

Keysight U1452A/U1452AT/ U1451A Insulation Tester

Notices

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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 which must be taken to maintain safe operation of the instrument.

	Direct current (DC)		Caution, risk of electric shock
	Alternating current (AC)		Caution, risk of danger (refer to this manual for specific Warning or Caution information)
	Both direct and alternating current	CAT III 1000 V	Category III 1000 V overvoltage protection
	Earth (ground) terminal	CAT IV 600 V	Category IV 600 V overvoltage protection
	Equipment protected throughout by double insulation or reinforced insulation		Do not use in distribution systems with voltages higher than 600 V

Safety Considerations

Read the information below before using this tester. Model U1452A appears in all illustrations.

WARNING

- Do not use the tester if it is damaged. Before you use the tester, inspect the case. Look for cracks or missing plastic. Pay particular attention to the insulation surrounding the connectors.
- Inspect the test leads for damaged insulation or exposed metal. Check the test leads for continuity. Replace damaged test leads before you use the tester.
- Do not operate the tester around explosive gas, vapor, or wet environments.
- Do not apply more than the rated voltage (as marked on the tester) between terminals, or between terminal and earth ground.
- Before use, verify the tester's operation by measuring a known voltage.
- When servicing the tester, use only the specified replacement parts.
- Use caution when working above 60 VDC, 30 VAC RMS, or 42.4 V peak. Such voltages pose a shock hazard.
- When using the probes, keep your fingers behind the finger guards on the probes.
- Connect the common test lead before you connect the live test lead. When you disconnect the leads, disconnect the live test lead first.
- Remove the test leads from the tester before you open the battery cover.
- Do not operate the tester with the battery cover or portions of the cover removed or loosened.
- To avoid false readings, which may lead to possible electric shock or personal injury, replace the battery as soon as the low battery indicator appears and flashes.
- Ensure that you do not perform insulation resistance tests in distribution systems with voltages higher than 600 V.
- For insulation resistance tests, ensure that you select a suitable test voltage for the equipment to be tested.

CAUTION

- Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, or capacitance.
 - Use the proper terminals, function, and range for your measurements.
 - This device is for use at altitudes of up to 2,000 m.
 - Always use the specified battery type. The power for the tester is supplied with four 1.5 V AA batteries. Observe the correct polarity markings before you insert the batteries to ensure proper insertion of the batteries in the tester.
 - You are advised to use low leakage batteries when changing to new batteries. Please remember to remove the batteries when the tester is not in use for a long period of time. Warning on the risk of battery leakage.
-

Measurement Category

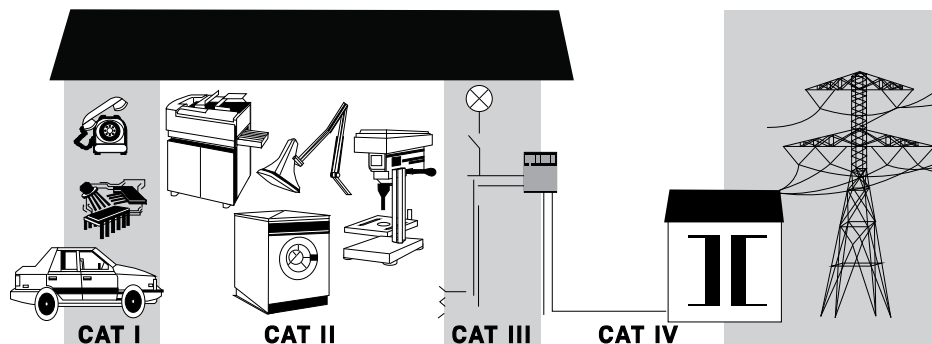
The Keysight U1452A/U1452AT/U1451A tester has a safety rating of CAT III, 1000 V and CAT IV, 600 V.

Measurement CAT I Measurements performed on circuits not directly connected to the AC mains. Examples are measurements on circuits not derived from the AC mains and specially protected (internal) mains-derived circuits.

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 – –20 °C to 55 °C, 0% to 80% RH (using Alkaline batteries), 20 minutes operating time
	Storage condition – –40 °C to 70 °C, 0% to 80% RH (without batteries)
Humidity	Full accuracy up to 80% RH for temperatures up to 30 °C, decreasing linearly to 50% RH at 55 °C
Altitude	Up to 2,000 meters
Pollution degree	Pollution degree II

NOTE

The U1452A/U1452AT/U1451A Product Name complies with the following safety and EMC requirements:

- Safety compliance
 - IEC 61010-1/EN61010-1, IEC 61010-2-030/EN61010-2-030, IEC61010-02-033/EN61010-2-033
 - Canada: CAN/CSA C22.2 No. 61010-1, CAN/CSA-C22.2 No.61010-2-030, CAN/CSA-C22.2 No.61010-2-033
 - USA: UL Std. No.61010-1, UL Std. No.61010-2-030, UL Std. No.61010-2-033
 - EMC compliance
 - IEC 61326-1/EN 61326-1
 - Canada: ICES/NMB-001
 - CISPR11/EN55011 Group 1 Class A
 - Australia/New Zealand: AS/NZS CISPR11
 - Refer to Declaration of Conformity for current revisions. Go to <http://www.keysight.com/go/conformity> for more information.
-

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>The RCM mark is a registered trademark of the Spectrum Management Agency of Australia. This signifies compliance with the Australia EMC Framework regulations under the terms of the Radio Communication Act of 1992.</p>
<p>ICES/NMB-001</p> <p>ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada.</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>
 <p>This symbol is a South Korean Class A EMC Declaration. This is a Class A instrument suitable for professional use and in electromagnetic environment outside of the home.</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.



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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/insulationtesters
(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
Safety Considerations	4
Measurement Category	6
Environmental Conditions	7
Regulatory Markings	8
Waste Electrical and Electronic Equipment (WEEE) Directive	
2002/96/EC	9
Product category:	9
Sales and Technical Support	9
1 Introduction	
About This Manual	20
Documentation map	20
Safety notes	20
Preparing Your Tester	21
Check the shipment	21
Install or change the batteries	21
Turn on your tester	24
Select the range	24
Adjust the tilt stand	25
Connect to the Handheld Meter Logger Software	26
Connect the Bluetooth adapter	27
Your Tester in Brief	28
Dimensions	28
Overview	30
Rotary switch	32
Keypad	34
Display screen	38
Input terminals	42
Cleaning Your Tester	43
Additional Features	44

Automatic power-off	44
Hazardous voltage indication	44
Power-on options	44
2 Making Measurements	
Insulation Resistance Test	48
Using the Remote Switch Probe	50
Locking the test	51
Timed insulation resistance/earth-bond resistance test	52
Measuring the Dielectric Absorption Ratio (DAR)	53
Measuring the Polarization Index (PI)	54
Viewing the leakage current	55
Earth-Bond Resistance Test	56
Measuring AC or DC Voltage	59
Auto AC or DC signal identification	61
Measuring Frequency	62
Measuring Resistance	64
Continuity Test	66
Measuring Capacitance	68
3 Tester Features	
Making Relative Measurements (Null)	72
Freezing the Display (TrigHold and AutoHold)	73
Performing Limit Comparisons (Limit)	75
Recording Measurement Data (Log)	77
Performing manual logs (HAND)	78
Performing interval logs (AUTO)	78
Performing event logs (TRIG)	79
Reviewing Previously Recorded Data (View)	81
4 Setup Options	
Using the Setup Menu	84
Editing numerical values	85

Setup Menu Summary	86
Setup Menu Items	89
Changing the variation count	89
Enabling smooth mode	89
Changing the beep frequency	90
Changing the auto power-off (APO) timer	91
Changing the LCD backlight timeout	91
Changing the continuity alert	92
Disabling the power-on melody	93
Changing the battery type	93
Resetting the tester's Setup options	94
Changing the display count	94
Changing the cable length unit	95
Changing the cable length scale	96
Changing the alert indicators	96
Changing the sample interval duration	97
Changing the recording option	98
Changing the IR and EBR test period	98
Changing the maximum inhibit voltage for IR tests	99
Disabling the lock once feature	100
Changing the button operation on the remote switch probe	100
Changing the Dielectric Absorption Ratio (DAR) for IR tests	101

5 Characteristics and Specifications

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List of Figures

Figure 1-1	Keysight Handheld Meter Logger Software	26
Figure 1-2	Bluetooth adapter connection	27
Figure 1-3	Width dimension	28
Figure 1-4	Height and depth dimensions	29
Figure 1-5	Display screen allocation example	38
Figure 1-6	Connecting the remote switch probe	42
Figure 2-1	Insulation resistance test example	49
Figure 2-2	T/Time operation	52
Figure 2-3	DAR operation	53
Figure 2-4	PI operation	54
Figure 2-5	Earth-bond resistance test example	57
Figure 2-6	AC or DC voltage measurement example	60
Figure 2-7	Definition of frequency	63
Figure 2-8	Resistance measurement example	65
Figure 2-9	Continuity test example	67
Figure 2-10	Capacitance measurement example	69

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List of Tables

Table 1-1	Front panel part descriptions	30
Table 1-2	Rear panel parts	31
Table 1-3	U1452A/U1452AT/U1451A rotary switch functions	32
Table 1-4	U1452A/U1452AT/U1451A keypad functions	34
Table 1-5	General annunciators	38
Table 1-6	Measurement units display	40
Table 1-7	Analog bar graph display	41
Table 1-8	Terminal connections for different measuring functions	42
Table 1-9	Power-on options	44
Table 2-1	Rotary switch position for insulation resistance tests	48
Table 2-2	Earth-bond resistance test position	56
Table 2-3	AC and DC voltage measurement positions	59
Table 2-4	Resistance measurement position	64
Table 2-5	Continuity test position	66
Table 2-6	Capacitance measurement position	68
Table 3-1	Limit settling default values	75
Table 3-2	Log maximum capacity	77
Table 3-3	Event log trigger conditions	79
Table 4-1	Setup menu key functions	84
Table 4-2	Setup menu item descriptions	86

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1 Introduction

About This Manual	20
Preparing Your Tester	21
Your Tester in Brief	28
Cleaning Your Tester	43
Additional Features	44

This chapter teaches you how to set up your tester for the first time. An introduction to all the features of the tester is also given.

About This Manual

Documentation map

The following manuals and software related to the *U1452A/U1452AT/U1451A Product Name* are available for download. Please visit our website at <http://www.keysight.com/find/hhTechLib> for the latest version.

Check the manual edition on the first page of each manual.

User's Guide. This manual.

Quick Start Guide. Downloadable from <http://www.keysight.com/find/hhTechLib>

Service Guide. Downloadable from <http://www.keysight.com/find/hhTechLib>

Keysight Handheld Meter Logger Software, Help, and Quick Start Guide.
Downloadable from <http://www.keysight.com/hhmeterlogger>

Safety notes

The following safety notes are used throughout this manual. More pertinent safety notes for using this product are located under the [Safety Symbols](#) section.

CAUTION

Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the product. Do not proceed beyond a caution notice until the indicated conditions are fully understood and met.

WARNING

Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.

Preparing Your Tester

Check the shipment

When you receive your tester, check the shipment according to the following procedure.

- 1** Inspect the shipping container for damage. Signs of damage may include a dented or torn shipping container or cushioning material that indicates signs of unusual stress or compacting. Save the packaging material in case the tester needs to be returned.
- 2** Carefully remove the contents from the shipping container, and verify that the standard accessories and your ordered options are included in the shipment according to the standard shipped items as below:
 - Hard carrying case
 - Alligator clips (red and black)
 - Test leads (red and black)
 - 19 mm probes (red and black)
 - 4 mm probes (red and black)
 - IR to USB cable
 - Four 1.5 V AA alkaline batteries
 - Remote switch probe and adapter (model U1452A only)
 - Certificate of Calibration
- 3** For any question or problems, refer to the Keysight contact numbers on the back of this manual.

Install or change the batteries

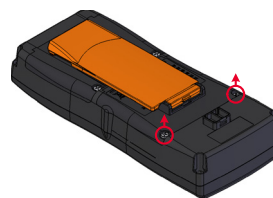
Your tester is powered by four 1.5 V AA alkaline batteries (included in the shipment). When you receive your tester, the batteries are not installed.

Use the following procedure to install or change the batteries.

CAUTION

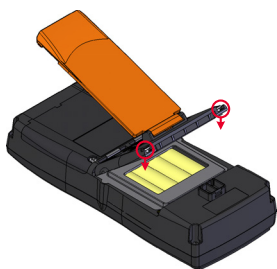
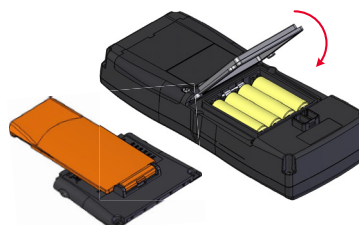
Before you proceed with the batteries installation, remove all cable connections to the terminals and ensure that the rotary switch is at the **OFF position. Use only the battery type specified in the data sheet.**

- 1 Remove the orange rubber holster. Pull from a top corner and stretch the orange rubber holster off the tester.
- 2 Loosen and remove the two screws with a suitable Phillips screwdriver as shown on the right.



- 3 Lift up and remove the battery cover as shown on the left.

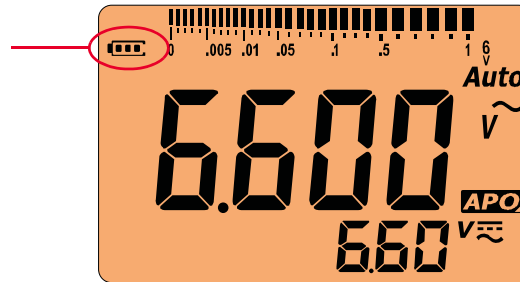
- 4 Lift the inner rubber cover to access the battery compartment.
- 5 Observe the proper batteries polarity. The terminal ends of each battery are indicated inside the battery compartment. Insert four 1.5 V AA batteries.




- 6 Ensure that the inner rubber cover is positioned properly.
- 7 Replace the battery cover back in its original position and tighten the screws.
- 8 Finally fit the orange rubber holster back on the tester.

The battery level indicator in the upper left-hand corner of the display indicates the relative condition of the batteries.

Battery level
indicator



Replace the batteries as soon as possible when the low battery indicator () is shown.

WARNING

To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the low battery indicator appears. Do not discharge the battery by shorting the battery or reverse the battery polarity in any of the subjects.

