

Keysight U1610/20A Handheld Digital Oscilloscope

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Safety Information

CAUTION








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

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.

Safety Symbols

The following symbols on the instrument and in the documentation indicate precautions that must be taken to maintain safe operation of the instrument.

	Direct current (DC)		Equipment protected throughout by double insulation or reinforced insulation
	Alternating current (AC)		Earth (ground) terminal
	Both direct and alternating current	CAT II	Category II overvoltage protection
	Caution, risk of danger (refer to this manual for specific Warning or Caution information)	CAT III	Category III overvoltage protection
	Caution, risk of electric shock		

General Safety Information

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements.

WARNING

- Remove all unused scope (oscilloscope) probes, DMM (digital multimeter) test leads, or USB cable.
 - Do not connect the DMM test leads and scope probes at the same time.
 - Disconnect the scope probe from the instrument before using the DMM functions.
 - Disconnect the DMM test leads from the instrument before using the scope functions.
-

WARNING

To avoid electrical shock or fire during battery replacement:

- Disconnect test leads, probes, power supply, and USB cable before opening the case or battery cover.
 - Do not operate the instrument with the battery cover open.
 - Use only specified insulated probes and test leads.
 - Use only the 10.8 V Li-Ion battery pack supplied with the instrument.
-

WARNING

To prevent fire or injury:

- Use only the designated AC/DC adapter and test leads supplied with the instrument.
 - Observe all ratings and markings on the instrument before connecting to the instrument.
 - When performing measurements, ensure that the right safety and performance ratings of instrument and accessories are used.
-

WARNING

- Plug the probe or test leads to the instrument before connecting to any active circuit for testing. Before disconnecting from the instrument, remove the probe or test leads from the active circuit.
 - Do not connect the USB cable when not in use. Keep the USB cable away from any probe, test lead, or exposed circuitry.
 - Do not expose the circuit or operate the instrument without its cover or while power is being supplied.
 - Do not use exposed metal BNC or banana plug connectors. Use only the insulated voltage probes, test leads, and adapters supplied with the instrument.
 - Do not supply any voltage when measuring resistance or capacitance in multimeter mode.
 - Do not operate the instrument if it does not operate properly. Have the instrument inspected by qualified service personnel.
 - Do not operate the instrument in wet or damp environments.
 - Do not operate the instrument in any environment at risk of explosion. Do not operate the instrument in the presence of flammable gases or flames.
 - Keep the instrument surface clean and dry. Keep the BNC connectors dry especially during high-voltage testing.
-

WARNING**Maximum Input Voltages**

- Input CH1 and CH2 direct (1:1 probe) – CAT III 300 V
- Input CH1 and CH2 via 10:1 probe – CAT III 600 V^[1], CAT II 1000 V^[1]
- Input CH1 and CH2 via 100:1 probe – CAT III 600 V^[1], CAT II 1000 V^[1], CAT I 3540 V^[1]
- Meter input – CAT III 600 V, CAT II 1000 V
- Scope input – CAT III 300 V
- Voltage ratings are Vrms (50 – 60 Hz) for AC sine wave and VDC for DC applications.

**Maximum Floating Voltage**

- Meter input - From any terminal to earth ground - CAT III 600 Vrms
- Scope input - From any terminal to earth ground - CAT III 300 Vrms

[1] Refer to the respective probe's manual for more information on the specification.

CAUTION

- If the instrument is used in a manner not specified by the manufacturer, the instrument protection may be impaired.
 - Always use a dry cloth to clean the instrument. Do not use ethyl alcohol or any other volatile liquid.
 - It is recommended to use the instrument under ventilated conditions and in the upright position to ensure adequate airflow at the rear.
 - Always cover the DC power inlet and the USB port by closing the lid when not in use.
-

CAUTION

Electrostatic discharge (ESD) can result in damage to the components in the instrument and accessories. To prevent electrostatic discharge (ESD):

- Select a static-free work location when installing and removing sensitive equipment.
 - Handle sensitive components to the minimum extent possible. Do not allow contacts between components and exposed connector pins.
 - Transport and store in ESD preventive bags or containers that protect sensitive components from static electricity.
 - The battery (optional) must be properly recycled or disposed.
-

Measurement Category

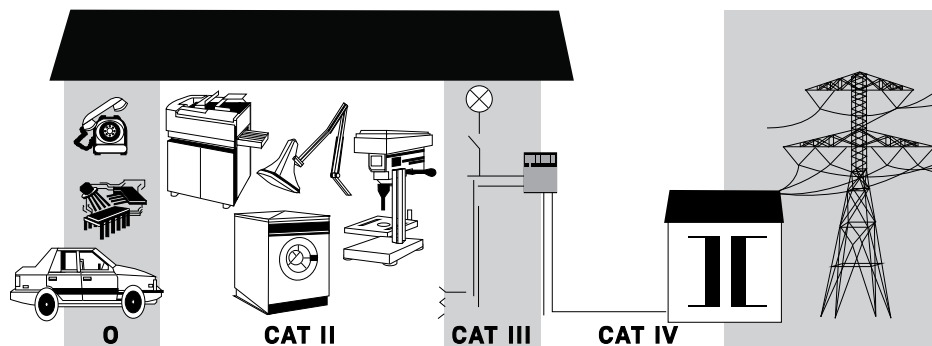
The U1610/20A has a safety rating of CAT II and CAT III.

