
Service Guide

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Agilent Model 54850 Series Infiniium Oscilloscopes

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
- Agilent 54852 offers 4 channels, 10 GSa/s sampling rate on all four channels, 2 GHz bandwidth
- Agilent 54853 offers 4 channels, 20 GSa/s sampling rate on all four channels, 2.5 GHz bandwidth
- Agilent 54854 offers 4 channels, 20 GSa/s sampling rate on all four channels, 4 GHz bandwidth
- Agilent 54855 offers 4 channels, 20 GSa/s sampling rate on all four channels, 6 GHz bandwidth

Display shows waveforms and graphical user interface

- Graphical interface allows direct interaction with waveforms, including drag-and-drop positioning and instant waveform zoom
- 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 (54855/54854) or 10 ps/div to 20 s/div (54853/54852)
- 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 floppy disk drive 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
- 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

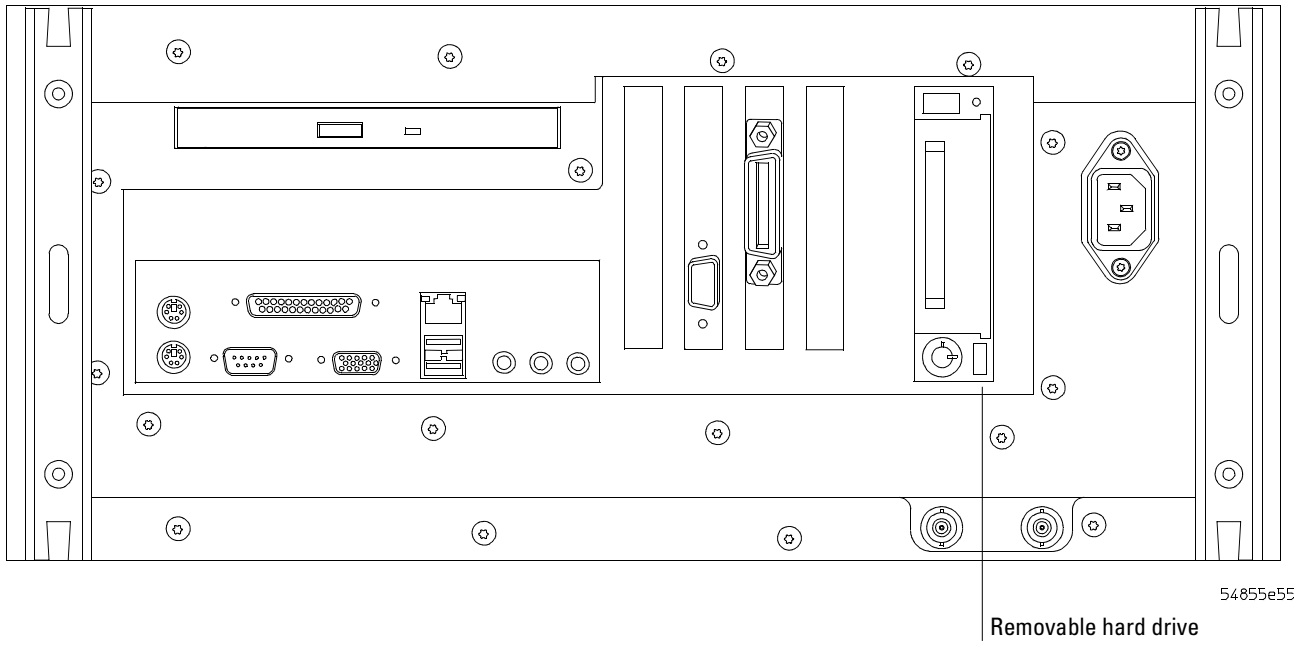
Marker and quick measurements help measure waveform parameters

- Waveform markers A and B to check voltage or Δ -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.

Rear panel with option 017



In This Book

This book provides the service documentation for the Agilent Technologies 54852, 54853, 54854, and 54855 oscilloscopes. It is divided into seven chapters.

Chapter 1 provides general information and specifications.

Chapter 2 shows you how to prepare the oscilloscope for use.

Chapter 3 gives performance tests.

Chapter 4 covers calibration procedures, how to do them, and how often they need to be done.

Chapter 5 gives the procedures and techniques for replacing assemblies and other parts.

Chapter 6 includes a list of exchange assemblies and other replaceable parts, part ordering information, and shipping information.

Chapter 7 briefly covers the internal operation of the oscilloscope.

At the back of the book you will find safety notice information.

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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.

- oscilloscope identification
- Options
- Accessories
- Specifications and characteristics
- Test equipment requirements

Oscilloscopes covered by this service guide

The oscilloscope can be identified by the product number on the back panel.

On the rear panel of the oscilloscope is a serial number label and a VIN # XXX. 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. The second part, or the last six digits from the right, contains a rolling number that is different for each Infiniium. This manual may not reflect changes made to the oscilloscope after the release data listed on the title page.

An oscilloscope manufactured after the printing of this manual may have a newer serial number. This newer serial prefix indicates that the oscilloscope may be different from those described in this manual. The manual for this oscilloscope will be revised as needed. If you have an oscilloscope with a newer serial number, please refer to the Agilent Technologies website and download a newer manual edition in Adobe Acrobat (pdf) format. The Agilent Technologies URL is: "www.agilent.com". It will be necessary to search for the product page, then click on "Manuals, Guides, & Notifications" link in the Library section of the product page.

Accessories supplied

The following accessories are supplied.

- Mouse, Agilent part number 1150-7913
- Keyboard, Agilent part number 1150-7809
- Accessory Pouch, Agilent part number 54810-68701
- Front-panel cover, Agilent part number 54810-42201
- Calibration cable assembly (54855 only), Agilent part number 54855-61620
- Probe De-skew and Performance Verification Kit, Agilent E2655A
- Precision 3.5 mm adapters (qty 2), Agilent part number 54855-67604 (54854 & 54855 only)
- BNC shorting cap, Agilent part number 1250-0929
- Power cord (see chapter 6, “Replaceable Parts,” for available power cords)
- *User's Quick Start Guide*

Options available

The following options are available for the oscilloscope.

Table 1-1

Infiniium Oscilloscope Options

Option	Description
001	1 MB Memory Upgrade
1CM	Add 1 Rackmount kit (E2609B)
A6J	ANSI Z-540 compliant calibration
R1280A	Return-to-Agilent - warranty and service plan
R-51B	Return-to-Agilent - warranty and service plan (months)
R1282A	Return-to-Agilent - calibration plan

You can order multiple options with the oscilloscope. Also, all model numbers shown in table 1-1 may also be ordered separately, using the model number. Some accessories that will enhance your work with the oscilloscope are listed in table 1-2.

Accessories available

The following accessories are available for use with the oscilloscope.

Table 1-2

Accessories for the Infiniium Oscilloscopes

Agilent Model Number	Description
54855-67604	18 GHz BNC-compatible to APC 3.5 mm adaptor
10833A	GPIO cable, 1 m
10833B	GPIO cable, 2 m
10833C	GPIO cable, 4 m
10833D	GPIO cable, 0.5 m
11094B	75 Ω Feedthrough Termination
1131A	3.5 GHz InfiniiMax Active Probe
1130A	1.5 GHz InfiniiMax Active Probe

Accessories available

Agilent Model Number	Description
1131A	3.5 GHz InfiniiMax Active Probe
1132A	5 GHz InfiniiMax Active Probe
1134A	7 GHz InfiniiMax Active Probe
1144A	800 MHz Active Probe
1145A	750 MHz Active Probe
1156A	1.5 GHz Active Probe
1157A	2.5 GHz Active Probe
1158A	4 GHz Active Probe
1181B	Testmobile with tilt tray
1184A	Testmobile with keyboard and mouse tray and drawer for accessories
34398A	RS-232-C Printer Cable
34399A	RS-232-C Adapter kit
54006A	6 GHz probe, 10:1 (500 Ω) or 20:1 (1 k Ω), .25 pf
C2950A	Parallel printer cable, 2 m
C2951A	Parallel printer cable, 3 m
E2609B	Rackmount kit
E2621A	75 Ω terminator
E2622A	100/110/120 Ω differential terminator
E2654A	EZ-Probe [®] Positioner
E2655A	Additional probe deskew and performance verification kit
E2669A	Differential connectivity kit
E2668A	Single-ended connectivity kit
E2675A	Differential browser and accessories
E2676A	Single-ended browser and accessories
E2677A	Differential solder-in probe head
E2678A	Single-ended/differential socketed probe
E2679A	Single-ended solder-in probe head
E2680A	1 MB Memory upgrade
E2681A	Jitter Analysis Software for the 54850A Series Infiniium oscilloscope
E2683A	USB Test Option
E2688A	Serial Bus Mask Test Option
E5850A	Time-correlation fixture, integrates Infiniium oscilloscope and 16700 logic analyzer
N1022A	Adapter 113X & 115X probes to 86100 infiniium DCA

Specifications and Characteristics

The following table lists the specifications and characteristics for the Agilent Technologies 54850 Series Infiniium Oscilloscopes. Asterisks (*) denotes warranted specifications, all others are typical. Specifications are valid after a 30 minute warm-up period, and within $\pm 5^\circ\text{C}$ from the self-calibration temperature.

Vertical

Input channels	4
Analog bandwidth (-3 dB)*	54855: 6 GHz 54854: 4 GHz 54853: 2.5 GHz 54852: 2 GHz
Rise time (10% to 90%)	54855: 70 ps 54854: 105 ps 54853: 168 ps 54852: 210
Input impedance	50 Ω $\pm 2.5\%$
Sensitivity ¹	1 mV/div to 1 V/div
Input coupling	DC
Vertical resolution ²	8 bits, ≥ 12 bits with averaging
Channel to channel isolation (any two channels with equal V/div settings)	DC to 100 MHz: 40 dB 100 MHz to 1 GHz: 28 dB >1 GHz to 6 GHz: 24dB
DC gain accuracy* ¹	$\pm 1\%$ of full scale at full resolution channel scale
Maximum input voltage*	5 Vrms, CAT I
Offset range	$> \pm 12$ div or ± 4 Volts, whichever is smallest
Offset accuracy* ¹	$\pm (2\% \text{ of channel offset} + 1\% \text{ of full scale})$
Dynamic range	± 4 div from center screen
DC voltage measurement accuracy* ¹	
Dual cursor	$\pm [(\text{DC gain accuracy}) + (\text{resolution})]$
Single cursor	$\pm [(\text{DC gain accuracy}) + (\text{offset accuracy}) + (\text{resolution}/2)]$



Horizontal

Main sweep time scale range	54855: 5 ps/div to 20 s/div 54854: 5 ps/div to 20 s/div 54853: 10 ps/div to 20 s/div 54852: 10 ps/div to 20 s/div
Main sweep time delay range	-200 s to 200 s
Delayed sweep time scale range	1 ps/div to current main time scale setting
Channel deskew range	-50 μs to 150 μs
Time scale accuracy ³	± 1 ppm pk
Delta-time measurement accuracy ^{6,7}	≥ 256 Averages: 70 fs rms, $\pm [(0.5 \text{ ps}) + (1 \times 10^{-6} \times \text{reading})]$ peak Averaging disabled: 2.0 ps rms, $\pm [(7.0 \text{ ps}) + (1 \times 10^{-6} \times \text{reading})]$ peak
Jitter measurement floor ⁶	
Time interval error:	54855: 1.4 ps rms 54854: 1.8 ps rms 54853: 2.0 ps rms 54852: 3.0 ps rms
Period jitter:	54855: 2.0 ps rms 54854: 2.5 ps rms 54853: 3.0 ps rms 54852: 4.5 ps rms
N-cycle, cycle-cycle jitter:	54855: 3.0 ps rms 54854: 3.8 ps rms 54853: 4.5 ps rms 54852: 6.8 ps rms

Chapter 1: General Information
Specifications and Characteristics

Acquisition

Real time sample rate per channel	20 GSa/s except for the 54852 which is 10 GSa/s
Memory depth per channel	
Standard	262,144 at all sample rates
Option 001	1,025,000 at all sample rates 32,800,000 \leq 2 GSa/s sample rate
Sampling modes	
Real time	Successive single-shot acquisitions
Real time with averaging	Selectable from 2 to 4096
Real time with peak detect	2 GSa/s peak detect, for less than 2 GSa/s sample rates (option 001 only)
Filters	
Sin(x)/x Interpolation	On/off selectable FIR digital filter. Digital signal processing adds points between acquired data points to enhance measurement accuracy and waveform display quality.

Trigger

Sensitivity ¹	
Internal Low ¹	54855: 0.5 div p-p 0 to 2 GHz, 1.0 div p-p 2 to 4 GHz, <2.5 div @ 5 GHz 54854: 0.5 div p-p 0 to 2 GHz, 1.0 div p-p 2 to 4 GHz 54853: 0.5 div p-p 0 to 2 GHz, 1.0 div p-p 2 to 2.5 GHz 54852: 0.5 div p-p 0 to 2 GHz
Internal High ¹	54855: 0.2 div p-p 0 to 6 GHz 54854: 0.2 div p-p 0 to 4 GHz 54853: 0.2 div p-p 0 to 2.5 GHz 54852: 0.2 div p-p 1 to 2 GHz
Auxiliary	DC to 500 MHz: 500 mV p-p CATI
Level range	
Internal	± 8 div from center screen
Auxiliary	± 5 V
Sweep modes	Auto, triggered, single
Trigger jitter ^{6,8}	54855: 1.0 ps rms 54854: 1.3 ps rms 54853: 1.7 ps rms 54852: 1.8 ps rms
Trigger holdoff range	80 ns to 320 ms
Trigger actions	Specify an action to occur and the frequency of the action when a trigger condition occurs. Actions include e-mail on trigger and QuickMeas+.

Trigger modes	
Edge	Triggers on a specified slope and voltage level on any channel or auxiliary trigger.
Glitch	Triggers on glitches narrower than the other pulses in your waveform by specifying a width less than your narrowest pulse and a polarity. Triggers on glitches as narrow as 500 ps. Glitch range settings: < 1.5 ns to < 160 ms.
Line Pattern	Triggers on the line voltage powering the oscilloscope. Triggers when a specified logical combination of the channels is entered, exited, present for a specified period of time or is within a specified time range. Each channel can have a value of High (H), Low (L) or Don't care (X). Triggers on patterns as narrow as 500 ps.
State	Pattern trigger clocked by the rising or falling edge of one channel. Logic type: AND or NAND.
Delay by time	The trigger is qualified by an edge. After a specified time delay between 30 ns to 160 ms, a rising or falling edge on any one selected input will generate the trigger.
Delay by events	The trigger is qualified by an edge. After a specified delay between 1 to 16,000,000 rising or falling edges, another rising or falling edge on any one selected input will generate the trigger.
Violation triggers	
Pulse width	Trigger on a pulse that is wider or narrower than the other pulses in your waveform by specifying a pulse width and a polarity. Triggers on pulse widths as narrow as 500 ps. Pulse width range settings: 1.5 ns to 160 ms.
Setup/hold	Triggers on setup, hold or setup and hold violations in your circuit. Requires a clock and data signal on any two input channels as trigger sources. High and low thresholds and setup and/or hold time must then be specified.
Transition	Trigger on pulse rising or falling edges that do not cross two voltage levels in > or < the amount of time specified.
Measurements and math	
Waveform measurements	
Voltage	Peak to peak, minimum, maximum, average, RMS, amplitude, base, top, overshoot, preshoot, upper, middle, lower, area.
Time	Period, frequency, positive width, negative width, duty cycle, delta time, rise time, fall time, Tmin, Tmax, channel-to-channel phase.
Frequency Domain	FFT frequency, FFT magnitude, FFT delta frequency, FFT delta magnitude, FFT phase.
Statistics	Displays the mean, standard deviation, minimum, maximum and number of measurements value for the displayed automatic measurements.
Histograms	Vertical (for timing and jitter measurements) or horizontal (noise and amplitude change) modes, regions are defined using waveform markers. Measurements included: mean, standard deviation, peak-to-peak value, median, min, max, total hits, peak (area of most hits), and mean \pm 1, 2, and 3 sigma.
Eye-diagram measurements	Eye-diagram measurements include eye height, eye width, eye jitter, crossing percentage, Q factor, and duty-cycle distortion.
Jitter measurements (E2681A EZJIT software package)	Cycle-cycle jitter, N-cycle jitter, cycle-cycle + width, cycle-cycle - width, cycle-cycle duty cycle, data rate, unit interval, time interval error data, time interval error clock, setup time, hold time, phase, period, frequency, + width, - width, duty cycle, rise time, fall time.
Mask testing	Allows pass/fail testing to user-defined or Agilent-supplied waveform templates. AutoMask lets you create a mask template from a captured waveform and define a tolerance range in time/voltage or percentage. Test modes include test forever, test to specified time or event limit, and stop on failure. Communications Mask Test Kit option provides a set of ITU-T G.703, ANSI T1.102, and IEEE 802.3 industry-standard masks for compliance testing.

Chapter 1: General Information

Specifications and Characteristics

Waveform math	Four functions, select from add, average, differentiate, divide, FFT magnitude, FFT phase, integrate, invert, magnify, min, max, multiply, subtract, versus, common mode, smoothing.
FFT	
Frequency range ⁴	4 DC to 10 GHz.
Frequency resolution	Sample rate/memory depth = Resolution.
Best resolution at maximum sample rate	20 GSa/1 Mpts = 20 kHz.
Frequency accuracy	$(1/2 \text{ frequency resolution}) + (1 \times 10^{-6})(\text{signal frequency})$.
Signal-to-noise ratio ⁵	60 dB at 32k memory depth.
Window modes	Hanning, flattop, rectangular.
Measurement modes	
Automatic measurements	Measure menu access to all measurements, five measurements can be displayed simultaneously.
QuickMeas	Front-panel button activates five pre-selected or five user-defined automatic measurements.
Drag-and-drop measurement toolbar	Measurement toolbar with common measurement icons that can be dragged and dropped onto the displayed waveforms.
Marker modes	Manual markers, track waveform data, track measurements.
Display	
Display	
Display	8.4 inch diagonal color TFT-LCD.
Resolution	640 pixels horizontally x 480 pixels vertically.
Annotation	Up to 12 labels, with up to 100 characters each, can be inserted into the waveform area.
Grids	Can display 1, 2 or 4 waveform grids.
Waveform style	Connected dots, dots, persistence (minimum, variable, infinite), color-graded infinite persistence.
Computer system and peripherals, I/O ports	
Computer system and peripherals	
Operating system	Windows® XP Pro.
CPU	Intel® Pentium® III 1 GHz microprocessor.
PC system memory	512 MB.
Drives	≥10 GB internal hard drive, CD-RW drive on rear panel, standard 3.5 inch 1.44 MB floppy drive.
Peripherals	Logitech optical USB mouse and compact keyboard supplied. All Infiniium models support any Windows-compatible input device with a serial, PS/2 or USB interface.
File types	
Waveforms	Compressed internal format, comma and tab separated X and Y pairs or voltage values.
Images	BMP, PCX, TIFF, GIF or JPEG.

I/O ports	
LAN	RJ-45 connector, supports 10Base-T and 100Base-T. Enables Web-enabled remote control, e-mail on trigger or demand, data/file transfers and network printing.
GPIB	IEEE 488.2, fully programmable.
RS-232 (serial)	COM1, printer and pointing device support.
Parallel	Centronics printer port.
PS/2	2 ports. Supports PS/2 pointing and input devices.
USB	2 ports. Allows connection of USB peripherals and pointing devices while the oscilloscope is on.
Video output	15 pin VGA, full color output of scope waveform display.
Dual-monitor video output	15 pin XGA, full color output for using third-party applications.
Auxiliary output	DC (± 2.4 V); square wave (~ 15 Hz and 456 MHz); trigger output (255 mV p-p into 50Ω).
Trigger output	5 V 50Ω back-terminated.
Time base reference output	10 MHz, 5 V 50Ω back-terminated.

General characteristics

Temperature	Operating: 5° C to +40° C. Non-operating: -40° C to +70° C.
Humidity	Operating: Up to 95% relative humidity (non-condensing) at +40°C. Non-operating: Up to 90% relative humidity at +65°C.
Altitude	Operating: Up to 4,600 meters (15,000 feet). Non-operating: Up to 15,300 meters (50,000 feet).
Vibration	Operating: Random vibration 5-500 Hz, 10 minutes per axis, 0.3 g(rms). Non-operating: Random vibration 5-500 Hz, 10 minutes per axis, 2.41 g(rms); resonant search 5-500 Hz, swept sine, 1 octave/minute sweep rate, (0.75g), 5 minute resonant dwell at 4 resonances per axis.
Power	100-240 VAC, \pm 10%, Cat II, 47 to 440 Hz; max power dissipated: 475 W.
Weight	Net: 13 kg (28.5 lbs.). Shipping: 16 kg (35.2 lbs.).
Dimensions (excluding handle)	Height: 216 mm (8.5 in). Width: 437 mm (17.19 in). Depth: 440 mm (17.34 in).
Safety	Meets IEC 61010-1 +A2, CSA certified to C22.2 No.1010.1, self-certified to UL 3111.

* Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period, and $\pm 5^{\circ}\text{C}$ from annual calibration temperature.

1. Full scale is defined as 8 vertical divisions. Vertical divisions are defined by the major scale settings above non-major scale settings. The major scale settings are 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V.
2. Vertical resolution for 8 bits = 0.4% of full scale, for 12 bits = 0.024% of full scale.
3. Within one year of previous calibration.
4. FFT amplitude readings are affected by input amplifier roll-off.
 - 54855: (-3 dB at 6 GHz, with amplitude decreasing as frequency increases above 6 GHz).
 - 54854: (-3 dB at 4 GHz, with amplitude decreasing as frequency increases above 4 GHz).
 - 54853: (-3 dB at 2.5 GHz, with amplitude decreasing as frequency increases above 2.5 GHz).
 - 54852: (-3 dB at 2 GHz, with amplitude decreasing as frequency increases above 2 GHz).
5. The noise floor varies with memory depth and averaging.
6. Signal peak-to-peak amplitude ≥ 5 divisions, vertical scale ≥ 10 mV/div, signal rise time 155 ps (54853), ≤ 225 ps (54854), 150 ps (54855), sample rate = 20 Gsa/s (10 GSa/s for 54852, sin(x)/x interpolation enabled, measurement threshold = fixed voltage at 50% level.
7. Between two edges on a single channel. Rms value refers to the standard deviation of 256 consecutive measurements performed using an individual oscilloscope.
8. Internal trigger. Trigger level contained within full scale display range of trigger channel.

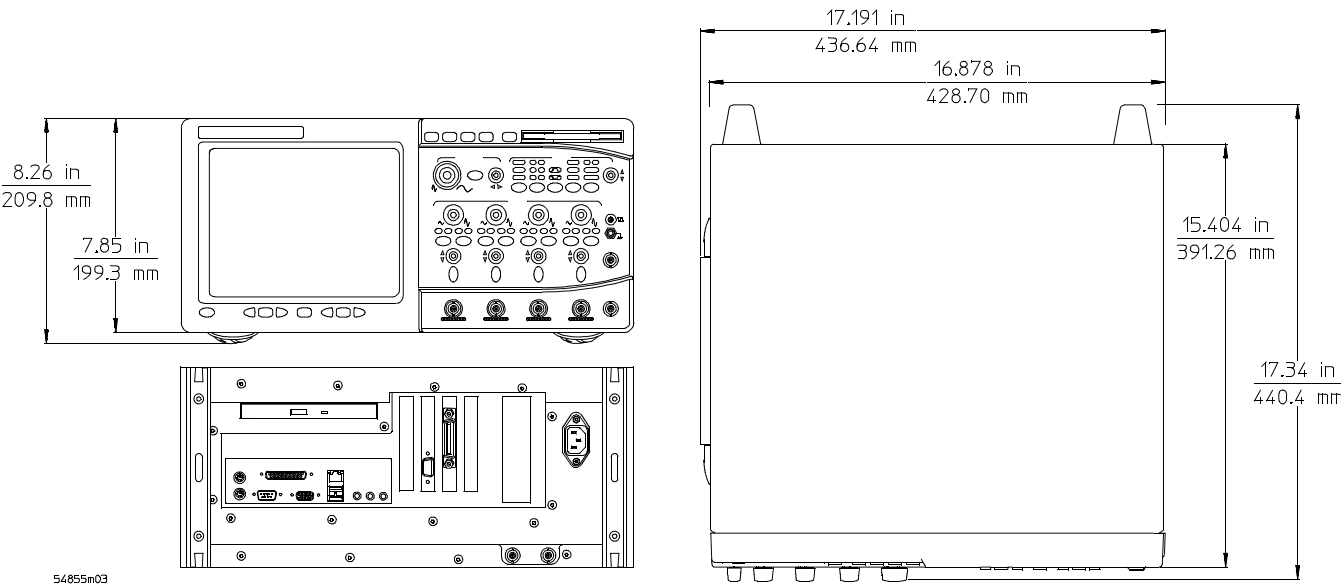
CAT I and CAT II Definitions

Installation category (overvoltage category) I: Signal level, special equipment or parts of equipment, telecommunication, electronic, etc., with smaller transient overvoltages than installation category (overvoltage category) II.

Installation category (overvoltage category) II: Local level, appliances, portable equipment etc., with smaller transient overvoltages than installation category (overvoltage category) III.

Dimensions

The following pictures shows the dimensions of the frame.



Recommended test equipment

The following table is a list of the test equipment required to test performance, calibrate and adjust, and troubleshoot this oscilloscope. The table indicates the critical specification of the test equipment and for which procedure the equipment is necessary. Equipment other than the recommended model may be used if it satisfies the critical specification listed in the table.

Recommended Test Equipment

Equipment Required	Critical Specifications	Recommended Model	Use
Digital Multimeter	DC voltage measurement accuracy better than $\pm 0.1\%$ of reading	Agilent 34401A or Agilent 3458A	P
Microwave CW Generator	Maximum Frequency ≥ 6 GHz Power range: -20 dBm to +16 dBm into 50 Ω Output resistance = 50 Ω 10 MHz Reference Signal Output	Agilent E8247C with Opt 520 or Agilent 82712B with Opt 1E5 or Agilent 8665B with Opt 004	P
Power Splitter	2 Resistor Power Splitter Max Frequency ≥ 18 GHz	Agilent 11667B	P
Power Meter	Agilent E-series power sensor compatibility	Agilent E4418B or E4419B	P
Power Sensor	Maximum Frequency ≥ 6 GHz Power range: -24 dBm to +16 dBm	Agilent E4413A	P
Microwave Cable Assembly	50 Ω characteristic impedance 3.5 mm (m) or SMA (m) connectors Max Frequency ≥ 18 GHz	Agilent 8120-4948 or Agilent 11500E or Gore EKD01D010480	P
Cable Assembly (2 required)	50 Ω characteristic impedance BNC (m) connectors	Agilent 8120-1840	P
Adapter	BNC Tee (m)(f)(f)	Agilent 1250-0781	P
Adapter	BNC (f) to dual banana	Agilent 1251-2277	P
Adapter	3.5 mm (f) to Precision BNC	Agilent 54855-67604	P
Shorting Cap	BNC (m)	Agilent 1250-0929	A
Cable Assembly (Cal Cable for 54853, 54853, and 54854)	50 Ω characteristic impedance BNC (m) connectors ≤ 12 Inch Length	Agilent 8120-1838 or Agilent 10502A	A
Cable Assembly (Cal Cable for 54855)	NO Substitute	Agilent 54855-61620	A
10 MHz Signal Source	Frequency accuracy better than 0.4 ppm	Agilent 53131A with Opt. 010 * or Agilent 5071A or Symmetricom 58503B **	A

* Requires time base calibration once every 6 months

** Requires link to GPS

Alternate Power Splitter/Power Sensor Equipment - List 1

Equipment Required	Critical Specifications	Recommended Model	Use
Power Splitter	2 Resistor Power Splitter Max Frequency ≥ 18 GHz	Agilent 11667A	P
Power Sensor	Maximum Frequency ≥ 6 GHz Power range: -24 dBm to +16 dBm	Agilent E4412A	P
Adapters	3.5 mm (f) to Precision BNC Type N (m) to 3.5 mm (f) Type N (m) to 3.5 mm (m)	Agilent 54855-67604 Agilent 1250-1744 Agilent 1250-1743	P

Alternate Power Splitter/Power Sensor Equipment - List 2

Equipment Required	Critical Specifications	Recommended Model	Use
Power Splitter	2 Resistor Power Splitter Max Frequency \geq 18 GHz	Agilent 11667A	P
Power Sensor	Maximum Frequency \geq 6 GHz Power range: -24 dBm to +16 dBm	Agilent E4412A	P
Adapters	3.5 mm (f) to Precision BNC 3.5 mm (f) to 3.5 mm (m) Type N (m) to 3.5 mm (m)	Agilent 54855-67604 Agilent 1250-1748 Agilent 1250-1750	P

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To inspect options and accessories 2-5
To connect power 2-7
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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.

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.

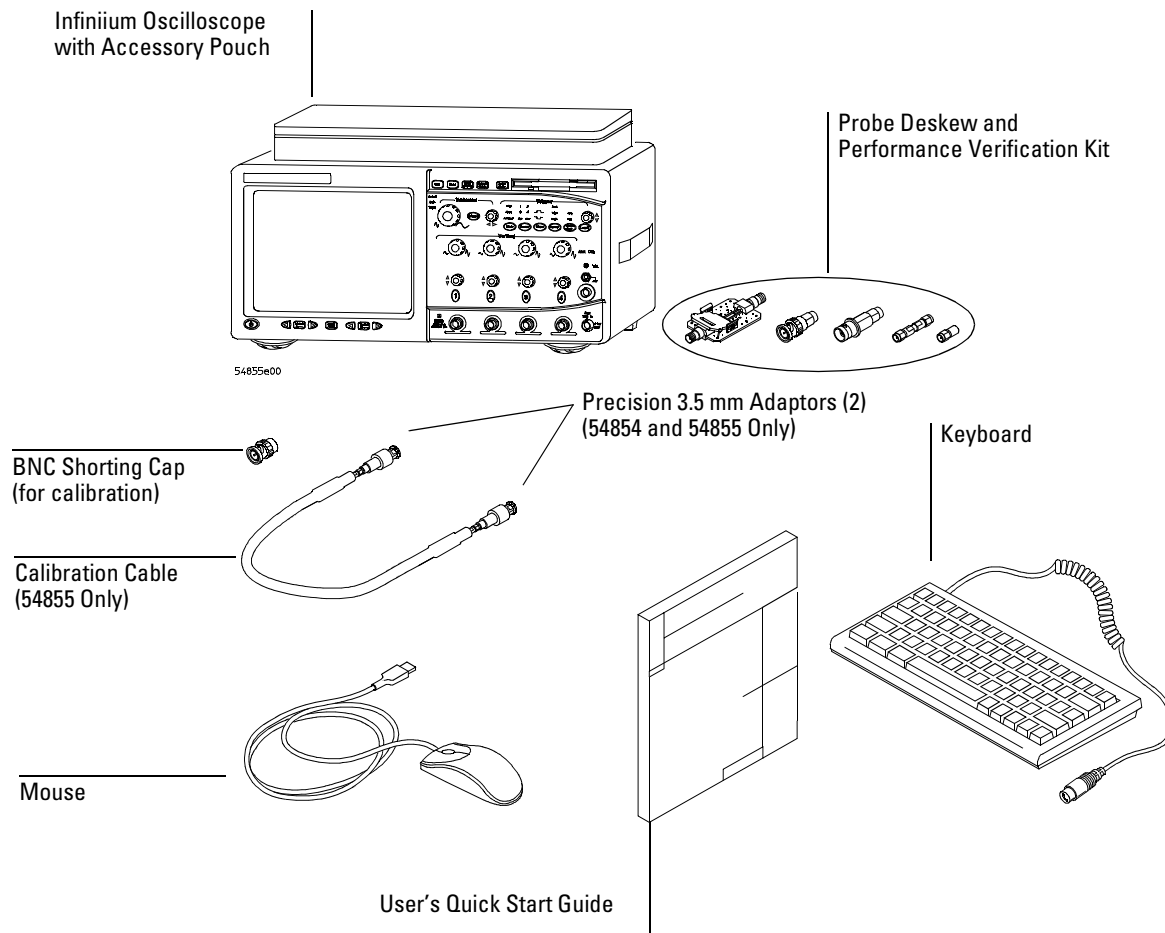
- ❑ Verify that you received the following items in the Infiniium Oscilloscope packaging.

- Infiniium Oscilloscope
- Mouse
- Calibration Cable (54855 model only)
- BNC Shorting Cap for calibrating oscilloscope
- Precision 3.5 mm Adaptors (54854 and 54855 models only)
- Accessory Pouch
- Front Panel Cover
- Keyboard
- Power cord
- Probe De-skew and Performance Verification Kit
- *User's Quick Start Guide*

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.

Figure 2-1



Package Contents for the Infiniium Oscilloscopes

To inspect options and accessories

- ❑ Verify that you received the options and accessories you ordered and that none were damaged.

If anything is missing, contact your nearest Agilent Technologies Sales Office. If the shipment was damaged, or the cushioning materials show signs of stress, contact the carrier and your Agilent Technologies Sales Office.

Some accessories that will enhance your work with the oscilloscopes are listed in table 2 -1.

Table 2 -1

Accessories for the Infiniium Oscilloscopes

Agilent Model Number	Description
54855-67602	18 GHz BNC-compatible to APC 3.5 mm adaptor
1250-2427	PC Board Mini-Probe Socket (horizontal mount)
1250-2428	PC Board Mini-Probe Socket (vertical mount)
1250-1454	BNC to Miniature Probe Adapter
10240B	BNC Blocking Capacitor
11094B	75 Ω Feedthrough Termination
10024A	16-pin IC clip
10211A	24-pin IC clip
10833A	GPIB cable, 1 m
10833B	GPIB cable, 2 m
10833C	GPIB cable, 4 m
10833D	GPIB cable, 0.5 m
1131A	3.5 GHz InfiniMax Active Probe
1132A	5 GHz InfiniMax Active Probe
1134A	7 GHz InfiniMax Active Probe
1156A	1.5 GHz Active Probe
1157A	2.5 GHz Active Probe
1158A	4 GHz Active Probe
1184A	Testmobile with keyboard and mouse tray and drawer for accessories
34398A	RS-232-C printer cable
34399A	RS-232-C Adapter kit
54006A	6 GHz probe, 10:1 (500 Ω) or 20:1 (1 k Ω), .25 pf
C2950A	Parallel printer cable, 2 m
C2951A	Parallel printer cable, 3 m
E2609B	Rackmount Kit
E2621A	75 Ω terminator
E2622A	100/110/120 Ω differential terminator
E2646A	SQiDD Fixture for USB option
E2654A	EZ-Probe [®] Positioner
E2655A	Additional probe deskew and performance verification kit
E2680A	1 MB Memory upgrade
E2681A	EZJIT Jitter Analysis Software
E2682A	VoiceControl Retrofit Kit

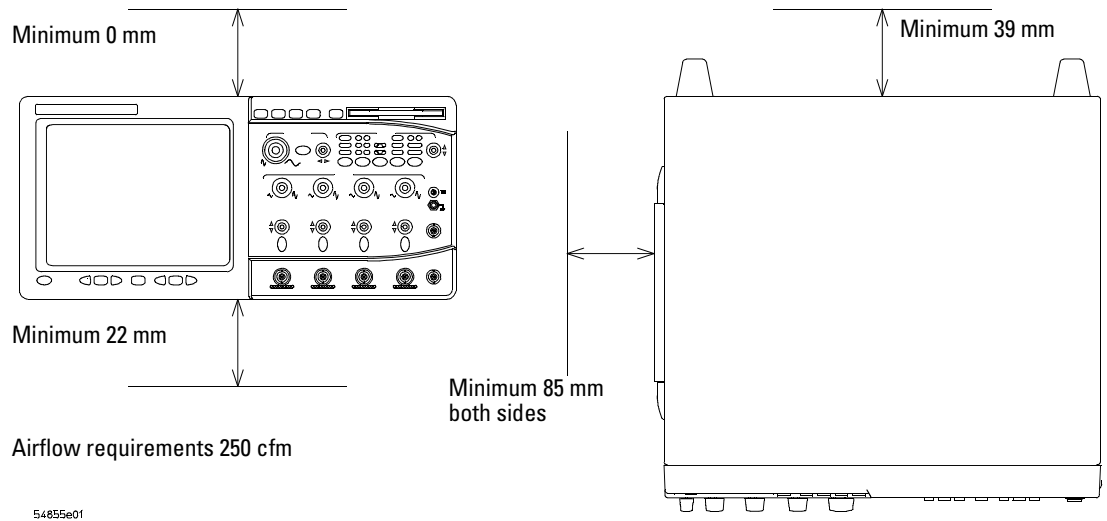
Chapter 2: Setting Up the Oscilloscope
To inspect options and accessories

Agilent Model Number	Description
E2683A	USB Test Option
E2685A	Telecommunications Mask Test Template Kit
E2688A	Serial Data Analysis Software Option
E5850A	Time-correlation fixture, integrates Infiniium oscilloscope and 16700 logic analyzer

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.

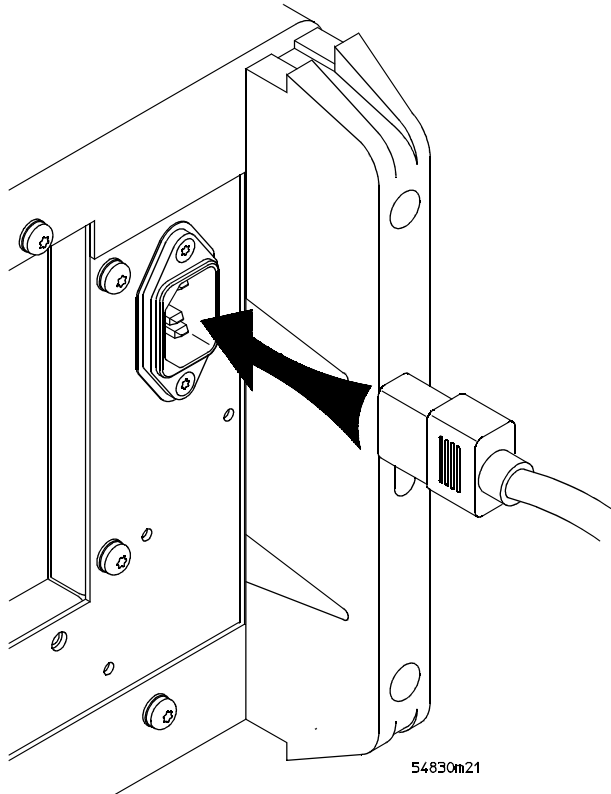
Figure 2-2



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 440 Hz all models)
Maximum power dissipation: 475 W.

Figure 2-3





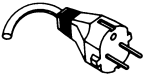

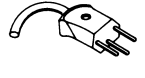
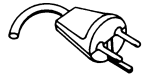


Infiniium Oscilloscope Power Cord Connection

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.

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 Type 12 90°	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
		8120-4600	90°	79/200	Jade Gray	
100V		8120-4753	Straight MITI	90/230	Dark Gray	Japan
		8120-4754	90°	90/230	Dark Gray	

* 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, the keyboard, a LAN cable, a printer, and a GPIB cable

See Figure 2-5 for the location of the connectors.

Mouse. Plug the mouse into the matching connector on the back panel of the oscilloscope. The

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.

connectors are labeled 1 and 5.

Keyboard. Plug the keyboard cable into the connector labeled 2 on the back panel of the oscilloscope.

A keyboard cannot be plugged into the oscilloscope after the Windows operating system has started booting.

LAN Cable. Connect your LAN cable to the RJ-45 connector labeled 3 on the back panel of the oscilloscope.

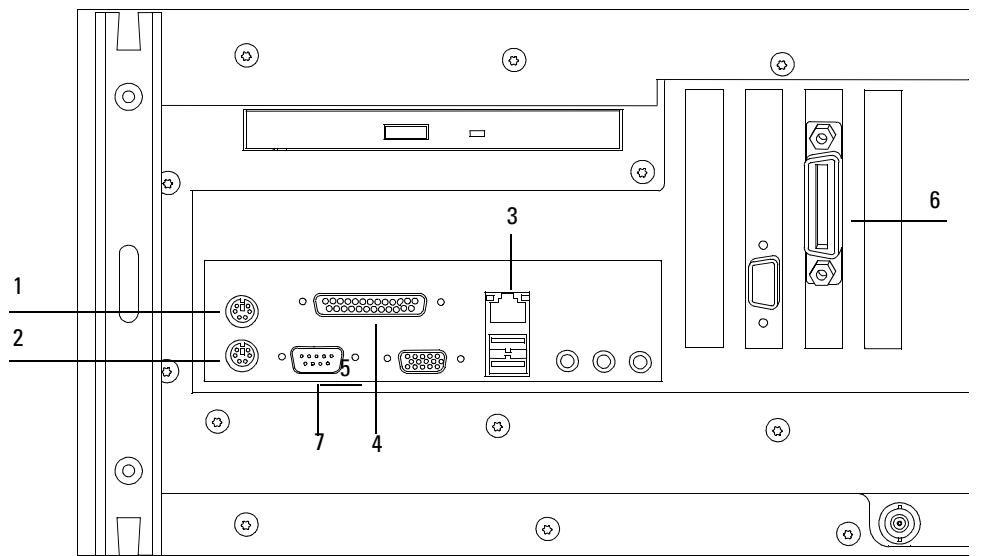
After you have connected to the LAN card, you must set up the network. Before you try to setup your network, you should exit the oscilloscope application. If you do not know how to setup a network in Windows XP, see your network administrator or use the Windows XP on-line help.

Printer Cable. If you have a parallel (Centronics) printer, you will need a parallel printer cable, such as an C2950A (2 m) or C2951A (3 m) cable. Connect cable into the connector labeled 4.

If you have a serial printer, you will need a 9-pin to 25-pin serial printer cable, such as an 34398A cable, plus the 34399A adapter kit. Some printers may require other cable configurations, but the oscilloscope has a 9-pin serial connector. Connect cable into the connector labeled 7.

GPIB Cable. Attach the GPIB connector to the GPIB interface card connector labeled 6 on the rear of the oscilloscope.

