Service Guide

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Agilent Model 54830 Series 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 54830 offers 2 channels, 4 GSa/s sampling rate in 1-channel mode, 2 GSa/s sampling rate in 2-channel mode, 600 MHz bandwidth. The 54830 MSO also includes 16 digital channels.
- Agilent 54831 offers 4 channels, 4 GSa/s sampling rate in 2-channel mode, 2 GSa/s sampling rate in 4-channel mode, 600 MHz bandwidth. The 54831 MSO also includes 16 digital channels.
- Agilent 54832 offers 4 channels, 4 GSa/s sampling rate in 2-channel mode, 2 GSa/s sampling rate in 4-channel mode, 1 GHz bandwidth. The 54832 MSO also includes 16 digital channels.
- Agilent 54833 offers 2 channels, 4 GSa/s sampling rate in 1-channel mode, 2 GSa/s sampling rate in 2-channel mode, 1 GHz bandwidth. The 54833 MSO also includes 16 digital channels.

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 200 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 oscilloscope 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
- Set coupling for trigger
- Use graphical user interface to simplify configuration of pattern, state, delay, violation, and video triggers
- Use auxiliary trigger to increase triggering flexibility

Vertical controls set input coupling, impedance, attenuation, and position

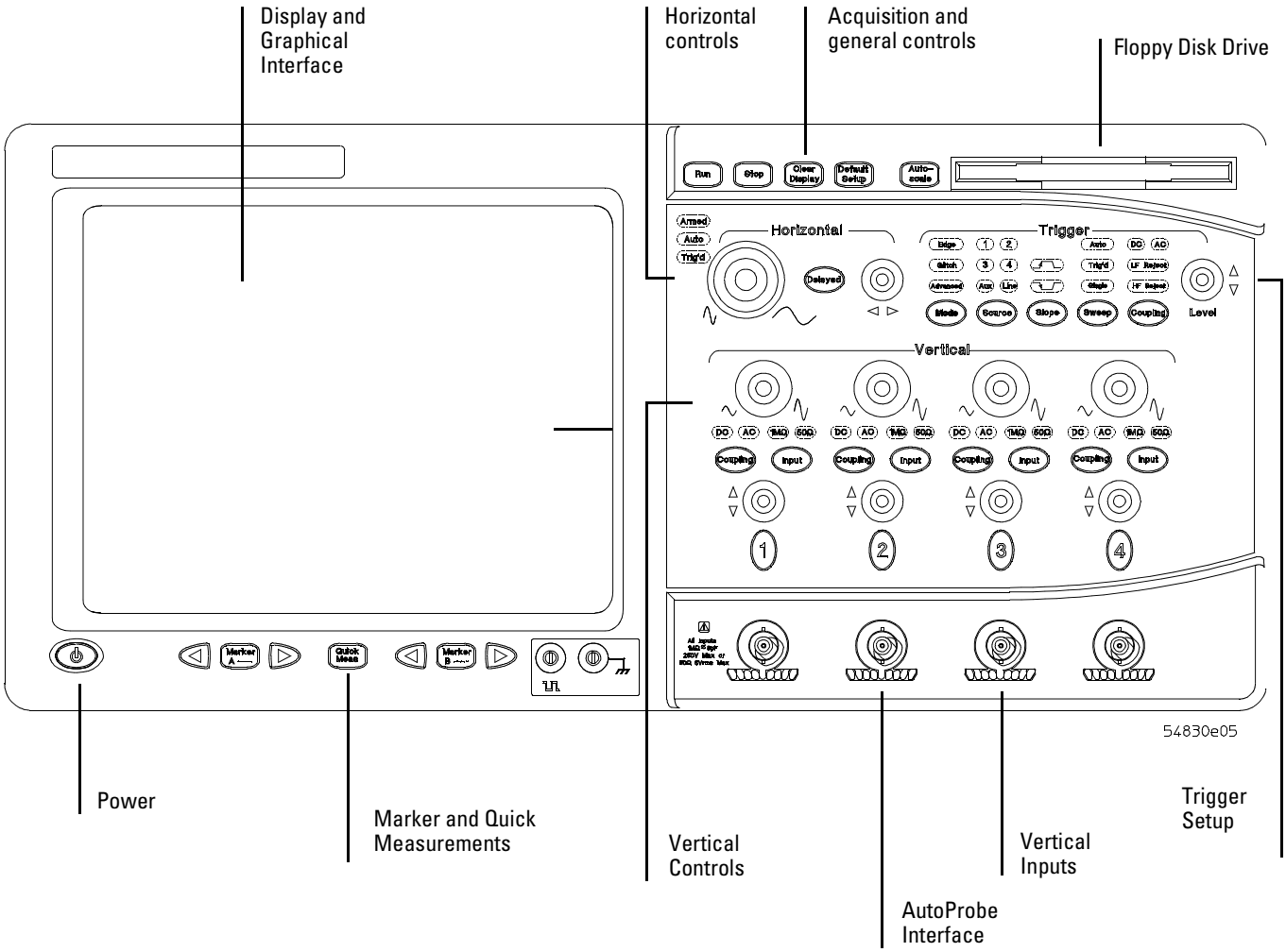
- AC or DC input coupling
- 1 MΩ or 50Ω input impedance
- Input attenuation adjustable from 2 mV/div to 1 V/div (plus 2 V/div in 1 MΩ)
- Color-coded knobs make it easy to find the controls that affect each waveform

Marker and quick measurements help measure waveform parameters

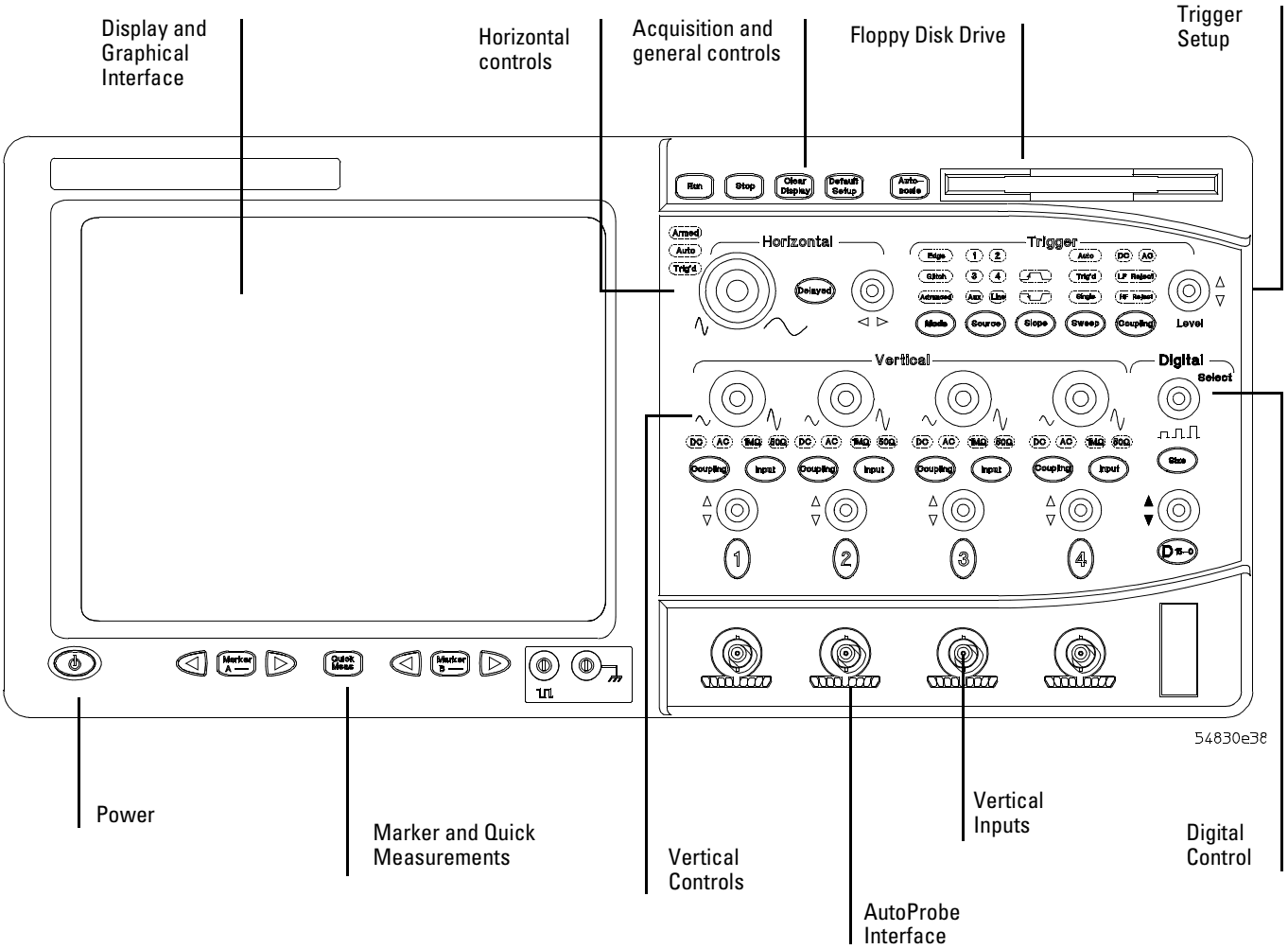
- Waveform markers A and B to check voltage and Δ–time at any point on the displayed waveform
- Quick Meas executes up to four predefined measurements instantly

Service Policy

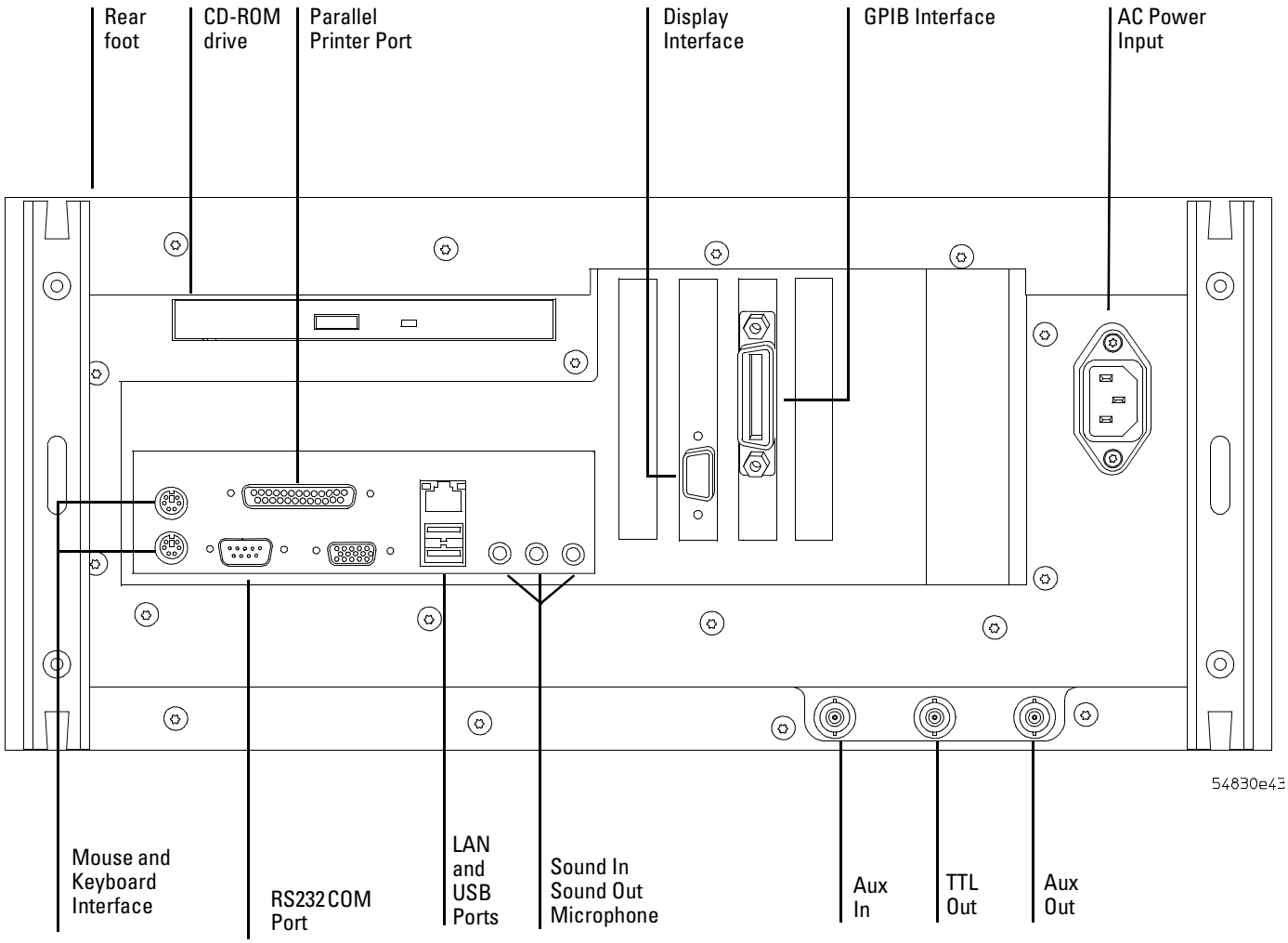
The service policy of this oscilloscope requires replacing defective assemblies. Some assemblies can be replaced on an exchange basis. Items such as the vertical attenuators, which are subject to wear and tear based on frequency of use, are a maintenance item that may need occasional replacement.



Front Panel of DSO Models



Front Panel of MSO Models



Rear Panel of 54830-series oscilloscope

In This Book

This book provides the service documentation for the Agilent Technologies 54830-series 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 and adjustment procedures, how to do them, and how often they need to be done.

Chapter 5 provides troubleshooting information.

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 information, Warranties, and Regulatory 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

On the rear panel of the oscilloscope is a serial number label and a VIN # 0XX. 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 on a key word such as "Infiniium Service Guide", and follow the links.

For additional information on configuration differences see the following sections in this service guide:

- "To configure the motherboard jumpers and setup the BIOS" in the Troubleshooting section 5 for information on determining:
  - which computer configuration is contained in your oscilloscope
  - setting up the BIOS correctly for that configuration
  - setting the motherboard jumpers if the PC motherboard is changed.
- Replaceable Parts section 7.
  This section contains exploded views for the different motherboard configurations, cabling schemes, and outside hardware versions. The Replaceable Parts List also contains the assembly part numbers for the different oscilloscope configurations.

Table 1-1 Oscilloscopes Covered by this Service Guide

Model	Description
Agilent 54830B	Two-channel digitizing oscilloscope with 4 GSa/s sample rate in 1-channel mode, 2 GSa/s sample rate in 2-channel mode, 600 MHz bandwidth.
Agilent 54830D	Two-channel digitizing oscilloscope with 4 GSa/s sample rate in 1-channel mode, 2 GSa/s sample rate in 2-channel mode, 600 MHz bandwidth, 16 digital channels.
Agilent 54831B	Four-channel digitizing oscilloscope with 4 GSa/s sample rate in 2-channel mode, 2 GSa/s sample rate in 4-channel mode, 600 MHz bandwidth
Agilent 54831D	Four-channel digitizing oscilloscope with 4 GSa/s sample rate in 2-channel mode, 2 GSa/s sample rate in 4-channel mode, 600 MHz bandwidth, 16 digital channels.
Agilent 54832B	Four-channel digitizing oscilloscope with 4 GSa/s sample rate in 2-channel mode, 2 GSa/s sample rate in 4-channel mode, 1 GHz bandwidth.
Agilent 54832D	Four-channel digitizing oscilloscope with 4 GSa/s sample rate in 2-channel mode, 2 GSa/s sample rate in 4-channel mode, 1 GHz bandwidth, 16 digital channels.
Agilent 54833A	Two-channel digitizing oscilloscope with 4 GSa/s sample rate in 1-channel mode, 2 GSa/s sample rate in 2-channel mode, 1 GHz bandwidth.
Agilent 54833D	Two-channel digitizing oscilloscope with 4 GSa/s sample rate in 1-channel mode, 2 GSa/s sample rate in 2-channel mode, 1 GHz bandwidth, 16 digital channels.

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

Accessories supplied

Standard accessories supplied

- Mouse, P/N 1150-7913
- Keyboard, P/N 1150-7809
- *User's Quick Start Guide*
- Accessory Pouch, P/N 54810-68701
- Power cord (see chapter 7, "Replaceable Parts," for available power cords)

MSO series oscilloscope accessories supplied

- Probe Kit, P/N 54826-68701

Other accessories supplied

- 54830B/D - (2) Agilent 1165 A 10:1 10 MΩ passive probes.
- 54831B/D - (4) Agilent 1165 A 10:1 10 MΩ passive probes.

Options available

The following options are available for the Infiniium oscilloscope.

Table 1-2 **Infiniium Oscilloscope Options**

Option Number	Description
Probe Options	
001	Add 2 standard probes—Agilent 1165A probes for the A, B, and D models
002	Add 1 Agilent 1162A 1:1, 1 MΩ, 1.5 m passive probe
004	Add 4 Agilent 1165 A Passive Probes
007	Add 1 Agilent Wedge Kit
008	Add 1 Agilent 1153A 200 MHz differential probe
011	Add 1 Agilent 1155A, dual channel 750 MHz active probe
012	Add 1 Agilent 1156A 1.5 GHz active probe
016	Add 1 Easy Probe Positioner
019	Add 1 1130A 1.5 GHz InfiniiMax differential probe
Memory Options	
040	Increase acquisition memory to 8 M on half channel and 4 M on all channels
080	Increase acquisition memory to 16 M on half channel and 8 M on all channels.
Service Options	
0B3	*Agilent Technologies Infiniium Oscilloscope Service Guide*
Other Options	
B30	USB Testing
B31	USB Testing Low/Full Speed
100	Communications Mask Test Kit
200	VoiceControl Option
1CM	Add 1 Rackmount kit (Agilent E2609B)
UL9	Add 1 cordless trackball (E2647A)
0BF	Add 1 Programmer's Guide

Other options are available. See your Agilent Technologies Sales Representative. You can order multiple options, or you can order most of these options separately, using the Agilent model number or part number.

Accessories available

The following accessories are available for use with the Agilent Technologies Infiniium oscilloscope.

Table 1-3 **Accessories for the Agilent Technologies Infiniium Oscilloscope Model 54830 Series**

Agilent 1144A	800 MHz Active Probe Requires Agilent 1142A power supply—Agilent 01144-61604 probe power extender also required when using 2 or more Agilent 1144A active probes
Agilent 1145A	2-channel 750 MHz SMT active probe Requires Agilent 1142A power supply
Agilent 1146A	Oscilloscope AC/DC Current Probe
Agilent 1152A	2.5 GHz, 10:1, 100 kΩ, 0.6 pF Active Probe
Agilent 1153A	200 MHz Differential Probe
Agilent 1155A	750 MHz 2-Channel, Low-Mass Active Probe
Agilent 1165A	Standard probe
Agilent 1162A	1:1 Passive Probe
Agilent 1163A	10:1 500-Ω, low-C Passive Probe
Agilent 1171A	500 MHz Low-Mass, miniature 10:1 10 MΩ Passive Probe
Agilent 1173A	500 MHz Low-Mass, miniature 20:1 10 MΩ Passive Probe
Agilent 10240B	BNC Blocking Capacitor
Agilent 10833A	GPIB cable, 1 m
Agilent 10833B	GPIB cable, 2 m
Agilent 10833C	GPIB cable, 4 m
Agilent 10833D	GPIB cable, 0.5 m
Agilent 11094B	75Ω Feedthrough Termination
Agilent 34810B	Benchlink Oscilloscope Software
Agilent 34398A + Agilent 34399A	RS-232-C printer cable + adapter kit
Agilent 54006A	6 GHz, 10:1 (500 Ω) or 20:1 (1 kΩ), .25 pF
Agilent 01144-61604	1:2 probe power fan-out (for use with Agilent 1144A and Agilent 1145A)
Agilent C2950A	Parallel printer cable, 2 m
Agilent E2609B	Rackmount Kit
Agilent E2647A	Cordless Trackball
Agilent E2636A	Microphone Replacement

Specifications & characteristics

The following tables list the performance specifications and operating characteristics for the Agilent Technologies 54830 Series oscilloscopes. Asterisks (*) denotes warranted specifications, all others are typical. Specifications are valid after a 30 minute warm-up period, and within ± 5 °C from the self-calibration temperature.

Digital Acquisition

Maximum Sample Rate	1 GSa/s
Memory Depth	4 M points/channel
Minimum Width Glitch Detection	2.5 ns

Analog Acquisition

Maximum Sample Rate	Real Time	Full channel mode 2 GSa/s Half channel mode 4 GSa/s
Maximum Effective Sample Rate	Equivalent Time	250 GSa/s
Memory Depth	Standard for B & D models	Full Channel Mode 2 M points Half Channel Mode 4 M points
	Standard for A models	Full Channel Mode 250 k points Half Channel Mode 500 k points
	With Option 040	Full Channel Mode 500 k points Half Channel Mode 1 M points
	With Option 080	Full Channel Mode 8 M points Half Channel Mode 16 M points
Sampling Modes	Real Time	
	Normal	Successive single shot acquisitions.
	Peak Detect	Captures and displays narrow pulses or glitches at all real time sample rates.
	Hi Resolution	Real-time boxcar averaging reduces random noise and increases vertical resolution.
	Equivalent Time	Random Repetitive sampling (higher time resolution at fast sweep speeds).
Filters	(Sin x)/x Interpolation: On/Off selectable FIR digital filter. Digital waveform processing adds points between acquired data points to enhance measurement accuracy and waveform display quality.	
Averaging	Selectable from 2 to 4096.	

Digital Vertical

Number of Channels	16 Digital - label D15 - D0
Threshold Groupings	Pod1: D7 - D0 Pod2: D15 - D8
Threshold Selections	TTL, 5.0 V CMOS, 3.3 V CMOS, 2.5 V CMOS, ECL, PECL, User Defined
User-Defined Threshold Range	±8.00 V in 10 mV increments
Maximum Input Voltage	±40 V peak CAT I
Threshold Accuracy	± (100 mV +3% threshold setting)
Input Dynamic Range	±10 V about threshold
Minimum Input Voltage Swing	500 mV peak-to-peak
Input Impedance	100 kΩ ±2.0% (≅8 pF) at probe tip (Digital)
Channel-to-Channel Skew	2 ns typical, 3 ns maximum
Glitch Detect	≥2.5 ns
Resolution	1 bit

Analog Vertical

Number of Channels	54830B/D & 54833A/D	2 (simultaneous acquisition)
	54831/32B/D	4 (simultaneous acquisition)
Bandwidth	Analog Bandwidth (-3dB)*	50Ω: 600 MHz — Agilent 54830/31B/D 50Ω: 1 GHz — Agilent 54832B/D & 54833A/D 1 MΩ: 500 MHz (with Agilent 1165A probe)
Rise Time[1]	50Ω: 583 ps (Agilent 54830/31B/D) 50Ω: 350 ps (Agilent 54832B/D & E54833A/D) 1 MΩ: 700 ps	
Sensitivity[2]	1 MΩ Coupling: 1 mV/div to 5 V/div 50 Ω Coupling: 1 mV/div to 1 V/div	
Resolution	8 bits (0.4% of full scale)	
Input Impedance*	1 MΩ ± 1% (≅13 pf), or 50 Ω ± 1.5%	
Input Coupling	1 MΩ:AC, DC; 50Ω DC	
Maximum Input Voltage	1 MΩ: 150 V RMS or DC CAT 1; ± 250 V (DC + AC) in AC coupling 50 Ω: 5 V_{rms}, CAT I	
Channel-to-channel Isolation (with channels at equal sensitivity)		dc to 50 MHz: 50 dB 50 MHz to 500 MHz: 40 dB 500 MHz to 1 GHz: 30 dB
Offset Range	Vertical Sensitivity (50Ω)	Available Offset
	1 mV to <5 mV/div 5 mV to <200 mV/div 200 mV to 1 V/div	± 2 V ± 5 V ± 20 V
	Vertical Sensitivity (100Ω)	Available Offset
	1 mV to <10 mV/div 10 mV to <20 mV/div 20 mV to <100 mV/div 100 mV to <1 V/div 1 V to 5 V/div	± 2 V ± 5 V ± 10 V ± 20 V ± 100 V
Dynamic Range	± 8 div from center screen (1 MΩ) ±12 div from center screen (50 Ω)	

dc Gain Accuracy*2	± 1.25% of full scale at full-resolution channel scale. The dc gain accuracy decreases 0.08% of full scale per degree C from the firmware calibration temperature.	
Offset Accuracy*2	± (1.25% of channel offset + 2% of full scale) at full-resolution channel scale.	
dc Voltage Measurement Accuracy*2,3	Dual Markers	±[(dc gain accuracy)+(resolution)]
	Single Marker	±[(dc gain accuracy) +(offset accuracy)+(resolution/2)]
Bandwidth Limit Filter	20 MHz	
AutoProbe Interface	AutoProbe is an intelligent communication and power link between compatible probes and Infiniium scopes. AutoProbe completely configures the oscilloscope for the attached probe. For instance, it identifies the probe type and sets up the proper input impedance, attenuation ratio, probe power and offset range, as needed.	

Horizontal

Main Time Base Range	54830/31B/D 54832B/D & 54833A/D	500 ps/div to 20 s/div 200 ps/div to 20 s/div
Horizontal Position Range	0 to ±200s	
Delayed Sweep Range	1 ps/div to current main time base setting.	
Resolution	4 ps	
Timebase Accuracy	15 ppm (±0.0015%)	
Jitter, rms	8 ps ±0.05ppm x [Delay Time]	

Analog Trigger

Sensitivity*2	Internal (normal) For vertical ranges >5 mV/div	dc to 500 MHz: 0.6 div 500 MHz to 1 GHz (50 Ω) 1.5 div
	External (54830B/D & 54833A/D)	dc to 100 MHz: 0.05x(signal range) 100 MHz to 500 MHz : 0.10x(signal range)
	Auxiliary (54831/32B/D)	dc to 500 MHz: 300 mV_{pp}
Level Range	Internal	1 MΩ ±8 div from center screen 50 Ω ±8div from center screen
	External (54830B/D & 54833A/D)	1 MΩ ±1 V, ±5 V, and ±25 V 50 Ω ±1 V, ±5 V, and ±8 V
	Auxiliary (54831/32B/D)	±5 V
Sweep Modes	Auto, triggered, single	
Trigger Coupling	dc, ac, low frequency reject (50 kHz), high frequency reject (50 kHz).	
Trigger Holdoff Range	50 ns to 10 s	
Trigger Modes	Edge	
	Line	
	Glitch	Select positive or negative polarity, width. Triggers on glitches as narrow as 500 ps.
	Pattern	Select inputs as High, Low or X (don't care) to create pattern. Triggers on patterns as narrow as 2.5 ns. Trigger when pattern is entered, exited, present > t, present over a range of time.

	State	Select one channel as clock, specify other inputs as High, Low or X. Logic Type: AND or NAND Setup time is 1 ns and hold time is 0 ns.
	Delay by Time	Time: 5 ns to 10 ns. The trigger is qualified by an edge. After the delay, a rising/falling edge on any one selected input will generate the trigger.
	Delay by Events	Events: 1 to 16,000,000 rising or falling edges. The trigger is qualified by an edge. After the delay, a rising/falling edge on any one selected input will generate the trigger.
	Video Triggering	525 lines/60 Hz (NTSC), 625 lines/50 Hz (PAL). Trigger on any line of Field 1 or Field 2. User defined triggering: User can specify sync pulse level, width and polarity, edge number.
	Violation Trigger Setup/Hold	Modes: Setup, Hold or Setup and Hold. Select Clock, Thresholds, setup and/or hold time.
	Pulse Width	Triggers on pulse width >t or, <t. Triggers on pulse as narrow as 500 ps.
	Transition (Slew Rate)	Select Rise Time or Fall Time, present > t or present < t, thresholds. Triggers on edges as fast 800 ps.
Accuracy for Glitch, Pulse Width, and time qualified pattern	1.5 ns to 20 ns: 20 ns to 160 ms	±(20% of setting + 500 ps) ±(3% of setting + 2 ns)

Digital Trigger (Digital channels are only available on the 54830/31/32/33D oscilloscopes)		
Threshold Range (User Defined)	±8.0 V in 10 mV increments	
Threshold Accuracy*	±(100 mV + 3% of threshold setting)	
Predefined Thresholds	TTL = 1.4 V, 5.0 V CMOS = 2.5 V, 3.3 V CMOS = 1.65 V, 2.5 V CMOS - 1.25 V, ECL = -1.3 V, PECL - 3.7 V	
Trigger Modes	Edge	
	Glitch	Select positive or negative polarity, width. Triggers on glitches as narrow as 5 ns.
	Pattern/State	Select inputs as High, Low or X (don't care) to create pattern. Triggers on patterns as narrow as 2.5 ns. For State, select logic type of AND or NAND. Setup time is 2 ns and hold time is 1 ns.
	Delay by Time	Time: 5 ns to 10 ms. The trigger is qualified by an edge. After the delay, a rising/falling edge on any one selected input will generate the trigger.
	Delay by Events	Events: 1 to 16,000,000 rising or falling edges. The trigger is qualified by an edge. After the delay, a rising/falling edge on any one selected input will generate the trigger.
	Pulse Width	Triggers on pulse Width >t or Width <t. Triggers on pulse as narrow as 2.5 ns.

Display		
Display	8.4-inch diagonal color active matrix LCD module incorporating amorphous silicon TFTs. Bus mode for D models.	
Annotation	Up to 12 annotations, with up to 100 characters each, can be inserted in the waveform viewing area. Annotations can be saved to and recalled from image files and setup files.	
Display Resolution	640 pixels horizontally x 480 pixels vertically	
Dual Intensity Infinite Persistence	Previous sweeps are stored in half bright display and most recent sweep in full bright. This allows easy differentiation of current and historic information.	
Waveform Overlap	When two waveforms overlap, a third color distinguishes the overlap area.	
Full screen mode	On/Off selectable.	
Connect-the-dots	On/Off selectable.	
Persistence	Minimum, Variable (100 ms to 40 s), Infinite. Up to 6 levels of grey scale.	
Graticule	On/Off	
Grid Intensity	0 to 100%	
	Waveforms/sec	>3,100
	Vpp Measurements/sec	>190
Deep Memory Display Update Rate (8 MPts)	Waveforms/sec	>50

Measurements (Digital channels are only available on the D models)

Waveform Measurements (Analog)		
	Voltage	Vpp, Vmin, Vavg, Vamptd, Vbase, Vtop, Vrms, Preshoot, Overshoot, Vupper, Vmiddle, Vlower, and Area
	Time	Rise Time, Fall Time, Period, Frequency, Tmin, Tmax, Positive Pulse Width, Negative Pulse Width, Channel-to-Channel Phase, Duty Cycle, and Delta Time
	Frequency	FFT Frequency, FFT Magnitude, FFT Phase, FFT Delta Frequency, and FFT Delta Magnitude
Waveform Measurements (Digital)		
	Time	Period, Frequency, Positive Pulse Width, Negative Pulse Width, Duty Cycle, and Delta Time
Threshold Definition	Selectable 10%, 50%, 90% or 20%, 50%, 80% or Custom (% or absolute voltage).	
Top-Base Definition	Standard or Custom (in absolute voltage).	
Statistics	On/Off selectable. Current measurement, mean, and standard deviation	
Measurement Toolbar	16 Drag and Drop automatic measurement icons.	
QuickMeas	Activates 4 preselected automatic measurements.	
Markers Modes	Manual Markers, Track Waveform Data, Track Measurements.	
Waveform Math	4 function waveforms f1-f4. Select from Add, Subtract, Multiply, Divide, Invert, Magnify, Vs, Min, Max, Integral, Differentiate, FFT Magnitude.	

FFT

Frequency Range[5]	2 channel mode: 4 channel mode:	dc to 2 GHz (Sample rate/2) dc to 1 GHz (Sample rate/2)
Frequency Accuracy	(1/2 frequency resolution)+($5x10^{-5}$)(waveform frequency)	
Freq. Resolution (with option 080 installed)	Best resolution at maximum Sample Rate	2 channel mode 250 Hz = $\frac{4\text{GHz}}{16\text{MB}}$ 4 channel mode 250 Hz = $\frac{2\text{GHz}}{8\text{MB}}$
Signal-to-noise	80 dB at 1 M memory depth. Noise floor varies with memory depth and with averaging.	
Window Modes	Hanning, Flattop, Rectangular.	

Computer System/ Storage

CPU	Intel Pentium III™ Microprocessor	
Disk Drive	Internal hard drive. MS-DOS® floppy disk drive.	Store and recall setups and waveforms. Store screen images to both the hard drive and floppy drive. Storage capacity is limited only by disk space.
CD-ROM	Rear panel CD-ROM drive	

File types	Waveforms	Internal Yvalues with header Yvalues with header XYPairs without header XYPairs with header
	Images	BMP, GIF, JPG, PCX, TIF.
Mouse	Standard mouse supplied—supports any Microsoft® mouse compatible pointing device, serial, PS/2, or USB.	
Operating System	Microsoft Windows XP	
Waveform Memories	4 nonvolatile waveform reference memories.	

I/O

LAN	RJ-45 connector, supports 10 Base-T and 100 Base-T
GPIB port	Fully programmable, complies with IEEE 488.2.
RS-232 (serial)	Mouse or Printer port (COM1)
Centronics	Parallel printer port
USB (2)	Can be used for USB peripherals and pointing device
PS/2 ports (2)	Mouse and Keyboard ports
TTL Output	TTL compatible trigger output
Video Output	15-pin VGA, full color.

Notes

1	Rise Time figures are calculated from: tr=.35/Bandwidth.
2	Magnification is used below the 10 mV/div range and between the major attenuation settings. Full scale is defined as the major attenuator setting over an intermediate setting. (Major settings for 50Ω: 10, 20, 50, 100, 200, 500, 1000 mV Major settings for 1 MΩ: all as for 50Ω plus 2 V)
3	N/A
4	For bandwidth limited signals, tr >=1.4 x sample interval.
5	FFT amplitude readings are affected by input amplifier roll-off (-3 dB, with amplitude decreasing as frequency increases above 500 MHz in 1 MΩ, 600 MHz in 50Ω for Agilent 54830/31B/D, 1 GHz in 50Ω for Agilent 54832B/D & 54833A/D).

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.

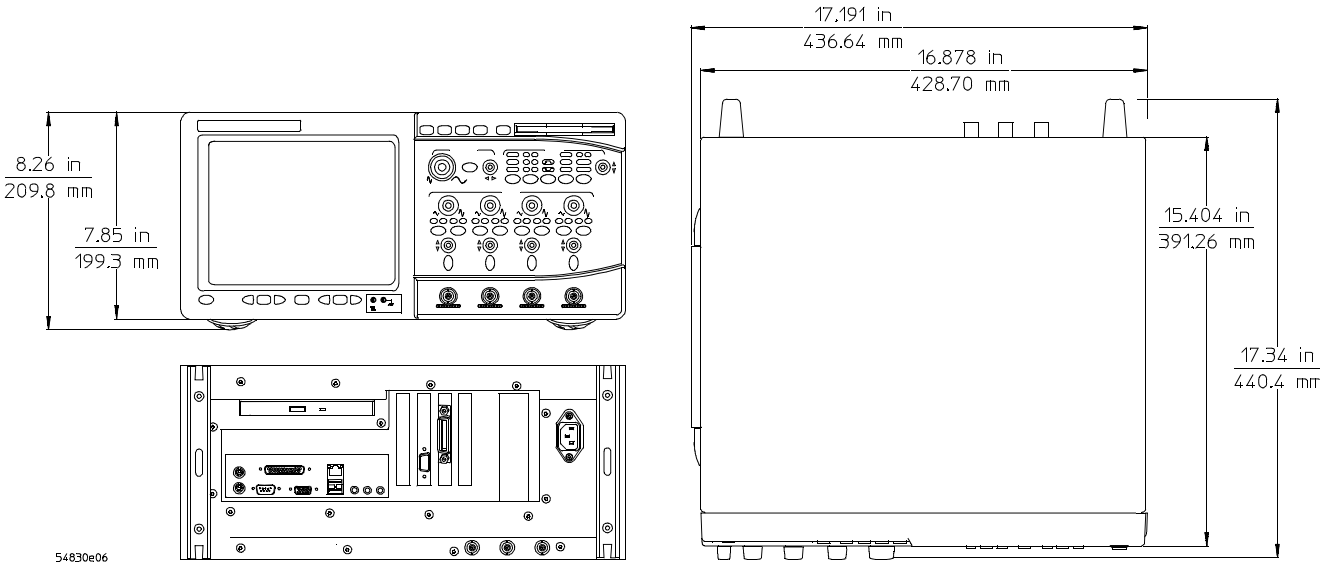
Agilent Technologies 54830 Series general characteristics

The Infiniium oscilloscopes meet the Agilent Technologies Environmental Specification (section 750) for class B-1 products with exceptions as described for temperature.

General Characteristics

Environmental	Temperature	Operating: 10°C to +40°C Nonoperating: –40°C to 70°C Indoor use only
	Humidity	Operating: Up to 95% relative humidity (noncondensing) at +40°C Nonoperating: Up to 90% relative humidity at +65°C
	Altitude	Operating: Up to 4 600 meters Nonoperating: Up to 15 300 meters
	Vibration	Operating: Random vibration 5-500 Hz, 10 minutes per axis, 0.3g (rms) Nonoperating: Random vibration 5-500 Hz, 10 minutes per axis, 2.41g (rms)
		Resonant search 5-500 Hz, swept sine, 1 octave/minute sweep rate, (0.75g), 5-minute resonant dwell at 4 resonances per axis.
Physical	Size (excluding handle)	Height: 216 mm Width: 437 mm Depth: 440 mm
	Weight	Net: approximately 20.5 kg
Power	Line voltage selection	None, PFC (Power Factor Correction)
	Line voltage range	100-240VAC, ± 10% CAT II
	Line frequency	47 to 440 Hz
	Maximum power consumption	440 W
Safety	Meets IEC1010-1 +A1, CSA certified to C22.2 No. 1010.1, Self certified to UL 3111.	

