Keysight Technologies
U1450A/U1460A
Insulation Resistance Testers

Data Sheet



KEYSIGHT TECHNOLOGIES

Introduction

Accomplish more in a day's work with the Keysight Technologies, Inc. U1450A/U1460A series insulation resistance testers. With a single tool, get remote testing capability and the fastest way to generate accurate test reports letting you carry out tests with full confidence.

- Remote testing coupled with report generation capability (Windows PC, iOS/Android)
- 50 V/100 V/250 V/500 V/1000 V test voltages
- Adjustable test voltages from 10 V up to 1.1 kV range [2]
- Up to 260 GΩ insulation resistance range
- Full-featured 4.5 digit OLED DMM (66,000 counts) [1]
- Timed/PI/DAR test
- IP 67 certified and drop proof up to 3 meters (10 feet)
- (–40 to +55 °C) operating temperature range [2]
- CAT III 1000 V/CAT IV 600 V safety ratings

1. U1461A only
2. U1453A and U1461A only

Test remotely and eliminate MORE reporting errors

Increase test efficiency and eliminate more reporting errors with the U1450A/U1460A Series' complimentary report generating software.

1. Keysight Handheld Meter Logger Software (Windows PC)[1]
2. Keysight Insulation Tester Application (iOS/Android)[2]

Eliminate the conventional data entering process and get error-free automated test reports generated in a tabulated or graphical form for easy interpretation and analysis – essential for troubleshooting, commissioning and preventive maintenance tasks. Better yet: All five insulation testers are compatible with the U1117A IR-to-*Bluetooth*® adapter to enable wireless remote testing using Windows PC[1] or on iOS/Android smart devices.[2]

Graph Mode View

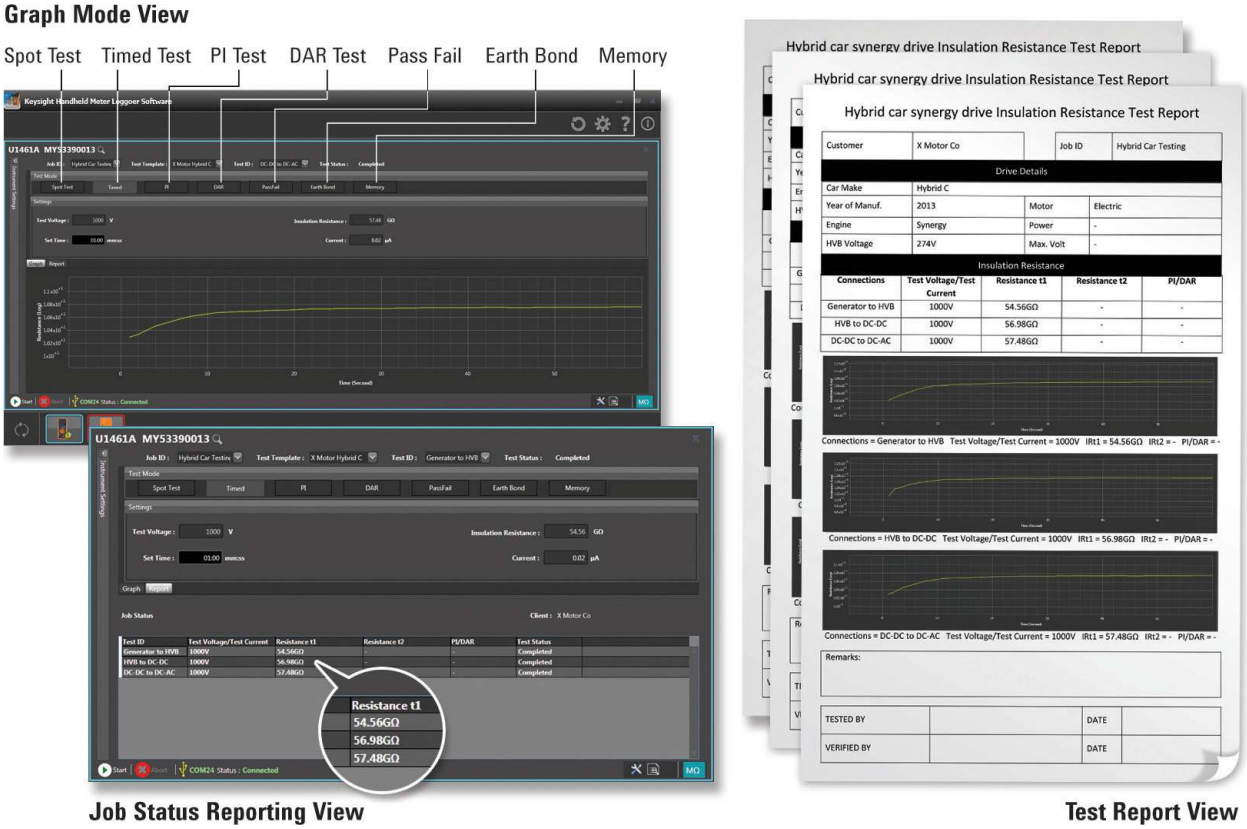


Figure 1. Keysight Handheld Logger Software Interface for Windows PC with guided operation and one button automatic report generation



Figure 2. Perform remote testing with Keysight InsulationTester Application



Figure 3. Data logging interface on Keysight Insulation Tester Application



Figure 4. U1117A IR-to-Bluetooth Adapter enables wireless remote testings with the U1450A/U1460A series

1. *Keysight Handheld Logger Meter for Windows PC can be downloaded from www.keysight.com/find/hhmeterlogger*
2. *Keysight Insulation Tester App for iOS and Android can be downloaded from www.keysight.com/find/insulationtesterapp or from Google Play store (https://play.google.com) /Apple iTunes App store (https://itunes.apple.com)*

Capable of handling MORE abuse in industrial settings

The insulation resistance testers are housed in robust overmold enclosures, certified to IP 67 for protection against water and dust. The robust tool is tested to withstand drops up to 3 meters (10 feet) high and operates over harsh temperature range of –40 to +55 °C[1]. Built to handle tough conditions and certified to stringent industrial standards, the U1450A/U1460A series is what you need to face the demands of everyday tasks.

