Service Guide

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Agilent Model 80000 Series Infiniium Oscilloscopes

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 DSO81304A offers 4 channels, 20 GSa/s sampling rate on all four channels, 13 GHz bandwidth
- Agilent DSO81204A offers 4 channels, 20 GSa/s sampling rate on all four channels, 12 GHz bandwidth
- Agilent DSO81004A offers 4 channels, 20 GSa/s sampling rate on all four channels, 10 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
- 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

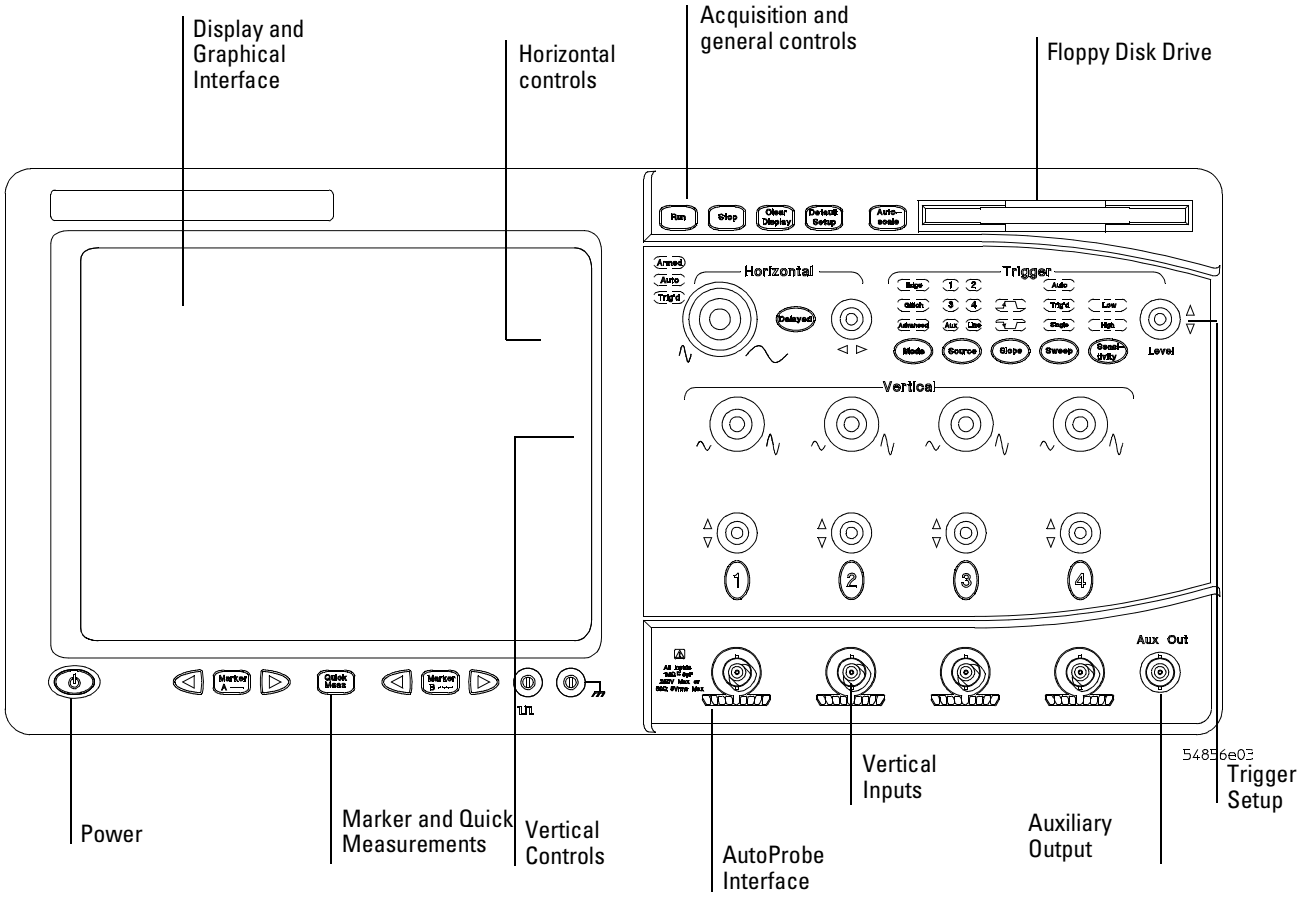
Marker and quick measurements help measure waveform parameters

- 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

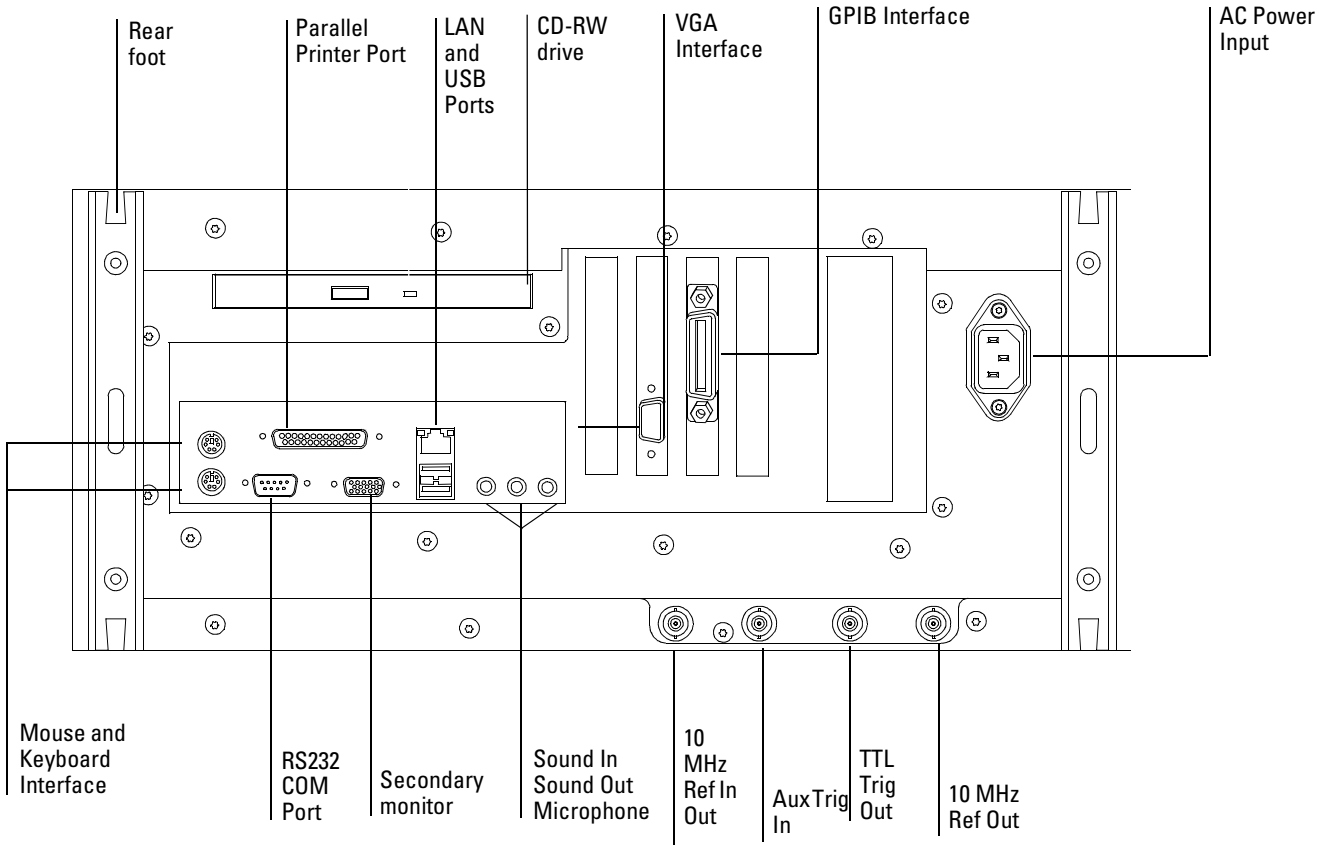
Service Policy

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

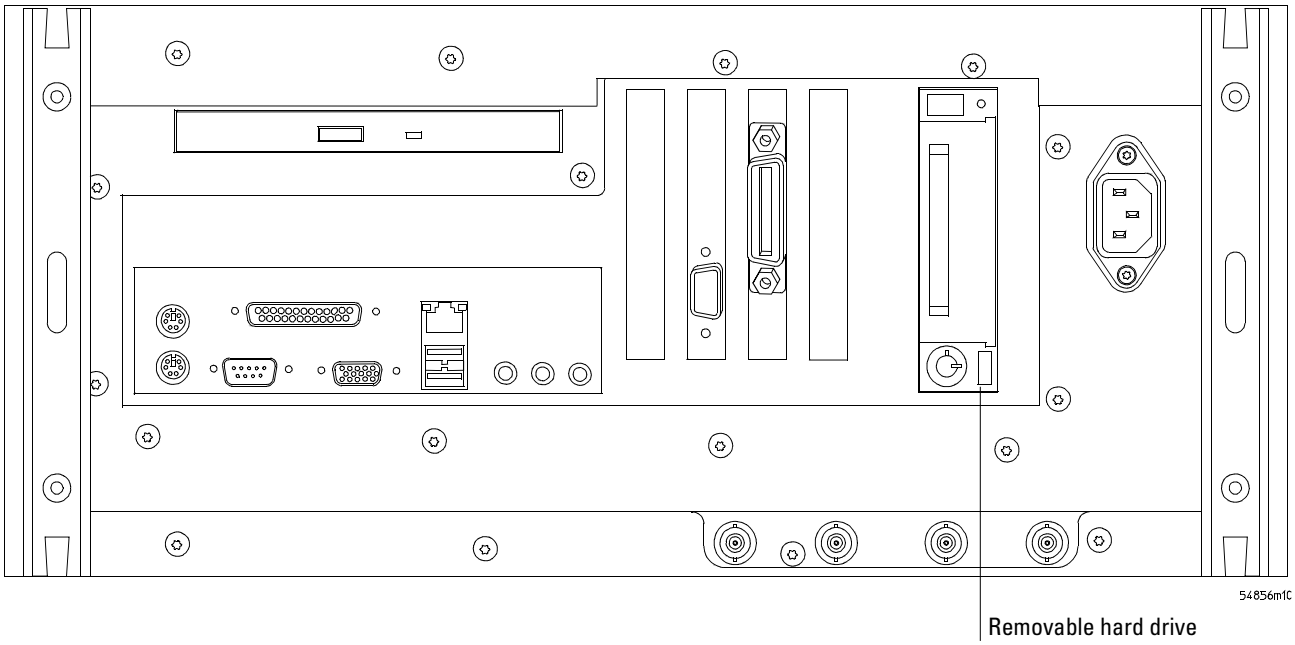
Front panel



Rear panel without option 017



Rear panel with option 017



In This Book

This book provides the service documentation for the Agilent Technologies DSO81304A, DSO81204A, and DSO81004A oscilloscopes. It is divided into eight 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 information on troublshooting to a faulty system.

Chapter 6 gives the procedures and techniques for replacing assemblies and other parts.

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

Chapter 8 briefly covers the internal operation of the oscilloscope.

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

Contents

1

General Information

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, 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
- BNC shorting cap, Agilent part number 1250-0929
- Power cord (see chapter 6, "Replaceable Parts," for available power cords)
- *User's Quick Start Guide*

Accessories available

The following accessories are available for use with the oscilloscope.

Table 1-1 Accessories for the Infiniium Oscilloscopes

Agilent Model Number	Description
54855-67604	18 GHz BNC-compatible to APC 3.5 mm adaptor
10833A	GPIB cable, 1 m
10833B	GPIB cable, 2 m
10833C	GPIB cable, 4 m
10833D	GPIB cable, 0.5 m
11094B	75 Ω Feedthrough Termination
1131A	3.5 GHz InfiniiMax Active Probe
1130A	1.5 GHz InfiniiMax Active Probe
1168A	10 GHz InfiniiMax Active Probe
1169A	12 GHz InfiniiMax Active Probe
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

Agilent Model Number	Description
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 80000 Series Infiniium oscilloscopes
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

The following table lists the specifications for the Agilent Technologies 80000 Series Infiniium Oscilloscopes. All specifications are warranted. Specifications are valid after a 30 minute warm-up period, and within ± 5 °C from the annual calibration temperature.

Vertical

Analog bandwidth (-3 dB)	DSO81304A: 12 GHz	DSO81204A: 12 GHz	DSO81004A: 10 GHz
DC gain accuracy[1]	±1.5% of full scale at full resolution channel scale		
Maximum input voltage	±5 V, CAT I		
Offset accuracy[1]	≤3.5 V: ± (1% of channel offset +1% of full scale) + 1 mV >3.5 V: ± (2% of channel offset +1% of full scale)		
DC voltage measurement accuracy[1]			
Dual cursor	± [(DC gain accuracy)+(resolution)]		
Single cursor	± [(DC gain accuracy)+(offset accuracy)+(resolution/2)]		

1. Full scale is defined as 8 vertical divisions. Magnification is used below 5 mV/div. Below 5 mV full scale is defined as 40 mV. The major scale settings are 5 mV, 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV and 1 V.

Characteristics

All characteristics are the typical performance values of the Infiniium oscilloscope and are not warranted. Footnotes are located on page 11.

Vertical

Input channels	4
DSP enhanced bandwidth (-3 dB)	DSO81304A: 13 GHz
Rise time (10% to 90%) (20% to 80%)	DSO81304A[9]: 33 ps DSO81204A: 36 ps DSO81004A: 42 ps DSO81304A[9]: 23 ps DSO81204A: 25 ps DSO81004A: 30 ps
Input impedance	50 Ω ±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 4 GHz: 60 dB 4 GHz to 10 GHz: 40 dB 10 GHz to BW: 35 dB
Offset range	Vertical sensitivity — Available offset 1 mV to ≥ 25 mV/div — ± 0.4 V > 25 mV to ≥ 50 mV/div — ± 0.9 V > 50 mV to ≥ 90 mV/div — ± 1.6 V > 90 mV to > 200 mV/div — ± 3.0 V ≥ 200 mV — ± 4.0 V
Dynamic range	± 4 div from center screen
RMS noise floor	Volts/div — DSO81004A — DSO81204A — DSO81304A 5 mV — 330 µV — 367 µV — 391 µV 10 mV — 390 µV — 429 µV — 475 µV 20 mV — 570 µV — 621 µV — 713 µV 50 mV — 1.3 mV — 1.4 mV — 1.7 mV 100 mV — 3.1 mV — 3.4 mV — 3.8 mV 200 mV — 6.0 mV — 6.6 mV — 7.5 mV 500 mV — 13 mV — 14.5 mV — 17 mV 1 V — 32 mV — 34 mV — 39 mV

Horizontal

Main sweep time scale range	5 ps/div to 20 s/div real time, 5 ps/div to 500 ns/div equivalent time
Main sweep time delay range	-200 s to 200 s real time, -25 µs to 200 s equivalent time
Delayed sweep time scale range	1 ps/div to current main time scale setting
Channel deskew range	±25 µs
Time scale accuracy[3]	±1 ppm pk
Delta-time measurement accuracy[6,7]	
≥ 256 Averages, rms	DSO81304A: 35 fs DSO81204A: 35 fs DSO81004A: 45 fs
Averaging disabled, rms	DSO81304A: 0.8 ps DSO81204A: 0.8 ps DSO81004A: 1.0 ps
≥ 256 Averages, peak	± [(0.5 ps) + (1 x 10^{-6} x |reading|)]
Averaging disabled, peak	± [(7.0 ps) + (1 x 10^{-6} x |reading|)]
Jitter measurement floor[6]	
Time interval error:	DSO81304A: 0.8 ps rms DSO81204A: 0.8 ps rms DSO81004A: 1.0 ps rms
Period jitter:	DSO81304A: 1.2 ps rms DSO81204A: 1.2 ps rms DSO81004A: 1.4 ps rms
N-cycle, cycle-cycle jitter:	DSO81304A: 1.8 ps rms DSO81204A: 1.8 ps rms DSO81004A: 2.2 ps rms

Acquisition

Real time sample rate per channel	40 GSa/s (2 channels simultaneously) 20 GSa/s (4 channels simultaneously)	
Memory depth per channel		
Standard	524,288 (2 channels)	262,144 (4 channels)
Option 001	2,050,000 (2 channels) 32,800,000 ≤ 4 GSa/s (2 channels)	1,025,000 (4 channels) 32,800,000 (4 channels) ≤ 2 GSa/s
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 (4 channels), 4 GSa/s peak detect (2 channels)	
Real time with hi resolution	Real time boxcar averaging reduces random noise and increases resolution.	
Equivalent time	Full bandwidth on all 4 channels, 262,144 sample points maximum memory. Acquires channels 1 and 3 simultaneously, followed by channels 2 and 4 simultaneously on subsequent triggers at 40 GSa/s each. High sample rate delivers excellent signal fidelity and throughput.	
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]	1.0 div p-p 0 to 4 GHz, 2.0 div p-p 4 to 8 GHz
Internal High[1]	0.3 div p-p 0 to 4 GHz, 1.0 div p-p 4 to 8 GHz
Auxiliary	DC to 1 GHz: 200 mV p-p into 50 Ω
Level range	
Internal	± 4 div from center screen or ± 4 Volts, whichever is smallest
Auxiliary	± 5 V, also limit input signal to ± 5 V
Sweep modes	Auto, triggered, single
Trigger jitter[6,8]	500 fs
Trigger holdoff range	100 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(rising, falling, or alternating between rising and falling) 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	Triggers on the line voltage powering the oscilloscope.
Pattern	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.
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 ± 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.

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, high pass filter, low pass filter.
FFT	
Frequency range[4]	DC to 20 GHz (at 40 GSa/s) or 10 GHz (at 20 GSa/s).
Frequency resolution	Sample rate/memory depth = Resolution.
Best resolution at maximum sample rate	20 kHz.
Frequency accuracy	(1/2 frequency resolution)+(1 x 10^{-6})(signal frequency).
Signal-to-noise ratio[5]	60 dB to 100 dB depending on settings.
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	≥20 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, binary data, 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 (~715 Hz and 456 MHz); trigger output (255 mV p-p into 50 Ω).
Trigger output	5 V 50 Ω back-terminated.
Time base reference output	10 MHz filtered sine wave with all harmonics ≤ -40 dBc. Amplitude into 50 Ω is 800 mV p-p to 1.26 V p-p (4 dBm ±2 dB) if derived from internal reference. Tracks external reference input input amplitude ±1 dB if applied and seleceted.
Time base reference input	Must be 10 MHz, input Z_0 = 50 Ω. Minimum 360 mV p-p (-5 dBm), maximum 2.0 V p-p (+10 dBm).

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 at 50 or 60 Hz; max input power 550 Watts.
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.

1. Full scale is defined as 8 vertical divisions. Magnification is used below 5 mV/div. Below 5 mV full scale is defined as 40 mV. The major scale settings are 5 mV, 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV and 1 V.
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 scope probe and oscilloscope limitations and input amplifier roll-off (e.g. -3 dB roll-off at specified bandwidth of the oscilloscope and scope probe system.
5. The FFT signal to noise ratio varies with the volts/div setting, the memory depth, and the use of time or frequency averaging.
6. Test signal peak-to-peak amplitude ≥5 divisions; vertical scale ≥10 mV/div; signal rise time ≤ 75 ps; sample rate = 40 GSa/s; 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.
9. Using Enhanced bandwidth.

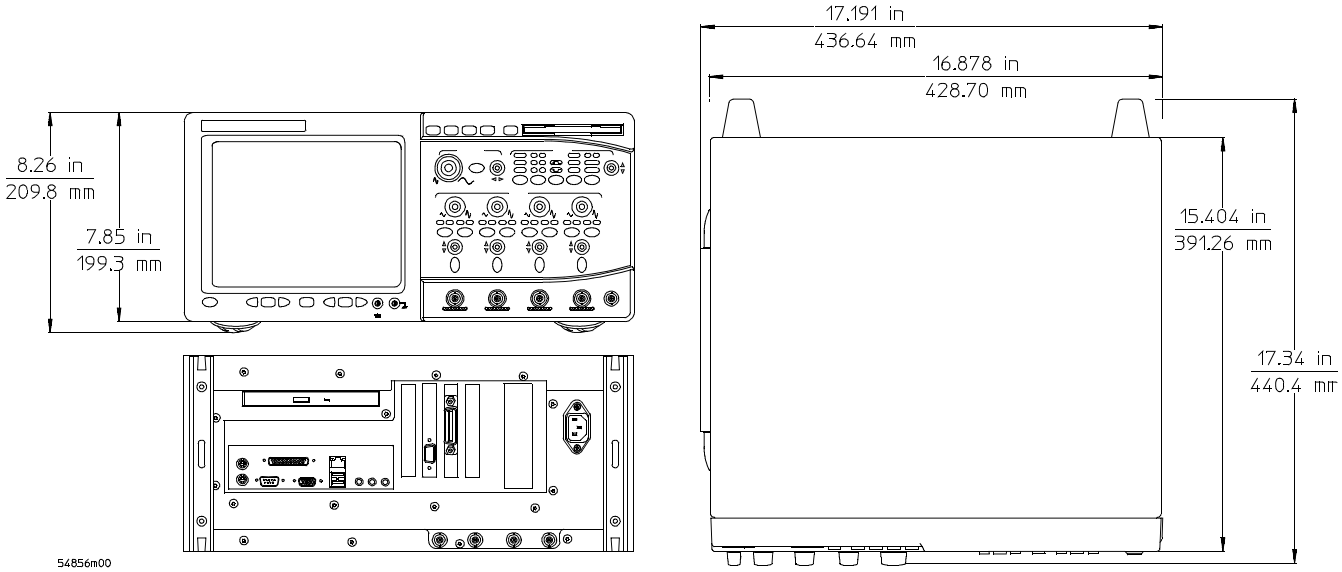
CAT I and CAT II Definitions

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 ±0.1% of reading	Agilent 34401A or Agilent 3458A	P
Microwave CW Generator	Maximum Frequency ≥ 14 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 ≥ 14 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 DSO81004A, DSO81004A, and DSO81204A)	50 Ω characteristic impedance BNC (m) connectors <= 12 Inch Length	Agilent 8120-1838 or Agilent 10502A	A
Cable Assembly (Cal Cable for DSO81304A)	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 ≥ 14 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 ≥ 18 GHz	Agilent 11667A	P
Power Sensor	Maximum Frequency ≥ 14 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

2

Setting Up the Oscilloscope

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.

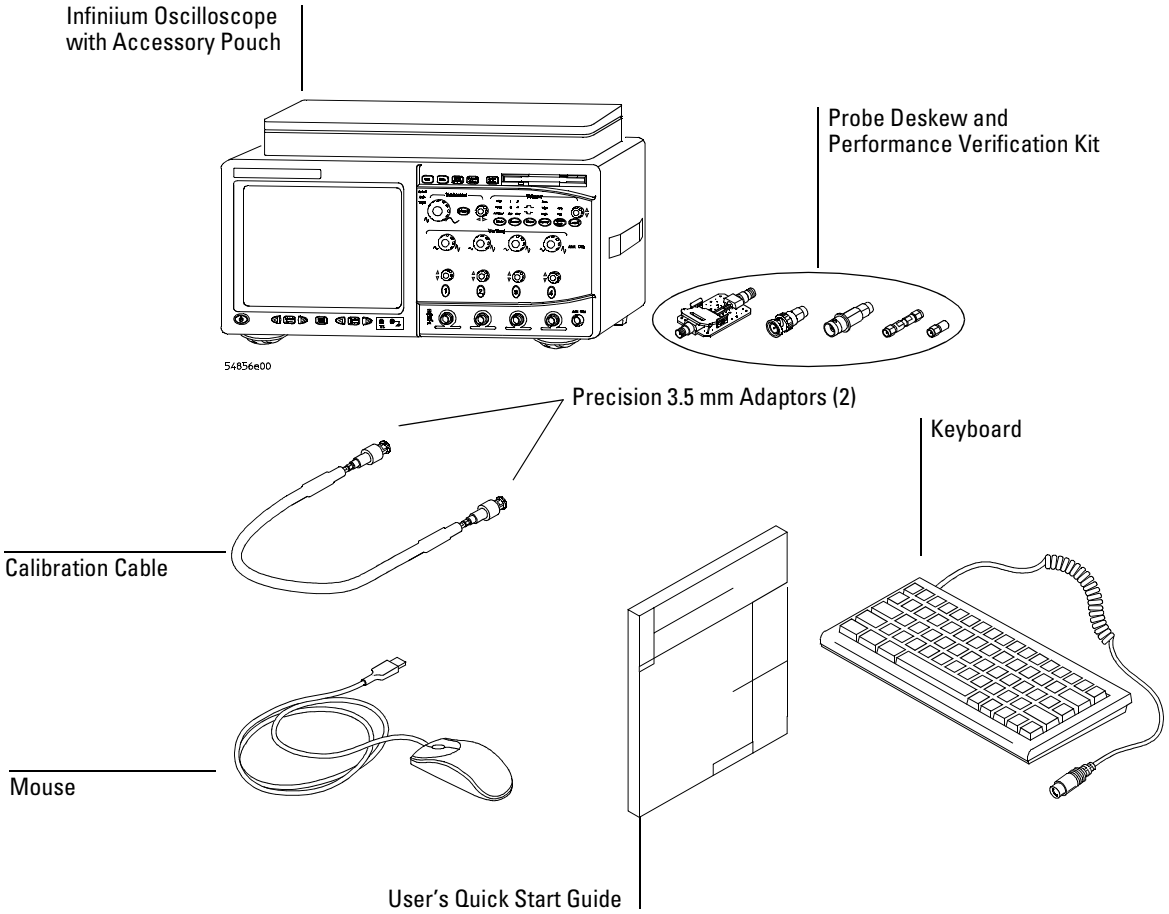
- Infiniium Oscilloscope
- Mouse
- Calibration Cable
- Precision 3.5 mm Adaptors
- Accessory Pouch
- Front Panel Cover
- Keyboard
- Power cord
- Probe De-skew and Performance Verification Kit
- *User's Quick Start Guide*

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	75Ω 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 InfiniiMax Active Probe
1132A	5 GHz InfiniiMax Active Probe
1134A	7 GHz InfiniiMax Active Probe
1156A	1.5 GHz Active Probe
1157A	2.5 GHz Active Probe
1158A	4 GHz Active Probe
1168A	10 GHz Active Probe
1169A	12 GHz Active Probe
1184A	Testmobile with keyboard and mouse tray and drawer for accessories
34398A 34399A	RS-232-C printer cable RS-232-C Adapter kit
54006A	6 GHz probe, 10:1 (500 Ω) or 20:1 (1 kΩ), .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

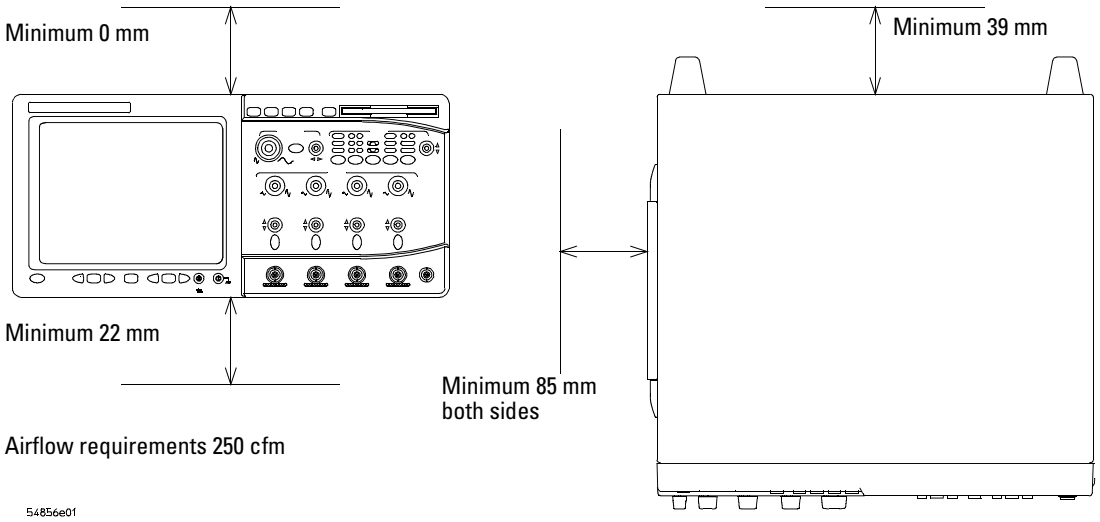
Agilent Model Number	Description
E2681A	EZJIT Jitter Analysis Software
E2682A	VoiceControl Retrofit Kit
E2683A	USB Test Option
E2685A	Telecommunications Mask Test Template Kit
E2688A	Serial Data Analysis Software Option
E5850A	Time-correlation fixture, integrates Infiniium oscilloscope and 16700 logic analyzer
N5401A	EZJIT Jitter Analysis Software

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

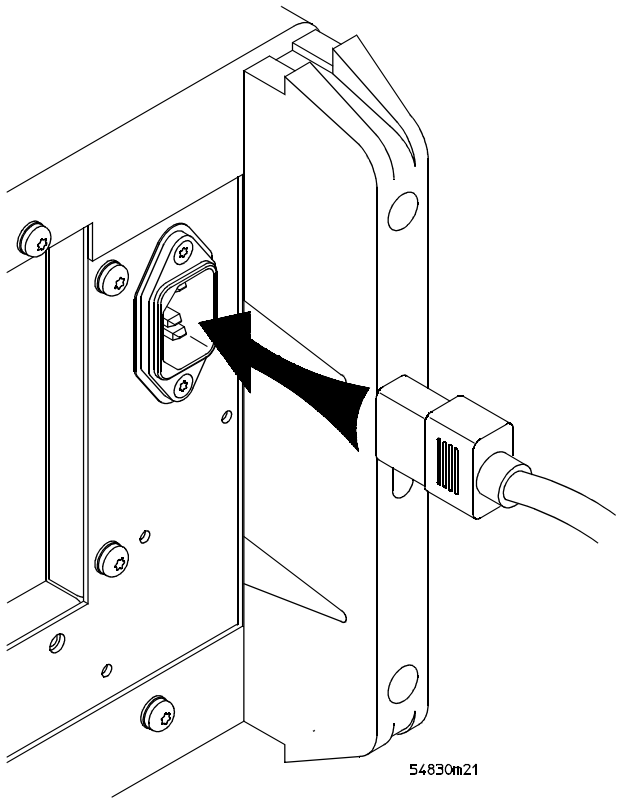


Positioning the Infiniium Oscilloscope with Sufficient Clearance

3 Connect the power cord to the rear of the oscilloscope, then to a suitable ac voltage source (100 to 240 VAC ±10%, 50 and 60 Hz all models)

Maximum power dissipation: 550 W.

Figure 2-3



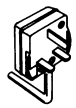
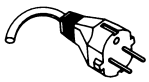
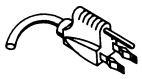
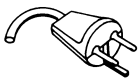
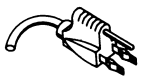
Infiniium Oscilloscope Power Cord Connection

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

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

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		India
100V		8120-4753	Straight MITI	90/230	Dark Gray	Japan
		8120-4754	90°	90/230		

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

To connect the mouse, 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.

> 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.

The 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.

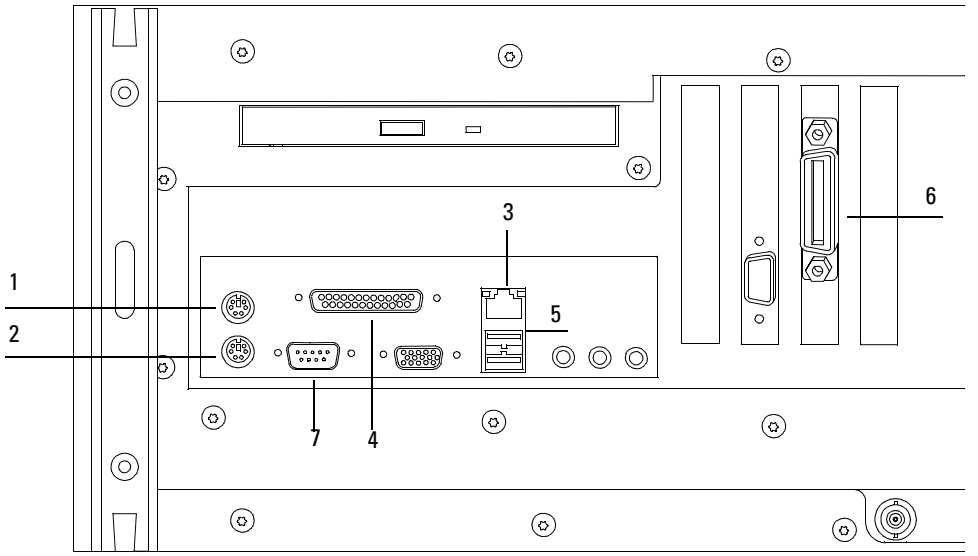
> After you have connected to the LAN card, you must set up the network. Before you try to setup your network, you should exit the oscilloscope application. If you do not know how to setup a network in Windows XP, see your network administrator or use the Windows XP on-line help.