Figure 1-1



54830 Series Oscilloscope Dimensions.

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 *
Signal Generator	1 - 1 GHz, sine wave, amplitude 30 - 200 mV_{rms}, time base accuracy 0.25 ppm	Agilent 8664A	P
Power Meter/Power Sensor	1 - 1 GHz, -70 dBm to +44 dBm, ±3% accuracy	Agilent E4418B/Agilent 8482A	P
DMM	6 1/2 digit (0.1 mV) resolution, dcV accuracy 8 ppm/year, 4-wire resistance acc. ±0.25%	Agilent 34401A	P, A, T
Power Supply	7 mV - 30 V dc, 0.1 mV accuracy and resolution	Agilent 6114A	P
Power Splitter	50 Ω type N, outputs differ by <0.15 dB	Agilent 11667A	P
Oscilloscope	General-purpose	Agilent 54622A	P, T
Blocking Capacitor	0.18 µF	Agilent 10240B	P
Cable	BNC 61 cm	Agilent 8120-1839	P, T
Cable	Type N (m)(m) - 3 foot	Agilent 11500B	P
Cable (2)	BNC - 3 foot	Agilent 10503A	P, A, T
Adapter	N (m) to BNC (m)	Agilent 1250-0082	P
Adapter	N (m) to BNC (f)	Agilent 1250-0780	P
Adapter	N (f) to BNC (m)	Agilent 1250-0077	A
Adapter (2)	BNC tee (m)(f)(f)	Agilent 1250-0781	P, T
Adapter	BNC (f)(f)	Agilent 1250-0080	T
Adapter (2)	BNC (f) to dual banana (m)	Agilent 1251-2277	P
Termination	BNC connectors 50 Ω	Agilent 0960-0301	P
Shorting cap	BNC	Agilent 1250-0774	P
BNC Elbow (2)	BNC Elbow (f)(m)	Agilent 1250-0076	
Resistor (2)	5 Ω, 5 W	Agilent 0812-0047	T
Video monitor	Accepts VGA-standard video signals		T
Keyboard	PC-compatible, ATX connector	Agilent E2610A-68701	T
Mouse	USB, PS/2, or serial compatible	Agilent C3751-60201	P, T
Digital Probe Kit		Agilent 54826-68701	P
POST Card	Power-on self test card compatible with PC-compatible systems, PCI configuration		T
Fan Install Tool	Assists with removal and installation of fan.	Agilent 5061-7354	A, T
Service Kit	Fan Safety Shield and Service Disk CD-ROM	Agilent 54832-68803	T
Fan Safety Shield	Clips onto side of chassis with cover removed	Agilent 54810-00601	A, T

* P = Performance Tests, A = Adjustments, T = Troubleshooting

2

Preparing for Use

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.

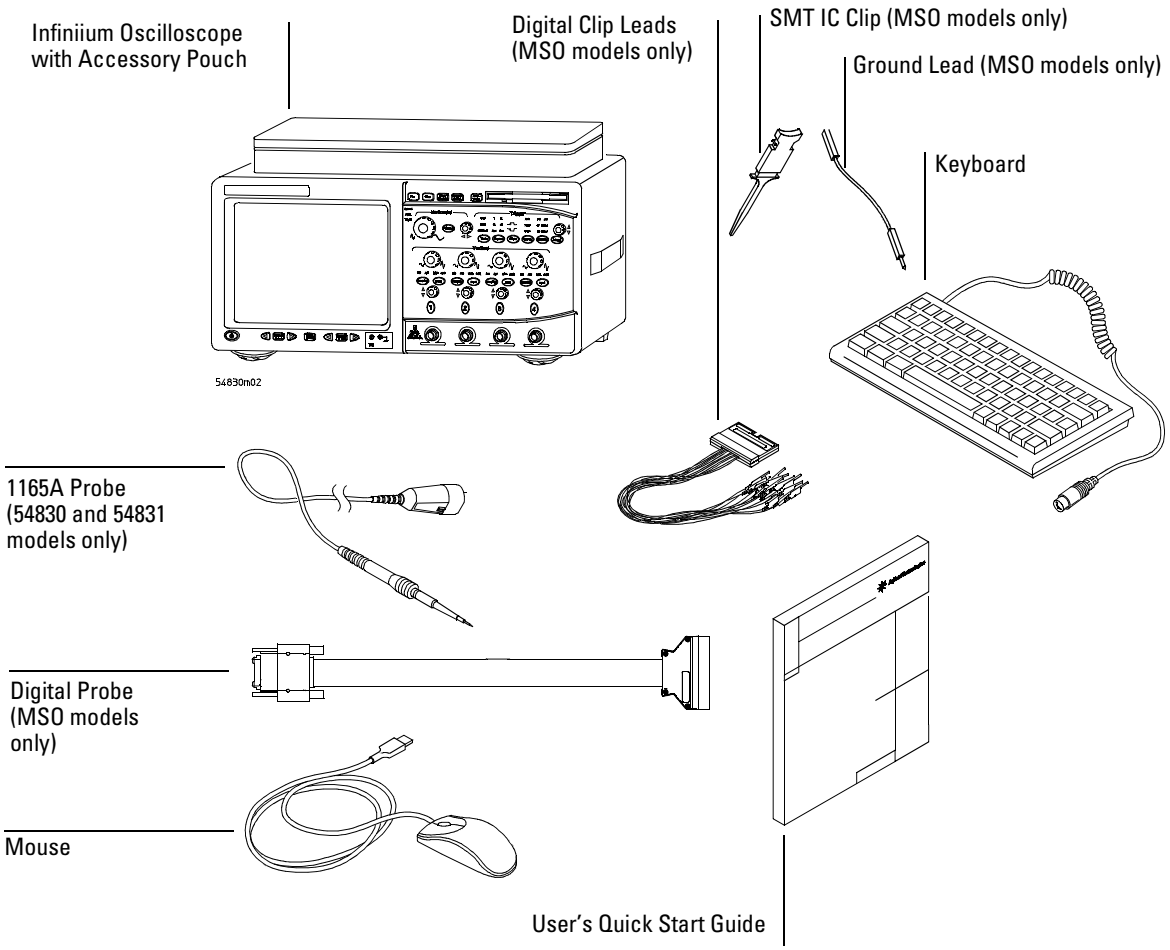
- Infiniium Oscilloscope
- Mouse
- (4) 1165A 10:1 10 MΩ passive probes (54831 model only)
- (2) 1165A 10:1 10 MΩ passive probes (54830 model only)
- Digital Probe Kit (5483xD models only)
- Accessory Pouch
- Front Panel Cover
- Keyboard
- Power cord
- *User's Quick Start Guide*

See Figure 2-1. (See table 2-1 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



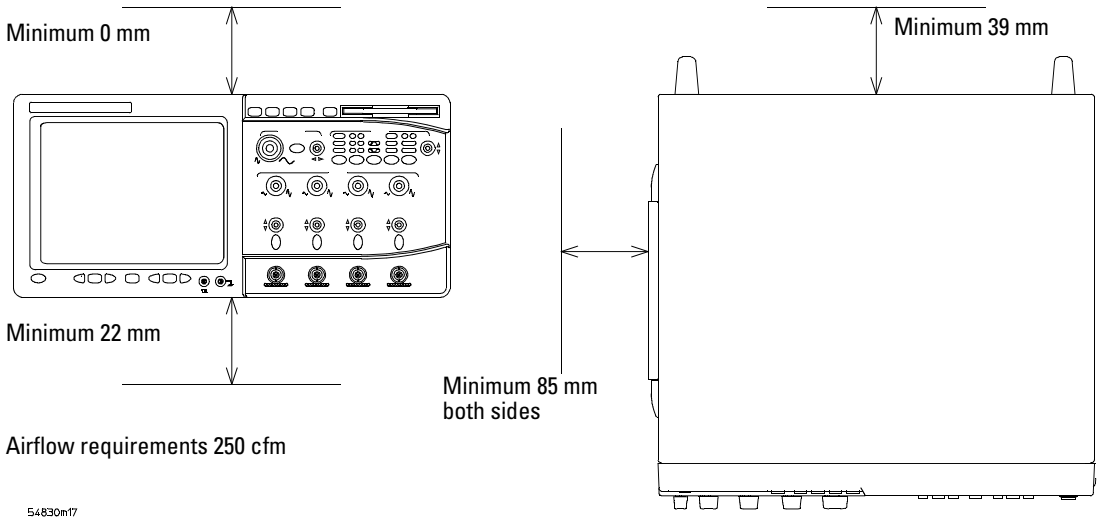
Package Contents for the 54830 Series Infiniium Oscilloscopes

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

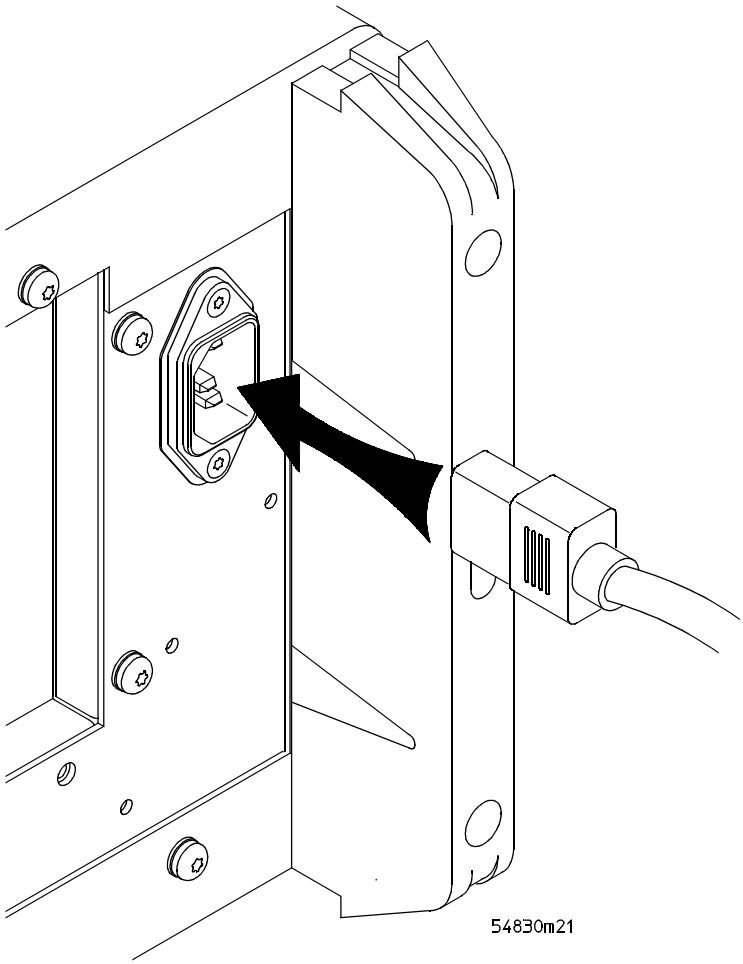


Positioning the Infiniium Oscilloscope with Sufficient Clearance

3 Connect the power cord to the rear of the oscilloscope, then to a suitable ac voltage source (100 to 240 VAC ±10%, 47 to 440 Hz all models)

Maximum power dissipation: 54830 series is 440 W.

Figure 2-3



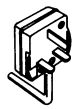
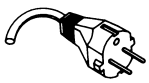
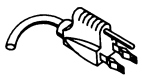
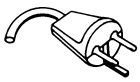
Infiniium Oscilloscope Power Cord Connection

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 2-1.

Table 2-1

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 2-4 for the location of the connectors.

Mouse. Plug the mouse into the matching connector on the back panel of the oscilloscope. The connectors are labeled 1 and 5.

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

Keyboard. Plug the keyboard cable into the 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.

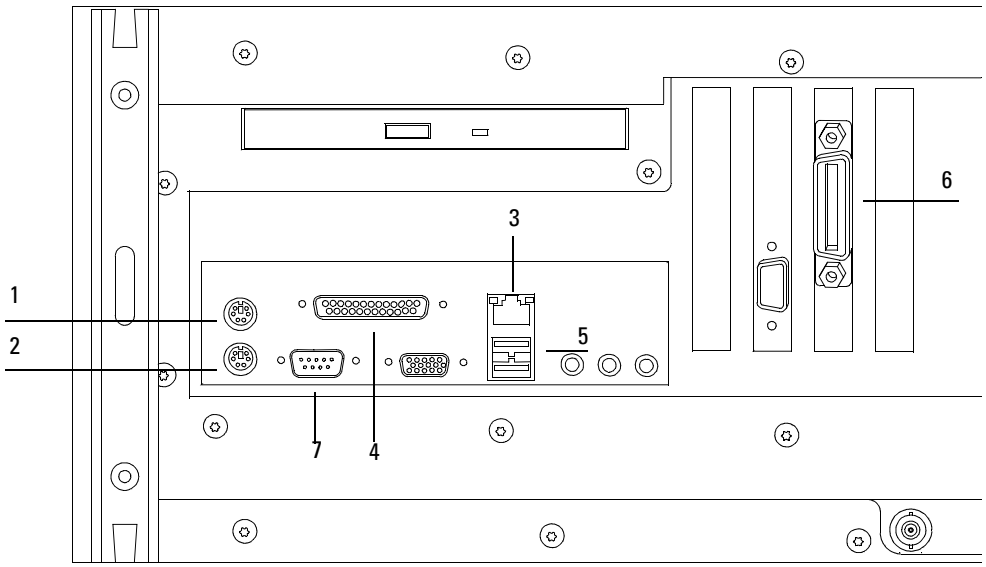
> After you have connected to the LAN card, you must set up the network. Before you try to setup your network, you should exit the oscilloscope application. If you do not know how to setup a network in Windows XP, see your network administrator or use the Windows XP on-line help.

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 2-4

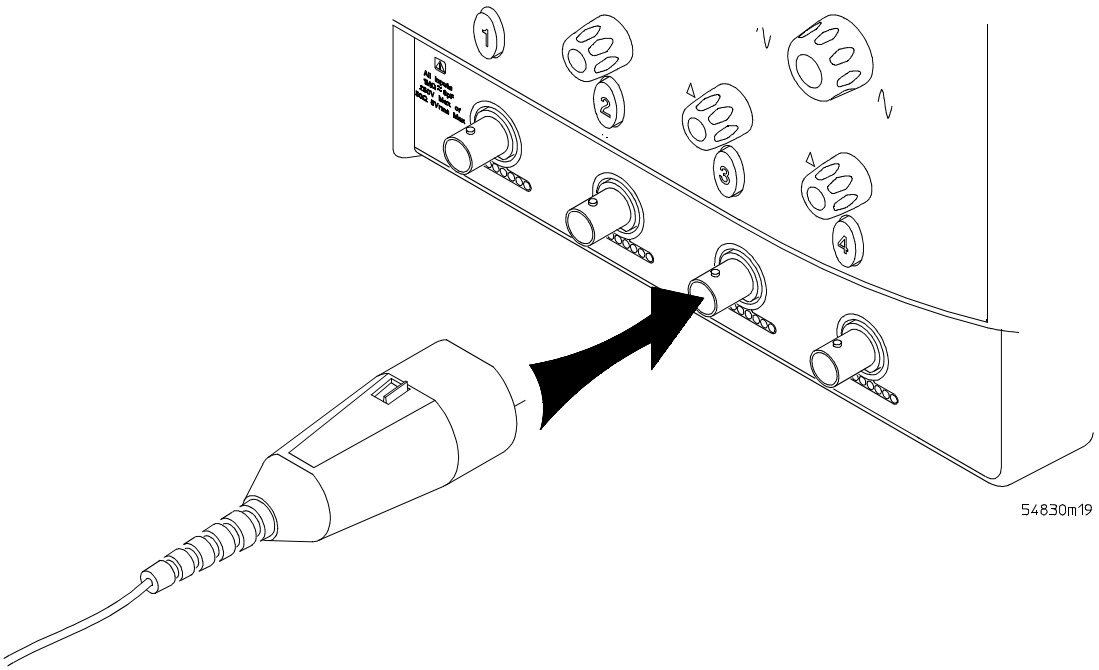


Back Panel

To connect oscilloscope probes

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

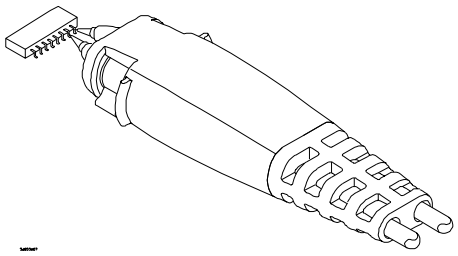
Figure 2-5



Attaching the Probe Connector

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

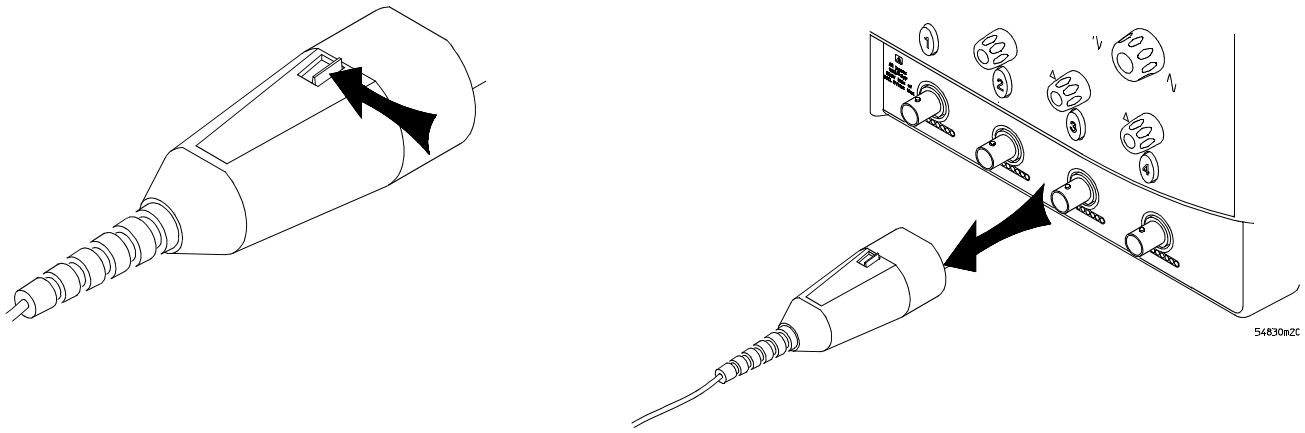
Figure 2-6



Probing the Circuit

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

Figure 2-7



Disconnecting the Oscilloscope Probe

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

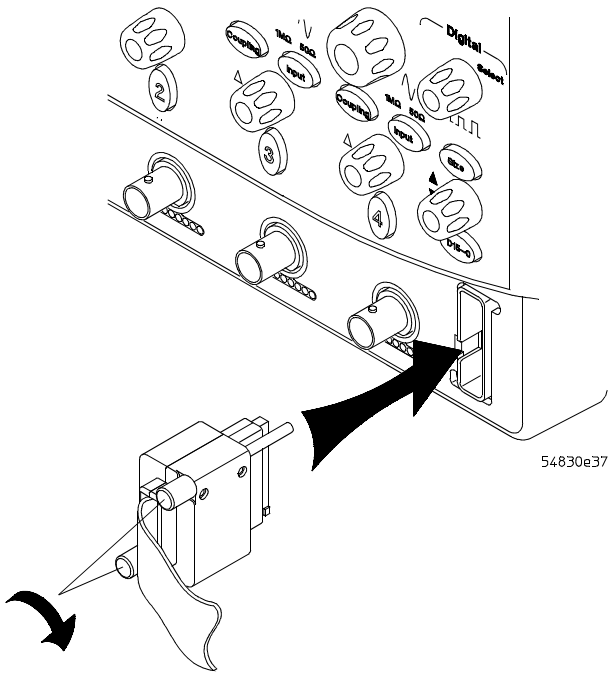
CAUTION ⚠ For the 54830 series oscilloscopes do not exceed the maximum input voltage rating. The maximum input voltage for 50 Ω inputs is 5 Vrms, CAT I. Maximum voltage at 1 MΩ impedance is ±100 V (dc + ac) [ac < 10 kHz], CAT I.

To connect the digital probe

The MSO series Infiniium oscilloscopes are the only oscilloscopes that have 16 digital channels.
The digital clip lead marked clk (clock) is unused. All the other digital clip leads are used for the digital channels.

1 Push the small connector end of the digital cable with the tab key facing left into the digital connector.
2 Tighten both thumb screws.

Figure 2-8



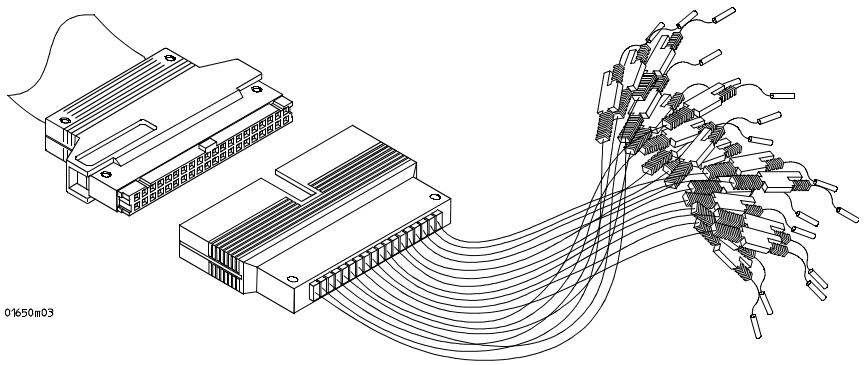
Connecting the Digital Cable to the Oscilloscope

Digital probe lead set

The MSO Infiniium oscilloscopes are the only oscilloscopes that have 16 digital channels.
The digital clip lead marked clk (clock) is unused. All the other digital clip leads are used for the digital channels.

The probe lead set has 16 digital channels with a ground lead for each channel.

Figure 2-9



Digital Probe Lead Set

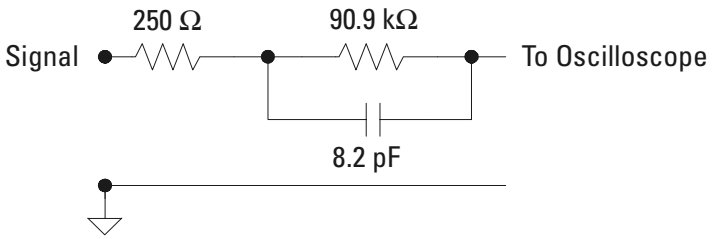
If a 0.63 mm square pin or a 0.66 diameter round pin is installed on the circuit under test, the signal and ground leads can be directly connect to these pins. Otherwise, the IC clips can be used to connect to the circuit.

CAUTION ⚠ Do not exceed the maximum input voltage rating of ±40 V peak, CAT I.

Probe tip isolation network and equivalent load

The probe tips of the probe lead set contain an isolation network which serves to minimize the loading effect of the digital channels on the circuit under test. The isolation network schematic is shown in Figure 2-10.

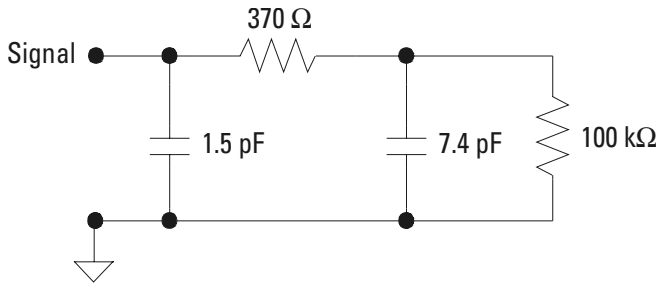
Figure 2-10



Probe Tip Isolation Network

The loading effect of the probe tip on the circuit under test is represented by the circuit shown in the equivalent load schematic in Figure 2-11.

Figure 2-11

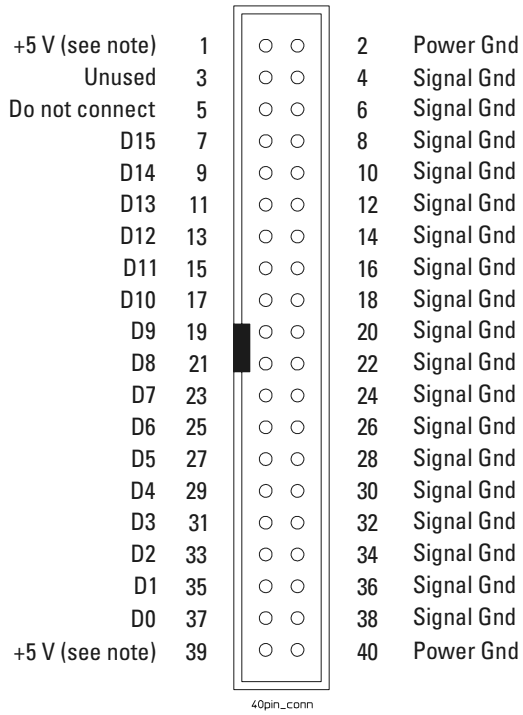


Equivalent Load including oscilloscope

Direct connection through 40-pin connector

The probe cable can also be directly plugged into various 40-pin connectors on the circuit board under test. This requires each signal pin of the 40-pin connector to have an isolation network (Figure 2-10) on the circuit board. The pinout of the 40-pin connector is shown in Figure 2-12.

Figure 2-12



40-pin Connector Pinout

Note: +5 V is supplied by the oscilloscope to provide power for the demo board. DO NOT connect these pins to the circuit board under test.

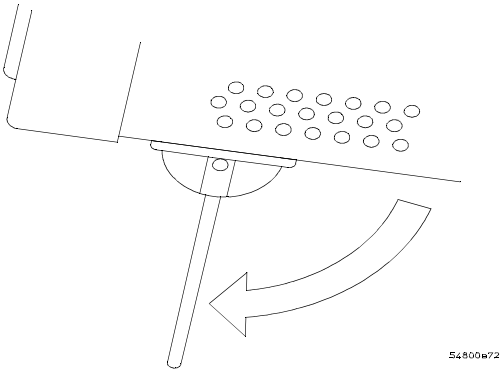
CAUTION ⚠ Do not exceed the maximum input voltage rating of ±40 V peak, CAT I. The isolation network must be used on all digital channels for this to be valid.

For more information on digital probing solutions, search for the document titled "Probing Solutions for Logic Analysis Systems" (Agilent part number 5968-4632E) on the Agilent Technologies web site at www.agilent.com.

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 2-13



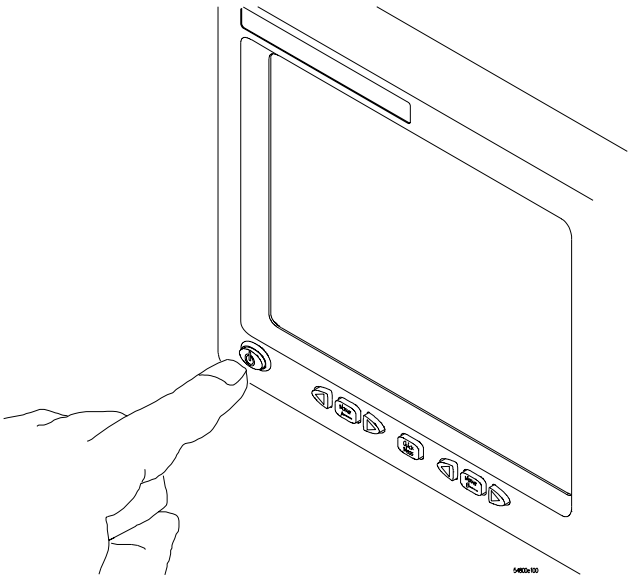
Latching the Oscilloscope Front Feet

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 2-14



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.

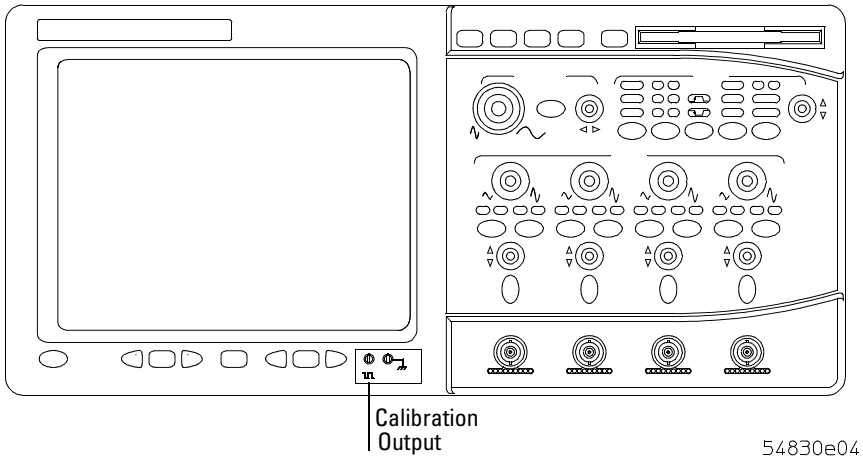
To verify basic oscilloscope operation

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 2-15



Verifying Basic Oscilloscope Operation for 54830 Series Oscilloscopes.

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 moves with the mouse movement.

Installing application programs on Infiniium

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

- Microsoft Office 2000
- MathWorks MATLAB
- Mathsoft MathCad 2001i
- McAfee VirusScan
- Symantec Norton AntiVirus

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

If you install an application other than those which Agilent has tested, it is possible that it could break the oscilloscope application. This would require you to reinstall the oscilloscope application using the recovery disks.

Changing Windows System Settings

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

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

- Do not change the Power Options.
- Do not change the System Properties Hardware Tab settings.
- Do not change the System Properties Advanced Tab settings.
- Do not change the Regional and Language Options Advanced Tab settings.
- Do not remove Fonts.
- Display Settings
  - Do not change or turn off the default screen saver. The screen saver turns off the display's backlights extending their life.
  - Do not change the screen resolution from 640 by 480 pixels or the color quality from High (24 bit).
  - Do not use the Windows XP Theme.
  - Do not change "Windows and buttons" from the "Windows Classic Style".
  - Do not change the Font size to Extra Large.
  - Do not use a Menu font size greater than 12 points.
  - Do not modify "1. Digital Flat Panel (640x480) on Chips and Technologies (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

The procedures in this section test measurement performance using Performance Specifications given in chapter 1 as performance standards. Specifications applicable to individual tests are noted at the test for reference.

Testing Interval

The performance test procedures may be performed for incoming inspection of the oscilloscope and should be performed periodically thereafter to ensure and maintain peak performance. The recommended test interval is yearly or every 2,000 hours of operation.

Test Interval Dependencies
The test interval depends on frequency and severity of use and the environmental conditions under which the oscilloscope is used. In recording test results, you may find that the test interval could be shortened or lengthened; however, such a decision should be based on substantial quantitative data.

See Also Chapter 4, "Calibrating and Adjusting," for information about the calibration cycle.

Equipment Required

A complete list of equipment required for the performance tests is in the Recommended Test Equipment table in chapter 1. Equipment required for individual tests is listed in the test. Any equipment satisfying the critical specifications listed may be substituted for the recommended model. The procedures are based on the model or part number recommended.

Self-Test Verification

To verify system operation with high confidence, without the test equipment and time required for performance tests, perform the self-tests. These internal tests verify many functions of the oscilloscope.

To run the self-tests, enable the graphical interface, then select Self Test from the Utilities menu. The Self Test drop down list box allows you to select oscilloscope Self Tests, Key and Knob Test, or LED Test. A message is displayed with the instruction to remove all inputs to the oscilloscope. During execution of the self-tests, the oscilloscope displays diagnostic messages indicating the status of each test.

If one of the self-tests fails, FAILED is displayed rather than PASSED, and a 16-bit diagnostic code is displayed. This code is used by factory service personnel when troubleshooting the main assembly. Failure of a self-test indicates an assembly failure. The assembly must be replaced before you attempt performance verification. For more troubleshooting information, refer to chapter 5, "Troubleshooting."

Test Record

You can record the results of the performance tests in the Performance Test Record provided at the end of this chapter. The Performance Test Record lists the performance tests and provides an area to mark test results. You can use the results recorded at incoming inspection for later comparisons during periodic maintenance, troubleshooting, and after repairs or adjustments.

Operating Hints

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

Clear Display

When using many averages, it often takes awhile for a waveform display to stabilize after a change. When a control on the oscilloscope is changed, averaging automatically restarts. When just the input signal is changed, the oscilloscope must average new data with the old so it takes longer for the waveform to stabilize.
Press the Clear Display key while changing input signals. The oscilloscope will restart averaging and give a quick indication of the result of the signal change.

Averaging

Averaging is used to assure a stable signal for measurements. It is not necessary to wait for complete stability of the signal (averaging complete), as long as the measurement is well within the limits of the test.

Specifications

The specifications that apply to a particular test are given with the test procedure. The specification as given with the test may be abbreviated for clarity. In case of any questions, refer to the complete specifications and characteristics in chapter 1, “General Information.”

Performance Test Procedures

Performance test procedures start with the next paragraph. Procedures may be done individually and in any order.

Let the oscilloscope Warm Up Before Testing
Allow the oscilloscope to warm up for at least 30 minutes prior to beginning performance tests. Failure to allow warm-up may cause the oscilloscope to fail tests.

To test the dc calibrator

The Aux Out BNC on the back panel is used for self-calibration and probe calibration. Though calibrator accuracy is not specified in the performance specifications, it must be within limits in order to provide accurate self-calibration.

Test Limits: -2.4 v to +2.4 v, Accuracy ±0.2% of delta voltage output

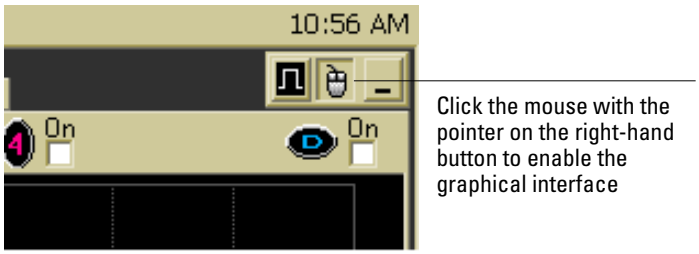
Equipment Required

Equipment	Critical Specifications	Recommended Model/Part
Digital Multimeter	0.1 mV resolution, better than 0.1% accuracy	Agilent 34401A
Cable	BNC	Agilent 10503A
Adapter	BNC (f) to banana (m)	Agilent 1251-2277

Procedure

1. Connect the multimeter to the back panel Aux Out BNC.
   Use the BNC cable and the BNC to banana plug adapter.
2. Enable the graphical interface.
   Use the mouse to click on the button in the upper right-hand corner of the display. See Figure 3-1.

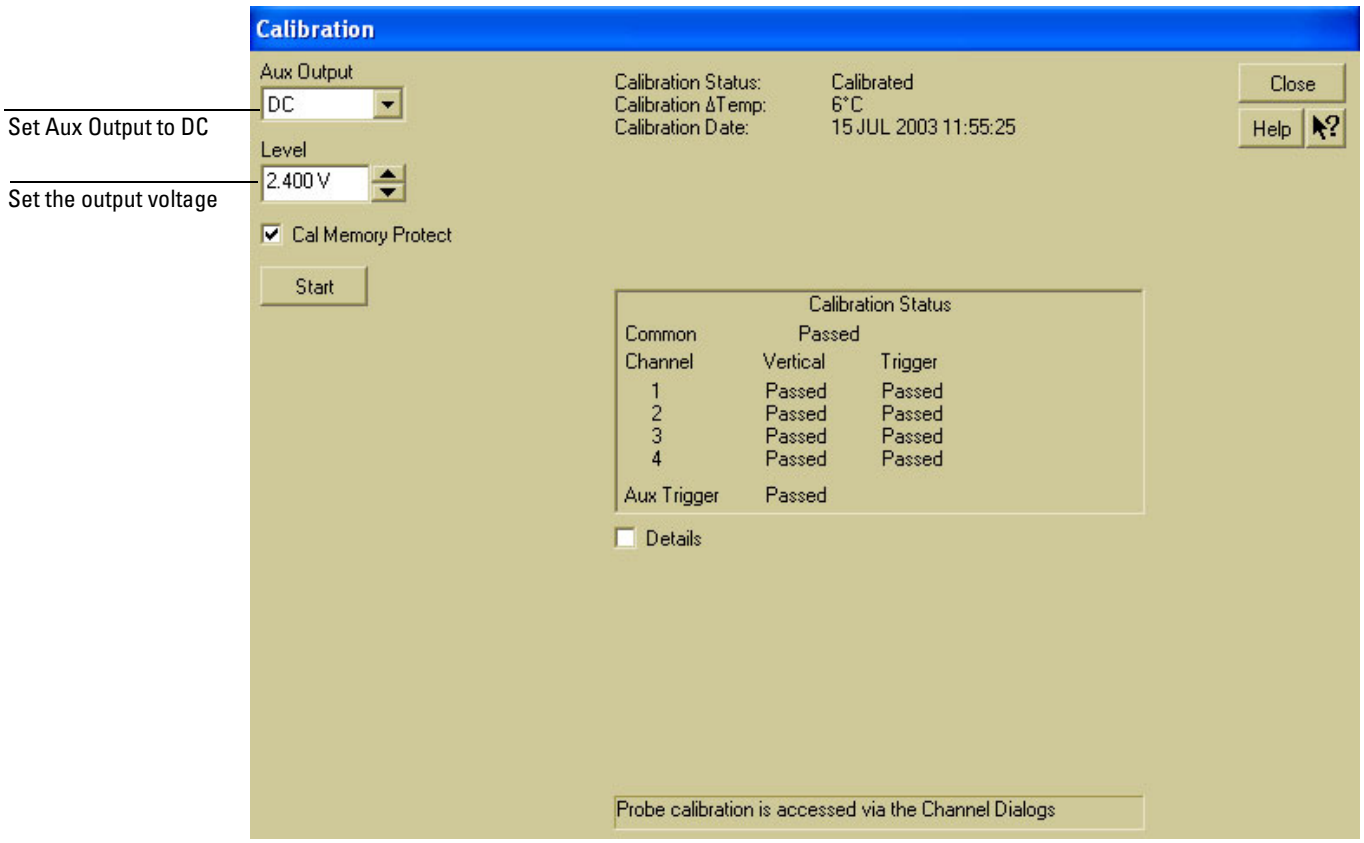
Figure 3-1



Enabling the graphical interface

3. Press Default Setup to set the oscilloscope to default conditions.
4. Select Calibration from the Utilities menu.
5. Select DC from the Aux Output drop-down list box.
   See Figure 3-2.

Figure 3-2



Selecting DC in the Calibration Dialog

6 Set the dc output voltage to +2.400 V using the Level spin box or the numeric keypad dialog.

You can access the numeric keypad dialog by clicking on the value in the Level box. Enter the values by clicking on digits, signs, and exponents in the keypad. Click Close when finished.

