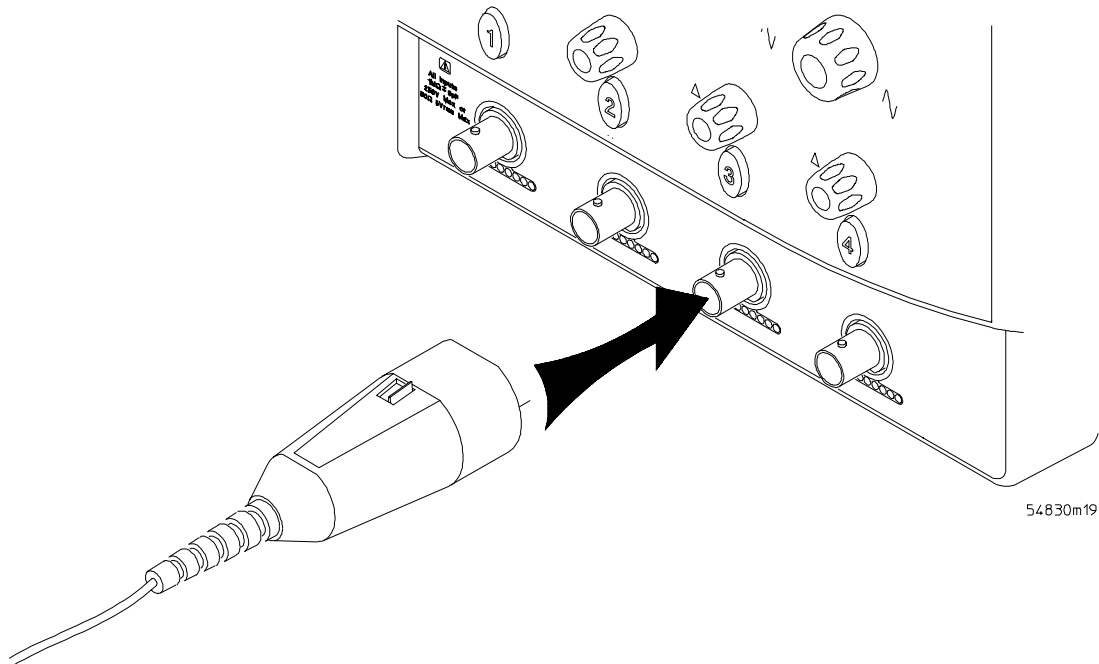


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## To connect optional InfiniiMax oscilloscope probes

- 1 Attach the probe connector to the desired oscilloscope channel or trigger input. Push it straight on until it latches into place.

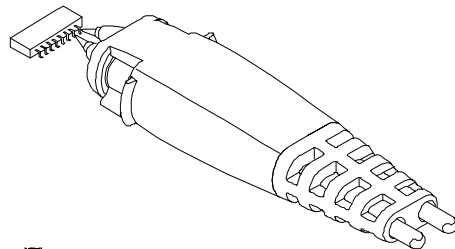
**Figure 2-7**



### Attaching the Probe Connector

- 2 Connect the probe to the circuit of interest using the browser or other probing accessories.

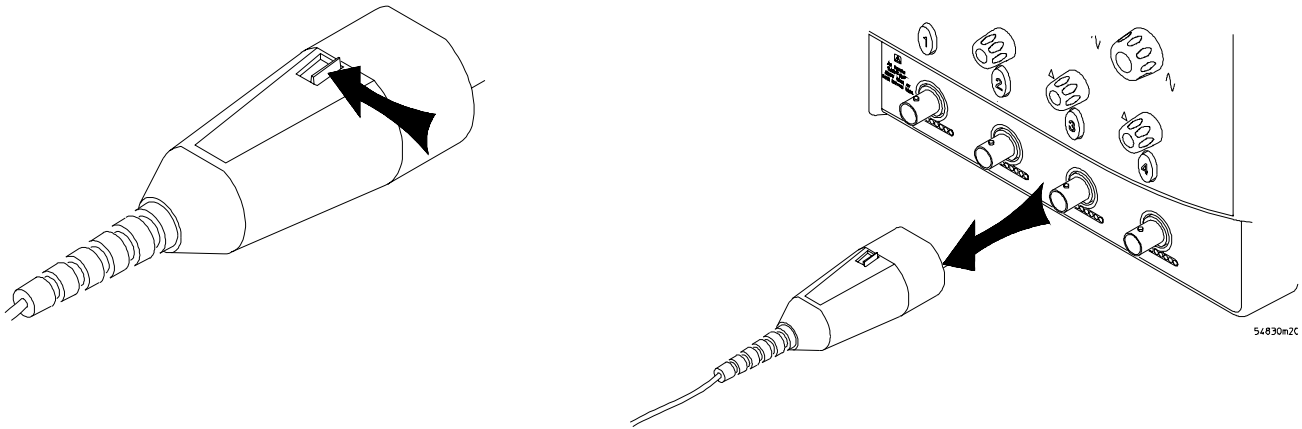
**Figure 2-8**



### Probing the Circuit

- 3 To disconnect the probe, push the small latch on top of the probe connector to the left, then pull the connector body away from the front panel of the oscilloscope without twisting it.

**Figure 2-9**



**Disconnecting the Oscilloscope Probe**

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**CAUTION**

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Do not attempt to twist the snap-on probes on or off the oscilloscope's BNC connector. Twisting the probe connector body will damage it.

---

**CAUTION**

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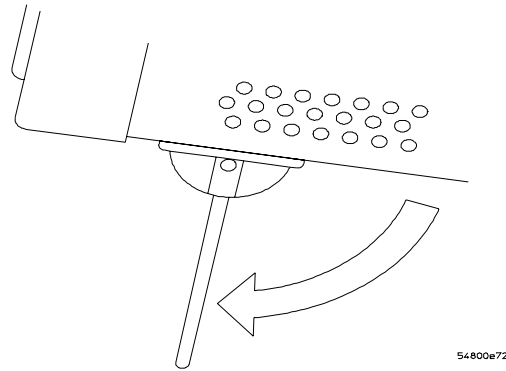
For the 8000 series oscilloscopes do not exceed the maximum input voltage rating. The maximum input voltage for 50  $\Omega$  inputs is 5 Vrms, CAT I. Maximum voltage at 1 M $\Omega$  impedance is  $\pm 100$  V (DC + AC) [AC < 10 kHz], CAT I.

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## To tilt the oscilloscope upward for easier viewing

- 1 Lift up the front of the oscilloscope, grasp the wire bail near the center, and pull it down and forward until it latches into place.

**Figure 2-10**



**Latching the Oscilloscope Front Feet**

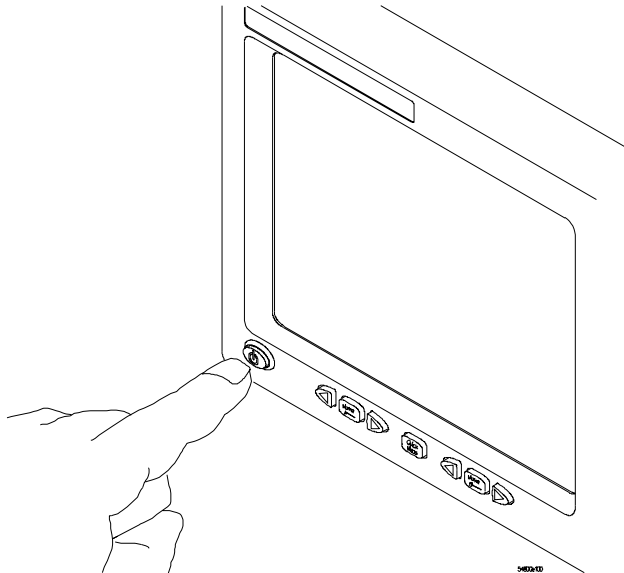
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## To turn on the oscilloscope

The first time that you turn on the oscilloscope, you will need to accept the Microsoft end user license agreement for Windows XP if prompted to do so.

- 1 Hook up all cables and accessories before applying power. You can connect and disconnect probes while the oscilloscope is turned on.
- 2 Depress the power switch in the lower left corner of the oscilloscope front panel.

**Figure 2-11**



### Turning on the Oscilloscope

After a short initialization period, the oscilloscope display appears. The oscilloscope is ready to use.

---

## Screen Saver

If the oscilloscope power is on, but the display is blank, then the screen saver has blanked the display to extend the life of the display back lights. To illuminate the display, press any key on the front panel.

The screen saver “Wait” time can be changed. To change the screen saver delay (Wait) time:

- a** Minimize the oscilloscope application
- b** Right-click on the Windows desktop.
- c** Select “Properties.”
- d** Select the “Screen Saver” tab.
- e** Type the desired delay in the “Wait” field.
- f** Select “OK.”

Do not disable the screen saver. It extends the life of the display’s back lights by shutting them off when the oscilloscope is not being used for long periods of time.

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## To turn off the oscilloscope

- 1** Momentarily depress the power switch at the lower left corner of the oscilloscope front panel. The oscilloscope will go through a normal Windows shutdown process.

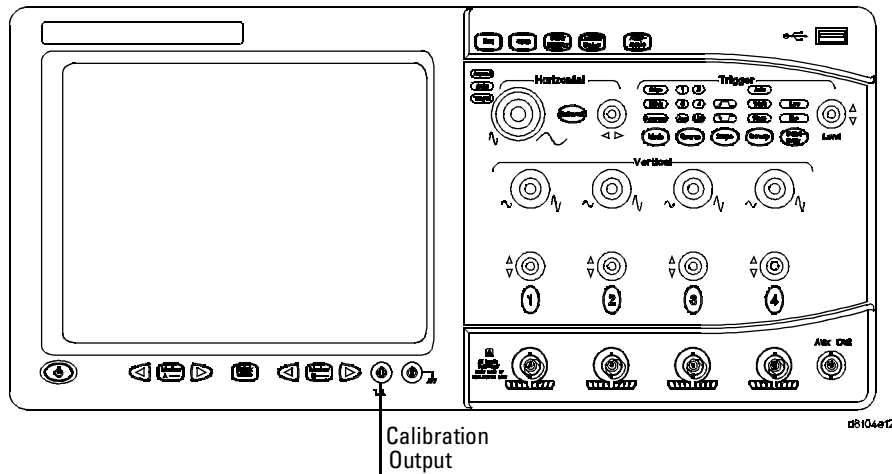
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## To verify basic oscilloscope operation

- 1 Connect an oscilloscope probe to channel 1.
- 2 Attach the probe to the probe compensation output on the front panel of the oscilloscope.

Use a probe grabber tip so you do not need to hold the probe. The probe compensation output is marked with a square wave symbol.

**Figure 2-12**



### Verifying Basic Oscilloscope Operation

- 3 Press the Default Setup key on the front panel.  
The display will pause momentarily while the oscilloscope is configured to its default settings.
- 4 Press the Autoscale key on the front panel.  
The display will pause momentarily while the oscilloscope adjusts the sweep speed and vertical scale. You should then see a square wave with an amplitude of approximately 1.1 Vpp at about 700 to 800 Hz. If you do not see the waveform, ensure your power source is adequate, the oscilloscope is powered-on, and the probe is connected securely to the front-panel channel input BNC and to the probe calibration output.
- 5 Move the mouse around the mouse surface and verify that the on-screen mouse pointer coincides with the mouse movement.

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## Installing application programs on Infiniium

Infiniium is an open Windows system. This allows you to install your own application software. Agilent has verified that the following applications are compatible with the Infiniium oscilloscope application.

- Agilent Vector Signal Analysis
- Agilent VEE Pro
- Amherst Systems Oscilloscope Tools
- Microsoft Office 2000
- MathWorks MATLAB
- Mathsoft MathCad 2001i
- McAfee VirusScan
- Symantec Norton AntiVirus

Before installing any software, you should exit the oscilloscope application.

If you install an application other than those which Agilent has tested, it is possible that it could break the oscilloscope application. This would require you to reinstall the oscilloscope application. Refer to the *Infiniium Oscilloscope User's Quick Start Guide* for instructions on reinstalling the oscilloscope application.

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## Changing Windows System Settings

Before changing any Windows System settings outside of the oscilloscope application you should **Exit** the oscilloscope application.

There are several Windows System settings that can be changed to suit your own personal preferences. However, there are some system settings that you should avoid changing because it will interfere with the proper operation of the oscilloscope.

- Do not change the Power Options.
- Do not change the System Properties Hardware Tab settings.
- Do not change the System Properties Advanced Tab settings.
- Do not change the Regional and Language Options Advanced Tab settings.
- Do not remove Fonts.
- Display Settings
  - Do not change or turn off the default screen saver. The screen saver turns off the display's backlights, extending their life.
  - Do not change the screen resolution or the color quality using the Control Panel Display Settings. You may modify display settings by double-clicking the Intel Graphics Media Accelerator Driver icon in the System tray.
  - Do not modify the Advanced settings.
- Do not use the Administrative Tools to enable or disable Internet Information Services (Web Server). Use the Infiniium Web Control dialog box to enable or disable the Web Server.

---

## To clean the oscilloscope

- Clean the oscilloscope with a soft cloth dampened with a mild soap and water solution.

---

### **CAUTION**

Do not use too much liquid in cleaning the oscilloscope. Water can enter the Infiniium front panel, damaging sensitive electronic components.

---



To run the self calibration 35

---

# Calibration

This chapter provides self calibration procedures for the oscilloscope.

## To run the self calibration

### Let the Oscilloscope Warm Up Before Adjusting

Warm up the oscilloscope for 30 minutes before starting calibration procedure. Failure to allow warm up may result in inaccurate calibration.

The self calibration uses signals generated in the oscilloscope to calibrate channel sensitivity, offsets, and trigger parameters. You should run the self calibration

- yearly, or according to your periodic needs,
- when you replace the acquisition assembly or acquisition hybrids,
- when you replace the hard drive or any other assembly,
- when the oscilloscope's operating temperature (after the 30 minute warm-up period) is more than  $\pm 5^{\circ}\text{C}$  different from that of the last calibration.

### Equipment Required

Equipment	Critical Specifications	Agilent Part Number
Adapters (2 supplied with oscilloscope)	3.5 mm (f) to precision BNC No substitute	Agilent 54855-67604
Cable Assembly	50 $\Omega$ characteristic impedance BNC (m) connectors ~ 36 inches (91 cm) to 48 inches (122 cm) long	Agilent 8120-1840
Cable Assembly (supplied with oscilloscope)	No substitute	Agilent 54855-61620
10 MHz Signal Source (required for time scale calibration)	Frequency accuracy better than 0.4 ppm	Agilent 53131A with Opt. 010*

\* The 10 MHz Signal Source requires time base calibration once every 6 months. The source should be powered on for at least 24 hours before use.

## Self calibration

### Calibration time

It will take approximately 1 hour to run the self calibration on the oscilloscope, including the time required to change cables from channel to channel.

### 1 Let the Oscilloscope Warm Up Before Running the Self Calibration.

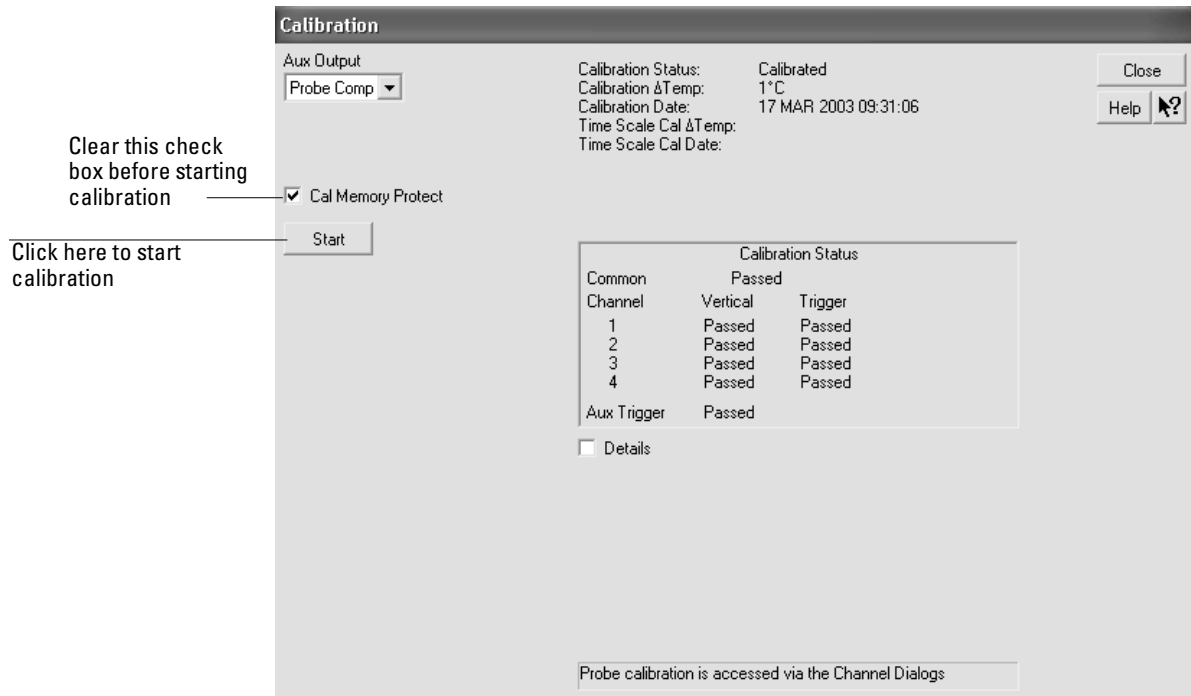
The self calibration should only be done after the oscilloscope has run for 30 minutes at ambient temperature with the cover installed. Calibration of an oscilloscope that has not warmed up may result in an inaccurate calibration.

### 2 Pull down the Utilities menu and Select Calibration.

### 3 Click the check box to clear the Cal Memory Protect condition.

You cannot run self calibration if this box is checked. See Figure 3-1.

Figure 3-1



#### Calibration Dialog

#### 4 Click Start, then follow the instructions on the screen.

The routine will ask you to do the following things in sequence:

##### a Decide if you wish to perform the Time Scale Calibration. Your choices are:

- Std - Time scale calibration will not be performed. Time scale calibration factors from the previous time scale calibration will be used and the 10 MHz reference signal will not be required. The remaining calibration procedure will continue.
- Std + Time - Performs the time scale calibration. This option requires you to connect a 10 MHz reference signal to channel 1 that meets the following specifications. Failure to use a reference signal that meets this specification will result in an inaccurate calibration.  
Frequency: 10 MHz  $\pm$ 0.4 ppm = 10 MHz  $\pm$ 4 Hz  
Amplitude: 0.2 V<sub>peak-to-peak</sub> to 5.0 V<sub>peak-to-peak</sub>  
Wave shape: Sine or Square
- Std + Dflt - Factory time scale calibration factors will be used. The 10 MHz reference signal will not be required. The remaining calibration procedure will continue.

##### b Disconnect everything from all inputs and Aux Out.

##### c Connect the cal cable from Aux Out to channel 1.

You must use the 54855-61620 cable assembly with two 54855-67604 adapters. Failure to use the appropriate cal cable will result in an inaccurate calibration.

##### d Connect the cal cable from Aux Out to each of the channel inputs as requested.

##### e Connect the 50 $\Omega$ BNC cable from the Aux Out to the Aux Trig In on the rear panel of the oscilloscope.

##### f A Passed/Failed indication is displayed for each calibration section. If any section fails, check the calibration cables and run the oscilloscope Self Test in the Utilities menu.

#### 5 After the calibration procedure is completed, click Close.

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DC Gain Accuracy Test	48
Analog Bandwidth - Maximum Frequency Check	54
Performance Test Record	61

This section documents performance test procedures. Performance verification for the products covered by this manual consists of three main steps:

- Performing the internal product self-tests to ensure that the measurement system is functioning properly
- Calibrating the product
- Testing the product to ensure that it is performing to specification

### **Performance Test Interval**

The procedures in this section may be performed for incoming inspection and should be performed periodically to verify that the oscilloscope is operating within specification. The recommended test interval is once per year or after 2000 hours of operation. Performance should also be tested after repairs or major upgrades.

### **Performance Test Record**

A test record form is provided at the end of this section. This record lists performance tests, test limits and provides space to record test results.

### **Test Order**

The tests in this section may be performed in any order desired. However, it is recommended to conduct the tests in the order presented in this manual as this represents an incremental approach to performance verification. This may be useful if you are attempting to troubleshoot a suspected problem.

### **Test Equipment**

Lists of equipment needed to conduct each test are provided for each test procedure. The procedures are written to minimize the number and types of oscilloscopes and accessories required. The oscilloscopes in these lists are ones that are currently available for sale by Agilent at the time of writing this document. In some cases, the test procedures use features specific to the oscilloscopes in the recommended equipment list. However, with some modification to the test procedures, oscilloscopes, cables and accessories that satisfy the critical specifications in these lists may be substituted for the recommended models with some modification to the test procedures.

Contact Agilent Technologies for more information about the Agilent products in these lists.

### **Fluke MET/CAL Procedures**

Fluke MET/CAL procedures are available for the 80000 Series oscilloscopes.

The MET/CAL badge with "PROCEDURES AVAILABLE" signifies that Fluke has created Warranted MET/CAL procedures to verify the performance of this instrument using MET/CAL metrology software. These procedures can be obtained from Fluke. Please see <http://www.fluke.com> and search for MET/CAL for more information.



---

## Performing Self-Test and Calibration

- 1** Perform self tests
  - a** Pull down the Utilities menu and select Self Test.
  - b** Select Scope Self Test from the Self Test list.
  - c** Click on Start Self Test to start the self test procedure.

If any of the self-tests fail, ensure that the failure is diagnosed and repaired before calibrating and testing performance.
- 2** Perform calibration. See “To run the self calibration” on page 35.

---

## Vertical Performance Verification

This section contains the following vertical performance verification:

- Offset Accuracy Test
- DC Gain Accuracy Test
- Analog Bandwidth Test



## Offset Accuracy Test

### CAUTION

Ensure that the input voltage to the oscilloscope never exceeds  $\pm 5$  V.

#### Let the oscilloscope warm up before testing

The oscilloscope under test must be warmed up (with the oscilloscope application running) for at least 30 minutes prior to the start of any performance test.

### Specifications

Offset Accuracy	$\leq 3.5$ V: $\pm(2\%$ of channel offset + $1\%$ of full scale + $1$ mV)
Full scale is defined as 8 vertical divisions. Magnification is used below $5$ mV/div. Below $5$ mV full scale is defined as $40$ mV. The major scale settings are $5$ mV, $10$ mV, $20$ mV, $50$ mV, $100$ mV, $200$ mV, $500$ mV and $1$ V.	

### Equipment Required

Description	Critical Specifications	Recommended Model/ Part Numbers
Digital Multimeter	DC voltage measurement accuracy better than $\pm 0.1\%$ of reading	Agilent 34401A or Agilent 3458A
Cable Assembly (2 required)	$50\Omega$ characteristic impedance, BNC (m) connectors	Agilent 8120-1840
Adapter	BNC Tee (m)(f)(f)	Agilent 1250-0781
Adapter	BNC (f) to dual banana	Agilent 1251-2277

The offset accuracy specification has two terms  $\pm(\text{offset gain} + \text{zero error})$ . The offset gain specification is  $\pm 2\%$  of channel offset and the zero error specification is  $\pm 1\%$  of full scale. The offset accuracy test procedure tests each of these terms individually.

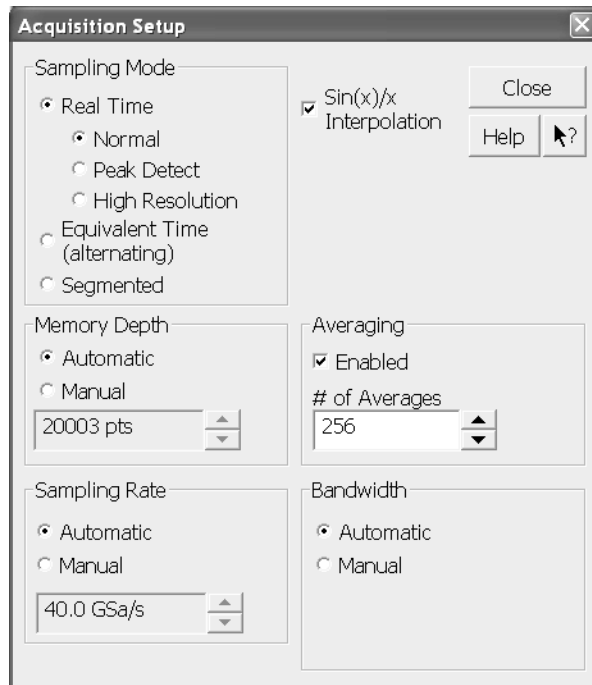
### Procedure

- Zero Error Test
- 1 Disconnect all cables from the scope channel inputs.
  - 2 Press Default Setup, then configure the scope as follows:
    - a Pull down the Setup menu and select Acquisition.

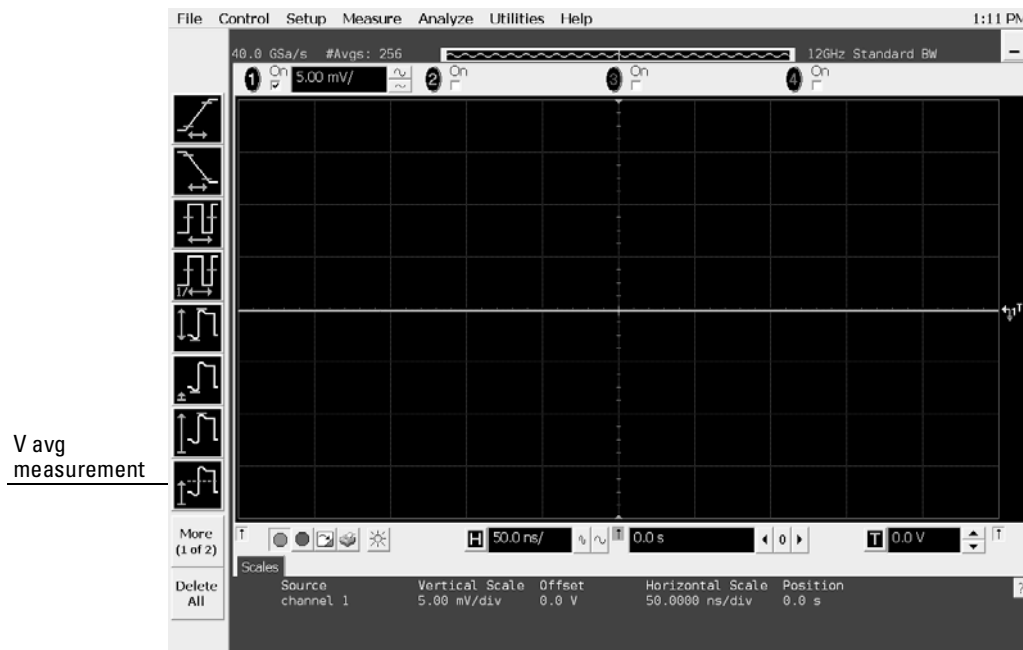
## Chapter 4: Testing Performance

### Offset Accuracy Test

- b When the Acquisition Setup window is displayed, enable averaging and set the # of averages to 256 as shown below.



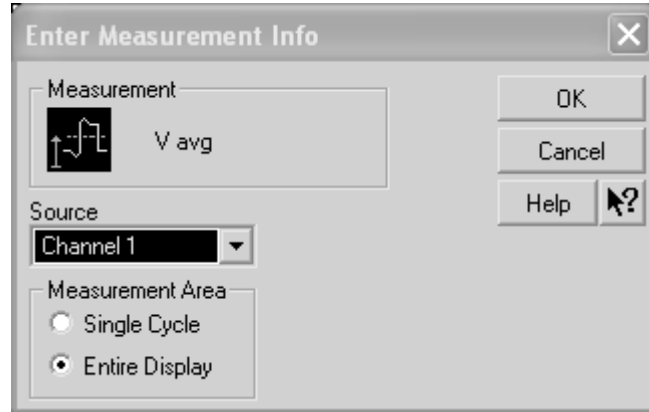
- 3 Configure the scope to measure Average voltage on channel 1 as follows:
- Change the vertical sensitivity of channel 1 to 5 mV/div.
  - Click the V avg measurement on the left side of the screen.



- c When the Enter Measurement Info window is displayed, ensure that the V avg function is set up as follows and then click OK:

Source = Channel 1

Measurement Area = Entire Display

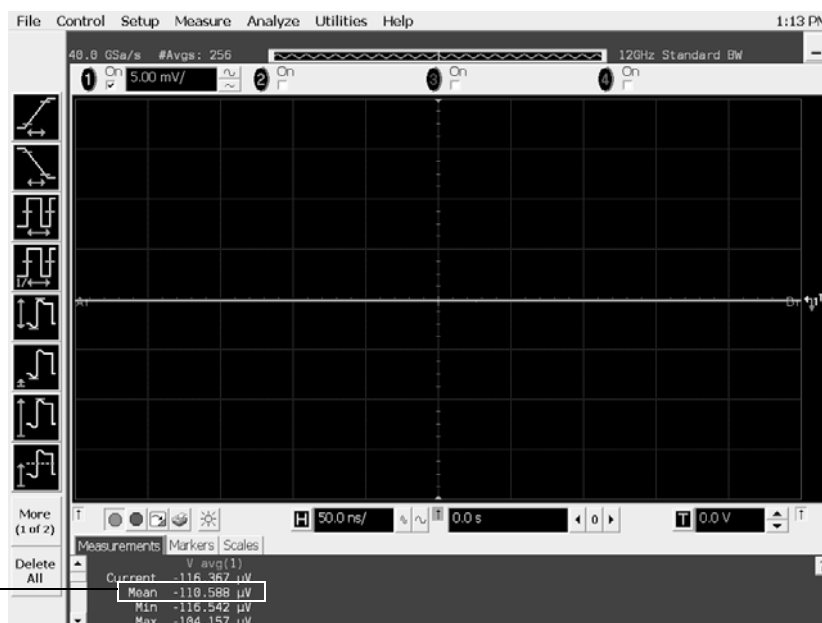


- 4 Press the Clear Display key on the scope and wait for the #Aves value (top left corner of screen) to return to 256. Record the scope's mean V avg reading in the Zero Error Test section of the Performance Test Record.

#### Notes

- For all scope readings in this procedure, use the mean value in the Measurements display area at the bottom of the screen.
- If a question mark is displayed in front of any of the values at the bottom of the screen, press the Clear Display key on the scope, wait for the #Aves value to return to 256 and then record the scope reading.

Record the  
mean reading



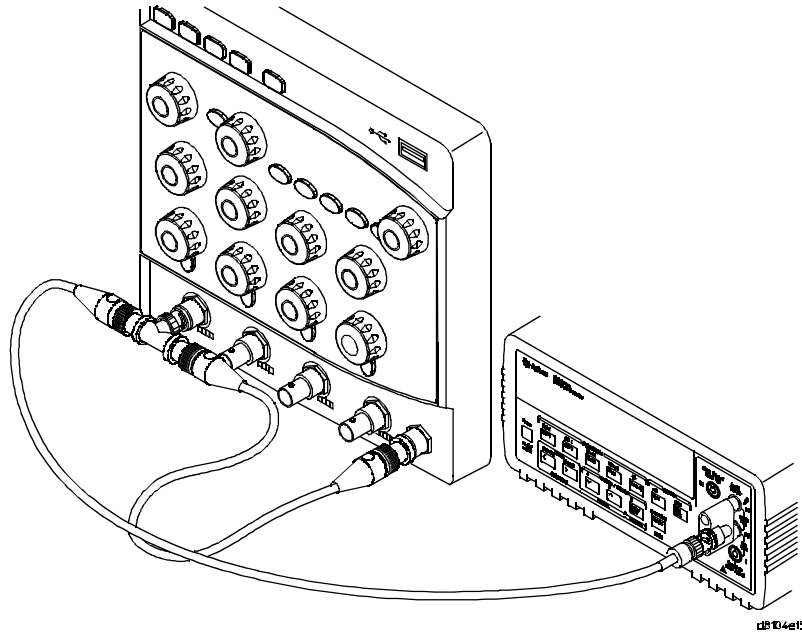
- 5 Change the vertical sensitivity of channel 1 to 10 mV/div, press the Clear Display key, wait for the #Aves value (top left corner of screen) to return to 256 and then record the scope V avg reading in the Zero Error Test section of the Performance Test Record.

- 6** Repeat step 5 for the remaining vertical sensitivities for channel 1 in the Zero Error Test section of the Performance Test Record.
- 7** Press Default Setup, then turn off channel 1 and turn channel 2 display on.
- 8** Configure the scope to measure V avg on Channel 2 as follows:
  - a** Pull down the Utilities menu and select Acquisition. When the Acquisition Setup window is displayed, enable averaging and set the # of averages to 256.
  - b** Change the vertical sensitivity of channel 2 to 5 mV/div.
  - c** Click the V avg measurement icon on the left side of the screen.
  - d** When the Enter Measurement Info window is displayed, ensure that the Vavg function is set up as follows and then click OK:  
Source = Channel 2  
Measurement area = Entire Display
- 9** Press the Clear Display key on the scope, wait for the #Aves value to return to 256 and then record the scope's mean V avg reading in the Zero Error Test section of the Performance Test Record.
- 10** Repeat step 9 for the remaining vertical sensitivities for channel 2 in the Zero Error section of the Performance Test Record.
- 11** Repeat steps 7 through 10 for channels 3 and 4.

Offset Gain Test

- 12** Make the connections to scope channel 1 as shown below.

**Connections**



**Notes:**

- Where it is used, it is important to connect the BNC Tee adapter directly to the scope channel input to minimize ground potential differences and to ensure that the DMM measures the input voltage to the scope channel as accurately as possible. Differences in ground potential can be a significant source of measurement error, particularly at high scope sensitivities.
- It also helps to reduce ground potential differences if the scope and DMM are connected to the same AC supply circuit.
- A fairly large number of averages are used in the scope measurements of this section to reduce measurement noise and to reduce the measurement error due to resolution.

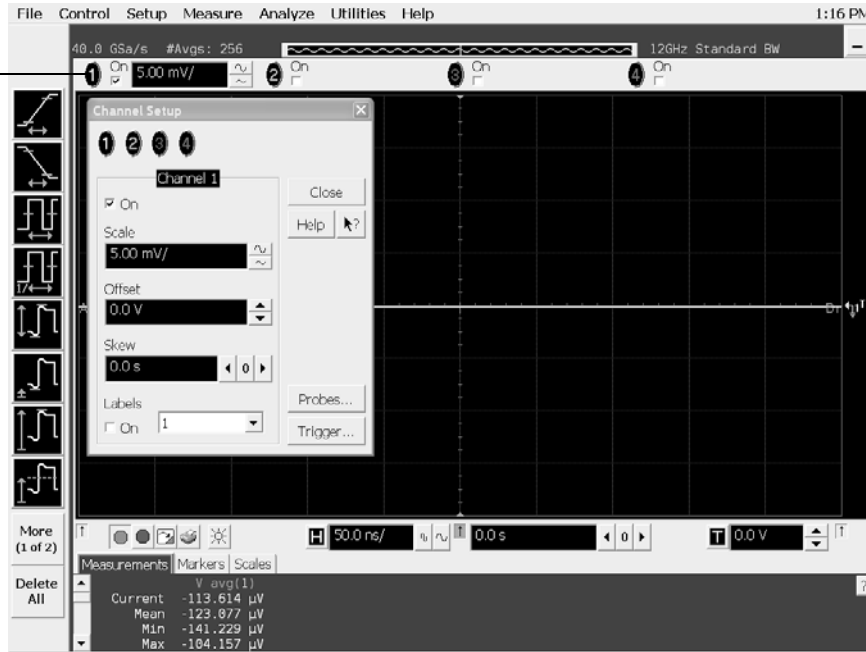
- 13** Set up the DMM to perform DC voltage measurements.

- 14** Configure the scope to measure V avg on Channel 1 as follows:

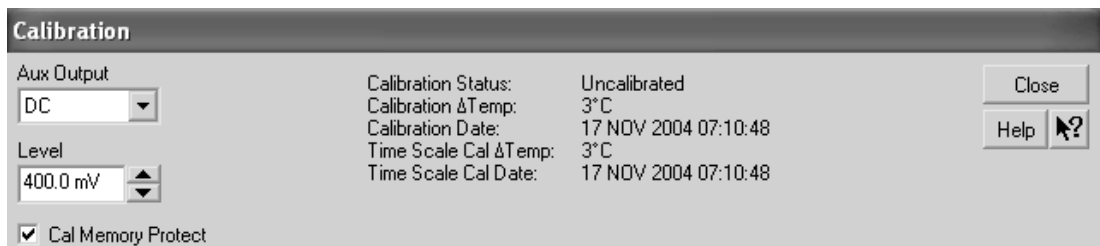
- a Press Default Setup.
- b Pull down the Utilities menu and select Acquisition. When the Acquisition Setup window is displayed, enable averaging and set the # of averages to 256.
- c Change the vertical sensitivity of channel 1 to 5 mV/div.
- d Click the V avg measurement icon on the left side of the screen.
- e When the Enter Measurement Info window is displayed, ensure that the V avg function is set up as follows and then click OK:  
Source = Channel 1  
Measurement area = Entire Display

- 15 Set the channel 1 offset value to 400.0 mV. This can be done using the front panel control or:
- Pull down the Setup menu and select Channel 1 or click the Channel 1 setup icon.
  - Click the Offset control arrows to change the offset value or click on the offset value and enter 400.0 mV in the dialog box.
  - Enter 400.0 mV in the Enter Offset dialog box.

Channel 1  
setup icon



- 16 Set the Aux Out voltage ( $V_{\text{Aux Out}}$ ) to +400.0 mV as follows:
- Pull down the Utilities menu and select Calibration.
  - Change the Aux Output function to DC (top left corner).
  - Set the Level to 400.0 mV.
  - Click on Close.



- 17 Press the Clear Display key on the scope, wait for the #Avgs value (top left corner of screen) to return to 256 and then record the DMM voltage reading as  $V_{\text{DMM}+}$  and the scope Vavg reading as  $V_{\text{Scope}+}$  in the Offset Gain Test section of the Performance Test Record.