0 Other circuits that are not directly connected to the mains.

Measurement CAT II Measurements performed on circuits directly connected to a low-voltage installation. Examples are measurements on household appliances, portable tools, and similar equipment.

Measurement CAT III 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 including stationary motors with permanent connection to the fixed installation.

Measurement CAT IV 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.



Environmental Conditions

This instrument is designed for indoor use and in an area with low condensation. The table below shows the general environmental requirements for this instrument.






Environmental condition	Requirement
Temperature	Operating condition: <ul style="list-style-type: none">- 0 °C to 50 °C (with battery only)- 0 °C to 40 °C (with power adapter) Storage condition: <ul style="list-style-type: none">- -20 °C to 70 °C
Humidity	Operating condition: <ul style="list-style-type: none">- Up to 80% RH (0 °C to 35 °C) (non-condensing)- Up to 50% RH (non-condensing)- 35 °C to 40 °C (with power adapter)- 35 °C to 50 °C (with battery only) Storage condition: <ul style="list-style-type: none">- Up to 95% RH at 40 °C (non-condensing)
Altitude	Up to 2000 m
Pollution degree	2

NOTE

The U1610/20A Handheld Digital Oscilloscope complies with the following safety and EMC requirements:

- IEC 61010-1:2010/EN 61010-1:2010
IEC 61010-2-030:2012/EN 61010-2-033:2012
 - Canada: CAN/CSA-C22.2 No. 61010-1-12
CAN/CSA-C22.2 No. 61010-2-030-12
CAN/CSA-C22.2 No. 61010-2-033-12
 - USA: ANSI/UL Std. No. 61010-1:2012
ANSI/UL Std. No. 61010-2-030 (1st Edition)
ANSI/UL Std. No. 61010-2-033 (1st Edition)
 - IEC 61326-1:2012/EN 61326-1:2013
 - Australia/New Zealand: AS/NZS CISPR 11:2011
 - Canada: ICES/NMB-001: ISSUE 4, June 2006
-

Regulatory Markings

 <p>The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives.</p> <p>ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001.</p> <p>Cet appareil ISM est conforme a la norme NMB-001 du Canada.</p> <p>ISM GRP.1 Class A indicates that this is an Industrial Scientific and Medical Group 1 Class A product.</p>	 <p>The RCM mark is a registered trademark of the Australian Communications and Media Authority.</p>  <p>This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.</p>
 <p>The CSA mark is a registered trademark of the Canadian Standards Association.</p>	 <p>This symbol indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.</p>

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.

Product category

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

The affixed product label is as shown below.



Do not dispose in domestic household waste.

To return this unwanted instrument, contact your nearest Keysight Service Center, or visit <http://about.keysight.com/en/companyinfo/environment/takeback.shtml> for more information.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

- www.keysight.com/find/handheldscope
(product-specific information and support, software and documentation updates)
- www.keysight.com/find/assist
(worldwide contact information for repair and service)

Table of Contents

Safety Symbols	3
General Safety Information	4
Measurement Category	8
Environmental Conditions	9
Regulatory Markings	11
Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/ EC	12
Product category	12
Sales and Technical Support	12
1 Performance Verification Tests	
Introduction	18
Test interval	18
Test record	18
Test consideration	18
Recommended Test Equipment	19
Oscilloscope Performance Verification Tests	20
Voltage measurement accuracy verification test	20
Bandwidth verification test	23
Multimeter Performance Verification Tests	26
DC voltage verification test	26
AC voltage verification test	27
Resistance verification test	29
Capacitance verification test	30
Keysight U1610/20A Handheld Digital Oscilloscope Test Record	32
Oscilloscope performance verification tests	32
Multimeter performance verification tests	33

2 Service and Maintenance

Warranty Services	38
Standard warranty (worldwide)	38
Accessories warranty	38
Standard calibration service (optional)	38
Returning the U1610/20A to Keysight for Service	39
Replaceable Parts	40
To order replaceable parts	40
Cleaning	41
Battery Replacement	42
Basic Troubleshooting Hints	43

List of Tables

Table 1-1	Recommended test equipment for oscilloscope performance verification tests	19
Table 1-2	Recommended test equipment for multimeter performance verification tests	19
Table 1-3	Settings for the voltage measurement accuracy verification test	22
Table 1-4	Settings for the DC voltage verification test	27
Table 1-5	Settings for the AC voltage verification test	28
Table 1-6	Settings for the resistance verification test	30
Table 1-7	Settings for the capacitance verification test	31
Table 2-1	Replaceable parts list	40

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1 Performance Verification Tests

Introduction	18
Recommended Test Equipment	19
Oscilloscope Performance Verification Tests	20
Multimeter Performance Verification Tests	26
Keysight U1610/20A Handheld Digital Oscilloscope Test Record	32

This chapter helps you to verify the performance of the U1610/20A.

Introduction

The performance verification tests described in this section are used to verify the measurement performance of the U1610/20A. These tests should be performed periodically to verify that the U1610/20A is operating within specifications (as listed in the *U1610/20A User's Guide*).

If the U1610/20A fails the performance verification tests, adjustment or repair is required.

Test interval

The recommended interval of the performance verification tests is once per year. Performance should also be tested after repairs or major upgrades.

Test record

You can use the test record form provided in “[Keysight U1610/20A Handheld Digital Oscilloscope Test Record](#)” on page 32 to record your performance test results.