7 The DVM should read near +2.400 V. Record the reading to four significant digits. V1 = _____.

8 Set the level to -2.400 V using the Level spin box or the numeric keypad dialog.

9 The DVM should read near –2.400 V. Record the reading. V2 = _____.

10 Subtract the second reading from the first reading, then divide the result by 4.8.

For example, if the first reading is +2.389 V and the second reading is -2.397 V, then

$$\frac{V1-V2}{4.8} = \frac{2.389-(-2.397)}{4.8} = 0.997$$

11 The final result should be between 0.998 and 1.002. Record the result in the Performance Test Record at the end of the chapter.

12 Click Close to exit the calibration menu.

If the test fails
Repair is necessary. See chapter 5, "Troubleshooting."

To test input resistance

This test checks the input resistance of the vertical inputs. A four-wire measurement is used to accurately measure the 50 Ω and 1 MΩ inputs.

Specification: 1 MΩ ±1% and 50 Ω ±1.5%

Equipment Required

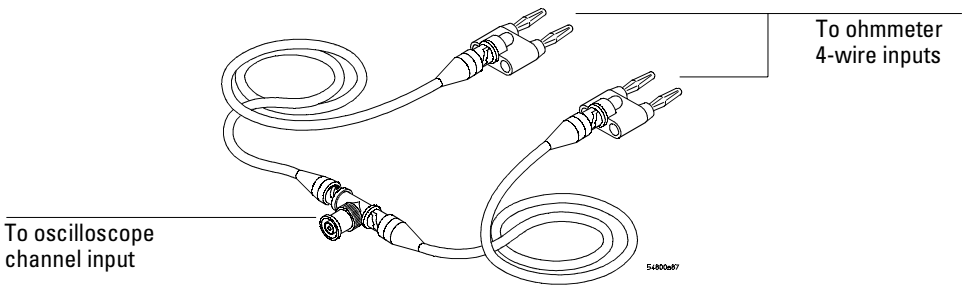
Equipment	Critical Specifications	Recommended Model/Part
Digital Multimeter	Measure resistance (4-wire) at better than 0.25% accuracy	Agilent 34401A
Cables (2)	BNC	Agilent 10503A
Adapter	BNC Tee (m)(f)(f)	Agilent 1250-0781
Adapters (2)	BNC (f) to dual banana (m)	Agilent 1251-2277

Procedure

1. Set up the multimeter to make a four-wire resistance measurement.
2. Assemble the test cables.
   - **a** Use the two BNC-to-banana adapters to connect one end of each BNC cable to the four-wire resistance connections on the multimeter.
   - **b** Connect the free ends of the cables to the BNC tee.

   See Figure 3-3.

Figure 3-3



Input Resistance Equipment Setup

3. Connect the male end of the BNC tee to the channel 1 input of the oscilloscope.
4. Press Default Setup to set the oscilloscope to default conditions.
5. Press the Input key for Channel 1 to select 1 MΩ, then 50 Ω, and verify resistance readings of 1 MΩ ±10 kΩ and 50 Ω ±0.50 Ω respectively.
6. Record the readings in the Performance Test Record.
7. Repeat steps 3 through 6 on the remaining channels, and on the external trigger of the 54830B, 54833A, and 54833D.

To test voltage measurement accuracy

This test verifies the voltage measurement accuracy of the oscilloscope. The measurement is made using dual-cursor automatic measurement so that offset errors are not a factor.

A power supply provides a reference voltage to check voltage measurement accuracy. The actual supply voltage is monitored for accuracy using a NIST-traceable voltmeter (especially at low voltages). A dc blocking capacitor and a BNC short are used to filter any noise generated by the power supply so it does not appear at the oscilloscope input.

Specification

Only the dual-cursor specification is tested.

Single Cursor Measurement: ±(gain accuracy + offset accuracy + resolution/2)
Dual Cursor Measurement: ±(gain accuracy + resolution)
Gain Accuracy: ± 1.25% of full scale at full resolution channel scale
Resolution: 8 bits, (0.4% of full scale without averaging); or 12 bits, (0.024% of full scale with 32 averages) at full resolution scale
Offset Accuracy: ±(1.25% of channel offset + 2% of full scale) at full-resolution scale

Equipment Required

Equipment	Critical Specifications	Recommended Model/Part
Power Supply	7 mV to 30 Vdc, 0.1 mV resolution	Agilent 6114A
Digital Multimeter (DVM)	Better than 0.1% accuracy	Agilent 34401A
Cables (2)	BNC	Agilent 10503A
Adapters (2)	BNC (f) to banana (m)	Agilent 1251-2277
Adapters (2)	BNC tee (m)(f)(f)	Agilent 1250-0781
Blocking capacitor	0.18 µF	Agilent 10240B
Shorting cap	BNC	Agilent 1250-0774

Procedure

1 Connect the equipment.

See Figure 3-4.

a Use a BNC-to-banana adapter to connect a BNC cable to the power supply.

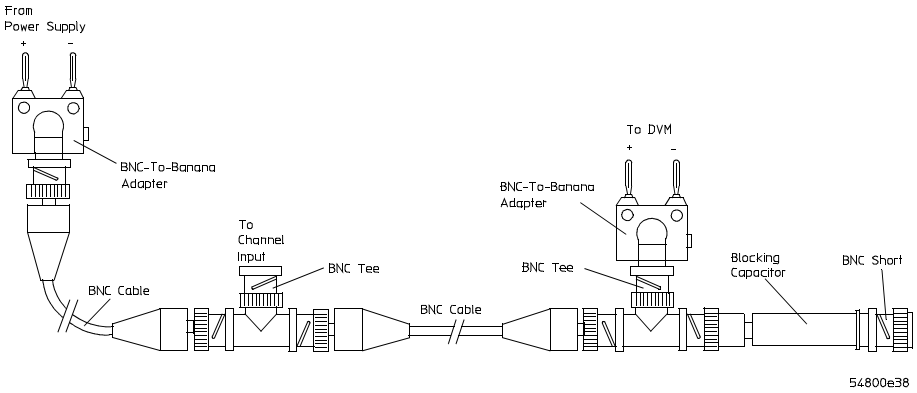
b Connect a BNC tee to the other end of the cable and connect the tee to channel 1 of the oscilloscope.

c Connect another BNC cable to the tee at the oscilloscope and connect a BNC tee to the other end of the cable.

d Connect the blocking capacitor to the BNC tee and connect the BNC short to the blocking capacitor.

e Connect a BNC-to-banana adapter to the same BNC tee and connect the adapter to the DVM input.

Figure 3-4



Voltage Measurement Accuracy Equipment Setup

2 Press Default Setup to set the oscilloscope to default conditions.

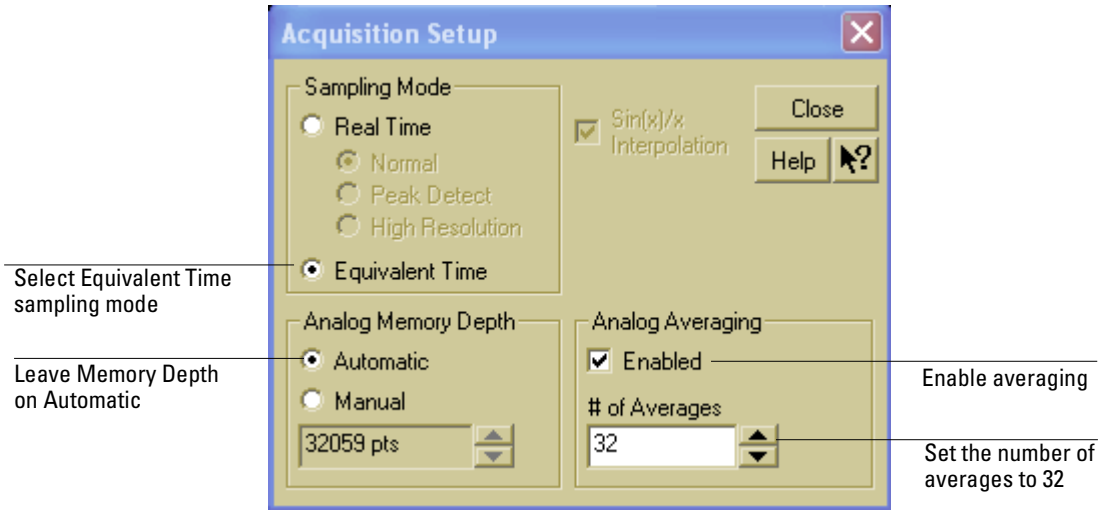
3 Set all channels to dc using the Coupling key and to 1 MΩ input impedance using the Input key.

4 Using the mouse, enable the graphical interface.

5 Select Acquisition from the Setup menu.

6 Select Equivalent Time sampling mode. Enable Averaging. Set the # of Averages to 32, using the numeric keypad dialog. Click Close.
See Figure 3-5.

Figure 3-5



Acquisition Setup for Voltage Accuracy Measurement

7 Use the following table for steps 8 through 15.

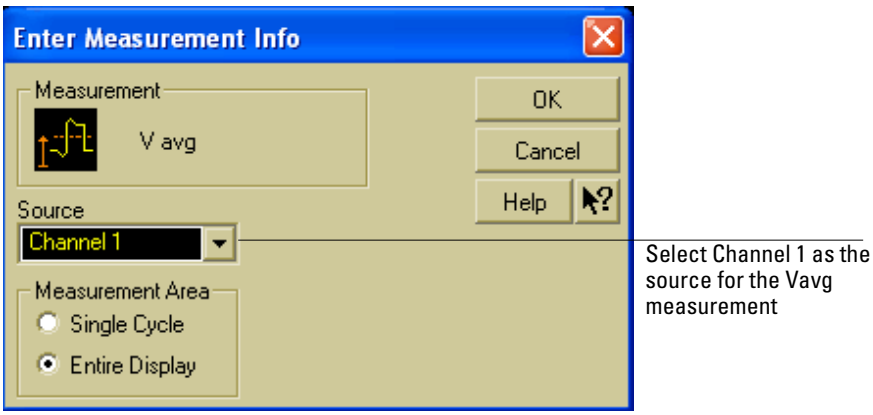
Volts/div	Position	Supply	Tolerance	Limits	
				minimum	maximum
5 V	17.5 V	35 V	+/- 510 mV	34.490 V	35.510 V
2 V	7 V	14 V	+/- 204 mV	13.796 V	14.204 V
1.25 V	4.375 V	8.75 V	+/- 127 mV	8.623 V	8.877 V
500 mV	1750 mV	3.5 V	+/- 51 mV	3.449 V	3.551 V
250 mV	875 mV	1750 mV	+/- 25.48 mV	1724.52 mV	1775.48 mV
100 mV	350 mV	700 mV	+/- 10.19 mV	689.808 mV	710.19 mV
50 mV	175 mV	350 mV	+/- 5.096 mV	344.904 mV	355.096 mV
20 mV	70 mV	140 mV	+/- 2.038 mV	137.962 mV	142.038 mV
10 mV	35 mV	70 mV	+/- 1.019 mV	68.981 mV	71.019 mV
7 mV	24.5 mV	49 mV	+/- 0.713 mV	48.287 mV	49.713 mV

Below 7 mV/div expansion is used and full scale is defined as 56 mV. The ranges from 1 to 6 mV/div are handled in firmware, and will be within specifications when the 7 mV/div range is within specifications.

8 Select Vavg from the Voltage submenu of the Measure menu. Ensure that Channel 1 is selected in the Source dialog and click Close.

See Figure 3-6.

Figure 3-6



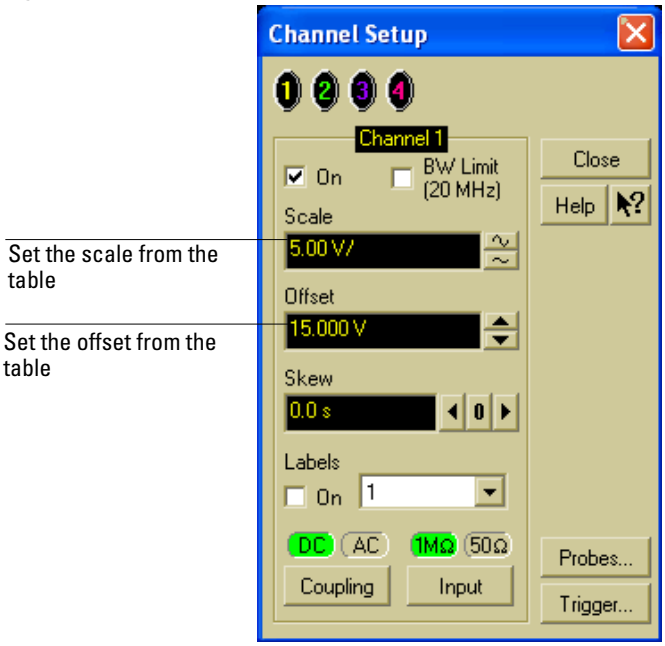
Source Selection for Vavg Measurement

9 Select Channel 1 from the Setup menu.

10 Set the vertical scaling for Channel 1 to the volts/div value from the first row of the table in step 7. Set the Offset value to the Position value from the first row of the same table. Click Close.

See Figure 3-7.

Figure 3-7



Vertical Scaling and Offset for Voltage Accuracy Measurement

> **To Set Vertical Scale and Position**
> You can also use the knobs to set the vertical scale and position, but it is usually easier to use the dialog box, particularly for the fine position setting.

11 With the supply disconnected from the channel input, note the V_{avg} mean reading. _____ V

It may take a moment for this value to settle because of averaging.

12 Set the power supply voltage from the first line of the table. Use the voltmeter to adjust the power supply for the most accurate output.

13 Connect the power supply to the channel input and note the V_{avg} reading. _____ V

Press Clear Display and wait a moment to read the value (so that averaging is complete).

14 Subtract the value in step 11 from the value in step 13. Record the difference in the Performance Test Record.

15 On the same channel, repeat steps 10 through 14 for the rest of the rows in the table.

16 With the channel keys, set the active channel OFF and the next ON.

A channel is ON if its key is illuminated and OFF if it is not illuminated.

17 Move the BNC tee to the next channel and repeat steps 8 through 15 for that channel.

18 Repeat steps 8 through 17 for the rest of the channels.

> **If the test fails**
> Voltage measurement errors can be caused by the need for self-calibration. Before troubleshooting the oscilloscope, perform self-calibration. See "To run the self-calibration" in chapter 4, "Calibrating and Adjusting." If self-calibration fails to correct the problem, the cause may be the attenuator or main assembly.

To test offset accuracy

This test checks the vertical offset accuracy.

Specification: ±(1.25% of channel offset + 2% of full scale) at full-resolution channel scale

Equipment Required

Equipment	Critical Specifications	Recommended Model/Part
Power Supply	0.5 V to 2 Vdc, ±1 mV accuracy	Agilent 6114A
Digital Multimeter (DVM)	Better than 0.1% accuracy	Agilent 34401A
Cables (2)	BNC	Agilent 10503A
Adapters (2)	BNC (f) to banana (m)	Agilent 1251-2277
Adapters (2)	BNC tee (m)(f)(f)	Agilent 1250-0781
Blocking capacitor	0.18 µF	Agilent 10240B
Shorting cap	BNC	Agilent 1250-0774

Procedure

1 Connect the equipment.

The cabling is the same as that used for the voltage measurement accuracy test. See figure 3-3.

- **a** Use a BNC-to-banana adapter to connect a BNC cable to the power supply.
- **b** Connect a BNC tee to the other end of the cable and connect the tee to channel 1 of the oscilloscope.
- **c** Connect another BNC cable to the tee at the oscilloscope and connect a BNC tee to the other end of the cable.
- **d** Connect the blocking capacitor to the BNC tee and connect the BNC short to the blocking capacitor.
- **e** Connect a BNC-to-banana adapter to the same BNC tee and connect the adapter to the DVM input.

2 Press Default Setup to set the oscilloscope to default conditions.

3 Select Acquisition from the Setup menu.

4 Select Equivalent Time under Sampling Mode. Enable Averaging, and set the # of Averages to 32. Click Close.

Setup is the same as that for the voltage measurement accuracy test. See figure 3-4.

5 Use the following table for steps 6 through 12.

Volts/div	Position	Supply	Tolerance	Limits	
				minimum	maximum
200 mV	2.00000 V	2.00 V	±57 mV	1.943	2.057 V
100 mV	1.00000 V	1.00 V	±28.5 mV	0.9715	1.0285 V
50 mV	500.000 mV	500 mV	±14.25 mV	485.75	514.25 mV

6 Select Channel 1 from the Setup menu.

7 Set the vertical Scale to the Volts/div value from the first row of the table. Set the Offset to the Position value from the first row of the table. Click Close.

8. Set the supply voltage to 2.00 V as in the first row of the table. Use the DVM to verify the setting.
9. Re-adjust the vertical position, if necessary, so the trace is as close to the horizontal center line of the grid as possible after it has settled (averaging complete).
10. Read the position voltage. It should be equal to the DVM reading, within the limits given in the table. Record the reading in the Performance Test Record.

    To find the current position setting, select Channel 1 from the Setup menu and read the Offset field. Click Close when finished.
11. Repeat steps 6 through 10 for the other lines in the table.
12. With the channel keys, set the active channel OFF and the next ON.
13. Move the BNC from one channel to the next.
14. Repeat steps 6 through 13 for each channel, setting the parameters of the channel being tested where appropriate.

If the test fails
Offset errors can be caused by the need for self-calibration. Perform self-calibration (see chapter 4, "Calibrating and Adjusting") before troubleshooting the oscilloscope.

To test bandwidth

This test checks the bandwidth of the oscilloscope.

Specification

Equivalent Time 54830/31B/D: dc to ≥600 MHz
54832B/D & 54833A/D: dc to ≥1 GHz

Real Time 54830B/D, 54831B/D: dc to ≥600 MHz
54832B/D, 54833 A/D:dc to ≥ 1 GHz

Equipment Required

Equipment	Critical Specifications	Recommended Model/Part
Signal Generator	1—1 GHz at ≈200 mVrms	Agilent 8656B/8648A
Power Meter/Sensor	1—1 GHz ±3% accuracy	Agilent E4418B/8482A
Power Splitter	outputs differ by <0.15 dB	Agilent 11667A
Cable	Type N (m) 24 inch	Agilent 11500B
Adapter	Type N (m) to BNC (m)	Agilent 1250-0082

Equivalent Time Test

1 Connect the equipment.
   a With the N cable, connect the signal generator to the power splitter input. Connect the power sensor to one output of the power splitter.
   b With an N-to-BNC adapter, connect the other splitter output to the channel 1 input.
2 Press Default Setup to set the oscilloscope to default conditions.
3 Select Acquisition from the Setup menu. Select Equivalent Time sampling mode. Enable averaging and set the # of Averages to 32. Click Close.
4 Set the vertical scale for Channel 1 to 100 mV/div using the knob. Select 50Ω input impedance.
5 Set the sweep speed to 50 ns/div using the horizontal sweep speed knob.
6 Set the signal generator for 10 MHz at +5.0 dBm.
   The signal on the oscilloscope screen should be about five cycles at six divisions amplitude.

Bandwidth Check Limits
Do not exceed 6 divisions when making the bandwidth check.

7 Select V_{amptd} from the Voltage submenu of the Measure menu.
8 After the measurement settles (when averaging is complete, about 10 seconds), note the $V_{amptd\ (1)}$ reading at the bottom of the screen. V_{10MHz} =_____mV.
9 Set the power meter Cal Factor % to the 10 MHz value from the calibration chart on the power sensor. Then press dB[REF] on the power meter to set a 0 dB reference.
   This establishes the baseline output power at 10 MHz as a reference for the bandwidth measurement.

10 Change the signal generator output frequency to 600 MHz for the 54830B/D & 54831B/D or 1 GHz for the 54832B/D & 54833A/D and set the power meter Cal Factor % to the appropriate value from the calibration chart on the power sensor.

This step compensates the power meter reading for changes in the power sensor output at 500 MHz with respect to 10 MHz.

11 Adjust the signal generator output amplitude for a power reading as close as possible to 0.0 dB[REL]. Write down the actual reading. Reading = _____ dB [REL].

The reading on the power meter will be used to correct the final bandwidth value.

12 Set the sweep speed to 1 ns/div using the horizontal sweep speed knob.

13 After the measurement settles (averaging complete), note the $V_{amptd(1)}$ reading.
$V_{600\ MHz\ or} V_{1\ GHz}$ = _____ mV

14 Calculate the response using the formula:

$$response(dB) = 20\log_{10}\frac{V_{600\ MHz\ or} V_{1\ GHz}}{V_{10\ MHz}} = 20\log_{10}\_\_\_\_\_ = \_\_\_\_\_ dB$$

For example:

$$20\log_{10}\frac{487\ mV}{559\ mV} = 20\log_{10}0.871 = -1.19 dB$$

15 Correct the result from step 14 with any difference in the power meter from step 11. Observe signs. For example:

Result from step 14 = –1.19 dB

Power meter reading = –0.5 dB(REL)

then true response = (–1.19)–(–0.5) = –0.69 dB

(_____) – (_____) = _____dB

16 The result from step 15 should be between +3.0 dB and –3.0 dB. Record the result in the Performance Test Record.

17 Switch the power splitter from the channel 1 to the channel 2 input.

18 Turn off the current channel and turn on the next channel using the channel keys.

19 Repeat steps 4 through 18 for the remaining channels, setting the parameters of the channel being tested where appropriate.

Real Time Test

20 Select Acquisition from the Setup menu.

21 Select Real Time sampling mode, turn off Averaging, then click Close.

22 Repeat steps 4 through 19, testing all vertical channels with the upper frequency limit as follows:

Agilent 54830B/D & 54831B/D; 600 MHz
Agilent 54832B/D & 54833A/D; 1 GHz

If the test fails
Failure of the bandwidth test can be caused by a faulty attenuator or main assembly, or the need for high-frequency pulse response adjustment.

To test time measurement accuracy

This test uses a precise frequency source to check the accuracy of time measurement functions.

Specification Delta-t accuracy

Equivalent Time: (≥16 averages)
±[(0.0015% × delta-t) + (full scale/(2 × memory depth))+ 30 ps]
Real Time: * ±[(0.005% × delta-t) + (0.2 × sample period)]

* The specification applies to bandwidth limited signals (tr ≥ 1.4 × sample period). The sample period is defined as 1/(sample rate). The specification also applies to those automatic measurements computing time intervals on identical slope edges (like pos-pos, neg-neg).

Equipment Required

Equipment	Critical Specifications	Recommended Model/Part
Signal Generator	1-40 MHz, timebase accuracy - 0.25 ppm	Agilent 8656B Opt. 001
RF Amplifier	40 MHz to 1 GHz, 20 dB gain	Agilent 8447D
Cable	Type-N 24 inch	Agilent 11500B
Cable	BNC	Agilent 10503A
Adapter	Type N (f) to BNC (m)	Agilent 1250-0077

The Agilent 8447D RF Amplifier is used as a saturation amplifier to create a very low-jitter squarewave from the sinewave output of the signal generator. You adjust the signal generator output level to change the rise time of the squarewave.

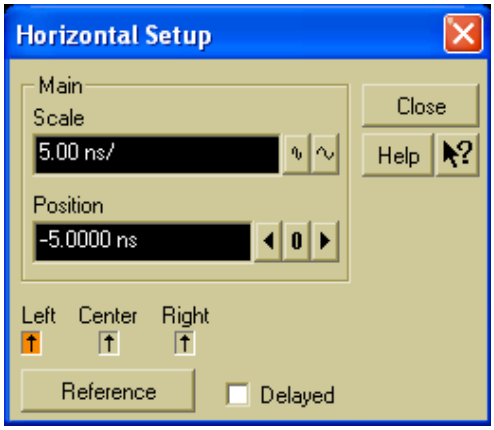
Equivalent Time Mode Procedure

This test checks time measurement in equivalent time mode with averaging.

1. Set the Agilent 8656B signal generator for a 40-MHz sine wave (25.0 ns period) at 250 mV_{rms}.
2. Connect the output of the signal generator to the INPUT of the Agilent 8447D RF amplifier.
3. Connect the OUTPUT of the RF amplifier to the channel 1 input of the oscilloscope.
4. Press Default Setup to set the oscilloscope to default conditions.
5. Press Input to select 50 Ω. Press Coupling to select dc.
6. Press Autoscale.
7. Set the vertical scale to 500 mV per division.

8 Select horizontal from the setup menu. Set the scale to 5 ns/div, position at –5.0 ns, and reference to the left.
See Figure 3-8.

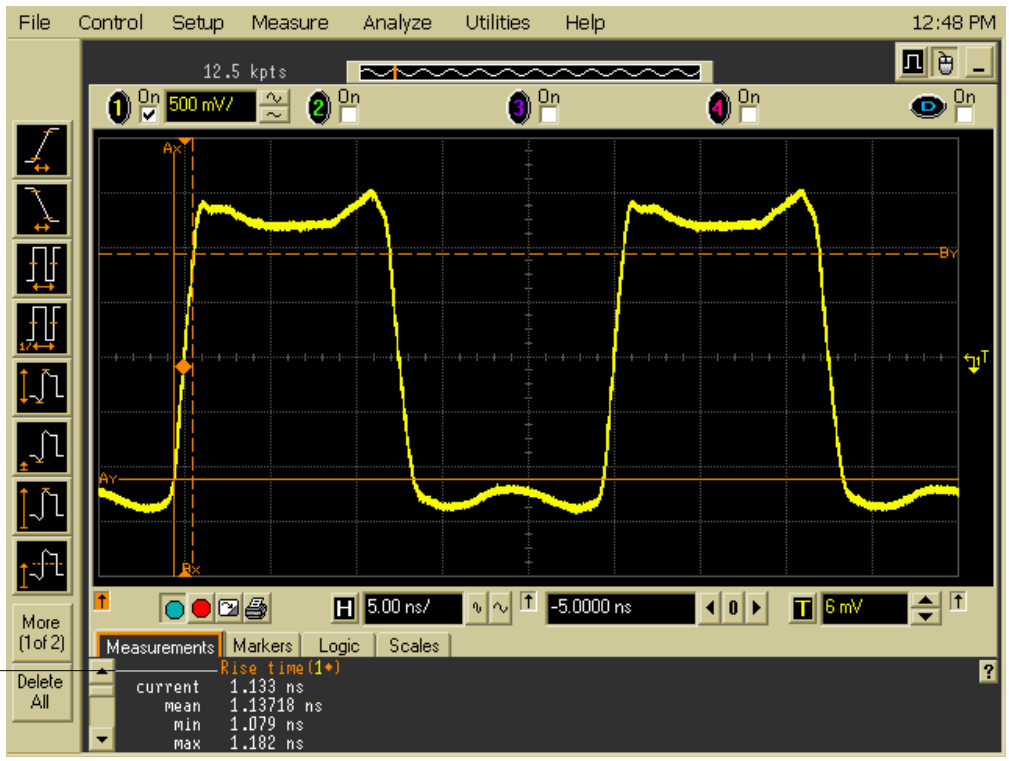
Figure 3-8



Horizontal Setup for Equivalent Time Procedure

9 Adjust the signal generator output voltage to obtain a waveform with a rise time of approximately 1.4-2.0 ns.
You can measure the rise time by selecting the rise time command from the Time submenu of the Measure menu. See Figure 3-9.

Figure 3-9



Use the rise time measurement to verify correct waveform shape for the time measurement accuracy check

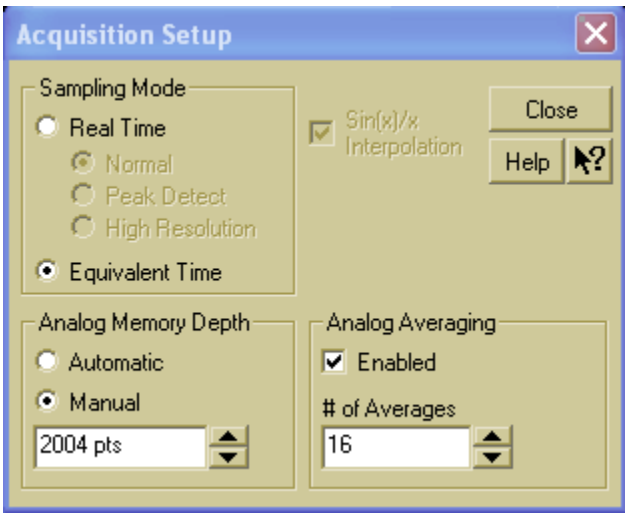
Waveform for Time Measurement Accuracy Check

10 Select Acquisition from the Setup menu.

11 Select Equivalent Time sampling mode. Enable Averaging and set the # Points to be averaged to 16. Select Manual Memory Depth. Set the memory depth to 2004 points. Click Close.

See Figure 3-10.

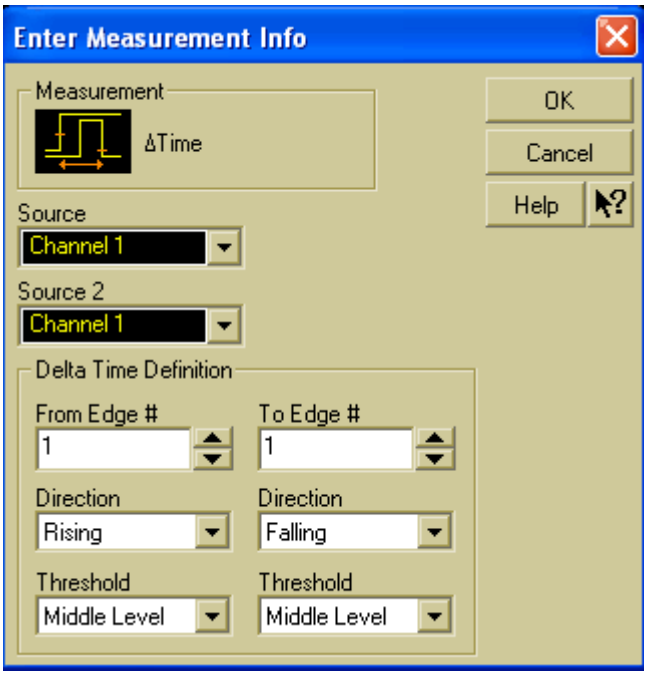
Figure 3-10



Acquisition Setup for Equivalent Time Procedure

12 Select Delta Time from the Time submenu of the Measure menu. Select Channel 1 as the source in the dialog that appears. See Figure 3-11.

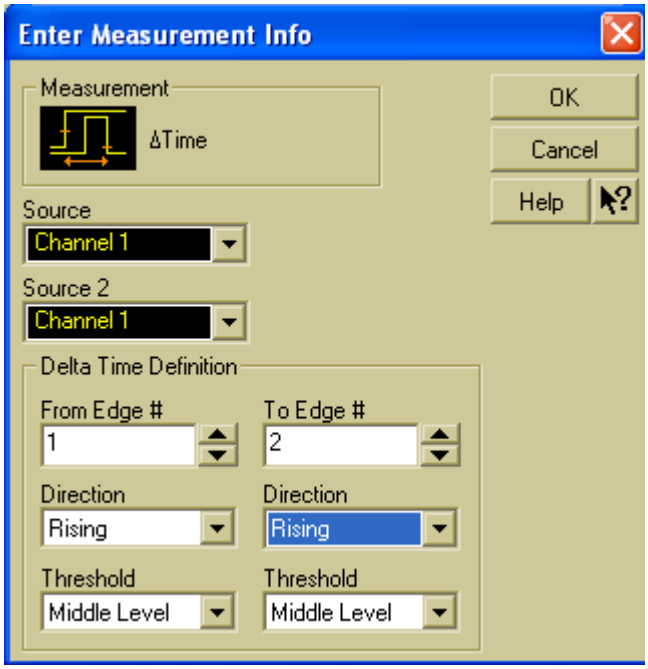
Figure 3-11



Source Selection for Delta Time Measurement

13 Set the From Edge # control to 1 with Direction Rising and Threshold Middle. Set the To Edge # control to 2 with Direction Rising and Threshold Middle. Click OK.
See Figure 3-12.

Figure 3-12



Measurement Settings for Time Interval Measurement

For Valid Statistical Data
In equivalent time mode, measurement specifications are valid with sixteen or more acquisitions averaged. Statistics accumulated before the required number of averaged acquisitions may show the oscilloscope to fail the specification. This is particularly true for minimum and maximum in this case since they are set by measurements taken with the fewest averages.

If the procedure above is followed exactly, the required number of acquisitions are averaged before statistics are turned on. Therefore, if you clear and restart measurements, averaging and statistics are restarted simultaneously and the result is erroneous data collected from the early averages.

If in doubt about the statistical data, after #Avg is complete select Clear Measurements or Clear All from the Measure tool bar, then repeat the custom measurement again. This restarts the statistics without restarting averaging and the result is valid statistical data.

14 Verify the period is 25 ns ± 43 ps, minimum 24.957 ns and maximum 25.043 ns. Record the minimum and maximum readings in the Performance Test Record.

15 Change the signal generator frequency to 100 MHz (10 ns period).

16 Select horizontal from the setup menu. Set the position to –11 ns.

17 Clear measurement statistics by pressing the Clear Display button on the front panel.

18 The delta time reading should be 10 ns ± 43 ps, minimum 9.957 ns and maximum 10.043 ns. Record the minimum and maximum readings in the Performance Test Record.

19 Change the signal generator frequency to 20 MHz (50 ns period).

20 Select horizontal from the setup menu. Set the scale to 100 ns/div, position to –11 ns.

21 Clear measurement statistics by pressing the Clear Display button on the front panel.

22 The delta time reading should be 50 ns ± 0.28 ns; minimum 49.72 ns and maximum 50.28 ns. Record the minimum and maximum readings in the Performance Test Record.

23 Change the signal generator frequency to 1 MHz (1 µs period).

24 Select horizontal from the setup menu. Set the scale to 1 µs/div, position to –11 ns.

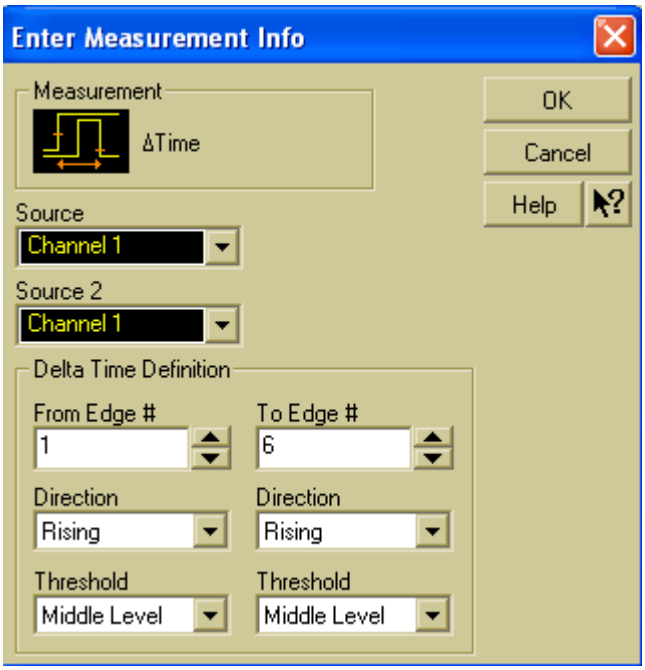
25 Clear measurement statistics by pressing the Clear Display button on the front panel.

26 The delta time reading should be 1 µs ± 2.5 ns, minimum 997.5 ns and maximum 1.0025 µs. Record the minimum and maximum readings in the Performance Test Record.

27 Move the cursor over the top of the ΔTime measurement at the bottom of the screen. Press the left mouse button and select Customize from the pop-up menu.

28 Set the To Edge # control to 6 with Direction Rising and Threshold Middle. Click OK. See Figure 3-13.

Figure 3-13



New Measurement Settings for Delta Time Measurement

29 Clear measurement statistics by pressing the Clear Display button on the front panel.

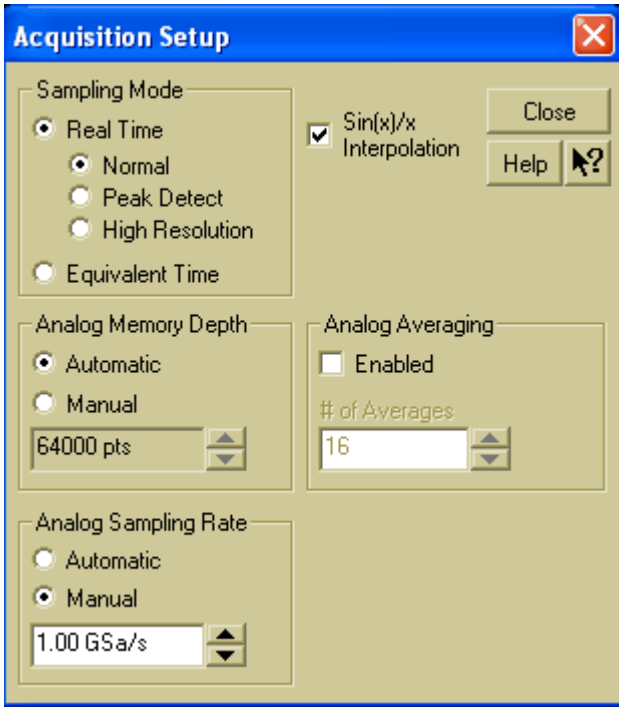
30 The delta time readings should be 5 µs ± 2.60 ns, minimum 4.9974 µs and maximum 5.0026 µs. Record the minimum and maximum readings in the Performance Test Record.

Real Time Mode Procedure

This procedure continues from the previous one.

1. Change the signal generator frequency to 25.31646 MHz (39.49999 ns period).
2. Select Acquisition from the Setup menu.
3. Select Real Time Normal sampling mode. Set Sampling Rate to Manual, 1 GSa/s. Disable Averaging and set Memory Depth to Automatic. Click Close.
   See Figure 3-14.

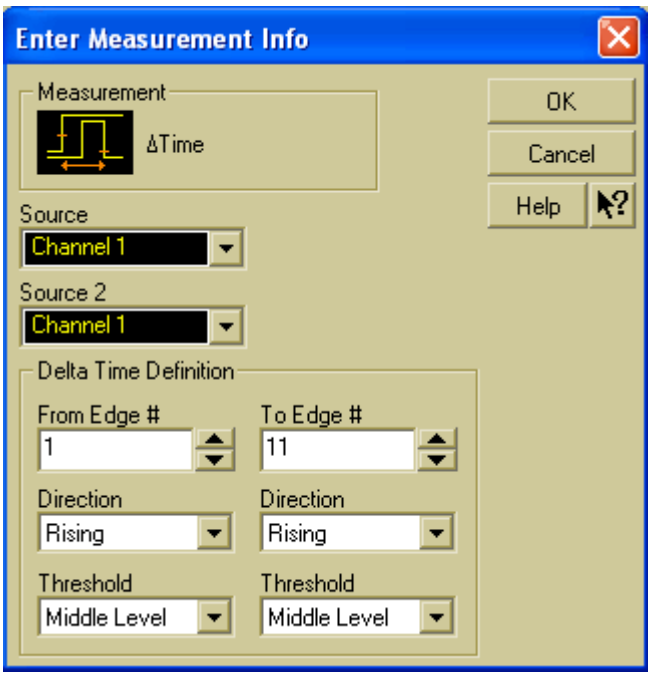
Figure 3-14



Acquisition Setup for Real Mode Procedure

4. Set sweep speed to 50 ns/div with horizontal position at 0.0 s.
5. Move the cursor over the top of the ΔTime measurement at the bottom of the screen. Press the left mouse button and select Customize from the pop-up menu.
6. Set To Edge # to 11 with Direction Rising and Threshold Middle. Click Close.
   See Figure 3-15.

