Keysight InfiniiVision 1200 X-Series and EDUX1052A/G Oscilloscopes

KEYSIGHT

SERVICE GUIDE

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.

In This Service Guide

This book provides the service information for the Keysight InfiniiVision 1200 X-Series and EDUX1052A/G oscilloscopes. This manual is divided into these chapters:

1 Characteristics and Specifications

This chapter contains a partial list of characteristics and specifications for the InfiniiVision 1200 X-Series and EDUX1052A/G oscilloscopes.

2 Testing Performance

This chapter explains how to verify correct oscilloscope operation and perform tests to ensure that the oscilloscope meets the performance specifications.

3 Calibrating and Adjusting

This chapter explains how to adjust the oscilloscope for optimum operating performance.

4 Troubleshooting

This chapter begins with suggestions for solving general problems that you may encounter with the oscilloscope. Procedures for troubleshooting the oscilloscope follow the problem solving suggestions.

5 Replacing Assemblies

The service policy for the InfiniiVision 1200 X-Series and EDUX1052A/G oscilloscopes is unit replacement, so there are no instructions for replacing internal assemblies in this service guide.

6 Replaceable Parts

Because the service policy for the InfiniiVision 1200 X-Series and EDUX1052A/G oscilloscopes is unit replacement, no replaceable parts are available.

7 Safety Notices

At the front of the book you will find safety notice descriptions and document warranties.

Abbreviated instructions for pressing a series of keys

Instructions for pressing a series of keys are written in an abbreviated manner. Instructions for pressing Key1, then pressing Softkey2, then pressing Softkey3 are abbreviated as follows:

Press **[Key1]** & **Softkey2** & **Softkey3**.

The keys may be front panel keys, or softkeys, which are located directly below the oscilloscope display.

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1 Characteristics and Specifications

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This chapter contains a partial list of characteristics and specifications for the Keysight InfiniiVision 1200 X-Series and EDUX1052A/G oscilloscopes.

For a full list of oscilloscopes characteristics and specifications see the data sheets.

The data sheets are available at www.keysight.com/products/DSOX1204G.

Power Requirements

Line voltage, frequency, and power:

- ~Line 100-120 Vac, 50/60/400 Hz
- 100-240 Vac, 50/60 Hz
- 50 W max

The oscilloscope tolerates mains supply voltage fluctuations up to ±10% of the nominal voltage.

Measurement Category

Measurement Category

The InfiniiVision 1200 X-Series and EDUX1052A/G oscilloscopes are not intended to be used for measurements in Measurement Category II, III, or IV.

WARNING **Use this instrument only for measurements within its specified measurement category (not rated for CAT II, III, IV). No transient overvoltages allowed.**

Measurement Category Definitions

The "Not rated for CAT II, III, IV" measurement category is for measurements performed on circuits not directly connected to MAINS. Examples are measurements on circuits not derived from MAINS, and specially protected (internal) MAINS derived circuits. In the latter case, transient stresses are variable; for that reason, the transient withstand capability of the equipment is made known to the user.

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

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

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

Maximum Input Voltages

CAUTION

Maximum input voltage for analog inputs:

150 Vrms, 200 Vpk

CAUTION

Maximum input voltage for external trigger input:

30 Vrms

Environmental Conditions

Environment	Indoor use only.
Ambient temperature	Operating: 0 °C to +50 °C Non-operating: –40 °C to +70 °C
Humidity	Operating: Up to 95% RH, non-condensing to temperatures up to +40 °C decreasing linearly to 50% RH at +50 °C Non-operating: Up to 90% RH up to +65 °C (non condensing)
Altitude	Operating: Up to 3,000 m Non-operating: Up to 15,300 m
Overvoltage Category	This product is intended to be powered by MAINS that comply to Overvoltage Category II, which is typical of cord-and-plug connected equipment.
Pollution Degree	The InfiniiVision 1200 X-Series and EDUX1052A/G oscilloscopes may be operated in environments of Pollution Degree 2 (or Pollution Degree 1).
Pollution Degree Definitions	Pollution Degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. Example: A clean room or climate controlled office environment. Pollution Degree 2. Normally only dry non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation may occur. Example: General indoor environment. Pollution Degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. Example: Sheltered outdoor environment.

Specifications

Please see the *InfiniiVision 1200 X-Series and EDUX1052A/G Oscilloscopes Data Sheet* for complete, up-to-date specifications and characteristics.

To download a copy of the data sheet please visit: www.keysight.com/products/DSOX1204G.

Or go to the Keysight home page at www.keysight.com and search for **1000 X-Series oscilloscopes data sheet**.

To order a data sheet by phone, please contact your local Keysight office.

Contact Us

To contact Keysight, see: www.keysight.com/find/contactus

2 Testing Performance

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This chapter explains how to verify correct oscilloscope operation and perform tests to ensure that the oscilloscope meets the performance specifications.

Overview

Let the Equipment Warm Up Before Testing

For accurate test results, let the test equipment and the oscilloscope warm up 30 minutes before testing.

Verifying Test Results

During the tests, record the readings in the Performance Test Record on page 36. To verify whether a test passes, verify that the reading is within the limits in the Performance Test Record.

If a performance test fails

If a performance test fails, first perform the User Cal procedure. Press the following keys to access User Cal: [Utility]→Service→Start User Cal.

List of Test Equipment

Below is a list of test equipment and accessories required to perform the performance test verification procedures.

Table 1 List of test equipment

Equipment	Critical Specifications	Recommended Model/ Part Number
Digital Multimeter	0.1 mV resolution, 0.005% accuracy	Keysight 34401A
Power Splitter	Outputs differ by 0.15 dB	Keysight 11667B
Oscilloscope Calibrator	DC offset voltage of -5.5 V to 70.5 V, 0.1 V resolution 25 MHz–500 MHz sine wave, 5 ppm	Fluke 5820A
Signal Generator	10 MHz, 50 MHz, 70 MHz, 100 MHz, and 200 MHz sine waves	Keysight N5181A
Power Meter	1 GHz ±3% accuracy	Keysight N1914A
Power Sensor	1 GHz ±3% accuracy	Keysight E9304A or N8482A
BNC banana cable	BNC (m) to dual banana	Pomona 2BC-BNC-36 or Keysight 11001-66001
BNC cable (qty 3)	BNC - BNC, 48” length	Keysight 10503A†
Cable	Type N (m) 609.6 mm (24 in.)	Keysight 11500B
Adapter	BNC(f) to banana(m)	Keysight 1251-2277†
Adapter	BNC Tee (m) (f) (f)	Keysight 1250-0781† or Pomona 3285
Adapter	Type N (m) to BNC (m)	Keysight 1250-0082 or Pomona 3288 with Pomona 3533
Blocking capacitor and shorting cap	Note: if a BNC blocking capacitor is not available use an SMA blocking capacitor.	Keysight 11742A + Pomona 4288 + Pomona 5088
Adapter (qty 3)	N(m) to BNC(f)	Keysight 1250-0780
50 Ohm Feedthrough Termination	50Ω BNC (f) to BNC (m)	Keysight 0960-0301

Most parts and equipment are available at www.keysight.com. See respective manufacturer’s websites for their equipment.
† These parts available at www.parts.keysight.com at the time this manual was published.