Test consideration

For accurate test results, let the U1610/20A and test equipment warm up for 30 minutes and perform self-calibration before testing. For more information on performing self-calibration, refer to the *U1610/20A User's Guide*.

NOTE

If performance tests fail after self-calibration, send the U1610/20A to your nearest Keysight Service Center for servicing.

Recommended Test Equipment

The test equipment recommended for performance verification are listed below. If the exact equipment is not available, substitute with another calibration standard of equivalent accuracy.

Table 1-1 Recommended test equipment for oscilloscope performance verification tests

Application	Equipment	Critical specification	Recommended equipment
Voltage measurement accuracy	Calibrator/Power supply	5 mV to 350 VDC, 0.1 mV resolution, ≥ 350 V	Fluke 5520A
	Cable	BNC (f) to BNC (f)	Keysight 10503A
	Adapter	BNC (f) to dual banana (m)	Keysight 1251-2277
Bandwidth	Calibrator	Leveled sine wave of up to 250 MHz	Fluke 5820A
	Feedthrough termination	50 Ω , BNC (m) and BNC (f)	Keysight 0960-0301
	Coaxial cable assembly	Type N (m) to BNC (m), 1 meter	Fluke 688960

Table 1-2 Recommended test equipment for multimeter performance verification tests

Application	Recommended equipment
DC voltage	Fluke 5520A
AC voltage	Fluke 5520A
Resistance	Fluke 5520A
Capacitance	Fluke 5520A

Oscilloscope Performance Verification Tests

The performance verification tests described in this section verify the channel measurement accuracy and acquisition system to provide confidence in functionality and accuracy of the U1610/20A. These performance verification tests are based on the U1610/20A specifications, as listed in the *U1610/20A User's Guide*.

Voltage measurement accuracy verification test

This test verifies the accuracy of the analog channel voltage measurement for each channel (DC vertical gain accuracy and dual cursor accuracy specifications). In this test, you will measure the DC voltage output of an oscilloscope calibrator using dual cursors on the U1610/20A.

Test limit:

$\pm\{4\% \text{ of full scale}^* + 0.4\% \text{ of full scale}^* (\sim 1 \text{ LSB})\}$

**Full scale on all ranges is defined as 8 divisions multiplied by the V/div setting.*

Refer to [Table 1-1](#) for the equipment required for this voltage measurement accuracy verification test. Perform the following procedure for channel 1 and then repeat the same procedure for channel 2.

1 On the U1610/20A:





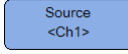

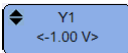
a Press  >  >  (**F1**) to turn on channel 1.

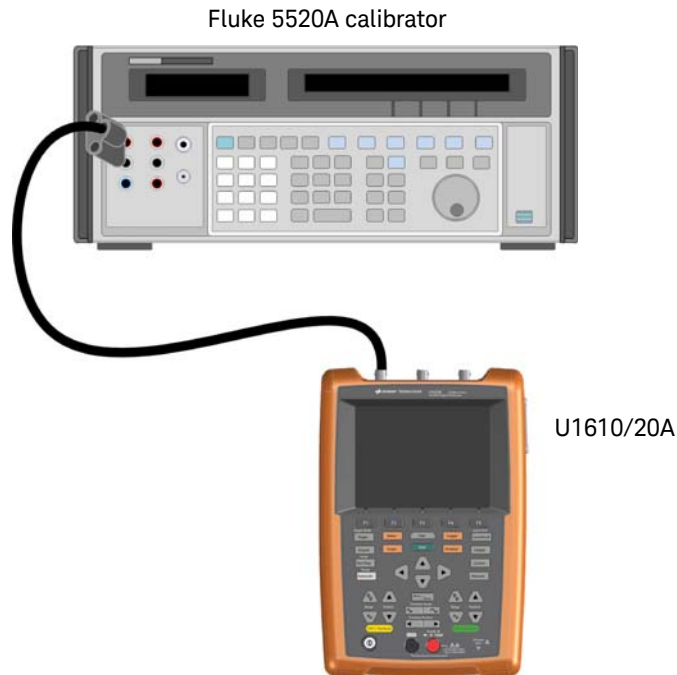
b Press  (**F2**) and use the  or  key, or press  to set the

offset to 0.5 major divisions from the bottom of display.

NOTE

Offset adjustment is not applicable for the 50 V/div vertical sensitivity.

- c Press  to set the vertical sensitivity to 20 V/div.
- d Press  >  (F4) and use the ▲ or ▼ key to set the average number to 64.
- e Press  >  (F1) to select the channel 1 source. Toggle  (F1) to select the Y cursor. Press  (F3) and use the ▲ or ▼ key to place the Y1 cursor on the offset line.
- 2 Connect the calibrator to the U1610/20A channel 1 as shown below.



1 Performance Verification Tests

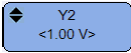
- 3 Set the calibrator output to 140 V. Wait a few seconds for the measurement to settle.
- 4 On the U1610/20A:
 - a Press  (F4) and use the ▲ or ▼ key to place the Y2 cursor at the center of the voltage trace.
 - b The Y1Y2 value on the display should be within the test limits of [Table 1-3](#) below.
- 5 Continue to verify the voltage measurement accuracy with the remaining V/div settings in [Table 1-3](#).
- 6 Once completed, disconnect the calibrator from the U1610/20A.
- 7 Repeat steps 1 to 6 for the U1610/20A channel 2.