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



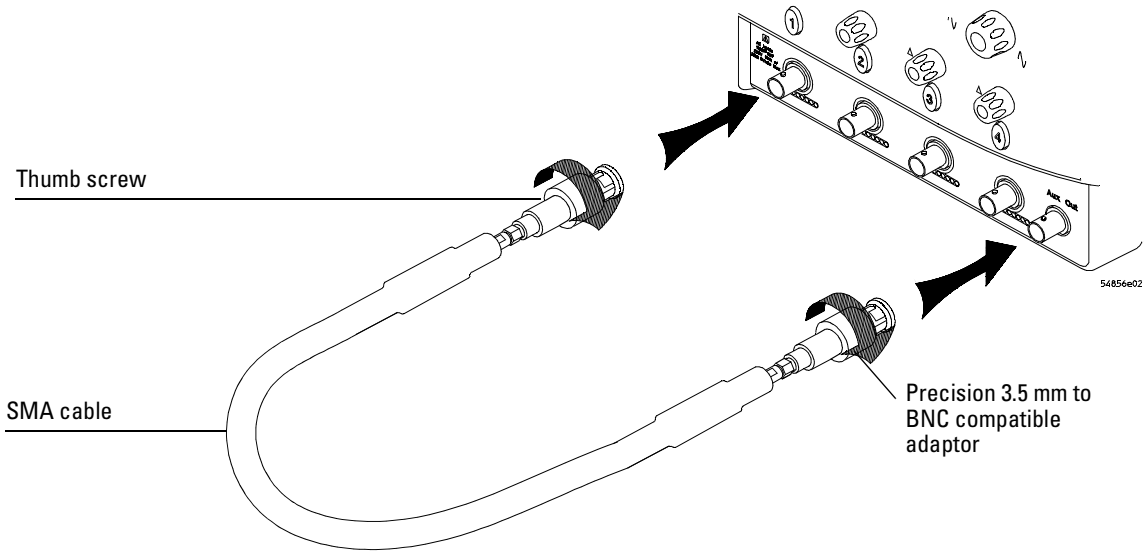
Back Panel

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 2-6

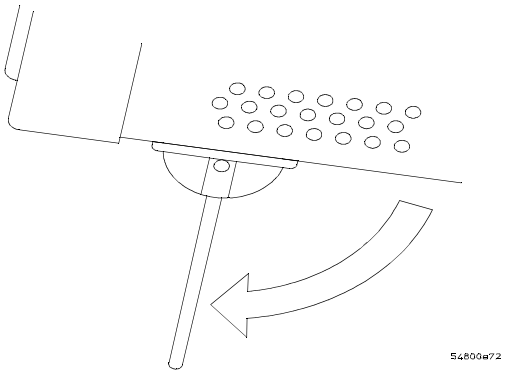


Connecting SMA to BNC Adaptors

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 2-7



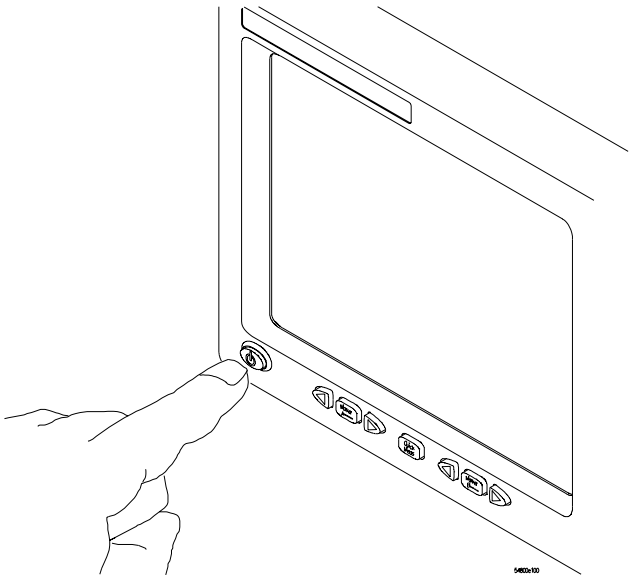
Latching the Oscilloscope Front Feet

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 2-8



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.

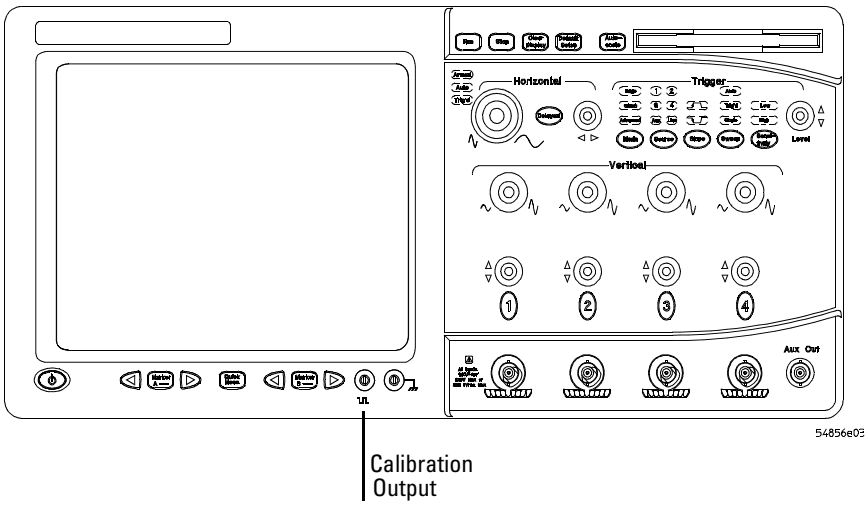
To verify basic oscilloscope operation

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 2-9



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.

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 (Asiliant) 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.

3

Testing Performance

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 Accuracy Test
- DC Gain Accuracy Test
- Analog Bandwidth Test

Offset Accuracy Test

CAUTION Ensure that the input voltage to the oscilloscope never exceeds ±5 V.

Specifications

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

Equipment Required

Description	Critical Specifications	Recommended Model/ Part Numbers
Digital Multimeter	DC voltage measurement accuracy better than ±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

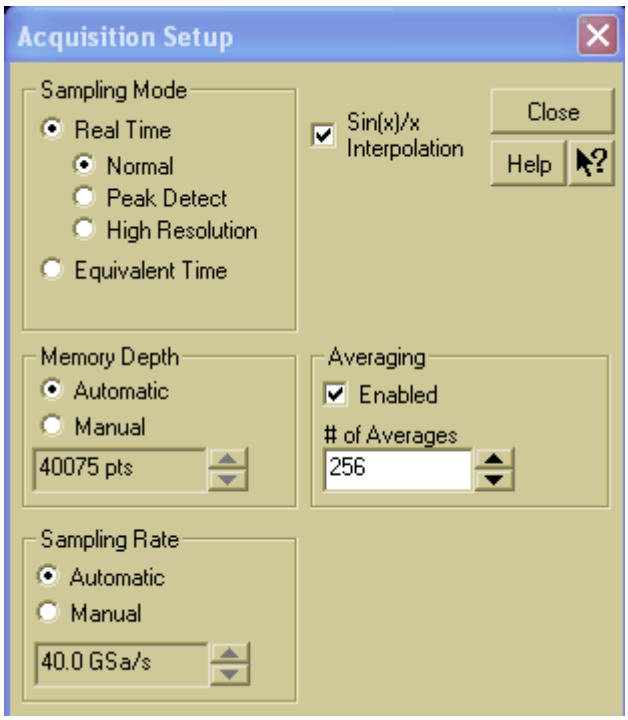
The offset accuracy specification has two terms ±(offset gain + zero offset) The offset gain specification is ±1% of channel offset and the zero offset specification is ±1% of full scale. The offset accuracy test procedure tests each of these terms individually.

Procedure

Zero Offset 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.

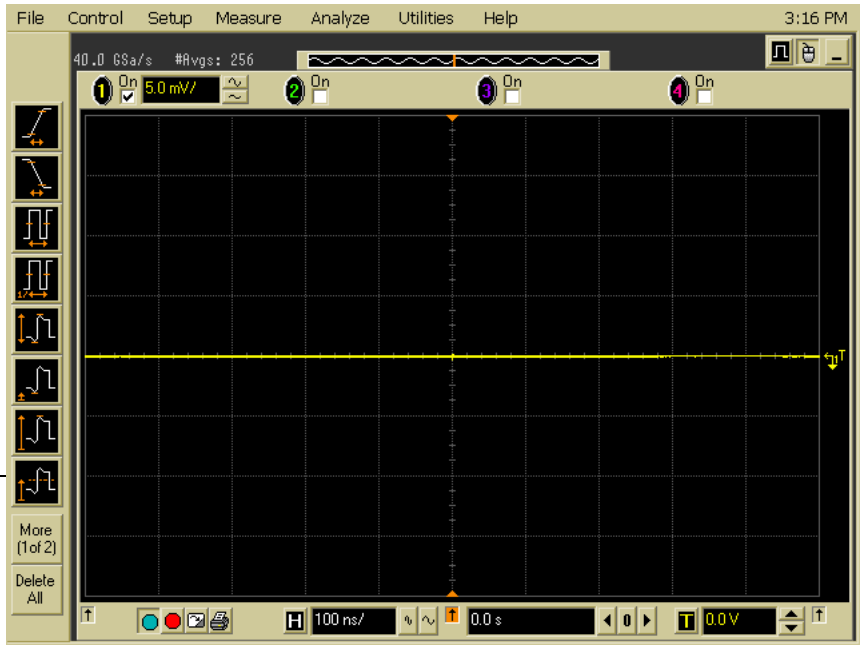
b When the Acquisition Setup window is displayed, enable averaging and set the # of averages to 256 as shown below.



3 Configure the scope to measure Average voltage on channel 1 as follows:

a Change the vertical sensitivity of channel 1 to 5 mV/div.

b Click the V avg measurement on the left side of the screen.

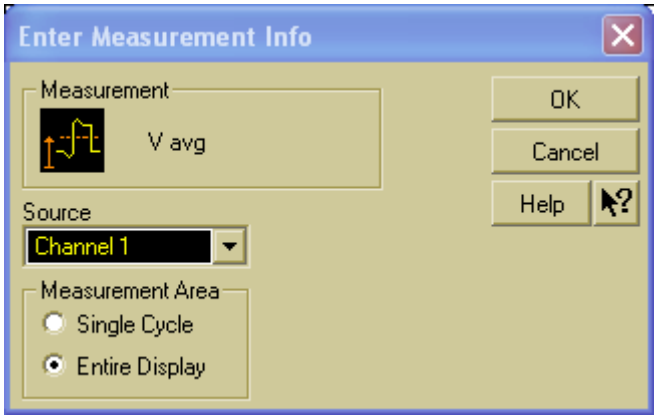


V avg measurement

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

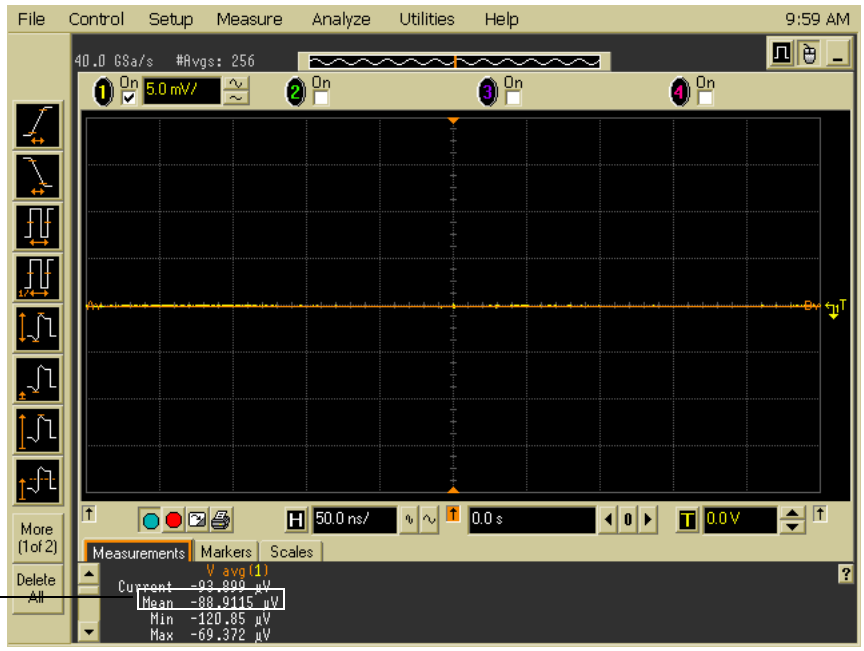
Measurement Area = Entire Display



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 Offset Test page 3-23 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.



Record the mean reading

5 Change the vertical sensitivity of channel 1 to 10 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 5 mV/div.
   c. Click the V avg measurement icon on the left side of the screen.
   d. When the Enter Measurement Info window is displayed, ensure that the Vavg function is set up as follows and then click OK:

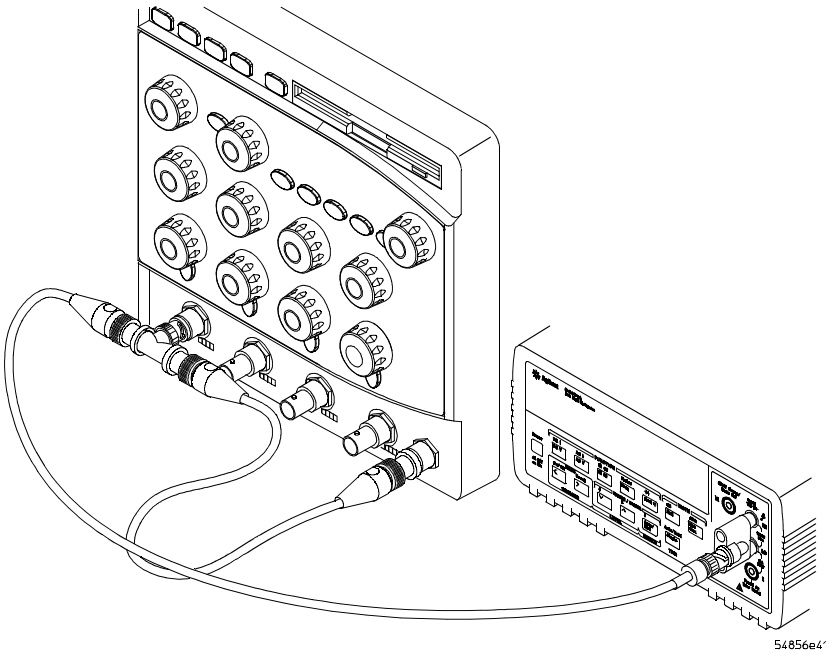
      Source = Channel 2

      Measurement area = Entire Display
9. Press the Clear Display key on the scope, wait for the #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 5 mV/div.

d Click the V avg measurement icon on the left side of the screen.

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

Source = Channel 1

Measurement area = Entire Display

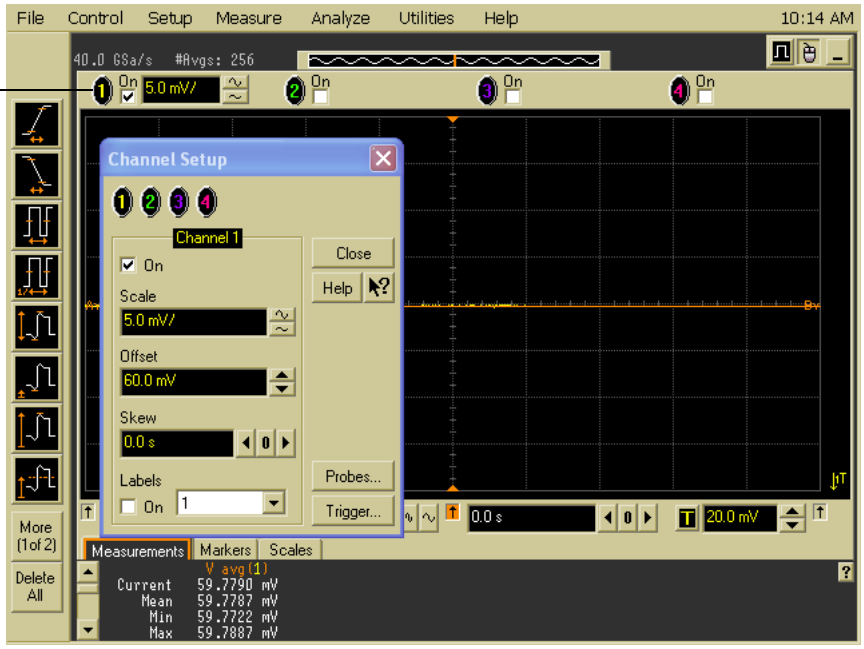
15 Set the channel 1 offset value to 60 mV. This can be done either using the front panel control or:

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 60 mV in the dialog box.

c Enter 60 mV in the Enter Offset dialog box.

Channel 1 setup icon



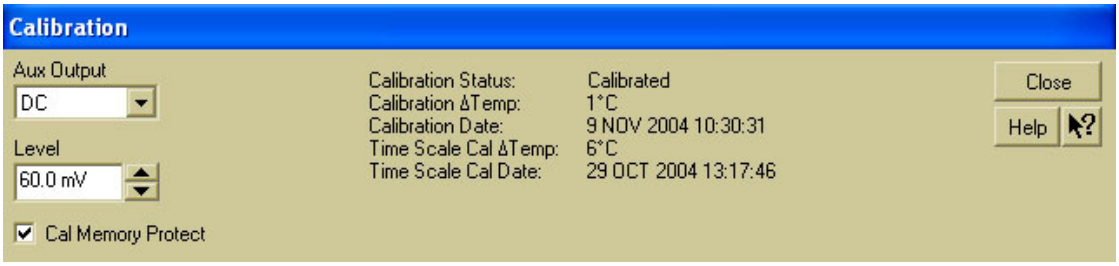
16 Set the Aux Out voltage ($V_{Aux\ Out}$) to +60 mV as follows:

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 60 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_{DMM+} and the scope Vavg reading as V_{Scope+} in the Offset Gain Test page 3-24 section of the Performance Test Record.

18 Change the channel 1 offset value to -60 mV.

19 Set the Aux Out voltage to -60 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 18 to 22 for the channels 2 to 4.

DC Gain Accuracy Test

CAUTION Ensure that the input voltage to the oscilloscope never exceeds ±5 V.

Specifications

DC Gain Accuracy	±1.5% of full scale at full resolution channel scale
Full scale is defined as 8 vertical divisions. Magnification is used below 5 mV/div. Below 5 mV full scale is defined as 40 mV. The major scale settings are 5 mV, 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV and 1 V.	

Equipment Required

Description	Critical Specifications	Recommended Model/ Part Numbers
Digital Multimeter	DC voltage measurement accuracy better than ±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

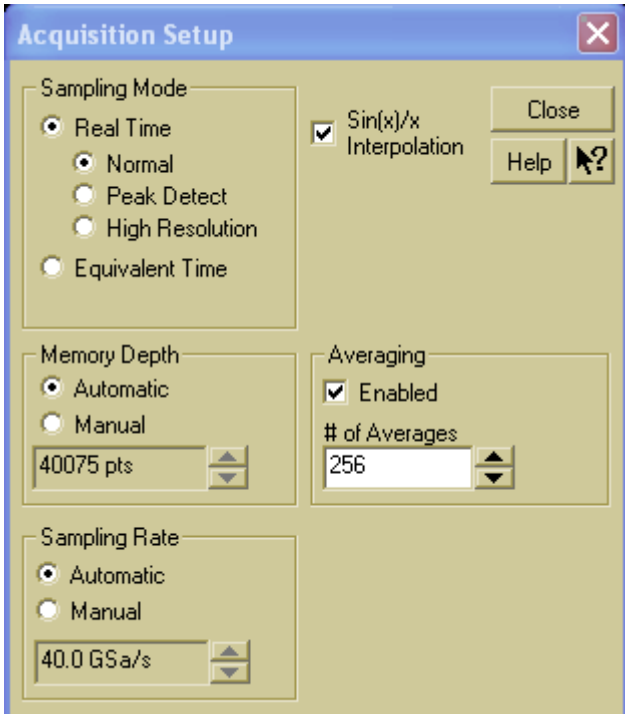
Procedure

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.



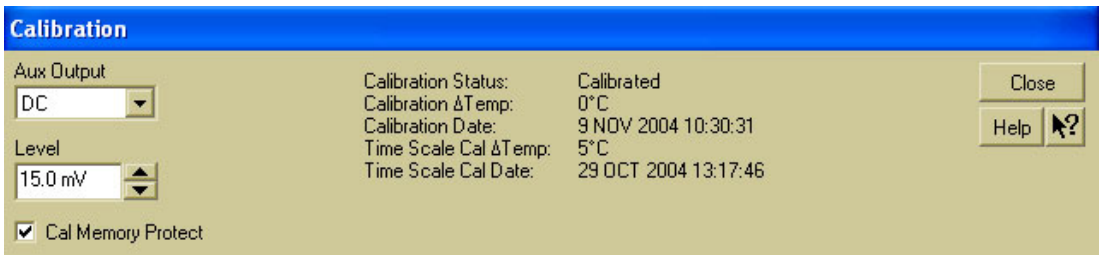
3 Set the Aux Out voltage ($V_{Aux\ Out}$) to +15 mV as follows:

a Pull down the Utilities menu and select Calibration.

b Change the Aux Output function to DC (top left corner).

c Set the Level to 15 mV.

d Click on Close.

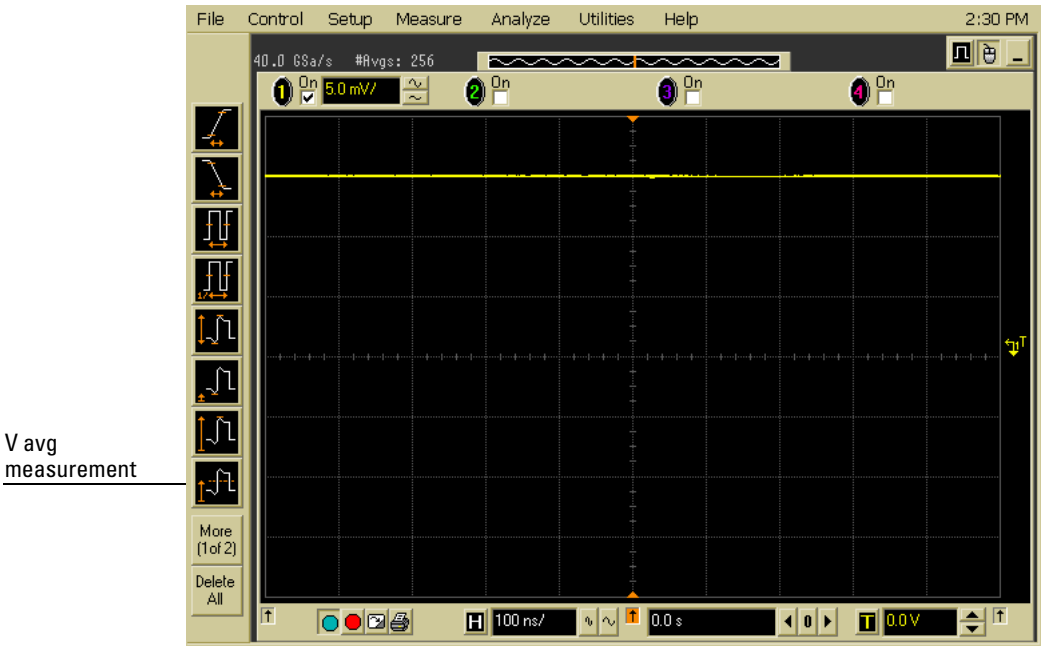


4 Set the channel 1 vertical sensitivity value to 5 mV/div. This can be done either using the front panel control or:

a Pull down the Setup menu and select Channel 1 or click the Channel 1 setup icon.

b Change the vertical sensitivity of channel 1 to 5 mV/div.

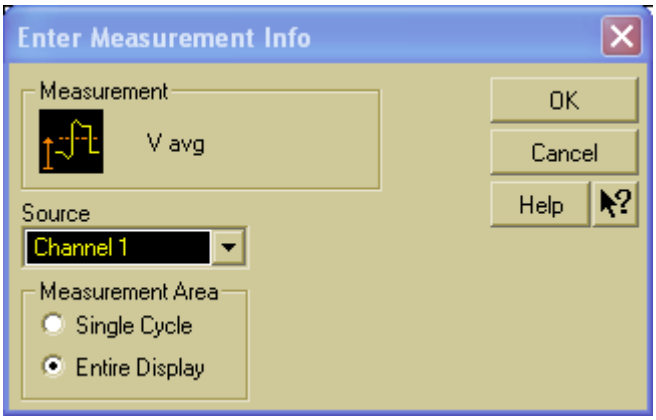
c Select the Vavg measurement as shown below.



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

Source = Channel 1

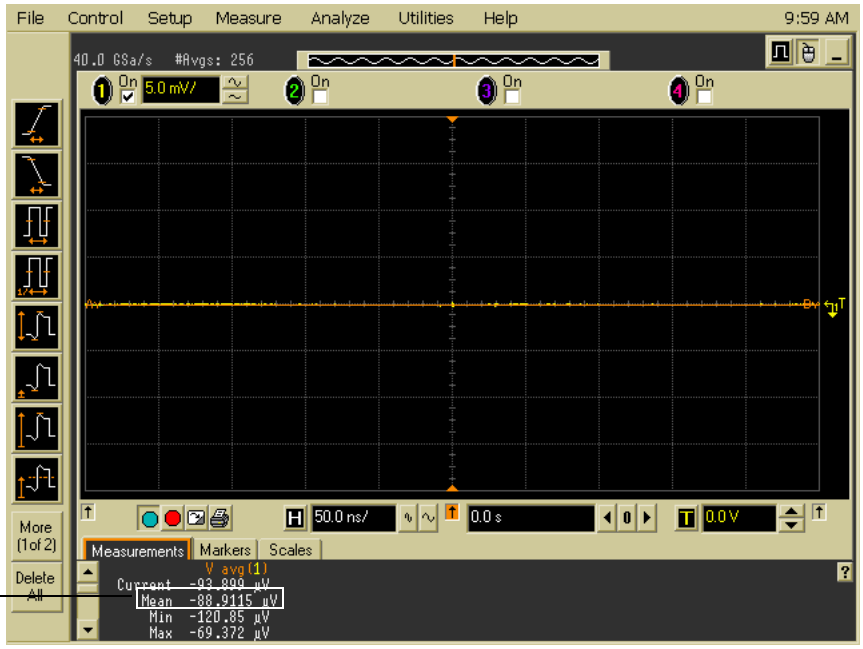
Measurement Area = Entire Display



5 Press the Clear Display key on the scope, wait for the #Avgs value (top left corner of screen) to return to 256 and then record the scope's mean V avg reading in the DC Gain Test page 3-25 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.



6 Change the the Aux Out voltage to -15 mV.

7 Press the Clear Display key on the scope, wait for the #Avgs value to return to 256 and then record the DMM voltage reading and the scope V avg reading in the DC Gain Test section of the Performance Test Record.

8 Repeat step 7 for the remaining vertical sensitivities for channel 1 in the DC Gain Test section of the Performance Test Record.

9 Press Default Setup, then turn off channel 1 and turn channel 2 display on.

10 Set the Aux Out voltage ($V_{Aux\ Out}$) to +15 mV as follows:

11 Configure the scope to measure V avg on Channel 2.

- **a** Pull down the Utilities menu and select Acquisition. When the Acquisition Setup window is displayed, enable averaging and set the # of averages to 256.
- **b** Change the vertical sensitivity of channel 2 to 5 mV/div.
- **c** Click the V avg measurement icon on the left side of the screen.
- **d** When the Enter Measurement Info window is displayed, ensure that the Vavg function is set up as follows and then click OK:

  Source = Channel 2

  Measurement area = Entire Display

12 Press the Clear Display key on the scope, wait for the #Avgs value to return to 256 and then record the DMM voltage reading and the scope V avg reading in the DC Gain Test section of the Performance Test Record.

13 Repeat step 12 for the remaining vertical sensitivities for channel 2 in the DC Gain section of the Performance Test Record.

14 Repeat steps 9 through 13 for channels 3 and 4.

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

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

Analog Bandwidth - Maximum Frequency Check

CAUTION Ensure that the input voltage to the oscilloscope never exceeds ±5 V.

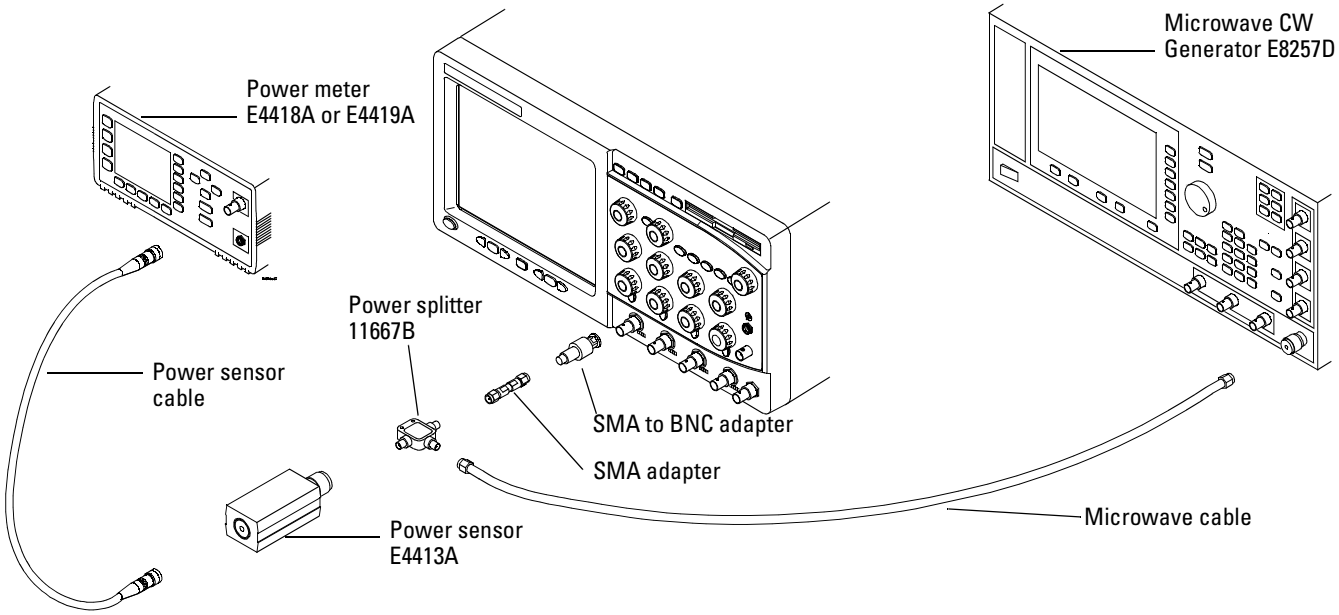
Specification

Analog Bandwidth (-3 dB)	
DSO81304A	12.0 GHz
DSO81204A	12.0 GHz
DSO81004A	10.0 GHz

Equipment Required

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

Connections



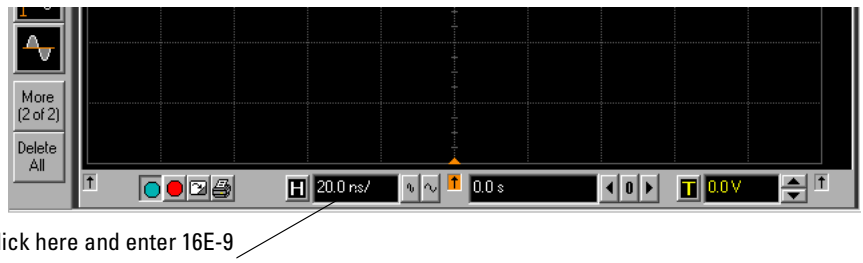
Notes

- Connect output 1 of the 11667B splitter to the scope Channel 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 5 mV/div.

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



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

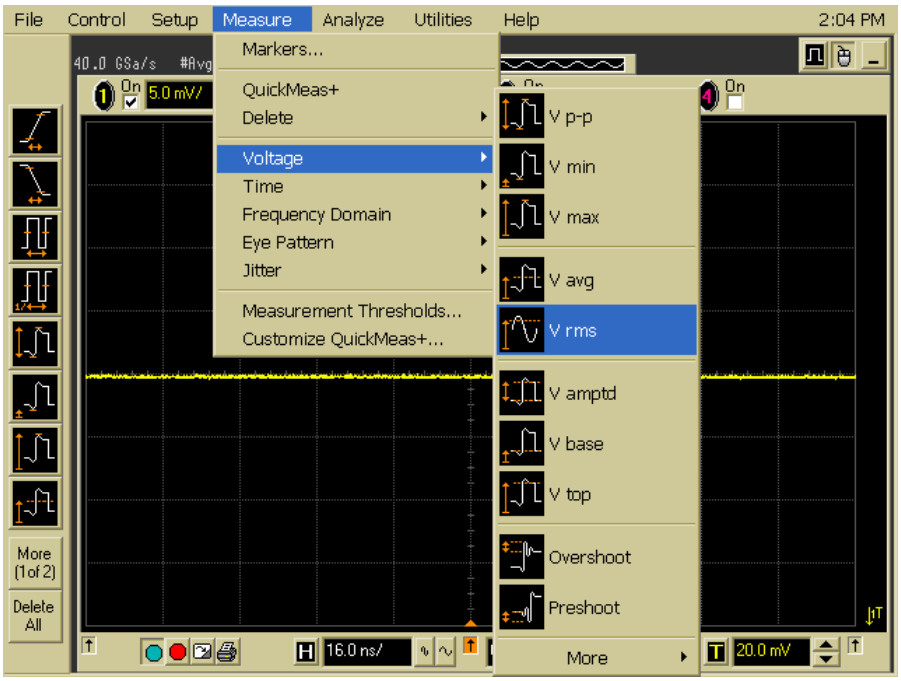
Memory Depth = Automatic

Sampling rate = Maximum (40 GSa/s)

Sin(x)/x Interpolation filter enabled

Averaging enabled with # of Averages = 16

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

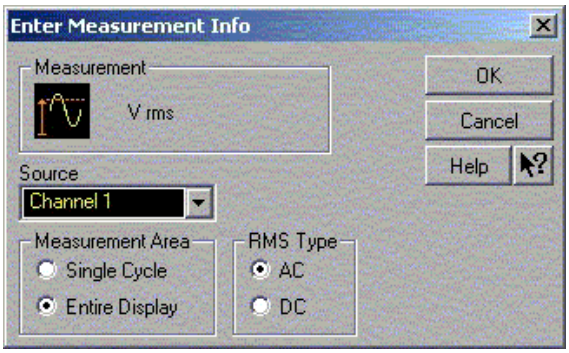


f When the RMS voltage measurement setup window is displayed, configure this measurement as follows:

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)
5 mV/div	0.02	-30
10 mV/div	0.04	-24
20 mV/div	0.08	-18
50 mV/div	0.20	-10
100 mV/div	0.40	-4
200 mV/div	0.80	+2
500 mV/div	2.0	+10
1 V/div	4.0	+16

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

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

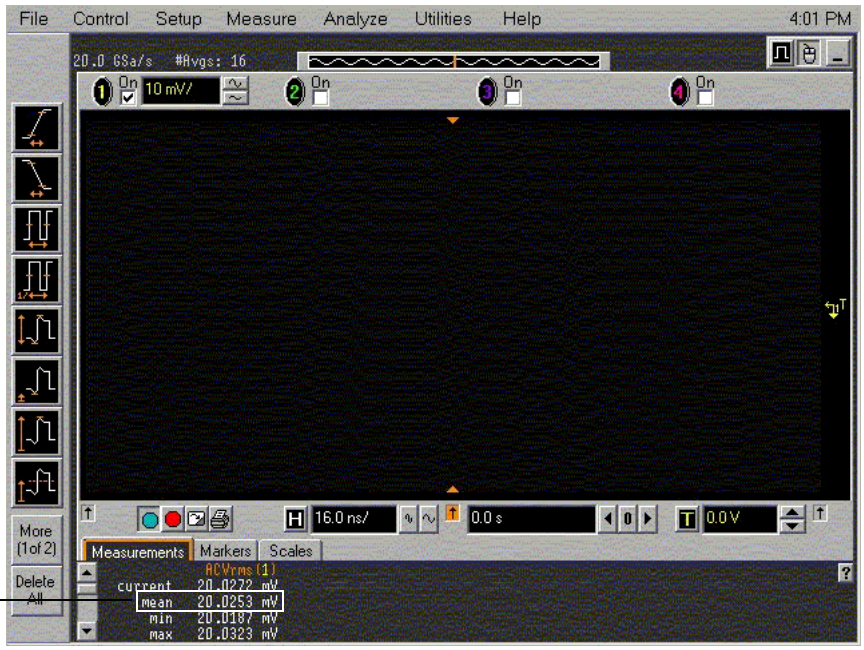
For example, if the power meter reading is 4.0 µW, then Vin = $(4.0*10^{-6} * 50\Omega)^{1/2}$ = 14.1 mVrms.