Conventions

The following conventions will be used when referring to oscilloscope models throughout this chapter.

Table 2 Conventions

Models	Referred to as:
EDUX1052A, EDUX1052G	50 MHz Models
DSOX1202A, DSOX1202G DSOX1204A, DSOX1204G	70 MHz Models
DSOX1202A, DSOX1202G with D1202BW1A upgrade DSOX1204A, DSOX1204G with D1200BW1A upgrade	100 MHz Models
DSOX1202A, DSOX1202G with D1202BW2A upgrade (from 70 MHz) or D1202BW3A upgrade (from 100 MHz) DSOX1204A, DSOX1204G with D1200BW2A upgrade (from 70 MHz) or D1200BW3A upgrade (from 100 MHz)	200 MHz Models

To verify DC vertical gain accuracy

This test verifies the accuracy of the analog channel DC vertical gain for each channel.

In this test, you will measure the dc voltage output of an oscilloscope calibrator using the oscilloscope's **Average - Full Screen** voltage measurement and compare the results with the multimeter reading.

Table 3 DC Vertical Gain Accuracy Test Limits

Test Limits	Notes
±3% of full scale (>= 10 mV/div); ±4% of full scale (< 10 mV/div)	▪ Full scale is defined as 8 mV on the 500 uV/div range. ▪ Full scale on all other ranges is defined as 8 divisions times the V/div setting.

Table 4 Equipment Required to Verify DC Vertical Gain Accuracy

Equipment	Critical Specifications	Recommended Model/Part
Oscilloscope Calibrator	3.5 mV to 70 Vdc, 0.1 V resolution	Fluke 5820A
Digital multimeter	Better than 0.01% accuracy	Keysight 34401A
Cable	BNC, Qty 2	Keysight 10503A
Shorting cap	BNC	Keysight 1250-0774
Adapter	BNC (f) to banana (m)	Keysight 1251-2277
Adapter	BNC tee (m) (f) (f)	Keysight 1250-0781 or Pomona 3285
Blocking capacitor		Keysight 11742A + Pomona 4288 + Pomona 5088

1 Press **[Save/Recall] > Default/Erase > Factory Default** to recall the factory default setup.
2 Set the probe attenuation to 1:1 on the analog channel you are testing (for example, **[1] > Probe > Probe**; then, turn the Entry knob to select **1.00 : 1**).

3 Set up the oscilloscope.

a Adjust the horizontal scale to **200.0 us/div**.

b Set the Volts/Div setting to the value in the first line and column of Table 5.

c Adjust the channel's vertical position knob to place the baseline (reference level) at 0.5 major division from the bottom of the display.

Table 5 Settings Used to Verify DC Vertical Gain Accuracy

Volts/Div Setting	Oscilloscope Calibrator Setting	Test Limits		
10 V/Div	70 V	67.6 V	to	72.4 V
5 V/Div	35 V	33.8 V	to	36.2 V
2 V/Div	14 V	13.52 V	to	14.48 V
1 V/Div	7 V	6.76 V	to	7.24 V
500 mV/Div	3.5 V	3.38 V	to	3.62 V
200 mV/Div	1.4 V	1.352 V	to	1.448 V
100 mV/Div	700 mV	676 mV	to	724 mV
50 mV/Div	350 mV	338 mV	to	362 mV
20 mV/Div	140 mV	135.2 mV	to	144.8 mV
10 mV/Div	70 mV	67.6 mV	to	72.4 mV
5 mV/Div[1]	35 mV	33.4 mV	to	36.6 mV
2 mV/Div[1]	14 mV	13.36 mV	to	14.64 mV
1 mV/Div[1]	7 mV	6.68 mV	to	7.32 mV
0.5 mV/Div[1, 2]	3.5 mV	3.18 mV	to	3.82 mV

[1] A blocking capacitor is required at this range to reduce noise. See "Use a Blocking Capacitor to Reduce Noise" on page 23.

[2] Full scale is defined as 8 mV on the 500 uV/div range. Full scale on all other ranges is defined as 8 divisions times the V/div setting.

d Press the **[Acquire]** key.

e Then press the **Acq Mode** softkey and select **Averaging**.

f Then press the **#Avgs** softkey and set it to 64.

Wait a few seconds for the measurement to settle.

4 Add a measurement for the average voltage:

a Press the **[Meas]** key.

b Press **Source**; then, turn the Entry knob (labeled on the front panel) to select the channel you are testing.

c Press **Type:**; then, turn the Entry knob to select **Average - Full Screen**, and press **Add Measurement**.

5 Read the “current” average voltage value as V1.

6 Use the BNC tee and cables to connect the oscilloscope calibrator/power supply to both the oscilloscope and the multimeter (see Figure 1).