Table 1-3 Settings for the voltage measurement accuracy verification test

U1610/20A setting	Calibrator setting	Minimum test limit	Maximum test limit
50 V/div	175 V	157.40 V	192.60 V
50 V/div	-175 V	-192.60 V	-157.40 V
20 V/div	140 V	132.96 V	147.04 V
10 V/div	70 V	66.48 V	73.52 V
5 V/div	35 V	33.24 V	36.76 V
2 V/div	14 V	13.30 V	14.70 V
1 V/div	7 V	6.65 V	7.35 V
500 mV/div	3.5 V	3.32 V	3.68 V
200 mV/div	1.4 V	1.33 V	1.47 V
100 mV/div	700 mV	664.80 mV	735.20 mV
50 mV/div	350 mV	332.40 mV	367.60 mV
20 mV/div	140 mV	132.96 mV	147.04 mV
10 mV/div	70 mV	66.48 mV	73.52 mV
5 mV/div	35 mV	33.24 mV	36.76 mV
2 mV/div	14 mV	13.30 mV	14.70 mV

Bandwidth verification test

This test verifies the bandwidth response of the U1610/20A. In this test, you will use an oscilloscope calibrator to output a leveled sine wave.

You will use the RMS voltage at 1 MHz and at bandwidth frequency to verify the bandwidth response of the U1610/20A.

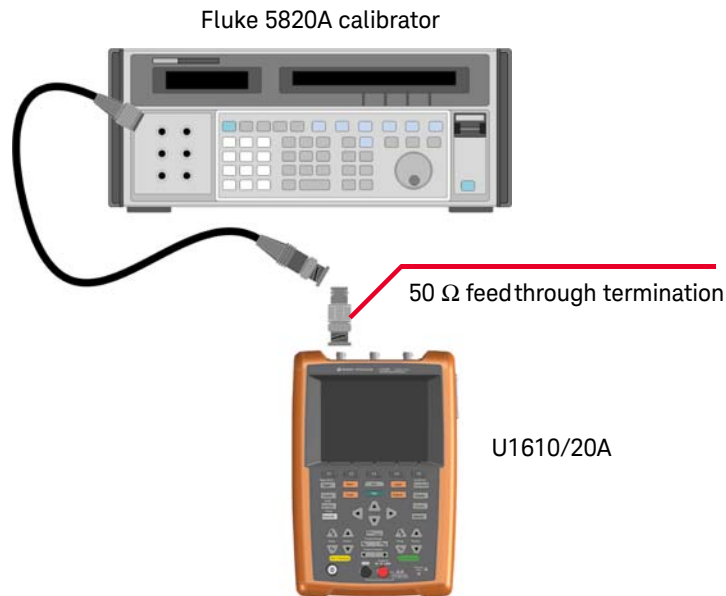
From specifications:

U1610A: Bandwidth (± 3 dB) = 100 MHz

U1620A: Bandwidth (± 3 dB) = 200 MHz


Refer to [Table 1-1](#) for the equipment required for this bandwidth verification test. Perform the following procedure for channel 1, and then repeat the same procedure for channel 2.


- 1 On the U1610/20A, press **Scope** > **Channel 1** > **Ch1 <On>** (**F1**) to turn on channel 1.
- 2 Connect the calibrator output through a 50 Ω feedthrough termination to the U1610/20A channel 1 input as shown below.


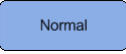


1 Performance Verification Tests

3 On the U1610/20A:

a Press  to set the horizontal scale factor to 200 ns/div.

b Press  to set the vertical sensitivity for channel 1 to 500 mV/div.


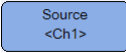
c Press  >  (**F1**) to set the acquisition mode to Normal.

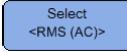

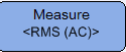
d Press  >  >  (**F2**) to select the channel 1 trigger source.

4 On the calibrator, perform the following configuration:

- Output: Level sine
- OPR/STBY: OPR
- Frequency: 1 MHz
- Amplitude: 1.2 V

5 On the U1610/20A:

a Press  >  (**F1**) to select the channel 1 source.


b Press  (**F2**) and use the  keys to select the RMS (AC) measurement, and then press  (**F3**).

c Wait a few seconds for the measurement to settle. View the RMS reading at the bottom of the display.

Record the reading: VRMS = _____ V

6 On the calibrator, change the frequency to 100 MHz (for U1610A) or 200 MHz (for U1620A).

7 On the U1610/20A:

- a** Press  to set the horizontal scale factor to 10 ns/div.
- b** Wait a few seconds for the measurement to settle.
- c** View the RMS reading at the bottom of the display.

Record the reading: VRMS = _____ mV

8 Calculate the bandwidth response of the U1610/20A:

$$\text{Bandwidth response} = 20 \log \left[\frac{\text{Reading}_{\text{of step 7}}}{\text{Reading}_{\text{of step 5}}} \right]$$

9 Repeat steps 1 to 8 for channel 2.

Multimeter Performance Verification Tests

Use the performance verification tests described in this section to verify the multimeter measurement performance of the U1610/20A. These tests are based on the U1610/20A specifications as listed in the *U1610/20A User's Guide*.

Refer to [Table 1-2](#) for the equipment required for the performance verification tests.