Record the RMS voltage in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record (Vin @ 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 (Vout @ 50 MHz). For all scope readings in this procedure, use the mean value in the Measurements display area at the bottom of the screen.

Notes

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



Record the mean reading

10 Calculate the reference gain as follows:

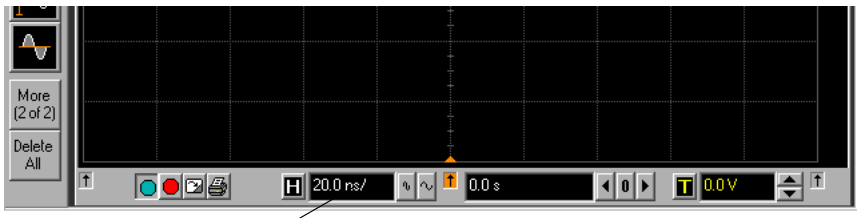
$$Gain_{50\ MHz} = \frac{V_{out\ @50\ \mathrm{MHz}}}{V_{in\ @50\ \mathrm{MHz}}}$$

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		
	DSO81004A	DSO81204A	DSO81304A
Maximum Frequency	10.0 GHz	12.0 GHz	12.0 GHz
Scope Time Base Setting	100 ps/div	100 ps/div	100 ps/div

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



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 µW, then Vin = $(4.0*10^{-6} * 50\Omega)^{1/2}$ = 14.1 mVrms.

Record the RMS voltage in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record (Vin @ 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 (Vout @ Max Freq).

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

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

For example, if (Vout @ Max Frequency) = 13.825 mV, (Vin @ Max Frequency) = 13.461 mV and Gain @ 50MHz = 1.0023, then:

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

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

16 Change the scope set up as follows:

a Change the channel vertical sensitivity to 10 mV/div.

b Reset the horizontal scale to 16 ns/div (to display 8 cycles of a 50 MHz waveform).

17 Change the generator output as follows:

a Reset the generator frequency to 50 MHz.

b Change the amplitude to the value suggested for this sensitivity in Table 3-1.

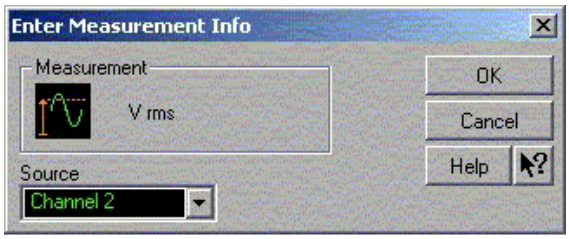
18 Repeat steps 8, 9, and 10 to measure the reference gain at 50 MHz for this sensitivity.

19 Repeat steps 11, 12, 13, and 14 to measure the gain at maximum frequency for this sensitivity.

20 Repeat steps 15 to 19 to complete measuring gains for remaining sensitivities for channel 1 in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record.

21 Move the splitter to channel 2 and change the scope configuration as follows:

- Ensure Channel 2 is displayed and all other channels are turned off.
- Set the vertical sensitivity of channel 2 to 5 mV/div.
- Set the horizontal scale to 16 ns/div (to display 8 cycles of a 50 MHz waveform).
- Right click on the V rms measurement at the bottom of the screen. When the RMS voltage measurement setup window is displayed, change the source from Channel 1 to Channel 2.



22 Repeat steps 7 to 20 to complete measuring gains for channel 2.

23 Move the splitter to channel 3 and change the scope configuration as follows:

a Ensure Channel 3 is displayed and all other channels are turned off.

b Set the vertical sensitivity of channel 3 to 5 mV/div.

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

d Click on the V rms measurement at the bottom of the screen and select Customize. When the V rms setup window is displayed, change the source from Channel 2 to Channel 3.

24 Repeat steps 7 to 20 to complete measuring gains for channel 3.

25 Move the splitter to channel 4 and change the scope configuration as follows.

a Ensure Channel 4 is displayed and all other channels are turned off.

b Set the vertical sensitivity of channel 4 to 5 mV/div.

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

d Click on the V rms measurement at the bottom of the screen. When the V rms setup window is displayed, change the source from Channel 3 to Channel 4.

26 Repeat steps 7 to 20 to complete measuring gains for channel 4.

Offset Performance Test

Zero Offset Test

Vertical Sensitivity	Test Limits	Channel 1	Channel 2	Channel 3	Channel 4
5 mV/div	-1.4 mV to +1.4 mV				
10 mV/div	-0.9 mV to +0.9 mV				
20 mV/div	-1.7 mV to +1.7 mV				
50 mV/div	-4.1 mV to +4.1 mV				
100 mV/div	-8.1 mV to +8.1 mV				
200 mV/div	-16.1 mV to +16.1 mV				
500 mV/div	-40.1 mV to +40.1 mV				
1 V/div	-80.1 mV to +80.1 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							
5 mV/div	±60 mV						+0.99 to +1.01
10 mV/div	±120 mV						+0.99 to +1.01
20 mV/div	±240 mV						+0.99 to +1.01
50 mV/div	±600 mV						+0.99 to +1.01
100 mV/div	±1.2 V						+0.99 to +1.01
200 mV/div	±2.4 V						+0.99 to +1.01
500 mV/div	±2.4 V						+0.99 to +1.01
1 V/div	±2.4 V						+0.99 to +1.01
Channel 2							
5 mV/div	±60 mV						+0.99 to +1.01
10 mV/div	±120 mV						+0.99 to +1.01
20 mV/div	±240 mV						+0.99 to +1.01
50 mV/div	±600 mV						+0.99 to +1.01
100 mV/div	±1.2 V						+0.99 to +1.01
200 mV/div	±2.4 V						+0.99 to +1.01
500 mV/div	±2.4 V						+0.99 to +1.01
1 V/div	±2.4 V						+0.99 to +1.01
Channel 3							
5 mV/div	±60 mV						+0.99 to +1.01
10 mV/div	±120 mV						+0.99 to +1.01
20 mV/div	±240 mV						+0.99 to +1.01
50 mV/div	±600 mV						+0.99 to +1.01
100 mV/div	±1.2 V						+0.99 to +1.01
200 mV/div	±2.4 V						+0.99 to +1.01
500 mV/div	±2.4 V						+0.99 to +1.01
1 V/div	±2.4 V						+0.99 to +1.01
Channel 4							
5 mV/div	±60 mV						+0.99 to +1.01
10 mV/div	±120 mV						+0.99 to +1.01
20 mV/div	±240 mV						+0.99 to +1.01
50 mV/div	±600 mV						+0.99 to +1.01
100 mV/div	±1.2 V						+0.99 to +1.01
200 mV/div	±2.4 V						+0.99 to +1.01
500 mV/div	±2.4 V						+0.99 to +1.01
1 V/div	±2.4 V						+0.99 to +1.01

DC Gain Test

Vertical Sensitivity	$V_{Aux\ Out}$ Setting	V_{DMM+}	V_{DMM-}	V_{Scope+}	V_{Scope-}	Calculated DC Gain	Offset Gain Test Limits
Channel 1							
5 mV/div	±15 mV						+0.985 to +1.015
10 mV/div	±30 mV						+0.985 to +1.015
20 mV/div	±60 mV						+0.985 to +1.015
50 mV/div	±150 mV						+0.985 to +1.015
100 mV/div	±300 mV						+0.985 to +1.015
200 mV/div	±600 mV						+0.985 to +1.015
500 mV/div	±1.5 V						+0.985 to +1.015
1 V/div	±2.4 V						+0.985 to +1.015
Channel 2							
5 mV/div	±15 mV						+0.985 to +1.015
10 mV/div	±30 mV						+0.985 to +1.015
20 mV/div	±60 mV						+0.985 to +1.015
50 mV/div	±150 mV						+0.985 to +1.015
100 mV/div	±300 mV						+0.985 to +1.015
200 mV/div	±600 mV						+0.985 to +1.015
500 mV/div	±1.5 V						+0.985 to +1.015
1 V/div	±2.4 V						+0.985 to +1.015
Channel 3							
5 mV/div	±15 mV						+0.985 to +1.015
10 mV/div	±30 mV						+0.985 to +1.015
20 mV/div	±60 mV						+0.985 to +1.015
50 mV/div	±150 mV						+0.985 to +1.015
100 mV/div	±300 mV						+0.985 to +1.015
200 mV/div	±600 mV						+0.985 to +1.015
500 mV/div	±1.5 V						+0.985 to +1.015
1 V/div	±2.4 V						+0.985 to +1.015
Channel 4							
5 mV/div	±15 mV						+0.985 to +1.015
10 mV/div	±30 mV						+0.985 to +1.015
20 mV/div	±60 mV						+0.985 to +1.015
50 mV/div	±150 mV						+0.985 to +1.015
100 mV/div	±300 mV						+0.985 to +1.015
200 mV/div	±600 mV						+0.985 to +1.015
500 mV/div	±1.5 V						+0.985 to +1.015
1 V/div	±2.4 V						+0.985 to +1.015

Analog Bandwidth - Maximum Frequency Check

Max frequency: DSO81004A = 10.0 GHz, DSO81204A = 12.0 GHz, DSO81304A = 12.0 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						
5 mV/div						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						
Channel 2						
5 mV/div						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						
Channel 3						
5 mV/div						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						
Channel 4						
5 mV/div						
10 mV/div						
20 mV/div						
50 mV/div						
100 mV/div						
200 mV/div						
500 mV/div						
1 V/div						

4

Calibration

Calibration

This chapter provides self calibration procedures for the oscilloscope.

To run the self calibration

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

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

- yearly, or according to your periodic needs,
- when you replace the acquisition assembly or acquisition hybrids,
- when you replace the hard drive or any other assembly,
- when the delta temperature is more than ±5 °C different than the last calibration, or

Equipment Required

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

* 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

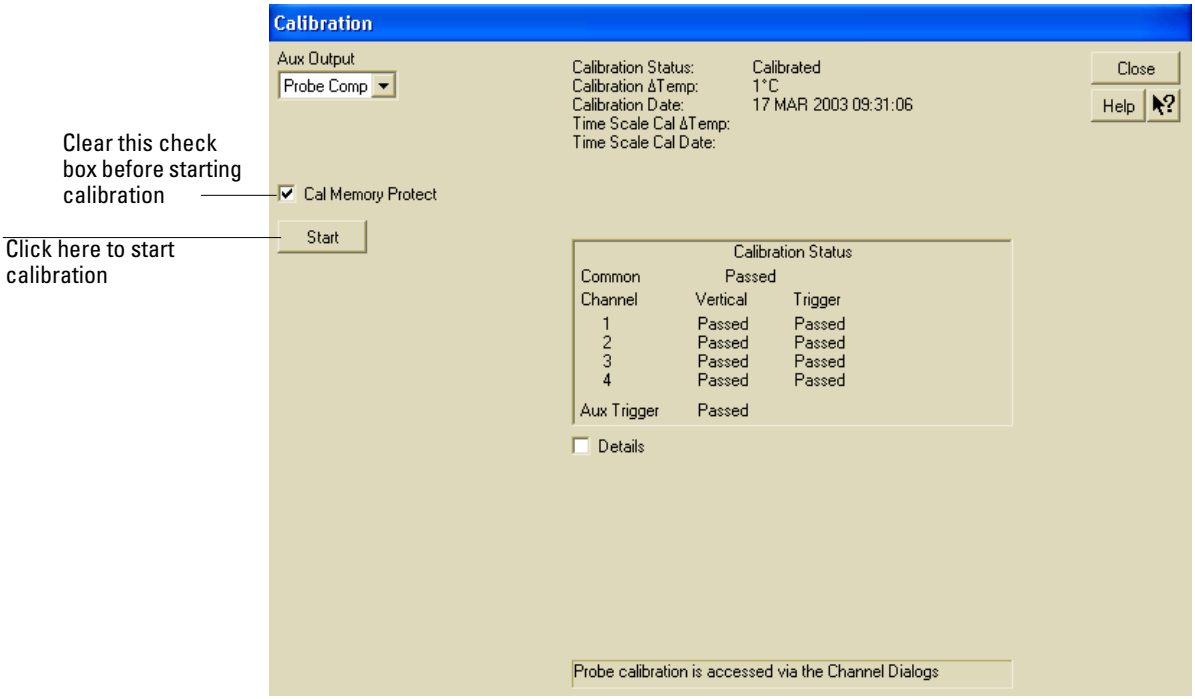
Calibration time
It will take approximately 1 hour to run the self calibration on the oscilloscope, including the time required to change cables from channel to channel.

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

2 Pull down the Utilities menu and Select Calibration.

3 Click the check box to clear the Cal Memory Protect condition.
You cannot run self calibration if this box is checked. See Figure 4-1.

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

- Std - Time scale calibration will not be performed. Time scale calibration factors from the previous time scale calibration will be used and the 10 MHz reference signal will not be required. The remaining calibration procedure will continue.
- Std + Time - Performs the time scale calibration. This option requires you to connect a 10 MHz reference signal to channel 1 that meets the following specifications. Failure to use a reference signal that meets this specification will result in an inaccurate calibration.

  Frequency: 10 MHz ±0.4 ppm = 10 MHz ±4 Hz
  Amplitude: 0.2 Vpeak-to-peak to 5.0 Vpeak-to-peak
  Wave shape: Sine or Square

- Std + Dflt - Factory time scale calibration factors will be used. The 10 MHz reference signal will not be required. The remaining calibration procedure will continue.

b Disconnect everything from all inputs and Aux Out.

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

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

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

e Connect the 50 Ω BNC cable from the Aux Out to the Aux Trig In on the rear panel of the oscilloscope.

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

5 After the calibration procedure is completed, click Close.

5

Troubleshooting

Troubleshooting

This section provides troubleshooting information for the Agilent Technologies DSO80000 series oscilloscopes. 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.

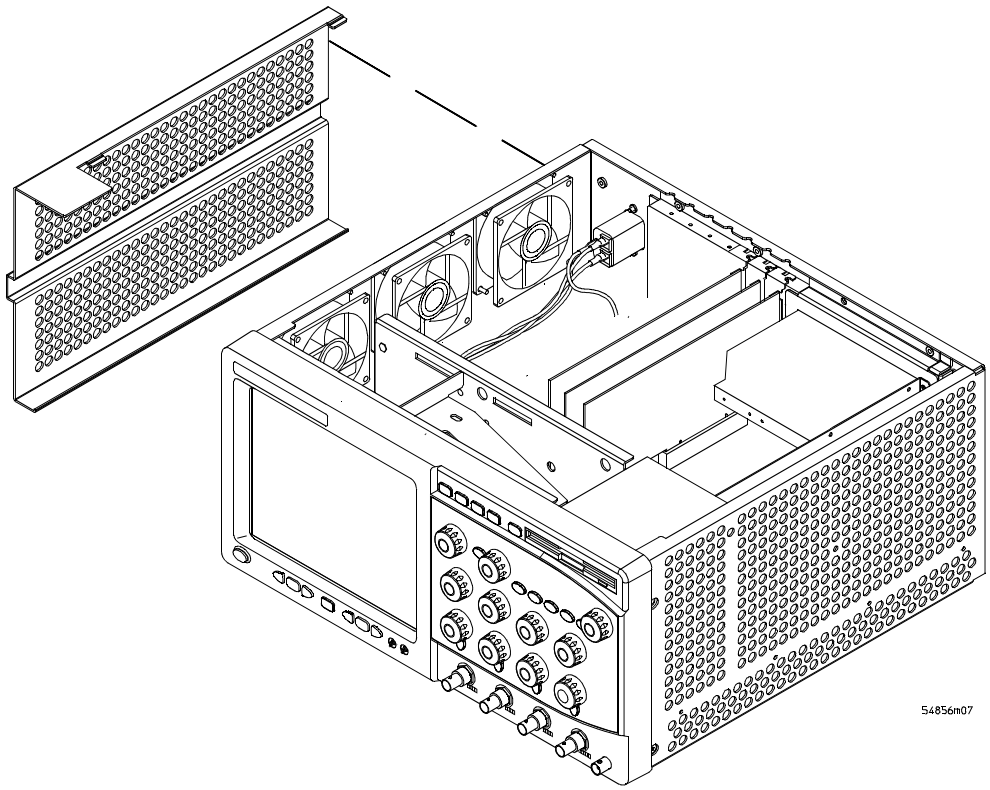
- Press the Default Setup key to set the oscilloscope to the default state.

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.

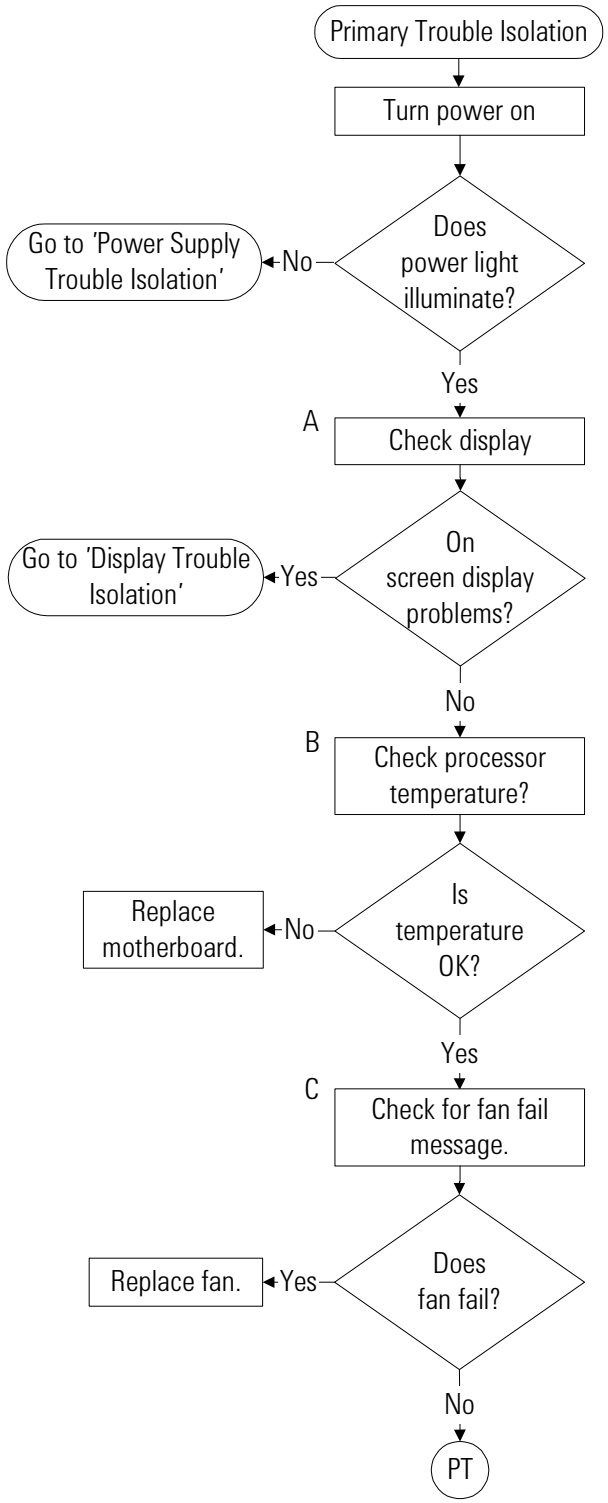
The primary procedural tool in this section is the flowchart. The flowchart contains the entire troubleshooting path from a failed oscilloscope to a working one, and will direct you in an orderly manner through the possible failure symptoms. Reference letters on the flowcharts point to procedural steps that explain the brief instructions in the chart.

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

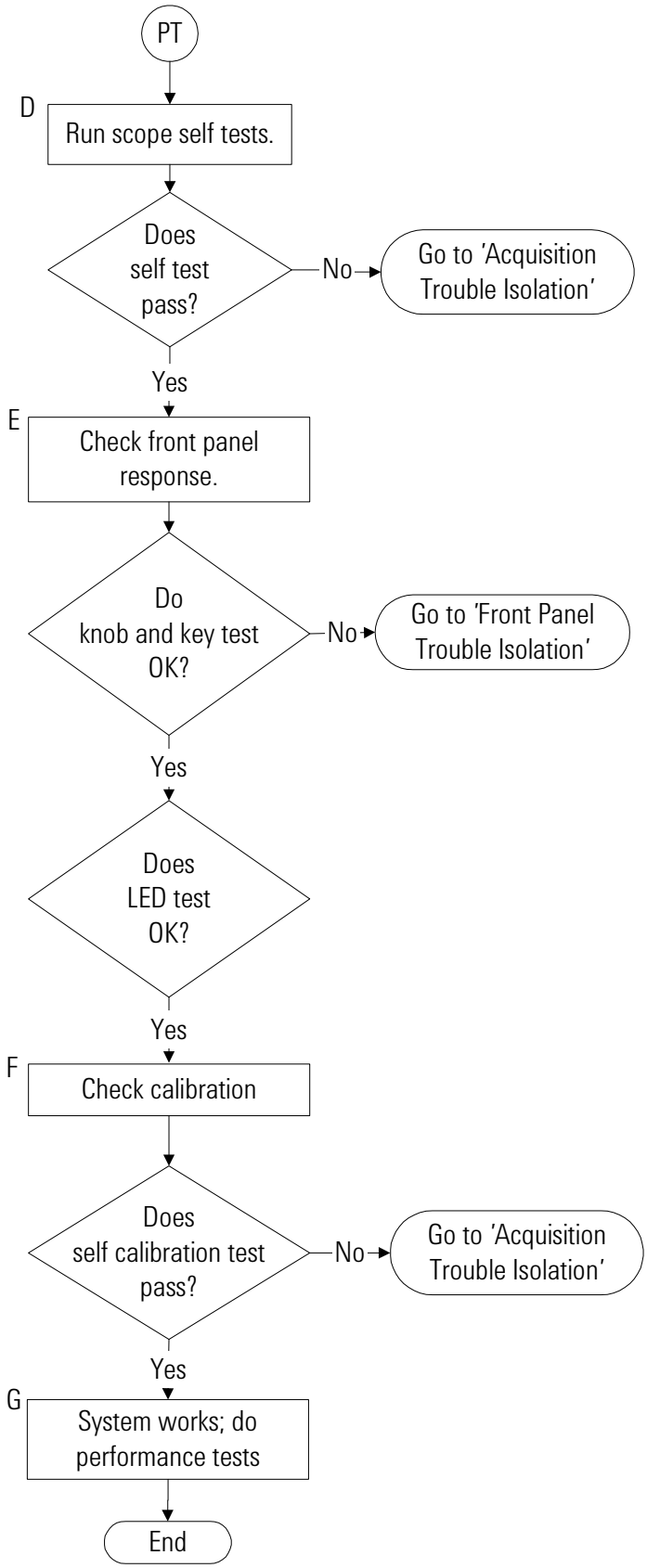
Primary Trouble Isolation

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

Primary Trouble Isolation Flowchart



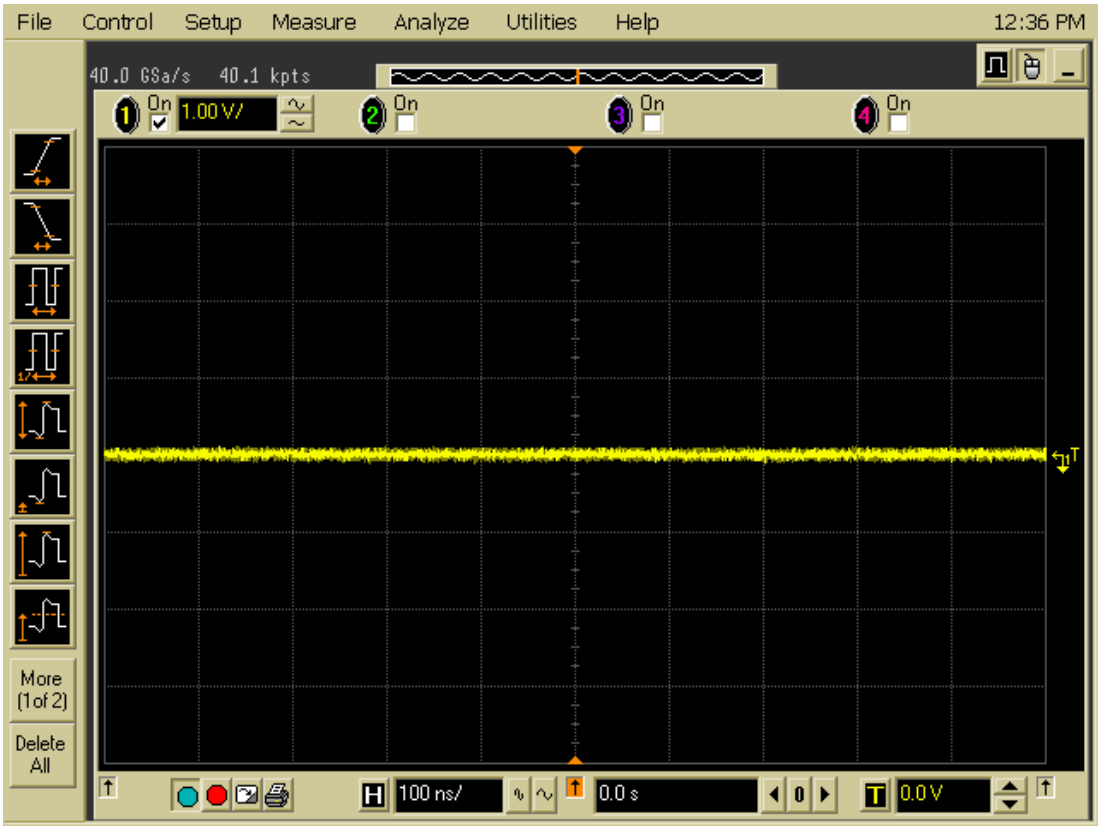
Primary Trouble Isolation Flowchart (continued)



A Check the display.

1 Press the Default Setup key.

Figure 5-1



Power-on Display Default

The display on the screen should be similar to . 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 B.

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

1 Reboot the oscilloscope.

2 Press del key when the splash screen is seen.

3 Scroll down to PC Health Status and press the Enter key.

4 Check that the Current CPU Temperature is around 45 °C.

If the processor temperature is hot, check the following:

1 Check that the processor's heatsink is properly attached.

2 Check that the heatsink fan cable is connected to the motherboard.

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

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

D Run oscilloscope self-tests.

1 Select Self Test from the Utilities menu.

2 Select Scope Self Tests from the Self Test drop down list box.

3 Click the Start Test button and follow the instructions on the screen.

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

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

Use this procedure to verify correct keyboard operation.

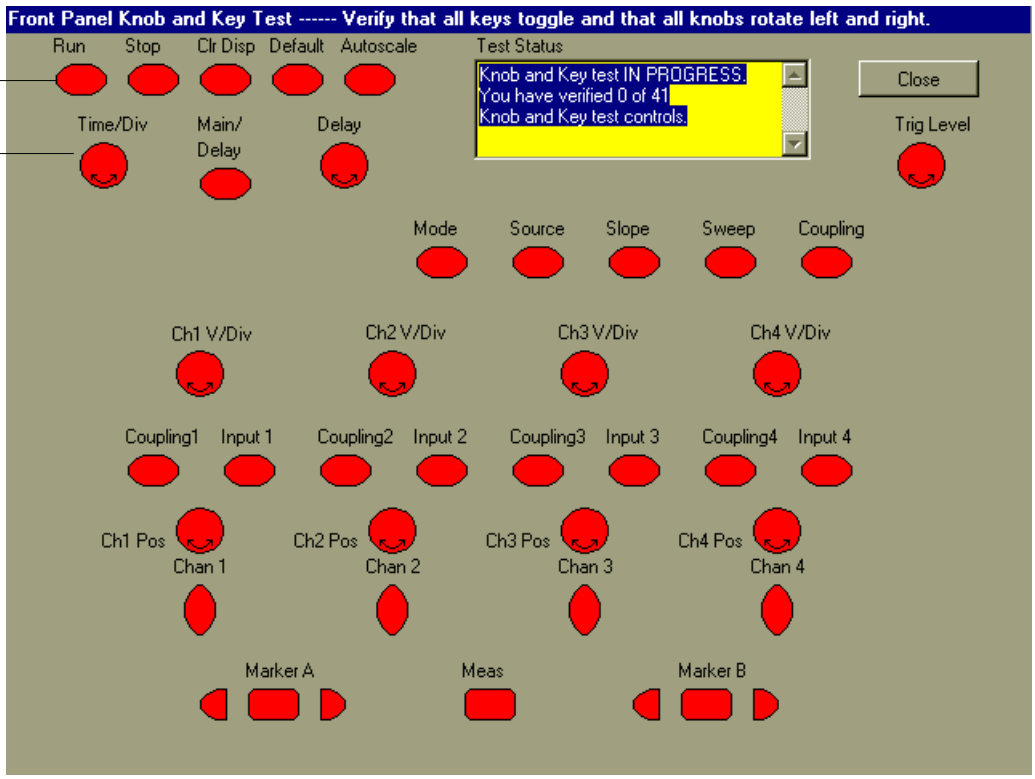
1 Select Self Test from the Utilities menu.

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

A new window appears with a symbolic representation of the keyboard. See Figure 5-2.

Figure 5-2

When you push a key or turn a knob in both directions, the corresponding symbol on this screen turns green.



Knob and Key Self Test Screen

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

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

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

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

5 When you are finished, click Close.

If any of the knobs or keys do not work, go to To check the keyboard; Trouble Isolation Procedure page 5-36.

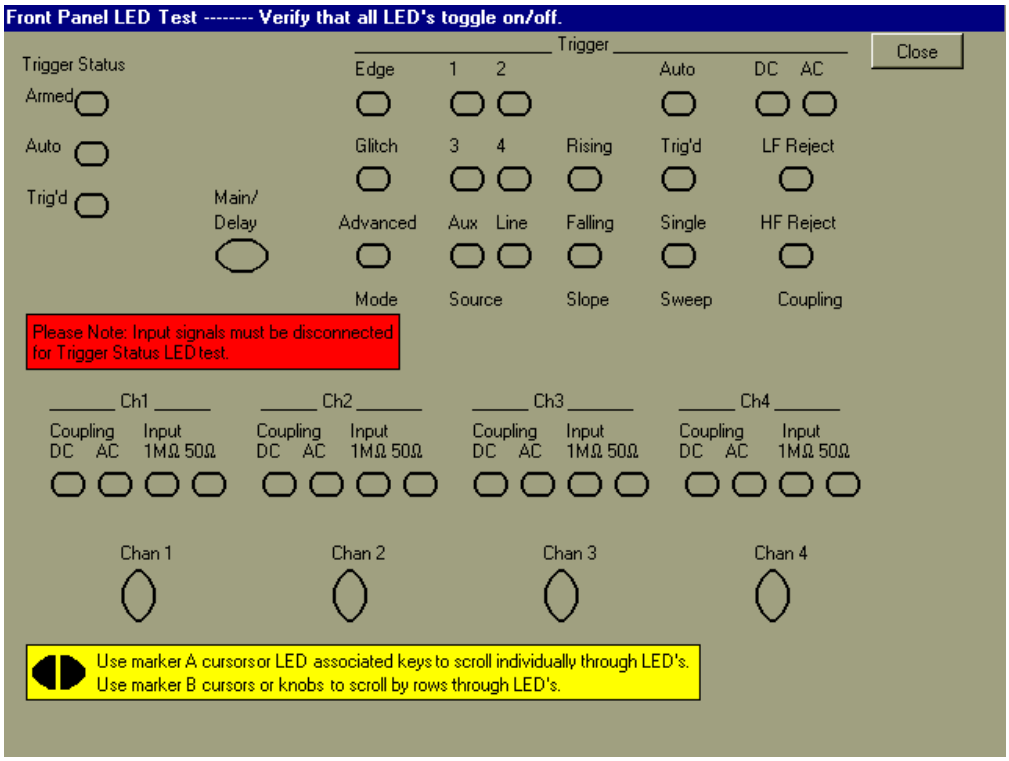
Use the following procedure to test the front-panel LED (light-emitting diode) indicators.