- 18 Change the channel 1 offset value to -400.0 mV.
- 19 Set the Aux Out voltage to -400.0 mV.
- 20 Press the Clear Display key on the scope, wait for the #Avgs value (top left corner of screen) to return to 256 and then record the DMM voltage reading as  $V_{DMM-}$  and the scope Vavg reading as  $V_{Scope-}$  in the Offset Gain Test section of the Performance Test Record.
- 21 Change the channel 1 offset value to 0 mV.
- 22 Set the Aux Out voltage to 0 mV.
- 23 Press the Clear Display key on the scope, wait for the #Avgs value (top left corner of screen) to return to 256 and then record the DMM voltage reading as  $V_{DMM0}$  and the scope Vavg reading as  $V_{Scope0}$  in the Offset Gain Test section of the Performance Test Record.
- 24 Calculate the offset gain error using the following expressions and record the value in the Offset Gain Test section of the Performance Test Record. The offset gain error is the greater (maximum magnitude) of either:

$$\left( \frac{V_{scope+} - V_{scope0}}{V_{DMM+} - V_{DMM0}} - 1 \right) 100$$

or

$$\left( \frac{V_{scope-} - V_{scope0}}{V_{DMM-} - V_{DMM0}} - 1 \right) 100$$

- 25 Repeat steps 15 to 21 for the remaining channel 1 vertical sensitivities in the Offset Gain Test section of the Performance Test Record. For each measurement, set both the Aux Out voltage ( $V_{Aux Out}$ ) and the Channel offset voltage to the positive  $V_{Aux Out}$  value and then to the negative  $V_{Aux Out}$  value in the " $V_{Aux Out}$  Setting" column of the Offset Gain Test table in the Performance Test Record for each of the vertical sensitivities.
- 26 Move the Tee connector to the next channel input and repeat steps 18 to 22 for the channels 2 to 4.

---

## DC Gain Accuracy Test

---

### CAUTION

Ensure that the input voltage to the oscilloscope never exceeds  $\pm 5$  V.

#### Let the oscilloscope warm up before testing

The oscilloscope under test must be warmed up (with the oscilloscope application running) for at least 30 minutes prior to the start of any performance test.

### Specifications

DC Gain Accuracy	$\pm 2\%$ of full scale at full resolution channel scale
Full scale is defined as 8 vertical divisions. Magnification is used below 5 mV/div. Below 5 mV full scale is defined as 40 mV. The major scale settings are 5 mV, 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV and 1 V.	

### Equipment Required

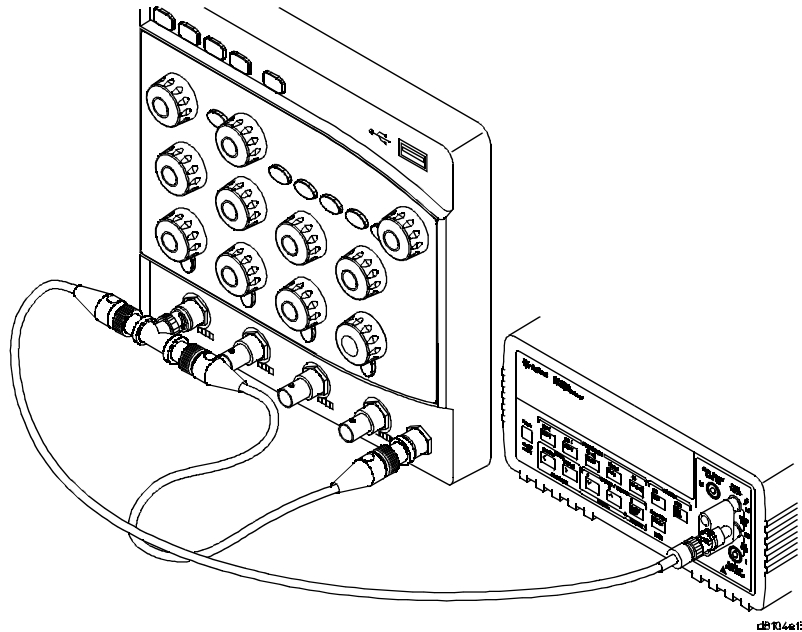
Description	Critical Specifications	Recommended Model/ Part Numbers
Digital Multimeter	DC voltage measurement accuracy better than $\pm 0.1\%$ of reading	Agilent 34401A or Agilent 3458A
Cable Assembly (2 required)	50 $\Omega$ characteristic impedance, BNC (m) connectors	Agilent 8120-1840
Adapter	BNC Tee (m)(f)(f)	Agilent 1250-0781
Adapter	BNC (f) to dual banana	Agilent 1251-2277



### Procedure

- 1 Make the connections to scope channel 1 as shown below.

### Connections

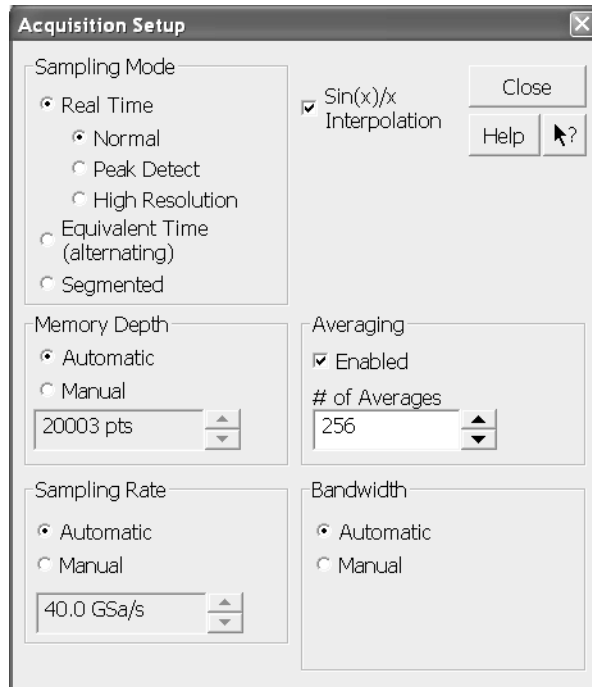


#### Notes:

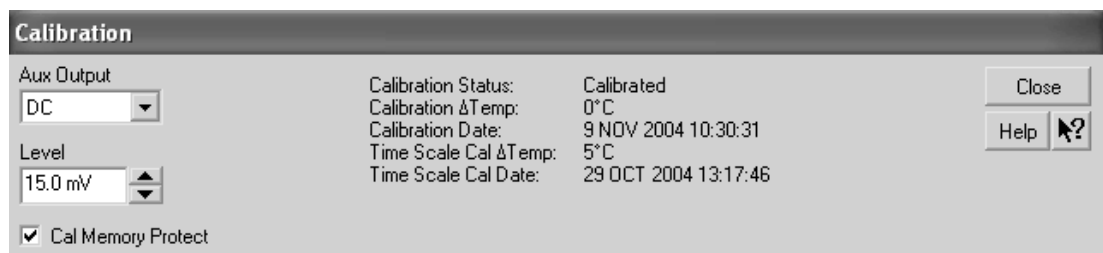
- Where it is used, it is important to connect the BNC Tee adapter directly to the scope channel input to minimize ground potential differences and to ensure that the DMM measures the input voltage to the scope channel as accurately as possible. Differences in ground potential can be a significant source of measurement error, particularly at high scope sensitivities.
- It also helps to reduce ground potential differences if the scope and DMM are connected to the same AC supply circuit.
- A fairly large number of averages are used in the scope measurements of this section to reduce measurement noise and to reduce the measurement error due to resolution.

- 2 Press Default Setup, then configure the scope as follows:
  - a Pull down the Setup menu and select Acquisition.

- b** When the Acquisition Setup window is displayed, enable averaging and set the # of averages to 256 as shown below.

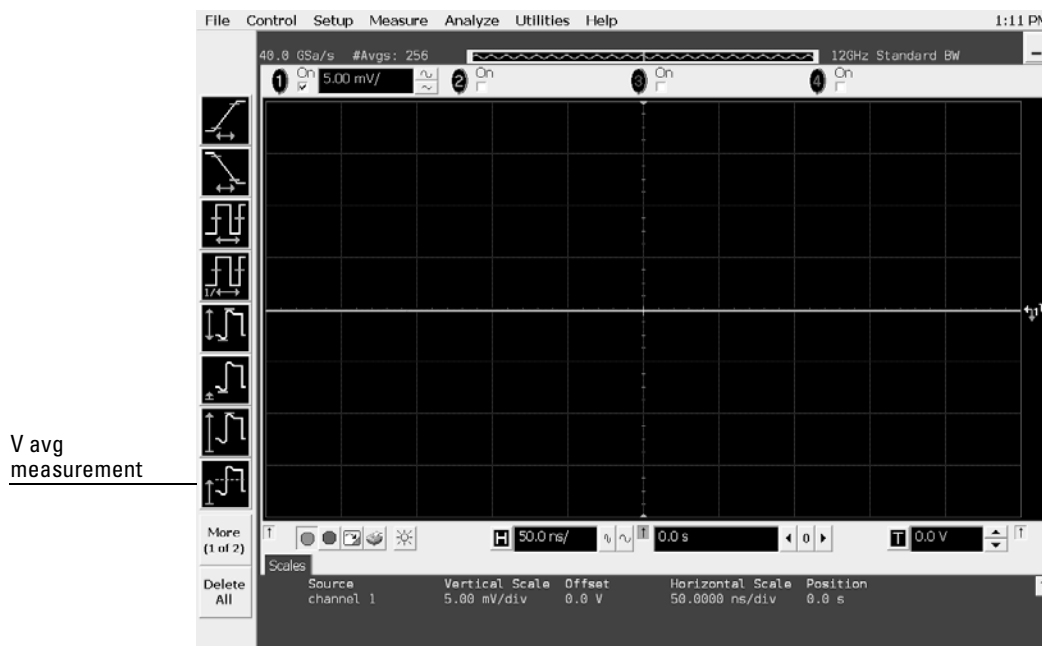


- 3** Set the Aux Out voltage ( $V_{\text{Aux Out}}$ ) to +15 mV as follows:
- a** Pull down the Utilities menu and select Calibration.
  - b** Change the Aux Output function to DC (top left corner).
  - c** Set the Level to 15 mV.
  - d** Click on Close.



- 4** Set the channel 1 vertical sensitivity value to 5 mV/div. This can be done either using the front panel control or:
- a** Pull down the Setup menu and select Channel 1 or click the Channel 1 setup icon.
  - b** Change the vertical sensitivity of channel 1 to 5 mV/div.

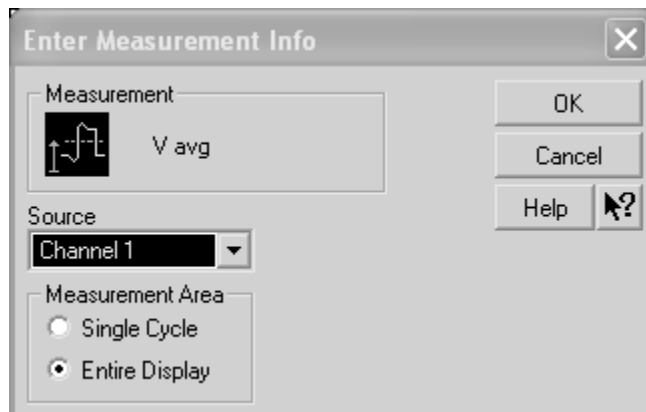
- c Select the Vavg measurement as shown below.



- d When the Enter Measurement Info window is displayed, ensure that the V avg function is set up as follows and then click OK:

Source = Channel 1

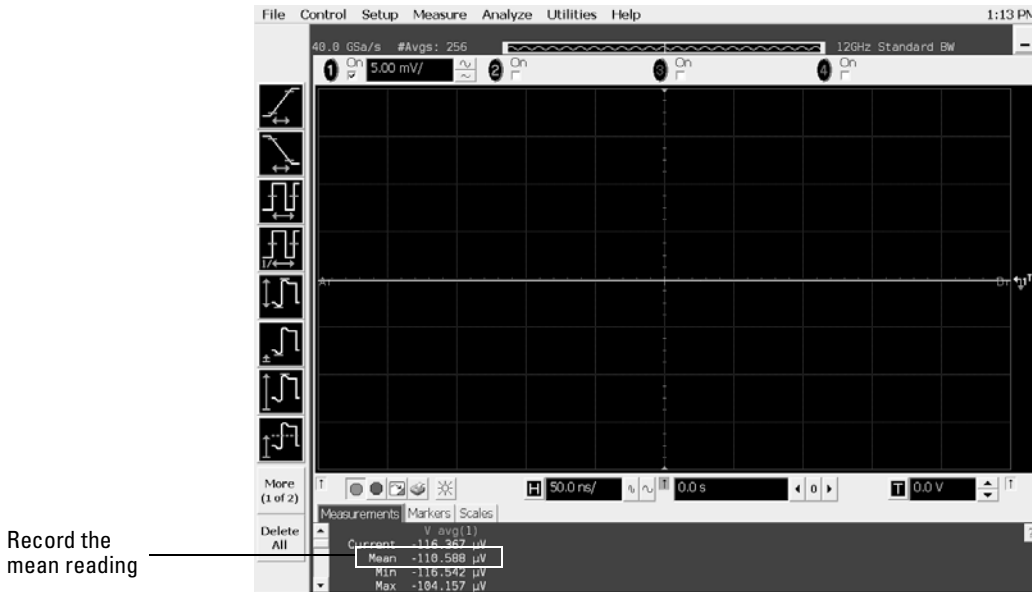
Measurement Area = Entire Display



- 5 Press the Clear Display key on the scope, wait for the #Aves value (top left corner of screen) to return to 256 and then record the scope's mean V avg reading in the DC Gain Test section of the Performance Test Record.

#### Notes

- For all scope readings in this procedure, use the mean value in the Measurements display area at the bottom of the screen.
- If a question mark is displayed in front of any of the values at the bottom of the screen, press the Clear Display key on the scope, wait for the #Aves value to return to 256 and then record the scope reading.



- 6 Change the Aux Out voltage to -15 mV.
- 7 Press the Clear Display key on the scope, wait for the #Avgs value to return to 256 and then record the DMM voltage reading and the scope V avg reading in the DC Gain Test section of the Performance Test Record.
- 8 Repeat step 7 for the remaining vertical sensitivities for channel 1 shown in the DC Gain Test section of the Performance Test Record.
- 9 Press Default Setup, then turn off channel 1 and turn channel 2 display on.
- 10 Set the Aux Out voltage ( $V_{\text{Aux Out}}$ ) to +15 mV as follows:
- 11 Configure the scope to measure V avg on Channel 2.
  - a Pull down the Utilities menu and select Acquisition. When the Acquisition Setup window is displayed, enable averaging and set the # of averages to 256.
  - b Change the vertical sensitivity of channel 2 to 5 mV/div.
  - c Click the V avg measurement icon on the left side of the screen.
  - d When the Enter Measurement Info window is displayed, ensure that the Vavg function is set up as follows and then click OK:
 

Source = Channel 2

Measurement area = Entire Display
- 12 Press the Clear Display key on the scope, wait for the #Avgs value to return to 256 and then record the DMM voltage reading and the scope V avg reading in the DC Gain Test section of the Performance Test Record.
- 13 Repeat step 12 for the remaining vertical sensitivities for channel 2 in the DC Gain section of the Performance Test Record.
- 14 Repeat steps 9 through 13 for channels 3 and 4.

- 15** Calculate the offset gain using the following expression and record this value in the DC Gain Test section of the Performance Test Record.

For vertical sensitivities of less than 1 volt use the following equation:

$$DCGainError = \frac{\Delta V_{out}}{\Delta V_{in}} = \left( \left( \frac{V_{scope+} - V_{scope-}}{V_{DMM+} - V_{DMM-}} - 1 \right) \right) \cdot 75$$

For vertical sensitivity = 1 V use the following equation:

$$DCGainError = \frac{\Delta V_{out}}{\Delta V_{in}} = \left( \frac{V_{scope+} - V_{scope-}}{V_{DMM+} - V_{DMM-}} - 1 \right) \cdot 60$$

## Analog Bandwidth - Maximum Frequency Check

### CAUTION

Ensure that the input voltage to the oscilloscope never exceeds  $\pm 5$  V.

#### Let the oscilloscope warm up before testing

The oscilloscope under test must be warmed up (with the oscilloscope application running) for at least 30 minutes prior to the start of any performance test.

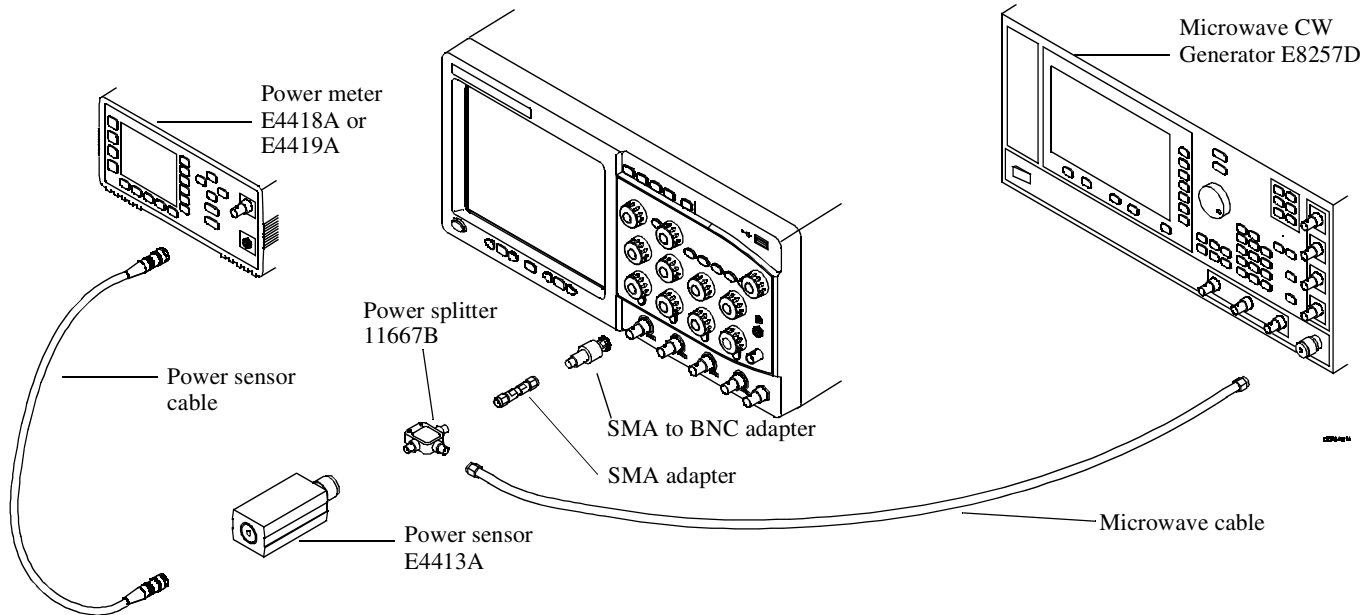
### Specification

Analog Bandwidth (-3 dB)	
DSO81304B	12.0 GHz, 11.8 GHz at 5 mV/div
DSO81204B	12.0 GHz, 11.8 GHz at 5 mV/div
DSO81004B	10.0 GHz
DSO80804B	8.0 GHz
DSO80604B	6.0 GHz
DSO80404B	4.0 GHz
DSO80304B	3.0 GHz
DSO80204B	2.0 GHz

### Equipment Required

Description	Critical Specifications	Recommended Model/ Part Numbers
Microwave CW Generator	Maximum Frequency $\geq 14$ GHz Power range: -20 dBm to +16 dBm into $50\Omega$ Output resistance = $50\Omega$	Agilent E8257D with Opt 520
Power Splitter	2 Resistor Power Splitter Max Frequency $\geq 18$ GHz	Agilent 11667B
Power Meter	Agilent E-series with power sensor compatibility	Agilent E4418B or E4419B
Power Sensor	Maximum Frequency $\geq 14$ GHz Power range: -24 dBm to +16 dBm	Agilent E4413A
Microwave Cable	$50\Omega$ Characteristic Impedance 3.5 mm (m) to 3.5 mm (m) SMA connectors Max Frequency $\geq 18$ GHz	Agilent 8120-4948
SMA Adapters	3.5 mm (m) to 3.5 mm (m) SMA	Agilent E2655-83202
SMA to BNC Adapter	3.5 mm (f) SMA to Precision BNC (No Substitute)	Agilent 54855-67604

## Connections



### Notes

- Connect output 1 of the 11667B splitter to the scope Channel 1 input directly using the 54855-67604 adapter, without any additional cabling or adapters.
- Connect the power sensor directly to output 2 of the power splitter without any additional cabling or adapters.
- Minimize the use of other adapters.
- Ensure that SMA and 3.5 mm connectors are tightened properly:  
8 in-lbs (90 N-cm) for 3.5 mm  
5 in-lbs (56 N-cm) for SMA

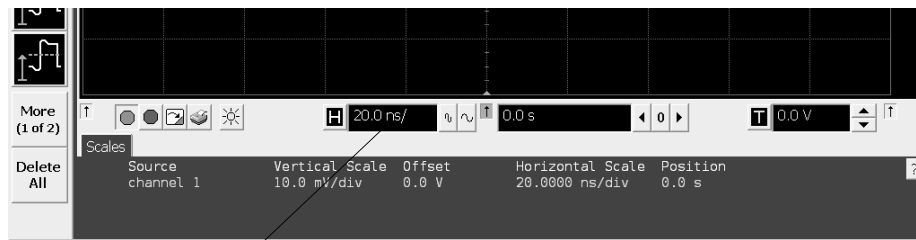
### Procedure

- 1 Preset the power meter.
- 2 Ensure that the power sensor is disconnected from any source and zero the meter.
- 3 Connect the power sensor to the power meter's Power Ref connector and calibrate the meter.
- 4 Make the connections to scope channel 1 as shown in the connection diagram above.
- 5 Set up the Power Meter to display measurements in units of Watts.
- 6 Press Default Setup, then configure the scope as follows:
  - a Ensure Channel 1 is displayed and all other channels are turned off.
  - b Set the vertical sensitivity of channel 1 to 5 mV/div.

## Chapter 4: Testing Performance

### Analog Bandwidth - Maximum Frequency Check

- c Set the horizontal scale to 16 ns/div (to display 8 cycles of a 50 MHz waveform).



Click here and enter 16E-9

- d Pull down the Setup menu, select Acquisition and then set up the acquisition parameters as follows:

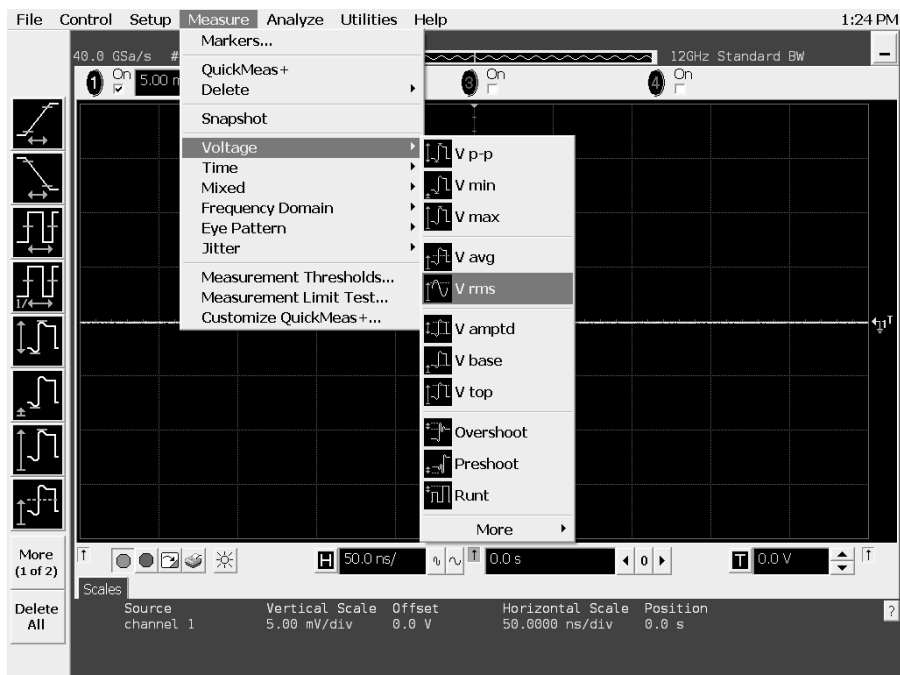
Memory Depth = Automatic

Sampling rate = Maximum (40 GSa/s)

Sin(x)/x Interpolation filter enabled

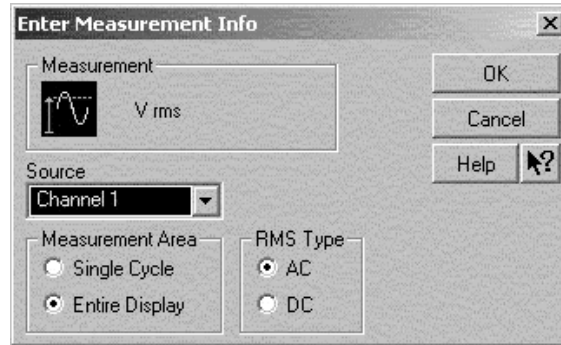
Averaging = Disabled

- e Pull down the Measure menu, select Voltage and then select V rms.





- f** When the RMS voltage measurement setup window is displayed, configure this measurement as follows:
- Source = Channel 1
  - Measurement Area = Entire Display
  - RMS Type = AC



- 7** Set the generator to apply a 50 MHz sine wave with a peak-to-peak amplitude of about 4 divisions.
- Use the following table to determine the approximate required signal amplitude.  
The amplitude values in the table below are not absolutely required. If your generator is unable to produce the recommended amplitude, then set the generator to the highest value that does not produce a vertically clipped signal on the scope.

**Table 3-1. Nominal Generator Amplitude Settings**

Scope Vertical Sensitivity	Generator Signal Amplitude (Vp-p)	Generator Signal Amplitude (dBm)
5 mV/div	0.02	-30
10 mV/div	0.04	-24
20 mV/div	0.08	-18
50 mV/div	0.20	-10
100 mV/div	0.40	-4
200 mV/div	0.80	+2
500 mV/div	2.0	+10
1 V/div	4.0	+16

- 8** Measure the input power to the scope channel and convert this measurement to Volts RMS using the expression:

$$V_{in} = \sqrt{P_{meas} \times 50\Omega}$$

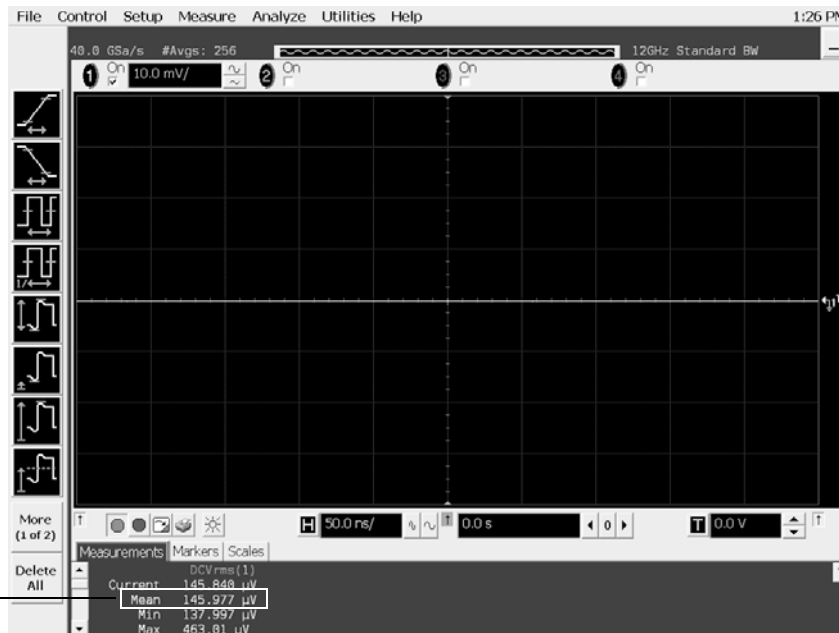
For example, if the power meter reading is 4.0  $\mu$ W, then  $V_{in} = (4.0 \times 10^{-6} \times 50\Omega)^{1/2} = 14.1$  mVrms. Record the RMS voltage in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record ( $V_{in}$  @ 50 MHz).

- 9 Press the Clear Display key on the scope and record the scope  $V_{rms}$  reading in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record ( $V_{out}$  @ 50 MHz). For all scope readings in this procedure, use the mean value in the Measurements display area at the bottom of the screen.

**Notes**

- For all scope readings in this procedure, use the mean value in the Measurements display area at the bottom of the screen.
- If a question mark is displayed in front of any of the values at the bottom of the screen, press the Clear Display key on the scope, wait for the #Avgs value to return to 16 and then record the scope reading.

Record the  
mean reading



- 10 Calculate the reference gain as follows:

$$Gain_{50\text{ MHz}} = \frac{V_{out} @ 50\text{ MHz}}{V_{in} @ 50\text{ MHz}}$$

Record this value in the Calculated Gain @50 MHz column in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record.

- 11 Change the generator frequency to the maximum value for the model being tested as shown in the table below. It is not necessary to adjust the signal amplitude at this point in the procedure.

Setting	Model			
	DS080204B	DS080304B	DS080404B	DS080604B
Maximum Frequency	2.0 GHz	3.0 GHz	4.0 GHz	6.0 GHz
Scope Time Base Setting	100 ps/div	100 ps/div	100 ps/div	100 ps/div
	Model			
	DS080804B	DS081004B	DS081204B	DS081304B
Maximum Frequency	8.0 GHz	10.0 GHz	12.0 GHz 11.8 GHz at 5 mV/div	12.0 GHz, 11.8 GHz at 5 mV/div
Scope Time Base Setting	100 ps/div	100 ps/div	100 ps/div	100 ps/div

- 12 Change the scope time base to the value for the model under test in the table above.



Click here and enter time  
base value from table

- 13 Measure the input power to the scope channel at the maximum frequency and convert this measurement to Volts RMS using the expression:

$$V_{in} = \sqrt{P_{meas} \times 50\Omega}$$

For example, if the power meter reading is 4.0  $\mu$ W, then  $V_{in} = (4.0 \times 10^{-6} \times 50\Omega)^{1/2} = 14.1$  mVrms. Record the RMS voltage in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record ( $V_{in}$  @ Max Freq).

- 14 Press the Clear Display key on the scope and record the scope  $V_{rms}$  reading in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record ( $V_{out}$  @ Max Freq).

- 15 Calculate the gain at the maximum frequency using the expression:

$$Gain_{Max\ Freq} = 20 \log_{10} \left[ \frac{(V_{out\ Max\ Freq}) / (V_{in\ Max\ Freq})}{Gain_{50\ MHz}} \right]$$

For example, if ( $V_{out}$  @ Max Frequency) = 13.825 mV, ( $V_{in}$  @ Max Frequency) = 13.461 mV and Gain @ 50MHz = 1.0023, then:

$$Gain_{Max\ Freq} = 20 \log_{10} \left[ \frac{13.825\ mV / 13.461\ mV}{1.0023} \right] = 0.212\ dB$$

Record this value in the Calculated Gain @Max Freq column in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record. To pass this test, this value must be greater than -3.0 dB.

- 16 Change the scope set up as follows:
  - a Change the channel vertical sensitivity to 10 mV/div.
  - b Reset the horizontal scale to 16 ns/div (to display 8 cycles of a 50 MHz waveform).
- 17 Change the generator output as follows:
  - a Reset the generator frequency to 50 MHz.
  - b Change the amplitude to the value suggested for this sensitivity in Table 3-1.
- 18 Repeat steps 8, 9, and 10 to measure the reference gain at 50 MHz for this sensitivity.
- 19 Repeat steps 11, 12, 13, and 14 to measure the gain at maximum frequency for this sensitivity.
- 20 Repeat steps 15 to 19 to complete measuring gains for remaining sensitivities for channel 1 in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record.
- 21 Move the splitter to channel 2 and change the scope configuration as follows:
  - Ensure Channel 2 is displayed and all other channels are turned off.
  - Set the vertical sensitivity of channel 2 to 5 mV/div.
  - Set the horizontal scale to 16 ns/div (to display 8 cycles of a 50 MHz waveform).
  - Right click on the V rms measurement at the bottom of the screen. When the RMS voltage measurement setup window is displayed, change the source from Channel 1 to Channel 2.



- 22 Repeat steps 7 to 20 to complete measuring gains for channel 2.
- 23 Move the splitter to channel 3 and change the scope configuration as follows:
  - a Ensure Channel 3 is displayed and all other channels are turned off.
  - b Set the vertical sensitivity of channel 3 to 5 mV/div.
  - c Set the horizontal scale to 16 ns/div (to display 8 cycles of a 50 MHz waveform).
  - d Click on the V rms measurement at the bottom of the screen and select Customize. When the V rms setup window is displayed, change the source from Channel 2 to Channel 3.
- 24 Repeat steps 7 to 20 to complete measuring gains for channel 3.
- 25 Move the splitter to channel 4 and change the scope configuration as follows:
  - a Ensure Channel 4 is displayed and all other channels are turned off.
  - b Set the vertical sensitivity of channel 4 to 5 mV/div.
  - c Set the horizontal scale to 16 ns/div (to display 8 cycles of a 50 MHz waveform).
  - d Click on the V rms measurement at the bottom of the screen. When the V rms setup window is displayed, change the source from Channel 3 to Channel 4.
- 26 Repeat steps 7 to 20 to complete measuring gains for channel 4.

---

## Performance Test Record

### Offset Performance Test

#### Zero Error Test

Vertical Sensitivity	Test Limits	Channel 1	Channel 2	Channel 3	Channel 4
5 mV/div	-1.4 mV to +1.4 mV				
10 mV/div	-1.8 mV to +1.8 mV				
20 mV/div	-2.6 mV to +2.6 mV				
50 mV/div	-5.0 mV to +5.0 mV				
100 mV/div	-9.0 mV to +9.0 mV				
200 mV/div	-17.0 mV to +17.0 mV				
500 mV/div	-41.0 mV to +41.0 mV				
1 V/div	-81.0 mV to +81.0 mV				

Chapter 4: Testing Performance  
Performance Test Record

Offset Gain Test

Vertical Sensitivity	V <sub>Aux Out</sub> Setting	V <sub>DMM+</sub>	V <sub>DMM-</sub>	V <sub>DMM0</sub>	V <sub>Scope+</sub>	V <sub>Scope-</sub>	V <sub>Scope0</sub>	Calculated Offset Gain Error	Offset Gain Error Test Limits
<b>Channel 1</b>									
5 mV/div	±400 mV								±2 %
10 mV/div	±400 mV								±2 %
20 mV/div	±400 mV								±2 %
50 mV/div	±900 mV								±2 %
100 mV/div	±1.6 V								±2 %
200 mV/div	±2.4 V								±2 %
500 mV/div	±2.4 V								±2 %
1 V/div	±2.4 V								±2 %
<b>Channel 2</b>									
5 mV/div	±400 mV								±2 %
10 mV/div	±400 mV								±2 %
20 mV/div	±400 mV								±2 %
50 mV/div	±900 mV								±2 %
100 mV/div	±1.6 V								±2 %
200 mV/div	±2.4 V								±2 %
500 mV/div	±2.4 V								±2 %
1 V/div	±2.4 V								±2 %
<b>Channel 3</b>									
5 mV/div	±400 mV								±2 %
10 mV/div	±400 mV								±2 %
20 mV/div	±400 mV								±2 %
50 mV/div	±900 mV								±2 %
100 mV/div	±1.6 V								±2 %
200 mV/div	±2.4 V								±2 %
500 mV/div	±2.4 V								±2 %
1 V/div	±2.4 V								±2 %
<b>Channel 4</b>									
5 mV/div	±400 mV								±2 %
10 mV/div	±400 mV								±2 %
20 mV/div	±400 mV								±2 %
50 mV/div	±900 mV								±2 %
100 mV/div	±1.6 V								±2 %
200 mV/div	±2.4 V								±2 %
500 mV/div	±2.4 V								±2 %
1 V/div	±2.4 V								±2 %

**DC Gain Test**

Vertical Sensitivity	V <sub>Aux Out</sub> Setting	V <sub>DMM+</sub>	V <sub>DMM-</sub>	V <sub>Scope+</sub>	V <sub>Scope-</sub>	Calculated DC Gain Error	DC Gain Error Test Limits
<b>Channel 1</b>							
5 mV/div	±15 mV						±2 %
10 mV/div	±30 mV						±2 %
20 mV/div	±60 mV						±2 %
50 mV/div	±150 mV						±2 %
100 mV/div	±300 mV						±2 %
200 mV/div	±600 mV						±2 %
500 mV/div	±1.5 V						±2 %
1 V/div	±2.4 V						±2 %
<b>Channel 2</b>							
5 mV/div	±15 mV						±2 %
10 mV/div	±30 mV						±2 %
20 mV/div	±60 mV						±2 %
50 mV/div	±150 mV						±2 %
100 mV/div	±300 mV						±2 %
200 mV/div	±600 mV						±2 %
500 mV/div	±1.5 V						±2 %
1 V/div	±2.4 V						±2 %
<b>Channel 3</b>							
5 mV/div	±15 mV						±2 %
10 mV/div	±30 mV						±2 %
20 mV/div	±60 mV						±2 %
50 mV/div	±150 mV						±2 %
100 mV/div	±300 mV						±2 %
200 mV/div	±600 mV						±2 %
500 mV/div	±1.5 V						±2 %
1 V/div	±2.4 V						±2 %
<b>Channel 4</b>							
5 mV/div	±15 mV						±2 %
10 mV/div	±30 mV						±2 %
20 mV/div	±60 mV						±2 %
50 mV/div	±150 mV						±2 %
100 mV/div	±300 mV						±2 %
200 mV/div	±600 mV						±2 %
500 mV/div	±1.5 V						±2 %
1 V/div	±2.4 V						±2 %

Chapter 4: Testing Performance  
**Performance Test Record**

**Analog Bandwidth - Maximum Frequency Check**

Max frequency: DS080204B = 2.0 GHz, DS080304B = 3.0 GHz, DS080404B = 4.0 GHz, DS080604B = 6.0 GHz,  
DS080804B = 8.0 GHz, DS081004B = 10.0 GHz, DS081204B = 12.0 GHz (11.8 GHz at 5 mV/div),  
DS081304B = 12.0 GHz (11.8 GHz at 5 mV/div).