Figure 2-5



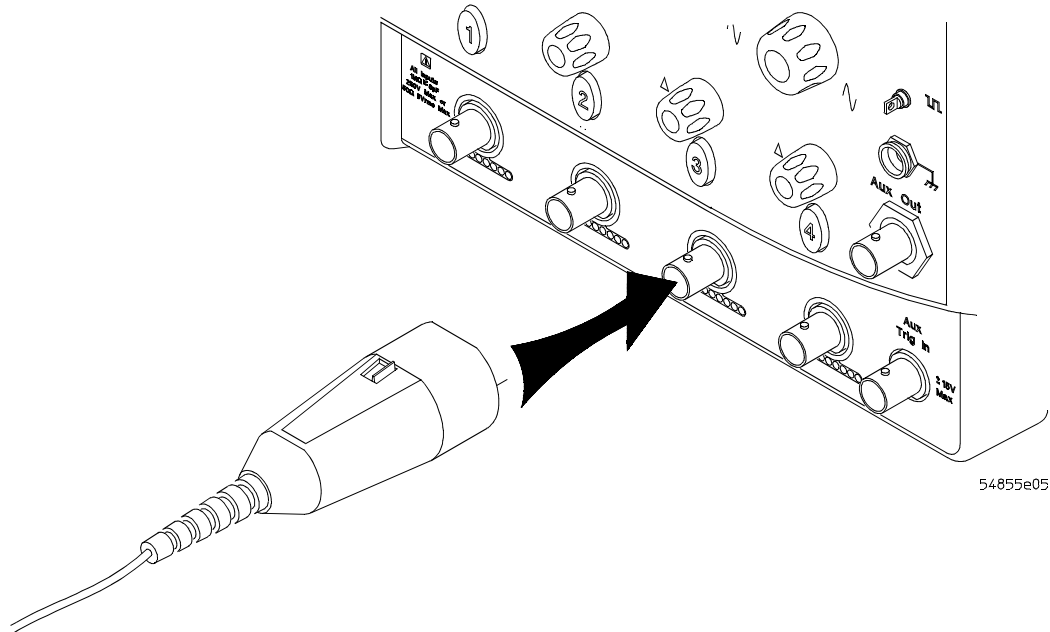
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Back Panel

To connect oscilloscope probes

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

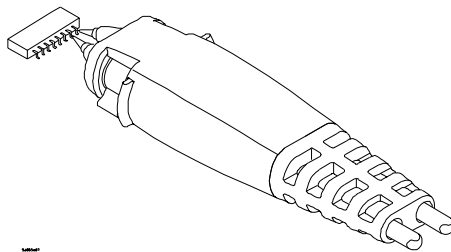
Figure 2-6



Attaching the Probe Connector

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

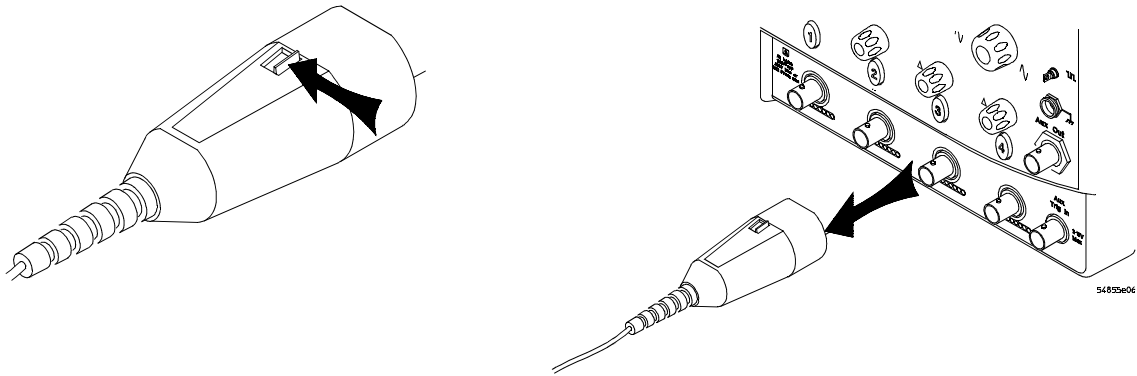
Figure 2-7



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 2-8



Disconnecting the Oscilloscope Probe

CAUTION

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



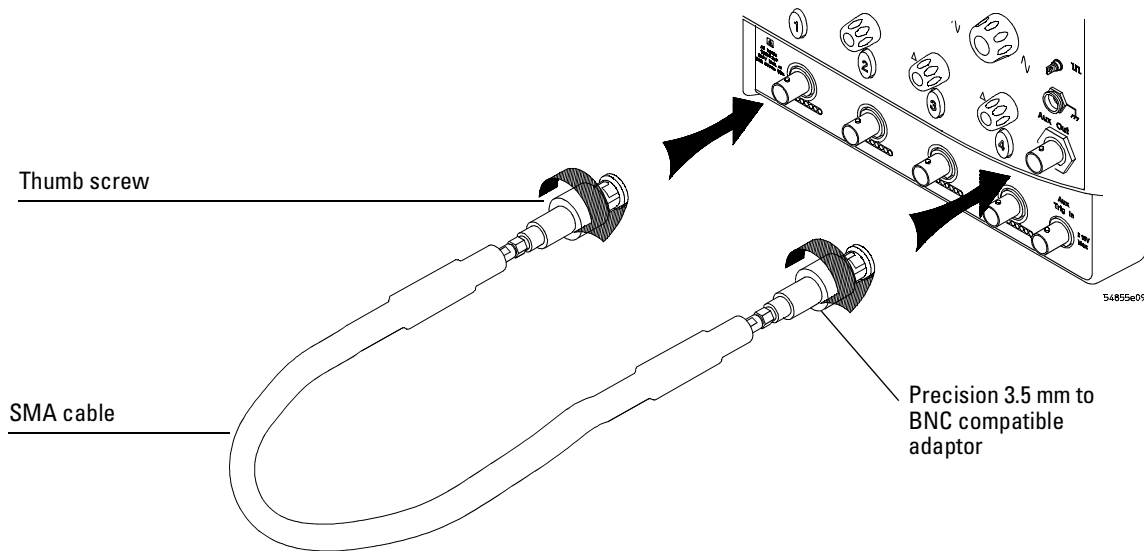
Do not exceed the maximum input voltage rating. The maximum input voltage for the 50 Ω inputs is 5 Vrms, CAT I.

To connect SMA Cables

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

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

Figure 2-9

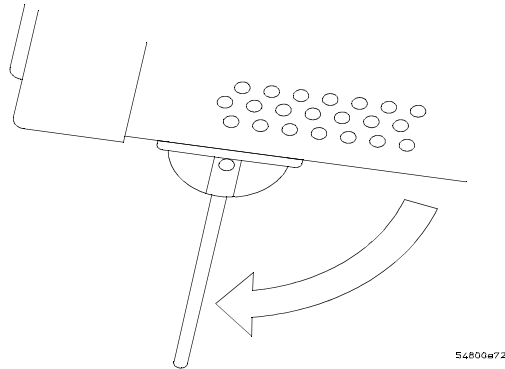


Connecting SMA to BNC Adaptors

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



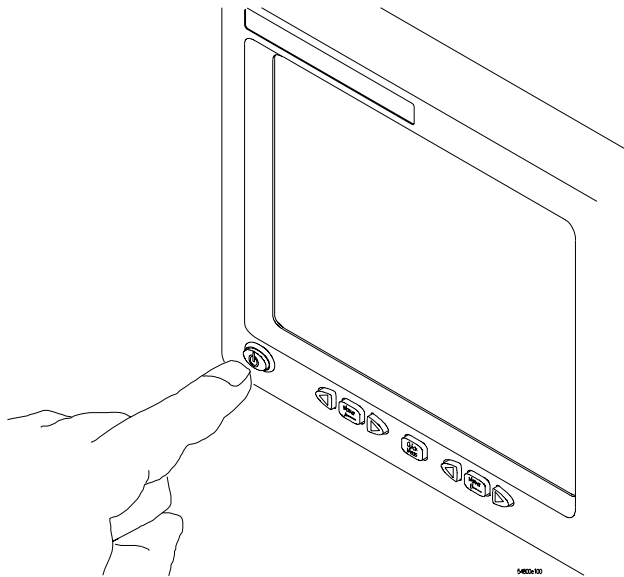
Latching the Oscilloscope Front Feet

To turn on the oscilloscope

The first time that you turn on the oscilloscope, you may need to have a keyboard and mouse connected. The keyboard and mouse are needed to enter the Product Key from the Microsoft Certificate of Authenticity for Windows XP if prompted to do so. This label is located on the rear panel of the Infiniium.

- 1 Depress the power switch in the lower left-hand 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.

- 2 Hook up all cables and accessories before applying power. You can connect and disconnect probes while the oscilloscope is turned on.

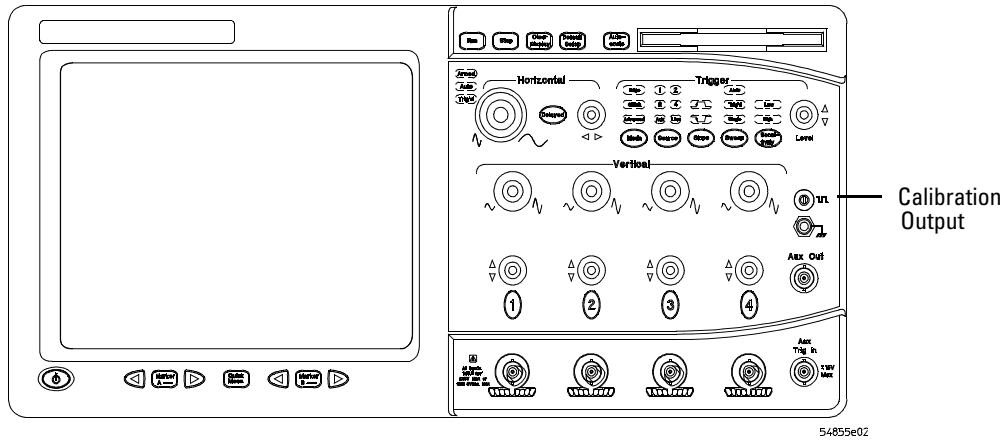
To turn off the oscilloscope

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

To verify basic oscilloscope operation

- 1 Connect an oscilloscope probe to channel 1.
- 2 Attach the probe to the calibration output on the front panel of the oscilloscope.
Use a probe grabber tip so you do not need to hold the probe. The calibration 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 peak-to-peak amplitude of approximately 5 divisions and a period of almost 7 divisions. If you do not see the waveform, ensure your power source is adequate, the oscilloscope is properly 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 follows the mouse movement.

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.

- 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 using the recovery disks.

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 from 640 by 480 pixels or the color quality from High (24 bit).
 - Do not use the Windows XP Theme.
 - Do not change "Windows and buttons" from the "Windows Classic Style".
 - Do not change the Font size to Extra Large.
 - Do not use a Menu font size greater than 12 points.
 - Do not modify "1. Digital Flat Panel (640x480) on Chips and Technologies (Asilant) 65550".
 - Do not set "Intel (r) 82815 Graphics Controller" to "Use this device as the primary monitor".
- 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.
- Do not delete or modify the InfiniiumAdmin user account.

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.

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Testing Performance

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.

Before Performing Performance Verification Testing

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.

1 Perform self tests

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

- 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 Performance calibration.

After the warm up period, calibrate the oscilloscope.

- a** Pull down the Utilities menu and select Calibration.
- b** Uncheck to Cal Memory Protect box to allow calibration.
- c** Click on Start to start the calibration procedure.

Follow the on-screen instructions as calibration proceeds.

Vertical Performance Verification

This section contains the following vertical performance verification:

- Offset Performance Test
 - Zero Error Test
 - Offset Gain Test
- DC Measurement Accuracy (Single Cursor) Test
- Analog Bandwidth (Maximum Frequency Check)

Offset Performance Test

Specifications

Offset Accuracy	= $\pm(2\%$ of channel offset + 1% of full scale) = $\pm(\text{Offset Gain} + \text{Zero Error})$
Offset Range	> ± 12 div, or ± 4 V, whichever is smallest
Full scale is defined as 8 vertical divisions. Vertical divisions are defined by the major scale settings above non-major scale settings. The major scale settings are 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV and 1 V.	

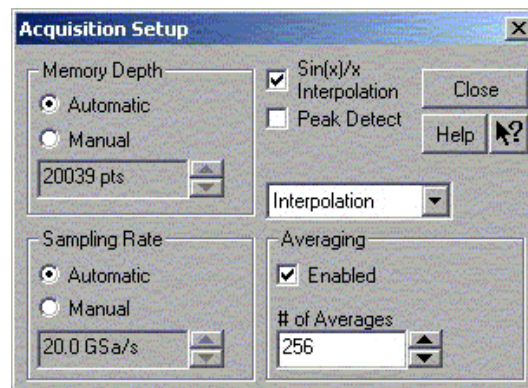
Equipment Required

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 Ω 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

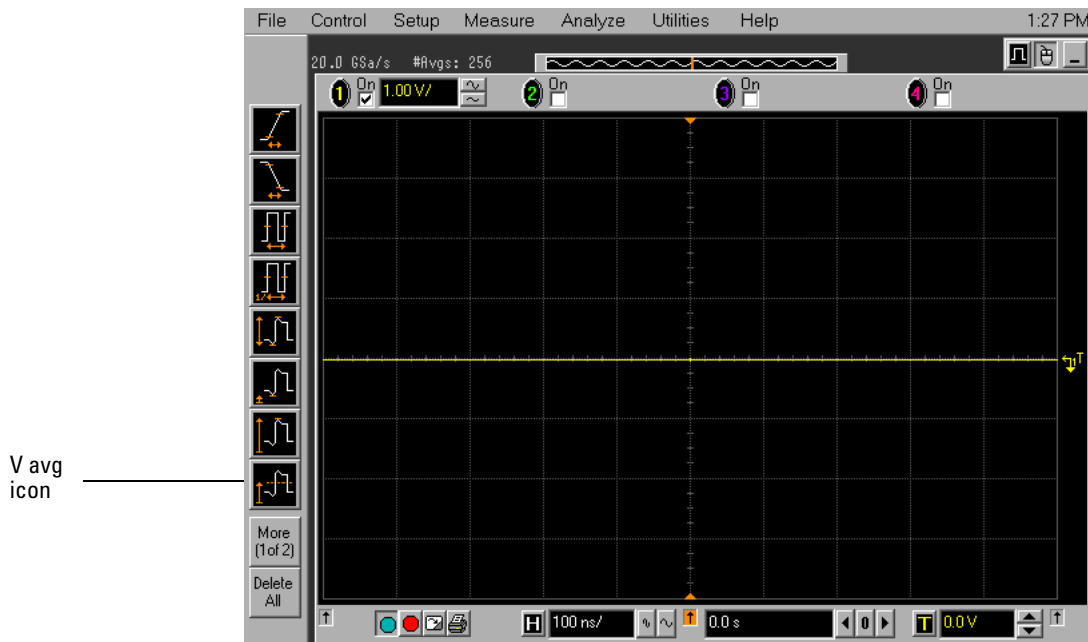
Procedure

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



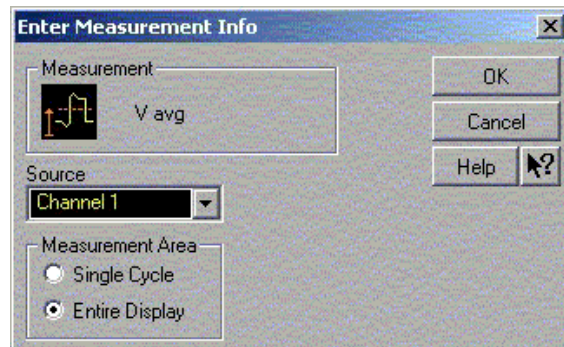
- 3 Configure the scope to measure Average voltage on channel 1 as follows:
- a Change the vertical sensitivity of channel 1 to 10mV/div.
 - b Click the V avg measurement icon on the left side of the screen.



- 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

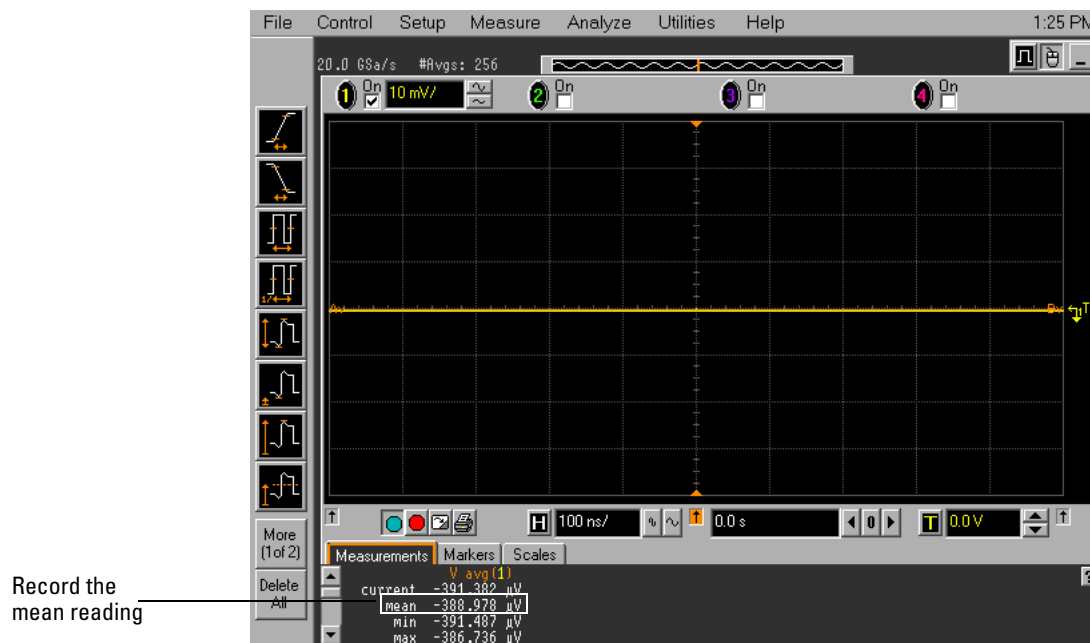
Measurement Area = Entire Display



- 4 Press the Clear Display key on the scope, wait for the #Avgs value (top left corner of screen) 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.

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 256 and then record the scope reading.

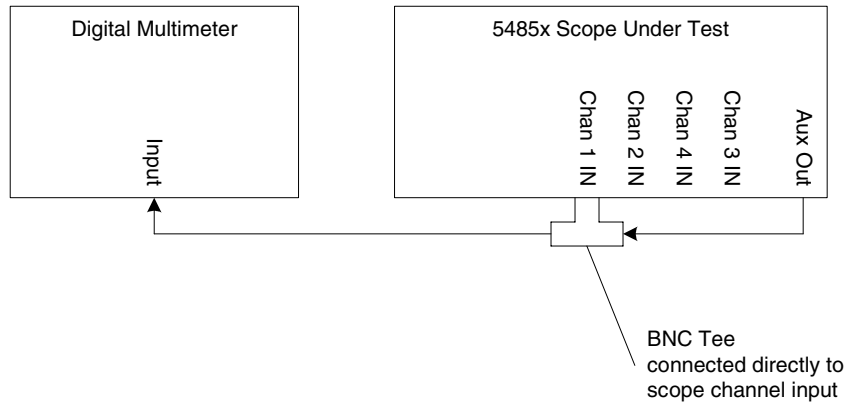


- 5 Change the vertical sensitivity of channel 1 to 20 mV/div, press the Clear Display key, wait for the #Avgs value (top left corner of screen) to return to 256 and then record the scope V avg reading in the Zero Error Test section of the Performance Test Record.
- 6 Repeat step 5 for the remaining 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 10 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 #Avgs value to return to 256 and then record the DMM voltage reading and the scope 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 between the scope and the test oscilloscopes 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 the external test oscilloscopes 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.

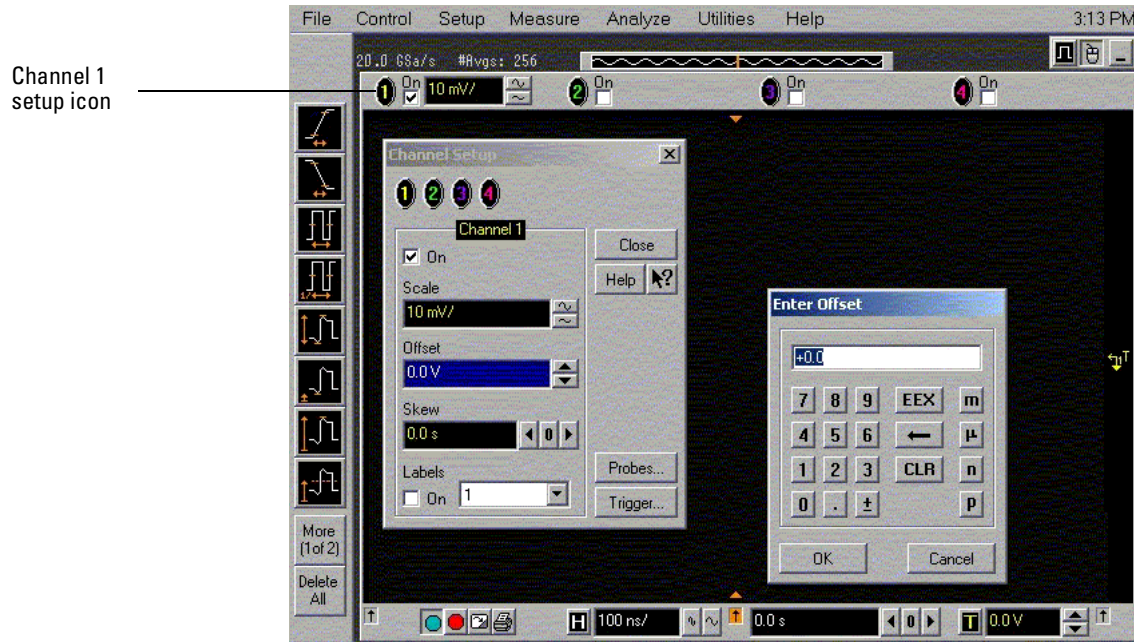
14 Configure the scope to measure V avg on Channel 1 as follows:

- 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 10 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:

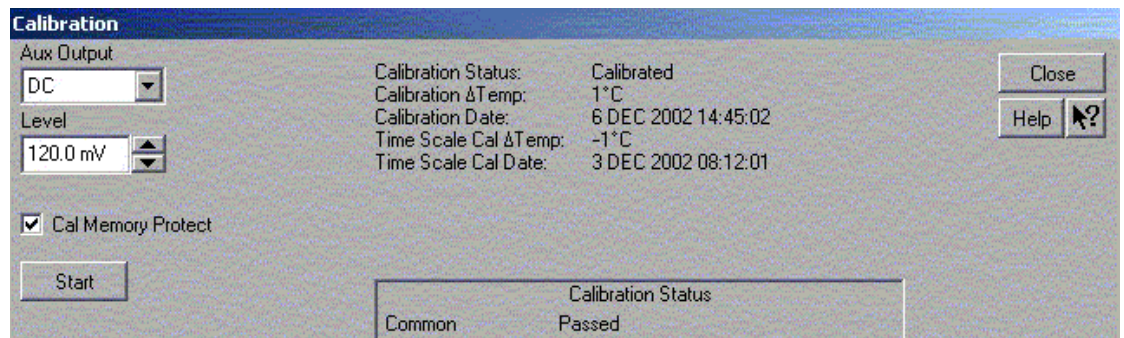
Source = Channel 1

Measurement area = Entire Display

- 15 Set the channel 1 offset value to 120 mV. 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 Click the Offset control arrows to change the offset value or click on the offset value and enter 120 mV in the dialog box.
 - c Enter 120 mV in the Enter Offset dialog box.



- 16 Set the Aux Out voltage ($V_{\text{Aux Out}}$) to +120 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 120 mV.
 - d 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.

Offset Performance Test

- 18** Change the channel 1 offset value to -120 mV.
- 19** Set the Aux Out voltage to -120 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** Calculate the offset gain using the following expression and record this value in the Offset Gain Test section of the Performance Test Record:

$$Offset\ Gain = \frac{\Delta V_{out}}{\Delta V_{in}} = \frac{V_{scope+} - V_{scope-}}{V_{DMM+} - V_{DMM-}}$$

- 22** 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.
- 23** Move the Tee connector to the next channel input and repeat steps 14 to 22 for the channels 2 to 4.

DC Measurement Accuracy (Single Cursor) Test

Specifications

DC Gain Accuracy	±1% of full scale at full resolution channel scale
Offset Accuracy	±(2% of channel offset + 1% of full scale)
Vertical Resolution	8 bits, ≥12 bits with averaging
DC Voltage Measurement Accuracy	
Single Cursor	±[(DC gain accuracy) + (offset accuracy) + (resolution/2)]
Dual Cursor	±[(DC gain accuracy) + (resolution)]
Full scale is defined as 8 vertical divisions. Vertical divisions are defined by the major scale settings above non-major scale settings. The major scale settings are 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV and 1 V.	
Vertical resolution for 8 bits = 0.4% of full scale, for 12 bits = 0.024% of full scale	

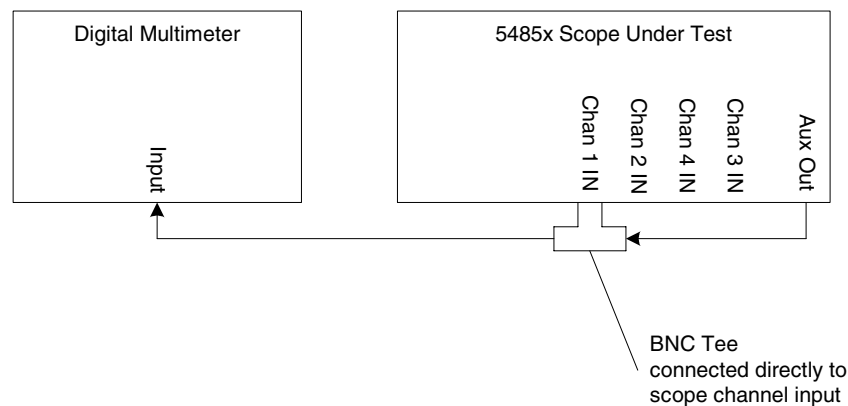
Example: Single cursor measurement 70 mV input @ 20 mV/div, 0 V channel offset with no averaging:

expected measurement error < ±[(1%(160 mV)) + (1%(160 mV) + (0.4%(160 mV)/2)] = ±3.52 mV.

Equipment Required

Description	Critical Specifications	Recommended Model/Part Numbers
Digital Multimeter	DC voltage measurement accuracy better than ±0.1% of reading	Agilent 34401A or Agilent 3458A
Cable Assembly (2 required)	50Ω 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

Connections

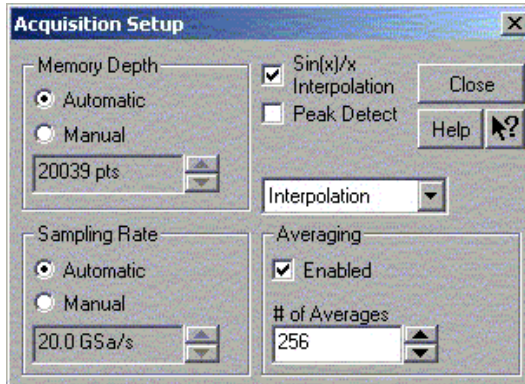


Notes

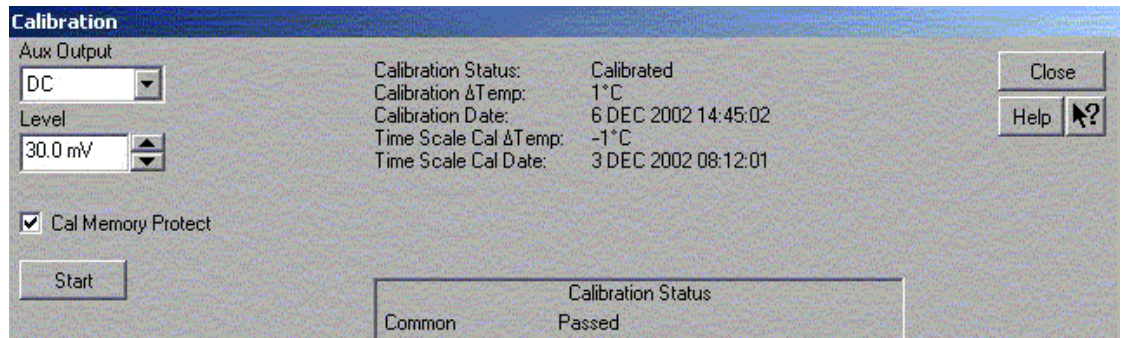
- It is important to connect the BNC Tee adapter directly to the scope channel input to minimize ground potential differences between the scope and the test oscilloscopes and to ensure that the DMM measures the input voltage to the scope channel as accurately as possible. Differences in ground potential 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 the external test oscilloscopes 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 to a negligible value.
- Only single cursor measurements are made in this procedure since this measurement covers all of the accuracy terms in this product's dc vertical accuracy specification and makes the procedure more efficient.

Procedure

- 1 Make the connections to scope channel 1 as shown in the connection diagram on the previous page.
- 2 Set up the DMM to perform DC voltage measurements.
- 3 Press Default Setup, then configure the scope as follows:
 - a Pull down the Utilities Menu and select Acquisition.
 - b When the Acquisition Setup window is displayed, enable averaging and set the # of averages to 256 as shown below.



- 4 Set the Aux output voltage to +30 mV DC 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 30 mV.
 - d Click on Close.



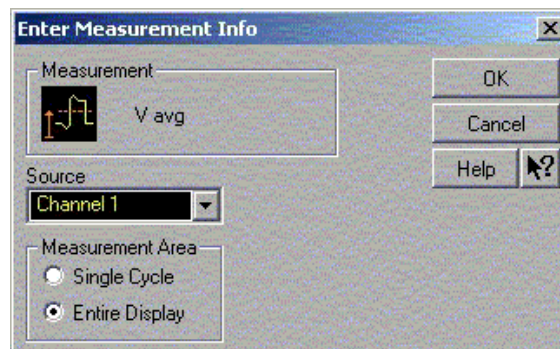
- 5 Configure the scope to measure Average voltage as follows:
 - a Change the vertical sensitivity of channel 1 to 10 mV/div.
 - b Click the V avg measurement icon on the left side of the screen.



- cWhen 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



- 6 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 (V_{DMM}) and the scope Vavg reading (V_{Scope}) in the DC Measurement Accuracy (Single Cursor) Test section of the Performance Test Record. For all scope readings in this procedure, use the mean value in the Measurements display area at the bottom of the screen. Calculate the upper and lower limits for this test using the V_{DMM} reading and the Max Scope Error (V_{ERR}) value in the results table. V_{Scope} must be between these two limits to pass this test.

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 256 and then record the scope reading.



- 7 Change the vertical sensitivity of channel 1 to 20 mV/div.
- 8 Change the Aux output voltage to +60 mV DC as in step 4 above.
- 9 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 and the scope V avg reading in the DC Measurement Accuracy (Single Cursor) Test section of the Performance Test Record.
- 10 Repeat steps 7, 8 and 9 for the remaining channel 1 vertical sensitivities in the table. For each measurement, set the Aux Out voltage to the " $V_{Aux Out}$ Setting" column in the DC Measurement Accuracy (Single Cursor) Test section of the Performance Test Record for each of the vertical sensitivities.
- 11 Move the BNC Tee adapter to scope channel 2. Press Default Setup, then turn off channel 1 and turn channel 2 display on.

- 12** Configure the scope to measure V avg on Channel 2 as follows:
 - a** Change the vertical sensitivity of channel 2 to 10 mV/div.
 - b** Click the V avg measurement icon 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 2
Measurement area = Entire Display
- 13** Press the Clear Display key on the scope, wait for the #Aves value to return to 256 and then record the DMM voltage reading and the scope V avg reading in the DC Measurement Accuracy (Single Cursor) Test section of the Performance Test Record.
- 14** Repeat steps 12 and 13 for the remaining channel 2 vertical sensitivities in the table. For each measurement, set the Aux Out voltage to the "V_{Aux Out} Setting" column in the DC Measurement Accuracy (Single Cursor) Test section of the Performance Test Record for each of the vertical sensitivities.
- 15** Repeat steps 11 to 14 for the remaining channels and sensitivities of the table in the DC Measurement Accuracy (Single Cursor) Test section of the Performance Test Record.

Analog Bandwidth - Maximum Frequency Check

Specification

Analog Bandwidth (-3 dB)	
54855	6.0 GHz
54854	4.0 GHz
54853	2.5 GHz
54852	2.0 GHz

Equipment Required

Description	Critical Specifications	Recommended Model/ Part Numbers
Microwave CW Generator	Maximum Frequency ≥ 6 GHz Power range: -20 dBm to +16 dBm into 50 Ω Output resistance = 50 Ω	Agilent E8247C with Opt 520 or Agilent 82712B with Opt 1E5 or Agilent 8665B with Opt 004
Power Splitter	2 Resistor Power Splitter Max Frequency ≥ 18 GHz	Agilent 11667B
Power Meter	Agilent E-series power sensor compatibility	Agilent E4418B or E4419B
Power Sensor	Maximum Frequency ≥ 6 GHz Power range: -24 dBm to +16 dBm	Agilent E4413A
Microwave Cable Assembly	50 Ω Characteristic Impedance (No Substitute) 3.5 mm (m) or SMA (m) connectors Max Frequency ≥ 18 GHz	Gore EKD01D010480
Adapters	3.5 mm (f) to Precision BNC (No Substitute)	Agilent 54855-67604

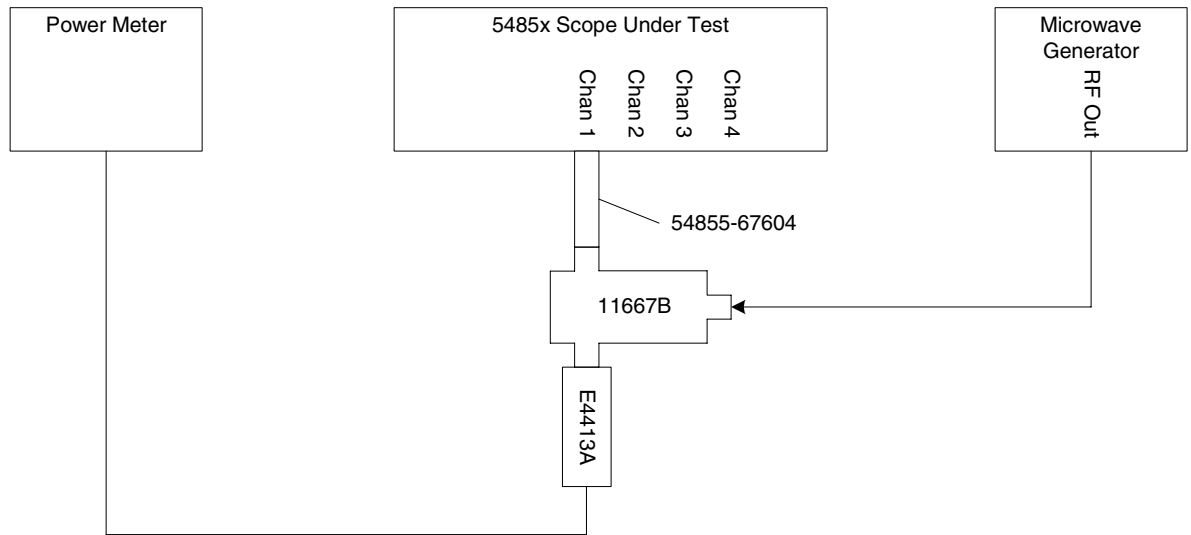
Alternate Power Splitter/Power Sensor Equipment List 1

Description	Critical Specifications	Recommended Model/ Part Numbers
Power Splitter	2 Resistor Power Splitter Max Frequency ≥ 18 GHz	Agilent 11667A
Power Sensor	Maximum Frequency ≥ 6 GHz Power range: -24 dBm to +16 dBm	Agilent E4412A
Adapters	3.5 mm (f) to Precision BNC (No Substitute) Type N (m) to 3.5 mm (f) Type N (m) to 3.5 mm (m)	Agilent 54855-67604 Agilent 1250-1744 Agilent 1250-1743

Alternate Power Splitter/Power Sensor Equipment List 2

Description	Critical Specifications	Recommended Model/ Part Numbers
Power Splitter	2 Resistor Power Splitter Max Frequency ≥ 18 GHz	Agilent 11667B
Power Sensor	Maximum Frequency ≥ 6 GHz Power range: -24 dBm to +16 dBm	Agilent E4413A
Adapters	3.5 mm (f) to Precision BNC (No Substitute) 3.5mm (m) to 3.5 mm (m) Type N (f) to 3.5 mm (m)	Agilent 54855-67604 Agilent 1250-1748 Agilent 1250-1750

Connections

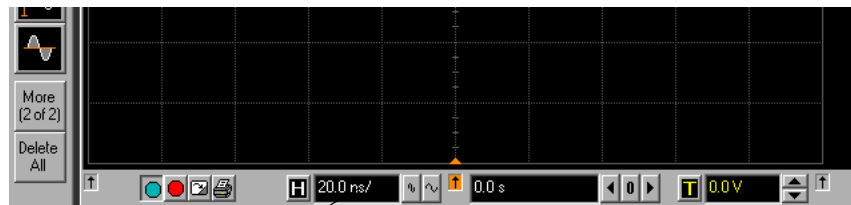


Notes

- Connect output 1 of the 11667B splitter to the scope Channel n 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

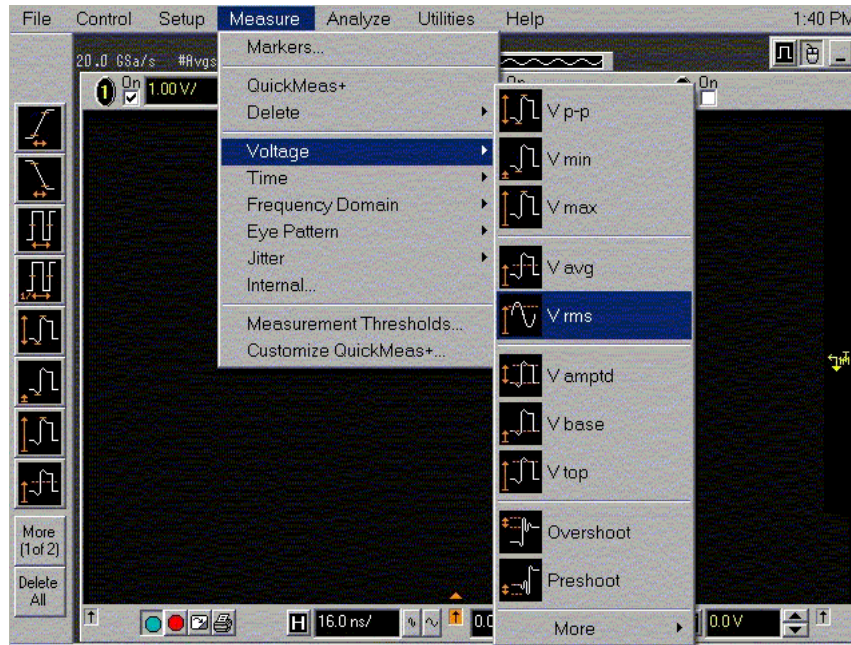
- 1 Preset the power meter.
- 2 Ensure that the power sensor is disconnected from any source and zero the meter.
- 3 Connect the power sensor to the power meter's Power Ref connector and calibrate the meter.
- 4 Make the connections to scope channel 1 as shown in the connection diagram above.
- 5 Set 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 10mV/div.
 - c Set the horizontal scale to 16 ns/div (to display 8 cycles of a 50 MHz waveform).



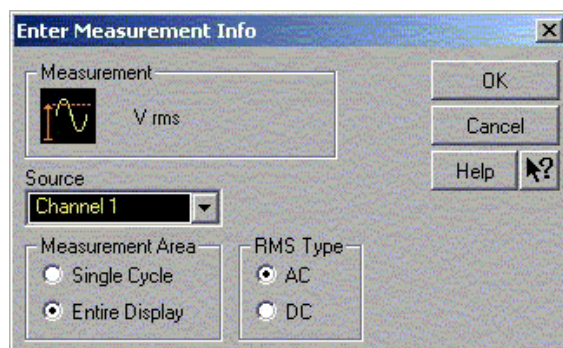
Click here and enter 16E-9

Chapter 3: Testing Performance
Analog Bandwidth - Maximum Frequency Check

- d** Pull down the Setup menu, select Acquisition and then set up the acquisition parameters as follows:
- Memory Depth = Automatic
 - Sampling rate = Maximum (20 GSa/s except for the 54852A which is 10 GSa/s)
 - Sin(x)/x Interpolation filter enabled
 - Averaging enabled with # of Averages = 16
- 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)
10 mV/div	0.08	-18
20 mV/div	0.16	-12
50 mV/div	0.4	-4
100 mV/div	0.8	+2
200 mV/div	1.6	+8
500 mV/div	4	+16
1 V/div	8	+22

- 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 μ 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, wait for the #Avgs value (top left corner of screen) to return to 16 and then 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.



- 10 Calculate the reference gain as follows:

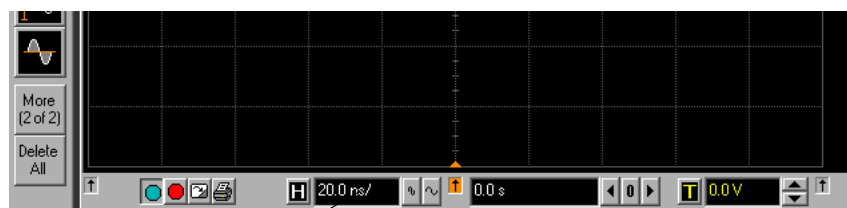
$$Gain_{50\text{ MHz}} = \frac{V_{out\text{ @50 MHz}}}{V_{in\text{ @50 MHz}}}$$

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			
	54852	54853	54854	54855
Maximum Frequency	2.0 GHz	2.5 GHz	4.0 GHz	6.0 GHz
Scope Time Base Setting	400 ps/div	320 ps/div	200 ps/div	133 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 μ 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, wait for the #Avgs value (top left corner of screen) to return to 16 and then 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:

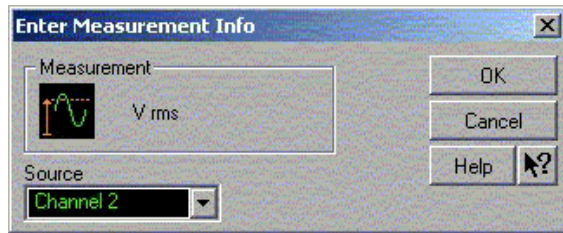
$$Gain_{Max\ Freq} = 20 \log_{10} \left[\frac{(V_{out\ Max\ Freq}) / (V_{in\ Max\ Freq})}{Gain_{50\ MHz}} \right]$$

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 20 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 10 mV/div.
 - Set the horizontal scale to 16 ns/div (to display 8 cycles of a 50MHz 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 10 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 10 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.