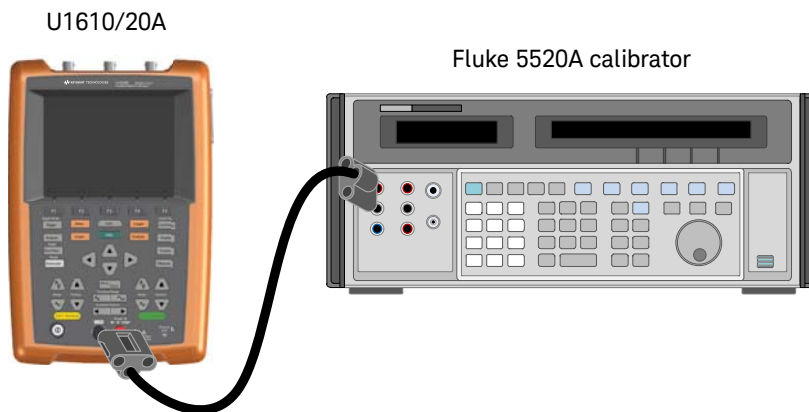
WARNING

Some of the verification tests involve high voltages; hence, only qualified personnel is recommended to perform the tests.

To avoid electrical shock or personal injury, always place the calibrator in Standby (STBY) mode before starting the verification test.

DC voltage verification test

- 1 Put the calibrator in Standby (**STBY**) mode.
- 2 On the U1610/20A, press **Meter** > **Meter <V DC>** (**F1**) and use the **◀▶** keys to select the V DC measurement function.
- 3 Connect the calibrator to the U1610/20A meter terminals using a banana plug as shown below. Ensure the polarity of the banana plug connection is correct.





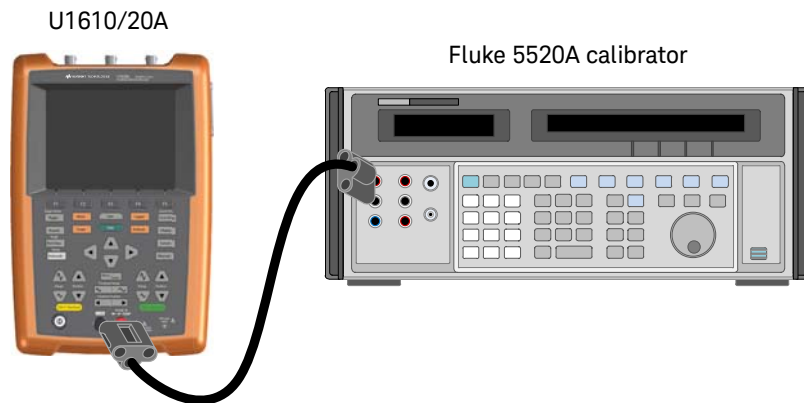
- 4 On both the calibrator and the U1610/20A, set each voltage range in the order shown in [Table 1-4](#) below.
- 5 Compare the measurement results to the corresponding test limits of [Table 1-4](#).

Table 1-4 Settings for the DC voltage verification test

Calibrator setting	Function	U1610/20A setting	Minimum limit	Maximum limit
100 mV	V DC	100 mV	99.85 mV	100.15 mV
1 V		1 V	0.9986 V	1.0014 V
10 V		10 V	9.989 V	10.011 V
100 V		100 V	99.89 V	100.11 V
1000 V		1000 V	998 V	1002 V

AC voltage verification test

- 1 Put the calibrator in Standby (**STBY**) mode.
- 2 On the U1610/20A, press **Meter** > **Meter <V AC>** (**F1**) and use the   keys to select the V AC measurement function.
- 3 Connect the calibrator to the U1610/20A meter terminals using a banana plug as shown below. Ensure the polarity of the banana plug connection is correct.




1 Performance Verification Tests

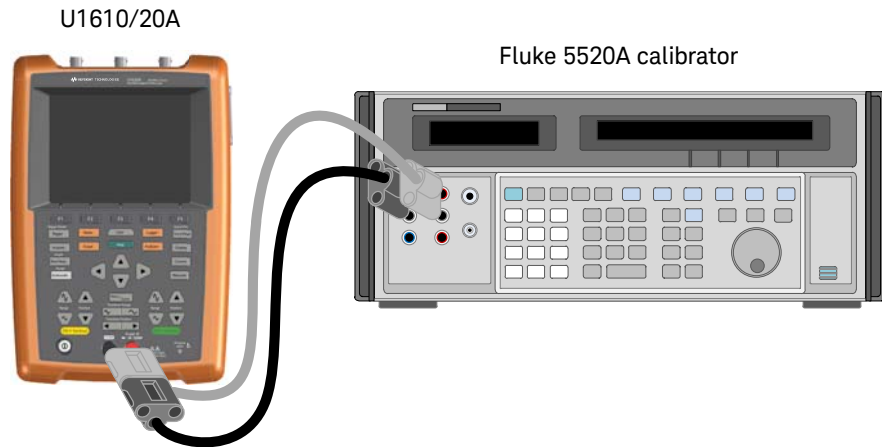
- 4 On both the calibrator and the U1610/20A, configure each setting in the order shown in [Table 1-5](#) below.
- 5 Compare the measurement results to the corresponding test limits of [Table 1-5](#).