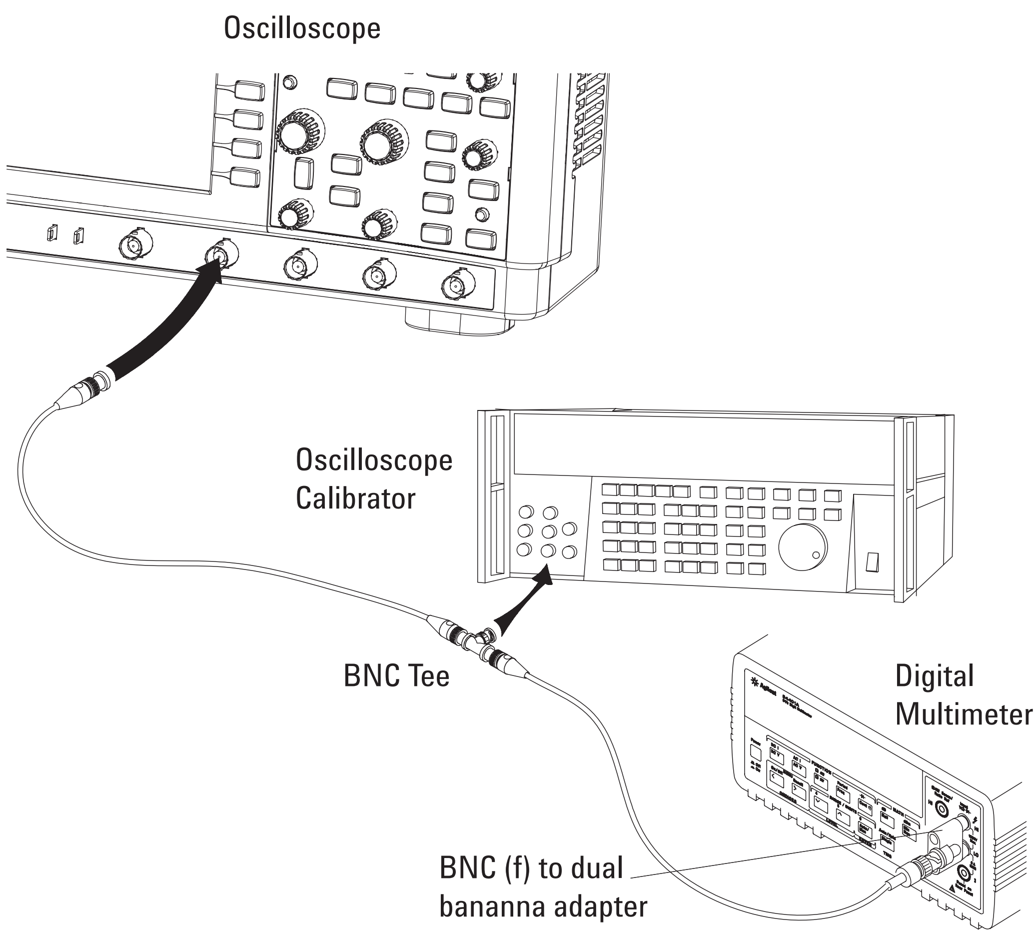


Figure 1 Setting up Equipment for DC Vertical Gain Accuracy Test

7. Adjust the output so that the multimeter reading displays, as close as possible, the first Volts/div calibrator setting value in Table 5.
8. Wait until the measurement settles.
9. Read the “current” average voltage value again as V2.
10. Calculate the difference V2 - V1.

The difference in average voltage readings should be within the test limits of Table 5.

If a result is not within the test limits, go to the “Troubleshooting” chapter. Then return here.

11 Disconnect the oscilloscope calibrator from the oscilloscope.

12 Repeat this procedure to check the DC vertical gain accuracy with the remaining Volts/div setting values in Table 5.

13 Finally, repeat this procedure for the remaining channels to be tested.

Use a Blocking Capacitor to Reduce Noise

On the more sensitive ranges, such as 0.5 mV/div, 1 mV/div, 2 mV/div, and 5 mV/div, noise may be a factor. To eliminate the noise, add a BNC Tee, blocking capacitor, and shorting cap at the oscilloscope channel input to shunt the noise to ground. See Figure 2. If a BNC capacitor is not available, use an SMA blocking capacitor, adapter, and cap. See “Blocking capacitor and shorting cap in the equipment list on page 17 for details.

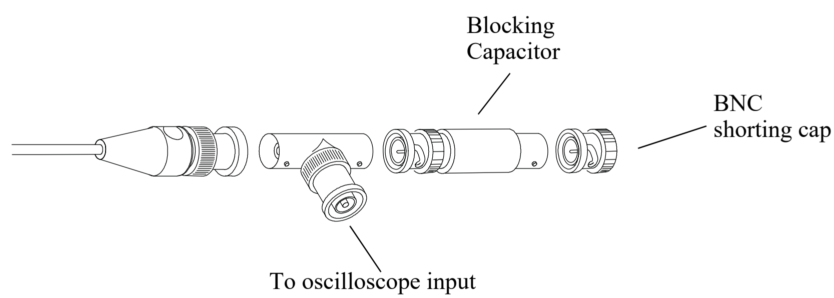


Figure 2 Using a Blocking Capacitor to Reduce Noise

To verify bandwidth (-3 dB)

This test checks the bandwidth (-3 dB) of the oscilloscope. In this test you will use a signal generator and a power meter.

Table 6 Bandwidth (-3 dB) Test Limits

Models	Test Limits
200 MHz Models	All channels (-3 dB), dc to 200 MHz
100 MHz Models	All channels (-3 dB), dc to 100 MHz
70 MHz Models	All channels (-3 dB), dc to 70 MHz
50 MHz Models	All channels (-3 dB), dc to 50 MHz

Table 7 Equipment Required to Verify Bandwidth (-3 dB)

Equipment	Critical Specifications	Recommended Model/Part
Signal Generator	100 kHz - 200 MHz at 200 mVrms	Keysight N5181A
Power Meter	1 MHz - 200 MHz ±3% accuracy	Keysight N1914A
Power Sensor	1 MHz - 200 MHz ±3% accuracy	Keysight E9304A or N8482A
Power Splitter	outputs differ by < 0.15 dB	Keysight 11667A
Cable	Type N (m) 24 inch	Keysight 11500B
Adapter	Type N (m) to BNC (m)	Keysight 1250-0082 or Pomona 3288 with Pomona 3533
50 Ohm Feedthrough Termination	50Ω BNC (f) to BNC (m)	Keysight 0960-0301

1 Connect the equipment (see Figure 3).

   a Use the N cable to connect the signal generator to the input of the power splitter input.

   b Connect the power sensor to one output of the power splitter.

   c Use an N-to-BNC adapter to connect the other splitter output to the channel 1 input using a 50 ohm feedthrough terminator at the oscilloscope input BNC.

