Keysight U1241C/U1242C Handheld Digital Multimeter

KEYSIGHT TECHNOLOGIES

User's Guide

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Safety Information

CAUTION

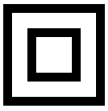
A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood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

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Safety Symbols

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

	Caution, risk of danger (refer to this manual for specific Warning or Caution information)		Earth (ground) terminal
	Equipment protected throughout by double insulation or reinforced insulation	**CAT III 1000 V**	Category III 1000 V overvoltage protection
CAT IV 600 V	Category IV 600 V overvoltage protection		

Safety Considerations

Read the information below before using this instrument.

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

WARNING

- Do not exceed any of the measurement limits defined in the specifications to avoid instrument damage and the risk of electric shock.
- Do not use the multimeter if it is damaged. Before you use the multimeter, 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 multimeter.
- Do not operate the multimeter around explosive gas, vapor, or wet environments.
- Do not apply more than the rated voltage (as marked on the multimeter) between terminals, or between terminal and earth ground.
- Never use the multimeter in wet conditions or when there is water on the surface. If the multimeter is wet, ensure that the multimeter is dried only by trained personnel.
- Before use, verify the multimeter's operation by measuring a known voltage.
- When measuring current, turn off the circuit power before connecting the multimeter in the circuit. Remember to place the multimeter in series with the circuit.
- When servicing the multimeter, use only the specified replacement parts.
- Use caution when working above 60 V DC, 30 V AC rms, or 42.4 V peak. Such voltages pose a shock hazard.

WARNING

- When using the probes, keep your fingers behind the finger guards on the probes.
- Only use the probe assemblies with RATED MEASUREMENT CATEGORY III or IV for MAINS measurements.
- 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 multimeter before you open the battery cover.
- Remove the test leads from the measuring source or target before changing the rotary switch position.
- Do not operate the multimeter 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.
- Comply with local and national safety requirements when working in hazardous areas, and use proper protection equipment.

CAUTION

- Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.
- Use the proper terminals, function, and range for your measurements.
- This multimeter is for use at altitudes of up to 3000 m.
- Never measure voltage when the current measurement is selected.
- Always use the specified battery type. The power for the multimeter is supplied with four 1.5 V AAA batteries. Observe the correct polarity markings before you insert the batteries to ensure proper insertion of the batteries in the multimeter.
- To prevent damage to the multimeter from battery leakage:
  - Always remove dead batteries immediately.
  - Always remove the batteries and store them separately if the multimeter is not going to be used for a long period.

Measurement Category

The U1241C/U1242C has safety ratings of CAT III 1000 V and CAT IV 600 V.

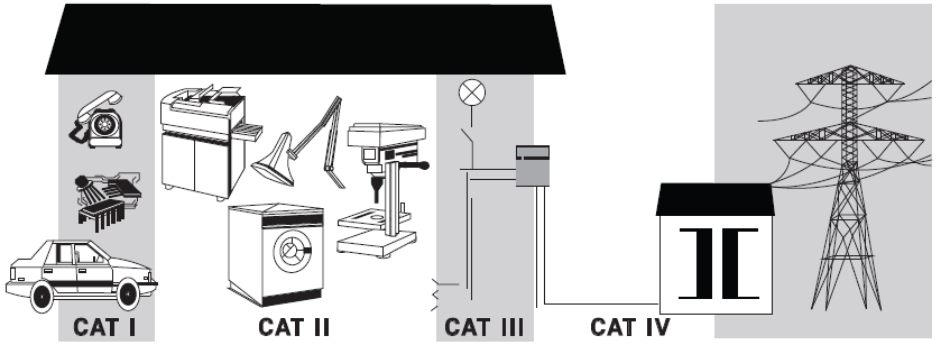
Measurement CAT I Measurements performed on circuits not directly connected to the AC mains. Examples are measurements on circuits not derived from the AC mains and specially protected (internal) mains-derived circuits.

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.

Use only the product rated Measurement Category on the location of measuring circuits as identified below.



Environmental Conditions

The U1241C/U1242C 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 Storage condition – –40 °C to 70 °C, 0 to 80% RH (without batteries)
Humidity	Up to 80% RH for temperature of up to 30 °C decreasing linearly to 50% RH at 55 °C
Altitude	Up to 3000 m
Pollution degree	2

Safety and Regulatory Information

The U1241C/U1242C complies with the following safety and Electromagnetic Compatibility (EMC) compliances:

Safety compliance

- IEC/EN 61010-1
- IEC/EN 61010-2-033
- Canada: CAN/CSA-C22.2 No. 61010-1, CAN/CSA-C22.2 No. 61010-033
- USA: ANSI/UL Std. No. 61010-1, ANSI/UL Std. No. 61010-033

EMC compliance

- IEC 61326-1/EN 61326-1
- Canada: ICES/NMB-001
- Australia/New Zealand: AS/NZS CISPR 11

Regulatory Markings

CE	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.	C US	The CSA mark is a registered trademark of the Canadian Standards Association.
CE ICES/NMB-001 ISM GRP 1-A	ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada.		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.
	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.	40	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.
	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.		

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

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

Product category

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

The affixed product label is as shown below.

Do not dispose in domestic household waste.

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

Sales and Technical Support

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

- www.keysight.com/find/U1241C or www.keysight.com/find/U1242C (product-specific information and support, software and documentation updates)
- www.keysight.com/find/assist (worldwide contact information for repair and service)

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This chapter lists the package contents for this multimeter, and it teaches you how to set up your multimeter for the first time. An introduction to all the features of the multimeter is also given. This introduction does not cover all of the capabilities of the multimeter but gives basic examples to help you perform basic operations on your multimeter.

NOTE The model U1242C appears in all illustrations in this manual.

About This Manual

Documentation map

The following manuals and software are available for your multimeter. For the latest version, 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. Printed copy for outdoor use, included with shipment.

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

Keysight Handheld Meter Logger Software.
Downloadable from http://www.keysight.com/find/hhmeterlogger.

Safety notes

The following safety notes are used throughout this manual. Familiarize yourself with each of the notes and its meaning before operating your multimeter. More pertinent safety notes for using this product are located under the **Safety Symbols** section.

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.

Preparing Your Multimeter

Check the shipment

When you receive your multimeter, 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 multimeter 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 list found in the printed copy of the *U1241C/U1242C Quick Start Guide*.
3. For any question or problems, refer to the Keysight contact numbers at www.keysight.com/find/assist.

Install the batteries

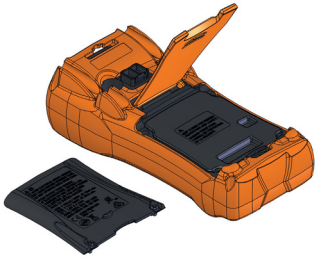
Your multimeter is powered by four 1.5 V AAA batteries (included with the shipment). When you receive your multimeter, the batteries are not installed.

Use the following procedure to install the batteries.

CAUTION **Before you proceed with the battery installation, remove all cable connections to the terminals and ensure that the rotary switch is at the OFF position. Use only the batteries provided with your multimeter.**

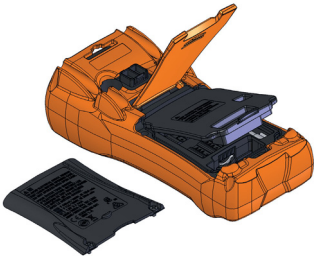
1 Lift the tilt stand as shown on the right.

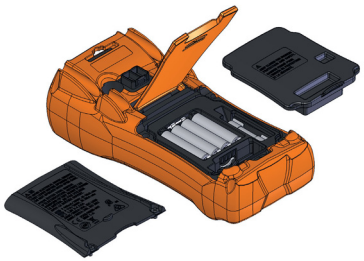
2 Loosen the two screws with a suitable Phillips screwdriver as shown on the right.



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

4 Lift the inner cover to access the battery compartment.





5 Observe the proper battery polarity. The terminal ends of each battery are indicated inside the battery compartment. Insert four 1.5 V AAA batteries.

6 Ensure that the inner cover is positioned properly.

7 Replace the battery cover back in its original position and tighten the screws.

The battery level indicator at the lower left corner of the display indicates the relative condition of the batteries. **Table 1-1** describes the various battery levels the indicator represents.

Table 1-1 Battery level indicator

Indication	Battery capacity	
	Primary battery (4.2 V to 6 V)	Secondary battery (rechargeable) (4.5 V to 5.4 V)
	Full capacity	
	2/3 capacity	
	1/3 capacity	
(Flashing periodically)	Almost empty	

NOTE When the battery voltage is < 3.8 V, the multimeter will shut down automatically regardless of whether the auto power off function has been disabled or not.

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 reversing the battery polarity in any of the subjects.

CAUTION

To avoid damage from battery leakage:

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

Turn on your multimeter

To power ON your multimeter, turn the rotary switch to any position other than OFF. The model number and firmware version of your multimeter will be shown briefly on the primary display and secondary display respectively.