Figure 3-15



Measurement Definitions for Real Mode Procedure

7 Select Period from the Time submenu of the Measure menu.

8 Period should be 39.5 ns ± 201.97 ps, minimum 39.298 ns, maximum 39.702 ns. Record the minimum and maximum readings in the Performance Test Record.

9 Delta time should read 395 ns ± 219.75 ps, minimum 394.780 ns, maximum 395.220 ns. Record the minimum and maximum readings in the Performance Test Record.

10 Press the Stop key on the front panel.

11 Press the Sweep key (in the Trigger section of the front panel) to highlight the LED labeled "Single."

12 Press the Clear Display key.

13 Set the timebase to 1 µs/div.

14 Press the Run key once.

15 Move the cursor over the top of the ΔTime measurement at the bottom of the screen. Press the left mouse button and select Customize from the pop-up menu.

16 Set the To Edge # to 101 with Direction Rising and Threshold Middle. Click OK.

17 Delta time mean should read 3.94999 µs ± 397 ps, minimum 3.94959 µs, maximum 3.95039 µs. Record the reading in the Performance Test Record.

18 Move the cursor over the top of the ΔTime measurement at the bottom of the screen. Press the left mouse button and select Customize from the pop-up menu.

19 Set the To Edge # to 201. Click OK.

20 The Delta time mean should read 7.89998 µs ± 595 ps, minimum 7.89938 µs and maximum 7.90057 µs. Record the reading in the Performance Test Record.

If the test fails
Before troubleshooting the oscilloscope, be sure to verify your test setup and the waveform shape, then repeat the procedure. Try the measurement on different channels. If you still encounter problems, there may be a problem with the acquisition board. You may need to adjust the pulse overshoot response. See chapter 4 for adjustment information on the pulse response. See chapter 5 for troubleshooting information.

To test trigger sensitivity

This test checks channel and external triggers for sensitivity at rated bandwidth.

Specification	dc to 100 MHz	100 MHz to 500 MHz	500 MHz to 1 GHz
Internal	0.5 div	1.0 div	1.5 div
External (54830/33x):	0.05 × signal range	0.10 × signal range	
Auxiliary (54831/32x)	dc to 500 MHz, 300 mV_{p-p}		

Equipment Required

Equipment	Critical Specifications	Recommended Model/Part
Signal Generator	100 MHz - 1 GHz, 30-80 mVrms output	Agilent 8648A
Power Splitter	outputs differ by <0.15 dB	Agilent 11667A
Termination	BNC feedthrough, 50 Ω	Agilent 10100C
Cable	Type N (m) 24 inch	Agilent 11500B
Cable	50 Ω BNC 36 inch	Agilent 10503A
Adapter	Type N (f) to BNC (m)	Agilent 1250-0077
Adapter	Type N (m) to BNC (m)	Agilent 1250-0082
Adapter	Type N (m) to BNC (f)	Agilent 1250-0780
Adapter	BNC tee (m)(f)(f)	Agilent 1250-0781

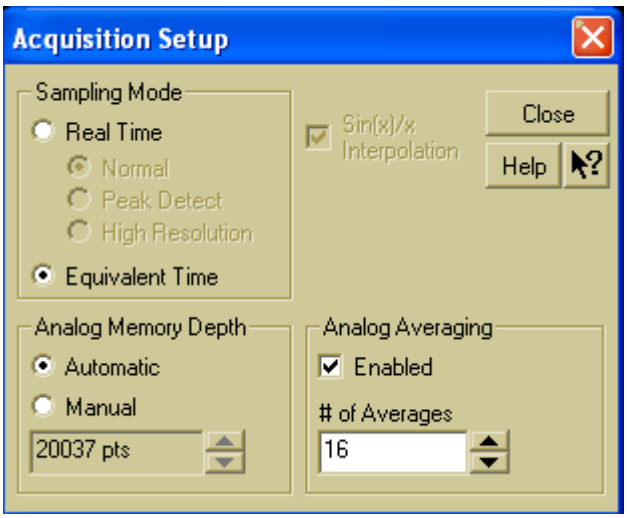
Internal Trigger Test

Perform this test on all vertical channels.

1. Press Default Setup.
2. Select Acquisition from the Setup menu.
3. Select Equivalent time sampling mode. Enable Averaging and set the number of averages to 16. Click Close.

   See Figure 3-16.

Figure 3-16



Acquisition Setup for Trigger Sensitivity Test

4 Set horizontal time/div to 5 ns/div.

5 Turn on Channel 1 and turn off all other channels.

You can do this by using the channel keys above each input BNC or by using the check boxes at the top of the waveform display area.

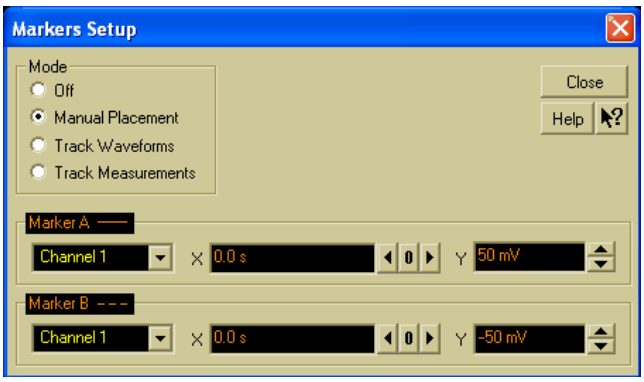
6 Set vertical scale for channel 1 to 200 mV/div. Select dc coupling and 50 Ω input impedance.

7 With an N cable and N-to-BNC adapter, connect the signal generator to the channel 1 input.

8 Set the signal frequency to 100 MHz and output level for 0.5 divisions of vertical deflection.

You can use the markers to set a 0.5 division reference. Select Markers from the Measure menu and select Manual Placement in the dialog that appears. Both Markers should be set to the same channel. Set the Y value for Marker A to +50.0 mV and the Y value for Marker B to –50.0 mV, then click Close. (If the markers do not appear on the screen, press the Marker A and Marker B keys on the front panel.) See Figure 3-17.

Figure 3-17



Setting the Markers for a 0.5 Division Reference

9 Press the Sweep key (Trigger section of the front panel controls) to select Trig'd.

The oscilloscope's Armed and Trig'd LEDs (in the Horizontal section of the front panel) should flash. However, the waveform display may not be stable.

10 Adjust the trigger level control for a stable display.
11 The test passes if triggering is stable. Record the result in the Performance Test Record.
12 Set the signal frequency to 500 MHz and the output level for 1 division of vertical deflection.

   Again, you can use the markers to check the deflection, with one set to +100 mV and the other to –100 mV.

13 Adjust the horizontal sweep speed to 1 ns/div.
14 Adjust the trigger level for a stable display.
15 The test passes if triggering is stable. Record the result in the Performance Test Record.
16 For the Agilent 54830B/31B set the signal frequency to 600 MHz. For the Agilent 54832B/D & 54833A/D set the signal frequency to 1 GHz. Set the output level for 1.5 division of vertical deflection.
17 Adjust the Horizontal sweep speed to 1 ns/div for the 54830B/D & 54831B/D or 500 ps/div for the 54832B/D & 54833A/D.
18 Adjust the trigger level for a stable display.
19 The test passes if triggering is stable. Record the result in the Performance Test Record.
20 Connect the signal generator to the channel 2 input.
21 Repeat steps 4 through 16 for the remaining channels.

Procedure—External Trigger Test (2-channel models only)

This test is necessary only on the Agilent 54830B/D & 54833A/D.

1 Connect the equipment.
   - **a** With the N cable, connect the signal generator to the power splitter input.
   - **b** Using an N-to-BNC adapter and BNC cable, connect one splitter output to the channel 1 input.
   - **c** Press the channel 1 button to turn the channel on. Set the channel to 50Ω, DC coupling.
   - **d** Connect the second splitter output to the Ext Trig input.

2 Set the signal generator frequency to 100 MHz and the output level to 32 mV_{rms} (90 mV_{pp} from the generator, 45 mV_{pp} into the trigger).
3 Press Autoscale.
4 Use the Ext Trig Input Range knob to set the range to ±1 V. Set Input to 50Ω and coupling to dc.
5 Press the Source key to select Ext.
6 Press the Sweep key to select Trig'd.
7 Adjust the trigger level for a stable display.
8 The test passes if triggering is stable. Record the result in the Performance Test Record.
9 Set the signal generator frequency to 500 MHz and output level to 64 mV_{rms} (180 mV_{pp} from the generator, 90 mV_{pp} into the trigger).
10 Adjust the trigger level for a stable display.
11 The test passes if triggering is stable. Record the result in the Performance Test Record.

Procedure—Auxiliary Trigger Test (4-channel models only)

This test is necessary only on the Agilent 54831B/D and Agilent 54832B/D.

The auxiliary trigger input is on the front panel of the oscilloscope near the vertical inputs. The dc input resistance of the aux trigger is 2.58kΩ, so to avoid reflections, the trigger source is back-terminated with 50 Ω.

1. With an N-to-BNC adapter and BNC cable, connect the signal generator to the input of the power splitter. Connect one output of the power splitter to the Aux Trig input through a 50 Ω feedthrough termination. Connect the other output of the power splitter to channel 1.
2. Set the signal generator for 500 MHz, approximately 0 dBm.
3. Set the channel 1 input to 50-Ω input impedance and press Autoscale.
4. Set the channel 1 scaling to 50 mV/div. Then set the signal generator for 6 divisions of signal (300 mV_{pp}).
5. Press the Source key (Trigger section of front panel) to highlight Aux.
6. Set the trigger level to 0.000 V.
7. Slowly adjust the Trigger Level knob slightly around the 0 V setting to obtain a stable trigger. Otherwise, the test fails. Record the result in the Performance Test Record.

If a test fails
Failure of the internal trigger or external trigger sensitivity tests can be caused by a defective main assembly or attenuator. Failure of the auxiliary trigger sensitivity is caused by a problem on the main assembly or a bad input cable. If you need further troubleshooting information, go to chapter 5, "Troubleshooting."

To verify threshold accuracy

This test verifies the data channel threshold accuracy specifications of the Agilent 54830/31/32/33D Mixed Signal Oscilloscope.

Test Threshold Accuracy only on the 54830/31/32/33D Mixed-Signal Oscilloscope
You need to perform these instructions only if you will be testing the Agilent 54830/31/32/33D Mixed-Signal Oscilloscope.

Threshold accuracy test limits = ±(100 mV + 3% of threshold setting).

When to Test You should perform this test every 24 months or after 4000 hours of operation, whichever comes first.

What to Test Use these instructions to test the threshold settings of digital channels D15-D0.

Verifying Test Results After each threshold test, record the voltage reading in the Performance Test Record at the end of this chapter. To verify whether a test passes, verify that the voltage reading is within the limits in the Performance Test Record.

Let the Equipment Warm Up Before Testing For accurate test results, let the test equipment and the oscilloscope warm up 30 minutes before testing.

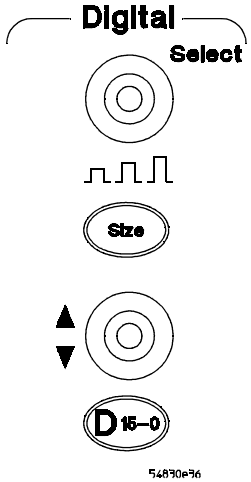
Equipment Required

Equipment	Critical Specifications	Recommended Model/Part
Digital Multimeter	0.1 mV resolution, 0.005% accuracy	Agilent 34401A
Power Supply	-5 V to 5 V CD	Agilent 6114A
BNC Cable		Agilent 10503A
BNC Grabbers		
Digital Probe Kit		54826-68701

1 Turn on the test equipment and the oscilloscope. Let them warm up for 30 minutes before starting the test.
2 Set up the power supply.
   a Set the power supply to prove a DC offset voltage.
   b You may use the multimeter to monitor the power supply DC output voltage.
3 Using the method described in section two of this manual connect the power supply output to DO digital channel on the oscilloscope.

4 Press the oscilloscope D_{15-0} on the front panel to turn on the digital channels. See Figure 3-18.

Figure 3-18

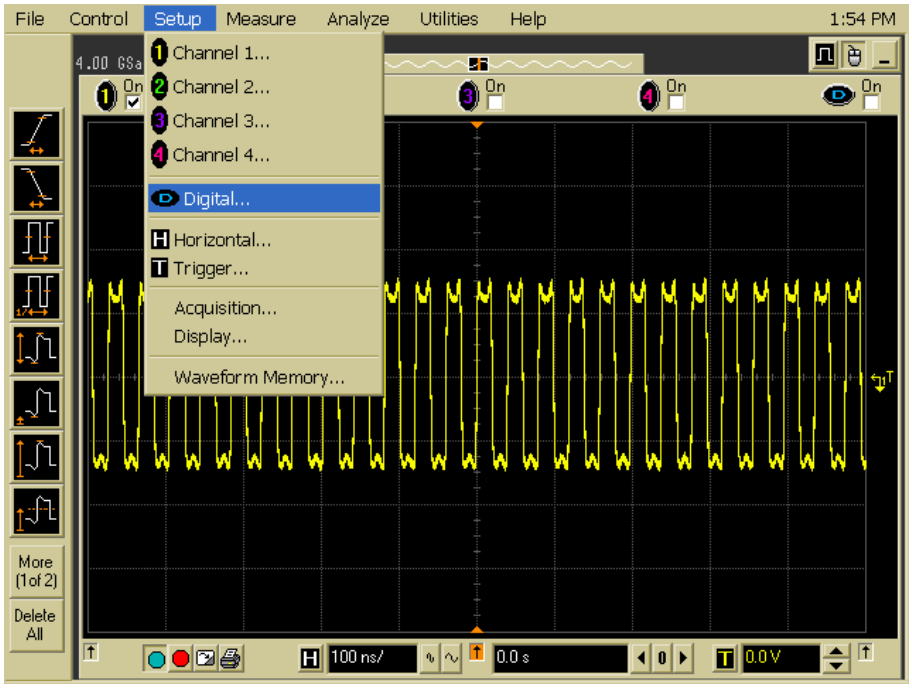


Digital Channels

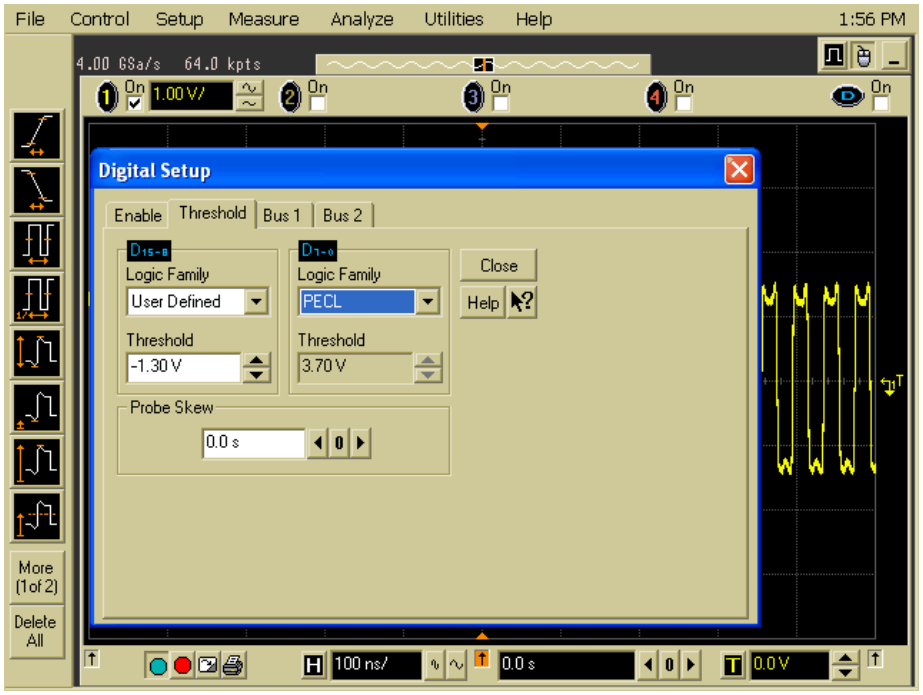
5 To adjust the threshold settings, open the Digital channels setup dialog box.

a Under the Setup menu, press the Digital selection. Select the threshold tab.

Figure 3-19



b Select user defined under the logic family selection.



Digital Channels Setup

c Enter the desired threshold value in the threshold selection box.

Threshold Accuracy Voltage Test Settings

Threshold voltage settings (in oscilloscope User softkey)	DC offset voltage setting (on oscilloscope calibrator)	Limits
+5.00 V	+5.250 V ±1 mV DC	Lower limit = +4.750 V Upper limit = +5.250 V
-5.00 V	-4.750 V ±1 mV DC	Lower limit = -5.250 V Upper limit = -4.750 V
0.00 V	+100 V ±1 mV DC	Upper limit = +100 mV Lower limit = -100 mV

6 Do the following steps for each of the threshold voltage levels shown in the above table.

a Set the threshold voltage to 5.0 V as described in step 5.

b Enter the corresponding DC offset voltage on the power supply. Use the multimeter to verify the voltage.

Digital channel activity indicators are displayed in the quick measurement window under the digital tab.

c Use the knob on the power supply to decrease the offset voltage, in increments of 10 mV, until the activity indicators for the digital channel under test is at the digital low level. Repeat for all channels or test multiple channels at the same time. Record the oscilloscope calibration voltage in the performance test record.

d Use the knob on the power supply to increase the offset voltage, in increments of 10 mV, until the activity indicators for the digital channel under test is at a digital high level. Repeat for all channels or test multiple channel at the same time. Record the oscilloscope calibrator voltage in the performance test record.

Before proceeding to the next step, make sure that you have recorded the oscilloscope calibrator voltage levels for each of the threshold settings shown in Table 3-3.

Performance Test Record

Agilent Technologies

Agilent 54830 Series Oscilloscopes

Model Number _____ Tested by_____

Serial Number _____ Work Order No._____

Recommended Test Interval - 1 Year/2000 hours Date_____

Recommended next testing_____ Ambient temperature _____

Test	Limits		Results			
	(Vmax - Vmin)/4.8 =Limits					
dc Calibrator Amplitude	1.000	0.998 to 1.002	_____			
			Channel 1	**Channel 2**	**Channel 3**	**Chan 4/Ext**
Input Resistance	50 Ω	49.5 Ω to 50.5 Ω	_____	_____	_____	_____
	1 MΩ	990 kΩ to 1.010 MΩ	_____	_____	_____	_____
Voltage Measurement Accuracy	**Range** **Supply**	**Limits**				
	5 V/div 35 V	34.490 V to 35.510 V	_____	_____	_____	_____
	2 V/div 14 V	13.796 V to 14.204 V	_____	_____	_____	_____
	1.25 V/div 8.75 V	8.623 V to 8.877 V	_____	_____	_____	_____
	500 mV 3.5 V	3.449 V to 3.551 V	_____	_____	_____	_____
	250 mV 1750 mV	1724.52 mV to 1775.48 mV	_____	_____	_____	_____
	100 mV 700 mV	689.808 mV to 710.19 mV	_____	_____	_____	_____
	50 mV 350 mV	344.904 mV to 355.096 mV	_____	_____	_____	_____
	20 mV 140 mV	137.962 mV to 142.038 mV	_____	_____	_____	_____
	10 mV 70 mV	68.981 mV to 71.019 mV	_____	_____	_____	_____
	7 mV 49 mV	48.287 mV to 49.713 mV	_____	_____	_____	_____
Offset Accuracy	**Range**	**Offset limits**				
	200 mV/div	2.0 V 1.943 to 2.057 V	_____	_____	_____	_____
	100 mV/div	1.0 V 0.9715 to 1.0285 V	_____	_____	_____	_____
	50 mV/div	500 485.75 to 514.25 mV	_____	_____	_____	_____

Test	Limits		Results			
Bandwidth		**Down from reference:**	**Channel 1**	**Channel 2**	**Channel 3**	**Channel 4**
	Equivalent Time	<3.0 dB at 600 MHz (54830/31B/D)	_____	_____	_____	_____
		<3.0 dB at 1 GHz (54832B/D & 54833A/D)	_____	_____	_____	_____
Bandwidth (Cont'd)	**Real Time**					
	Agilent 54830/31B/D 54832B/D & 54833A/D	<3.0 dB at 600 MHz <3.0 dB at 1 GHz	_____	_____	_____	_____
Time measurement accuracy — equivalent time mode	**ΔTime**	**Limits**	**Minimum**		**Maximum**	
	25 ns	24.957 to 25.043 ns	_____		_____	
	10 ns	9.957 to 10.043 ns	_____		_____	
	50 ns	49.72 to 50.28 ns	_____		_____	
	1 μs	0.9975 to 1.0025 μs	_____		_____	
	5 μs	4.9974 to 5.0026 μs	_____		_____	
Time measurement accuracy — real time mode	**Period**	**Limits**				
	39.5 ns	39.298 to 39.702 ns	_____		_____	
	ΔTime(edge#11)	**Limits**				
	395 ns	394.780 to 395.220 ns	_____		_____	
	ΔTime (edge#101)	**Limits**				
	3.94999 μs	3.94959 to 3.95039 μs	_____		_____	
	ΔTime (edge#201)	**Limits**				
	7.89998 μs	7.89938 to 7.90057 μs	_____		_____	
Trigger Sensitivity	**Mode**	**Stable Trigger On:**	**Pass/Fail**			
	Internal Trigger		**Channel 1**	**Channel 2**	**Channel 3**	**Channel 4**
		0.5 div at 100 MHz	_____	_____	_____	_____
		1.0 div at 500 MHz	_____	_____	_____	_____
	54830/31B/D only	1.5 div at 600 MHz	_____	_____	_____	_____
	54832B/D & 54833A/D only	1.5 div at 1 GHz	_____	_____	_____	_____
	External Trigger (Agilent 54830B/D & 54833A/D only)					
	on ±1 V range:	45 mV_{pp} at 100 MHz	_____			
		90 mV_{pp} at 500 MHz	_____			
	Auxiliary Trigger (Agilent 54831/32B/D only)					
		300 mV_{pp} at 500 MHz	_____			

Test	Limits		Results	
Digital Channels Threshold Accuracy (54830/31/32/33 D)	**±100 mV +3% of threshold setting**		**Pass/Fail**	
	Specification	**Limits**	**Channel D7-D0**	**Channel D15-D8**
	5 V -250 mV	4.750 V	_____	_____
	5 V +250 mV	5.250 V	_____	_____
	-5 V -250 mV	-5.250 V	_____	_____
	-5 V +250 mV	-4.750 V	_____	_____
	0 V -100 mV	-100 mV	_____	_____
	0 V +100 mV	100 mV	_____	_____

4

Calibrating and Adjusting

Calibrating and Adjusting

This chapter provides firmware (self calibration) and hardware adjustment procedures for the Agilent Technologies 54830 Series oscilloscope.

- Self calibration

Self Calibration Interval and Hardware Adjustments

The firmware calibration is the self cal (self calibration). Self calibration should be done every year, or every 2,000 hours of operation, whichever comes first. There are no hardware adjustments required for the 54830 Series oscilloscope.

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

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

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

Calibration Procedures

The procedures start with the next paragraphs. Unless specified elsewhere, procedures must be followed in the order given. Display checks are optional and independent of other procedures.

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

WARNING SHOCK HAZARD!
Read the Safety information at the back of this guide before performing adjustment 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 run the self calibration

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

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

Equipment Required

Equipment	Critical Specifications	Recommended Model/Part
Adapters (2)	BNC (f) to BNC (m) right angle	Agilent 1250-0076
Cable	BNC 50 Ω	Agilent 8120-1839

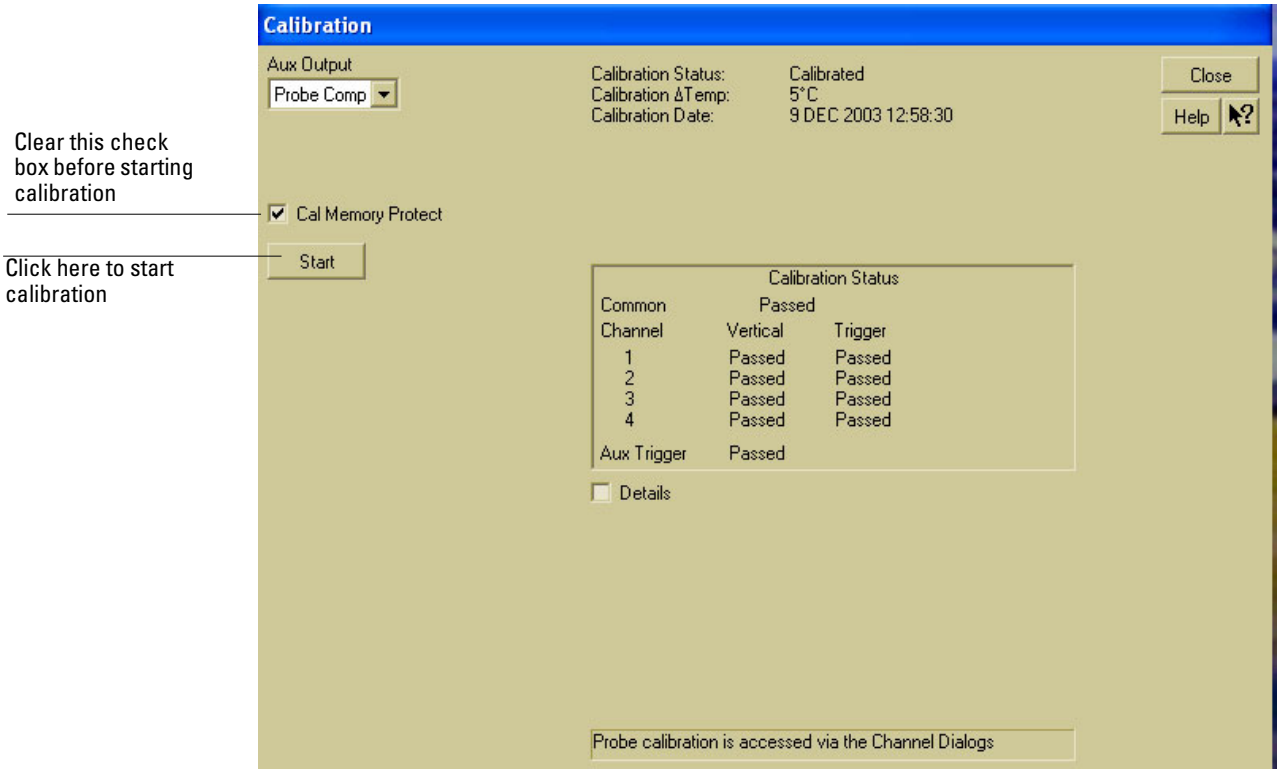
Let the Oscilloscope Warm Up Before Running the Self Calibration
The self calibration should only be done after the oscilloscope has run for 30 minutes at ambient temperature with the cover installed.

self calibration

Calibration time
It will take approximately 45 minutes to run the self calibration on the oscilloscope, including the time required to change cables from channel to channel.

1 Select Calibration from the Utilities menu.
2 If the Cal Memory Protect box in the Calibration dialog is checked, click the check box to clear the check mark.
See Figure 4-1.

Figure 4-1



Calibration Dialog

Clear Cal Memory Protect to Run self calibration
You cannot run self calibration if this box is checked.

3 Connect an adapter to each end of the cable.

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

You will be asked first to disconnect all channels and the Aux Output (located on the rear panel of the oscilloscope), then to connect Aux Out to each channel and the auxiliary trigger in turn. After you complete each cable change, click OK in the dialog box to continue the calibration.

The oscilloscope displays a Passed/Failed message as each calibration routine is completed.

5 Click Close.

If calibration fails
Go to chapter 5 “Troubleshooting.”

5

Troubleshooting

Troubleshooting

This section provides troubleshooting information for the Agilent Technologies 54830 Series oscilloscope. The service strategy of this oscilloscope is replacement of defective assemblies.

Safety

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

WARNING

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

WARNING

INJURY CAN RESULT!
Use caution when working around the cooling fan with the cover removed from the oscilloscope. The cooling fan blades are exposed on one side and can be hazardous. Install the optional fan safety shield (Agilent Technologies P/N 54810-00601) to protect your fingers from the fan blades.

Tools Required

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

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

ESD Precautions

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

Keystroke Conventions

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

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

Default Setup

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

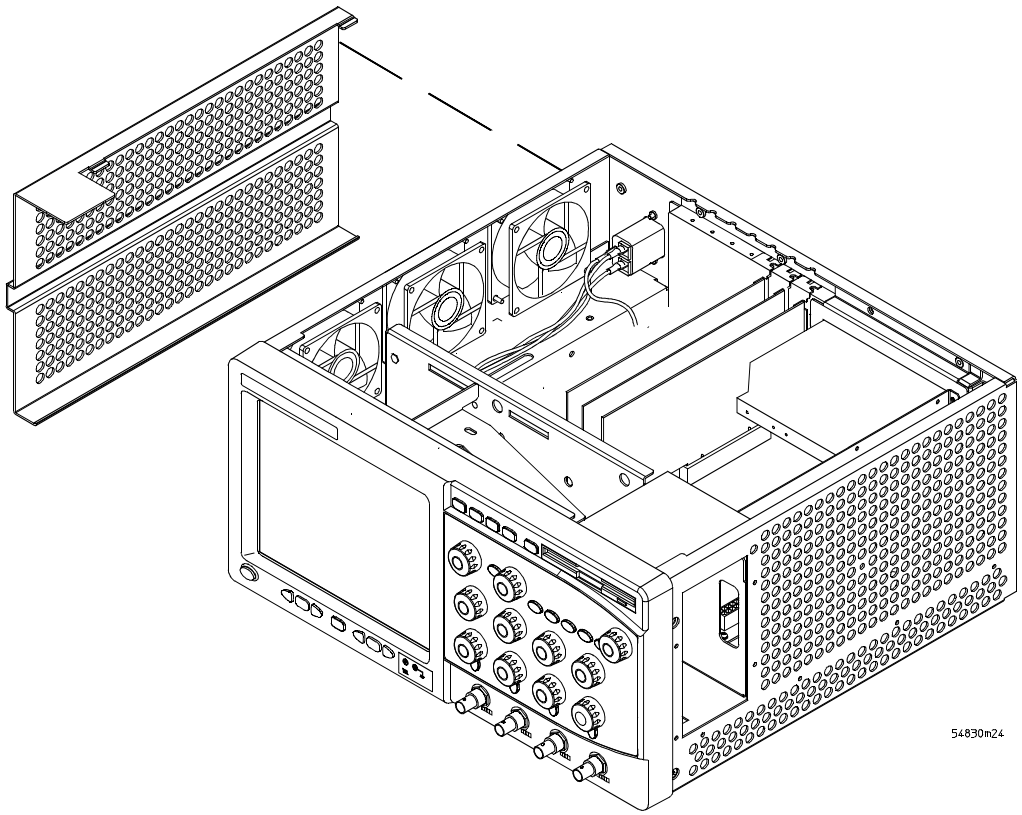
- Press the Default Setup key to set the oscilloscope to the default state.

To install the fan safety shield

1 Disconnect the oscilloscope power cord and remove the cover.
If necessary, refer to the procedures in chapter 6 "Replacing Assemblies".

2 Clip the fan safety shield over the outside of the oscilloscope chassis next to the fans.
See Figure 5-1.

Figure 5-1



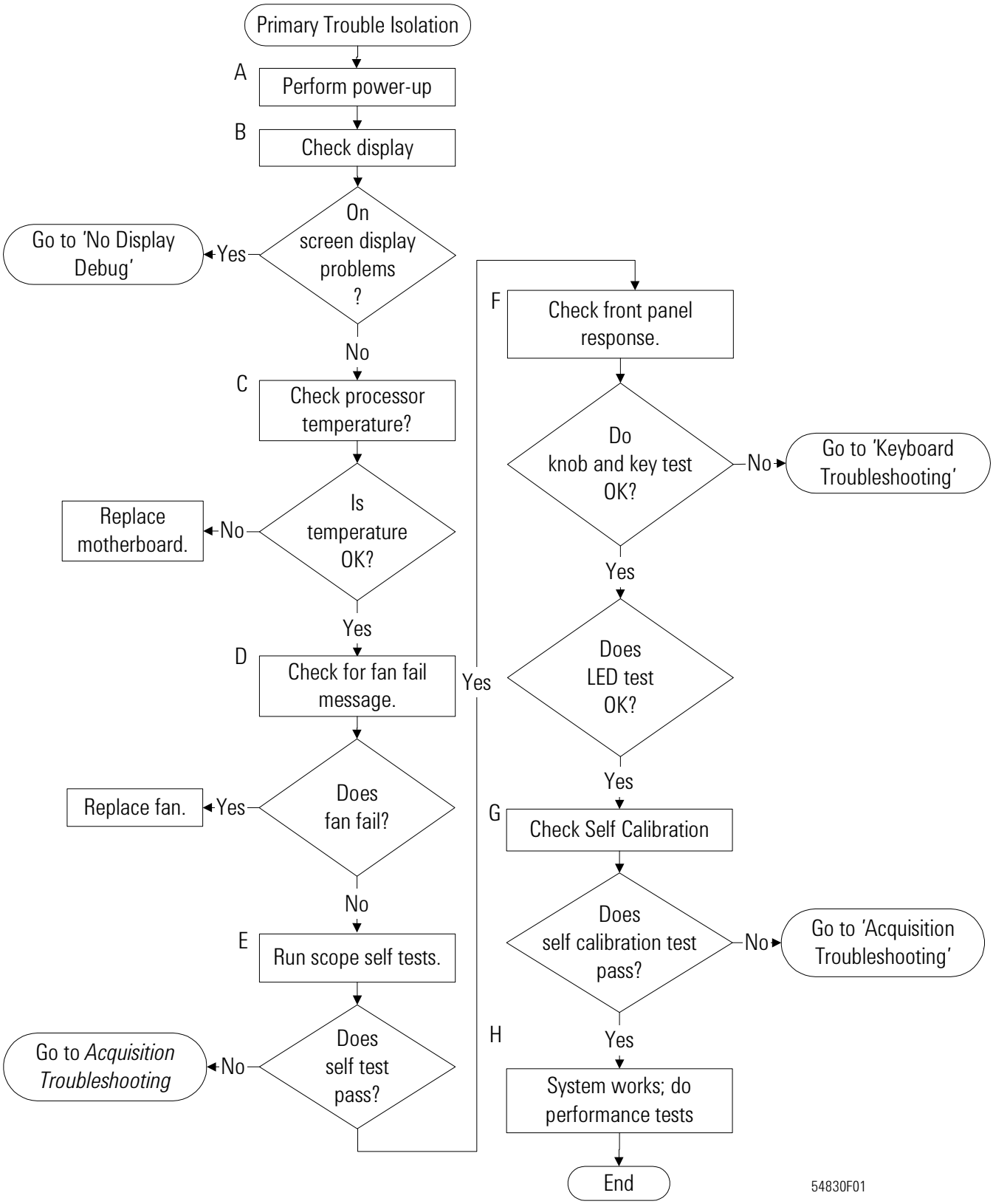
Installing the Fan Safety Shield

To troubleshoot the oscilloscope

The troubleshooting procedure is used to isolate problems to a faulty assembly. When you find the faulty assembly, use the disassembly and assembly procedures in chapter 6 to replace the assembly.

The primary procedural tool in this section is the flowchart. The flowchart contains the entire troubleshooting path from a failed oscilloscope to a working one, and will direct you in an orderly manner through the possible failure symptoms. Reference letters on the flowcharts point to procedural steps that explain the brief instructions in the chart. Do not try to troubleshoot by following only the reference text because the text is not in the correct order for troubleshooting. Instead, simply follow the flowchart.

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



Primary Trouble Isolation Flowchart

Primary Trouble Isolation

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

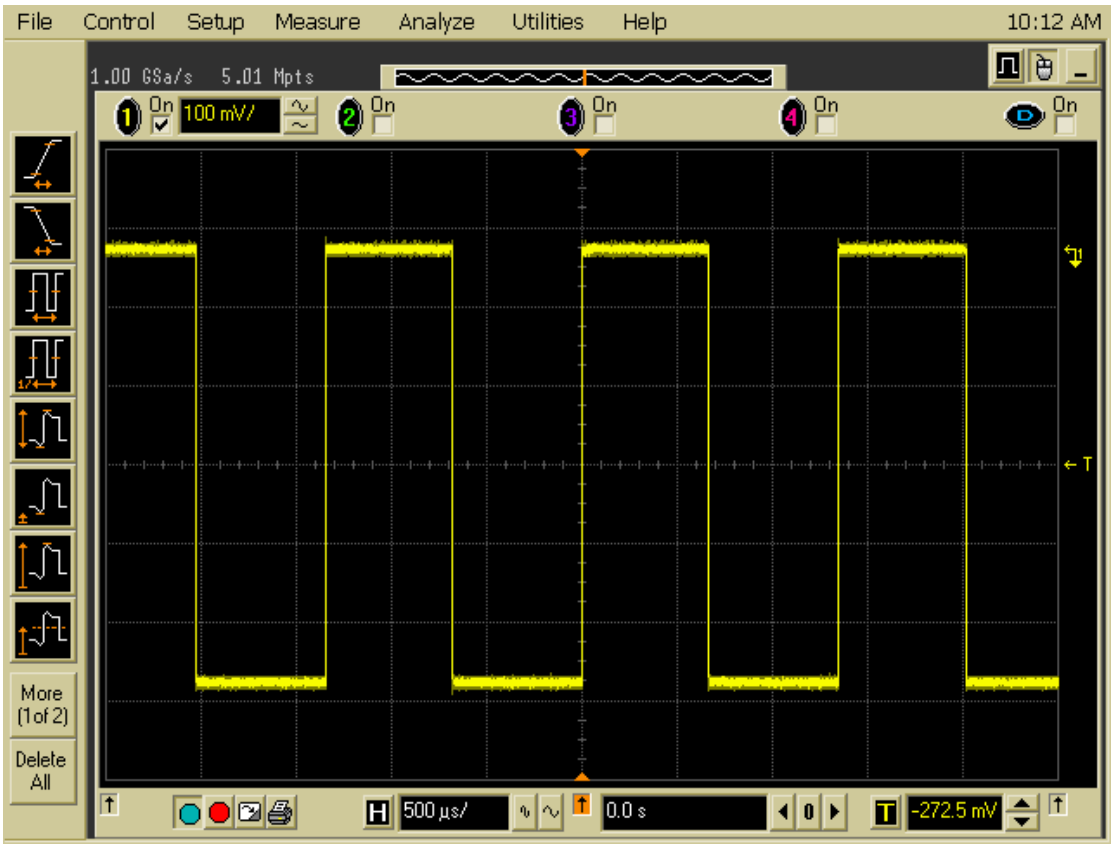
A letter is assigned to boxes in the flowchart. The letter corresponds to a specific section in the reference text. Be sure to use the flowchart itself for your troubleshooting path.