Vertical Sensitivity	Measurement					
	Vin @ 50 MHz	Vout @ 50 MHz	Calculated Gain @ 50 MHz (Test Limit = greater than - 3 dB)	Vin @ Max Freq	Vout @ Max Freq	Calculated Gain @ Max Freq (Test Limit = greater than - 3 dB)
<b>Channel 1</b>						
5 mV/div						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						
<b>Channel 2</b>						
5 mV/div						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						
<b>Channel 3</b>						
5 mV/div						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						
<b>Channel 4</b>						
5 mV/div						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						



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# Troubleshooting

This section provides troubleshooting information for the Agilent Technologies 80000 Series oscilloscopes. The service strategy of this oscilloscope is replacement of defective assemblies.

## Safety

Read the Safety Notices at the back of this manual before servicing the oscilloscope. Before performing any procedure, review it for cautions and warnings.

---

### WARNING

#### SHOCK HAZARD!

Maintenance should be performed by trained service personnel aware of the hazards involved (for example, moving parts, fire and electric shock). Lack of training and awareness of the hazards could result in electrical shock or other injury. When maintenance can be performed without power applied, the power cord should be removed from the oscilloscope.

---

---

### WARNING

#### INJURY CAN RESULT!

Use caution when working around the cooling fan with the cover removed from the oscilloscope. The cooling fan blades are exposed on one side and can be hazardous. Install the optional fan safety shield (Agilent Technologies P/N 54810-00601) for protection from the moving fan blades.

---

## Tools Required

You will need basic electronic troubleshooting tools, including a digital multimeter and a 100 MHz (or faster) oscilloscope.

If you need to remove and replace assemblies, see chapter 6, “Replacing Assemblies.”

## ESD Precautions

When using any of the procedures in this chapter, you must use proper ESD precautions to protect the oscilloscope components from ESD damage. Failure to follow proper ESD control procedures may cause immediate failure or latent damage. Latent damage may result in equipment failure after a period of time. As a minimum, you should place the oscilloscope on a properly grounded ESD mat and wear a properly grounded ESD wrist strap when working on the oscilloscope.

## Keystroke Conventions

To guide you while setting up the oscilloscope, the following conventions are used to represent keystrokes and other interactions with the oscilloscope:

- When you need to issue a command through the graphical interface, the command will be phrased like this: “Select <command> from the <menu name> menu.”
- When you need to select an object on the graphical interface, the instructions will be phrased something like this: “Select the OK button.”
- When you need to press a key the instructions will be phrased something like this: “Press the Run key.”

### Default Setup

A Default Setup is provided to return the oscilloscope to a known state. The default setup can be used to undo previous setups so that they do not interfere with the current measurement. Use the default setup when a procedure requires it.

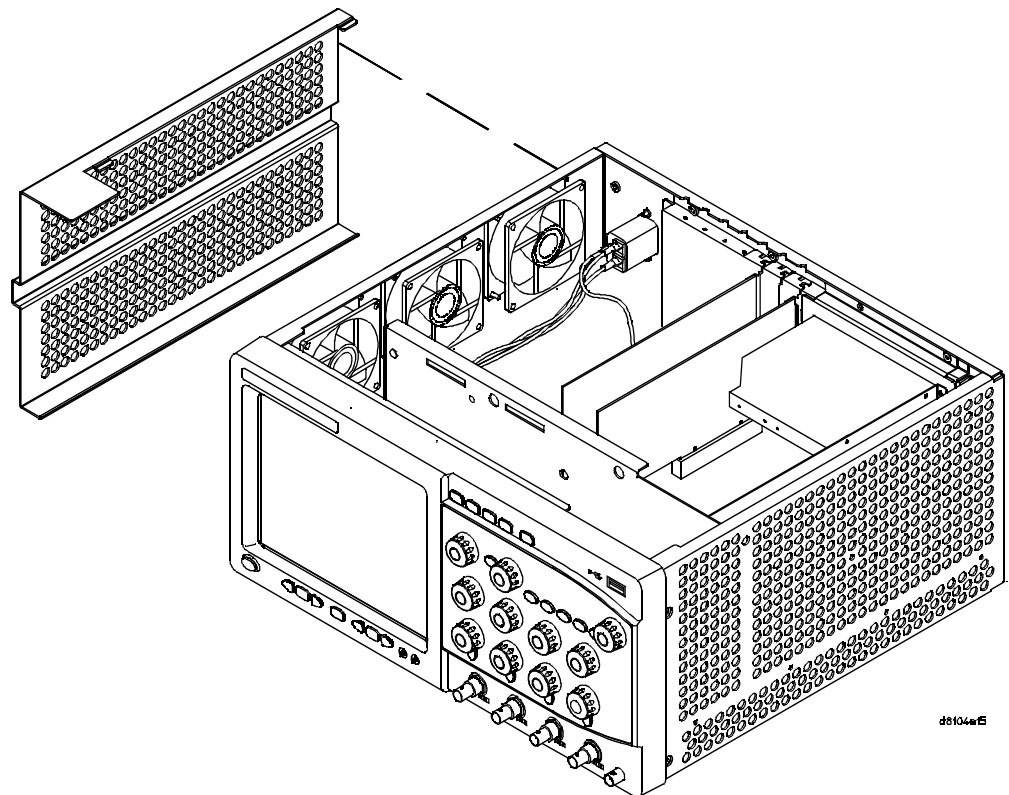
- Press the Default Setup key to set the oscilloscope to the default state.

---

## To install the fan safety shield

- 1 Disconnect the oscilloscope power cord and remove the cover.  
If necessary, refer to the procedures in chapter 6 "Replacing Assemblies".
- 2 Clip the fan safety shield over the outside of the oscilloscope chassis next to the fans.  
See Figure 5-1e Figure 5-1.

Figure 5-1



Installing the Fan Safety Shield

---

## To troubleshoot the oscilloscope

The troubleshooting procedure is used to isolate problems to a faulty assembly. When you find the faulty assembly, use the disassembly and assembly procedures in "Replacing Assemblies," beginning on page 101 to replace the assembly.

The primary procedural tool in this section is the flowchart. The flowchart contains the entire troubleshooting path from a failed oscilloscope to a working one. It will direct you through the possible failure symptoms in an orderly manner. Reference letters on the flow chart (for example: A, B, and C) refer to sections in this chapter where the procedures are described in detail.

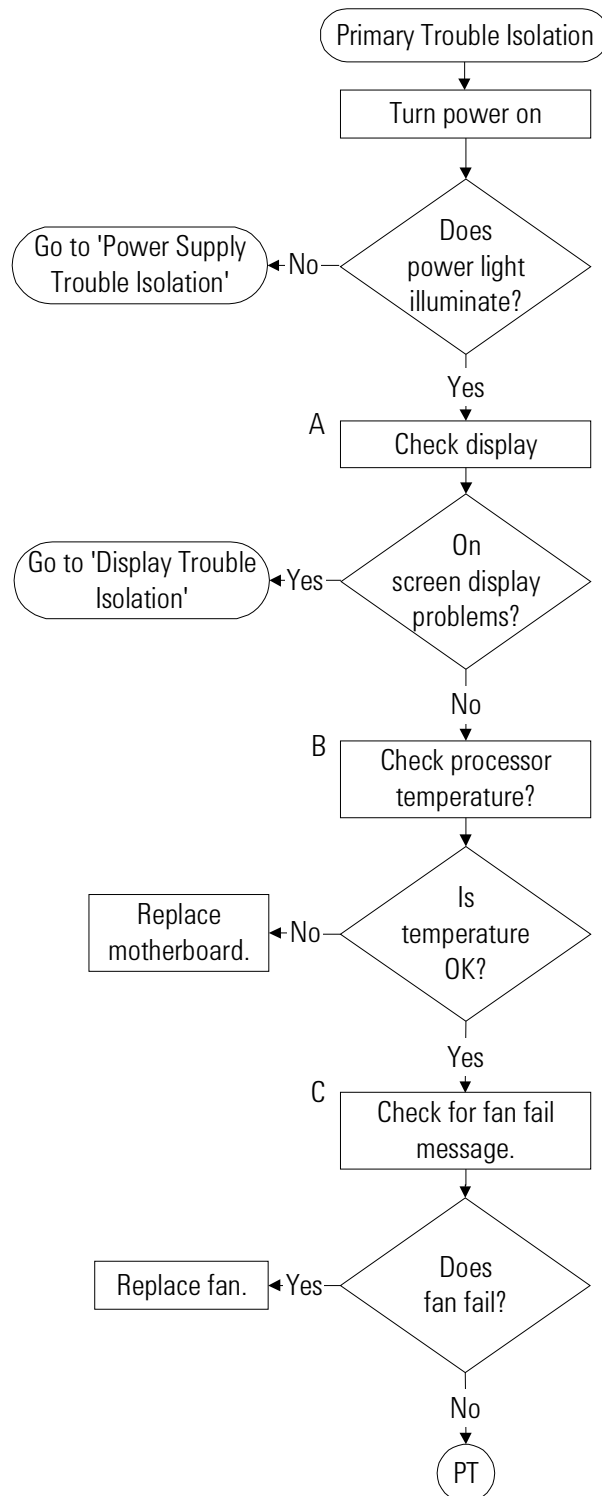
If you are unfamiliar with this oscilloscope, start with the Primary Trouble Isolation Flowchart.

---

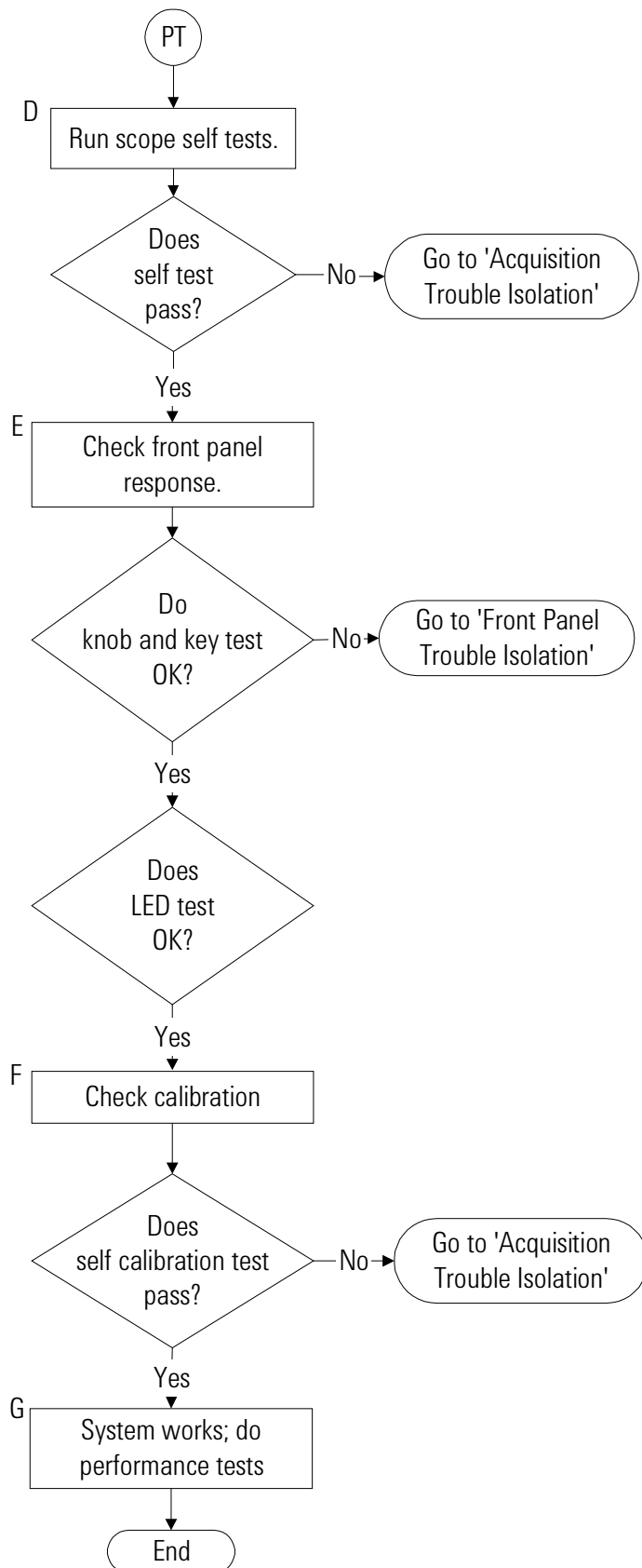
## Primary Trouble Isolation

A letter is assigned to boxes in the flowchart. The letter corresponds to a specific section in the reference text. Be sure to use the flowchart for your troubleshooting path.

**Primary Trouble Isolation Flowchart (Part 1 of 2)**



**Primary Trouble Isolation Flowchart (Part 2 of 2)**



## A Perform power-up.

### 1 Power-on the oscilloscope.

Connect the oscilloscope power cord and press the power button in the lower left corner of the front panel. The oscilloscope will boot-up, and the oscilloscope graticule will be displayed on the screen. The exact appearance may vary depending on the setup selected before the oscilloscope was turned off.

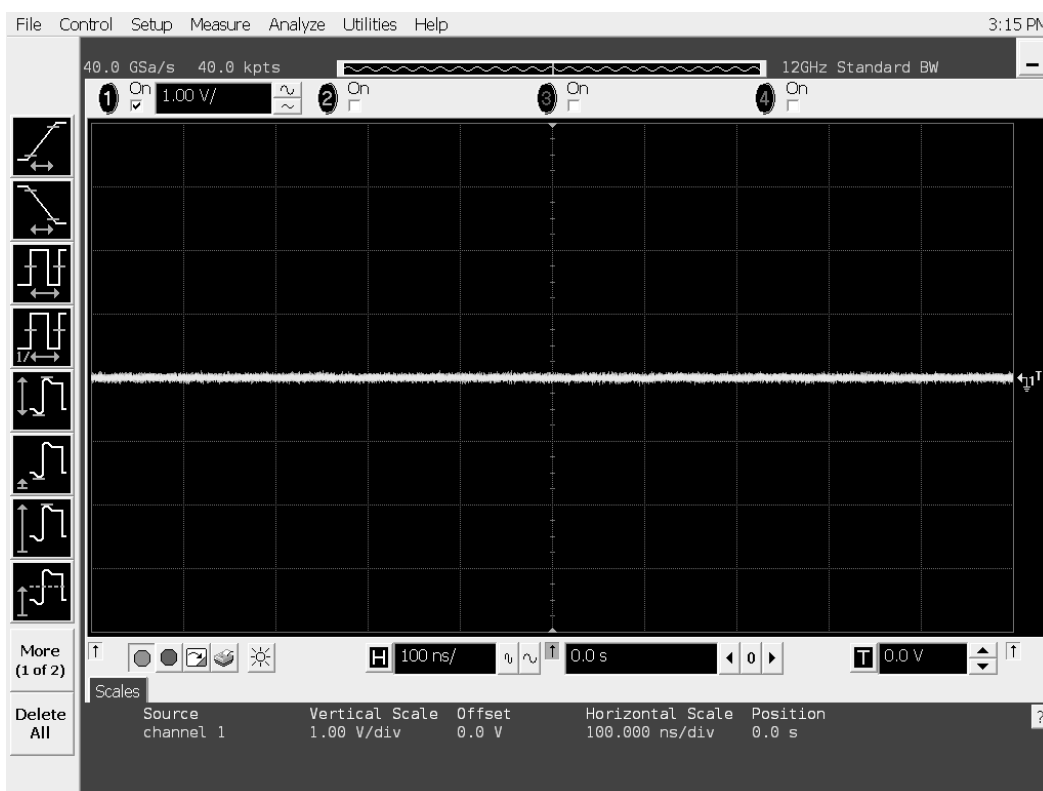
### 2 Press the Default Setup key.

This returns the oscilloscope to a known state.

### 3 Check the display.

The display on the screen should be similar to the figure below. If there is no display on the oscilloscope flat-panel display after power-up, see “Front Panel Display Trouble Isolation” on page 86. Otherwise, see “Check the processor temperature.” on page 72.

**Figure 5-2**



**Power-on Display**

**B Check the processor temperature.**

If the processor temperature is over 70 °C, the motherboard will turn on an audible alarm. If the alarm can be heard:

- 1 Reboot the oscilloscope.
- 2 Press del key when the splash screen is seen.
- 3 Scroll down to PC Health Status and press the Enter key.
- 4 Check that the Current CPU Temperature is around 45 °C.

If the processor temperature is hot, check the following:

- 1 Check that the processor's heatsink is properly attached.
- 2 Check that the heatsink fan cable is connected to the motherboard.

If the above steps do not solve the problem then replace the motherboard assembly.

**C Check for the fan failure message.**

When the oscilloscope application loads, it will check that the fans are running. If a fan is not running, a fan failure message will appear. If more than one fan has failed, the oscilloscope will shut down.

**D Run oscilloscope self-tests.**

- 1 Select Self Test from the Utilities menu.
- 2 Select Scope Self Tests from the Self Test drop down list box.
- 3 Click the Start Test button and follow the instructions on the screen.

If any of the selftests fail, go to the Acquisition Trouble Isolation troubleshooting flowchart later in this chapter for further troubleshooting. Otherwise, go to step E.

**E Check the front panel response by running the knob, key, and LED self tests.**

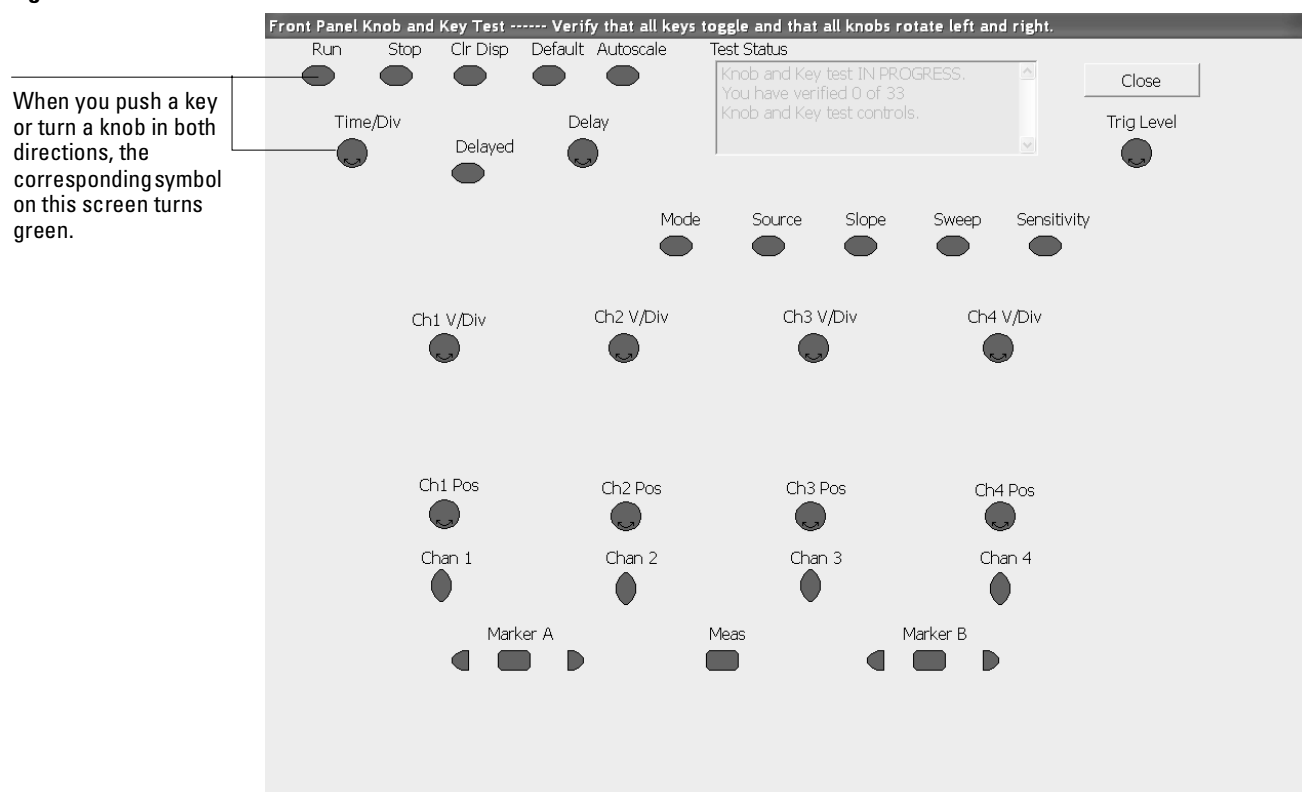
Use this procedure to verify correct keyboard operation.

- 1 Select Self Test from the Utilities menu.
- 2 Select Knob and Key from the Self Test drop down list box, then click Start.

A new window appears with a symbolic representation of the keyboard. See Figure 5-3.



Figure 5-3



#### Knob and Key Self Test Screen

#### 3 Push each key on the keyboard until you have pushed all keys.

When you push a key, the corresponding key symbol on the display should change from red to green.

#### 4 Turn each knob in both directions until you have turned all knobs.

When you turn a knob in one direction, the corresponding knob symbol on the display should change from red to yellow. When you then turn the knob in the other direction, the knob symbol should change from yellow to green.

#### 5 When you are finished, click Close.

If any of the knobs or keys do not work, go to To check the keyboard; Trouble Isolation Procedure 97.

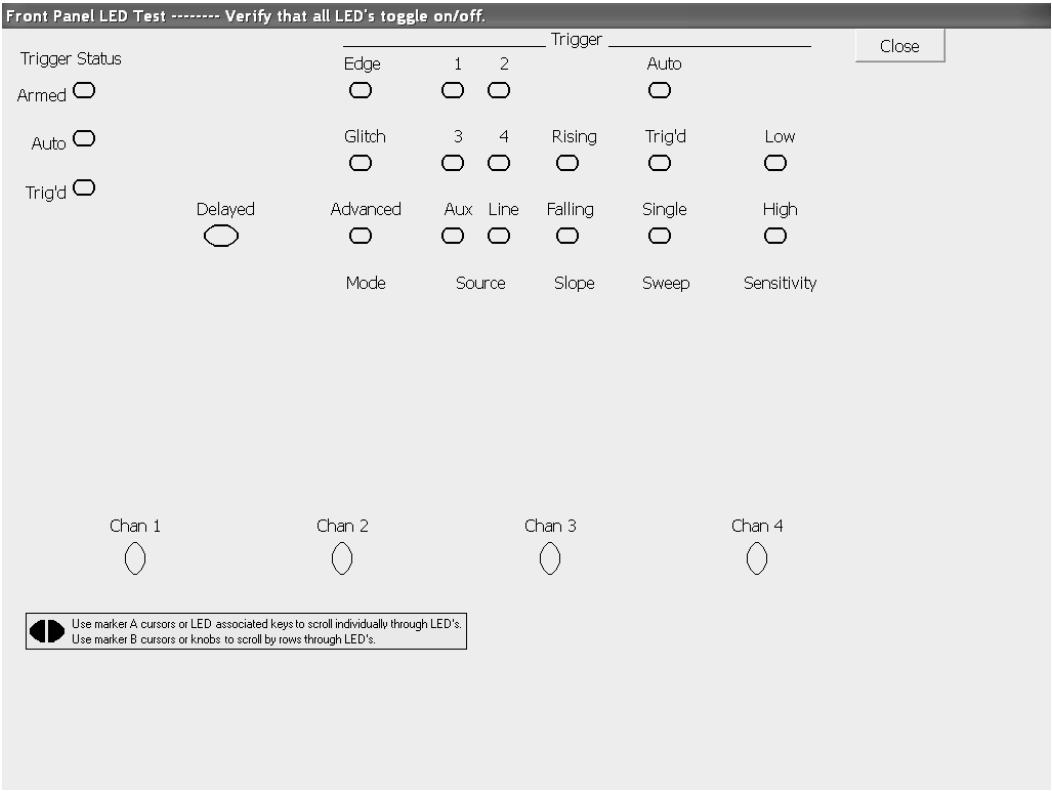
Use the following procedure to test the front-panel LED (light-emitting diode) indicators.

#### 1 Select Self Test from the Utilities menu.

#### 2 Select LED from the Self Test drop-down list box, then click Start Test.

The LED test screen appears, which shows a symbolic representation of all front panel LED indicators. See Figure 5-4.

Figure 5-4



LED Test Screen

- 3 Push the Marker A left and right arrow keys to highlight each LED symbol in the test screen. Verify that the corresponding LEDs on the front panel are the only ones illuminated.

**Test by Rows**  
You can use the Marker B arrow keys to test LEDs by row; however, in the event that two LED indicators are shorted together, there is a small chance that the test will not reveal the failure.

- 4** When you are finished, click Close.  
If any of the LEDs do not work, go to “To check the LEDs” later in this chapter.
- 5** If both tests pass, go to step F.
- F** Self Calibration
  - 1** Complete a self Calibration by following the procedures in chapter 3, “Testing Performance.”
  - 2** If the calibration test fails, replace the acquisition assembly. If the calibration test passes, go to step G.
- G** The system is operational. Performance test the oscilloscope using the procedures in chapter 3 of this service manual.

---

## Power Supply Trouble Isolation

---

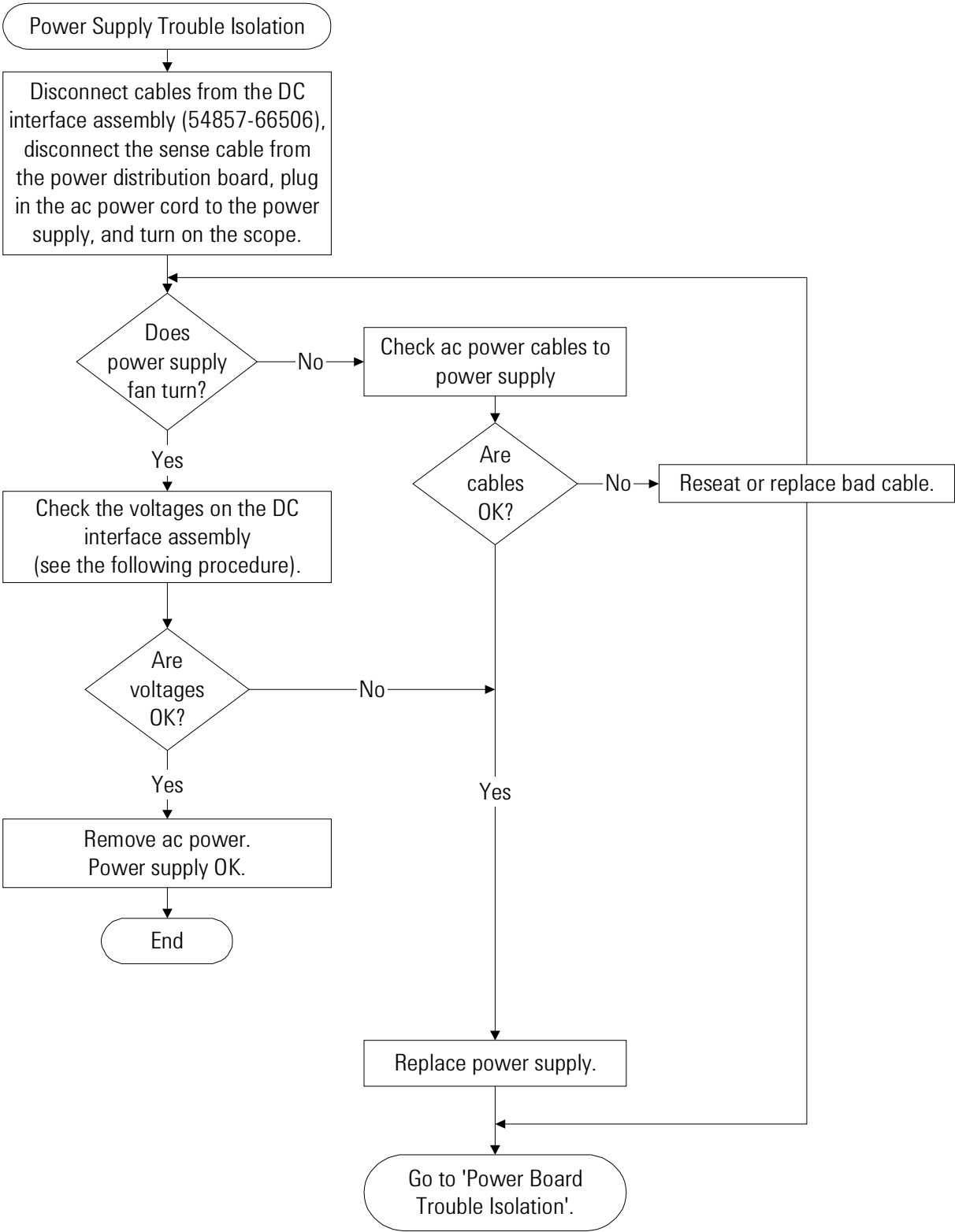
### **WARNING**

#### **SHOCK HAZARD!**

The maintenance described in this section is performed with power supplied to the oscilloscope and with the protective covers removed. Only trained service personnel who are aware of the hazards involved should perform the maintenance. Read the safety summary at the back of this book before proceeding. Failure to observe safety precautions may result in electric shock.

---

Figure 5-5

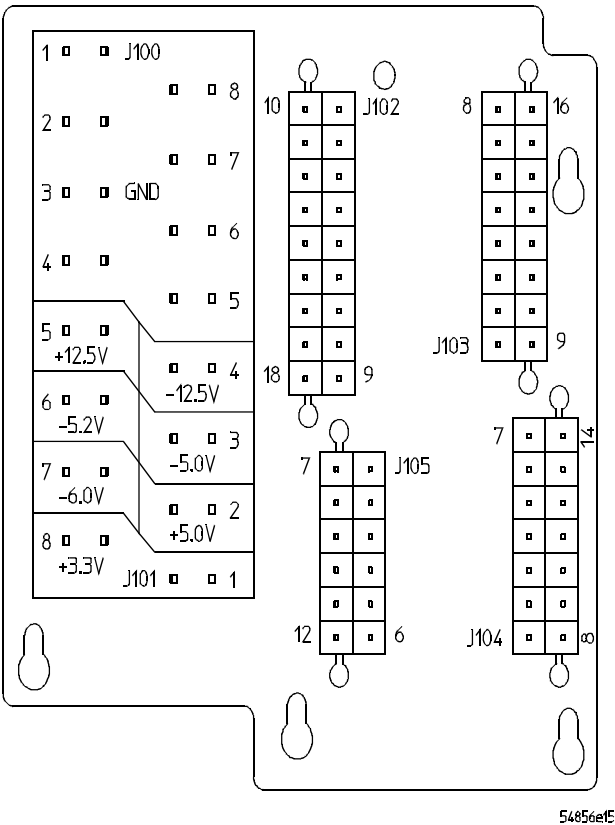


**Power Supply Trouble Isolation Flowchart**

These trouble isolation instructions help isolate the problem to the assembly level when the power system is not operating. Because of advanced power system protection features, the problem may not be with the supply itself, and therefore you will need to work through the procedure systematically to determine the source of the fault.

- 1 Check the power supply voltages from the power supply. See Figure 5-6 for the location of these test points. Table 5-7 on page 78 shows the allowable range of power supply voltages.

Figure 5-6



Power Supply Voltage Test Locations

Table 5-7

Power Supply Voltage Limits	
Supply Voltage Specification	Limits
+12.6 V $\pm$ 0.1 V	+12.5 V to +12.7 V
-12.6 V $\pm$ 0.1 V	-12.5 V to -12.7 V
-5.3 V $\pm$ 0.05 V	-5.25 V to -5.35 V
-5.1 V $\pm$ 0.05 V	-5.05 V to -5.15 V
-6.1 V $\pm$ 0.05 V	-6.05 V to -6.15 V
+5.1 V $\pm$ 0.05 V	+5.05 V to +5.15 V
+3.35 V $\pm$ 0.03 V	+3.32 V to +3.38 V

## Power Board Trouble Isolation

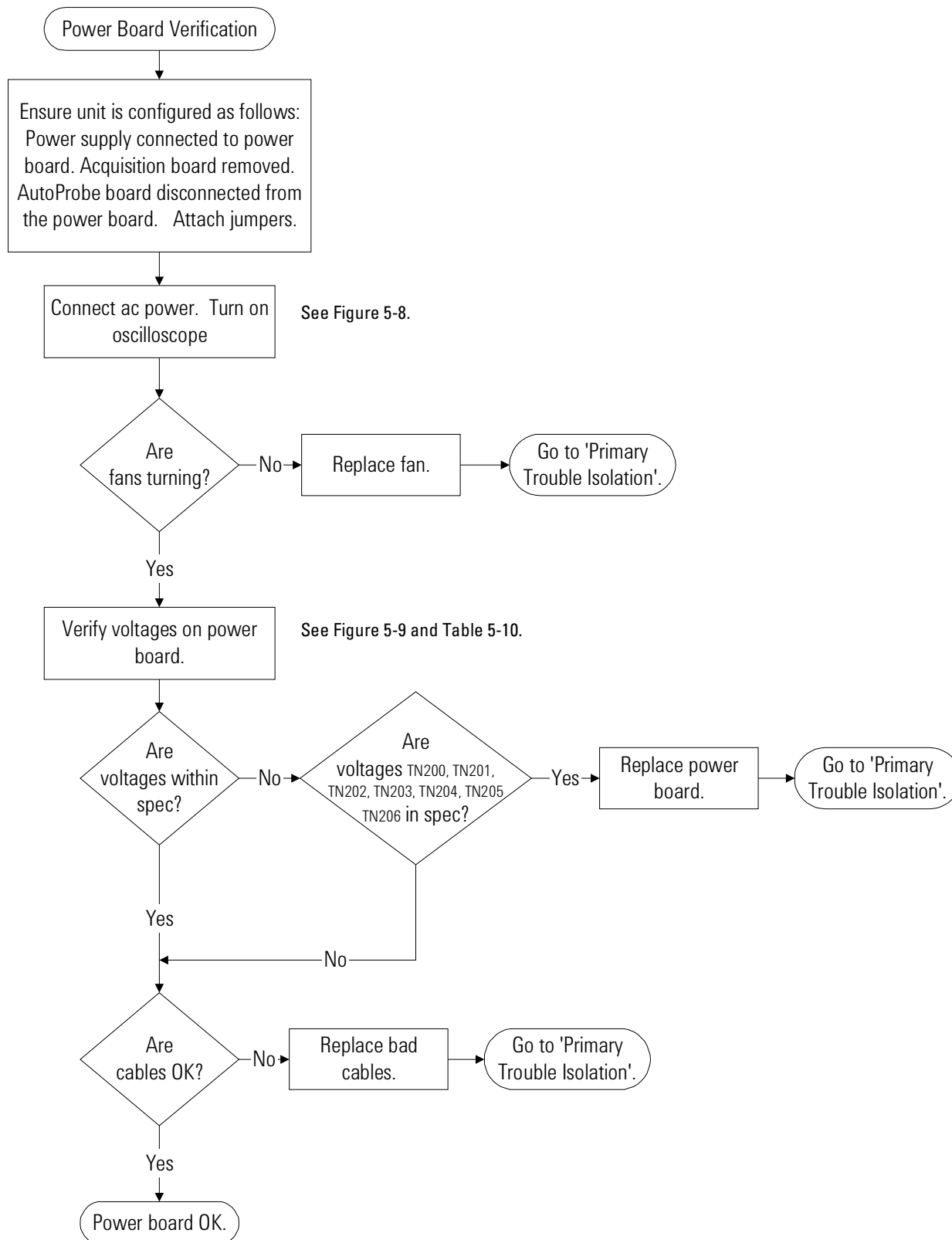
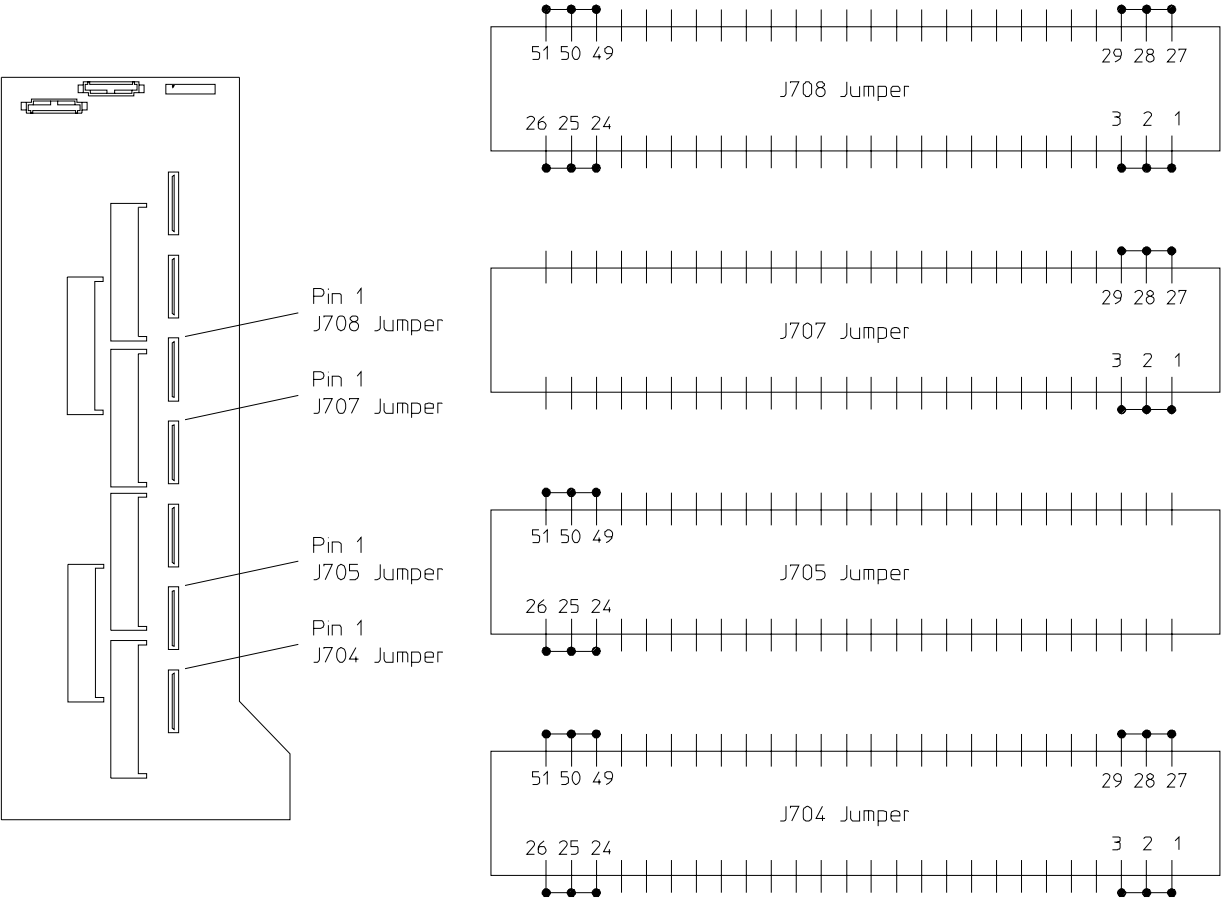


Figure 5-8

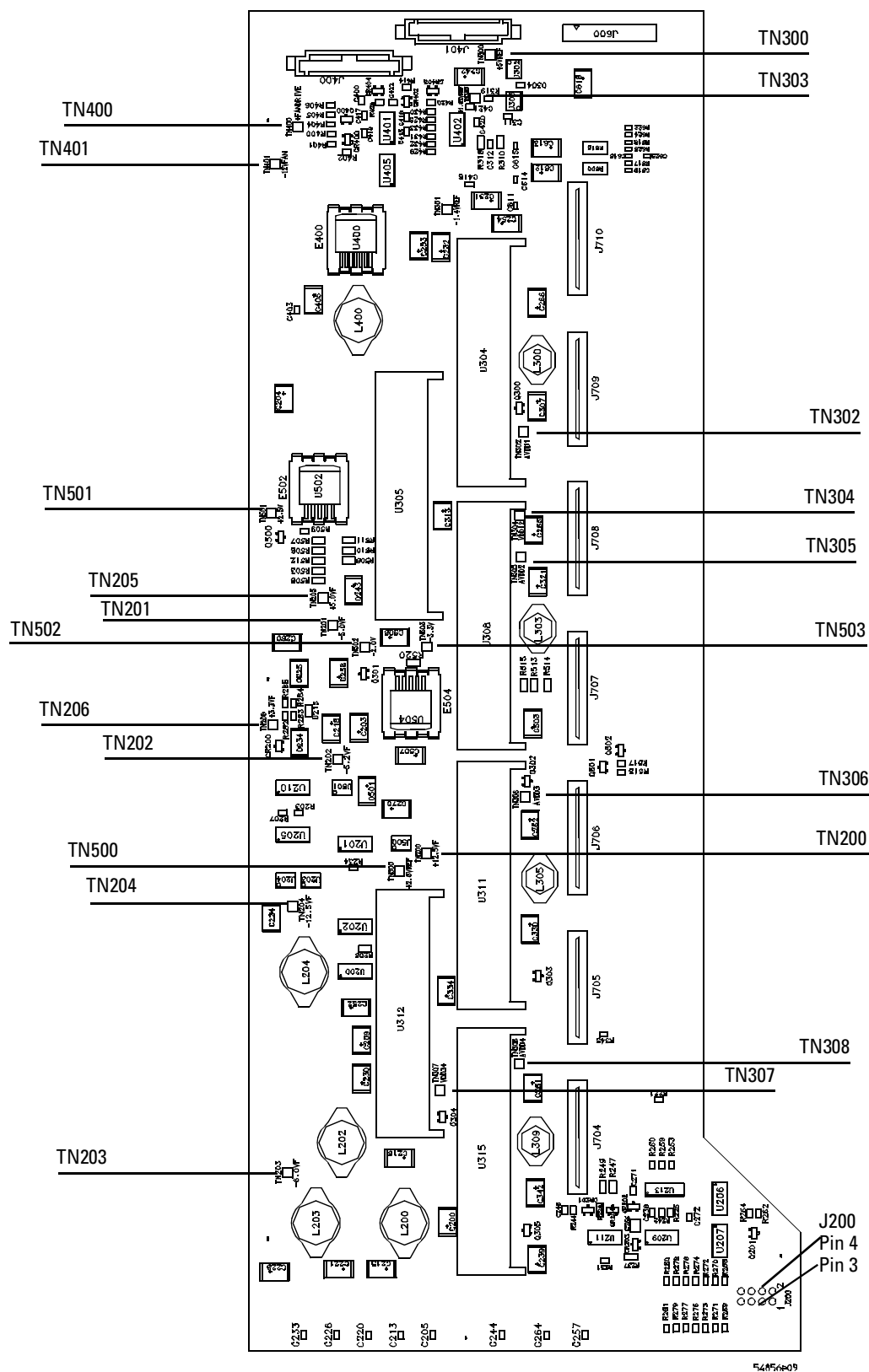


54856e1c

Jumpers for voltage feedback on power board.



