Service Guide

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90000 X / L-Series Infiniium Oscilloscopes

Agilent Technologies

Ease of use with high performance

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

- **Traditional oscilloscope front-panel interface provides direct access to the controls needed for most troubleshooting tasks.**
- **Graphical user interface with menus, windows, dialogs, and toolbars provides easy access to dozens of configuration and analysis tools, ensuring you can set up and make the most complex measurements.**
- **All models offer 80 GSa/s sampling rate on all four channels.**
- **Models with bandwidths from 16 GHz to 32 GHz.**

Display shows waveforms and graphical user interface

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

Horizontal controls set sweep speed and position

- **Intensified waveforms on main sweep window make it easy to see what will appear in the zoom window.**

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

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

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

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

Trigger setup controls set mode and basic parameters

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

Vertical controls set attenuation, and position

- **Color-coded knobs make it easy to find the controls that affect each waveform.**

Marker and quick measurements help measure waveform parameters

- **Waveform markers A and B to check voltage or Δ-time at any point on the displayed waveform.**

Service Policy

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

In This Book

This book provides the service documentation for the Agilent Technologies 90000 X-Series and 90000L Series oscilloscopes. It is divided into five chapters.

Chapter 1, "General Information," explains which model numbers are covered by this guide, supplied accessories, and where to find the specifications for the 90000 X-Series / 90000 L-Series oscilloscopes.

Chapter 2, "Calibration," explains how and when you should run the user calibration procedure.

Chapter 3, "Testing Performance," provides information about testing the oscilloscope to verify that it performs according to specifications.

Chapter 4, "Replacing Assemblies," provides information about replacing assemblies in the oscilloscope.

Chapter 5, "Replaceable Parts," provides information about ordering replaceable parts.

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

1

General Information

Instruments covered by this service guide

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

If you have an oscilloscope that was manufactured after the release of this manual, please check the Agilent Technologies website at www.agilent.com to see whether a newer version of this manual is available.

The following 90000 X-Series and L-Series oscilloscopes are covered in this guide.

Table 1 -1 **Oscilloscopes Covered by this Service Guide**

Model	Bandwidth
DSOX/DSAX91604A	**16 GHz bandwidth**
DSOX/DSAX92004A	**20 GHz bandwidth**
DSOX/DSAX92504A	**25 GHz bandwidth**
DSOX/DSAX92804A	**28 GHz bandwidth**
DSO/DSA93004L	**30 GHz bandwidth**
DSOX/DSAX93204A	**32 GHz bandwidth**

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

Accessories supplied

The following accessories are supplied.

- Mouse
- Stylus
- Keyboard
- Accessory Pouch
- Front-panel Cover
- Calibration Cable Assembly
- Connector Saver Adapters (qty 5)
- Wrench
- Power Cord

Specifications and Characteristics

For complete specifications and characteristics, direct your web browser to www.agilent.com and perform a search for the oscilloscope's model number. Then select "Data Sheets" from the Library.

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

Specifications are valid after a 30 minute warm-up period, and within ± 5°C from the temperature at which the last self-calibration was performed.

2

Calibration

Calibration

This chapter provides self calibration procedures for the oscilloscope.

To run the self calibration

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

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

- yearly, or according to your periodic needs,
- when you replace the hard drive,
- when the oscilloscope's operating temperature (after the 30 minute warm-up period) is more than ±5 °C different from that of the last calibration.

Equipment Required

Equipment	Critical Specifications	Agilent Part Number
Connector Saver Adapters (5 supplied with oscilloscope)	3.5mm female to female	Agilent 5061-5311 (for 20 GHz, 25 GHz, 28, 30, and 32 GHz models) Agilent 1250-3758 (for 16 GHz models)
Cable assembly	50 Ohm chracteristic impedance BNC (m) connectors, 36 inches (91 cm) to 48 inches (122 cm) long	Agilent 8120-1840
Adapter	SMA(m) to BNC(f)	Agilent 1250-1200
Cable Assembly (supplied with oscilloscope)	No substitute	Agilent 54916-61626
10 MHz Signal Source (required for time scale calibration)	Output Frequency: 10 MHz Absolute Freq. Error: < ±0.0275 ppm	Agilent 53132A with Opt. 012

Self calibration

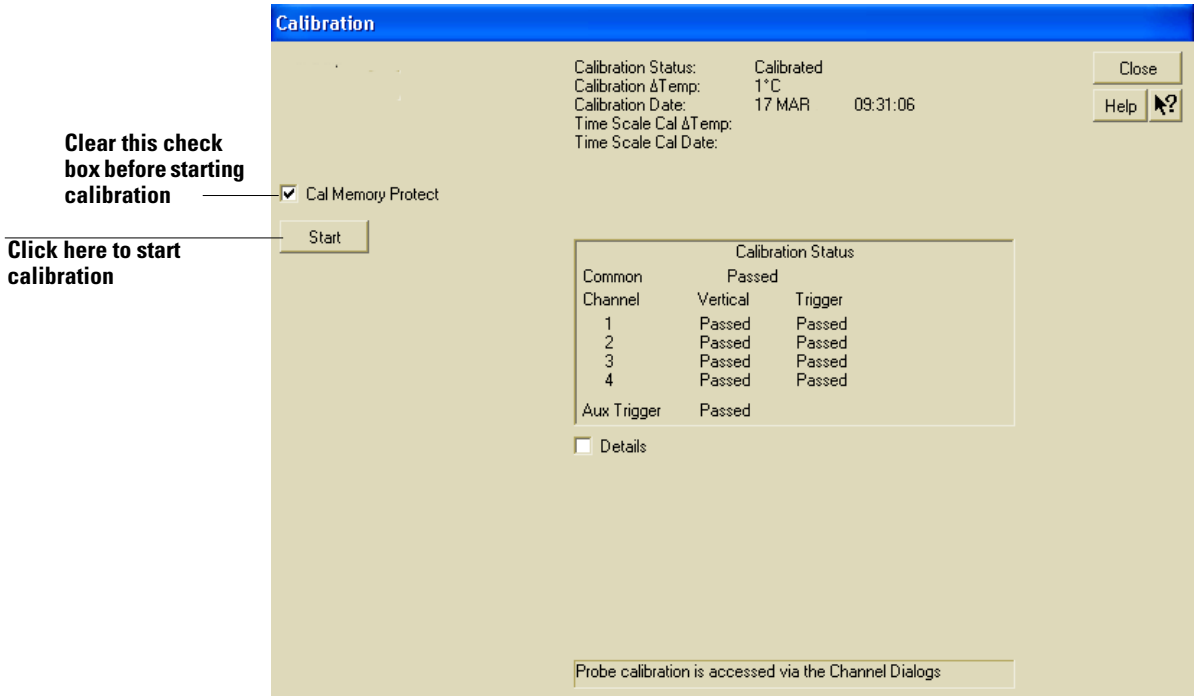
Calibration time
It will take approximately 2 hours and fifteen minutes to run the self calibration on the oscilloscope, including the time required to change cables from channel to channel.

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

2 Pull down the Utilities menu and Select Calibration.

3 Click the check box to clear the Cal Memory Protect condition.
You cannot run self calibration if this box is checked. See Figure 2-1.

Figure 2-1



Calibration Dialog

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

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

a Disconnect everything from all inputs and Cal Out.

b Connect the calibration cable from Cal Out to channel 1.

You must use the 54916-61626 cable assembly with two connector saver adapters for all oscilloscopes. Failure to use the appropriate calibration cable will result in an inaccurate calibration.

c Connect the calibration cable from Cal Out to each of the channel inputs as requested.

d When instructed, connect the calibration cable from the Cal Out on the front panel of the oscilloscope to the 1250-1200 SMA(m) to BNC(f) adapter and then connect the other end of the 1250-1200 adapter to the 8120-1840 BNC cable. Connect the other end of the BNC cable to the Trig In on the rear of the oscilloscope.

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

5 After the calibration procedure is completed, click Close.

2

Testing Performance

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

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

Performance Test Interval

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

Performance Test Record

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

Test Order

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

Test Equipment

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

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

Performing Self-Test and Calibration

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

   If any of the self-tests fail, ensure that the failure is diagnosed and repaired before calibrating and testing performance.
2 Perform calibration. See “To run the self calibration” on page 11.

Vertical Performance Verification

This section contains the following vertical performance verification:

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

Offset Accuracy Test

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

Let the oscilloscope warm up before testing

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

Specifications

Offset Accuracy	**≤ 3.5 V: ±(2% of channel offset + 1% of full scale + 1 mV)** **> 3.5 V: ±(2% of channel offset + 1% of full scale)**
Full scale is defined as 8 vertical divisions. Magnification is used below 10 mV/div. Below 10 mV/div, full scale is defined as 80 mV. The major scale settings are 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV and 1 V.	

Equipment Required

Description	Critical Specifications	Recommended Model/ Part Numbers
Digital Multimeter	DC voltage measurement accuracy better than ±0.1% of reading	Agilent 34401A or Agilent 3458A
Cable Assembly (2 required)	50Ω characteristic impedance, BNC (m) connectors	Agilent 8120-1840
Adapter	BNC Tee (m)(f)(f)	Agilent 1250-0781
Adapter	BNC (f) to dual banana	Agilent 1251-2277
Connection Saver	Shipped with each DSO/DSAX 90000A and DSO/DSA93004L Series oscilloscope	Agilent 5061-5311 (used with 20, 25, 28, 30, and 32 GHz oscilloscope models) Agilent 1250-3758 (used with 16 GHz oscilloscope models)
Adapter (2 required)	BNC (f) to SMA (m) Adapter	Agilent 1250-1200

NOTE: The offset accuracy specification has two terms ±(offset gain + zero error). The offset gain specification is ±2% of channel offset while the zero error specification is ±(1% of full scale + 1mV) for ≤ 3.5V and 1% of full scale for > 3.5V. The offset accuracy test procedure tests each of these terms individually.

Procedure

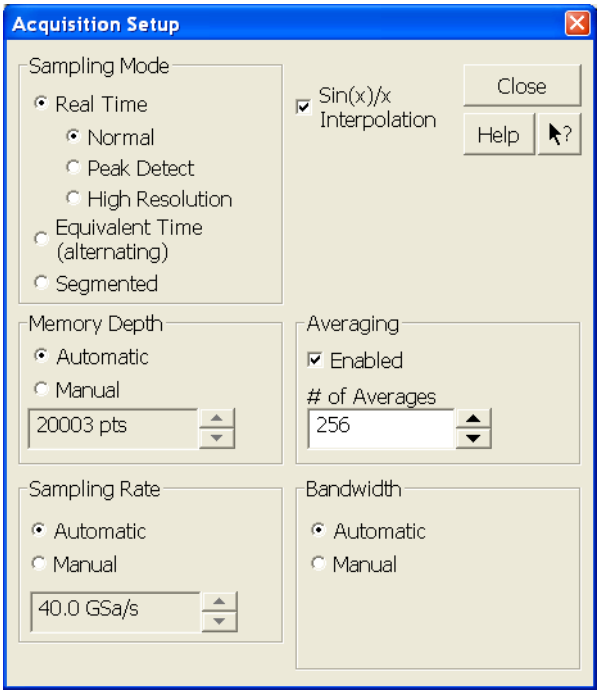
Zero Error Test

1 Disconnect all cables from the scope channel inputs.

2 Press Default Setup, then configure the scope as follows:

a Pull down the Setup menu and select Acquisition.

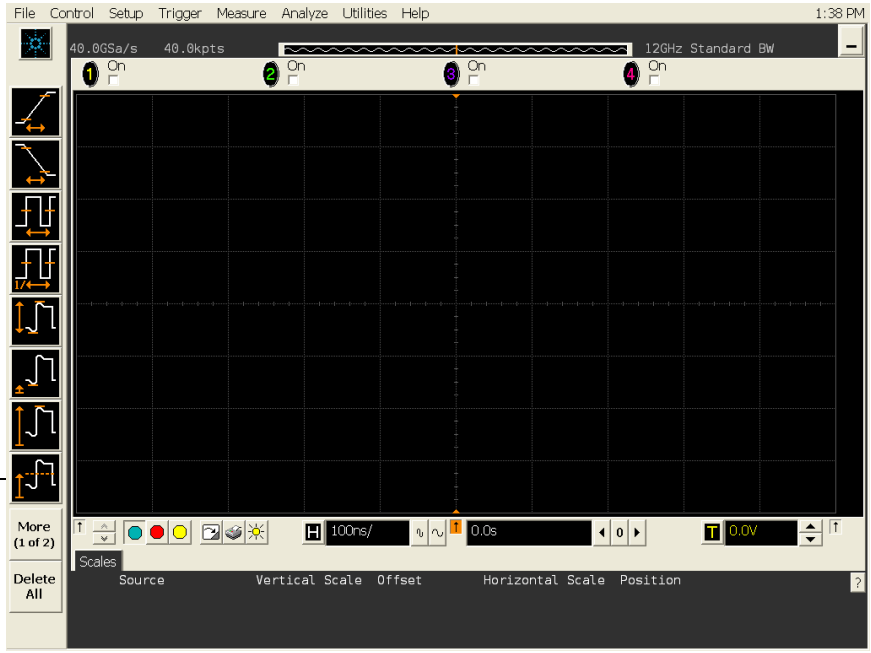
b When the Acquisition Setup window is displayed, enable averaging and set the # of averages to 256 as shown below.



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

a Change the vertical sensitivity of channel 1 to 10 mV/div.

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

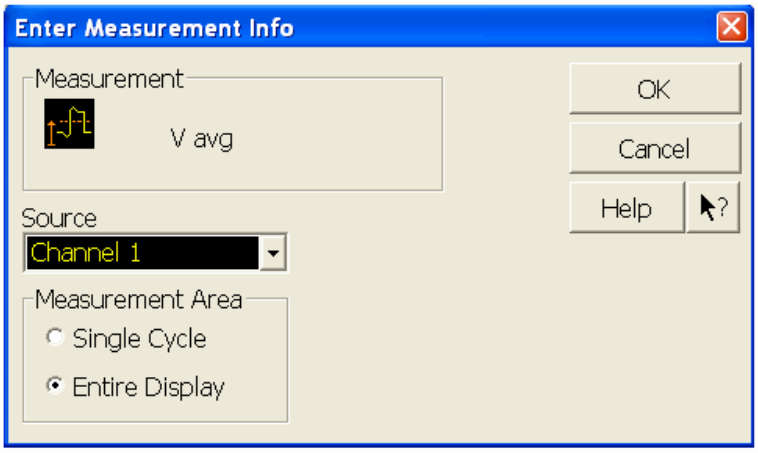


V avg measurement

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

Source = Channel 1

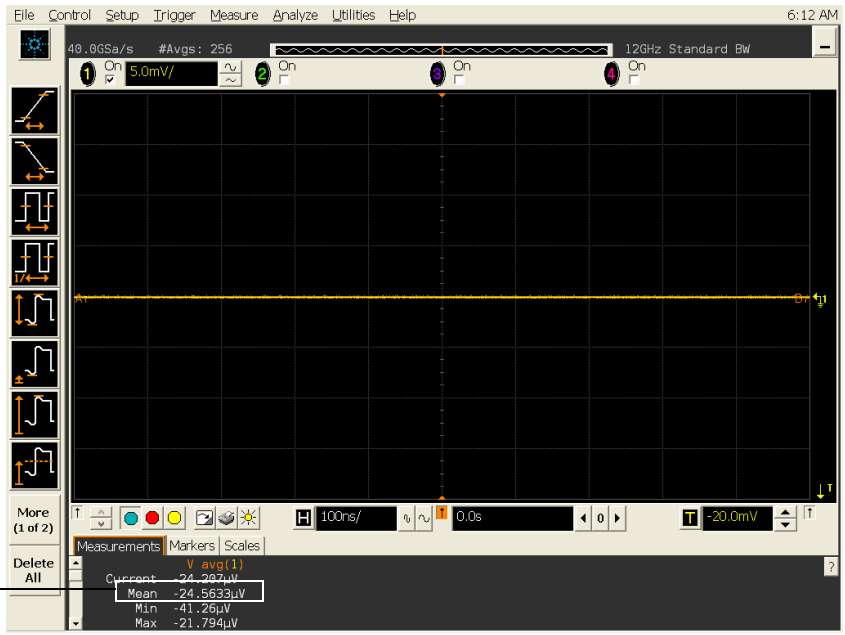
Measurement Area = Entire Display



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

Notes

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



Record the mean reading

5 Change the vertical sensitivity of channel 1 to 20 mV/div, press the Clear Display key, wait for the #Avgs value (top left corner of screen) to return to 256 and then record the scope V avg reading in the Zero Error Test section of the Performance Test Record.