A Perform power-up.

1 Power-on the oscilloscope.

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

Figure 5-2



Power-on Display Default (Graphical Interface Disabled)

2 Press the Default Setup key.

B Check the display.

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

C Run oscilloscope self-tests.

1 Select Self Test from the Utilities menu.

2 Select oscilloscope 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 D.

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

Use this procedure to verify correct keyboard operation.

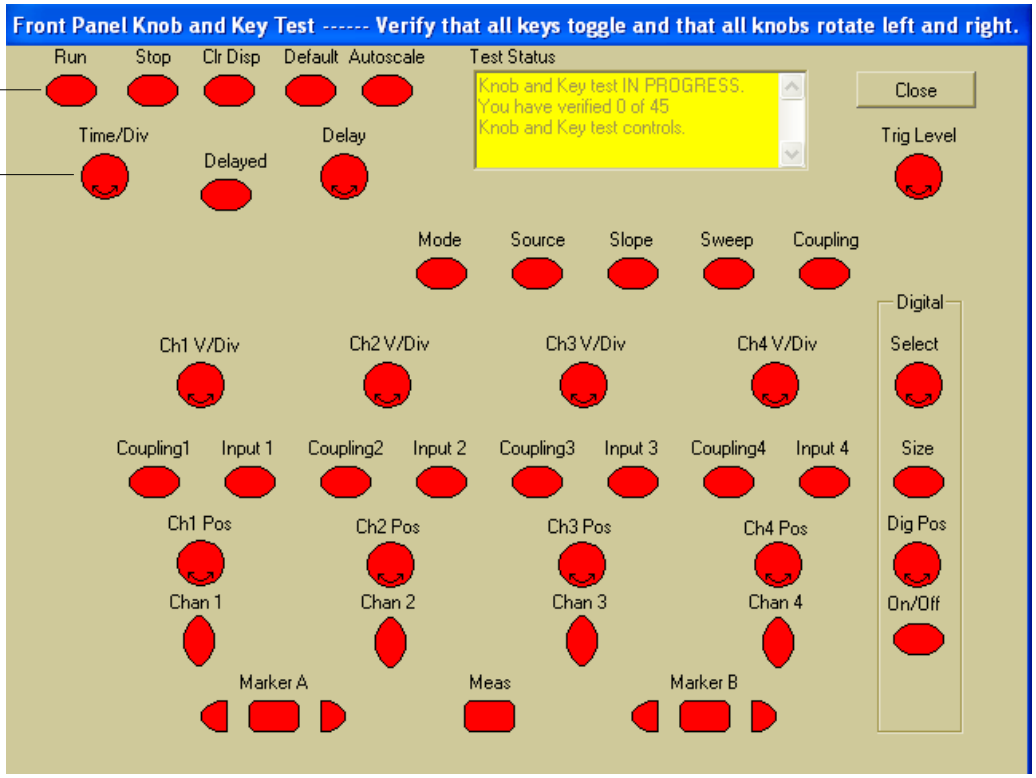
1 Select Self Test from the Utilities menu.

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

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

Figure 5-3

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; Troubleshooting Procedure 5-14.

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

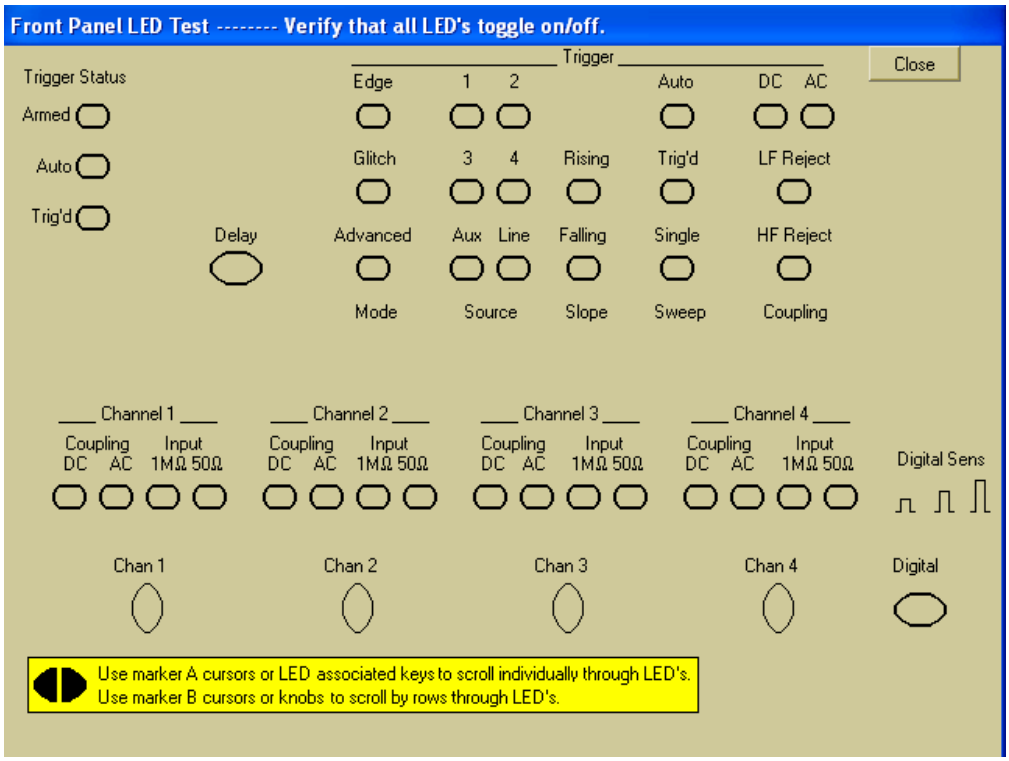
1 Enable the graphical interface.

2 Select Self Test from the Utilities menu.

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

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

Figure 5-4



LED Test Screen

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

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

5 When you are finished, click Close.

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

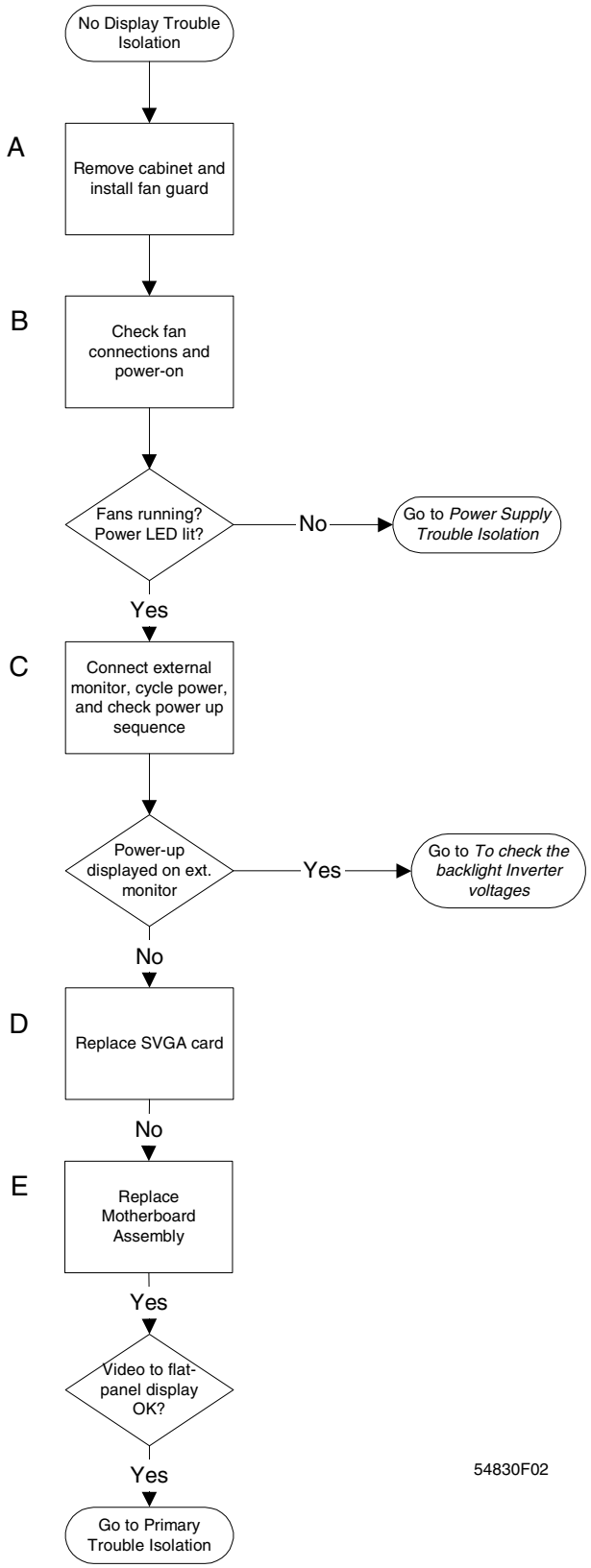
6 If both tests pass, go to step E.

E Self Calibration

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

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

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



No Display Trouble Isolation Flowchart

No Display Trouble Isolation

This trouble isolation procedure helps isolate a problem to the assembly level when there is no display on the flat-panel liquid crystal display screen.

A Remove the cabinet and install the fan safety shield.

1. Disconnect the power cord from the oscilloscope. Refer to chapter 6, "Replacing Assemblies," for instructions on removing the cabinet. Use care in handling the oscilloscope.
2. Install the optional fan safety shield, Agilent Technologies P/N 54810-00601, over the fans on the left side of the oscilloscope.

WARNING SHOCK HAZARD!
The backlight inverter assembly, which is mounted at the front corner of the oscilloscope near the flat-panel display, operates at 900 V 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.

B Check the fan connections.

Verify that the fan mounted in the left side of the oscilloscope and the CPU fan (on the motherboard) are connected.

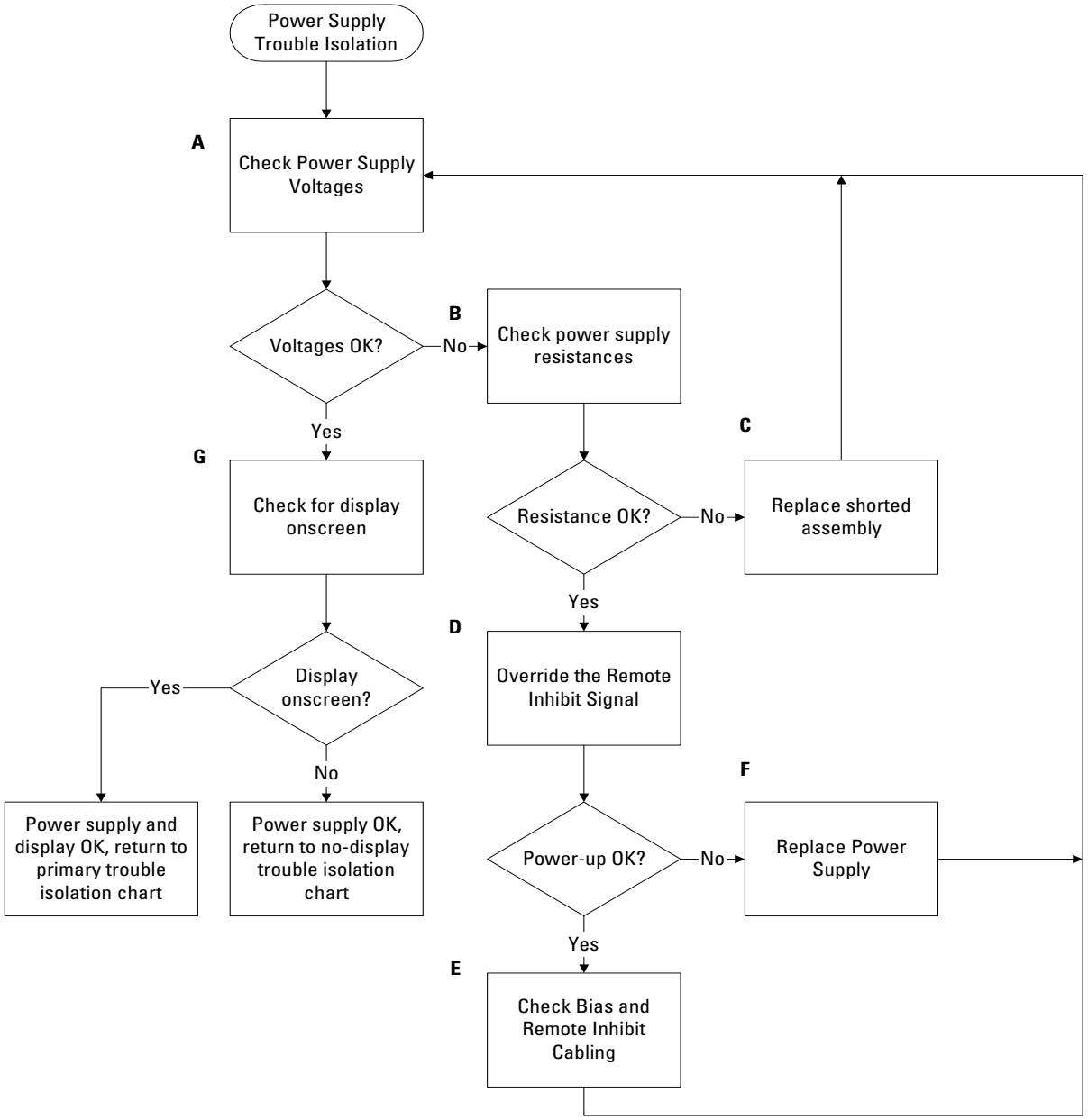
1. The oscilloscope fans connects to the fan controller board on the bottom deck A20.
2. The CPU fan connects to the top side of the motherboard noted "CPU Fan."
3. The Power Supply fan is at the rear of the power supply.
4. Connect the power cord and press the power switch on the front panel. Verify that all fans are running and that the front panel power switch LED is illuminated. These are indications that the power supply is functioning. If the fans and LED are off, go to the Power Supply Trouble Isolation flowchart. Otherwise go to step C.

C Connect an external monitor, cycle power, and observe the following oscilloscope power-on sequence. If the power-up on external monitor test fails go to step D.

D Replace Display Card All (Agilent Technologies P/N 54810-66525). If the display is still having problems go to step E.

E Replace the motherboard assembly A19.

Power Supply Trouble Isolation



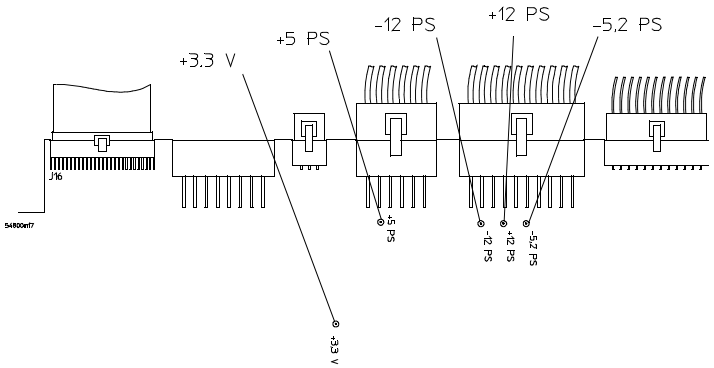
Power Supply Trouble Isolation Flowchart

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

A Check the power supply voltages.

You check the power supply voltages on the acquisition board, A13. 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 (A13)

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

Supply Voltage Specification	Limits
+5.1 V ± 0.1 V	+5.0 V to +5.2 V
-5.2 V ± 0.1 V	-5.1 V to -5.3 V
+12.2 V ± 0.3 V	+11.9 V to +12.5 V
-12.2 V ± 0.3 V	-11.9 V to -12.5 V
+3.3 V ± 0.1 V	+3.2 V to + 3.4 V

B Turn off the power and measure the power supply resistances to ground to check for shorted supply lines.

You can probe the test points on A13, shown in Figure 5-5, for this resistance check.

C Replace any shorted assembly.

You can locate the shorted assembly by disconnecting assemblies from the power supply, one at a time.

Reconnect Assemblies and Cables
Reconnect all assemblies after testing. The oscilloscope must have all cables connected for correct power up.

4 Override the Remote Inhibit signal.

Power up the by unit removing the W2 control cable from the fan controller board.

E Replace the power supply.

1 If the +15 V bias is correct, but the oscilloscope will not power up with a 196-220Ω resistor, replace the power supply. Chapter 6 explains how to remove and replace the power supply.

2 Re-assemble the oscilloscope and apply power.

F Check for the oscilloscope display onscreen.

1 You should see the oscilloscope display (see figure 5-2). If not, see the No Display Trouble Isolation Flowchart.

2 If you see the display, return to the Primary Trouble Isolation Flowchart.

To check probe power outputs

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

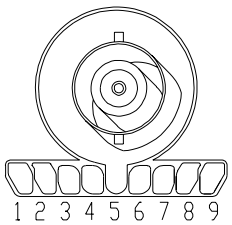
Use the table and figure to the right to check the power output at the connectors.

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

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

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

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



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

To Check the keyboard; Troubleshooting Procedure

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

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

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

5. Set the cursor keyboard and keyboard assembly on an antistatic electrical insulated surface.
6. Connect the cursor keyboard cable to the keyboard assembly. Connect the keyboard cable to the oscilloscope 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 W12, with W12 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 W12, oscilloscope interface 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 W12 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.

To check the motherboard, CPU, and RAM

This procedure verifies that the PC system board and the associated CPU and RAM are functioning. It assumes that the power supply, display board, and an external VGA monitor are functioning correctly.

1. Connect an external keyboard to the keyboard port.
2. Connect an external VGA monitor to the VGA output connector on the rear panel.
3. Hold down the Tab key on the external keyboard, then apply power to the oscilloscope.
4. Verify that a message, such as the following, appears on the external monitor:

```
Award Modular Bios v6.00PG
Copyright...
VP22...

Main Processor: Intel Pentium III 866 MHz
Memory Testing: 262144 K Ok
:
Primary Master: IBM DJSA-205...
Primary Slave: SLIM4 00
Secondary Master: MATSHITA CR-122 7508
```

Messages Vary Slightly
These messages may vary slightly depending on the motherboard version.

If the above message is displayed, you can assume that the PC system board, CPU, and RAM are functioning correctly.

If you need to run setup, press DEL. Otherwise, turn off power and proceed with troubleshooting. See “To configure the motherboard jumpers and set up the BIOS” for information.

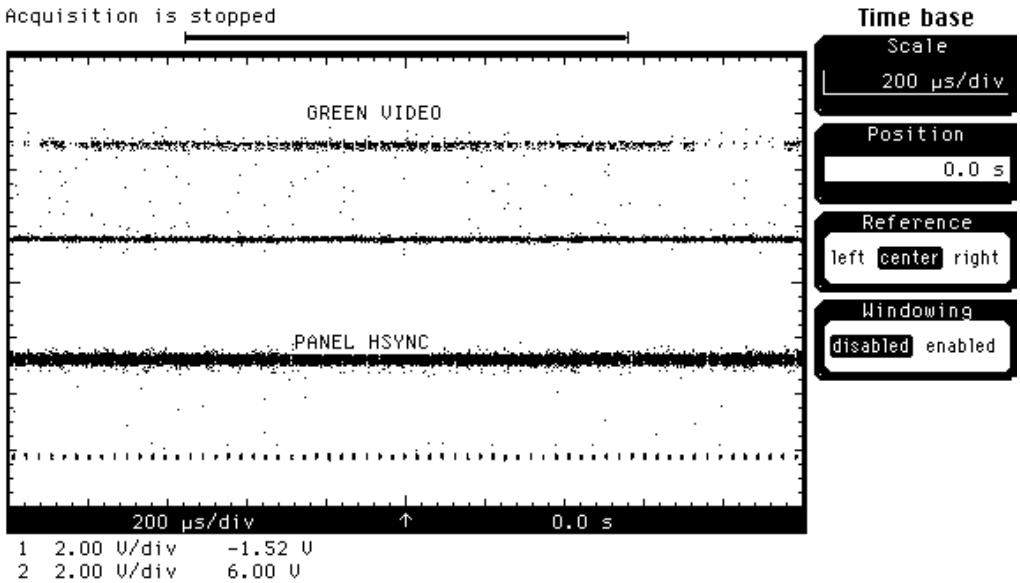
To check the display board video signals

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 5-2 **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 5-6



Video Signals

To check the backlight inverter voltages

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

- There is 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 A11.

Table 5-3 **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

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:

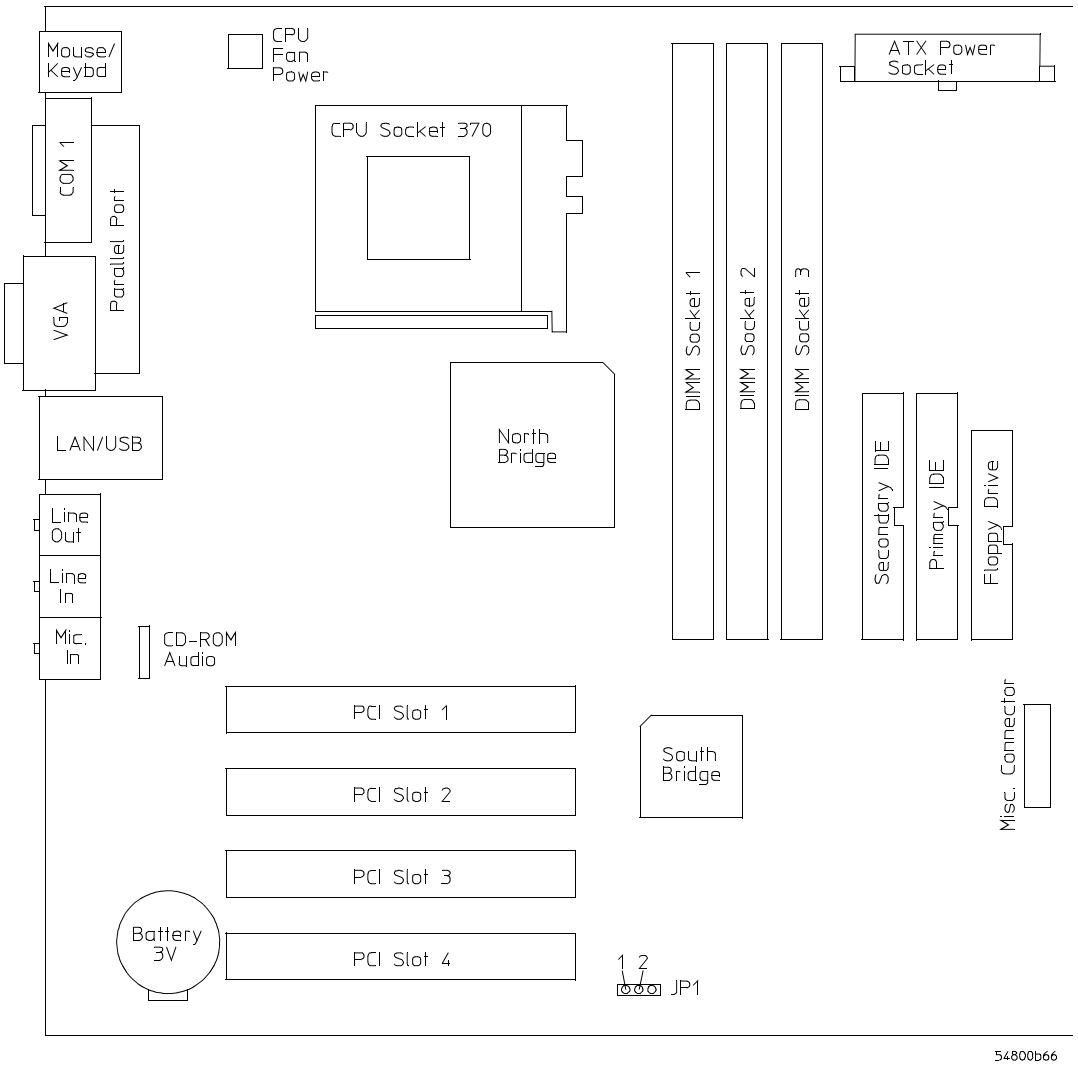
Award Modular BIOS v.6.0PG
Copyright
VP22
Main Processor: Intel Pentium III 1 GHz
Memory Test: 262144K OK

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.

Figure 5-7



MOT VP-22 Motherboard

Configure the MOT series VP-22 Motherboard BIOS parameters.

Use this procedure to set the MOT VP-22 motherboard BIOS.

1 Connect the power cable to the Infiniium oscilloscope.

2 Connect the external keyboard to the rear panel.

3 Press the delete key when you see the following prompt on the bottom of the screen

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

Note: If you are not seeing the prompt, or the oscilloscope does not appear to be functioning, check the motherboard jumper setting, and the ribbon cable connectors. Otherwise, continue with the next step.

BIOS Setup Procedure

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

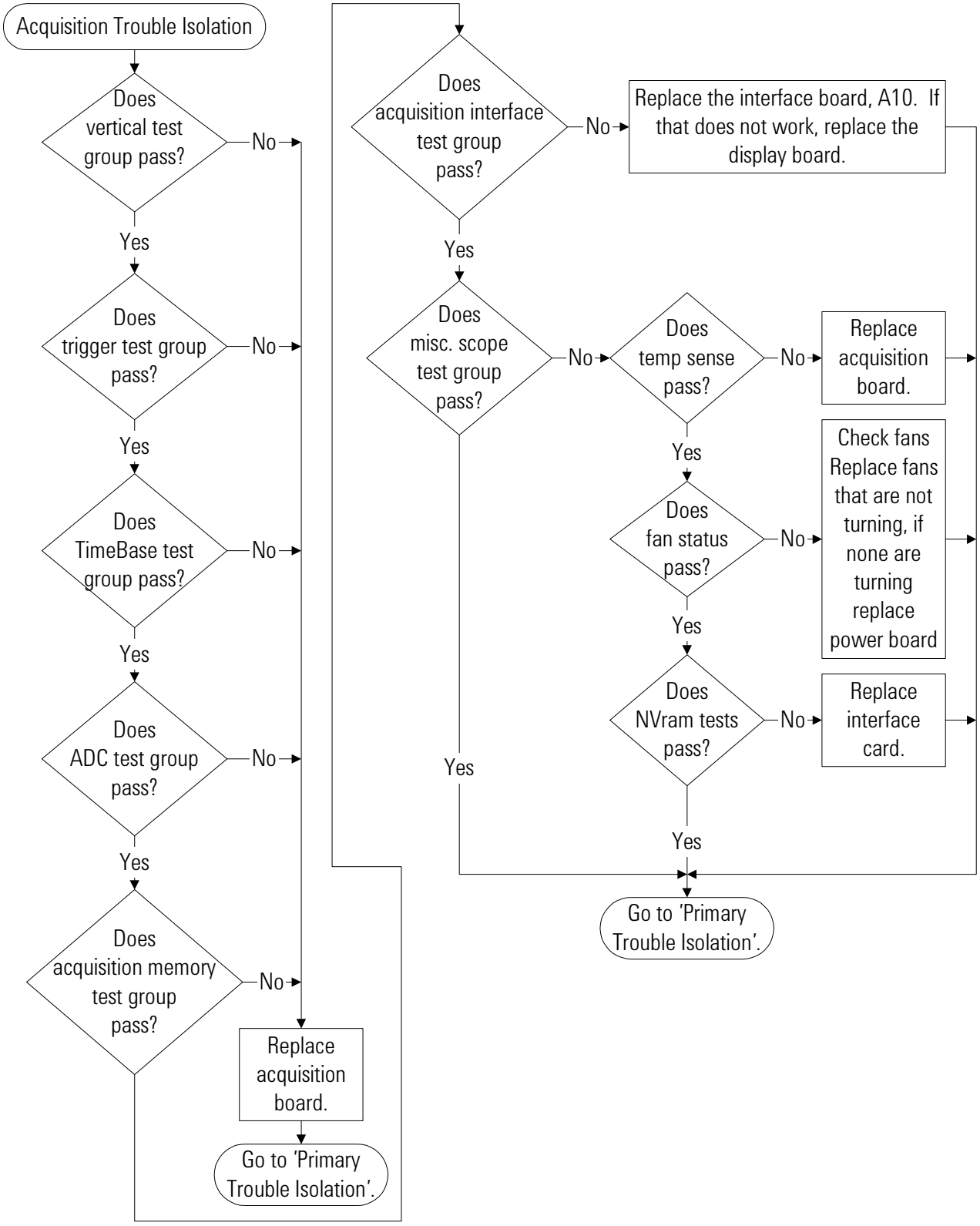
To troubleshoot the acquisition system

1 Select Self Test from the Utilities menu.

2 Click Start Self Test to run the test.

At the end of the self test the diagnostics box will show the results of each of the major group tests. If a group test fails, additional information will be shown with regards to the failure.

Figure 5-8



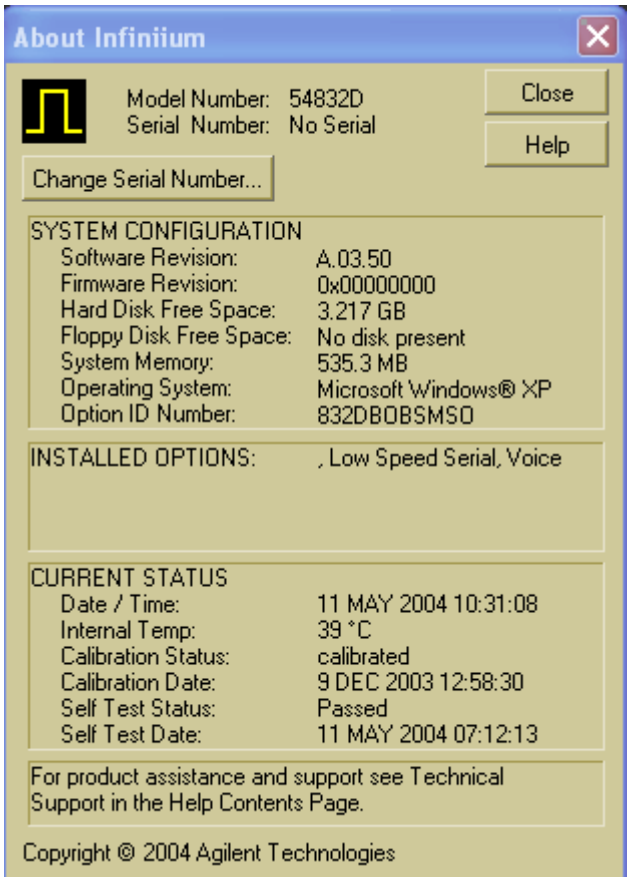
Acquisition Trouble Isolation

Software Revisions

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

A dialog box appears showing the current version number for the oscilloscope software and on-line information system software. This information may be useful when contacting Agilent Technologies for further service information. See Figure 5-9.

Figure 5-9



About Infiniium... Information

6

Replacing Assemblies

Replacing Assemblies

Use the procedures in this chapter when removing and replacing assemblies and parts in the Agilent Technologies 54830 Series oscilloscope.

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 while power is applied.

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 number
   - oscilloscope serial number
   - 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 cover

Use these steps to remove and replace the cover. When necessary, refer to other removal procedures.

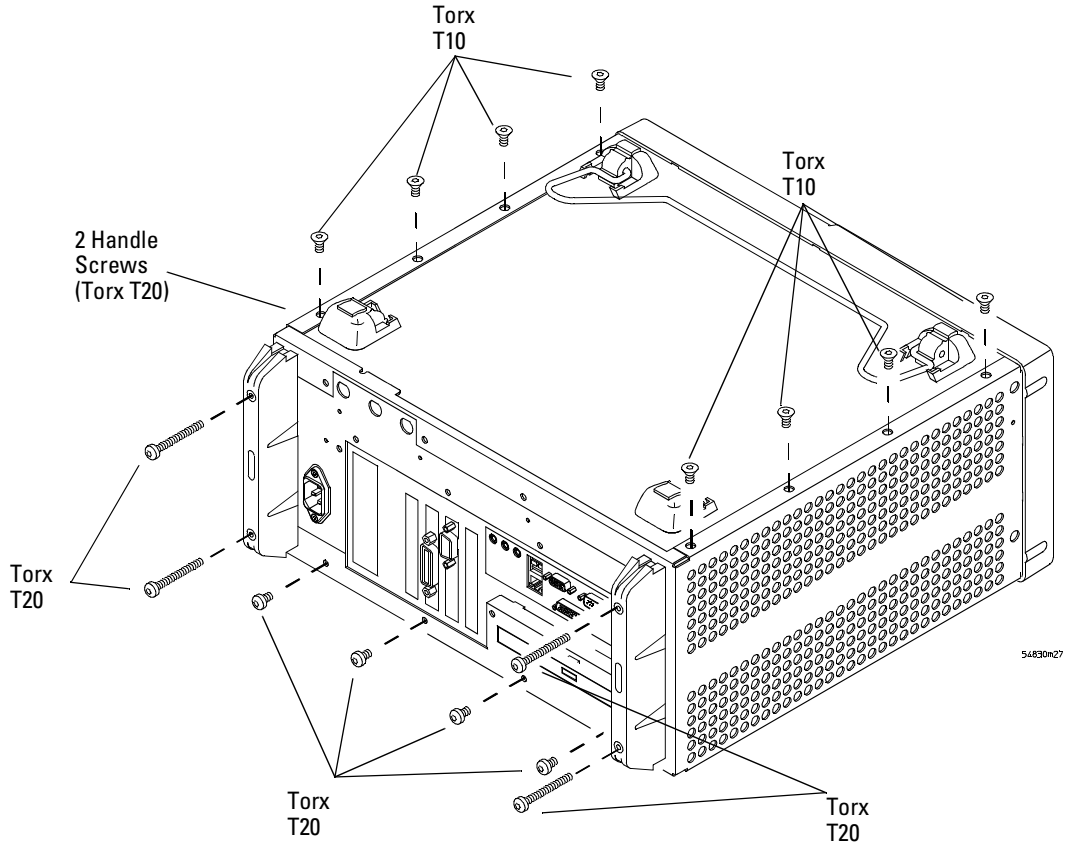
1. Disconnect the power cable.
2. Disconnect all oscilloscope probes and BNC input cables from the front panel.
3. Disconnect any other cables, such as mouse, keyboard, printer, or GPIB cables.
4. Remove the two Torx T20 screws securing the side handle.
5. Remove the four Torx T20 screws that secure the rear feet (two in each foot).
6. Remove the eight Torx T20 screws that secure the top sleeve and the bottom sleeve to the chassis.
7. Place the unit so the bottom is facing up.
8. Remove the eight Torx T10 screws that secure the bottom sleeve to the chassis.
9. Set the unit on its bottom. Carefully slide the top sleeve off of the frame by pulling the front panel and the cover away from each other.
10. Set the unit on its top. Carefully slide the bottom sleeve off of the frame.
11. To replace the cover, reverse the above procedure.

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

CAUTION

PROPERLY TIGHTEN HANDLE AND SCREWS!
Torque the side handle and rear feet screws to 2 Nm (18 in-lb).

Figure 6-1



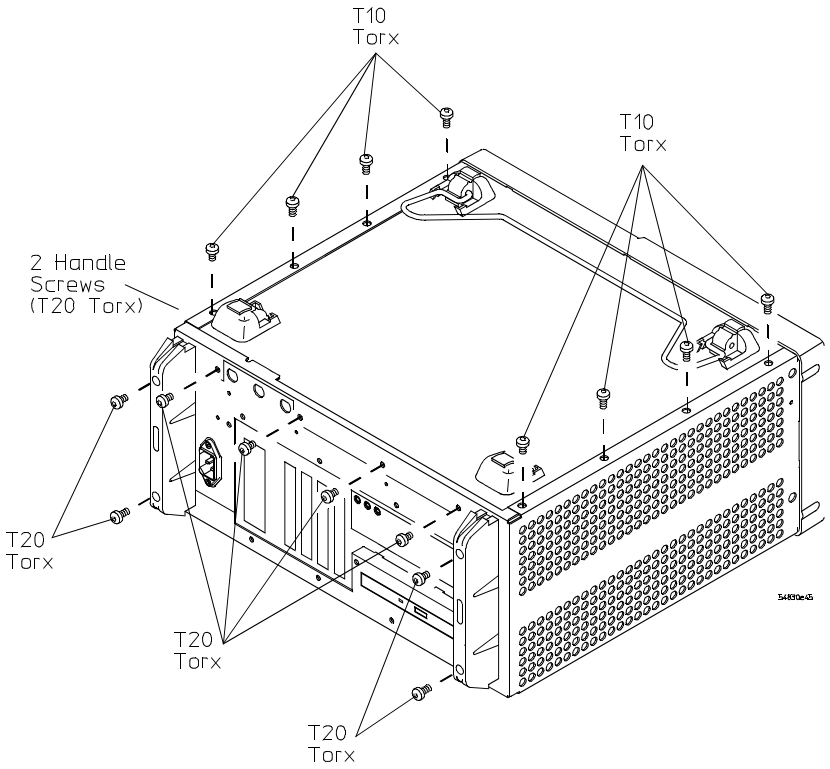
Cover Fasteners

To remove and replace the bottom sleeve

Use these steps to remove the bottom sleeve.