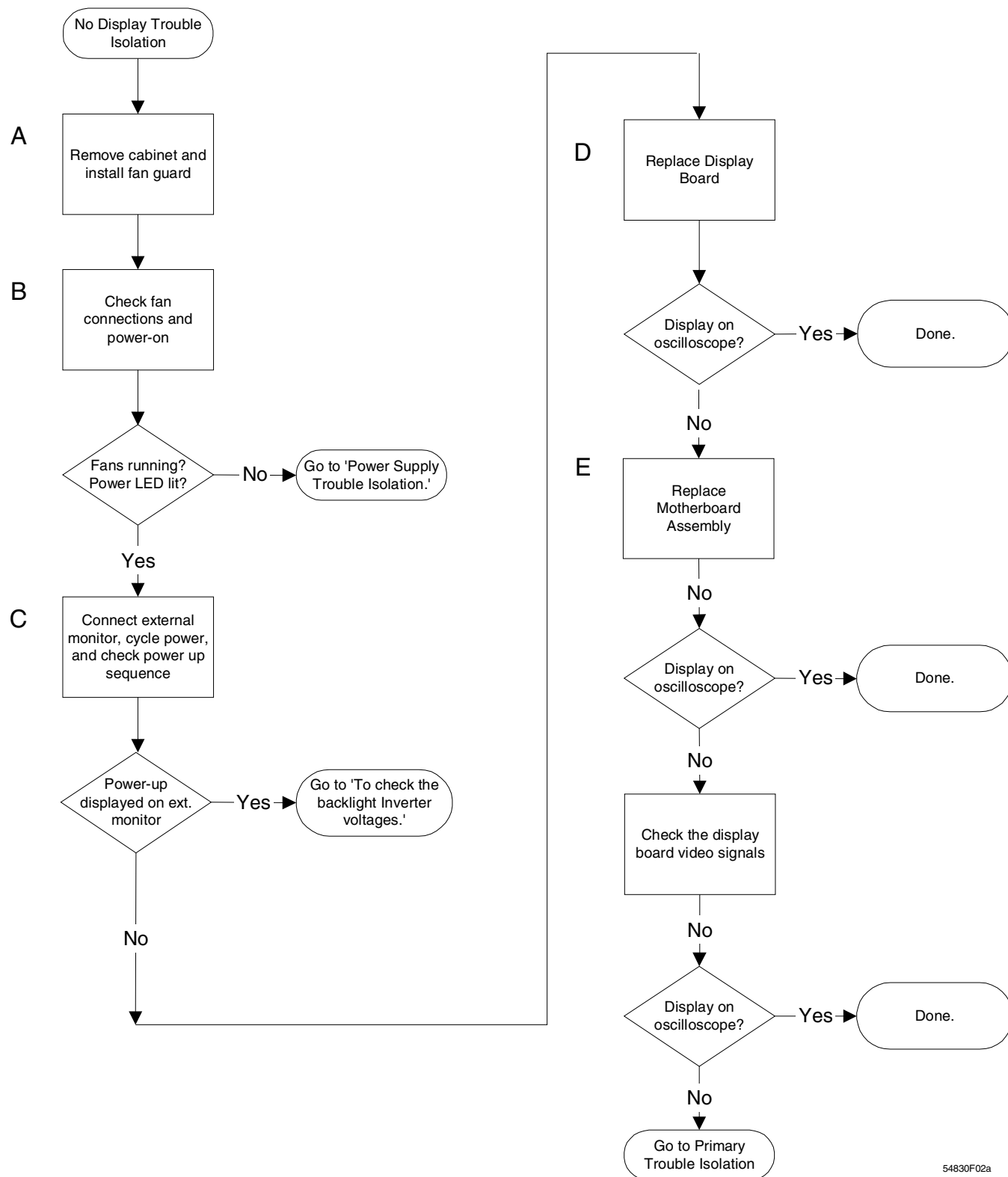
Figure 5-9 Power Board Voltage Test Points



**Table 5-10**

<b>Power Board Voltage Checks</b>		
<b>Test Point +</b>	<b>Test Point -</b>	<b>Specification</b>
TN400 (+FANDRIVE)	TN400 (-12VFAN)	+7 V to + 12.5 V
TN501	Ground	+2.5 V $\pm$ 0.05 V
TN204	Ground	-12.0 V $\pm$ 0.1 V
TN205	Ground	+5.0 V +0.1 V -0.02 V
TN201	Ground	-5.0 V -0.1 V +0.02 V
TN502	Ground	-2.0 V $\pm$ 0.05 V
TN503	Ground	-3.3 V $\pm$ 0.05 V
TN206	Ground	+3.3 V +0.05 V -0.02 V
TN202	Ground	-5.2 V -0.1 V +0.02 V
TN500	Ground	+2.5 V $\pm$ 0.01 V
TN200	Ground	+12.5 V $\pm$ 0.1 V
TN203	Ground	-6.0 V -0.1 V +0.02 V
J200 pin 3 or 4	Ground	+ 5.0 V $\pm$ 0.1 V
TN307	Ground	+1.620 V $\pm$ 0.049 V
TN304	Ground	+1.620 V $\pm$ 0.049 V
TN302	Ground	+1.6200 V $\pm$ 0.0016 V
TN305	Ground	+1.6200 V $\pm$ 0.0016 V
TN306	Ground	+1.6200 V $\pm$ 0.0016 V
TN308	Ground	+1.6200 V $\pm$ 0.0016 V
TN300	Ground	+5.0 V $\pm$ 0.002 V
TN303	Ground	+1.62 V $\pm$ 0.002 V

## Display Trouble Isolation



54830F02a

Display Trouble Isolation Flowchart

---

## To check the backlight inverter voltages

The backlight inverter board A5 is located in the front-left corner of the oscilloscope (as you face the front panel).

- There is an input connector at one side of the board.
- There are two output connectors on the other end of the board, that power the two backlights which are inserted into the flat panel display.

The output voltage is approximately 300-450 V<sub>rms</sub>, 40 kHz (measured differentially between the two wires) when the backlight is illuminated. The voltage is approximately 1 kV before the backlight tube is illuminated. A red LED on the backlight inverter board illuminates when the output voltage is present.

When the backlight goes off (when the oscilloscope's operating system switches to screen saver mode) the voltage on pins 1 and 2 (with respect to ground) slowly decays to 0 V.

The outputs are controlled by the input. Notice that input pin 5 goes low to enable the output voltage. These pins can be reached at J1 on the display board A11.

**Table 5-11**

---

**Backlight Inverter Board Input Voltages**

---

Input Pin #	7	6	5	4	3	2	1
Backlight OFF	0 V	0 V	0 V	0 V	0 V	0 V	0 V
Backlight ON	5 V	0 V	2.5 V	0 V	0 V	12 V	12 V

## To check the display board video signals

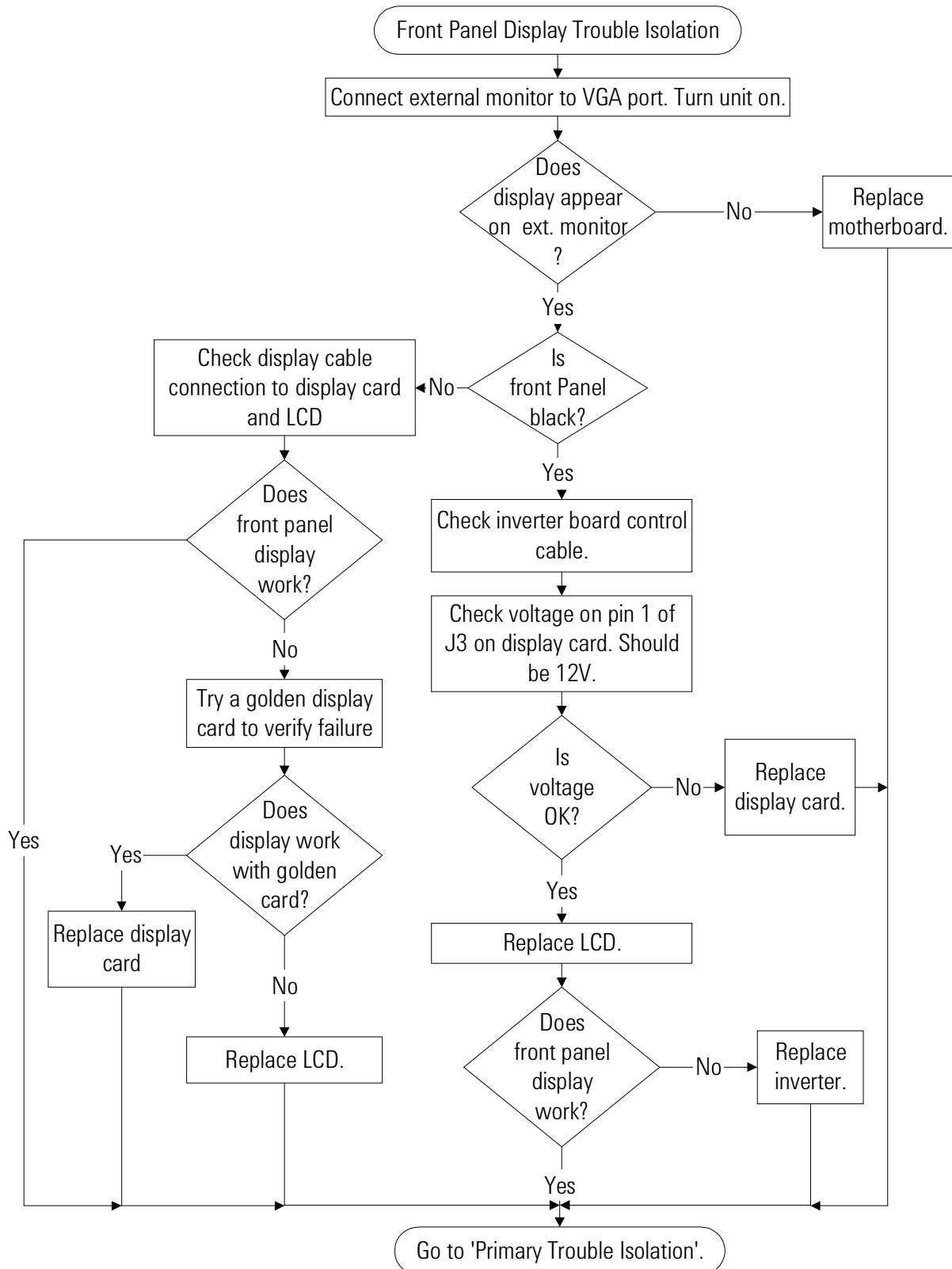
The video signals are checked on the 32-pin connector J2 on the display board A12. You can use an oscilloscope with a bandwidth of at least 100 MHz to verify the signals. Even-numbered pins are closest to the PC board. If the signals are not present, suspect the display card. If the signals are present and the backlights are on, suspect the flat-panel display as the problem. Note that CLK, A0, A1, A2, and A3 are Low Voltage Differential Signals (LVDS).

**Table 5-12**

**Video Signals**

Pin Number	Signal	Pin Number	Signal
1	NC	26	NC
2	CLK-	27	NC
3	CLK+	28	NC
4	GROUND	29	NC
5	A3-	30	NC
6	A3+	31	NC
7	GROUND	32	NC
8	A2-		
9	A2+		
10	GROUND		
11	A1-		
12	A1+		
13	GROUND		
14	A0-		
15	A0+		
16	NC		
17	NC		
18	NC		
19	NC		
20	NC		
21	GROUND		
22	GROUND		
23	+3.3 V		
24	+3.3 V		
25	+3.3 V		

## Front Panel Display Trouble Isolation



---

**WARNING****SHOCK HAZARD!**

The backlight inverter assembly, which is mounted at the front corner of the oscilloscope near the flat-panel display, operates at 1.3 kV at turn on. DO NOT handle this assembly while it is in operation. An LED on the inverter board illuminates to indicate the presence of high voltage.

---

---

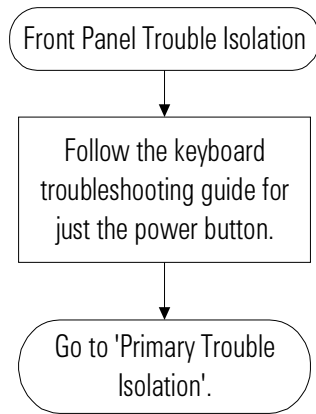
**WARNING****INJURY CAN RESULT!**

Once the cover is removed, the fan blades are exposed both inside and outside the chassis. Disconnect the power cable before working around the fan. Use extreme caution in working with the oscilloscope when the cover is removed. Install the fan safety shield (Agilent Technologies P/N 54810-00601) on the side of the chassis over the fan. Failure to observe these precautions may result in injury.

---

For information on how to replace the display parts, see "Replacing Assemblies," beginning on page 101.

## Front Panel Trouble Isolation





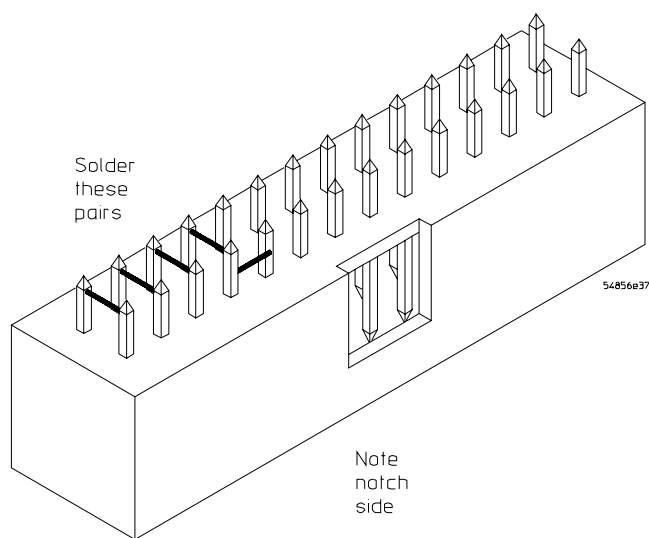
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## Motherboard Verification

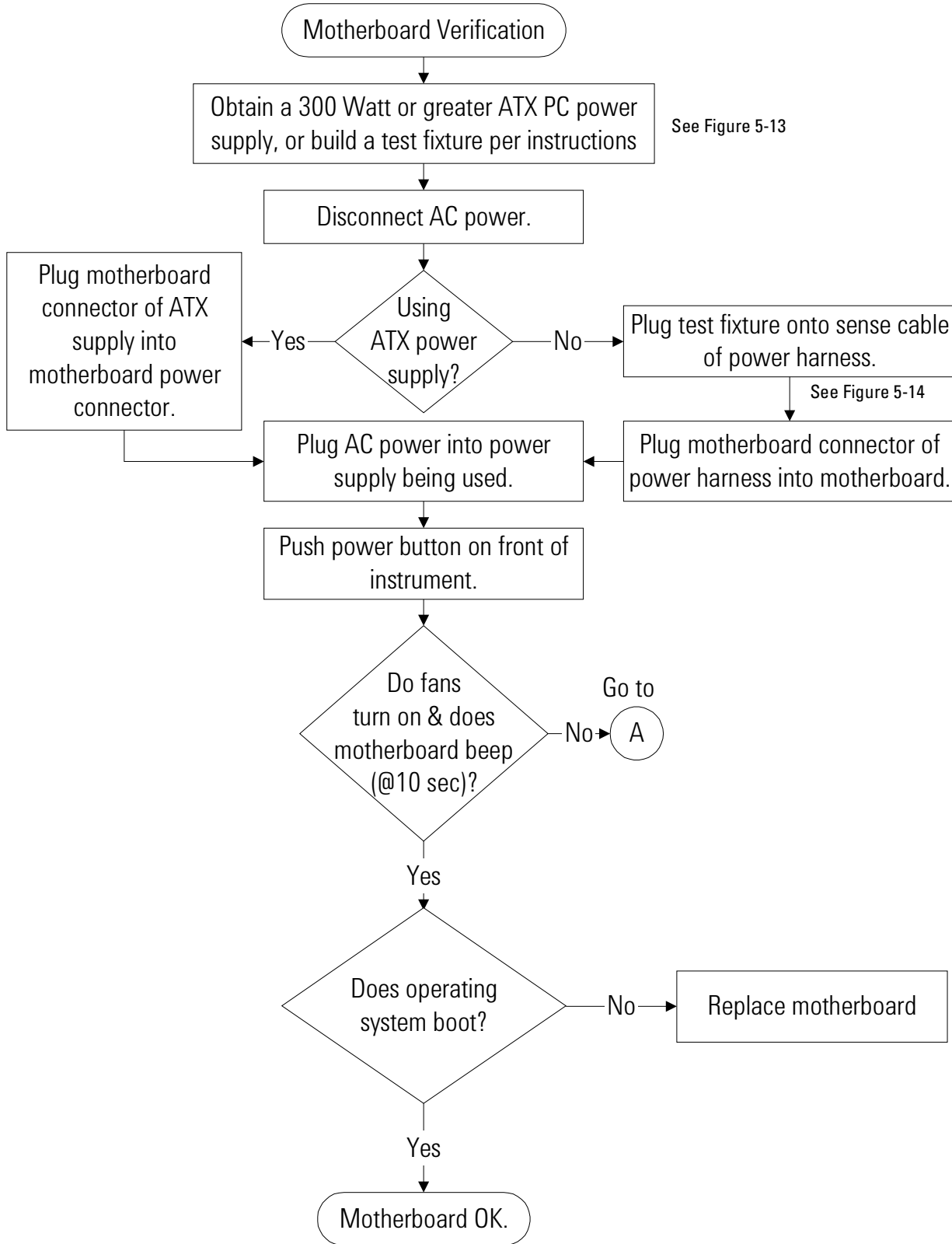
The mother board verification requires the use of either a 300 Watt or greater ATX PC power supply or a test fixture that can be built as follows.

Using an AMP connector, Tyco Electronics part number 2-103168-3 or Agilent part number 1252-1468, solder wires between the pins as shown in Figure 5-13.

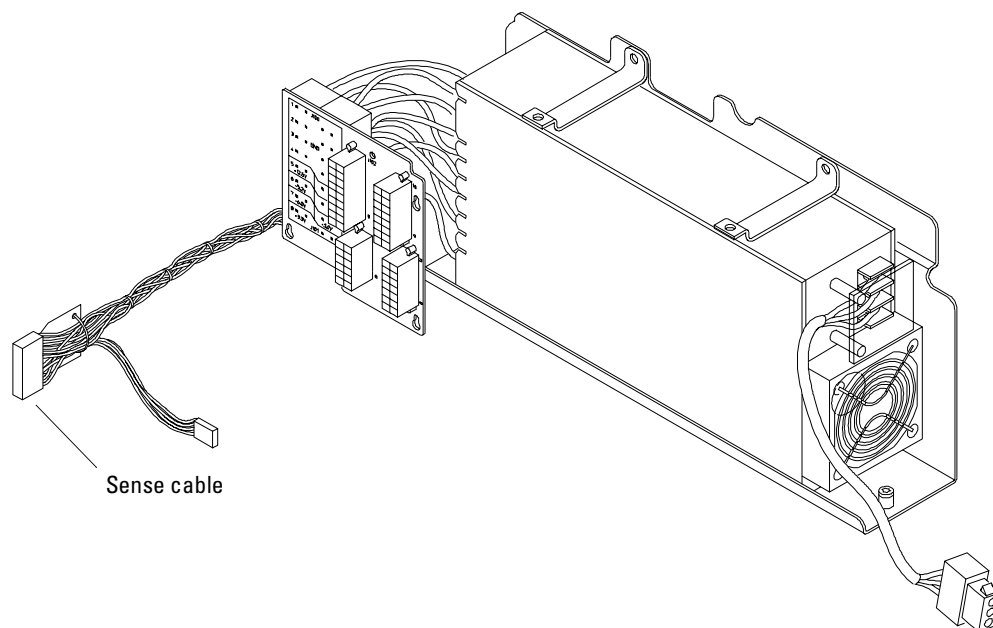
**Figure 5-13**



**Test Fixture**



**Figure 5-14**



54856e25

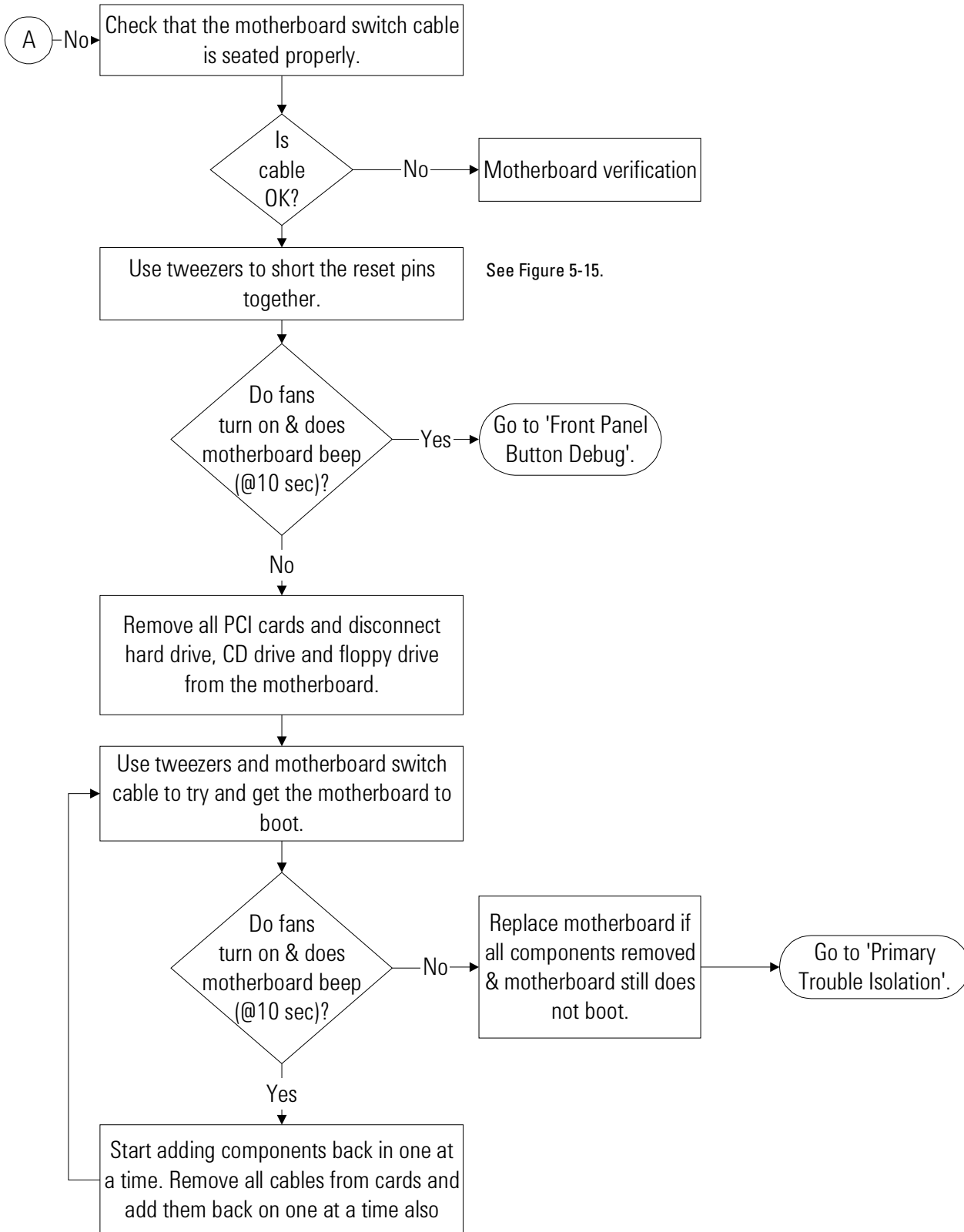
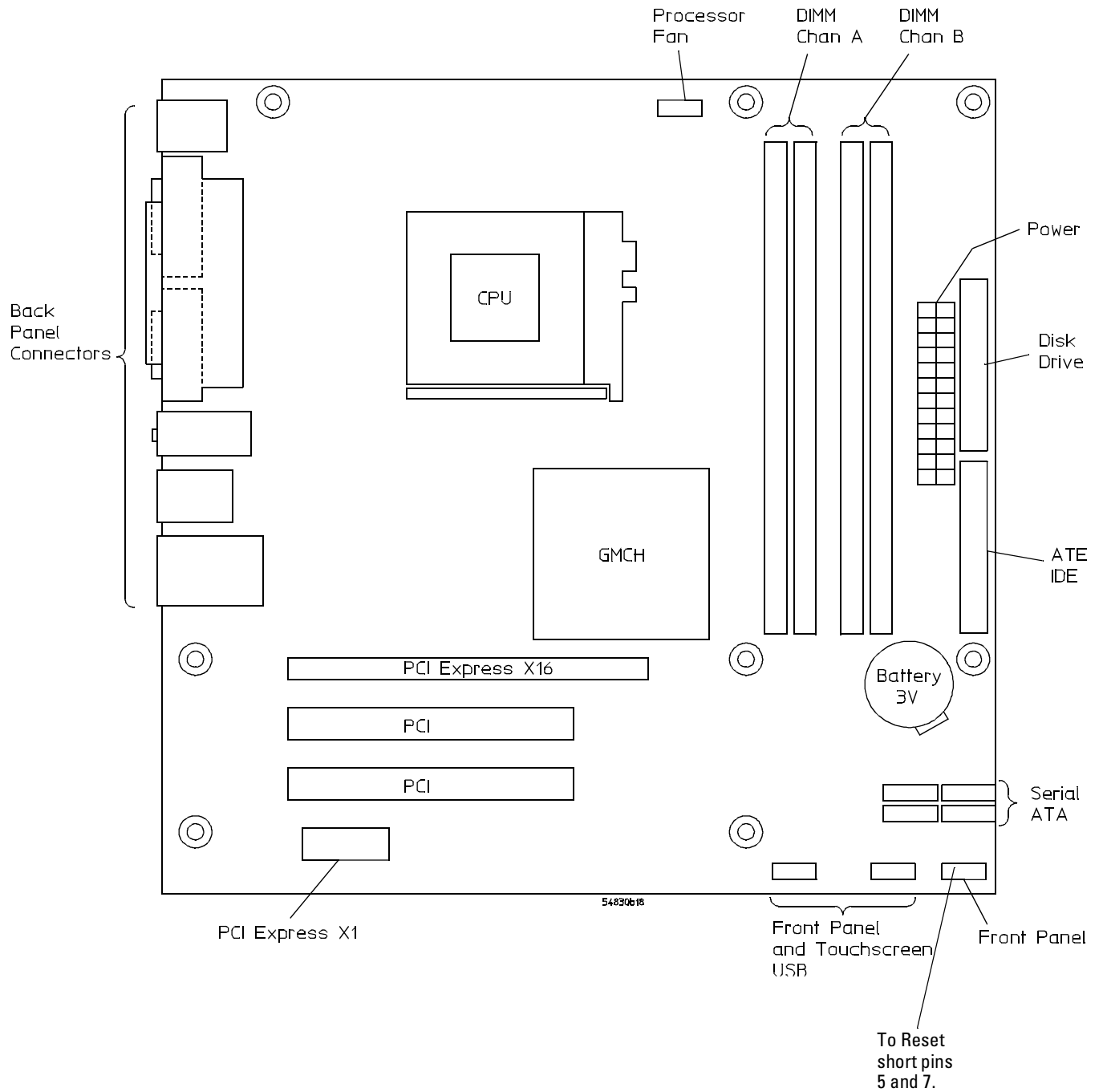


Figure 5-15: Intel D915GUX Motherboard



## To setup the BIOS

If the BIOS settings become corrupt, the Infiniium oscilloscope PC motherboard will not recognize the hard drive and the unit may not boot. The motherboard BIOS setup procedure is presented in the following pages.

### **Configure the Intel D915GUX Motherboard BIOS parameters.**

Use this procedure to set the motherboard BIOS.

- 1** Connect the power cable to the Infiniium oscilloscope.
- 2** Connect the external keyboard to the rear panel.
- 3** Press the delete key when you see the following prompt on the bottom of the screen

Press TAB to Show POST screen, DEL to enter SETUP, F12 to select boot device.

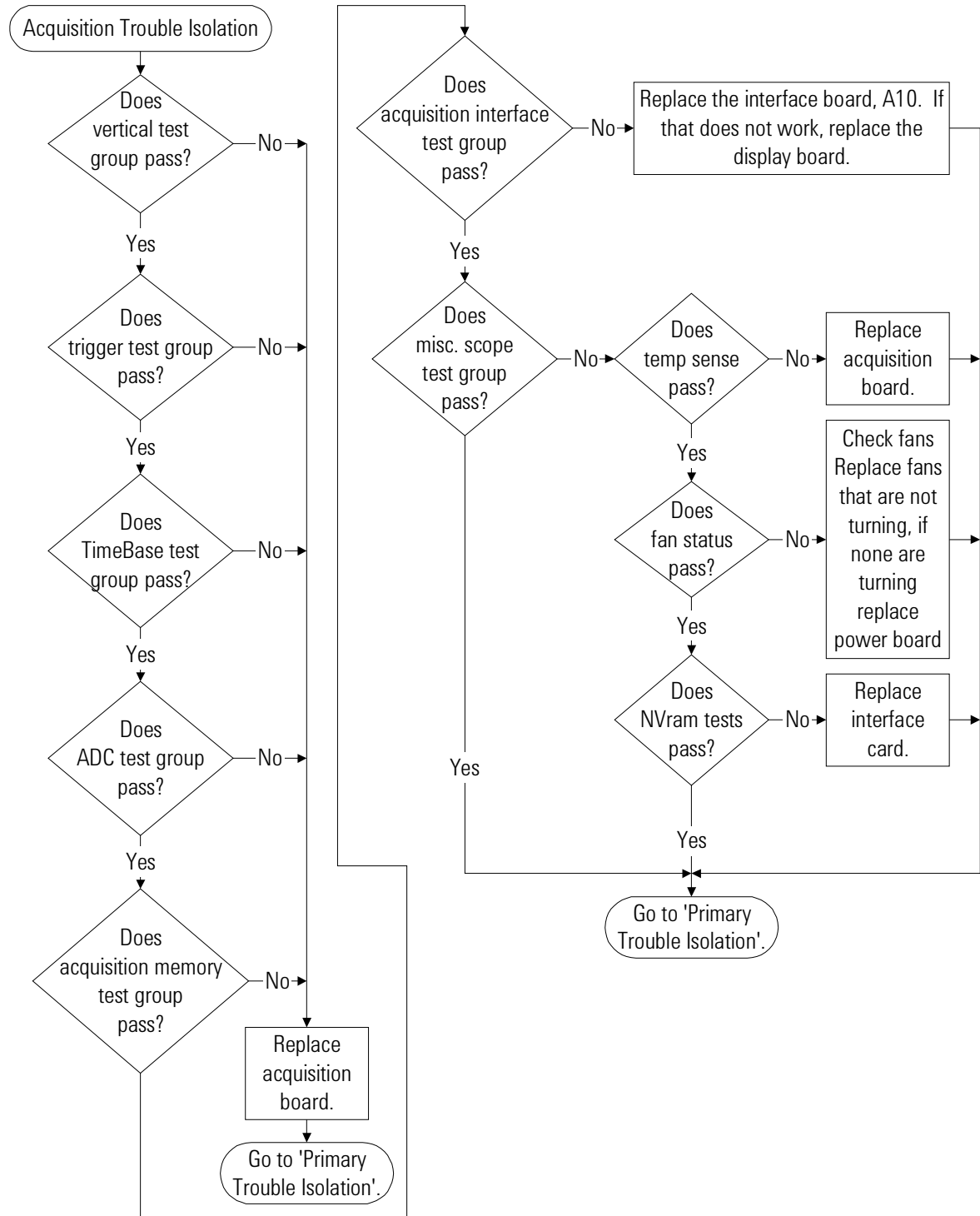
Note: If you do not see the prompt, or the oscilloscope does not appear to be functioning, check the ribbon cable connectors. Otherwise, continue with the next step.

### **BIOS Setup Procedure**

- 1** Go to **Load Optimized Defaults** and press Enter key. Select **Y** to load the defaults, then press the Enter key.
- 2** Press F10 to save and exit the setup. Type "Y" to save changes.

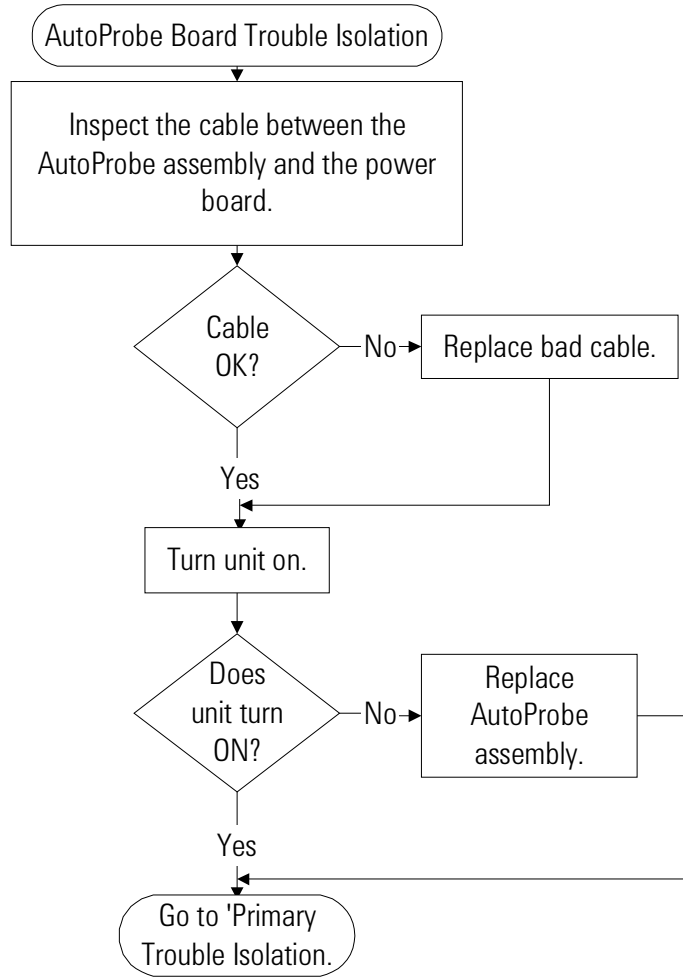
## Acquisition Trouble Isolation

If Acquisition board has been removed by a prior procedure, reinstall Acquisition board.