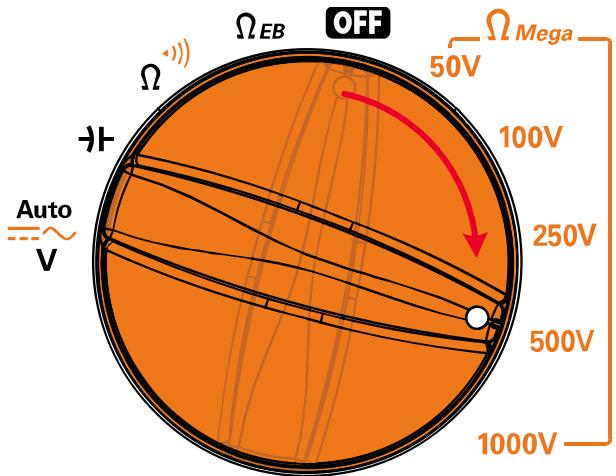
CAUTION

To avoid instruments being damage from battery leakage:

- Always remove dead batteries immediately.
- Always remove the batteries and store them separately if the tester is not going to be used for a long period.

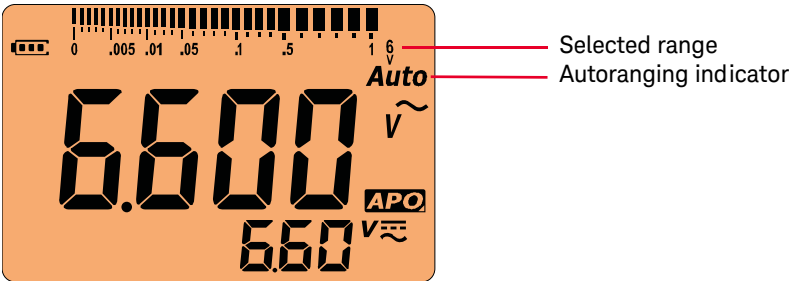
Turn on your tester

To power ON your tester, turn the rotary switch from the **OFF** position to any other position.



Select the range

The tester's selected range is always displayed on the right-hand end of the bar graph.



Pressing **Range** changes the tester range (and disables auto-ranging). Each additional press of **Range** (in manual ranging) sets the tester to the next higher range, unless it is already in the highest range, at which point the range switches to the lowest range.

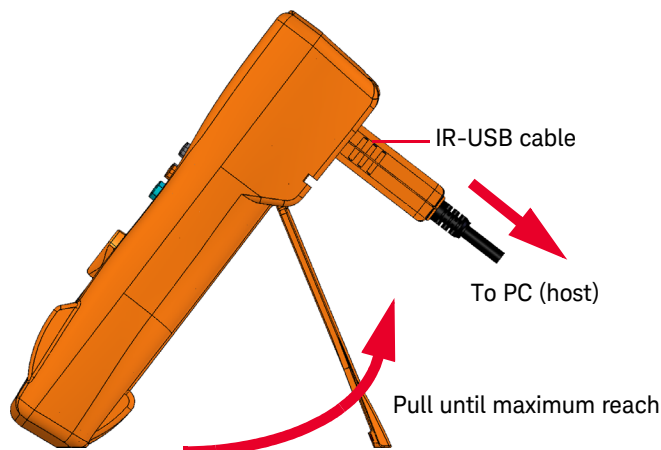
Press and hold **Range** to switch the tester to auto-ranging. Auto-ranging is convenient because the tester automatically selects an appropriate range for sensing and displaying each measurement.

NOTE

- Changing the tester range (and disabling auto-ranging) is not allowed for earth-bond resistance tests and insulation resistance tests.
- In auto-range, the tester selects the lowest range to display the highest available precision (resolution) for the input signal.
- If a reading is greater than maximum available range, **OL** (overload) is shown on the display – except for earth-bond resistance tests and insulation resistance tests where to indicate maximum reading, **>** is shown on the display instead.

Adjust the tilt stand

To adjust the tester to a 60° standing position, pull the tilt-stand outward to its maximum reach.



Connect to the Handheld Meter Logger Software

You can use the IR communication link (IR communication port, located at the rear panel) and the Keysight Handheld Meter Logger Software to control your tester remotely, perform data logging operations, and transfer the contents of your tester's memory to a PC.

Ensure that the Keysight logo on the U1173A IR-USB cable connected to the tester is facing up. Firmly push the IR head into the tester's IR communication port until it snaps into place.

Refer to the *Keysight Handheld Meter Logger Software Help* and *Quick Start Guide* for more information on the IR communication link and the Keysight Handheld Meter Logger Software.

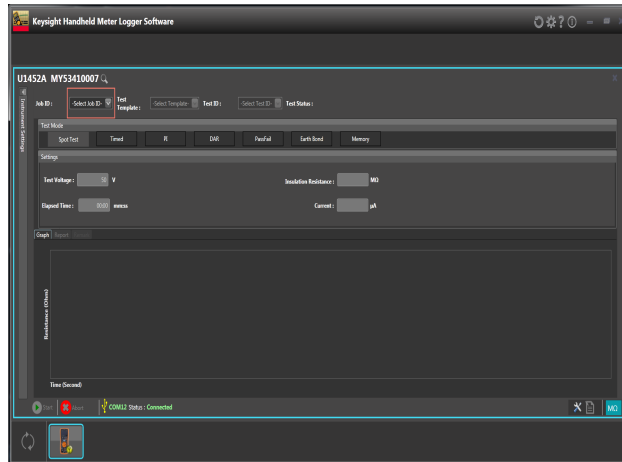


Figure 1-1 Keysight Handheld Meter Logger Software

The Keysight Handheld Meter Logger Software and its supporting documents (Quick Start Guide and Help) are available for download from <http://www.keysight.com/hhmeterlogger>.

Connect the Bluetooth adapter

The U1117A Infrared (IR)-to-**Bluetooth**® adapter allows you to connect the tester wirelessly to any Windows PC, Android device, or iOS device.

The U1117A is compatible with the following application or software:

- Keysight Handheld Meter Logger (for Windows PC)
- Keysight Mobile Meter (for Android or iOS devices)
- Keysight Mobile Logger (for Android or iOS devices)

Snap the optic side of the U1117A to the tester's IR communication port (see [Figure 1-2](#)).

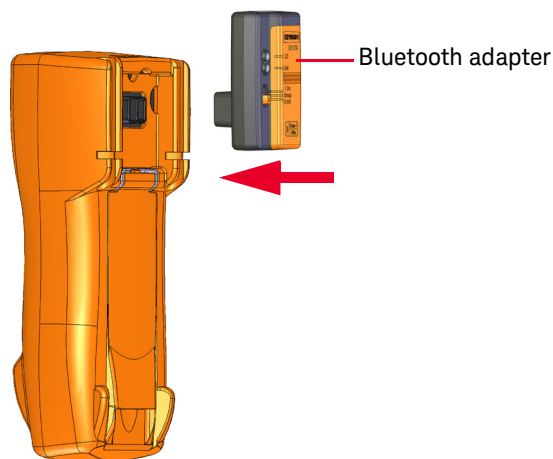


Figure 1-2 Bluetooth adapter connection

Refer to the *Keysight U1117A IR-to-Bluetooth Adapter Operating Instructions* (download from <http://www.keysight.com/find/U1117A>) for more information on how to set up the U1117A to a Windows PC, Android device, or iOS device.

Your Tester in Brief

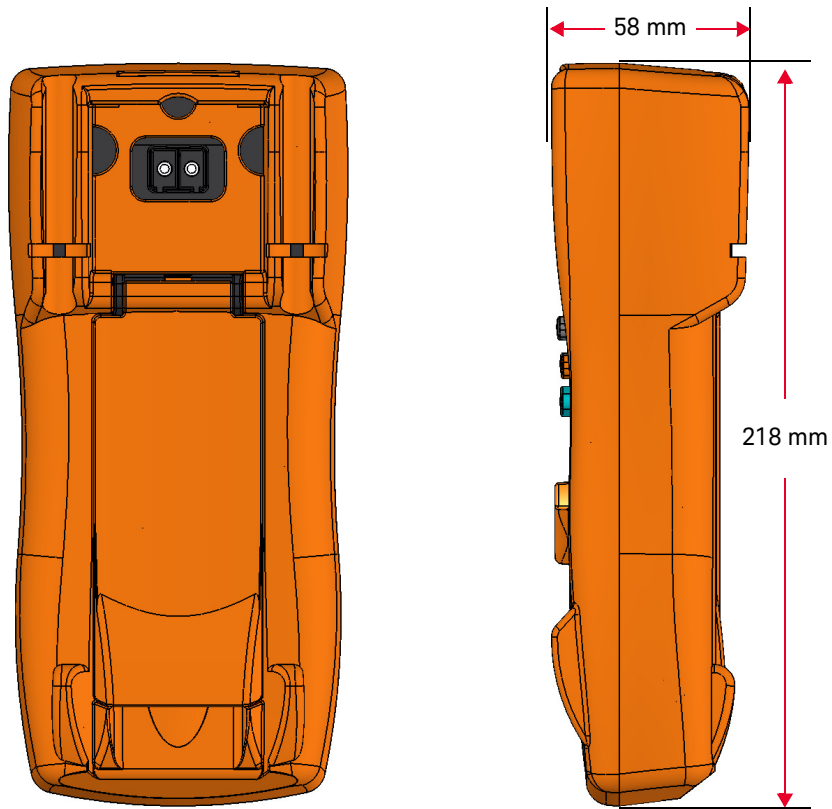
Dimensions

Front view



Figure 1-3 Width dimension

Rear and side view

**Figure 1-4** Height and depth dimensions

Overview

Front panel

The front panel parts of your tester are described in this section.

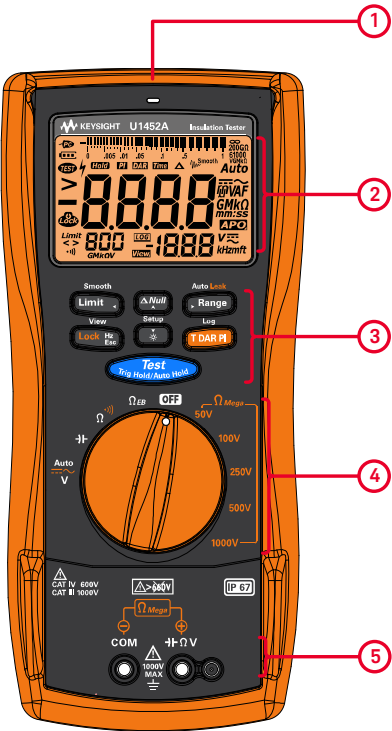


Table 1-1 Front panel part descriptions

Legend	Description	Learn more on:
1	Red LED indicator	page 72
2	Display screen	page 38
3	Keypad	page 34
4	Rotary switch	page 32
5	Input terminals	page 42

Rear panel

The rear panel parts of your tester are described in this section.

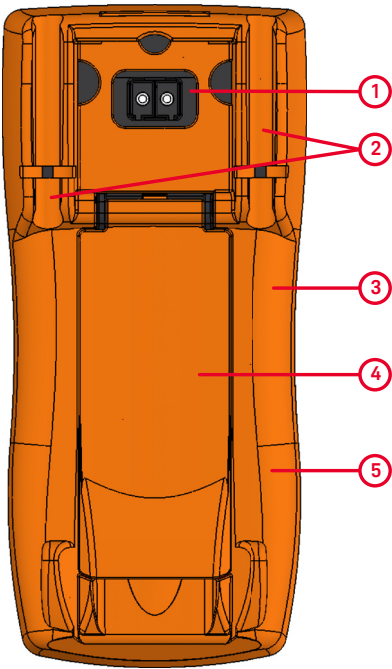


Table 1-2 Rear panel parts

Legend	Description	Learn more on:
1	IR communication port	page 26
2	Test lead/probe holders	-
3	Battery access (under the orange rubber holster)	page 21
4	Tilt stand	page 25
5	Fuse access (under the orange rubber holster)	-

Rotary switch

The measurement functions for each rotary switch position are described in [Table 1-3](#). Turning the rotary switch changes the measurement function and resets all other measurement options.

WARNING

Remove the test leads from the measuring source or target before changing the rotary switch position.

NOTE

Press **T D A R M** to select the alternate measurement function(s) or test methods for insulation resistance tests. See [page 34](#) for more information on the **T D A R M** key.

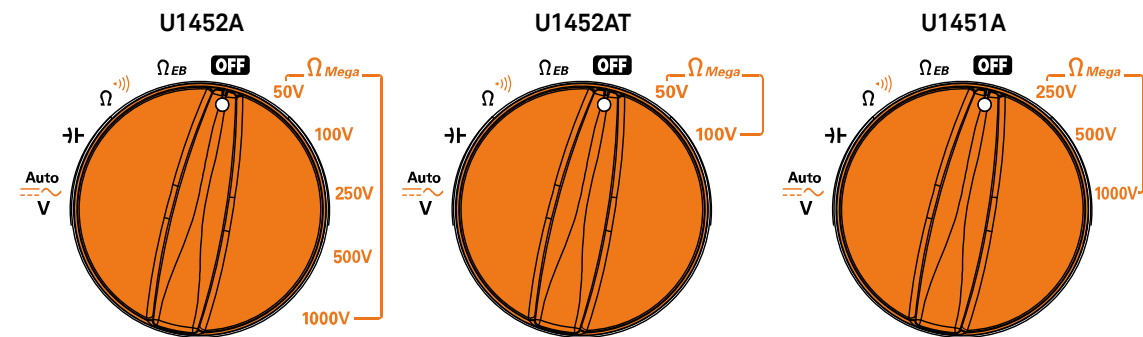





Table 1-3 U1452A/U1452AT/U1451A rotary switch functions

Legend	Measurement function	U1452A	U1452AT	U1451A	Learn more on:
	50 V Insulation resistance test	✓	✓	-	
	T - Timed test	✓	✓	-	
Ω Mega 50V	DAR - Dielectric Absorption Ratio test	✓	✓	-	page 56
	PI - Polarization Index Test	✓	✓	-	

Table 1-3 U1452A/U1452AT/U1451A rotary switch functions (continued)

Legend	Measurement function	U1452A	U1452AT	U1451A	Learn more on:
	100 V Insulation resistance test	✓	✓	-	page 56
	T - Timed test	✓	✓	-	
	DAR - Dielectric Absorption Ratio test	✓	✓	-	
	PI - Polarization Index Test	✓	✓	-	
	250 V Insulation resistance test	✓	-	✓	page 56
	T - Timed test	✓	-	✓	
	DAR - Dielectric Absorption Ratio test	✓	-	-	
	PI - Polarization Index Test	✓	-	-	
	500 V Insulation resistance test	✓	-	✓	page 56
	T - Timed test	✓	-	✓	
	DAR - Dielectric Absorption Ratio test	✓	-	-	
	PI - Polarization Index Test	✓	-	-	
	1000 V Insulation resistance test	✓	-	✓	page 56
	T - Timed test	✓	-	✓	
	DAR - Dielectric Absorption Ratio test	✓	-	-	
	PI - Polarization Index Test	✓	-	-	
	Earth-bond resistance test	✓	✓	✓	page 56
	T - Timed test	✓	✓	✓	
	Resistance measurement	✓	✓	✓	page 64
	Continuity test	✓	✓	✓	page 66
	Capacitance measurement	✓	✓	✓	page 68
	Auto voltage measurement	✓	✓	✓	page 48
	DC voltage measurement	✓	✓	✓	
	AC voltage measurement	✓	✓	✓	

Keypad

The operation of each key is explained in Table 1-4 below. Pressing a key enables a function, displays a related symbol, and emits a beep. Turning the rotary switch to another position resets the current operation of the key.