Horizontal Performance Verification

This section contains the follow horizontal performance verification:

- Time Base Accuracy Test
- Delta-time Measurement Accuracy Test

Time Base Accuracy Test

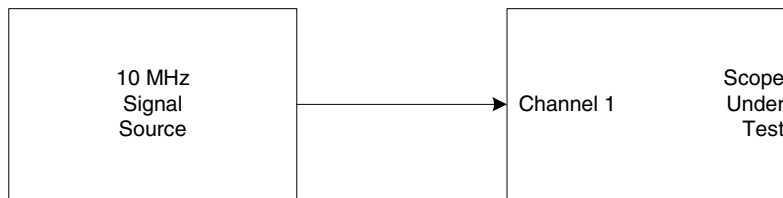
Specification

Time Scale Accuracy	± 1 ppm peak
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Equipment Required

Description	Critical Specifications	Recommended Model/Part Numbers
10 MHz Signal Source	Sine Wave with Amplitude ≤ 6 Vp-p into 50 Ω Frequency Accuracy better than 0.4 ppm Output resistance = 50 Ω	Agilent E8247C with Opt 520 or Agilent 82712B with Opt 1E5 or Agilent 8665B with Opt 004
Microwave Cable Assembly	50 Ω Characteristic Impedance (No Substitute) 3.5 mm (m) or SMA (m) connectors Max Frequency ≥ 18 GHz	Gore EKD01D010480
Adapters	3.5mm (f) to Precision BNC	Agilent 54855-67604

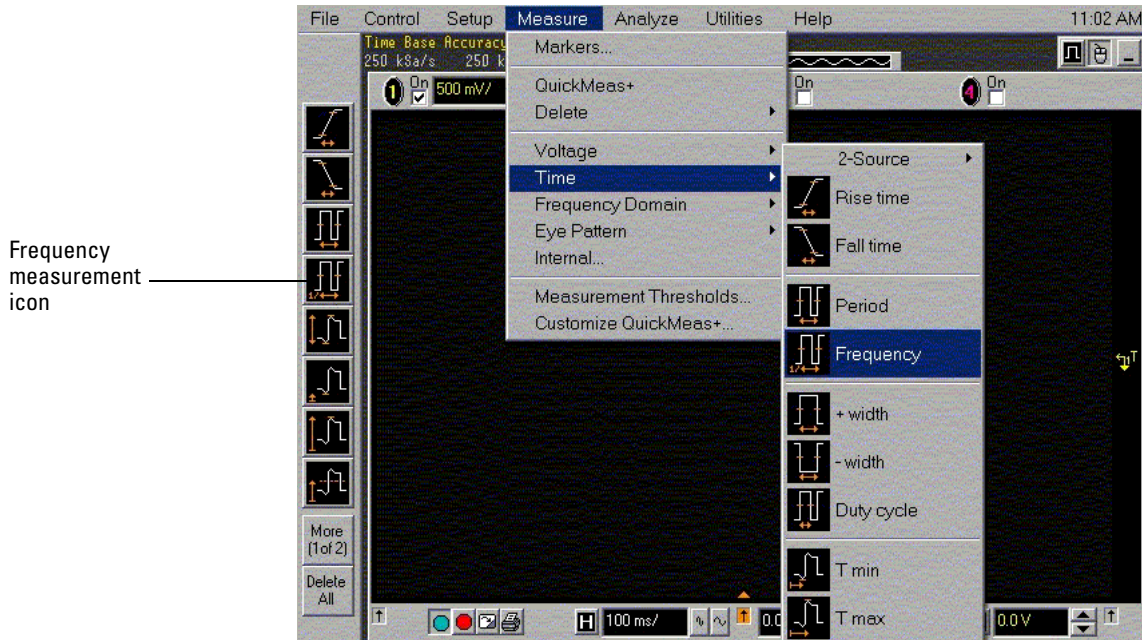
Connections



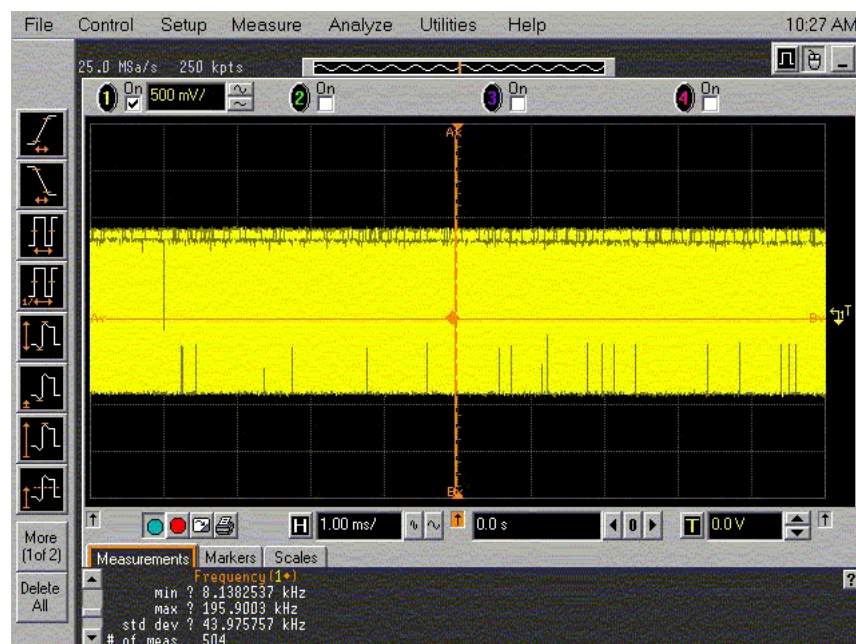
Procedure

- 1 Connect the 10 MHz signal source to scope channel 1 as shown in the connection diagram above.
- 2 Set up the scope as follows:
 - a Press Default Setup.
 - b Press Auto-scale.
 - c Change the timebase setting to 1 ms/div.

- 3 Set up the scope to measure frequency as follows:
 - a Click the Frequency measurement icon on the left side of the screen, or
 - b Pull down the Measure menu, select Time and then select Frequency.



- c If the time base is calibrated, the displayed waveform will be un-aliased at this time base setting and will appear like the one on the screen image shown below.
The question marks in the frequency measurement area at the bottom of the screen indicate that the frequency is not measurable at this time scale.



- d If the time base is NOT calibrated, an aliased waveform with a frequency in the range of about 30 Hz to 140 Hz will be displayed.

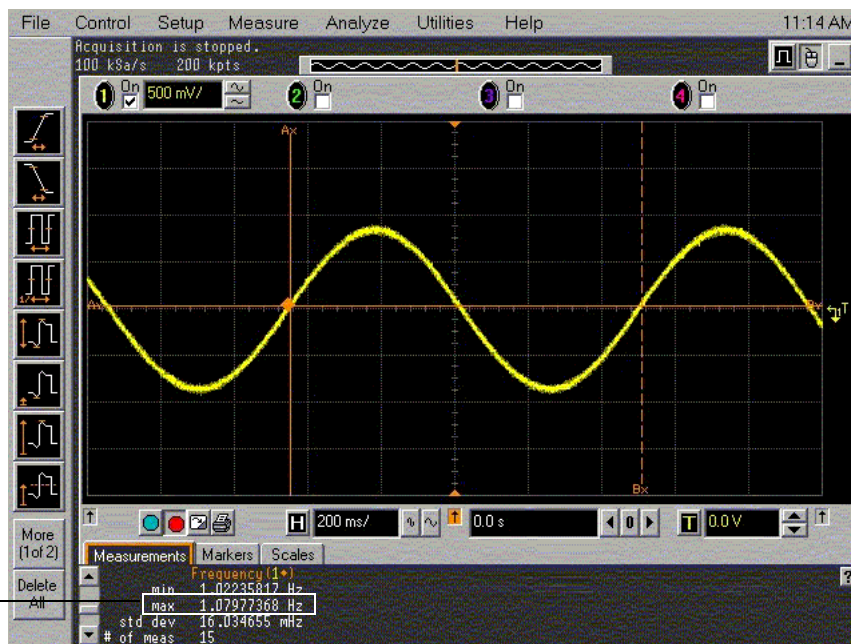
- 4 Increase the time base setting to 2 ms/div and then press the Clear Display key.
 - a If at least 1 complete cycle is displayed and NO question marks are displayed in the frequency measurement area at the bottom of the screen, record the max frequency in the Aliased Frequency Measurement field in the Time Base Accuracy Test section of the Performance Test Record.
 - b If less than one cycle is displayed or if question marks appear in the frequency measurement area, continue to increase the time base setting and then press the Clear Display key until at least 1 complete cycle is displayed and NO question marks are displayed in the frequency measurement area at the bottom of the screen.
 - c In most cases, it will be necessary to repeat this procedure until the time base setting is about 100 ms/div to 500 ms/div. A typical aliased waveform will look like the one shown below.

Wait until the # of meas field shows 15 or more measurements and then record the max reading in the Aliased Frequency Measurement field in the Time Base Accuracy Test section of the Performance Test Record.

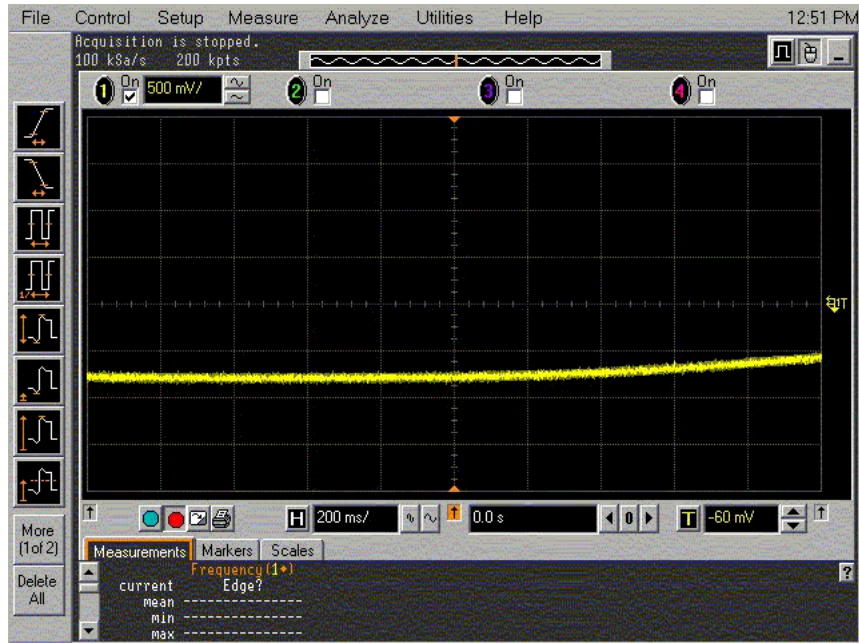
To meet specification, the aliased frequency must be less than or equal to 10 Hz.

If the scope was just calibrated, the aliased frequency must be less than or equal to 5 Hz to account for an aging rate of 0.5 ppm per year.

Record the
max reading



- d In some cases, the time base clock will be too close in frequency to the input signal used in this test. If this is the case, a waveform like the one shown below will be displayed. If this case, it will be impossible to capture a full cycle of the aliased waveform. If this occurs with the timebase set to 200 ms/div or higher, and if the frequency accuracy of the source is 0.4 ppm or better, then the scope under test passes this test.



Delta-time Measurement Accuracy Test

Specification

≥256 Averages	RMS: 70 fs Peak: $\pm[(0.5 \text{ ps}) + (1 \times 10^{-6} * \text{reading})]$
Averaging disabled	RMS: 2.0 ps Peak: $\pm[(7.0 \text{ ps}) + (1 \times 10^{-6} * \text{reading})]$
Signal peak-to-peak amplitude ≥5 divisions, vertical scale ≥10mV/div, signal rise time 155ps (54853) ≤225 ps (54854) 150 ps (54855), sample rate = 20 GSa/s, sinx/x interpolation enabled, measurement threshold = fixed voltage at 50% level. Measurement is between two edges on a single channel. RMS value refers to the standard deviation of 256 consecutive measurements performed using an individual oscilloscope.	

Equipment Required

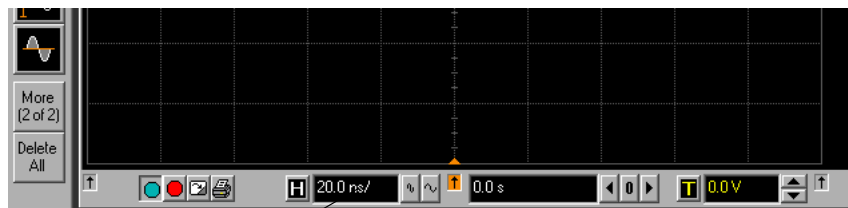
Description	Critical Specifications	Recommended Model/Part Numbers
Microwave CW Generator	Maximum Frequency ≥6 GHz Power range: -20 dBm to +16 dBm into 50Ω Frequency Accuracy better than 0.4 ppm Output resistance = 50Ω	Agilent E8247C with Opt 520 or Agilent 82712B with Opt 1E5 or Agilent 8665B with Opt 004
Microwave Cable Assembly	50Ω Characteristic Impedance (No Substitute) 3.5 mm (m) or SMA (m) connectors Max Frequency ≥18 GHz	Gore EKD01D010480
Adapter	3.5 mm (f) to Precision BNC (No Substitute)	Agilent 54855-67604

Connections



Procedure

- 1 Connect the microwave signal source to scope channel 1 as shown in the connection diagram above.
- 2 Set up the scope as follows:
 - a Press Default Setup.
 - b Set channel 1 vertical sensitivity to 100 mV/div.
 - c Set the horizontal scale to 48 ps/div (54855 and 54854), 76 ps/div (54853), or 100 ps/div (54852).



Click here and enter 48E-12, 76E-12, or 100E-12

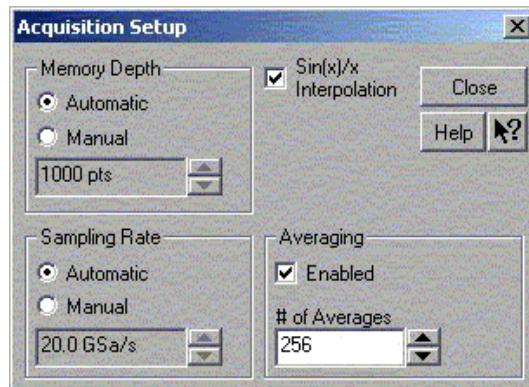
- d** Pull down the Setup menu, select Acquisition and then set up the acquisition parameters as follows:

Memory Depth = Automatic

Sampling rate = Automatic or maximum (20 GSa/s except for the 54852 which is 10 GSa/s)

Sin(x)/x filter enabled

Averaging enabled with # of Averages = 256



- 3** Set up the signal source to operate as follows:

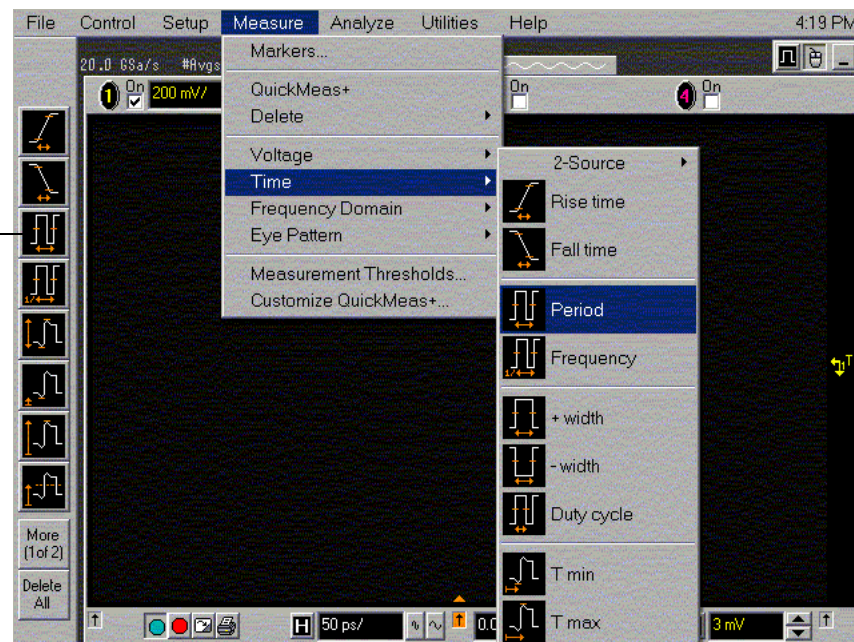
Frequency = 4 GHz (54855 and 54854), 2.5 GHz (54853), or 10 GSa/s (54852)

Amplitude = ~7 divisions peak to peak (~+2.5 dBm)

- 4** Set up the scope to measure period as follows:

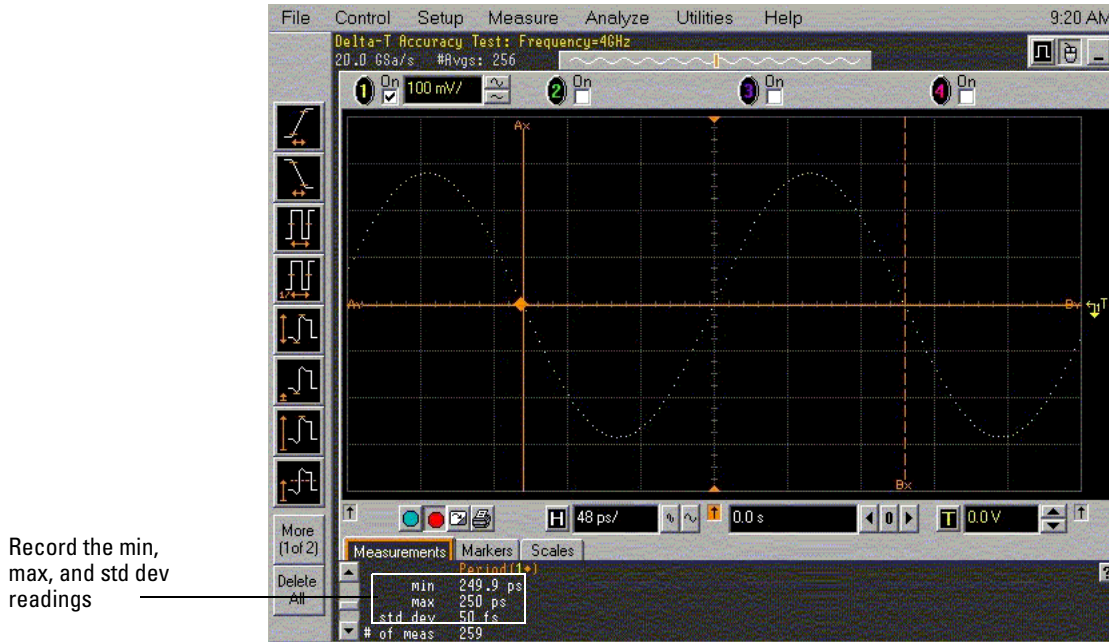
- a** Click the Period measurement icon on the left side of the screen, or
- b** Pull down the Measure menu, select Time and then select Period.

Period
measurement
icon



Chapter 3: Testing Performance
Delta-time Measurement Accuracy Test

- 5 Scroll down the measurement bar at the bottom of the screen so the min, max, std dev and # of meas fields are visible as shown below.
- 6 Press the Clear Display key, then allow the # of meas field to increment to at least 256 and then press the Stop key.
- 7 Record the min, max and std dev values in the Delta-time Results with Averaging Enabled section of the Performance Test Record.



- 8 Pull down the Setup menu, select Acquisition and then disable Averaging.
- 9 Press the Clear Display key, then allow the # of meas field to increment to at least 256 and then press the Stop key.
- 10 Record the min, max and std dev values in the Delta-time Results with Averaging Disabled section of the Performance Test Record.

Trigger Performance Verification

This section contains the follow trigger performance verification:

- Internal Channel Trigger Accuracy Test
 - Low Sensitivity Measurements @ 1 GHz
 - Low Sensitivity Measurements @ 2.0 GHz (54852), 2.5 GHz (54853), or 4 GHz (54854 and 54855)
 - High Sensitivity Measurements @ Maximum Frequency: 2.0 GHz (54852), 2.5 GHz (54853), 4 GHz (54854), or 6 GHz (54855)
- Trigger Jitter Test

Internal Channel Trigger Sensitivity Test

Specification

Low sensitivity mode:	54855: 0.5 div p-p 0 to 2 GHz, 1.0 div p-p 2 to 4 GHz, <2.5 div @ 5 GHz 54854: 0.5 div p-p 0 to 2 GHz, 1.0 div p-p 2 to 4 GHz 54853: 0.5 div p-p 0 to 2 GHz, 1.0 div p-p 2 to 2.5 GHz 54852: 0.5 div p-p 0 to 2 GHz
High sensitivity mode:	54855: 0.2 div p-p 0 to 6 GHz 54854: 0.2 div p-p 0 to 4 GHz 54853: 0.2 div p-p 0 to 2.5 GHz 54852: 0.2 div p-p 0 to 2.0 GHz

Equipment Required

Description	Critical Specifications	Recommended Model/ Part Numbers
Microwave CW Generator	Maximum Frequency ≥ 6 GHz Power range: -20 dBm to +16 dBm into 50 Ω Output resistance = 50 Ω	Agilent E8247C with Opt 520 or Agilent 82712B with Opt 1E5 or Agilent 8665B with Opt 004
Microwave Cable Assembly	50 Ω Characteristic Impedance (No Substitute) 3.5 mm (m) or SMA (m) connectors Max Frequency ≥ 18 GHz	Gore EKD01D010480
Adapters	3.5 mm (f) to Precision BNC	Agilent 54855-67604

Connections

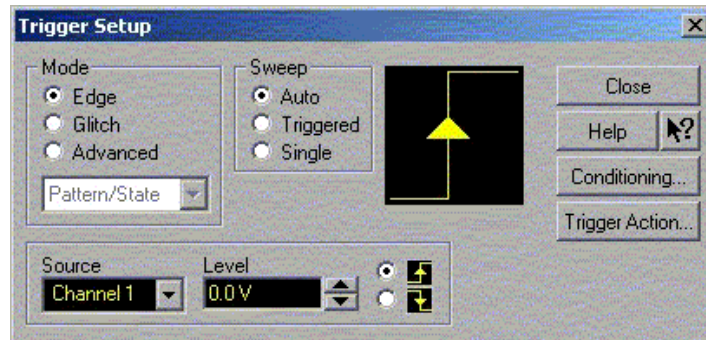


Procedure

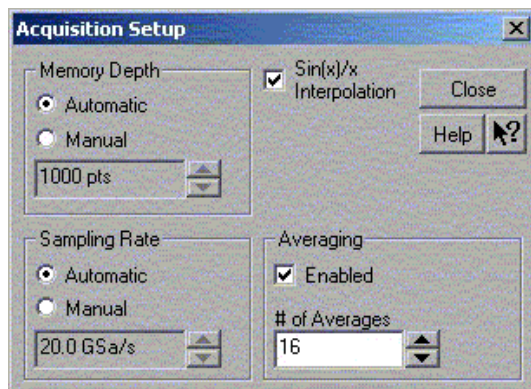
Low Sensitivity Measurements @ 2 GHz

- 1 Connect the microwave signal source to scope channel 1 as shown in the connection diagram above.
- 2 Set up the scope as follows:
 - a Press Default Setup.
 - b Set channel 1 vertical sensitivity to 1.0 V/div.
 - c Set the horizontal scale to 2 ns/div.

- d** Pull down the Setup menu, select trigger and then set up the trigger parameter as follows:
- Mode = Edge
 - Source = Channel 1
 - Sweep = Auto
- Click on Conditioning and select Low Sensitivity.

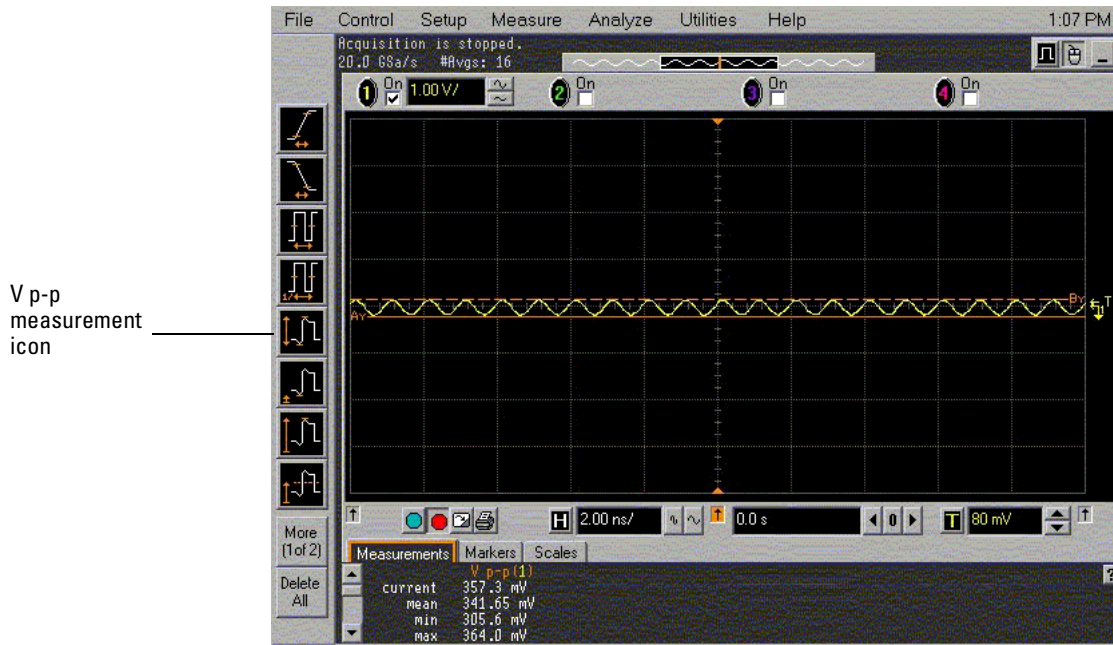


- e** Pull down the Setup menu, select Acquisition and then set up the acquisition parameters as follows:
- Memory Depth = Automatic
 - Sampling rate = Maximum 20 GSa/s except for the 54852 which is 10 GSa/s
 - Sin(x)/x Interpolation filter enabled
 - Averaging enabled with # of Averages = 16



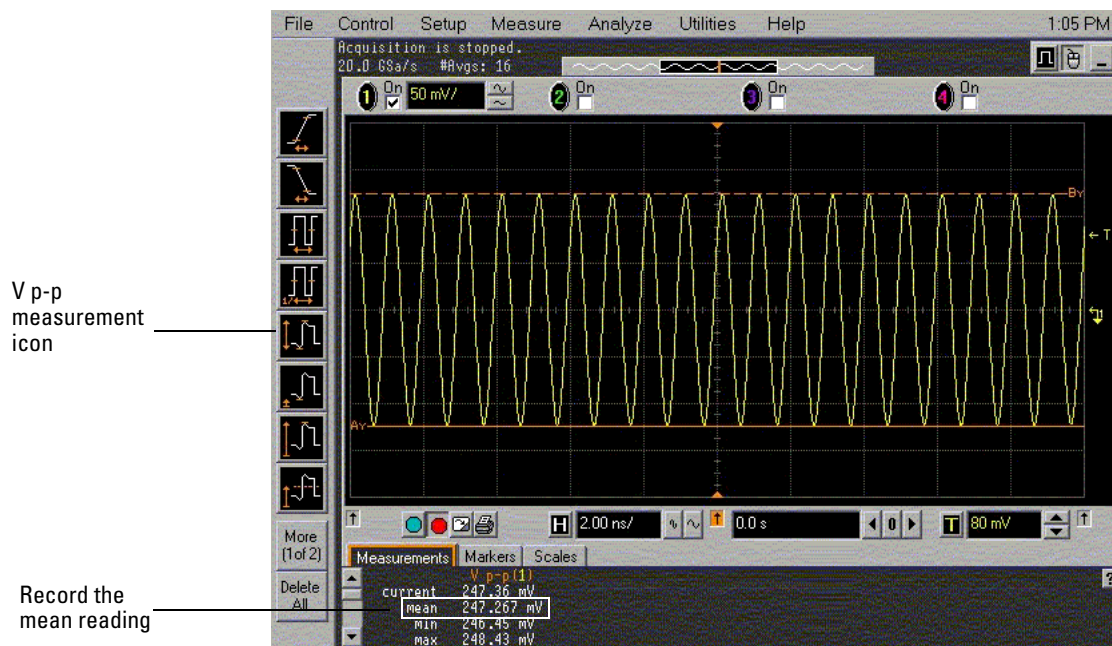
- 3** Set up the source generator as follows:
- Frequency = 2 GHz
 - Amplitude = -5.0 dBm

- 4 Click the V p-p voltage measurement icon on the left side of the display and then coarsely adjust the signal amplitude until the mean amplitude is ≥ 500 mVp-p. Press the Clear Display key after each amplitude adjustment.



- 5 Turn the V p-p measurement off.
- 6 Press the trigger Sweep key until Trig'd is illuminated and then carefully adjust the trigger Level control until the Trig'd indicator by the Horizontal timebase knob turns on solidly (not blinking) to indicate stable triggering.
- 7 Reduce the source generator signal amplitude in 0.2 dBm decrements until the Trig'd indicator by the Horizontal timebase knob starts to blink on and off. When the Trig'd indicator starts to blink, carefully re-adjust the trigger level to try to re-establish stable triggering (Trig'd indicator not blinking.) If stable triggering is re-established, then continue to reduce input signal amplitude until the Trig'd indicator starts to blink on and off. Repeat this procedure until adjusting the trigger level cannot re-establish stable triggering.

- 8 Measure the signal amplitude applied to channel 1 as follows:
 - a Increase the vertical sensitivity of channel 1 until the displayed waveform is at least 4 divisions in amplitude and is not clipped.
 - b Click the V p-p measurement icon on the left side of the screen.
 - c Record the mean V p-p value displayed at the bottom of the screen in the space provided in the Internal Trigger Sensitivity Test section (Low Sensitivity @ 2 GHz) of the Performance Test Record for channel 1.



- d Convert this measurement into units of divisions at 1 V/div using the expression:

$$\text{Trig Sens} = \frac{\text{Measured } V_{p-p}}{1 \text{ V/div}} = \text{_____ divisions}$$

- e Record this peak-to-peak division value in the space provided in the Internal Trigger Sensitivity Test section (Low Sensitivity @ 2 GHz) section of the Performance Test Record for channel 1.
- 9 Turn off the V p-p measurement.
- 10 Move the cable from channel 1 to channel 2.
- 11 Change the scope setup as follows
 - a Turn channel 1 display off.
 - b Turn channel 2 display on.
 - c Set channel 2 vertical sensitivity to 1.0 V/div.
 - d Press the trigger Source key until 2 is illuminated.
 - e Press the trigger Sweep key until Auto is illuminated.
- 12 Reset the source generator output to -5 dBm.
- 13 Repeat steps 4 to 8 inclusive for channel 2.
- 14 Turn off the V p-p measurement.
- 15 Move the cable from channel 2 to channel 3.

- 16** Change the scope setup as follows:
 - a** Turn channel 2 display off.
 - b** Turn channel 3 display on.
 - c** Set channel 3 vertical sensitivity to 1.0 V/div.
 - d** Press the trigger Source key until 3 is illuminated.
 - e** Press the trigger Sweep key until Auto is illuminated.
- 17** Reset the generator output to -5 dBm.
- 18** Repeat steps 4 to 8 inclusive for channel 3.
- 19** Move the cable from channel 3 to channel 4.
- 20** Change the scope setup as follows:
 - a** Turn channel 3 display off.
 - b** Turn channel 4 display on.
 - c** Set channel 4 vertical sensitivity to 1.0 V/div.
 - d** Press the trigger Source key until 4 is illuminated.
 - e** Press the trigger Sweep key until Auto is illuminated.
- 21** Reset the generator output to -5 dBm.
- 22** Repeat steps 4 to 8 inclusive for channel 4.

Low Sensitivity Measurements @ 2.5 GHz (54853), or 4 GHz (54854 and 54855)

- 1 Connect the microwave signal source to scope channel 1.
- 2 Set up the scope as follows:
 - a Press the Default Setup key.
 - b Set channel 1 vertical sensitivity to 1.0 V/div.
 - c Set the horizontal scale to 2 ns/div.
 - d Pull down the Setup menu, select trigger and then set up the trigger parameter as follows:
 Mode = Edge
 Source = Channel 1
 Sweep = Auto
 Click on Conditioning and select Low Sensitivity.
 - e Pull down the Setup menu, select Acquisition and then set up the acquisition parameters as follows:
 Memory Depth = Automatic
 Sampling rate = Maximum 20 GSa/s
 Sin(x)/x Interpolation filter enabled
 Averaging enabled with # of Averages = 16
- 3 Set up the source generator as follows:
 Frequency = 2.5 GHz (if testing 54853), or 4.0 GHz (if testing 54854 or 54855)
 Amplitude = -1.5 dBm
- 4 Click the V p-p measurement icon on the left side of the display and then coarsely adjust the signal amplitude until the mean amplitude is ≥ 1.0 Vp-p. Press the Clear Display key after each amplitude adjustment.
- 5 Turn the V p-p measurement off.
- 6 Press the trigger Sweep key until Trig'd is illuminated and then carefully adjust the trigger Level control until the Trig'd indicator by the Horizontal timebase knob turns on solidly (not blinking) to indicate stable triggering.
- 7 Reduce the source generator signal amplitude in 0.2 dBm decrements until the Trig'd indicator by the Horizontal timebase knob starts to blink on and off. When the Trig'd indicator starts to blink, carefully re-adjust the trigger level to try to re-establish stable triggering (Trig'd indicator not blinking.) If stable triggering is re-established, then continue to reduce input signal amplitude until the Trig'd indicator starts to blink on and off. Repeat this procedure until adjusting the trigger level cannot re-establish stable triggering.
- 8 Measure the signal amplitude applied to channel 1 as follows:
 - a Increase the vertical sensitivity of channel 1 until the displayed waveform is at least 4 divisions in amplitude and is not clipped.
 - b Click the V p-p measurement icon on the left side of the screen.
 - c Record the V p-p mean value displayed at the bottom of the screen in the space provided in the Internal Trigger Sensitivity Test section (Low Sensitivity @ 4 GHz or 2.5 GHz) section of the Performance Test Record for channel 1.
 - d Convert this measurement into units of divisions at 1V/div using the expression:

$$Trig\ Sens = \frac{V_{pp}}{1\ V/div} = \underline{\hspace{2cm}} \text{ divisions}$$

- e Record this peak-to-peak division value in the space provided in the Internal Trigger Sensitivity Test section (Low Sensitivity @ 4 GHz or 2.5 GHz) section of the Performance Test Record for channel 1.

- 9** Turn off the V p-p measurement.
- 10** Move the cable from channel 1 to channel 2.
- 11** Change the scope setup as follows:
 - a** Turn channel 1 display off.
 - b** Turn channel 2 display on.
 - c** Set channel 2 vertical sensitivity to 1.0 V/div.
 - d** Press the trigger Source key until 2 is illuminated.
 - e** Press the trigger Sweep key until Auto is illuminated.
- 12** Reset the source generator output amplitude to -1.5 dBm.
- 13** Repeat steps 4 to 8 inclusive for channel 2.
- 14** Turn off the V p-p measurement.
- 15** Move the cable from channel 2 to channel 3
- 16** Change the scope setup as follows:
 - a** Turn channel 2 display off.
 - b** Turn channel 3 display on.
 - c** Set channel 3 vertical sensitivity to 1.0 V/div.
 - d** Press the trigger Source key until 3 is illuminated.
 - e** Press the trigger Sweep key until Auto is illuminated.
- 17** Reset the source generator output amplitude to -1.5 dBm.
- 18** Repeat steps 4 to 8 inclusive for channel 3.
- 19** Move the cable from channel 3 to channel 4
- 20** Change the scope setup as follows:
 - a** Turn channel 3 display off.
 - b** Turn channel 4 display on.
 - c** Set channel 4 vertical sensitivity to 1.0 V/div.
 - d** Press the trigger Source key until 4 is illuminated.
 - e** Press the trigger Sweep key until Auto is illuminated.
- 21** Reset the source generator output amplitude to -1.5 dBm.
- 22** Repeat steps 4 to 8 inclusive for channel 4.

Low Sensitivity Measurements @ 5 GHz (54855 only)

- 1 Connect the microwave signal source to scope channel 1.
- 2 Set up the scope as follows:
 - a Press the Default Setup key.
 - b Set channel 1 vertical sensitivity to 1.0 V/div.
 - c Set the horizontal scale to 2 ns/div.
 - d Pull down the Setup menu, select trigger and then set up the trigger parameter as follows:
 Mode = Edge
 Source = Channel 1
 Sweep = Auto
 Click on Conditioning and select Low Sensitivity.
 - e Pull down the Setup menu, select Acquisition and then set up the acquisition parameters as follows:
 Memory Depth = Automatic
 Sampling rate = Maximum 20 GSa/s
 Sin(x)/x Interpolation filter enabled
 Averaging enabled with # of Averages = 16
- 3 Set up the source generator as follows:
 Frequency = 5 GHz
 Amplitude = -1.5 dBm
- 4 Click the V p-p measurement icon on the left side of the display and then coarsely adjust the signal amplitude until the mean amplitude is ≥ 2.5 Vp-p. Press the Clear Display key after each amplitude adjustment.
- 5 Turn the V p-p measurement off.
- 6 Press the trigger Sweep key until Trig'd is illuminated and then carefully adjust the trigger Level control until the Trig'd indicator by the Horizontal timebase knob turns on solidly (not blinking) to indicate stable triggering.
- 7 Reduce the source generator signal amplitude in 0.2 dBm decrements until the Trig'd indicator by the Horizontal timebase knob starts to blink on and off. When the Trig'd indicator starts to blink, carefully re-adjust the trigger level to try to re-establish stable triggering (Trig'd indicator not blinking.) If stable triggering is re-established, then continue to reduce input signal amplitude until the Trig'd indicator starts to blink on and off. Repeat this procedure until adjusting the trigger level cannot re-establish stable triggering.
- 8 Measure the signal amplitude applied to channel 1 as follows:
 - a Increase the vertical sensitivity of channel 1 until the displayed waveform is at least 4 divisions in amplitude and is not clipped.
 - b Click the V p-p measurement icon on the left side of the screen.
 - c Record the V p-p mean value displayed at the bottom of the screen in the space provided in the Internal Trigger Sensitivity Test section (Low Sensitivity @ 5 GHz) section of the Performance Test Record for channel 1.
 - d Convert this measurement into units of divisions at 1V/div using the expression:

$$Trig\ Sens = \frac{V_{pp}}{1\ V/div} = \underline{\hspace{2cm}} \text{ divisions}$$

- e Record this peak-to-peak division value in the space provided in the Internal Trigger Sensitivity Test section (Low Sensitivity @ 5 GHz) section of the Performance Test Record for channel 1.

- 9** Turn off the V p-p measurement.
- 10** Move the cable from channel 1 to channel 2.
- 11** Change the scope setup as follows:
 - a** Turn channel 1 display off.
 - b** Turn channel 2 display on.
 - c** Set channel 2 vertical sensitivity to 1.0 V/div.
 - d** Press the trigger Source key until 2 is illuminated.
 - e** Press the trigger Sweep key until Auto is illuminated.
- 12** Reset the source generator output amplitude to -1.5 dBm.
- 13** Repeat steps 4 to 8 inclusive for channel 2.
- 14** Turn off the V p-p measurement.
- 15** Move the cable from channel 2 to channel 3
- 16** Change the scope setup as follows:
 - a** Turn channel 2 display off.
 - b** Turn channel 3 display on.
 - c** Set channel 3 vertical sensitivity to 1.0 V/div.
 - d** Press the trigger Source key until 3 is illuminated.
 - e** Press the trigger Sweep key until Auto is illuminated.
- 17** Reset the source generator output amplitude to -1.5 dBm.
- 18** Repeat steps 4 to 8 inclusive for channel 3.
- 19** Move the cable from channel 3 to channel 4
- 20** Change the scope setup as follows:
 - a** Turn channel 3 display off.
 - b** Turn channel 4 display on.
 - c** Set channel 4 vertical sensitivity to 1.0 V/div.
 - d** Press the trigger Source key until 4 is illuminated.
 - e** Press the trigger Sweep key until Auto is illuminated.
- 21** Reset the source generator output amplitude to -1.5 dBm.
- 22** Repeat steps 4 to 8 inclusive for channel 4.

High Sensitivity Measurements @ Maximum Frequency: 2.0 GHz (54852), 2.5 GHz (54853), or 4 GHz (54854) or 6 GHz (54855)

- 1 Connect the microwave signal source to scope channel 1.
- 2 Set up the scope as follows:
 - a Press Default Setup.
 - b Set channel 1 vertical sensitivity to 1.0 V/div.
 - c Set the horizontal scale to 2 ns/div.
 - d Pull down the Setup menu, select trigger and then set up the trigger parameter as follows:
 Mode = Edge
 Source = Channel 1
 Sweep = Auto
 Click on Conditioning and select High Sensitivity.
 - e Pull down the Setup menu, select Acquisition and then set up the acquisition parameters as follows:
 Memory Depth = Automatic
 Sampling rate = Maximum 20 GSa/s except for the 54852 which is 10 GSa/s
 Sin(x)/x Interpolation filter enabled
 Averaging enabled with # of Averages = 16
- 3 Set up the source generator as follows:
 Frequency = 2.0 GHz (if testing 54852), 2.5 GHz (if testing 54853), 4.0 GHz (if testing 54854), or 6.0 GHz (if testing 54855)
 Amplitude = -10.0 dBm
- 4 Click the V p-p measurement icon on the left side of the display and then coarsely adjust the signal amplitude until the mean amplitude is ≥ 200 mVp-p. Press the Clear Display key after each amplitude adjustment.
- 5 Turn the V p-p measurement off.
- 6 Press the trigger Sweep key until Trig'd is illuminated and then carefully adjust the trigger Level control until the Trig'd indicator by the Horizontal timebase knob turns on solidly (not blinking) to indicate stable triggering.
- 7 Reduce the source generator signal amplitude in 0.2 dBm decrements until the Trig'd indicator by the Horizontal timebase knob starts to blink on and off. When the Trig'd indicator starts to blink, carefully re-adjust the trigger level to try to re-establish stable triggering (Trig'd indicator not blinking.) If stable triggering is re-established, then continue to reduce input signal amplitude until the Trig'd indicator starts to blink on and off. Repeat this procedure until adjusting the trigger level cannot re-establish stable triggering.
- 8 Measure the signal amplitude applied to channel 1 as follows:
 - a Increase the vertical sensitivity of channel 1 until the displayed waveform is at least 4 divisions in amplitude and is not clipped.
 - b Click the V p-p measurement icon on the left side of the screen.
 - c Record the mean V p-p value displayed at the bottom of the screen in the space provided in the Internal Trigger Sensitivity Test section (High Sensitivity @ Max Frequency) section of the Performance Test Record for channel 1.
 - d Convert this measurement into units of divisions at 1V/div using the expression:

$$Trig\ Sens = \frac{V_{pp}}{1\ V/div} = \text{_____ divisions}$$

- e Record this peak-to-peak division value in the space provided in the Internal Trigger Sensitivity Test section (High Sensitivity @ Max Frequency) section of the Performance Test Record for channel 1.