1 Select Self Test from the Utilities menu.

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

The LED test screen appears, which shows a symbolic representation of all front panel LED indicators. See Figure 5-3.

Figure 5-3



LED Test Screen

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

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

4 When you are finished, click Close.

If any of the LEDS do not work, go to "To check the LEDs" later in this chapter.

5 If both tests pass, go to step F.

F Self Calibration

1 Complete a self Calibration by following the procedures in chapter 3, "Testing Performance."

2 If the calibration test fails, replace the acquisition assembly. If the calibration test passes, go to step G.

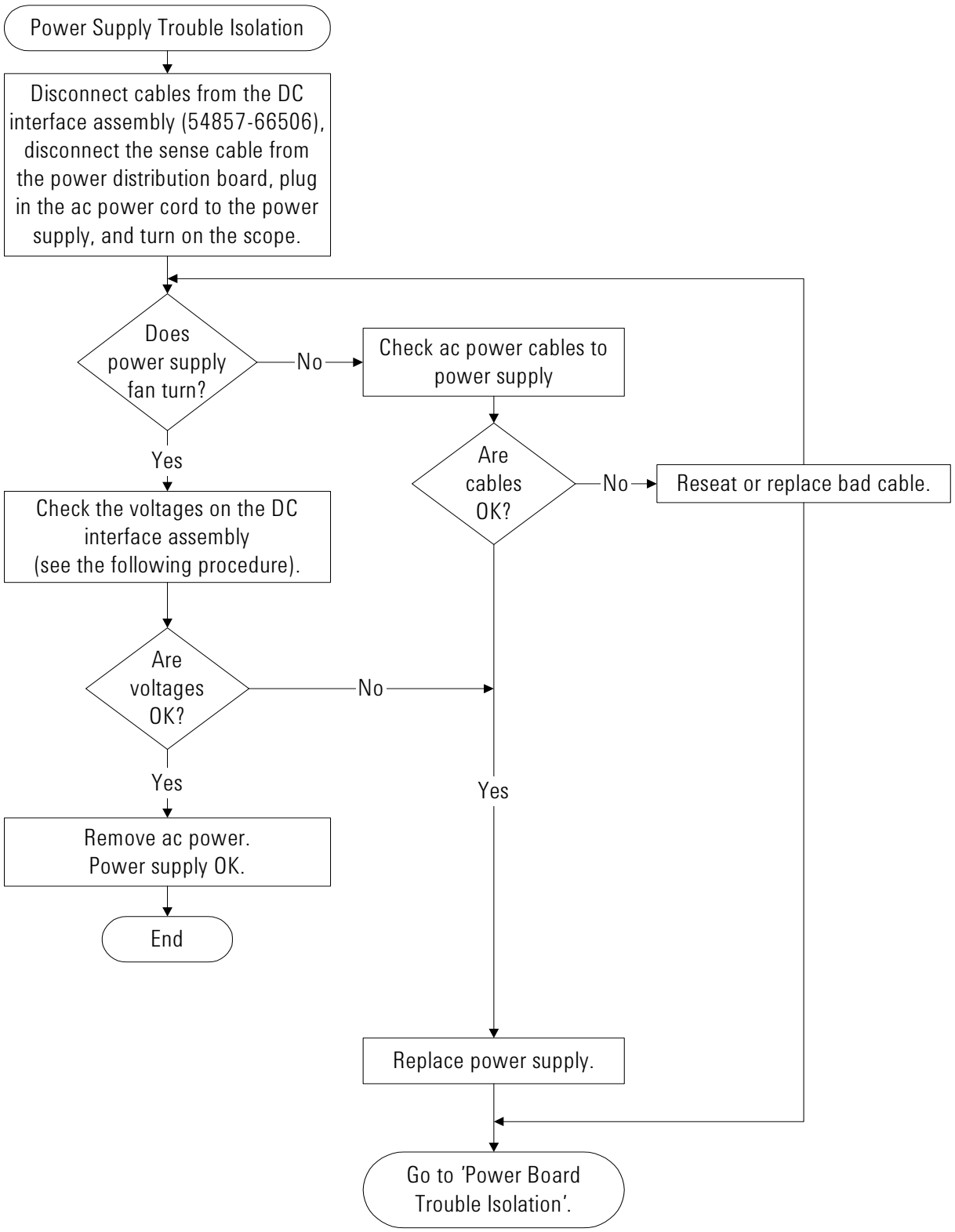
G The system is operational. Performance test the oscilloscope using the procedures in chapter 3 of this service manual.

Power Supply Trouble Isolation

WARNING

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

Figure 5-4

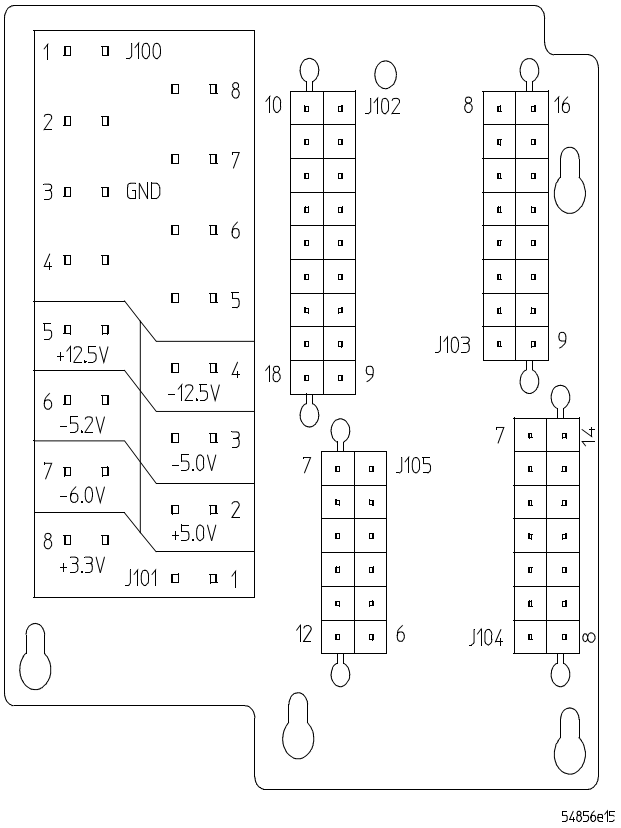


Power Supply Trouble Isolation Flowchart

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

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

Figure 5-5



Power Supply Voltage Test Locations

Table 5-1 **Power Supply Voltage Limits**

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

Power Board Trouble Isolation

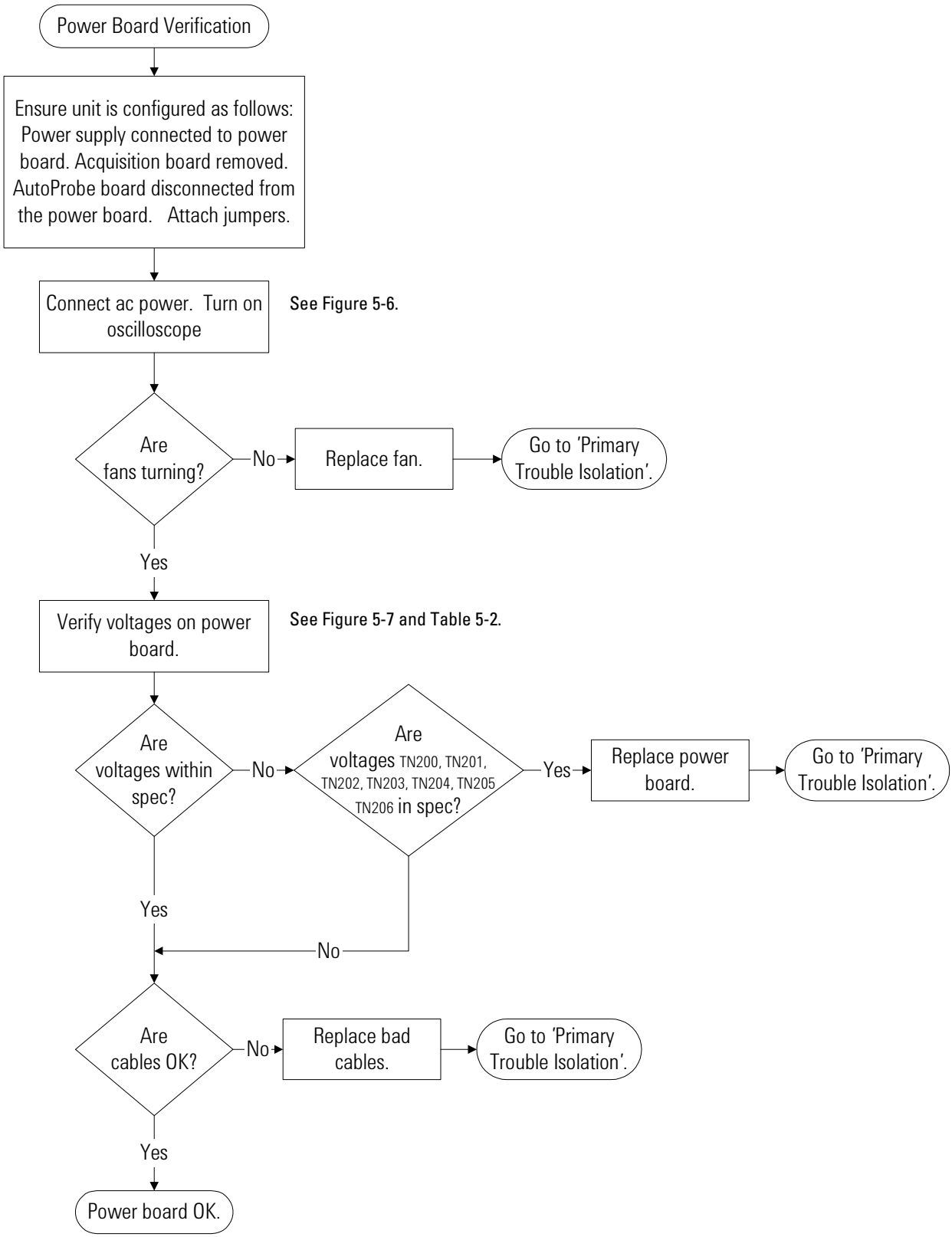
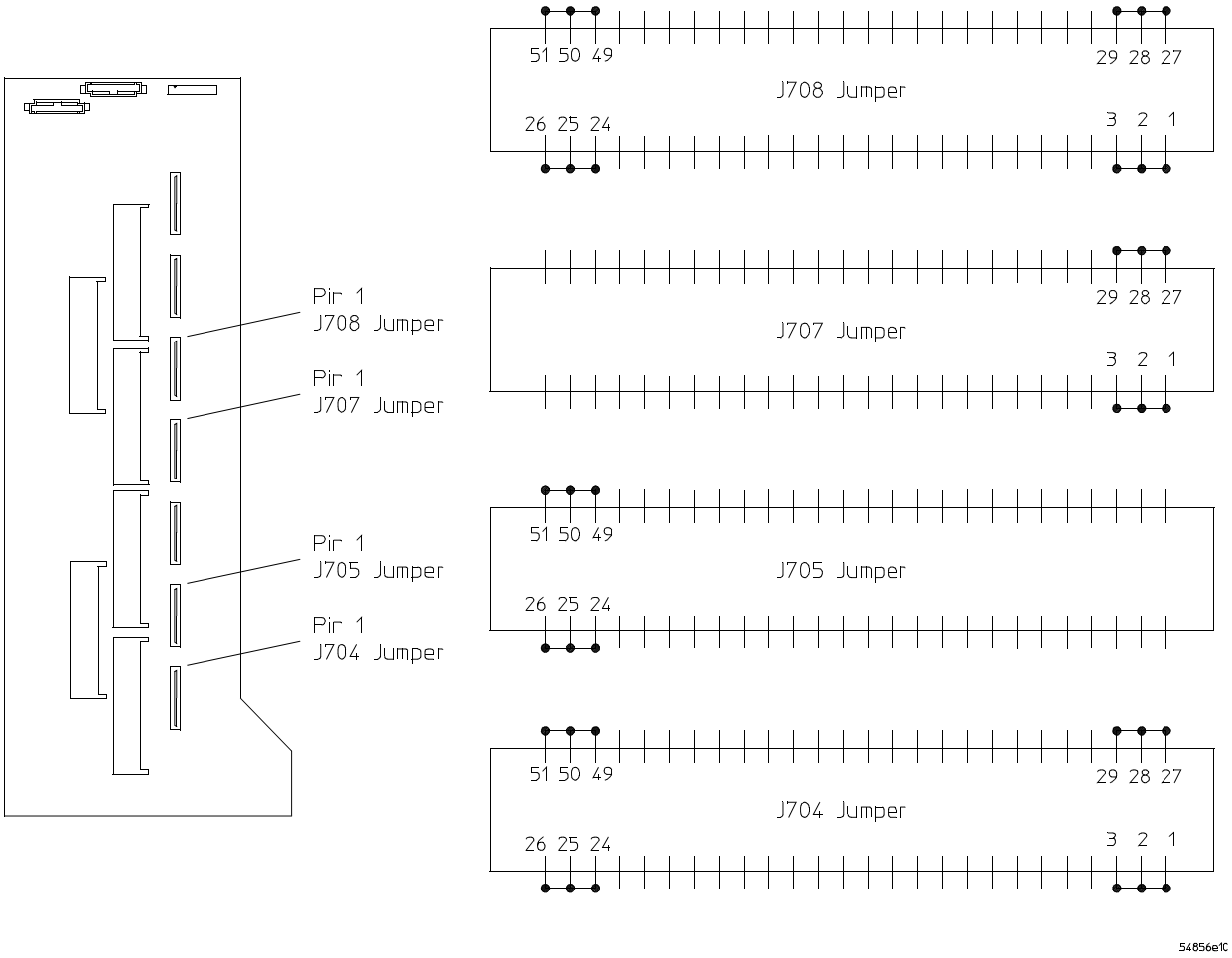


Figure 5-6



Jumpers for voltage feedback on power board.

Figure 5-7 Power Board Voltage Test Points

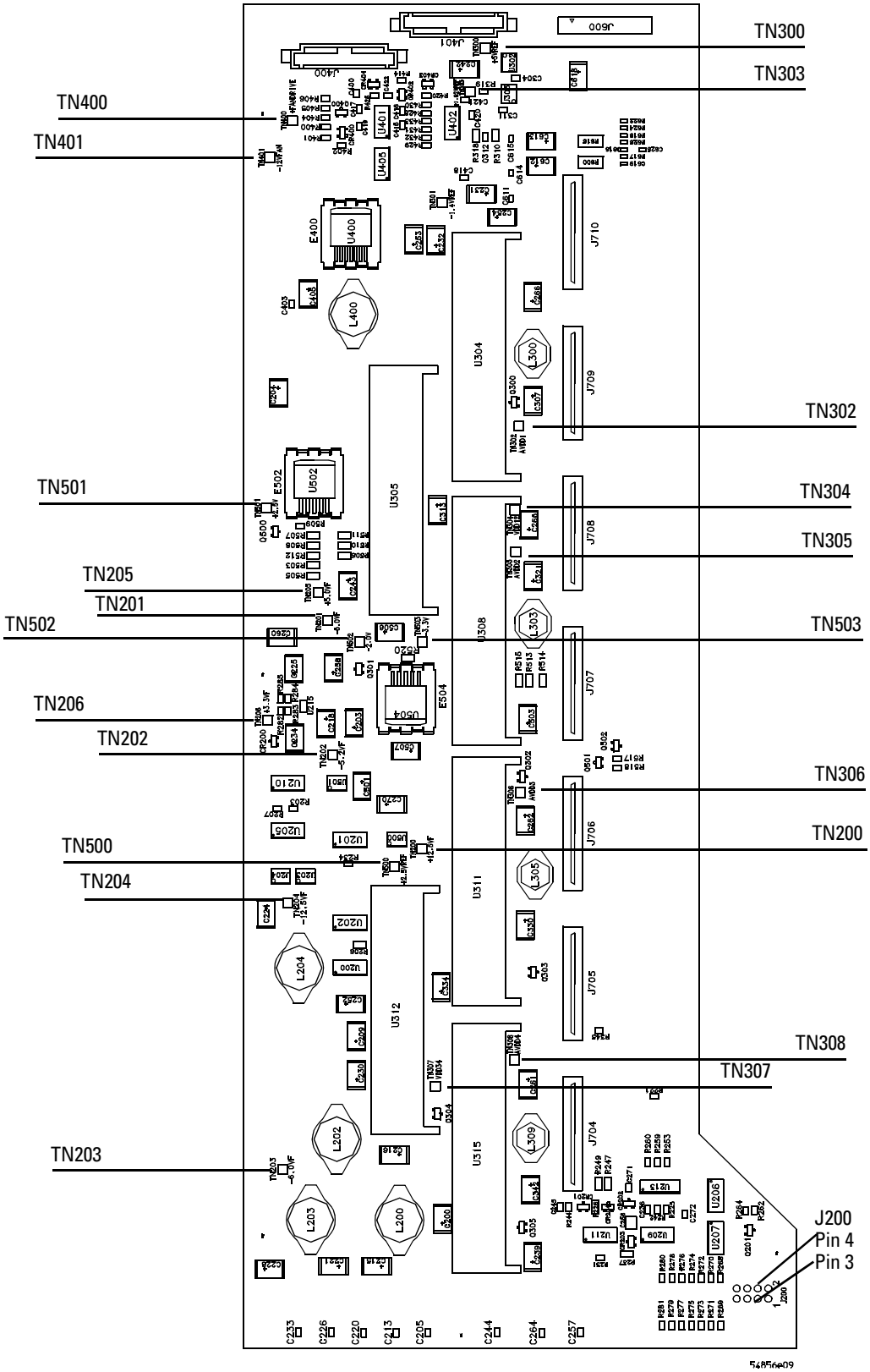
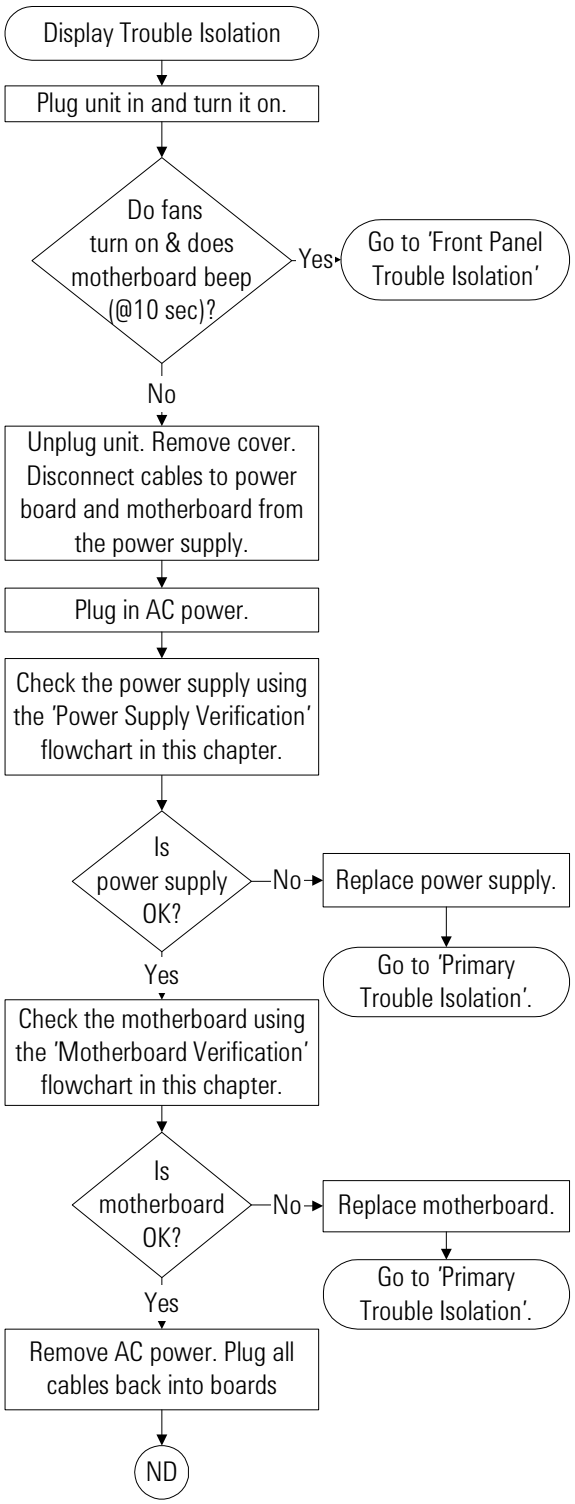


Table 5-2 Power Board Voltage Checks

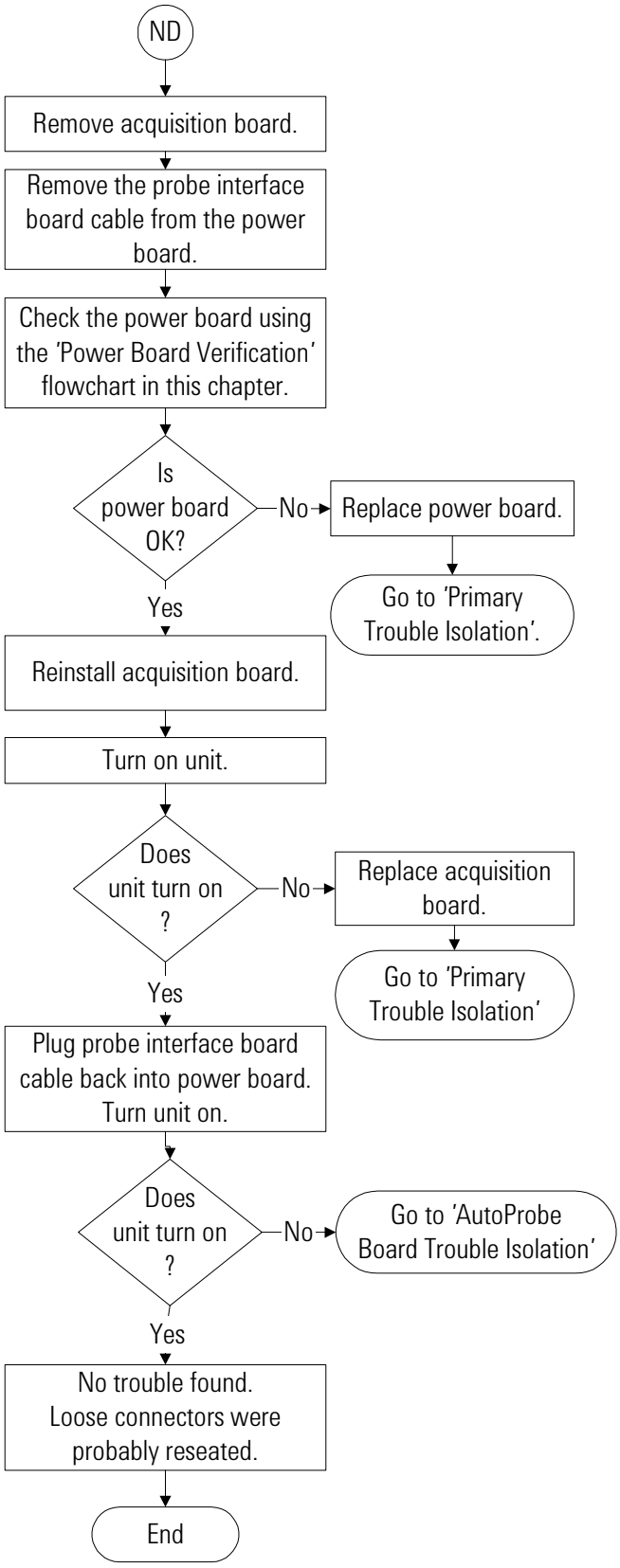
Test Point +	Test Point -	Specification
TN400 (+FANDRIVE)	TN400 (-12VFAN)	+7 V to + 12.5 V
TN501	Ground	+2.5 V ±0.05 V
TN204	Ground	-12.0 V ±0.1 V
TN205	Ground	+5.0 V +0.1 V -0.02 V
TN201	Ground	-5.0 V -0.1 V +0.02 V
TN502	Ground	-2.0 V ±0.05 V
TN503	Ground	-3.3 V ±0.05 V
TN206	Ground	+3.3 V +0.05 V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

Display Trouble Isolation

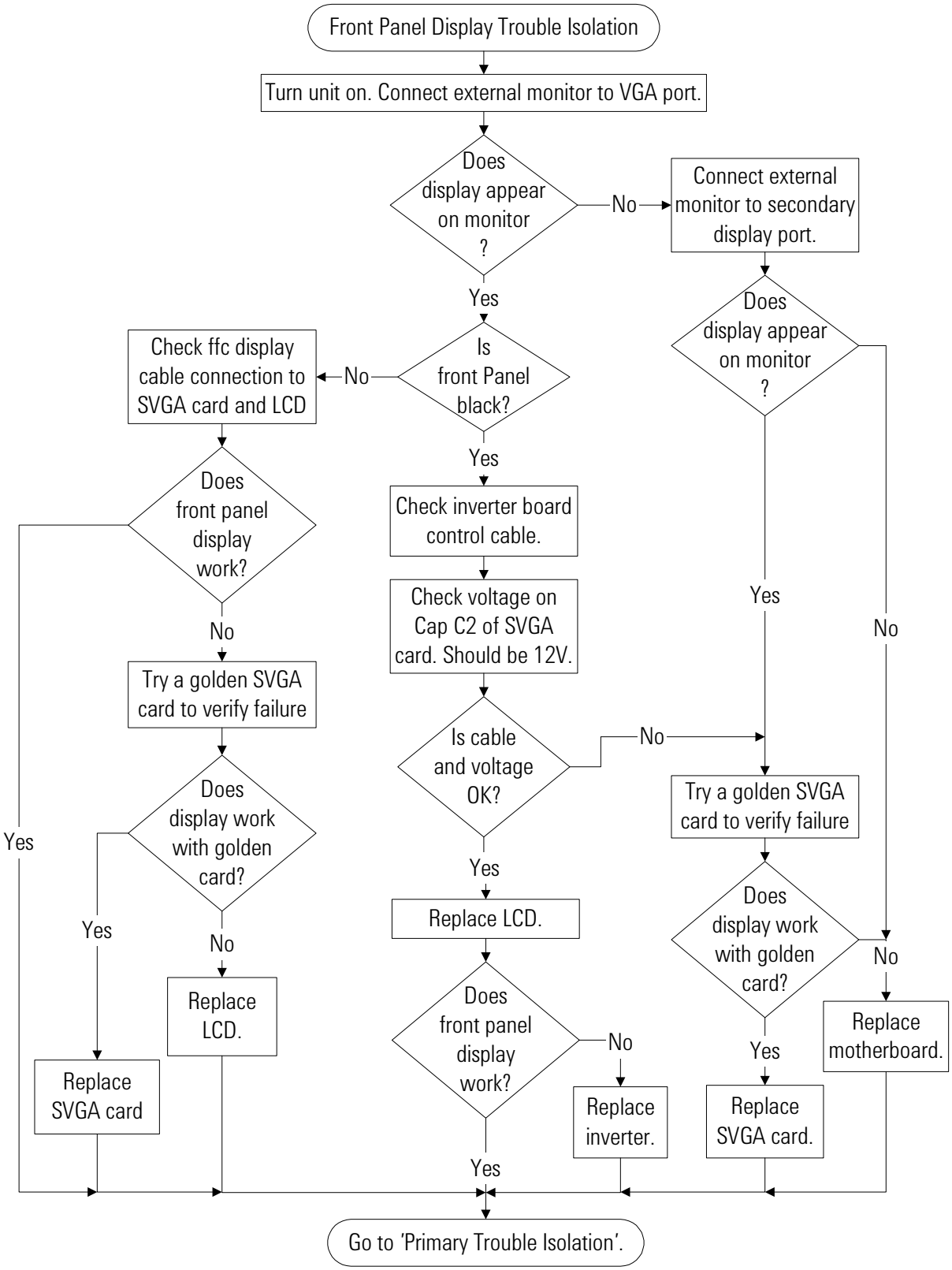


Display Trouble Isolation Flowchart

Display Trouble Isoltion Flowchart (continued)



Front Panel Display Trouble Isolation

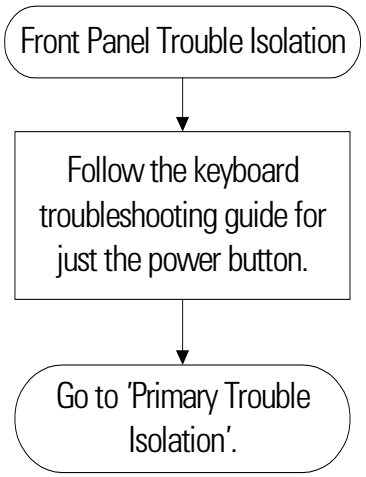


WARNING SHOCK HAZARD!
The backlight inverter assembly, which is mounted at the front corner of the oscilloscope near the flat-panel display, operates at 1.3 kV at turn on. DO NOT handle this assembly while it is in operation.

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.

Front Panel Trouble Isolation

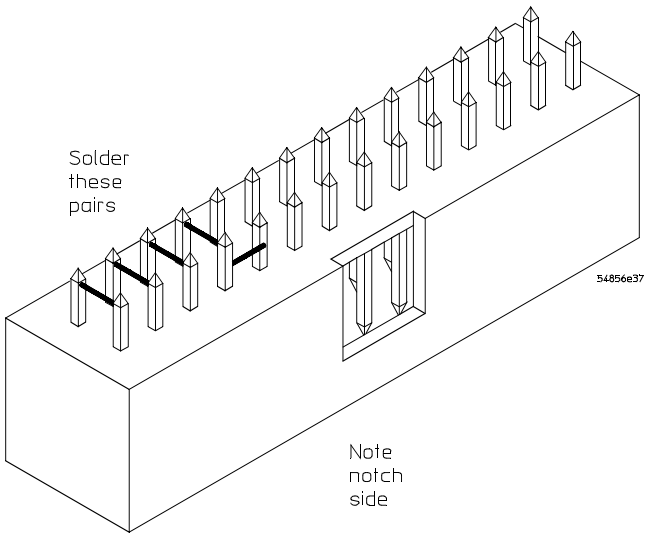


Motherboard Verification

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

Using an AMP connector, Tyco Electronics part number 2-103168-3 or Agilent part number 1252-1468, solder wires between the pins as shown in Figure 5-8.