6 Repeat step 5 for the remaining vertical sensitivities for channel 1 in the Zero Error Test section of the Performance Test Record.

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

8 Configure the scope to measure V avg on Channel 2 as follows:

a Pull down the Setup menu and select Acquisition. When the Acquisition Setup window is displayed, enable averaging and set the # of averages to 256.

b Change the vertical sensitivity of channel 2 to 10 mV/div.

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

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

Source = Channel 2

Measurement area = Entire Display

9 Press the Clear Display key on the scope, wait for the #Avgs value to return to 256 and then record the scope's mean V avg reading in the Zero Error Test section of the Performance Test Record.

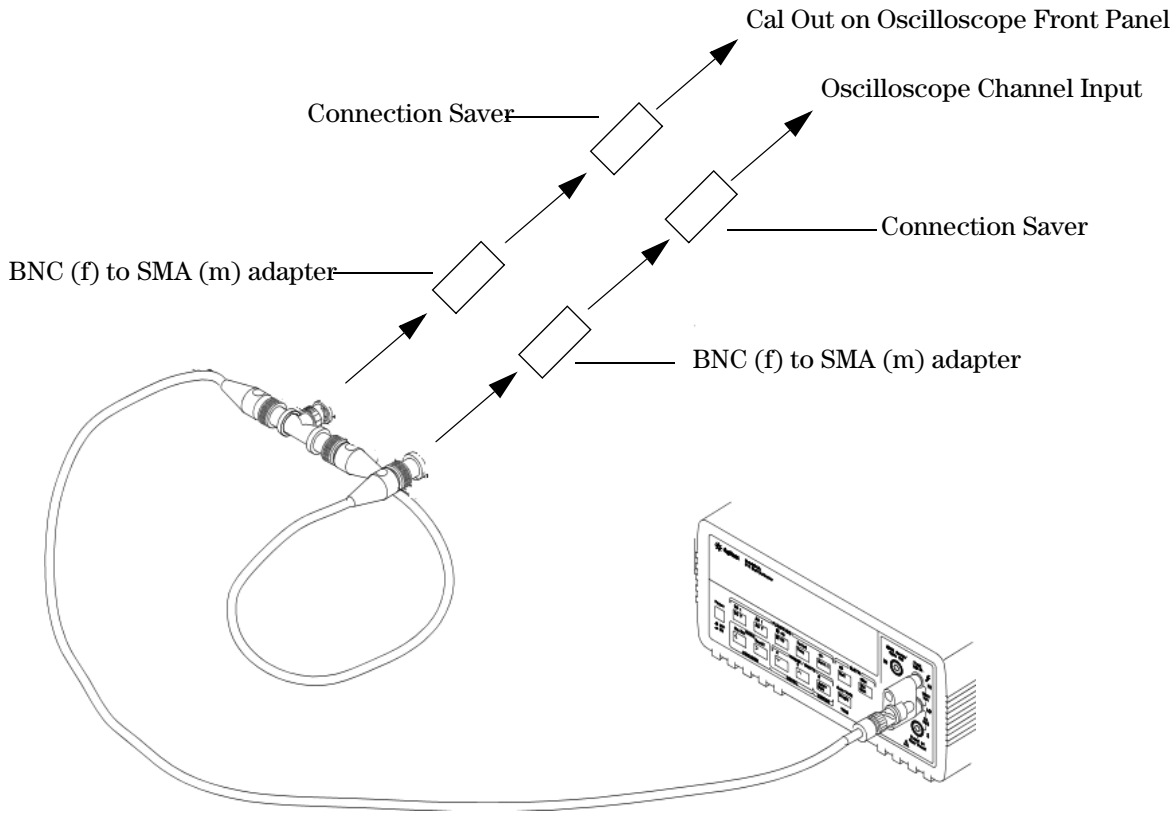
10 Repeat step 9 for the remaining vertical sensitivities for channel 2 in the Zero Error section of the Performance Test Record.

11 Repeat steps 7 through 10 for channels 3 and 4.

Offset Gain Test

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

Connections



Notes:

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

13 Set up the DMM to perform DC voltage measurements.

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

a Press Default Setup.

b Pull down the Setup menu and select Acquisition. When the Acquisition Setup window is displayed, enable averaging and set the # of averages to 256.

c Change the vertical sensitivity of channel 1 to 10 mV/div.

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

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

Source = Channel 1

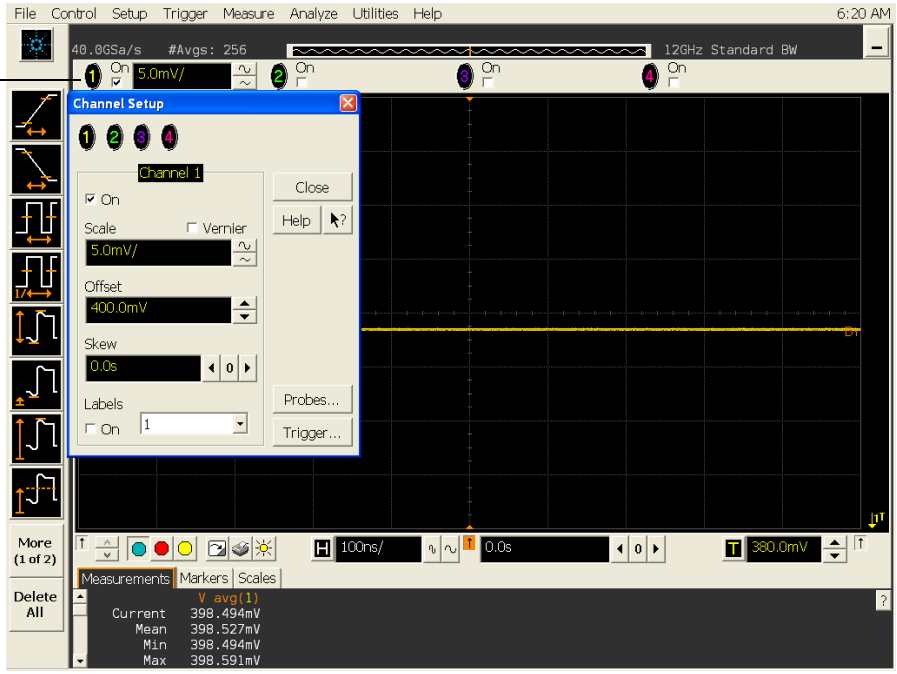
Measurement area = Entire Display

15 Set the channel 1 offset value to 400.0 mV. This can be done using the front panel control or:

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

b Click the Offset control arrows to change the offset value or click on the offset value and enter 400.0 mV in the dialog box..

Channel 1 setup icon



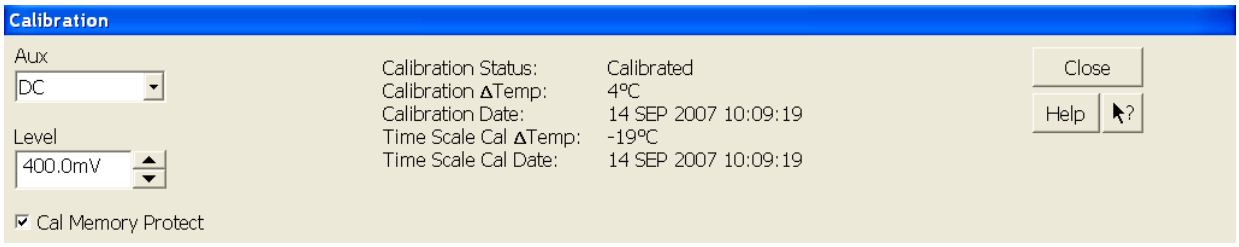
16 Set the Cal Out voltage ($V_{Cal\ Out}$) to +400.0 mV as follows:

a Pull down the Utilities menu and select Calibration.

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

c Set the Level to 400.0 mV.

d Click on Close.



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

18 Change the channel 1 offset value to -400.0 mV.

19 Set the Cal Out voltage to -400.0 mV.

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

21 Change the channel 1 offset value to 0 mV.

22 Set the Cal Out voltage to 0 mV.

23 Press the Clear Display key on the scope, wait for the #Avgs value (top left corner of screen) to return to 256 and then record the DMM voltage reading as V_{DMM0} and the scope Vavg reading as V_{Scope0} in the Offset Gain Test section of the Performance Test Record.

24 Calculate the offset gain error using the following expressions and record the value in the Offset Gain Test section of the Performance Test Record. The offset gain error is the greater (maximum magnitude) of either:

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

or

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

25 Repeat steps 15 to 24 for the remaining channel 1 vertical sensitivities in the Offset Gain Test section of the Performance Test Record. For each measurement, set both the Cal Out voltage ($V_{Cal\ Out}$) and the Channel offset voltage to the positive $V_{Cal\ Out}$ value and then to the negative $V_{Cal\ Out}$ value in the "$V_{Cal\ Out}$ Setting" column of the Offset Gain Test table in the Performance Test Record for each of the vertical sensitivities.

26 Move the Tee connector to the next channel input and repeat steps 15 to 24 for channels 2 to 4.

DC Gain Accuracy Test

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

Let the oscilloscope warm up before testing

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

Specifications

DC Gain Accuracy	**±2% of full scale at full resolution channel scale**
Full scale is defined as 8 vertical divisions. Magnification is used below 10 mV/div. Below 10 mV/div full scale is defined as 80 mV. The major scale settings are 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV and 1 V.	

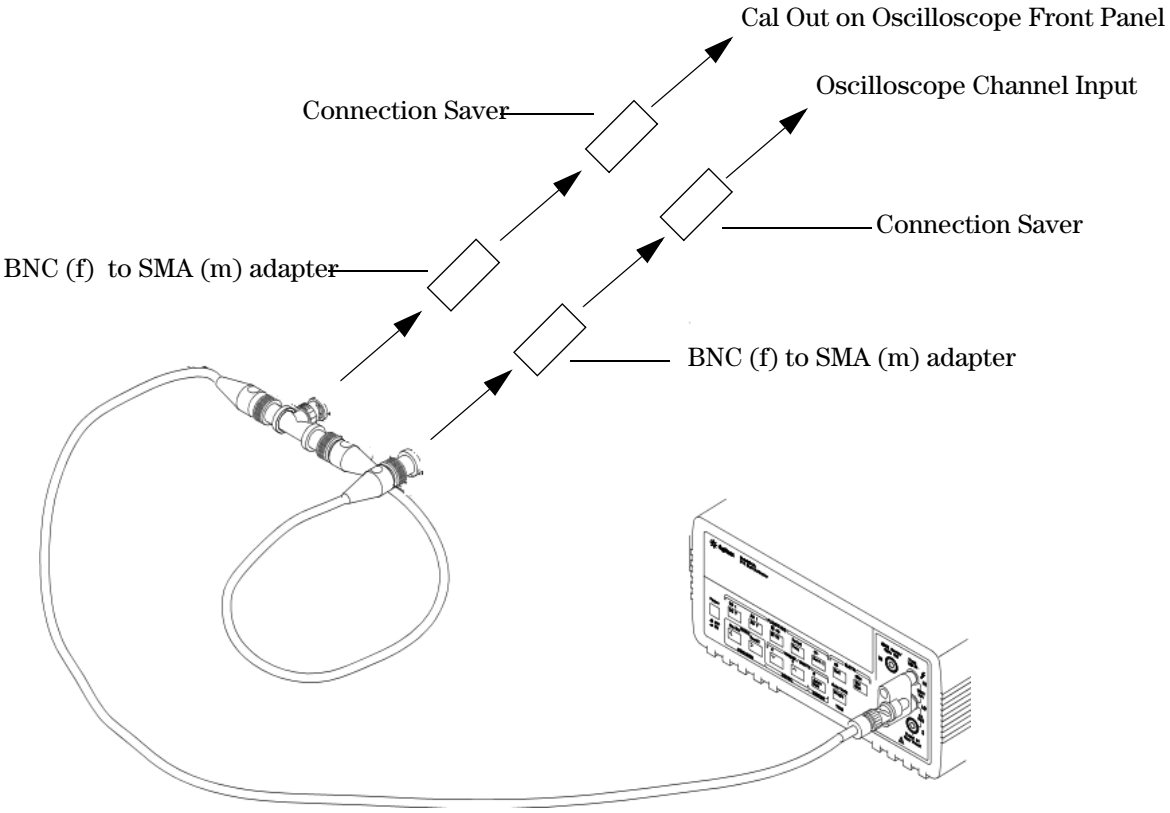
Equipment Required

Description	Critical Specifications	Recommended Model/ Part Numbers
Digital Multimeter	DC voltage measurement accuracy better than ±0.1% of reading	Agilent 34401A or Agilent 3458A
Cable Assembly (2 required)	50Ω characteristic impedance, BNC (m) connectors	Agilent 8120-1840
Adapter	BNC Tee (m)(f)(f)	Agilent 1250-0781
Adapter	BNC (f) to dual banana	Agilent 1251-2277
Connection Saver	Shipped with each DSO/DSAX 90000A and DSO/DSA93004L Series oscilloscope	Agilent 5061-5311 (used with 20, 25, 28, 30, and 32 GHz oscilloscope models) Agilent 1250-3758 (used with 16 GHz oscilloscope models)
Adapter (2 required)	BNC (f) to SMA (m) Adapter	Agilent 1250-1200

Procedure

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

Connections



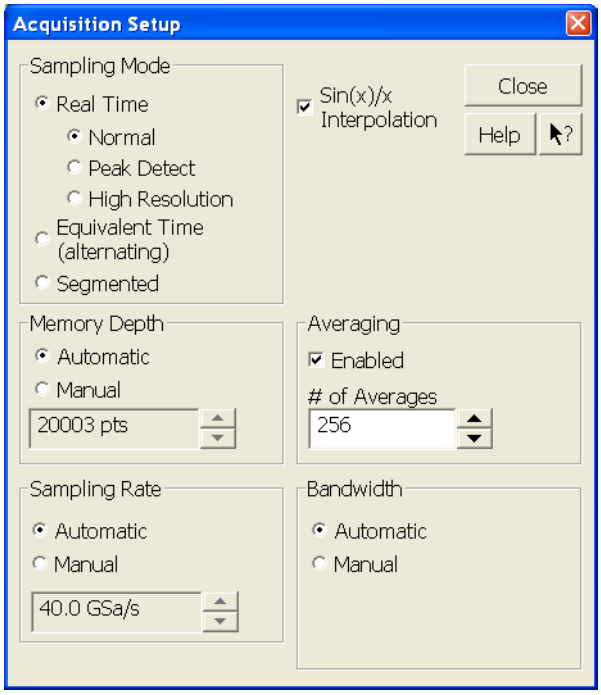
Notes:

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

2 Press Default Setup, then configure the scope as follows:

a Pull down the Setup menu and select Acquisition.

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



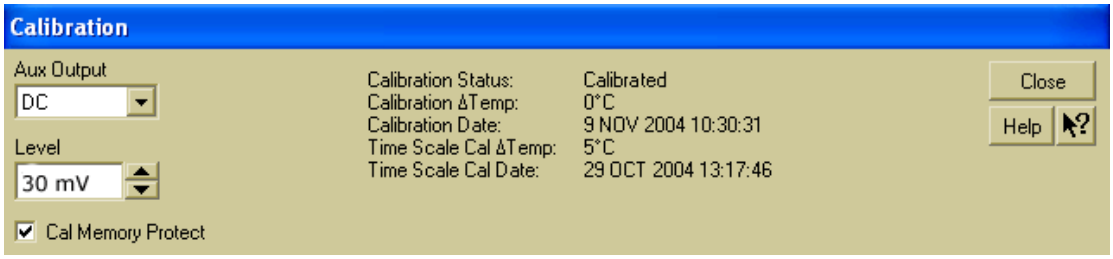
3 Set the Cal Out voltage ($V_{Cal\ Out}$) to +30 mV as follows:

a Pull down the Utilities menu and select Calibration.