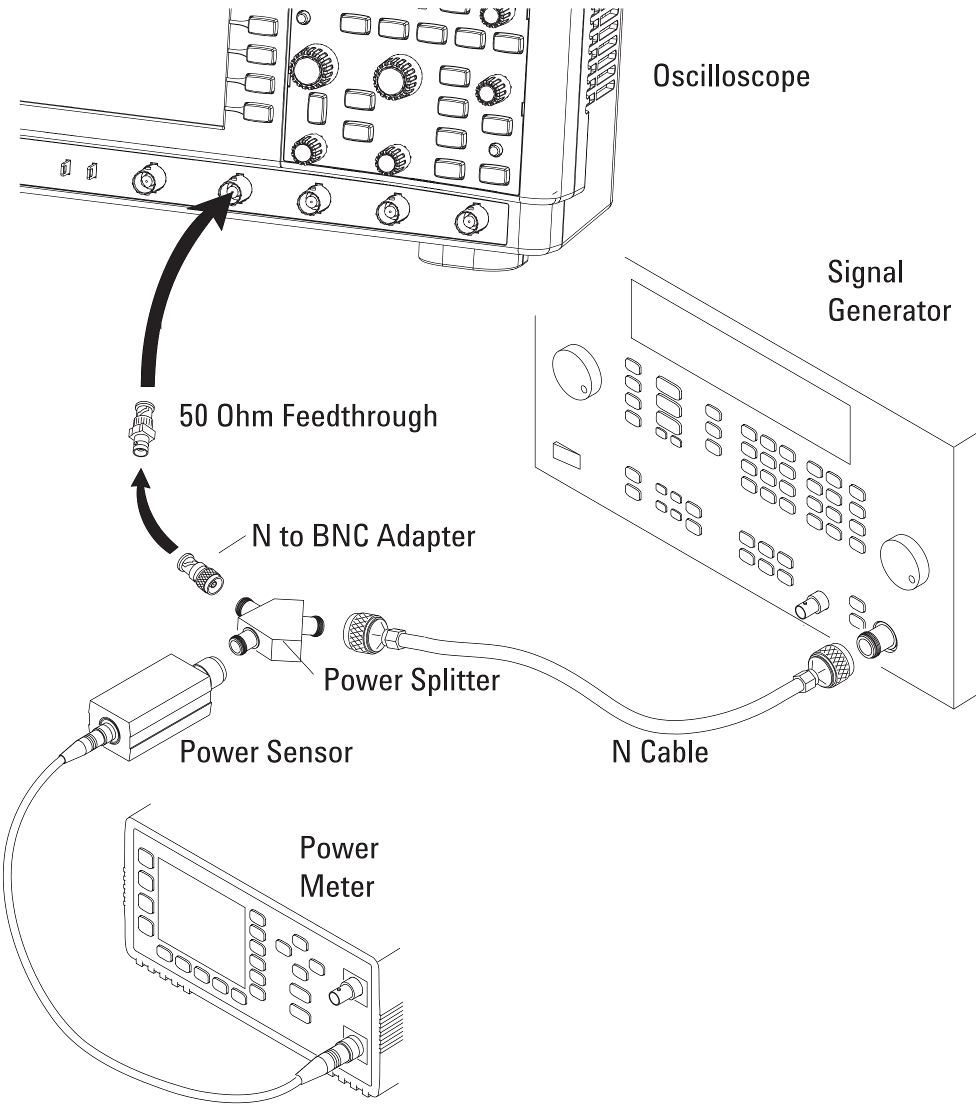


Figure 3 Setting Up Equipment for Bandwidth (-3 dB) Verification Test

2 Set up the power meter.

Set the power meter to display measurements in units of watts.

3 Set up the oscilloscope.

   a Press the **[Default Setup]** key.

   b Set channel 1 **Coupling** to **DC**.

   c Set the time base to 500 ns/div.

   d Set the Volts/Div for channel 1 to 200 mV/div.

   e Press the **[Acquire]** key, then press the **Averaging** softkey.

   f Turn the Entry knob to set **# Avgs** to 8 averages.

4 Set the signal generator for 1 MHz and six divisions of amplitude.

The signal on the oscilloscope screen should be about five cycles at six divisions amplitude.

5 Set up the Amplitude measurement

   a Press the **[Meas]** key.

   b Press the **Clear Meas** softkey and then the **Clear All** softkey.

   c Press the **Type:** softkey and use the Entry knob to select **AC RMS - N Cycles** within the select menu.

   d Press the **Add Measurement** softkey.

6 Note the oscilloscope AC RMS - Cyc(1) reading at the bottom of the screen. (This is the RMS value with any dc offset removed.)

7 Set the power meter Cal Factor % to the 1 MHz value on the calibration chart on the power sensor.

8 Note the reading on the power meter and covert to Vrms using the expression:

$$Vin_{1MHz} = \sqrt{Pmeas_{1MHz} \times 50\Omega}$$

For example, if the power meter reading is 892 uW, then $Vin_{1MHz} = (892*10^{-6} * 50\Omega)^{1/2} = 211.2\ mV_{rms}$.

9 Change the signal generator output frequency according to the maximum frequency for the oscilloscope using the following:

- 200 MHz Models: 200 MHz
- 100 MHz Models: 100 MHz
- 70 MHz Models: 70 MHz
- 50 MHz Models: 50 MHz

10 Referencing the frequency from step 9, set the power meter Cal Factor % to the frequency value on the calibration chart on the power sensor.

11 Set the oscilloscope sweep speed according to the following:

- 200 MHz Models: 2 ns/div
- 100 MHz Models: 5 ns/div
- 70 MHz Models: 5 ns/div
- 50 MHz Models: 5 ns/div

12 Note the oscilloscope AC RMS - Cyc(1) reading at the bottom of the screen.

13 Note the reading on the power meter and covert to Vrms using the expression:

$$Vin_{maxfreq} = \sqrt{Pmeas_{maxfreq} \times 50\Omega}$$

14 Calculate the response using the expression:

$$\text{response(dB)} = 20\log_{10}\left[\frac{\text{Vout}_{\text{max freq}} / \text{Vin}_{\text{max freq}}}{\text{Vout}_{\text{1 MHz}} / \text{Vin}_{\text{1 MHz}}}\right]$$

Example

If:
$Pmeas_{1\_MHz}$ = 892 uW
Std Dev(n) $_{1MHz}$ = 210.4 mV
Pmeas $_{max\_freq}$ = 687 uW
Std Dev(n) $_{max\ freq}$ = 161.6 mV

Then after converting the values from the power meter to Vrms:

$$\text{response(dB)} = 20\log_{10}\left[\frac{161.6\text{ mV} / 185.3\text{ mV}}{210.4\text{ mV} / 211.2\text{ mV}}\right] = -1.16\text{ dB}$$

15 The result from step 14 should be between +3.0 dB and -3.0 dB. Record the result in the Performance Test Record (see page 36).

16 Move the power splitter from the channel 1 to the channel 2 input.

17 Turn off the current channel and turn on channel 2 using the channel keys.

18 Set the trigger source to channel 2.

19 Repeat steps 3 through 15 for the remaining channels, setting the parameters of the channel being tested where appropriate.

To verify time base accuracy

This test verifies the accuracy of the time base.

Table 8 Time Base Accuracy Test Limits

Models	Test Limits
All Models	50 ppm ±5 ppm per year (aging)

In this test you will measure the absolute error of the time base oscillator and compare the results to the specification.