Test the MOST applications with the same device

The adjustable insulation test voltage from 10 V to 1.1 kV in 1 V steps on selected two models[1] allows you to set precise test voltages catered to unique test application requirements. These typical applications are commercial avionics testing, military communications system testing and production line testing. The standard test voltages from 50 V to 1 kV is also available for selected models[2].



Figure 5. Adjustable insulation test voltage up to 1.1 kV



Figure 6. Insulation resistance tester with full featured DMM

Make MORE measurements with two-in-one tool

Selected models of the U1450A/U1460A series insulation resistance testers includes a full-featured OLED digital multimeter, with up to 4 ½ digits of resolution. Get all the functionality such as voltage measurements (AC V/DC V/AC mV/DC mV), current measurements (AC mA/DC mA/AC µA/DC µA), capacitance, resistance, temperature, diode test, low pass filter (LPF) and non-contact AC voltage detection (Vsense) that caters for a broad range of applications. Stretch to measure more for higher accuracy measurements readings with crystal clear OLED display – all within one tool.

1. *U1453A/U1461A only*
2. *Refer to U1450A/U1460A Series Comparison Chart at a glance*

Take a Closer Look

OLED front panel



U1450A/U1460A Series Comparison Chart at a glance

Industry	**Industrial and Power**				**Telecommunication**
	U1451A	**U1452A**	**U1453A**	**U1461A**	**U1452AT**
Display type	LCD	LCD	OLED	OLED	LCD
Basic features					
Insulation test voltage range	250 V, 500 V, 1,000 V	50 V, 100 V, 250 V, 500 V, 1,000 V	50 V, 100 V, 250 V, 500 V, 1,000 V	50 V, 100 V, 250 V, 500 V, 1,000 V	50 V, 100 V
Insulation resistance range	66 GΩ	260 GΩ	260 GΩ	260 GΩ	66 GΩ
Earth bond resistance range	60 Ω to 60 KΩ	60 Ω to 60 KΩ	6 Ω to 60 KΩ	6 Ω to 60 KΩ	60 Ω to 60 KΩ
Timed, PI, DAR	Timed only	√	√	√	√
Adjustable insulation test voltages	–	–	10 V to 1.1 KV	10 V to 1.1 KV	–
Live circuit test inhibit (30 V, 50 V, 75 V)	√	√	√	√	√
Calculate cable length by capacitance	√	√	√	√	√
Automatic discharge for capacitive circuits under test	√	√	√	√	√
Data management					
Remote testing and report generation[1]	√	√	√	√	√
Multimeter features					
DMM display resolution	6,600 counts	6,600 counts	66,000[2]/ 6,600 counts	66,000[2]/ 6,600 counts	6,600 counts
AC specification	Calibrated for sine wave	Calibrated for sine wave	True RMS	True RMS	Calibrated for sine wave
Measurements	AC/DC voltage, resistance, continuity, capacitance	AC/DC voltage, resistance, continuity, capacitance	AC/DC voltage, resistance, continuity, capacitance, diode test	AC/DC voltage (V, mV), AC/DC current (µA, mA), resistance, continuity, capacitance, diode test, temperature	AC/DC voltage, resistance, continuity, capacitance
DMM special features					
Low Pass Filter (LPF)	–	–	–	√	–
Non-Contact AC Voltage Detection (Vsense)	–	–	–	√	–
General specifications					
IP rating, drop test	IP 67, 10 ft (3 meters)	IP 67, 10 ft (3 meters)	IP 67, 10 ft (3 meters)	IP 67, 10 ft (3 meters)	IP 67, 10 ft (3 meters)
Safety protection	CAT III 1000 V/ CAT IV 600 V	CAT III 1000 V/ CAT IV 600 V	CAT III 1000 V/ CAT IV 600 V	CAT III 1000 V/ CAT IV 600 V	CAT III 1000 V/ CAT IV 600 V
Operating temperature	–20 to +55 °C	–20 to +55 °C	–40 to +55 °C	–40 to +55 °C	–20 to +55 °C
Battery life	270 hours	270 hours	160 hours	160 hours	270 hours
Warranty	3 years	3 years	3 years	3 years	3 years

1. Requires the Keysight Handheld Logger software for Windows PC, or the Keysight Insulation Tester app for iOS/Android smart devices
2. User selectable display resolution in MENU default is 6,600 counts

Specifications

U1451A/U1452A/U1452AT insulation resistance specifications

Insulation resistance specifications with accuracy of ± (% of reading + number of least significant digit)