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

c Set the Level to 30 mV.

d Click on Close.

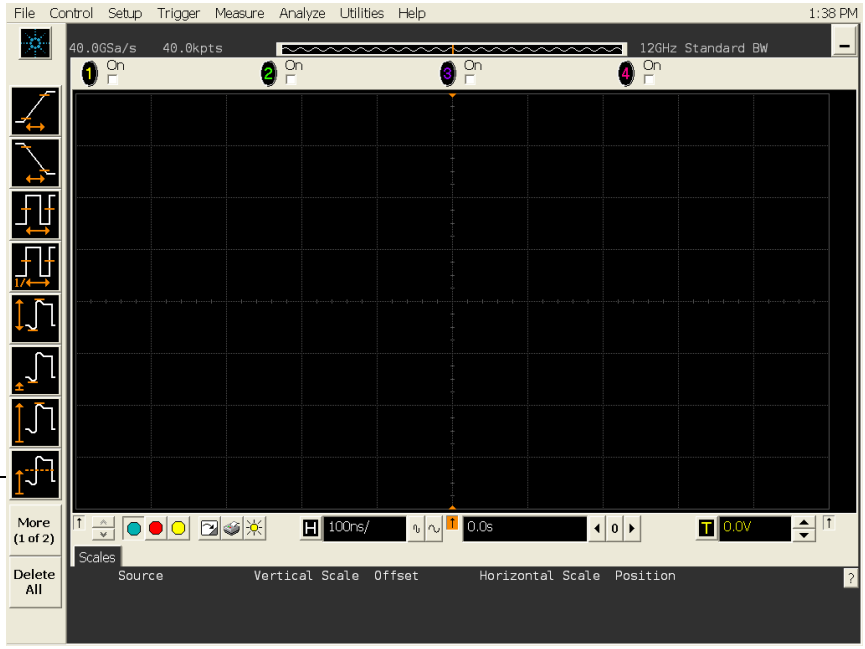


4 Set the channel 1 vertical sensitivity value to 10 mV/div. This can be done either using the front panel control or:

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

b Change the vertical sensitivity of channel 1 to 10 mV/div.

c Select the Vavg measurement as shown below.

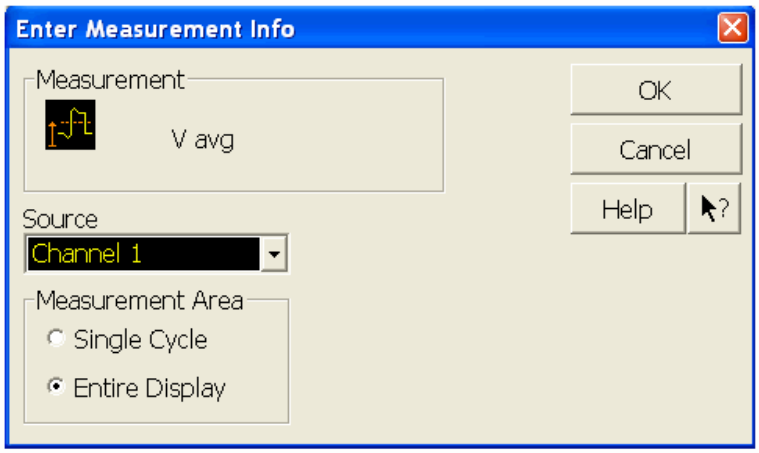


V avg measurement

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

Source = Channel 1

Measurement Area = Entire Display



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

Notes

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

Record the mean reading

6 Change the Cal Out voltage to -30 mV.

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

8 Calculate the DC gain using the following expression and record this value in the DC Gain Test section of the Performance Test Record.

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

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

For vertical sensitivity = 1 V use the following equation:

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

9 Repeat steps 3 to 8 for the remaining channel 1 vertical sensitivities in the DC Gain Test section of the Performance Test Record. For each measurement, set both the Cal Out voltage (V_{CalOut}) and the Channel offset voltage to the positive V_{CalOut} value and then to the negative V_{CalOut} value in the "V_{CalOut} Setting" column of the DC Gain Test table in the Performance Test Record for each of the vertical sensitivities.

10 Move the Tee connector to the next channel input and repeat steps 3 to 9 for channels 2 to 4.

Analog Bandwidth - Maximum Frequency Check

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

Let the oscilloscope warm up before testing

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

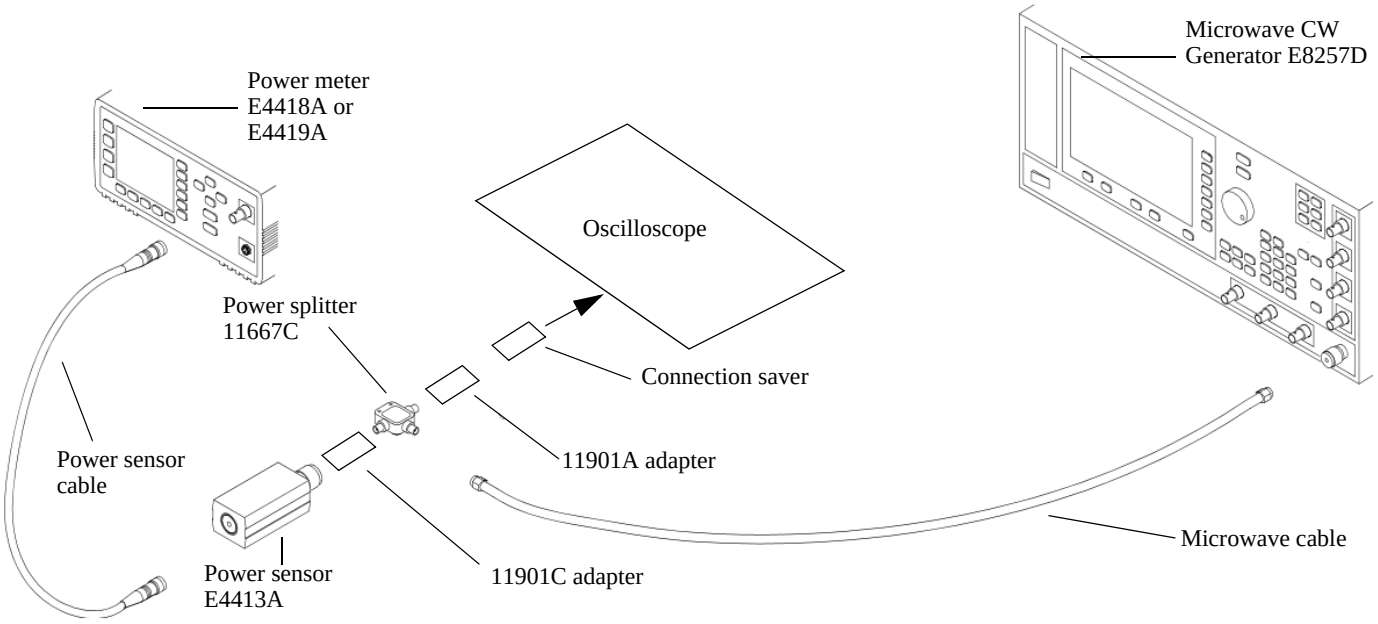
Specification

Analog Bandwidth (-3 dB)	
DSO/DSAX91604A	16.0 GHz
DSO/DSAX92004A	20.0 GHz
DSO/DSAX92504A	25.0 GHz
DSO/DSAX92804A	28.0 GHz
DSO/DSA93004L	30.0 GHz
DSO/DSAX93204A	32.0 GHz

Equipment Required

Description	Critical Specifications	Recommended Model/ Part Numbers
Microwave CW Generator	Maximum Frequency ≥ 32 GHz Power range: -20 dBm to +16 dBm into 50Ω Output resistance = 50Ω	Agilent E8257D with Opt 540
Power Splitter	2 Resistor Power Splitter Max Frequency ≥32 GHz	Agilent 11667C
Power Meter	Agilent E-series with power sensor compatibility	Agilent E4418B or E4419B
Power Sensor	Maximum Frequency ≥ 32 GHz Power range: -24 dBm to +16 dBm	Agilent 8487A or Agilent E4413B with 8485A-033
Microwave Cable	50Ω Characteristic Impedance 2.4 mm (m) to 2.4 mm (m) SMA connectors Max Frequency ≥32 GHz	Agilent N5180-60204
Adapter	2.4 mm (m) to 3.5 mm (m) (qty. 1)	Agilent 11901A
Adapter	2.4 mm (m) to 3.5 mm (f) (qty. 2)	Agilent 11901C
Connector Saver	shipped with DSOA/DSAX 90000A and DSO/DSA93004L models	Agilent 5061-5311 (used with 20, 25, 28, 30, and 32 GHz oscilloscope models) Agilent 1250-3758 (used with 16 GHz oscilloscope models)

Connections



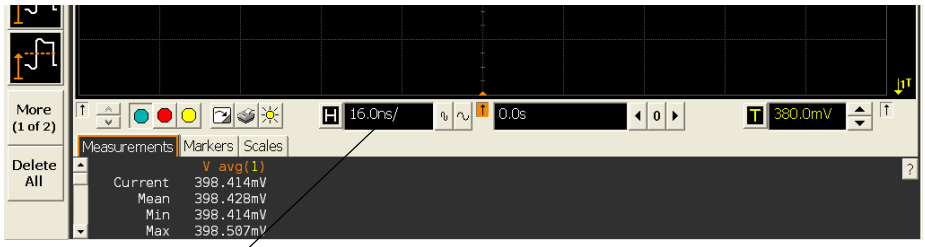
Notes

- Connect output 1 of the 11667C splitter to the scope Channel n input directly using the 11901A adapter and a connector saver (either 5061-5311 or 1250-3758 depending on the oscilloscope's bandwidth), without any additional cabling or adapters.
- Connect the power sensor directly to output 2 of the power splitter using the 11901C adapter without any additional cabling or adapters.
- Connect the microwave cable directly to output 3 of the power splitter using the 11901C adapter without any additional cabling or adapters.
- Minimize the use of other adapters.
- Ensure that 2.4 mm and 3.5 mm connectors are tightened properly:
  8 in-lbs (90 N-cm) for 3.5 mm
  8 in-lbs (90 N-cm) for 2.4 mm

Procedure

1. Preset the power meter.
2. Ensure that the power sensor is disconnected from any source and zero the meter.
3. Connect the power sensor to the power meter's Power Ref connector and calibrate the meter.
4. Make the connections to oscilloscope channel 1 as shown in the connection diagram above.
5. Set up the Power Meter to display measurements in units of Watts.
6. Press Default Setup, then configure the scope as follows:
   a. Ensure Channel 1 is displayed and all other channels are turned off.
   b. Set the vertical sensitivity of channel 1 to 10 mV/div.

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



Click here and enter 16E-9

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

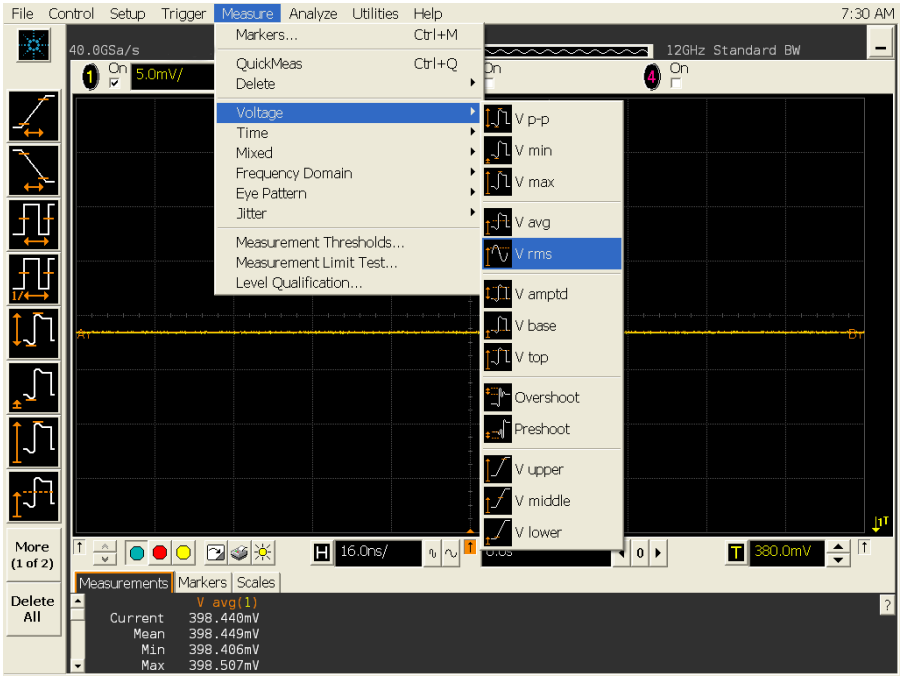
Memory Depth = Automatic

Sampling rate = Maximum (80 GSa/s)

Sin(x)/x Interpolation filter enabled

Averaging = Disabled

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

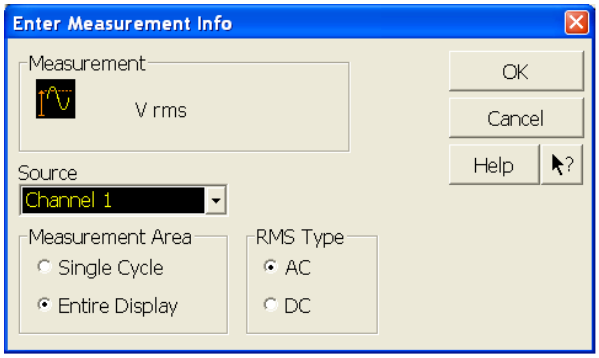


f When the RMS voltage measurement setup window is displayed, configure this measurement as follows:

Source = Channel 1

Measurement Area = Entire Display

RMS Type = AC



7 Set the generator to apply a 50 MHz sine wave with a peak-to-peak amplitude of about 4 divisions.

- Use the following table to determine the approximate required signal amplitude.

  The amplitude values in the table below are not absolutely required. If your generator is unable to produce the recommended amplitude, then set the generator to the highest value that does not produce a vertically clipped signal on the scope.

Table 3-1. Nominal Generator Amplitude Settings

Scope Vertical Sensitivity	Generator Signal Amplitude (Vp-p)	Generator Signal Amplitude (dBm)
10 mV/div	0.08	-18
20 mV/div	0.16	-12
50 mV/div	0.4	-4
100 mV/div	0.8	+2
200 mV/div	1.6	+8
500 mV/div	4.0	+16
1 V/div	6.3	+20

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

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

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

Record the RMS voltage in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record (Vin @ 50 MHz).

9 Press the Clear Display key on the scope and record the scope V rms reading in the Analog Bandwidth - Maximum Frequency Check section of the Performance Test Record (Vout @ 50 MHz).

Notes

- For all scope readings in this procedure, use the mean value in the Measurements display area at the bottom of the screen.