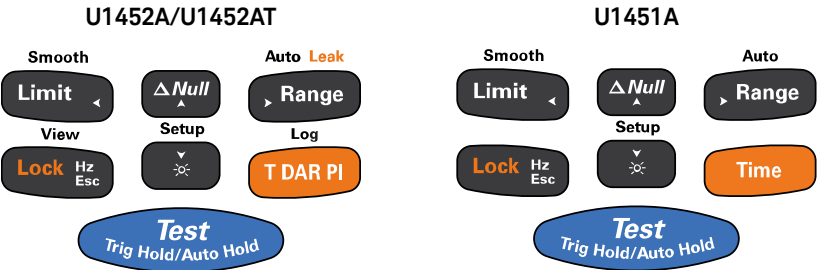


Table 1-4 U1452A/U1452AT/U1451A keypad functions









Legend	Function when pressed for:	
	Less than 1 second	More than 1 second
	Insulation Resistance (IR) Test: Initiates an IR test (when the rotary switch is in one of the Ω Mega positions) as long as  is held – the tester sources (outputs) a high voltage and measures insulation resistance and  is shown on the display.	
	Earth-Bond Resistance (EBR) Test: Initiates an EBR test (when the rotary switch is in the Ω EB position) as long as  is held – the tester measures earth-bond resistance and  is shown on the display.	
	Trig Hold: Freezes the present reading in the display (except when the rotary switch is in one of the Ω Mega positions or in the Ω EB position). <ul style="list-style-type: none">– In TrigHold mode, press  to manually trigger the holding of the next measured value.– Press and hold  again to exit this mode.	Auto Hold: Automatically freezes the present reading once the reading is stable (except when the rotary switch is in one of the Ω Mega positions or in the Ω EB position). <ul style="list-style-type: none">– In AutoHold mode, the reading is updated automatically once the reading is stable and the count setting is exceeded.– Press and hold  again to exit this mode.

Table 1-4 U1452A/U1452AT/U1451A keypad functions (continued)







Legend	Function when pressed for:	
	Less than 1 second	More than 1 second
U1451A 	<p>Lock: Press  to lock the insulation test or earth-bond resistance test (when the rotary switch is in the appropriate position).</p> <p>Press  >  to initiate an IR or EBR test. The test will remain active until you press  or  again to release the lock.</p>	<p>View: Press and hold  to enter the Log Review menu.</p> <ul style="list-style-type: none"> – Press  to cycle through the previously recorded manual (VIEW H), interval (VIEW A), or event (VIEW E) logging data. – Press  or  to view first or last logged data respectively. – Press  or  to scroll through the logged data. – Press  to delete the last logged data. – Press and hold  to clear all the logged data for the selected logging mode. – Press and hold  again to exit this mode.
U1452A/U1452AT 	<p>Hz: Press  to display the frequency for voltage or current measurements.</p> <p>Press  again to disable the frequency display.</p> <p>Esc: Press  in the Setup menu to discard your changes.</p>	
U1451A 	<p>Press  to switch or cycle between the default and alternate measurement function(s).</p> <p>T: Configures the tester for a timed test (when the rotary switch is in one of the Ω Mega positions or the Ω EB position).</p> <p>The test will start when you press .</p>	<p>Log: The recording option (HAND, AUTO, or TRIG) must first be selected in the Setup menu (see page 98).</p> <ul style="list-style-type: none"> – HAND (manual data logging) – Press and hold  to log the present reading into the memory. The display will return to normal after a short while (\approx 1 second). To manually log another reading, press and hold  again. – AUTO (automatic data logging) – Press and hold  to enable the automatic data logging mode, where data is logged at the interval defined in the Setup menu (see page 97). Press and hold  again to exit this mode. – TRIG (event data logging) – Press and hold  to enable the event data logging mode, where data is logged each time a triggering condition is satisfied (see page 80). Press and hold  again to exit this mode.
U1452A/U1452AT 	<p>DAR: Configures the tester for a dielectric absorption ratio test (when the rotary switch is in one of the Ω Mega positions).</p> <p>The test will start when you press .</p> <p>PI: Configures the tester for a polarization index test (when the rotary switch is in one of the Ω Mega positions).</p> <p>The test will start when you press .</p>	

Table 1-4 U1452A/U1452AT/U1451A keypad functions (continued)


























Legend	Function when pressed for:	
	Less than 1 second	More than 1 second
<div><div>Smooth</div><div>Limit</div></div>	<p>Limit: Press  to enable the comparison for limit mode.</p> <ul style="list-style-type: none">– Press  again to set the comparison value. Use the arrow keys to change the value shown and press  to save your changes.– Press and hold  to exit this mode.	<p>Smooth: Press and hold  to smoothen the refresh rate of the readings.</p> <p>Press and hold  again to exit this mode.</p>
<div><div>U1451A</div><div>Auto</div><div>Range</div></div>	<p>Range: Press  to set a manual range and disable auto-ranging.</p> <p>Press  again to cycle through each available measurement range.</p>	<p>Auto: Press and hold  to enable auto-ranging.</p>
<div><div>U1452A/U1452AT</div><div>Auto Leak</div><div>Range</div></div>	<p>Leak: Press  to display the leakage current.</p>	
<div><div>Δ Null</div></div>	<p>Null: Press  to enable the relative function.</p> <ul style="list-style-type: none">– The displayed value is saved as a reference to be subtracted from subsequent measurements.– Press  again to view the stored reference value that has been saved. The display will return to normal after a brief period of time (approx. 3 seconds).– Pressing  while the stored reference value is being displayed will cancel the relative function.	

Table 1-4 U1452A/U1452AT/U1451A keypad functions (continued)

Legend	Function when pressed for:	
	Less than 1 second	More than 1 second
<div>Setup</div> <div></div>	<div>: Press  to enable or disable the LCD backlight.</div>	<div>Setup: Press and hold  to enter the Setup menu.</div> <div><ul style="list-style-type: none">– In the Setup menu, press  or  to navigate through the menu pages. Press  or  at each menu page to move the cursor to a specific menu item.– Press  to change the value of the selected menu item. Use the arrow keys to change the value shown.– Press  again to save your changes, or press  to discard your changes.– Press and hold  again to exit the Setup menu.</div>

Display screen

The display annunciators of your tester are described in this section. See also “[Measurement units](#)” on page 40 for a list of available measurement signs and notations and “[Analog bar graph](#)” on page 41 for a tutorial on the analog bar graph located at the bottom of your display screen.

Display annunciators

The display annunciators of your tester are described in the [Table 1-5](#).

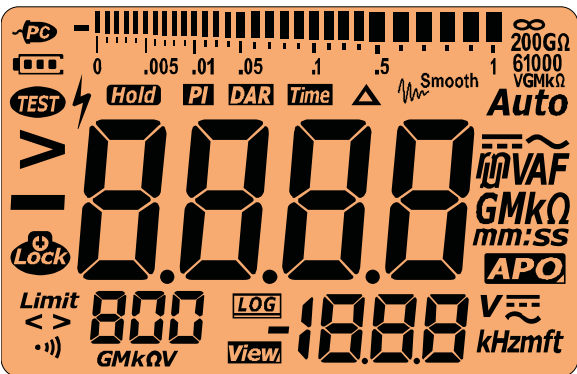


Figure 1-5 Display screen allocation example

Table 1-5 General annunciators






Legend	Description
	Remote control enabled
	Battery capacity indication
	Analog bar graph
	Test indication for insulation resistance and earth-bond resistance tests
	Hazardous voltage sign for measuring voltage ≥ 30 V or OL (overload)

Table 1-5 General annunciators (continued)










Legend	Description
Hold	Auto hold/Trigger hold enabled
PI	Polarization Index test enabled
DAR	Dielectric Absorption Ratio test enabled
Time	Timed test enabled
△	Relative (Null) enabled
 Smooth	Smooth mode enabled
Auto	Auto-ranging enabled or Auto signal indicator enabled
>	Greater than range (for insulation resistance and earth-bond resistance tests)
 Lock	Test and Test Lock indication for insulation resistance and earth-bond resistance tests
-8888.8	Primary display
	AC or DC indication
rD VAF GMkΩ	Measuring units for primary display
mm:ss	Test time indication for earth-bond resistance and insulation resistance tests
APO	APO (Auto Power-Off) enabled
Limit <>	Limit comparison enabled
LOG	Data logging in progress

Table 1-5 General annunciators (continued)

Legend	Description
	View mode for reviewing previously logged data
	Audible continuity test selected
	Secondary display
	Measuring units and AC+DC indication for secondary display
	Tertiary display
	Measuring units for tertiary display

Measurement units

The available signs and notations for each measurement function in your tester are described in [Table 1-6](#). The units listed below are applicable to the primary display and secondary display measurements of your tester.

Table 1-6 Measurement units display

Sign/Notation	Description
G	Giga 1E+09 (1000000000)
M	Mega 1E+06 (1000000)
k	kilo 1E+03 (1000)
n	nano 1E-09 (0.000000001)
μ	micro 1E-06 (0.000001)
m	milli 1E-03 (0.001)
mV, V	Voltage, units for voltage measurement
nF, μF, mF	Farad, units for capacitance measurement

Table 1-6 Measurement units display (continued)

Sign/Notation	Description
Ω , k Ω , M Ω , G Ω ,	Ohm, units for resistance measurement
kHz, Hz	Hertz, units for frequency measurement
m	Meter, unit for length
ft	Feet, unit for length

Analog bar graph

The analog bar emulates the needle on an analog tester, without displaying the overshoot.




NOTE

For frequency measurements, the bar graph does not represent the primary display value.

For example, when frequency is displayed on the primary display during voltage measurement, the bar graph represents the voltage value (not the frequency value).

The “-” sign indicates that the measured or calculated value is negative. Each segment is presented as a ratio to the range value indicated on the peak bar-graph. The unit and range will be indicated according to various measurements (see Table 1-7).

Table 1-7 Analog bar graph display



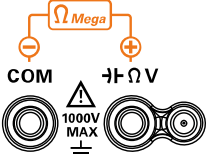







Function	Bar graph
V	
Ω , Ω_{EB} , Ω_{Mega}	
$\rightarrow I \leftarrow$	

Input terminals

WARNING To avoid damaging this device, do not exceed the input limit.

The terminal connections for the different measurement functions of your tester are described in the table below.

Table 1-8 Terminal connections for different measuring functions

Rotary switch position	Input terminals	Overload protection
		1000 Vrms
		1000 Vrms for short circuit <0.3 A
     		440 mA/1000 V, 30 kA fast-acting fuse

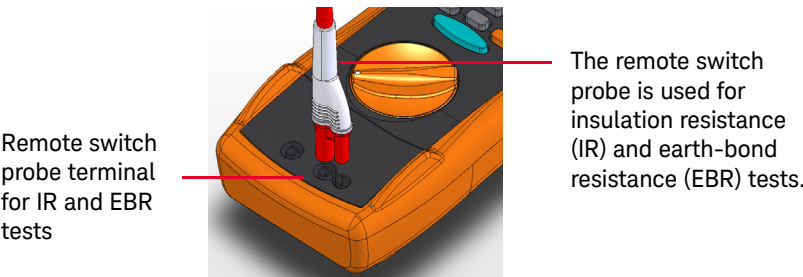


Figure 1-6 Connecting the remote switch probe

Cleaning Your Tester

WARNING

To avoid electrical shock or damage to the tester, ensure that the insides of the casing stay dry at all times.

Dirt or moisture in the terminals can distort readings. Follow the steps below to clean your tester.

- 1** Turn the tester off, and remove the test leads.
- 2** Turn the tester over, and shake out any dirt that may have accumulated in the terminals.

Wipe the case with a damp cloth and mild detergent – do not use abrasives or solvents. Wipe the contacts in each terminal with a clean swab dipped in alcohol.

Additional Features

Automatic power-off

Your tester automatically turns off if the rotary switch is not moved or a key is not pressed for 10 minutes (default). Pressing any key will turn the tester back on after it is powered off automatically.

To change the timer period or completely disable the automatic power-off, refer to “[Changing the auto power-off \(APO\) timer](#)” on page 91.

Hazardous voltage indication

The tester will display the hazardous voltage (⚡) symbol as an early precaution when the measured voltage is equal to or greater than \pm DC 30 V or AC 30 V, or when the measured voltage is over the measurement range, **OL** (overload).

Power-on options

Some options can be selected only while you turn the tester on. These power-on options are listed in the table below. To select a power-on option, press and hold the specified key while turning the rotary switch from the **OFF** position to any other position. Power-on options remain selected until the tester is turned off.

Table 1-9 Power-on options




Key	Description
	Simulates the Auto Power-Off (APO) mode. Press any key to turn the tester back on and resume normal operation.
	Checks firmware version. The tester’s firmware version will be shown on the primary display. Press any key to exit this mode.
	Toggles the red LED indicator alert for insulation resistance tests. If enabled, the red LED indicator will blink every two seconds during an insulation resistance test. The red LED indicator alert is disabled when the Limit feature (see page 75) is enabled.

Table 1-9 Power-on options (continued)

Key	Description
<div>U1451A</div> <div>Time</div>	Change the resolution count to high. To permanently enable change the resolution count. See “Changing the display count” on page 94.
<div>U1452A/U1452AT</div> <div>Log</div> <div>T DAR PI</div>	
<div>Test</div> <div>Trig Hold/Auto Hold</div>	Tests the LCD. All LCD annunciators are lighted. Press any key to exit this mode.

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2 Making Measurements







Insulation Resistance Test	48
Earth-Bond Resistance Test	56
Measuring AC or DC Voltage	59
Measuring Frequency	62
Measuring Resistance	64
Continuity Test	66
Measuring Capacitance	68

The following sections describe how to take measurements with your tester.

Insulation Resistance Test

Set up your tester as shown in [Figure 2-1](#). Set the rotary switch to a test voltage value that does not exceed the maximum voltage limitation of the circuit under test. Ensure that the device-under-test (DUT) is de-energized before performing any resistance measurement.