Figure 1-1 Start-up display

To power OFF your multimeter, turn the rotary switch to the OFF position.

Automatic power off

Your multimeter automatically turns off after 15 minutes (default) if:

- the rotary switch is not moved, or
- a key is not pressed, or
- dynamic recording mode is disabled.

To turn the multimeter back on after it is powered off automatically:

- turn the rotary switch to the OFF position and then turn it to any ON position, or
- press any key, or
- move the rotary switch.

Enabling the backlight

If viewing the display becomes difficult in low-light conditions, press  to activate the backlight of the LCD and keypad.

To conserve battery life, a user-adjustable timeout controls how long the backlight stays on. The default timeout is 15 seconds.

Selecting the range

The multimeter's selected range is always displayed at the right end of the bar graph. Pressing 

enables manual ranging while pressing 

for > 1 second enables autoranging. It also cycles through the available multimeter ranges when manual ranging is enabled.

Autoranging is convenient because the multimeter automatically selects an appropriate range for sensing and displaying each measurement. However, manual ranging results in better performance since the multimeter does not have to determine which range to use for each measurement.

NOTE **The range is fixed for diode tests, temperature, current (A), and Z_{LOW} measurements.**

In autorange, the multimeter selects the lowest range to display the highest available precision (resolution) for the input signal. If manual range is already enabled, press 

for > 1 second to enter the autoranging mode.

If autoranging is enabled, press 

to enter the manual range mode.

Each additional press of 

sets the multimeter to the next higher range, unless it is already in the highest range, at which point the range switches to the lowest range.

Alerts and warnings during measurement

Hazardous voltage indication

The multimeter will display the hazardous voltage (⚡) symbol as an early precaution when the measured voltage is:

Measurement	DC		AC
V (mV)	≥ +30 V or +OL (voltage overload)	≤ –30 V or –OL	≥ 30 V or OL

This symbol will also be displayed when the input signal exceeds the limitation of measuring circuit as frequency dependence.

Hazardous current indication

The multimeter will display the ⚡ symbol as an early precaution when the measured current has reached the maximum fuse rating as follows:

Measurement	DC		AC
A	≥ +11 A or +OL (current overload)	≤ –11 A or –OL	≥ 11 A or OL
µA/mA	≥ 440 mA or +OL	≤ –440 mA or –OL	≥ 440 mA or OL

CAUTION If your measuring current is > 10 A ~ 19.999 A, you will need to lower the current within a 30 seconds time limitation to avoid blowing the multimeter's fuse.

Input warning

CAUTION To avoid circuit damage and possibly blowing the multimeter's current fuse, do not place the probes across (in parallel with) a powered circuit when a lead is plugged into a current terminal. This causes a short circuit because the resistance through the multimeter's current terminals is very low.

The multimeter emits a continuous beep and the red LED indicator lights up when the test lead is inserted into the **A** or **µ•mA** input terminal but the rotary switch is not set to the correct current position. The secondary display will show A-Er or HAEr until the test lead is removed. The beeping will stop automatically after 5 seconds even if the test lead is not removed.

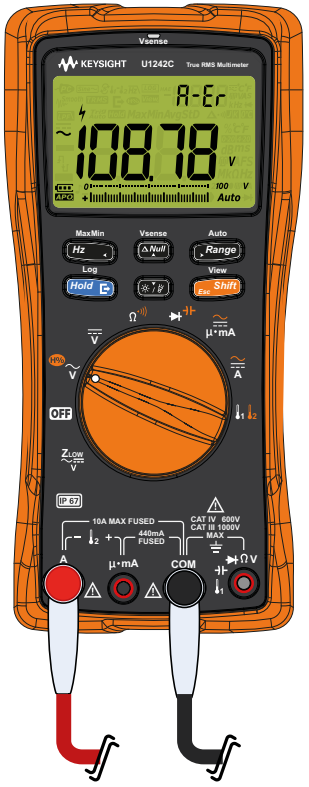


Figure 1-2 Example of wrong terminal input

This warning is intended to stop you from attempting to measure voltage, continuity, resistance, capacitance, diode, or temperature values when the leads are plugged into a current terminal.

When the rotary switch is set to the current measurement position but no lead is inserted into its respective input terminal, the multimeter emits a continuous beep and the red LED indicator lights up. The secondary display will show LEAd, and the warning alert will stop after 3 seconds approximately.

Figure 1-3 LEAd input warning display

Adjusting the tilt stand

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

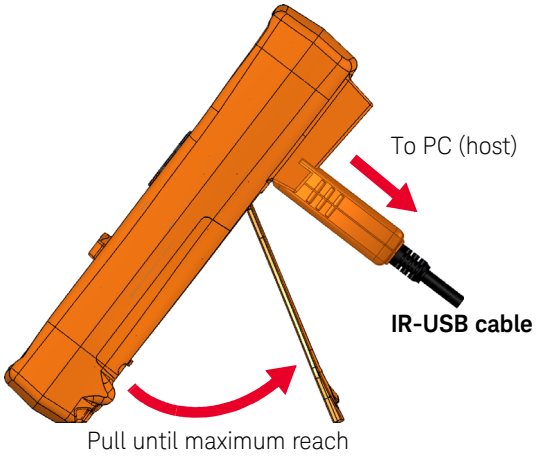


Figure 1-4 Tilt-stand adjustment and IR-USB cable connection

Remote communication

You can communicate remotely with the multimeter from your PC via an IR-to-USB connection (see **Using an IR-to-USB cable**) or an IR-to-*Bluetooth*® connection (see **Using a Bluetooth adapter**).

When configuring the IR interface of the multimeter, use the following settings as the default:

- Baud rate: 9600 bits per second
- Parity bit: None
- Data bit: 8 data bits
- Number of stop bit: 1 bit

You can also use any of the following software to communicate with the multimeter:

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

Using an IR-to-USB cable

The U1173B IR-to-USB cable (included in the shipment) can be used to connect your multimeter to your PC via the IR communication link (IR communication port, located at the rear panel). Ensure that the Keysight logo on the IR-to-USB cable that connects to the multimeter is facing up. Firmly push the IR head into the multimeter's IR communication port until it snaps into place (see **Figure 1-4**).

Using a *Bluetooth* adapter

The U1117A Infrared (IR)-to-*Bluetooth* adapter (purchased separately) allows you to connect the multimeter 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 multimeter's IR communication port.

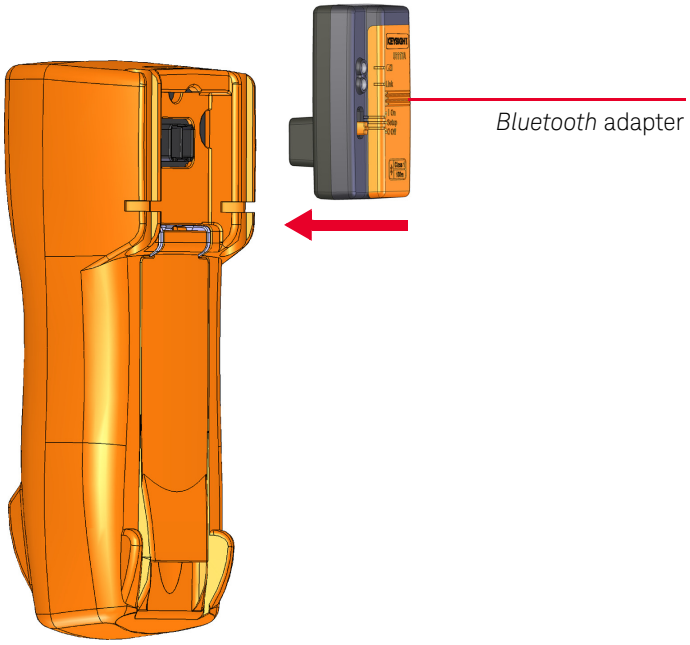


Figure 1-5 *Bluetooth* adapter connection

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

Using the Handheld Meter Logger Software

You can use the IR communication link and the Keysight Handheld Meter Logger software to control your multimeter remotely, perform data logging operations, and transfer the contents of your multimeter's memory to a PC. Refer to the *Handheld Meter Logger Software Help File* for more information on the IR communication link and the Handheld Meter Logger software.

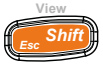
Figure 1-6 Handheld Meter Logger software

You can download the Handheld Meter Logger software and its supporting documents from http://www.keysight.com/find/hhmeterlogger.

Power-on options

Some options can be selected only while you turn the multimeter on. To select a power-on option, press and hold the specified key while turning the rotary switch to any other position (OFF to on). Power-on options remain selected until the multimeter is turned off.

Table 1-2 Power-on options

Key	Description
	Accesses the multimeter's Setup menu. Press this key for > 1 second to exit the Setup menu.
	Simulates the APO (auto power off) mode. Press any key to turn the multimeter back on and resume normal operation.
	Tests the LCD. All LCD annunciators are lit. Use this mode to verify that there are no defective LCD annunciators. Press any key to exit this mode.
	Turns on the flashlight. Press  or  to change the brightness level (with the backlight turned on at the same time). Press  for > 1 second to exit this mode.