Record the mean reading

10 Calculate the reference gain as follows:

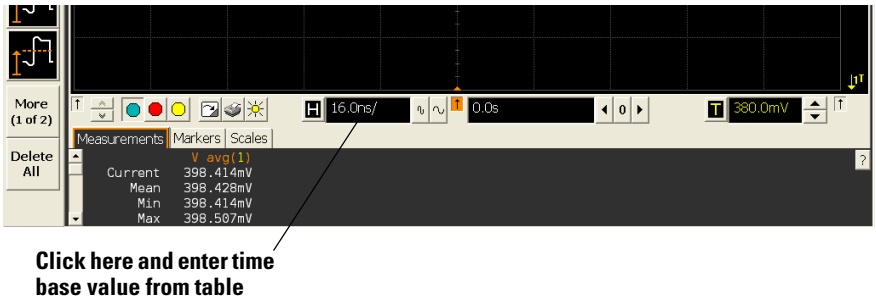
$$Gain_{50\ MHz} = \frac{V_{out\ @50\ \mathrm{MHz}}}{V_{in\ @50\ \mathrm{MHz}}}$$

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

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

Setting	Model		
	DSO/DSAX 91604A	DSO/DSAX 92004A	DSO/DSAX 92504A
Maximum Frequency	16 GHz	20 GHz	25 GHz
Scope Time Base Setting	50 ps/div	50 ps/div	50 ps/div
	Model		
	DSO/DSAX 92804A	DSO/DSA 93004L	DSO/DSAX 93204A
Maximum Frequency	28 GHz	30 GHz	32 GHz
Scope Time Base Setting	50 ps/div	50 ps/div	50 ps/div

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



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

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

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

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

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

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

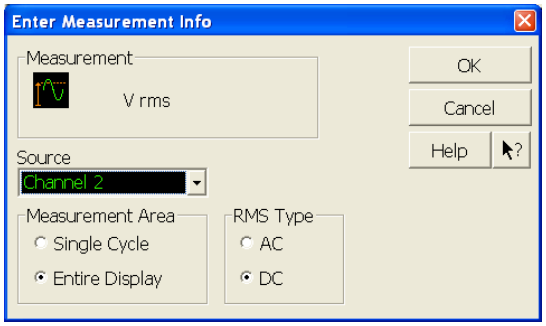
$$Gain_{Max\ \mathrm{Freq}} = 20 \log_{10}\left[\frac{(V_{out\ Max\ Freq})/(V_{in\ Max\ Freq})}{Gain_{50\ MHz}}\right]$$

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

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

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

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



22 Repeat steps 7 to 20 to complete measuring gains for channel 2.
23 Move the splitter to channel 3 and change the scope configuration as follows:
   a Ensure Channel 3 is displayed and all other channels are turned off.
   b Set the vertical sensitivity of channel 3 to 10 mV/div.
   c Set the horizontal scale to 16 ns/div (to display 8 cycles of a 50 MHz waveform).
   d Click on the V rms measurement at the bottom of the screen and select Customize. When the V rms setup window is displayed, change the source from Channel 2 to Channel 3.
24 Repeat steps 7 to 20 to complete measuring gains for channel 3.
25 Move the splitter to channel 4 and change the scope configuration as follows.
   a Ensure Channel 4 is displayed and all other channels are turned off.
   b Set the vertical sensitivity of channel 4 to 10 mV/div.
   c Set the horizontal scale to 16 ns/div (to display 8 cycles of a 50 MHz waveform).
   d Click on the V rms measurement at the bottom of the screen. When the V rms setup window is displayed, change the source from Channel 3 to Channel 4.
26 Repeat steps 7 to 20 to complete measuring gains for channel 4.

Time Scale Accuracy (TSA)

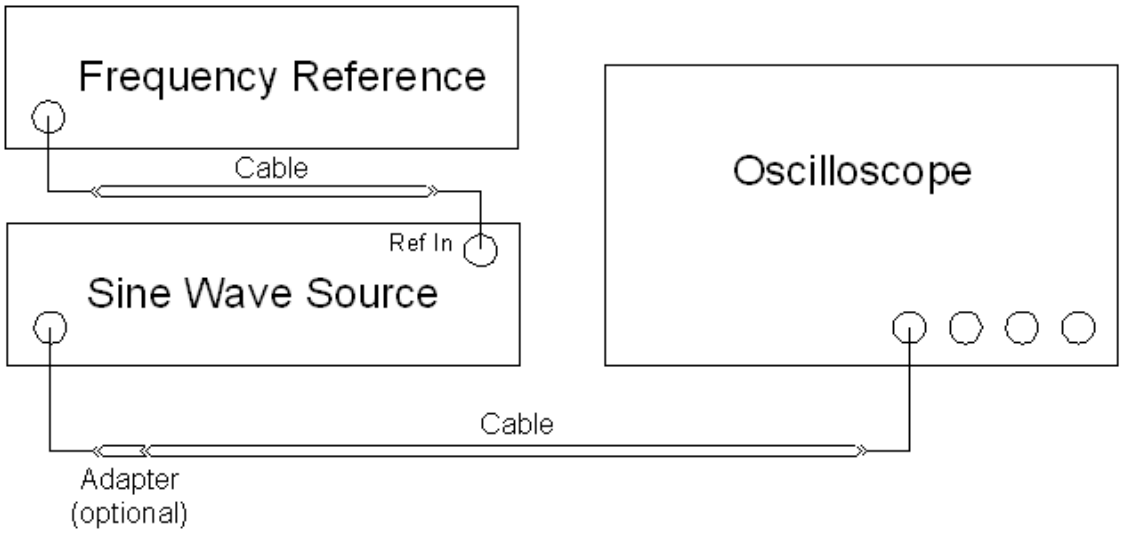
This procedure verifies the maximum TSA specification for the oscilloscope.

Equipment Required

Equipment	Critical Specifications	Recommended Model/Part
Synthesized sine wave source	Output Frequency: ≥ 10 MHz Output Amplitude: 0 dBm Frequency Resolution: 0.1 Hz	Agilent E8267D PSG
10 MHz frequency reference	Output Frequency: 10 MHz Absolute Freq. Error: < ±0.0275 ppm	Agilent 53132A opt. 012 frequency counter
RF cable	50 ohm characteristic impedance (no substitute) BNC (m) connectors Max Frequency: ≥ 50 MHz	Agilent 8120-1840
Adapters, assorted	3.5 mm (f) to Precision BNC (m) 3.5 mm (f) to 3.5 mm (f)	Agilent 54855-67604 Agilent 83059B

Connections

Connect the equipment as shown in the following figure.



Procedure

1. Configure the sine wave source to output a 0 dBm (600 mVpp) sine wave into 50 ohms with a frequency of 10.00002000 MHz.
2. Adjust source amplitude such that displayed sine wave is 600 mVpp.
3. Press the **Default Setup** key on the oscilloscope.
4. Set channel 1's vertical scale to 100 mV/div.
5. Set the oscilloscope sample rate to 100 kSa/s.
6. Set the scope's horizontal scale to 20 ms/div.
7. Set the measurement thresholds for all waveforms to a fixed voltage level of 0 V and ±20 mV hysteresis. To do this, go under **Measure** > **Thresholds** in the top menu. Then select **Custom: level +/- Hysteresis** and enter 20 mV into the **Hysteresis** field and 0 V into the T**hreshold Level** field.
8. Enable a frequency measurement on channel 1.
9. On the oscilloscope, press **Stop**.
10. Press **Clear Display**.
11. Press **Run**, wait until 10 acquisitions have accumulated, and then press **Stop**.
12. Convert the average frequency value to time scale error by subtracting 20 Hz and dividing by 10 Hz/ppm.
13. Record the time since calibration (in years) in the table. The calibration date can be found in the Calibration menu window.
14. Calculate the test limits using the following formula and record them in the table.
    Test Limits = ±(0.100 + 0.100 x Years Since Calibration)
15. Record the results in the Performance Test Record.

Performance Test Record

Agilent Technologies	Agilent 90000-X Series / 90000-L Series Oscilloscopes
Model Number _____	Tested by_____
Serial Number _____	Work Order No._____
Recommended Test Interval - 1 Year/2000 hours	Date_____
Recommended next test date _____	Ambient temperature _____

Offset Performance Test

Zero Error Test

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

Offset Gain Test

Vertical Sensitivity	$V_{Cal\ Out}$ Setting	V_{DMM+}	V_{DMM-}	V_{DMM0}	V_{Scope+}	V_{Scope-}	V_{Scope0}	Calculated Offset Gain Error	Offset Gain Error Test Limits
Channel 1									
10 mV/div	±400 mV								±2 %
20 mV/div	±400 mV								±2 %
50 mV/div	±700 mV								±2 %
100 mV/div	±1.2 V								±2 %
200 mV/div	±2.2 V								±2 %
500 mV/div	±2.4 V								±2 %
1 V/div	±2.4 V								±2 %
Channel 2									
10 mV/div	±400 mV								±2 %
20 mV/div	±400 mV								±2 %
50 mV/div	±700 mV								±2 %
100 mV/div	±1.2 V								±2 %
200 mV/div	±2.2 V								±2 %
500 mV/div	±2.4 V								±2 %
1 V/div	±2.4 V								±2 %
Channel 3									
10 mV/div	±400 mV								±2 %
20 mV/div	±400 mV								±2 %
50 mV/div	±700 mV								±2 %
100 mV/div	±1.2 V								±2 %
200 mV/div	±2.2 V								±2 %
500 mV/div	±2.4 V								±2 %
1 V/div	±2.4 V								±2 %
Channel 4									
10 mV/div	±400 mV								±2 %
20 mV/div	±400 mV								±2 %
50 mV/div	±700 mV								±2 %
100 mV/div	±1.2 V								±2 %
200 mV/div	±2.2 V								±2 %
500 mV/div	±2.4 V								±2 %
1 V/div	±2.4 V								±2 %

DC Gain Test

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

Analog Bandwidth - Maximum Frequency Check

Max frequency: DSO/DSAX91604A = 16 GHz, DSO/DSAX92004A = 20 GHz, DSO/DSAX92504A = 25 GHz, DSO/DSAX92804A = 28 GHz, DSO/DSA93004L = 30 GHz, DSO/DSAX93204A = 32 GHz .

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

Time Scale Accuracy

Measured Time Scale Error (ppm)	Years Since Calibration (years)	Low Test Limit (ppm)	High Test Limit (ppm)	Pass/Fail
_____	_____	_____	_____	_____

4

Replacing Assemblies

Replacing Assemblies

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

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

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

ESD Precautions

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

CAUTION

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

Tools Required

The following tools are required for these procedures.

- Torx drivers: T10, T20
- Socket wrench: 9/16 inch
- Torque wrench: 3.5 mm (8 in-lbs)
- Medium size (3/16-in) flat-blade screwdriver

CAUTION

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

WARNING

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

WARNING

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

WARNING

INJURY CAN RESULT!
Use caution when the oscilloscope fan blades are exposed as they can cause injury.

WARNING

SHOCK HAZARD!
When the bulk 12V power supply is removed from the oscilloscope, two AC leads are exposed. Therefore, the power cable should be disconnected from the bulk 12V power supply before the supply is removed. Caution should also be exercised to not contact these leads as severe shock could result.

To return the oscilloscope to Agilent Technologies for service

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

1. Write the following information on a tag and attach it to the oscilloscope.
   - Name and address of owner
   - Oscilloscope model numbers
   - Oscilloscope serial numbers
   - Description of the service required or failure indications
2. Remove all accessories from the oscilloscope.

   Accessories include all cables. Do not include accessories unless they are associated with the failure symptoms.
3. Protect the oscilloscope by wrapping it in plastic or heavy paper.
4. Pack the oscilloscope in foam or other shock absorbing material and place it in a strong shipping container.

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

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

To remove and replace the cover, top plate, and bottom plate

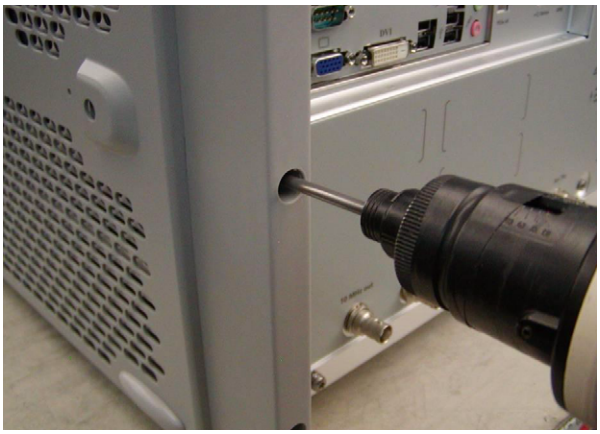
Use this procedure to remove and replace the cover, top plate, and bottom plate. When necessary, refer to other removal procedures. The pictures in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

1. Disconnect the power cable.
2. Disconnect all oscilloscope probes and BNC input cables from the front panel.
3. Disconnect any other cables, such as mouse, keyboard, printer, USB, or LAN cables.
4. Remove the accessory pouch from the top of the oscilloscope if it is attached.
5. Remove the two Torx T20 screws securing the side handles on both sides of the oscilloscope (when installing, torque to 18 in-lbs).

Figure 4-1

6. Remove the 6 Torx T20 screws that secure the rear feet (three in each foot). When installing, torque to 18 in-lbs.

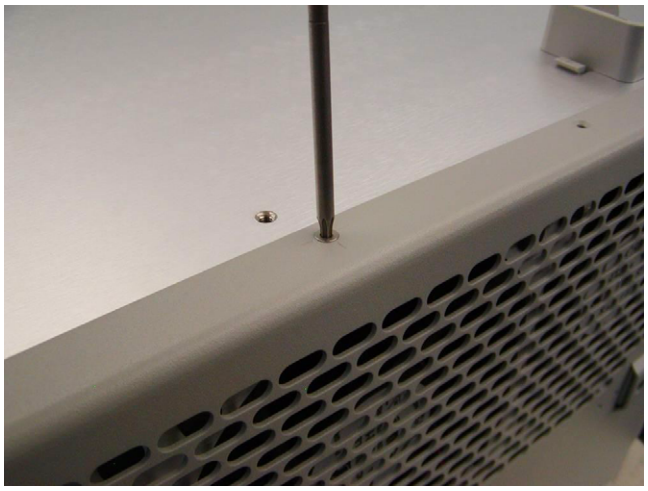
Figure 4-2



7. Remove the three M4 screws (located on the top edge of the rear panel of the oscilloscope - see Figure 4-3) and then turn the instrument on its side and remove the ten Torx T10 screws (located on the underside of the oscilloscope - see Figure 4-4. Torque to 5 in-lbs when installing) that attach the outer cover to the chassis.

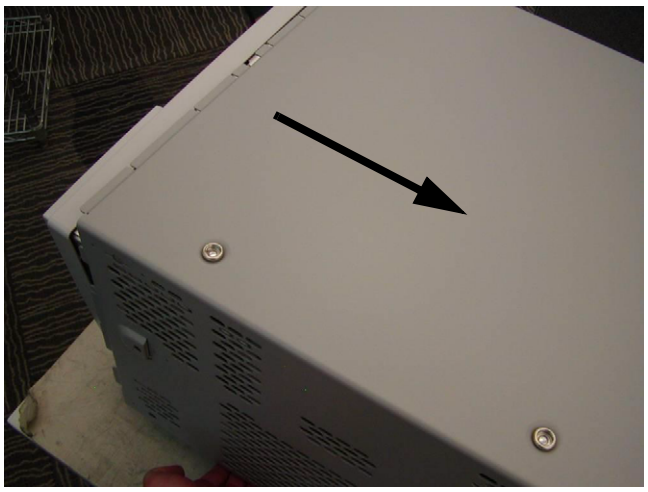
Figure 4-3

Figure 4-4



8 Carefully slide the cover towards the rear of the instrument and off the chassis as shown in Figure 4-5.

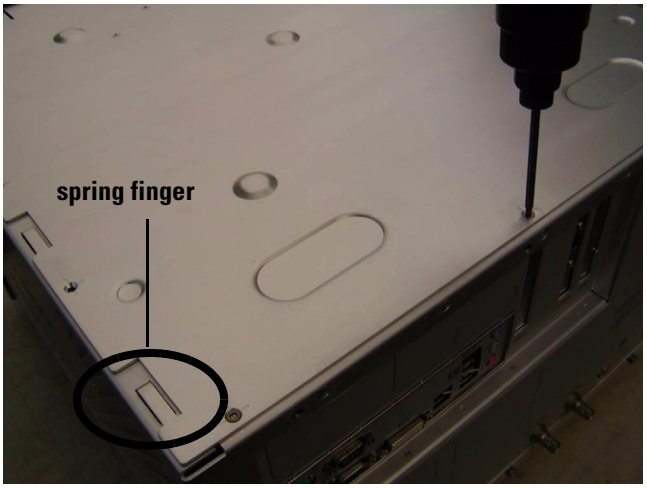
Figure 4-5



9 Once the cover is removed, you can remove the top plate by removing the three Torx

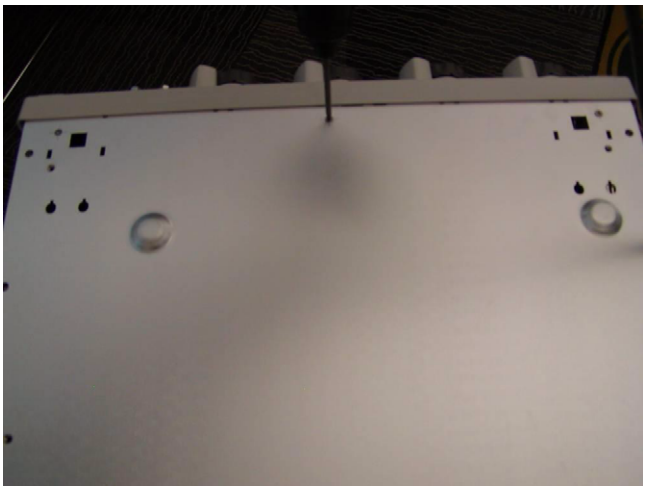
T10 screws from its rear edges as shown in Figure 4-6 and then pulling the plate towards the rear panel to dislodge the spring fingers. Then lift the top plate off of the chassis. When installing, ensure all 11 spring fingers engage the chassis as designed and torque the screws to 5 in-lbs.