Table 2-1 Rotary switch position for insulation resistance tests

Legend	Default function		Function when  is pressed	
Rotary switch position	Primary display	Secondary display	Primary display	Secondary display
	50 V insulation resistance test			
	100 V insulation resistance test		1	Timed (T) test
	250 V insulation resistance test	AC+DC V	2	Dielectric Absorption Ratio (DAR) test
		or DC V (during test)	3	Polarization Index (PI) test
	1000 V insulation resistance test			

CAUTION

- **DO NOT** perform insulation resistance test in distribution systems with voltages higher than 600 V.
- The tester automatically detects if the circuit is energized. If the external voltage is detected to be greater than 30 V (or 50 V or 75 V; depending on selected option in Setup), the test is inhibited. The symbol ⚡ is shown on the display when either the external voltage or the test voltage is greater than 30 V. Disconnect the tester and remove the power of the circuit before proceeding.

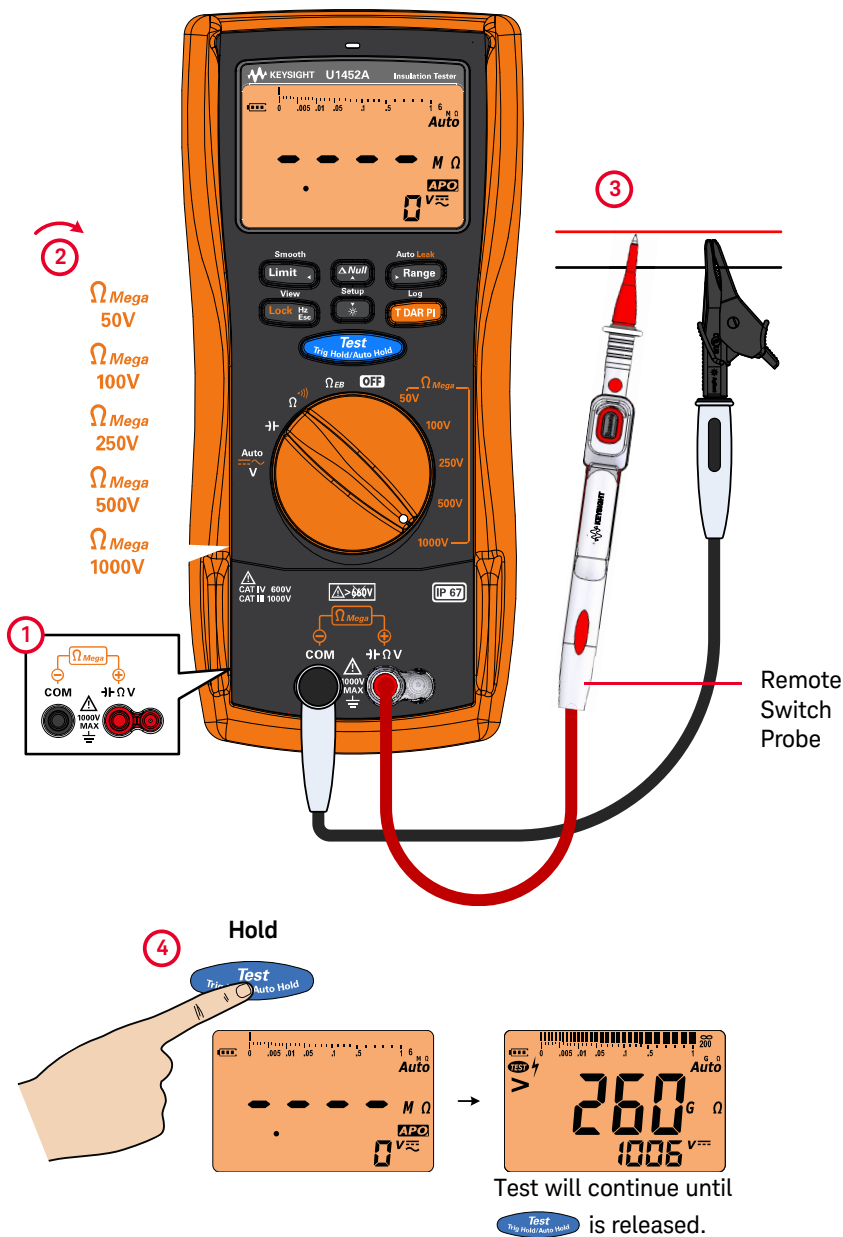


Figure 2-1 Insulation resistance test example

CAUTION


The insulation meter will auto-discharge the DUT when the test complete. However, the DUT will not be auto-discharged when you disconnect the probe before the test is complete. Avoid touching the DUT when the DUT is not fully discharged as it may lead to possible electric shock.

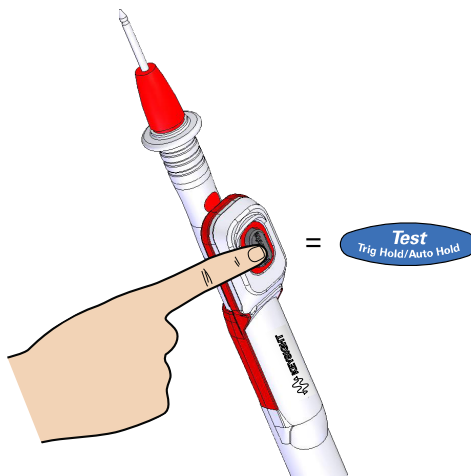
NOTE

When an insulation test is in progress, the red LED indicator at the top of the tester will blink every 2 seconds (if the Limit function is not enabled). To disable this feature see **“Power-on options”** on page 44.

Using the Remote Switch Probe

The Remote Switch Probe (included in shipment) is used with insulation resistance tests and earth-bond resistance tests, enabling the tester to be controlled remotely from the button on the Remote Switch Probe.

By default the button on the Remote Switch Probe emulates the  button on the tester.

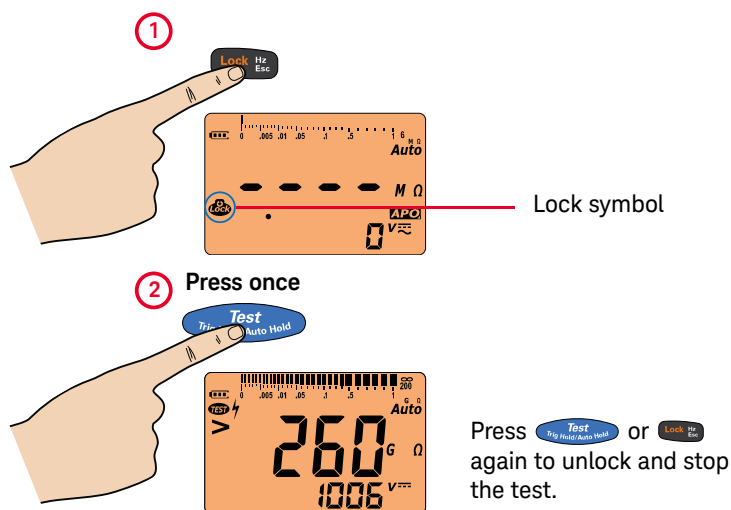


To change the default button operation, see **“Changing the button operation on the remote switch probe”** on page 100.

Locking the test

You can lock the insulation resistance tests or earth-bond resistance tests temporarily.

Press **Lock** Hz Esc to enable the *lock once* feature. The **Lock** symbol will be shown on the display. The test will start when you press **Test** Trig Hold/Auto Hold, and it remain active until **Test** Trig Hold/Auto Hold or **Lock** Hz Esc is pressed again.



By default, the tester will reset the locked status when the test is stopped by pressing **Test** Trig Hold/Auto Hold or **Lock** Hz Esc. See [“Changing the Dielectric Absorption Ratio \(DAR\) for IR tests”](#) on page 101 to disable this feature.

If you disable this feature, you will need to press **Lock** Hz Esc to unlock the tester, even if the test has already stopped.

Timed insulation resistance/earth-bond resistance test

Use the timed test to obtain measurement results with consistent test times – for later comparisons. Set up your tester as shown in [Figure 2-1](#), and follow the steps shown below.

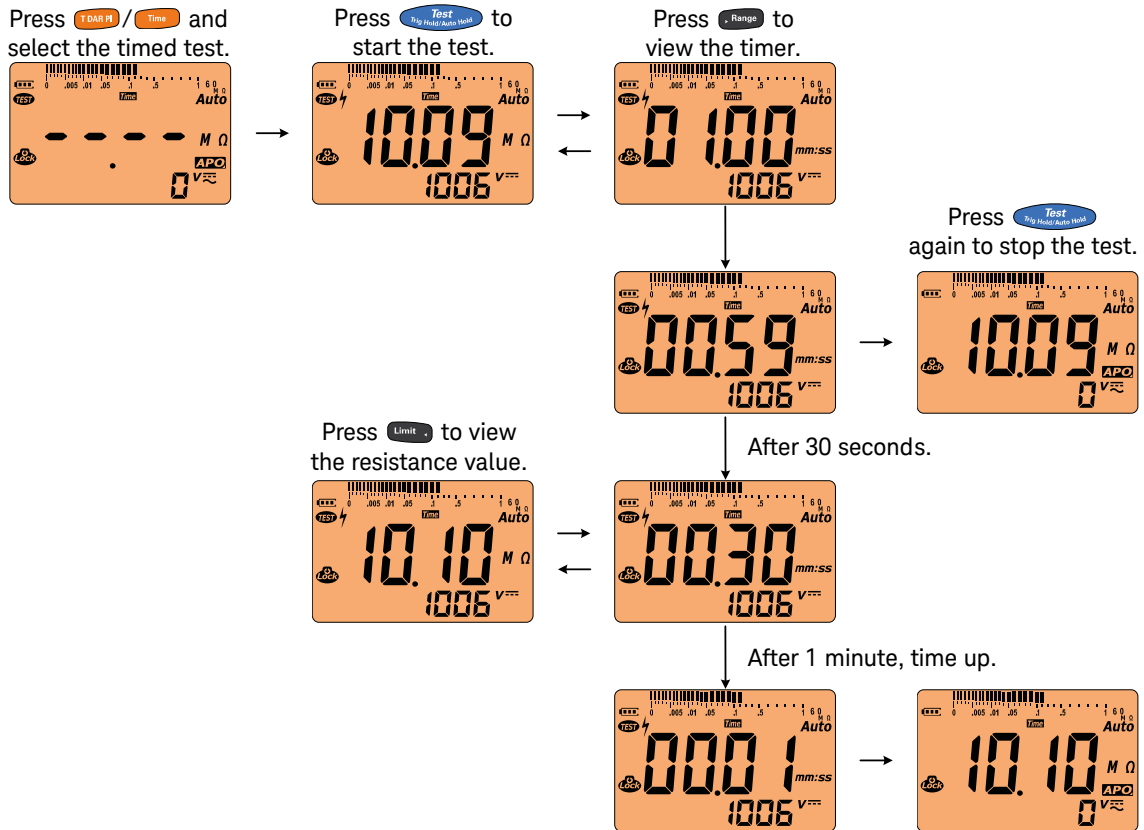


Figure 2-2 T/Time operation

Measuring the Dielectric Absorption Ratio (DAR)

Dielectric Absorption Ratio (DAR) is the ratio of the insulation resistance tested at 60 seconds to the insulation resistance tested at 30 seconds. Set up your tester as shown in **Figure 2-1**, and follow the steps shown below.

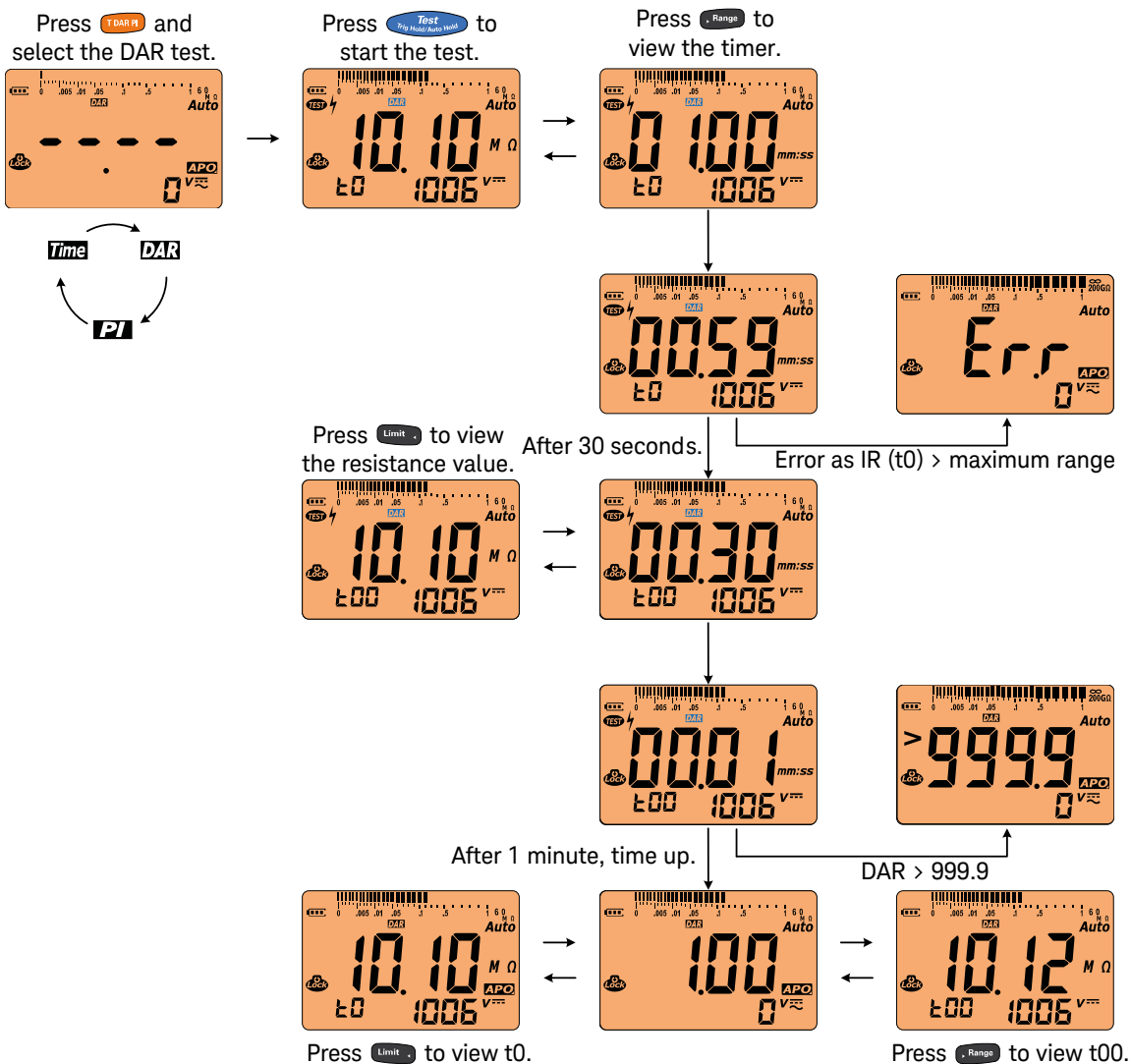


Figure 2-3 DAR operation

Measuring the Polarization Index (PI)

Polarization Index (PI) is the ratio of the insulation resistance tested at 10 minutes to the insulation resistance tested at 1 minute. Set up your tester as shown in **Figure 2-1**, and follow the steps shown below.