Table 9 Equipment Required to Verify Time Base Accuracy

Equipment	Critical Specifications	Recommended Model/Part
Signal Generator	100 kHz - 200 MHz, 0.01 Hz frequency resolution, jitter: < 2ps	Keysight N5181A
Cable	BNC, 3 feet	Keysight 10503A
50 Ohm Feedthrough Termination	50Ω BNC (f) to BNC (m)	Keysight 0960-0301

1 Set up the signal generator.

   a Set the output to 10 MHz, approximately 1 V_{pp} sine wave.

2 Connect the output of the signal generator to oscilloscope channel 1 using the BNC cable. Also, connect a 50 ohm feedthrough termination between the channel 1 input and the BNC cable.

3 Set up the oscilloscope:

   a Press **[AutoScale]**.

   b Set the oscilloscope Channel 1 vertical sensitivity to 200 mv/div.

   c Set the oscilloscope horizontal sweep speed control to 10 ns/div.

   d Adjust the intensity to get a sharp, clear trace.

   e Adjust the oscilloscope's trigger level so that the rising edge of the waveform at the center of the screen is located where the center horizontal and vertical grid lines cross (center screen).

   f Ensure the horizontal position control is set to 0.0 seconds.

4 Make the measurement.

   a Set oscilloscope horizontal sweep speed control to 1 ms/div.

   b Set horizontal position control to +1 ms (rotate control CCW).

   c Set the oscilloscope horizontal sweep speed control to 10 ns/div.

   d Record the number of nanoseconds from where the rising edge crosses the center horizontal grid line to the center vertical grid line. The number of nanoseconds is equivalent to the time base error in ppm.

   e Derive the date code from the oscilloscope's serial number to calculate the number of years since manufacture. Include any fractional portion of a year.

      i First, get the 3rd to 6th digits of the serial number. For example, for the serial number CN47470001, get "4747".

      ii If the number is greater than 4000, subtract 4000 to get the Date Code. For example, 4747-4000 is "0747".

      iii If the number is smaller than 4000, add 6000 to get the Date Code.

      iv In the Date Code, the first two digits represent the year, and the second two digits represent the week in the year. For example, for "0747", the year is "07" and the week is "47".

   f Use the following formula to calculate the test limits.

   Time base accuracy limit: 50 ppm ±5 ppm per year (aging)

   g Record the result and compare it to the limits in the Performance Test Record (see page 36).

To verify trigger sensitivity

These tests verify the trigger sensitivity. In these tests, you will apply a sine wave to the oscilloscope at two bandwidths: 10 MHz and the maximum bandwidth of the oscilloscope. For each sine wave, you will decrease the amplitude of the signal to a specified level and check to see if the oscilloscope still triggers.

Table 10 Equipment Required to Verify Trigger Sensitivity

Equipment	Critical Specifications	Recommended Model/Part
Signal Generator	10 MHz and 50 MHz, 70 MHz, 100 MHz, or 200 MHz sine waves	Keysight N5181A
Power splitter	Outputs differ < 0.15 dB	Keysight 11667A
Power Meter		Keysight N1914A
Power Sensor		Keysight E9304A or N8482A
Cable	BNC, Qty 3	Keysight 10503A
Adapter	N (m) to BNC (f), Qty 3	Keysight 1250-0780
Feedthrough	50Ω BNC (f) to BNC (m)	Keysight 0960-0301

Test Internal Trigger Sensitivity

Table 11 Internal Trigger Sensitivity Specifications

Oscilloscope Models	Internal Trigger Sensitivity Specification Bandwidth	
	<= 10 MHz	Maximum Bandwidth
50 MHz	greater of 0.6 div or 2.5 mV	greater of 0.9 div or 3.8 mV
70 MHz	greater of 0.6 div or 2.5 mV	greater of 0.9 div or 3.8 mV
100 MHz	greater of 0.6 div or 2.5 mV	greater of 1.2 div or 5 mV
200 MHz	greater of 0.6 div or 2.5 mV	greater of 1.2 div or 5 mV

Follow these steps to perform the internal trigger sensitivity test:

1. On the oscilloscope, press the **[Default Setup]** key.
2. Press the **[Mode/Coupling]** key; then, press the **Mode** softkey to select **Normal**.
3. Connect the equipment (see Figure 4).
   a. Connect the signal generator output to the oscilloscope channel 1 input.
   b. Connect a 50 ohm feedthrough termination between the channel 1 input and the BNC cable.