Figure 4-6



10 To remove the bottom plate, flip the oscilloscope upside down and remove the Torx T20 and T10 screws from the bottom panel as shown in Figure 4-7. A guide pin in the lip of the plate will align with a hole in the rear panel of the chassis when installing (also torque T10 screws to 5 in-lbs and T20 scres to 18 in-lbs when installing). Slide the bottom panel up and away from the chassis.

Figure 4-7



11 To replace the cover, top plate, and bottom plate, reverse the above procedure. Please note that all sheet metal holes that are supposed to have screws placed in them are marked by lines on four sides of the hole as shown in Figure 4-8

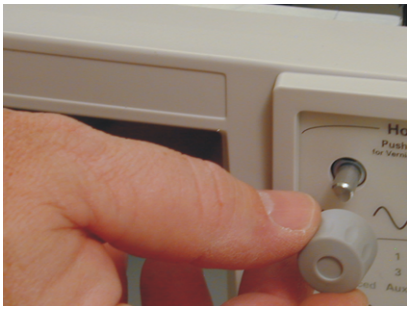
Figure 4-8

To remove and replace the front panel assembly

1 Disconnect the power cable and remove the cover, top plate, and bottom plate as described above in the section on removing the cover, top plate, and bottom plate.

2 If you are removing the keyboard then grasp and pull on all knobs located on the front panel to remove them (Figure 4-9). If you are not removing the keyboard then this step is not necessary.

Figure 4-9



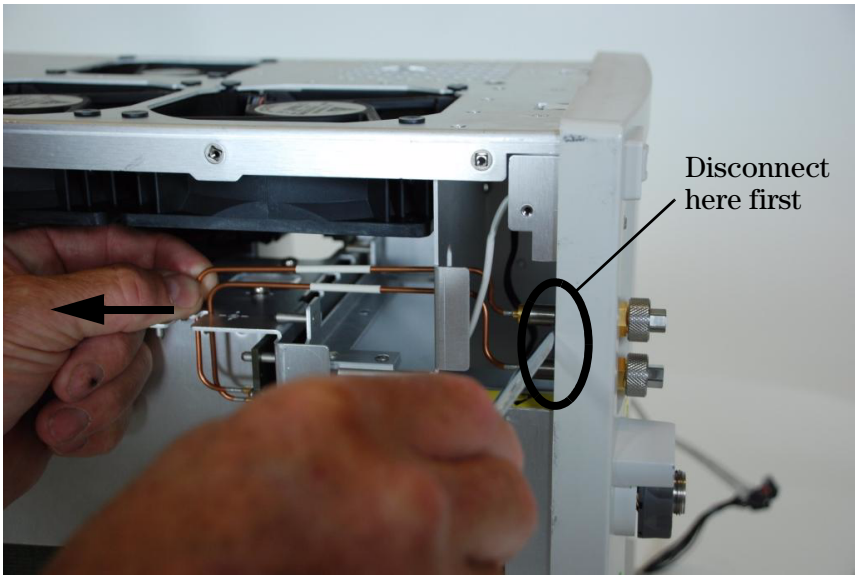
3 Disconnect the Display cable and On/Off cable from the motherboard end of the cables.

4 Disconnect the USB and Front Panel Power cables from the front panel (these are accessible from the top side of the scope).

5 Turn the scope upside down and disconnect the two semi-rigid Cal Out/ Aux Out cables from both the front panel and backplane board. As the figure below shows, first disconnect the cables from the rear side of the Cal Out connections and then pull straight back to remove the cables from the backplane board. CAUTION: Be sure to pull straight back so as not to bend or break the connection to the backplane board.

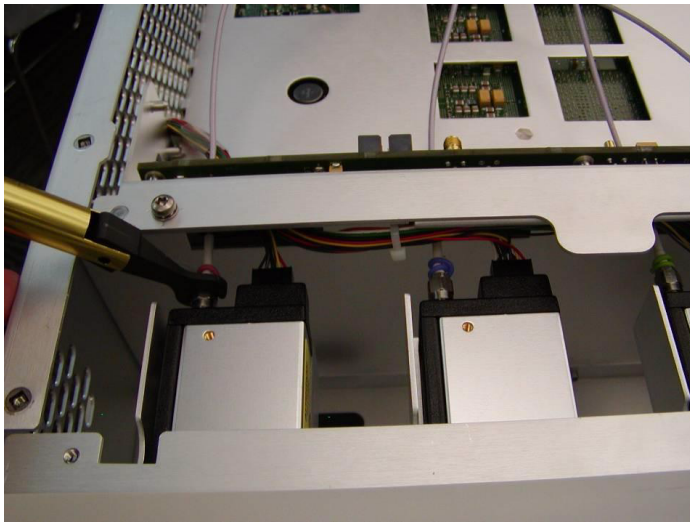
When reconnecting these cables, torque the Cal Out connection to 8 in-lbs.

Figure 4-10

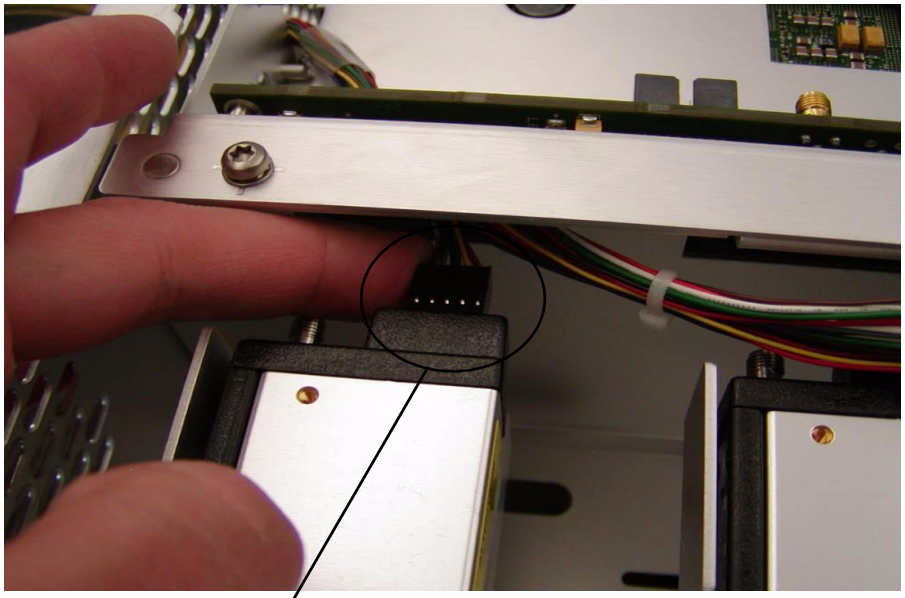


6 Disconnect each input cable (when reconnecting, you can determine the appropriate connections by matching the colored o-ring to th bezel color. Tighten to 8 in-lbs using a calibrated 5-16 Open End torque wrench) - See Figure 4-11.

Figure 4-11



7 Remove the attenuator power cable from each input channel attenuator as shown in the figure below. The attenuators are keyed to match the connectors.



Remove this connection from each channel attenuator and then route the entire cable through the backplane bo

8 Remove the six T10 screws that attach the side of the chassis and the front panel assembly - See Figure 4-12 (torque to 5 in-lbs when installing and the screws must be tightened in the order shown in the figure below).

Figure 4-12

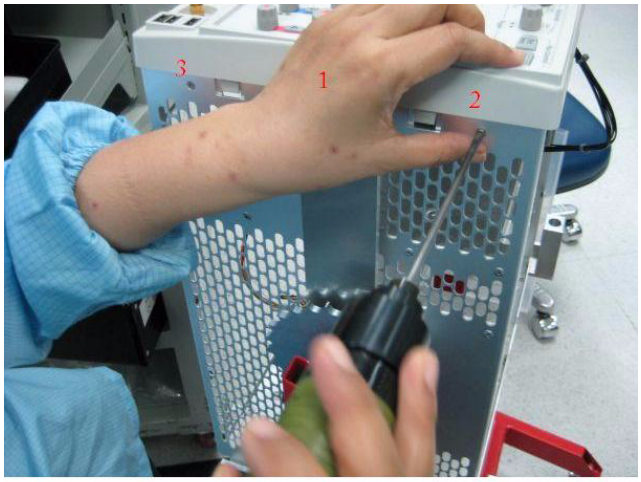
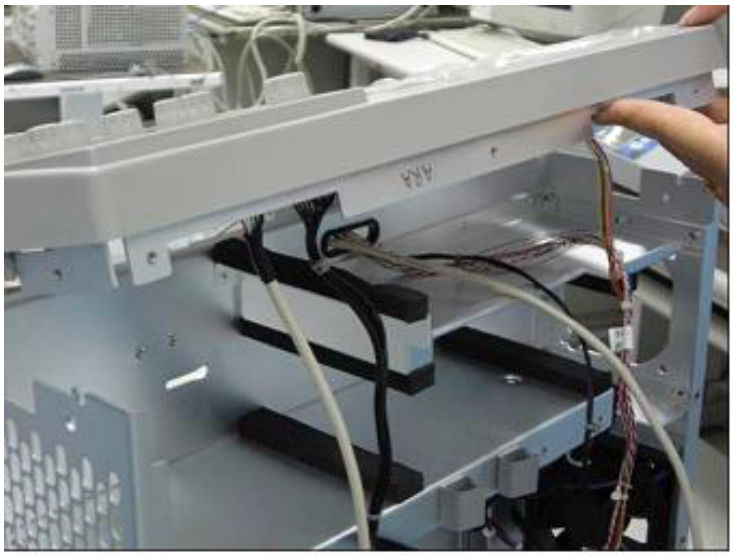


Figure 4-13

9 Tilt the front panel up to see the cables connected to it. Either disconnect them from the front panel side of the connectiong or route the display cable, On/Off cable, and USB front/touchscreen cable through the grommet on the chassis after disconnecting them from the other side of their connections (Figure 4-14).

Figure 4-14



10 CAUTION: When installing the front panel assembly onto the oscilloscope, make sure not to damage the cables when setting the front panel on the chassis.

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

To remove and replace front panel assembly parts

Remove the front panel assembly as described in the previous section.

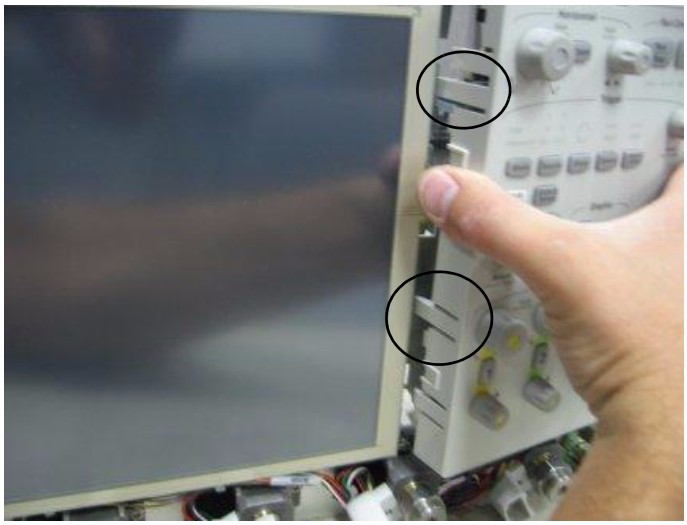
Front Panel Clutches

1. WARNING: This step will ruin the clutch and you will have to replace it with a new one. Use a ribbon or something else thin to place behind the dark grey clutch and pull on it to pop it off of the oscilloscope.
2. You can now remove the 3.5 mm input connectors and replace them.

Front Panel Bezzle and Front Panel Circuit Assembly

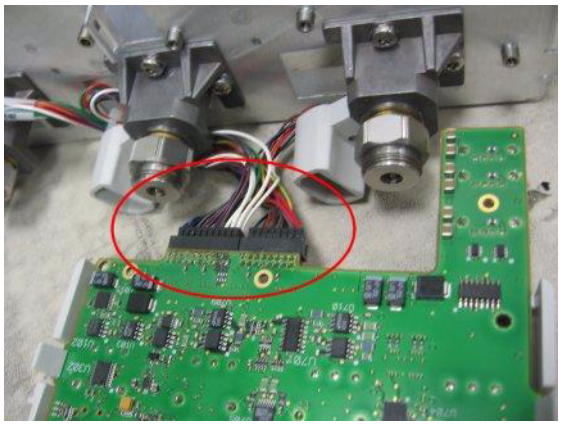
1. Grasp and pull all of the knobs off of the front panel as shown in the previous section.
2. There are two tabs on either side, one tab on top, and one tab on the bottom. Pop these with your fingers to dislodge the front panel bezzle.
3. Reverse directions to attach the front panel bezzle.
4. To remove the front panel circuit assembly, unsnap the board from the deck as shown below. You may need a flathead screwdriver to dislodge the tabs.

Figure 4-15.



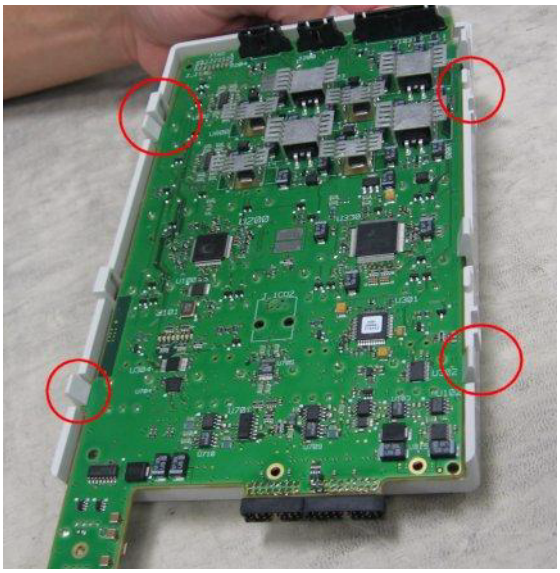
5. Disconnect the cables shown below from the board.

Figure 4-16.



6 Disengage the four tabs holding the board to the keypad as shown below.

Figure 4-17.



7 To reassemble the front panel circuit board, reverse these steps.

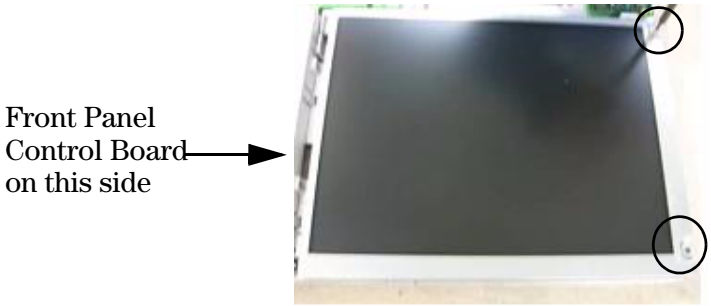
Display Assembly

1 Remove the front panel assembly and front panel bezzle as described previously.
2 Remove the inverter shield from the deck by angling it as shown below.

Figure 4-18.

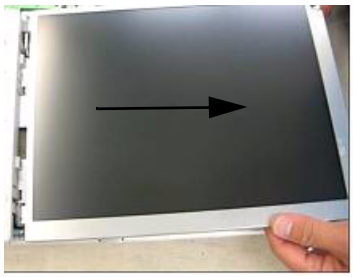
3 Remove the two screws holding the display to the chassis as shown below.