- 9 Turn off the V p-p measurement.
- 10 Move the cable from channel 1 to channel 2.
- 11 Change the scope setup as follows:
 - a Turn channel 1 display off.
 - b Turn channel 2 display on.
 - c Set channel 2 vertical sensitivity to 1.0 V/div.
 - d Press the trigger Source key until 2 is illuminated.
 - e Press the trigger Sweep key until Auto is illuminated.
- 12 Reset the source generator output amplitude to -10.0 dBm.
- 13 Repeat steps 4 to 8 inclusive for channel 2.
- 14 Turn off the V p-p measurement.
- 15 Move the cable from channel 2 to channel 3.
- 16 Change the scope setup as follows:
 - a Turn channel 2 display off.
 - b Turn channel 3 display on.
 - c Set channel 3 vertical sensitivity to 1.0 V/div.
 - d Press the trigger Source key until 3 is illuminated.
 - e Press the trigger Sweep key until Auto is illuminated.
- 17 Reset the source generator output amplitude to -10.0 dBm.
- 18 Repeat steps 4 to 8 inclusive for channel 3.
- 19 Move the cable from channel 3 to channel 4.
- 20 Change the scope setup as follows:
 - a Turn channel 3 display off.
 - b Turn channel 4 display on.
 - c Set channel 4 vertical sensitivity to 1.0 V/div.
 - d Press the trigger Source key until 4 is illuminated.
 - e Press the trigger Sweep key until Auto is illuminated.
- 21 Reset the source generator output amplitude to -10.0 dBm.
- 22 Repeat steps 4 to 8 inclusive for channel 4.

Trigger Jitter Test

Specification

54855	1.0 ps rms
54854	1.3 ps rms
54853	1.7 ps rms
54852	1.8 ps rms
Signal peak-to-peak amplitude ≥ 5 divisions, vertical scale $\geq 10\text{mV/div}$, signal rise time ≤ 415 ps (54852), ≤ 330 ps (54853), ≤ 225 ps (54854), and ≤ 150 ps (54855), sample rate = 20 GSa/s (10 GSa/s for 54852), sinx/x interpolation enabled, measurement threshold = fixed voltage at 50% level. Internal trigger: Trigger level contained within full scale display range of trigger channel.	

Equipment Required

Description	Critical Specifications	Recommended Model/ Part Numbers
Microwave CW Generator	Maximum Frequency ≥ 6 GHz Power range: -20 dBm to +16 dBm into 50 Ω Frequency Accuracy better than 0.4 ppm Output resistance = 50 Ω	Agilent E8247C with Opt 520 or Agilent 82712B with Opt 1E5 or Agilent 8665B with Opt 004
Microwave Cable Assembly	50 Ω Characteristic Impedance (No Substitute) 3.5 mm (m) or SMA (m) connectors Max Frequency ≥ 18 GHz	Gore EKD01D010480
Adapter	3.5 mm (f) to Precision BNC	Agilent 54855-67604

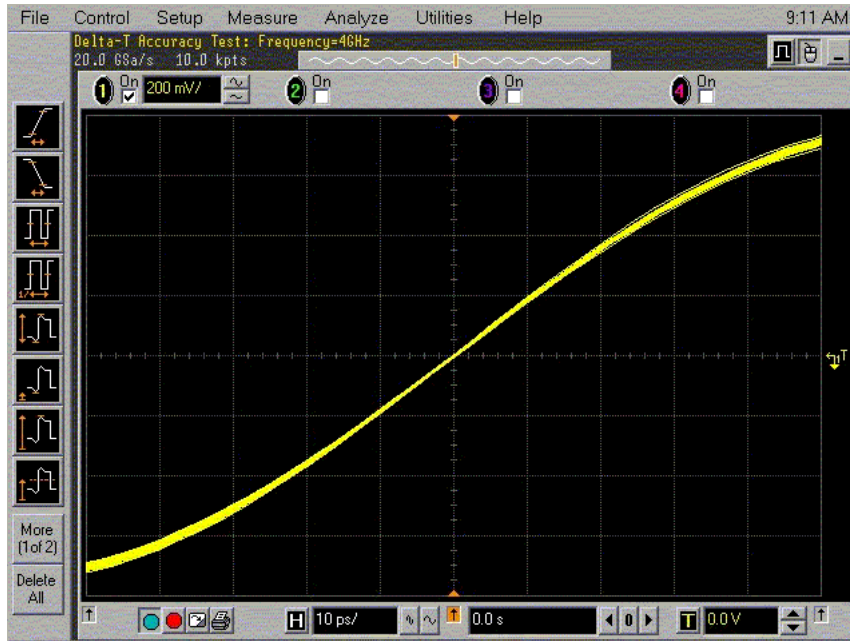
Connections



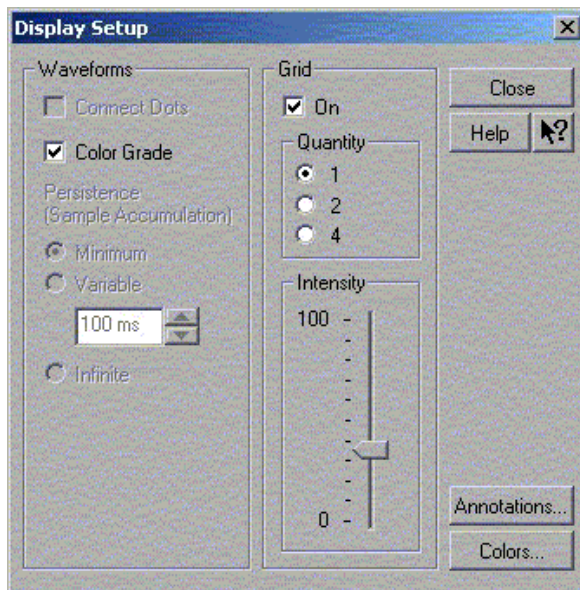
Procedure

- 1 Connect the microwave signal source to scope channel 1 as shown in the connection diagram above.
- 2 Set up the source to operate as follows:
Frequency = 4 GHz (54855 and 54854), 2.5 GHz (54853), or 2.0 GHz (54852)
Amplitude = +10 dBm

- 3 Set up the scope as follows:
 - a Press Default Setup.
 - b Set channel 1 vertical sensitivity to 200 mV/div.
 - c Set the horizontal scale to 10 ps/div.
 - d Trigger Mode: Edge triggered, Rising edge.
 - e Trigger Source = Channel 1.

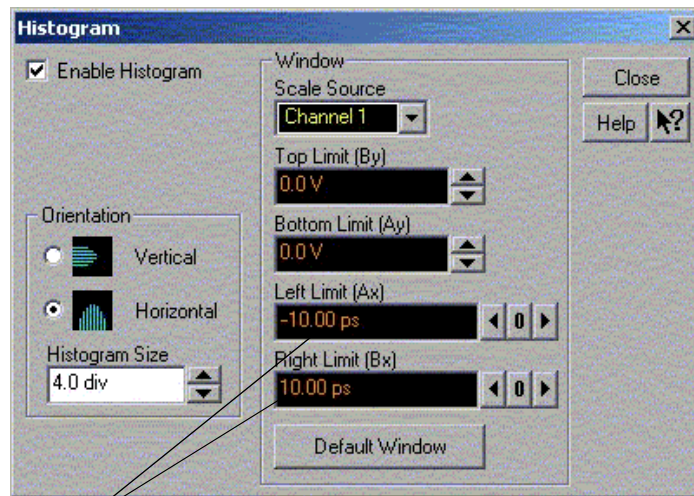


- 4 Configure the scope to measure jitter as follows:
 - a Pull down the Setup menu and select Display.



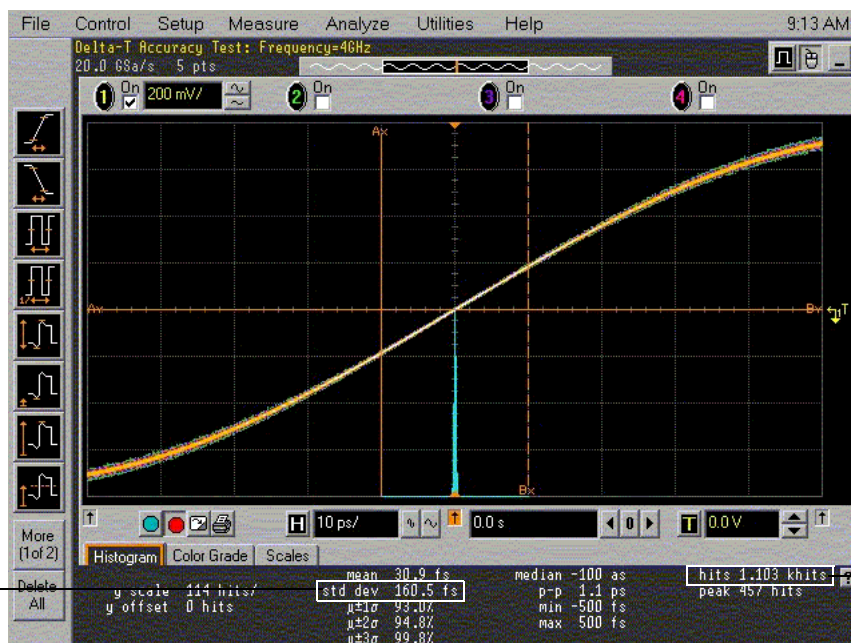
- b Enable Color Grade.

- c Pull down the Analyze menu and select Histogram.
- d Set up the histogram parameters as shown below:
 Orientation = Horizontal
 Scale Source = Channel 1
 Top Limit (By) = 0.0 V
 Bottom Limit (Ay) = 0.0 V
 Left Limit (Ax) = -10 ps
 Right Limit (Bx) = 10 ps
 Histogram is enabled



Click here and enter limits from step d

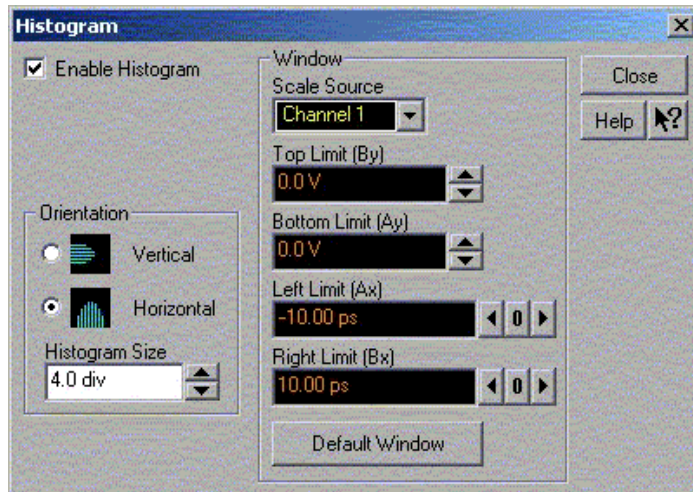
- 5 Press the Clear Display key, allow the hits counter to increment to at least 512 and then record the std dev value in the Trigger Jitter Test section of the Performance Test Record for channel 1.



Record the std dev reading

hits counter

- 6 Move the cable from channel 1 to channel 2. Turn the channel 1 display off and turn channel 2 display on.
 - a Set channel 2 vertical sensitivity to 200 mV/div.
 - b Change the trigger source to channel 2.
- 7 Pull down the Analyze menu and select Histogram. When the histogram menu is displayed, change the scale source from channel 1 to channel 2.



- 8 Press the Clear Display key, allow the hits counter to increment to at least 512 and then record the std dev value in the Trigger Jitter Test section of the Performance Test Record for channel 2.
- 9 Repeat steps 6 to 8 for channels 3 and 4.

Performance Test Record

Offset Performance Test

Zero Error Test

Vertical Sensitivity	Test Limits	Channel 1	Channel 2	Channel 3	Channel 4
10 mV/div	-0.8 mV to +0.8 mV				
20 mV/div	-1.6 mV to +1.6 mV				
50 mV/div	-4.0 mV to +4.0 mV				
100 mV/div	-8.0 mV to +8.0 mV				
200 mV/div	-16.0 mV to +16.0 mV				
500 mV/div	-40.0 mV to +40.0 mV				
1 V/div	-80.0 mV to +80.0 mV				

Offset Gain Test

Vertical Sensitivity	V _{Aux Out} Setting	V _{DMM+}	V _{DMM-}	V _{Scope+}	V _{Scope-}	Calculated Offset Gain	Offset Gain Test Limits
Channel 1							
10 mV/div	±120 mV						+0.98 to +1.02
20 mV/div	±240 mV						+0.98 to +1.02
50 mV/div	±600 mV						+0.98 to +1.02
100 mV/div	±1.2 V						+0.98 to +1.02
200 mV/div	±2.4 V						+0.98 to +1.02
500 mV/div	±2.4 V						+0.98 to +1.02
1 V/div	±2.4 V						+0.98 to +1.02
Channel 2							
10 mV/div	±120 mV						+0.98 to +1.02
20 mV/div	±240 mV						+0.98 to +1.02
50 mV/div	±600 mV						+0.98 to +1.02
100 mV/div	±1.2 V						+0.98 to +1.02
200 mV/div	±2.4 V						+0.98 to +1.02
500 mV/div	±2.4 V						+0.98 to +1.02
1 V/div	±2.4 V						+0.98 to +1.02
Channel 3							
10 mV/div	±120 mV						+0.98 to +1.02
20 mV/div	±240 mV						+0.98 to +1.02
50 mV/div	±600 mV						+0.98 to +1.02
100 mV/div	±1.2 V						+0.98 to +1.02
200 mV/div	±2.4 V						+0.98 to +1.02
500 mV/div	±2.4 V						+0.98 to +1.02
1 V/div	±2.4 V						+0.98 to +1.02
Channel 4							
10 mV/div	±120 mV						+0.98 to +1.02
20 mV/div	±240 mV						+0.98 to +1.02
50 mV/div	±600 mV						+0.98 to +1.02
100 mV/div	±1.2 V						+0.98 to +1.02
200 mV/div	±2.4 V						+0.98 to +1.02
500 mV/div	±2.4 V						+0.98 to +1.02
1 V/div	±2.4 V						+0.98 to +1.02

Chapter 3: Testing Performance
Performance Test Record

DC Measurement Accuracy (Single Cursor) Test

Vertical Sensitivity	V _{Aux Out} Setting	V _{DMM}	V _{Scope}	Max Scope Error (V _{ERR})	Calculated Vscope Lower Limit (V _{DMM} – V _{ERR})	Calculated Vscope Upper Limit (V _{DMM} + V _{ERR})
Channel 1						
10 mV/div	+30 mV			1.6 mV		
20 mV/div	+60 mV			3.2 mV		
50 mV/div	+150 mV			8.0 mV		
100 mV/div	+300 mV			16.0 mV		
200 mV/div	+600 mV			32.0 mV		
500 mV/div	+1.5 V			80.0 mV		
1 V/div	+2.4 V			160 mV		
Channel 2						
10 mV/div	+30 mV			1.6 mV		
20 mV/div	+60 mV			3.2 mV		
50 mV/div	+150 mV			8.0 mV		
100 mV/div	+300 mV			16.0 mV		
200 mV/div	+600 mV			32.0 mV		
500 mV/div	+1.5 V			80.0 mV		
1 V/div	+2.4 V			160 mV		
Channel 3						
10 mV/div	+30 mV			1.6 mV		
20 mV/div	+60 mV			3.2 mV		
50 mV/div	+150 mV			8.0 mV		
100 mV/div	+300 mV			16.0 mV		
200 mV/div	+600 mV			32.0 mV		
500 mV/div	+1.5 V			80.0 mV		
1 V/div	+2.4 V			160 mV		
Channel 4						
10 mV/div	+30 mV			1.6 mV		
20 mV/div	+60 mV			3.2 mV		
50 mV/div	+150 mV			8.0 mV		
100 mV/div	+300 mV			16.0 mV		
200 mV/div	+600 mV			32.0 mV		
500 mV/div	+1.5 V			80.0 mV		
1 V/div	+2.4 V			160 mV		

Analog Bandwidth - Maximum Frequency Check

Max frequency: 54852 = 2.0 GHz, 54853 = 2.5 GHz, 54854 = 4.0 GHz, 54855 = 6.0 GHz

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)
Channel 1						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						
Channel 2						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						
Channel 3						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						
Channel 4						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						

Time Base Accuracy Test

Aliased Frequency Measurement	Test Limits
	≤ 10 Hz to meet specification ≤ 5 Hz if timebase just calibrated

Chapter 3: Testing Performance
Performance Test Record

Delta-time Measurement Accuracy Test

Result Name	Measured Value	Test Limit
Delta-time Results with Averaging Enabled		
Min		249.5 ps
Max		250.5 ps
Std dev		70 fs
Delta-time Results with Averaging Disabled		
Min		242.5 ps
Max		257.5 ps
Std dev		2.0 ps

Internal Channel Trigger Sensitivity Test

Channel	Peak to Peak Voltage	Peak to Peak Divisions	Test Limit
Low Sensitivity Measurements and Results @ 2 GHz			
1			0.5 division
2			0.5 division
3			0.5 division
4			0.5 division
Low Sensitivity Measurements and Results @ 4 GHz (54855 & 54854) or 2.5 GHz (54853)			
1			1.0 division
2			1.0 division
3			1.0 division
4			1.0 division
Low Sensitivity Measurements and Results @ 5 GHz (54855 only)			
1			<2.5 division
2			<2.5 division
3			<2.5 division
4			<2.5 division
High Sensitivity Measurements and Results @ Max Frequency			
1			0.2 division
2			0.2 division
3			0.2 division
4			0.2 division

Trigger Jitter Test

Channel	Measured Value (Std Dev)	Test Limits
1		54855: 1.0 ps 54854: 1.3 ps 54853: 1.7 ps 54852: 1.8 ps
2		54855: 1.0 ps 54854: 1.3 ps 54853: 1.7 ps 54852: 1.8 ps
3		54855: 1.0 ps 54854: 1.3 ps 54853: 1.7 ps 54852: 1.8 ps
4		54855: 1.0 ps 54854: 1.3 ps 54853: 1.7 ps 54852: 1.8 ps

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Calibration

This chapter provides firmware (self calibration) procedures for the oscilloscope.

- Power Supply Check
- Oscillator Check
- Flat-Panel Display Check
- Self calibration

Equipment Required

Equipment required for adjustments is listed in the Recommended Test Equipment table in chapter 1 of this manual. Any equipment that satisfies the critical specification listed in the table may be substituted for the recommended model. Equipment for individual procedures is listed at the procedure.

Self Calibration Interval and Hardware Adjustments

The firmware calibration is the self cal (self calibration). Self calibration should be done every year, or every 2,000 hours of operation, whichever comes first. The hardware adjustment consists of checking the power supply and flat-panel display. These adjustments only need to be done under circumstances set by certain needs, which are explained in other areas of this guide.

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 adjust or replace the acquisition assembly or acquisition hybrids,
- when you replace the hard drive or any other assembly,
- when the delta temperature is more than ± 5 °C different than the last calibration, or
- after performing incoming performance verification and before performing outgoing performance verification.

The need for self calibration will also depend on your experience and on the environment in which you use the oscilloscope.

Mainframe Cal Factor Memory Error

If power is applied to the oscilloscope and the message “Mainframe cal factor memory error: Please perform calibration” is displayed, you must calibrate the oscilloscope. See “To run the self calibration” in this chapter.

If the oscilloscope does not pass the self calibration, repair is necessary.

Operating Hints

Some knowledge of operating the oscilloscope is helpful. However, procedures are written so that little experience is necessary. The following hints will speed progress of the procedures.

When using many averages, it often takes awhile for a waveform display to stabilize after a change. When a front panel control on the oscilloscope is changed, averaging automatically restarts. When the input signal or an adjustment is changed, the oscilloscope averages new data with the old, so it takes longer for the waveform to stabilize to the new value. Press the Clear Display key while changing input signals or adjustments. Clearing the display restarts averaging, which gives a quicker indication of the result of the change.

Loading Default Oscilloscope Settings

To reset the oscilloscope to default conditions, press the Default Setup key.

Loading New Software

This oscilloscope stores its operating system code on a hard disk drive. New code is loaded into the oscilloscope by using the CD-ROM. It is rarely necessary to reload the code. If your system is not working correctly you may need to update to newer code or re-image the disk. Find the latest software at www.agilent.com/find/infiniium_software.

To load new code, enable the graphical interface, then select Upgrade Software from the Utilities menu. You can then follow the instructions on the screen.

Calibration Procedures

The procedures start with the next paragraphs. Unless specified elsewhere, procedures must be followed in the order given.

Let the Oscilloscope Warm Up Before Adjusting

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

To run the self 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 adjust or replace the acquisition assembly or acquisition hybrids,
- when you replace the hard drive or any other assembly,
- when the delta temperature is more than ± 5 °C different than the last calibration, or
- after performing incoming performance verification and before performing outgoing performance verification.

Equipment Required

Equipment	Critical Specifications	Recommended Model/Part
Adapter (supplied with 54854 & 54855 - 2 required for 54855 calibration)	3.5 mm (f) to precision BNC No substitute	Agilent 54855-67604
Shorting Cap (supplied with all 3 models)	BNC (m)	Agilent 1250-0929
Cable Assembly	50 Ω characteristic impedance BNC (m) connectors \leq 12 inch length	Agilent 10502A or Agilent 8120-1838
Cable Assembly (cal cable supplied with 54855)	No substitute	Agilent 54855-61620
10 MHz Signal Source (required for time scale calibration)	Frequency accuracy better than 0.4ppm	Agilent 53131A with Opt. 010* or Agilent 5071A or Symmetricom 58503B **

* Requires time base calibration once every 6 months. Should not be powered off for more than 24 hours after time base calibration.

** Requires link to GPS

Self calibration

Calibration time

It will take approximately 20 minutes 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.

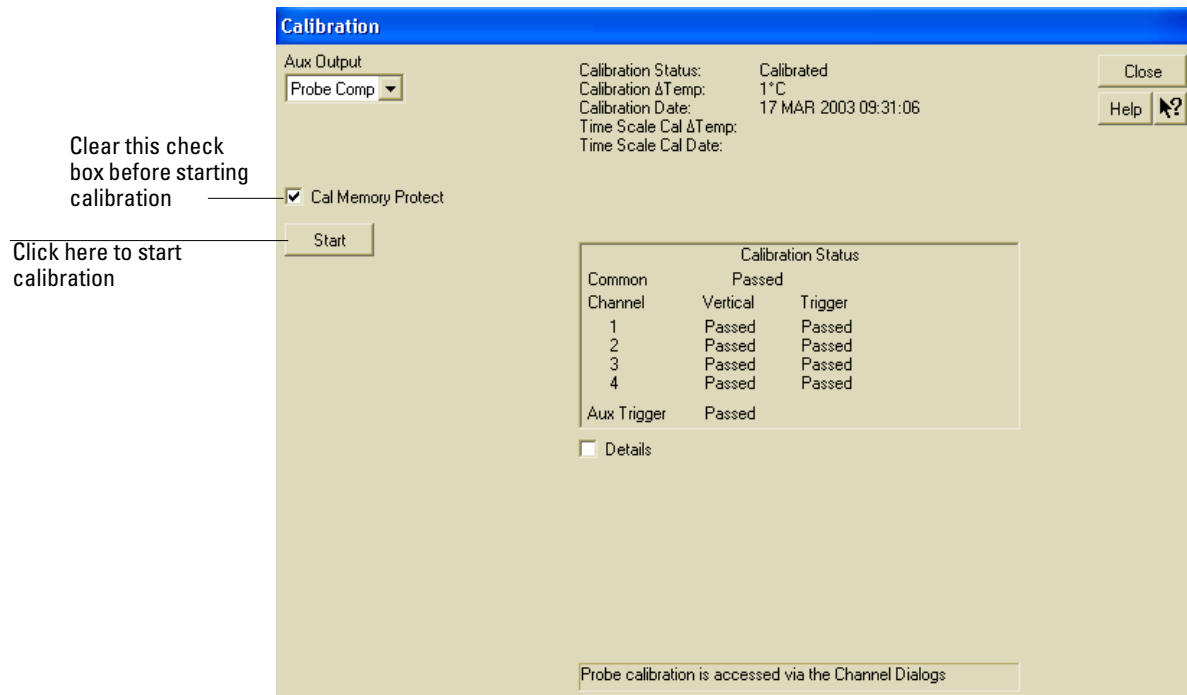
The self calibration should only be done after the oscilloscope has run for 30 minutes at ambient temperature with the cover installed. Calibration of an oscilloscope that has not warmed up may result in an inaccurate calibration.

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 4-3.

Figure 4-1



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 Disconnect everything from all inputs and Aux Out.
- b Connect the shorting cap to each of the channel inputs, in turn.
- c Connect the cal cable from Aux Out to channel 1.

You must use the recommended calibration cable for this procedure. Refer to the Recommended Equipment table for the correct cable type. In particular, when calibrating the 54855, 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 Decide if you wish to perform the Time Scale Calibration. Your choices are:

- Calibrate - 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: $10\text{MHz} \pm 0.4\text{ppm} = 10\text{MHz} \pm 4\text{Hz}$
Amplitude: $0.2\text{V}_{\text{peak-to-peak}}$ to $5.0\text{V}_{\text{peak-to-peak}}$
Wave shape: Sine or Square
- Skip - 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.
- Default - Factory time scale calibration factors will be used. The 10 MHz reference signal will not be required. The remaining calibration procedure will continue.

e Connect the cal cable from Aux Out to each of the channel inputs and Aux Trig In, in turn.

f A Passed/Failed indication is displayed for each calibration section. If any section fails, repeat the self-calibration procedure.

5 After the calibration procedure is completed, click Close.

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Troubleshooting

Troubleshooting

This section provides troubleshooting information for the Agilent Technologies 54852/53/54/55 oscilloscope. The service strategy of this oscilloscope is replacement of defective assemblies.

Safety

Read the Safety Summary at the front 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, fire and electric shock). Lack of training and awareness of the hazards could result in electrical shock. 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) to protect your fingers from the fan blades.

Tools Required

You will need basic electronic troubleshooting tools, including a digital multimeter, external Atx supply or loopback connector, external monitor, and a 100 MHz oscilloscope. Performance verification tests have more stringent requirements. See chapter 1 for the list of recommended test equipment.

If you need to remove and replace assemblies, you will need some of the hand tools listed in chapter 6, “Replacing Assemblies.”

ESD Precautions

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

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 click on an object on the graphical interface, the instructions will be phrased something like this: “Click the OK button.”
- When you need to press a key, the instructions will be phrased something like this: “Press the Run key.”

Default Setup

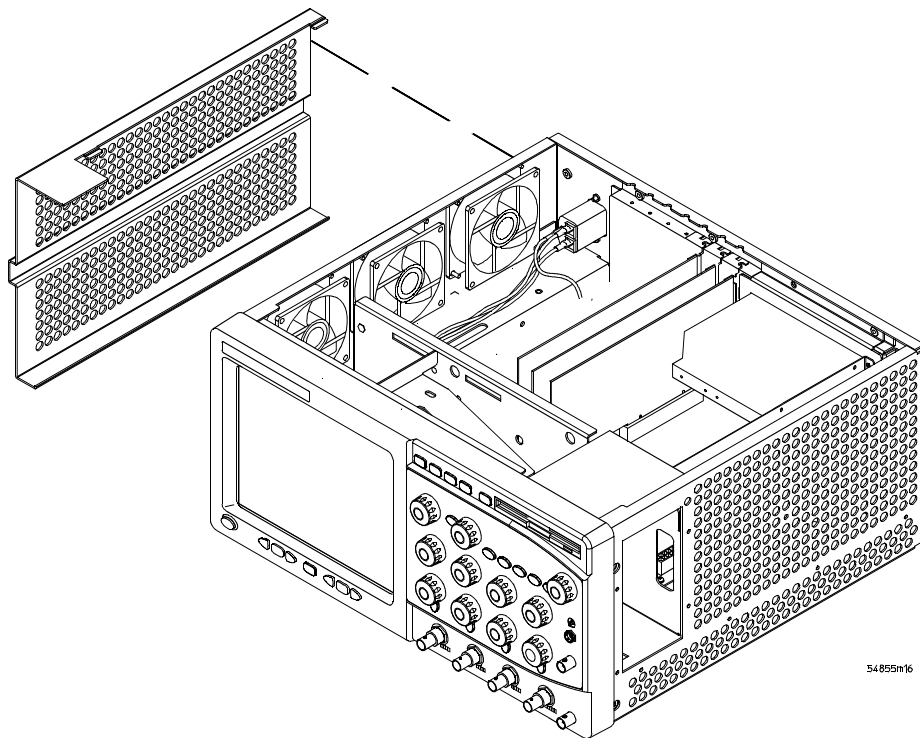
A Default Setup is provided to assure the oscilloscope setup is in a known default state. The default setup prevents previous setups from interfering with the next test. It also simplifies the oscilloscope setup procedure. Use the default setup when a procedure requires it.

- 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 5-1.

Figure 5-1



Installing the Fan Safety Shield

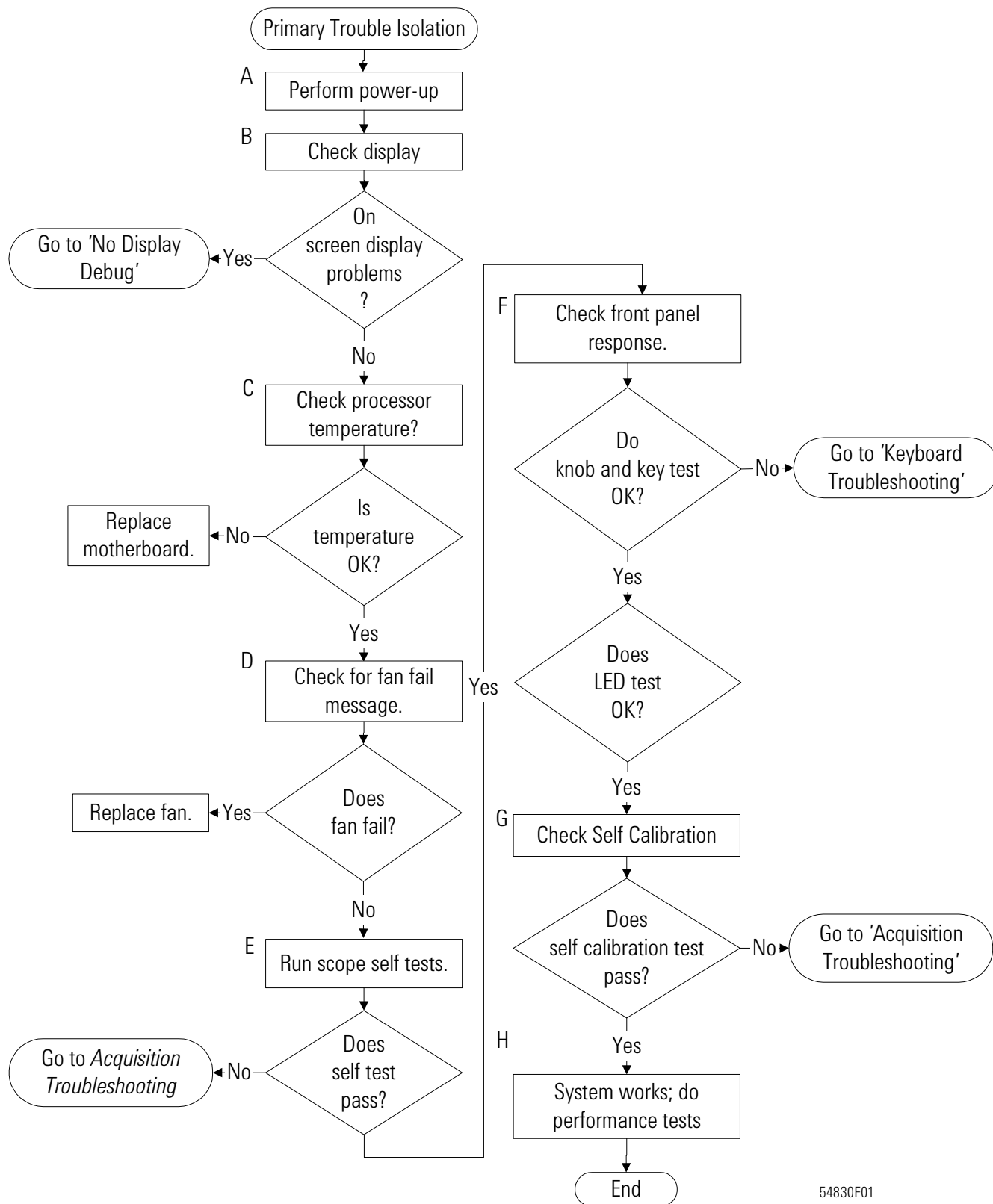
To troubleshoot the oscilloscope

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 chapter 6 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, and will direct you in an orderly manner through the possible failure symptoms. Reference letters on the flowcharts point to procedural steps that explain the brief instructions in the chart. Do not try to troubleshoot by following only the reference text because the text is not in the correct order for troubleshooting. Instead, simply follow the flowchart.

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

Primary Trouble Isolation Flowchart



54830F01

Primary Trouble Isolation

The actions in the Primary Trouble Isolation are done without disassembling the oscilloscope. Interaction of the front panel with the rest of the oscilloscope and other indicators are used to help identify the problem area.

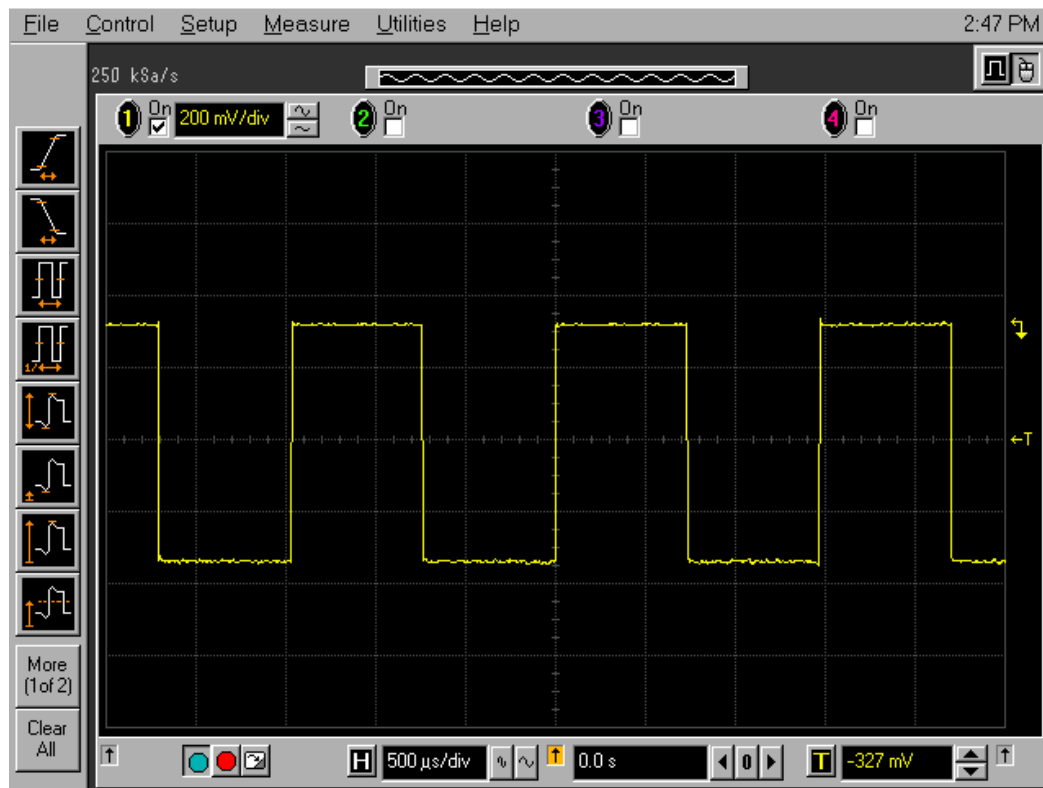
A letter is assigned to boxes in the flowchart. The letter corresponds to a specific section in the reference text. Be sure to use the flowchart itself for your troubleshooting path.

A Perform power-up.

1 Power-on the oscilloscope.

A short time after the oscilloscope is turned on, the scope graticule is displayed on the screen. The screen should look similar to the next figure. The exact appearance may vary depending on the setup selected before the oscilloscope was turned off.

Figure 5-2



Power-on Display Default (Graphical Interface Disabled)

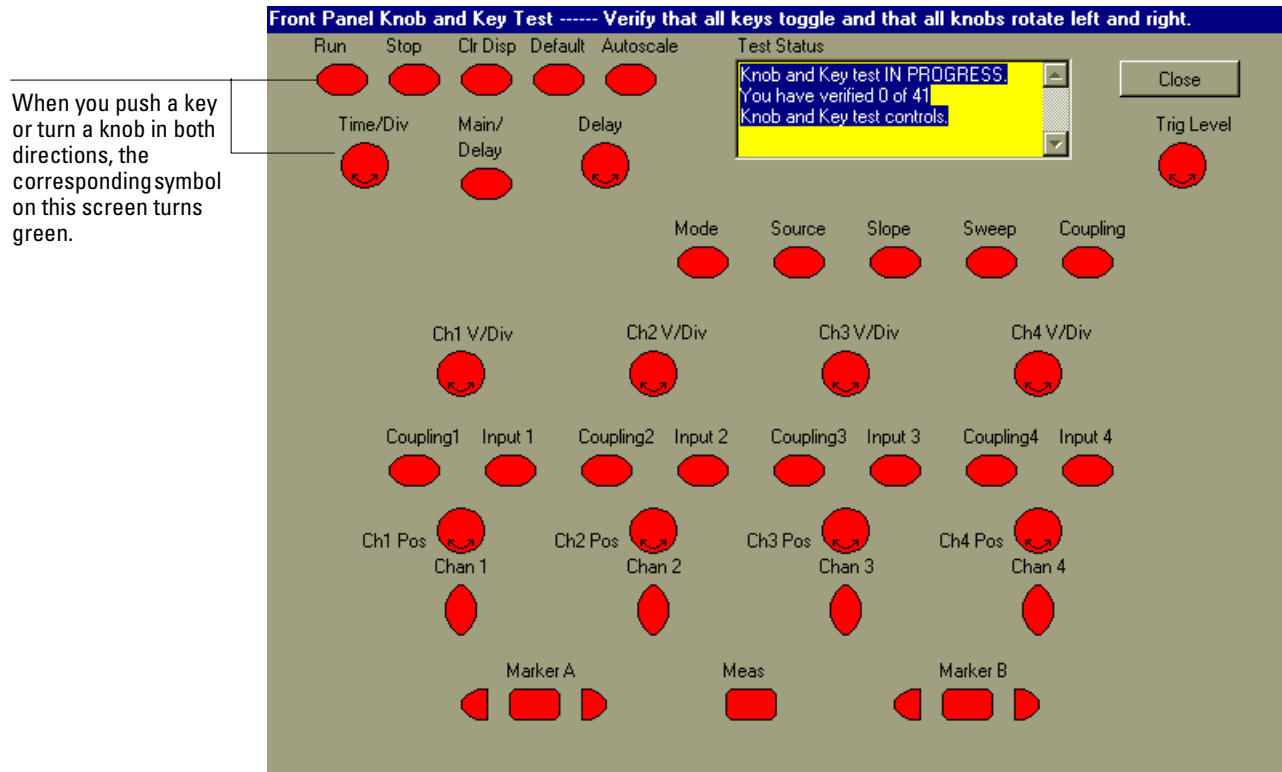
2 Press the Default Setup key.

B Check the display.

The display on the screen should be similar to the figure above. If there is no display on the oscilloscope flat-panel display after power-up, go to the No Display Trouble Isolation Flowchart otherwise go to step C.

- C** 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.
- D** 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.
- E** Run oscilloscope self-tests.
- 1 Enable the graphical interface. Refer to section 2 "Preparing for use" for instructions.
 - 2 Select Self Test from the Utilities menu.
 - 3 Select Scope Self Tests from the Self Test drop down list box.
 - 4 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 F.
- F** Check the front panel response by running the knob, key, and LED self tests.
- Use this procedure to verify correct keyboard operation.
- 1 Enable the graphical interface.
 - 2 Select Self Test from the Utilities menu.
 - 3 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 5-6.

Figure 5-3



Knob and Key Self Test Screen

- 4 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.

- 5 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.

- 6 When you are finished, click Close.

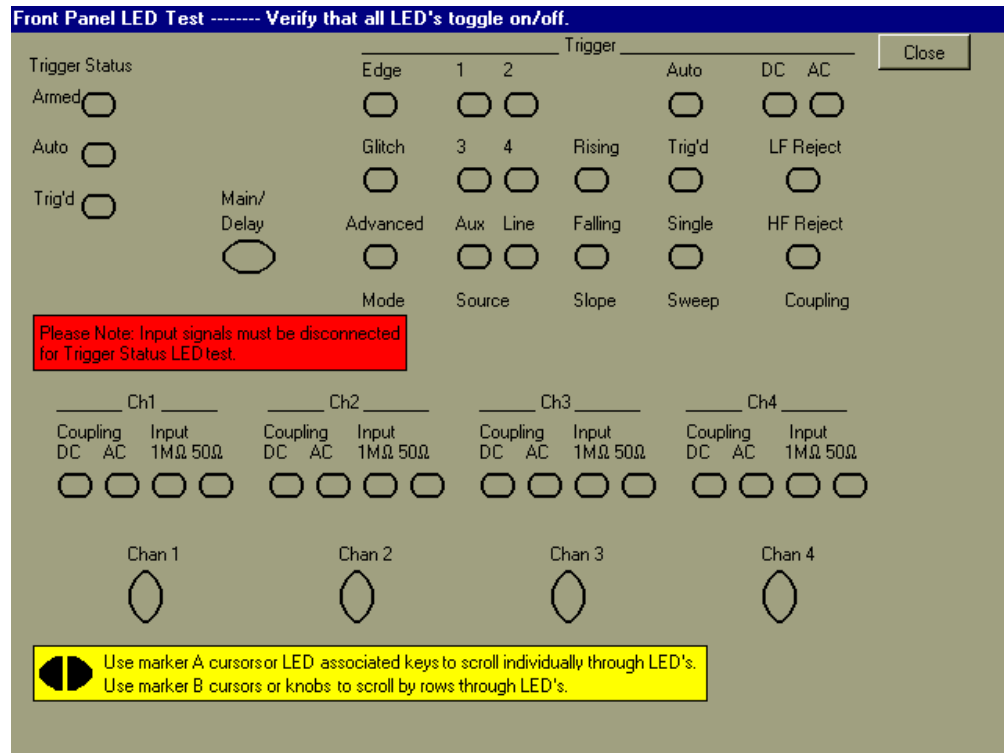
If any of the knobs or keys do not work, go to To check the keyboard; Troubleshooting Procedure 5-26.