Your Multimeter in Brief

Overview

Front panel

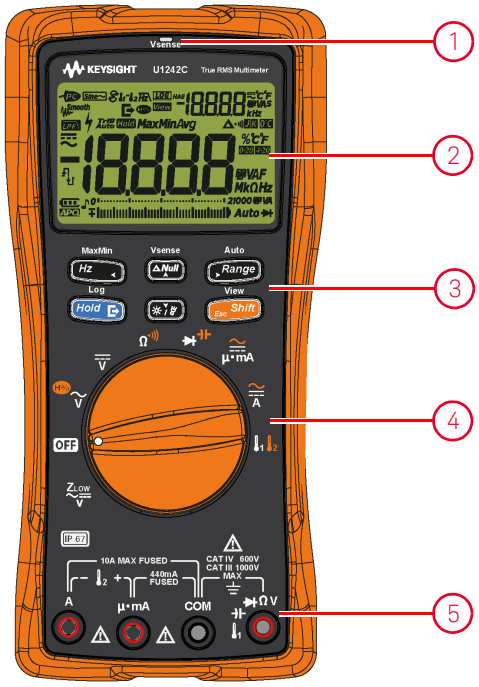


Figure 1-7 Front panel

Table 1-3 Front panel parts

Legend	Description	Learn more on:
1	Vsense red LED indicator	page 96
2	Display screen	page 42
3	Keypad	page 39
4	Rotary switch	page 37
5	Input terminals	page 47

Rear panel

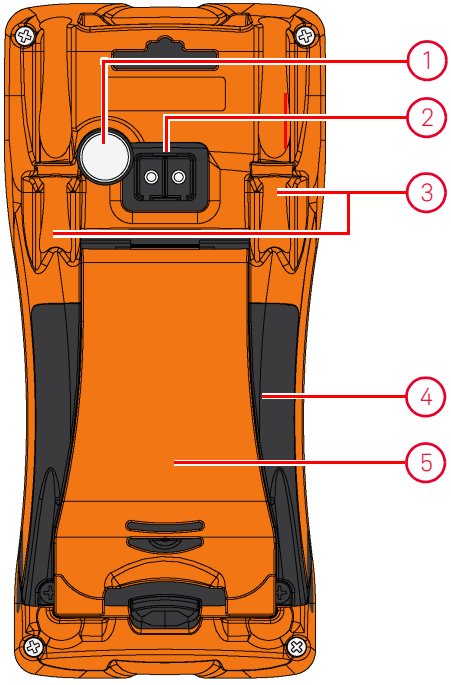


Figure 1-8 Rear panel

Table 1-4 Rear panel parts

Legend	Description	Learn more on:
1	Flashlight	**page 34** and **page 41**
2	IR communication port	**page 31**
3	Test lead/probe holders	–
4	Battery and fuse access cover	**page 24**
5	Tilt stand	**page 30**

Rotary switch

Table 1-5 describes the measurement functions for each rotary switch position. Turning the rotary switch changes the measurement function and resets all other measurement options.

NOTE

Some rotary switch positions have a shifted function printed in orange. Press View Esc Shift to switch between the shifted and regular functions. See **page 41** for more information on View Esc Shift.

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

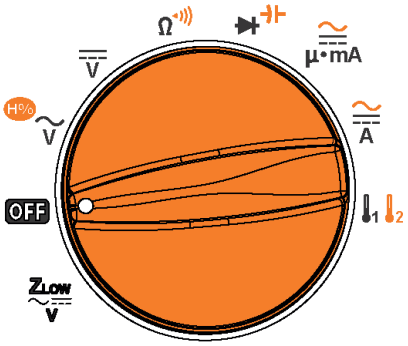


Figure 1-9 Rotary switch

Table 1-5 Rotary switch functions

Legend	Description	Learn more on:
ZLOW V [a]	Low impedance AC or DC voltage measurement for eliminating stray voltages	**page 61**
OFF	Off	**page 26**

Table 1-5 Rotary switch functions (continued)

Legend	Description	Learn more on:
	AC voltage measurement or harmonic ratio function[a]	**page 53** and **page 55**
	DC voltage measurement	**page 57**
	Resistance measurement or continuity test	**page 63** and **page 66**
	Diode test or capacitance measurement	**page 69** and **page 73**
	AC or DC current measurement (up to milliamperes)	**page 85**
	AC or DC current measurement	**page 85**
	Temperature (T1, T2[a], or T1–T2[a]) measurement or AC/DC mV measurement (when enabled from the Setup menu; refer to "**Changing the thermocouple type or setting the mV measurement**" on page 126)	**page 59** and **page 79**

[a] U1242C only.

Keypad

Table 1-6 describes the operation of each key. 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.

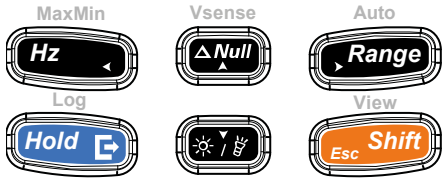


Figure 1-10 Keys

Table 1-6 Keypad functions

Legend	Function when pressed for:		Learn more on:
	Less than 1 second	More than 1 second	
MaxMin Hz	**Enables the frequency test mode for voltage or current measurements.** – Press Hz again to scroll through the low pass frequency filter (Hz\), voltage/current measurement, and frequency (Hz) measurement.	**Starts the dynamic (Max/Min/Avg) recording.** – Press Hz again to cycle through maximum (**Max**), minimum (**Min**), average (**Avg**), and present (**MaxMinAvg**) readings. **Stops and exits the dynamic (Max/Min/Avg) recording.**	**page 75** and **page 100**
Vsense Null	**Sets the Null/Relative mode.** – The displayed value is saved as a reference to be subtracted from subsequent measurements. – While in Null mode, press Null again to view the stored reference value that has been saved. The display will return to normal after 3 seconds. – Pressing Null while the relative value is being displayed will cancel the Null mode.	**Toggles on/off non-contact voltage detection (Vsense).**	**page 96** and **page 98**

Table 1-6 Keypad functions (continued)

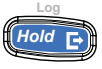
Legend	Function when pressed for:		Learn more on:
	Less than 1 second	More than 1 second	
	**Sets a manual range and disables autoranging.** – Press  again to cycle through each available measurement range. **Switches between environment temperature compensation (ETC) and non-ETC (0 °C) for temperature measurements.** **Changes the Vsense detector sensitivity.**	**Enables autoranging.** **Switches between the temperature unit (°C or °F) for temperature measurements when enabled from the multimeter's Setup mode.** **Press  for > 1 second to unlock this setting.**	**page 27**, **page 79**, and **page 128**
	**Freezes the present reading in the display (Trig Hold mode).** – In the Trig Hold mode, press  to manually trigger the holding of the next measured value. **Automatically freezes the present reading once the reading is stable (Auto Hold mode; when enabled from the multimeter's Setup mode).** – In the Auto Hold mode, the reading is updated automatically once the reading is stable and the count setting is exceeded. – Press  again to exit this mode. **Stores a record of the measured signal and exports it via the multimeter's optical communication port.** **Restarts the dynamic (Max/Min/Avg) recording.**	**Starts and stops data logging.** – If data logging is set as HAnd (manual data logging), pressing  for > 1 second will log the present reading into the memory. The display will return to normal after a short while (≈ 1 second). To manually log another reading, press  again for > 1 second. – If data logging is set as AUto (interval data logging), pressing  for > 1 second will enter the interval data logging mode, where data is logged at the interval defined in the multimeter's Setup mode. – If data logging is set as trIG (event data logging), pressing  for > 1 second will enter the event data logging mode, where data is logged each time a triggering condition is satisfied. **Unlocks the temperature unit display setting in the Setup mode.**	**page 100**, **page 102**, **page 104**, and **page 128**

Table 1-6 Keypad functions (continued)

Legend	Function when pressed for:		Learn more on:
	Less than 1 second	More than 1 second	
	**Turns the backlight on or off.**	**Turns the flashlight on or off.**	**page 27** and **page 123**
	**Switches between the regular and shifted (icon printed in orange above the rotary switch position – if available) measurement functions.** **Enables the Scan mode for temperature measurements (U1242C only).**	**Enters and exits the Log Review menu (with the Hold mode disabled)** – Press  again to cycle through the previously recorded export (), manual (**H**), interval (**A**), or event (**E**) logging data. – Press  or to view the first or last logged data respectively. Press  or  to scroll through the logged data. – Press  for > 1 second to clear all the logged data for the selected logging mode. Press  to clear the last logged data only. – Press  for > 1 second to sanitize the log memory when data of all logging modes have been cleared. **Exits the Trig Hold or Auto Hold mode.** **Press  while turning the rotary switch (from OFF to on) to access the Setup menu.**	**page 34**, **page 37**, **page 84**, **page 110**, and **page 114**

Display screen

Table 1-7 describes the general display annunciators of your multimeter. See also "**Measurement units**" on page 45 for a list of available measurement signs and notations and "**Analog bar graph**" on page 46 for a tutorial on the analog bar graph located at the bottom of your display screen.