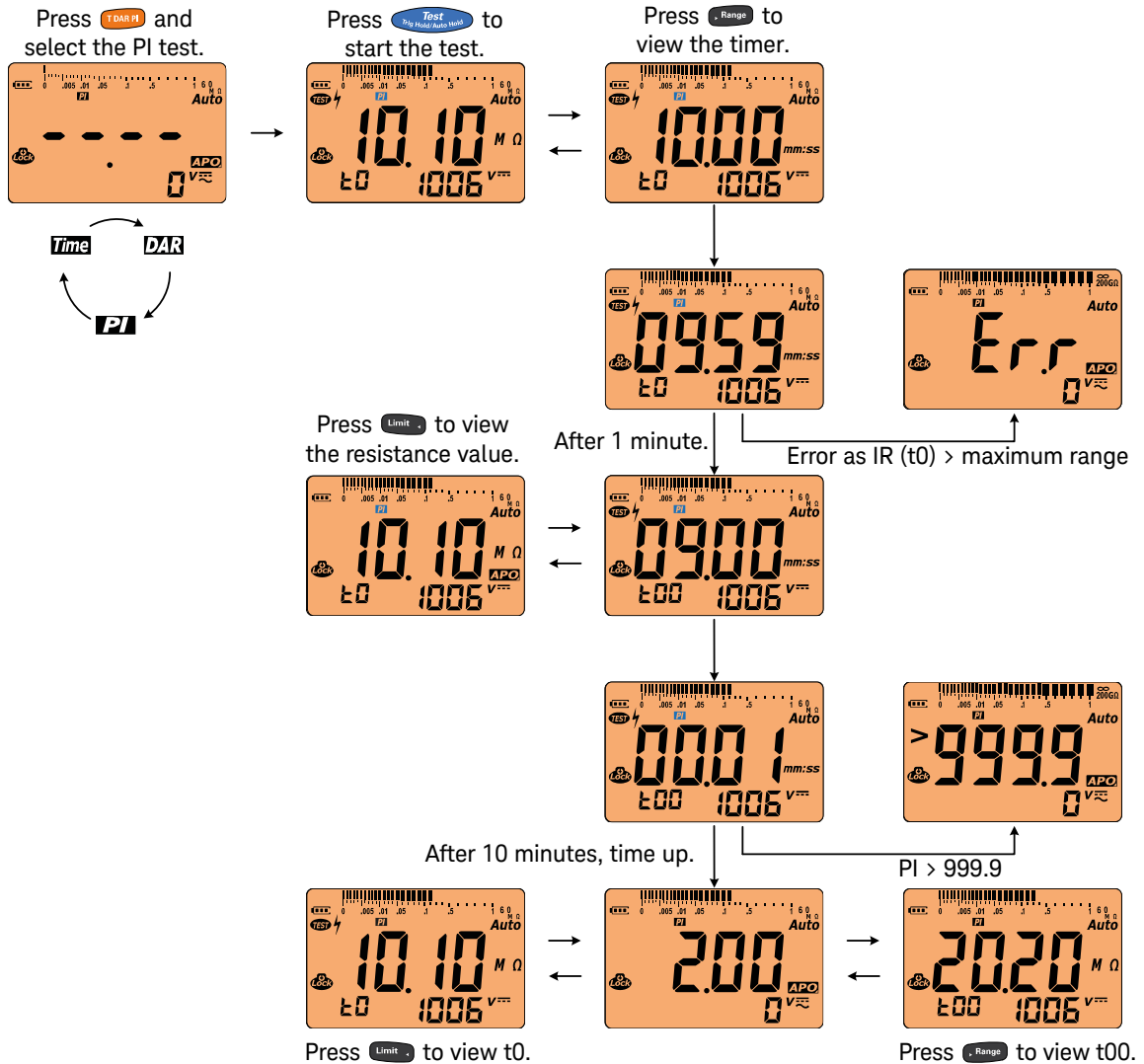


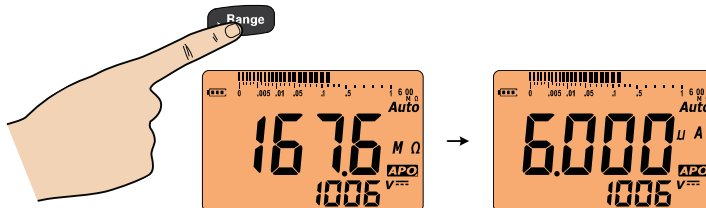
Figure 2-4 PI operation

NOTE

- Because of the time required to perform the T, PI, and DAR tests, the use of alligator test clips is recommended.
- For timed (page 52) tests, The length of the timer is 1 minute by default. To change this value, see “Changing the IR and EBR test period” on page 98 for more information.
- For DAR (page 53) tests, you can change the DAR from 60:30 to 60:15 in the Setup. See “Changing the Dielectric Absorption Ratio (DAR) for IR tests” on page 101 for more information.
- For DAR (page 53) and PI (page 54) tests, **Err** is shown on the display if the IR is greater than the maximum range or less than 0.001 M Ω ; if the test is interrupted by the user; or if the tester’s battery is low.

Viewing the leakage current


Press **Range** to view the leakage current display. The leakage current display is related to the insulation resistance. The higher the resistance tested, the lower the current is to be measured.



Earth-Bond Resistance Test

Set up your tester to perform earth-bond resistance tests as shown in [Figure 2-5](#).

Table 2-2 Earth-bond resistance test position

Legend	Default function		Function when  is pressed	
Rotary switch position	Primary display	Secondary display	Primary display	Secondary display
Ω_{EB}	Earth-bond resistance test	AC+DC V or DC V (during test)	Timed (T) test	AC+DC V or DC V (during test)

CAUTION

- To avoid possible damage to your tester or to the equipment under test, disconnect the circuit power and discharge all high-voltage capacitors before measuring resistance.
- The tester automatically detects if the circuit is energized. If the external voltage is detected to be greater than 2 V, the test will not start. Disconnect the tester and remove power before proceeding.

NOTE

- The earth-bond resistance function is used to measure the resistance between earth conductors, protective earth conductors, and conductors for equipotential bonding; including their connections and terminals; with an indication of the measured value or indication of limits.
- The voltage source is <6.8 V, and the current is >200 mA when the resistance of $\leq 2 \Omega$ is to be measured. When the source voltage is <4.7 V, the tester will inhibit the test automatically. The secondary display indicates the voltage (with auto-ranging enabled).
- The APO (auto power-off) function is disabled during the test.
- See also **“Timed insulation resistance/earth-bond resistance test”** on page 52.

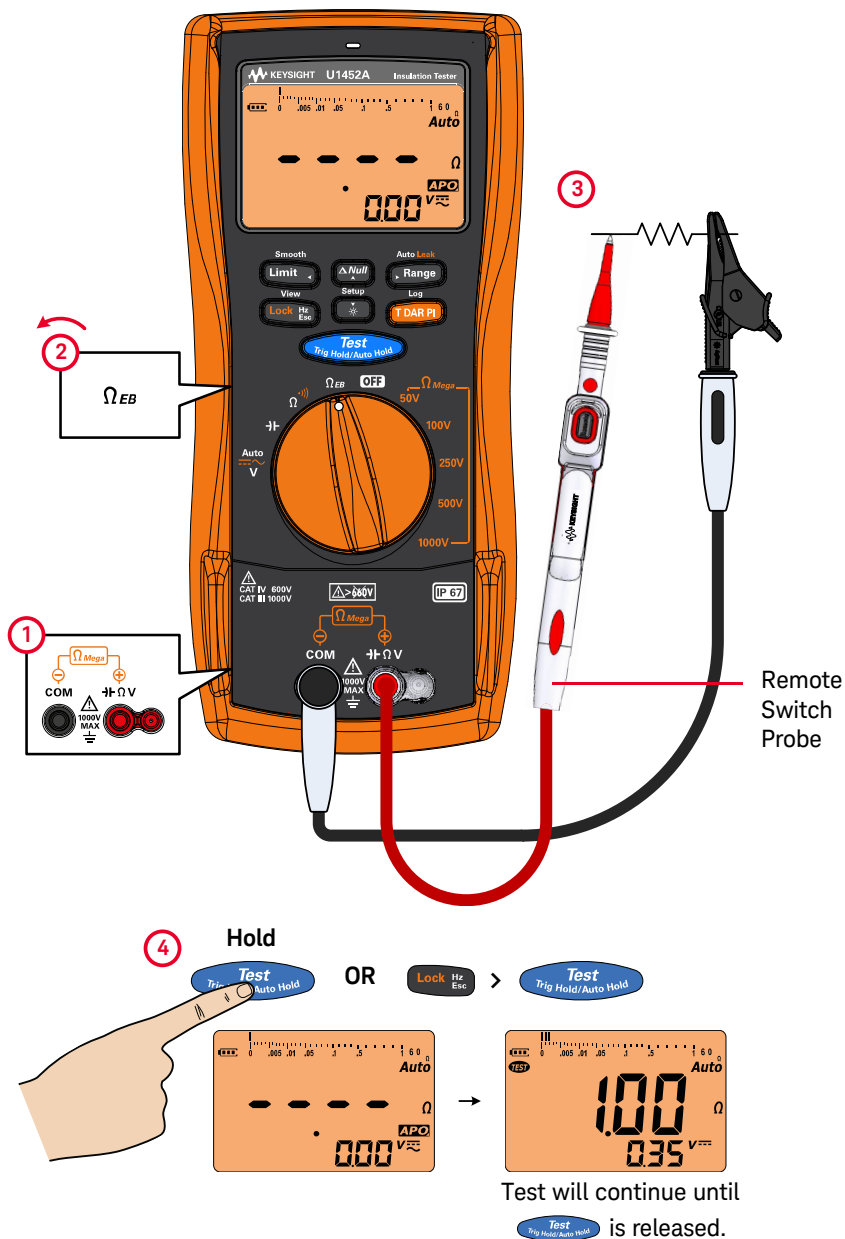

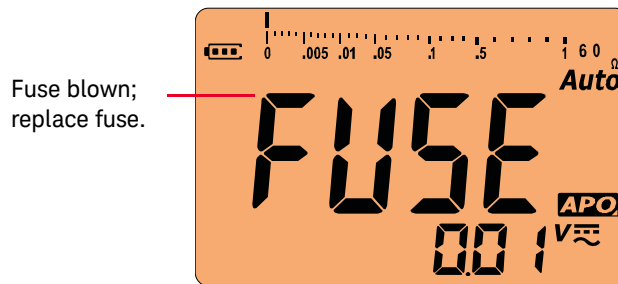


Figure 2-5 Earth-bond resistance test example

Using the earth-bond resistance test to verify the fuse condition



- 1 Keep the test leads open, and ensure that no voltage is applied to the terminals.
- 2 Press and hold  to verify the fuse condition.
- 3 If the fuse has been blown, **FUSE** will be shown on the display. Follow the instructions in the *U1452A/U1452AT/U1451A Service Guide* to replace the fuse.




Measuring AC or DC Voltage

Set up your tester to measure AC or DC voltage as shown in [Figure 2-6](#).

Table 2-3 AC and DC voltage measurement positions

Legend	Default function		Function when  is pressed	
Rotary switch position	Primary display	Secondary display	Primary display	Secondary display
	Auto (V)	AC+DC V	<i>Cycles between</i>	
			1 DC V	1 AC+DC V
			2 AC V	2 AC+DC V
			3 Auto (V)	3 AC+DC V

- NOTE
- This tester displays DC voltage values as well as their polarity. Negative DC voltages will return a negative sign on the left of the display.
 - Press  to measure the frequency of the voltage source. See [“Measuring Frequency”](#) on page 62 to learn more.

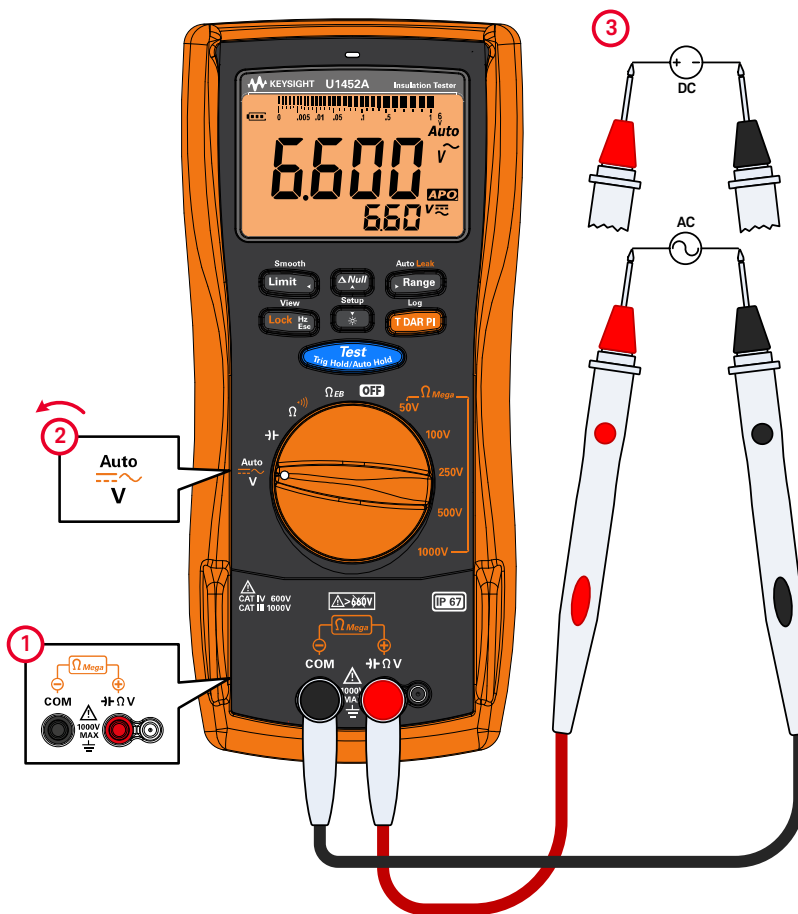
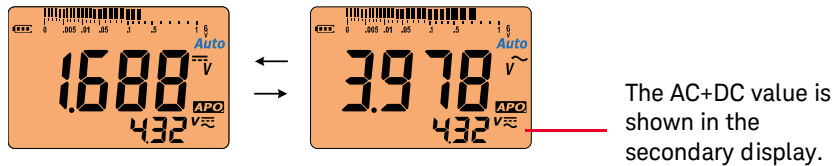


Figure 2-6 AC or DC voltage measurement example

Auto AC or DC signal identification

The **Auto** function is able to automatically identify the signal component (AC or DC) of an electrical source and select a suitable measurement range according to the AC+DC reading.