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

- 1 Enable the graphical interface.
- 2 Select Self Test from the Utilities menu.
- 3 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 5-7.

Figure 5-4



LED Test Screen

- 4 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.

- 5 When you are finished, click Close.
- If any of the LEDs do not work, go to "To check the LEDs" later in this chapter.

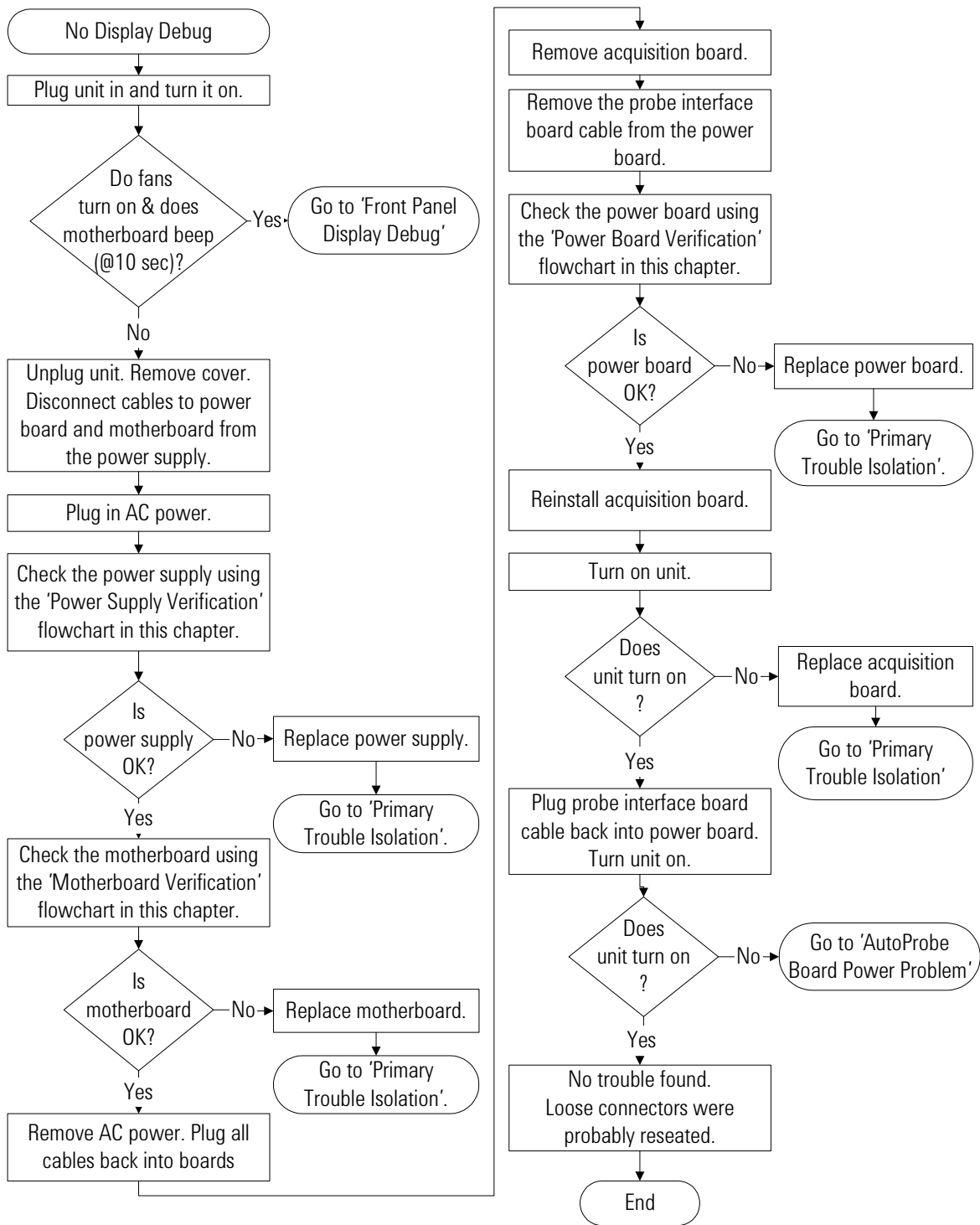
- 6 If both tests pass, go to step E.

G 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 F.

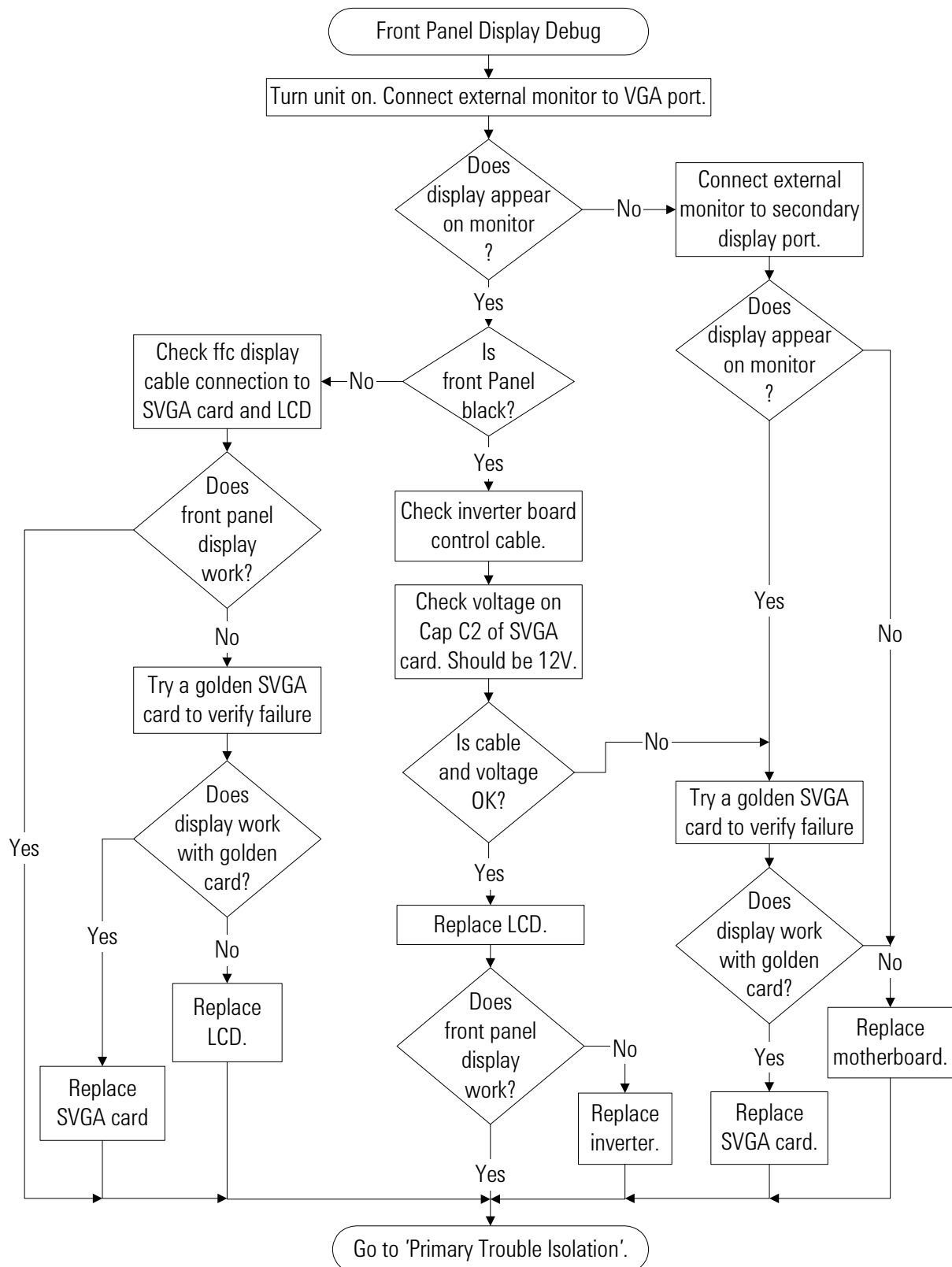
- H The system is operational. Performance test the oscilloscope using the procedures in chapter 3 of this service manual.

No Display Trouble Isolation



No Display Trouble Isolation Flowchart

Front Panel Display Debug



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.

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.

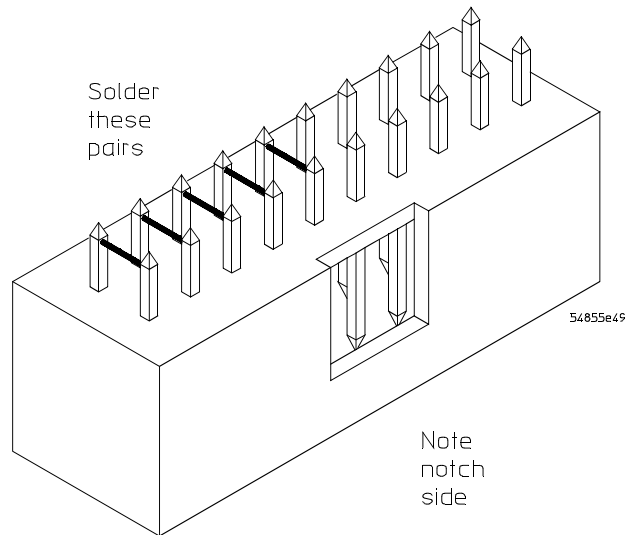
For information on how to replace the display parts, see chapter 6.

Motherboard Verification

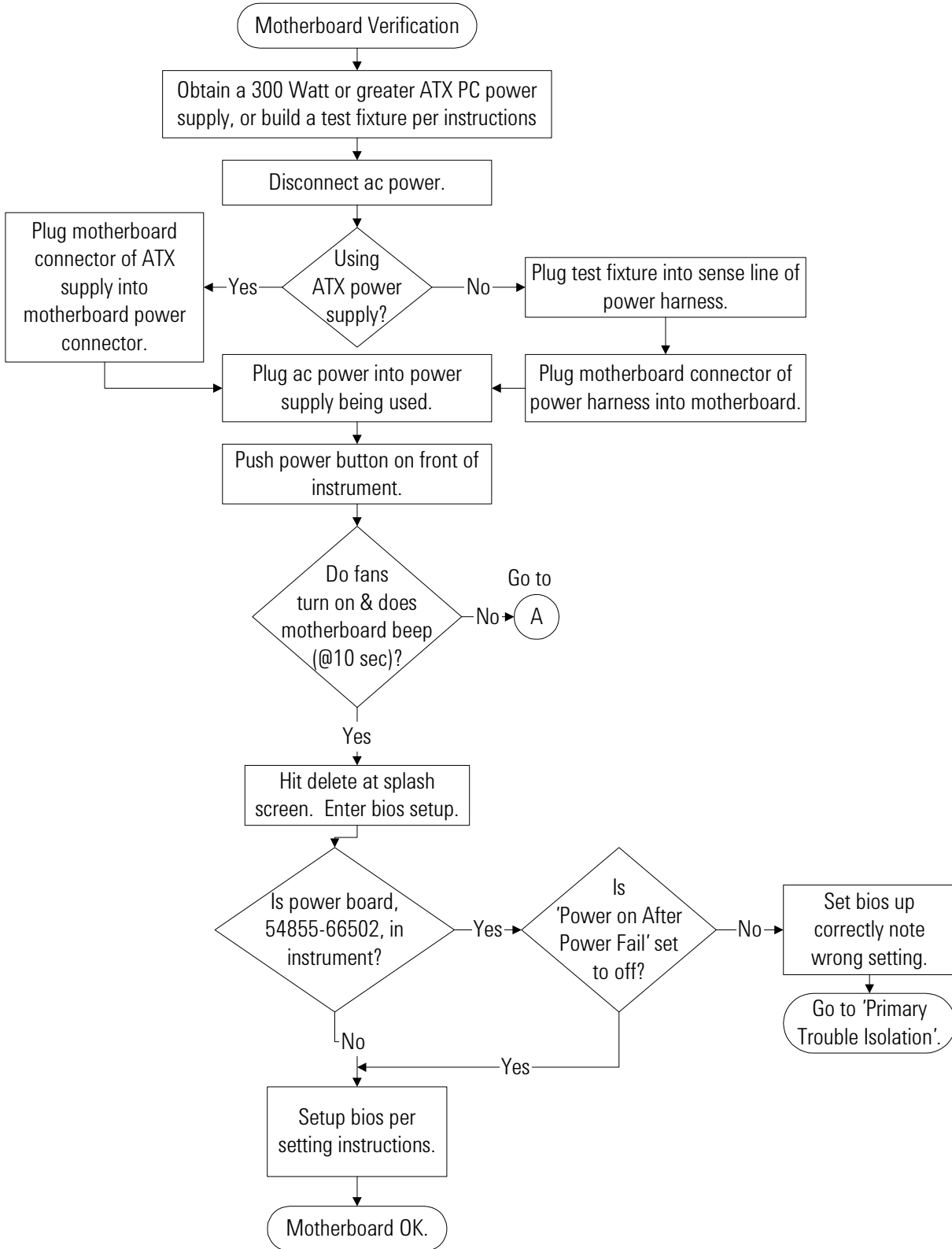
The motherboard verification requires the use of either a 300 Watt or greater ATX PC power supply or a test fixture that can be built as follows.

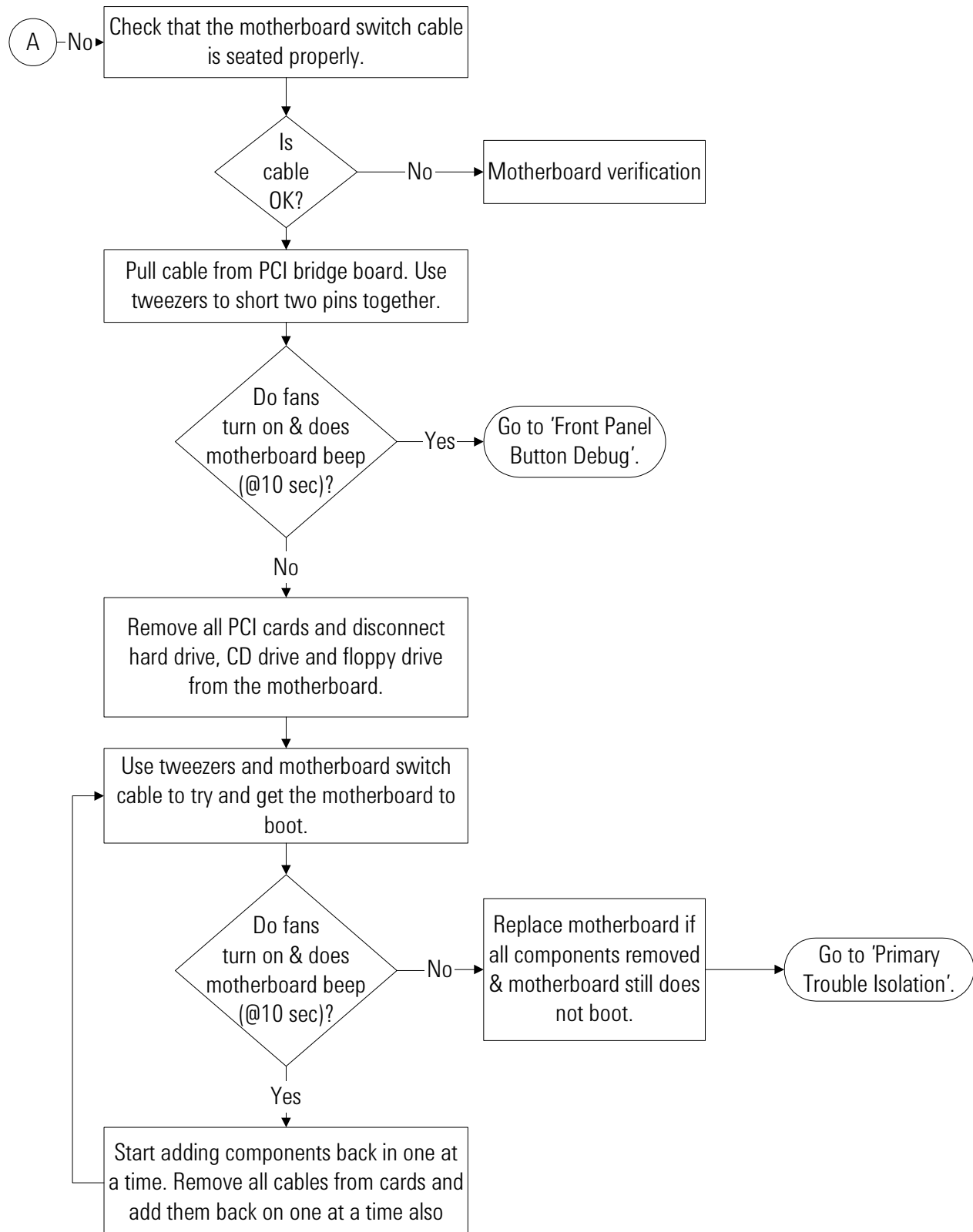
Using an AMP connector, Tyco Electronics part number 103168-8 or Agilent part number 1252-0659, solder wires between the pins as shown in the Figure 5-5.

Figure 5-5



Test Fixture





To configure the motherboard jumpers and setup BIOS

If the BIOS settings become corrupted, the Infiniium oscilloscope PC motherboard will not recognize the hard drive and the unit will not boot. To determine the correct BIOS setup procedure for your configuration, determine the following information:

- BIOS release number
- RAM size shown on screen at power-up

From this information, determine the correct WINBIOS setup procedure in order to enter the correct BIOS setting.

Configure the MOT series VP-22 1 GHz CPU, floppy drive, and CD-ROM.

This configuration is labeled “VIN #42” on the oscilloscope rear panel. Infiniium oscilloscopes of this configuration are equipped with the MOT Series VP-22 motherboard and the Intel 1 GHz processor. The motherboard’s voltage select is automatic for the correct processor voltage.

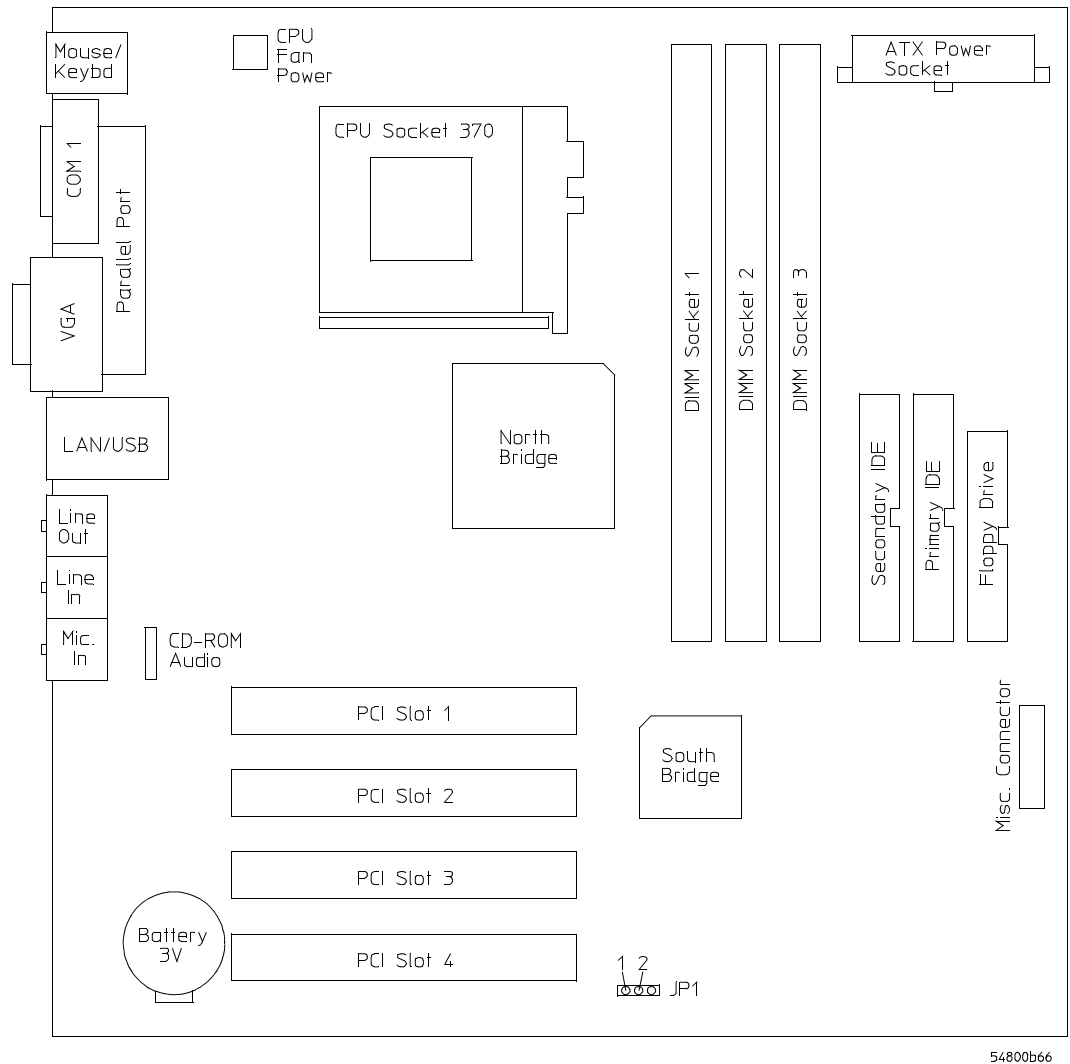
This motherboard configuration lists the following message or similar at turn-on:

Award Modular BIOS v.6.0PG
Copyright
VP22
Main Processor: Intel Pentium III 1 GHz
Memory Test: 262144K OK

See “Configure the MOT series VP-22 Motherboard BIOS parameters” for the appropriate BIOS setup procedure.

This configuration/vintage incorporates mechanical changes to the oscilloscope chassis and cabling to match the change in form factor of this motherboard. See Replaceable Parts chapter for new part numbers.

The motherboard jumper information and BIOS setups procedures are presented in the following pages.



Configure the MOT series VP-22 Motherboard BIOS parameters.

Use this procedure to set the MOT VP-22 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 are not seeing the prompt, or the oscilloscope does not appear to be functioning, check the motherboard jumper setting, and the ribbon cable connectors. Otherwise, continue with the next step.

BIOS Setup Procedure

- 1** Go to **Load Setting 2 Defaults** and press Enter key. Select **Y** to load the defaults of **BIOS Setting 2** and press the Enter key.
- 2** If you have a power board part number 54855-66502 then perform the following steps. Otherwise, go to step 7.
- 3** Go to **Power Management Setup** and press the Enter key.
- 4** Select the **PWORN After PWR-Fail** setting and press the Enter key.
- 5** Select the **Off** option and press the Enter key.
- 6** Return to the **CMOS Setup Utility** by pressing the Esc key.
- 7** Press F10 to save and exit the setup. Type “Y” to save changes.

POST Code Listing

Use the following listing to troubleshoot the motherboard. You will need a POST (Power-On Self Test) card installed in an PCI slot to use this listing.

POST Code Listing

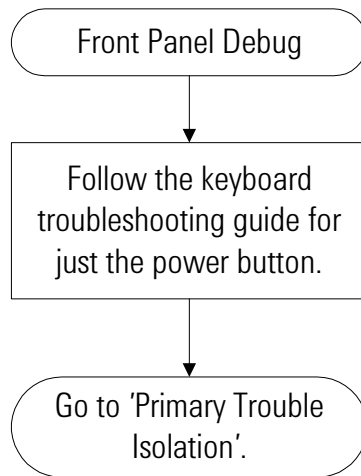
Checkpoint**Code****Description**

CF	Test CMOS read/write functionality
C0	Early Chipset Initialization. Disable Shadow RAM; Program basic chipset registers.
C1	Memory Detect.
C3	Expand the compressed BIOS code to DRAM.
C5	Use chipset hook to copy BIOS back to shadow RAM in E000 & F000.
01	Expand the Xgroup codes located in physical address 1000:0.
03	Initialize Superio_Early_Init switch
05	Blank out the screen and clear CMOS error flag.
07	Clear 8042 interface and Initialize 8042 self-test.
08	Test keyboard controller for Winbond 977 series Super I/O chips and enable keyboard interface.
0A	Disable PS/2 mouse interface (optional). Auto detect mouse and keyboard ports. Reset Keyboard for Winbond 977 series Super I/O chips.
0E	Test F000 segment shadow to see if it is R/W-able or not. If test fails the speaker will keep beeping.
10	Auto detect flash type to load appropriate flash R/W codes into the runtime area in F000 for EscD & DMI support.
12	Use walking 1's algorithm to check out the interface in CMOS circuitry. Set real time clock power status, and then check for override.
14	Program chipset default values into chipset. Chipset default values are MODBINable by OEM customers.
16	Initialize Early_Init_onboard_generator switch.
18	Detect CPU information.
1B	Initialize interrupts vector table.
1D	Initialize Early_PM_Init switch.
1F	Load keyboard matrix (notebook only).
21	Initialize HPM (notebooks only).
23	Check validity of RTC value. Load CMOS setting into BIOS stack. If CMOS checksum fails use default values. Prepare BIOS resource map for PCI and PnP use. Onboard clock generator initialized. Early PCI initialization.
27	Initialize Int 09 buffer.
29	Program CPU internal MTRR for 0-640K memory address. Initialize the APIC for pentium class CPU. Measure CPU speed. Invoke video BIOS.
2D	Initialize multi language. Put information on screen display, including Award title, CPU type and speed.
33	Reset keyboard except Winbond 977 series Super I/O chips.
3C	Test 8254.

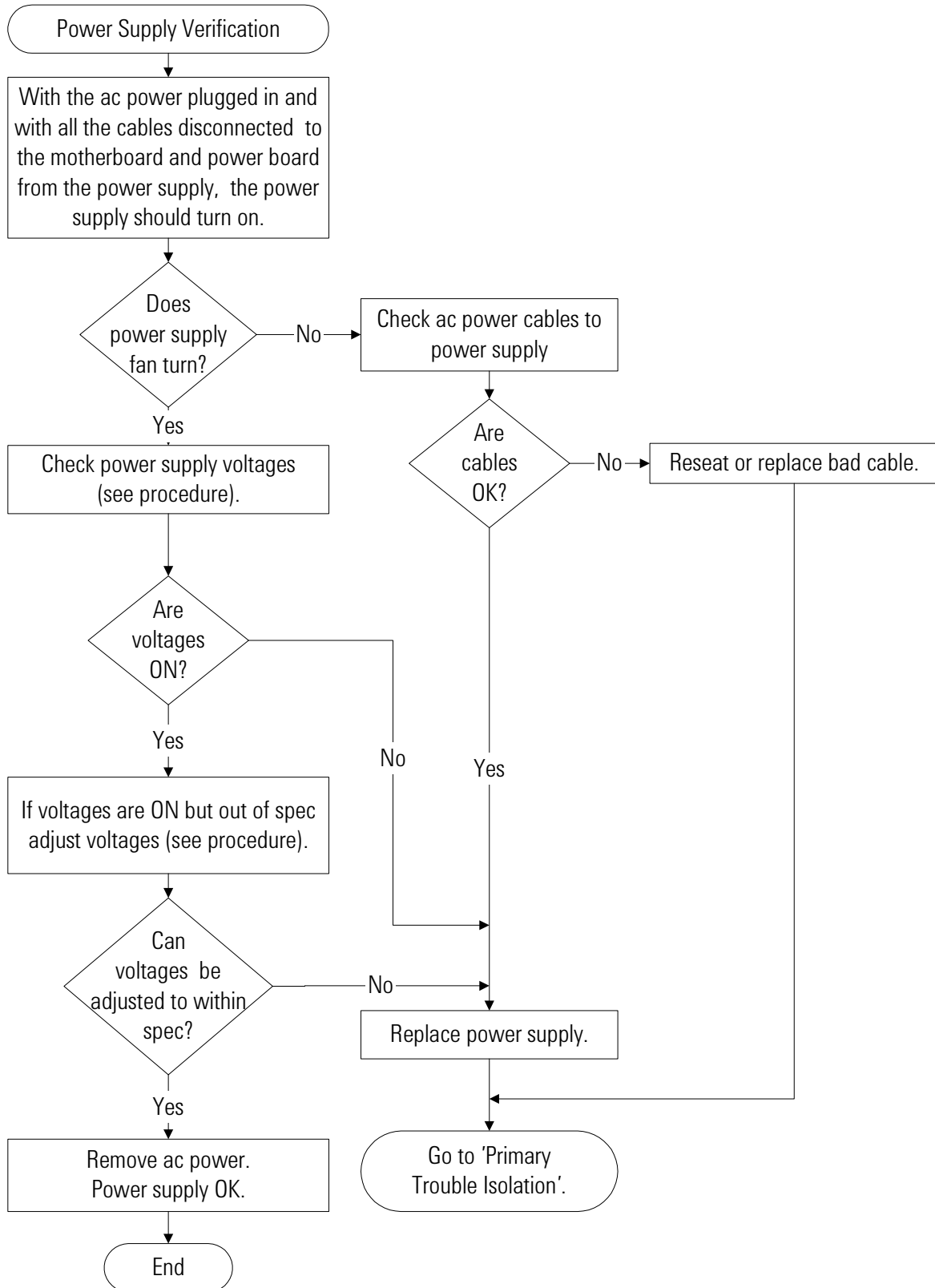
POST Code Listing

3E	Test 8259 interrupt mask bits for channel 1.
40	Test 8259 interrupt mask bits for channel 2.
43	Test 8259 functionality.
47	Initialize EISA slot.
49	Calculate total memory by testing the last double word of each 64K page.
4E	Program MTRR of M1 CPU. Initialize APIC for P6 class CPU.
50	Initialize USB.
52	Test all memory and clear all extended memory to 0.
55	Display number of processors for multi processor platforms.
57	Display PnP logo. Early ISA PnP initialization.
59	Initialize the combined Trend Anti-Virus code.
5B	Show message for entering awardflash.exe.
5D	Initialize Init_Onboard_Super_IO switch. Init_Onboard_AUDIO switch
60	Okay to enter setup utility.
65	Initialize PS/2 mouse.
67	Prepare memory size information for function call: INT 15hex ax=E820hex.
69	Turn on L2 Cache.
6B	Program Chipset registers according to items dEscribed in setup & Auto configuration table.
6D	Assign resources to all ISA PnP devices. Auto assign ports to COM ports if setup is on Auto.
6F	Initialize floppy controller. Set up floppy related fields in 40:hardware.
73	Enter AWARDFLASH.EXE if found if floppy drive.
75	Detect and install all IDE devices. Example: hard drive, LS120, CDROM.
77	Detect serial ports and parallel ports.
7A	Detect and install co-processor.
7F	Switch back to text mode if full screen is supported.
82	Call chipset power management hook. Recover the text found used by EPA logo. If password is set, ask for password.
83	Save all data in stack back to CMOS.
84	Initialize ISA PnP boot devices.
85	USB final initialization. Net PC. Switch screen back to text mode. Set up APCI table at of memory. Invoke ISA adapter ROMs. Assign IRQs to PCI devices. Initialize APM. Clear noise of IRQs.
93	Read HDD book sector information for trend Anti-Virus code.
94	Enable L2 Cache. Program boot up speed. Chipset final initialization. Power management final initialization. Clear screen & display summary table. Program K write allocation. Program P6 class write combining.
95	Program Daylight Savings. Update Keyboard LED an typematic rate.
96	Build MP table. build and updated EscD. Set CMOS century to 20 Hex or 19Hex. Load CMOS time into DOS timer tick. Build MSIRQ routing table.
FF	Boot Attempt (INT 19 Hex).

Front Panel Debug



Power Supply Trouble Isolation

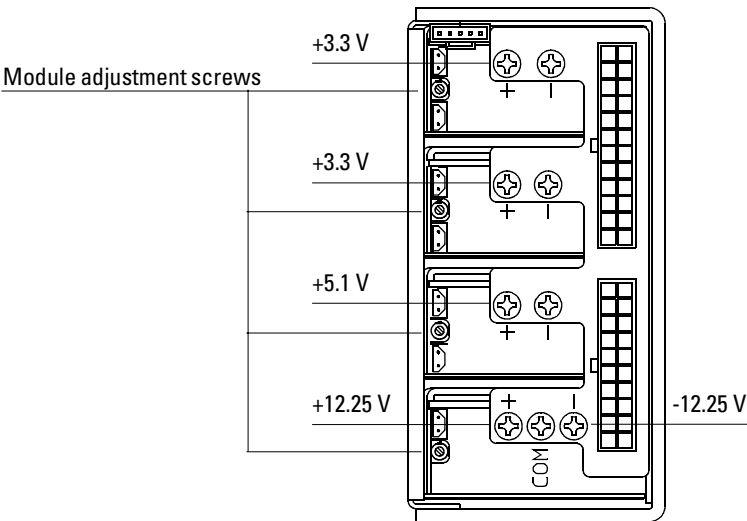


Power Supply Trouble Isolation Flowchart

These trouble isolation instructions help isolate the problem to the assembly level when the power supply is not operating. Because of advanced power supply 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 on the power supply. See Figure 5-6 for the location of these test points. Table 5-7 on page 23 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
+5.1 V \pm 0.4%	+5.08 V to +5.12 V
+3.3 V \pm 0.4%	+3.33 V to +3.36 V
+12.25 V \pm 0.4%	+12.2 V to +12.3 V
-12.25 V \pm 10%V	-11.03 V to -13.48 V

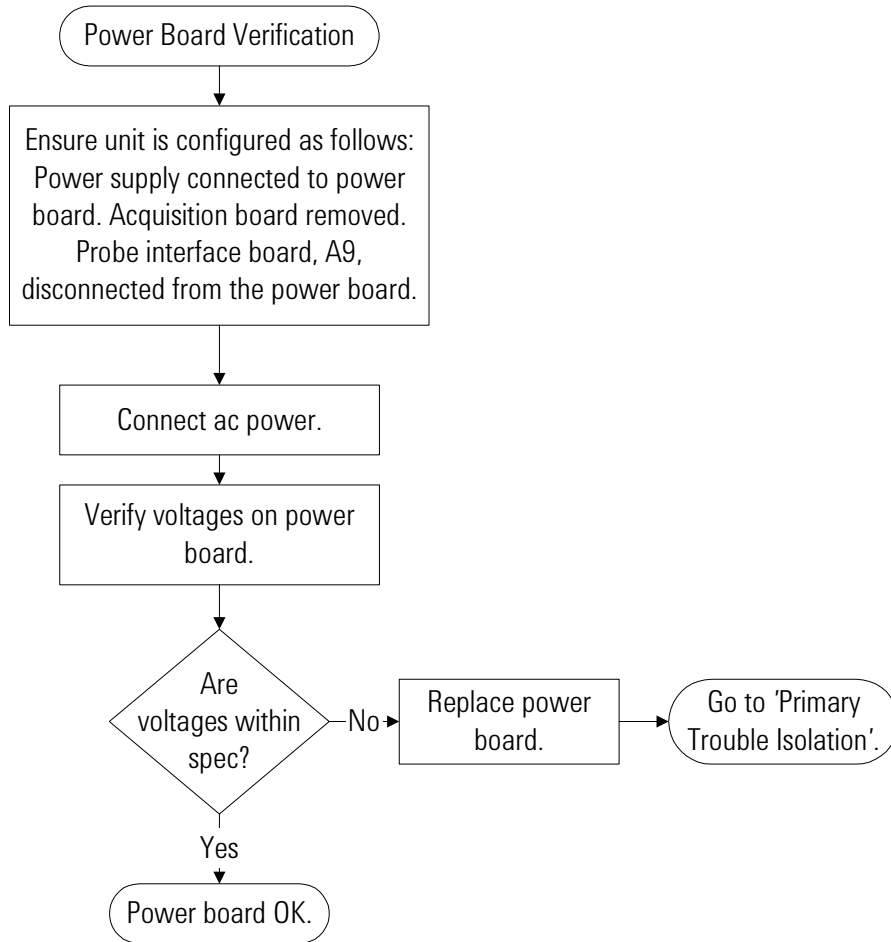
Power supply adjustment procedure

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.

- 2 Use a volt meter to monitor each of the supply's output voltages. Use a long screwdriver, being careful not to touch any other components, to turn the adjustment screw for each supply voltage until it is within the specified limits.

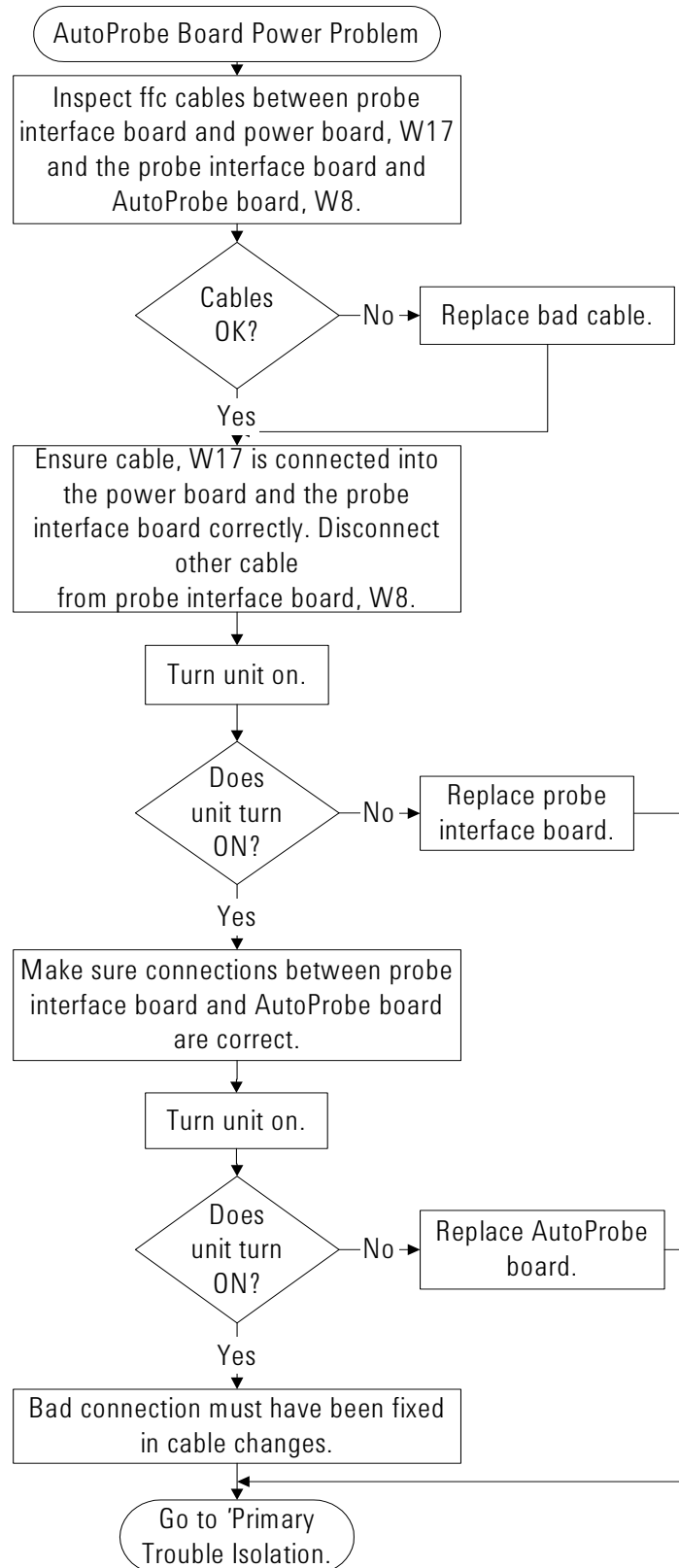
Power Board Trouble Isolation



Power Board Check

Connector	Test Point	Specification	Range
J4	AVDD4F	+1.62 V \pm 1%	+1.60 V to +1.64 V
	AVDD34	+1.60 V \pm 3%	+1.55 V to +1.65 V
J5	AVDD3F	+1.62 V \pm 1%	+1.60 V to +1.64 V
	+2.0 V	+2.0 V \pm 0.4%	+1.992 V to +2.008 V
	-1.4 V	-1.4 V \pm 0.3%	-1.3958 to -1.4042 V
J6	+3.3 V	+3.35 V \pm 0.4%	+3.3366 V to +3.3634 V
	-5.2 V	-5.2 V \pm 0.4%	-5.1792 V to -5.2208 V
J7	+5VF	+5.0 V \pm 0.4%	+4.98 V to +5.02 V
	-2 V	-2.0 V \pm 0.4%	-1.992 V to -2.008 V
	-3.3 V	-3.3 V \pm 0.4%	-3.2868 V to -3.3132 V
	AVDD2F	+1.62 V \pm 1%	+1.6038 V to +1.6362 V
J8	AVDD12	+1.60 V \pm 3%	+1.552 V to +1.648 V
	AVDD1F	+1.62 V \pm 1%	+1.6038 V to +1.6362 V
J9	+2.5 V	+2.5 V \pm 0.4%	2.49 V to +2.51
	-12 VF	-12 V \pm 10%	-10.8 V to -13.2 V
	+12 VF	+12 V \pm 0.4%	+11.952 V to +12.048 V

AutoProbe Board Trouble Isolation



To check the keyboard; Troubleshooting 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 V \pm 0.5 V when both LEDs are supposed to be off.
- 2.5 V \pm 0.5 V when Trig'd is supposed to be on and Auto is supposed to be off.
- 5.0 V \pm 0.5 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.