Test voltage	Range	Resolution	Accuracy	Test current
50 V	6 MΩ	0.001 MΩ	2% + 5	1 mA @ 50 kΩ
	< 50 MΩ	0.01 MΩ	2% + 5	
	~60 GΩ	~0.01 GΩ	2% + 5[2]	
100 V	6 MΩ	0.001 MΩ	2% + 5	1 mA @ 100 kΩ
	60 MΩ	0.01 MΩ	2% + 5	
	< 100 MΩ	0.1 MΩ	2% + 5	
	~60 GΩ	~0.01 GΩ	2% + 5[2]	
250 V	6 MΩ	0.001 MΩ	1.5% + 5	1 mA @ 250 kΩ
	60 MΩ	0.01 MΩ	1.5% + 5	
	< 250 MΩ	0.1 MΩ	1.5% + 5	
	~200 GΩ	~0.1 GΩ	1.5% + 5[2]	
500 V	6 MΩ	0.001 MΩ	1.5% + 5	1 mA @ 500 kΩ
	60 MΩ	0.01 MΩ	1.5% + 5	
	< 500 MΩ	0.1 MΩ	1.5% + 5	
	~200 GΩ	~0.1 GΩ	1.5% + 5[2]	
1000 V	6 MΩ	0.001 MΩ	1.5% + 5	1 mA @ 1 MΩ
	60 MΩ	0.01 MΩ	1.5% + 5	
	600 MΩ	0.1 MΩ	1.5% + 5	
	< 1 GΩ	0.001 GΩ	1.5% + 5	
	~200 GΩ	~0.1 GΩ	1.5% + 5[2]	

1. The voltage indication on the display refers to the voltage at the DUT (device under test), and the accuracy is according to the DC voltage measurement. The default test voltage is shown in the table below.

Ω_{Mega} position (Mark)	1000 V	500 V	250 V	100 V	50 V
Test voltage	1000 V	500 V	250 V	100 V	50 V
Test accuracy	0% to +20 %	0% to +20 %	0% to +20 %	0% to +20 %	0% to +20 %

The test voltage across a resistor of a value of UN × (1000 Ω/V) shall not differ by more than 10% relative to noload (open) voltage, as a result of possibly present AC voltage components in the output voltage, when a capacitor of 1 µF is connected in parallel with the insulation resistance to be measured. UN represents the nominal output test voltage.

2. Additional accuracy is to be added to the basic accuracy as shown in the table below.

Voltage	1000 V	500 V	250 V	100 V	50 V
Above	1 GΩ	500 MΩ	250 MΩ	100 MΩ	50 MΩ
Basic accuracy	1.5% + 5	1.5% + 5	1.5% + 5	2.0% + 5	2.0% + 5
Additional accuracy	0.1%/GΩ	0.2%/GΩ	0.4%/GΩ	1.0%/GΩ	2.0%/GΩ

U1453A/U1461A insulation resistance specifications

Insulation resistance specifications with accuracy of ± (% of reading + number of least significant digit)

Test voltage	Range	Resolution	Accuracy	Test current
50 V	6 MΩ	0.001 MΩ	1.5% + 5	1 mA @ 50 kΩ
	< 50 MΩ	0.01 MΩ	1.5% + 5	
	~60 GΩ	~0.01 GΩ	1.5% + 5[2]	
100 V	6 MΩ	0.001 MΩ	1.5% + 5	1 mA @ 100 kΩ
	60 MΩ	0.01 MΩ	1.5% + 5	
	< 100 MΩ	0.1 MΩ	1.5% + 5	
	~60 GΩ	~0.01 GΩ	1.5% + 5[2]	
250 V	6 MΩ	0.001 MΩ	1.5% + 5	1 mA @ 250 kΩ
	60 MΩ	0.01 MΩ	1.5% + 5	
	< 250 MΩ	0.1 MΩ	1.5% + 5	
	~200 GΩ	~0.1 GΩ	1.5% + 5[2]	
500 V	6 MΩ	0.001 MΩ	1.2% + 5	1 mA @ 500 kΩ
	60 MΩ	0.01 MΩ	1.2% + 5	
	< 500 MΩ	0.1 MΩ	1.2% + 5	
	~200 GΩ	~0.1 GΩ	1.2% + 5[2]	
1000 V	6 MΩ	0.001 MΩ	1.2% + 5	1 mA @ 1 MΩ
	60 MΩ	0.01 MΩ	1.2% + 5	
	600 MΩ	0.1 MΩ	1.2% + 5	
	< 1 GΩ	0.001 GΩ	1.2% + 5	
	~200 GΩ	~0.1 GΩ	1.2% + 5[2]	

1. The voltage indication on the display refers to the voltage at the DUT (device under test), and the accuracy is according to the DC voltage measurement. The marked test voltage and the actual test voltage may be different if the test voltage is adjusted in the Setup. Refer to the table below for more details.

Ω_{Mega} position (Mark)	1000 V	500 V	250 V	100 V	50 V
Default test voltage (factory)	1000 V	500 V	250 V	100 V	50 V
Deviation	2.0 V	1.5 V	1.5 V	1.5 V	1.0 V
	0.2%	0.3%	0.6%	1.5%	2.0%
Adjustable test voltage (user)	10 to 1100 V	10 to 600 V	10 to 300 V	10 to 120 V	10 to 60 V
Incremental	1 V	1 V	1 V	1 V	1 V

2. Additional accuracy is to be added to the basic accuracy as shown in the table below.

Voltage	1000 V	500 V	250 V	100 V	50 V
Above	1 GΩ	500 MΩ	250 MΩ	100 MΩ	50 MΩ
Basic accuracy	1.2% + 5	1.2% + 5	1.5% + 5	1.5% + 5	1.5% + 5
Additional accuracy	0.05%/GΩ	0.1%/GΩ	0.2%/GΩ	0.5%/GΩ	1.0%/GΩ

U1451A/U1452A/U1452AT earth bond resistance specifications

Earth-bond resistance specifications with accuracy of ± (% of reading + number of least significant digit)[1, 2]

		Accuracy		
Range	**Resolution**	**U1451A**	**U1452A/U1452AT**	**Open circuit voltage**
60 Ω	0.01 Ω	1.5% + 3	1.0% +3	> 4 V and < 7 V
600 Ω	0.1 Ω	1.5% + 3	1.0% +3	
6 kΩ	0.001 kΩ	1.5% + 3	1.0% +3	
60 kΩ	0.01 kΩ	1.5% + 3	1.0% +3	