Figure 5-8



Test Fixture

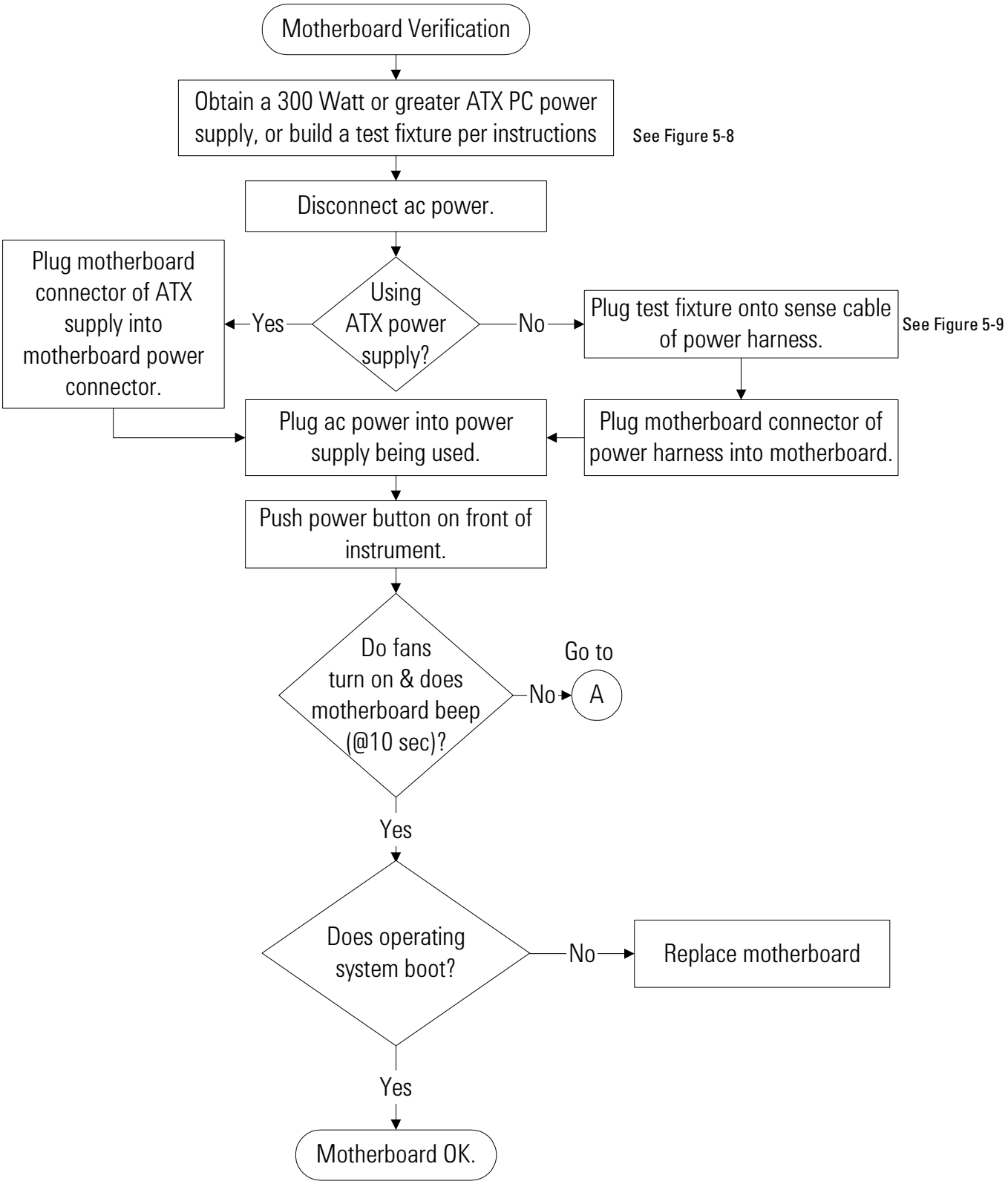
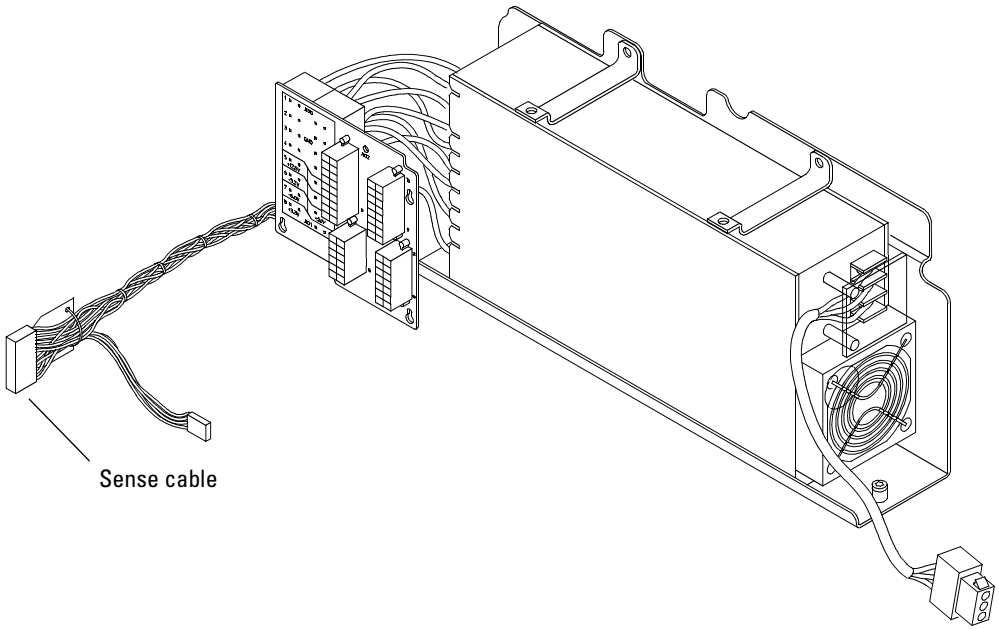

Motherboard Verification
Obtain a 300 Watt or greater ATX PC power supply, or build a test fixture per instructions
See Figure 5-8
Disconnect ac power.
Using ATX power supply?
Yes
Plug motherboard connector of ATX supply into motherboard power connector.
No
Plug test fixture onto sense cable of power harness.
See Figure 5-9
Plug motherboard connector of power harness into motherboard.
Plug ac power into power supply being used.
Push power button on front of instrument.
Do fans turn on & does motherboard beep (@10 sec)?
No
Go to
A
Yes
Does operating system boot?
No
Replace motherboard
Yes
Motherboard OK.

Figure 5-9



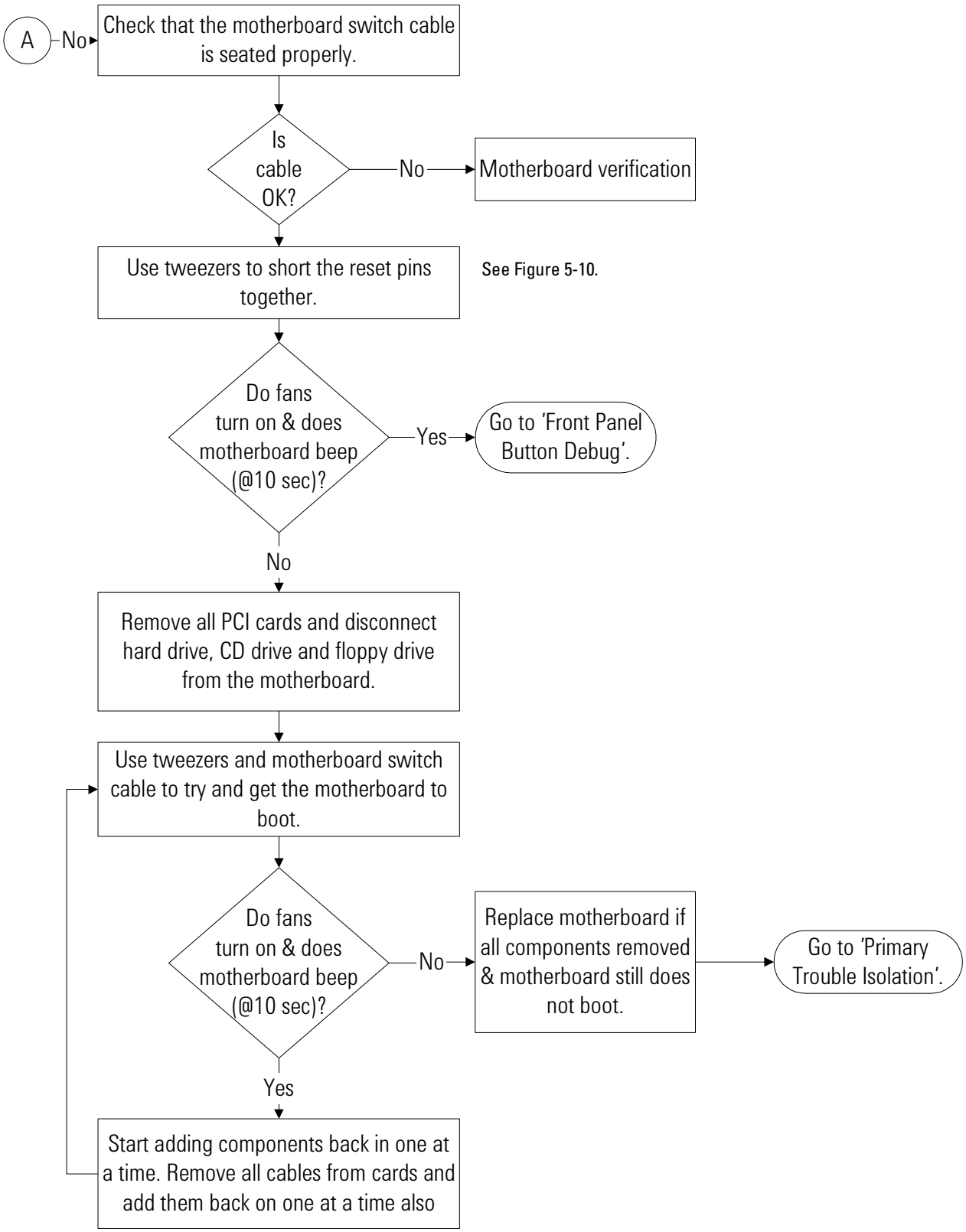
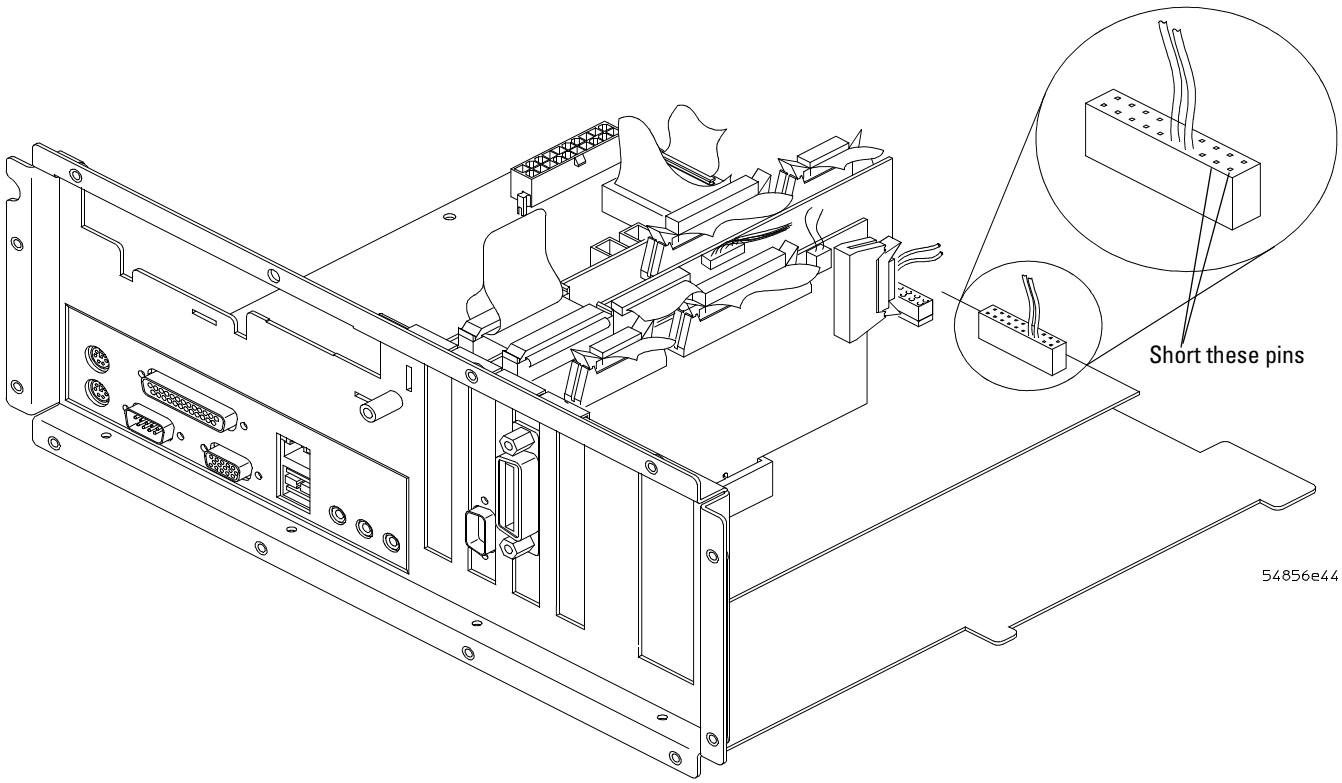

A
No
Check that the motherboard switch cable is seated properly.
Is cable OK?
No
Motherboard verification
Use tweezers to short the reset pins together.
See Figure 5-10.
Do fans turn on & does motherboard beep (@10 sec)?
Yes
Go to 'Front Panel Button Debug'.
No
Remove all PCI cards and disconnect hard drive, CD drive and floppy drive from the motherboard.
Use tweezers and motherboard switch cable to try and get the motherboard to boot.
Do fans turn on & does motherboard beep (@10 sec)?
No
Replace motherboard if all components removed & motherboard still does not boot.
Go to 'Primary Trouble Isolation'.
Yes
Start adding components back in one at a time. Remove all cables from cards and add them back on one at a time also

Figure 5-10



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 wit 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.

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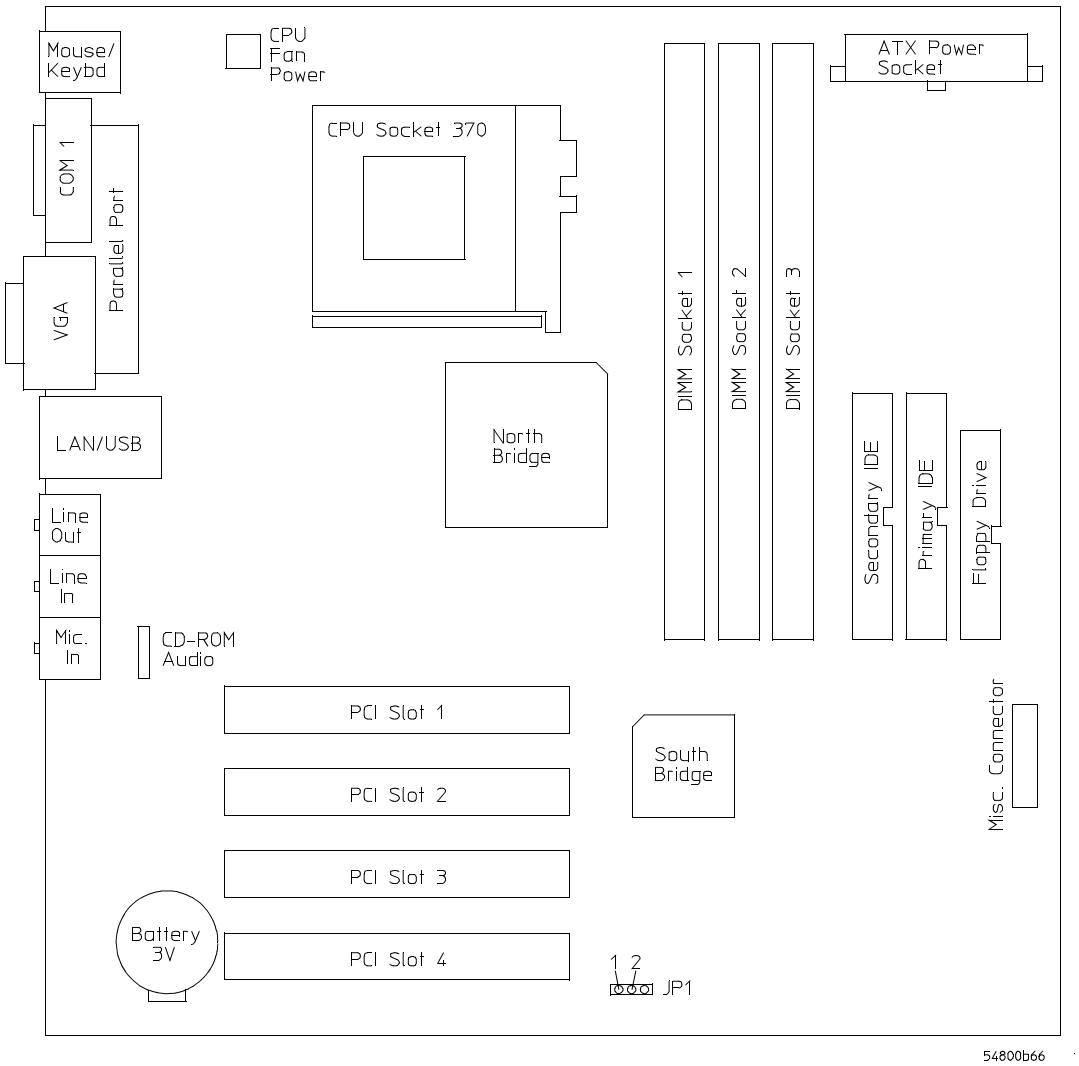


Configure the MOT series VP-22 Motherboard BIOS parameters.

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 DSO81304A-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 **FORMER-STS** 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.

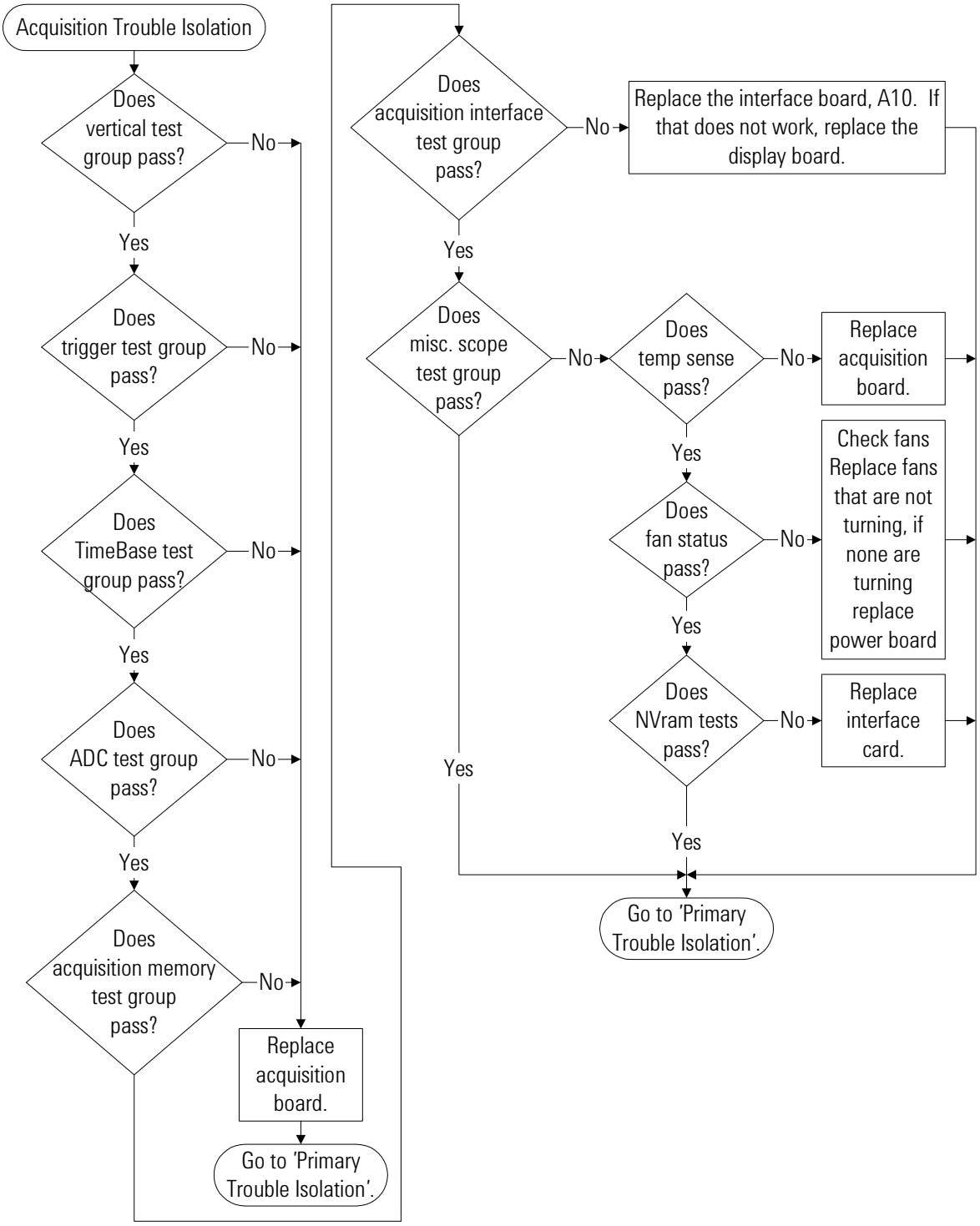
POST Code Listing

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.

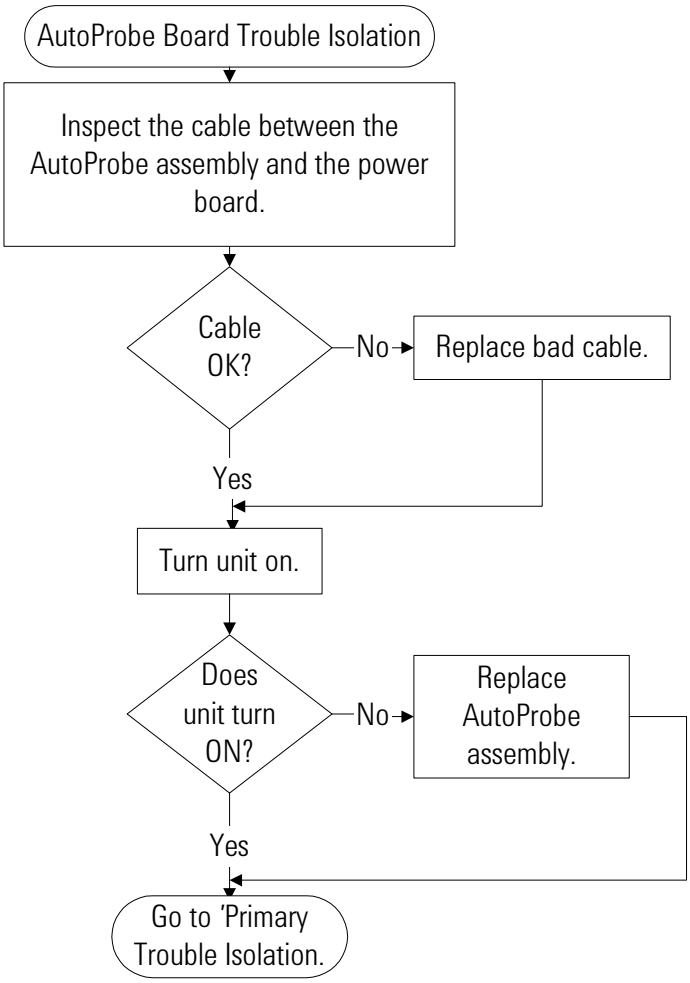
3E	Test 8259 interrupt mask bits for channel 1.
40	Test 8259 interrupt mask bits for channel 2.
43	Test 8259 functionality.
47	Initialize EISA slot.
49	Calculate total memory by testing the last double word of each 64K page.
4E	Program MTRR of M1 CPU. Initialize APIC for P6 class CPU.
50	Initialize USB.
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).

Acquisition Trouble Isolation

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



AutoProbe Board Trouble Isolation



To check the keyboard; Trouble Isolation Procedure

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

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

CAUTION CONTAMINATION CAN CAUSE INTERMITTENT OPERATION!
Be careful not to contaminate the key side of the PC board or the keypads. Dust and fingerprints on these parts may cause intermittent key operation.

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

To check the LEDs

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

- 0 V ±0.5 V when both LEDs are supposed to be off.
- 2.5 V ±0.5 V when Trig'd is supposed to be on and Auto is supposed to be off.
- 5.0 V ±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 ±0.5 V when Armed is supposed to be on.
- < 3.6 V ±0.5 V when Armed is supposed to be on.

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

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

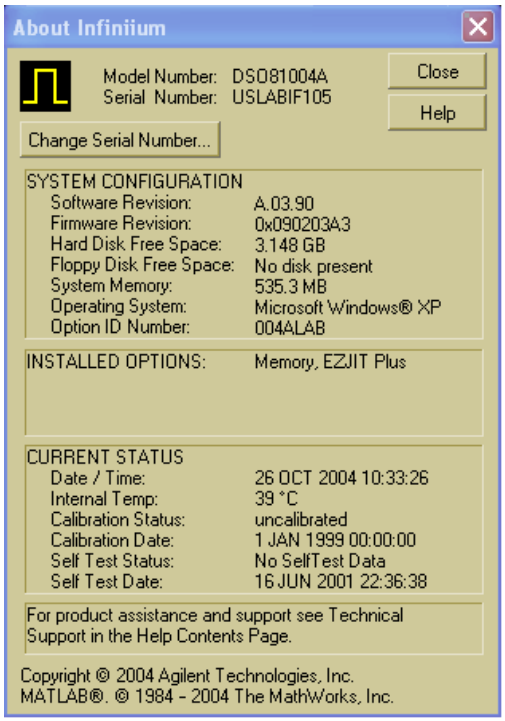
Software Revisions

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

Enable the Graphical Interface
The graphical interface must be enabled to select this command.

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

Figure 5-11



About Infiniium... Information

To check probe power outputs

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

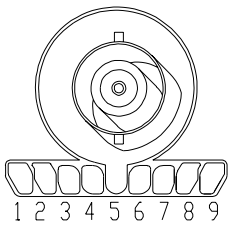
Use the table and figure to the right to check the power output at the connectors.

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

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

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

Pin	Supply
1	+3V
2	–3V
3	Offset
4	Data
5 & ring	Probe ID
6	Clk
7	R_p
8	–12 V
9	+12 V



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

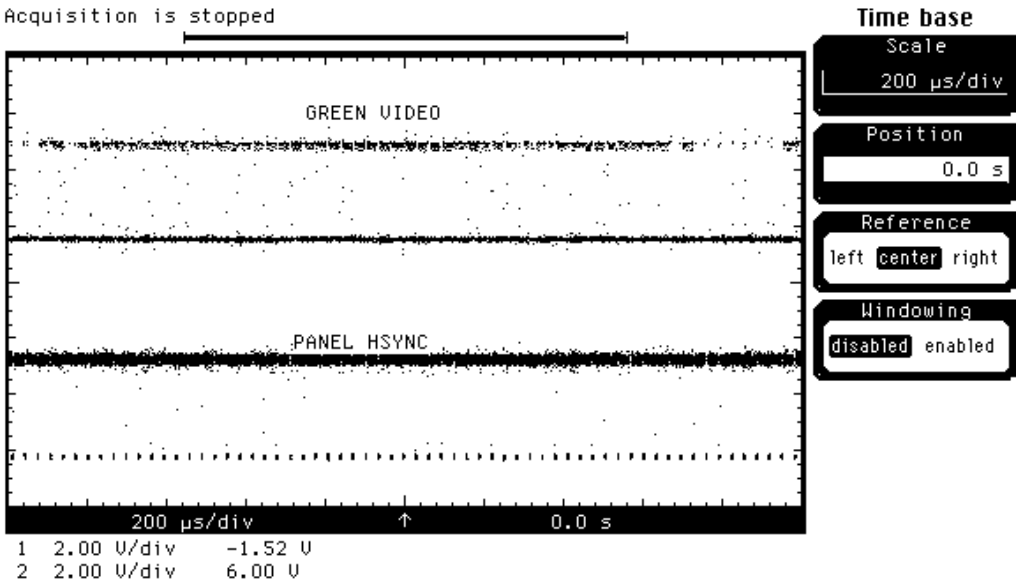
To check the display board video signals

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 5-3 **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 5-12



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 5-4 **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

6

Replacing Assemblies

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.

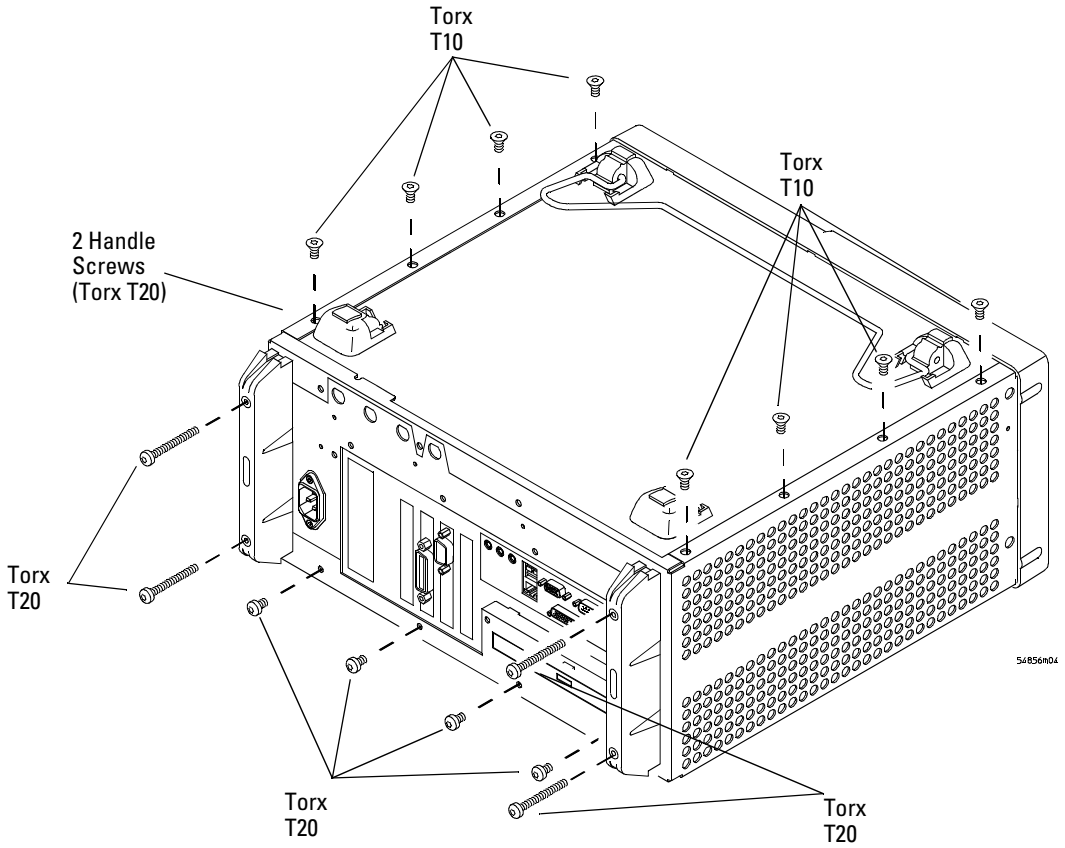
   In any correspondence, refer to oscilloscope by model number and full serial number.

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

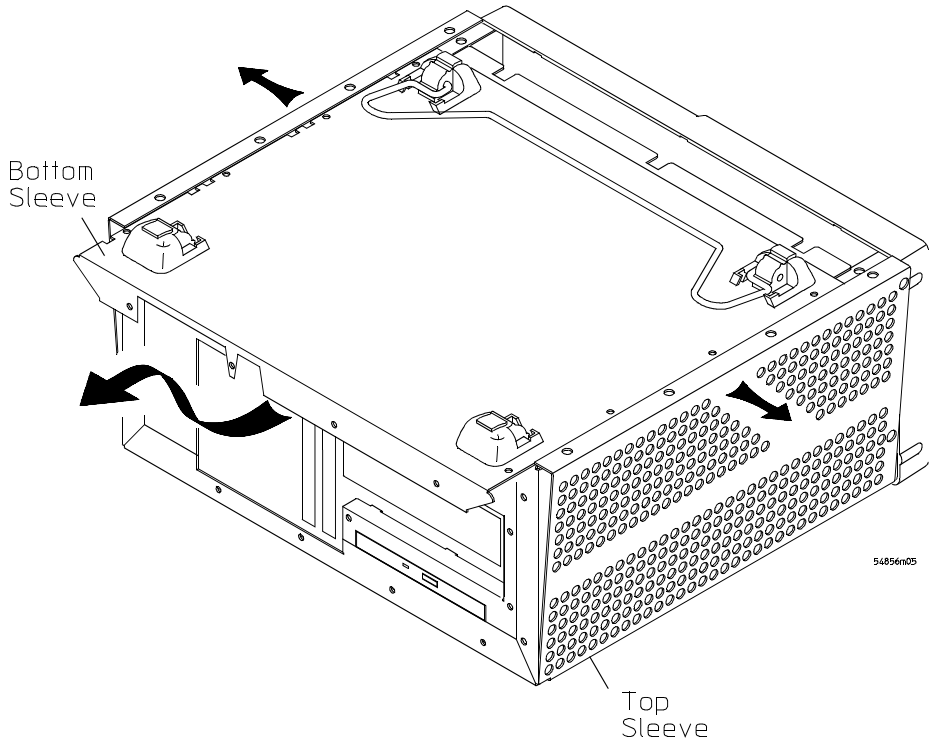
10 Carefully slide the top cover off of the frame by pulling the front panel and the top cover away from each other.

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

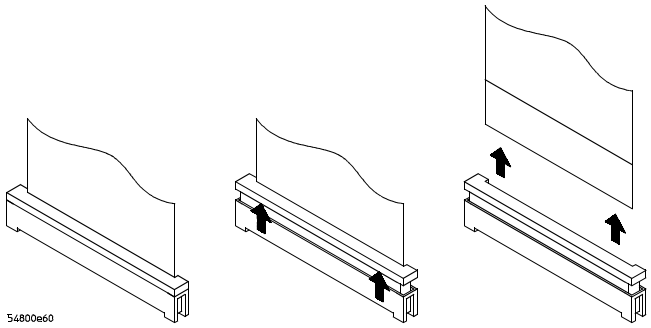
CAUTION The mylar flex cables and their connectors are fragile; mishandling may damage the cable or connector.