1 Disconnect the power cable.
2 Disconnect all oscilloscope probes and BNC input cables from the front panel.
3 Disconnect any other cables, such as mouse, keyboard, printer, or GPIB cables.
4 Place the unit so the bottom is facing up.
5 Remove the four Torx T20 screws that secure the rear feet (two in each foot).
6 Remove the eight Torx T10 screws that secure the bottom to the chassis.
7 Remove the four Torx T20 screws that secure the back panel to the chassis.

Figure 6-2

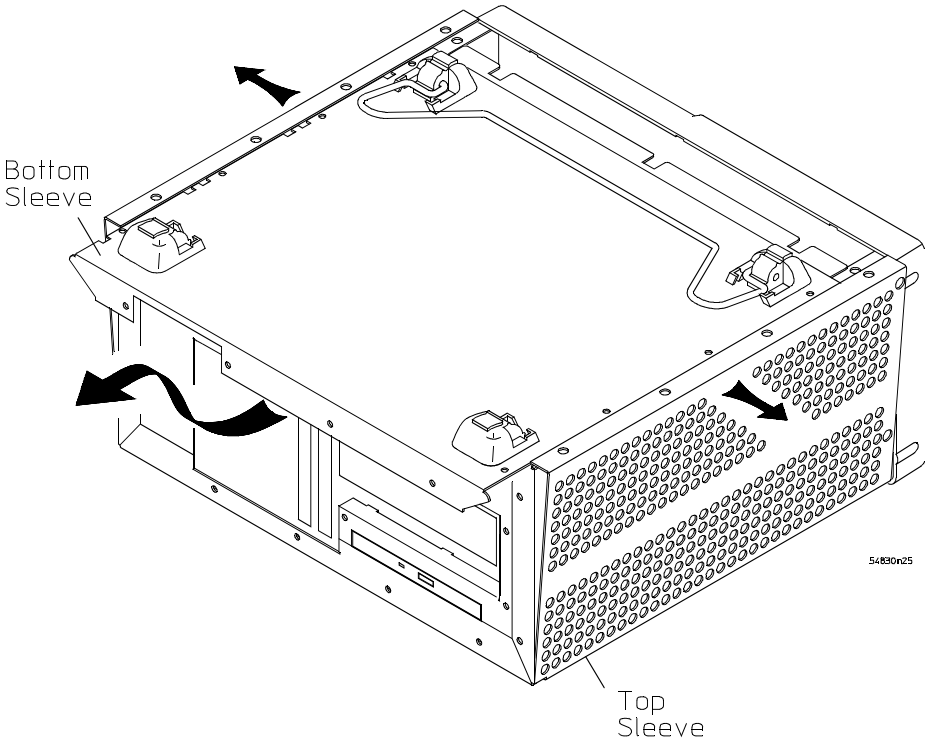


Bottom Sleeve Fasteners

8 Remove the two T20 handle screws to remove the handle.

9 Gently lift the bottom sleeve up and out. Be careful to not catch the feet on the chassis.

Figure 6-3



Remove Bottom Sleeve

10 To replace the bottom sleeve, reverse the above procedure.

CAUTION PROPERLY TIGHTEN HANDLE AND SCREWS!
Torque the side handle and rear feet screws to 2 Nm (18 in-lb).

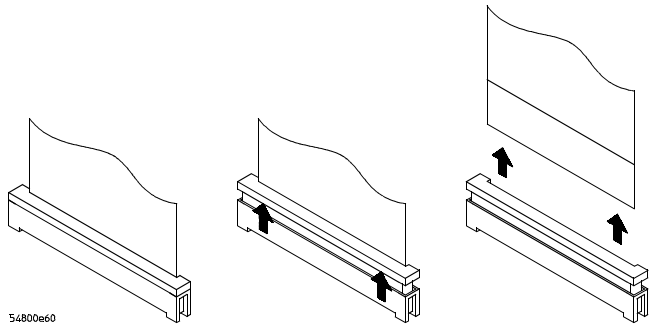
To disconnect and connect Mylar flex cables

Use this procedure when you are instructed to disconnect or connect a Mylar flex cable. Such 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 6-4

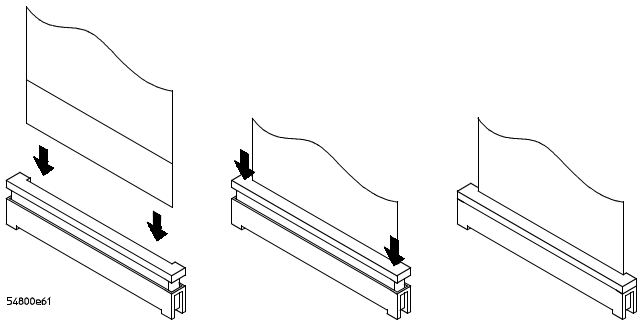


Disconnecting a Mylar Ribbon Cable

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 6-5



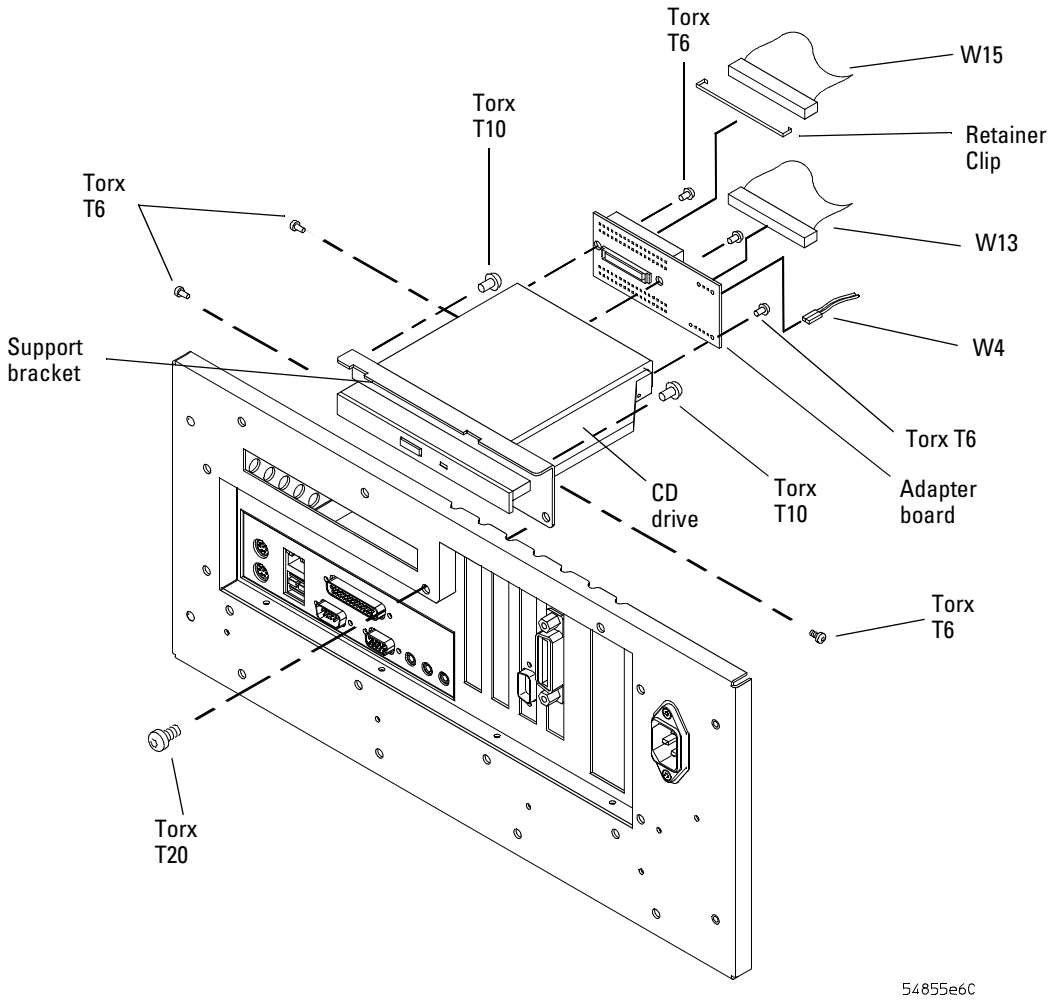
Connecting Mylar Ribbon Cables

To remove and replaced the CD-ROM drive

Use this procedure to remove and replace the CD-ROM drive. When necessary, refer to other removal procedures.

1. Disconnect the power cable and remove the top sleeve.
2. Remove the following cables:
   - IDE Cable (W15)
   - CD-ROM Power cable (W4)
   - IDE Cable (W13) (Not used in oscilloscopes with option 017)
3. Using a T10 driver, remove the two CD-ROM support bracket screws holding the CD-ROM drive in place.
4. Using a T20 driver remove the back panel screw holding the CD-ROM drive in place.
5. Move the CD-ROM drive back towards the front frame, then lift and pull to remove.
6. Using a T6 driver, remove the three screws securing the CD-ROM to the support bracket.

Figure 6-6



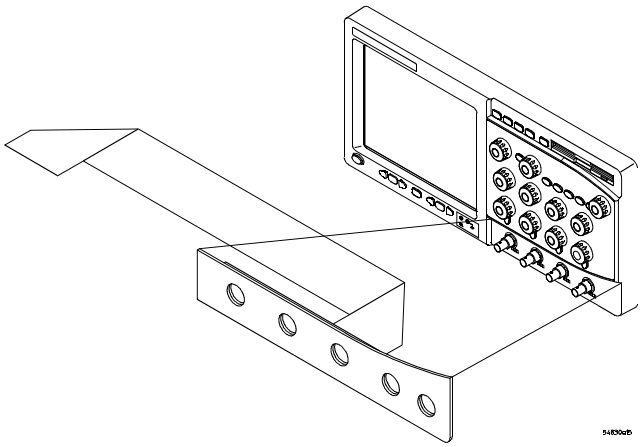
Removing the CD-ROM Drive

7 Remove the A4 CD-ROM Adapter Board from the rear of the CD-ROM.
8 To replace the CD-ROM drive, reverse the above procedure with a new drive.

To remove and replace the AutoProbe assembly

Use this procedure to remove and replace the AutoProbe assembly. When necessary, refer to other removal procedures.

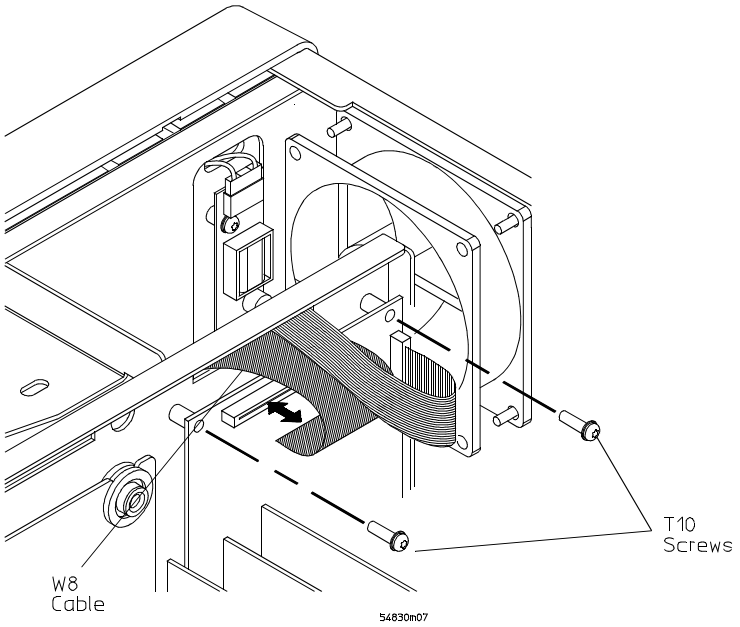
Figure 6-7



AutoProbe Assembly

1. Disconnect the power cable and remove the top and bottom sleeves.
2. Remove the AutoProbe connector assembly, the subpanel, and the probe connector assembly that fits around the front-panel BNC connectors, by doing the following:
   a. Disconnect the mylar ribbon cable W8 from the Probe Power and Control Board, A9.
   See "To disconnect and connect Mylar flex cables" in this chapter.

Figure 6-8

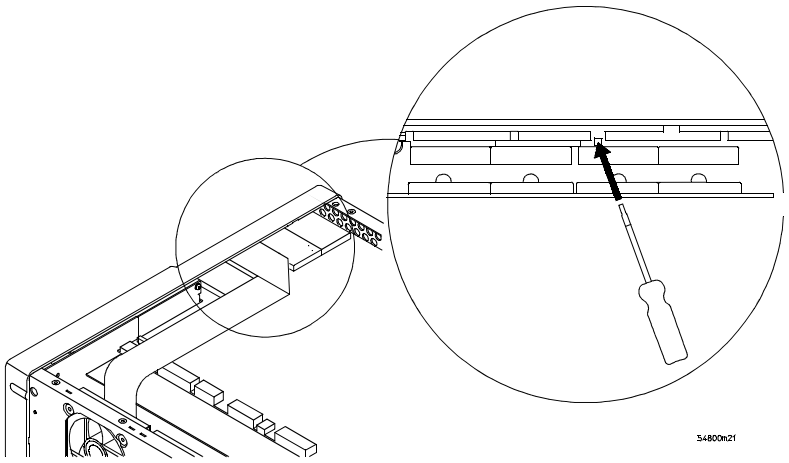


Disconnecting W8

b Locate the access hole in the front-panel assembly below and almost between channel two and channel three attenuators.

c From the back of the front panel, use 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 6-9

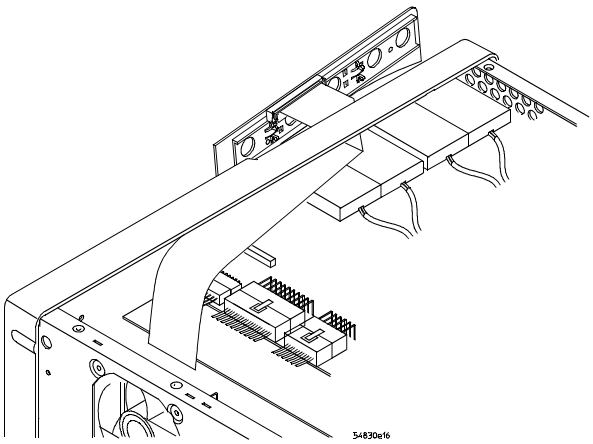


Access Hole

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 Finish removing the AutoProbe assembly by feeding the mylar ribbon cable through the front panel slot.

Figure 6-10



Pushing Out the AutoProbe Faceplate

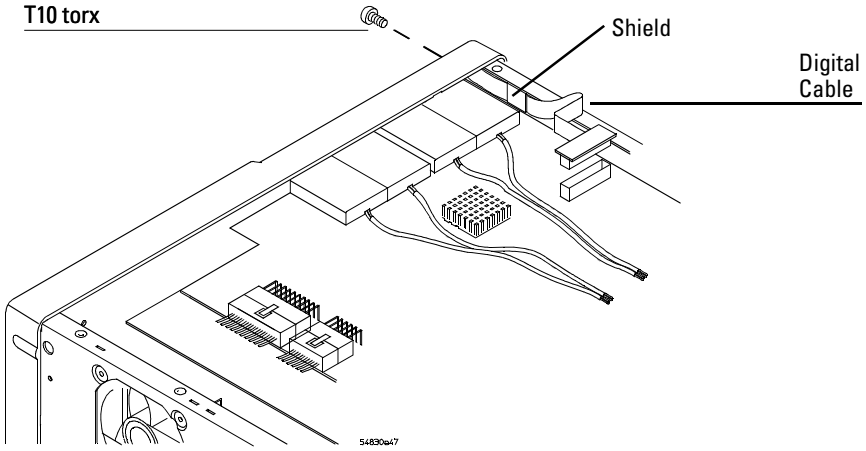
3 To replace the AutoProbe assembly, reverse the above procedure.

To remove and replace the internal digital input cable (MSO models only)

Use this procedure to remove and replace the W24 internal digital cable. When necessary, refer to other removal procedures.

1. Disconnect the power cable and remove the bottom sleeve.
2. Remove the autoprobe board assembly from the front frame.
3. Disconnect the W24 internal digital cable from the A1 acquisition board.
4. Clip the tie wraps holding the digital cable and shield to the side of the chassis.
5. Using a T10 driver remove the screw holding the W24 internal digital cable to the front panel.

Figure 6-11



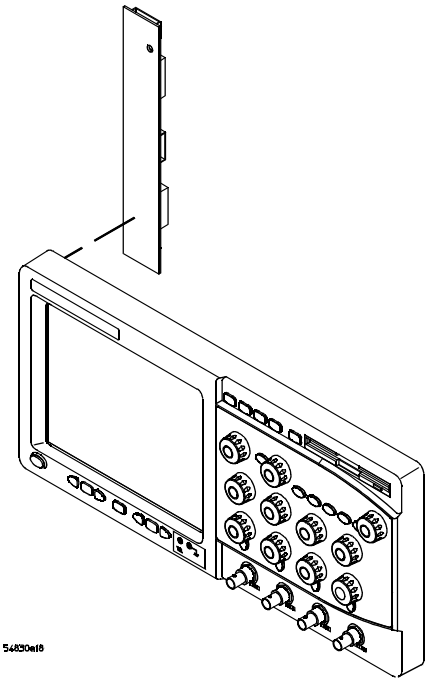
Removing the Internal Digital Cable

6. Pull the W24 internal digital cable out through the rear of the front panel.
7. To replace the W24 internal digital cable, reverse the above procedure.

To remove and replace the backlight inverter board

Use this procedure to remove and replace the backlight inverter board. When necessary, refer to other removal procedures.

Figure 6-12



Backlight Inverter Board

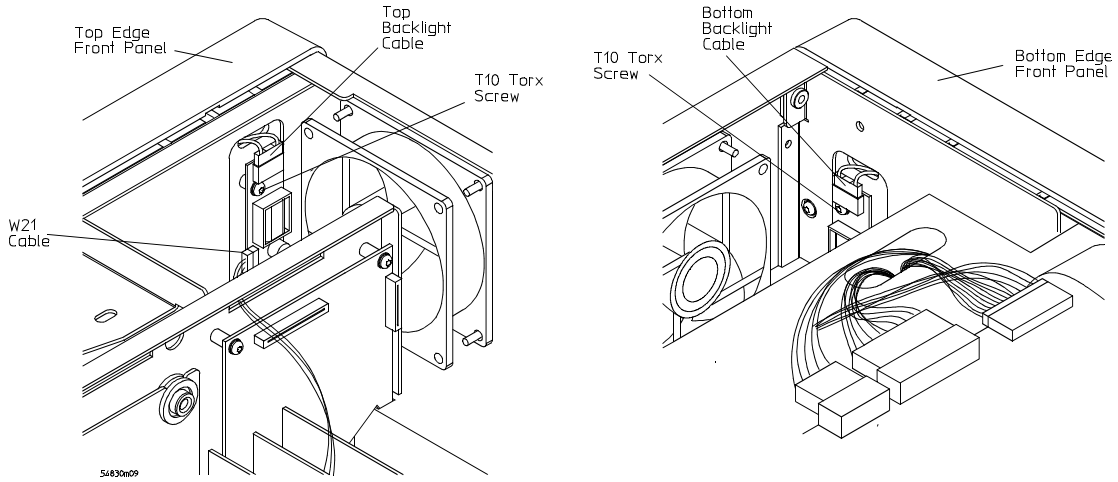
WARNING

SHOCK HAZARD!
The backlight inverter assembly, which is mounted at the front corner of the oscilloscope near the flat-panel display, operates at high voltages from 300-1 kV ac_{rms}. DO NOT handle this assembly while it is in operation.

1. Disconnect the power cable and remove the top and bottom covers.
2. Disconnect the two backlight cables from the top and bottom of the backlight inverter board.
   You can either stand the chassis on end or turn it over to gain access to both cables.
3. Disconnect the backlight primary cable W21 from the side of the backlight inverter board.
4. Using a long T10 driver, remove the two Torx T10 screws that secure the backlight inverter board to the chassis.

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

Figure 6-13



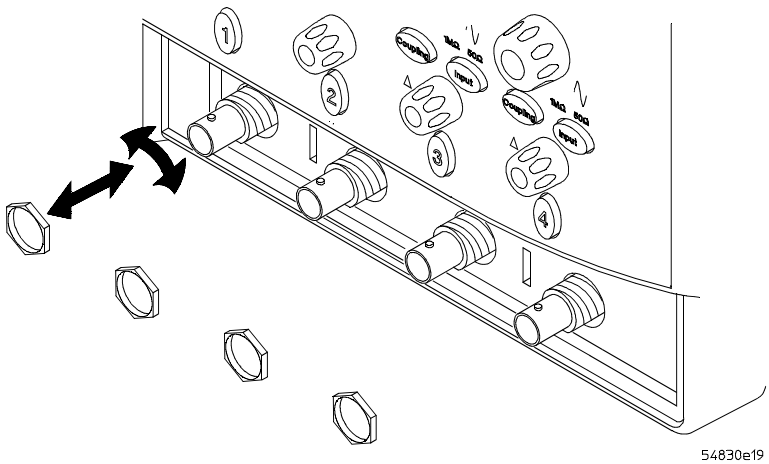
Removing the Backlight Inverter Board

To remove and replace the front panel assembly

Use these steps to remove and replace the front panel assembly. When necessary, refer to other removal procedures.

1 Disconnect the power cable and remove the cover.
2 Remove the AutoProbe assembly A16 and Mylar flex cable W8.
3 Remove the W24 Internal digital cable if you have an MSO model oscilloscope.
4 Remove the hex nuts that secure the BNC connectors to the front panel.
Use a 9/16” nut-driver to remove the hex nuts.

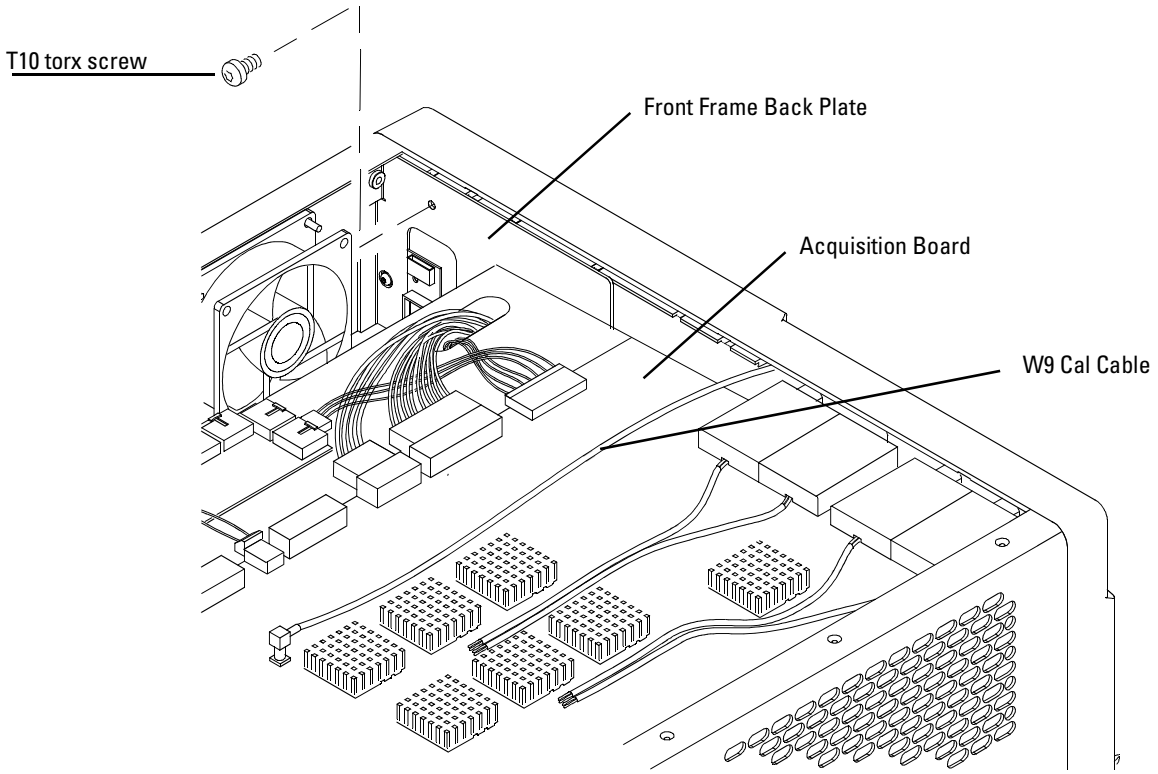
Figure 6-14



Removing the BNC Nuts

5 Disconnect the cal cable W9 from J14 on the acquisition board.
6 Using a T10 driver, remove the Torx T10 screw from the front frame back plate.

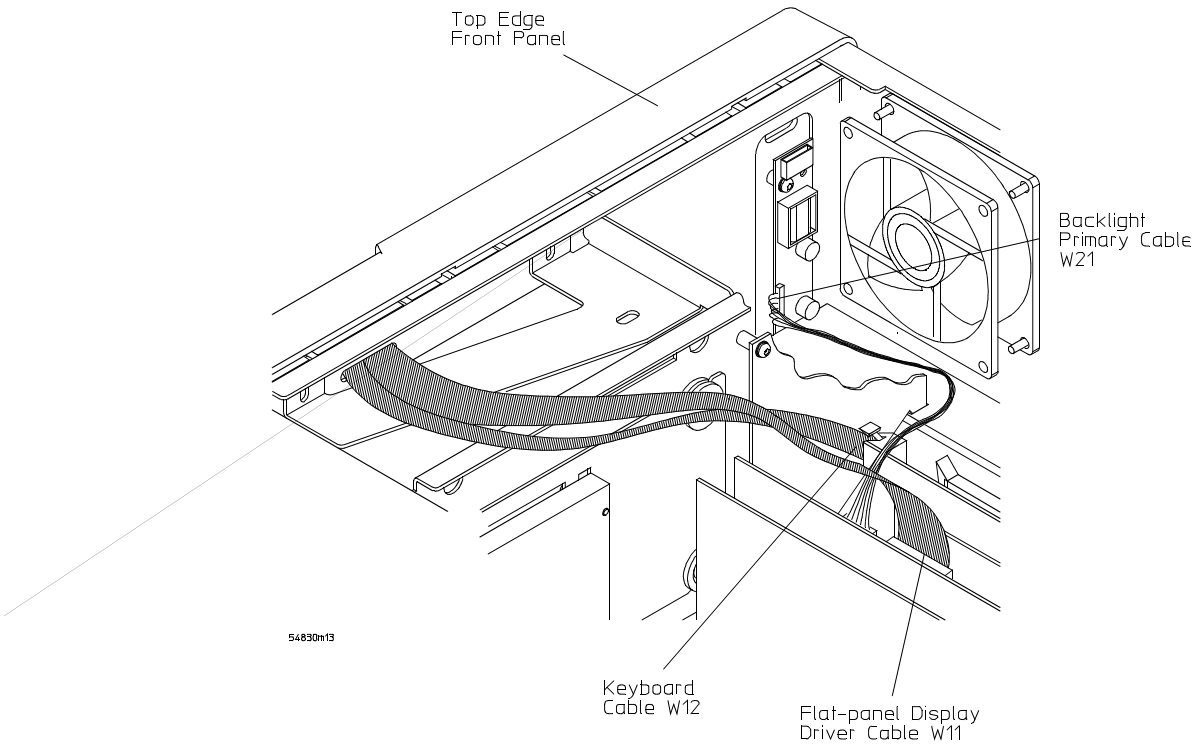
Figure 6-15



Cal Cable W9

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

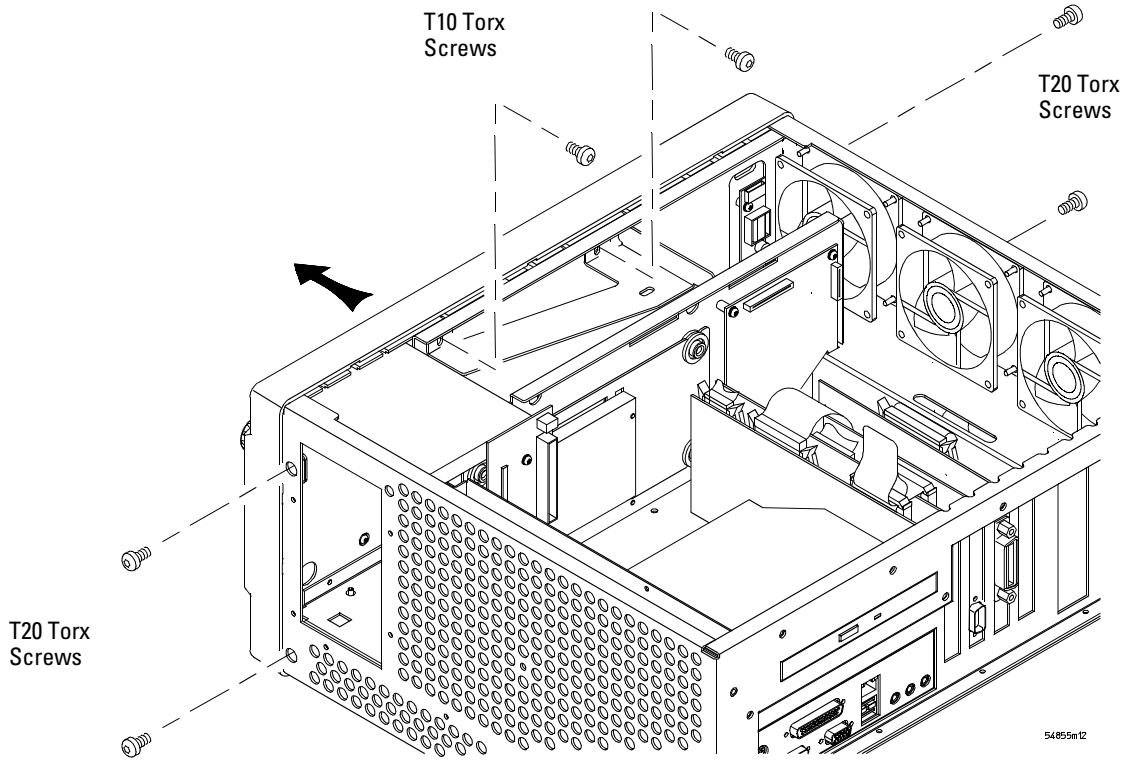
Figure 6-16



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

8 Remove the four Torx T20 screws that secure the chassis sides to the front panel assembly.

Figure 6-17



Front Panel Side Screws

9 Remove the two Torx T10 screws that secure the chassis front to the front panel assembly.

10 Pull the front panel assembly away from the chassis, being careful to feed the ribbon cables W11 and W12 out through the slot in the front of the chassis and not to damage the backlight inverter board.

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

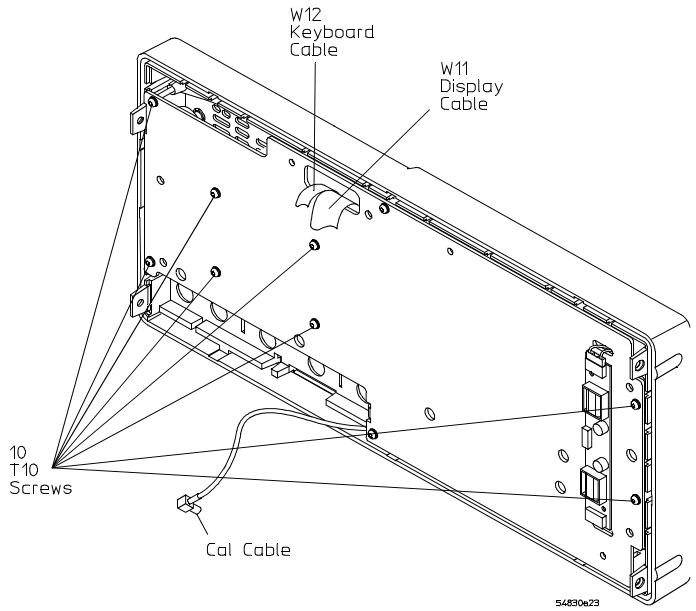
Ensure that you observe polarity designations when reconnecting the ribbon cables.

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

Use these steps to disassemble and reassemble the front panel assembly, including the keyboard and flat-panel display. 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 6-18



Front Panel Cover Plate Screws

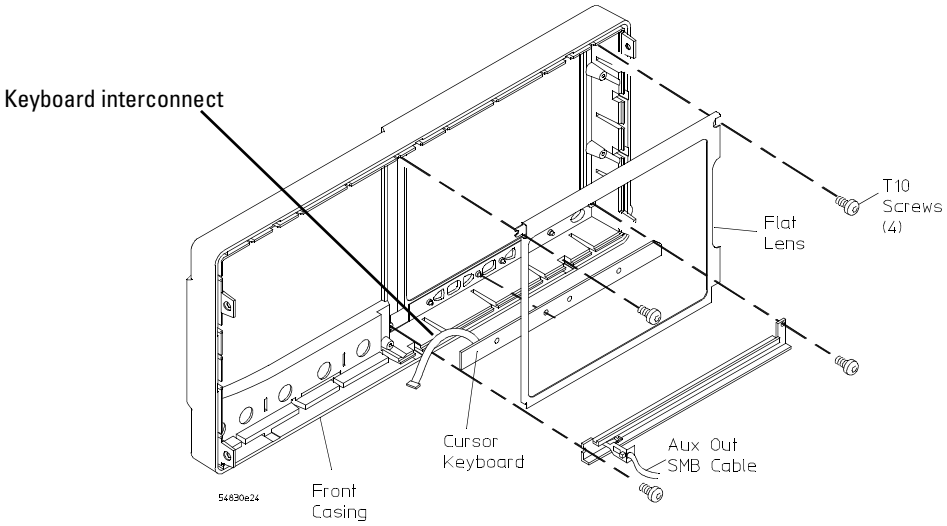
4 Carefully feed the front-panel keyboard cable W12 and the flat-panel display driver cable W11 through the cable access hole while separating the front panel cover plate from the front casting.

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

5 To remove the main keyboard, disconnect the cursor keyboard cable W20, pull off the knobs, and lift out the keyboard.
6 To remove the flat-panel display from the front-panel cover plate, remove the three Torx fasteners.

7 To remove the cursor keyboard and flat lens, remove the four Torx T10 screws that secure the lens corners, then carefully remove the lens. You can lift the cursor keyboard directly out of the front casting.

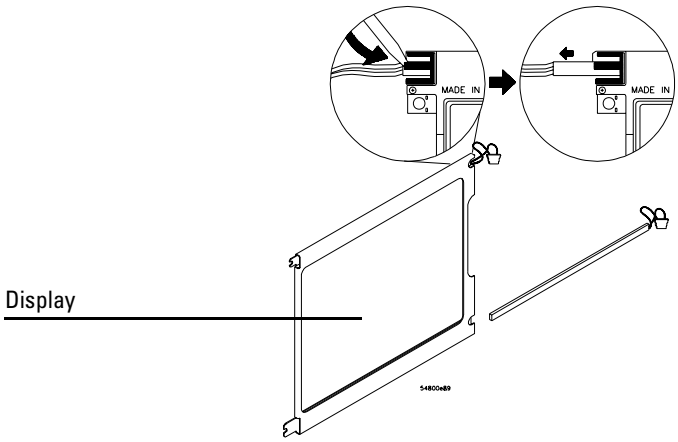
Figure 6-19



Removing the Cursor Keyboard

8 To remove the backlights, lift the tab and slide each backlight out of the flat-panel display.

Figure 6-20



Removing the backlights

9 To reassemble the front panel assembly, reverse the above procedure.

The cursor keyboard has holes that fit over locating pins in the front panel casting.

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

CAUTION

PREVENT GLASS BREAKAGE!
Use care when handling the Lens Glass and the FPD monitor to prevent glass breakage.

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

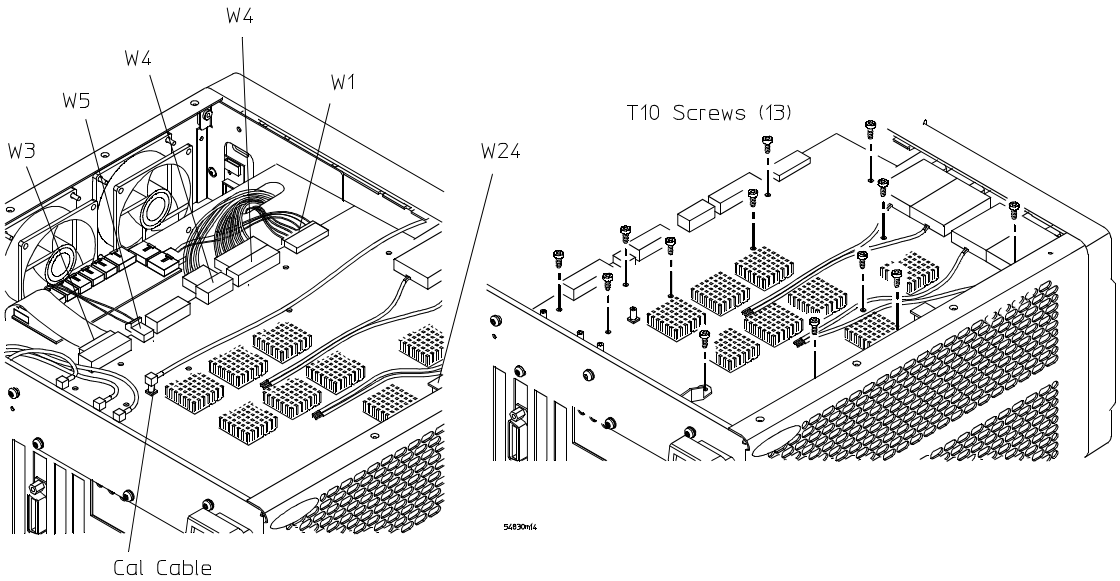
To remove and replace the acquisition board assembly

Use this procedure to remove and replace the acquisition assembly. When necessary, refer to other removal procedures.

1. Disconnect the power cable and remove the cover.
2. Remove the Probe Interface subpanel assembly.
3. Remove the hex nuts that secure the BNC connectors to the front panel.
   Use a 9/16" nut-driver to remove the hex nuts. See page 6–11.
4. Disconnect the three or four SMB cables from J13, J14, J15, and J16 from the Acquisition assembly.
   These cables are located behind the Aux Trigger Input BNC connector. See page 6–12.
5. Disconnect the following cables from the inside edge of the Acquisition assembly:
   - Power supply sense cable W1
   - Probe control cable W17
   - Power harness cable W4
   - Line sync cable W5
   - Acquisition cable W3
   - Internal digital cable W24 (MSO model oscilloscopes only)

   These cables are attached to J5, J150, J6, J7, J9, J10, and J18 connectors. The J18 connector is near the CH4 attenuator.
6. Remove the twelve Torx T10 screws that secure the acquisition board to the chassis, then lift the board back from the front panel until the BNC connectors clear the panel. Lift the board away from the chassis.