General display annunciators

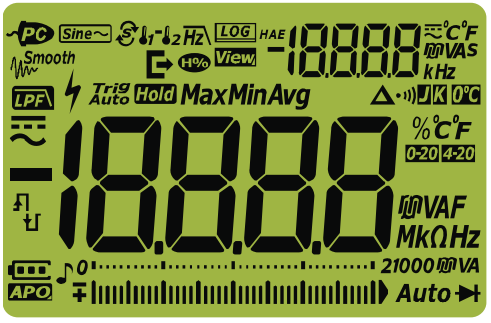


Figure 1-11 Display screen

Table 1-7 General annunciators

Legend	Description	Learn more on:
PC	Remote control enabled	–
Sine	Averaging sense measurements for sine waves[a]	**page 53**, **page 55**, **page 59**, **page 75**, and **page 85**
Scan T1-T2	Scan[a], T1, T2[a], and T1-T2[a] for temperature measurements	**page 79**
Hz	Low pass filter for frequency measurements	**page 78**
LOG	Data logging in progress	**page 104**
HAE	Data logging type	**page 104**
	Data log export in progress	**page 104**
View	View mode for reviewing previously logged data	**page 110**

Table 1-7 General annunciators (continued)

Legend	Description	Learn more on:
-18.8.8.8	Secondary measurement display	–
⎓ ~	AC or DC indication for the secondary display	**page 55**, **page 61**, and **page 75**
°C °F mV VAS kHz	Measuring units for the secondary display	**page 44**
Smooth	Smooth mode enabled	**page 120**
H%	Harmonic ratio indication[a]	**page 37** and **page 55**
LPF	DC filter enabled for DC voltage measurements	**page 138**
⚡	Hazardous voltage sign for measuring voltage ≥30 V or overload Hazardous current sign for measuring current exceeding the fuse rating	**page 28** and **page 96**
Trig Hold	Trigger hold enabled	**page 102**
Auto Hold	Auto hold enabled	**page 102** and **page 119**
Max	Maximum reading shown on primary display	**page 100**
Min	Minimum reading shown on primary display	
Avg	Averaged reading shown on primary display	
MaxMinAvg	Dynamic recording mode for Max, Min, Avg, and present (MaxMinAvg) display	
△	Relative (Null) enabled	**page 98**
•))	Audible continuity test selected	**page 66**, **page 131**, and **page 132**
J	J-type thermocouple selected[a]	**page 79** and **page 126**
K	K-type thermocouple selected	
0°C	Temperature measurement without ambient compensation selected	**page 83**

Table 1-7 General annunciators (continued)

Legend	Description	Learn more on:
%℃℉ MΩVAF MkΩHz	Measuring units for the primary display	**page 44**
0-20	0-20 mA % scale mode selected	**page 91** and **page 139**
4-20	4-20 mA % scale mode selected	
-18888	Primary measurement display	–
⎓	DC (direct current)	**page 57**, **page 59**, and **page 85**
~	AC (alternating current)	**page 53**, **page 59**, **page 61**, **page 85**, and **page 96**
	– Capacitor is charging (during capacitance measurement) – Open continuity	**page 66** and **page 73**
	– Capacitor is discharging (during capacitance measurement) – Short continuity	
0 21000 MΩVA	Analog bar graph and measurement range	**page 27** and **page 46**
Auto	Autoranging enabled	**page 27**
	Diode test selected	**page 69**
	Tone enabled	–
	Battery capacity indication	**page 24**
APO	Auto power off (APO) enabled	**page 26**, **page 34**, and **page 121**
OL	Overload (the reading exceeds the display range)	–

[a] U1242C only.

Measurement units

Table 1-8 describes the available signs and notations for each measurement function in your multimeter. The units listed below are applicable to the primary display and secondary display measurements of your multimeter.

Table 1-8 Measurement units display

Sign/Notation	Description	
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	
A, mA, µA	Ampere units for current measurement	
nF, µF, mF	Farad units for capacitance measurement	
Ω, kΩ, MΩ	Ohm units for resistance measurement	
MHz, kHz, Hz	Hertz units for frequency measurement	
%0-20	Percent, unit for the scale proportional to DC 0~20 mA	
%4-20	Percent, unit for the scale proportional to DC 4~20 mA	
°C	Degree Celsius, unit for temperature measurement	
°F	Degree Fahrenheit, unit for temperature measurement	

Analog bar graph

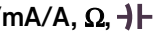
The analog bar emulates the needle on an analog multimeter, without displaying the overshoot. When measuring peak or null adjustments and viewing fast-changing inputs, the bar graph provides a useful indication because it has a faster updating rate[1] to cater to fast-response applications.

For frequency, 4-20 mA % scale, 0-20 mA % scale, and temperature measurements, the bar graph does not represent the primary display value.

For example, when frequency is displayed on the primary display during voltage or current measurement, the bar graph represents the voltage or current value (not the frequency value). Another example is when the 4-20 mA % scale or 0-20 mA % scale is displayed on the primary display, the bar graph represents the current value and not the percentage value.

The "+" or "–" sign indicates whether the measured or calculated value is positive or negative. Each segment represents 250 counts based on 10000 counts depending on the range indicated on the peak bar graph.

Table 1-9 Analog bar graph display

Range	Counts/Segments	Used for the function
	500	
	250	V, mV, µA/mA/A, Ω, 
	250	
	250	

An unstable bar graph and unmatched primary display when measuring DC voltage usually means the presence of AC voltages in the circuit.

[1] The analog bar graph measurement rate is > 30 times/second for DC voltage, current, and resistance measurements.

Input terminals

Table 1-10 describes the terminal connections for the different measurement functions of your multimeter. Observe the rotary switch position of your multimeter before connecting the test leads to the connector terminals.

WARNING Ensure that the terminal connections are correct for that particular measurement function before starting any measurement.

CAUTION To avoid damaging this multimeter, do not exceed the rated input limit.

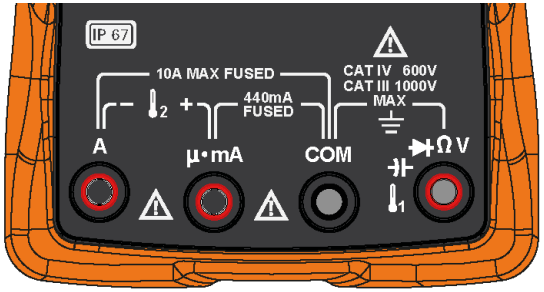
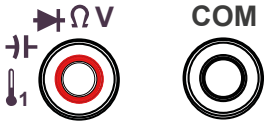
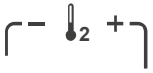
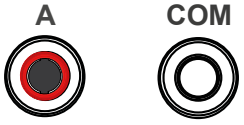


Figure 1-12 Connector terminals

Table 1-10 Terminal connections for different measurement functions

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

[a] Also includes the AC/DC mV function when enabled from the Setup menu. Refer to "**Measuring AC or DC mV**" on page 59.

Cleaning Your Multimeter

WARNING **To avoid electrical shock or damage to the multimeter, 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 multimeter.

1. Turn the multimeter off and remove the test leads.
2. Turn the multimeter over and shake out any dirt that may have accumulated in the terminals.
3. 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.

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2 Making Measurements

Crest Factor 52
Measuring AC Voltage 53
Measuring Harmonic Ratio (U1242C only) 55
Measuring DC Voltage 57
Measuring AC or DC mV 59
Using Z_{LOW} for Voltage Measurements (U1242C only) 61
Measuring Resistance 63
Testing for Continuity 66
Testing Diodes 69
Measuring Capacitance 73
Measuring Frequency 75
Measuring Temperature 79
Measuring AC or DC Current 85

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

Crest Factor

The crest factor may be determined by using this formula:

$$Crest\ factor = \frac{Peak\ value}{True\ rms\ value}$$

The crest factor may be up to 3.0 at full scale except for the 1000 V and 600 mV ranges, where these ranges are 1.5 at full scale. For non-sinusoidal waveforms, add (0.5% reading + 0.3% full scale) typically.

Voltage range	Crest factor	Maximum input (V_{peak})
100 mV	3	300 mV
600 mV	1.5	900 mV
1000 mV	3	3000 mV
10 V	3	30 V
100 V	3	300 V
1000 V	1.5	1500 V

WARNING Exceeding the crest factor limit may result in an incorrect or a lower reading. Do not exceed the crest factor limit to avoid instrument damage and the risk of electric shock.

Measuring AC Voltage

Set up your multimeter to measure AC voltage as shown in **Figure 2-2**. Probe the test points and read the display.