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



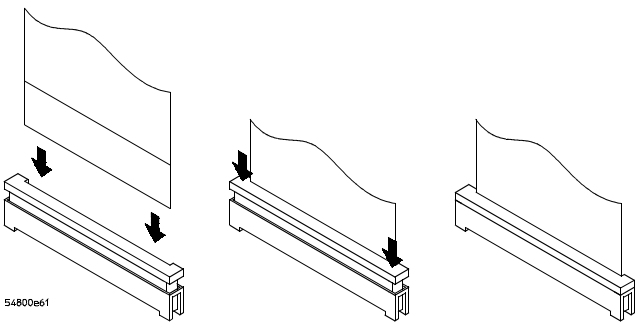
Disconnecting a Mylar Ribbon Cable

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



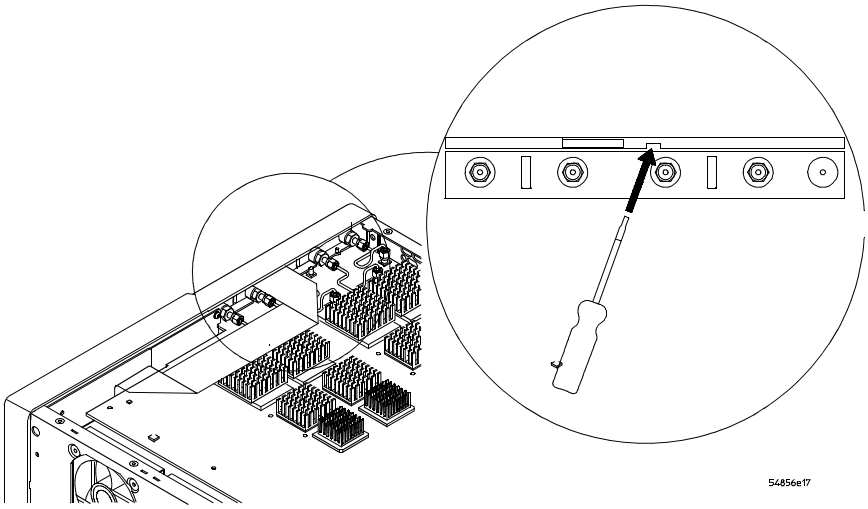
Connecting Mylar Ribbon Cables

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

Figure 6-5

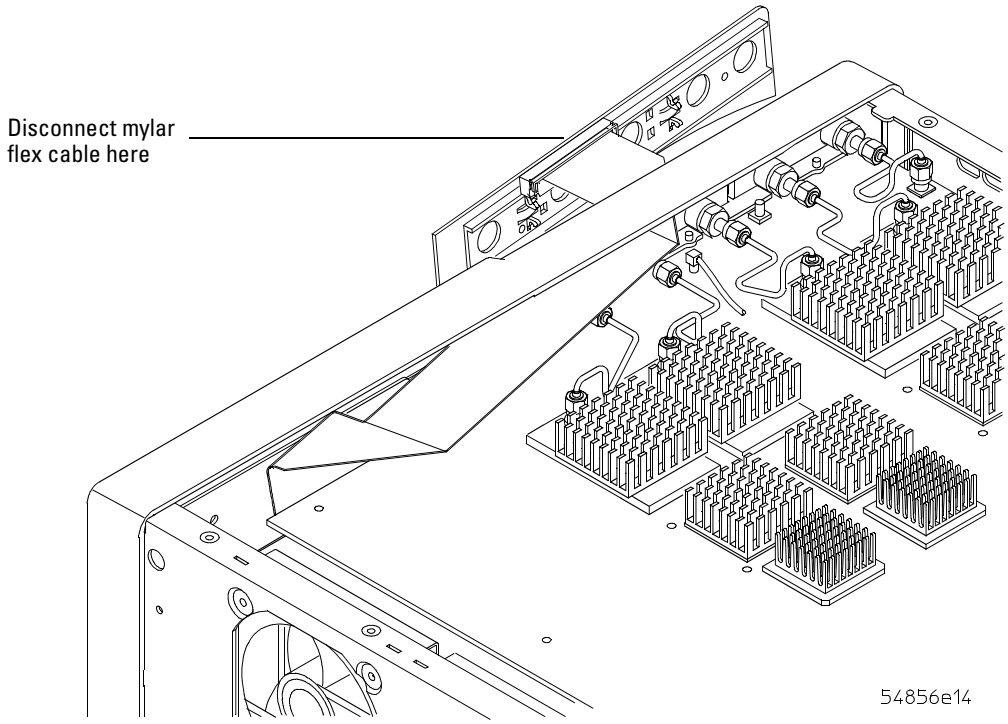


Access Hole

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

d Disconnect the mylar flex cable from the AutoProbe board.
See "To disconnect and connect Mylar flex cables" in this chapter.

Figure 6-6



Pushing Out the AutoProbe Faceplate

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

To remove and replace the probe power and control board

When necessary, refer to other removal procedures.

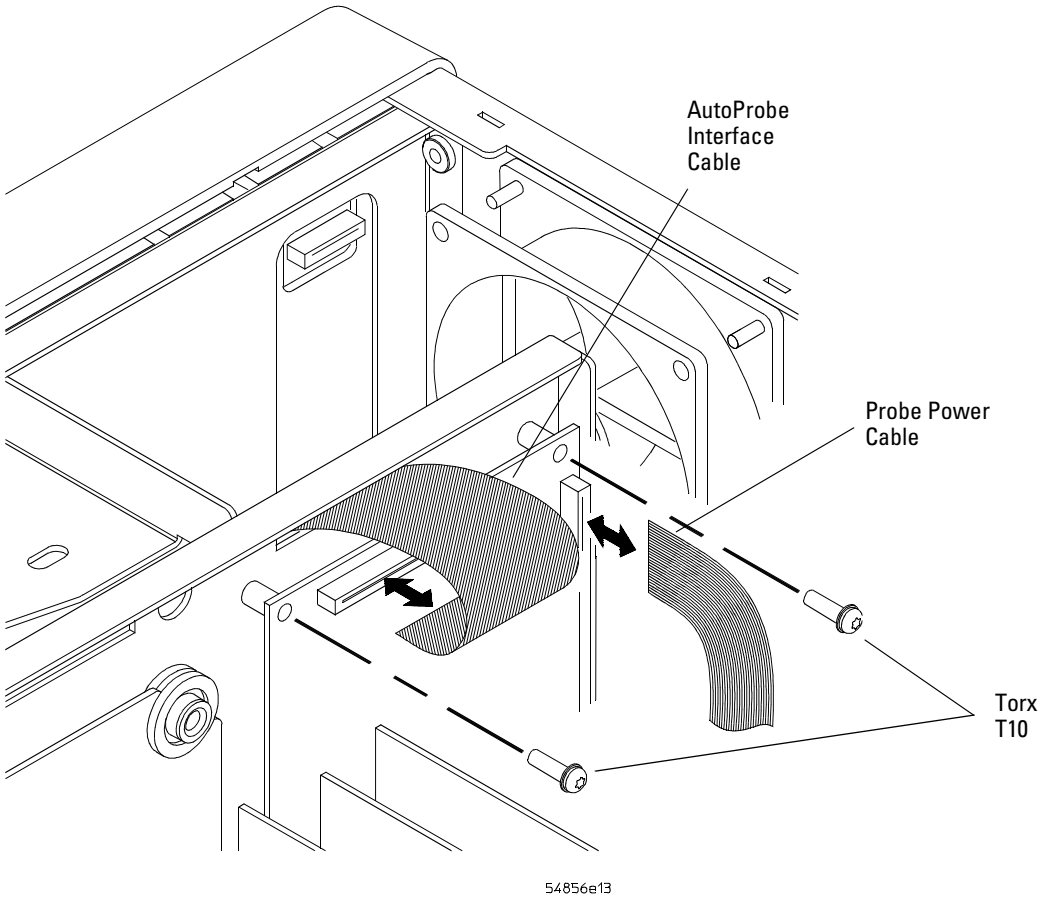
1 Disconnect the power cable and remove the top cover.

2 Disconnect the AutoProbe interface cable.

The connector must be unlocked before you can remove the flex cable. See To disconnect and connect Mylar flex cables on page 6-6.

3 Disconnect the probe power cable.

Figure 6-7



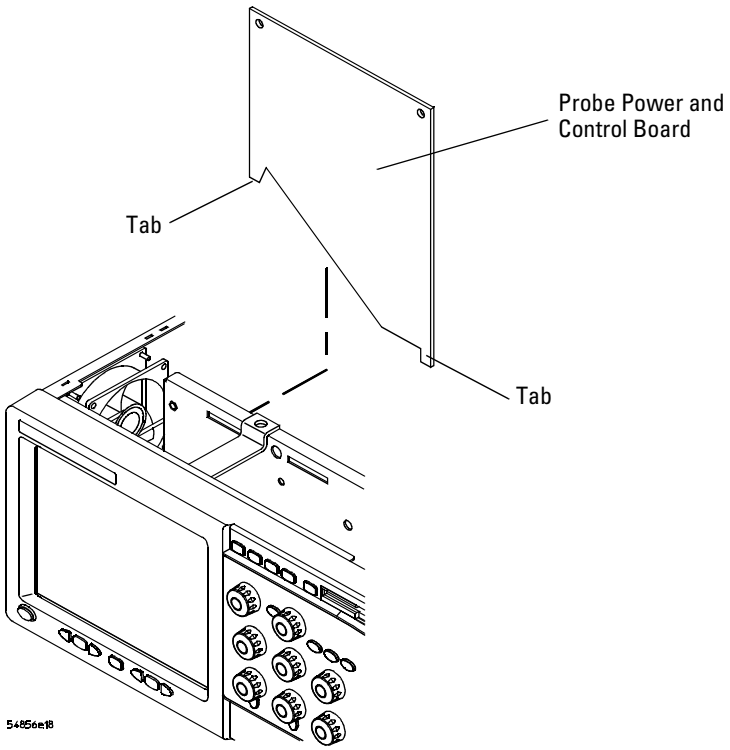
Remove the Probe Power and Control Assembly

4 Remove the two Torx T10 screws securing the probe power and control assembly to the chassis.

5 Lift the probe power and control assembly out and away from the chassis.

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 6-8



Probe Power and Control Assembly

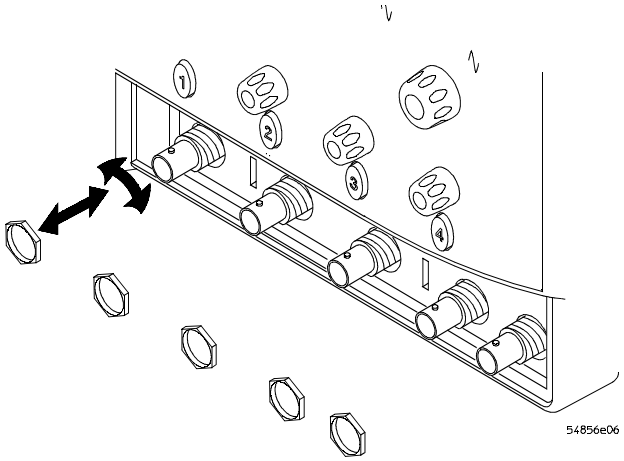
To remove and replace the front panel assembly

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. See To remove and replace the AutoProbe assembly on page 6-7.
3. Using a 5/8" nut driver, remove the hex nuts that secure the BNC connectors to the front panel.

> **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.

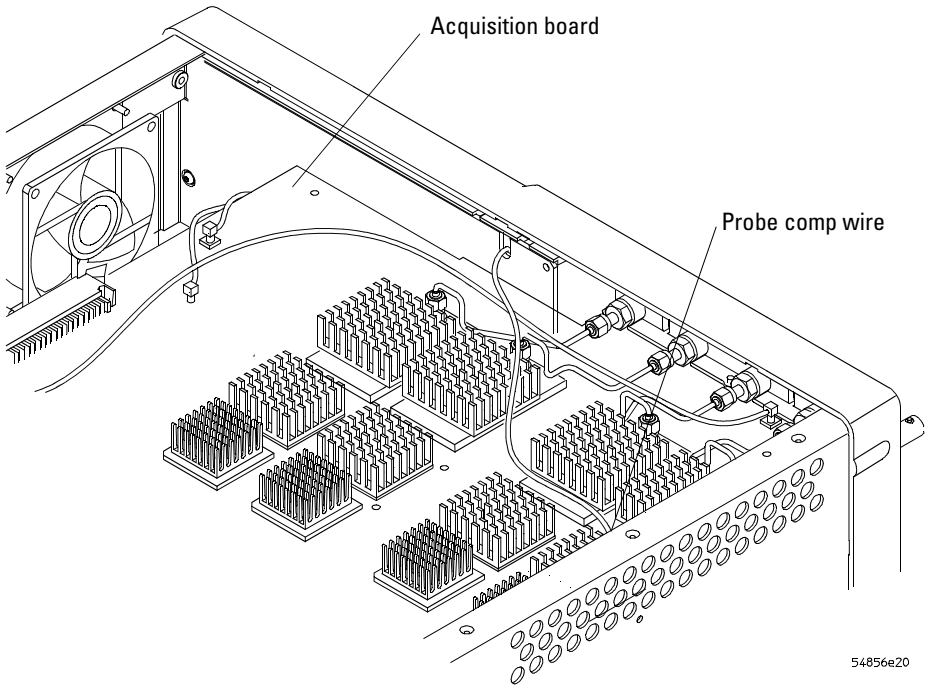
Figure 6-9



Removing the BNC Nuts

4. Disconnect the probe comp wire from the acquisition board. If necessary, use pliers to remove the probe comp wire.

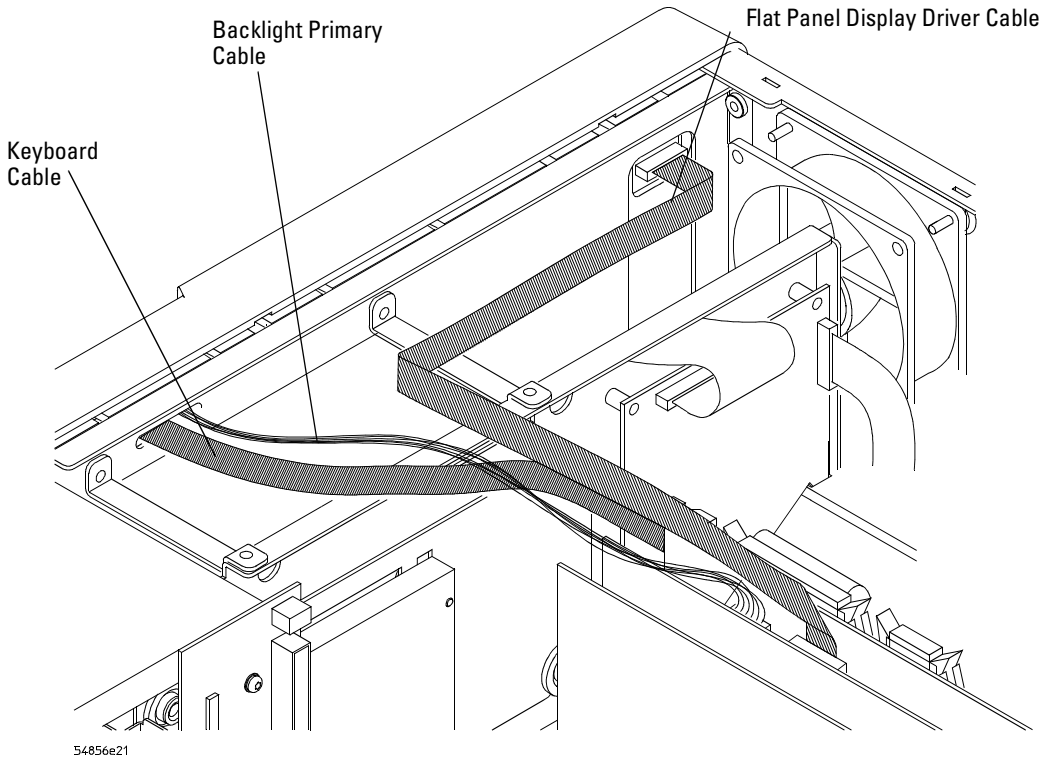
Figure 6-10



Removing Probe Comp Wire

5 Disconnect the backlight primary cable, flat-panel display driver cable, and keyboard cable.

Figure 6-11

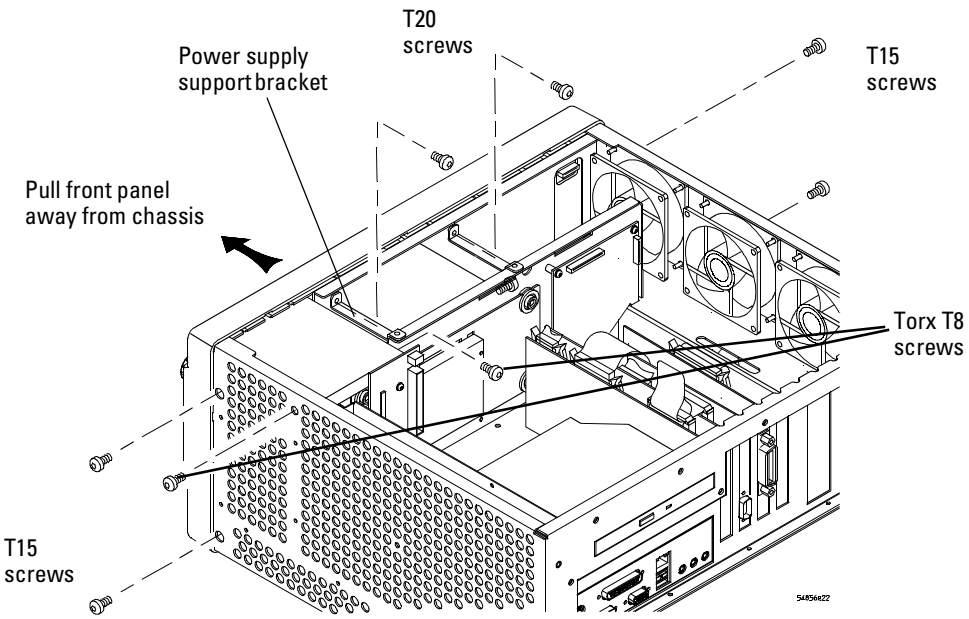


Disconnecting Backlight Primary Cable, Display Driver Cable, and Keyboard Cable

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

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

Figure 6-12



Front Panel Side Screws

7 Remove the two Torx T20 screws that secure the power supply support bracket to the front panel assembly.

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

8 Remove the two Torx T8 screws that hold the floppy drive and pull the drive back a little to keep the front panel from getting caught on it.

When re-assembling, torque the two Torx T8 screws to 3 in-lb.

9 Pull the front panel assembly away from the chassis out through the slots in the front of the chassis.

10 To replace the front panel assembly, reverse the above procedure.

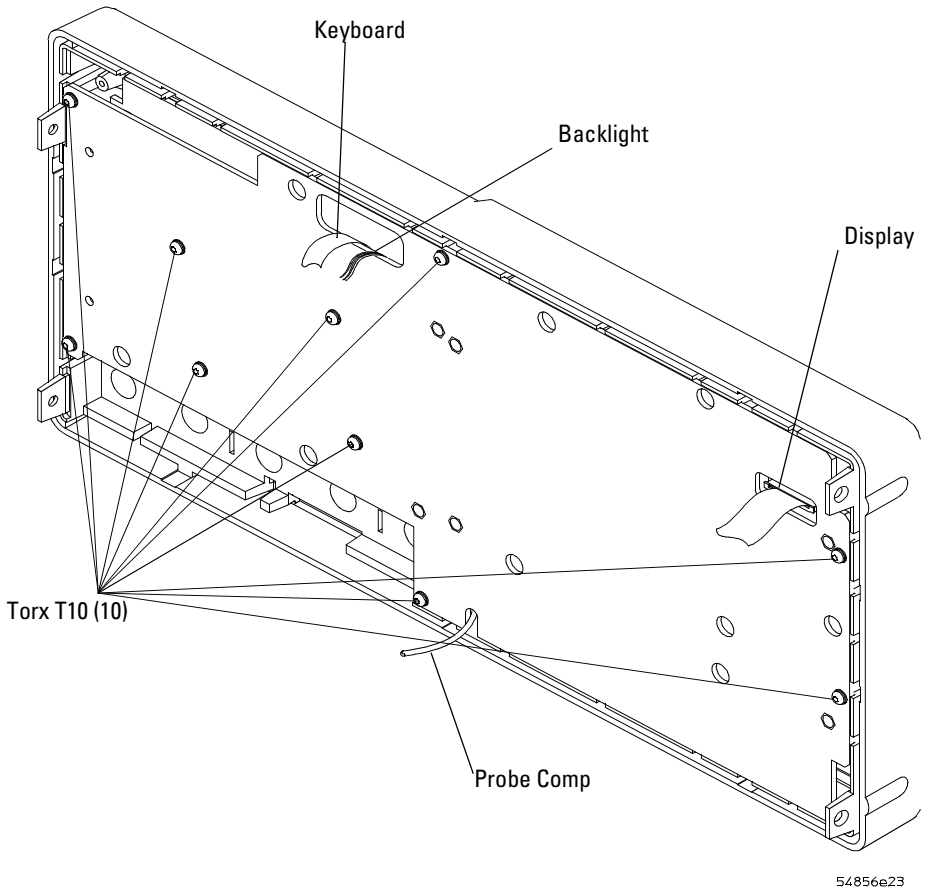
Ensure that you observe polarity designations when reconnecting the ribbon cables.

To remove and replace the keyboard, backlight inverter board, 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 6-13



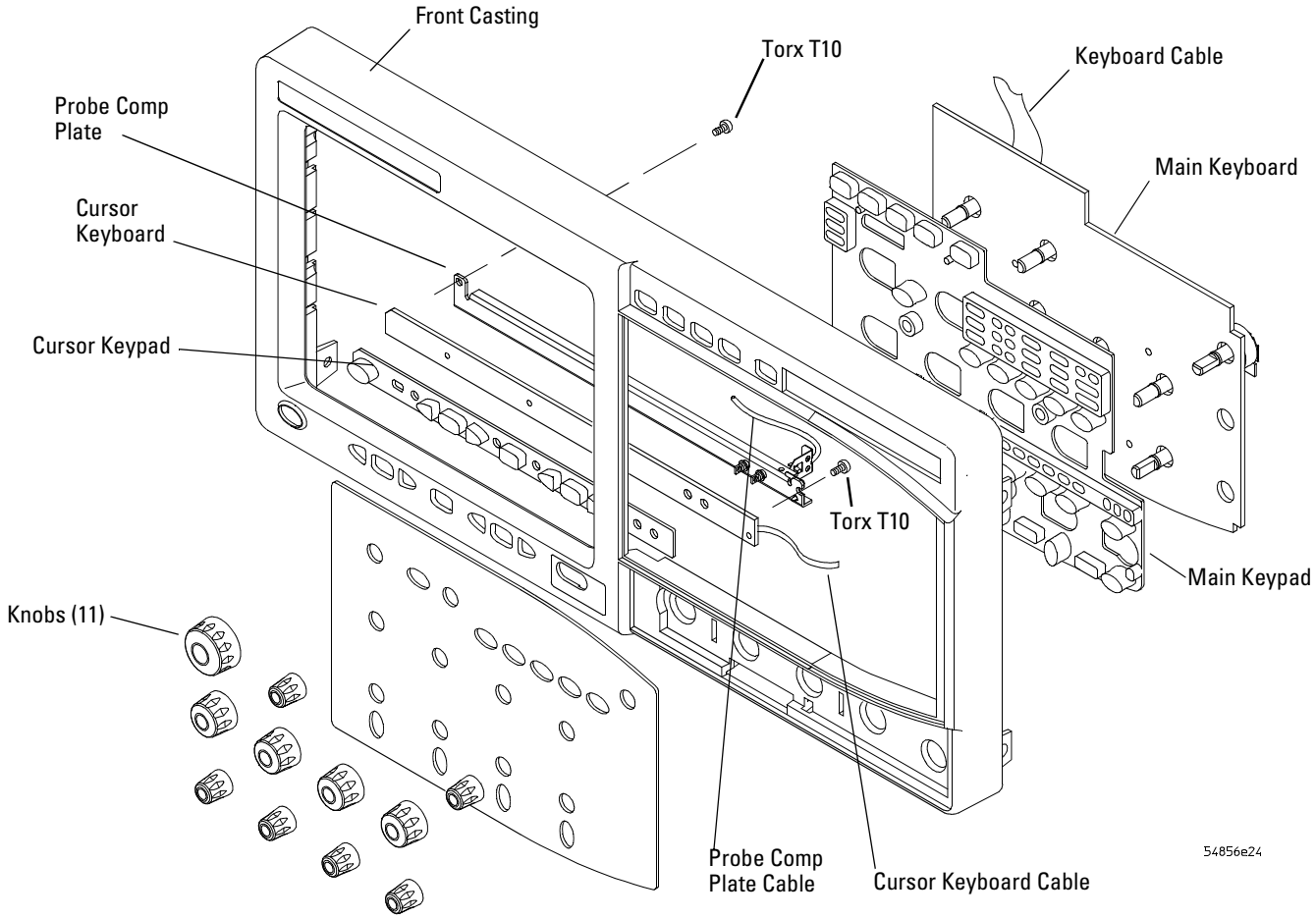
Front Panel Cover Plate Screws

4 Carefully feed the cables through the cable access holes 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, pull off the knobs, and lift out the keyboard.

Figure 6-14



Main Keyboard Knobs and Cable

6 To remove the cursor keyboard:

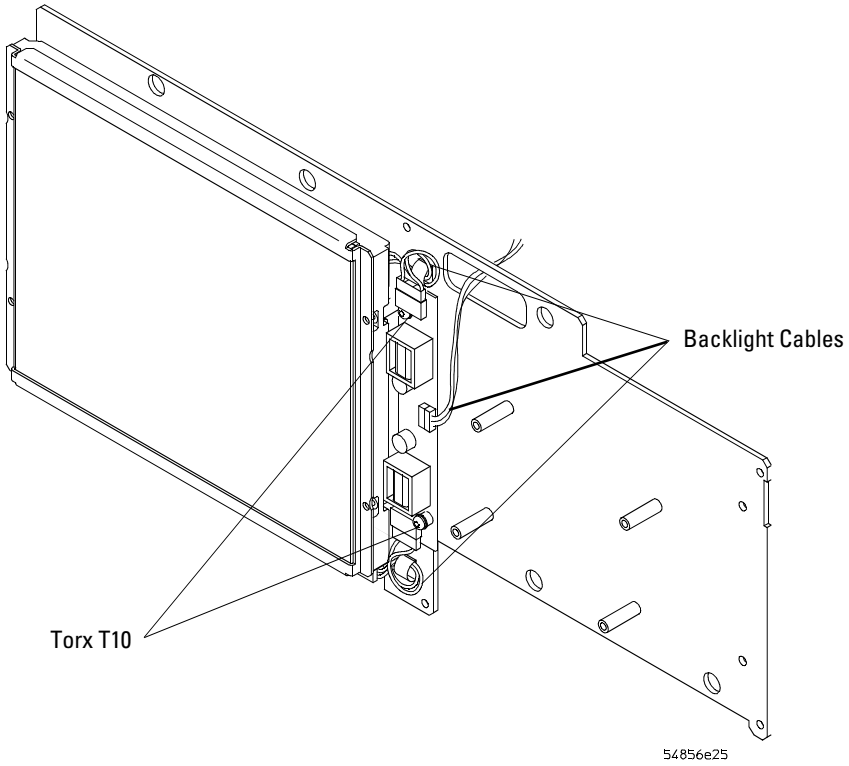
a Remove the two Torx T10 screws securing the probe comp plate to the front casting.

b Lift the probe comp plate, cursor keyboard, and cursor keypad out.

7 To remove the backlight inverter board:

a Disconnect the two backlight cable from the backlight inverter board.

Figure 6-15



Removing the Backlight Inverter Board

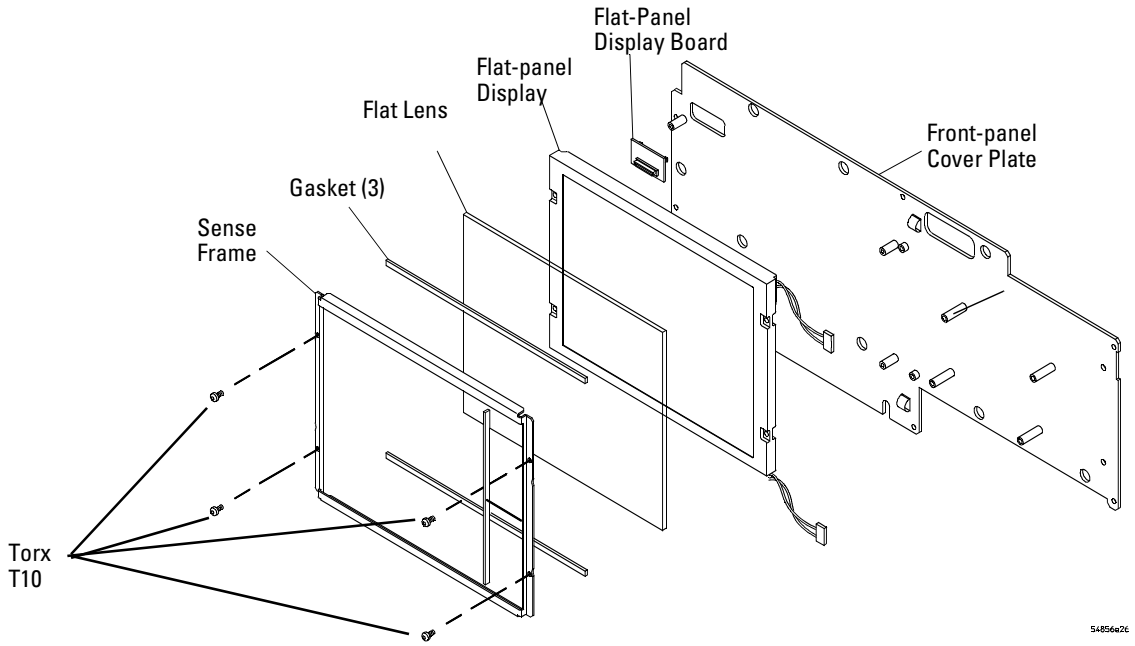
b Remove the two Torx T10 screws securing the backlight inverter board to the cover plate.

8 To remove the flat-panel display, flat lens, lens frame, lens frame gaskets, display board from the front-panel cover plate:

a Remove the four Torx T10 screws securing the display to the cover plate.

When re-assembling, torque the four Torx T10 screws to 3 in-lb.

Figure 6-16



Removing the Cursor Keyboard

9 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 flat lens and the flat-panel display to prevent glass breakage. Make sure lens gasket is positioned correctly.

Inspect the inside surfaces of the flat lens and the flat-panel display 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 flat-panel display by applying the glass cleaner to the lint-free lens paper or soft lens cloth. Do not apply glass cleaner directly to the flat-panel display. This will prevent cleaner from corroding flat-panel display 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.

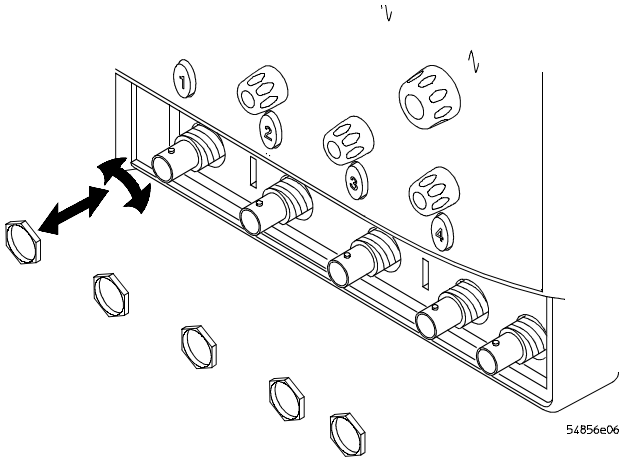
2 Remove the AutoProbe assembly.

3 Using a 5/8" nut driver, remove the hex nuts that secure the BNC connectors to the front panel.

Replacing the BNC hex nuts

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

Figure 6-17



Removing the BNC Nuts

4 Disconnect the following cables from the acquisition board:

- Line Trig Input Cable
- Acquisition Cable
- 10 MHz Ref Output Cable
- 10 MHz Input Cable
- Aux Trig Input Cable
- Probe Comp/Cal Cable
- Ext Trig Output Cable

5 Remove the six Torx T10 screws that secure the acquisition board to the chassis.

Replacing the screws

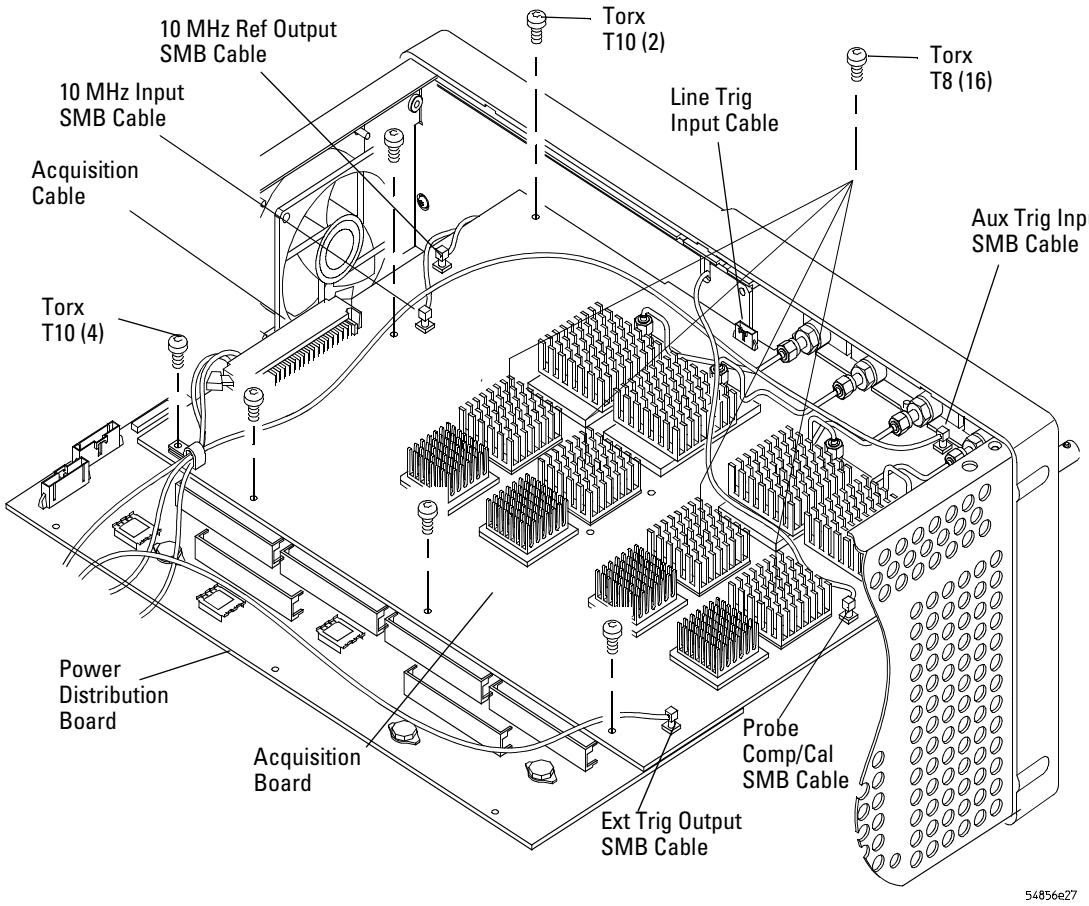
For each Torx T10 screw torque to 5 in-lb.

6 Remove the sixteen Torx T8 screws from the A/D converter heat sinks.

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.