1. The following statements are true for earth-bond resistance tests:
   - Overload protection: < 2 V and 0.44 A/1000 V; 10 × 35 mm 30 kA fast-acting fuse
   - Short circuit: > 200.0 mA as resistance ≤ 2 Ω
2. The accuracy is specified after the Null function is used to subtract the test lead resistance and thermal effect (by shorting the test leads)

U1453A/U1461A earth bond resistance specifications

Earth-bond resistance specifications with accuracy of ± (% of reading + number of least significant digit)[1]

Range	**Resolution**	**Accuracy**	**Open circuit voltage**
6 Ω[2]	0.001 Ω	0.5% + 20	> 4 V and < 7 V
60 Ω[2]	0.01 Ω	0.5% + 2	
600 Ω[2]	0.1 Ω	0.5% + 2	
6 kΩ	0.001 kΩ	0.5% + 2	
60 kΩ	0.01 kΩ	0.5% + 2	

1. The following statements are true for earth-bond resistance tests:
   - Overload protection: 0.44 A/1000 V; 10 × 35 mm 30 kA fast-acting fuse
   - Short circuit: > 200.0 mA as resistance ≤ 2 Ω
2. The accuracy of the 6 to 600 Ω range is specified after the Null function is used to subtract the test lead resistance and thermal effect (by shorting the test leads)

U1451A/U1452A/U1452AT EN61557 specifications

The following specifications are a requirement for European labeling.

	Intrinsic uncertainty		
Measurement	**U1451A**	**U1452A/U1452AT**	**Operating uncertainty[1]**
Voltage	± (0.5% + 2)	± (0.2% + 2)	30%
Earth-bond resistance	± (1.5% + 3)	± (1.0% + 3)	30%
Insulation resistance	Based on the test voltage and range. **Refer to insulation resistance specifications for U1451A/U1452A/U1452AT.**		30%

1. The maximum resistance to meet the standard of EN61557-1, 5.2.4, which indicates the maximum amount allowed as less than 30%

Test voltage[1, 2, 3]	IR <	Intrinsic uncertainty (A)	Temperature (E3)	Operating uncertainty
50 V	12.85 GΩ	27.6%	2%	27.6% + 1.15 x E3
100 V	25.7 GΩ	27.6%	2%	27.6% + 1.15 x E3
250 V	65.5 GΩ	27.6%	2%	27.6% + 1.15 x E3
500 V	131 GΩ	27.6%	2%	27.6% + 1.15 x E3
1000 V	260 GΩ	27.4%	2%	27.4% + 1.15 x E3

1. Specification confidence level to 99.73% as coverage factor up to 3
2. Temperature range is from 0 to 35 °C
3. Test voltage/maximum range for different models:

Test voltage	U1451A	U1452A	U1452AT
50 V	–	60 GΩ	60 GΩ
100 V	–	60 GΩ	60 GΩ
250 V	60 GΩ	200 GΩ	–
500 V	60 GΩ	200 GΩ	–
1000 V	60 GΩ	200 GΩ	–

U1453A/U1461A EN61557 specifications

The following specifications are a requirement for European labeling.

	Intrinsic uncertainty		
Measurement	**U1461A**	**U1453A**	**Operating uncertainty[1]**
Voltage	± (0.09% + 1)	± (0.09% + 1)	30%
Earth-bond resistance	± (0.5% + 2)	± (0.5% + 2)	30%
	± (0.5% + 20)[2]	± (0.5% + 20)[2]	30%
Insulation resistance	Based on the test voltage and range. **Refer to insulation resistance specifications for U1453A/U1461A.**		30%

1. The maximum resistance to meet the standard of EN61557-1, 5.2.4, which indicates the maximum amount allowed as less than 30%
2. For 6 Ω range only

Test voltage[1, 2,]	IR <	Intrinsic uncertainty (A)	Temperature (E3)	Operating uncertainty
50 V	25.7 GΩ	27.65%	2%	27.65% + 1.15 x E3
100 V	51.4 GΩ	27.65%	2%	27.65% + 1.15 x E3
250 V	131 GΩ	25.65%	2%	25.65% + 1.15 x E3
500 V	260 GΩ	27.45%	2%	27.45% + 1.15 x E3
1000 V	260 GΩ	14.45%	2%	14.45% + 1.15 x E3

1. Specification confidence level to 99.73% as coverage factor up to 3
2. Temperature range is from 0 to 35 °C

U1453A/U1461A adjustable DC test voltage specifications

Adjusted DC test voltage specifications with accuracy of ± (% of reading + number of least significant digit)[1, 2]

Range	Resolution	Accuracy	Rate current
1100 V	1 V	0.5% + 1	1 mA nominal

1. The minimum test voltage may be set from 10 V
2. The indication at the rated output voltage across a resistor with a value of UN × (1000 Ω/V) shall not differ by more than 10% relative to the indicated value, as a result of possibly present AC voltage components in the output voltage, when a capacitor of 1 µF is connected in parallel with the insulation resistance to be measured

U1451A/U1452A/U1452AT DC voltage specifications

DC voltage specifications with accuracy of ± (% of reading + number of least significant digit)

			Accuracy		
Function	Range	Resolution	U1451A	U1452A/U1452AT	Input impedance
Voltage[1]	6 V	0.001 V	0.5% + 2	0.2% + 2	10 MΩ (nominal)
	60 V	0.01 V	0.5% + 2	0.2% + 2	10 MΩ (nominal)
	600 V	0.1 V	0.5% + 2	0.2% + 2	10 MΩ (nominal)
	1000 V	1 V	0.5% + 2	0.2% + 2	10 MΩ (nominal)