The symbol **Auto** blinks during the identification.



The **Auto** function identifies the signal component using the following rules:

- It will consider which component value is greater between the AC or DC.
- The AC value should be greater than a minimum value of 50 counts (based on 6000 counts) of range to prevent residual value due to range changing.
- The frequency measured is greater than 10 Hz for the AC mode.

While the signal is being identified, you can press **T D A R N** to lock the (AC or DC) signal on the primary display.

At any time, you can press **Range** to stop the **Auto** function and lock the identified signal component (AC or DC).

Measuring Frequency


Your tester allows simultaneous monitoring of real-time voltage with frequency measurements. To measure frequency, rotate the switch to measure voltage (see [Figure 2-6](#)) and set up the tester accordingly.

Press . Probe the test points, and read the display.

WARNING

Never measure the frequency where the voltage level exceeds the specified range. Manually set the voltage range if you want to measure frequencies below 20 Hz.

NOTE

- Pressing  controls the input range of the voltage function and not the frequency range.
- To obtain the best measuring results for frequency measurements, please use the AC measuring path.

Frequency measurement techniques

- Measuring the frequency of a signal helps detect the presence of harmonic currents in neutral conductors and determines whether these neutral currents are the result of unbalanced phases or non-linear loads.
- Frequency is the number of cycles a signal completes each second. Frequency is defined as $1/\text{Period}$. Period is defined as the time between the middle threshold crossings of two consecutive, like-polarity edges, as shown in [Figure 2-7](#).
- The tester measures the frequency of a voltage signal by counting the number of times the signal crosses a threshold level within a specified period of time.
- If a reading shows as 0 Hz or is unstable, the input signal may be below or near the trigger level. You can usually correct these problems by manually selecting a lower input range, which increases the sensitivity of the tester.

- If a reading seems to be a multiple of what you expect, the input signal may be distorted. Distortion can cause multiple triggerings of the frequency counter. Selecting a higher voltage range might solve this problem by decreasing the sensitivity of the tester. In general, the lowest frequency displayed is the correct one.
- The frequency of the input signal is shown in the primary display. The voltage value of the signal is shown in the secondary display. The bar graph does not indicate frequency but indicates the voltage value of the input signal.

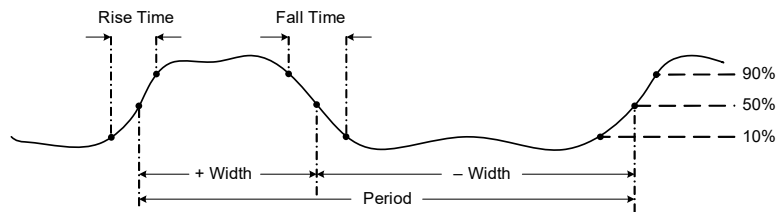




Figure 2-7 Definition of frequency

Measuring Resistance

Set up your tester to measure resistance as shown in [Figure 2-8](#).

Table 2-4 Resistance measurement position

Legend	Default function		Function when  is pressed	
Rotary switch position	Primary display	Secondary display	Primary display	Secondary display
	Resistance	-	Continuity	-


CAUTION

To avoid possible damage to your tester or to the equipment under test, disconnect the circuit power and discharge all high-voltage capacitors before measuring resistance.

NOTE

Resistance (opposition to the current flow) is measured by sending a small current out through the test leads to the circuit under test. Because this current flows through all possible paths between the leads, the resistance reading represents the total resistance of all paths between the leads. Resistance is measured in ohms (Ω).

Keep the following in mind when measuring resistance.

- The test leads can add 0.1 Ω to 0.2 Ω of error to resistance measurements. To test the leads, touch the probe tips together and read the resistance of the leads. To remove lead resistance from the measurement, hold the test lead tips together and press . Now the resistance at the probe tips will be subtracted from all future display readings.
- Because the tester's test current flows through all possible paths between the probe tips, the measured value of a resistor in a circuit is often different from the resistor's rated value.

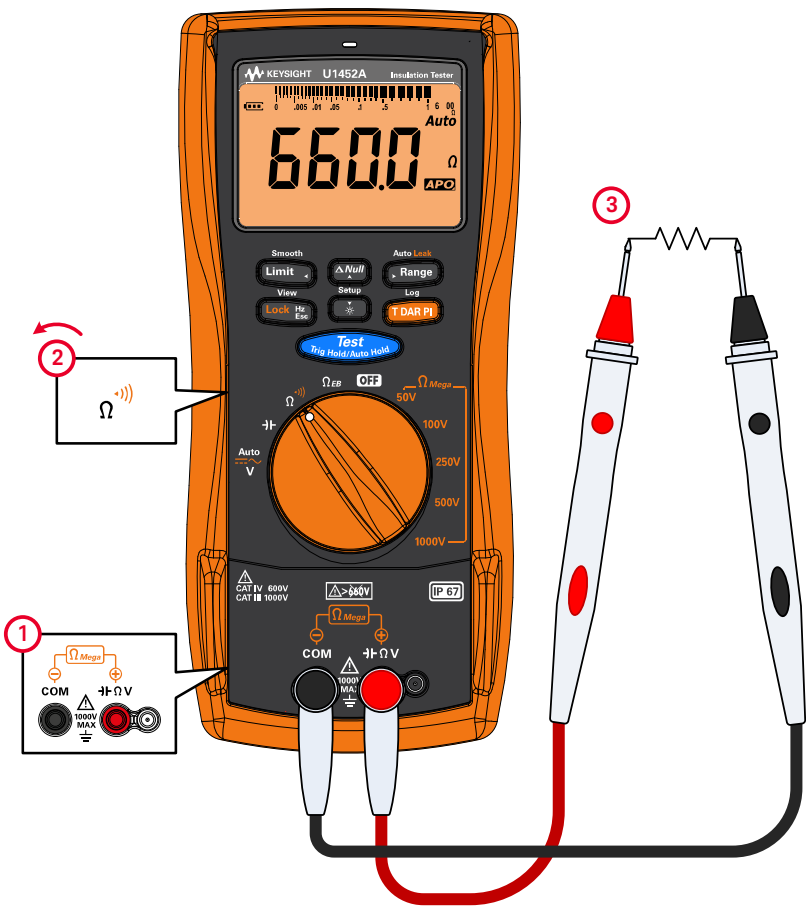




Figure 2-8 Resistance measurement example

Continuity Test

Set up your tester to perform continuity tests as shown in [Figure 2-9](#). The beeper will sound and the red will light LED up as a continuity indication.

Table 2-5 Continuity test position

Legend	Default function		Function when  is pressed	
Rotary switch position	Primary display	Secondary display	Primary display	Secondary display
	Resistance	-	Continuity	-

CAUTION

To avoid possible damage to your tester or to the equipment under test, disconnect the circuit power and discharge all high-voltage capacitors before testing for continuity.

NOTE

- Continuity is the presence of circuit continuities. The beeper sounds as the resistance falls down to the threshold, and the red LED indicator will be lit (if enabled in the Setup). The audible and visual alert allows you to perform quick continuity tests without having to watch the display.
- The continuity function detects intermittent shorts and opens. A brief short causes the tester to emit a short beep.
- You can enable or disable the audible alert via the Setup. See [“Changing the continuity alert”](#) on page 92 for more information on the audible alert option.

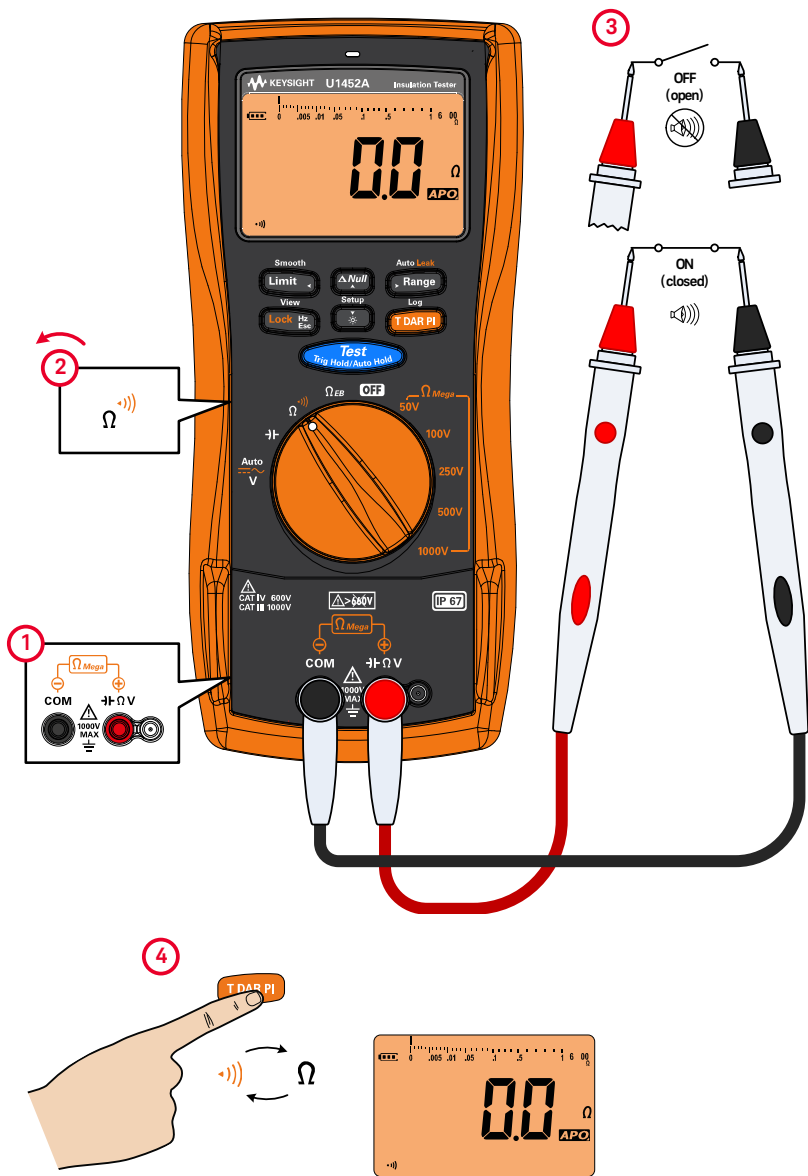




Figure 2-9 Continuity test example

Measuring Capacitance

Set up your tester to measure capacitance as shown in [Figure 2-10](#). The cable length of the circuit under test is shown in the secondary display.

- The default cable length scale is 1 km per 40 nF (km/C). To change this value, see [“Changing the cable length scale”](#) on page 96.
- You can also change the cable length unit (Meter or Feet). To change this value, see [“Changing the cable length unit”](#) on page 95.

Table 2-6 Capacitance measurement position

Legend	Default function		Function when  is pressed	
Rotary switch position	Primary display	Secondary display	Primary display	Secondary display
	Capacitance	Cable length	-	-

CAUTION

To avoid possible damage to the tester or to the equipment under test, disconnect circuit power and discharge all high-voltage capacitors before measuring capacitance. Use the DC voltage function to confirm that the capacitor is fully discharged.

NOTE

- The tester measures capacitance by using an AC sine wave.
- The resistance of the test leads will impact the accuracy of the measurement. It is recommended to use short leads to measure capacitance.
- The test frequency is 54.5 Hz.

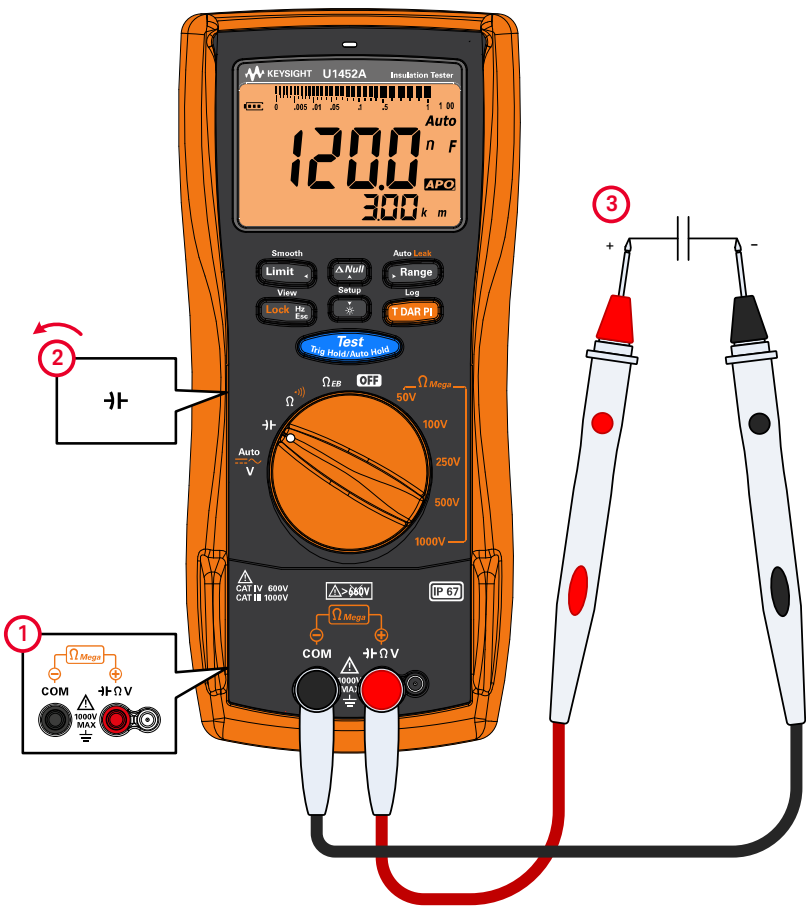


Figure 2-10 Capacitance measurement example

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3 Tester Features

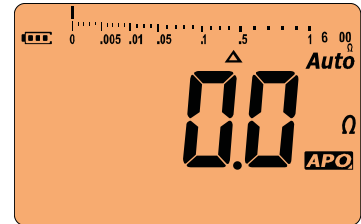
Making Relative Measurements (Null)	72
Freezing the Display (TrigHold and AutoHold)	73
Performing Limit Comparisons (Limit)	75
Recording Measurement Data (Log)	77
Reviewing Previously Recorded Data (View)	81

The following sections describe the additional features available in your tester.