Table 2-1 Rotary switch position allowing AC voltage measurements

Legend	Default function	Function when View Esc Shift is pressed
H% ~ V	AC V (true rms)	Cycles between – AC V (averaging sense)[a] – Harmonic ratio[a] with AC V (averaging sense) – Harmonic ratio[a] with AC V (true rms), or – AC V (true rms)

[a] U1242C only. The averaging sense AC measurement applies for sine wave inputs only. It provides more accurate readings for linear loads measurement such as standard induction motors, resistance heating, and incandescent lights.

NOTE AC voltage measurements measured with this multimeter are returned as average response readings for sine waves (for U1242C only) or true rms readings.

Figure 2-1 AC voltage display

NOTE

Press MaxMin Hz to enable the frequency test mode for voltage measurements.

Refer to “**Measuring Frequency**” on page 75.

Figure 2-2 Measuring AC voltage

Measuring Harmonic Ratio (U1242C only)

The harmonic ratio function indicates the deviation of non-sinusoidal to sinusoidal waveform from the range of 0% to 100%, which indicates the presence of harmonics. A pure sinusoidal waveform without harmonics gives a value of 0%. A higher harmonic ratio means more harmonics are present on the signal.

Table 2-2 Rotary switch position allowing harmonic ratio measurements

Legend	Default function	Function when View Esc Shift is pressed
H% ~ V	AC V (true rms)	Cycles between – AC V (averaging sense)[a] – Harmonic ratio[a] with AC V (averaging sense) – Harmonic ratio[a] with AC V (true rms), or – AC V (true rms)

[a] U1242C only.

To set up your multimeter to measure harmonic ratio, first set up your multimeter to measure AC voltage as shown in **Figure 2-2**. Probe the test points and read the display.

NOTE The harmonic ratio measurement is shown in the primary display and the AC voltage measurement is shown in the secondary display.

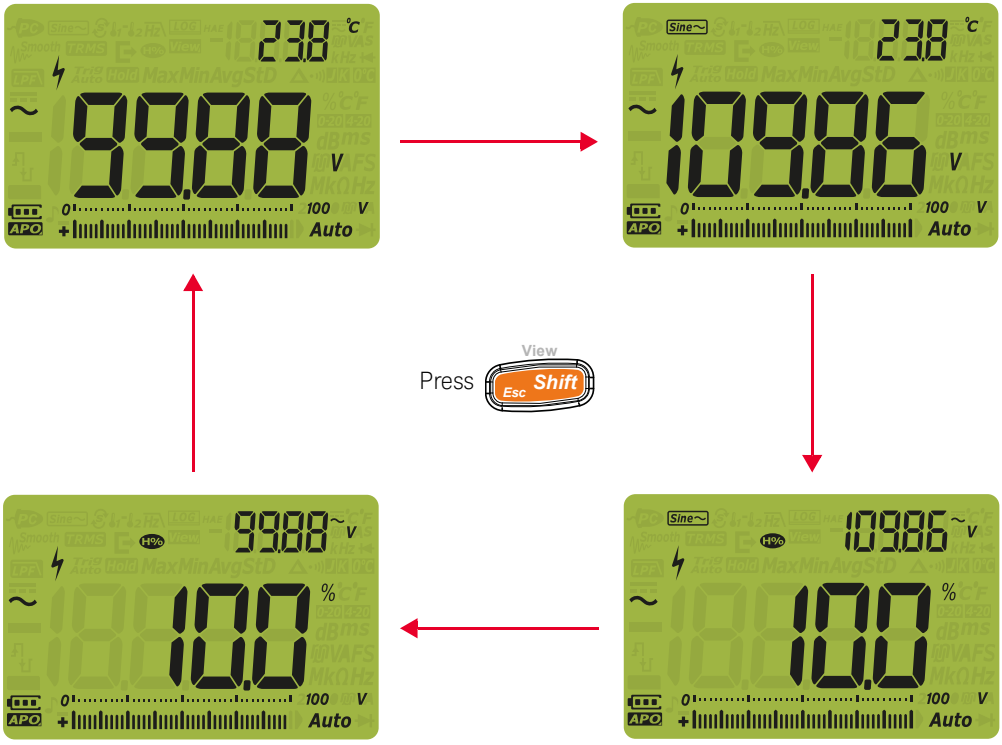

Figure 2-3 Harmonic ratio measurement

Measuring DC Voltage

Set up your multimeter to measure DC voltage as shown in **Figure 2-5**. Probe the test points and read the display.

Table 2-3 Rotary switch position allowing DC voltage measurements

Legend	Default function
V⎓	DC V

NOTE This multimeter displays DC voltage values as well as their polarity. Negative DC voltages will return a negative sign on the left of the display.

CAUTION If you are measuring a signal which includes AC components and the peak value is exceeding the measurement range, you will need to lock a range that is greater than the peak of voltage. Use the maximum range of 1000 V to check the signal condition, and manually select a suitable range for the signal.

As the DC voltage measurement has the Normal (Series) Mode Rejection Rate (NMRR) capability for 50/60 Hz noise, a hazardous voltage indication of ϟ will be shown even if the display is showing 0 V or < 30 V. The measurement range will automatically be set to a higher range, and the analog bar graph will be varying fast or greater than the displayed value.

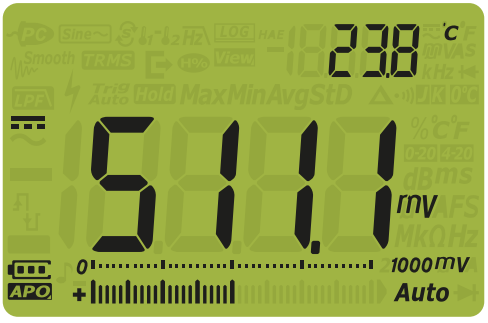

Figure 2-4 DC voltage display

NOTE Press MaxMin Hz to enable the frequency test mode for voltage measurements.

Refer to “**Measuring Frequency**” on page 75.

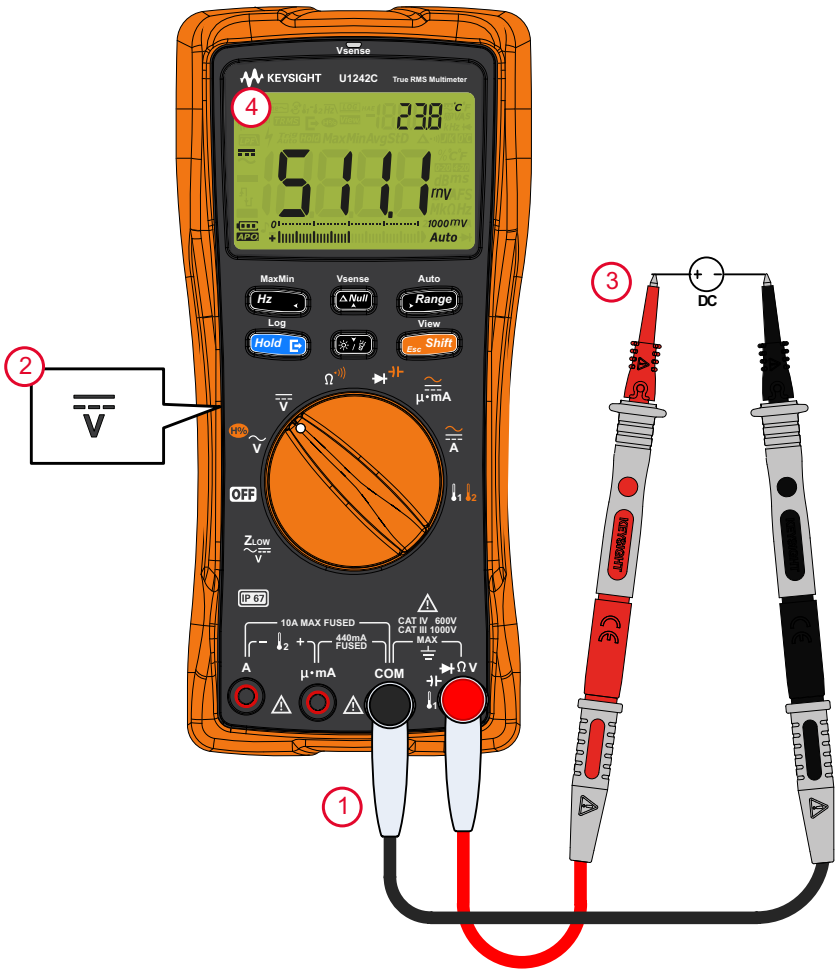

Figure 2-5 Measuring DC voltage

Measuring AC or DC mV

You can set the multimeter to measure AC or DC mV at the following rotary switch position (you must first enable the mV measurement function from the Setup menu. Refer to "**Changing the thermocouple type or setting the mV measurement**" on page 126.).

NOTE When this Setup item is enabled, the original temperature functions offered in this rotary switch position are disabled and replaced by AC or DC mV measurements.

Table 2-4 Rotary switch position allowing AC or DC mV measurements

Legend	Default function	Function when View Esc Shift is pressed
	DC mV	Cycles between – AC mV (true rms) – AC mV (averaging sense)[a], or – DC mV

[a] U1242C only.

NOTE It is recommended to use the mV function when measuring low voltages.