Figure 6-18

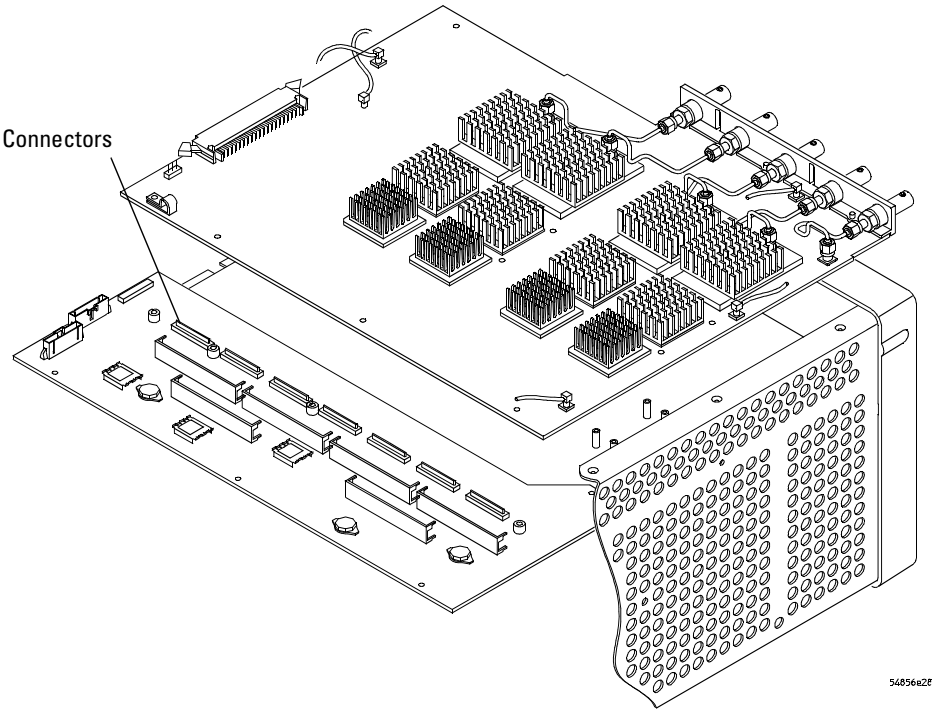


Removing Cables and Screws

7 Carefully lift the back of the board to separate the acquisition board connectors from the power distribution board.

8 Lift the board back from the front panel until the BNC connectors clear the front panel, then lift the board away from the chassis.

Figure 6-19



Separate Acquisition Board from Power Distribution Board

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

To remove and replace the power regulator distribution board

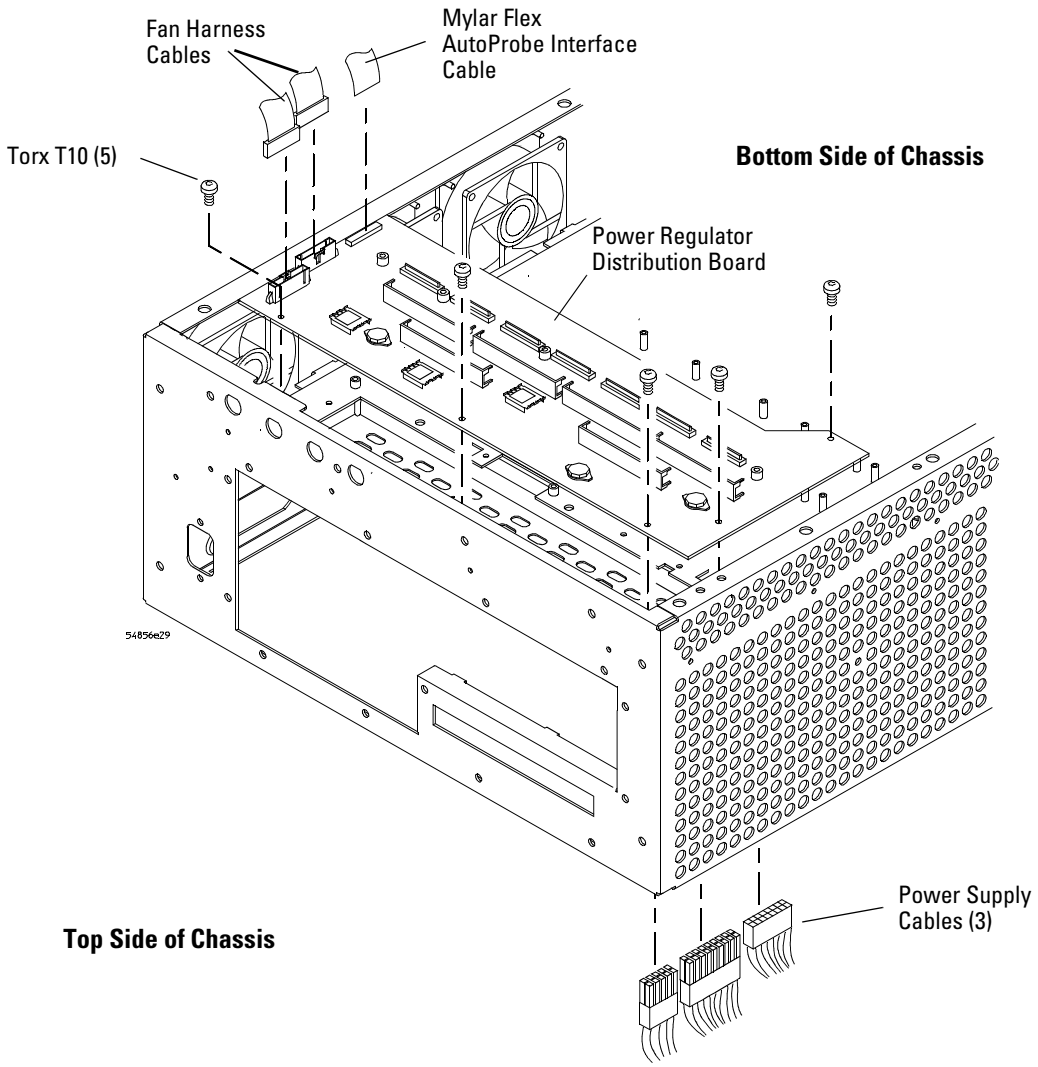
When necessary, refer to other removal procedures.

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 from the top side of the chassis
   - Fan harness cables on the bottom side of the chassis
   - Mylar flex probe power cable
4. Remove the five Torx T10 screws from the power regulator distribution board.

Replacing the screws

For each Torx T10 screw torque to 5 in-lb.

Figure 6-20



Removing the Power Regulator Distribution Board

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

To remove and replace the 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 and the acquisition board cable 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.

Replacing the screw

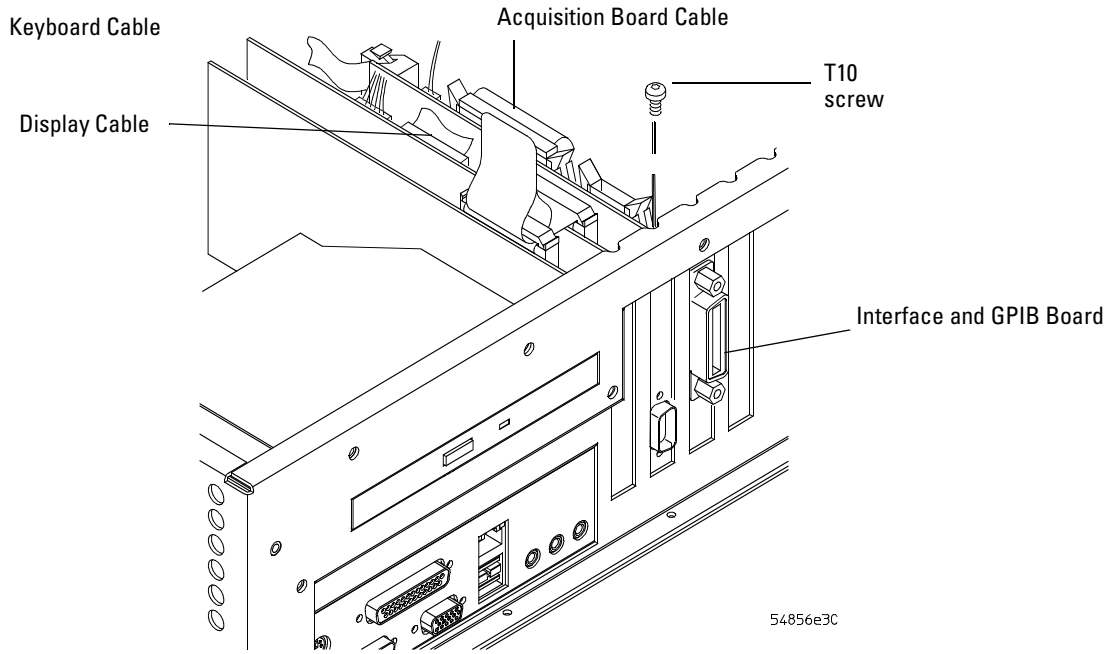
For the Torx T10 screw torque to 5 in-lb.

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.

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

Figure 6-21



Removing the interface and GPIB board

To remove and replace the oscilloscope graphics board and display board

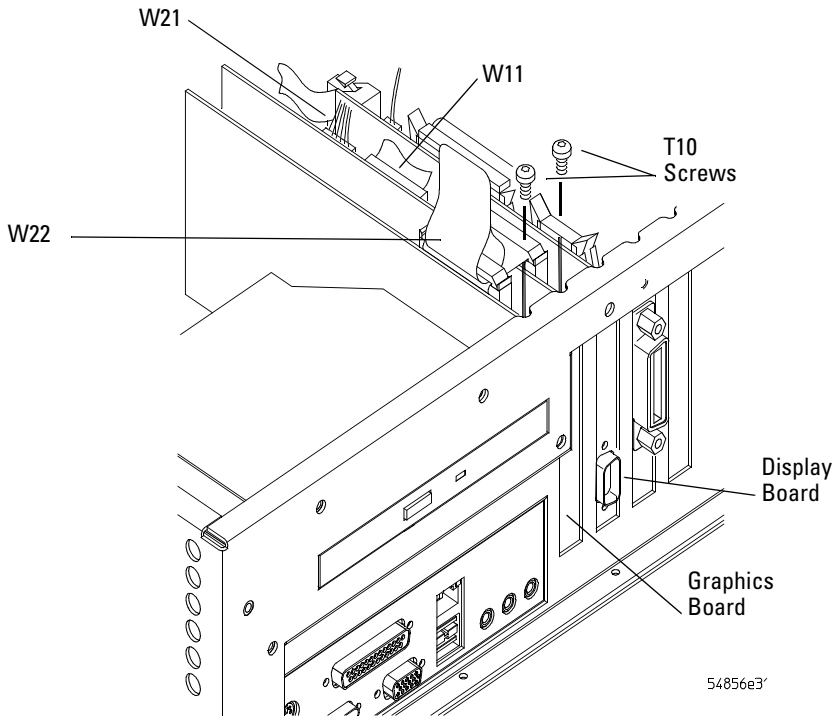
When necessary, refer to other removal procedures.

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.

Replacing the screws

For each Torx T10 screw torque to 5 in-lb.

Figure 6-22



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

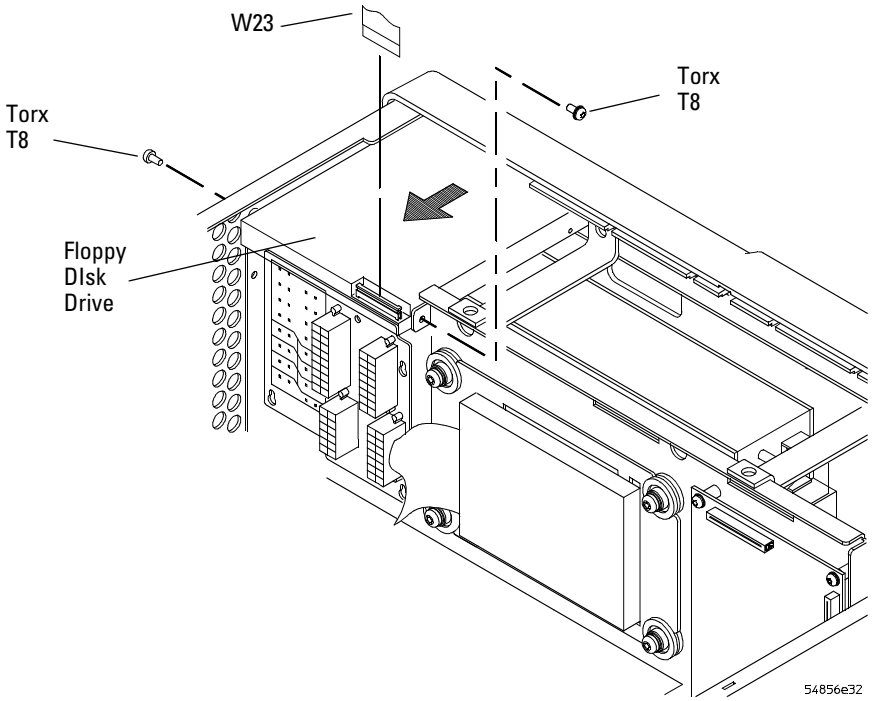
When necessary, refer to other removal procedures.

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.

When re-assembling, torque the two Torx T8 screws to 3 in-lb.

4 Pull the floppy disk drive from the front frame.

Figure 6-23



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.

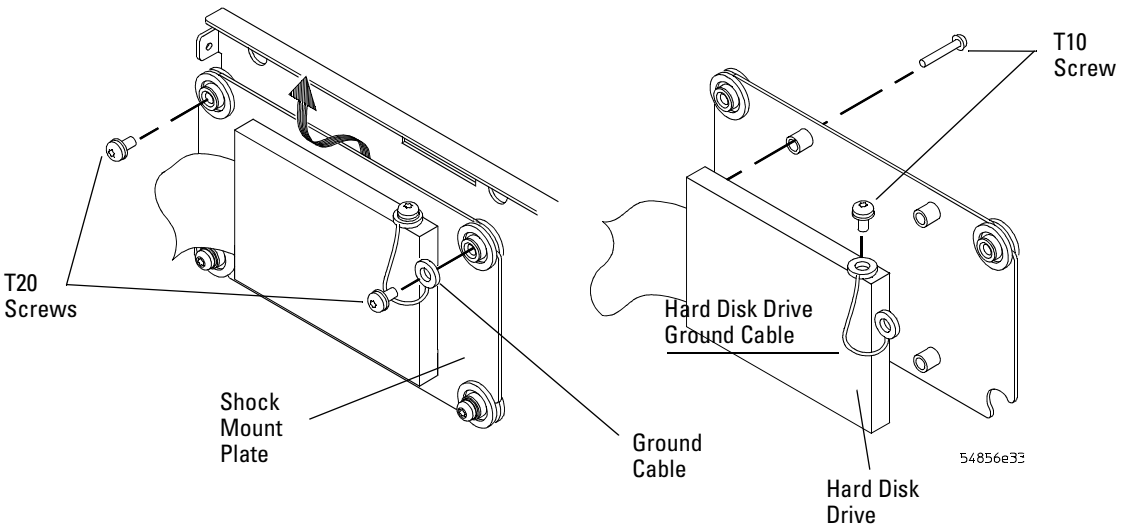
CAUTION DO NOT LET THE DISK DRIVE FALL!
Support the drive while removing the screws so that the drive does not fall.

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.

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

Figure 6-24



Removing the Internal Hard Disk Drive

4 Lift the disk drive assembly enough to clear the lower shock mounts 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 T10 Torx screw holding the hard disk drive ground cable.

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

When re-assembling, torque the four Torx T10 screws to 5 in-lb.

7 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 two Torx T10 screw securing the block to the CD-ROM support rail.

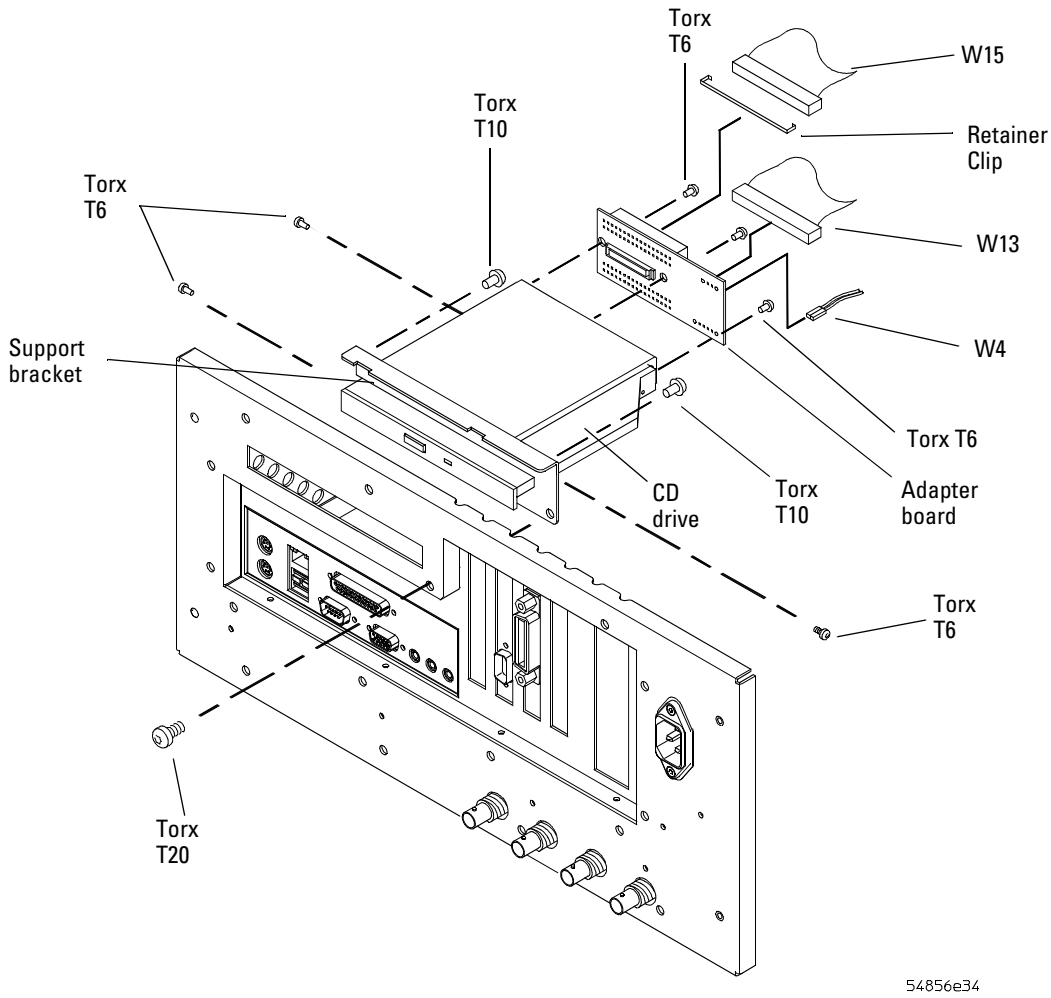
When re-assembling, torque the Torx T10 screws to 5 in-lb.

4 Remove the Torx T20 screw securing the CD-ROM support bracket to the rear chassis.

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

5 Slide the CD-ROM assembly inwards towards the front frame, then lift up and remove.

Figure 6-25



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.

When re-assembling, torque the three Torx T6 screws to 1.5 in-lb.

7 Remove the two Torx T6 screws securing the CD-ROM Adapter Board to the rear of the CD-ROM drive.

When re-assembling, torque the two Torx T6 screws to 1.5 in-lb.

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

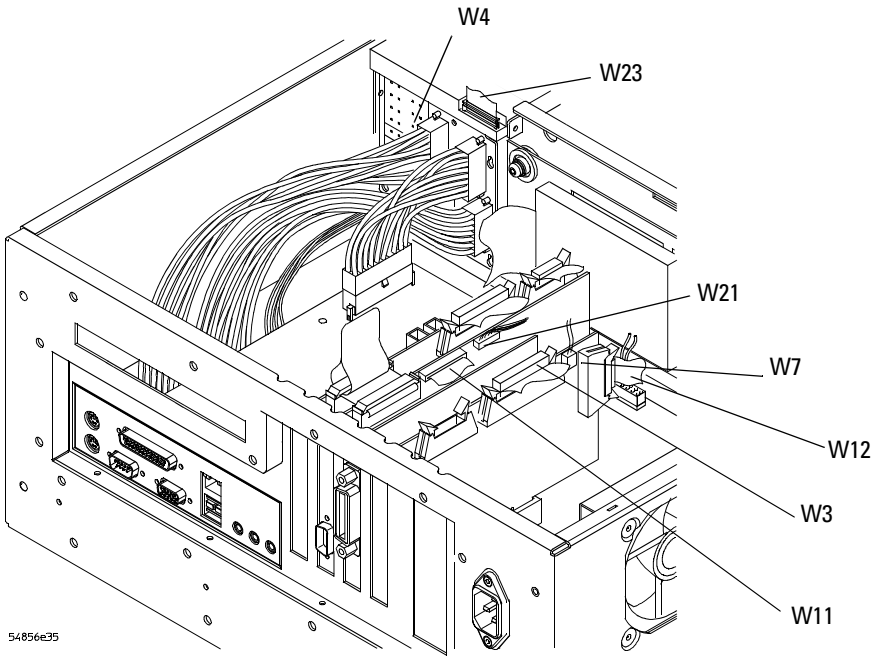
When necessary, refer to other removal procedures.

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 6-26.
- 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 6-26



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 CD-ROM cable that goes to the motherboard connector IDE2 at the motherboard end of the cable. See Figure 6-27.

6 Remove all PCI cards from the motherboard.

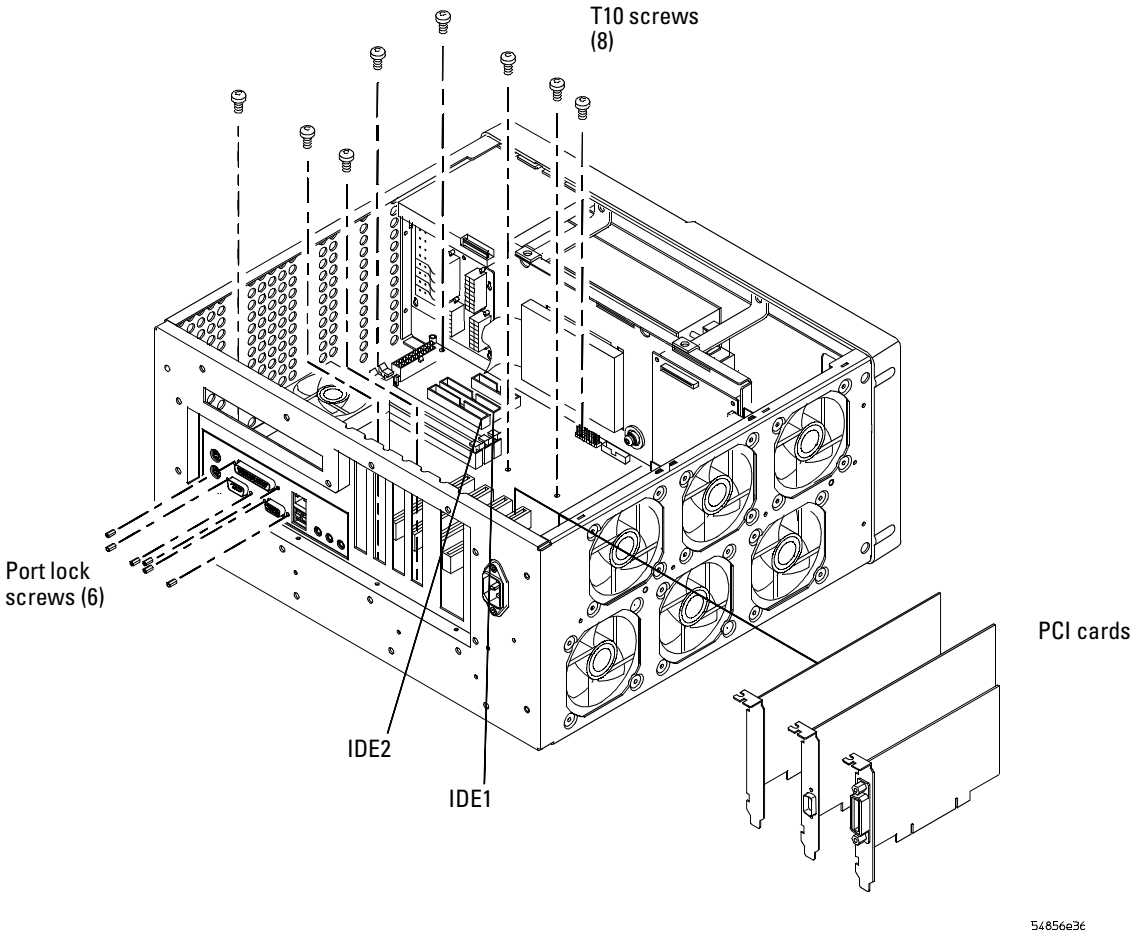
7 Remove the 8 T10 screws holding the motherboard to the chassis.

When re-assembling, torque the 8 Torx T10 screws to 5 in-lb.

8 Remove the 6 port lock screws holding the port connectors to the chassis.

When re-assembling, torque the 6 port lock screws to 5 in-lb.

Figure 6-27



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

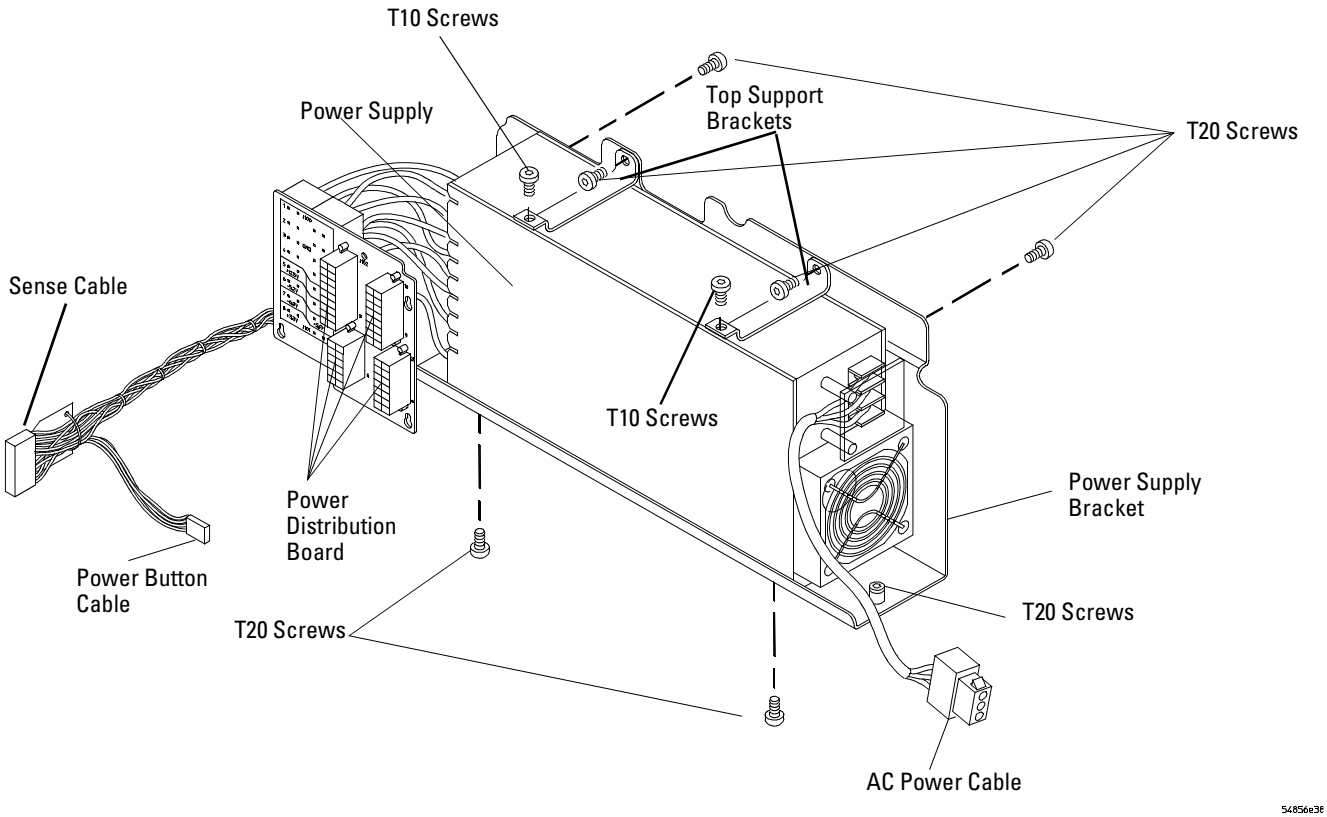
When necessary, refer to other removal procedures.

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 Disconnect the following cables from their connectors but do not disconnect them from the power supply.
   - Sense Cable
   - Power Button Cable
   - AC Power Cable

Figure 6-28



Disconnecting Power Supply Cables

4 Disconnect the cable from the power distribution board.
5 Remove the two Torx T10 screws that hold the top support brackets to the chassis.

When re-assembling, torque the two Torx T10 screws to 5 in-lb.

6 Remove the two Torx T20 screws that hold the top support backets to the power supply bracket.

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

7 Loosen the two Torx T20 screws at both ends of the power supply bracket that secure the bracket to the frame.

These screws are part of the power supply bracket and can not be remove from the bracket.

8 Remove the power supply and power supply bracket from the chassis.

9 Remove the two Torx T20 screws from the side of the power supply bracket.

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

10 Remove the two Torx T20 screws from the bottom of the power supply bracket.

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

11 Separate the power supply from the power supply bracket.

12 To replace the supply, reverse the installation procedure.

To remove and replace the fans

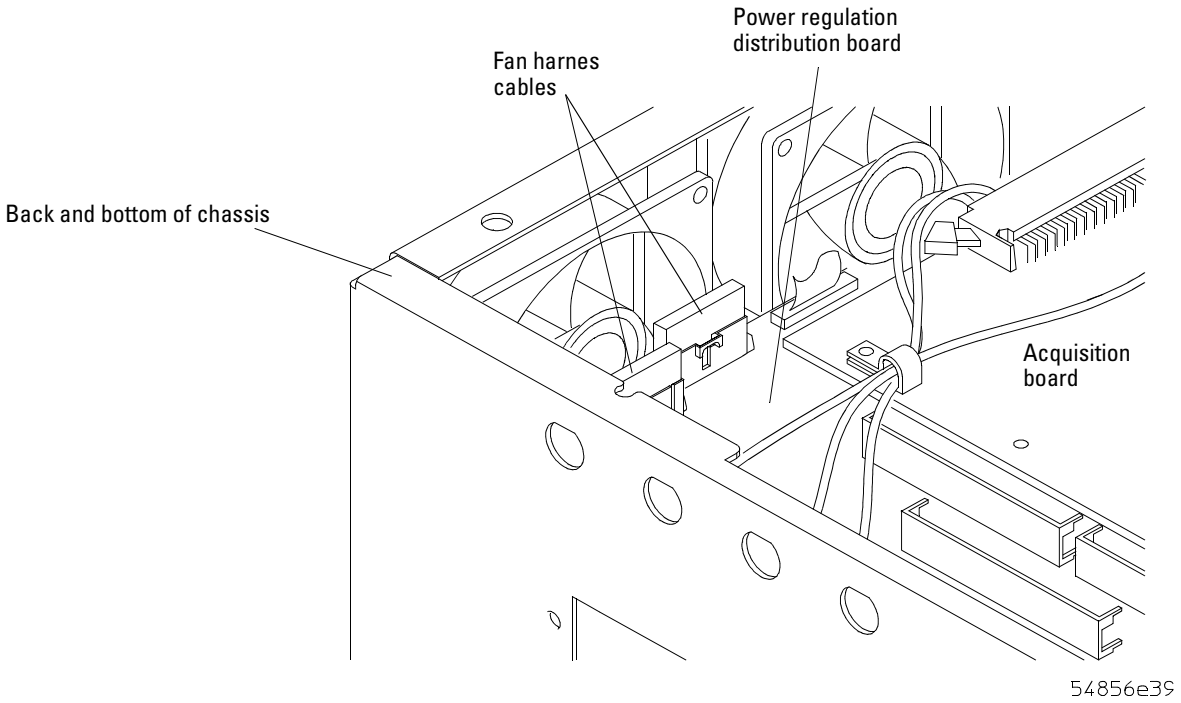
WARNING

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.

Figure 6-29

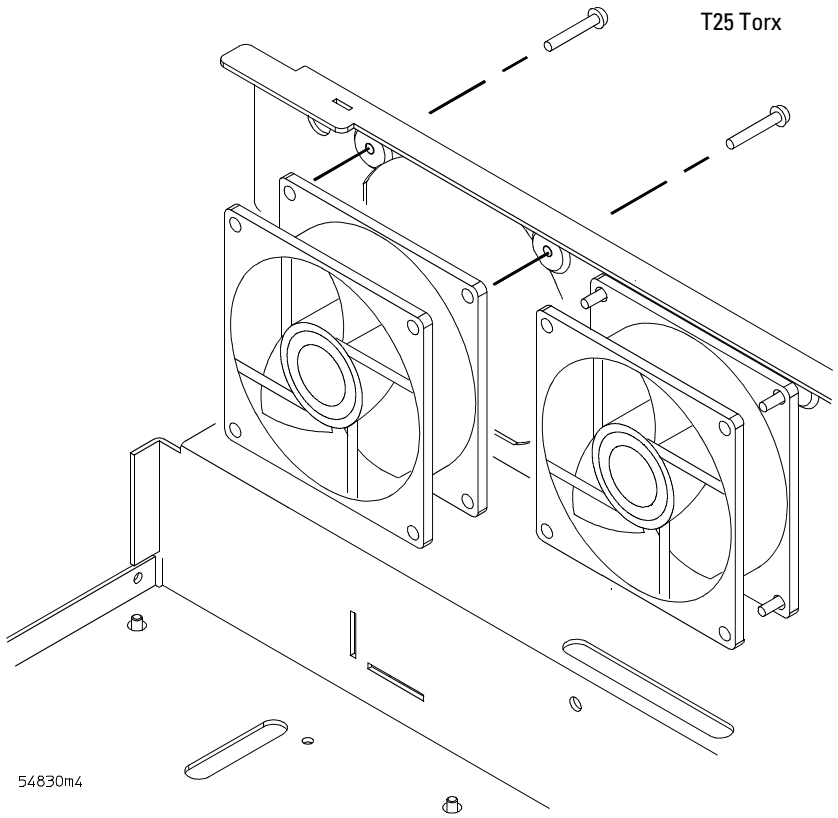


Removal of Fan Harnes Cables

3 Remove the four T25 Torx screws securing the fan to the chassis.

When re-assembling, torque the two Torx T25 screws to 12 in-lb.