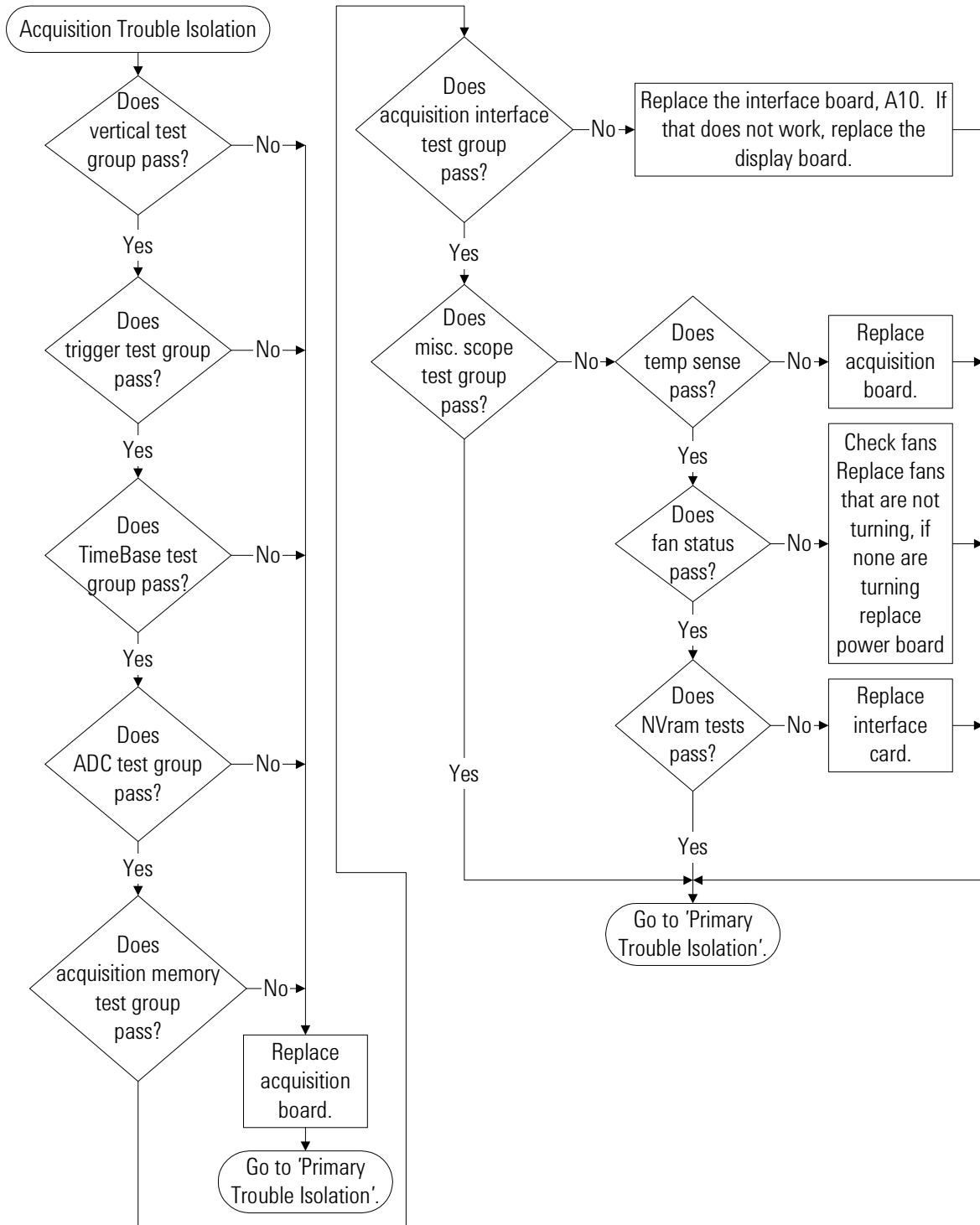
If you find a problem with the Armed LED, check pin 5 of W16 with the cable disconnected from the keyboard. The voltage should be as follows:

- 5.0 V \pm 0.5 V when Armed is supposed to be on.
- < 3.6 V \pm 0.5 V when Armed is supposed to be off.

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.

To troubleshoot the acquisition system



Software Revisions

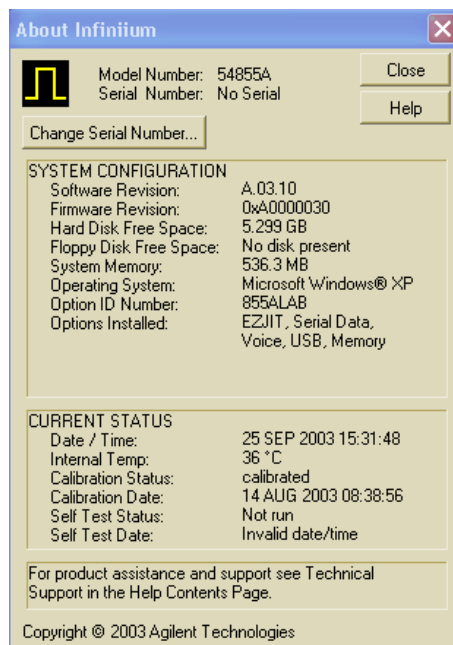
- Select About Infiniium... from the Help Menu.

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 5-8



About Infiniium... Information

To check probe power outputs

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

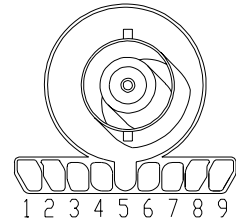
Use the table and figure to the right to check the power output at the connectors.

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 & 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 _p
8	–12 V
9	+12 V



Any failure may be a problem with the probe power and control assembly, the AutoProbe flex cable W8, the probe power and control cable W17, or the power board.

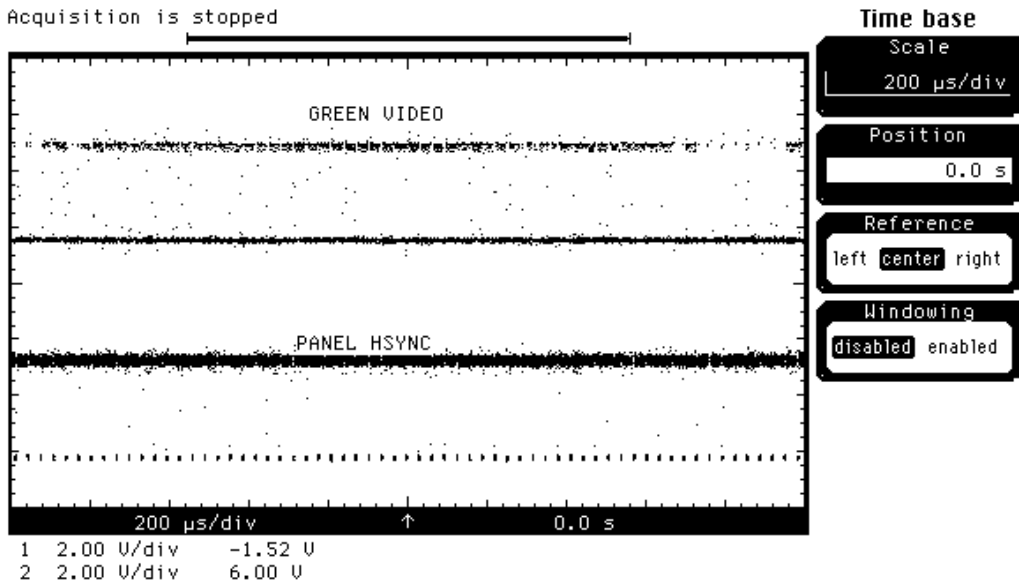
To check the display board video signals

The video signals are checked on the 40-pin connector J103 on the display board A5. Use a 100 MHz, general-purpose oscilloscope, such as the Agilent Technologies 54600B, to verify the signals. Even-numbered pins are on the top side of the connector. The video signals are present during the system boot process before the backlights come on. 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.

Table 5-9

Video Signals	
Pin Number	Signal
1-2	+3.3 V
3, 5-6	NC
4, 7-9, 11, 15, 19, 23, 27, 31, 35, 38, 40	Ground
12-14, 16-18	Blue video
20-22, 24-26	Green video
28-30, 32-34	Red video
10	Panel enable
36	Panel HSync
37	Panel VSync
39	Panel Clk

Figure 5-10



Video Signals

To check the backlight inverter voltages

WARNING

SHOCK HAZARD!
The backlight inverter assembly, which is mounted at the front corner of the oscilloscope near the flat-panel display, can operate at a voltage as high as 1.3 kV ac_{rms}. DO NOT handle this assembly while it is in operation.

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

- There is one input connector on the side of the board.
- There are two output connectors, one at each end of the board (top and bottom), which power the two backlights inserted into the flat panel display.

The output voltage is approximately 300-450 V_{rms}, 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.

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 A5.

Table 5-11

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

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To return the oscilloscope to Agilent Technologies for service 6-3
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To disconnect and connect Mylar flex cables 6-6
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To remove and replace the probe power and control board 6-9
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To remove and replace the front panel assembly 6-13
To remove and replace the keyboard and flat-panel display assemblies 6-16
To remove and replace the acquisition board assembly 6-19
To remove and replace the power regulator distribution board 6-22
To remove and replace the interface and GPIB board 6-23
To remove and replace the oscilloscope graphics board and display board 6-24
To remove and replace the floppy disk drive 6-25
To remove and replace the internal hard disk drive 6-26
To remove and replace the CD-ROM drive 6-28
To remove and replace the motherboard 6-30
To remove and replace the power supply 6-32
To remove and replace the fans 6-36

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.

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
- 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.

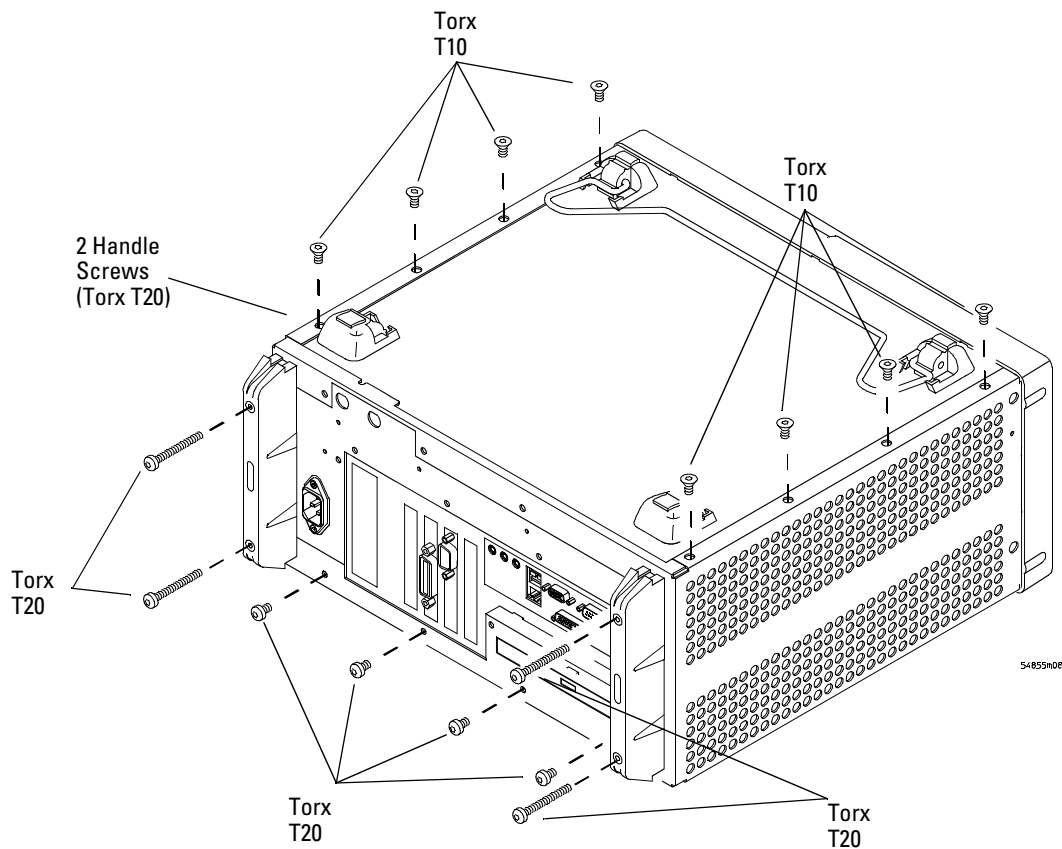
In any correspondence, refer to oscilloscope by model number and full serial number.

To remove and replace the covers

When necessary, refer to other removal procedures.

- 1 Disconnect the power cable.
- 2 Disconnect all scope 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 eight Torx T20 screws that secure the top cover to the rear of the chassis.
- 7 Place the unit so the bottom is facing up.
- 8 Remove the eight Torx T10 screws that secure the top and bottom covers to the chassis.
- 9 Place the unit so the top is facing up.

Figure 6-1



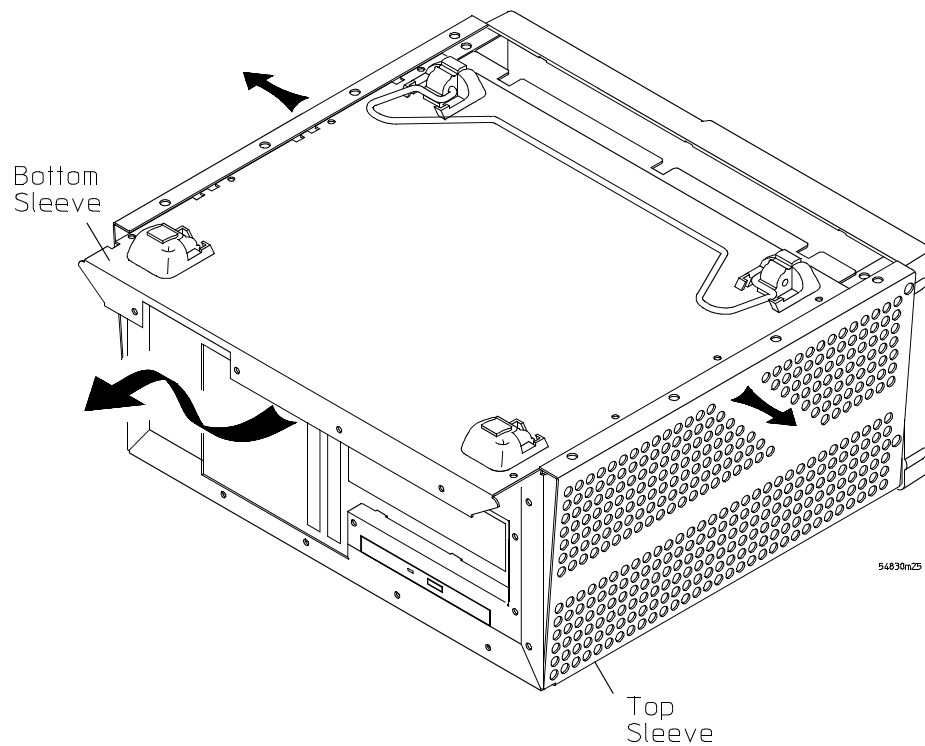
Fasteners to remove handle, rear feet, top cover

- 10 Carefully slide the top cover off of the frame by pulling the front panel and the top cover away from each other.
- 11 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

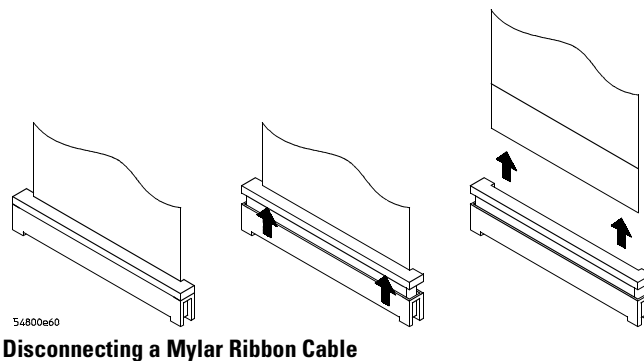
CAUTION

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.

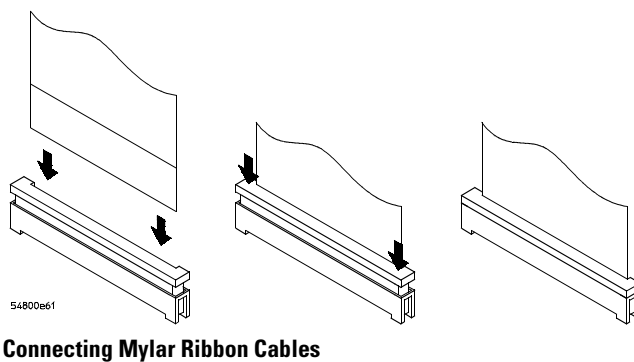
Figure 6-3



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.

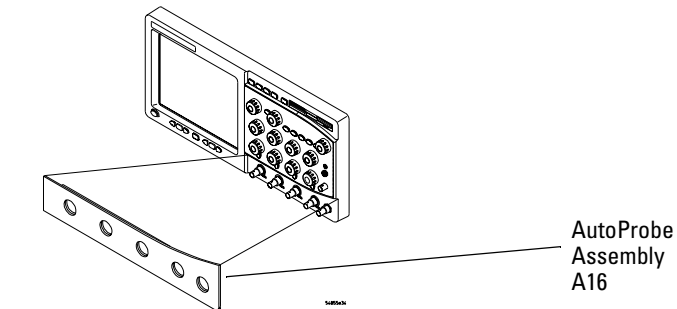
Figure 6-4



To remove and replace the AutoProbe assembly

When necessary, refer to other removal procedures.

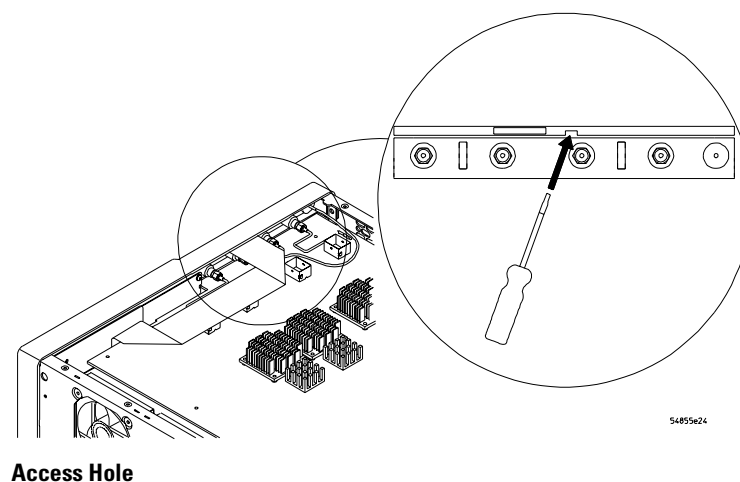
Figure 6-5



AutoProbe Assembly

- 1 Disconnect the power cable and remove the top and bottom covers.
- 2 Remove the AutoProbe assembly, the subpanel, and the probe connector assembly that fits around the front-panel BNC connectors, 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 6-6

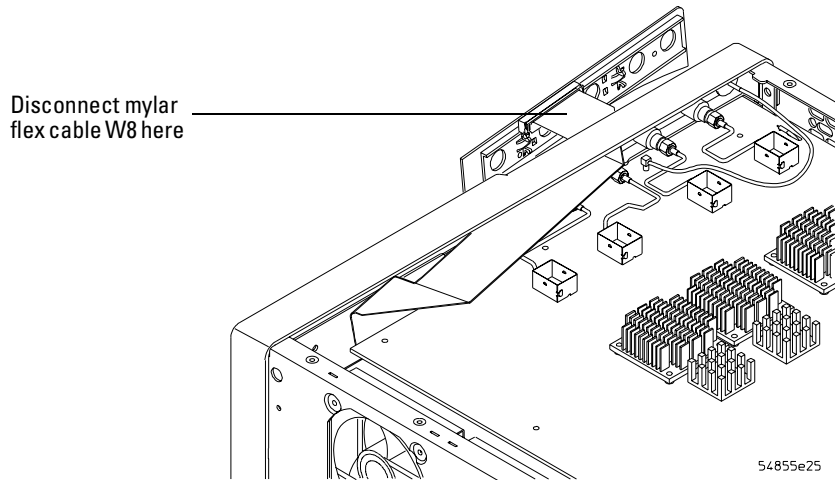


CAUTION

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.

- d** Disconnect the mylar flex cable W8 from the AutoProbe board.
See “To disconnect and connect Mylar flex cables” in this chapter.

Figure 6-7



Pushing Out the AutoProbe Faceplate

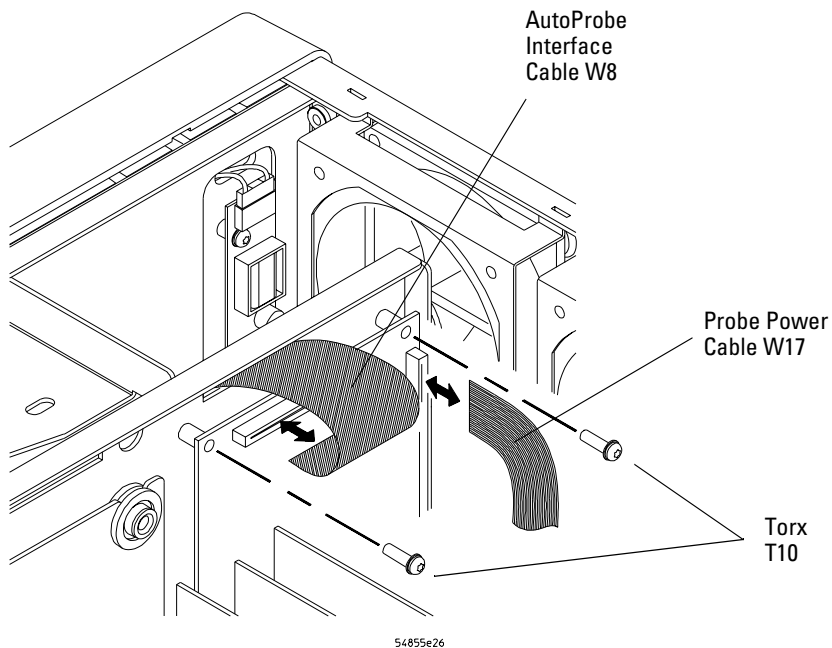
- 3** To replace the AutoProbe assembly, reverse the above procedure.

To remove and replace the probe power and control board

When necessary, refer to other removal procedures.

- 1 Disconnect the power cable and remove the top cover.
- 2 Disconnect the mylar flex cable W8 that connects the probe power and control assembly to the AutoProbe assembly.
The connector must be unlocked before you can remove the flex cable. See “To disconnect and connect Mylar flex cables” in this chapter.
- 3 Disconnect the mylar flex cable W17 from the probe power and control assembly.

Figure 6-8



Remove the Probe Power and Control Assembly

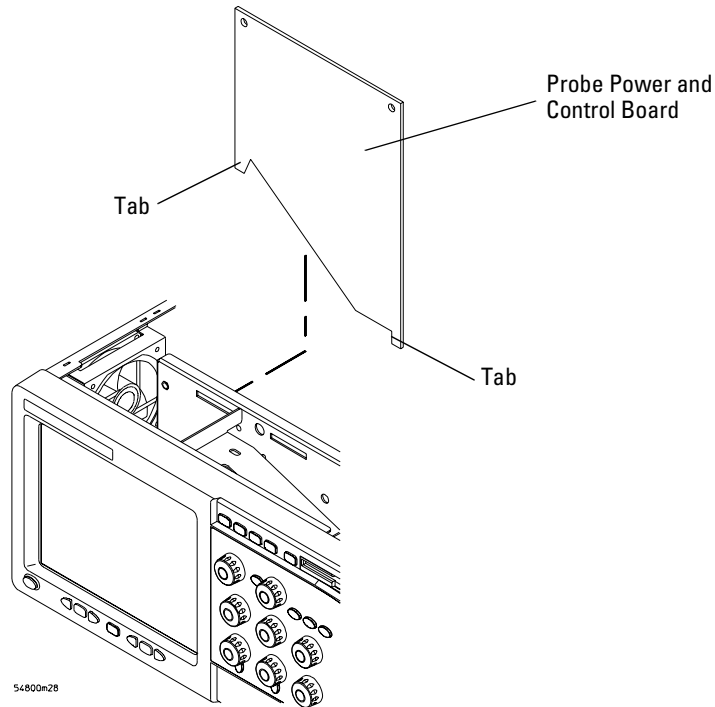
- 4 Remove the two Torx T10 screws securing the probe power and control assembly to the chassis.
- 5 Lift the probe power and control assembly out and away from the chassis.

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 reconnect mylar flex cables” in this chapter.

Figure 6-9

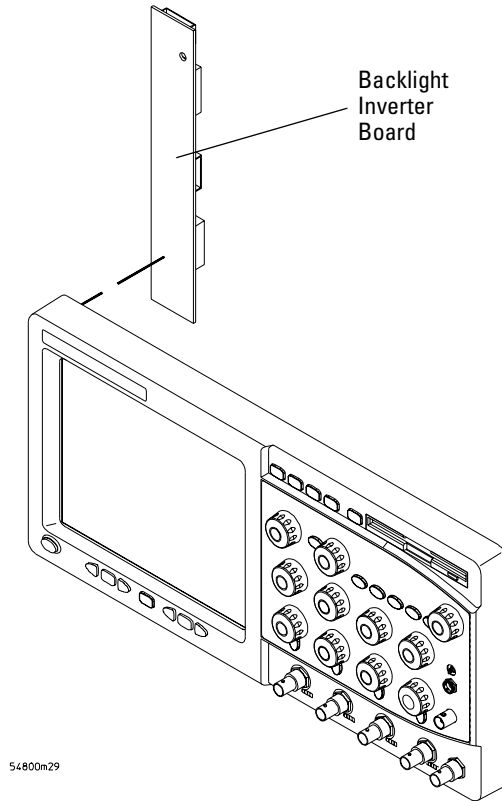


Probe Power and Control Assembly

To remove and replace the backlight inverter board

When necessary, refer to other removal procedures.

Figure 6-10



Backlight Inverter Board

WARNING

SHOCK HAZARD!

The backlight inverter assembly, which is mounted at the front corner of the oscilloscope near the flat-panel display, operates at a high voltage of 1.3 kV $a_{c_{rms}}$. DO NOT handle this assembly while it is in operation.

- 1 Disconnect the power cable and remove the top and bottom covers.

To remove and replace the backlight inverter board

- 2 Disconnect the two backlight cables from the top and bottom of the backlight inverter board.

You can either stand the chassis on end or turn it over to gain access to both cables.

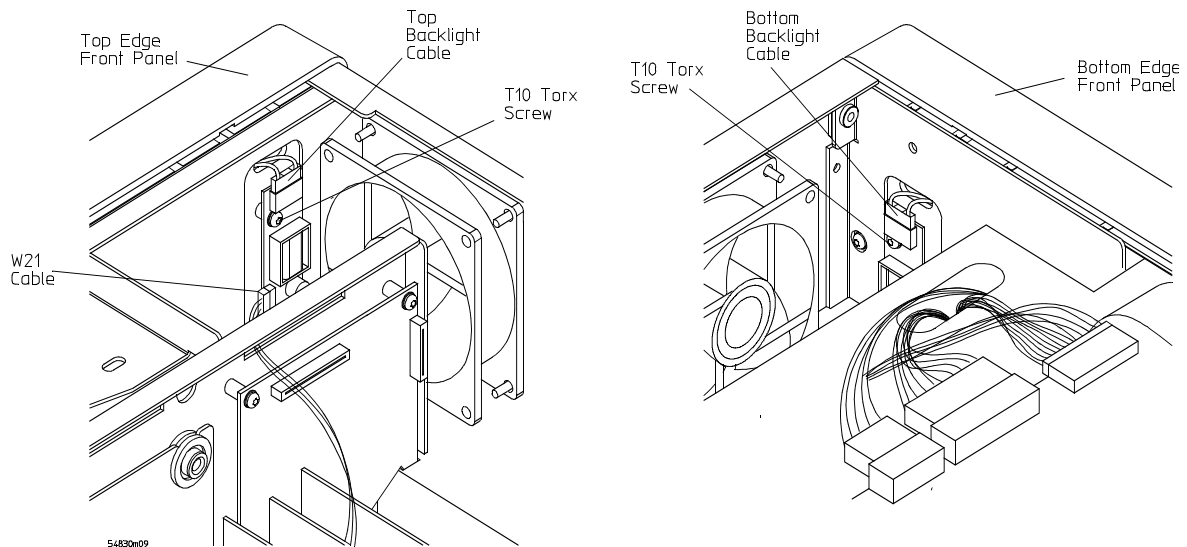
- 3 Disconnect the backlight primary cable W21 from the side of the backlight inverter board.

- 4 Remove the two Torx T10 screws that secure the backlight inverter board to the chassis.

Avoid Interference

You may need to use a Torx key or stubby Torx driver to avoid interference with other parts in the chassis.

Figure 6-11



Removing the Backlight Inverter Board

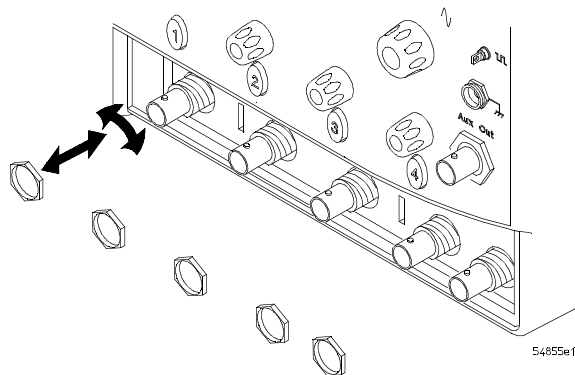
- 5 Lift the backlight inverter board out through the top of the chassis.
- 6 To replace the backlight inverter board, reverse the assembly procedure.

To remove and replace the front panel assembly

When necessary, refer to other removal procedures.

- 1 Disconnect the power cable and remove the top and bottom covers.
- 2 Remove the Auto-Probe assembly A16 and Mylar flex cable W8.
- 3 Using a 5/8" nut driver, remove the hex nuts that secure the BNC connectors to the front panel.

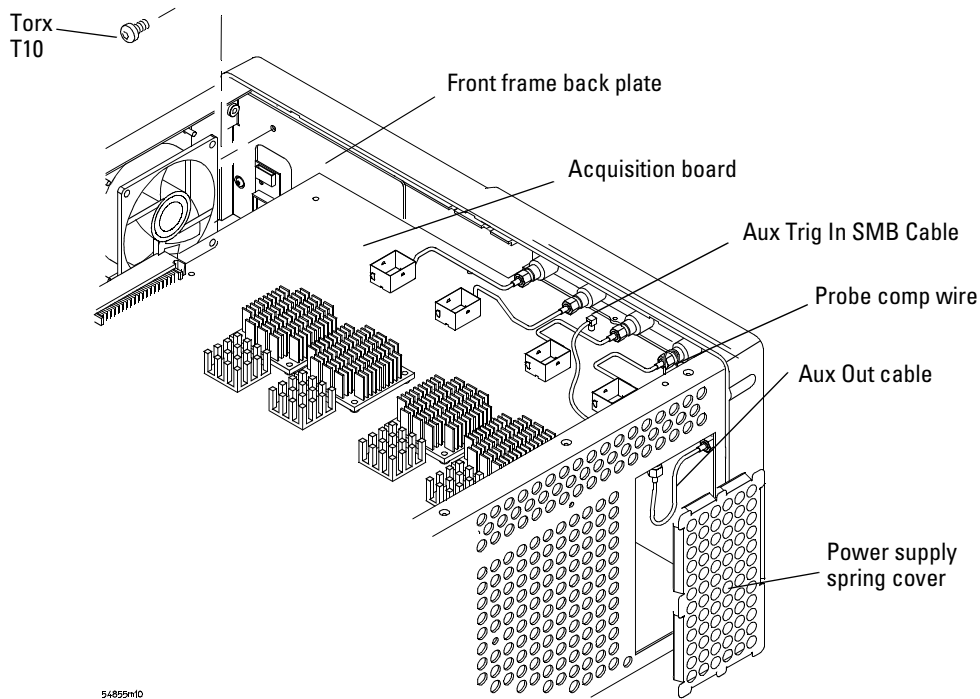
Figure 6-12



Removing the BNC Nuts

- 4 Remove the power supply spring cover from the left side of the chassis.
- 5 Using a 5/16" open-end wrench, disconnect the Aux Out semi-rigid cable from the rear of the front panel.
- 6 Disconnect the probe comp wire from the acquisition board. If necessary, use pliers to remove the probe comp wire.
- 7 Remove the Torx T10 screw that secures the front frame to the chassis.

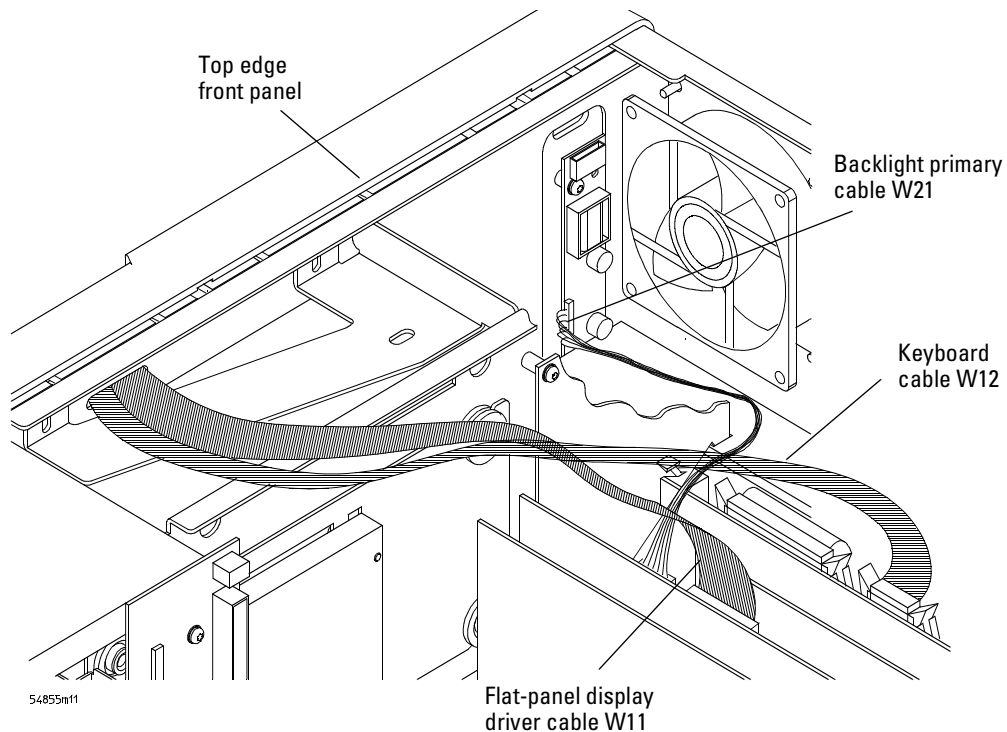
Figure 6-13



Removing Aux Out Cable W9, Probe Comp Wire W10, and Back Plate Screw

- 8 Disconnect the backlight primary cable W21, flat-panel display driver cable W11, and keyboard cable W12.

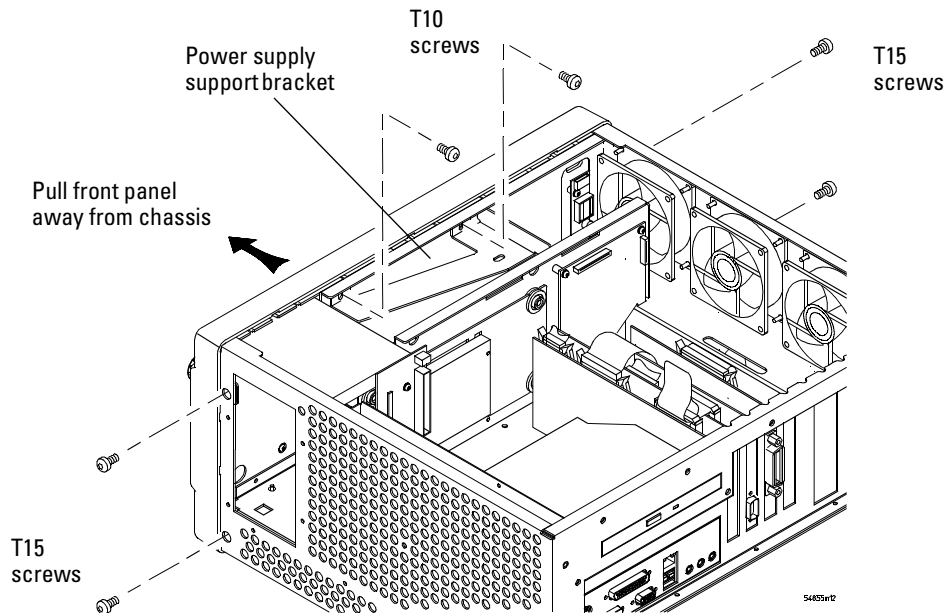
Figure 6-14



Disconnecting W21 Backlight Primary Cable, W11 Display Driver Cable, and W12 Keyboard Cable

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

Figure 6-15



Front Panel Side Screws

- 10 Remove the two Torx T10 screws that secure the power supply support bracket to the front panel assembly.
- 11 Pull the front panel assembly away from the chassis, being careful to feed the ribbon cables W16 and W20 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.
Ensure that you observe polarity designations when reconnecting the ribbon cables.

Replacing the BNC hex nuts

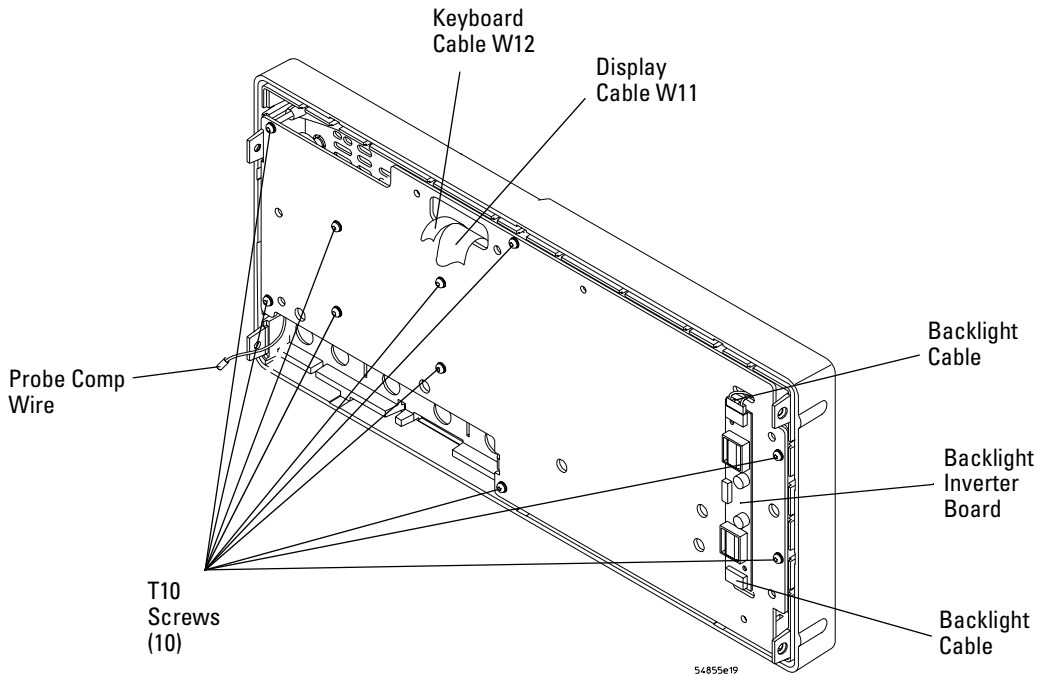
When assembling the hex nuts to secure the BNC connectors to the front panel, put the conical side of the nut toward the front-panel casting.

To remove and replace the keyboard and flat-panel display assemblies

Where necessary, refer to other removal procedures.

- 1 Disconnect the power cable and remove the cover.
- 2 Remove the front panel assembly from the chassis.
- 3 Remove the ten Torx T10 screws that secure the front panel cover plate to the front casting.

Figure 6-16



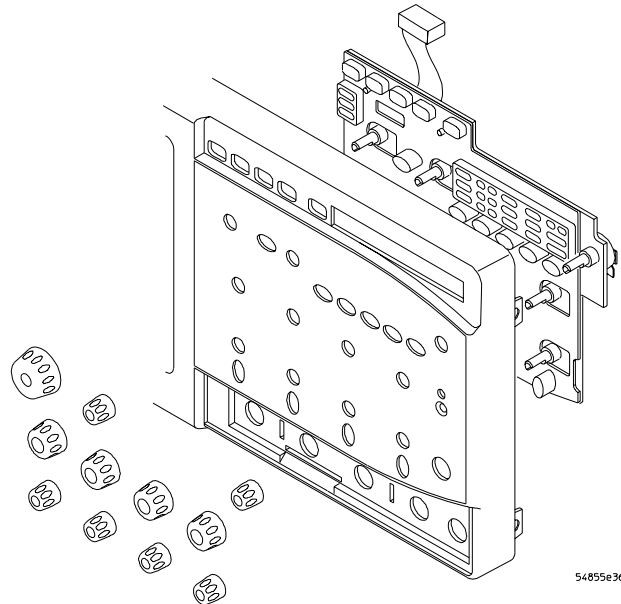
Front Panel Cover Plate Screws

- 4 Carefully feed the front-panel keyboard cable W12 and the flat-panel display driver cable W11 through the cable access hole while separating the front panel cover plate from the front casting.

Keep Long Screws Separate for Re-assembly

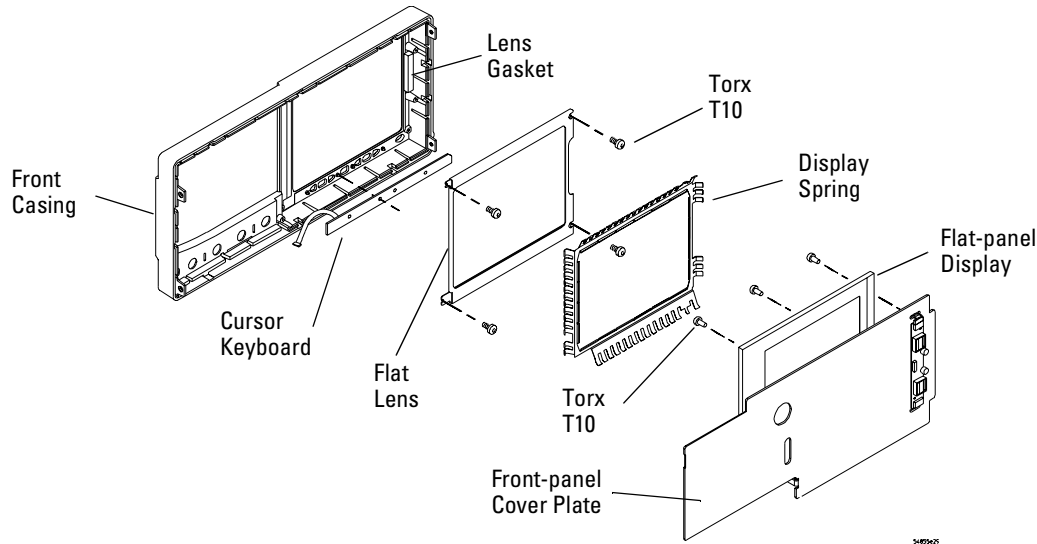
The four screws that fasten the keyboard to the front panel plate are longer than those around the perimeter of the plate. Keep them separate for re-assembly.

- 5 To remove the main keyboard, disconnect the cursor keyboard cable W13, pull off the knobs, and lift out the keyboard.