Set up your multimeter to measure voltage as shown in **Figure 2-2** or **Figure 2-5**. Probe the test points and read the display.

Figure 2-6 DC mV display

NOTE

- For AC or DC mV measurements, the measurement range is fixed at 100 mV or 1000 mV, and the input impedance can be set as 10 MΩ (by default) or >1000 MΩ. Refer to "**Setting the input impedance**" on page 137.
- Press MaxMin Hz to enable the frequency test mode for voltage measurements. Refer to "**Measuring Frequency**" on page 75.

Using Z_{LOW} for Voltage Measurements (U1242C only)

CAUTION Do not use the Z_{LOW} function to measure voltages in circuits that could be damaged by this function's low impedance (≈2 kΩ).

The low input impedance (Z_{LOW}) function in your multimeter presents a low impedance across the leads to obtain a more accurate measurement.

Table 2-5 Rotary switch position allowing Z_{LOW} measurements

Legend	Default function
	Z_{LOW} (AC/DC) V

To set up your multimeter to make a Z_{LOW} voltage measurement, first set up your multimeter to measure voltage as shown in **Figure 2-2** or **Figure 2-5**. Probe the test points and read the display.

NOTE The AC voltage measurement is shown in the primary display and the DC voltage measurement is shown in the secondary display.

NOTE *Use the low input impedance (Z_{LOW}) function to remove stray or induced voltages from your measurements.*

Stray (ghost) voltages are voltages present on a circuit that should not be energized. Stray voltages can be caused by capacitive coupling between energized wiring and adjacent unused wiring.

Z_{LOW} can remove stray voltages from your measurements by dissipating the coupling voltage. Use Z_{LOW} to reduce the possibility of false readings in areas where the presence of stray voltages are suspected.

You can also use Z_{LOW} for tripping a residual-current device (RCD) or a residual-current circuit breaker (RCCB). Z_{LOW} can discharge stray voltages from probes touching on terminals after the RCD or RCCB is tripped. This will prevent false readings in voltage measurements with high-input impedance after a power off or trip.

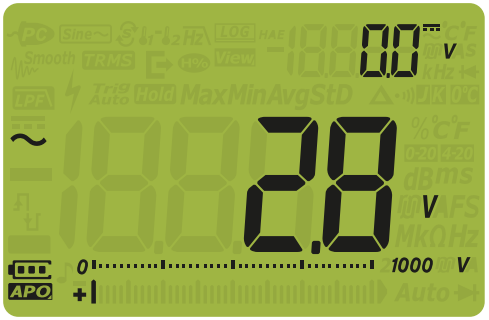

Figure 2-7 Z_{LOW} display

NOTE During Z_{LOW} measurements, autoranging is disabled and the multimeter's range is set to 1000 V in the manual ranging mode.

Use Z_{LOW} to test a battery's health

Aside from reading a battery's voltage level using the DC voltage measurement function, you can also use the Z_{LOW} function to test a battery's health.

If you detect that the measured battery's voltage shown in the Z_{LOW} function is declining gradually, this means that the capacity of the battery-under-test is not enough to support regular functions. Use this simple and quick test to determine if a battery has enough voltage capacity to support regular activities.

NOTE Prolonged use of the Z_{LOW} function will consume the capacity of the battery-under-test.

Measuring Resistance

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

Set up your multimeter to measure resistance as shown in **Figure 2-9**. Probe the test points and read the display.

Table 2-6 Rotary switch position allowing resistance measurements

Legend	Default function	Function when View Esc Shift is pressed
Ω	Resistance measurement (Ω)	Continuity test (•))

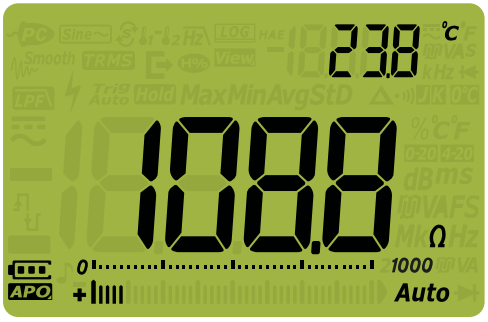

Figure 2-8 Resistance display

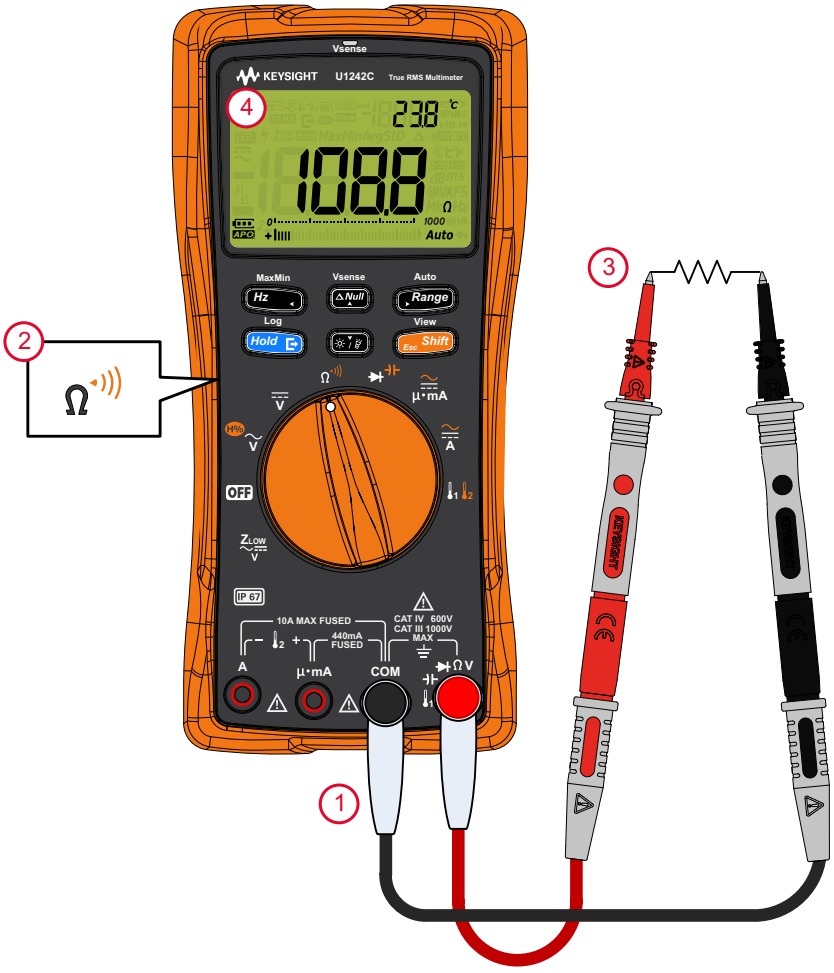

Figure 2-9 Measuring resistance

NOTE

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.
- Be aware that the resistance function can produce enough voltage to forward-bias silicon diode or transistor junctions.

Testing for Continuity

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

Set up your multimeter to test for continuity as shown in **Figure 2-10**. Probe the test points and read the display.

Table 2-7 Rotary switch position allowing continuity tests

Legend	Default function	Function when View Esc Shift is pressed
Ω•))	Resistance measurement (Ω)	Continuity test (•))

NOTE The continuity test features a beeper that sounds and a red LED indicator that lights up as long as a circuit is incomplete or broken. The audible and visual alerts allow you to perform quick continuity tests without having to watch the display.

In continuity, a short means a measured value is less than the threshold resistance values listed in **Table 2-8**. Press Auto Range to select different threshold resistance values.

Table 2-8 Threshold resistance values

Range	Resolution	Accuracy	Continuity threshold	Overload protection
100 Ω	0.01 Ω	0.2% +5	28 ± 10 Ω	1000 Vrms < 0.3 A short circuit current
1000 Ω	0.1 Ω	0.2% +2	28 ± 10 Ω	
10 kΩ	0.001 kΩ	0.2% +2	0.151 ± 0.05 kΩ	
100 kΩ	0.01 kΩ	0.2% +2	1.38 ± 0.5 kΩ	
1000 kΩ	0.1 kΩ	0.2% +2	13.8 ± 4.3 kΩ	
10 MΩ	0.001 MΩ	0.8% +2	0.12 ± 0.04 MΩ	
100 MΩ	0.01 MΩ	1.5% +3 (< 50 MΩ) 3.0% +3 (> 50 MΩ)	0.12 ± 0.04 MΩ	

NOTE

You can set the beeper to sound and the red LED indicator to light up as a continuity indication whether the circuit-under-test is less than (short) or more than or equal to (open) the threshold resistance. Refer to "**Changing the continuity type**" on page 131.

- Normal open: The circuit is normally open, the beeper will sound and the LED indicator will light up when a short is detected.
- Normal closed: The circuit is normally closed, the beeper will sound and the LED indicator will light up when an open is detected.

The audible continuity will be locked in the minimum range of 1000 Ω for resistance measurement.