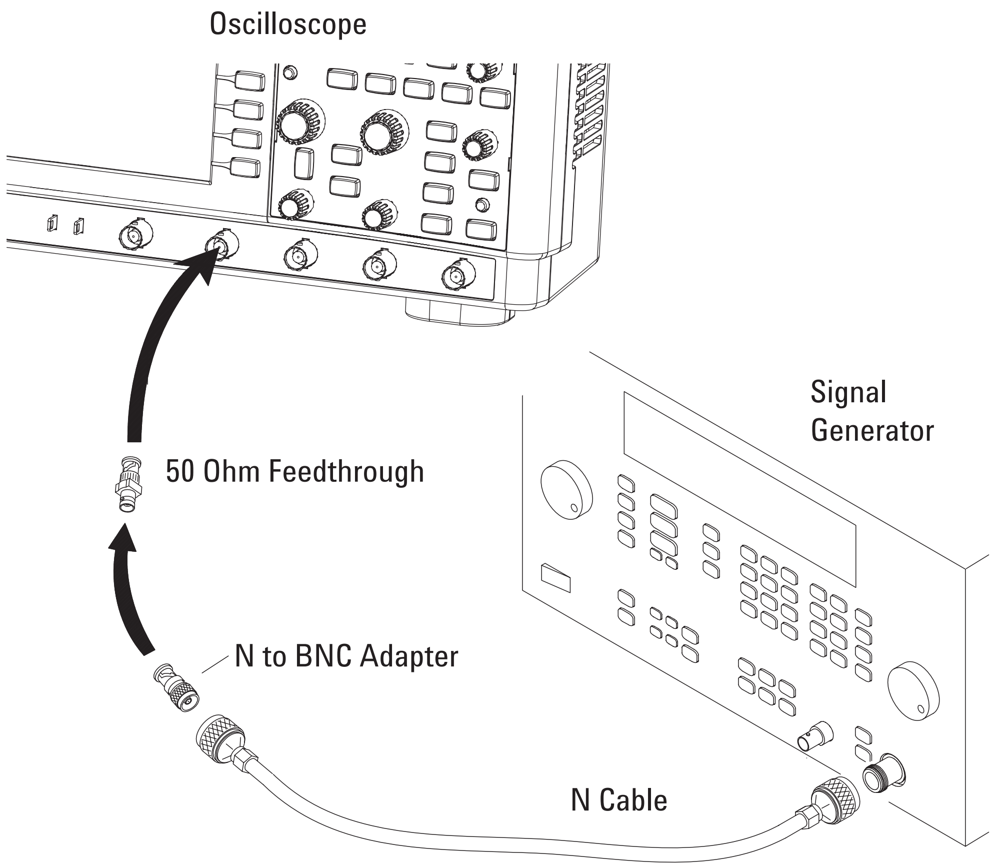


Figure 4 Setting Up Equipment for Internal Trigger Sensitivity Test

4 Set the output frequency of the signal generator to 10 MHz.

5 Perform these steps to test at the 10 MHz setting:

- **a** Set the signal generator amplitude to about 20 mV_{pp}.
- **b** Press the **[AutoScale]** key.
- **c** Set the time base to 10 ns/div.
- **d** Set channel 1 to 10 mV/div.
- **e** Decrease the amplitude from the signal generator until 0.6 vertical divisions of the signal (about 6 mV_{pp}) is displayed.

The trigger is stable when the displayed waveform is stable. If the trigger is not stable, try adjusting the trigger level. If adjusting the trigger level makes the trigger stable, the test still passes. If adjusting the trigger does not help, see the “Troubleshooting” chapter. Then return here.

- **f** Record the result as Pass or Fail in the Performance Test Record (see page 36).
- **g** Repeat this step for the remaining oscilloscope channels.

6 Set the output frequency of the signal generator to the maximum bandwidth of the oscilloscope:

- 200 MHz models: 200 MHz
- 100 MHz models: 100 MHz
- 70 MHz models: 70 MHz
- 50 MHz models: 50 MHz

7 Perform these steps to test at the maximum bandwidth setting:

- **a** Set the signal generator amplitude to about 20 mV_{pp}.
- **b** Press the **[AutoScale]** key.
- **c** Set the time base to 10 ns/div.
- **d** Set channel 1 to 10 mV/div.
- **e** Decrease the amplitude from the signal generator as described in the following table according to your oscilloscope’s maximum bandwidth:

Oscilloscope’s maximum bandwidth:	Decrease amplitude until these vertical divisions are displayed:	Which is about this V:
50 MHz	0.9 vertical divisions	9 mVpp
70 MHz	0.9 vertical divisions	9 mVpp
100 MHz	1.2 vertical divisions	12 mVpp
200 MHz	1.2 vertical divisions	12 mVpp

The trigger is stable when the displayed waveform is stable. If the trigger is not stable, try adjusting the trigger level. If adjusting the trigger level makes the trigger stable, the test still passes. If adjusting the trigger does not help, see the “Troubleshooting” chapter. Then return here.

f Record the result as Pass or Fail in the Performance Test Record (see page 36).

g Repeat this step for the remaining oscilloscope channels.

Keysight InfiniiVision 1200 X-Series and EDUX1052A/G Oscilloscopes Performance Test Record

Serial No. ______________________________	Test by _______________________
Test Interval ____________________________	Work Order No. __________________
Recommended Next Testing ___________________	Temperature __________

DC Vertical Gain Accuracy						
Range	**Power Supply Setting**	**Test Limits**	**Channel 1**	**Channel 2**	**Channel 3**	**Channel 4**
10 V/Div	70 V	67.6 V to 72.4 V	______	______	______	______
5 V/Div	35 V	33.8 V to 36.2 V	______	______	______	______
2 V/Div	14 V	13.52 V to 14.48 V	______	______	______	______
1 V/Div	7 V	6.76 V to 7.24 V	______	______	______	______
500 mV/Div	3.5 V	3.38 V to 3.62 V	______	______	______	______
200 mV/Div	1.4 V	1.352 V to 1.448 V	______	______	______	______
100 mV/Div	700 mV	676 mV to 724 mV	______	______	______	______
50 mV/Div	350 mV	338 mV to 362 mV	______	______	______	______
20 mV/Div	140 mV	135.2 mV to 144.8 mV	______	______	______	______
10 mV/Div	70 mV	67.6 mV to 72.4 mV	______	______	______	______
5 mV/Div	35 mV	33.4 mV to 36.6 mV	______	______	______	______
2 mV/Div	14 mV	13.36 mV to 14.64 mV	______	______	______	______
1 mV/Div	7 mV	6.68 mV to 7.32 mV	______	______	______	______
0.5 mV/Div	3.5 mV	3.18 mV to 3.82 mV	______	______	______	______

Bandwidth (-3 dB)	**Model**	**Test Limits**	**Channel 1**	**Channel 2**	**Channel 3**	**Channel 4**
	200 MHz	-3 dB at 200 MHz	______	______	______	______
	100 MHz	-3 dB at 100 MHz	______	______	______	______
	70 MHz	-3 dB at 70 MHz	______	______	______	______
	50 MHz	-3 dB at 50 MHz	______	______	______	______

Time Base Accuracy	**Limits**	**Calculated time base accuracy limit (ppm)**	**Measured time base error (ppm)**	**Pass/Fail**
	Time Base Accuracy Limit: 50 ppm ±5 ppm per year (aging)	________	________	________

Internal Trigger Sensitivity						
	Generator Setting	**Test Limits, greater of**	**Channel 1**	**Channel 2**	**Channel 3**	**Channel 4**
200 MHz models:	10 MHz	0.6 div or 2.5 mV	_______	_______	_______	_______
	Max BW (200 MHz)	1.2 div or 5 mV	_______	_______	_______	_______
100 MHz models:	10 MHz	0.6 div or 2.5 mV	_______	_______	_______	_______
	Max BW (100 MHz)	1.2 div or 5 mV	_______	_______	_______	_______
70 MHz models:	10 MHz	0.6 div or 2.5 mV	_______	_______	_______	_______
	Max BW (70 MHz)	0.9 div or 3.8 mV	_______	_______	_______	_______
50 MHz models:	10 MHz	0.6 div or 2.5 mV	_______	_______	_______	_______
	Max BW (50 MHz)	0.9 div or 3.8 mV	_______	_______	_______	_______

3 Calibrating and Adjusting

This chapter explains how to adjust the oscilloscope for optimum operating performance. You should perform user calibration according to the following recommendations:

- Every five years or after 10000 hours of operation
- If the ambient temperature is >10 °C from the calibration temperature
- If you want to maximize the measurement accuracy

The amount of use, environmental conditions, and experience with other instruments help determine if you need shorter adjustment intervals.

Let the Equipment Warm Up Before Adjusting

Before you start the adjustments, let the oscilloscope warm up for at least 30 minutes.