Figure 6-30



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.

7

Replaceable Parts

Replaceable Parts

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

Ordering Replaceable Parts

Listed Parts

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

Unlisted Parts

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

Direct Mail Order System

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

- Direct ordering and shipping from the Agilent Technologies parts center in California, USA.
- No maximum or minimum on any mail order. (There is a minimum amount for parts ordered through a local Agilent Technologies Sales Office when the orders require billing and invoicing.)
- Prepaid transportation. (There is a small handling charge for each order.)
- No invoices.

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

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

Exchange Assemblies

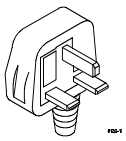
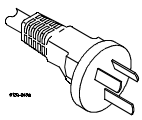
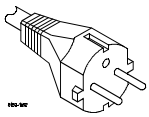
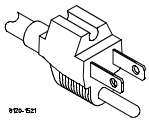
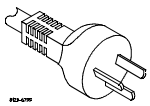
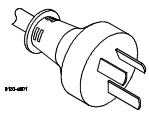
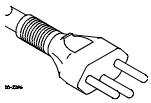
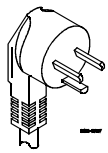
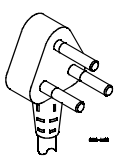
Some parts used in this oscilloscope have been set up for an exchange program. This program allows the customer to exchange a faulty assembly with one that has been repaired, calibrated, and performance-verified by the factory. The cost is significantly less than that of a new part. The exchange parts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

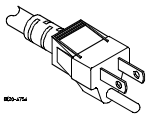
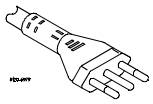
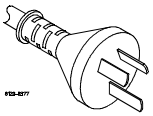
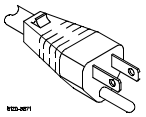
After receiving the repaired exchange part from Agilent Technologies, a United States customer has 30 days to return the faulty assembly. For orders not originating in the United States, contact the local Agilent Technologies service organization. If the faulty assembly is not returned within the warranty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

Power Cables and Plug Configurations

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

Power Cables and Plug Configurations

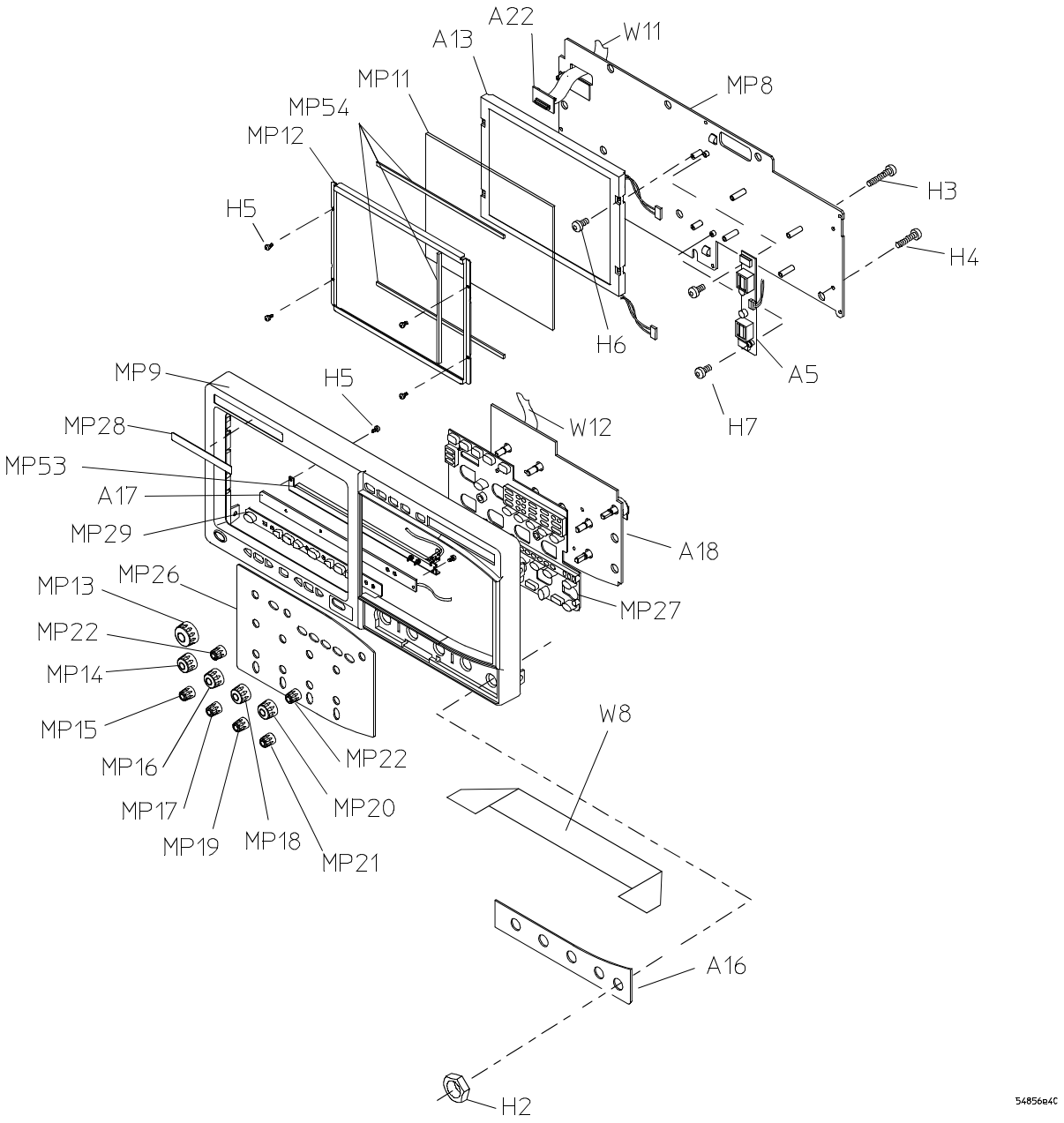
Plug Type	Cable Part No.	Plug Description	Length (in/cm)	Color	Country
Opt 900 250V 	8120-1703	90°	90/228	Mint Gray	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore
Opt 901 250V 	8120-0696	90°	87/221	Mint Gray	Australia, New Zealand
Opt 902 250V 	8120-1692	90°	79/200	Mint Gray	East and West Europe,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

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

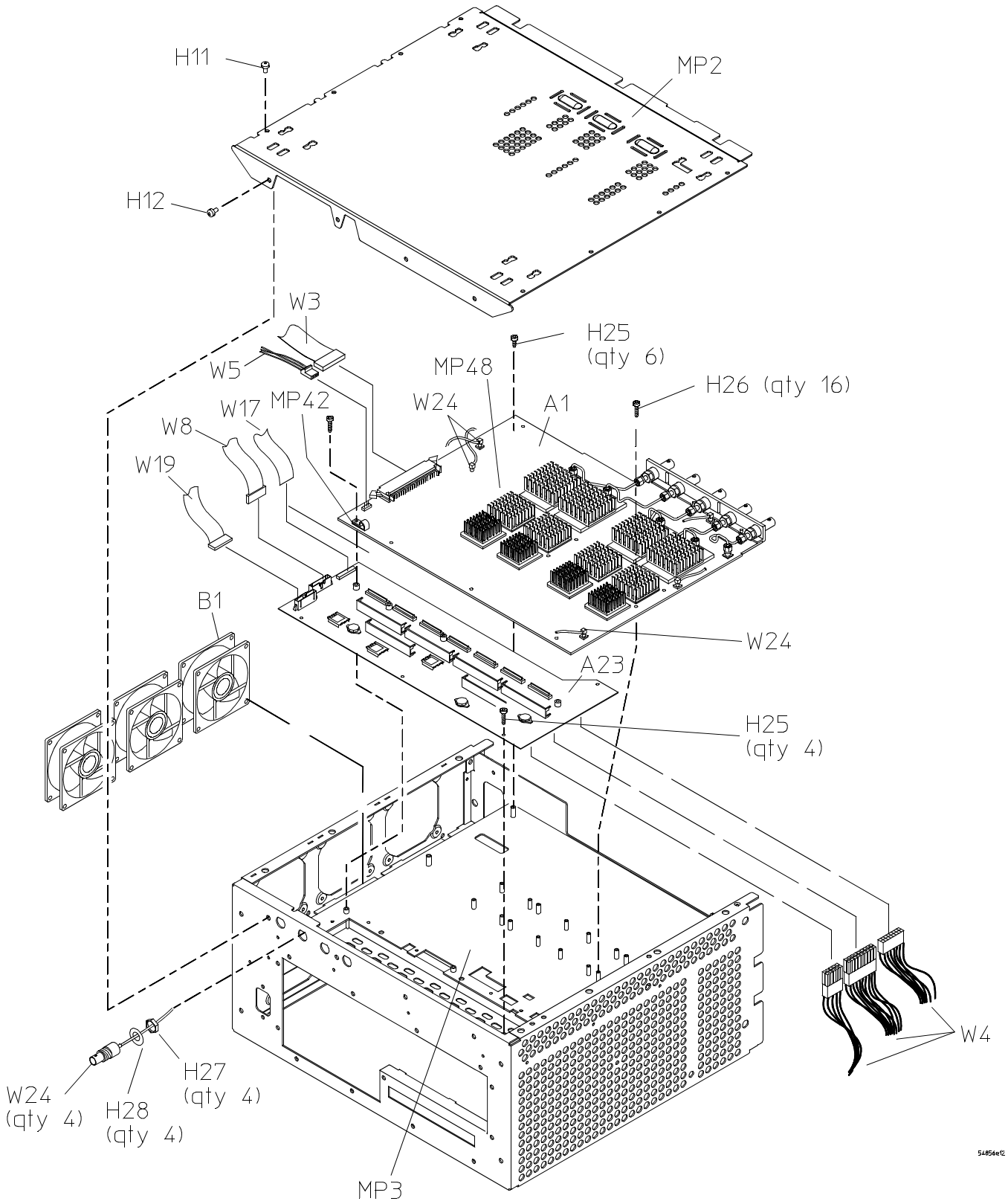
* Part number shown for plug is industry identifier for plug only. Number shown for cable is Agilent Technologies part number for complete cable including plug.
** These cords are included in the CSA certification approval of the equipment.
E = Earth Ground
L = Line
N = Neutral

Exploded Views

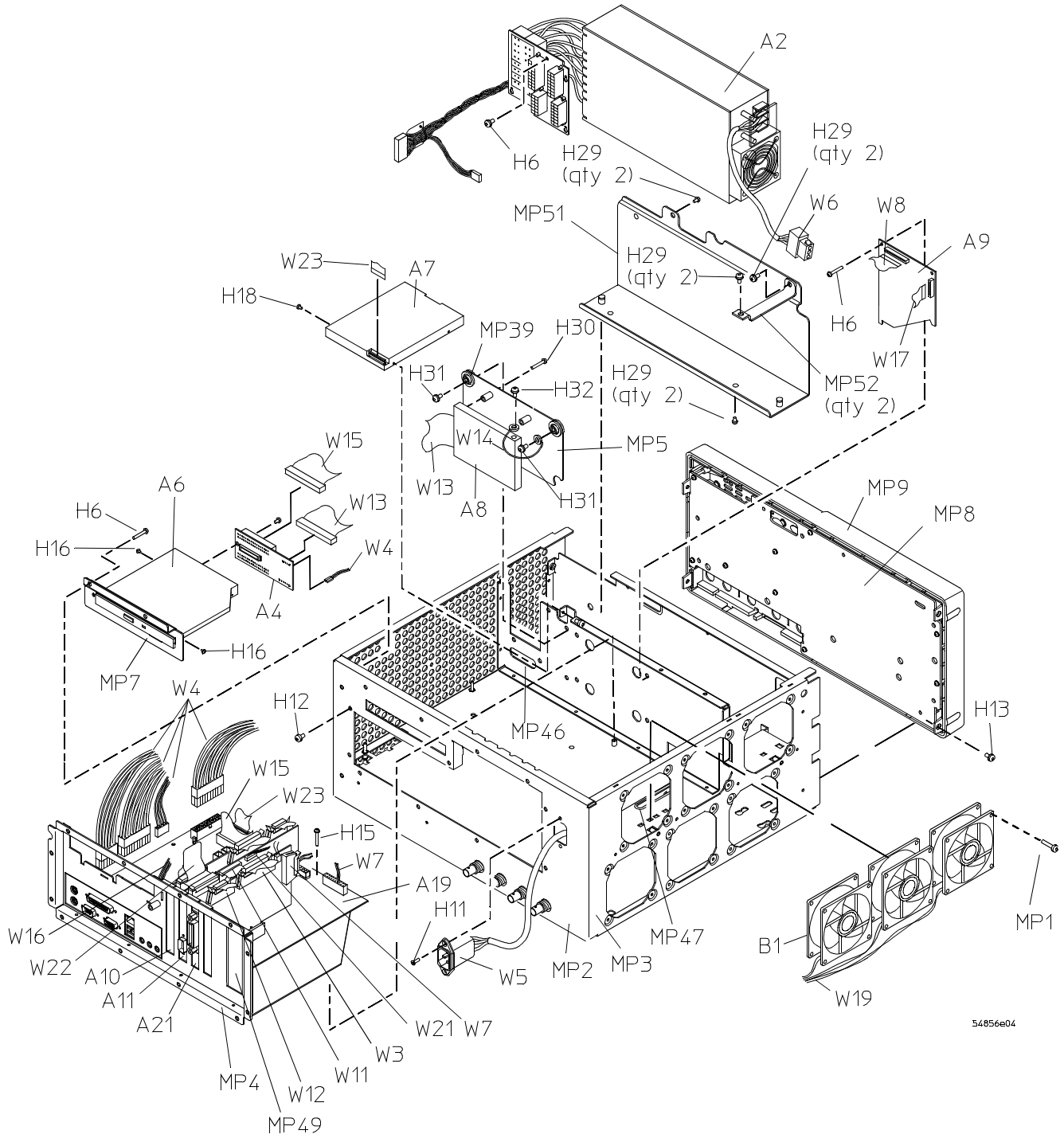
Front Frame and Front Panel



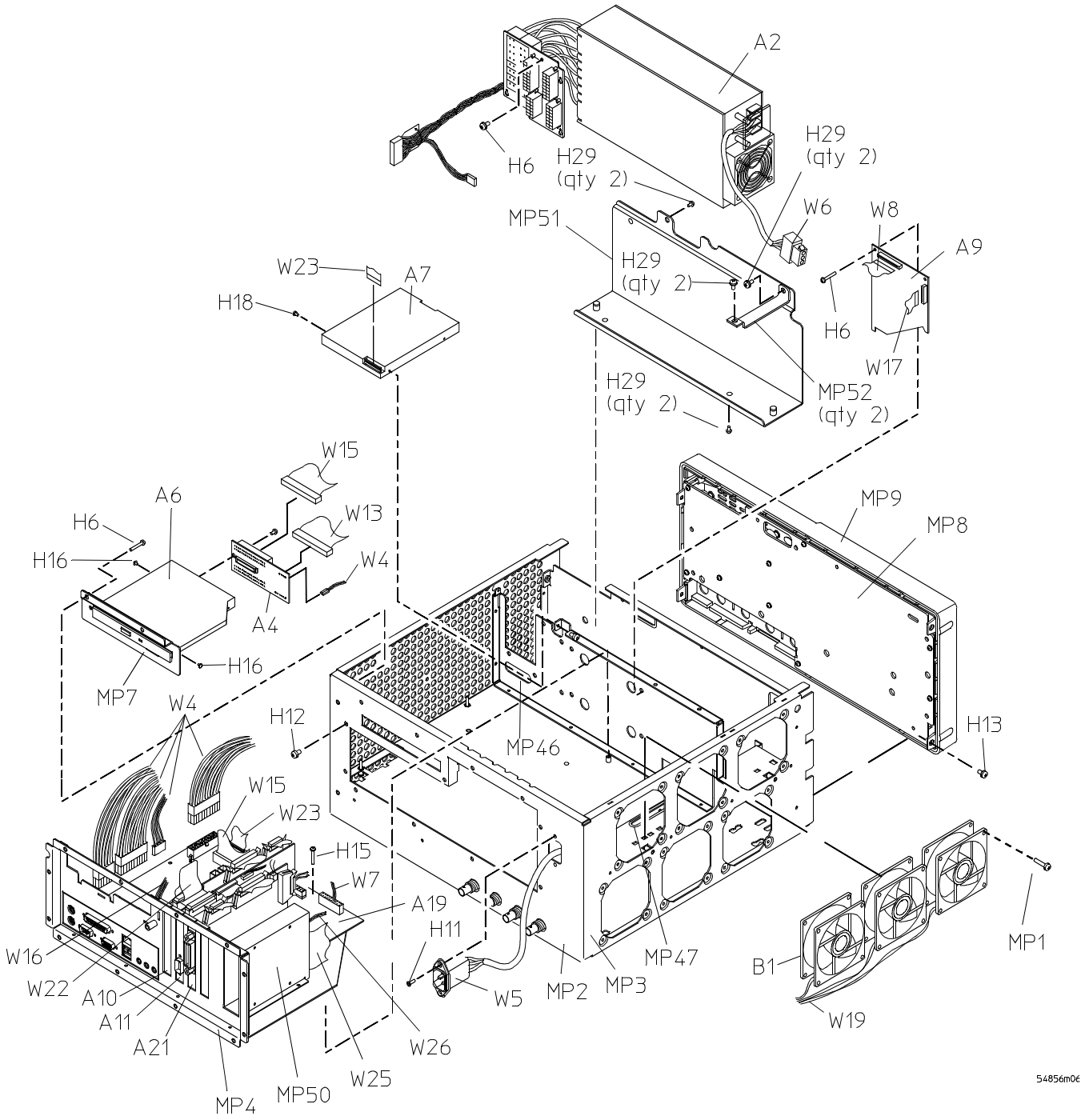
Fan and Acquisition Assembly



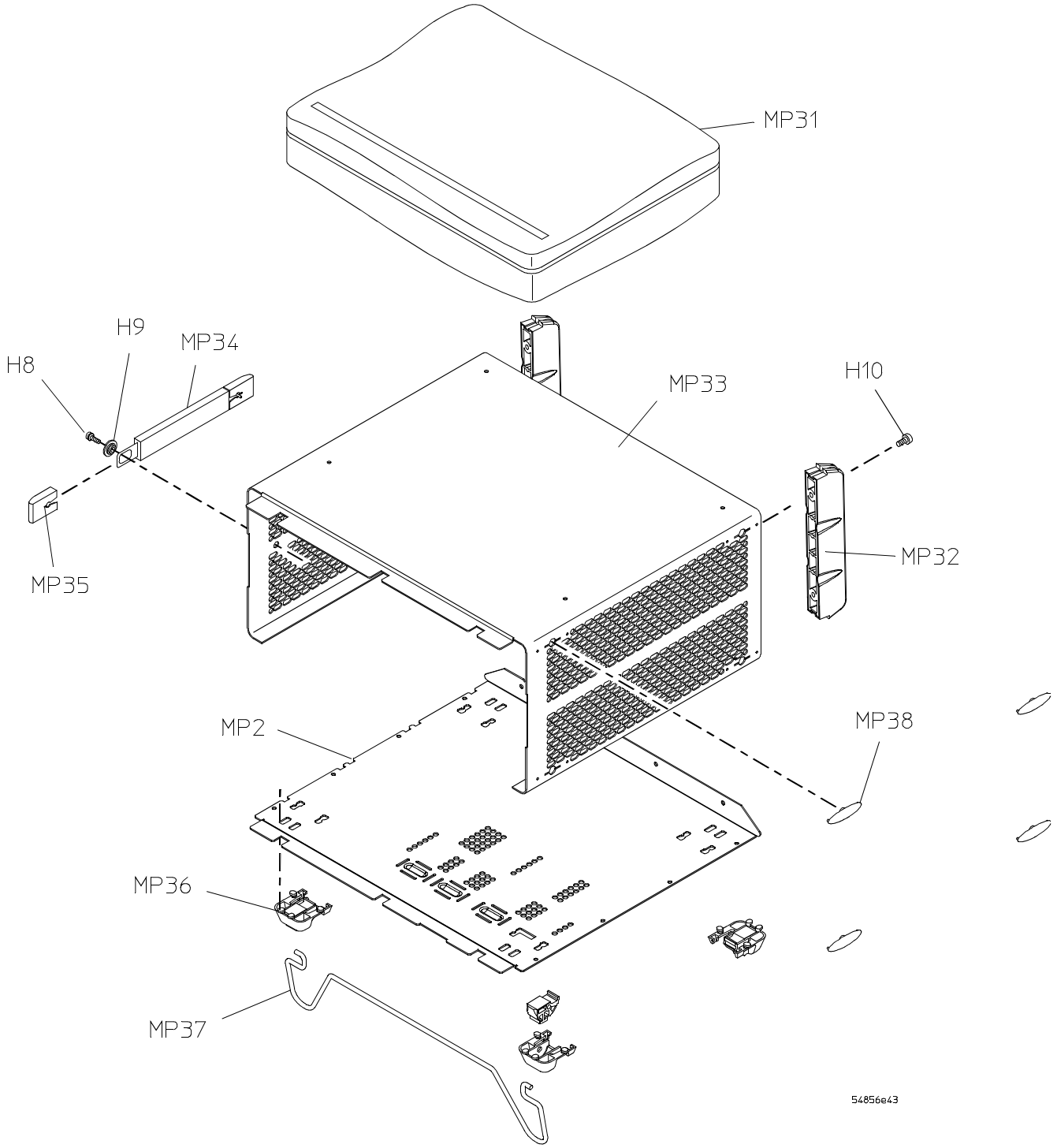
Power Supply and PC Motherboard without option 017



Power Supply and PC Motherboard with option 017



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	54857-69501	1	4-CH ACQUISITION ASSEMBLY (Agilent Model DSO81004A)
A1	54858-69501	1	4-CH ACQUISITION ASSEMBLY (Agilent Model DSO81204A)
A1	54859-69501	1	4-CH ACQUISITION ASSEMBLY (Agilent Model DSO81304A)
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
MP26	54857-68804	1	SUBASSEMBLY FRONT PANEL
MP28	54857-94303	1	LOGO LABEL/DSO81004A (Infiniium 10 GHz 20GSa/s)
MP28	54857-94312	1	LOGO LABEL/DSO81204A (Infiniium 12 GHz 20GSa/s)
MP28	54859-94301	1	LOGO LABEL/DSO81304A (Infiniium 13 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	54856-62601	1	POWER SUPPLY ASSEMBLY
A5	0950-2888	1	INVERTER BOARD
A13	2090-0897	1	LCD DISPLAY

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

Replaceable Parts

Ref. Des.	Agilent Part Number	QTY	Description
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
A16	54857-68803	1	PROBE INTERFACE KIT
A17	54826-66507	1	KEYBOARD - CURSOR
A18	54832-66504	1	MIAIN KEYBOARD - 4CH
A21	54855-66515	1	INTERFACE & GPIB BOARD
A22	54855-66512	1	FLAT-PANEL DISPLAY BOARD
A23	54857-66502	1	POWER DISTRIBUTION BOARD
Fans			
B1	3160-4134	6	12 V FAN
Internal Chassis Parts			
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	12	PAN HEAD SCREW 6 MM
H6	0515-0372	22	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
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

Replaceable Parts

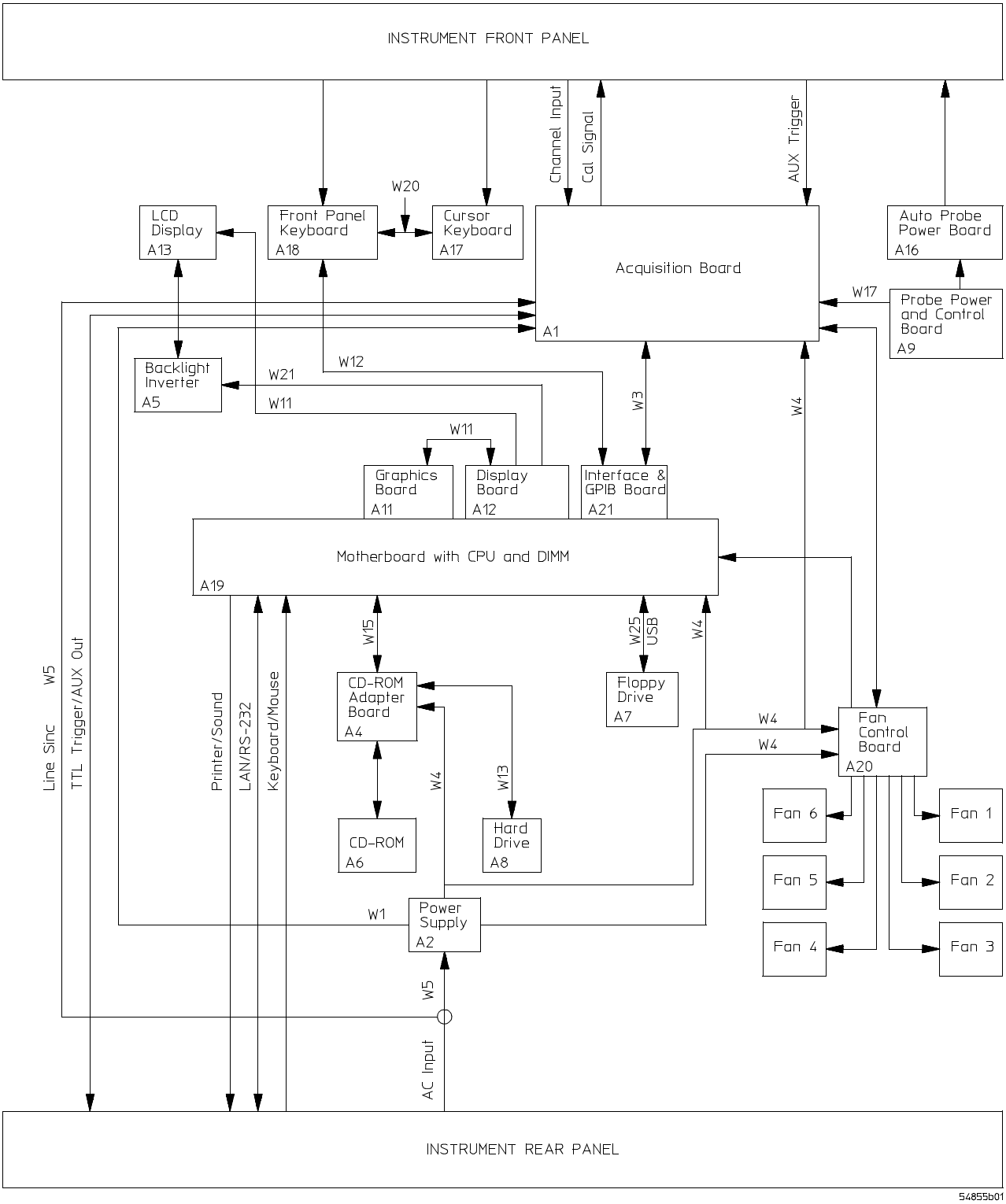
Ref. Des.	Agilent Part Number	QTY	Description
H28	2950-0054	2	NUT
H29	0515-0433	9	M4X0.7 8MM SCREW; TORX T20
H30	0515-0374	4	M3X0.5 10MM SCREW; TORX T10
H31	0515-0383	4	M4X0.7 16MM SCREW; TORX T20
H32	0515-0663	1	M3X0.5 4MM SCREW; TORX T10
MP1	0624-1066	24	FAN SCREWS
MP2	54855-00501	1	SLEEVE BOTTOM
MP3	54855-00104	1	CHASSIS ASSEMBLY
MP4	54857-60102	1	ATX TRAY
MP5	54857-01211	1	HARD DRIVE BRACKET (NOT ON OPTION 017)
MP7	54857-01214	1	CDROM MOUNT BRACKET
MP8	54857-04103	1	FRONT FRAME BACK PLATE
MP9	54857-40501	1	FRONT FRAME
MP10	54810-01213	1	POWER SUPPLY SUPPORT BRACKET
MP11	54857-88001	1	LENS GLASS
MP12	54857-01205	2	LENS BRACKET
MP23	54801-24701	1	BRACKET STIFFENER
MP27	54857-41901	1	MAIN KEYPAD
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
MP44	54832-09103	1	POWER SUPPLY SPRING COVER
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)
MP51	54857-01213	1	POWER SUPPLY BRACKET
MP52	54857-01215	2	SUPPORT BRACKET
MP53	54857-61201	1	PROBE COMP PLATE
MP54	01680-87101	2	LENS GASKET
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

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)

8

Theory of Operation

Figure 8-1



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 Trigger Input BNC.
- 10 MHz Reference Output BNC.
- 10 MHz Reference Input 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. Maximum input power is 550 W. The ac input frequency is 50 or 60 Hz.

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

FPD Monitor Assembly

The 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 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.

Front Panel

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

The elastomeric keypad has 22 keys, 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 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.

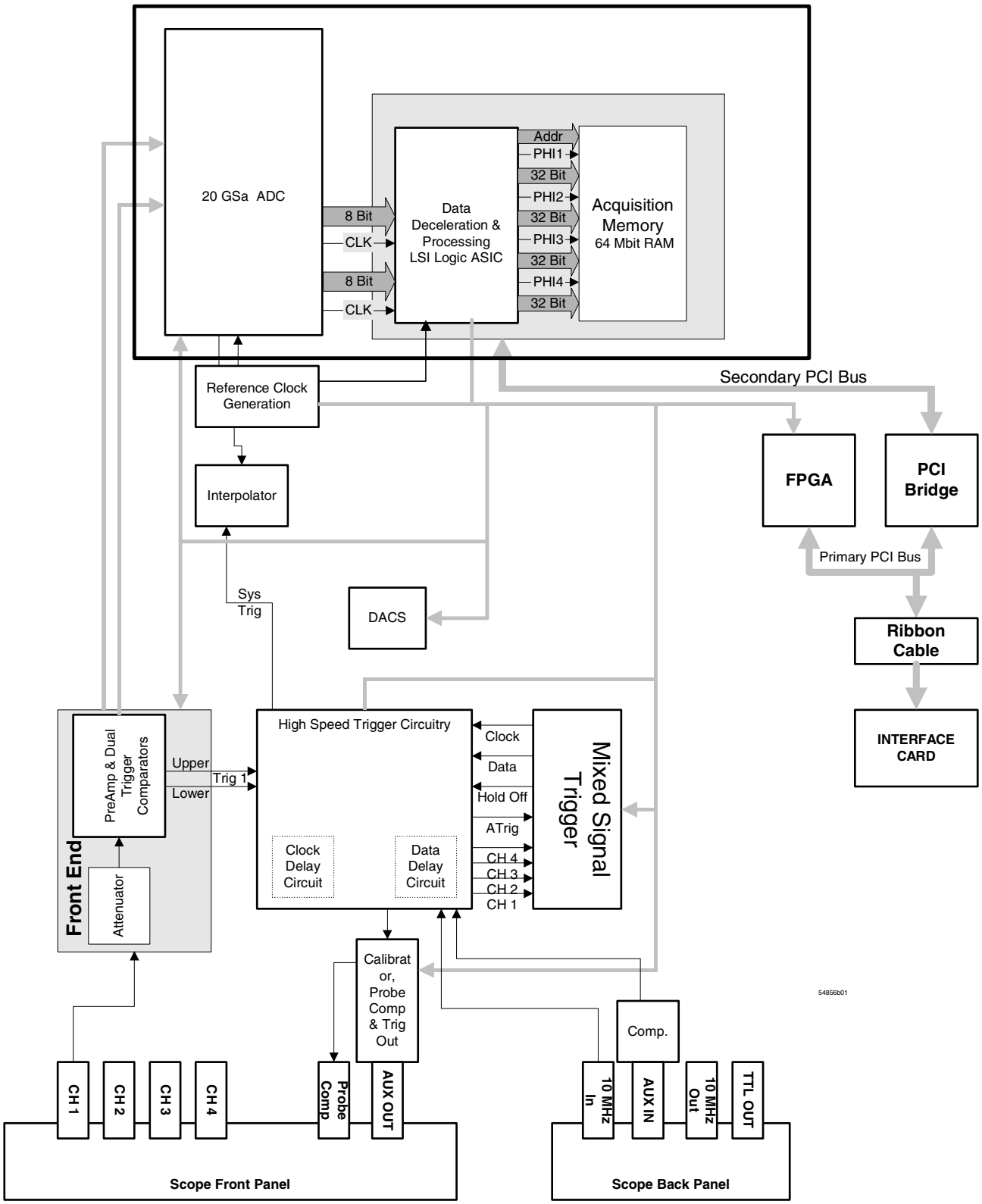
Display Board

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

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 trigger signals synchronize acquisition through the trigger and time base circuitry. A reference oscillator and the time base provide the base sample rates.

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

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

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

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

Time Base The time base provides the sample clocks and timing necessary for data acquisition. It primarily consists of a reference oscillator, 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
- Mixed Signal 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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Notices

Manual Part Number

54856-97000, December 2004

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WARNING

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

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.