NOTE

- The continuity function detects intermittent shorts and opens lasting as briefly as 1 ms. A brief short or open causes the multimeter to emit a short beep and its red LED indicator to light up.
- You can enable or disable the audible and visual alerts via the multimeter's Setup. Refer to "**Changing the continuity alert type**" on page 132.

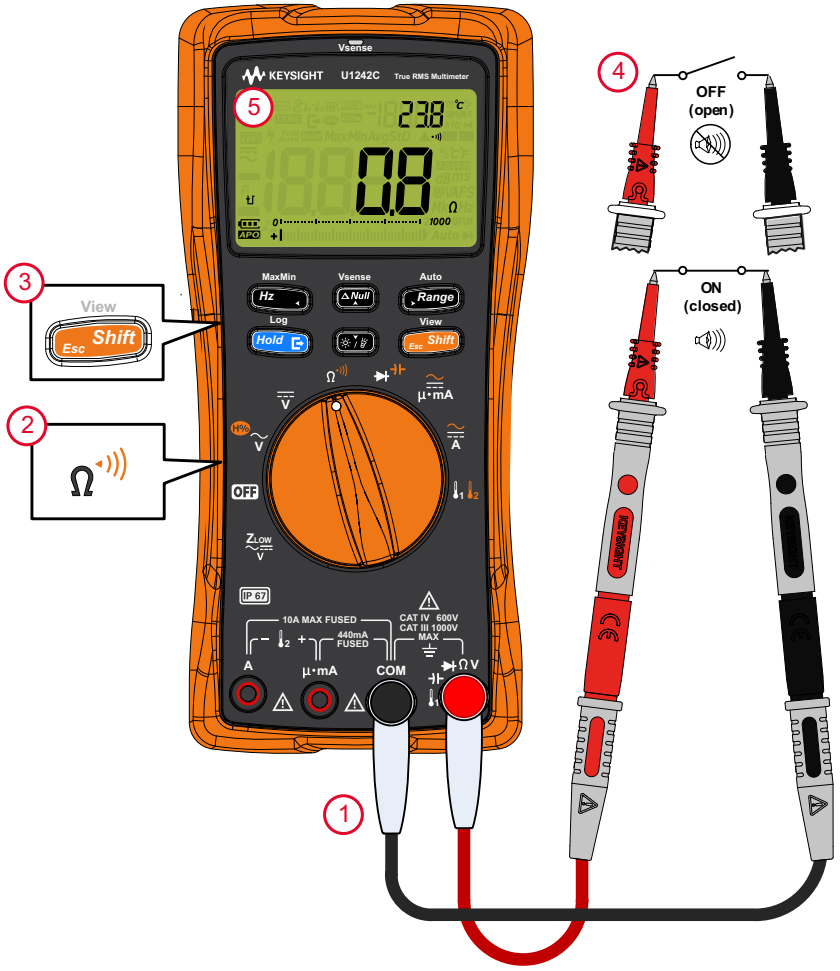

Figure 2-10 Testing for continuity

Testing Diodes

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

Set up your multimeter to test diodes as shown in **Figure 2-13**. Probe the test points and read the display.

Table 2-9 Rotary switch position allowing diode tests

Legend	Default function	Function when View Esc Shift is pressed
	Diode test (▶|)	Capacitance measurement (⊣⊢)

NOTE

- Use the diode test to check diodes, transistors, silicon controlled rectifiers (SCRs), and other semiconductor devices. A good diode allows current to flow in one direction only.
- This test sends a current through a semiconductor junction and then measures the junction's voltage drop. A typical junction drop is 0.3 V to 0.8 V.
- Connect the red test lead to the positive terminal (anode) of the diode and the black test lead to the negative terminal (cathode).

Figure 2-11 Diode display

NOTE

- Your multimeter can display diode forward bias of up to approximately 2.1 V. The forward bias of a typical diode is within the range of 0.3 V to 0.8 V; however, the reading can vary depending on the resistance of other pathways between the probe tips.
- If the beeper is enabled during a diode test, the multimeter will emit a beep for a normal junction and a continuous beep for a shorted junction below 0.050 V. See "**Changing the beep frequency**" on page 129 to disable the beeper.

Reverse the probes (as shown in **Figure 2-14**) and measure the voltage across the diode again. Assess the diode according to the following guidelines:

- A diode is considered good if the multimeter displays OL in reverse bias mode.
- A diode is considered shorted if the multimeter displays approximately 0 V in both forward and reverse bias modes, and the multimeter beeps repeatedly.
- A diode is considered open if the multimeter displays OL in both forward and reverse bias modes.