User Calibration

Perform user-calibration:

- Every five years or after 10000 hours of operation.
- If the ambient temperature is >10° C from the calibration temperature.
- If you want to maximize the measurement accuracy.

The amount of use, environmental conditions, and experience with other instruments help determine if you need shorter User Cal intervals.

User Cal performs an internal self-alignment routine to optimize the signal path in the oscilloscope. The routine uses internally generated signals to optimize circuits that affect channel sensitivity, offset, and trigger parameters. Disconnect all inputs and allow the oscilloscope to warm up before performing this procedure.

Performing User Cal will invalidate your Certificate of Calibration. If NIST (National Institute of Standards and Technology) traceability is required perform the procedures in Chapter 2 in this book using traceable sources.

To perform User Cal

1. Disconnect all inputs from the front panel and allow the oscilloscope to warm up before performing this procedure.
2. Make sure user calibration protection is not on by pressing the **[Utility] > Options > Auxiliary**; then, press the **Cal Protect** softkey to disable calibration protection.
3. Press the **[Utility]** key; then, press the **Service** softkey.
4. Begin the User Cal by pressing the **Start User Cal** softkey.

User Cal Status

Pressing the **User Cal Status** softkey displays the following summary results of the previous User Cal, and the status of probe calibrations for probes that can be calibrated. Note that AutoProbes do not need to be calibrated, but InfiniiMax probes can be calibrated.

```
Results:
User Cal date:
Change in temperature since last User Cal:
Failure:
Comments:
Probe Cal Status:
```

4 Troubleshooting

Solving General Problems with the Oscilloscope / 42
Verifying Basic Operation / 44

Read All Cautions and Warnings
Before you begin any troubleshooting, read all Warning and Cautions in the “Troubleshooting” section.

This chapter begins with “Solving General Problems with the Oscilloscope. It tells you what to do in these cases:

- If there is no display.
- If there is no trace display.
- If the trace display is unusual or unexpected.
- If you cannot see a channel.

Next, this chapter describes procedures for “Verifying Basic Operation of the oscilloscope:

- To power-on the oscilloscope.
- To perform hardware self test.
- To perform front panel self test.
- To verify default setup.
- To perform an Auto Scale on the Probe Comp signal.
- To compensate passive probes.

The service policy for all InfiniiVision 1200 X-Series and EDUX1052A/G oscilloscopes is unit replacement, so there are no internal assembly troubleshooting instructions in this service guide.

Solving General Problems with the Oscilloscope

This section describes how to solve general problems that you may encounter while using the Keysight InfiniiVision 1200 X-Series and EDUX1052A/G oscilloscopes.

If there is no display

- ✔ Check that the power cord is firmly seated in the oscilloscope power receptacle.
- ✔ Check that the power source is live.
- ✔ Check that the front-panel power switch is on.
- ✔ If there is still no display, go to the troubleshooting procedures in this chapter.

If there is no trace display

- ✔ Check that the Intensity (on the front panel) is adjusted correctly.
- ✔ Recall the default setup by pressing **[Default Setup]**. This will ensure that the trigger mode is Auto.
- ✔ Check that the probe clips are securely connected to points in the circuit under test, and that the ground is connected.
- ✔ Check that the circuit under test is powered on.
- ✔ Press the **[Auto Scale]** key.
- ✔ Obtain service from Keysight Technologies, if necessary.

If the trace display is unusual or unexpected

- ✔ Check that the Horizontal time/division setting is correct for the expected frequency range of the input signals.
- ✔ The sampling speed of the oscilloscope depends on the time/division setting. It may be that when time/division is set to slower speeds, the oscilloscope is sampling too slowly to capture all of the transitions on the waveform. Use peak detect mode.

- ✔ Check that all oscilloscope probes are connected to the correct signals in the circuit under test.
- ✔ Ensure that the probe's ground lead is securely connected to a ground point in the circuit under test. For high-speed measurements, each probe's individual ground lead should also be connected to a ground point closest to the signal point in the circuit under test.
- ✔ Check that the trigger setup is correct.
- ✔ A correct trigger setup is the most important factor in helping you capture the data you desire. See the *User's Guide* for information about triggering.
- ✔ Check that persistence in the Display menu is turned off, then press the **Clear Display** softkey.
- ✔ Press the **[Auto Scale]** key.

If you cannot see a channel

- ✔ Recall the default setup by pressing **[Default Setup]**. This will ensure that the trigger mode is Auto.
- ✔ Check that the oscilloscope probe's BNC connector is securely attached to the oscilloscope's input connector.
- ✔ Check that the probe clips are securely connected to points in the circuit under test.
- ✔ Check that the circuit under test is powered on.

  You may have pressed the **[Auto Scale]** key before an input signal was available.

  Performing the checks listed here ensures that the signals from the circuit under test will be seen by the oscilloscope. Perform the remaining checks in this topic to make sure the oscilloscope channels are on, and to obtain an automatic setup.
- ✔ Check that the desired oscilloscope channels are turned on.
  - **a** Press the analog channel key until it is illuminated.
- ✔ Press the **[Auto Scale]** key to automatically set up all channels.

Verifying Basic Operation

To power-on the oscilloscope

1 Connect the power cord to the rear of the oscilloscope, then to a suitable ac voltage source.

The oscilloscope power supply automatically adjusts for input line voltages in the range of 100 to 240 VAC. Ensure that you have the correct line cord. The power cord provided is matched to the country of origin.

WARNING

AVOID INJURY.
Always operate the oscilloscope with an approved three conductor power cable. Do not negate the protective action of the three conductor power cable.

- Press the power switch.
  - When the oscilloscope is turned on, the front panel LEDs will briefly light up in groups from bottom to top.
  - Next the Keysight logo appears on the display.
  - Next a message will appear with tips on getting started using the oscilloscope. At this time you can press any key to remove the message and view the display. Or you can wait and the message will automatically disappear.
  - It will take a total of about 20-30 seconds for the oscilloscope to go through its basic self test and power-up routine.

2 Proceed to "To perform hardware self test" on page 44.

To perform hardware self test

Pressing **[Utility] > Service > Hardware Self Test** performs a series of internal procedures to verify that the oscilloscope is operating properly.

It is recommended you run Hardware Self Test:

- After experiencing abnormal operation.
- For additional information to better describe an oscilloscope failure.
- To verify proper operation after the oscilloscope has been repaired.

Successfully passing Hardware Self Test does not guarantee 100% of the oscilloscope's functionality. Hardware Self Test is designed to provide an 80% confidence level that the oscilloscope is operating properly.