1. DC V overload protection: 1000 V_{RMS}

U1453A/U1461A DC voltage specifications

DC voltage specifications with accuracy of ± (% of reading + number of least significant digit)

Function	Range	Resolution	Accuracy	Input impedance
Voltage	60 mV[1]	0.01 mV	0.09% + 1	10 MΩ[3]
	600 mV[1]	0.1 mV	0.09% + 1	10 MΩ[3]
	6 V[2]	0.001 V	0.09% + 1	11.11 MΩ
	60 V[2]	0.01 V	0.09% + 1	10.1 MΩ
	600 V[2]	0.1 V	0.09% + 1	10 MΩ
	1000 V[2]	1 V	0.09% + 1	10 MΩ

1. The following statements are true for DC mV measurements:
   - DC mV measurements are for model U1461A only
   - The accuracy is specified after the Null function is used to subtract the thermal effect (by shorting the test leads)
   - DC mV overload protection: 1000 VRMS for short circuits with < 0.3 A current
2. DC V overload protection: 1000 VRMS
3. The input impedance may be set to > 1 GΩ in the Setup menu

U1451A/U1452A/U1452AT AC voltage specifications

AC voltage specifications with accuracy of ± (% of reading + number of least significant digit)

			Accuracy
Function	Range	Resolution	45 to 400 Hz
Voltage[1]	6 V	0.001 V	2.0% + 3
	60 V	0.01 V	2.0% + 3
	600 V	0.1 V	2.0% + 3
	1000 V	1 V	2.0% + 3

1. The following statements are true for resistance measurements:
   - AC V overload protection: 1000 V_{RMS}
   - AC V input impedance: 10 MΩ in parallel with < 100 pF (nominal)
   - The input signal is lower than the product of 1,000,000 V×Hz

U1453A/U1461A AC voltage specifications

True RMS AC voltage specifications with accuracy of ± (% of reading + number of least significant digit)

			Accuracy		
Function	**Range**	**Resolution**	**45 to 65 Hz**	**65 Hz to 5 kHz**	**5 to 20 kHz**
Voltage[6]	60 mV[1, 2, 4]	0.01 mV	1.0% + 3	1.5% + 3	2.0% + 4
	600 mV[1, 2, 4]	0.1 mV	1.0% + 3	1.5% + 3	2.0% + 4
	6 V[3, 5]	0.001 V	1.0% + 3	1.5% + 3	2.0% + 4
	60 V[3, 5]	0.01 V	1.0% + 3	1.5% + 3	2.0% + 4
	600 V[3, 5]	0.1 V	1.0% + 3	1.5% + 3 @ < 1 kHz	–
	1000 V[3, 5]	0.1 V	1.0% + 3	1.5% + 3 @ < 1 kHz	–
	LPF (low-pass filter) enabled, applicable for all voltage ranges and resolution[1, 3, 5]		1.0% + 3	1.5% + 3 @ < 200 Hz 6.0% + 3 @ < 440 Hz	–

1. AC mV and LPF measurements are for model U1461A only
2. AC mV overload protection: 1000 V_{RMS} for short circuits with < 0.3 A current
3. AC V overload protection: 1000 V_{RMS}
4. AC mV input impedance: The input impedance may be set to > 1 GΩ in the Setup menu, the default input impedance is 10 MΩ in parallel with 100 pF (nominal)
5. AC V input impedance: 10 MΩ in parallel with < 100 pF (nominal)
6. The input signal is lower than the product of 20,000,000 V×Hz

U1461A DC current specifications

DC current specifications with accuracy of ± (% of reading + number of least significant digit)

Function	**Range**	**Resolution**	**Accuracy**	**Burden voltage/shunt**
Current[1]	6 µA	0.001 µA	0.8% + 2[3]	< 0.24 V/39.2 kΩ
	60 µA	0.01 µA	0.4% + 1[3]	< 0.24 V/3.56 kΩ
	600 µA	0.1 µA	0.2% + 1	< 0.062 V/100 Ω
	6 mA	0.001 mA	0.2% + 1	< 0.62 V/100 Ω
	60 mA	0.01 mA	0.2% + 1	< 0.16 V/1 Ω
	440 mA[2]	0.1 mA	0.2% + 1	< 1.17 V/1 Ω

1. Overload protection: 0.44 A/1000 V; 10 × 35 mm 30 kA fast-acting fuse
2. Specification for 440 mA range: 440 mA continuous for signals > 440 mA up to 600 mA for 120 seconds maximum
3. The accuracy of the 6 to 60 µA range is specified after the Null function is used to zero the offset (by opening the test leads)

U1461A AC current specifications

True RMS AC current specifications with accuracy of ± (% of reading + number of least significant digit)

			Accuracy	
Function	**Range**	**Resolution**	**45 Hz to 1 kHz**	**Burden voltage/shunt**
Current[1]	6 µA	0.001 µA	2.0% + 2	< 0.24 V/39.2 kΩ
	60 µA	0.01 µA	1.5% + 2	< 0.24 V/3.56 kΩ
	600 µA	0.1 µA	1.0% + 2	< 0.062 V/100 Ω
	6 mA	0.001 mA	1.0% + 2	< 0.62 V/100 Ω
	60 mA	0.01 mA	1.0% + 2	< 0.16 V/1 Ω
	440 mA[2]	0.1 mA	1.0% + 2	< 1.17 V/1 Ω