Figure 4-19.



4 Slide the display away from the control panel to disengage the tabs.

Figure 4-20.



5 You can now disconnect any cables connected to the display.

To remove and replace the motherboard

1 Disconnect the power cable and remove the cover and top plate as described previously.
2 Disconnect all the cables from the motherboard (there is a list of these cables on page page 71).
3 Remove the Torx T10 screws attaching the motherboard to the frame. When installing, torque to 5 in-lbs.
4 Loosen the four screws in the large fan as shown below.

Figure 4-21

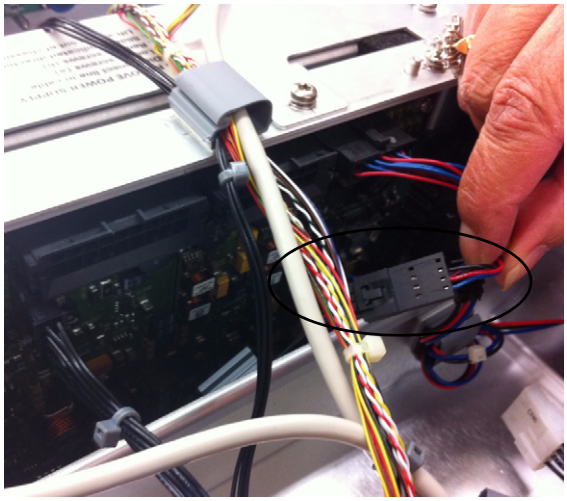
5 Pull the motherboard towards the front panel and then lift out.
6 To reassemble the motherboard, reverse the above procedure.

To remove and replace the acquisition boards/backplane assembly

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

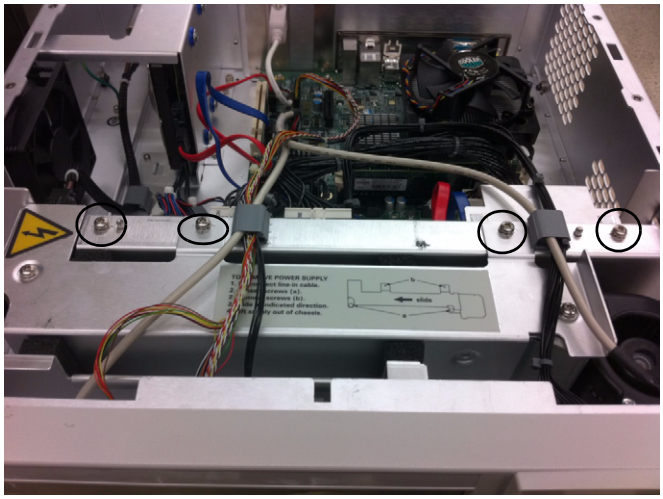
1. Disconnect the power cable and remove the cover, top plate, and bottom plate as described previously.
2. From the top side of the scope, remove the 7 cables connected to the backplane board. One of these cables is the IC fan cable that is towards the bottom of the backplane board so you need to look down the board to see it and then follow the cable up to where you can disconnect it. It is the cable circled in Figure 4-22.

Figure 4-22



3. Remove the four screws on top of the backplane board.

Figure 4-23



4. Loosen the two screws located at the bottom of the power supply and then push the power supply towards the side of the scope with the fans. With it pushed to the side, you can tighten the screws back down into a set of new holes to keep the power supply in place when you flip the scope over in an upcoming step.

Figure 4-24

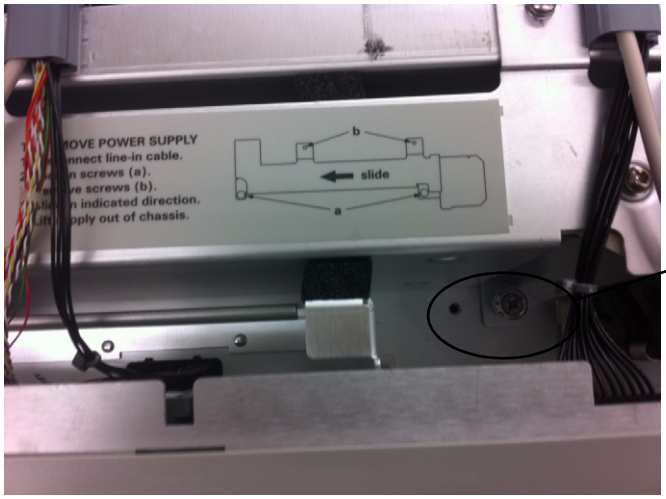
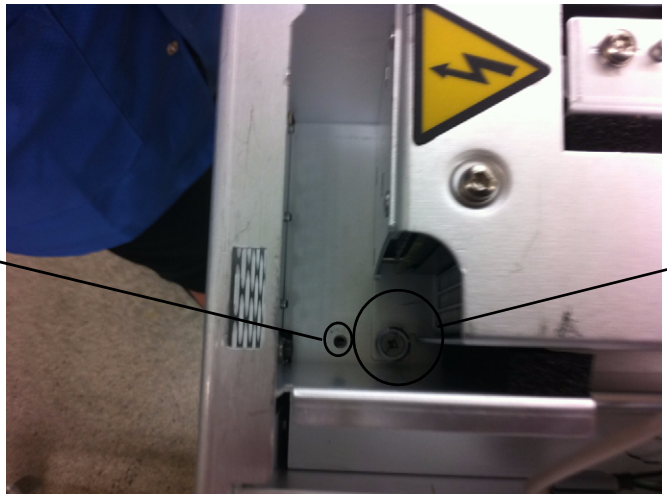
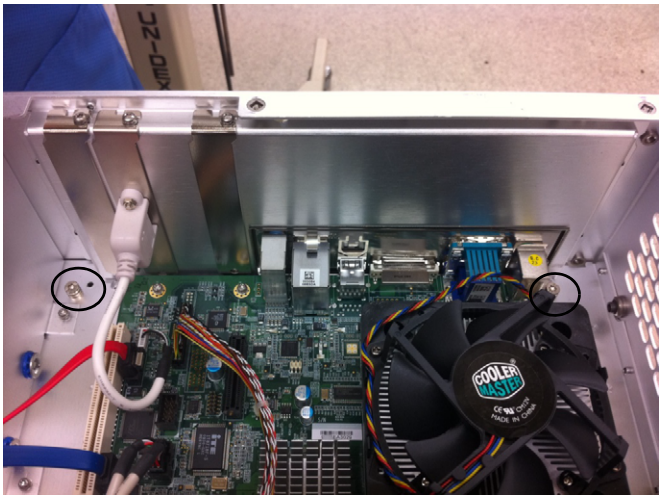


Figure 4-25



5 Loosen the two screws near the motherboard / rear panel.

Figure 4-26



6 Turn the oscilloscope upside down and remove the SMAs connections to the bottom of the backplane board (Figure 4-27). When reconnecting, route these cables

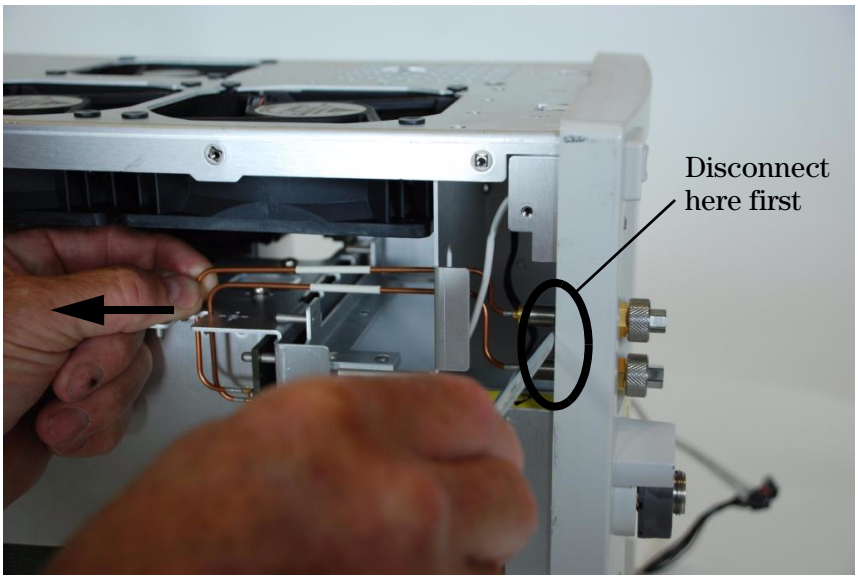
underneath the input cables. Also when reconnecting cables, the cables are labeled as are the connections on the backplane board so you can ensure you properly connect each cable to its correct location.

Figure 4-27

7 Remove the two semi-rigid cables from the rear side of the Cal Out / Aux Out connectors on the front panel (Figure 4-28). As the figure shows, first disconnect the cables from the rear side of the Cal Out / Aux Out connections and then pull straight back to remove the cables from the backplane board. CAUTION: Be sure to pull straight back so as not to bend or break the connection to the backplane board.

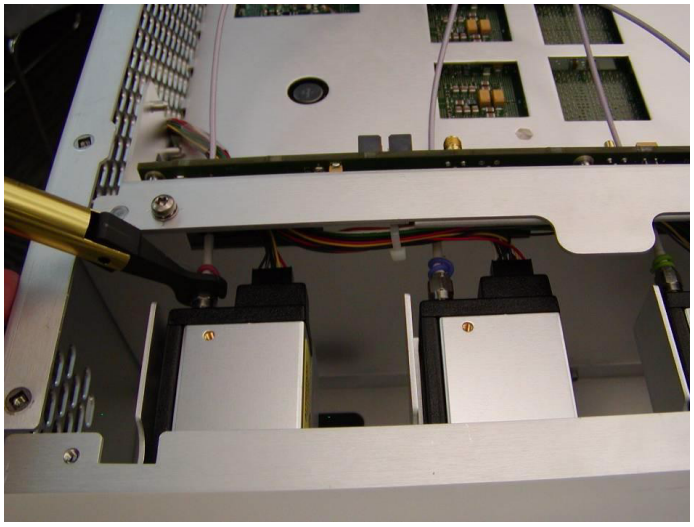
When reconnecting these cables, torque the Cal Out / Aux Out connections to 8 in-lbs.

Figure 4-28



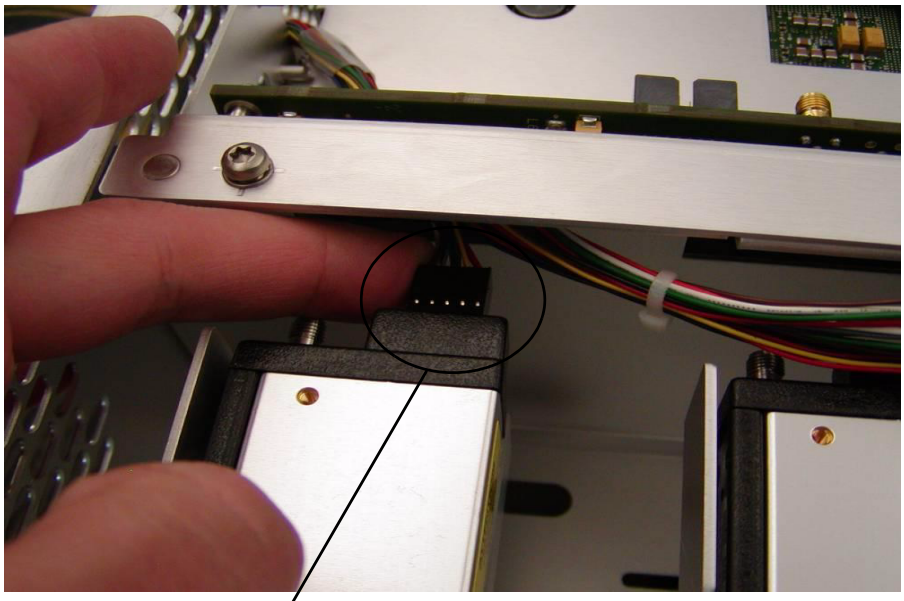
8 Disconnect each input cable and route them through the openings in the backplane (when reconnecting, you can determine the appropriate connections by matching the colored o-ring to th bezel color. Tighten to 8 in-lbs using a calibrated 5-16 Open End torque wrench) - See Figure 4-29.

Figure 4-29



9 Remove the attenuator power cable from each input channel attenuator and route attenuator power cable through the grommet in the backplane (10). The attenuators are keyed to match the connectors.

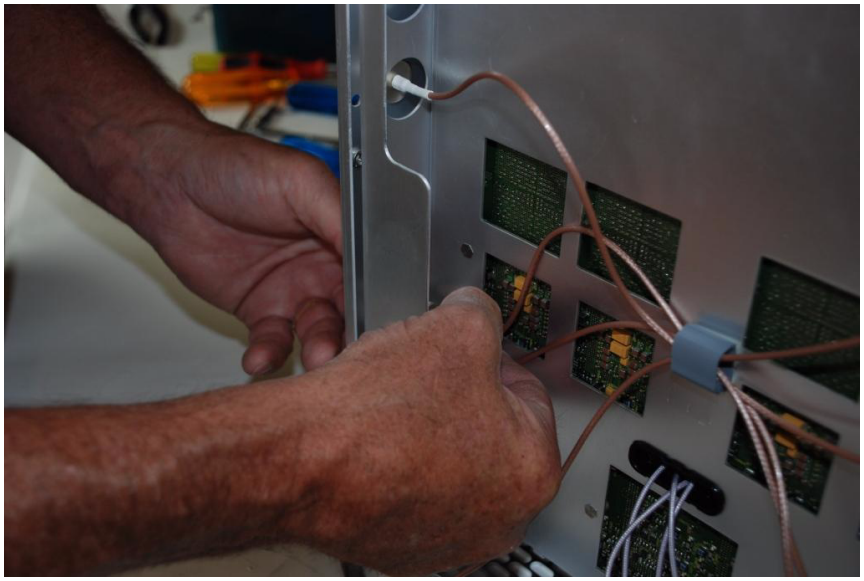
10 .



Remove this connection from each channel attenuator and then route the entire cable through the backplane bo

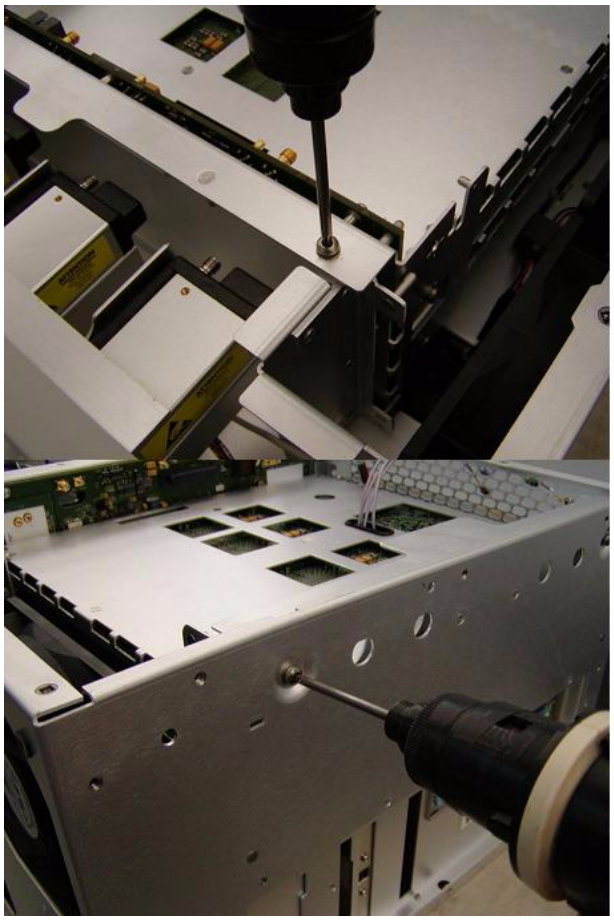
11 Remove the rear panel BNCs (Figure 4-30).

Figure 4-30



12 Remove the two Torx T20 screws from top of the backplane board and two T20 screws from the rear of the instrument as shown (Figure 4-31).

Figure 4-31



13 Disconnect all cables from the backplane board (you will need to look from both the top and bottom of the scope to see them all and reach them).