To perform front panel self test

Pressing **[Utility] > Service > Front Panel Self Test** lets you test the front panel keys and knobs as well as the oscilloscope display.

Follow the on-screen instructions.

Failures in the front panel self test indicate problems with the keyboard, keypad, or display.

To verify default setup

The oscilloscope is designed to turn on with the setup from the last turn on or previous setup.

To recall the default setup:

1. Press the **[Default Setup]** key.

   This returns the oscilloscope to its default settings and places the oscilloscope in a known operating condition. The major default settings are:

   - **Horizontal**:
     - main mode.
     - 100 us/div scale.
     - 0 s delay.
     - center time reference.
   - **Vertical**:
     - Channel 1 on.
     - 5 V/div scale.
     - dc coupling.
     - 0 V position.
     - probe attenuation factor to 10.0:1.
   - **Trigger**:
     - Edge trigger.
     - Auto sweep mode.

    - 0 V level.
    - channel 1 source.
    - dc coupling.
    - rising edge slope.
    - 60 ns holdoff time.
- **Display**:
    - 20% grid intensity.
    - persistence off.
- **Other:**
    - Acquire mode normal.
    - Run/Stop to Run.
    - cursor measurements off.

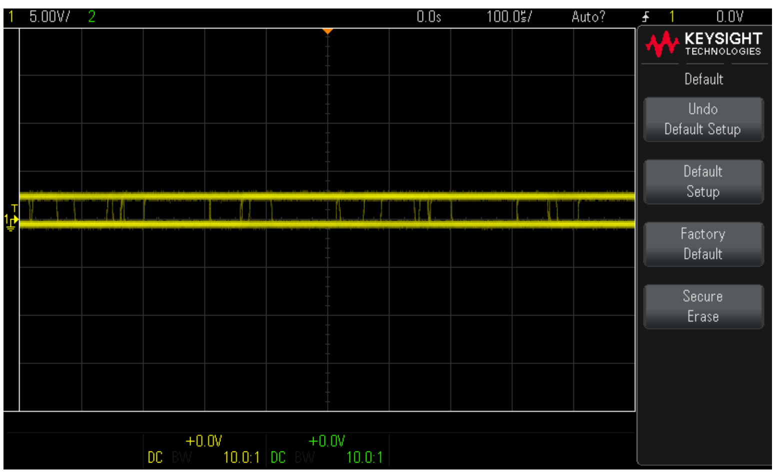


Figure 5 Default setup screen

2 If your screen looks substantially different, replace the unit.

To perform an Auto Scale on the Probe Comp signal

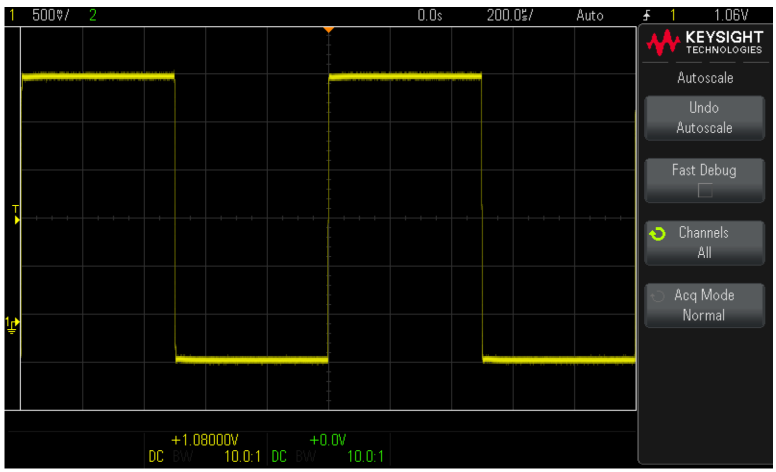
1 Press the **[Default Setup]** key. The oscilloscope is now configured to its default settings.

2 Connect an oscilloscope probe from channel 1 to the **Probe Comp** signal terminal on the front panel.

3 Connect the probe's ground lead to the ground terminal that is next to the **Demo 2** (Probe Comp) terminal.

4 Press **[AutoScale]**.

5 You should see a waveform on the oscilloscope's display similar to this:



If you see the waveform, but the square wave is not shaped correctly as shown above, perform the procedure "To compensate passive probes" on page 48.

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 analog channel input BNC and to the Demo 2 (Probe Comp) terminal.

To compensate passive probes

You should compensate your passive probes to match their characteristics to the oscilloscope's channels. A poorly compensated probe can introduce measurement errors.

1 Perform the procedure "To perform an Auto Scale on the Probe Comp signal" on page 47
2 Press the channel key to which the probe is connected (**[1]**, **[2]**).
3 In the Channel Menu, press **Probe**.
4 In the Channel Probe Menu, press **Probe Check**; then, follow the instructions on-screen.

   If necessary, use a nonmetallic tool (supplied with the probe) to adjust the trimmer capacitor on the probe for the flattest pulse possible.

   On the some probes, the trimmer capacitor is the yellow adjustment on the probe tip. On other probes, the trimmer capacitor is located on the probe BNC connector.

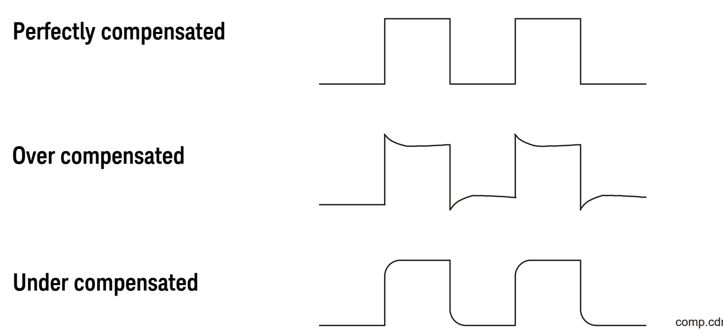


Figure 6 Example pulses

5 Connect probes to all other oscilloscope channels (channel 2 of a 2-channel oscilloscope).
6 Repeat the procedure for each channel.

The process of compensating the probes serves as a basic test to verify that the oscilloscope is functional.

5 Replacing Assemblies

The service policy for all InfiniiVision 1200 X-Series and EDUX1052A/G oscilloscopes is unit replacement, so there are no instructions for replacing internal assemblies in this service guide.

6 Replaceable Parts

Because the service policy for InfiniiVision 1200 X-Series and EDUX1052A/G oscilloscopes is unit replacement, no replaceable parts are available for these oscilloscopes.

7 Safety Notices

This apparatus has been designed and tested in accordance with IEC Publication 61010, 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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