Making Relative Measurements (Null)






When making null measurements, also called relative, each reading is the difference between a stored (selected or measured) null value and the input signal.


One possible application is to increase the accuracy of a resistance measurement by nulling the test lead resistance.





NOTE

Null can be set for both auto and manual range settings, but not in the case of an overload.

- 1 To activate Null, press . The measurement value at the time that when Null () is enabled, is stored as the reference value.
- 2 Press  again to view the stored reference value (the  annunciator blinks). The display will return to normal after 3 seconds.
- 3 To disable Null, press  while the stored reference value is shown (step 2).


For any measurement function, you can directly measure and store the null value by pressing  with the test leads open (nulls the test lead capacitance), shorted (nulls the test lead resistance), or across a desired null value circuit.


NOTE

- In resistance measurement, the tester will read a non-zero value even when the two test leads are in direct contact, because of the resistance of these leads. Press  to zero-adjust the display.
- For DC voltage measurements, the thermal effect will influence the accuracy of the measurements. Short the test leads and press  when the displayed value is stable to zero-adjust the display.

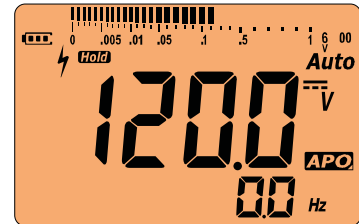
Freezing the Display (TrigHold and AutoHold)

TrigHold operation


Press  to freeze the display for any function, except for the Ω Mega or the Ω EB function.

Press  again to trigger a new reading. The **Hold** annunciator blinks while waiting for the reading to be stable.


Press and hold  to exit this mode.



NOTE

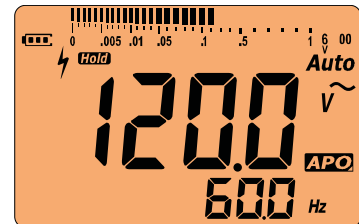
Pressing  when the rotary switch is in one of the Ω Mega or the Ω EB position will result in a test being performed instead.

AutoHold operation


Press and hold  to activate AutoHold for any function, except for the Ω Mega or the Ω EB function.

AutoHold monitors the input signal and updates the display and, if enabled, emits a beep, whenever a new stable measurement is detected. The **Hold** annunciator blinks while waiting for the reading to be stable.

Press and hold  to exit this mode.



NOTE

Pressing and holding  when the rotary switch is in one of the Ω Mega or the Ω EB position will result in a test being performed instead.

A trigger point is one that varies more than a selected adjustable (AutoHold threshold) variation count (default 500 counts). The following conditions are not included in the update.

Function	None updated counts
Voltage	50
Resistance	OL or Open
Capacitance	50

To change the default AutoHold threshold count see “[Changing the variation count](#)” on page 89 for more information.

NOTE	If the reading value is unable to reach a stable state, the reading value will not be updated.
-------------	--

Performing Limit Comparisons (Limit)

Limit is used to compare the test result with the chosen settling value. The default settling values are shown in the table below.

You can set pass condition to be > or < the value measured.

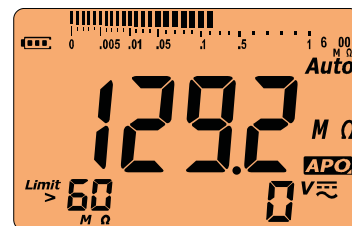




Table 3-1 Limit settling default values

Function	Default value	Range	Limit settling range
Voltage measurement ^[a]	>30 V	Auto or Manual	1 V < LS < 900 V
Resistance measurement	<10 Ω	Auto or Manual	1 Ω < LS < 90 M Ω
Capacitance measurement ^[b]	>10	Range locked	10 < LS < 900
Earth-bond resistance test	<10 Ω	Auto	1 Ω < LS < 90 k Ω
Insulation resistance test	>10 M Ω	Auto	1 k Ω < LS < 90 G Ω

[a] Absolute value comparison, regardless of polarity.

[b] Limit for capacitance is represented without a unit.

- 1 Press **Limit** to activate Limit.
- 2 Press **Limit** again to set the comparison value. Use the arrow keys to position the cursor and to change the value shown.
- 3 The most significant digit can be set to a value from 1 to 9. The remaining two digits can be set to 0, 00, or left blank along with any unit combination (see [Table 3-1](#)).
- 4 Position the cursor on the \triangleright annunciator to change the Limit pass condition (< or >).

- 5 Press  to save your changes (or press  to discard your changes).
- 6 If the new value is passed:
 - PAS is shown
 - A short beep tone is heard
 - The red LED blinks once
- 7 If the new value is failed:
 - FAi is shown
 - Three short beep tones are heard
 - The red LED blinks thrice

NOTE

When the Limit feature is enabled for insulation resistance tests, the red LED indicator lights up accordingly to the changes in the limit values instead of blinking every 2 seconds.

Recording Measurement Data (Log)

Log provides you with the convenience of recording test data for future review or analysis. Since data is stored in the nonvolatile memory, the data remains saved even when the tester is turned OFF or if the battery is replaced.

Log collects measurement information over a user-specified duration. There are three Log options that can be used to capture measurement data: manual (**HAND**), interval (**AUTO**), or event (**TRIG**).


- A manual log stores an instance of the measured signal each time you press and hold  (see [page 78](#)).
- An interval log stores a record of the measured signal at a user-specified interval (see [page 78](#)).
- An event log stores a record of the measured signal each time a trigger condition is satisfied (see [page 79](#)).

Table 3-2 Log maximum capacity

Log option	Maximum capacity for saving
Manual (HAND)	H00 to H99 (100 entries)
Interval (AUTO)	A00 to A99 (100 entries)
Event (TRIG)	E00 to E99 (100 entries)

NOTE

Each recorded index includes two parameters: the primary display and the secondary display. Examples include IR-V or V-Hz.

Before starting a recording session, set up the tester for the measurements to be recorded.

To change the Log option see [“Changing the recording option”](#) on page 98 for more information.

See [“Reviewing Previously Recorded Data \(View\)”](#) on page 81 to review or erase the recorded entries.


Performing manual logs (HAND)

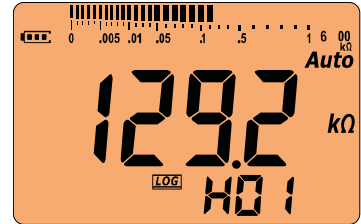
Ensure that **HAnd** is selected as the Log option in the Setup.

- 1 Press and hold  to store the present input signal value.

LOG and the log entry number are displayed. The display will return to normal after a short while (around 1 second).

- 2 Repeat **step 1** again to save the next input signal value.

The maximum number of readings that can be stored for the manual log is 100 entries. When all entries are occupied, **HFU** will be shown when you press and hold .

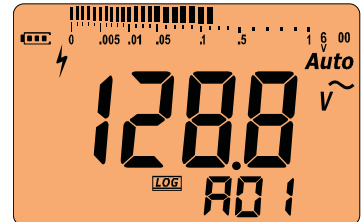


Performing interval logs (AUTO)

Ensure that **Auto** is selected as the Log option in the Setup.

The default recording interval duration is 1 second. To change the recording interval duration, see “**Changing the sample interval duration**” on page 97 for more information.


The duration set in the Setup will determine how long each recording interval takes. The input signal value at the end of each interval will be recorded and saved into the tester's memory.




Start the interval log mode


- 1 Press and hold  to start interval log mode.

LOG and the log entry number are displayed. Subsequent readings are automatically recorded into the tester's memory at the interval specified in the Setup.

- 2 Press and hold  again to exit the interval log mode.

The maximum number of readings that can be stored for the interval log is 100 entries. When all entries are occupied, AFU will be shown when you press and hold .

NOTE

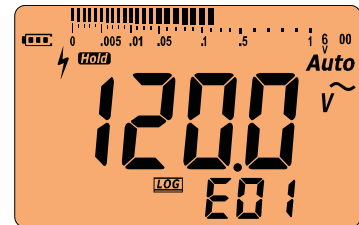
When the interval log recording session is running, all other keypad operations are disabled; the exception is , which, when pressed for more than 1 second, will stop and exit the recording session. Furthermore, APO (auto power-off) is disabled during the recording session.

Performing event logs (TRIG)

Ensure that triG is selected as the Log option in the Setup.

Event logs are used only with the following modes:

- TrigHold and AutoHold (page 73)
- Earth-bond resistance tests (page 56)
- Insulation resistance tests (page 56)
- T/DAR/PI tests (page 48)



Event records are triggered by the measured signal satisfying a trigger condition set by the measurement function used in the following modes:

Table 3-3 Event log trigger conditions



Modes	Trigger condition	Primary display recorded	Secondary display recorded
	<i>The input signal value is recorded:</i>		
TrigHold	Each time you press  and the reading update is stable.	Voltage, resistance, or capacitance	Voltage, frequency, capacitance cable length, or output source voltage
AutoHold	When the input signal varies more than the variation count and the reading update is stable.	Voltage, resistance, or capacitance	Voltage, frequency, capacitance cable length, or output source voltage

Table 3-3 Event log trigger conditions (continued)

Modes	Trigger condition	Primary display recorded	Secondary display recorded
	<i>The input signal value is recorded:</i>		
Earth-bond resistance test	Each time you press  to stop the test output source.	Resistance or leak current value	Test output source voltage
Insulation resistance test			
T/Time	When the time is up (Timer = 00:00), the final value is recorded before the test output source is stopped.	Resistance or leak current value	Test output source voltage

NOTE


The values of DAR t30 (or DAR t15), DAR t60, PI t1, and PI t10 will be recorded in every IR rotary switch location. For more information on DAR and PI tests, see [page 53](#) and [page 54](#) respectively.


Start the event log mode

1 Select one of the modes listed in [Table 3-3](#).

2 Press and hold  to start event log mode.

LOG and the log entry number are displayed. The primary display and secondary display readings will be recorded into the memory. Subsequent readings are automatically recorded into the tester's memory every time the trigger condition specified in [Table 3-3](#) is satisfied.

3 Press and hold  again to exit the event log mode.



The maximum number of readings that can be stored for the event log is 100 entries. When all entries are occupied, **EFU** will be shown when you press and hold .

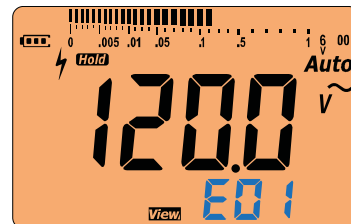
NOTE

APO (auto power-off) is disabled during the recording session.








Reviewing Previously Recorded Data (View)

Viewing data stored in the tester's memory is performed through the  key.

- 1 Press and hold  to View the previously recorded data. Press  again to cycle through the manual (H), interval (A), or event (E) records.




If nothing has been recorded, H--, A--, or E-- will be displayed instead.

- 2 Select the desired recording category to view its entries.
 - a Press  to jump to the first stored entry. Press  to jump to the last stored entry.
 - b Press  to view the next stored entry. The index number increases by one. Press  to view the previous stored entry. The index number decreases by one.
 - c Press  to clear the last stored entry for the selected log type. Press and hold  to clear all entries for the selected log type.
- 3 Press and hold  again to exit the View mode.

Sanitizing the Log Memories

You have the option to sanitize the log memories of your tester. This operation erases the log memories of your tester thoroughly. The data stored in the tester's memory will not be able to be reconstructed in any way after the data sanitization operation.

Prior to sanitizing the log memories, ensure that all manual (H), interval (A), or event (E) records have been cleared (see [step c](#)). When all entries are cleared (H--, A--, and E--), press and hold  to sanitize the log memories.



CAUTION

The data sanitization operation may take up to 30 seconds to complete. Do not press any keys or turn the rotary switch until the data sanitization operation is completed.

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4 Setup Options

Using the Setup Menu	84
Setup Menu Summary	86
Setup Menu Items	89

The following sections describe how to change the preset features of your tester.













Using the Setup Menu

The Setup menu allows you to change a number of nonvolatile preset features. Modifying these settings affects the general operation of your tester across several functions. Select a setting to edit in order to perform one of the following actions:

- Switch between two values, such as on or off.
- Cycle through multiple values from a predefined list.
- Decrease or increase a numerical value within a fixed range.

The contents of the Setup menu are summarized in [Table 4-2 on page 86](#).

Table 4-1 Setup menu key functions

Legend	Description
<div>Setup</div> <div></div>	<ul style="list-style-type: none">– Press  for more than 1 second to access the Setup menu.– Press and hold  until the tester restarts to exit the Setup menu.
<div>Limit</div> <div></div> <div>Range</div> <div></div>	<ul style="list-style-type: none">– Press  or  to browse each menu page.
<div>Null</div> <div></div> <div></div>	<ul style="list-style-type: none">– Press  or  at each menu page to move the cursor to a specific menu item.
<div>U1451A</div> <div>Time</div> <div></div>	<ul style="list-style-type: none">– Press  to edit the selected menu item. The menu item's value will flash to indicate that you can now change the value shown.
<div>U1452A/U1452AT</div> <div>Log</div> <div>T DAR PI</div> <div></div>	<ul style="list-style-type: none">– Press  or  again to switch between two values, to cycle through multiple values from a list, or to decrease or increase a numerical value.– Press  to save your changes.
<div>Lock</div> <div></div>	<ul style="list-style-type: none">– While the menu item's value is flashing, press  to discard your changes.

NOTE

The tester will automatically exit the Setup menu after 30 seconds of inactivity.

Editing numerical values

When editing numerical values, use the **Limit** and **Range** to position the cursor on a numerical digit.

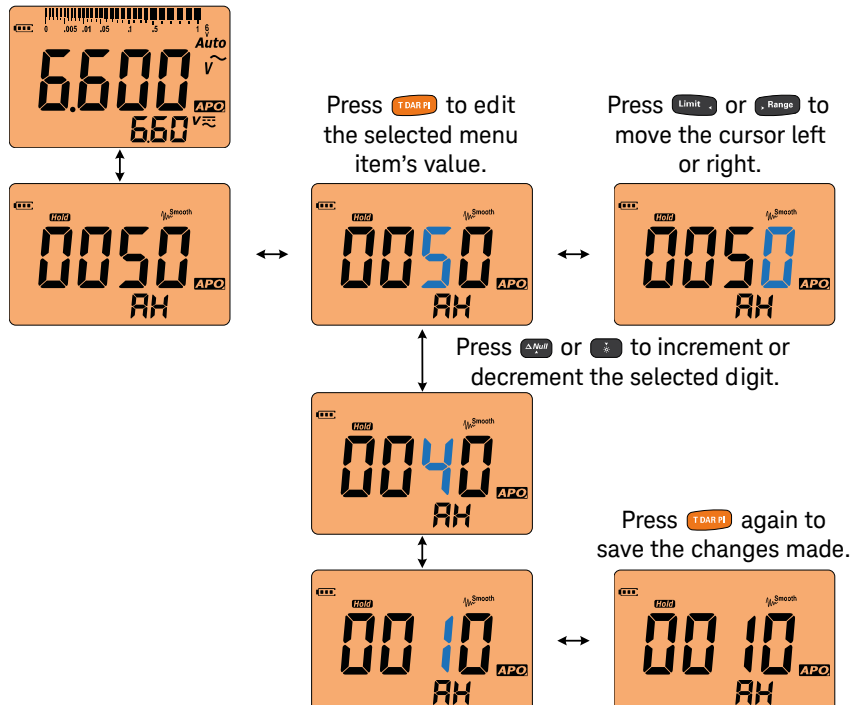
- Press **Limit** to move the cursor to the left, and
- Press **Range** to move the cursor to the right.