14 Then lift the entire acquisition boards/backplane assembly out of the chassis (Figure 4-32).

Figure 4-32

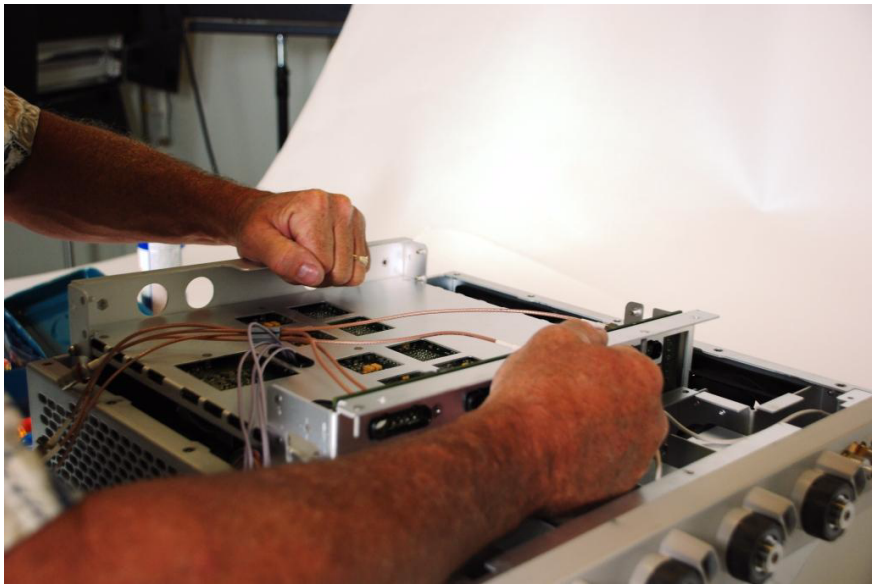
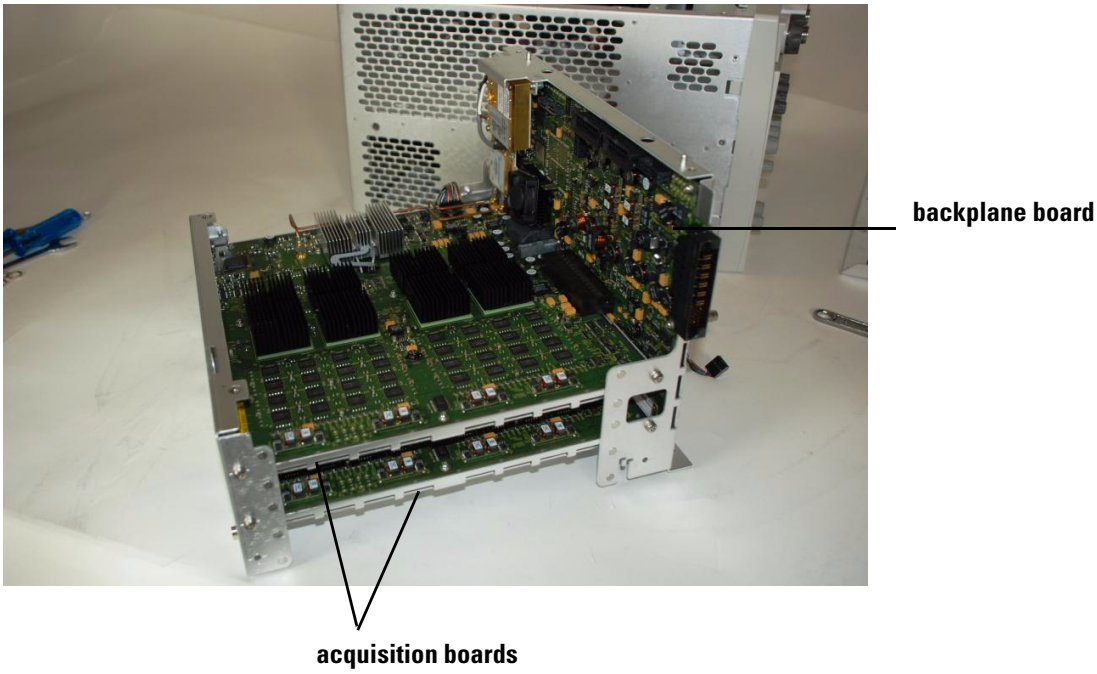


Figure 4-33

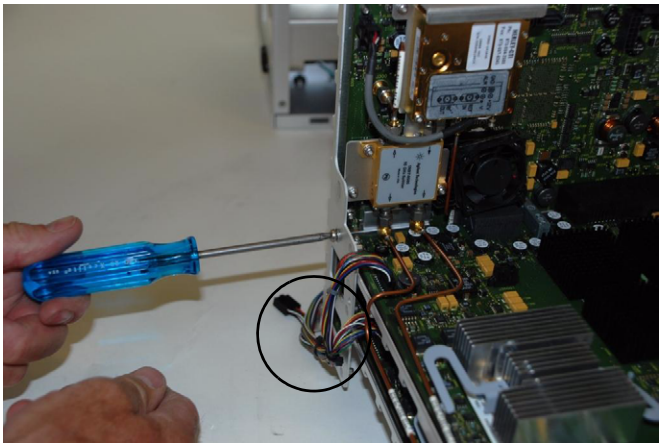


To remove the backplane assembly from the acquisition assemblies

1 Remove the entire acquisition/backplane assembly as described in the previous section.

2 Remove the four Torx T20 screws (two per acquisition assembly) on the side of the backplane assembly (Figure 4-34).

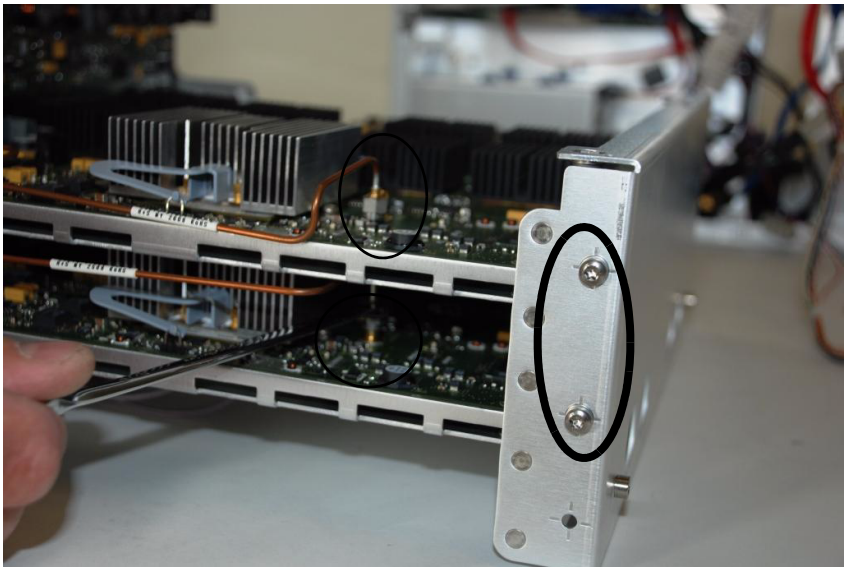
Figure 4-34



3 Disconnect the cables circled in red in Figure 4-34.

4 Disconnect the two semi-rigid cables from the acquisition boards.

Figure 4-35



5 Remove the four T20 screws from the foot of the assembly (two of them are cirlced in blue in the figure above).

6 Use the handles on the acquisition boards to separate the backplane assembly from each of the acquisition assemblies. This does require a bit of force as they are connected via several connections with numerous pins.

7 Remove the Torx T10 screws to remove each of the boards from their respective

subassembly chassis (Figure 4-38).

8 Please note that a new backplane board does not come with the Oscillator and Splitter Assembly so you will want to move these from the old backplane board to the new one. One key thing to note is that the following semi-rigid cable must be installed correctly.

Figure 4-36

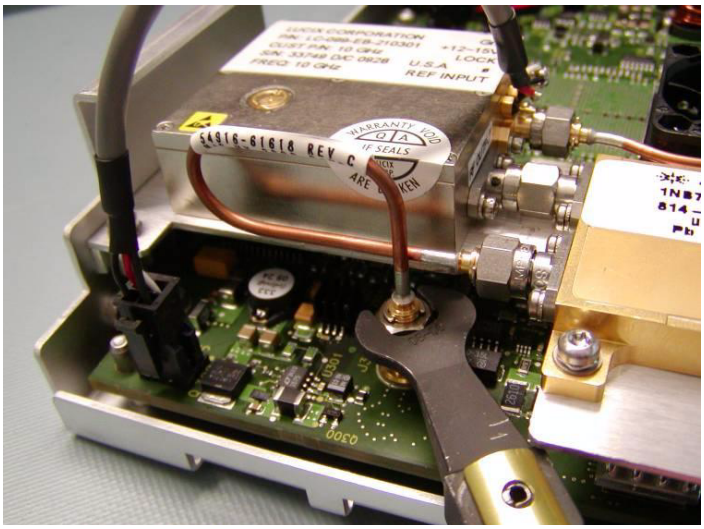


Figure 4-37

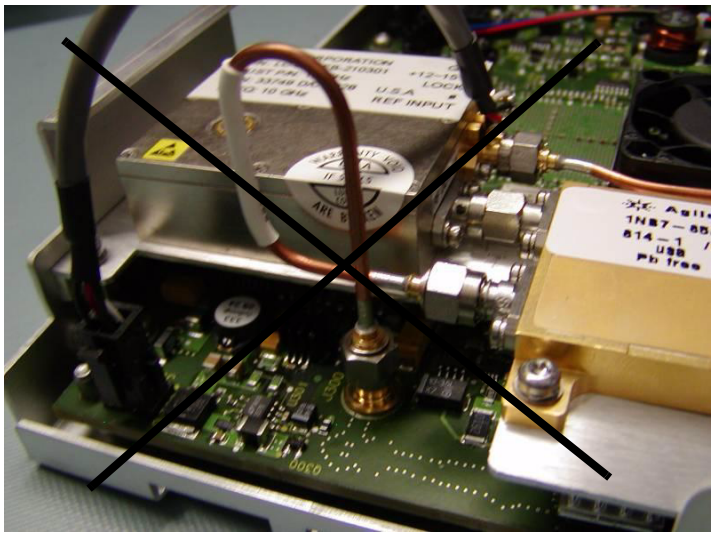


Figure 4-38

9 To reassemble the backplane/acquisition assembly, reverse these instructions.

To set the calibration factors after replacing the acquisition board

The calibration/self test procedure must be performed after replacing the acquisition board. Consult the calibration chapter in this Service Guide.

Let the oscilloscope warm up before testing

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

To remove and replace the hard disk drive

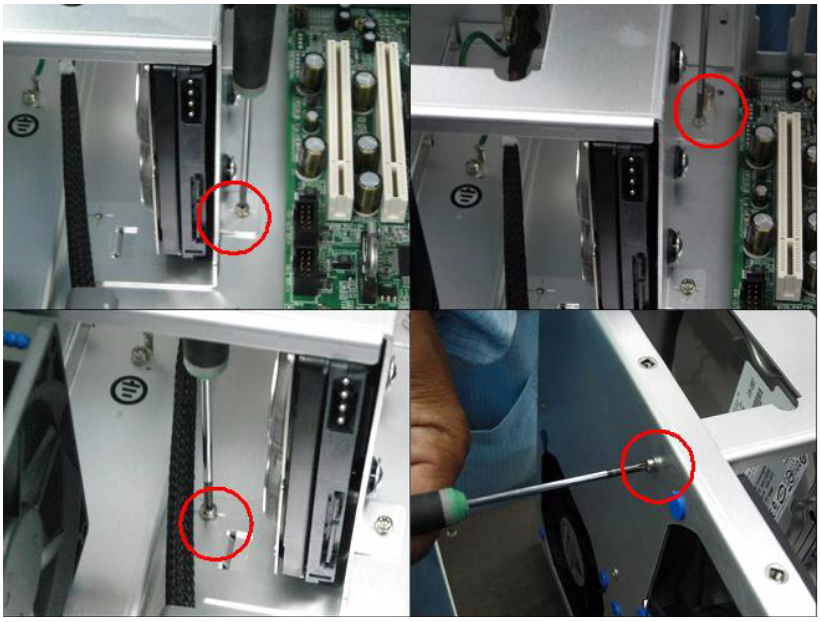
Use this procedure to remove and replace the hard disk drive. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

1 Disconnect the power cable and remove the cover and top plate as described previously.

2 Disconnect the cables connected to the hard drive.

3 Remove the four T10 screws shown below (Figure 4-39). Tighten to 5 in-lbs when assembling.

Figure 4-39



4 Remove the one T10 screw from the rear panel as shown below (Figure 4-40).

Figure 4-40

5 With the HDD and its frame removed, you can remove the HDD from the frame by removing the following four screws.

Figure 4-41

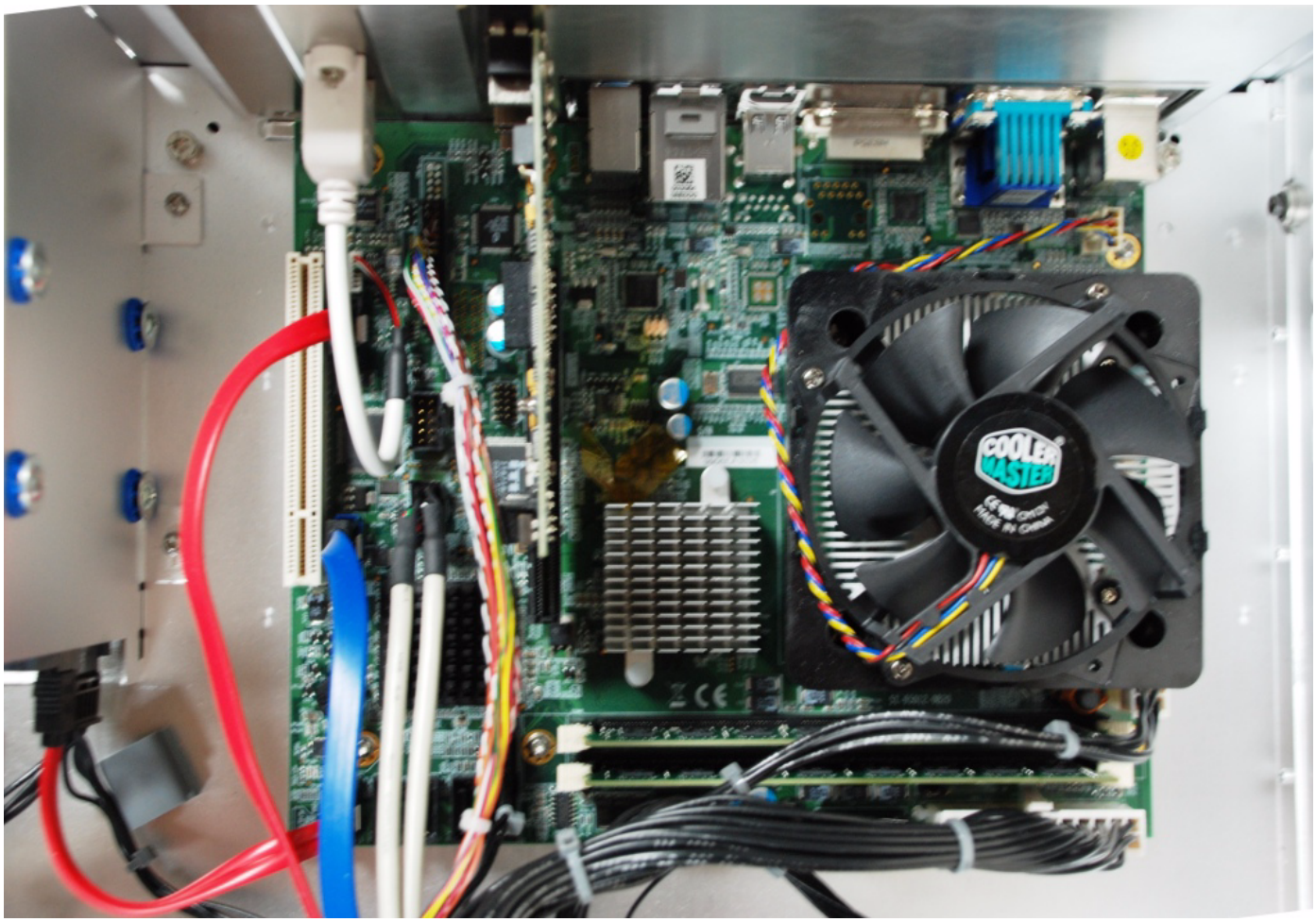
6 To replace the hard disk drive and hard drive control board, reverse the above procedure.