Figure 6-17**Main Keyboard Knobs and Cable**

- 6 To remove the flat-panel display from the front-panel cover plate:
 - a Disconnect the two backlight cables from the backlight inverter board (see previous figure).
 - b Remove the three Torx T10 screws securing the display to the cover plate.
- 7 To remove the cursor keyboard and flat lens:
 - a Remove the display spring. Note orientation of spring for reassembly.
 - b Remove the four Torx T10 screws that secure the corners of the lens bracket.
 - c Carefully remove the lens.

You can lift the cursor keyboard directly out of the front casting.

Figure 6-18**Removing the Cursor Keyboard**

- 8** To re-assemble 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 Lens Glass and the FPD monitor to prevent glass breakage. Make sure lens gasket is positioned correctly.

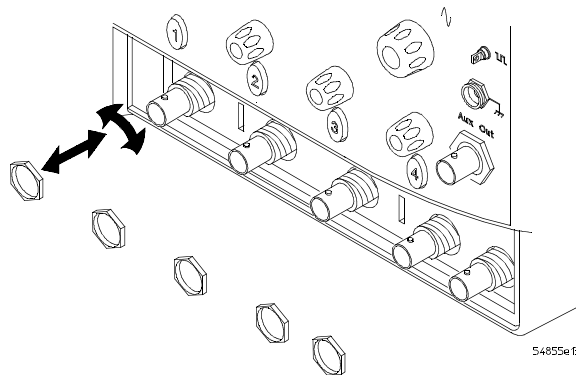
Inspect the inside surfaces of the Lens Glass and the Display Monitor closely for dust, smudges, and finger prints. Viewing these with line-of-sight 45 degrees to the surface is the best method for seeing subtle faults. Clean the inside surfaces with glass cleaner and lint-free lens paper before re-assembly. 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. This will prevent cleaner from corroding FPD connections.

To remove and replace the acquisition board assembly

When necessary, refer to other removal procedures.

- 1 Disconnect the power cable and remove the top and bottom covers.
- 2 Remove the AutoProbe assembly.
- 3 Using a 5/8" nut driver, remove the hex nuts that secure the BNC connectors to the front panel.

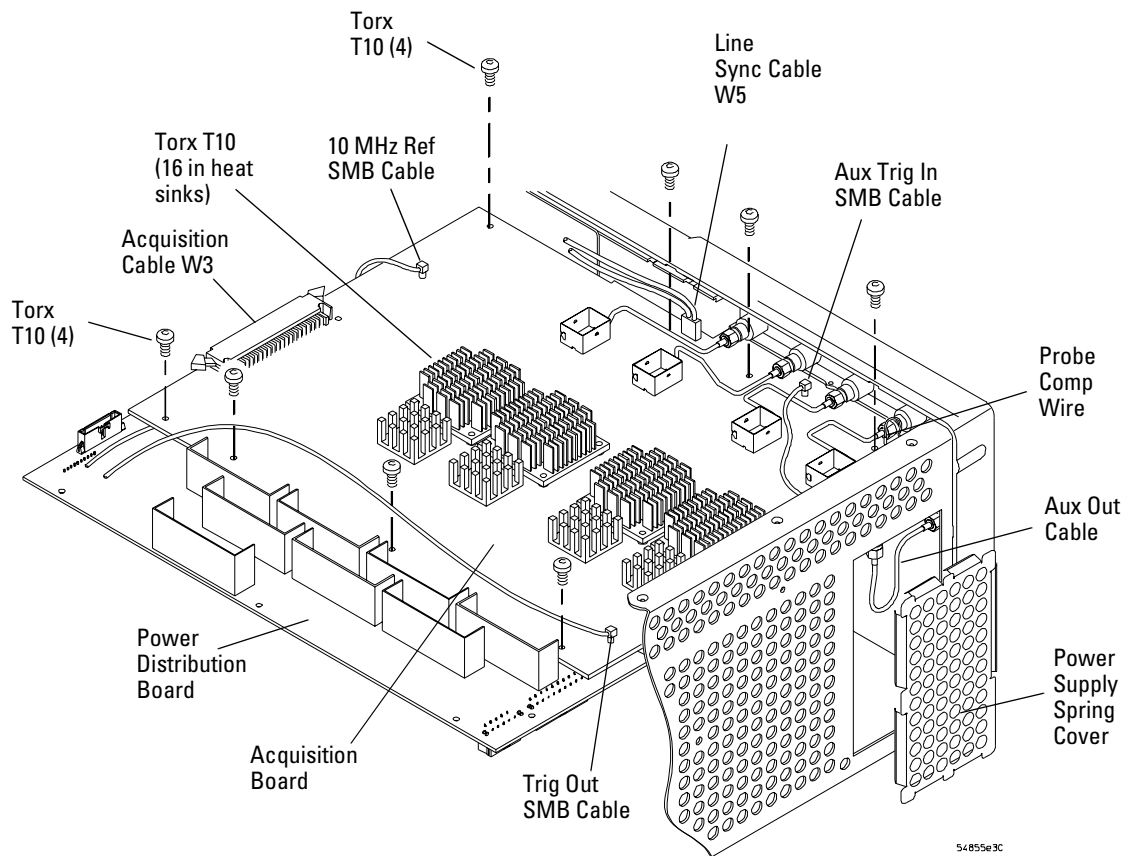
Figure 6-19



Removing the BNC Nuts

- 4 Remove the power supply spring cover.
- 5 Using 1/4" and 5/16" open-end wrenches, disconnect the semi-rigid Aux Out cable between the bottom of the acquisition board and the main part of the cable.
Hold the 1/4" wrench stationary while turning the 5/16" wrench.
- 6 Disconnect the following cables from the acquisition board:
 - Line sync cable W5
 - Acquisition cable W3
 - 10 MHz Ref SMB cable
 - Trig Out SMB cable
 - Aux Trig In SMB cable
 - Probe Comp wire
- 7 Remove the six Torx T10 screws that secure the acquisition board to the chassis.
- 8 Remove the sixteen Torx T8 screws from the A/D converter heat sinks.

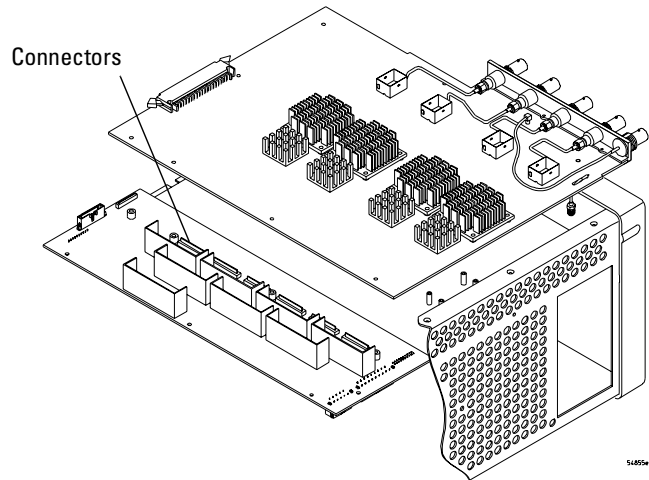
Figure 6-20



Removing Cables and Screws

- 9 Carefully lift the back of the board to separate the acquisition board connectors from the power distribution board.
- 10 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 6-21



Separate Acquisition Board from Power Distribution Board

- 11 To re-install the acquisition board assembly, reverse the above procedure.

Replacing the heat sink screws

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.

Replacing the BNC hex nuts

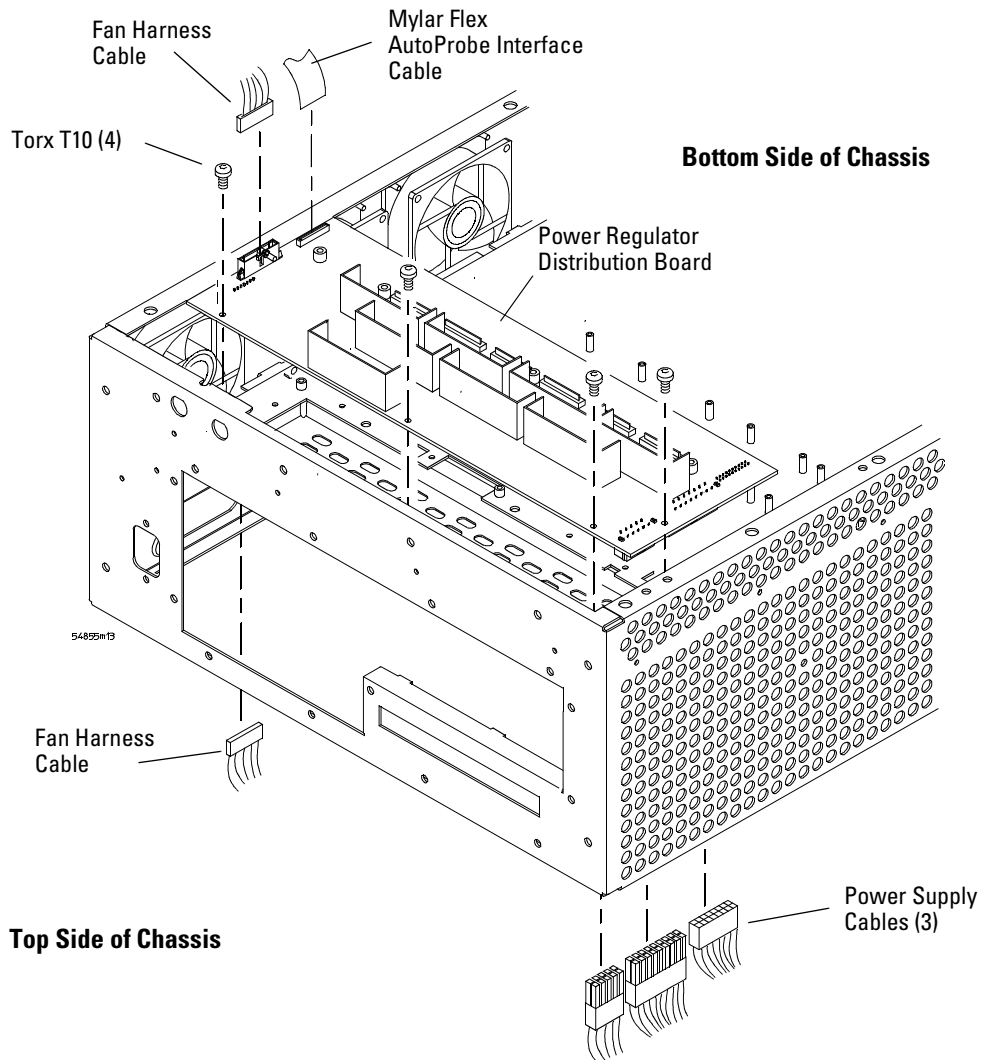
When assembling the hex nuts to secure the BNC connectors to the front panel, put the conical side of the nut toward the front-panel casting.

To remove and replace the power regulator distribution board

When necessary, refer to other removal procedures.

- 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 (part of W4) from the top side of the chassis
 - Fan harness cable W19 on the top side of the chassis
 - Fan harness cable W19 on the bottom side of the chassis
 - Mylar flex probe power cable W17
- 4** Remove the four Torx T10 screws from the power regulator distribution board.
- 5** Lift the board out of the chassis.
- 6** To re-install, reverse this procedure.

Figure 6-22



Removing the Power Regulator Distribution Board

To remove and replace the interface and GPIB board

When necessary, refer to other removal procedures.

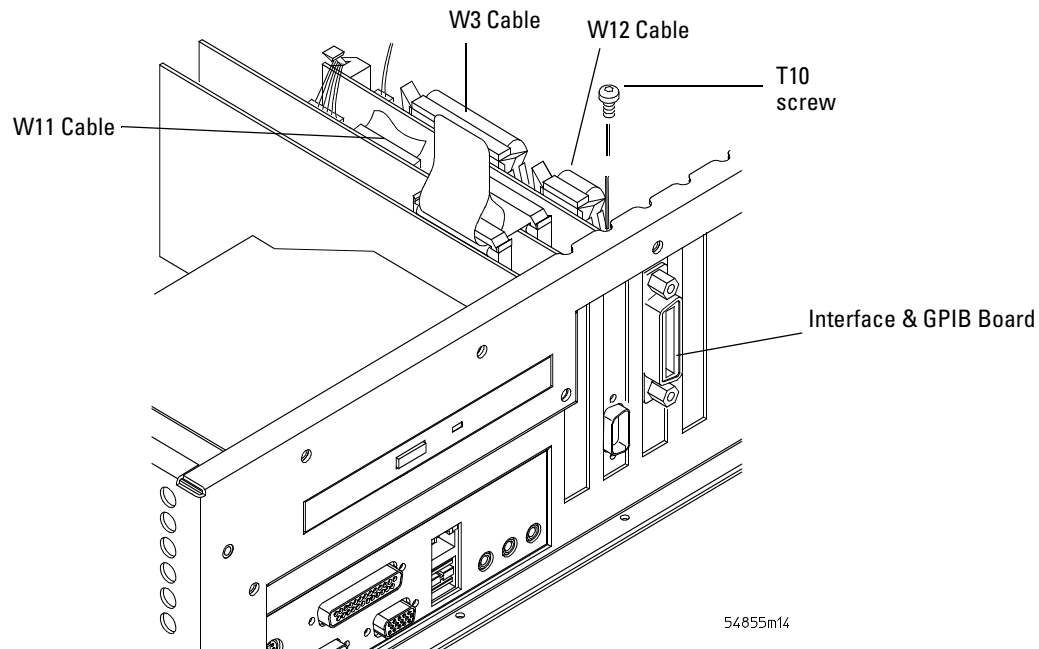
- 1 Disconnect the power cable and remove the top cover.
- 2 Remove the keyboard cable (W12) and the acquisition board cable (W3) from the interface and GPIB board.
- 3 Remove the Torx T10 screw that secures the interface and GPIB board to the rear of the chassis.
- 4 Pull the board up to disengage it from the motherboard, then lift up and out of the chassis.

CAUTION

BE CAREFUL NOT TO SNAG THE DISPLAY CABLE W11.

- 5 To replace the board, reverse the removal procedure.

Figure 6-23



Removing the interface and GPIB board

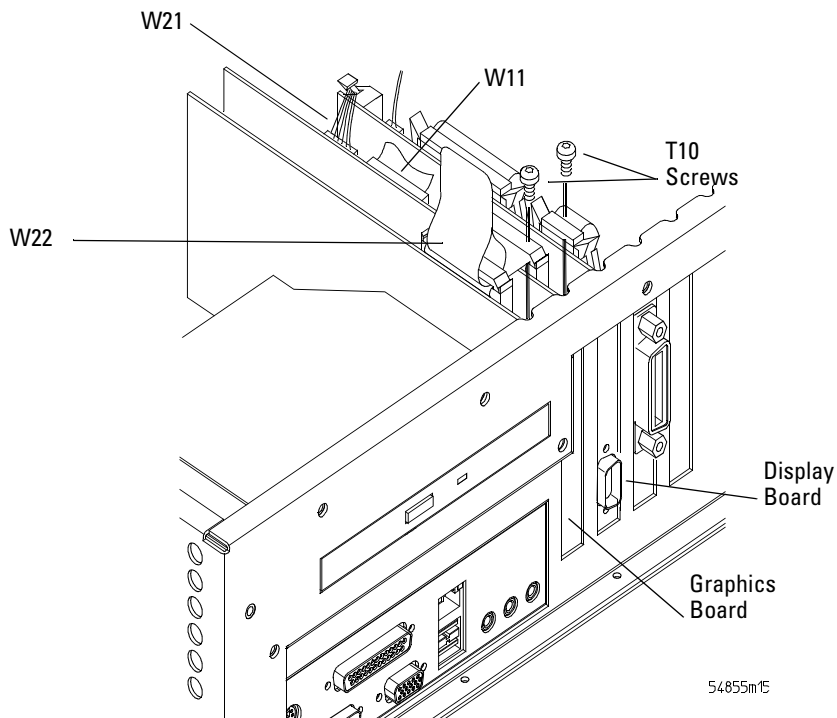
To remove and replace the oscilloscope graphics board and display board

When necessary, refer to other removal procedures.

- 1** Disconnect the power cable and remove the top cover.
- 2** Disconnect these cables from the display board:
 - Bridge cable W22
 - Backlight primary cable W21
 - Flat panel display driver cable W11
- 3** Remove the two Torx T10 screws that secure the graphics and display boards to the chassis.

These screws are at the rear of the chassis.

Figure 6-24



Removing the Graphics and Display Boards

- 4** Grasp the graphics board at the top corners and pull the board straight up until it is free of the card cage.
- 5** Grasp the display board at the top corners and pull the board straight up until it is free of the card cage.
- 6** To replace the graphics and display boards, reverse the above procedure.

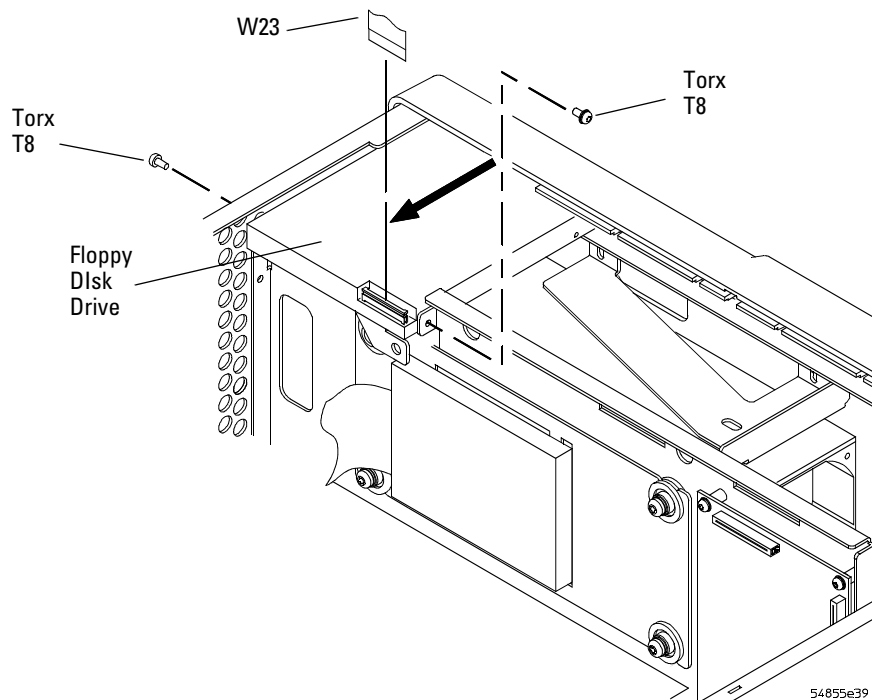
Be sure to observe correct polarity on all cables when replacing the boards.

To remove and replace the floppy disk drive

When necessary, refer to other removal procedures.

- 1 Disconnect the power cable and remove the top cover.
- 2 Disconnect mylar flex cable W23 at the rear of the floppy disk drive.
- 3 Using a T8 driver remove the two side screws holding the floppy disk drive in place.
- 4 Pull the floppy disk drive from the front frame.

Figure 6-25



Removing the Floppy Disk Drive Screws

- 5 To replace the floppy disk drive, reverse the above procedure with a new disk drive.

To remove and replace the internal hard disk drive

- 1 Disconnect the power cable and remove the top cover.

If the oscilloscope has option 017 (removable hard disk drive) installed then there is no internal hard disk drive.

- 2 Remove the IDE cable and hard drive cable from the rear of the CD-ROM drive.

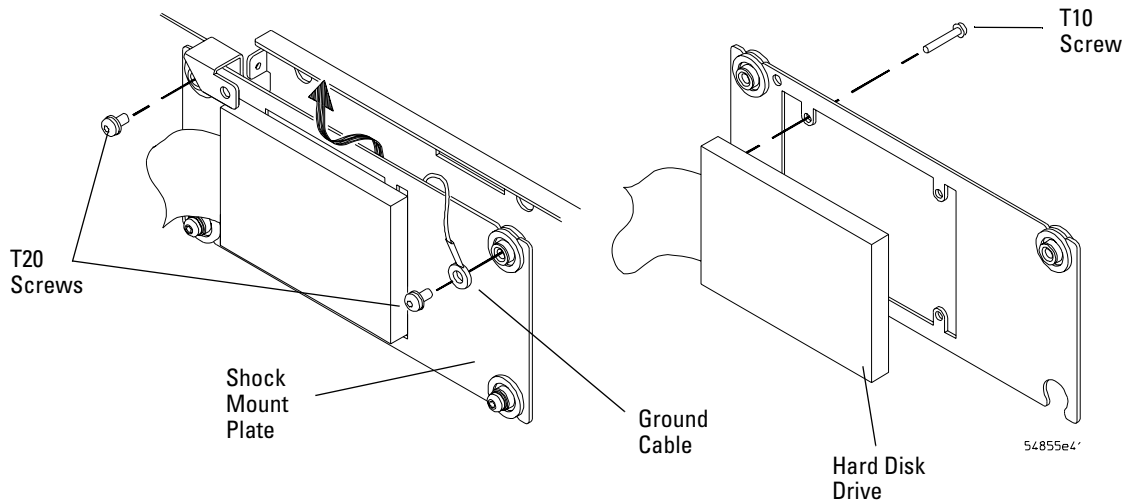
CAUTION

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

- 3 Remove the two top T20 Torx screws holding the shock mount in place.

You may need to use a Torx key to loosen the screws.

Figure 6-26



Removing the Internal Hard Disk Drive

- 4 Lift the disk drive assembly enough to clear the lower shock mounts, then move assembly toward fans enough to clear the chassis bracket under the floppy disk drive, then lift the disk drive out of the chassis.
Some cables may need to be removed to allow removal of the disk drive.
- 5 Remove the four T10 Torx screws holding the disk drive onto the shock mount.
- 6 To replace the hard disk reverse, the above procedure with a new hard drive.

CAUTION

DO NOT OVER TIGHTEN THE SCREWS!
Do not overtighten the T10 screws that secure the Internal Hard Disk Drive to the bracket. Torque to 3 in-lbs.

Reinstalling the internal hard drive

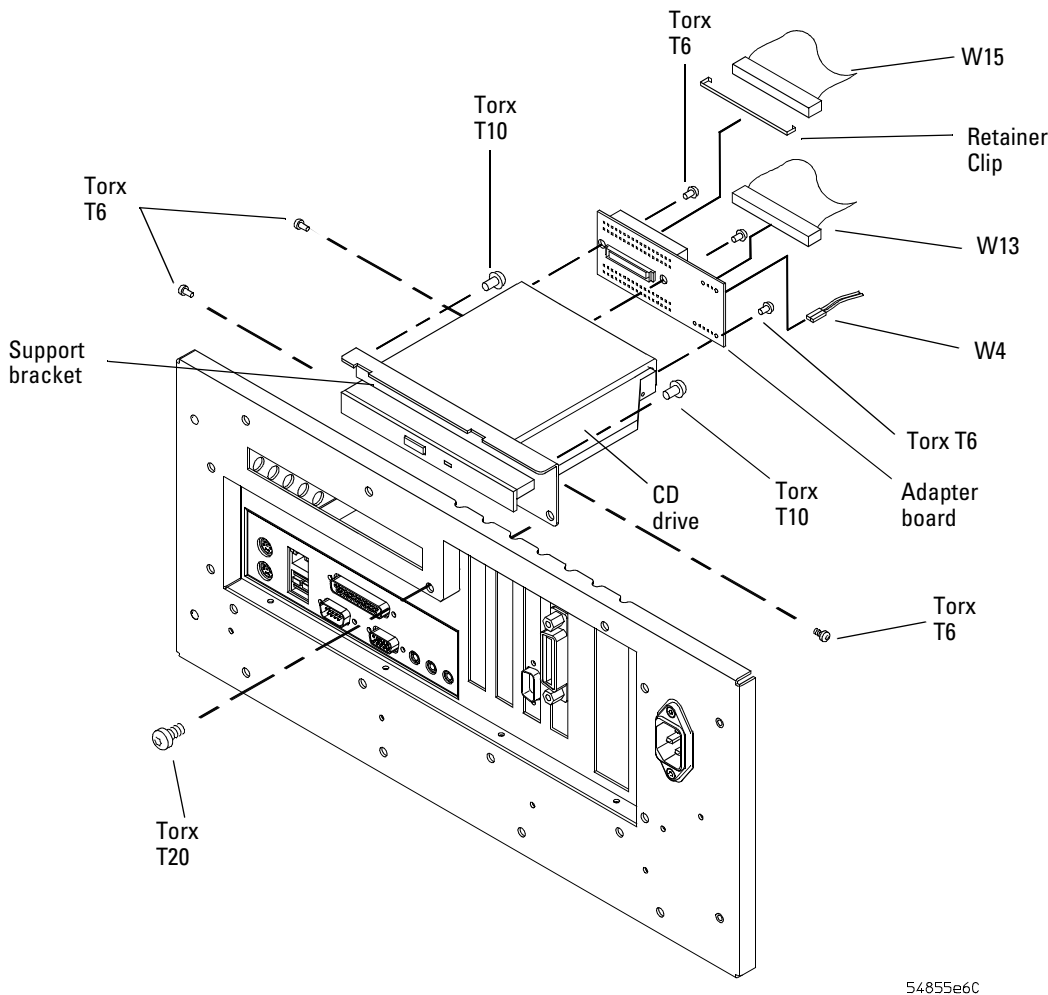
1. Make sure the assembly is inserted into the center slots of the lower shock mounts.
2. Be sure to reconnect the hard drive ground cable to the upper-right shock mount screw.
3. Tighten the upper shock mount screws to 18 in-lbs.

To remove and replace the CD-ROM drive

When necessary, refer to other removal procedures.

- 1 Disconnect the power cable and remove the top cover.
- 2 Remove the following cables from the back of the CD-ROM drive:
 - IDE cable W15 - remove connector retainer clip first.
 - Hard drive cable W13 if option 017 (removable hard drive) is not installed.
 - CD-ROM Power cable W4 - push in on plastic tab to release
- 3 Remove the Torx T10 screw securing the block to the CD-ROM support rail.
- 4 Remove the Torx T20 screw securing the CD-ROM support bracket to the rear chassis.
- 5 Slide the CD-ROM assembly inwards towards the front frame, then lift up and remove.

Figure 6-27



Removing the CD-ROM Drive

- 6 Remove the two Torx T6 screws securing the CD-ROM drive to the support rail and one screw securing the CD-ROM drive to the support bracket.
- 7 Remove the two Torx T6 screws securing the CD-ROM Adapter Board to the rear of the CD-ROM drive.
- 8 Remove the CD-ROM Adapter Board from the rear of the CD-ROM drive.

- 9 To replace the CD-ROM drive, reverse the above procedure with a new drive.

To remove and replace the motherboard

When necessary, refer to other removal procedures.

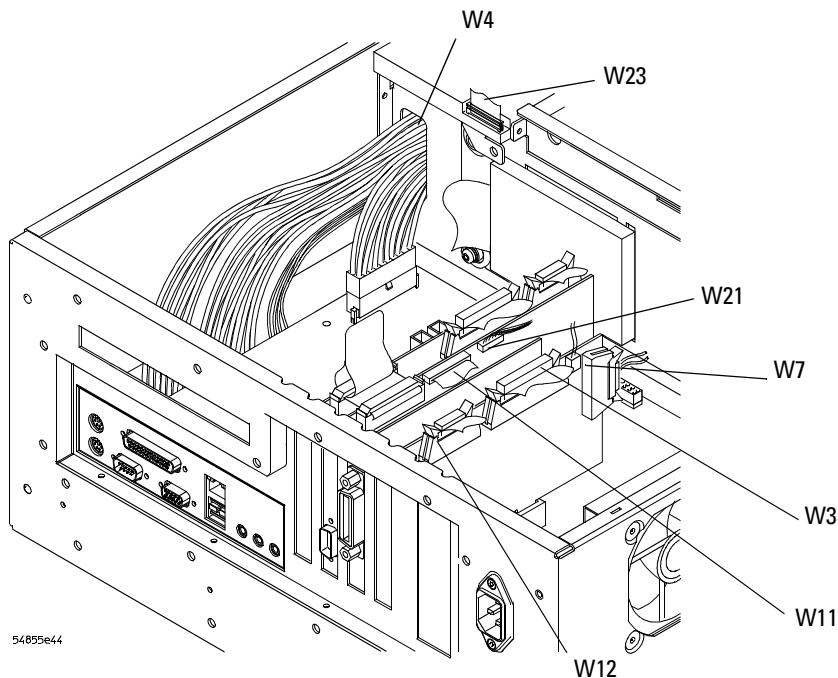
CAUTION

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 and bottom covers.
- 2** Remove the CD-ROM drive.
- 3** Disconnect the following cables. See Figure 6-28.
 - Mylar flex cable W23 from floppy disk drive
 - Motherboard power supply cable W4
 - Motherboard switch cable W7
 - Display ribbon cable W11
 - Keyboard cable W12
 - Acquisition cable W3
 - Backlight primary cable W21

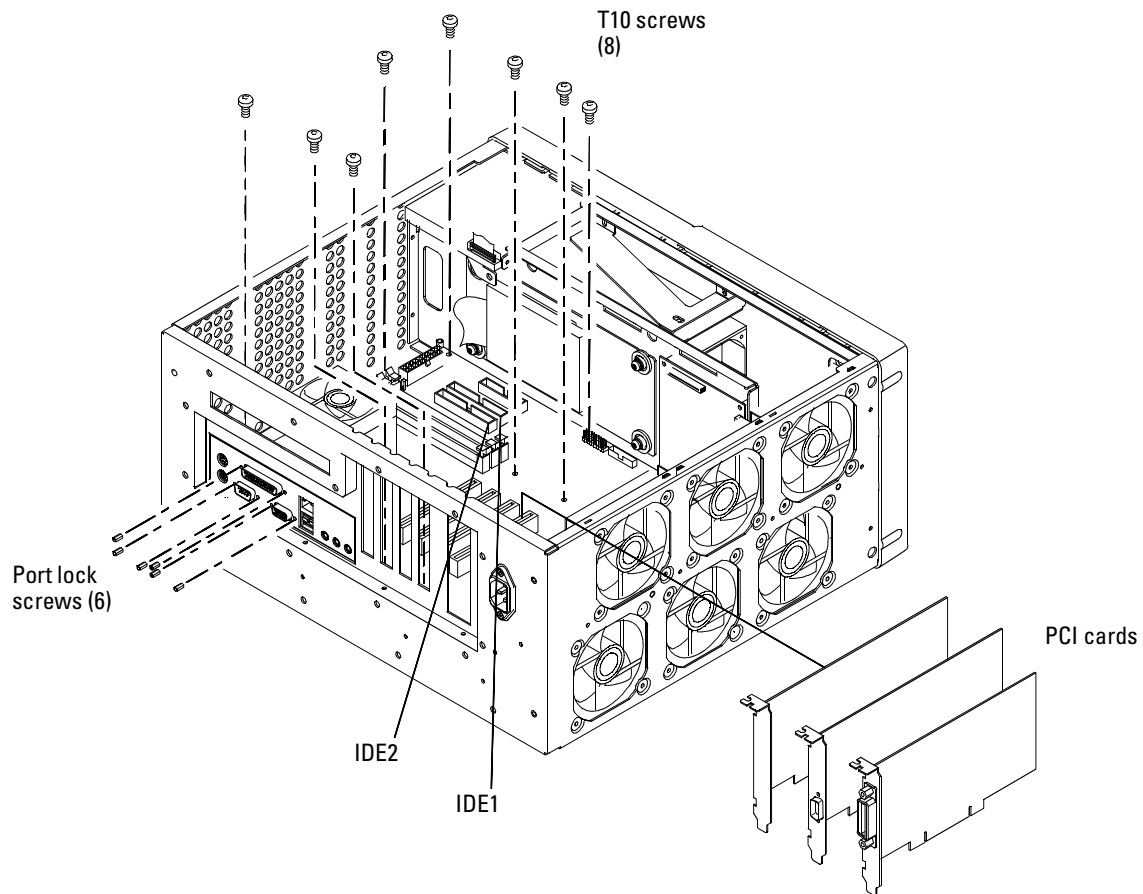
Figure 6-28



Removing the Cables

- 4 Remove the cable that goes to the mother board connector IDE1 at the motherboard end of the cable.
- 5 If option 017 (removable hard drive) is installed, remove the CDROM cable that goes to the motherboard connector IDE2 at the motherboard end of the cable. See Figure 6-29.
- 6 Remove all PCI cards from the motherboard.
- 7 Remove the 8 T10 screws holding the motherboard to the chassis.
- 8 Remove the 6 port lock screws holding the port connectors to the chassis.

Figure 6-29



54855e5e

Removing the Motherboard Screws, IDE Cable, and PCI Cards

- 9 To replace the motherboard assembly, reverse the above procedure.
- 10 Apply power to the oscilloscope.
- 11 Run the self-test to verify the oscilloscope is operating properly. Select Self Test from the Utilities menu and then Start in the Self Test dialog box.

To remove and replace the power supply

When necessary, refer to other removal procedures.

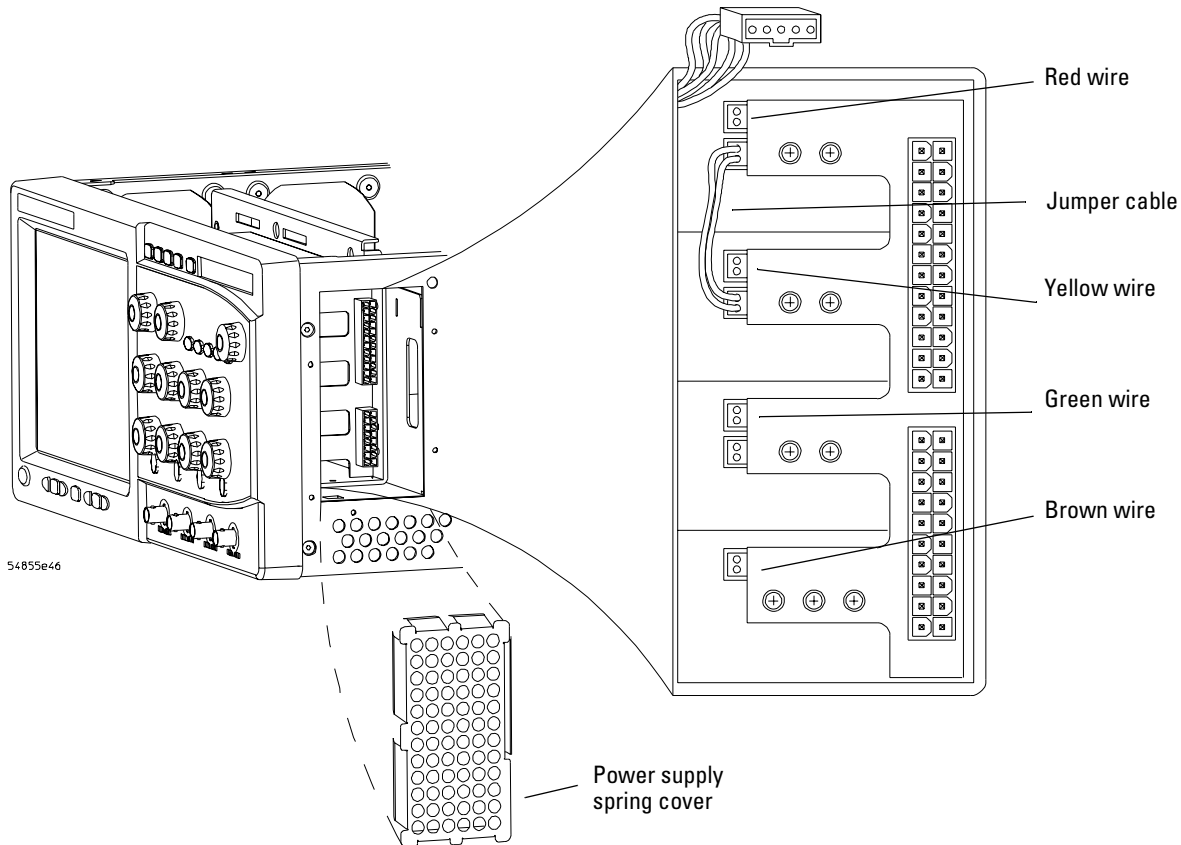
WARNING

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 Remove the floppy disk drive.
- 3 Remove the motherboard subassembly.
- 4 Remove the power supply spring cover.
- 5 Disconnect the cables from the front of the supply.

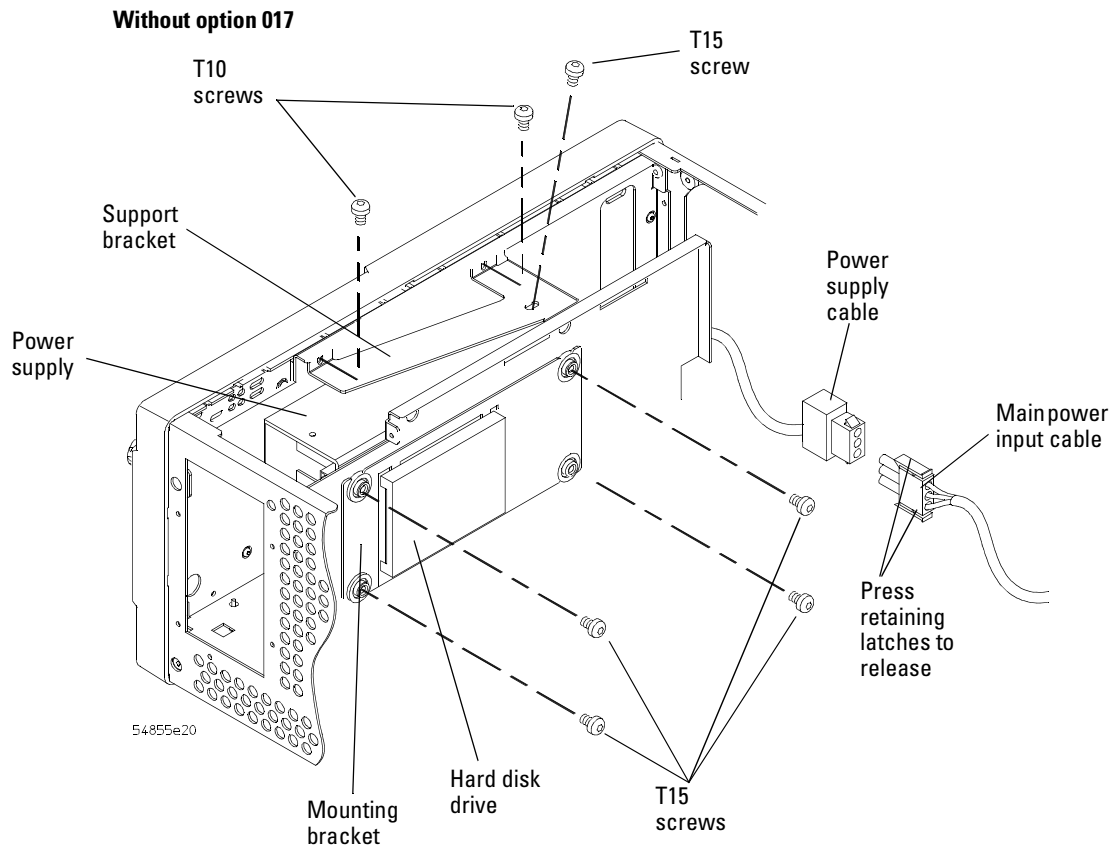
Figure 6-30



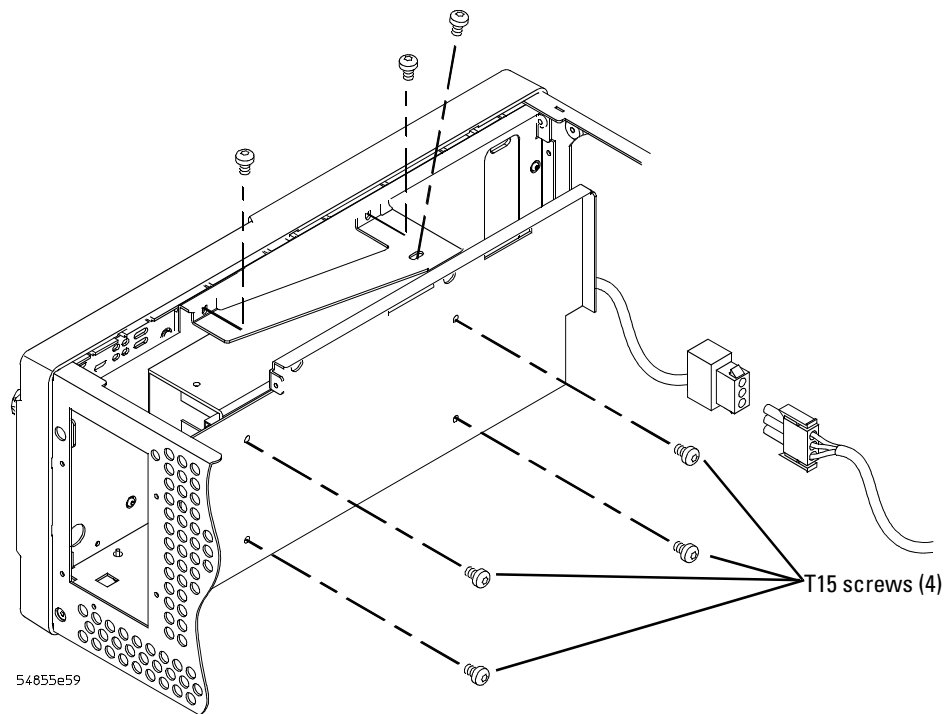
Disconnecting Power Supply Cables

- 6** Remove the Torx T15 screw that secures the power supply support bracket to the power supply.
- 7** Remove the two Torx T10 screws that secure the support bracket to the front chassis.
- 8** If you do not have option 017 (removable hard disk drive), follow the instructions for removing the hard disk drive found earlier in this chapter.
If you have option 017 installed, remove the four T15 Torx screws in the side of the power supply. See Figure 6-31.
- 9** Separate the main power input cable from the power supply cable to the power supply.

Figure 6-31



With option 017



Removing Hard Disk, Support Bracket, and Power Supply

- 10 Lift the supply up and out of the chassis.

- 11 To replace the supply, reverse the installation procedure.