Table 1-5 Settings for the AC voltage verification test

Calibrator voltage setting	Calibrator frequency setting	U1610/20A range setting	Minimum limit	Maximum limit
100 mV	45 Hz	100 mV	98.95 mV	101.05 mV
100 mV	500 Hz	100 mV	98.95 mV	101.05 mV
100 mV	1 kHz	100 mV	98.95 mV	101.05 mV
100 mV	2 kHz	100 mV	98.95 mV	101.05 mV
1 V	45 Hz	1 V	0.9895 V	1.0105 V
1 V	500 Hz	1 V	0.9895 V	1.0105 V
1 V	1 kHz	1 V	0.9795 V	1.0205 V
10 V	45 Hz	10 V	9.895 V	10.105 V
10 V	500 Hz	10 V	9.895 V	10.105 V
10 V	1 kHz	10 V	9.895 V	10.105 V
10 V	2 kHz	10 V	9.795 V	10.205 V
100 V	45 Hz	100 V	98.95 V	101.05 V
100 V	500 Hz	100 V	98.95 V	101.05 V
100 V	1 kHz	100 V	98.95 V	101.05 V
100 V	2 kHz	100 V	97.95 V	102.05 V
1000 V	45 Hz	1000 V	989.5 V	1010.5 V
1000 V	500 Hz	1000 V	989.5 V	1010.5 V
1000 V	1 kHz	1000 V	989.5 V	1010.5 V

Resistance verification test

- 1 Put the calibrator in Standby (**STBY**) mode.
- 2 On the U1610/20A, press **Meter** > **Meter <Resistance>** (**F1**) and use the  keys to select the resistance measurement function.
- 3 Connect the calibrator to the U1610/20A meter terminals using a 2-wire compensation mode as shown below. Ensure the polarity of the banana plug connection is correct.



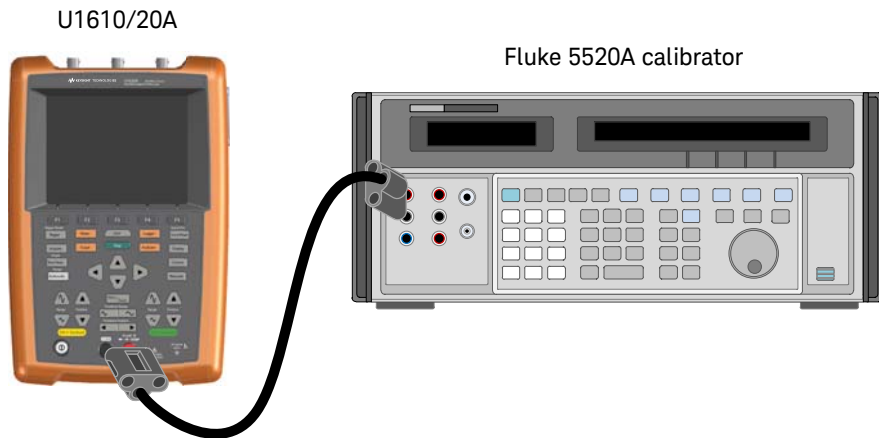
- 4 On both the calibrator and the U1610/20A, set each resistance range in the order shown in [Table 1-6](#).
- 5 Compare the measurement results to the corresponding test limits of [Table 1-6](#).

Table 1-6 Settings for the resistance verification test

Calibrator setting	Function	U1610/20A setting	Minimum limit	Maximum limit
1000 Ω	Resistance	1000 Ω	996.7 Ω	1003.3 Ω
10 k Ω		10 k Ω	9.967 k Ω	10.033 k Ω
100 k Ω		100 k Ω	99.67 k Ω	100.33 k Ω
1 M Ω		1 M Ω	0.994 M Ω	1.006 M Ω
10 M Ω		10 M Ω	9.917 M Ω	10.083 M Ω
100 M Ω		100 M Ω	98.47 M Ω	101.53 M Ω

Capacitance verification test

- 1 Put the calibrator in Standby (**STBY**) mode.
- 2 On the U1610/20A, press **Meter** > **Meter <Capacitance>** (**F1**) and use the **◀▶** keys to select the capacitance measurement function.
- 3 Connect the calibrator to the U1610/20A meter terminals using a banana plug as shown below. Ensure the polarity of the banana plug connection is correct.



- 4 On both the calibrator and the U1610/20A, set each capacitance range in the order shown in [Table 1-7](#).
- 5 Compare the measurement results to the corresponding test limits of [Table 1-7](#).

Table 1-7 Settings for the capacitance verification test

Calibrator setting	Function	U1610/20A setting	Minimum limit	Maximum limit
1000 nF	Capacitance	1000 nF	987.6 nF	1012.4 nF
10 μ F		10 μ F	9.876 μ F	10.124 μ F
100 μ F		100 μ F	98.76 μ F	101.24 μ F
1000 μ F		1000 μ F	979.6 μ F	1020.4 μ F
10 mF		10 mF	9.796 mF	10.204 mF

Keysight U1610/20A Handheld Digital Oscilloscope Test Record

Serial No.: _____ Test By: _____
 Test Interval: _____ Work Order No.: _____
 Recommended Next Testing: _____ Temperature: _____