Cable removal (for replacing the motherboard)

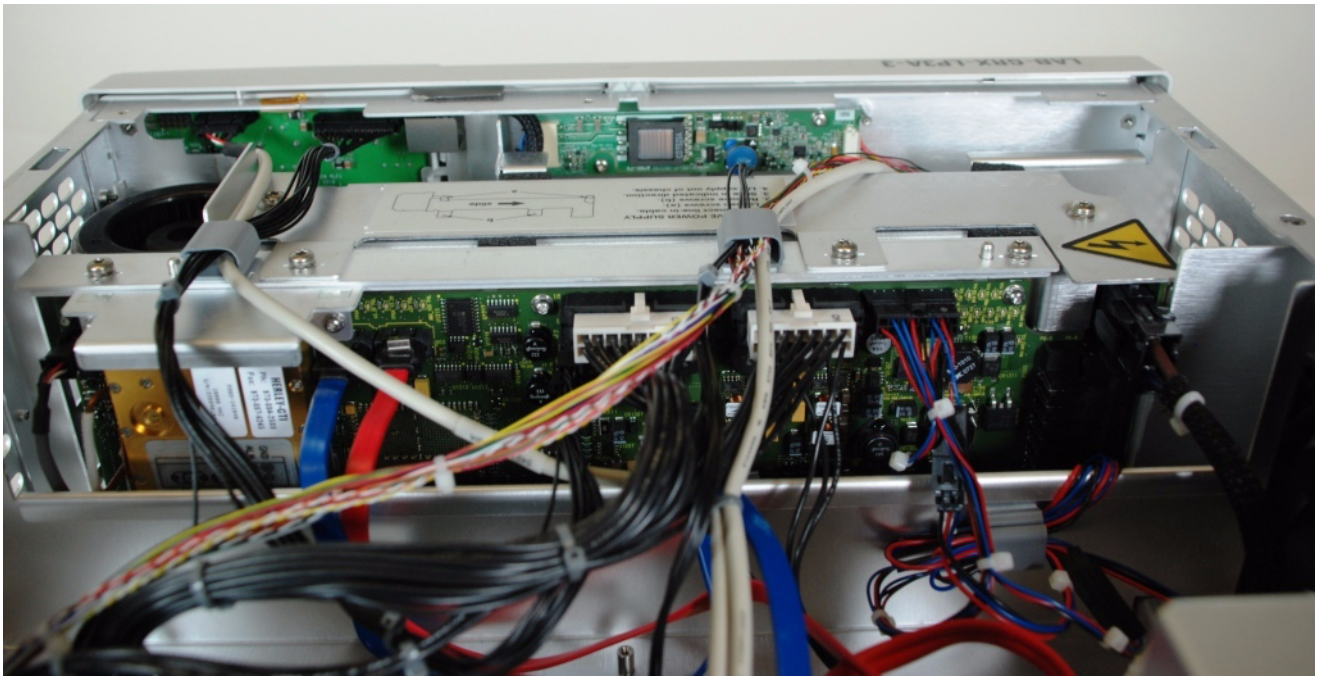
This section shows the various cables that need to be removed when replacing the motherboard.

1 Disconnect the power cable and remove the top cover.
2 Disconnect all cables from the motherboard.
Below is a overview picture showing the cables that need to be removed from the motherboard.

Figure 4-42



And here is a picture of the cables connected to the backplane board as viewed from the rear of the oscilloscope.



To remove and replace the power supply

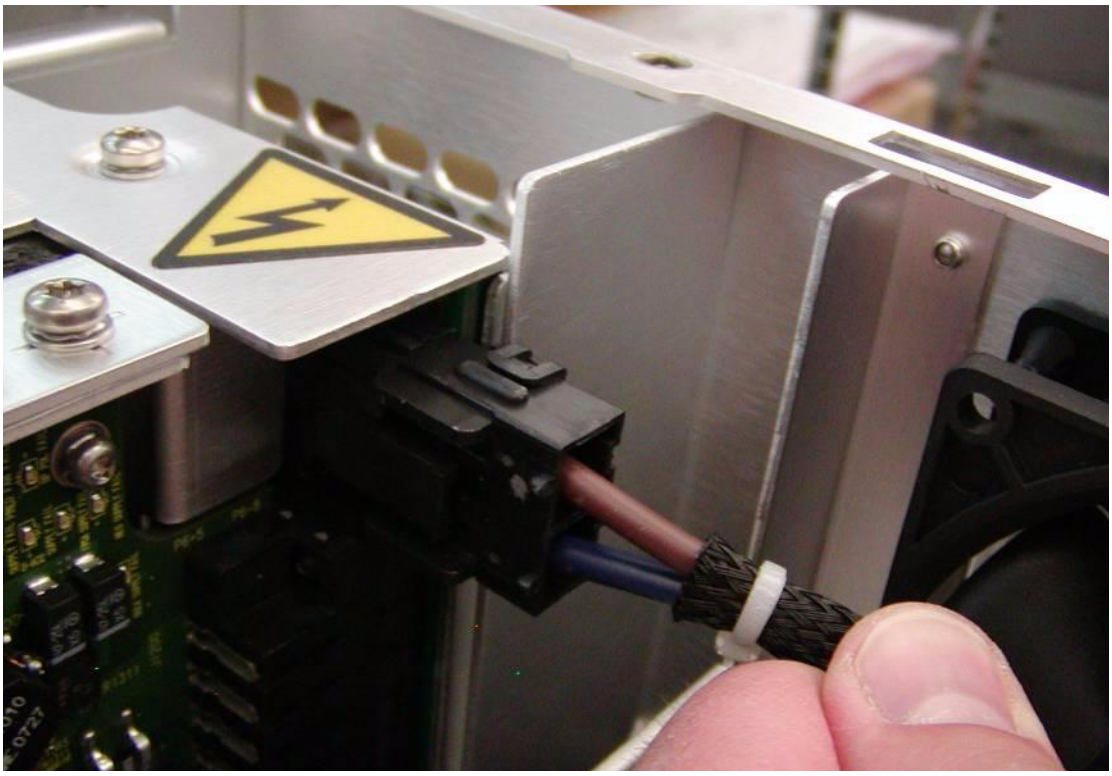
Use this procedure to remove and replace the power supply. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

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

WARNING SHOCK HAZARD!
When the power supply is removed, two AC leads are exposed. Take extra care not to contact these leads.

1 Disconnect the power cable and remove the top cover as described previously.
2 Disconnect the AC power cable from the bulk 12V power supply.
The picture below shows where the AC power cable connects to the bulk 12V power supply.

Figure 4-43



3 Follow the instruction on the label attached to the top of the power supply to remove it.

To remove and replace the fans

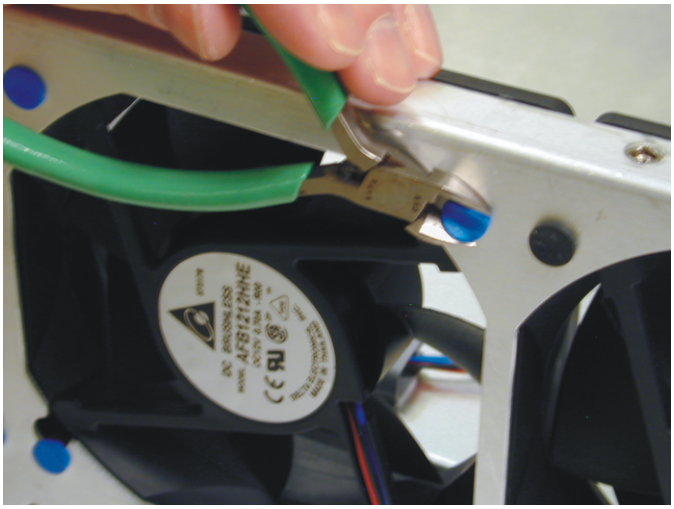
WARNING

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

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

1. Disconnect the power cable and remove the cover and top plate.
2. Disconnect the fan harness cables.
3. Clip off the end of each of the locking buttons (see Figure 4-44) and take the fan out. Repeat for each fan that needs to be replaced.

Figure 4-44



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.

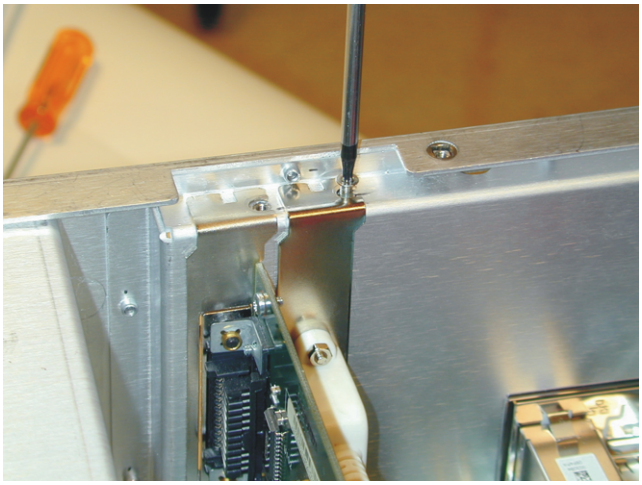
4. To install the fan, reverse this procedure.

To remove and replace the USB or GPIB port

Use this procedure to remove and replace the USB or GPIB port (GPIB is an option and may not be on your oscilloscope). The procedure is exactly the same for both of these ports so only one will be shown here. When necessary, refer to other removal procedures. The graphics in this chapter are representative of the oscilloscope at the time of this printing. Your unit may look different.

1 Disconnect the power cable and remove the cover and top plate.
2 Remove the screw from top edge of chassis (Figure 4-45).

Figure 4-45



3 Undo the connection to the motherboard by disconnecting the cable.
4 Pull the port out of the instrument.
5 To replace one of these ports, reverse the directions.

5

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.

Replaceable Parts List

The following table is a list of replaceable parts. The information given for each part consists of the following:

- 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

Agilent Part Number	QTY	Description
Repair Center Replacement Only	1	Infinium DSO, 16 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSOX91604A)
Repair Center Replacement Only	1	Infinium DSO, 20 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSOX92004A)
Repair Center Replacement Only	1	Infinium DSO, 25 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSOX92504A)
Repair Center Replacement Only	1	Infinium DSO, 28 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSOX92804A)
Repair Center Replacement Only	1	Infinium DSO, 32 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSOX93204A)
Repair Center Replacement Only	1	Infinium DSOA, 16 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSAX91604A)
Repair Center Replacement Only	1	Infinium DSA, 20 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSAX92004A)
Repair Center Replacement Only	1	Infinium DSA, 25 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSAX92504A)
Repair Center Replacement Only	1	Infinium DSA, 28 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSAX92804A)
Repair Center Replacement Only	1	Infinium DSA, 32 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSAX93204A)
Repair Center Replacement Only	1	Infinium DSO, 30 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSO93004L)
Repair Center Replacement Only	1	Infinium DSA, 30 GHz, 80 GSa/s, 4 channel Oscilloscope (Agilent Model DSA93004L)
54916-00101	1	Deck - Front Panel
54916-66406	1	On/Off Printed Circuit Assembly
54916-68718	1	Touchscreen / Display Assembly
54916-00102	1	Chassis
54916-00201	1	Panel - Rear
54916-00202	1	Panel - Top
54916-00203	1	Panel - Bottom
54913-68710	1	Fan Replacement Kit 120 MM
54916-66512	1	Backplane Printed Circuit Assembly
54916-66501	2	Acquisition Printed Circuit Assembly 16 to 32 GHz

Replaceable Parts

Agilent Part Number	QTY	Description
54916-66511	2	Acquisition Printed Circuit Assembly 16 to 28 GHz
54916-66521	2	Acquisition Printed Circuit Assembly 16 to 25 GHz
54916-66531	2	Acquisition Printed Circuit Assembly 16 to 20 GHz
54916-66541	2	Acquisition Printed Circuit Assembly 16 GHz
54916-66410	1	PCA RHDD Board
54913-68711	1	Fan Replacement Kit 90 MM
0950-4068	1	Inverter Dual Backlight 8-Watt 1-Output - Front Panel
0960-2869	1	Mother Board Printed Circuit Assembly
54916-68704	1	Power Supply Sub-assembly
54916-94310	1	Label DSOX91604A
54916-94311	1	Label DSOX92004A
54916-94312	1	Label DSOX92504A
54916-94313	1	Label DSOX92804A
54916-94315	1	Label DSO93004L
54916-94314	1	Label DSOX93204A
54916-94320	1	Label DSAX91604A
54916-94321	1	Label DSAX92004A
54916-94322	1	Label DSAX92504A
54916-94323	1	Label DSAX92804A
54916-94325	1	Label DSA93004L
54916-94324	1	Label DSAX93204A
54916-94301	1	Label - Control Panel
54916-94302	1	Label - I/O Front
54916-94306	1	Label - Rear Panel
54916-94308	1	Label - PC Rear Panel
54916-94309	1	Label - PC I/O
54913-94300		Colored Knob Labels
54916-47411	8	Knob 12 MM
54916-47412	5	Knob 18 MM
54916-45001	1	Inner clutch
54916-47401	1	Outer clutch
54916-44101	1	Cover - Front
54916-41901	1	Switch Control Panel
54916-68708	1	Cover Assembly
54916-66405	1	PCA Keyboard
54916-66404	1	PCA Autoprobe Board
54916-66403	1	PCA PS Bridge
54916-63402	1	Oscillator Assembly - DRO
54916-60003	10	Connector Saver Collars
54916-60004	10	Connector Saver Collars
54916-42201	1	Bezel
54916-41001		Foot - Tilt Base
54916-41002		Foot - Tilt Lever
54916-64901	1	Handle Assembly
54916-42001	1	Casting - Probe Mate
54916-01206		Bracket - Cal Connectors
54916-01205		Bracket - Oscillator
54916-00601		Shield - Inverter
54916-61603	1	PC Power
33325-60013	1	Step Attenuator - Front Panel
54916-04112	1	Plate - CPU Adapter

Replaceable Parts

Agilent Part Number	QTY	Description
54916-07101	1	Input Connector Ground Spring
0960-2796	1	Touch Screen Controller Board 5V-DC
5062-1247	1	Assembly - 3.5 mm Connector
54542-26101	1	Ground lug
08673-67601	1	Connector Assembly - Output
54913-40201	1	Panel - Control
54916-61603	1	Cable - PC Power
54913-61604	1	Cable - On/Off
54913-61605	1	Cable - Power front
54913-61608	1	Cable - Display
54916-61601	1	Cable - Input
54916-61606	1	Cable - USB Front /Touchscreen
54916-61615	1	Cable - Attenuator
54916-61617	1	Cable - Autoprobe
54916-61618	1	Cable - SR Backplane Clock Out
54916-61619	1	Cable - SR Oscillator Reference
54916-61620	1	Cable - SR Clock Ch1 + Ch2
54916-61621	4	Cable - SR Clock Ch3 + Ch4
54916-61622		Cable - Aux BNC/SMA
54916-61624		Cable - SR Step Out
54916-61625		Cable - SR Aux Out
54916-61626		Cable - Calibration
54916-61628		Cable - SMA/SMB Vertical 0.3 m

Safety Notices

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

Warnings

• Before turning on the instrument, you must connect the protective earth terminal of the instrument to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. You must not negate the protective action by using an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two-conductor outlet is not sufficient protection.

• Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuseholders. To do so could cause a shock or fire hazard.

• If you energize this instrument by an auto transformer (for voltage reduction or mains isolation), the common terminal must be connected to the earth terminal of the power source.

• Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.

• Service instructions are for trained service personnel. To avoid dangerous electric shock, do not perform any service unless qualified to do so. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

• Do not install substitute parts or perform any unauthorized modification to the instrument.

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

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

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

To clean the instrument

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

Safety Symbols

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

Hazardous voltage symbol.

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

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Notices

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