---

## AutoProbe Board Trouble Isolation





---

## To check the keyboard; Trouble Isolation Procedure

Use this procedure only if you encounter key failures in the keyboard test procedure. If any knobs fail, replace the keyboard assembly.

- 1** Disconnect the power cord and remove the cover.
- 2** Remove the front panel assembly.  
See chapter 6 for instructions.
- 3** Remove the keyboard assembly and the cursor keyboard assembly from the front panel assembly. Partially re-assemble the front panel assembly, including the flat-panel display and lens, but omitting the keyboard and cursor keyboard. Re-attach the partial assembly to the chassis.  
Be sure to reconnect the display video cable and the backlight inverter cables. See chapter 6 for instructions on removing and disassembling the front panel.
- 4** Separate the elastomeric keypads from the cursor keyboard and keyboard assemblies.

---

### CAUTION

CONTAMINATION CAN CAUSE INTERMITTENT OPERATION!

Be careful not to contaminate the key side of the PC board or the keypads. Dust and fingerprints on these parts may cause intermittent key operation.

---

- 5** Set the cursor keyboard and keyboard assembly on an antistatic electrical insulated surface.
- 6** Connect the cursor keyboard cable to the keyboard assembly. Connect the keyboard cable to the scope interface board in the chassis.  
You may need to set the chassis on its side to allow proper routing of the cables without straining them.
- 7** Reconnect the power cable and apply power.
- 8** Enable the graphical interface, then start the keyboard test as described in the previous procedure.
- 9** Carefully short the PC board trace, with a paper clip or screwdriver, at each nonoperating key (as determined by keyboard test), and look for an appropriate response on the display.
  - If the display responds as though a key were pressed, replace the elastomeric keypad.
  - If the display does not respond as though a key were pressed, replace the keyboard.
- 10** Re-assemble the oscilloscope.

## To check the LEDs

If you see a failure with the Auto or Trig'd LEDs, check the voltage at pin 6 of W16, with W16 disconnected from the keyboard. The voltage should be as follows:

- $0\text{ V} \pm 0.5\text{ V}$  when both LEDs are supposed to be off.
- $2.5\text{ V} \pm 0.5\text{ V}$  when Trig'd is supposed to be on and Auto is supposed to be off.
- $5.0\text{ V} \pm 0.5\text{ V}$  when both LEDs are supposed to be on.

If the voltages are not correct, the problem may be with keyboard cable W2, PCI bridge board A21, acquisition cable W3, or acquisition board A1. Try troubleshooting the acquisition system first to verify correct behavior before replacing any assemblies. If the voltages are correct but the LEDs do not light correctly, replace the keyboard assembly.

If you find a problem with the Armed LED, check pin 5 of W16 with the cable disconnected from the keyboard. The voltage should be as follows:

- $5.0\text{ V} \pm 0.5\text{ V}$  when Armed is supposed to be on.
- $< 3.6\text{ V} \pm 0.5\text{ V}$  when Armed is supposed to be on.

Isolation is the same as for the Trig'd and Auto LEDs.

If you find any other failures, replace the keyboard assembly. If the front panel power indicator LED does not light, replace the cursor keyboard assembly.

---

## Software Revisions

- Select About Infiniium... from the Help Menu.

### Enable the Graphical Interface

The graphical interface must be enabled to select this command.

A dialog box appears showing the current version number for the scope software and on-line information system software. This information may be useful when contacting Agilent Technologies for further service information. See figure 5-13.

**Figure 5-16**



### About Infiniium... Information

---

## To check probe power outputs

Probe power outputs are on the front panel, surrounding each BNC input.

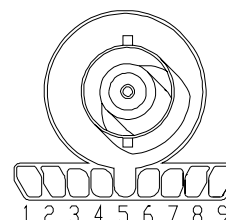
Use the table and figure to the right to check the power output at the connectors.

The +12 V and –12 V supplies come from ripple regulator on the power board, and the +3 V and –3 V supplies are developed in three-terminal regulators on the probe power and control assembly.

Measure the voltages with respect to the ground terminal on the front panel, located near the Aux Out BNC.

Do not attempt to measure voltages at pins 3 through 7.

Pin	Supply
1	+3V
2	–3V
3	Offset
4	Data
5 & ring	Probe ID
6	Clk
7	R <sub>p</sub>
8	–12 V
9	+12 V



Any failure may be a problem with the probe power and control assembly, the AutoProbe flex cable, the probe power and control cable, or the power board.

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# Replacing Assemblies

Use the procedures in this chapter when removing and replacing assemblies and parts in the Agilent Technologies oscilloscopes.

In general, the procedures that follow are placed in the order to be used to remove a particular assembly. The procedures listed first are for assemblies that must be removed first.

The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

## ESD Precautions

When using any of the procedures in this chapter you must use proper ESD precautions. As a minimum you must place the oscilloscope on a properly grounded ESD mat and wear a properly grounded ESD wrist strap.

---

### CAUTION

AVOID DAMAGE TO THE OSCILLOSCOPE!  
Failure to implement proper antistatic measures may result in damage to the oscilloscope.

---

## Tools Required

The following tools are required for these procedures.

- Torx drivers: T6, T8, T10, T15, T20
- Socket wrench: 5/8 inch and 9/16 inch
- Medium size (3/16-in) flat-blade screwdriver
- Nut Drivers: 3/16-in, 9/32-in, 5/16-in, 5/8-in
- Torque driver, 0.34 Nm (3 in-lbs), 5 mm or 3/16-in hex drive
- Torque driver, 0.34 Nm (3 in-lbs), Torx T6 drive

---

### CAUTION

REMOVE POWER BEFORE REMOVING OR REPLACING ASSEMBLIES!  
Do not remove or replace any circuit board assemblies in this oscilloscope while power is applied. The assemblies contain components which may be damaged if the assembly is removed or replaced while power is connected to the oscilloscope.

---

---

### WARNING

SHOCK HAZARD!  
To avoid electrical shock, adhere closely to the following procedures. Also, after disconnecting the power cable, wait at least three minutes for the capacitors on the power supply to discharge before servicing this oscilloscope. Hazardous voltages exist on the inverter for the display monitor.

---

---

### WARNING

SHOCK HAZARD!  
Read the Safety information at the back of this guide before performing the following procedures. Failure to observe safety precautions may result in electrical shock.

---

---

**WARNING**

---

**INJURY CAN RESULT!**

Install the fan safety shield (included in the Service Kit) if you remove the oscilloscope cover. Without this shield, the oscilloscope fan blades are exposed and can cause injury.

---

---

## To return the oscilloscope to Agilent Technologies for service

Before shipping the oscilloscope to Agilent Technologies, contact your nearest Agilent Technologies oscilloscope Support Center (or Agilent Technologies Service Center if outside the United States) for additional details.

**1 Write the following information on a tag and attach it to the oscilloscope.**

- Name and address of owner
- Oscilloscope model numbers
- Oscilloscope serial numbers
- Description of the service required or failure indications

**2 Remove all accessories from the oscilloscope.**

Accessories include all cables. Do not include accessories unless they are associated with the failure symptoms.

**3 Protect the oscilloscope by wrapping it in plastic or heavy paper.**

**4 Pack the oscilloscope in foam or other shock absorbing material and place it in a strong shipping container.**

You can use the original shipping materials or order materials from an Agilent Technologies Sales Office. If neither are available, place 8 to 10 cm (3 to 4 inches) of shock-absorbing material around the oscilloscope and place it in a box that does not allow movement during shipping.

**5 Seal the shipping container securely.**

**6 Mark the shipping container as FRAGILE.**

In any correspondence, refer to oscilloscope by model number and full serial number.

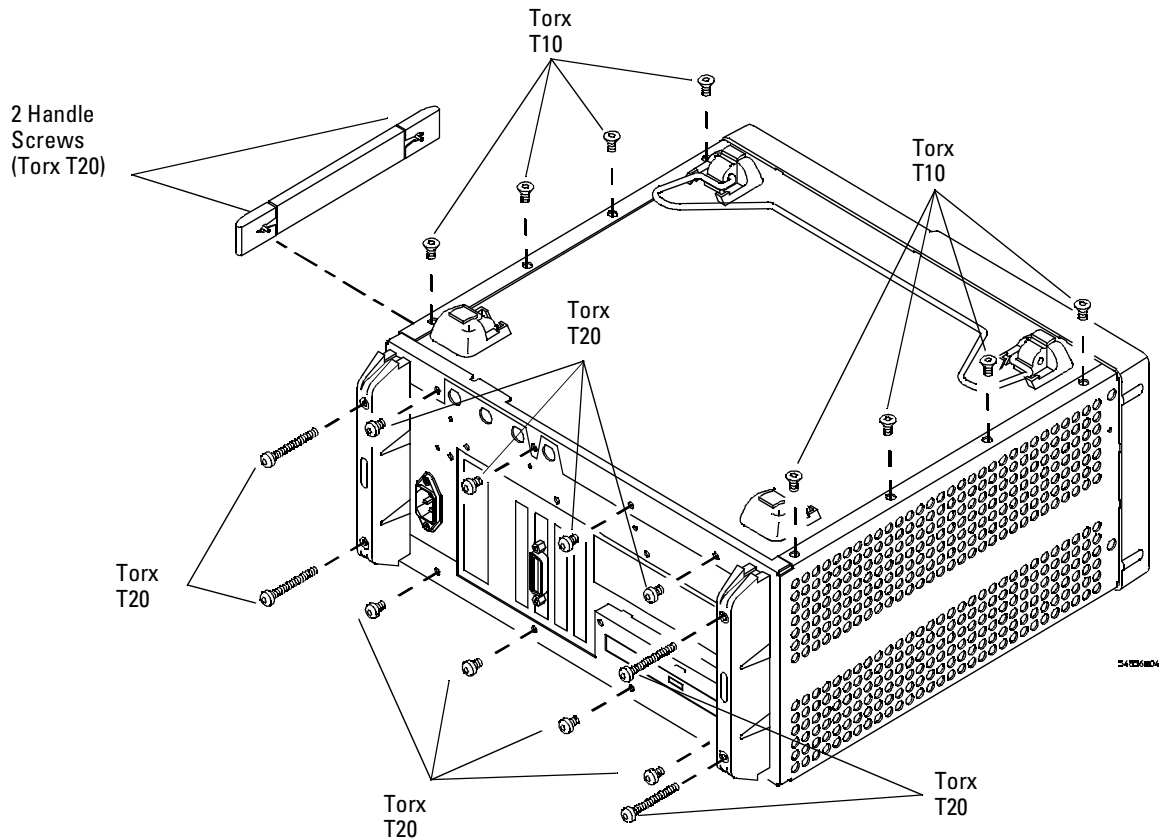
---

## To remove and replace the covers

Use this procedure to remove and replace the covers. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1 Disconnect the power cable.
- 2 Disconnect all oscilloscope probes and BNC input cables from the front panel.
- 3 Disconnect any other cables, such as mouse, keyboard, printer, or GPIB cables.
- 4 Remove the two Torx T20 screws securing the side handle.
- 5 Remove the four Torx T20 screws that secure the rear feet (two in each foot).
- 6 Remove the four Torx T20 screws that secure the top sleeve to the chassis.  
If removing the bottom cover only, you do not need to remove these four screws.
- 7 Remove the four Torx T20 screws that secure the bottom cover to the chassis.  
If removing the top sleeve only, you do not need to remove these four screws.
- 8 Place the unit so the bottom is facing up.
- 9 Remove the eight Torx T10 screws that secure the top and bottom covers to the chassis.

**Figure 6-1**



**Fasteners to remove handle, rear feet, and covers**



- 10** Carefully slide the bottom cover off the frame while spreading the top sleeve open as shown.
- 11** Turn the instrument over and carefully slide the top sleeve off of the frame.
- 12** To replace the covers, reverse the above procedure.

Be sure to keep ribbon cables out of the way when replacing the covers, particularly the flex cable and connector for the AutoProbe assembly at the bottom front of the oscilloscope.

---

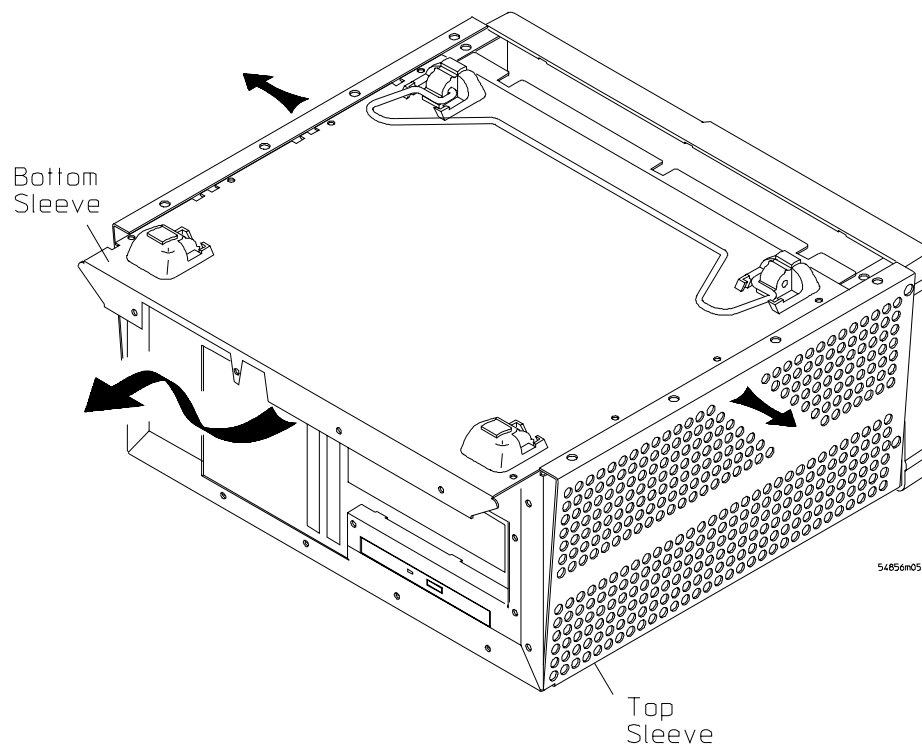
**CAUTION**

---

**PROPERLY TIGHTEN HANDLE AND SCREWS!**

Tighten the side handle screws to 2.4 Nm (21 in-lbs) and rear feet screws to 2 Nm (18 in-lbs).

**Figure 6-2**



**Remove bottom cover**

---

## To disconnect and connect Mylar flex cables

---

### CAUTION

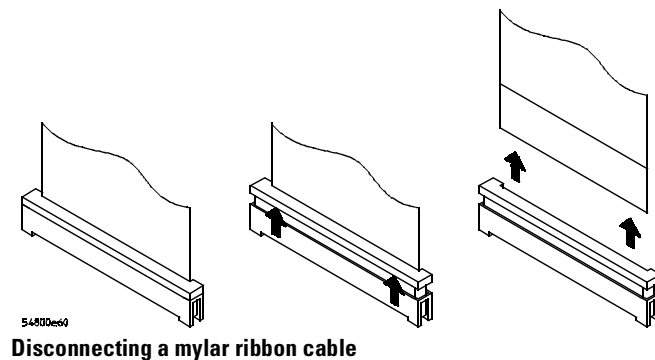
The mylar flex cables and their connectors are fragile; mishandling may damage the cable or connector.

---

#### To disconnect the cable

- 1 Pry up the retainer slightly at either end of the connector using a small flat-blade screwdriver. Do not force the retainer; it should remain attached to the body of the socket.
- 2 Gently pull the flex cable out of the connector.

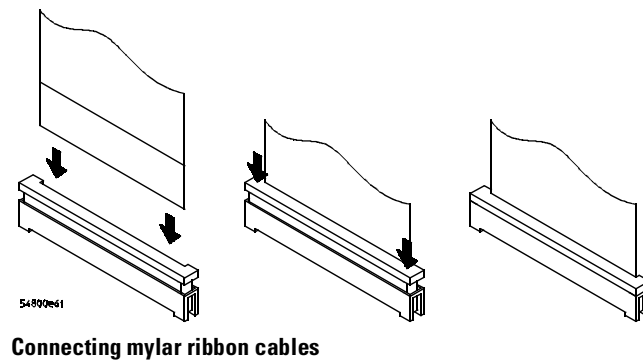
Figure 6-3



#### To reconnect the cable

- 1 Ensure that the cable retainer is up, then insert the ribbon cable into the socket, making sure to observe polarity of the cable with respect to the connector.
- 2 Push the ends of the retainer down onto the connector body, using a small flat-bladed screwdriver. The retainer should be flush with the connector body when you are finished.

Figure 6-4



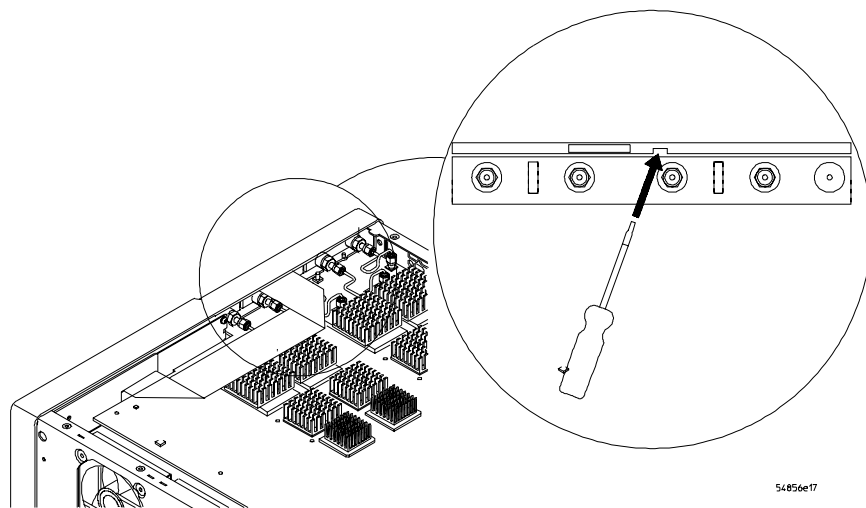
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## To remove and replace the AutoProbe assembly

Use this procedure to remove and replace the AutoProbe assembly. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1 Disconnect the power cable and remove the top and bottom covers.
- 2 Remove the AutoProbe assembly by doing the following:
  - a Place the unit so the bottom is facing up.
  - b Locate the access hole on the inside of the front-panel assembly which is below and almost between channel 2 and channel 3 BNC connectors.
  - c From the back of the front panel, put a small screw driver or other slender pointed object through the access hole to push the AutoProbe assembly faceplate away from the front panel assembly.

Figure 6-5



Access hole

---

### CAUTION

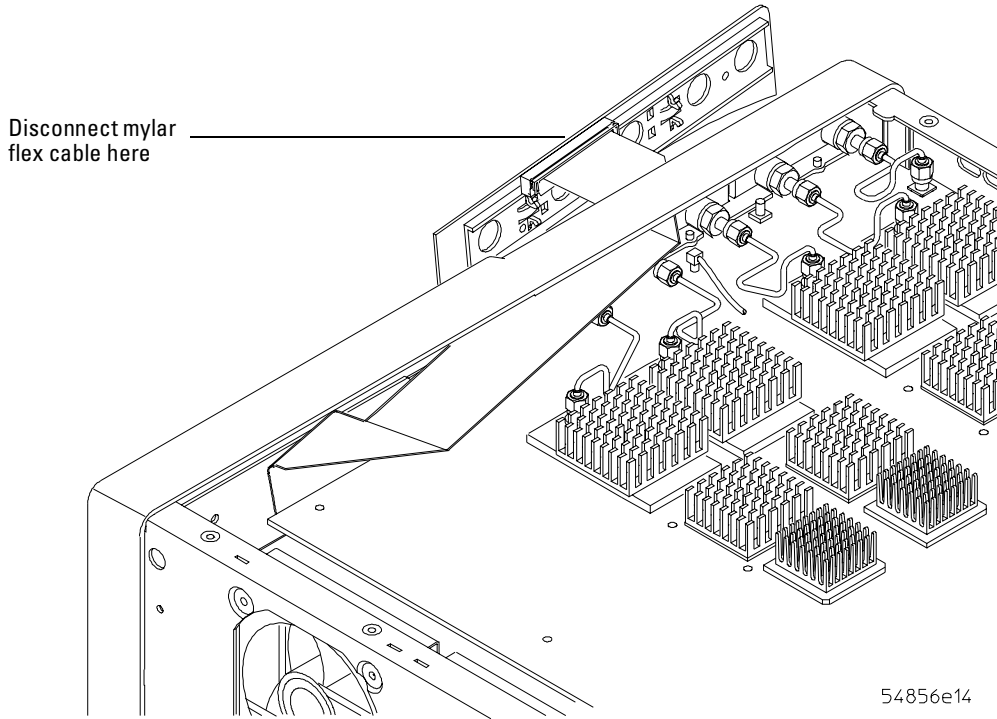
AVOID DAMAGE TO THE RIBBON CABLE AND FACEPLATE!  
Do not pry around the edge of the assembly. Doing so may damage the ribbon cable or faceplate.

---

Chapter 6: Replacing Assemblies  
**To remove and replace the AutoProbe assembly**

- d** Disconnect the mylar flex cable from the AutoProbe board.  
See See “To disconnect and connect Mylar flex cables” on page 106.

**Figure 6-6**



**Pushing out the AutoProbe faceplate**

- 3** To replace the AutoProbe assembly, reverse the above procedure.

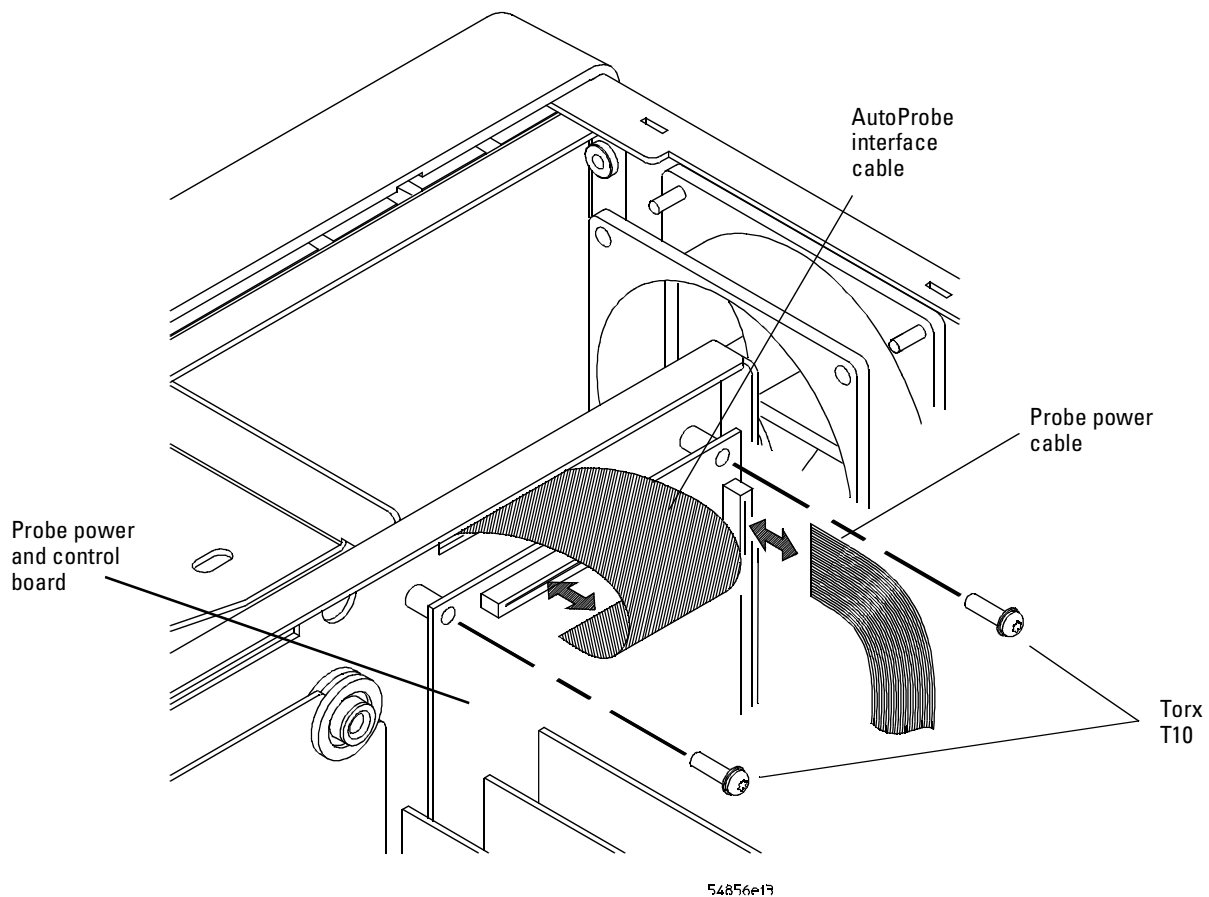
---

## To remove and replace the probe power and control board

Use this procedure to remove and replace the probe power and control board. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1 Disconnect the power cable and remove the top cover.**
- 2 Disconnect the AutoProbe interface cable.**  
The connector must be unlocked before you can remove the flex cable. See “To disconnect and connect Mylar flex cables” on page 106..
- 3 Disconnect the probe power cable.**

**Figure 6-7**



### Remove the probe power and control assembly

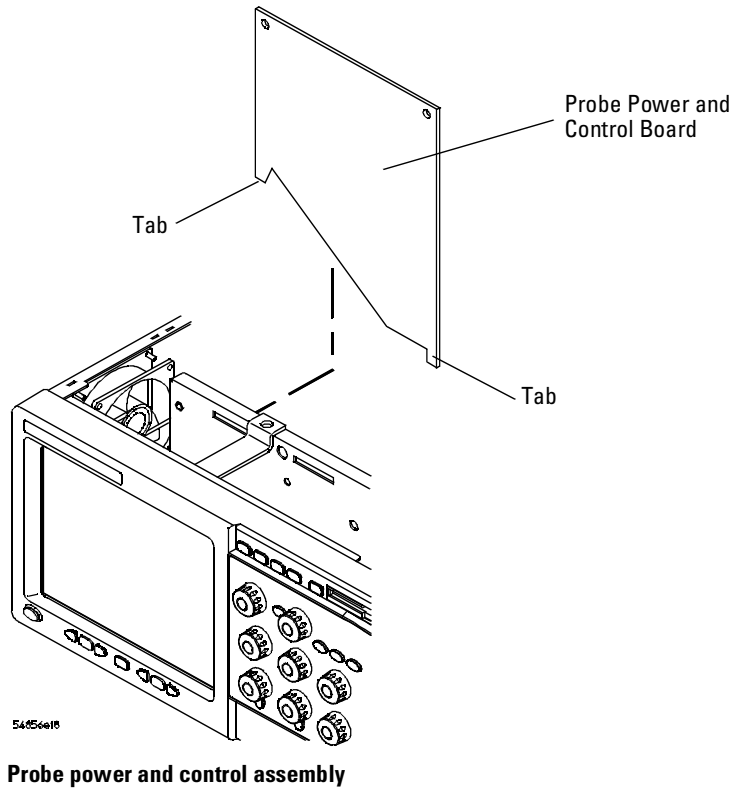
- 4 Remove the two Torx T10 screws securing the probe power and control assembly to the chassis.**
- 5 Lift the probe power and control assembly out and away from the chassis.**

**To remove and replace the probe power and control board**

**6 To replace the probe power and control assembly, reverse the above procedure.**

When inserting the assembly, be sure the two tabs on the circuit board engage the two slots in the sheet metal. Also, be sure to carefully lock in the connector for the mylar flex cable when reattaching the cable. See “To disconnect and connect Mylar flex cables” on page 106.

**Figure 6-8**



---

## To remove and replace the backlight inverter board

Use this procedure to remove and replace the backlight inverter board. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

---

### WARNING

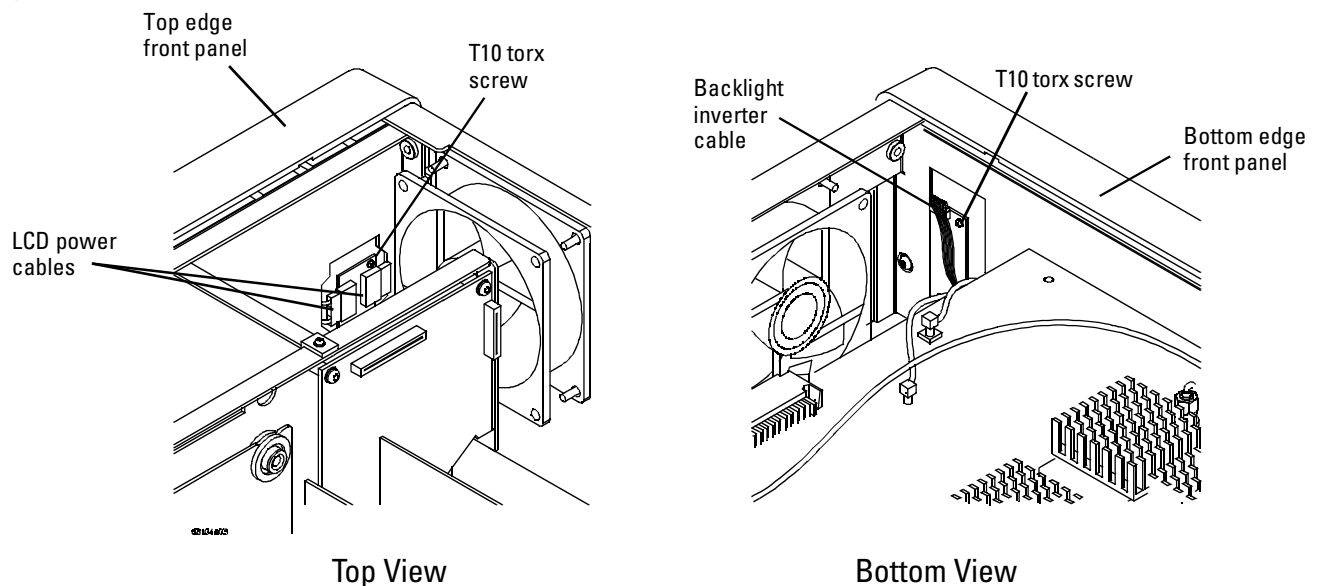
#### SHOCK HAZARD!

The backlight inverter assembly, which is mounted at the front corner of the oscilloscope near the flat-panel display, operates at high voltages from 300-1 kVAC<sub>rms</sub>. DO NOT handle this assembly while it is in operation.

---

- 1 Disconnect the power cable and remove the top and bottom covers.
- 2 Disconnect the two backlight cables from the top of the backlight inverter board.
- 3 Disconnect the backlight primary cable from the bottom of the backlight inverter board.
- 4 Using a long Torx T10 driver, remove the two Torx T10 screws that secure the backlight inverter board to the chassis.
- 5 Lift the backlight inverter board out through the top of the chassis.
- 6 To replace the backlight inverter board, reverse this procedure.

Figure 6-9



### Removing the backlight inverter board

---

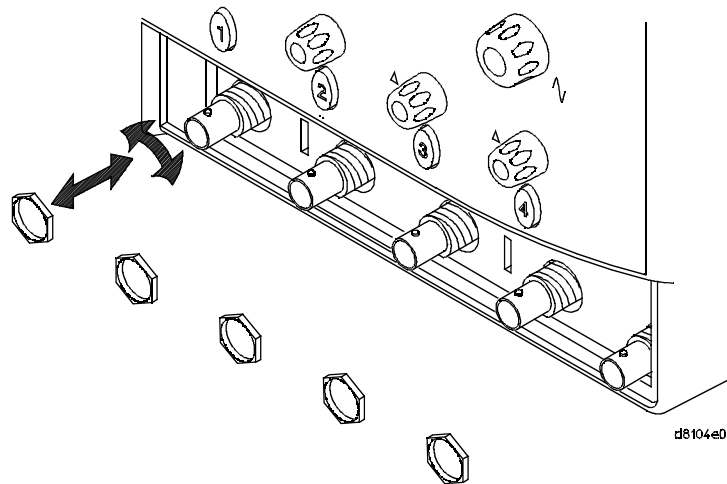
## To remove and replace the front panel assembly

Use this procedure to remove and replace the front panel assembly. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1** Disconnect the power cable and remove the top and bottom covers.
- 2** Remove the Auto-Probe assembly.  
See “To remove and replace the AutoProbe assembly” on page 107..
- 3** Using a 9/16” nut driver, remove the hex nuts that secure the BNC connectors to the front panel.

When assembling the hex nuts to secure the BNC connectors to the front panel, put the conical side of the nut toward the front-panel casting.

**Figure 6-10**

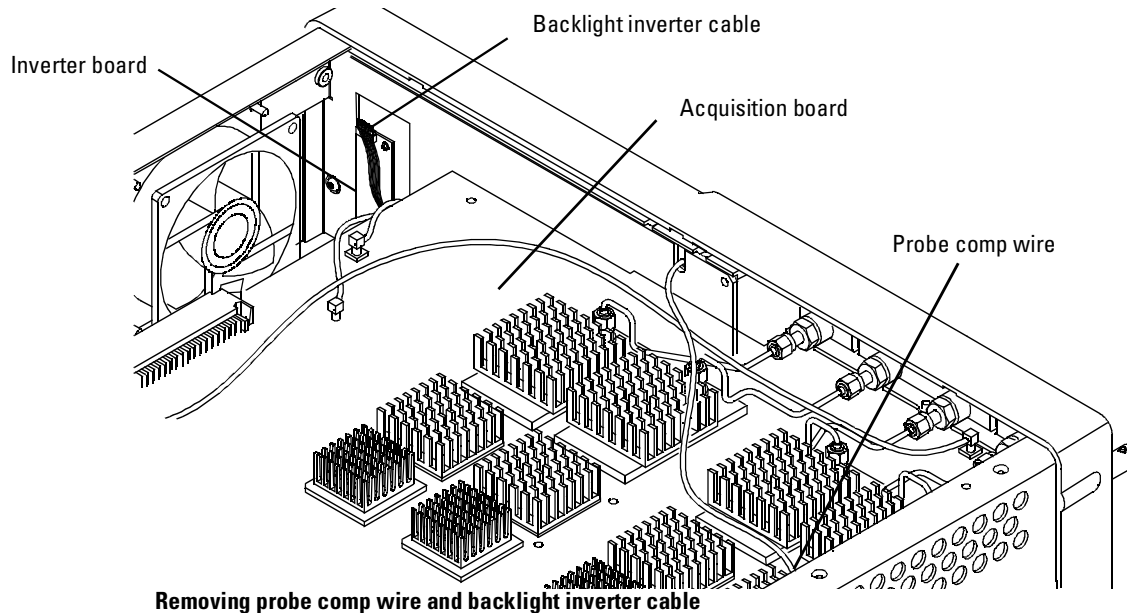


**Removing the BNC nuts**



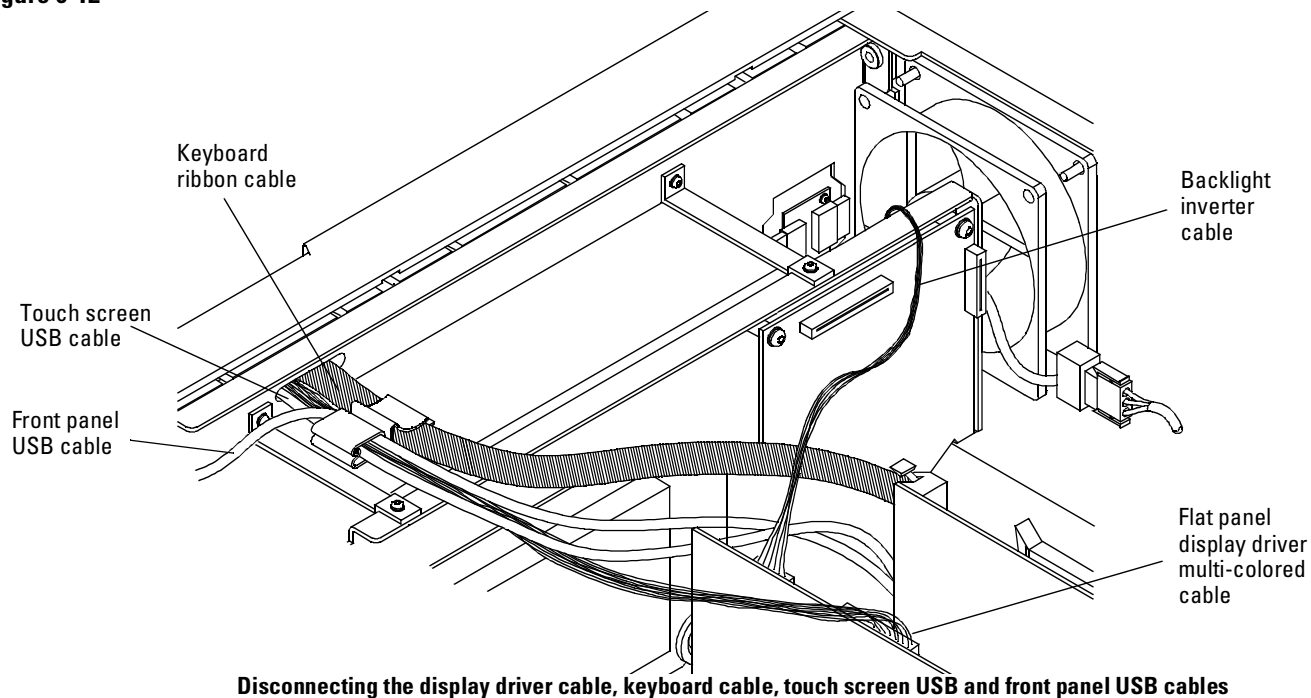
- 4 Disconnect the probe comp wire from the acquisition board.  
If necessary, use pliers to remove the probe comp wire.
- 5 Disconnect the backlight inverter cable from the inverter board.

**Figure 6-11**



- 6 Disconnect the flat-panel display driver cable and keyboard ribbon cable.
- 7 Use a sharp instrument to remove the silicone holding the pin headers of the touch screen and front panel USB cables to their connectors on the motherboard. See Figure 6-14.
- 8 Disconnect the 2 USB cables from the motherboard.