To remove and replace the fans

WARNING

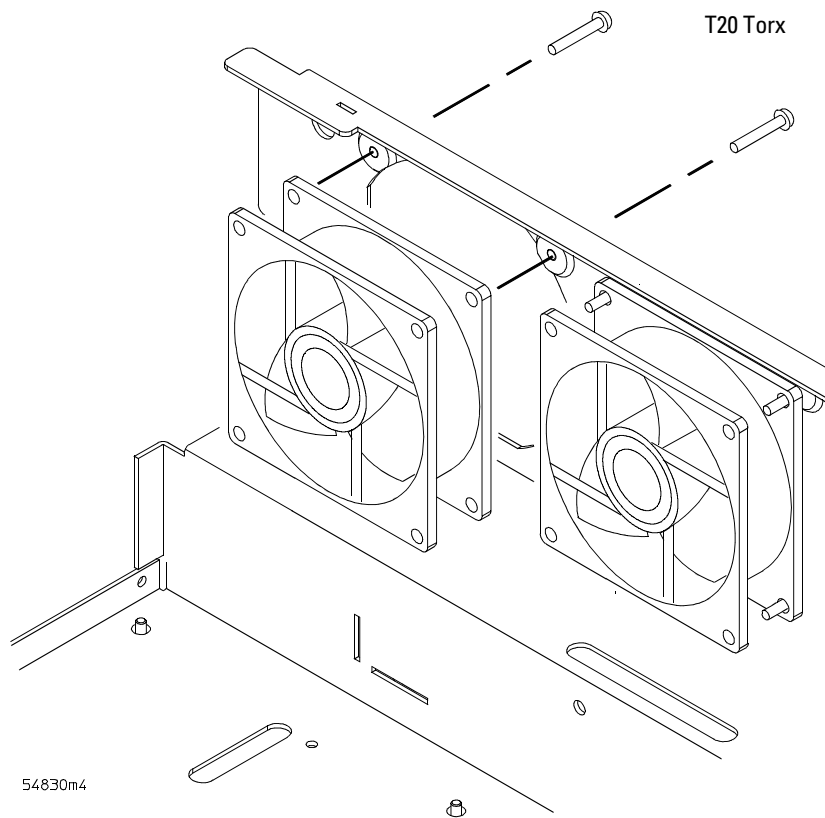
AVOID INJURY!

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.

When necessary, refer to other removal procedures.

- 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.
One cable is on the top of the chassis and one cable is on the bottom of the chassis.
- 3 Remove the four T20 Torx screws securing the fan to the chassis.

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.

- 4 To install the fan, reverse this procedure.

Ordering Replaceable Parts	7-2
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Power Cables and Plug Configurations	7-3
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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

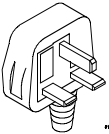
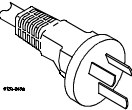
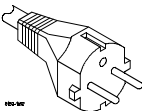
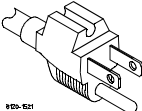
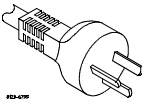
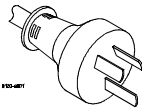
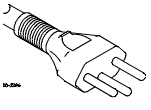
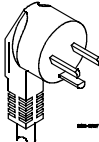
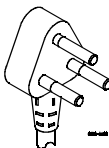
Some parts used in this oscilloscope have been set up for an exchange program. This program allows the customer to exchange a faulty assembly with one that has been repaired, calibrated, and performance-verified by the factory. The cost is significantly less than that of a new part. The exchange parts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

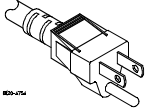
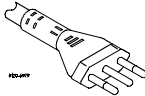
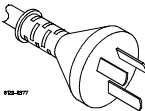
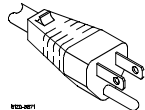
Power Cables and Plug Configurations

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

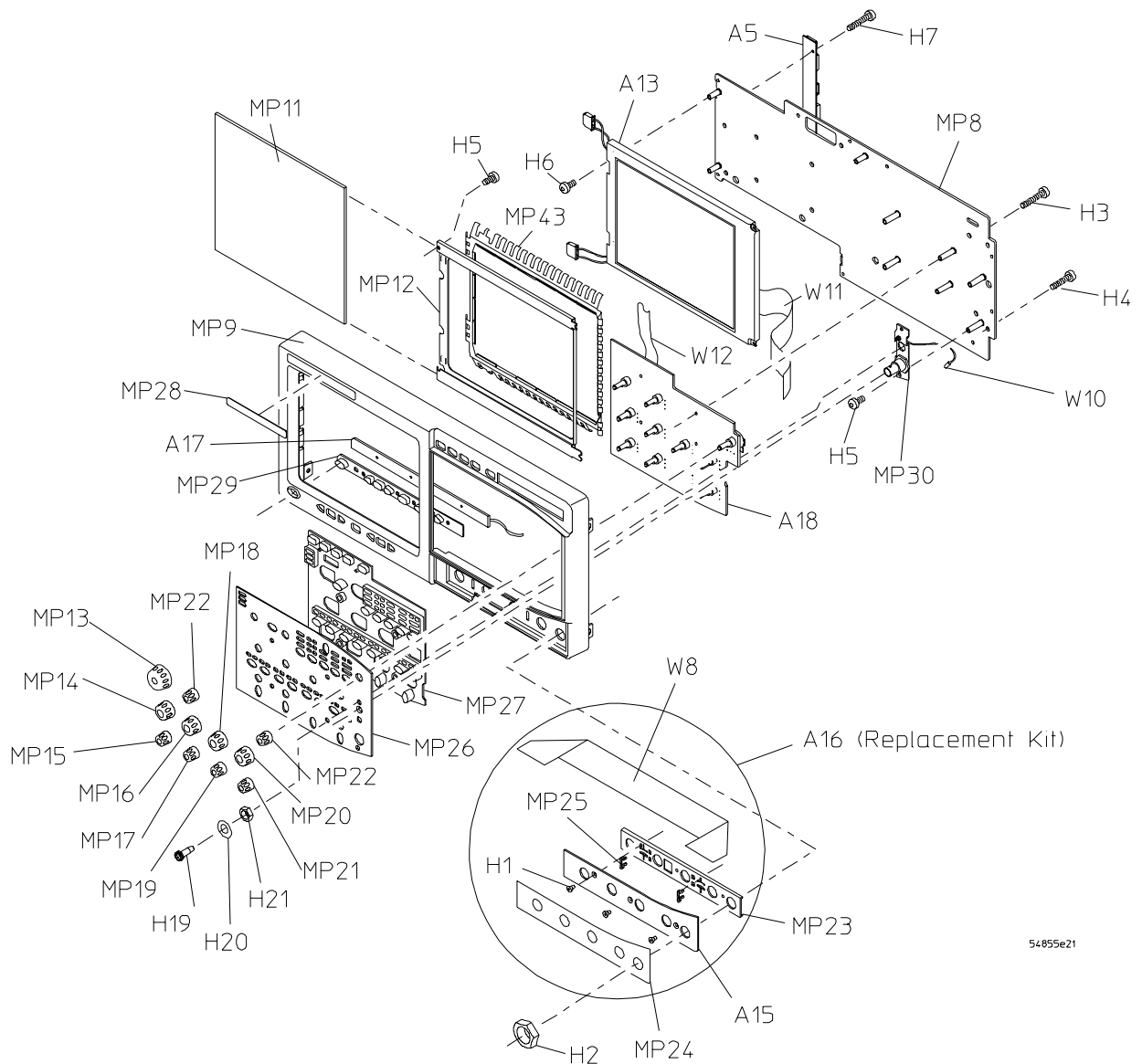
Chapter 7: Replaceable Parts
Power Cables and Plug Configurations

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

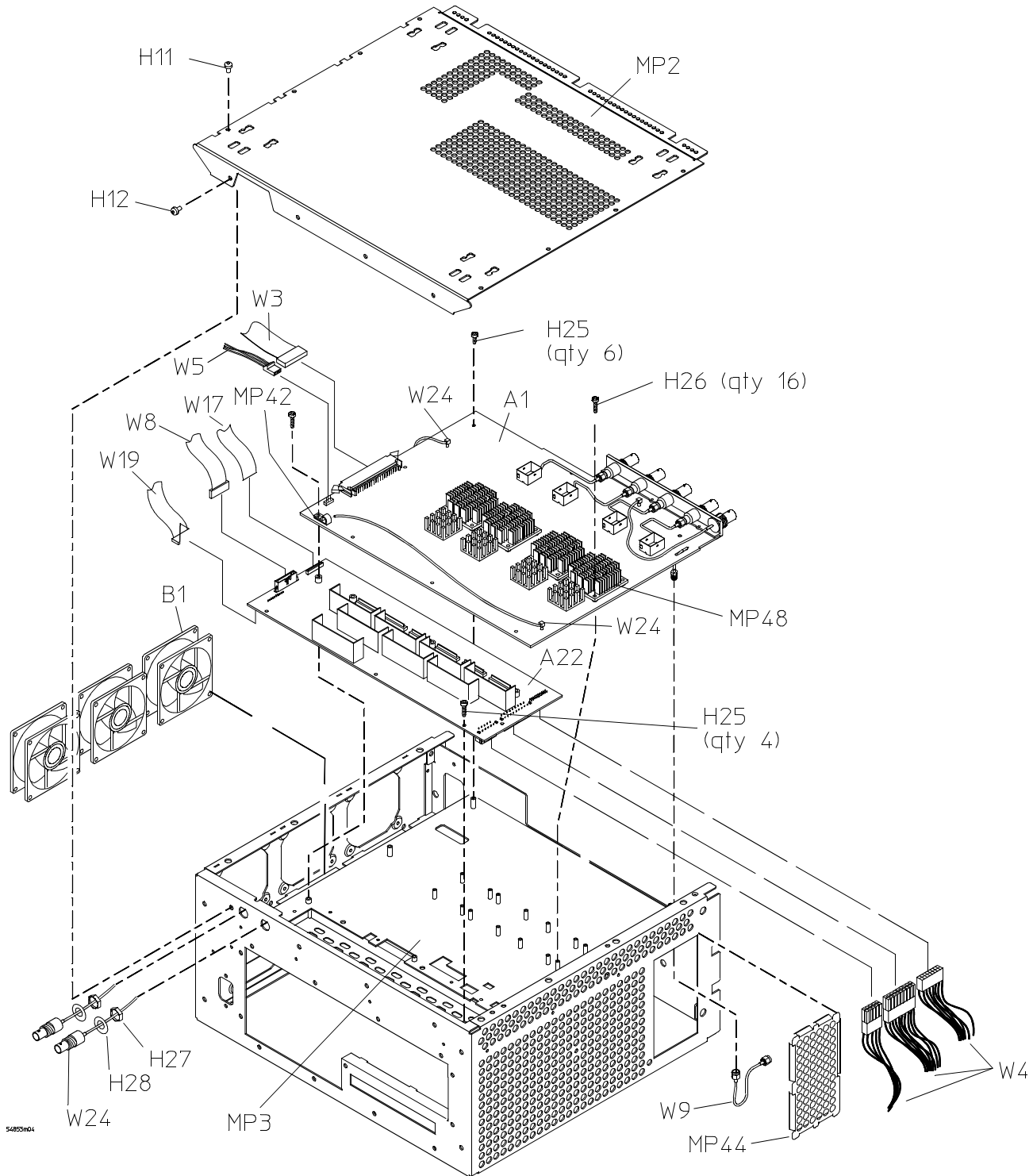
Exploded Views

Front Frame and Front Panel

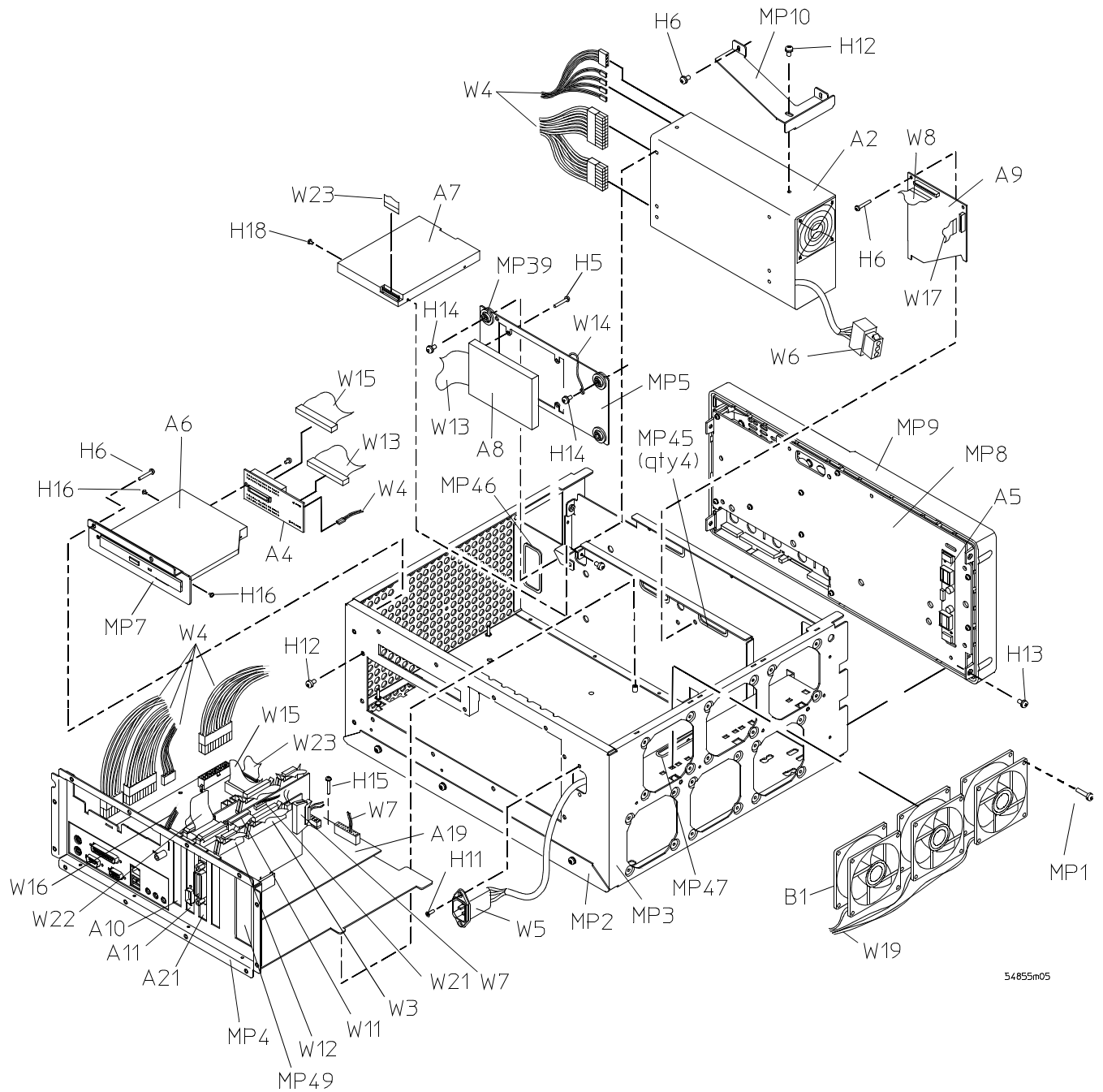


54855e21

Fan and Acquisition Assembly

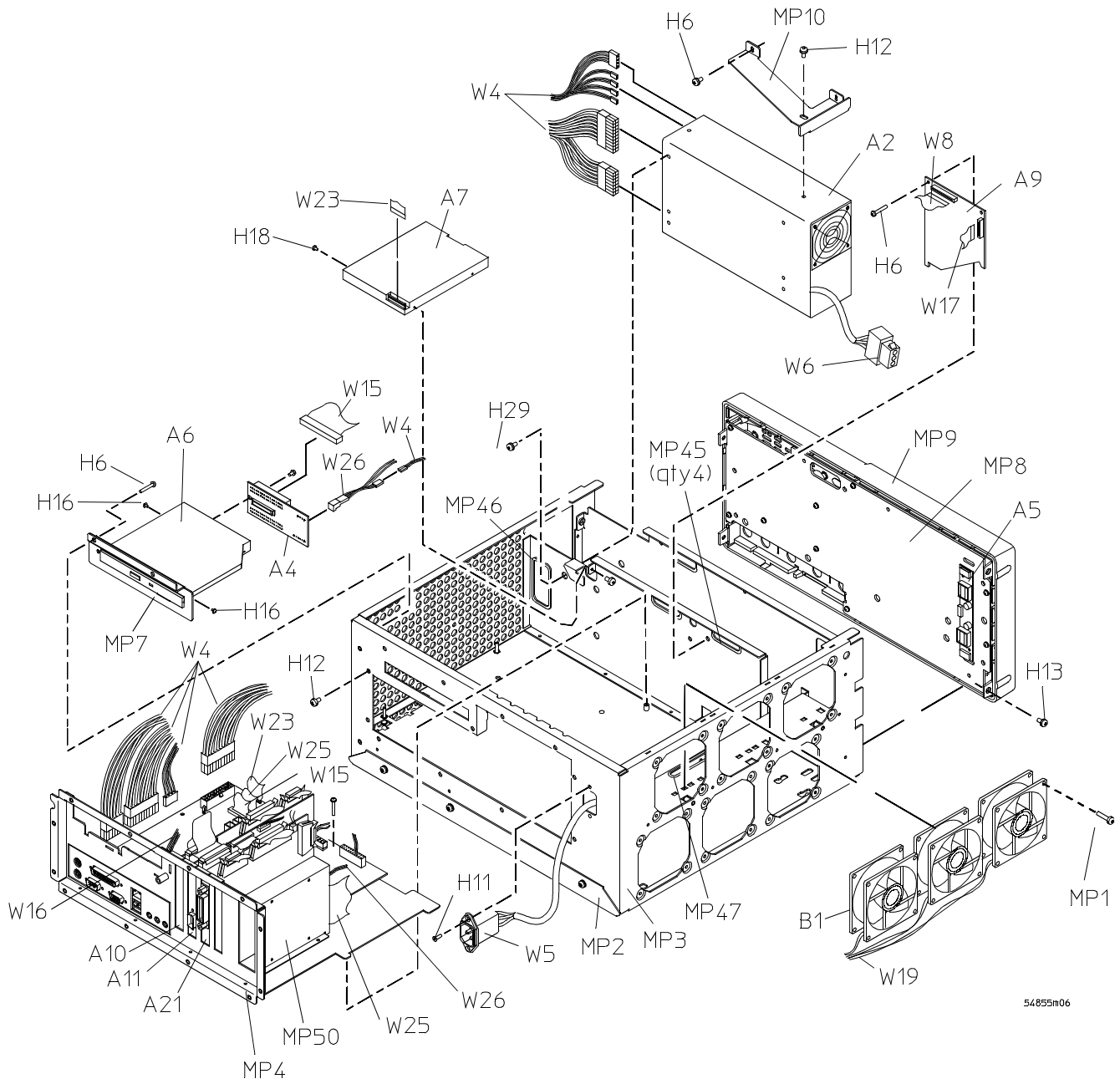


Power Supply and PC Motherboard without option 017



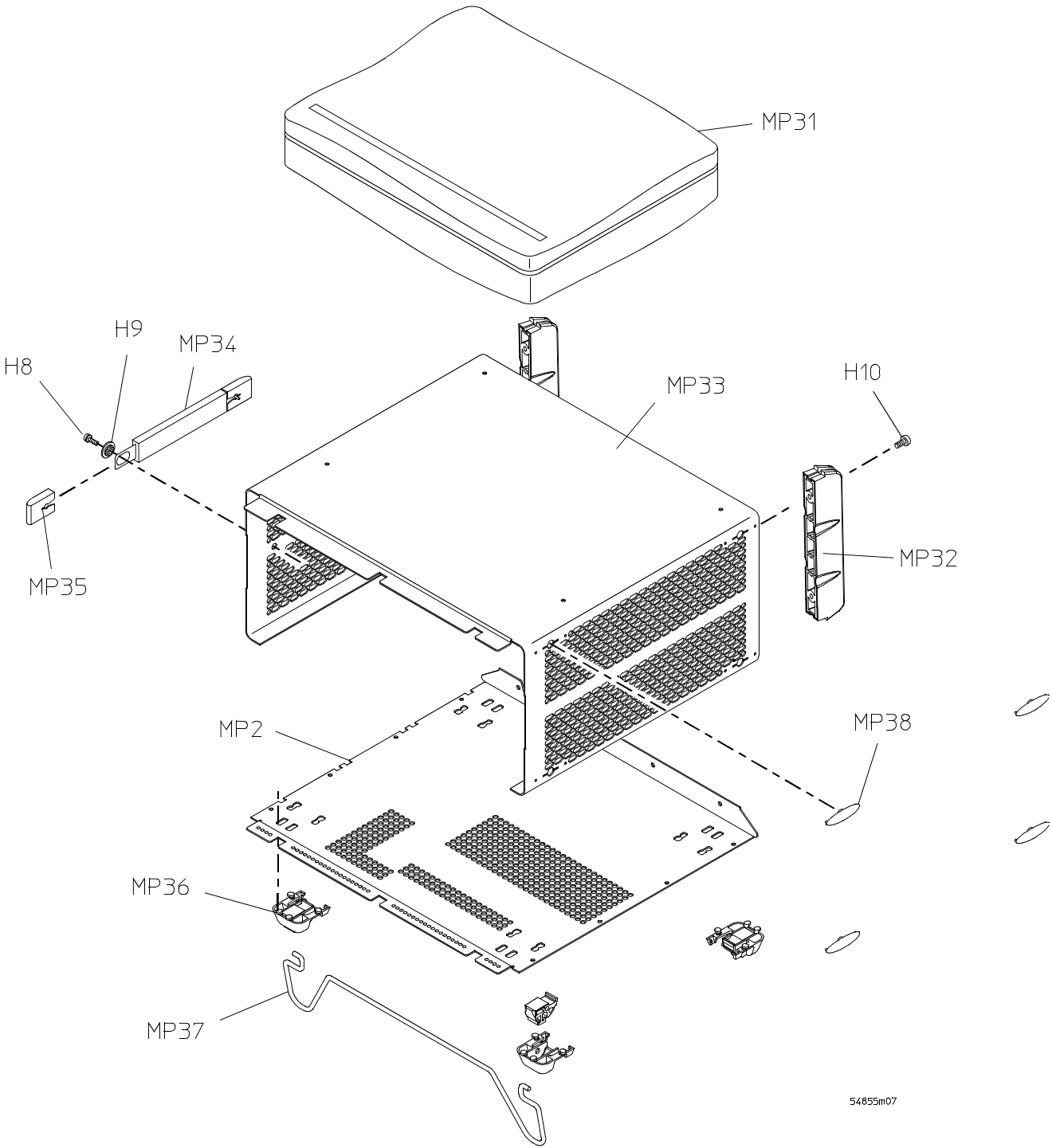
54855m05

Power Supply and PC Motherboard with option 017



54855m06

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
Exchange Assemblies			
A1	54852-69401	1	4-CH ACQUISITION ASSEMBLY (Agilent Model 54852A)
A1	54853-69502	1	4-CH ACQUISITION ASSEMBLY (Agilent Model 54853A) for use with software versions V.A.03.10 or higher
A1	54854-69504	1	4-CH ACQUISITION ASSEMBLY (Agilent Model 54854A) for use with software versions V.A.03.10 or higher
A1	54855-69513	1	4-CH ACQUISITION ASSEMBLY (Agilent Model 54855A) for use with software versions V.A.03.10 or higher
External Chassis Parts			
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
MP 20	54801-47411	1	KNOB 18 MM PINK
MP21	54801-47407	1	KNOB 12 MM PINK
MP22	54801-47401	2	KNOB 12 MM GRAY
MP24	54855-68703	1	AUTO PROBE LABEL
MP26	54855-94302	1	FRONT PANEL 4CH LABEL
MP28	54852-94301	1	LOGO LABEL/54852A (Infinitiium 2 GHz 10GSa/s)
MP28	54853-94301	1	LOGO LABEL/54853A (Infinitiium 2.5 GHz 20GSa/s)
MP28	54854-94301	1	LOGO LABEL/54854A (Infinitiium 4 GHz 20GSa/s)
MP28	54855-94301	1	LOGO LABEL/54855A (Infinitiium 6 GHz 20GSa/s)
MP31	54810-68701	1	ACCESSORY POUCH
MP32	5042-1798	2	REAR FEET
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
W18	8120-1521	1	CABLE-POWER (standard 125V USA)
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)
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)
Electrical Assemblies			
A2	0950-4369	1	POWER SUPPLY
A5	0950-3235	1	INVERTER BOARD

Chapter 7: Replaceable Parts
Replaceable Parts List

Replaceable Parts

Ref. Des.	Agilent Part Number	QTY	Description
A13	2090-0396	1	LCD DISPLAY

PC Motherboard (Motorola Motherboard w/1.44 MByte Floppy Drive and CD ROM Drive)

A4	86100-66517	1	CDROM ADAPTER BOARD (NOT ON OPTION 017)
	54810-66541	1	CDROM ADAPTER BOARD (WITH OPTION 017)
A6	0950-4411	1	CD ROM R/W
A7	0950-4362	1	3.5 INCH FLOPPY DRIVE
A8		1	HARD DRIVE w/SOFTWARE (NOT ON OPTION 017) Go to the web site to find the hard drive part number: www.agilent.com/find/infiniium_software
A19	0960-2481	1	MOTHERBOARD SUBASSEMBLY
W13	54801-61643	1	HARD DRIVE MINI IDE CABLE (NOT ON OPTION 017)
W14	54810-61615	1	HARD DRIVE GROUND CABLE (NOT ON OPTION 017)
W15	54810-61611	2	IDE HARD DRIVE CABLE

All Configurations

A9	54810-66506	1	PROBE INTERFACE BOARD
A10	54810-66529	1	WAVEFORM DISPLAY BOARD
A11	54810-66525	1	DISPLAY BOARD
A15	54855-68811	1	AUTO PROBE I/F
A16	54855-68703	1	PROBE INTERFACE KIT
A17	54810-66507	1	KEYBOARD - CURSOR
A18	54855-66506	1	KEYBOARD - 4CH
A21	54855-66515	1	INTERFACE & GPIB BOARD

Fans

B1	3160-4134	6	12 V FAN
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Internal Chassis Parts

H1	0515-2219	3	MACHINE SCREW 5 MM
H2	54503-25701	5	HEX NUT BNC
H3	0515-1025	4	PAN HEAD SCREW 26 MM
H4	0515-1410	6	PAN HEAD SCREW 20 MM
H5	0515-0430	11	PAN HEAD SCREW 6 MM (NOT ON OPTION 017)
H6	0515-0372	21	PAN HEAD SCREW 8 MM
H7	0515-1246	2	PATCH LOCK SCREW 6 MM
H8	5021-4302	2	M4x0.7 20MM-LG PANHD PATCHLOCK BLACK
H9	54801-24702	2	RETAINER STRAP HANDLE
H10	0515-2195	8	PAN HANDLE SCREW 40 MM
H11	0515-1103	10	FLAT HEAD SCREW
H12	0515-0380	18	PAN HEAD SCREW
H13	0515-1403	4	M4X0.7 6 MM 90DEG FLATHD T15
H14	0515-0436	4	MS M4x0.7 18 MM LG SCREW (NOT ON OPTION 017)
H15	0515-0375	3	MS MSx0.5 16 MM LG
H16	0515-0365	5	SCR MACHINE
H18	0515-2691	2	MS M2.6X0.45 6 MM PAN HEAD
H19	54542-26101	1	GROUND LUG
H20	2190-0027	1	WIL.256 .478 .02

Replaceable Parts

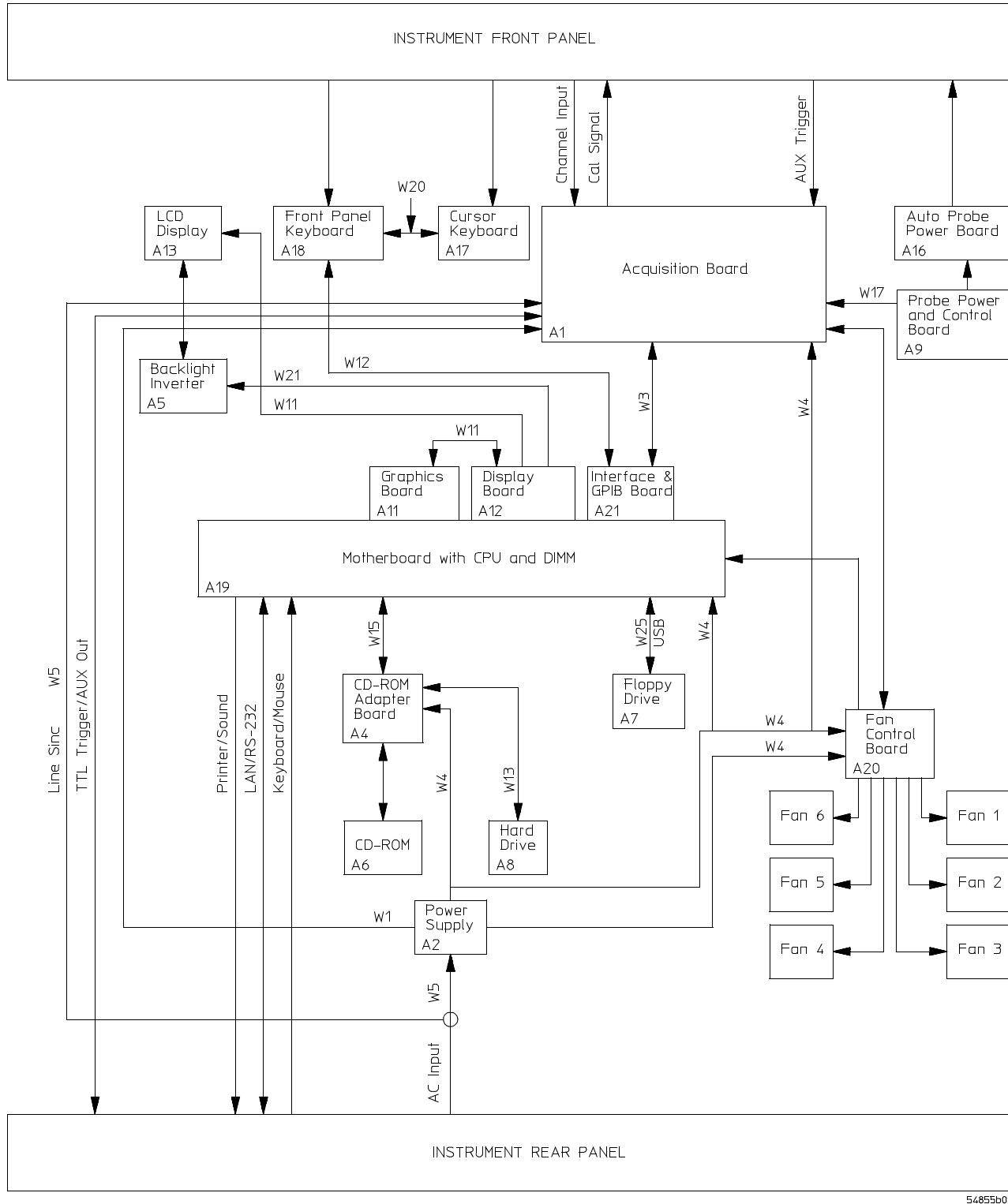
Ref. Des.	Agilent Part Number	QTY	Description
H21	2950-0072	1	NUTH 1/4-32 .062
H25	0515-0666	10	M3 SCREW
H26	0515-0368	16	M2.5x12MM SCREW
H27	2190-0068	2	WASHER
H28	2950-0054	2	NUT
H29	0515-0433	4	M4X0.7 8MM SCREW; TORX T20
MP1	0624-1066	24	FAN SCREWS
MP2	54855-00501	1	SLEEVE BOTTOM
MP3	54855-00104	1	CHASSIS ASSEMBLY
MP4	54857-60102	1	ATX TRAY
MP5	54810-01211	1	HARD DRIVE BRACKET (NOT ON OPTION 017)
MP7	54857-01214	1	CDROM MOUNT BRACKET
MP8	54810-04103	1	FRONT FRAME BACK PLATE
MP9	54801-40502	1	FRONT FRAME
MP10	54810-01213	1	POWER SUPPLY SUPPORT BRACKET
MP11	54801-88001	1	LENS GLASS
MP12	54801-01205	2	LENS BRACKET
MP23	54801-24701	1	BRACKET STIFFENER
MP25	54801-09101	1	SPRING STEEL
MP27	54855-41901	1	KEYPAD 4CH
MP29	54810-41902	1	CURSOR KEYPAD
MP30	54801-01206	1	CAL BNC BRACKET
MP33	54810-04104	1	SLEEVE TOP
MP39	1520-0238	4	GROMET (NOT ON OPTION 017)
MP42	1400-3242	1	CABLE CLAMP
MP43	54832-09102	1	DISPLAY SPRING
MP44	54832-09103	1	POWER SUPPLY SPRING COVER
MP45	54810-42203	4	GROMMET 9x38
MP46	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 (WITH OPTION 017)
Cables			
W3	54826-61606	1	ACQUISITION SIGNAL CABLE
W4	54855-61604	1	POWER HARNESS CABLE
W5	54855-61621	1	POWER INPUT/LINE SINC
W6	54810-61613	1	CABLE ASSEMBLY POWER SUPPLY
W7	54810-61609	1	MOTHERBOARD SWITCH CABLE
W8	54810-61606	1	AUTO PROBE INTERFACE CABLE
W9	54855-61617	1	SEMI-RIGID CAL CABLE
W10	54801-61634	1	PROBE COMP CABLE
W11	54810-61610	1	DISPLAY CABLE
W12	54855-61602	1	KEYBOARD CABLE
W17	54855-61608	1	PROBE POWER CABLE
W19	54855-61606	1	FAN CABLE
W20	54801-61626	1	KEYBOARD INTERCONNECT
W21	54810-61605	1	BACKLIGHT POWER CABLE
W22	54801-61624	1	DISPLAY JUMPER CABLE
W23	54855-61610	1	FLOPPY DRIVE CABLE

Replaceable Parts

Ref. Des.	Agilent Part Number	QTY	Description
W24	54855-61618	2	AUX TRIG OUT CABLE
W25	01680-61625	1	IDE HARD DISK DRIVE CABLE (WITH OPTION 017)
W26	54855-61622	1	REMOVABLE HARD DISK POWER CABLE (WITH OPTION 017)

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Figure 8-1



54855b01

Oscilloscope Block Diagram Shown for Original Configuration w/1.44 MByte Floppy Drive

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 3 1/2-inch flexible disk drive.
- BNC connectors for channel input signals.
- 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.
- VGA monitor connection.
- Mouse and keyboard connections.
- LAN 10/100 connection.
- Auxiliary Input BNC (not on 2 channel oscilloscopes).
- Output BNC.
- TTL trigger output BNC.
- USB and PS/2 Interface.

The oscilloscope has several assemblies. Use 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 475W. The ac input frequency is 47 to 440 Hz.

Filtered voltages of +5.1 V, –5.2 V, +12.2 V, 3.3 V, and –12.2 V are supplied and distributed throughout the oscilloscope.

FPD Monitor Assembly

The monitor is a thin film liquid-crystal display (TFT-LCD). This FPD is an 8.4-inch diagonal, 640 by 480 pixel VGA 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 (acrms) and drives the back light.

Acquisition System

The acquisition system includes four attenuator assemblies on four channel oscilloscopes and two attenuator assemblies on two channel oscilloscopes on the acquisition board. The attenuators condition the signal, which is then digitized and stored by the acquisition board. 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.

Attenuators

The attenuators provide the appropriate impedance matching and all the attenuation and gain selection for each input channel. The attenuators are part of the acquisition board.

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 30 keys, all 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. 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 Remote Inhibit sense line that is routed to the power supply.

Disk Drives

The floppy disk drive is a 1.44 Mbyte, MS-DOS compatible. It is located on the front panel. The disk drive can be used to load a new oscilloscope operating system or to load application-specific software.

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.

Either 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, RAM, keyboard and mouse interfaces, serial and parallel interfaces, CDROM, hard and floppy disk drive interfaces, and PCI (Peripheral Component Interconnect) buses.

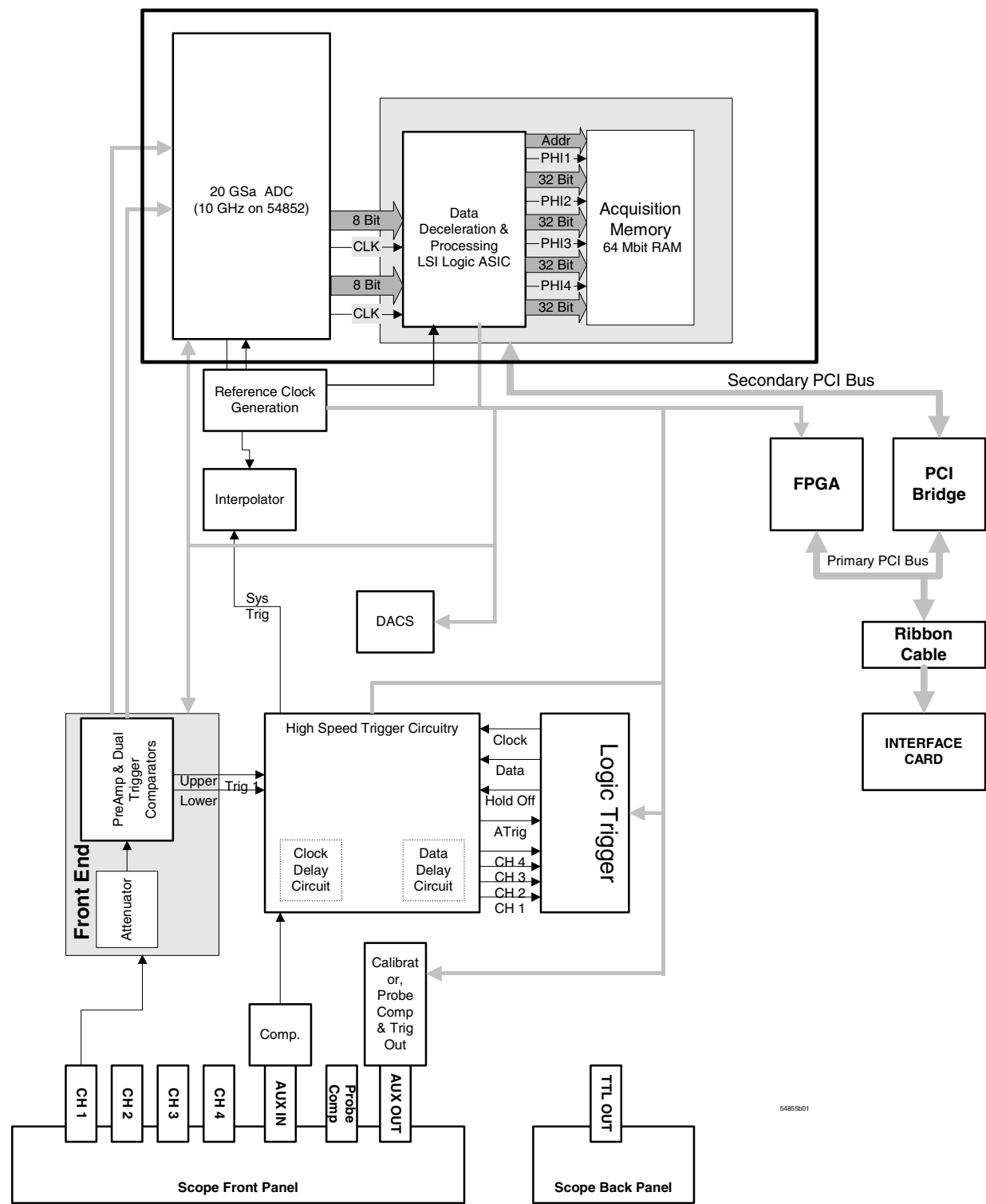
Display Board

The Display Board controls the flat-panel display monitor. There are two major video paths on this board. The first is used by the system controller on the motherboard to draw all general display elements, including the grid, status indicators, and toolbars and menus for the graphical interface. This is handled through a standard VGA chip, BIOS, and Graphics Board, similar to a standard PC VGA interface. The other path is the video input from the oscilloscope interface board, which is multiplexed with the main video to produce the video signals for the flat-panel display. The video from the oscilloscope graphics board is the waveform display data.

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 BNCs. 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

Attenuator Theory

The channel input signals are conditioned by the channel attenuator assemblies. There are four completely independent attenuators on each assembly. There are two identical outputs for each channel: one to drive the ADC hybrids and one to drive the trigger circuitry.

After the passive attenuators, the signal is split into high-frequency and low-frequency components. Low-frequency components are amplified on the main assembly where they are combined with the offset voltage.

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 from the channel attenuators. The four channels are identical. 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 two 20 GSa/s (10 GHz for 54852) ADCs.

Trigger There are four main trigger circuits: Trigger Conditioning, Analog Comparators, a Trigger Multiplexer, and Logic 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 channel triggers are sent to the Logic Trigger. The logic trigger provides the advanced triggering functions, such as holdoff, delay, and pattern duration and range. The data delay and clock delay timers are used to implement trigger functions that require timing between 1.5 and 20 ns.

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, time base IC, and trigger interpolator pulse stretcher.

- The 10 MHz oscillator provides the timebase reference.
- The time base has programmable dividers to provide the rest of the sample frequencies appropriate for the time range selected. The time base uses the time-stretched output of the interpolator pulse stretcher to time-reference the sampling to the trigger point. The time base has counters to control how much data is taken after the trigger event (post-trigger data). After enough pre-trigger samples have occurred, the time base IC sends a signal to the trigger multiplexer (ARM) indicating it is ready for the trigger event. When the trigger condition is satisfied, the trigger multiplexer sends a signal back to the time base (SYSTRIG). The time base IC then starts the post-trigger delay counter. When the countdown reaches zero, the sample clocks are stopped and the CPU is signaled that the acquisition is complete.
- The Interpolator Pulse Stretcher is a dual-slope integrator that acts as a time-interval stretcher. When the trigger system receives a signal that meets the programmed triggering requirements (SYSTRIG), it signals the time base. The time base then sends a pulse to the pulse stretcher. The pulse is equal in width to the time between the trigger (SYSTRIG) and the next sample clock. The pulse stretcher stretches this time by a factor of approximately 1000. Meanwhile, the time base hybrid runs a counter with a clock derived from the sample rate oscillator. When the interpolator indicates the stretch is complete, the counter is stopped. The count represents, with high accuracy, the time between the trigger and the first sample clock. The count is stored and used to place the recently acquired data in relationship to the trigger point.

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, or a dc voltage in the range -2.5 to $+2.5$ V. 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
- Two logic trigger functions

Interface and GPIB Board (A21)

The Interface Board (A21) has three 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.

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.

Waveform Display Management A PC video connector connects the oscilloscope interface board to the display board. The oscilloscope interface board accepts video clock and synchronization signals from the display board, and drives 16 bits of RGB data in 5,6,5 format to the display controller on the display board. The display driver will only substitute the PC video RGB data from the oscilloscope interface card for the other video data when the screen data matches the value specified in the display driver. In this way, the oscilloscope interface card can supply the waveform data from the acquisition system and have it properly multiplexed with regular video data for output on the flat-panel display.

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 oscilloscope graphics board provides high-speed access to oscilloscope configuration settings.

Safety Notices

This apparatus has been designed and tested in accordance with IEC Publication 1010, 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.

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