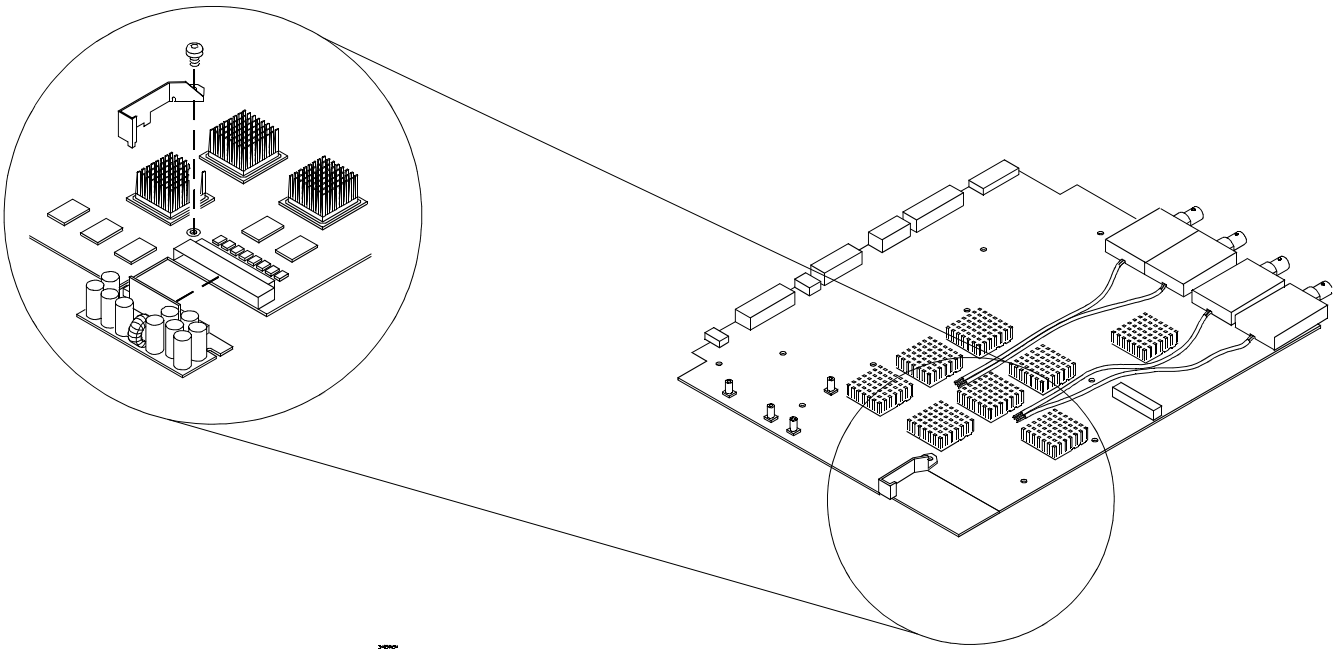
Figure 6-21



Removing the Acquisition Assembly

7 Remove the power board from the acquisition assembly.

Figure 6-22



Removing the Power Board

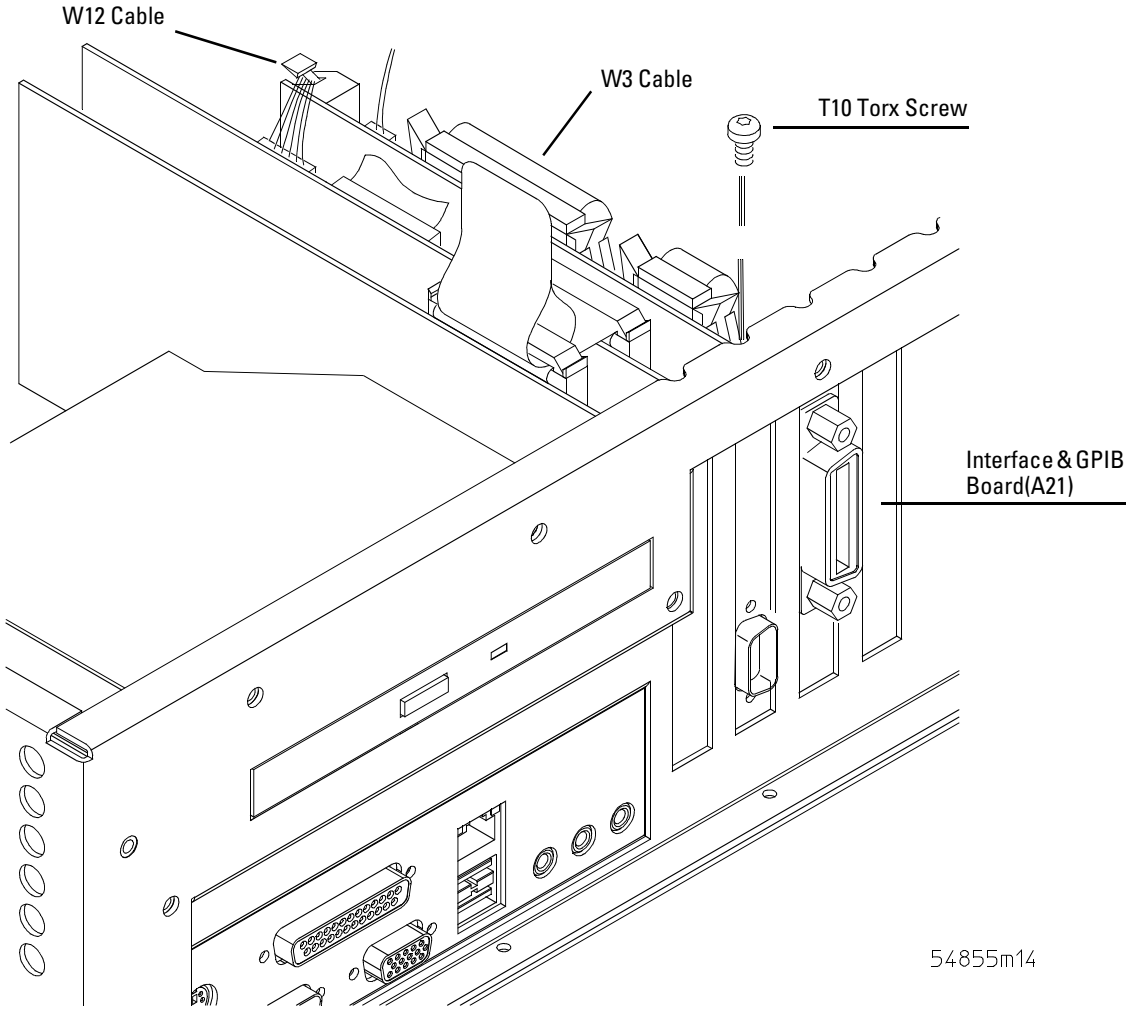
8 To re-install the acquisition board assembly, reverse the above procedure. Be sure to observe correct polarity for all cables.

To remove and replace the interface and GPIB board

Use this procedure to remove and replace the interface and GPIB board, A21. When necessary, refer to other removal procedures.

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

Figure 6-23



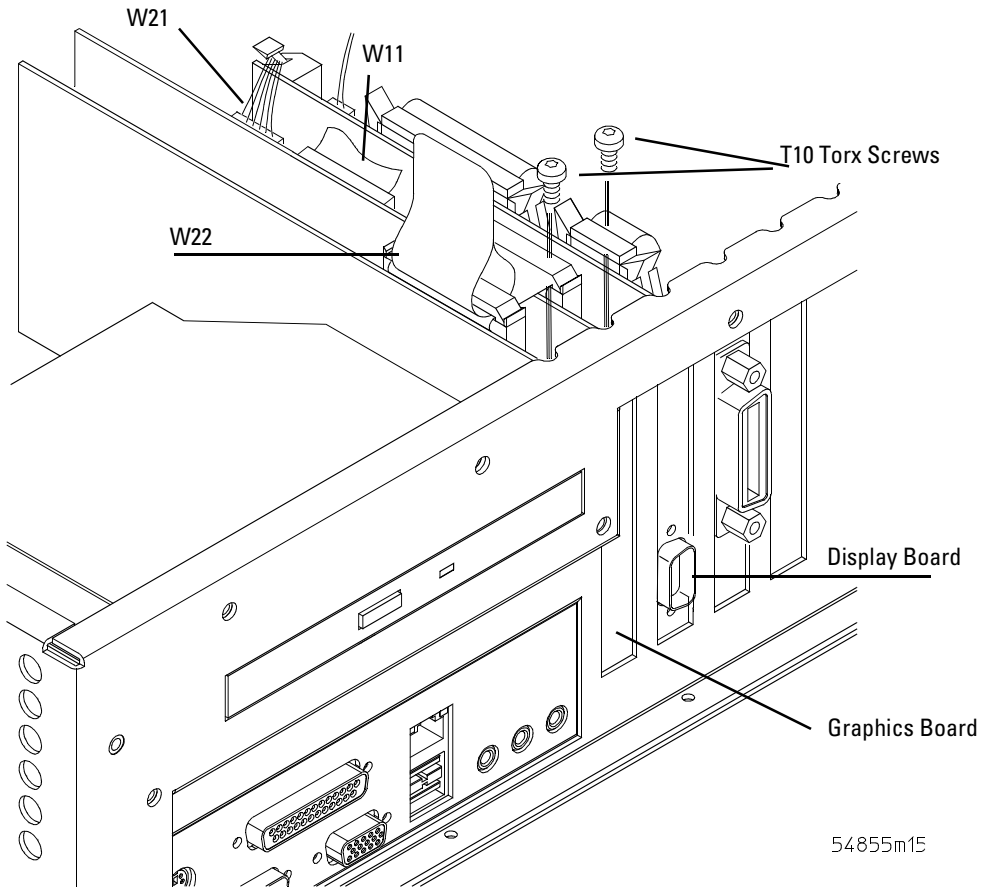
Removing the Interface and GPIB Board

To remove and replace the oscilloscope graphics board and display board

Use these steps to remove and replace the oscilloscope interface board and display board. When necessary, refer to other removal procedures.

1. Disconnect the power cable and remove the cover.
2. Disconnect these cables from the display board:
   - Bridge cable W22
   - Backlight primary cable W21
   - Display video cable W11
3. Remove the two Torx T10 screws that secure the oscilloscope interface and display boards to the chassis.
   These screws are at the rear of the chassis.

Figure 6-24



Removing the Oscilloscope Interface and Display Boards

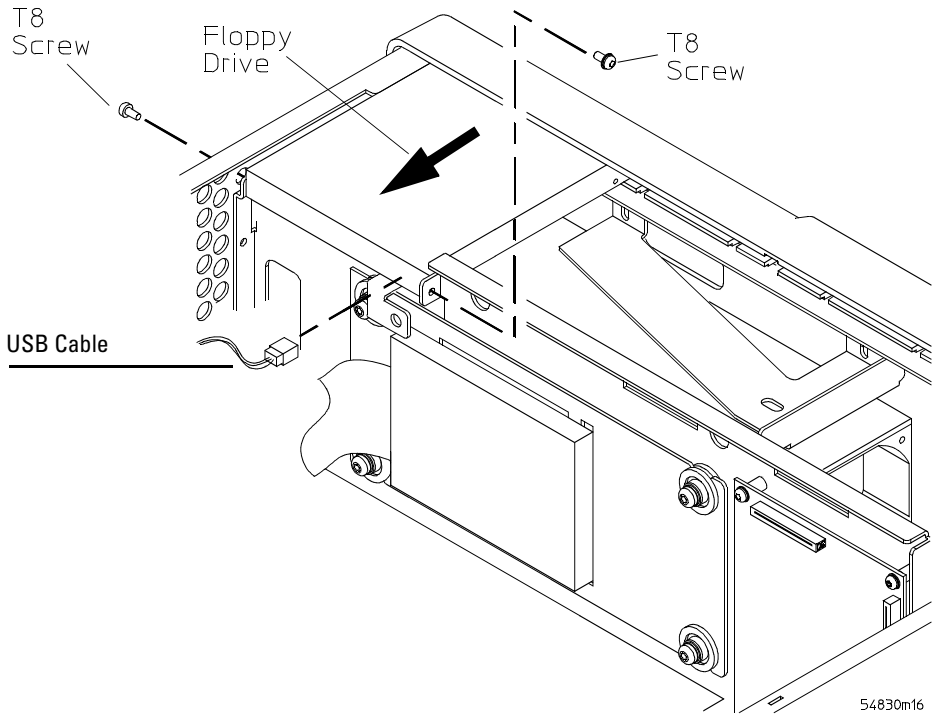
4. Grasp the graphics board at the top corners and pull the board straight up until it is free of the card cage.
5. Grasp the display board at the top corners and pull the board straight up until it is free of the card cage.
6. To replace the oscilloscope graphics and display boards, reverse the above procedure.
   Be sure to observe correct polarity on all cables when replacing the boards.

To remove and replace the floppy disk drive

Use this procedure to remove and replace the floppy disk drive. When necessary, refer to other removal procedures.

1 Disconnect the power cable and remove the top sleeve.
2 Remove USB cable from the floppy drive.
3 Using a T8 driver remove the two side screws holding the floppy disk drive in place.
4 Pull the floppy disk drive from the front frame.

Figure 6-25



Removing the Floppy Disk Drive Screws

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

To remove and replace the hard disk drive

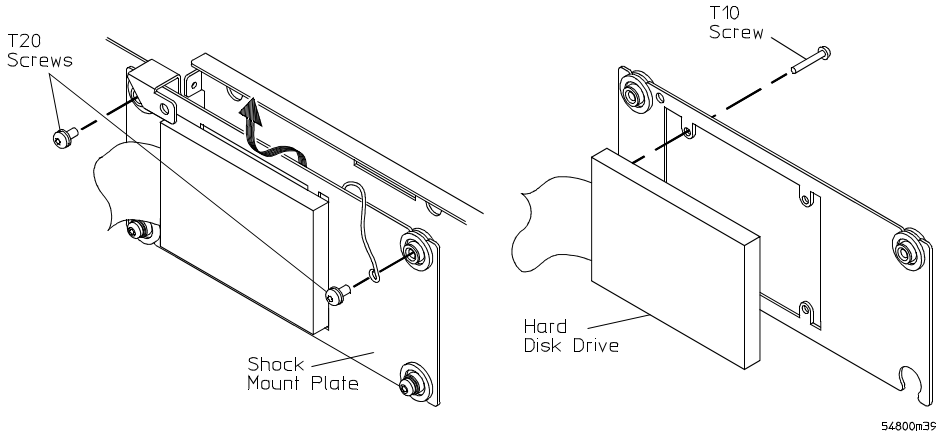
No internal hard disk drive is installed in oscilloscopes with option 017 installed.

1 Disconnect the power cable and remove the top sleeve.
2 Remove the hard drive IDE cable.

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

3 Using a T20 driver remove the two screws holding the shock mount in place.
4 Tilt the disk drive assembly forward and lift up to remove.
5 Using a T10 remove the four screws holding the disk drive onto the shock mount.

Figure 6-26



Removing the Hard Disk Drive

6 To replace the hard disk reverse, the above procedure with a new hard drive.

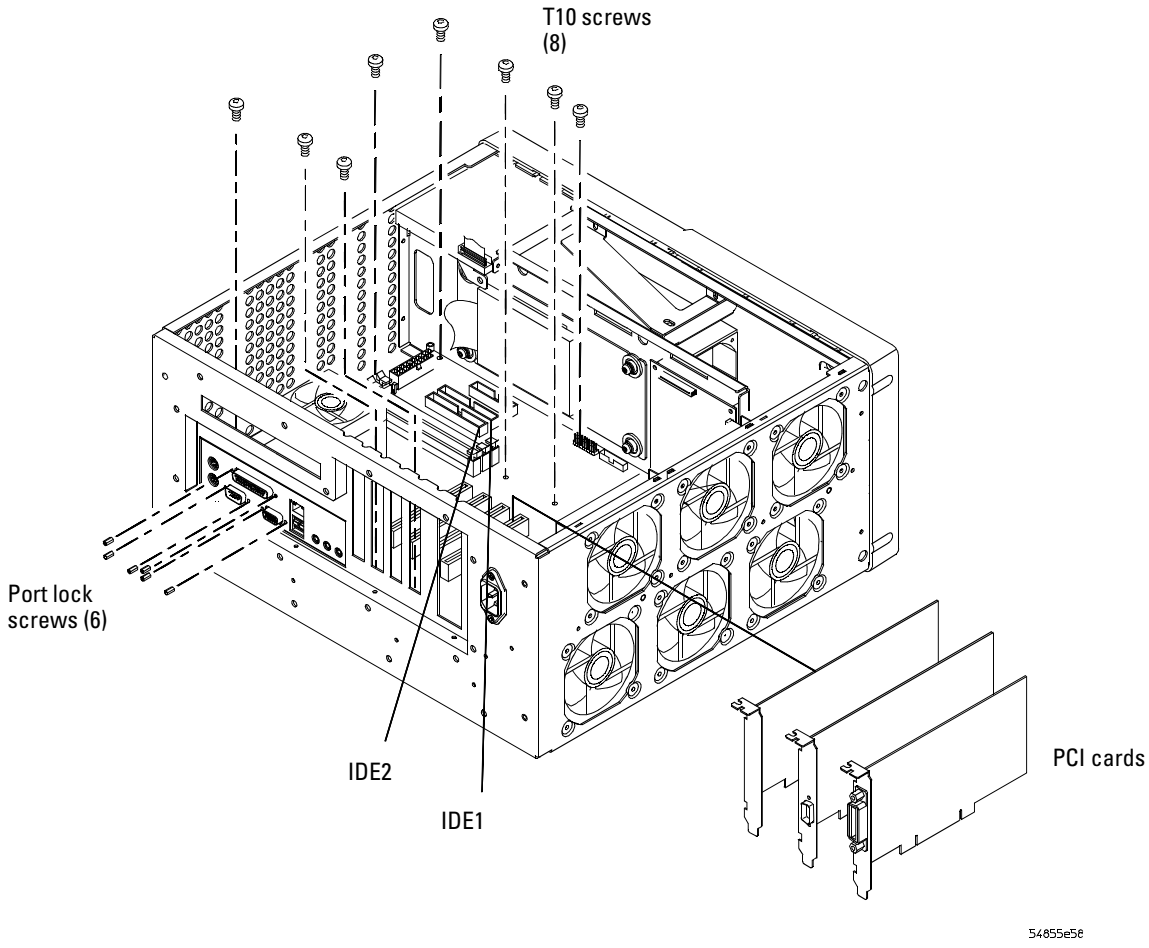
CAUTION DO NOT OVER TIGHTEN THE SCREWS!
Do not overtighten the T10 screws that secure the Hard Disk Drive to the bracket. Torque to 3 in-lb.

To remove and replace the motherboard

Use the following procedure to remove and replace the motherboard assembly. When necessary, refer to other removal procedures.

1. Disconnect the power cable and remove the cover.
2. Remove the CD-ROM drive.
3. Remove all cables from the PCI cards.
4. Remove all PCI cards from the motherboard.
5. Disconnect all cables from the motherboard.
6. Remove the six 5 mm hex nuts from the back panel connectors.
7. Remove the six T10 screws holding the motherboard to the ATX tray.

Figure 6-27



Removing the Motherboard

8. Remove the remaining T10 screws from the motherboard.
9. Lift the motherboard out of the tray.
10. To replace the motherboard assembly, reverse the above procedure.
11. Run the self test to verify the oscilloscope is operating properly.
See "Self Test Verification" in chapter 3.

To remove and replace the power supply

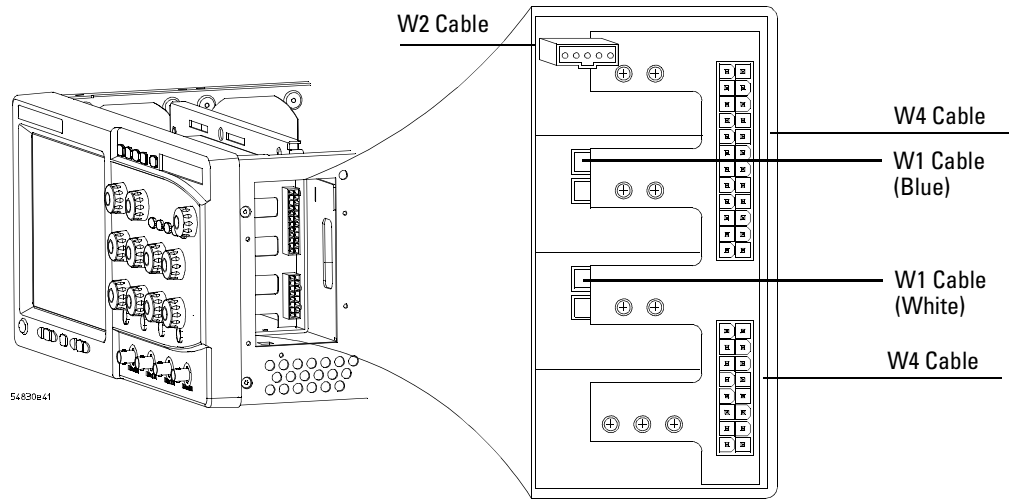
Use these steps to remove the power supply assembly. When necessary, refer to other removal procedures.

WARNING

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

1. Disconnect the power cable and remove the top cover.
2. Disconnect the cables from the front of the supply.
   Ensure the W1 cable is attached as shown in the diagram below.
3. Remove the motherboard subassembly.

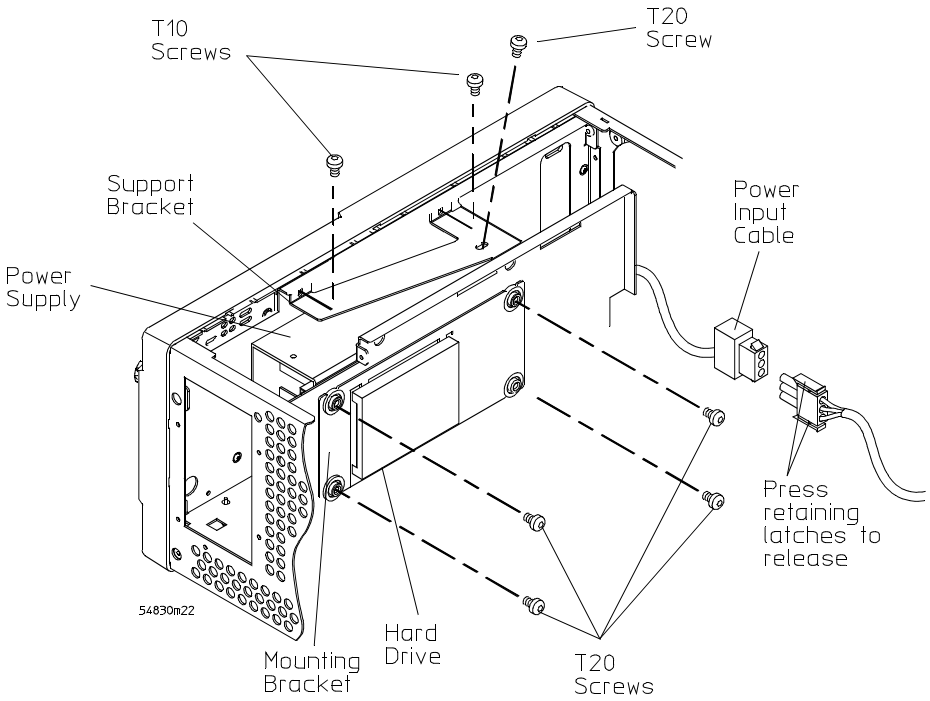
Figure 6-28



Power Supply Subassembly

4 Remove the Torx T20 screw that secures the power supply support bracket to the power supply.
5 Remove the two Torx T10 screws that secure the support bracket to the chassis.
6 Remove the four Torx T20 screws that secure the hard drive to the mounting bracket.

Figure 6-29



Removing the Motherboard Subassembly Torx Screws and Cables.

7 Separate the power input cable from the cable assembly to the power supply.
8 Lift the supply up and out of the chassis.
9 To replace the supply, reverse the installation procedure. Ensure that the AC power connector is aligned with the cutout in the rear panel, that the supply chassis rests on the two tabs in the oscilloscope chassis, and that the ground wire is routed through the notch at the rear of the power supply chassis.

Cable W2, which is the middle connector in front, connects to the pins toward the top of the supply.

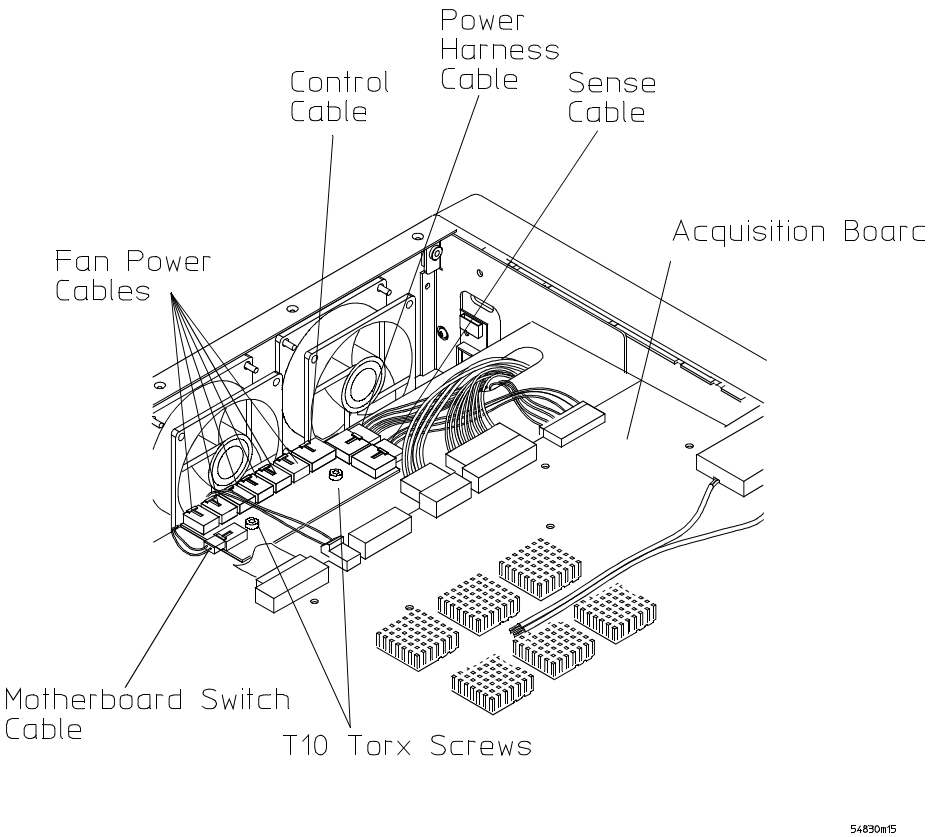
To ensure electrical safety, you must reconnect the ground wire to the chassis.

To remove and replace the fan controller board

1 Disconnect the power cable and remove the cover.
2 Disconnect the following cables from the fan control board.
- All six fan power cables from the fan control board
- Motherboard sense line 1 at P8
- Power supply control cable at P10
- Controller board power at P1
- Motherboard sense line 2 at P9

3 Remove the two T10 screws from the fan controller board.
4 Lift board out of chassis.
5 To re-install, reverse this procedure.

Figure 6-30



Removing the Fan Controller Board

To remove and replace a fan

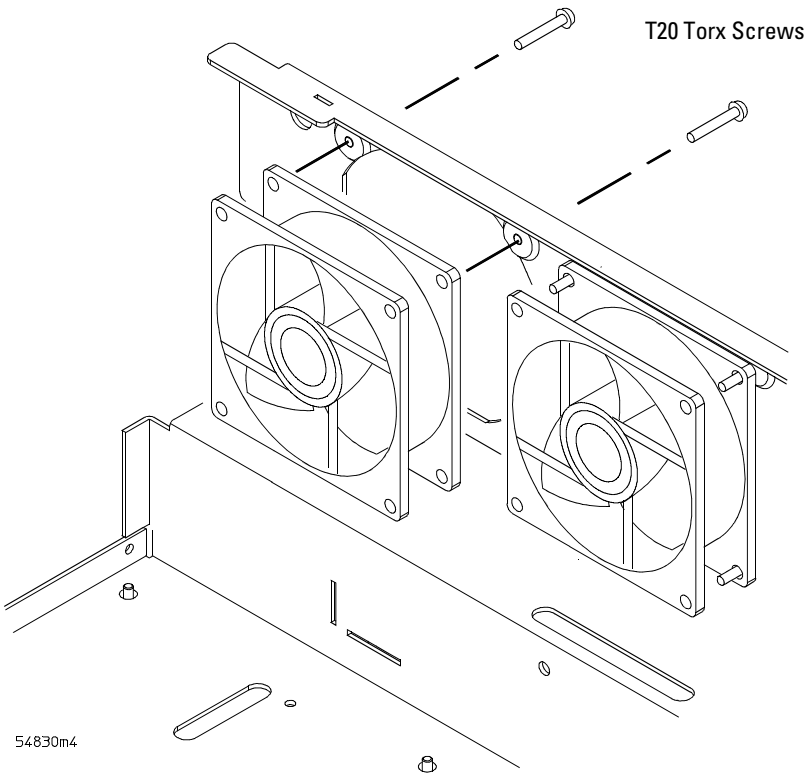
WARNING

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

Use this procedure to remove and replace the fans. When necessary, refer to other removal procedures.

1. Disconnect the power cable and remove the cover.
2. Disconnect the fan cable from the fan control board.
3. Remove the four T20 fan screws securing the fan to the chassis.

Figure 6-31



Removing Fan Fasteners

CAUTION

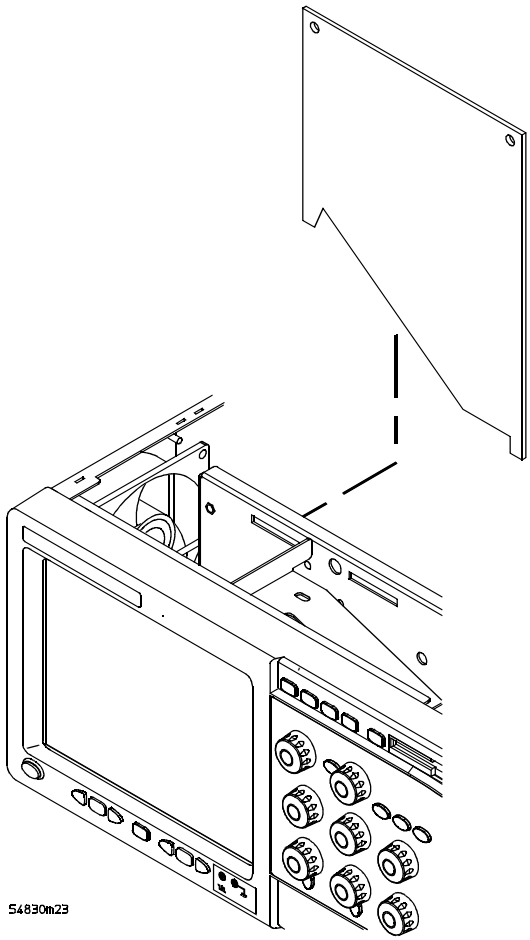
AVOID OVERHEATING THE oscilloscope!
When replacing the fan, be sure the direction of the fan air flow is coming from the inside to the outside of the oscilloscope. Check the flow arrows on the fan and check for proper flow once power is applied to the oscilloscope. Improper air flow can overheat the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

4. To install the fan, reverse this procedure.

To remove and replace the probe power and control assembly

Use this procedure to remove the probe power and control assembly. When necessary, refer to other removal procedures.

Figure 6-32



Probe Power and Control Assembly

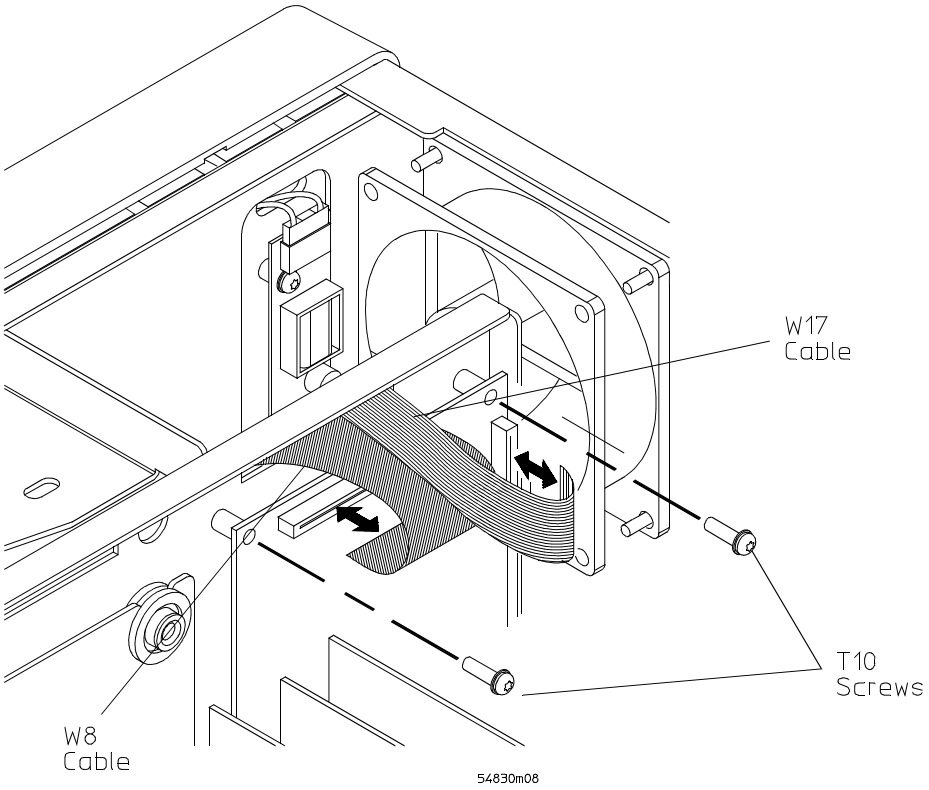
1. Disconnect the power cable and remove the top cover.
2. Disconnect the mylar flex cable W8 that connects the probe power and control assembly to the AutoProbe assembly.

   The connector must be unlocked before you can remove the flex cable. See "To disconnect and connect Mylar flex cables" in this chapter.
3. Disconnect the mylar flex cable W17 from the probe power and control assembly.
4. Remove the two Torx T10 screws securing the probe power and control assembly to the chassis.

Avoid Interference with the Fan
You may need to use a Torx key or stubby Torx driver to avoid interference with the fan.

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

Figure 6-33



Remove the Probe Power and Control Assembly

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.

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

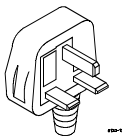
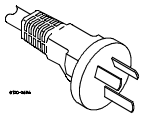
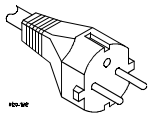
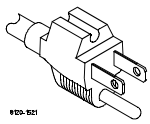
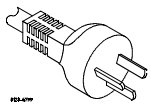
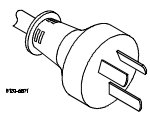
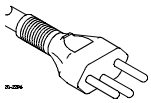
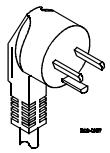
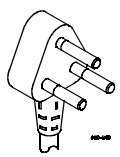
Some parts used in this oscilloscope have been set up for an exchange program. This program allows the customer to exchange a faulty assembly with one that has been repaired, calibrated, and performance-verified by the factory. The cost is significantly less than that of a new part. The exchange parts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

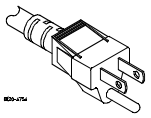
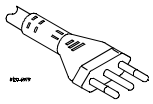
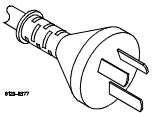
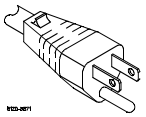
After receiving the repaired exchange part from Agilent Technologies, a United States customer has 30 days to return the faulty assembly. For orders not originating in the United States, contact the local Agilent Technologies service organization. If the faulty assembly is not returned within the warranty 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.