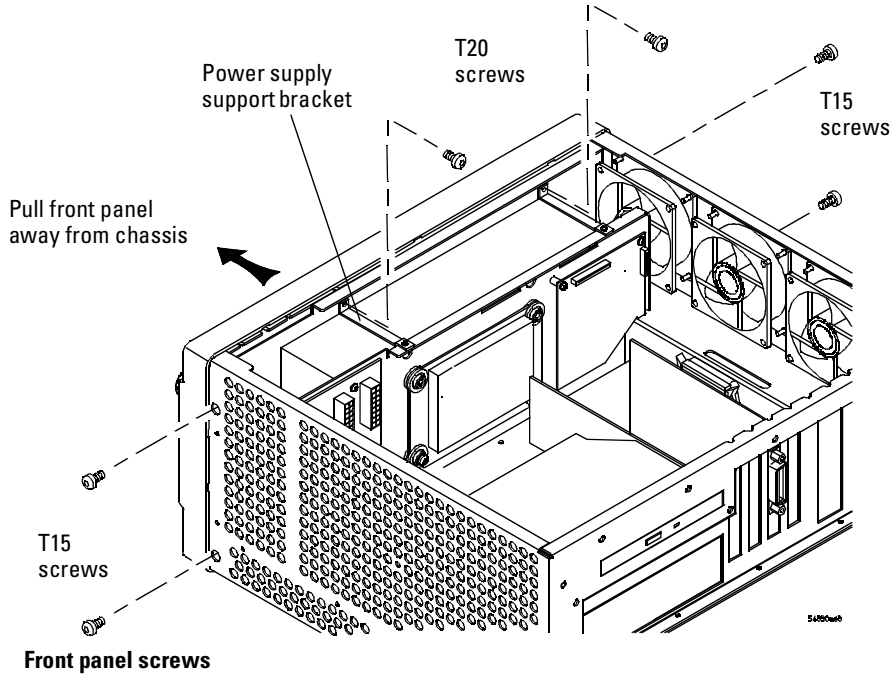
**Figure 6-12**



**To remove and replace the front panel assembly**

- 9** Remove the four Torx T15 screws that secure the chassis sides to the front panel assembly.

When re-assembling, torque the four Torx T15 screws to 18 in-lb.

**Figure 6-13**

- 10** Remove the two Torx T20 screws that secure the power supply support brackets to the front panel assembly.

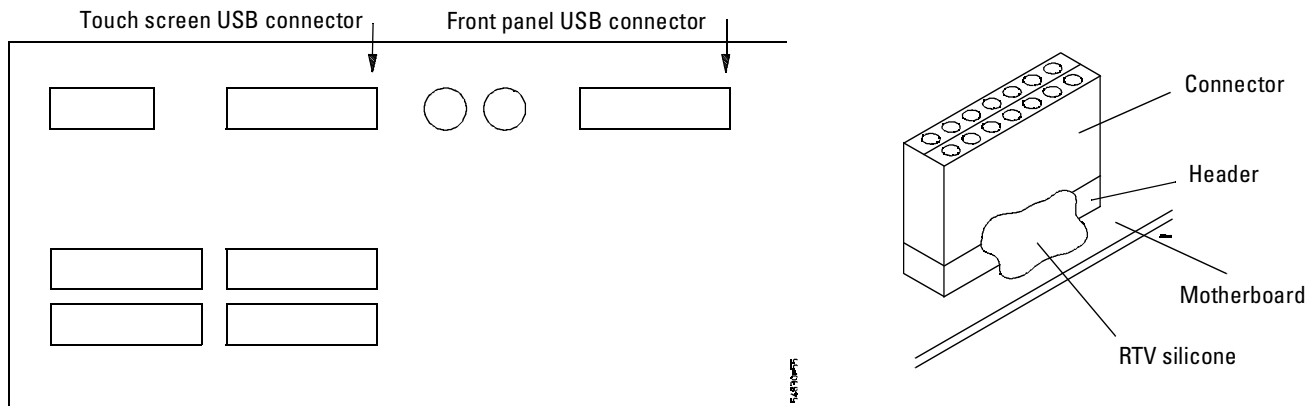
When re-assembling, torque the two Torx T20 screws to 18 in-lb.

- 11** Pull the front panel assembly away from the chassis, being careful to feed the keyboard ribbon cable and display driver cable out through the slot in the front of the chassis and not to damage the backlight inverter board.

- 12** To replace the front panel assembly, reverse the above procedure.

Apply enough Loctite 5145 or equivalent RTV (room temperature vulcanization) silicone to secure the connectors to the headers and the motherboard. (See Figure 6-14.)

Be sure to torque the hex nuts for the BNC connectors and the T15 torx screws to 2 Nm (18 in-lb).

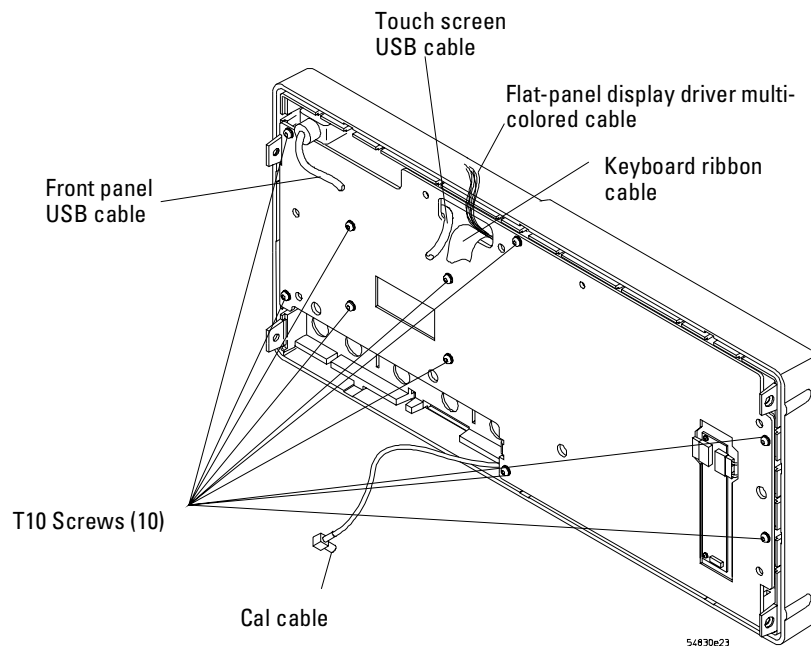
**Figure 6-14****Connecting and securing the USB cables to the motherboard**

## To remove and replace the keyboard, touch screen, and flat-panel display assemblies

Use this procedure to disassemble and reassemble the keyboard, touch screen, and flat-panel display. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1 Disconnect the power cable and remove the top and bottom cover.
- 2 Remove the front panel assembly from the chassis (see page 112).
- 3 Remove the ten Torx T10 screws that secure the front panel cover plate to the front casting.

Figure 6-15



### Front panel cover plate screws

- 4 Carefully feed the front-panel keyboard ribbon cable through the cable access hole while separating the front panel cover plate from the front casting.  
The display driver cable and touch screen USB cable remain attached to the cover plate.

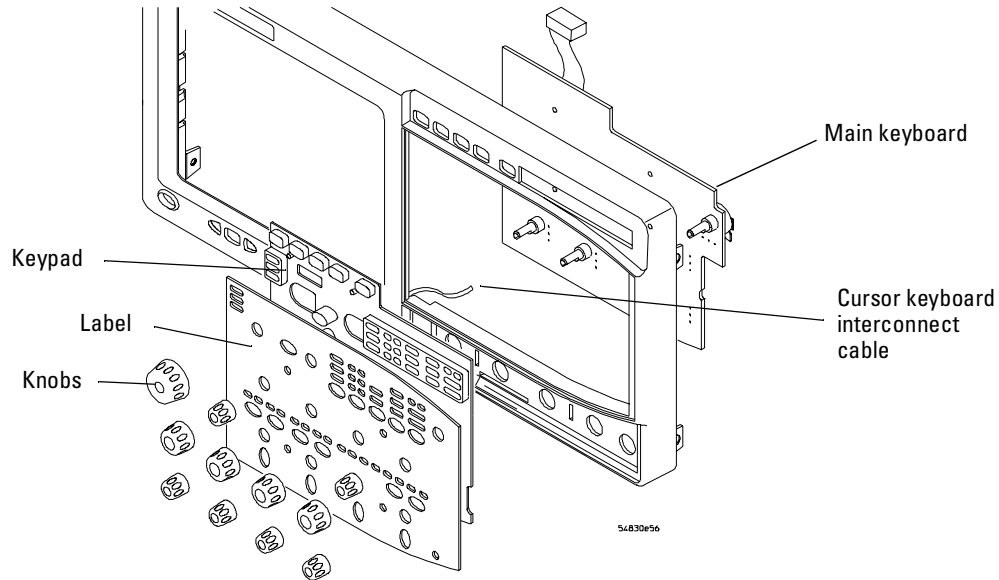
#### Keep Long Screws Separate for Re-assembly

The four screws that fasten the keyboard to the front panel plate are longer than those around the perimeter of the plate. Keep them separate for re-assembly.

**To remove and replace the keyboard, touch screen, and flat-panel display assemblies**

- 5 To remove the main keyboard assembly, disconnect the cursor keyboard interconnect cable, pull off the knobs, and lift out the keyboard.

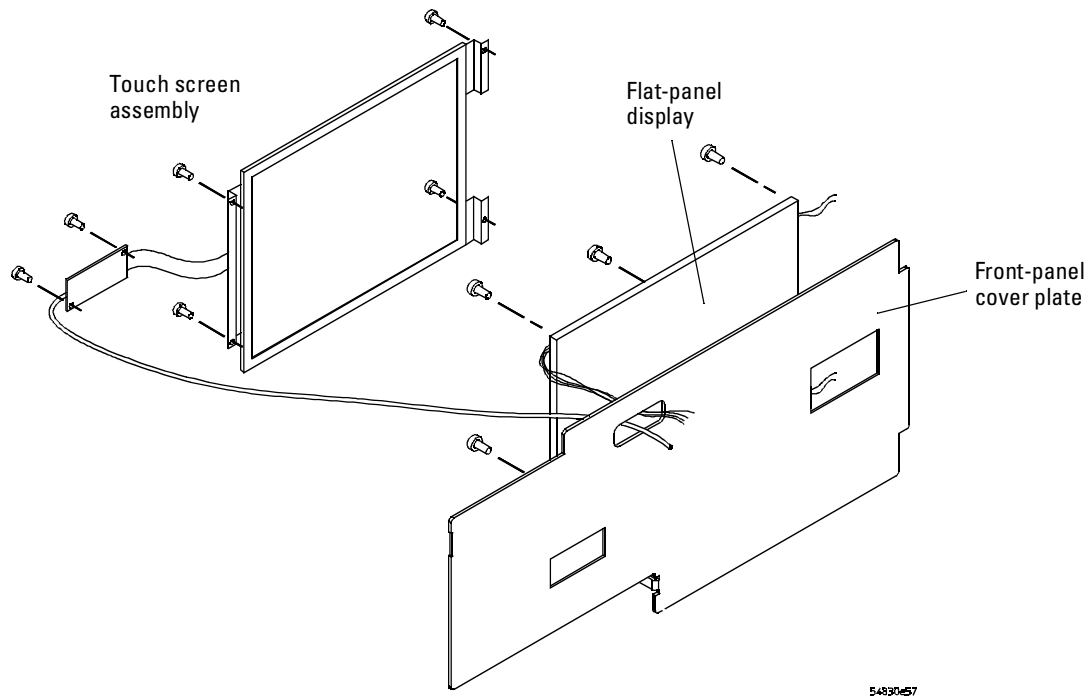
**Figure 6-16**



**Removing the keyboard**

- 6 To remove the touch screen assembly from the front-panel cover plate, remove the six T8 Torx fasteners.
- 7 To remove the flat-panel display assembly, remove the backlight inverter board (see page 111), then remove the four T8 Torx fasteners.

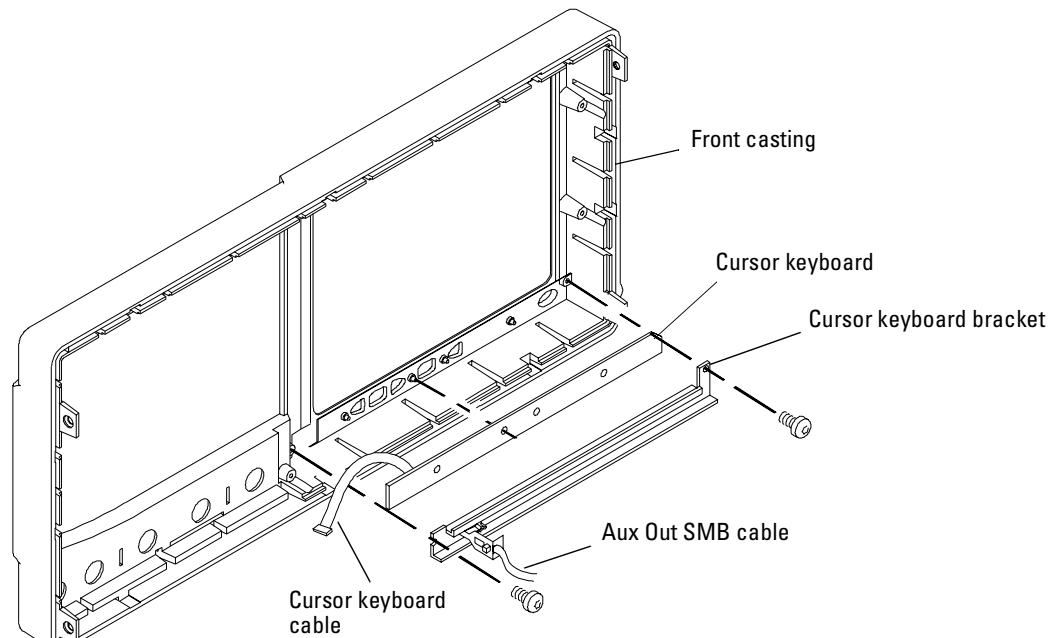
**Figure 6-17**



**Removing the touch screen and flat-panel display**

- 8 To remove the cursor keyboard, remove the two Torx T10 screws that secure the cursor keyboard bracket then lift the cursor keyboard directly out of the front casting.

Figure 6-18



Removing the cursor keyboard

- 9 To reassemble the front panel assembly, reverse the above procedure.  
The cursor keyboard has holes that fit over locating pins in the front panel casting.

---

**CAUTION**

---

**PREVENT GLASS BREAKAGE!**

Use care when handling the touch screen and the flat-panel display to prevent glass breakage.

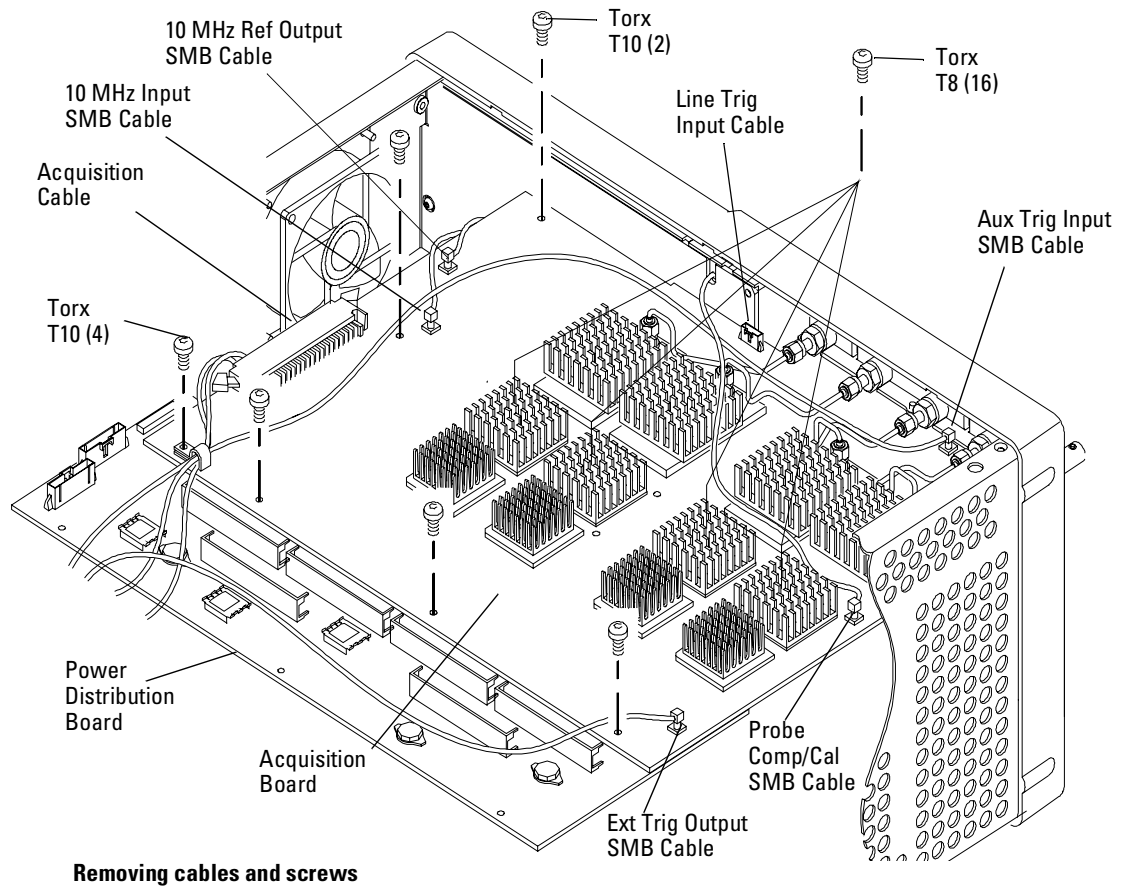
Inspect the inside surfaces of the touch screen and the flat-panel display closely for dust, smudges, and fingerprints. Viewing these with line-of-sight 45 degrees to the surface is the best method for seeing subtle flaws. Clean the surfaces of the touch screen with glass cleaner and lint-free lens paper before re-assembly. Clean the front of the FPD monitor by applying the glass cleaner to the lint-free lens paper or soft lens cloth. Do not apply glass cleaner directly to the FPD monitor.

## To remove and replace the acquisition board assembly

Use this procedure to remove and replace the acquisition board assembly. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1** Disconnect the power cable and remove the top and bottom covers.
- 2** Remove the AutoProbe assembly.
- 3** Remove the hex nuts that secure the BNC connectors to the front panel. (See “To remove and replace the front panel assembly” on page 112.)
- 4** Disconnect the following cables from the acquisition board:
  - Line Trig Input Cable
  - Acquisition Cable
  - 10 MHz Ref Output Cable
  - 10 MHz Input Cable
  - Aux Trig Input Cable
  - Probe Comp/Cal Cable
  - Ext Trig Output Cable
- 5** Remove the six Torx T10 screws that secure the acquisition board to the chassis.  
When re-assembling, torque the screws to 5 in-lb.
- 6** Remove the sixteen Torx T8 screws from the A/D converter heat sinks.  
When replacing the heat sink screws start all screws but do not torque them. For each heat sink torque 2 diagonally opposed screws first, and then torque the other 2 screws to 5 in-lb.

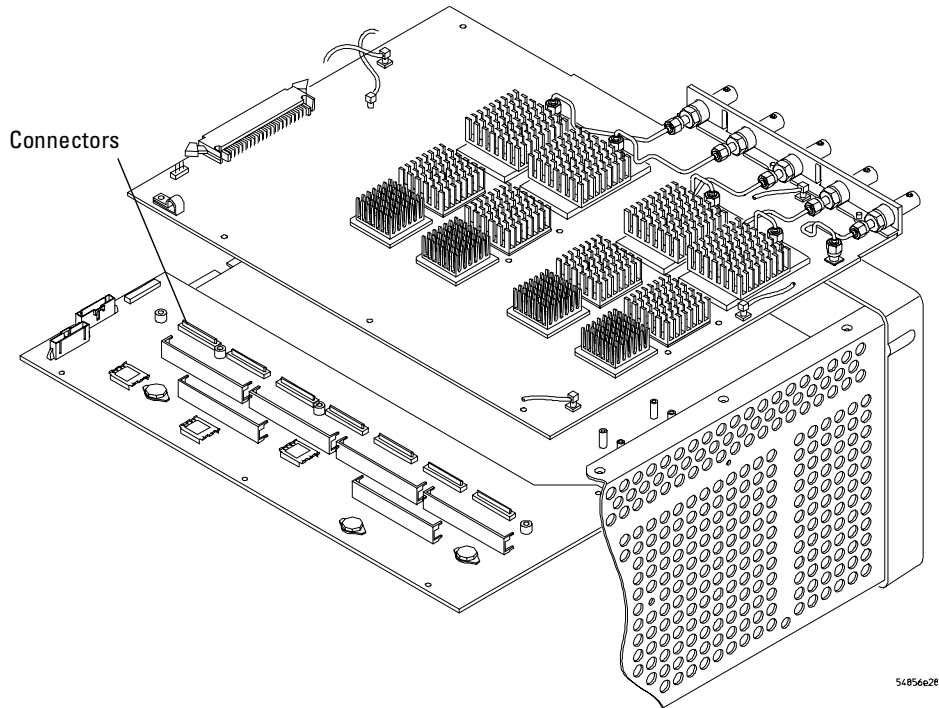
Figure 6-19



**To remove and replace the acquisition board assembly**

- 7 Carefully lift the back of the board to separate the acquisition board connectors from the power distribution board.
- 8 Lift the board back from the front panel until the BNC connectors clear the front panel, then lift the board away from the chassis.

**Figure 6-20**



**Separate acquisition board from power distribution board**

- 9 To re-install the acquisition board assembly, reverse the above procedure.
- 10 Now the calibration factors must be set. See “To set the calibration factors after replacing the acquisition board” on page 121.



## To set the calibration factors after replacing the acquisition board

The following procedure must be performed after replacing the acquisition board. This procedure only needs to be performed once after the acquisition board is replaced.

### Let the oscilloscope warm up before testing

The oscilloscope under test must be warmed up (with the oscilloscope application running) for at least 30 minutes prior to the start of any performance test.

### Equipment Required

Description	Critical Specifications	Recommended Model/ Part Numbers
Digital Multimeter	No substitute	Agilent 34401A
10 MHz Signal Source (required for time scale calibration)	Frequency accuracy better than 0.4 ppm	Agilent 53131A with Opt. 010*
Cable Assembly	No substitute	Agilent 54855-61620
Cable Assembly	RS-232 (f)(f)	Agilent 34398A
Cable Assembly	50 $\Omega$ characteristic impedance BNC (m) connectors ~ 36 inches (91 cm) to 48 inches (122 cm) long	Agilent 8120-1840
Adapter	BNC Barrel (f)(f)	Agilent 1250-0080
Adapter	BNC shorting cap	Agilent 1250-0929
Adapter (Qty. 2)	No substitute	Agilent 54855-67604
Adapter	BNC (f) to dual banana	Agilent 1251-2277
* The 10 MHz Signal Source requires time base calibration once every 6 months. The source should be powered on for at least 24 hours before use.		

### 1 Perform self tests

- a Exit the oscilloscope application.
- b From a command prompt, run the oscilloscope software using the following syntax:  
c:\scope\bin\agscope.exe -service

While the oscilloscope is warming up, run the self-test to ensure that the hardware is functioning properly. To run the self-test:

- c Pull down the Utilities menu and select Self Test.
- d Select Scope Self Test from the Self Test list.
- e Click on Start Self Test to start the self test procedure.

If any of the self-tests fail, ensure that the failure is diagnosed and repaired before calibrating and testing performance.

### 2 Performance calibration.

After the warm up period, calibrate the oscilloscope.

- a Connect the RS-232 cable to the Digital Multimeter RS-232 port and to the RS-232 port on the oscilloscope.
- b Set Digital Multimeter as follows:  
Interface: RS-232  
Baud Rate: 9600 Baud

**To set the calibration factors after replacing the acquisition board**

Parity: None: 8 bits

Language: SCPI

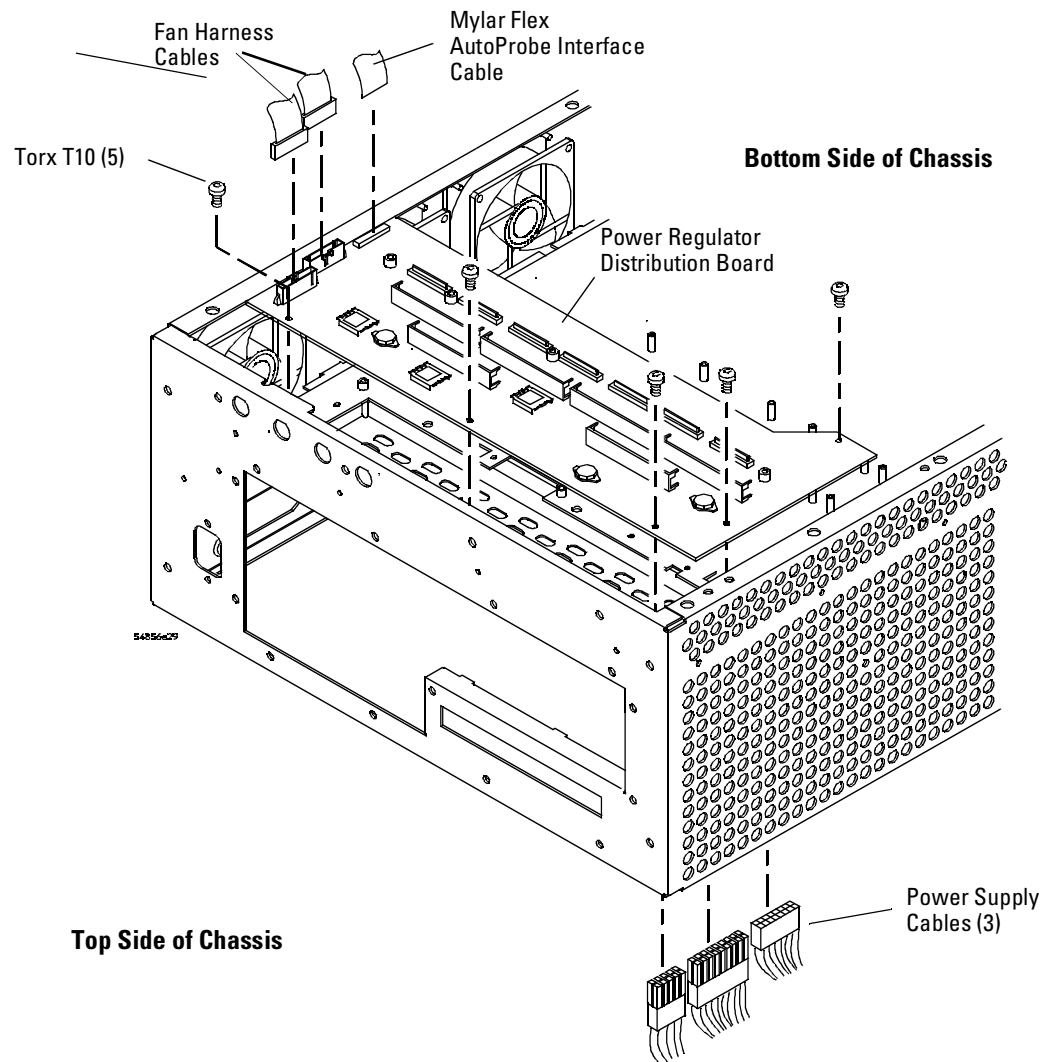
- c** Pull down the Utilities menu and select Calibration.
  - d** Uncheck to Cal Memory Protect box to allow calibration.
  - e** Click on Start to start the calibration procedure.
- Follow the on-screen instructions as calibration proceeds.

## To remove and replace the power regulator distribution board

Use this procedure to remove and replace the power regulator distribution board. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1** Disconnect the power cable and remove the top and bottom covers.
- 2** Remove the Acquisition board assembly.
- 3** Disconnect the following cables from the power regulator distribution board:
  - Three power supply cables from the top side of the chassis
  - Fan harness cables on the bottom side of the chassis
  - Mylar flex probe power cable
- 4** Remove the five Torx T10 screws from the power regulator distribution board.  
When re-assembling, torque the screws to 5 in-lb.

**Figure 6-21**



### Removing the power regulator distribution board

- 5** Lift the board out of the chassis.
- 6** To re-install, reverse this procedure.

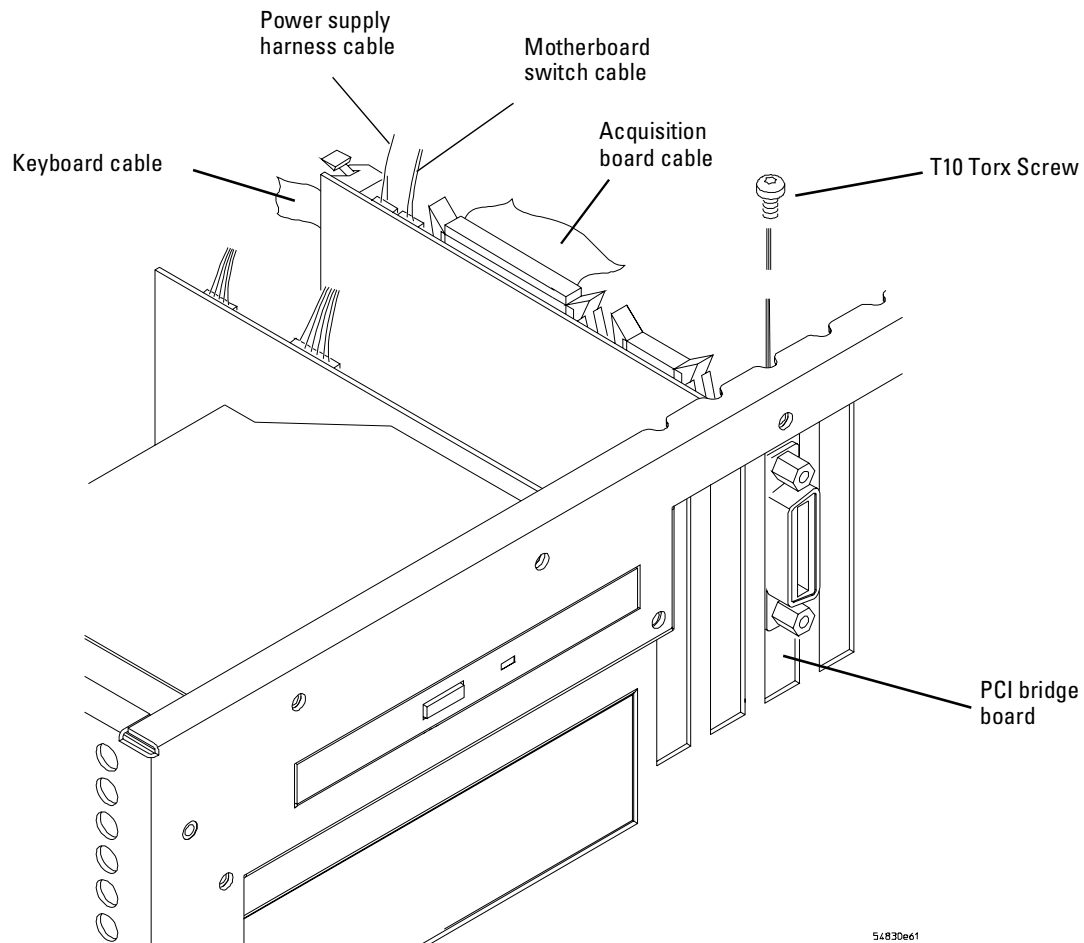
---

## To remove and replace the PCI bridge board

Use this procedure to remove and replace the PCI bridge board. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1 Disconnect the power cable and remove the top cover.
- 2 Remove the keyboard cable, power supply cable, motherboard cable, and acquisition board cable from the PCI bridge board.
- 3 Remove the Torx T10 screw that secures the PCI bridge board to the rear of the chassis.
- 4 Pull the board up to disengage it from the motherboard, then lift it up and out of the chassis.
- 5 To replace the board, reverse the removal procedure.

**Figure 6-22**



**Removing the PC interface and GPIB board**

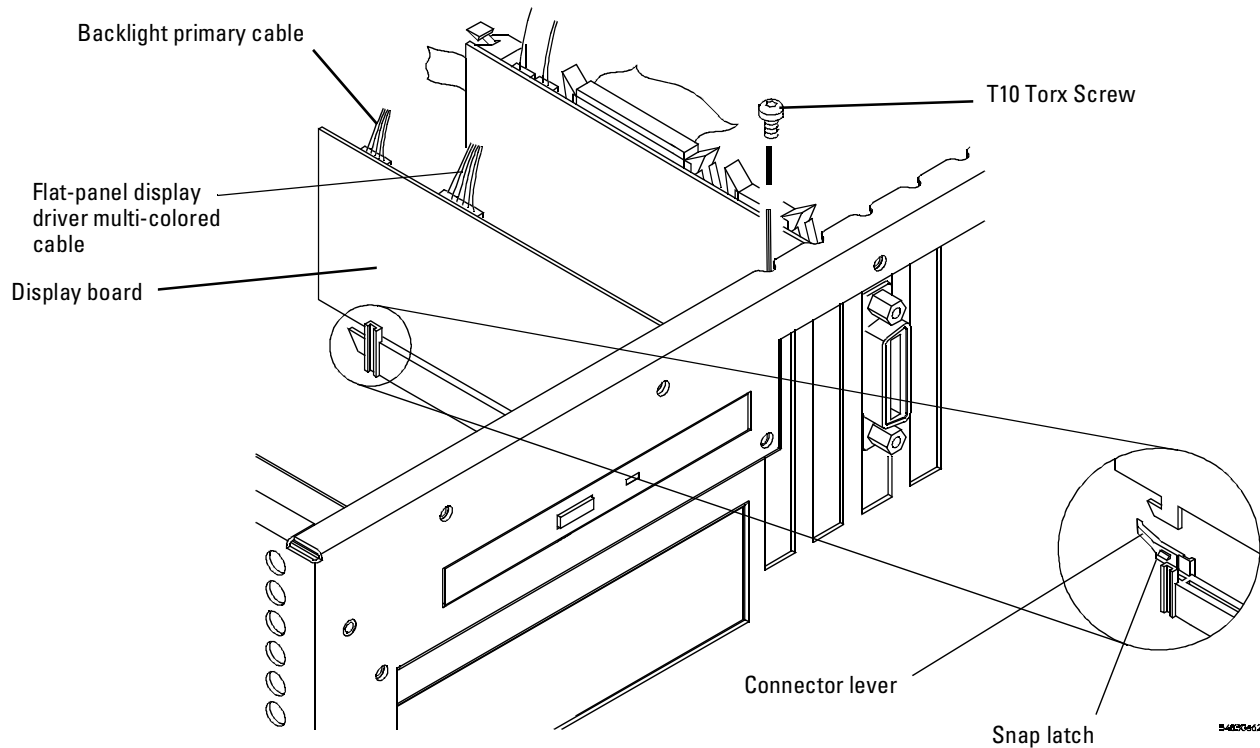
---

## To remove and replace the display board

Use this procedure to remove and replace the display board. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1** Disconnect the power cable and remove the top cover.
- 2** Disconnect these cables from the display board:
  - Backlight primary cable
  - Flat-panel display driver multi-colored cable
- 3** Remove the Torx T10 screw that secures the display board to the chassis.

**Figure 6-23**



### Removing the display board

- 4** While pulling connector's lever back to release the latch, grasp the board at the top corners and pull it straight up until it is free of the card cage.
- 5** To replace the board, reverse the above procedure.

Be sure to observe correct polarity on all cables when replacing the board.

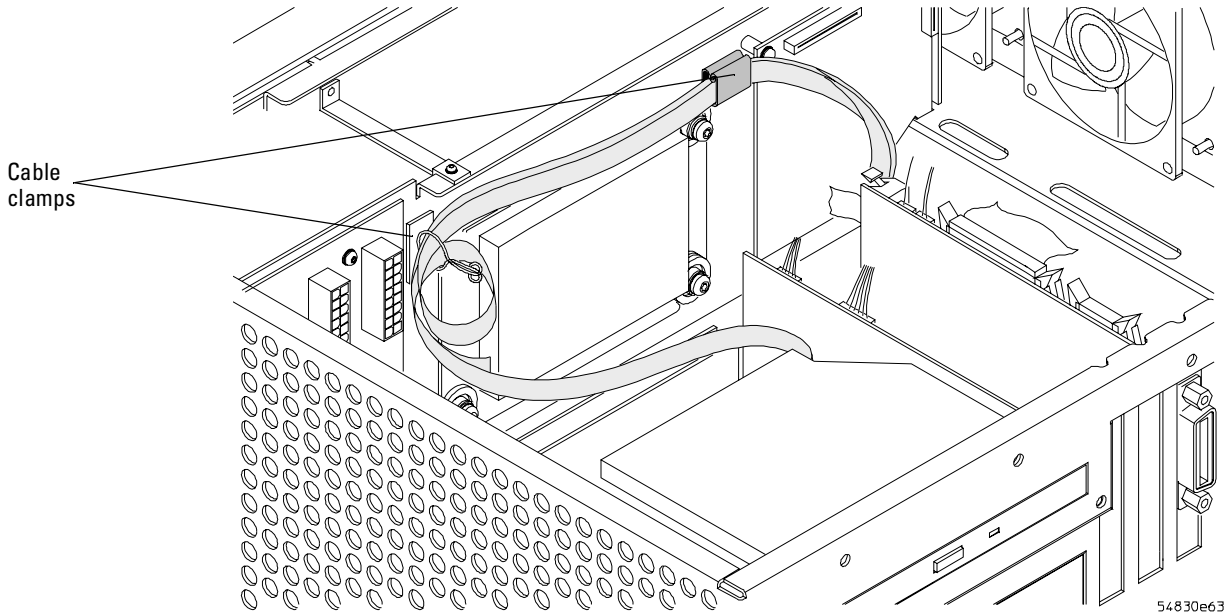
---

## To remove and replace the hard disk drive

Use this procedure to remove and replace the hard disk drive. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1 Disconnect the power cable and remove the top sleeve.
- 2 Remove the CD-ROM and hard drive cables from the cable clamps.

**Figure 6-24**



**Removing cables from cable clamps**

- 3 Remove the two Torx T20 screws holding the shock mount in place (see See Figure 6-25).  
You may need to use a Torx key to loosen the screws.  
When re-assembling, torque the screws to 18 in-lb.
- 4 Tilt the disk drive assembly forward and lift up to remove.