Oscilloscope performance verification tests

Voltage measurement accuracy verification test

U1610/20A setting	Calibrator setting	Minimum test limit	Maximum test limit	Channel 1	Channel 2
50 V/div	175 V	157.40 V	192.60 V		
50 V/div	-175 V	-192.60 V	-157.40 V		
20 V/div	140 V	132.96 V	147.04 V		
10 V/div	70 V	66.48 V	73.52 V		
5 V/div	35 V	33.24 V	36.76 V		
2 V/div	14 V	13.30 V	14.70 V		
1 V/div	7 V	6.65 V	7.35 V		
500 mV/div	3.5 V	3.32 V	3.68 V		
200 mV/div	1.4 V	1.33 V	1.47 V		
100 mV/div	700 mV	664.80 mV	735.20 mV		
50 mV/div	350 mV	332.40 mV	367.60 mV		
20 mV/div	140 mV	132.96 mV	147.04 mV		
10 mV/div	70 mV	66.48 mV	73.52 mV		
5 mV/div	35 mV	33.24 mV	36.76 mV		
2 mV/div	14 mV	13.30 mV	14.70 mV		

Band width verification test

Model	Test limit	Channel 1	Channel 2
U1610A	± 3 dB at 100 MHz		
U1620A	± 3 dB at 200 MHz		

Multimeter performance verification tests

DC voltage verification test

Calibrator setting	U1610/20A setting	Minimum limit	Maximum limit	Result
100 mV	100 mV	99.85 mV	100.15 mV	
1 V	1 V	0.9986 V	1.0014 V	
10 V	10 V	9.989 V	10.011 V	
100 V	100 V	99.89 V	100.11 V	
1000 V	1000 V	998 V	1002 V	

AC voltage verification test

Calibrator voltage setting	Calibrator frequency setting	U1610/20A range setting	Minimum limit	Maximum limit	Result
100 mV	45 Hz	100 mV	98.95 mV	101.05 mV	
100 mV	500 Hz	100 mV	98.95 mV	101.05 mV	
100 mV	1 kHz	100 mV	98.95 mV	101.05 mV	
100 mV	2 kHz	100 mV	98.95 mV	101.05 mV	
1 V	45 Hz	1 V	0.9895 V	1.0105 V	
1 V	500 Hz	1 V	0.9895 V	1.0105 V	
1 V	1 kHz	1 V	0.9795 V	1.0205 V	
10 V	45 Hz	10 V	9.895 V	10.105 V	
10 V	500 Hz	10 V	9.895 V	10.105 V	
10 V	1 kHz	10 V	9.895 V	10.105 V	
10 V	2 kHz	10 V	9.975 V	10.205 V	
100 V	45 Hz	100 V	98.95 V	101.05 V	
100 V	500 Hz	100 V	98.95 V	101.05 V	
100 V	1 kHz	100 V	98.95 V	101.05 V	
100 V	2 kHz	100 V	97.95 V	102.05 V	
1000 V	45 Hz	1000 V	989.5 V	1010.5 V	
1000 V	500 Hz	1000 V	989.5 V	1010.5 V	
1000 V	1 kHz	1000 V	989.5 V	1010.5 V	

Resistance verification test

Calibrator setting	U1610/20A setting	Minimum limit	Maximum limit	Result
1000 Ω	1000 Ω	996.7 Ω	1003.3 Ω	
10 k Ω	10 k Ω	9.967 k Ω	10.033 k Ω	
100 k Ω	100 k Ω	99.67 k Ω	100.33 k Ω	
1 M Ω	1 M Ω	0.994 M Ω	1.006 M Ω	
10 M Ω	10 M Ω	9.917 M Ω	10.083 M Ω	
100 M Ω	100 M Ω	98.47 M Ω	101.53 M Ω	

Capacitance verification test

Calibrator setting	U1610/20A setting	Minimum limit	Maximum limit	Result
1000 nF	1000 nF	987.6 nF	1012.4 nF	
10 μ F	10 μ F	9.876 μ F	10.124 μ F	
100 μ F	100 μ F	98.76 μ F	101.24 μ F	
1000 μ F	1000 μ F	979.6 μ F	1020.4 μ F	
10 mF	10 mF	9.796 mF	10.204 mF	

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2 Service and Maintenance

Warranty Services	38
Returning the U1610/20A to Keysight for Service	39
Replaceable Parts	40
Cleaning	41
Battery Replacement	42
Basic Troubleshooting Hints	43

This chapter explains the warranty services offered and the appropriate actions to take if you have a problem with your U1610/20A.

Warranty Services

Standard warranty (worldwide)

If your U1610/20A fails during the three years warranty period, Keysight will repair or replace the unit under the terms of your warranty. After the expiration of the warranty, Keysight will offer repair services at a very competitive price.

This warranty does not cover defects resulting from improper or inadequate maintenance by the Buyer, Buyer-supplied products or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

If your U1610/20A is defective, contact the nearest Keysight Service Center to obtain service for your unit. They will arrange to have your unit repaired or replaced.

To obtain warranty, service, or technical support assistance, you can contact Keysight (refer to [“Sales and Technical Support”](#) on page 12).

Accessories warranty

Keysight offers warranty for product accessories for up to 3 months from the end-user acceptance date.

Standard calibration service (optional)

Keysight offers an optional calibration service contract for a period of 3 years from the end-user acceptance date.

Returning the U1610/20A to Keysight for Service

Before shipping your U1610/20A for repair or replacement, Keysight recommends that you acquire the shipping instructions from a Keysight Service Center. A clear understanding of the shipping instructions is necessary to secure your product for shipment.