When the cursor is positioned over a digit, use the **Δ Null** and **↓** keys to change the numerical digit.

- Press **Δ Null** to increment the digit, and
- Press **↓** to decrement the digit.

When you have completed your changes, save the new numerical value by pressing **T DAR Pl**. (Or alternatively, if you wish to discard the changes you made, press **Lock Hr**.)

Press and hold **↓** for more than 1 second to enter the Setup menu.



Setup Menu Summary

The Setup menu items are summarized in the table below. Click the respective “Learn more” pages for more information on each menu item.

Table 4-2 Setup menu item descriptions





Legend	Available settings	Description	Learn more on:
 Hold AH	0001 to 9999 counts	Set the AutoHold and Smooth threshold count from 1 to 9999 counts. Default is 0050 counts.	page 89
 SMO	0001 to 9999 (d or E)	Set the settling value from 0001 to 9999. You can also disable this feature (d). Default is disabled (0009 _d).	page 89
bEE	3200 Hz to 4267 Hz, or oFF	Set the beep frequency from 3200 Hz to 4267 Hz. You can also disable this feature (oFF). Default is 3840 Hz.	page 90
APo	01 to 99 minutes (d or E)	Set the auto power-off timer period from 1 to 99 minutes (1 hour, 39 minutes). You can also disable this feature (d). Default is 15 minutes (15 _E).	page 91
bLt	01 to 99 seconds (d or E)	Set the backlight timer period from 1 to 99 seconds (1 minute, 39 seconds). You can also disable this feature (d). Default is 15 seconds (15 _E).	page 91
 tyP	SHor or tonE	Set the tester to sound a single beep (SHor) or a tone (tone) during continuity alerts for short circuits. Default is a single beep for short circuits (SHor).	page 92
Snd	MELo, USEr, bEEE, or oFF	Set the power-on melody to the factory default (MELo), a beep (bEEE), or disable this feature (oFF). Default is a beep (bEEE).	page 93
bAt	PRi or SEC	Change the battery selection from primary (PRi) to secondary (SEC). Default is primary (PRi).	page 93
rSt	yES or no	Reset the tester to its factory default settings.	page 94

Table 4-2 Setup menu item descriptions (continued)

Legend	Available settings	Description	Learn more on:
Cnt	Hi or Lo	Set the display count to High (Hi) or Low (Lo). Default is Low (Lo).	page 94
CAb _{mft}	Mete (m) or Foot (ft)	Set the cable length unit to Meter (Mete) or Foot (Foot) for capacitance measurements. Default is Mete (m).	page 95
CAb	01 to 99 nF/km	Set the capacitance measurement versus cable length scale from 1 to 99 nF/km. Default is 40 nF/km.	page 96
Limit  ALE	bE.rL, --.rL, bE.--, or --.--	Set the tester to beep momentarily and light up the red LED indicator for limit and continuity alerts. You can also disable either or both alerts (off). Default is to beep momentarily and light up the red LED indicator (bE.rL).	page 96
 tiM	0001 to 9999 seconds	Set the logging duration for interval logs from 1 to 9999 seconds (2 hours, 46 minutes, 39 seconds). Default is 1 second.	page 97
 tyP	HAnd, AUto, or triG	Set the data logging option (HAnd : manual log, AUto : interval log, or triG : event log). Default is manual log (HAnd).	page 98
tiM	00.05 to 59.59 _{mm:ss}	Set the insulation resistance or earth-bond resistance test period. Default is 10 seconds (00.10_{mm:ss})	page 98
inH	30 V, 50 V, or 75 V	Set the maximum inhibit voltage for insulation resistance test. Default is 30 V.	page 99
onE	yES or no	Enable or disable the lock once feature. Default is enabled (yES).	page 100

Table 4-2 Setup menu item descriptions (continued)

Legend	Available settings	Description	Learn more on:
rEM	bt-1 to bt-7 (d or E)	Change or disable the button operation on the remote probe. Default is  (bt-7 _E).	page 100
DAR tiM	60.30 or 60.15 seconds	Set the Dielectric Absorption Ratio in seconds (60:30 or 60:15). Default is 60:30 (seconds).	page 101







Setup Menu Items

Changing the variation count

This setting is used with the AutoHold feature (see [page 73](#)). When the variation of the measured value exceeds the value of the variation count, the AutoHold feature will be ready to trigger.

Legend	Range	Default setting
AH	(0001 to 9999) counts	0050

To change the variation count:

- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to AH ( Smooth and **Hold** are shown on the display), and press  to edit the value.
- 3 Use the arrow keys to change the variation count.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.







Enabling smooth mode

Smooth is used to smoothen the refresh rate of the readings in order to reduce the impact of unexpected noise and to help you achieve a stable reading.

The smooth refresh rate can be set from 0001 to 9999. The smooth time is defined as the set value + 1. Smooth will be restarted when the variation count is exceeded, when the range is changed, or after a tester function or feature is enabled. The variation count is set to the value used for the AutoHold feature (see [“Changing the variation count”](#) on page 89).

Legend	Range	Default setting
SMo	- 0001 to 9999 - d(isabled) or E(nabled)	0009 _d

To change the smooth refresh rate:






- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to SMo ( is shown on the display), and press  to edit the value.
- 3 Use the arrow keys to change the smooth refresh rate. Select E to enable the Smooth feature.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Changing the beep frequency

The beeper alerts users to the presence of circuit continuities and newly sensed values for Max Min recordings.

Legend	Range	Default setting
bEE	(4267, 4151, 4042, 3938, 3840, 3746, 3675, 3572, 3491, 3413, 3339, 3268, 3200) Hz, or oFF	3840

To change the beep frequency:






- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to bEE, and press  to edit the value.
- 3 Use the arrow keys to change the beep frequency. Select oFF to disable the beeper.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Changing the auto power-off (APO) timer

The APO (see [page 24](#)) feature uses a timer to determine when to automatically turn the tester off.

Legend	Range	Default setting
APO	– (01 to 99) minutes – E(nabled) or d(isabled)	15 _E

To change the APO timer period:






- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to APO, and press  to edit the value.
- 3 Use the arrow keys to change the APO timer period. Select d to disable the APO feature.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Changing the LCD backlight timeout

The tester's LCD backlight uses a timer to determine when to turn off the LCD backlight.

Legend	Range	Default setting
bLT	– (01 to 99) seconds – E(nabled) or d(isabled)	15 _E

To change the LCD backlight timer period:







- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to **bLT**, and press  to edit the value.
- 3 Use the arrow keys to change the backlight timer period. Select **d** to disable the backlight timer.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Changing the continuity alert

This setting is used with continuity tests (see [page 66](#)). The tester will beep to alert users to the presence of circuit continuities for short circuits. If tone is selected, the tester will sound different tones according to the bar graph display.

Legend	Range	Default setting
tyP	SHor(t) or tonE	SHor

To change the continuity alert:



- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to **tyP** ( is shown on the display), and press  to edit the value.
- 3 Use the arrow keys to change the continuity alert.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Disabling the power-on melody

The tester plays a melody or a beep when it is powered on.




Legend	Range	Default setting
Snd	MELo(dy), USEr, bEEE, or oFF	bEEE

To disable the power-on melody:

- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to **Snd**, and press  to edit the value.
- 3 Use the arrow keys to change the power-on melody. Select **oFF** to disable the power-on melody.

NOTE

The **USEr** option is for Keysight internal use.






- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Changing the battery type

If you are using rechargeable batteries to power your tester, change the battery type from **PRi** to **SEC** for the tester to accurately reflect the battery capacity indication.

Legend	Range	Default setting
bAt	PRi(mary) or SEC(ondary)	PRi





To change the battery type:

- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to **bAt**, and press  to edit the value.
- 3 Use the arrow keys to change the battery type.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Resetting the tester's Setup options

The tester's Setup options can be reset to its default values through the Setup menu.

Legend	Range	Default setting
rSt	yES or no	no

- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to **rSt**, and press  to edit the value.
- 3 Use the arrow keys to select yES.
- 4 Press and hold  for more than 1 second to perform the reset. The tester will beep once and return to the first Setup menu page. Or, alternatively press  to discard your changes.

Changing the display count






Use these settings to change the display count for the following measurements/ tests. The low resolution count is a tenth of the original display count. As an example, if the original display count is 6000 counts, then the low resolution display count is 600 counts.

Legend	Range	Default setting
Cnt	Hi(gh) or Lo(w)	Lo

NOTE

- Voltage and capacitance measurements are fixed at 6000 counts.
- DAR and PI tests are fixed at 9999 counts.

To change the display count:



- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to Cnt, and press  to edit the value.
- 3 Use the arrow keys to change the display count.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Changing the cable length unit

This setting is used with capacitance measurements (see [page 68](#)). Change the unit (Meter or Feet) of the cable length display.

Legend	Range	Default setting
CAb _{mft}	Mete(r) or Foot	Mete

To change the cable length unit:

- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to CAb_{mft}, and press  to edit the value.
- 3 Use the arrow keys to change the cable length unit.

- 4 Press **T DAR PI** to save your changes (or press **Lock Hz Err** to discard your changes).
- 5 Press and hold **Y** until the tester restarts to return to normal operation.

Changing the cable length scale

This setting is used with capacitance measurements (see [page 68](#)). Change the scale from 1 nF to 99 nF per kilometer for capacitance transfers to cable length.

Legend	Range	Default setting
CAb	(01 to 99) nF	40

To change the cable length scale:






- 1 Press **Y** for more than 1 second to enter the Setup menu.
- 2 Browse to CAb, and press **T DAR PI** to edit the value.
- 3 Use the arrow keys to change the cable length scale.
- 4 Press **T DAR PI** to save your changes (or press **Lock Hz Err** to discard your changes).
- 5 Press and hold **Y** until the tester restarts to return to normal operation.

Changing the alert indicators

The tester's audible and visual alerts users to the presence of circuit continuities (see [page 66](#)) and values exceeding the Limit values set (see [page 66](#)).

Legend	Range	Default setting
ALE	bE.rL, --.rL, bE.--, or --.--	bE.rL

To change the alert indicators:






- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to ALE (**Limit** and **•||** is shown on the display), and press  to edit the value.
- 3 Use the arrow keys to change the alert indicators. Select -- to disable either the beeper, the red LED, or both the alert indicators.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Changing the sample interval duration

This setting is used with the Interval Data Logging feature (see [page 78](#)). The tester will record a measurement value at the beginning of every sample interval.

Legend	Range	Default setting
tiM	(0001 to 9999) seconds	0001

To change the sample interval duration:

- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to tiM (**LOG** is shown on the display), and press  to edit the value.
- 3 Use the arrow keys to change the sample interval duration.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.






Changing the recording option

This setting is used with the Data Logging feature (see [page 77](#)). There are three available recording options for the Data Logging feature.

- **HAnd**: Manual log
- **AUto**: Interval log
- **triG**: Event log

Legend	Range	Default setting
tyP	HAnd, auTO, or triG	HAnd

To change the recording option:






- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to tyP (**LOG** is shown on the display), and press  to edit the value.
- 3 Use the arrow keys to change the recording option.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Changing the IR and EBR test period

This setting is used with insulation resistance tests (see [page 56](#)) or earth-bond resistance measurements (see [page 56](#)). The tester performs the test over the timed period defined in this setting.

Legend	Range	Default setting
tiM	(00.05 to 59.59) mm:ss	00.10

To change the insulation resistance and earth-bond resistance test period:






- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to **tiM**, and press  to edit the value.
- 3 Use the arrow keys to change the test period.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Changing the maximum inhibit voltage for IR tests


This setting is used with insulation resistance tests (see [page 56](#)). The tester will not perform the insulation resistance test if it detects that the external voltage exceeds the inhibit voltage value set here.


Legend	Range	Default setting
inH	(30, 50, or 75) V	30

To change the maximum inhibit voltage:

- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to **inH**, and press  to edit the value.
- 3 Use the arrow keys to change the value of the inhibit voltage.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.






Disabling the lock once feature

This setting is used with insulation resistance tests (see [page 56](#)) and earth-bond resistance measurements (see [page 56](#)). By default, the tester will reset the locked status when the test is stopped by pressing .

If you disable this feature, you will need to press  to unlock the tester, even if the test has already stopped.

Legend	Range	Default setting
onE	yES or no	yES

To disable the lock once feature:






- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to onE, and press  to edit the value.
- 3 Use the arrow keys to select yES.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Changing the button operation on the remote switch probe

This setting is used with the remote switch probe. The button operation on the remote switch probe will emulate the function selected in this setting.

Legend	Range	Default setting
rEM	- bt-1 - 	bt-7 _E
	- bt-2 - 	
	- bt-3 - 	
	- bt-4 - 	
	- bt-5 - 	
	- bt-6 - 	
	- bt-7 - 	
	- d(isable) or E(nable)	

To change the button operation on the remote switch probe:






- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to rEM, and press  to edit the value.
- 3 Use the arrow keys to change the function of the remote switch probe button. Select d to disable the remote switch probe button.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

Changing the Dielectric Absorption Ratio (DAR) for IR tests

This setting is used with insulation resistance tests (see [page 56](#)). The tester perform the DAR test using the ratio set here.

Legend	Range	Default setting
tiM	(60.30 or 60.15) seconds	60.30

To change the DAR ratio:

- 1 Press  for more than 1 second to enter the Setup menu.
- 2 Browse to **tiM** (**DAR** is shown on the display), and press  to edit the value.
- 3 Use the arrow keys to change the value of the DAR ratio.
- 4 Press  to save your changes (or press  to discard your changes).
- 5 Press and hold  until the tester restarts to return to normal operation.

5

Characteristics and Specifications

For the characteristics and specifications of the U1452A/U1452AT/U1451A Insulation Tester, refer to the datasheet at <http://literature.cdn.keysight.com/litweb/pdf/5991-4290EN.pdf>.

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