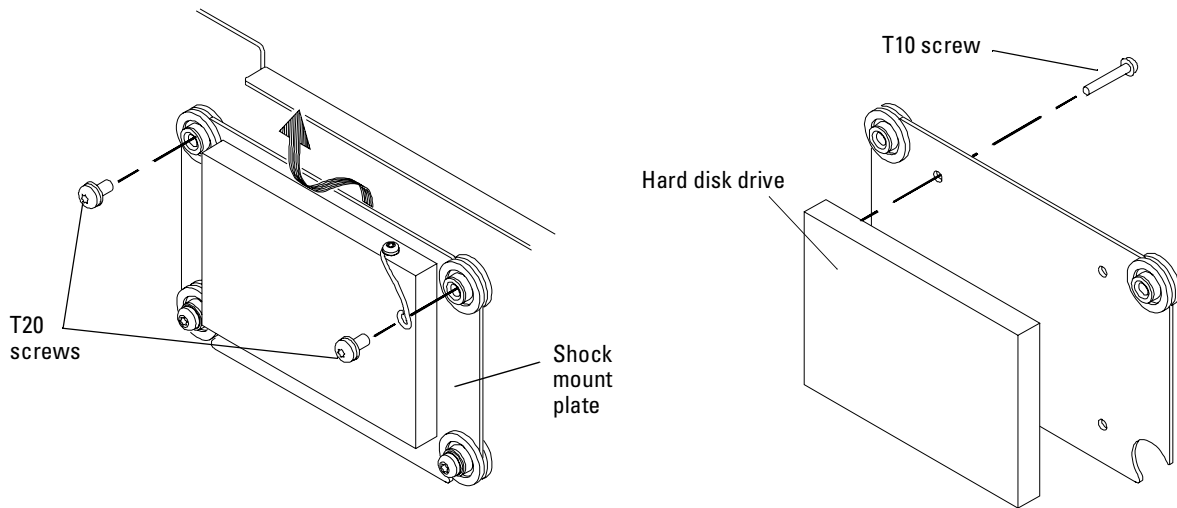
---

### **CAUTION**

**DO NOT LET THE DISK DRIVE FALL!**  
Support the drive while removing the screws so that the drive does not fall.

- 5 Remove the four Torx T10 screws holding the disk drive onto the shock mount.

**Figure 6-25**



**Removing the hard disk drive**

**6 To replace the hard disk drive, reverse the above procedure.**

Be sure to reconnect the hard drive ground cable to the upper-right shock mount screw.

---

**CAUTION**

**DO NOT OVER TIGHTEN THE SCREWS!**

Do not overtighten the Torx T10 screws that secure the Hard Disk Drive to the bracket. Torque to 3 in-lb.

---

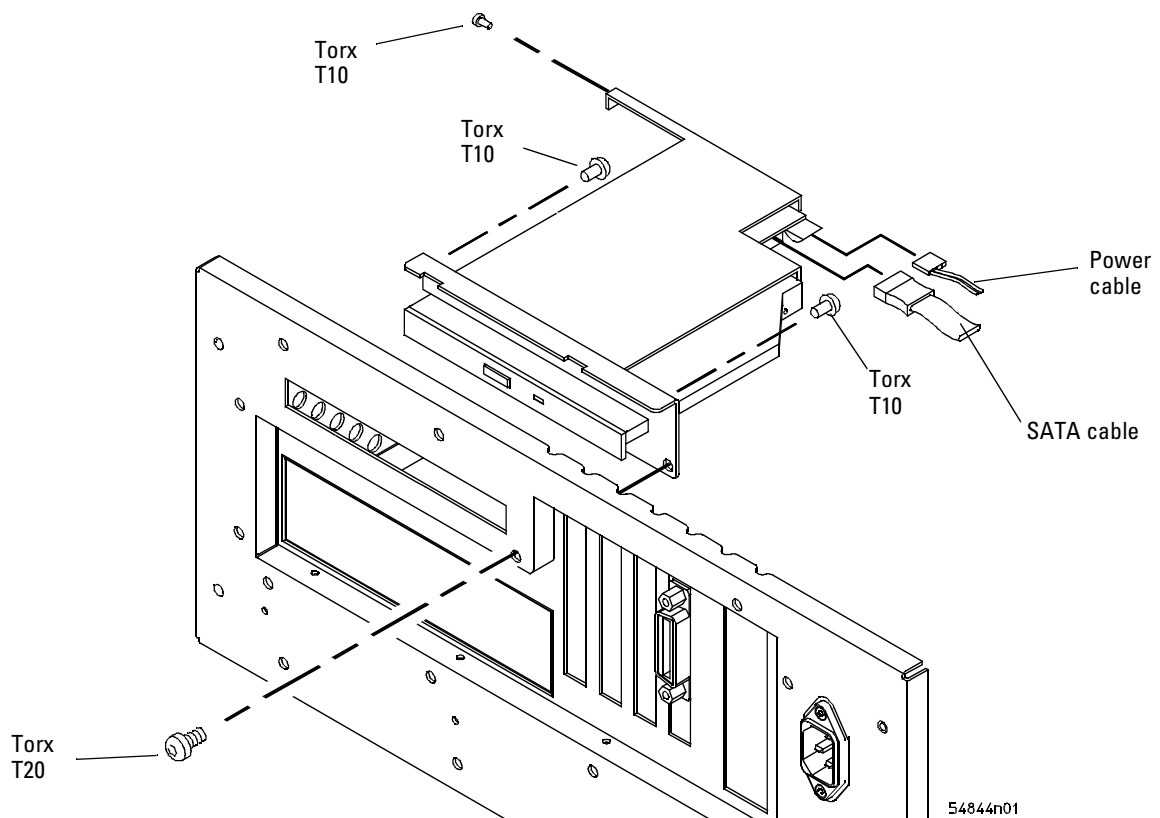
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## To remove and replace the CD-ROM drive

Use this procedure to remove and replace the CD-ROM drive. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1** Disconnect the power cable from the instrument and remove the top sleeve.
- 2** Remove the following cables:
  - SATA Cable
  - CD-ROM Power cable
- 3** Using a Torx T10 driver, remove the three CD-ROM support bracket screws holding the CD-ROM drive in place.  
When re-assembling, torque the three Torx T10 screws to 5 in-lb.
- 4** Using a T20 driver remove the rear panel screw holding the CD-ROM drive in place.  
When re-assembling, torque the Torx T20 screw to 18 in-lb.
- 5** Move the CD-ROM drive back towards the front frame, then lift and pull to remove.

**Figure 6-26**

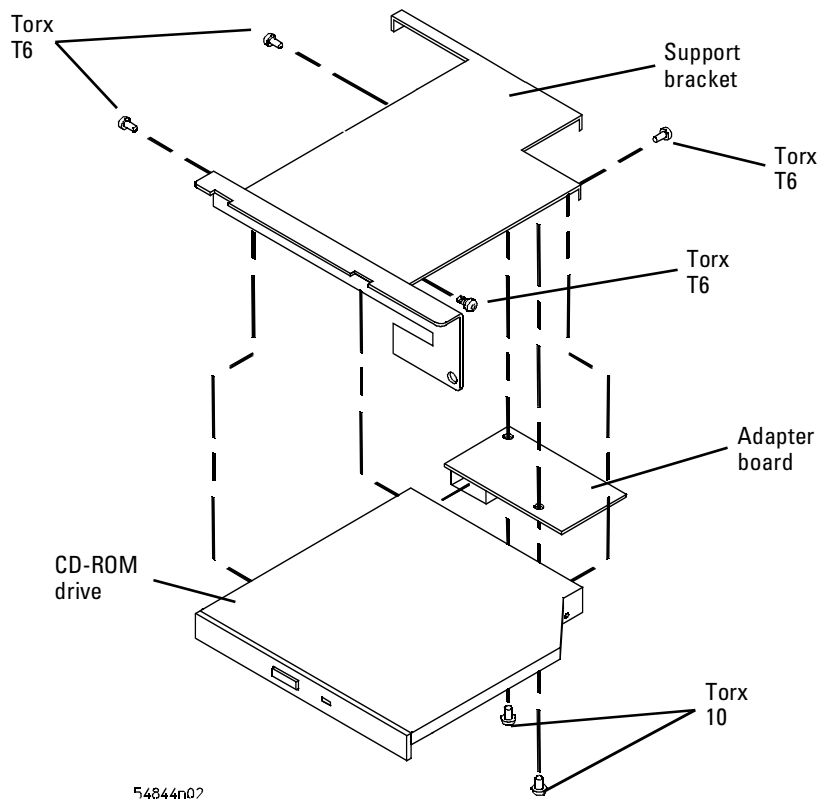


**Removing the CD-ROM assembly**



- 6** Using a Torx T6 driver, remove the three screws securing the CD-ROM to the support bracket.  
When re-assembling, torque the three Torx T6 screws to 1.5 in-lb.
- 7** Using a Torx T10 driver, remove the two screws securing the CD-ROM adapter board to the support bracket.  
When re-assembling, torque the two Torx T6 screws to 1.5 in-lb.

**Figure 6-27**



**Removing the support bracket and adapter board**

- 8** To replace the CD-ROM drive, reverse the above procedure.

## To remove and replace the motherboard

Use this procedure to remove and replace the motherboard assembly. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

### CAUTION

REPLACE MOTHERBOARD WITH THE SAME TYPE!

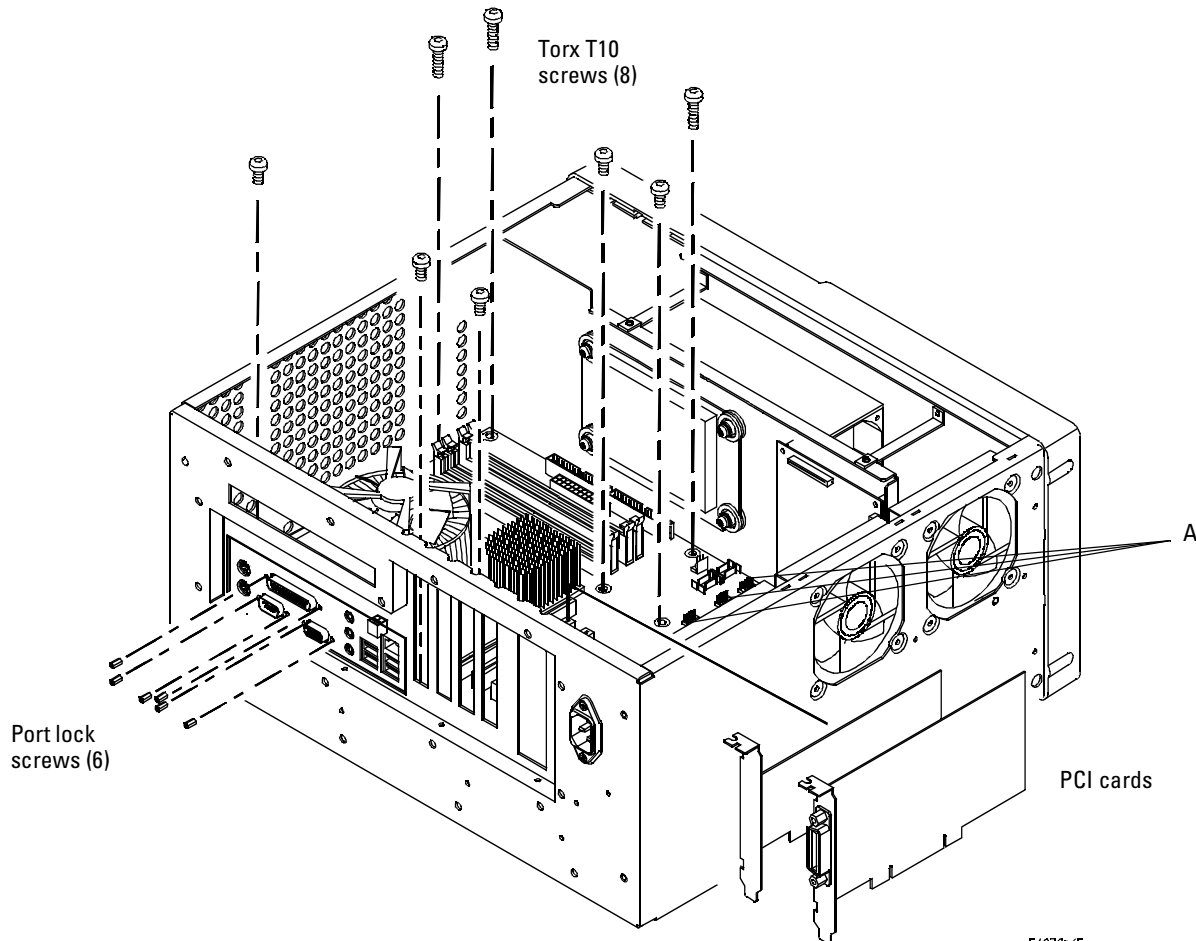
Be sure to order the correct motherboard, and replace the motherboard with the same type.

- 1 Disconnect the power cable and remove the top cover.
- 2 Remove the CD-ROM drive (see page 128).
- 3 Remove all cables from the PCI cards.
- 4 Remove all PCI cards from the motherboard.
- 5 Disconnect all cables from the motherboard.

Note that the connectors marked 'A' below require removal of the silicone, using a sharp instrument, before disconnecting. When reconnecting, use enough Loctite 5145 or equivalent RTV silicone to secure the connectors to the headers and the motherboard. (See Figure 6-14.)

- 6 Remove the six 5 mm port lock screws from the rear panel connectors.
- 7 Remove the 5 short and 3 long Torx T10 screws holding the motherboard to the ATX tray.

Figure 6-28



Removing the motherboard

548706v5

- 8 Lift the motherboard out of the tray.
- 9 To replace the motherboard assembly, reverse the above procedure.
- 10 Run the self test to verify the oscilloscope is operating properly.  
See “Run oscilloscope self-tests.” on page 72.

---

## To remove and replace the power supply

Use this procedure to remove and replace the power supply. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

---

### WARNING

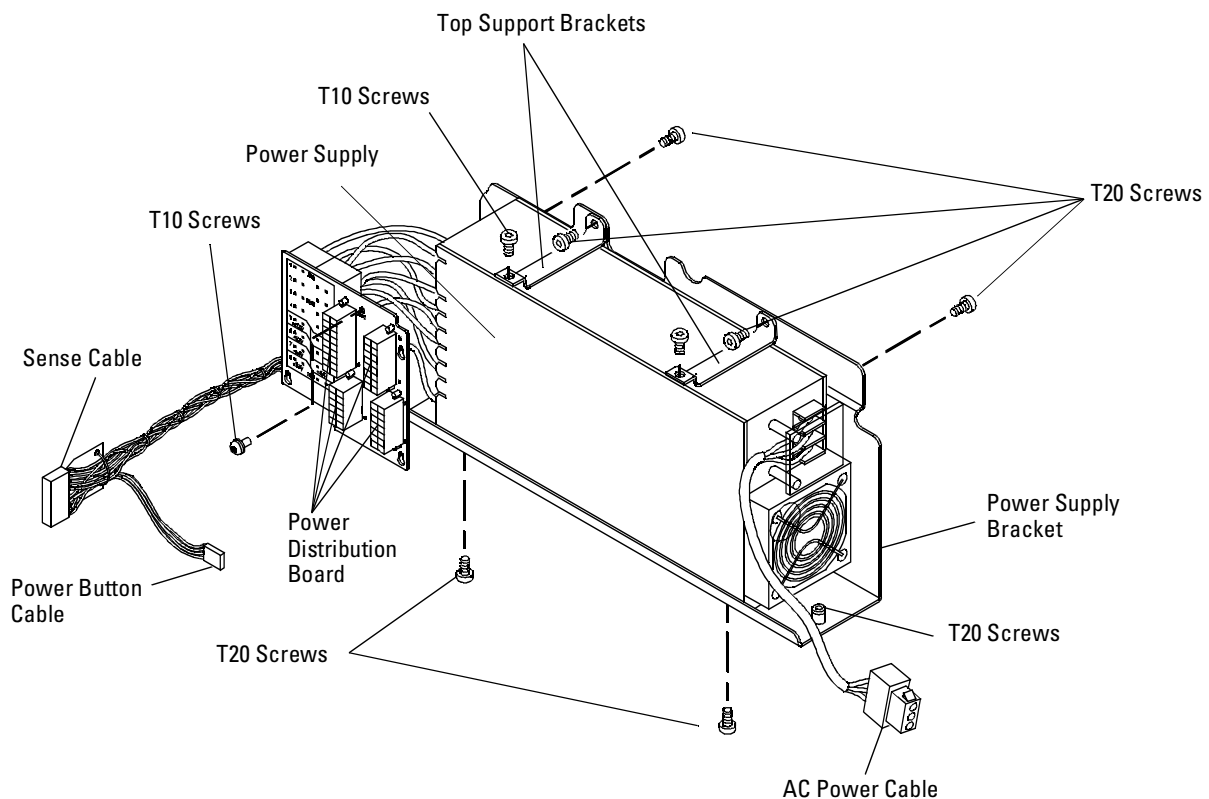
#### SHOCK HAZARD!

If the power supply is defective it could have a dangerous charge on some capacitors. This charge could remain for many days after removing power from the supply.

---

- 1 Disconnect the power cable and remove the top cover.
- 2 Disconnect the sense cable, power button cable, and AC power cable from their connectors but do not disconnect them from the power supply.

**Figure 6-29**

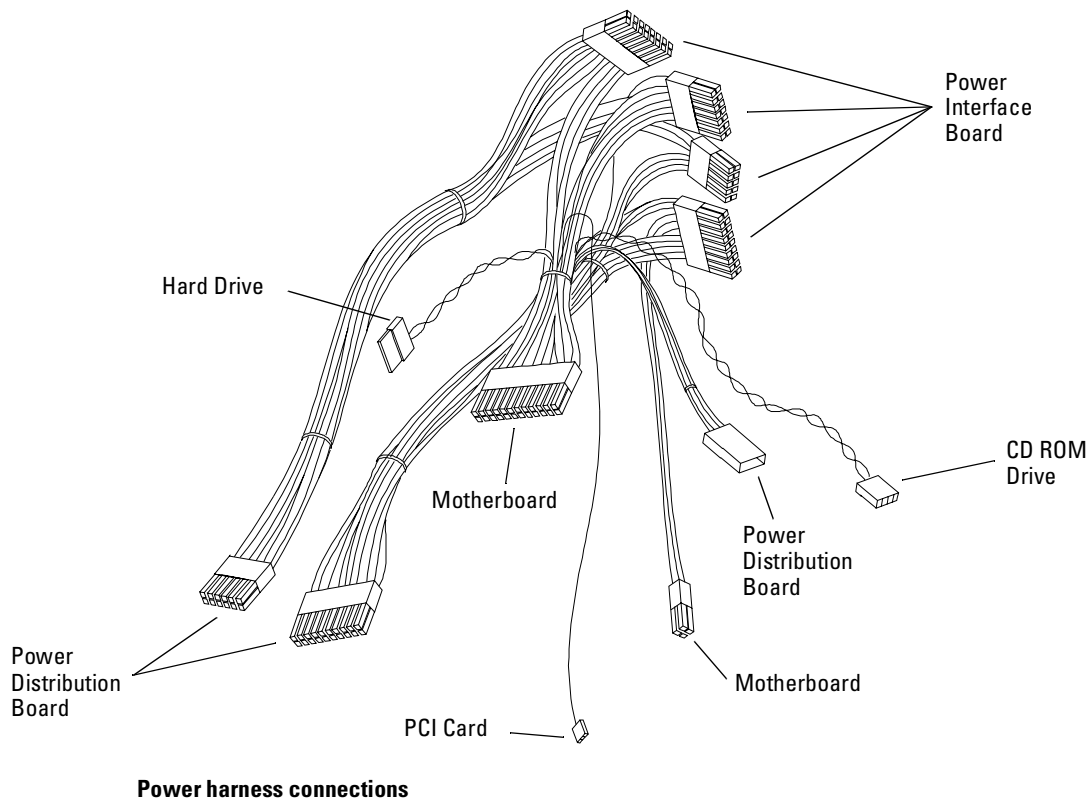


### Disconnecting power supply cables

**To remove and replace the power supply**

- 3 Disconnect the four power harness connectors from the power interface board.
- 4 Remove the two Torx T10 screws that hold the top support brackets to the chassis.  
When re-assembling, torque the two Torx T10 screws to 5 in-lb.
- 5 Remove the two Torx T20 screws that hold the top support brackets to the power supply bracket.  
When re-assembling, torque the Torx T20 screws to 18 in-lb.
- 6 Loosen the two Torx T20 screws at both ends of the power supply bracket that secure the bracket to the frame.  
These screws are part of the power supply bracket and can not be remove from the bracket.
- 7 Remove the power supply and power supply bracket from the chassis.
- 8 Remove the two Torx T20 screws from the side of the power supply bracket.  
When re-assembling, torque the Torx T20 screws to 18 in-lb.
- 9 Remove the two Torx T20 screws from the bottom of the power supply bracket.  
When re-assembling, torque the Torx T20 screws to 18 in-lb.
- 10 Separate the power supply from the power supply bracket.
- 11 To replace the supply, reverse the removal procedure.

**Figure 6-30**



---

## To remove and replace the fans

---

### WARNING

#### AVOID INJURY!

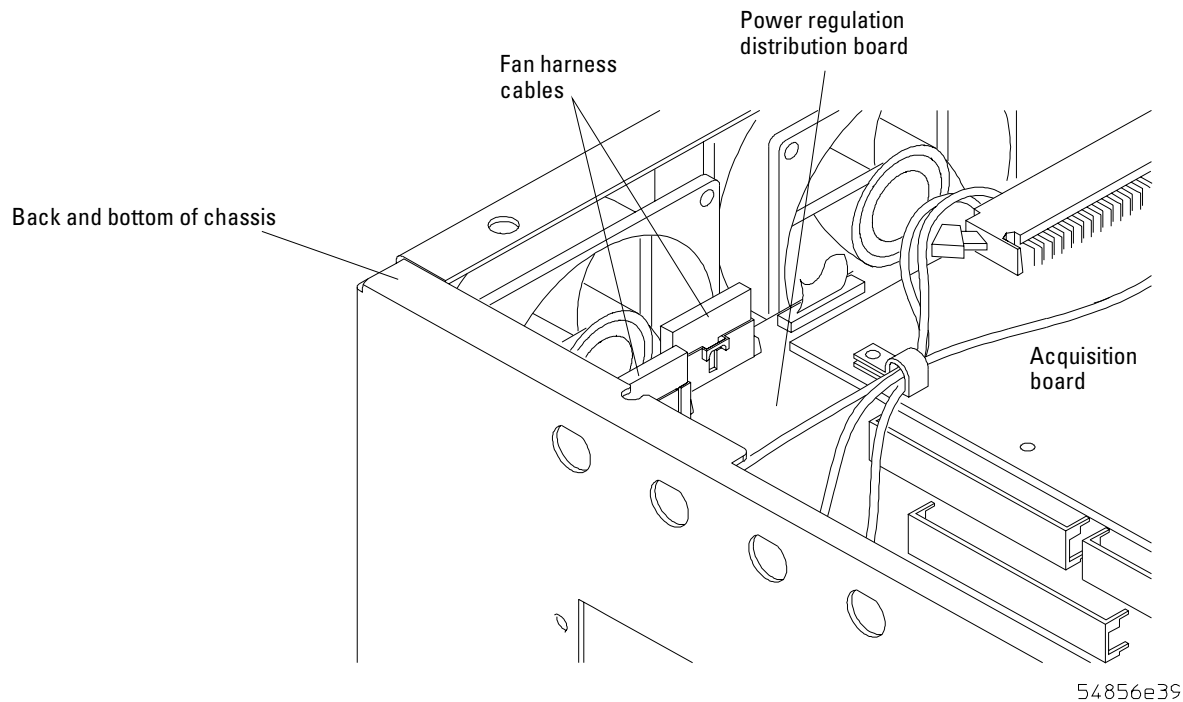
The fan blades are exposed both inside and outside the chassis. Disconnect the power cable before working around the fan. Use extreme caution in working with the oscilloscope. Failure to observe these precautions may result in injury.

---

Use this procedure to remove and replace the fans. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

- 1 Disconnect the power cable and remove the top and bottom covers.
- 2 Disconnect the two fan harness cables from the power regulator distribution board.

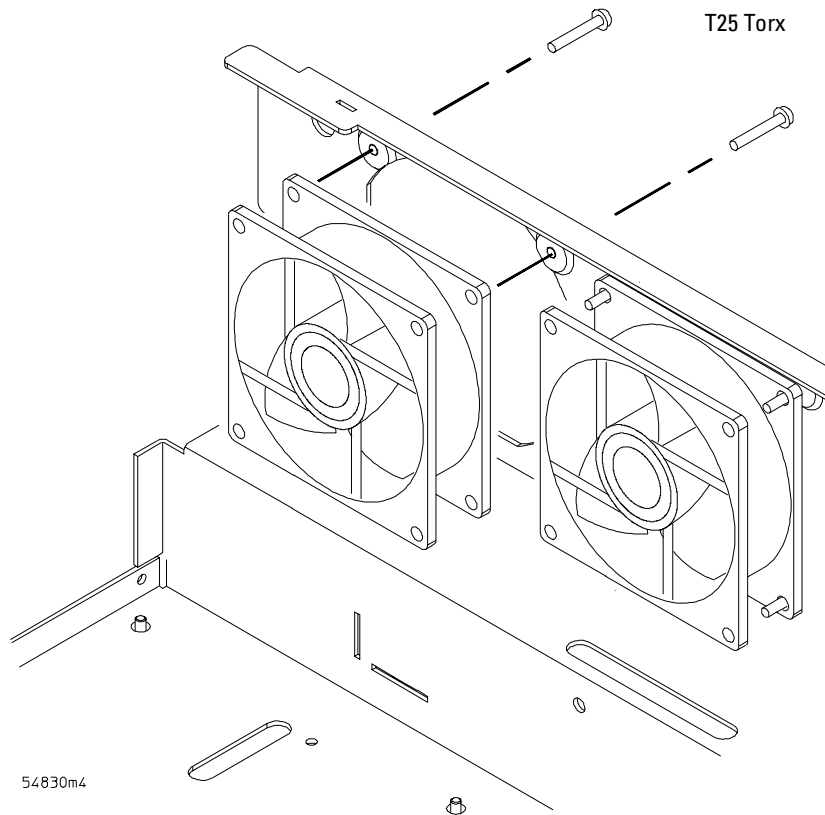
Figure 6-31



#### Removal of fan harness cables

- 3 Remove the four T25 Torx screws securing the fan to the chassis.  
When re-assembling, torque the two Torx T25 screws to 7 in-lb.

Figure 6-32



#### Removing Fan Fasteners

---

#### CAUTION

#### AVOID OVERHEATING THE OSCILLOSCOPE

When replacing the fan, be sure the direction of the fan air flow is coming from the inside to the outside of the oscilloscope. Check the flow arrows on the fan and check for proper flow once power is applied to the oscilloscope. Improper air flow can overheat the oscilloscope.

To install the fan, reverse this procedure.

Ordering Replaceable Parts	136
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Unlisted Parts	136
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## Replaceable Parts

---

# Replaceable Parts

This chapter of the *Agilent Technologies Infiniium Oscilloscope Service Guide* includes information for ordering parts. Service support for this oscilloscope is replacement of parts to the assembly level. The replaceable parts include assemblies and chassis parts.

---

## Ordering Replaceable Parts

### Listed Parts

To order a part in the parts list, quote the Agilent Technologies part number, indicate the quantity desired, and address the order to the nearest Agilent Technologies Sales Office.

### Unlisted Parts

To order a part not listed in the parts list, include the oscilloscope part number, oscilloscope serial number, a description of the part (including its function), and the number of parts required. Address the order to the nearest Agilent Technologies Sales Office.

### Direct Mail Order System

Within the USA, Agilent Technologies can supply parts through a direct mail order system. There are several advantages to this system:

- Direct ordering and shipping from the Agilent Technologies parts center in California, USA.
- 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.)
- Prepaid transportation. (There is a small handling charge for each order.)
- No invoices.

In order for Agilent Technologies to provide these advantages, please send a check or money order with each order.

Mail order forms and specific ordering information are available through your local Agilent Technologies Sales Office. Addresses and telephone numbers are located in a separate document shipped with the manuals.

### Exchange Assemblies

Some parts used in this oscilloscope have been set up for an exchange program. This program allows the customer to exchange a faulty assembly with one that has been repaired, calibrated, and performance-verified by the factory. The cost is significantly less than that of a new part. The exchange parts have a part number in the form XXXXX-695XX.

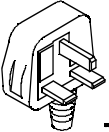
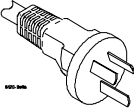
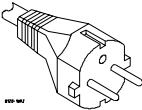
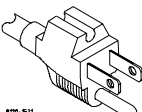
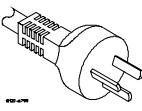
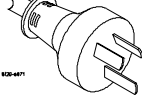
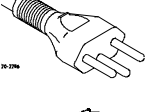
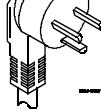
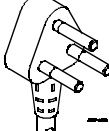
After receiving the repaired exchange part from Agilent Technologies, a United States customer has 30 days to return the faulty assembly. For orders not originating in the United States, contact the local Agilent Technologies service organization. If the faulty assembly is not returned within the warranty time limit, the customer will be charged an additional amount. The additional amount will be the difference in price between a new assembly and that of an exchange assembly.



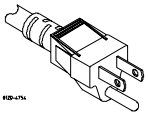
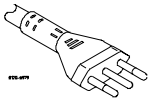
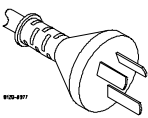
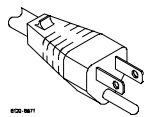
## Power Cables and Plug Configurations

This oscilloscope is equipped with a three-wire power cable. The type of power cable plug shipped with the oscilloscope depends on the country of destination. The following figure shows option numbers of available power cables and plug configurations.

Power Cables and Plug Configurations

Plug Type	Cable Part No.	Plug Description	Length (in/cm)	Color	Country
Opt 900 250V 	8120-1703	90°	90/228	Mint Gray	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore
Opt 901 250V 	8120-0696	90°	87/221	Mint Gray	Australia, New Zealand
Opt 902 250V 	8120-1692	90°	79/200	Mint Gray	East and West Europe, Saudi Arabia, So. Africa, India (unpolarized in many nations)
Opt 903** 125V 	8120-1521	90°	90/228	Jade Gray	United States, Canada, Mexico, Philippines, Taiwan
Opt 919 250V 	8120-6799	90°	90/228		Israel
Opt 920 250 V 	8120-6871	90°			Argentina
Opt 906 250V 	8120-2296	1959-24507 Type 12 90°	79/200	Mint Gray	Switzerland
Opt 912 220V 	8120-2957	90°	79/200	Mint Gray	Denmark
Opt 917 250V 	8120-4600	90°	79/200		Republic of South Africa India

Chapter 7: Replaceable Parts  
**Power Cables and Plug Configurations**

Plug Type	Cable Part No.	Plug Description	Length (in/cm)	Color	Country
Opt 918 100V 	8120-4754	90°	90/230		Japan
Opt 921 	8120-6979	90°			Chile
Opt 922 	8120-8377	90°			
Opt 927 	8120-8871	90°			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.