- 1** Attach a tag to the U1610/20A with the following information:
 - Name and address of owner
 - Instrument model number
 - Instrument serial number
 - Description of the service required or failure indications
- 2** Remove all accessories from the U1610/20A. Do not include accessories unless they are associated with the failure symptoms.
- 3** Protect the U1610/20A by wrapping it in plastic or heavy paper.
- 4** Pack the U1610/20A in foam or other shock-absorbing material and place it in a strong shipping container.

You are recommended to use the original shipping material or order materials from a Keysight Sales Office. If both options are not available, place 8 to 10 cm (3 to 4 inches) of shock-absorbing and static-free packaging material around the U1610/20A to avoid movement during shipping.
- 5** Seal the shipping container securely.
- 6** Mark the shipping container as **FRAGILE**. In the ensuing correspondence, refer to the instrument by its model number and full serial number.

NOTE

Keysight suggests that you always insure your shipments.

Replaceable Parts

This section contains information for ordering replaceable parts for your U1610/20A. [Table 2-1](#) includes a brief description of each replaceable part with its corresponding part number.

NOTE

You can find the latest U1610/20A support parts list in the Keysight Test & Measurement Parts Catalog: <http://www.keysight.com/find/parts>.

To order replaceable parts

You can order replaceable parts from Keysight using the part numbers as listed in [Table 2-1](#).

NOTE

Not all parts listed are available as field-replaceable parts.

To order replaceable parts from Keysight:

- 1 Contact your nearest Keysight Sales Office or Service Center.
- 2 Identify the parts by their corresponding Keysight part numbers shown in the replaceable parts list.
- 3 Provide the instrument model number and serial number.

Table 2-1 Replaceable parts list

Part number	Description
U1610-60205	Battery cover
U1610-60206	Stand
U1610-65001	Hand strap
U1610-65002	Neck strap

Cleaning

If the U1610/20A requires cleaning, follow these instructions:

- Disconnect the power source from the U1610/20A.
- Clean the external surfaces of the U1610/20A with a soft, lint-free, and slightly dampened cloth.
- Make sure the U1610/20A is completely dry before reconnecting it to a power source. Disassembly is not required or recommended for cleaning.

Battery Replacement

NOTE

No recalibration is required after replacing the battery.

WARNING

To avoid electric shock, disconnect all input and power cord from the U1610/20A. Do not operate the U1610/20A until the battery access cover is closed securely.

- 1 Loosen the screw of the battery access cover as indicated.



- 2 Open the battery access cover.
- 3 Pull out the battery from the battery compartment as shown.





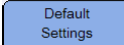



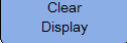


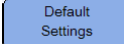

- 4 Install a new battery pack and re-assemble the battery access cover.


WARNING

Do not use non-rechargeable batteries (e.g., alkaline, carbon-zinc) with the AC/DC adapter connected.

Basic Troubleshooting Hints

This section provides hints and suggestions for solving general problems that you may encounter with the U1610/20A.

Problem	Hint/Suggestion
No display	<ul style="list-style-type: none"> - Check that  at the front panel is turned on. - Check the battery condition. Charge the battery if the battery is exhausted.
No trace display	<ul style="list-style-type: none"> - Reset to factory default settings ( > ). - Check that the scope probe lead wires are securely inserted into the connector assembly and that the probe clips are making good contact with the probe lead wires. - Check that the circuit-under-test is powered on, the probe clips are securely connected to test points on the circuit-under-test, and ground is connected. - Press  to automatically trigger the signal to the best display.
Trace display is unusual or unexpected	<ul style="list-style-type: none"> - Check that the horizontal time/division is correctly set for the expected frequency range of the input signals. - Check that all scope probes are connected to the correct signals on the circuit-under-test, and the ground lead is securely connected to ground of the circuit-under-test. - The trigger setup is the most important factor in capturing the signal you desire. Check that the trigger setup is correct. - Check that  >  (F3) is turned off. Press  to clear the display. - Press  to automatically trigger the signal to the best display.
No channel display	<ul style="list-style-type: none"> - Reset to factory default settings ( > ). - Check that the scope probe cable is securely connected to the input connector. - Check that the scope probe lead wires are securely inserted into the connector assembly and that the probe clips are making good contact with the probe lead wires. - Check that the circuit-under-test is powered on, the probe clips are securely connected to test points on the circuit-under-test, and ground is connected. - Check that the corresponding scope channel is being turned on. - Press  to automatically trigger the signal to the best display.

Problem	Hint/Suggestion
Unable to charge the U1610/20A with the AC/DC adapter after the battery is flat or when the battery voltage level is too low to power on the U1610/20A	Perform the following steps to reset the battery charging: <ul style="list-style-type: none"> - Pull out the battery from the battery compartment. Refer to "Battery Replacement" on page 42 for more information. - Plug in the AC/DC adapter. - Power on the U1610/20A. - Install the battery back. - The U1610/20A will start the charging process. The battery will take approximately 6 to 8 hours to be fully charged with the U1610/20A powered on.
Unable to power on after turning off the U1610/20A, with the AC/DC adapter still connected	<ul style="list-style-type: none"> - Remove and plug back in the AC/DC adapter to the U1610/20A. Press  to power on the U1610/20A.

NOTE

If you cannot get any response from the U1610/20A, contact the nearest Keysight Service Center to obtain further assistance.



This information is subject to change without notice. Always refer to the Keysight website for the latest revision.

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