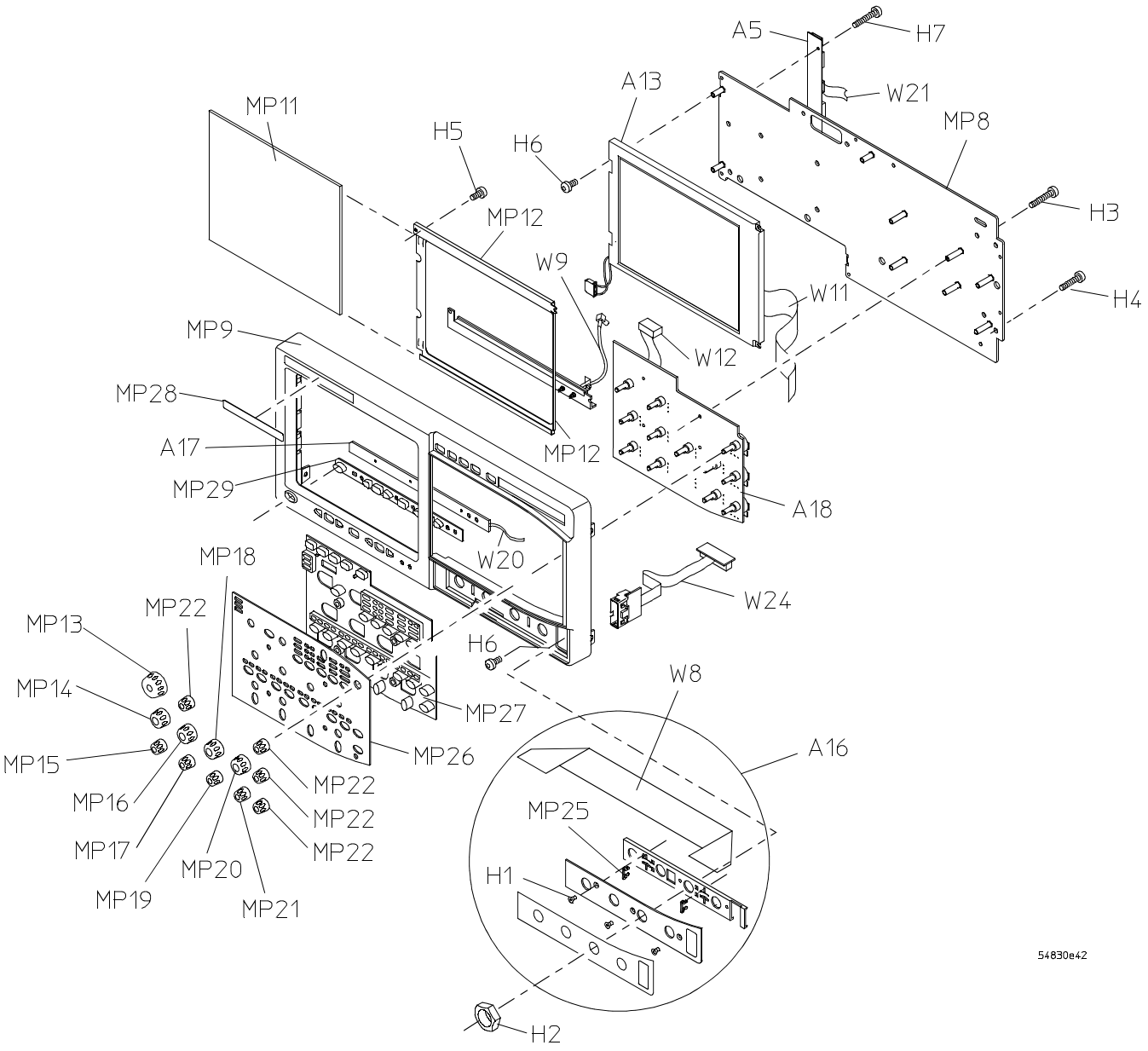
Power Cables and Plug Configurations

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

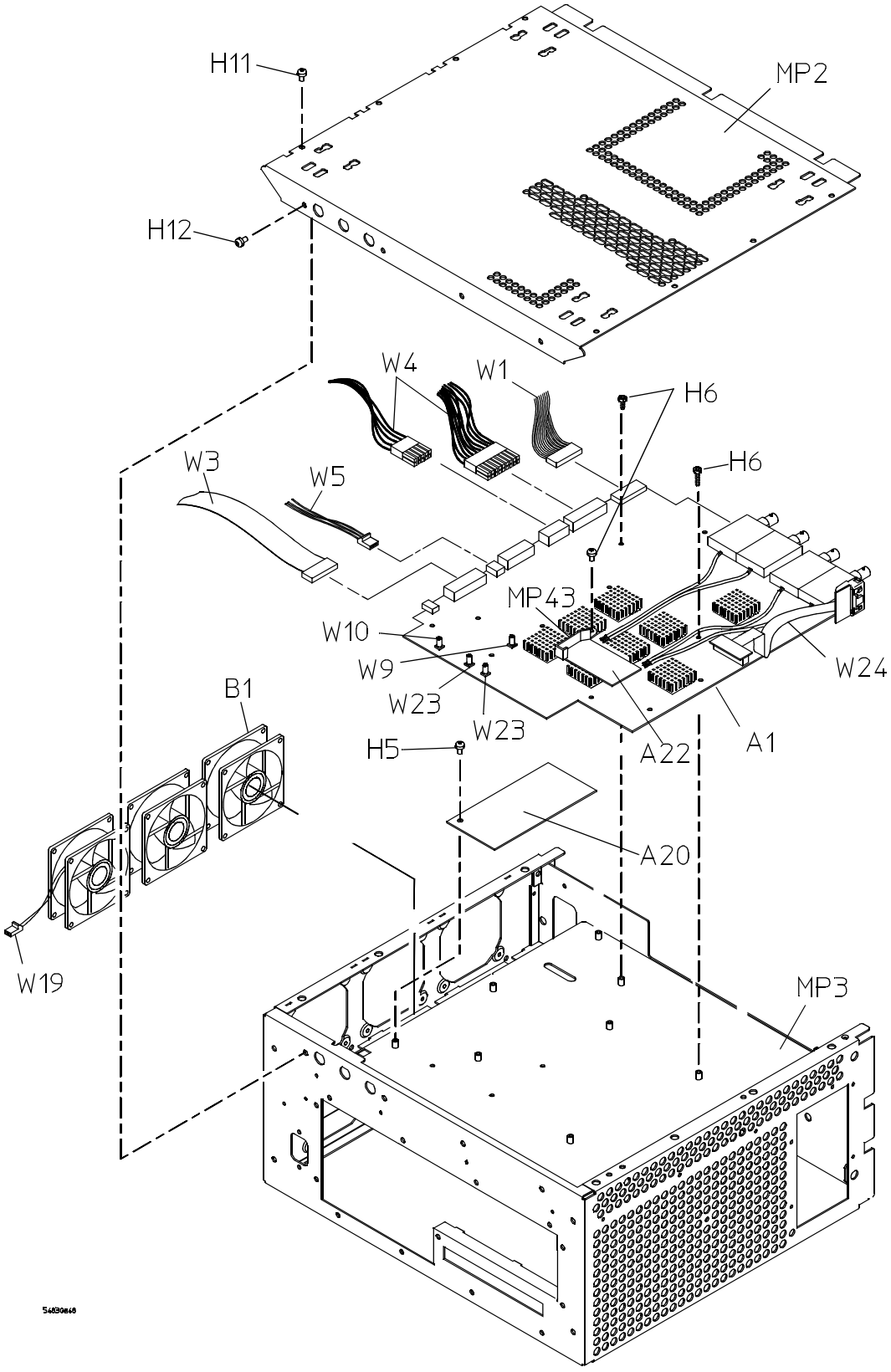
Plug Type	Cable Part No.	Plug Description	Length (in/cm)	Color	Country
Opt 918 100V 	8120-4754	90°	90/230		Japan
Opt 921 	8120-6979	90°			Chile
Opt 922 	8120-8377	90°			
Opt 927 	8120-8871	90°			Thailand

* 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

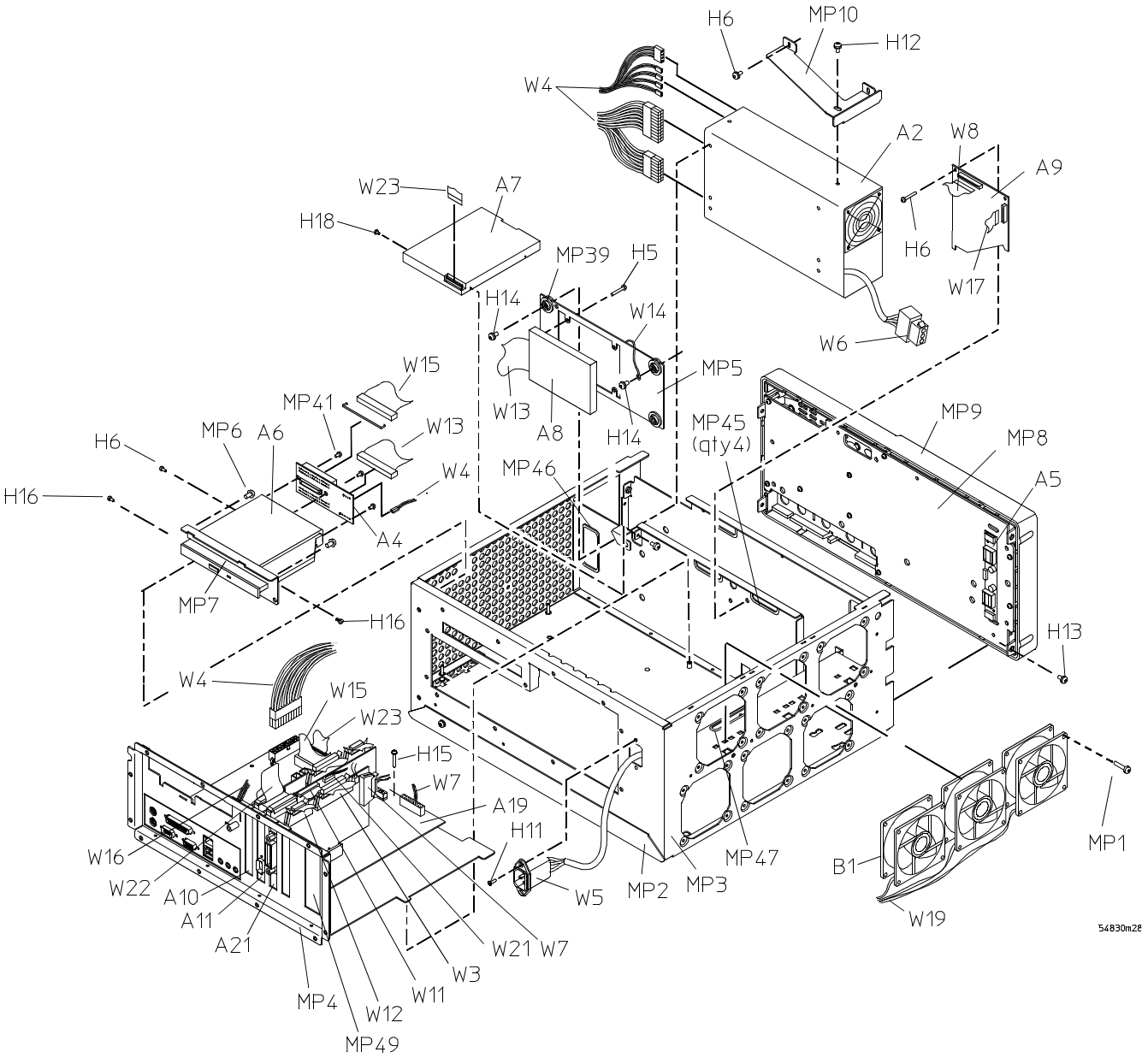


Front Frame and Front Panel

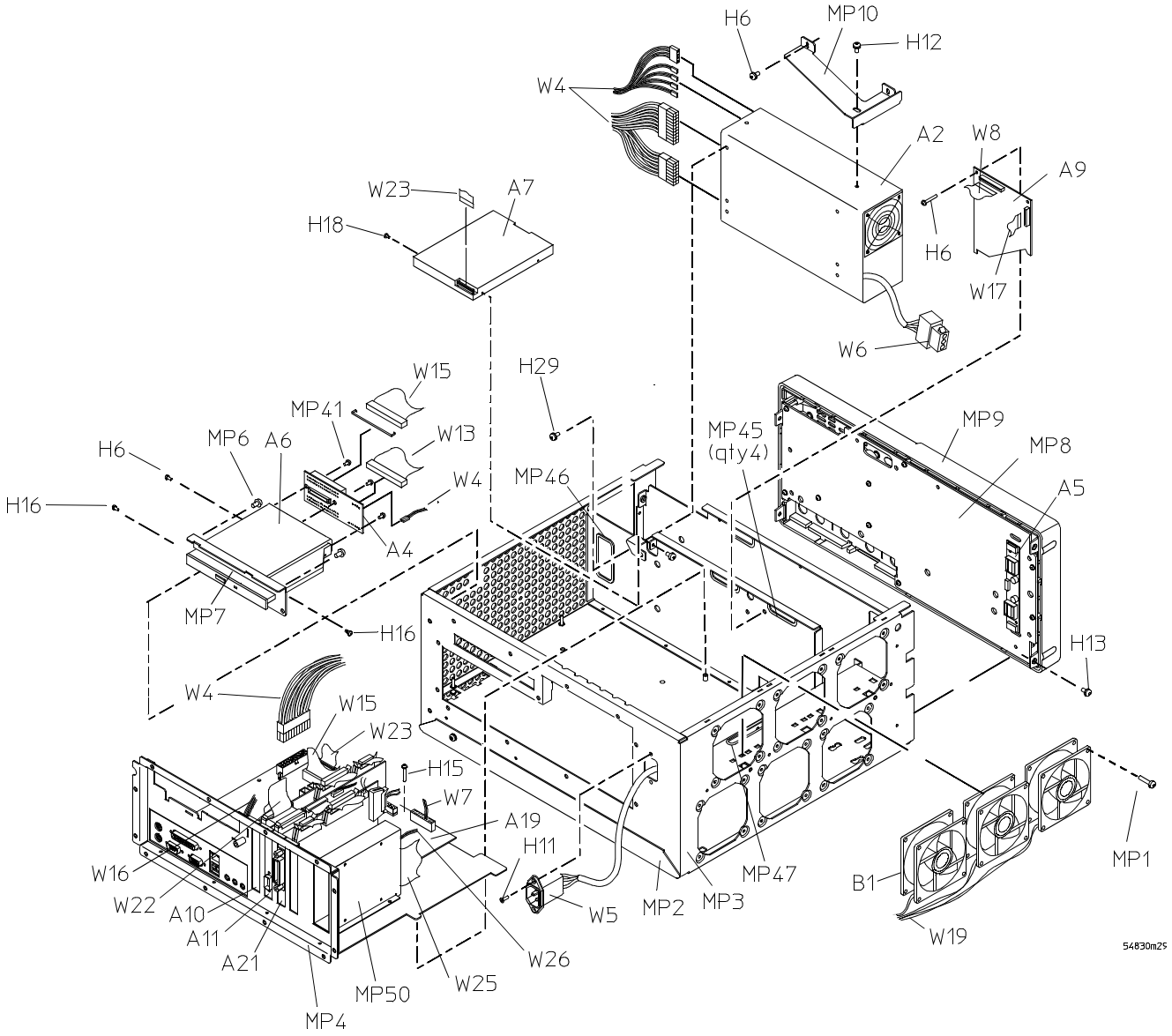


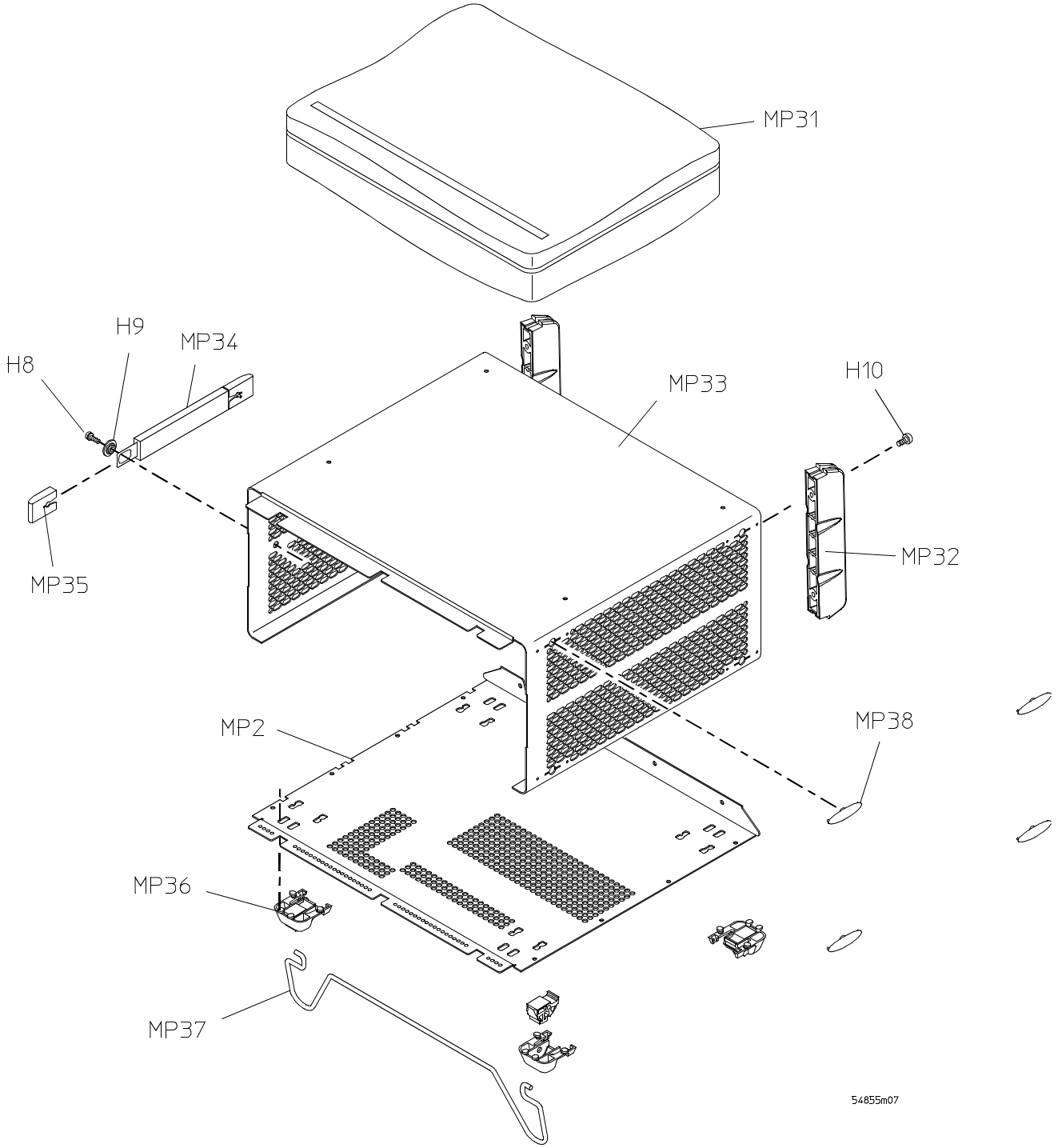
Fan and Acquisition Assembly

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	54830-66505 or 54830-66407	1	2-CH ACQUISITION ASSEMBLY (Agilent Model 54830B requires software version Windows 98 2.35 or XP 3.5 or later) All others require this assembly.
A1	54831-66505 or 54831-66407	1	4-CH ACQUISITION ASSEMBLY (Agilent Model 54831B requires software version Windows 98 2.35 or XP 3.5 or later) All others require this assembly.
A1	54832-66505 or 54832-66406	1	4-CH ACQUISITION ASSEMBLY (Agilent Model 54832B requires software version Windows 98 2.35 or XP 3.5 or later) All others require this assembly.
A1	54836-66502 or 54830-66406	1	2-CH ACQUISITION ASSEMBLY (Agilent Model 54830D requires software version Windows 98 2.35 or XP 3.5 or later) All others require this assembly.
A1	54837-66502 or 54831-66406	1	4-CH ACQUISITION ASSEMBLY (Agilent Model 54831D requires software version Windows 98 2.35 or XP 3.5 or later) All others require this assembly.
A1	54838-66502 or 54832-66407	1	4-CH ACQUISITION ASSEMBLY (Agilent Model 54832D requires software version Windows 98 2.35 or XP 3.5 or later) All others require this assembly.
A1	54833-66501 or 54833-66407	1	2-CH ACQUISITION ASSEMBLY (Agilent Model 54833A requires software version Windows 98 2.35 or XP 3.5 or later) All others require this assembly.
A1	54833-66502 or 54833-66406	1	2-CH ACQUISITION ASSEMBLY (Agilent Model 54833D requires software version Windows 98 2.35 or XP 3.5 or later) All others require this assembly.
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	4	KNOB 12 MM GRAY
MP26	54832-94330	1	FRONT PANEL 4-CH LABEL (54831/32B)
MP26	54830-94330	1	FRONT PANEL 2-CH LABEL (54830B, 54833A)
MP26	54838-94330	1	FRONT PANEL 4-CH LABEL (54831/32D)
MP26	54836-94330	1	FRONT PANEL 2-CH LABEL (54830D, 54833D)
MP28	54831-94303	1	LOGO LABEL (54831M)
MP28	54830-94308	1	LOGO LABEL (54830B)
MP28	54831-94308	1	LOGO LABEL (54831B)
MP28	54832-94308	1	LOGO LABEL (54832B)
MP28	54832-94309	1	LOGO LABEL (54832D)
MP28	54931-94309	1	LOGO LABEL (54831D)
MP28	54830-94309	1	LOGO LABEL (54830D)
MP28	54833-94302	1	LOGO LABEL (54833A)
MP28	54833-94301	1	LOGO LABEL (54833D)
MP31	54810-68701	1	ACCESSORY POUCH
MP32	5042-1798	2	REAR FEET
MP34	54810-44901	1	MOLD OVER HANDLE

Replaceable Parts

Ref. Des.	Agilent Part Number	QTY	Description
MP35	54810-45001	2	END CAP HANDLE
MP36	54810-61001	4	BOTTOM FEET w/INSERT
MP37	54810-03702	1	TILT STAND
MP38	01680-41002	4	SIDE FOOT
W18	8120-1521	1	CABLE-POWER (standard 125V USA)
W18	8120-1703	1	CABLE-POWER (Option 900-UK)
W18	8120-0696	1	CABLE-POWER (Option 901-AUSTL)
W18	8120-1692	1	CABLE-POWER (Option 902-EUR)
W18	8120-2296	1	CABLE-POWER (Option 906-SWIT)
W18	8120-2957	1	CABLE-POWER (Option 912-DEN)
W18	8120-4600	1	CABLE-POWER (Option 917-AFRICA)
W18	8120-4754	1	CABLE-POWER (Option 918-JAPAN)
W18	8120-6799	1	CABLE-POWER (Option 919-ISRAEL)
W18	8120-6871	1	CABLE-POWER (Option 920-ARGENTINA)
W18	8120-6979	1	CABLE-POWER (Option 921-CHILE)
W18	8120-8377	1	CABLE-POWER (Option 922)
W18	8120-8871	1	CABLE-POWER (Option 927-THAILAND)
Electrical Assemblies			
A2	0950-4191	1	POWER SUPPLY
A5	0950-3235	1	INVERTER BOARD
A13	2090-0396	1	LCD DISPLAY
PC Motherboard			
A4	86100-66517 54810-66541	1	CDROM ADAPTER BOARD (NOT ON OPTION 017) CDROM ADAPTER BOARD (WITH OPTION 017)
A6	0950-4373	1	CD ROM Drive
A7	0950-4362	1	1.44 FLOPPY DRIVE
A8		1	HARD DRIVE with 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	1	IDE HARD DRIVE CABLE
All Configurations			
A9	54810-66506	1	PROBE INTERFACE BOARD
A11	54810-66529	1	GRAPHICS BOARD
A12	54810-66525	1	DISPLAY BOARD
A16	54830-68703	0	2-CH REPLACEMENT I/O KIT (54830B, 54833A)
A16	54832-68703	0	4-CH REPLACEMENT I/O KIT (54831B/32B)
A16	54838-68703	0	4-CH REPLACEMENT I/O KIT (54831/32D)
A16	54836-68701	0	2-CH REPLACEMENT I/O KIT (54830D, 54833D)
A17	54826-66507	1	KEYBOARD - CURSOR
A18	54832-66504	1	KEYBOARD - 4CH (54831/32B)
A18	54830-66504	1	KEYBOARD - 2CH (54830B, 54833A)
A18	54826-66504	1	KEYBOARD - 4CH (54831/32D)
A18	54831-66504	1	KEYBOARD - 2CH (54830D, 54833D)

Replaceable Parts

Ref. Des.	Agilent Part Number	QTY	Description
A20	54810-66545	1	FAN CONTROLLER BOARD
A21	54855-66515	1	INTERFACE & GPIB BOARD
A22	0950-4113	1	DC TO DC COVERTOR BOARD
Fans			
B1	3160-4134	6	12 V FAN
Internal Chassis Parts			
H1	0515-2219	3	MACHINE SCREW 5 MM
H2	54503-25701	3	HEX NUT BNC (54830/33)
H2	54503-25701	4	HEX NUT BNC (54831/32)
H3	0515-1025	3	PAN HEAD SCREW 26 MM
H4	0515-1410	4	PAN HEAD SCREW 20 MM
H5	0515-0430	11	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	4	M4x0.7 20MM-LG PANHD PATCHLOCK BLACK
H9	54801-24702	1	RETAINER STRAP HANDLE
H10	0515-2195	4	PAN HANDLE SCREW 40 MM
H11	0515-1103	10	FLAT HEAD SCREW
H12	0515-0380	17	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	6	SCR MACHINE
H18	0515-2691	2	MS M2.6X0.45 6 MM PAN HEAD
MP1	0624-1066	24	FAN SCREWS
MP2	54832-04105	1	SLEEVE BOTTOM
MP3	54830-00105	1	CHASSIS ASSEMBLY
MP4	54857-60102	1	ATX TRAY
MP5	54810-01211	1	HARD DRIVE BRACKET (NOT ON OPTION 017)
MP7	54857-01214	1	CDROM MOUNT BRACKET
MP8	54832-04103	1	FRONT FRAME BACK PLATE
MP9	54832-40501	1	FRONT FRAME (54830/31/32/33D)
MP10	54810-01213	1	POWER SUPPLY SUPPORT BRACKET
MP11	54826-88001	1	LENS GLASS
MP12	54826-01205	1	LENS BRACKET
MP25	54801-09101	2	SPRING STEEL
MP27	54831-41903	1	KEYPAD 4-CH (54831/32B)
MP27	54830-41905	1	KEYPAD 2-CH (54830B/33A)
MP27	54831-41901	2	KEYPAD 4-CH (54831/32D)
MP27	54830-41904	1	KEYPAD 2-CH (54830D/33D)
MP29	54826-41902	1	CURSOR KEYPAD
MP33	54810-04104	1	SLEEVE TOP
MP39	1520-0238	4	GROMET (NOT ON OPTION 017)
MP40	54857-60201	1	REMOVEABLE HARD DRIVE COVER PLATE (NOT ON OPTION 017)
MP41	54857-01216	1	REMOVEABLE HARD DRIVE BRACKET (WITH OPTION 017)
MP42	1252-7017	4	RETAINER CLIP
MP43	54826-01207	1	DC-TO-DC CONVERTER BRACKET

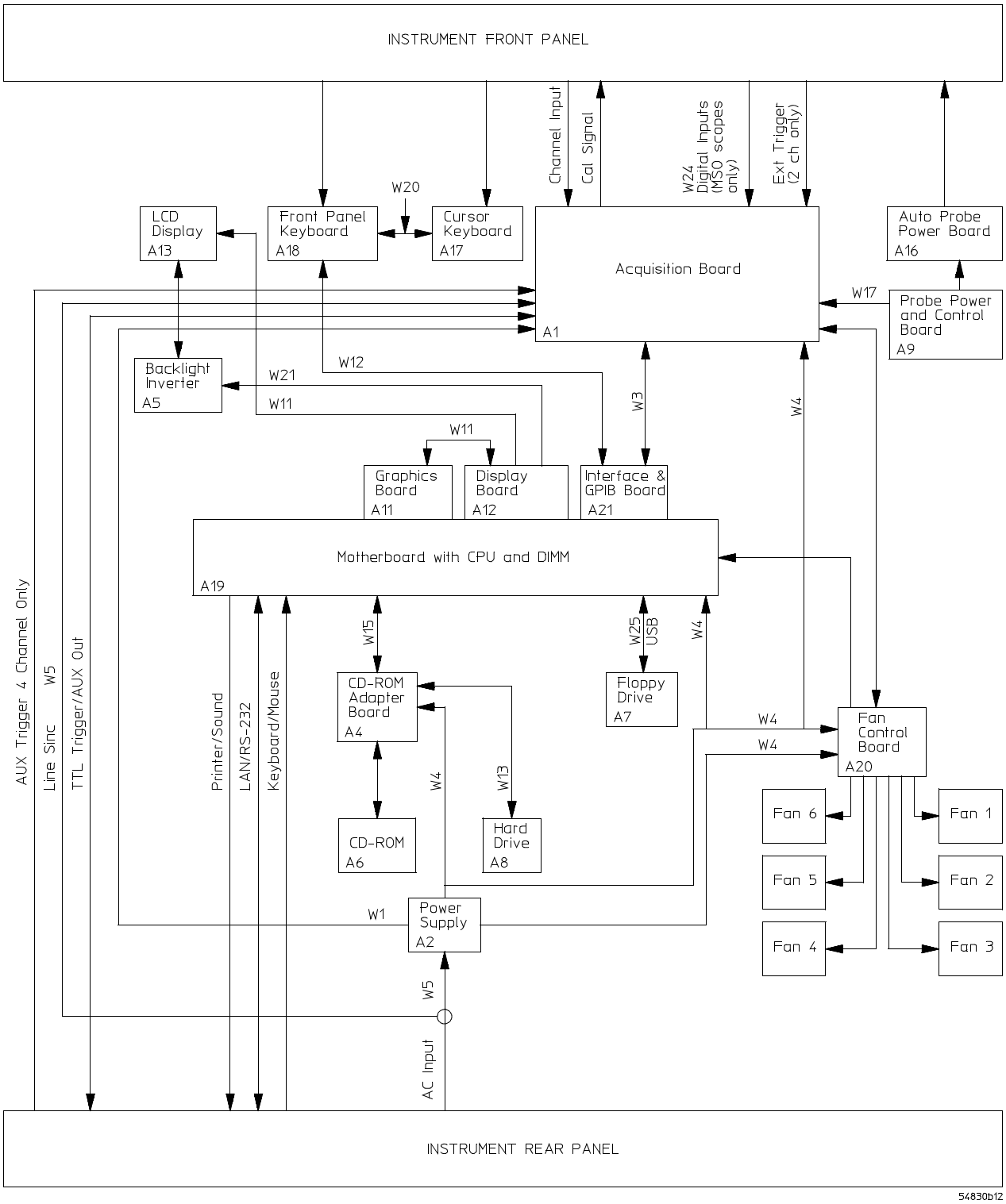
Replaceable Parts

Ref. Des.	Agilent Part Number	QTY	Description
Cables			
W1	54810-61608	1	SENSE CABLE
W2	54810-61607	1	CONTROL CABLE
W3	54826-61606	1	ACQUISITION SIGNAL CABLE
W4	54810-61621	1	POWER HARNESS CABLE
W5	54810-61617	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	54826-61609	1	CAL CABLE
W10	54826-61610	1	SMB CABLE AUX OUT
W11	54810-61610	1	DISPLAY CABLE
W12	54826-61601	1	KEYBOARD CABLE
W17	54810-61604	1	PROBE POWER CABLE
W19	54810-61603	6	FAN CABLE
W20	54801-61626	1	KEYBOARD INTERCONNECT
W21	54810-61605	1	BACKLIGHT POWER CABLE
W22	54801-61624	1	DISPLAY JUMPER CABLE
W23	54801-61638	2	SMB CABLE BNC TTL & EXT. TRIGGER
W24	54826-61604	1	INTERNAL DIGITAL INPUT CABLE (54830/31/32/33D)
W25	54855-61627	1	FLOPPY DISK DRIVE CABLE
W26	01680-61625	1	IDE HARD DRIVE CABLE (WITH OPTION 017)
W27	54855-61622	1	REMOVEABLE HARD DRIVE 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 Input BNC (not on 2 channel oscilloscopes).
- Output BNC.
- TTL trigger output BNC.
- USB and PS/2 Interface.

The oscilloscope has several assemblies and four attenuators. 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, +/-10%. Maximum input power is 440W. The ac input frequency is 47 to 440 Hz.

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

FPD Monitor Assembly

The monitor is a thin film liquid-crystal display (TFT-LCD). This FPD is an 8.4-inch diagonal, 640 by 480 pixel VGA Color Monitor. The assembly requires +3.3 V and +12 V from the power supply.

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

Acquisition System

The acquisition system includes four attenuator assemblies on four channel oscilloscopes and two attenuator assemblies on two channel oscilloscopes on the acquisition board. The attenuators condition the signal, which is then digitized and stored by the acquisition board. The graphics board provides the system control interface from the motherboard, and also interfaces the acquisition board to the display board for display of the acquired data. More detailed theory on the acquisition system follows this top-level block theory.

Attenuators

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

Front Panel

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

The elastomeric keypad has 30 keys, all dedicated to a single function to improve ease of use. A conductive element on the inside of each key shorts a gap on the underlying keyboard circuit. The keyboard controller detects this short and sends the proper keypress information to the system controller on the motherboard.

There are eleven dedicated knobs. Each knob controls a mechanical encoder. The output of the encoder is a 2-bit gray code that is read by the micro controller for direction and distance turned.

A pushbutton controls the power through a Remote Inhibit sense line that is routed to the power supply.

Disk Drives

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

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

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

Motherboard

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

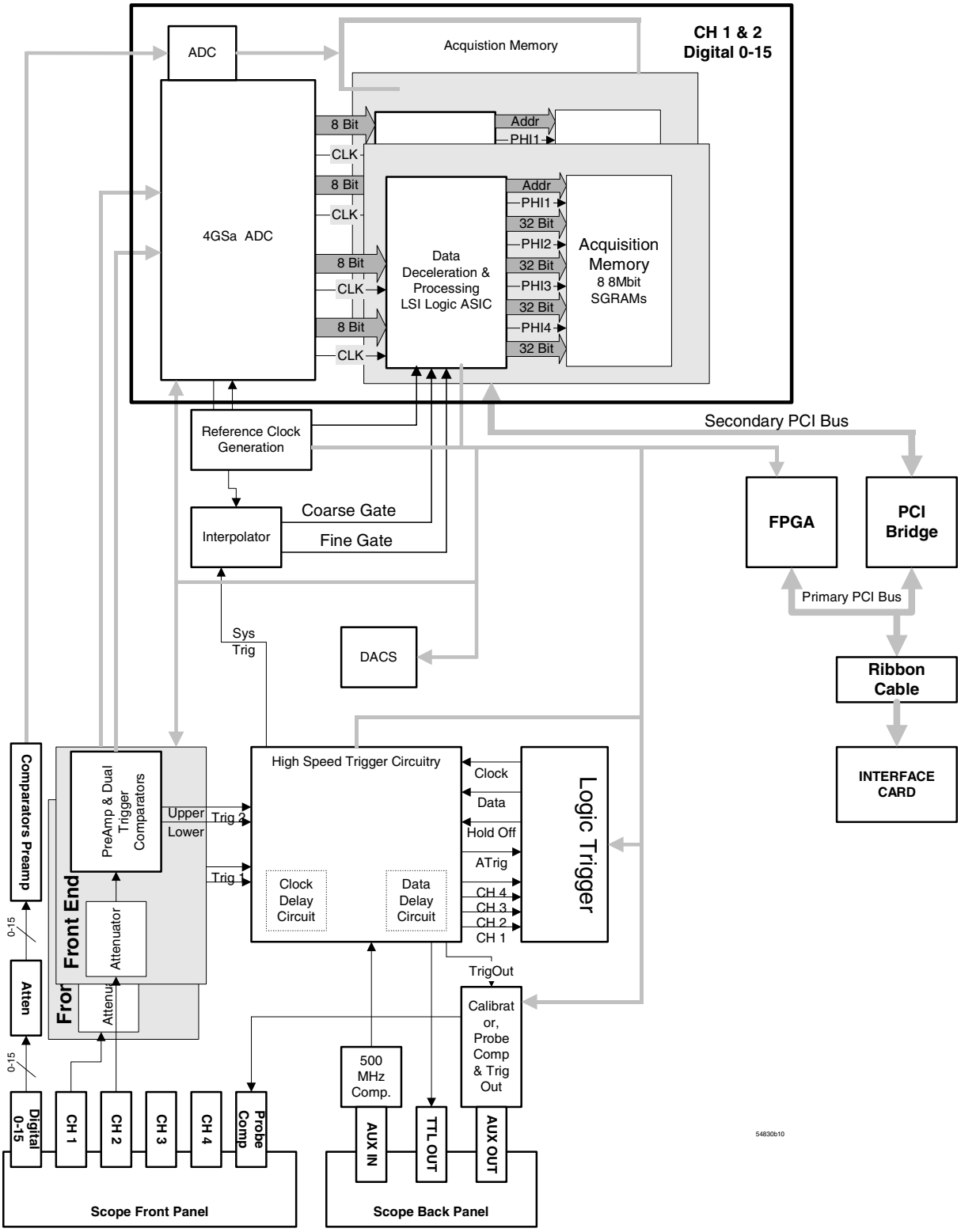
Display Board

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

Probe Power and Control

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

Figure 8-2



Acquisition Block Diagram

Attenuator Theory

The channel input signals are conditioned by the channel attenuator assemblies. There are four completely independent attenuators on each assembly, but one channel can be routed in the preamp/multiplexer hybrid to drive both channel outputs for sample rate doubling purposes. Each channel contains passive attenuators, an impedance converter, and a programmable gain amplifier. There are two identical outputs for each channel: one to drive the ADC hybrids and one to drive the trigger circuitry.

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

The high- and low-frequency components of the signal are recombined and applied to the input FET of the impedance converter. The FET provides a high impedance load for the input attenuators and a low impedance drive for a buffer, which drives 50 Ω.

Acquisition Theory

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

Acquisition Board

The acquisition circuitry samples, digitizes, and stores the signals from the channel attenuators. The four channels are identical. The trigger signals synchronize acquisition through the trigger and time base circuitry. A reference oscillator and the time base provide the base sample rates.

ADC The Agilent Technologies Infiniium Oscilloscope ADC provides all of the sampling, digitizing, and high-speed waveform storage. Each ADC contains two 2 GSa/s ADCs. They can be run in phase to increase resolution, or out-of-phase to sample at 4 GSa/s. The ADC includes a delay-locked loop to synchronize the sample clock to the 125 MHz timebase reference clock. For sample rates < 2 GSa/s, data is decimated.

Trigger There are four main trigger circuits: Trigger Conditioning, Analog Comparators, a Trigger Multiplexer, and Logic Trigger. Trigger signals from the channel are fed to the analog trigger comparators and the trigger conditioning circuit. The trigger conditioning circuitry selects dc, ac, low-frequency reject, high-frequency reject, and noise reject (hysteresis) modes and sets the trigger levels. The trigger multiplexer selects the trigger modes, such as edge, glitch, and pattern trigger.

The channel triggers are sent to the Logic Trigger. The logic trigger provides the advanced triggering functions, such as holdoff, delay, and pattern duration and range. The data delay and clock delay timers are used to implement trigger functions that require timing between 1.5 and 20 ns.

The auxiliary trigger, which cannot be displayed on screen, is compared to the trigger level setting in a separate circuit. The line sync trigger line from the power supply is combined in a multiplexer with the TV trigger and the high frequency reject comparators before being sent to the analog trigger.

Time Base The time base provides the sample clocks and timing necessary for data acquisition. It primarily consists of a reference oscillator, time base IC, and trigger interpolator pulse stretcher.

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

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

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

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

- Channel offsets
- Trigger levels
- Two logic trigger functions

Acquisition Modes

The Agilent Technologies oscilloscopes provide two acquisition modes:

- full channel mode
- half channel mode

Full Channel Mode In this mode, the oscilloscope uses all the channel inputs.

Half Channel Mode In this mode, the oscilloscope only uses the odd channel inputs. The ADC hybrids for the channel 1 inputs are routed to both the channel 1 and channel 2 ADC hybrids. The hybrids are time-aligned to sample 90° out-of-phase to yield a sample rate of 4 GSa/s. Channel 3 and channel 4 are combined in the same way on four channel oscilloscopes.

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

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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.