1. Overload protection: 0.44 A/1000 V; 10 × 35 mm 30 kA fast-acting fuse
2. Specification for 440 mA range: 440 mA continuous for signals > 440 mA up to 600 mA for 120 seconds maximum

U1451A/U1452A/U1452AT resistance specifications

Resistance specifications with accuracy of ± (% of reading + number of least significant digit)

			Accuracy	
Function	**Range**	**Resolution**	**U1451A**	**U1452A/U1452AT**
Resistance[1]	600 Ω	0.1 Ω	1.5% + 3	1.0% + 3
	6 kΩ	0.001 kΩ	1.5% + 3	1.0% + 3
	60 kΩ	0.01 kΩ	1.5% + 3	1.0% + 3
	600 kΩ	0.1 kΩ	1.5% + 3	1.0% + 3
	6 MΩ	0.001 MΩ	2.0% + 3	1.2% + 3
	60 MΩ	0.01 MΩ	2.5% + 3	2.0% + 3

1. The following statements are true for resistance measurements:
   - Overload protection: 1000 VRMS for short circuits with < 0.3 A current
   - Maximum open voltage is < +2.8 V
   - The built-in buzzer beeps when the resistance measured is less than 30 Ω ± 15 Ω
   - The accuracy is specified after the Null function is used to subtract the test lead resistance and thermal effect (by shorting the test leads)

U1453A/U1461A resistance/audible continuity specifications

Resistance/Audible continuity specifications with accuracy of ± (% of reading + number of least significant digit)

Function	**Range**	**Resolution**	**Accuracy**	**Continuity threshold**
Resistance[1]	600 Ω[2]	0.1 Ω	0.5% + 2	12 ± 4 Ω
	6 kΩ	0.001 kΩ	0.5% + 2	0.06 ± 0.02 kΩ
	60 kΩ	0.01 kΩ	0.5% + 2	0.33 ± 0.17 kΩ
	600 kΩ	0.1 kΩ	0.5% + 2	3.6 ± 1.8 kΩ
	6 MΩ[3]	0.001 MΩ	0.8% + 2	0.13 ± 0.07 MΩ
	60 MΩ[3, 4]	0.01 MΩ	1.5% + 3	0.13 ± 0.07 MΩ

1. The following statements are true for resistance measurements:
   - Overload protection: 1000 VRMS for short circuits with < 0.3 A current
   - Maximum open voltage is < +2.1 V
   - The built-in buzzer beeps when the resistance measured is less than 12 Ω ± 4 Ω. The tester can capture intermittent measurements longer than 1 ms.
2. The accuracy of the 600 MΩ range is specified after the Null function is used to subtract the test lead resistance and thermal effect (by shorting the test leads)
3. For the ranges of 6 MΩ and 60 MΩ, the RH is specified for < 60% @ 30 °C
4. The temperature coefficient of the 60 MΩ range is 0.1 × (specified accuracy)/°C (from –40 to 18 °C or 28 to 55 °C)

U1453A/U1461A diode test specifications

Diode specifications with accuracy of ± (% of reading + number of least significant digit)

Function	**Range**	**Resolution**	**Accuracy**	**Test current**
Diode[1]	1 V[2]	0.001 V	2% + 3	0.21 mA
	Auto[3]	0.001 V	2% + 3	0.21 mA

1. The following statements are true for diode tests:
   - Overload protection: 1000 V_{RMS} for short circuits with < 0.3 A current
   - The built-in buzzer beeps continuously when the voltage measured is less than 0.04 ± 0.02 V and beeps once for forward-biased diode or semiconductor junctions measured between 0.3 V and 0.8 V (0.3 V ≤ reading ≤ 0.8 V)
2. Open voltage for diode: < +2.1 VDC
3. Open voltage for Auto-diode: < +2.1 VDC and > –2.1 VDC

U1451A/U1452A/U1452AT capacitance specifications

Capacitance specifications with accuracy of ± (% of reading + number of least significant digit)[1, 2, 3]

Range	Resolution	Accuracy	Signal
100 nF	0.1 nF	3% + 2	Sine wave: 54.5 Hz, < 2 V
1 µF	0.001 µF	3% + 2	
10 µF	0.01 µF	3% + 2	
100 µF	0.1 µF	5% + 2[4] @ < 50 µF	

1. Overload protection: 1000 VRMS for short circuits with < 0.3 A current
2. The accuracy for all ranges is specified based on a film capacitor or better, and after the Null function is used to subtract the residual values (by opening the test leads)
3. The maximum display is 1200 counts
4. Add additional accuracy of 0.1% per µF for values greater than 50 µF ☐ for example, 100 µF, additional accuracy of 5% is to be added

U1453A/U1461A capacitance specifications

Capacitance specifications with accuracy of ± (% of reading + number of least significant digit)[1, 2]

Range	Resolution	Accuracy	Measuring rate (at full scale)
10 nF	0.01 nF	1% + 2	5 times/second
100 nF	0.1 nF	1% + 2	
1 µF	0.001 µF	1% + 2	2.4 times/second
10 µF	0.01 µF	1% + 2	
100 µF	0.1 µF	1% + 2	
1 mF	0.001 mF	1% + 2	1.0 times/second
10 mF	0.01 mF	1% + 2	0.1 times/second

1. Overload protection: 1000 VRMS for short circuits with < 0.3 A current
2. The accuracy for all ranges is specified based on a film capacitor or better, and after the Null function is used to subtract the residual values (by opening the test leads)

U1451A/U1452A/U1452AT frequency specifications

Frequency specifications with accuracy of ± (% of reading + number of least significant digit)[1, 2]

Range	Resolution	Accuracy	Minimum input frequency
19.99 Hz	0.01 Hz	0.2% + 1	2 Hz
199.99 Hz	0.1 Hz	0.2% + 1	
< 400 Hz	1 Hz	0.2% + 1 @ ≤ 400 Hz	

1. Overload protection: 1000 V; input signal is < 1,000,000 V × Hz (product of voltage and frequency)
2. The frequency measurement is susceptible to error when measuring low-voltage and low-frequency signals. Shielding inputs from external noise pickup is critical for minimizing measurement errors.