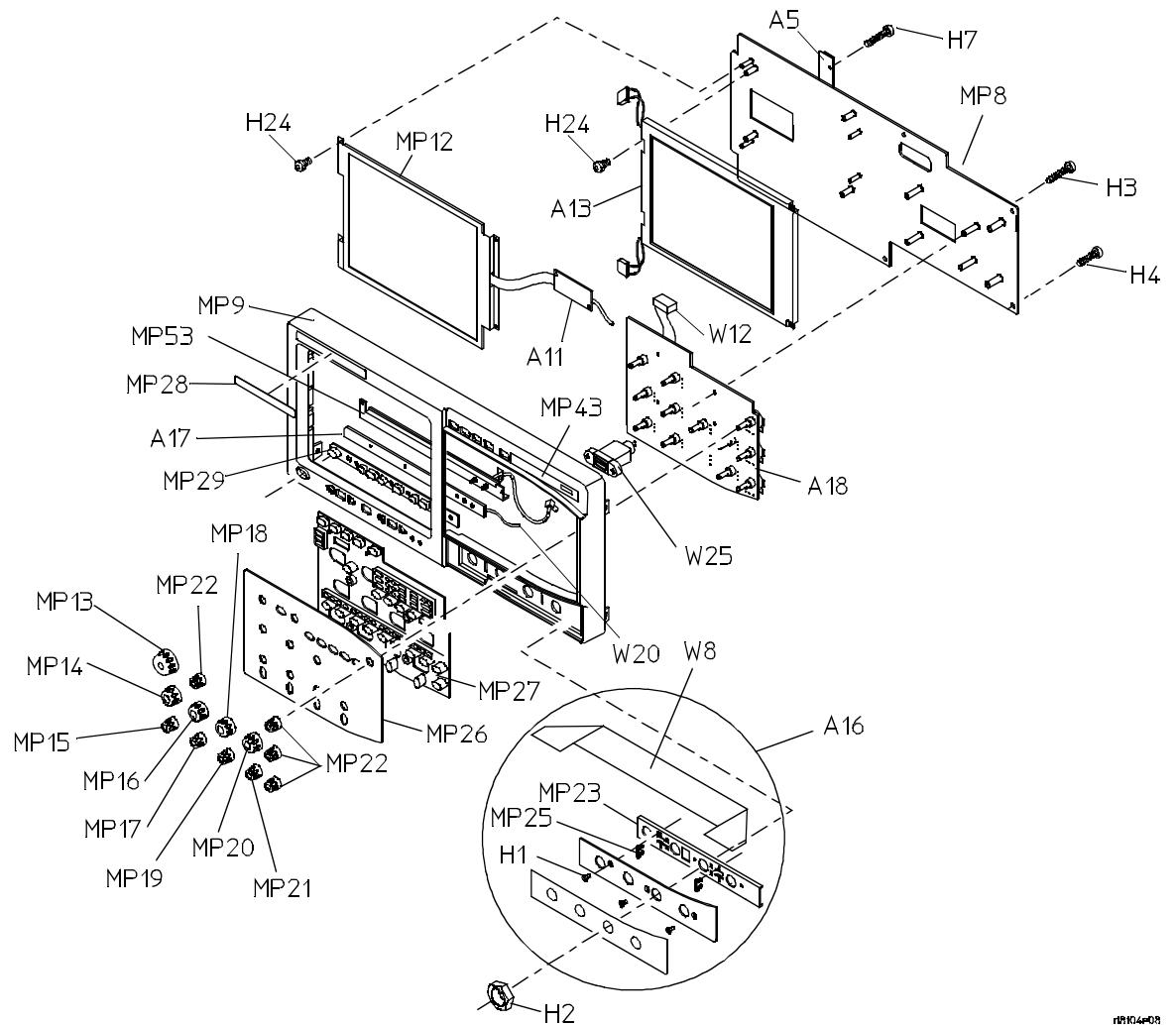
E = Earth Ground

L = Line

N = Neutral

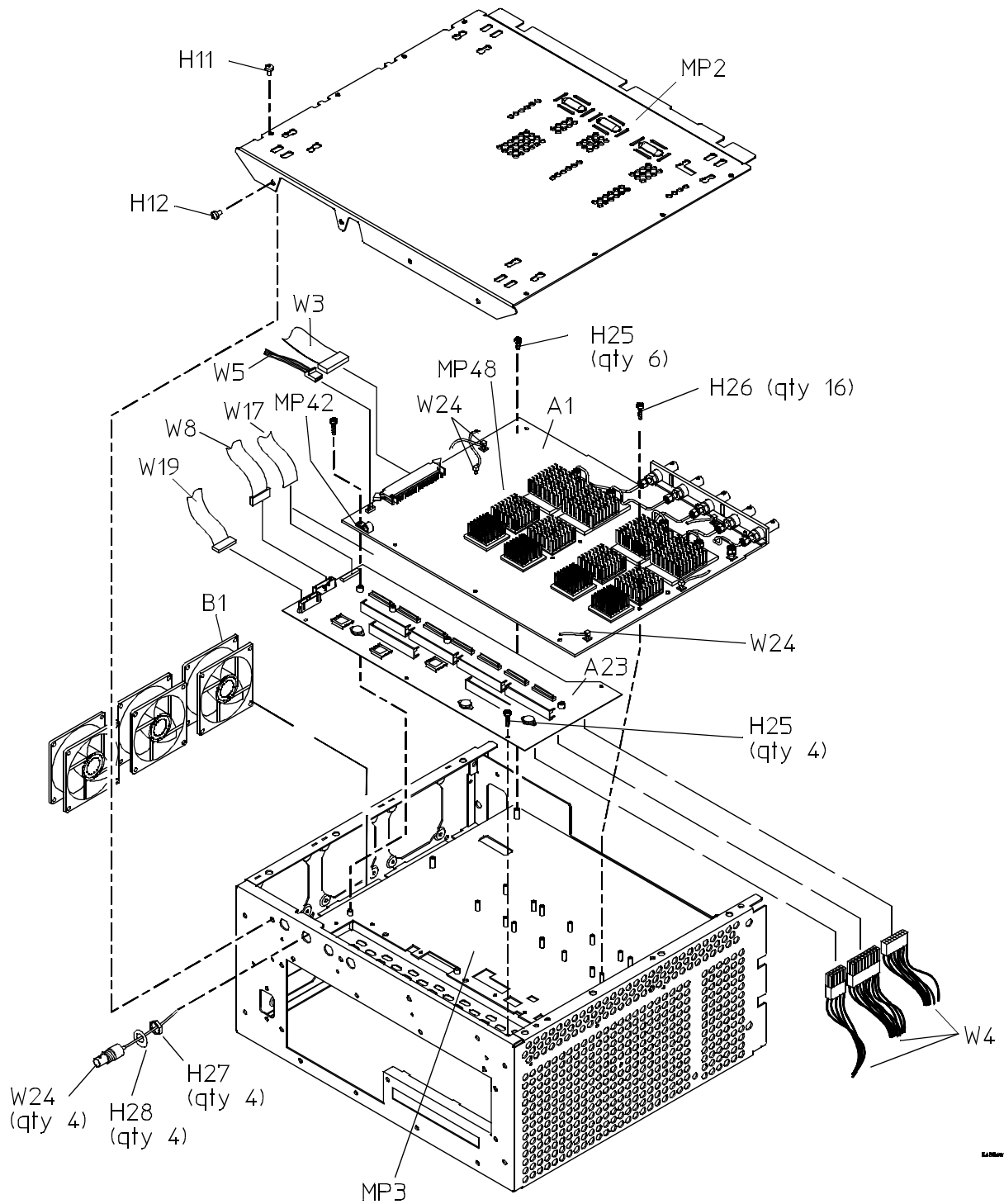
## Exploded Views

### Front Frame and Front Panel

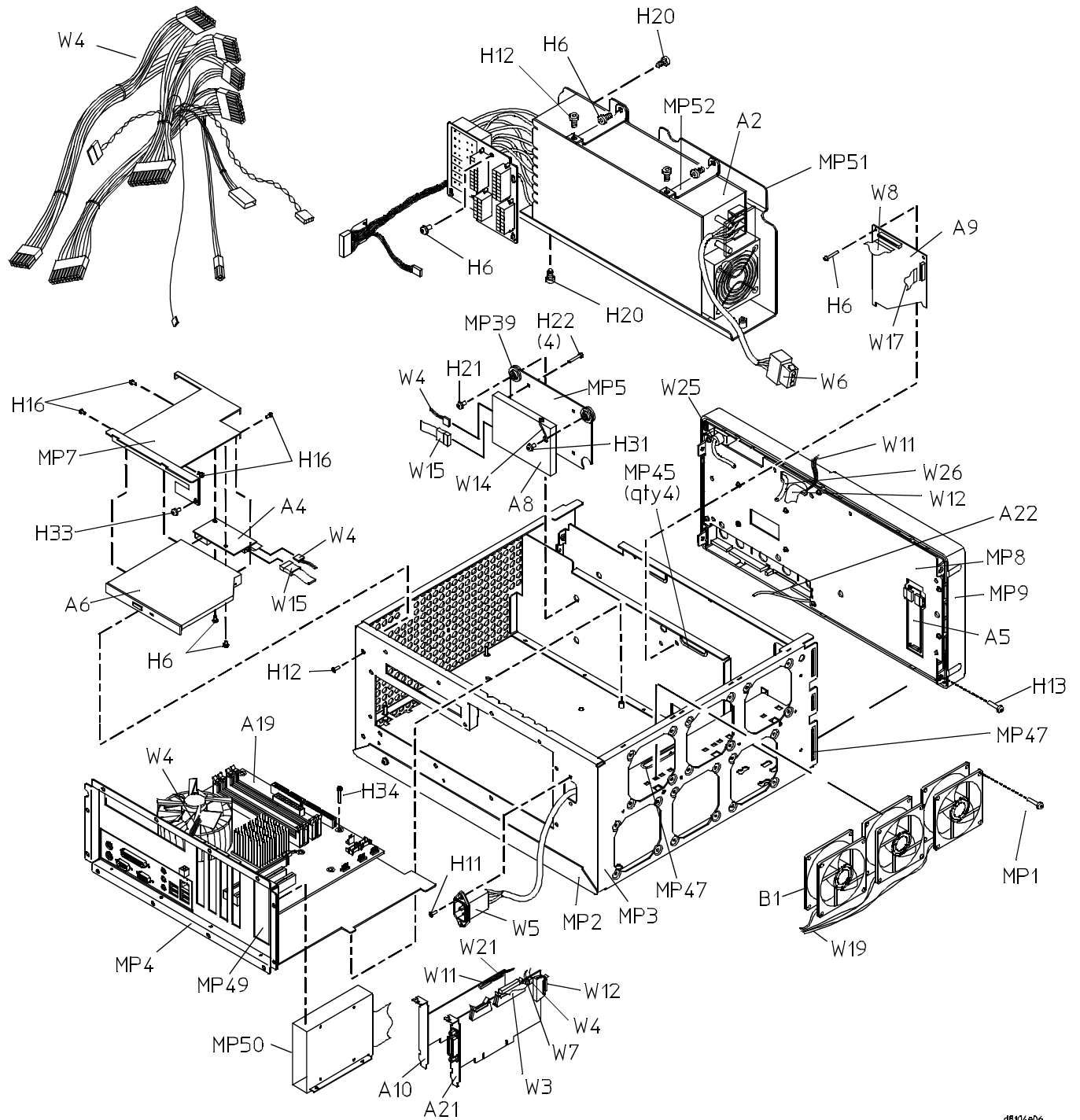


19104-01

Fan and Acquisition Assembly

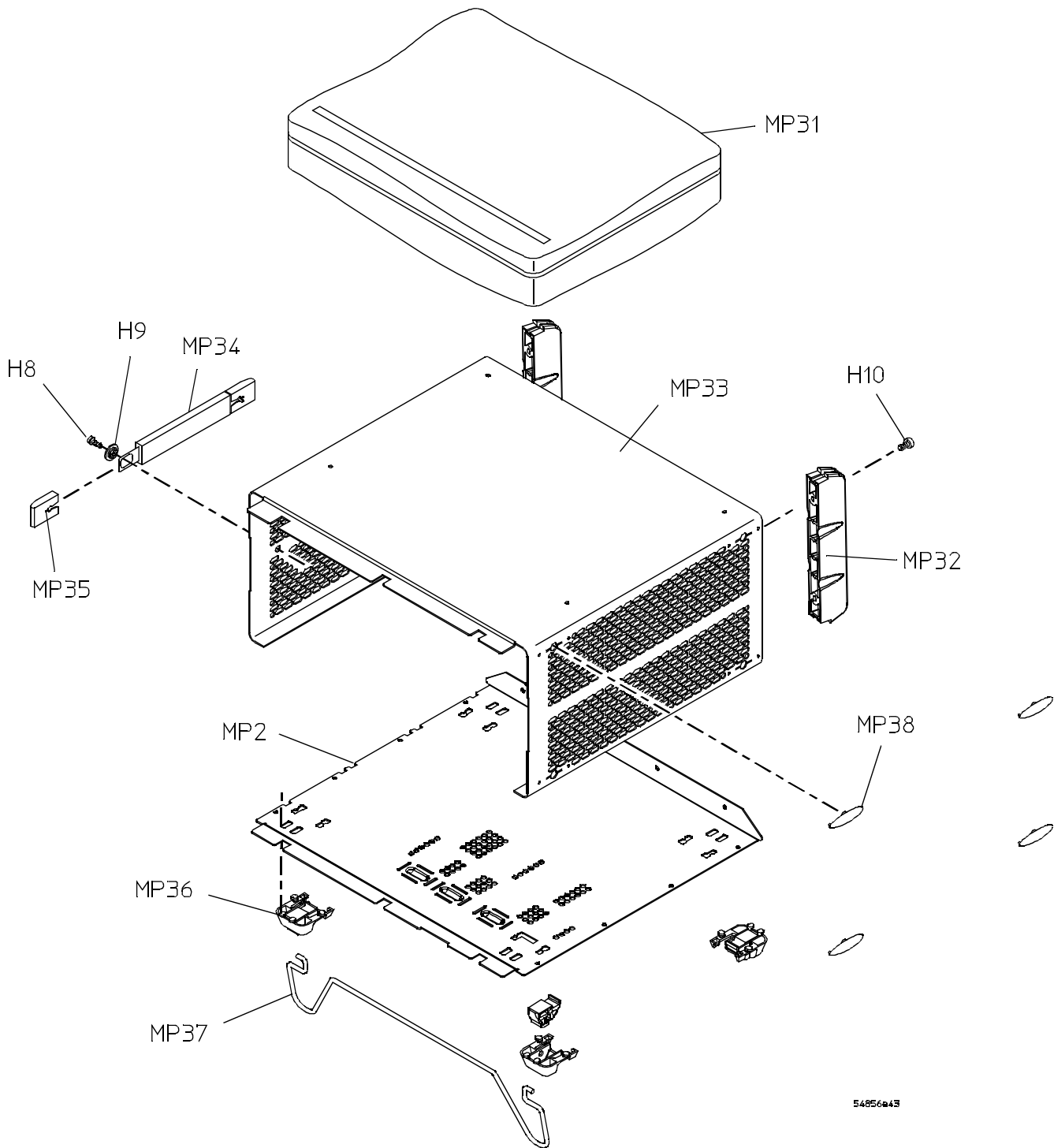


Power Supply and PC Motherboard



df104e06

Sleeve and Accessory Pouch



## Replaceable Parts List

The following table is a list of replaceable parts and is organized as follows:

- Exchange assemblies in alphanumeric order by reference designation.
- External chassis parts in alphanumeric order by reference designation. These parts are generally those that take the physical wear and tear of use.
- Internal parts in several categories. Each category is in alphanumeric order by reference designation. Replacing these parts generally requires opening the cabinet.

The information given for each part consists of the following:

- Reference designation.
- Agilent Technologies part number.
- Total quantity (QTY) in oscilloscope or on assembly. The total quantity is given once and at the first appearance of the part number in the list.
- Description of the part.

### Replaceable Parts

Ref. Des.	Agilent Part Number	QTY	Description
A1	Repair Center Replacement Only	1	4-CH ACQUISITION ASSEMBLY (Agilent Model DSO80204B)
A1	Repair Center Replacement Only	1	4-CH ACQUISITION ASSEMBLY (Agilent Model DSO80304B)
A1	Repair Center Replacement Only	1	4-CH ACQUISITION ASSEMBLY (Agilent Model DSO80404B)
A1	Repair Center Replacement Only	1	4-CH ACQUISITION ASSEMBLY (Agilent Model DSO80604B)
A1	Repair Center Replacement Only	1	4-CH ACQUISITION ASSEMBLY (Agilent Model DSO80804B)
A1	Repair Center Replacement Only	1	4-CH ACQUISITION ASSEMBLY (Agilent Model DSO81004B)
A1	Repair Center Replacement Only	1	4-CH ACQUISITION ASSEMBLY (Agilent Model DSO81204B)
A1	Repair Center Replacement Only	1	4-CH ACQUISITION ASSEMBLY (Agilent Model DSO81304B)
A2	54857-62601	1	POWER SUPPLY SUBASSEMBLY
A4	0960-2522	1	CD ROM ADAPTER BOARD (NOT ON OPTION 017)
A5	0950-4635	1	INVERTER BOARD
A6	0950-4741	1	CD ROM R/W
A8		1	HARD DRIVE w/SOFTWARE (NOT ON OPTION 017)
A9	54810-66506	1	PROBE INTERFACE BOARD
A10	0960-2530	1	DISPLAY BOARD
A11	54858-66513	1	USB TOUCHSCREEN CONTROLLER BOARD, PROGRAMMED
A13	2090-0911	1	XGA DISPLAY
A16	54857-68803	1	PROBE INTERFACE KIT
A17	54826-66507	1	KEYBOARD - CURSOR
A18	54832-66504	1	MAIN KEYBOARD
A19	D81004-68809	1	MOTHERBOARD SUBASSEMBLY
A21	54855-66515	1	INTERFACE & GPIB BOARD

Chapter 7: Replaceable Parts  
**Replaceable Parts List**

**Replaceable Parts**

<b>Ref. Des.</b>	<b>Agilent Part Number</b>	<b>QTY</b>	<b>Description</b>
A23	54857-66502	1	POWER DISTRIBUTION BOARD
B1	3160-4134	6	12 V FAN
H1	0515-2219	3	SCREW-MACHINE M2.5 X 0.45; 5 MM-LG; T8 ; RECESS, 90 DEGREE FLAT
H2	54503-25701	5	HEX NUT BNC
H3	0515-1025	4	SCREW-MACHINE M3.0 X 0.50; 26 MM-LG; T10; RECESS; WASHER
H4	0515-1410	6	SCREW-MACHINE M3.0 X 0.50; 20 MM-LG; T10; RECESS, PAN; WASHER
H6	0515-0372	22	SCREW-MACHINE M3 X 0.5 8 MM-LG; T10; RECESS; WASHER
H7	0515-1246	2	SCREW-MACHINE; M3.0 X 0.50; 6 MM-LG; T10; RECESS, PAN; PATCH LOCK
H8	5021-4302	2	SCREW MACHINE M4X0.7 20MM-LG
H9	54801-24702	2	SPACER-STRAP HANDLE
H10	0515-2195	8	SCREW-MACHINE M4.0 X 0.70; 40 MM-LG; T20; RECESS, PAN; WASHER
H11	0515-1103	10	SCREW-MACHINE M3.0 X 0.50; 10 MM-LG; T10; RECESS, 90 DGR-FLT
H11	0515-1103	10	SCREW-MACHINE M3.0 X 0.50; 10 MM-LG; T10; RECESS, 90 DGR-FLT
H12	0515-0380	18	SCREW-MACHINE M4.0 X 0.70; 10 MM-LG; T20; RECESS, PAN; WASHER
H12	0515-0380	18	SCREW-MACHINE M4.0 X 0.70; 10 MM-LG; T20; RECESS, PAN; WASHER
H13	0515-1403	4	SCREW-SPCL M4 X 0.7; 6 MM-LG; 90-DEG-FLH-HD
H15	0515-0375	3	SCREW-MACHINE ASSEMBLY M3 X 0.5 16MM-LG
H16	0515-0365	5	SCREW-MACHINE M2 X 0.4; 4 MM-LG
H20	2190-0027	1	WASHER-LK INTL T 1/4 IN .256-IN-ID
H21	0515-0436	4	SCREW-MACH M4.0 X 0.70; 18 MM-LG; T20; WASHER (NOT ON OPTION 017)
H22	0515-0374	4	SCREW-MACH; M3.0 X 0.50; 10 MM LONG; T10; WASHER
H24	0515-1940	4	SCREW-MACH; M2.5 X 0.45; 6 MM LONG; T8; LOCK
H25	0515-0666	10	SCREW-MACHINE M3.0 X 0.50; 18 MM-LG; T10; RECESS, PAN; WASHER
H26	0515-0368	16	SCREW-MACHINE M2.5 X 0.45; 12 MM-LG; T8; RECESS; WASHER
H27	2950-0054	2	NUT 1/2-28 THD
H28	2190-0068	2	WASHER-LK INTL T 1/2 IN .505-IN-ID
H31	0515-0383	4	SCREW-MACH M4 X 0.7; 16 MM-LG; T20 REC; WASHER (not on option 017)
H33	0515-0456	1	SCREW-MACHINE M4 X 0.7; 20 MM-LG; T20 RECESS; WASHER
H34	0515-0664	9	SCREW-MACHINE M3 X 0.5; 16 MM-LG PAN-HD
MP1	0624-1066	24	FAN SCREWS
MP2	D8104-00501	1	SLEEVE BOTTOM
MP3	D8104-60101	1	CHASSIS ASSEMBLY
MP4	D8104-60102	1	ATX TRAY
MP5	54857-01211	1	HARD DRIVE BRACKET (NOT ON OPTION 017)
MP7	D8104-01201	1	CD ROM MOUNT BRACKET
MP8	D8104-04103	1	FRONT FRAME BACK PLATE
MP9	D8104-40501	1	FRONT FRAME
MP12	D8104-01205	1	LENS BRACKET
MP13	54801-47403	1	KNOB 24 MM GRAY
MP14	54801-47408	1	KNOB 18 MM YELLOW
MP15	54801-47404	1	KNOB 12 MM YELLOW
MP16	54801-47409	1	KNOB 18 MM GREEN
MP17	54801-47405	1	KNOB 12 MM GREEN
MP18	54801-47410	1	KNOB 18 MM PURPLE
MP19	54801-47406	1	KNOB 12 MM PURPLE
MP20	54801-47411	1	KNOB 18 MM PINK
MP21	54801-47407	1	KNOB 12 MM PINK
MP22	54801-47401	2	KNOB 12 MM GRAY



## Replaceable Parts

Ref. Des.	Agilent Part Number	QTY	Description
MP23	54801-24701	1	BRACKET STIFFENER
MP25	54801-09101	2	SPRING, STEEL 1095
MP26	54857-68804	1	SUBASSEMBLY FRONT PANEL
MP27	54857-41901	1	MAIN KEYPAD
MP29	54810-41902	1	CURSOR KEYPAD
MP31	54810-68701	1	ACCESSORY POUCH
MP32	5042-1798	2	REAR FEET
MP33	54810-04104	1	SLEEVE TOP
MP34	54810-44901	1	MOLD OVER HANDLE
MP35	54810-45001	2	END CAP HANDLE
MP36	54810-61001	4	BOTTOM FEET w/INSERT
MP37	54810-03702	1	TILT STAND
MP38	01680-41002	4	SIDE FOOT
MP39	1520-0238	4	GROMMET (NOT ON OPTION 017)
MP40	D8104-94302	1	USB LABEL (not shown)
MP42	1400-3242	1	CABLE CLAMP
MP43	54852-94309	1	LOGO LABEL/DSO80204B
MP43	54853-94309	1	LOGO LABEL/DSO80304B
MP43	54854-94309	1	LOGO LABEL/DSO80404B
MP43	54855-94309	1	LOGO LABEL/DSO80604B
MP43	54856-94309	1	LOGO LABEL/DSO80804B
MP43	54857-94309	1	LOGO LABEL/DSO81004B
MP43	54858-94309	1	LOGO LABEL/DSO81204B
MP43	54859-94309	1	LOGO LABEL/DSO81304B
MP44	54857-60201	1	ATX PANEL COVER
MP45	54810-42204	1	GROMMET 9x64
MP47	54810-42202	1	GROMMET 20x50
MP48	54855-61101	4	HEAT SINK
MP49	54857-60201	1	REMOVEABLE HARD DRIVE COVER PLATE (NOT ON OPTION 017)
MP50	54857-01216	1	REMOVEABLE HARD DRIVE BRACKET (OPTION 017 ONLY)
MP51	54857-01213	1	POWER SUPPLY BRACKET
MP52	54857-01215	2	SUPPORT BRACKET
MP53	54857-61201	1	PROBE COMP PLATE
W3	54826-61606	1	ACQUISITION SIGNAL CABLE
W4	D8104-61601	1	POWER HARNESS CABLE
W5	54855-61621	1	POWER INPUT/LINE SINC
W6	54810-61613	1	CABLE ASSEMBLY POWER SUPPLY
W7	54855-61624	1	MOTHERBOARD SWITCH CABLE
W8	54810-61606	1	AUTO PROBE INTERFACE CABLE
W11	54857-61613	1	DISPLAY CABLE
W12	54855-61602	1	KEYBOARD CABLE
W14	54810-61615	1	HARD DRIVE GROUND CABLE (NOT ON OPTION 017)
W15	D8104-61603	2	SATA HDD CABLE
W17	54855-61608	1	PROBE POWER CABLE
W18	8120-1703	1	CABLE-POWER (Option 900-UK)
W18	8120-0696	1	CABLE-POWER (Option 901-AUSTL)
W18	8120-1692	1	CABLE-POWER (Option 902-EUR)
W18	8120-2296	1	CABLE-POWER (Option 906-SWIT)
W18	8120-2957	1	CABLE-POWER (Option 912-DEN)
W18	8120-4600	1	CABLE-POWER (Option 917-AFRICA)

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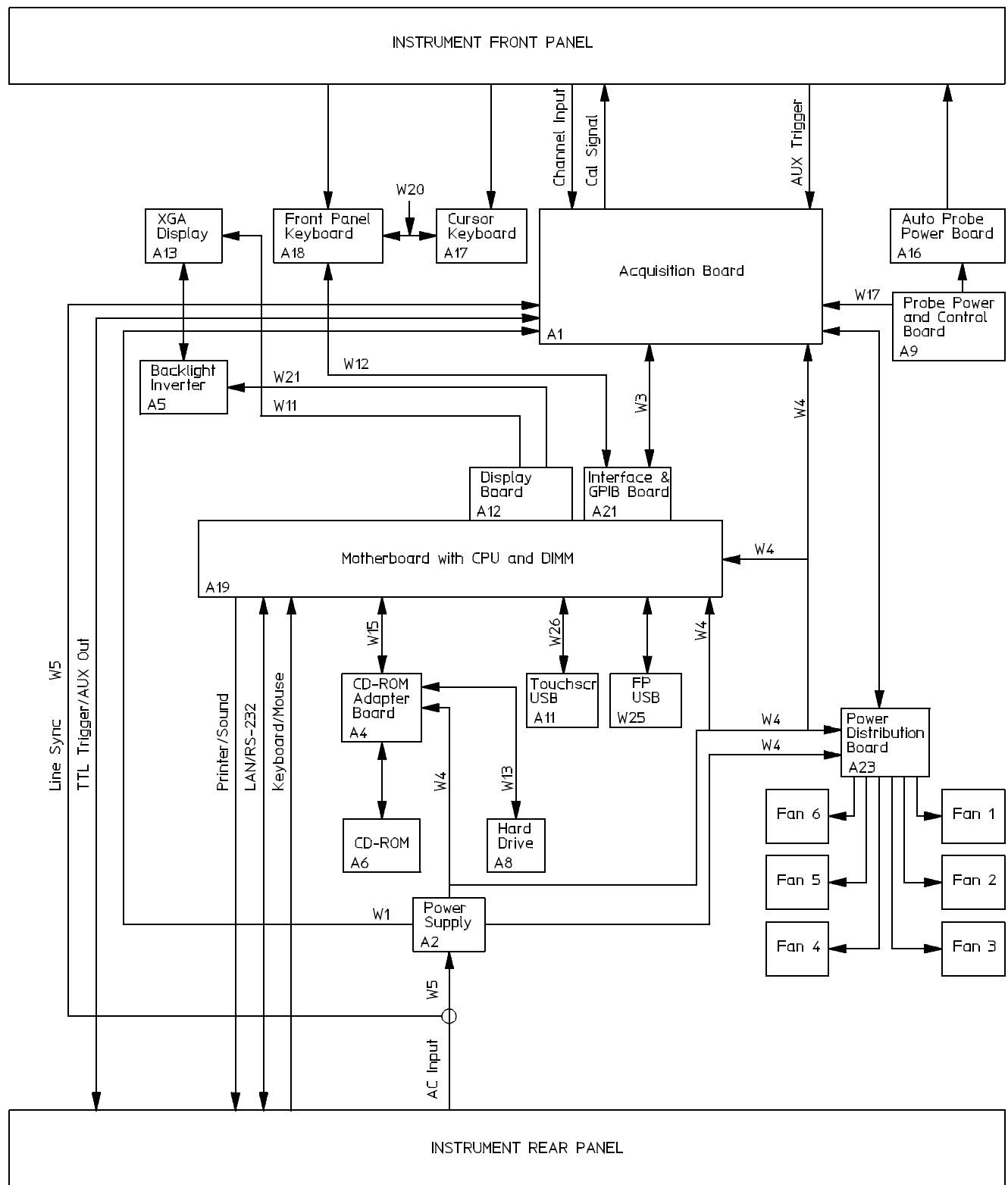
**Replaceable Parts**

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<b>Ref. Des.</b>	<b>Agilent Part Number</b>	<b>QTY</b>	<b>Description</b>
W18	8120-4754	1	CABLE-POWER (Option 918-JAPAN)
W18	8120-6799	1	CABLE-POWER (Option 919-ISRAEL)
W18	8120-6871	1	CABLE-POWER (Option 920-ARGENTINA)
W18	8120-6979	1	CABLE-POWER (Option 921-CHILE)
W18	8120-8377	1	CABLE-POWER (Option 922)
W18	8120-8871	1	CABLE-POWER (Option 927-THAILAND)
W18	8120-1521	1	CABLE-POWER (standard 125V USA)
W19	54855-61606	1	FAN CABLE
W20	54801-61626	1	KEYBOARD INTERCONNECT
W21	D8104-61605	1	BACKLIGHT POWER CABLE
W24	54855-61618	2	AUX TRIG OUT CABLE
W25	D8104-61602	1	USB CABLE
W26	D8104-61604	1	TOUCHSCREEN CABLE

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Figure 8-1



d5104b01

Oscilloscope Block Diagram

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# Theory of Operation

This *Service Guide* supports troubleshooting the Agilent Technologies oscilloscopes to assembly level. Theory of operation is included only as supplemental information. It is not comprehensive enough for component-level troubleshooting.

---

## Block-Level Theory

### **The front panel provides:**

- Dedicated knobs and pushbuttons for major oscilloscope functions.
- An 8.4-inch (diagonal) color flat panel display for waveform, measurement, and graphical interface display.
- A front panel USB 2.0 port.
- Precision BNC connectors for channel input signals.
- BNC connector for auxiliary output signal.
- AutoProbe interface for probe power and probe control.
- A connection for probe compensation.

### **The rear panel provides several connections:**

- The line power input.
- An GPIB connector, for connection to an oscilloscope controller.
- An RS-232 connection.
- A parallel printer connection.
- XGA monitor connection.
- Mouse and keyboard connections.
- LAN 10/100 connection.
- Auxiliary Trigger Input BNC.
- 10 MHz Reference Output BNC.
- 10 MHz Reference Input BNC.
- TTL trigger output BNC.
- Rear panel USB 2.0 ports.

The oscilloscope consists of several assemblies. Refer to the oscilloscope block diagram on the previous page for the following discussion.

### **Power Supply Assembly**

The AC input to the power supply is 100–240 VAC  $\pm 10\%$ . Maximum input power is 550 W. The AC input frequency is 47 to 63 Hz.

Filtered voltages of +5.1 V, +12.25 V, 3.3 V, and –12.25 V are supplied and distributed throughout the oscilloscope.

### **FPD Monitor Assembly**

The Flat Panel Display (FPD) monitor is a thin film liquid-crystal display (TFT-LCD). This FPD is an 8.4-inch diagonal, 1024 by 768 pixel XGA color monitor. The assembly requires +3.3 V and +12 V from the power supply.

A twin fluorescent back light provides illumination for the LCD. The Backlight Inverter assembly converts the +12 V to +300–1000 volts (AC rms) and drives the back light.

### **Acquisition System**

The acquisition circuitry samples, digitizes, and stores the signals for each channel. The graphics board provides the system control interface from the motherboard, and also interfaces the acquisition board to the display board for display of the acquired data. More detailed theory on the acquisition system follows this top-level block theory.

### **Front Panel**

The front panel is read and controlled by a micro controller IC. This device contains a microprocessor, RAM, ROM, and a DUART for communication with the microprocessor on the main assembly. The micro controller is located on the keyboard and communicates with the system control circuitry through an RS-232 cable. It reads the keys and knobs and controls the LED indicators.

The elastomeric keypad has 22 keys, each dedicated to a single function to improve ease of use. A conductive element on the inside of each key shorts a gap on the underlying keyboard circuit board. The keyboard controller detects this short and sends the proper keypress information to the system controller on the motherboard.

There are eleven dedicated knobs. Each knob controls a mechanical encoder. The output of the encoder is a 2-bit gray code that is read by the micro controller for direction and distance turned. A pushbutton controls the power through a Power Control line that is routed to the motherboard.

### **Disk Drive**

The hard disk drive is a high-capacity, shock-resistant unit. It is used to store the oscilloscope operating system and certain system configuration data.

The drive can also be used to store and recall oscilloscope setups and waveforms.

### **Motherboard**

The motherboard provides all system control and interface functions for the oscilloscope. It contains a CPU, ROM, and RAM; keyboard and mouse interfaces, serial and parallel interfaces, CDROM, hard disk drive interface, PCI (Peripheral Component Interconnect) buses, and a x1 PCI Express bus connector.

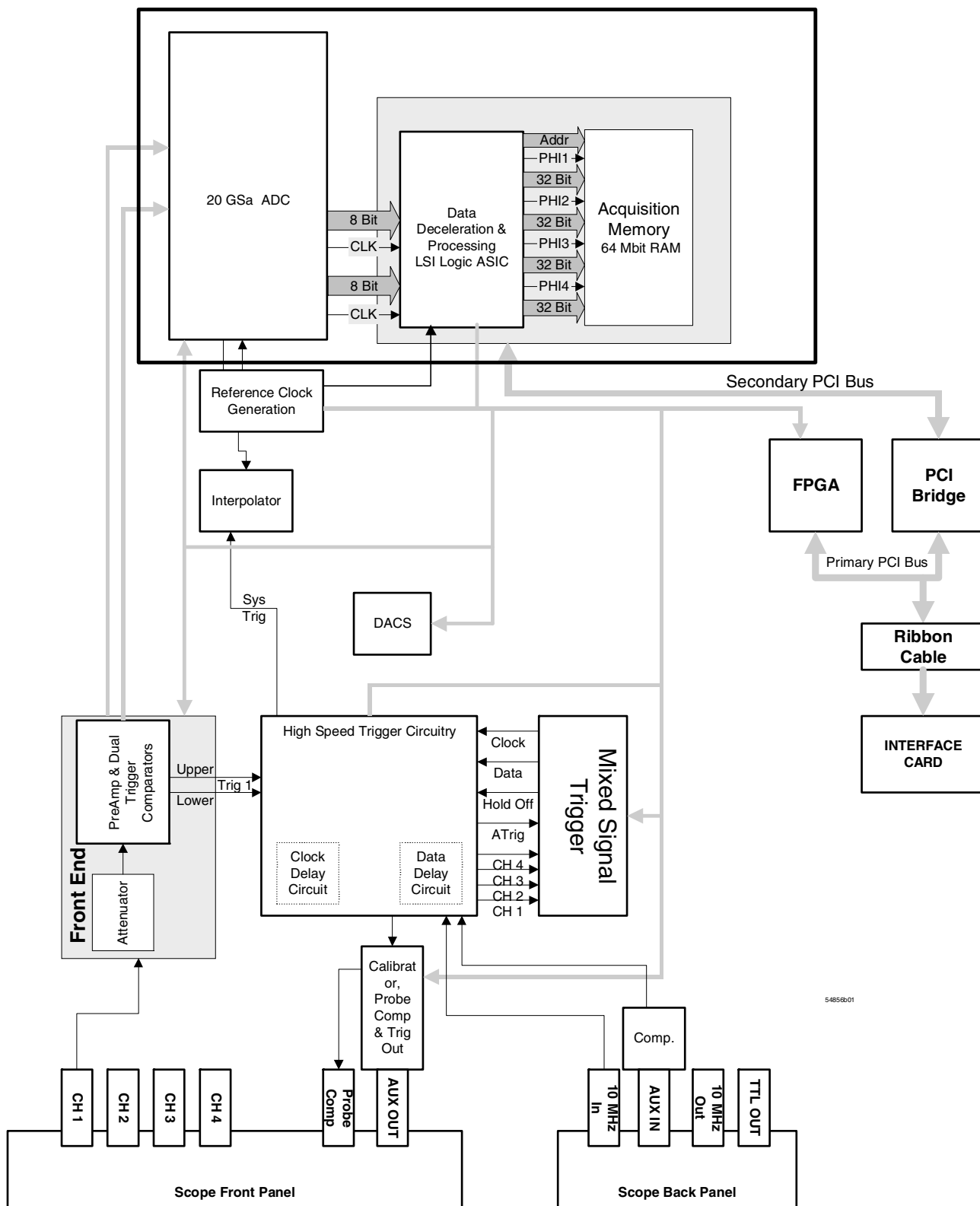
### **Display Board**

The Display Board controls the flat-panel display monitor. It translates the video signals from the motherboard's on-board video system to the Low Voltage Differential Signal (LVDS) signals that drive the FPD monitor. The display board also provides +12 V to the backlight inverter.

### **Probe Power and Control**

The Probe Power and Control board provides filtered, regulated power to the front-panel AutoProbe interface. It also provides serial communications capability, offset and probe detection and identification circuitry. All of these are interfaced to the probe through the conductive pads surrounding the BNC connectors. Using the facilities of this board, the Autoprobe interface can supply power for active probes, notify the oscilloscope operating system when a probe is connected or disconnected, identify the probe type to the oscilloscope operating system for automatic configuration, and communicate with the probe to support advanced probe functionality.

Figure 8-2



Acquisition Block Diagram



---

## Acquisition Theory

The acquisition system includes two major sections. One is the acquisition board, which conditions, stores, and processes the input signals. The other is the A1 interface board, which provides the interface from the acquisition to the motherboard and display, and also interfaces the motherboard to the front-panel keyboard.

### **Acquisition Board**

The acquisition circuitry samples, digitizes, and stores the signals for each channel. The trigger signals synchronize acquisition through the trigger and time base circuitry. A reference oscillator and the time base provide the base sample rates.

**ADC** The Agilent Technologies Infiniium Oscilloscope ADC provides all of the sampling, digitizing, and high-speed waveform storage. Each ADC contains one 20 GSa/s ADC.

**Trigger** There are four main trigger circuits: Trigger Conditioning, Analog Comparators, a Trigger Multiplexer, and Mixed Signal Trigger. Trigger signals from the channel are fed to the analog trigger comparators and the trigger conditioning circuit. The trigger conditioning circuitry selects low or high sensitivity modes and sets the trigger levels. The trigger multiplexer selects the trigger modes, such as edge, glitch, and pattern trigger. The data delay and clock delay timers are used to implement trigger functions that require timing between 1.5 and 20 ns.

The channel triggers are sent to the Mixed Signal Trigger. The Mixed Signal Trigger provides the advanced triggering functions, such as holdoff, delay, and pattern duration and range.

The auxiliary trigger, which cannot be displayed on screen, is compared to the trigger level setting in a separate circuit.

### **Time Base**

The time base provides the sample clocks and timing necessary for data acquisition. It primarily consists of a reference oscillator, state machine, and trigger-time interpolator.

- The time base reference can be supplied by the on-board 10 MHz oscillator, or by an external 10 MHz reference signal.
- The state machine sequences through the stages of the acquisition. First it times the pre-trigger delay, which guarantees that the required amount of data to the left of the trigger has been captured. When this times out, it sends a signal (ARM) to the trigger multiplexer. The next time the trigger condition is satisfied, the trigger multiplexer sends a signal (SYSTRIG) back to the state machine. After receiving SYSTRIG, the state machine counts down the post-trigger delay time, then stops the acquisition. The stored data now covers the requested time window relative to the trigger. Finally, the state machine signals the CPU that the acquisition is complete.
- The trigger-time interpolator measures the time between the trigger event (SYSTRIG) and the next sample clock. The interpolator circuitry converts this time difference into a voltage and digitizes it with an analog-to-digital converter (ADC). Using this value, the CPU precisely positions the acquired samples relative to the trigger for plotting and making measurements.

### **Calibration**

The Calibration circuit provides several signals to the Probe Compensation and Aux Out outputs. Which signal is driven to the front panel depends on the current selection from the drop-down menu in the Calibration dialog box. Available signals for Aux Out include a 715 Hz probe compensation signal, a pulse representing the trigger event, the timebase clock, a DC voltage in the range  $-2.5$  to  $+2.5$  V, or a high-speed edge used to calibrate the A/D converters. The DC voltage is used for self-calibration, and is an output from a 16-channel DAC. The calibration signals are sent to an analog multiplexer, which selects the signal that will be sent to the front panel.

### **Microprocessor Interface**

The Microprocessor Interface provides control and interface between the system control and digital functions in the acquisition circuitry.

### **Analog Interface**

The Analog Interface provides analog control of functions in the acquisition circuitry. It is primarily DACs with accurate references and filtered outputs. The analog interface controls:

- Channel offsets
- Trigger levels
- Mixed Signal Trigger functions

### **Interface and GPIB Board (A21)**

The Interface Board (A21) has four primary functions:

- Interface the acquisition board to the motherboard system controller.
- Implement miscellaneous oscilloscope functions, including an RS-232 interface to the front-panel keyboard, a 32-bit timer, and non-volatile RAM.
- GPIB remote control interface.
- Acquisition control for segmented memory acquisition.

The GPIB Interface provides IEEE-488.2 standard bus services for the oscilloscope. The card interfaces the bus to the motherboard system controller, allowing the system controller to receive and process GPIB commands and return data to the bus. The circuit consists of three main components. The GPIB controller provides an interface between the microprocessor system and the GPIB in accordance with IEEE 488 standards. An 8-bit data buffer and 8-bit control line buffer connect the GPIB controller to the GPIB bus. The GPIB is a 24-conductor shielded cable carrying 8 data lines, 8 control lines, 7 system grounds, and 1 chassis ground.

### **Acquisition Board Interface**

The interface to the acquisition board consists of 16 data lines, 10 address lines, a R/W line, and read and write strobes. A second read strobe is used for reading acquisition data; the address latches are not used when this strobe is active. Three lines are used to indicate run, trigger, and interpolator status; two control lines are used for trigger control and clocking.

There are two address ranges on the acquisition board; the first is used for reading acquisition data, while the second is used to access status and control elements of the board.

### **Miscellaneous System Functions**

An RS-232 interface is used to communicate with the front panel keyboard. The connector routes transmit and receive, power supply bias and inhibit signals, and keyboard power to the keyboard. The interface functionality is contained in the FPGA. The data rate is 19.2 KBaud, with 1 start bit, 8 data bits (LSB first), and one stop bit, no parity. The keyboard itself has a controller that transmits and receives data through this interface.

Non-Volatile RAM (NVRAM) on the Interface & GPIB board provides high-speed access to oscilloscope configuration settings.



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# Safety Notices

This apparatus has been designed and tested in accordance with IEC Publication EN 61010-1:2001, Safety Requirements for Measuring Apparatus, and has been supplied in a safe condition. This is a Safety Class I instrument (provided with terminal for protective earthing). Before applying power, verify that the correct safety precautions are taken (see the following warnings). In addition, note the external markings on the instrument that are described under "Safety Symbols."

## Warnings

- Before turning on the instrument, you must connect the protective earth terminal of the instrument to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. You must not negate the protective action by using an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two-conductor outlet is not sufficient protection.
- Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuseholders. To do so could cause a shock or fire hazard.
- If you energize this instrument by an auto transformer (for voltage reduction or mains isolation), the common terminal must be connected to the earth terminal of the power source.
- Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.
- Service instructions are for trained service personnel. To avoid dangerous electric shock, do not perform any service unless qualified to do so. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
- Do not install substitute parts or perform any unauthorized modification to the instrument.

- Capacitors inside the instrument may retain a charge even if the instrument is disconnected from its source of supply.

- Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

- Do not use the instrument in a manner not specified by the manufacturer.

## 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.

## Safety Symbols



Instruction manual symbol: the product is marked with this symbol when it is necessary for you to refer to the instruction manual in order to protect against damage to the product.



Hazardous voltage symbol.



Earth terminal symbol: Used to indicate a circuit common connected to grounded chassis.

---

# Notices

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