U1453A/U1461A frequency specifications

Frequency specifications with accuracy of ± (% of reading + number of least significant digit)[1, 2]

Range	Resolution	Accuracy	Minimum input frequency
99.99 Hz	0.01 Hz	0.02% + 1	0.5 Hz
999.9 Hz	0.1 Hz	0.02% + 1	
9.999 kHz	0.001 kHz	0.02% + 1	
99.99 kHz	0.01 kHz	0.02% + 1	
999.9 kHz	0.1 kHz	0.2% + 1 @ ≤ 100 kHz	
9.999 MHz	0.001 MHz	0.2% + 1 @ ≤ 100 kHz	

1. Overload protection: 1000 V; input signal is < 20,000,000 V × Hz (product of voltage and frequency)
2. The frequency measurement is susceptible to error when measuring low-voltage and low-frequency signals. Shielding inputs from external noise pickup is critical for minimizing measurement errors. Turning on the low-pass filter (model U1461A only) may help you to filter out the noise and achieve a stable reading.

U1461A duty cycle and pulse width specifications

Duty cycle and pulse width specifications with accuracy of ± (% of reading + number of least significant digit)[2]

Function	Mode	Range	Resolution	Accuracy at full scale
Duty cycle[2]	DC coupling	99.9%	–	0.3% per kHz + 0.3%
	AC coupling	99.9%	–	0.3% per kHz + 0.3%
Pulse width[3]	–	999.9 ms	0.01 ms	(duty cycle accuracy/frequency) + 0.01 ms
	–	2000 ms	0.1 ms	(duty cycle accuracy/frequency) + 0.1 ms

1. Overload protection: 1000 V; input signal is < 20,000,000 V × Hz (product of voltage and frequency)
2. The frequency measurement is susceptible to error when measuring low-voltage and low-frequency signals. Shielding inputs from external noise pickup is critical for minimizing measurement errors. Turning on the low-pass filter (model U1461A only) may help you to filter out the noise and achieve a stable reading.
3. The accuracy for duty cycle and pulse width measurements is based on a 6 V square-wave input to the DC 6 V range. For AC couplings, the duty cycle range can be measured within the range of 10% to 90% for signal frequencies > 20 Hz.
4. The range of the duty cycle is determined by the frequency of the signal: {10 µs × frequency × 100%} to {[1 – (10 µs × frequency)] × 100%}
5. The pulse width (positive or negative) must be > 10 µs. The range of the pulse width is determined by the frequency of the signal.

U1453A/U1461A temperature specifications

Temperature specifications with accuracy of ± (% of reading + offset error)[1]

Thermal type	Range	Resolution	Accuracy
K	–200 to 1372 °C	0.1 °C	1% + 1 °C
	–328 to 2502 °F	0.1 °F	1% + 1.8 °F
J	–200 to 1200 °C	0.1 °C	1% + 1 °C
	–346 to 2192 °F	0.1 °F	1% + 1.8 °F

The following statements are true for temperature measurements:
- The specifications above are specified after 60 minutes of warm-up time
- The accuracy does not include the tolerance of the thermocouple probe
- Do not allow the temperature sensor to contact a surface that is energized above 30 VRMS or 60 VDC. Such voltages pose a shock hazard.
- Ensure that the ambient temperature is stable within ± 1 °C and that the Null function is used to reduce the test lead's thermal effect and temperature offset. Before using Null function, set the tester to measure temperature without ambient compensation and keep the thermocouple probe as close to the tester as possible (avoid contact with any surface that has a different temperature from the ambient temperature).
- When measuring temperature with respect to any temperature calibrator, try to set both the calibrator and tester with an external reference (without internal ambient compensation). If both the calibrator and tester are set with internal reference (with internal ambient compensation), some deviations may show between the readings of the calibrator and tester, due to differences in ambient compensation between the calibrator and tester. Keeping the tester close to the output terminal of calibrator will help reduce the deviation.
- The temperature calculation is specified according to the safety standards of EN/IEC-60548-1 and NIST175

U1451A/U1452A/U1452AT frequency sensitivity during voltage measurement

Input range[1]	Minimum sensitivity (RMS sine wave)
6 V	0.5 V
60 V	5 V
600 V	65 V
1000 V	65 V

1. Maximum input for specified accuracy, refer to "U1451A/U1452A/U1452AT AC voltage specifications"

U1453A/U1461A frequency sensitivity during voltage measurement

Input range[1]	Minimum sensitivity (RMS sine wave) 20 Hz to 100 kHz	Trigger level for DC coupling 20 Hz to 100 kHz
60 mV	10 mV	15 mV
600 mV	27 mV	55 mV
6 V	0.25 V	0.55 V
60 V	2.5 V	5.5 V
600 V	25 V	55 V
1000 V	170 V	460 V

1. Maximum input for specified accuracy, refer to "U1453A/U1461A AC voltage specifications"

U1461A frequency sensitivity during current measurement

Input range[1]	Minimum sensitivity (RMS sine wave) 20 Hz to 20 kHz
6 µA	0.5 µA
60 µA	5 µA
600 µA	45 µA
6 mA	0.45 mA
60 mA	4.5 mA
440 mA	45 mA

1. Maximum input for specified accuracy, refer to "U1453A/U1461A AC current specifications"

U1451A/U1452A/U1452AT voltage display update rate

Display update rate (approximate)

Function	Times/second
AC V	5
DC V	5
Ω	5
Capacitance	5
EBR	5
IR	5
Frequency	1 (> 10 Hz)

U1453A/U1461A display update rate

Display update rate (approximate)[1, 2]

Function	Slow (times/second)	Fast (times/second)
AC V (V or mV)	5	10/20/40
DC V (V or mV)	5	10/20/40
Ω	5	10/20/40
Diode	5	10/20/40
Auto-diode	1	–
Capacitance	1 (< 1 mF)	–
DC mA/µA	5	10/20/40
AC mA/µA	5	10/20/40
Temperature	5	10/20/40
Frequency	1 (> 10 Hz)	–

1. The tester has a built in combination filter for data update rate.
2. The CMRR and NMRR are specified based on five times the data update rate.

General specifications

Battery type	4 × 1.5 V AA Alkaline batteries (ANSI/NEDA 15A or IEC LR6) 4 × 1.5 V AA Lithium Iron Disulfide batteries (ANSI/NEDA 15LF or IEC FR6) 4 × 1.5 V AA Zinc Chloride batteries (ANSI/NEDA 15D or IEC R6) (U1453A/U1461A only)
Battery life U1451A/U1452A/U1452AT U1453A/U1461A	 270 hours (Alkaline batteries) 50/60/80 hours typical at high/medium/low brightness (Alkaline batteries)
Power consumption	2.7 VA maximum (with backlight/maximum brightness)
Fuse	10 × 35 mm 30 kA fast-acting fuse
Display U1451A/U1452A/U1452AT U1453A/U1461A	 Liquid Crystal Display (LCD), 4 digits with maximum reading of 6,600 counts Organic LED (OLED) with maximum reading of 6,600/66,000 and 660/6,600 counts selectable
Connectivity	IR-to-USB cable U1117A IR-to-Bluetooth Adapter (Bluetooth Class 1) U1177A IR-to-Bluetooth Adapter (Bluetooth Class 2)
Operating environment U1451A/U1452A/U1452AT U1453A/U1461A	 –20 to 55 °C, 0% to 80% RH (with alkaline batteries) 0 to 2000 meters altitude –20 to 55 °C, 0% to 80% RH (with alkaline batteries) –40 to 55 °C, 0% to 80% RH (with lithium batteries) 0 to 2000 meters altitude
Storage compliance	–40 to 70 °C, 0% to 80% RH with battery removed
Safety compliance	IEC/EN 61010-1:2010 EN 61557-1, IEC/EN 61557-2, and IEC/EN 61557-4
EMC compliance	IEC 61326-1:2005/EN 61326-1:2006
Measurement category	CAT III 1000 V/CAT IV 600 V
Common Mode Rejection Ratio (CMRR)	> 120 dB at DC, 50/60 Hz ± 0.1% (1 kΩ unbalanced)
Normal Mode Rejection Ratio (NMRR)	> 60 dB at 50/60 Hz ± 0.1%
Temperature coefficient U1451A/U1452A/U1452AT U1453A/U1461A	 0.05 × (specified accuracy)/°C (from –20 to 18 °C, or 28 to 55 °C) 0.05 × (specified accuracy)/°C (from –40 to 18 °C, or 28 to 55 °C)
IP rating	IP-67, protected against dust and the effect of immersion between 15 cm and 1 m
Drop test	1 meter per EN/IEC 61010-1:2001 and 3 meters (10 feet), 6 sides drop to oak floor and tester with holster
Dimensions (W × H × D)	100 × 218 × 58 mm
Weight U1451A/U1452A/U1452AT U1453A/U1461A	 728 grams (with alkaline batteries and rubber holster) 686 grams (with lithium batteries and rubber holster)
Warranty	3 years for main unit 3 months for standard accessories unless otherwise specified

Ordering information


U1451A


U1452A


U1452AT


U1453A


U1461A

Standard shipped accessories

	U1451A	U1452A	U1452AT	U1453A	U1461A
Hard carrying case	√	√	√	√	√
Alligator clips (red and black)	√	√	√	√	√
Test leads with 4 mm probe (red and black) and 19 mm probe (red and black)	√	√	√	√	√
IR-to-USB cable (U1173B)	√	√	√	√	√
Batteries	4 x AA Alkaline	4 x AA Alkaline	4 x AA Alkaline	4 x AA Lithium	4 x AA Lithium
Remote switch probe with adapter	–	√	–	√	√
IR-to-***Bluetooth*** adapter (U1117A)[1]	–	√	–	√	√
Operating instruction (U1117A)	–	√	–	√	√
Thermocoupler adapter (J/K-Type), bead (J-Type and K-Type)	–	–	–	–	√
Quick Start Guide	√	√	√	√	√
Certificate of calibration	√	√	√	√	√

1. All U1450A/60A Series models support the U1117A IR-to-Bluetooth adapter, however the U1117A cannot be shipped to selected countries as a standard accessory. Please refer to www.keysight.com/find/U1117A for more information.

Optional accessories		
U5403A Remote switch probe		Remote switch probe with fixed plug and adapter – Rated CAT III 1000 V, CAT IV 600 V, 15 A.
U1162A Alligator clips		One pair of insulated alligator clips (red and black) Recommended for use with Keysight standard test leads Rated CAT III 1000 V, CAT IV 600 V, 15 A.
U1117A IR-Bluetooth Adapter		Bluetooth Class 1 adapter – Up to 100 meter operating range – Compatible with iOS/Android and Windows PC

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Published in USA, August 4, 2014
5991-4290EN
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