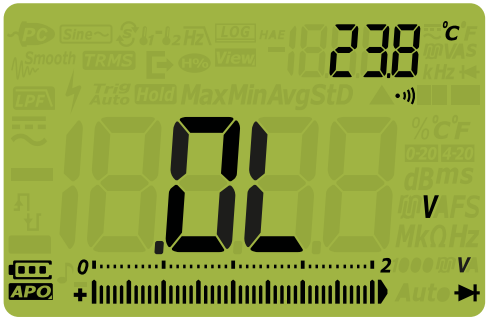

Figure 2-12 Open diode display

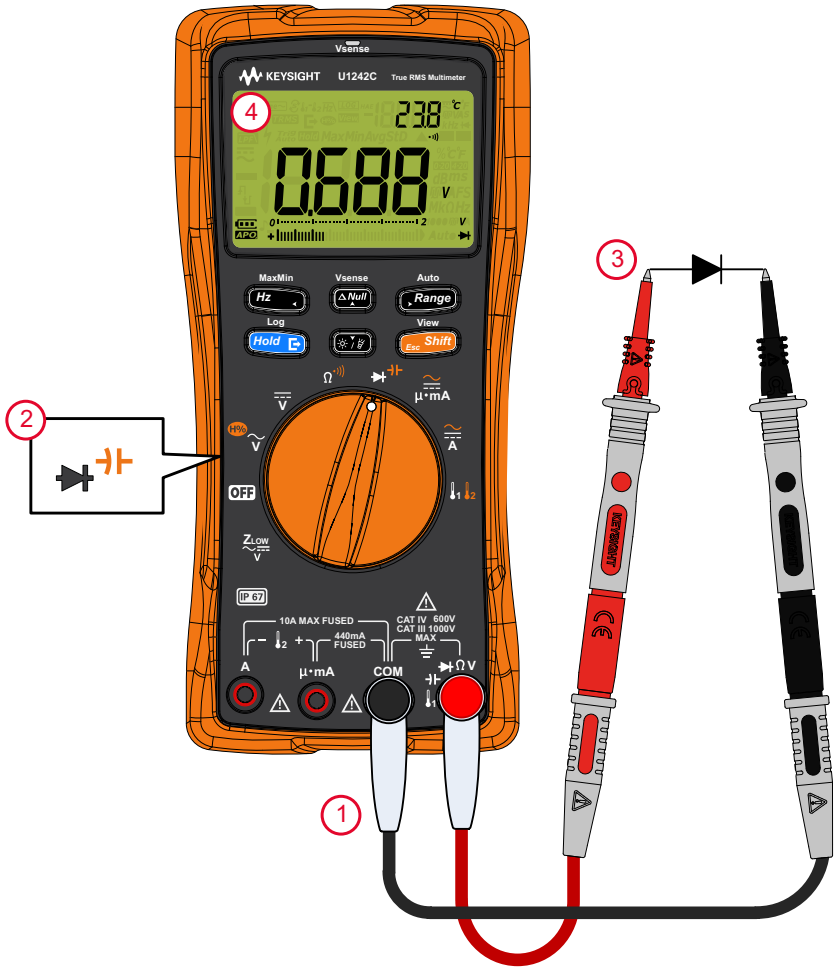

Figure 2-13 Testing a forward bias diode

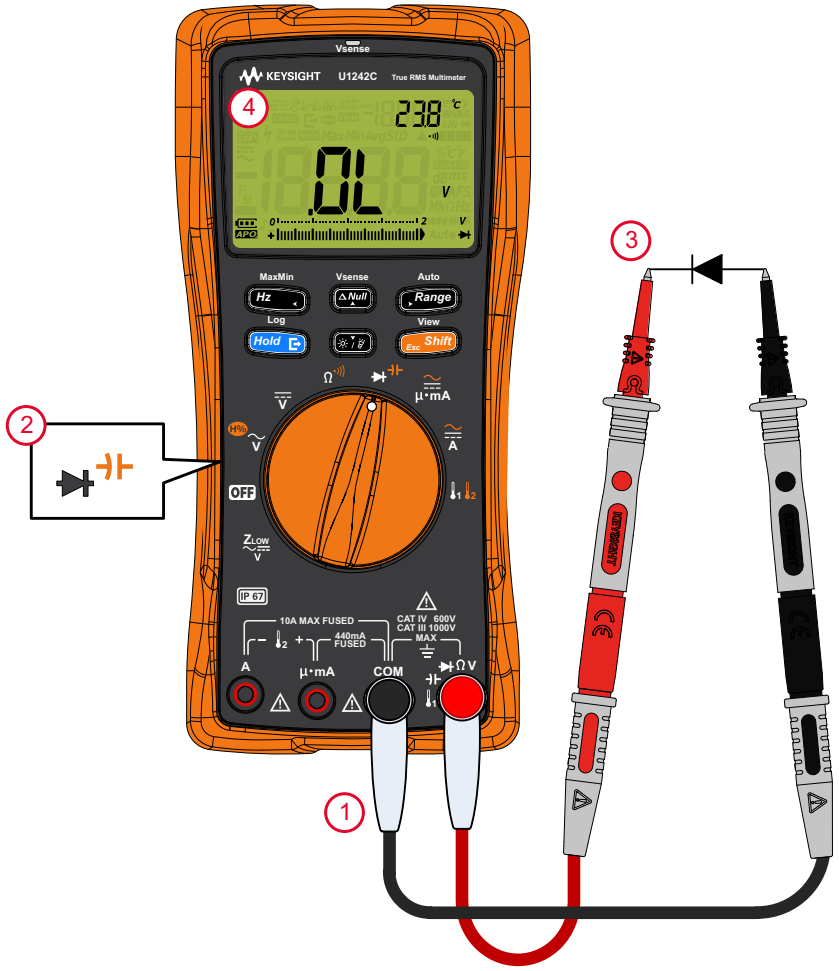

Figure 2-14 Testing a reverse bias diode

Measuring Capacitance

CAUTION To avoid possible damage to the multimeter 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.

Set up your multimeter to measure capacitance as shown in **Figure 2-16**. Probe the test points and read the display.

Table 2-10 Rotary switch position allowing capacitance measurements

Legend	Default function	Function when View Esc Shift is pressed
	Diode test (▶|)	Capacitance measurement (⊣⊢)

NOTE

- The multimeter measures capacitance by charging the capacitor with a known current for a known period of time, measuring the resulting voltage, and then calculating the capacitance.
- ⎍ is shown on the bottom left of the display when the capacitor is charging, and ⎎ is shown when the capacitor is discharging.

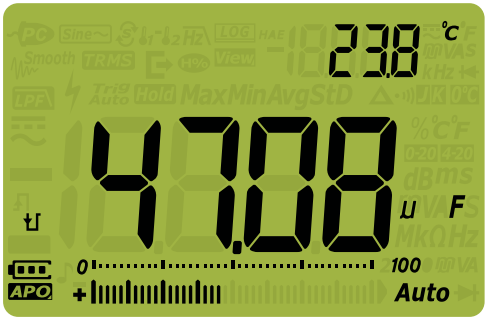

Figure 2-15 Capacitance display

NOTE

- To improve measurement accuracy of small value capacitors, press Vsense Null with the test leads open to subtract the residual capacitance of the multimeter and leads.
- For measuring capacitance values > 1000 µF, discharge the capacitor first, and then select a suitable range for measurement. This will speed up the measurement time and also ensure that the correct capacitance value is obtained.

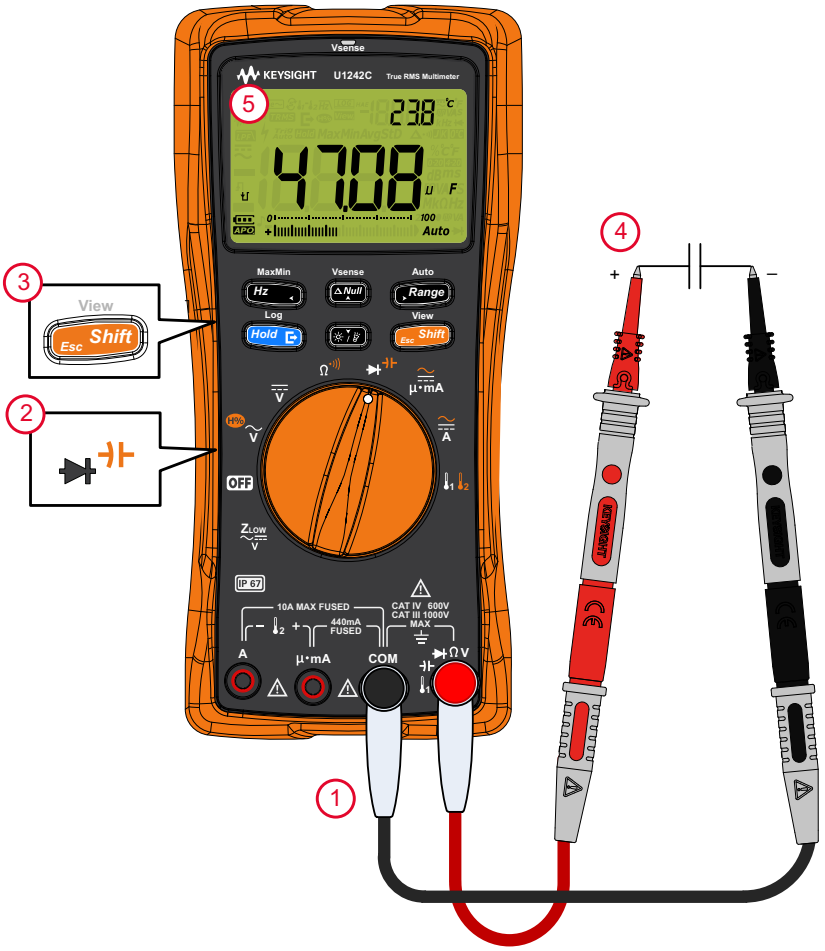

Figure 2-16 Measuring capacitance

Measuring Frequency

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

Your multimeter allows simultaneous monitoring of real-time voltage or current with frequency measurements. **Table 2-11** highlights the functions allowing frequency measurements in your multimeter.

Table 2-11 Rotary switch positions allowing frequency measurements

Legend	Default function	Function when View Esc Shift is pressed
	AC V (true rms)	Cycles between – AC V (averaging sense)[a] – Harmonic ratio[a] with AC V (averaging sense) – Harmonic ratio[a] with AC V (true rms), or – AC V (true rms)
	DC V	–
	DC A	Cycles between – AC A (true rms) – AC A (averaging sense)[a], or – DC A
	DC mA (or μA)	Cycles between – % scale of 4-20 mA (or 0-20 mA) with DC mA (or μA) – AC mA (or μA) (true rms) – AC mA (or μA) (averaging sense)[a], or – DC mA (or μA)

[a] U1242C only.

NOTE

- 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/Period. Period is defined as the time between the middle threshold crossings of two consecutive, like-polarity edges, as shown in **Figure 2-17**.
- The multimeter measures the frequency of a voltage or current signal by counting the number of times the signal crosses a threshold level within a specified period of time.

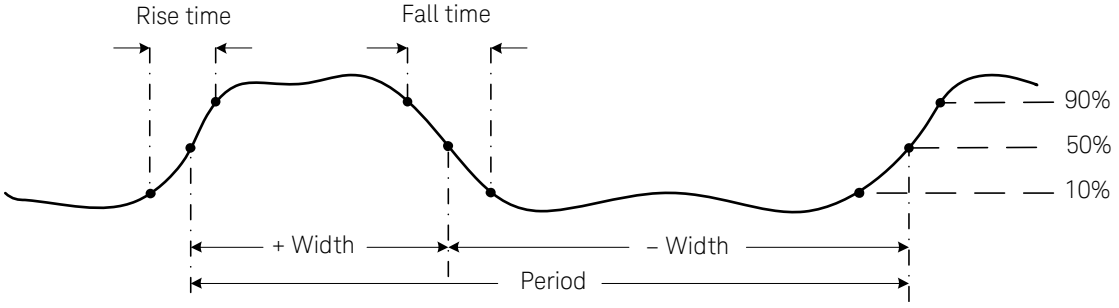

Figure 2-17 Frequency measurement

Pressing Auto Range controls the input range of the voltage or ampere and not the frequency range.

1 To measure frequency, rotate the switch to one of the primary functions allowing frequency measurements highlighted in **Table 2-11**.

NOTE

To obtain the best measuring results for frequency measurements, use the AC measuring path.

2 Probe the test points and press MaxMin Hz. Read the display.

Figure 2-18 Frequency display

The frequency of the input signal is shown in the primary display. The voltage or ampere value of the signal is shown in the secondary display. The bar graph does not indicate frequency but indicates the voltage or ampere value of the input signal.

Press MaxMin Hz to cycle through the low pass frequency filter function (see **page 78**), voltage/current measurements, and frequency measurements.

Using the low pass frequency filter function for frequency measurements

Your multimeter is equipped with a low pass frequency filter (Hz\) to help reduce unwanted noise when measuring frequency. When the filter is enabled, your multimeter continues measuring voltage/current via the selected averaging sense or true rms function, but now the signal diverts through a filter that blocks unwanted frequency of ~ 1 kHz. The filter with the averaging sense circuit can improve measurement performance on composite sine waves that are typically generated by inverters and variable frequency drives.

During frequency measurement, press MaxMin Hz to enable the low pass frequency filter.

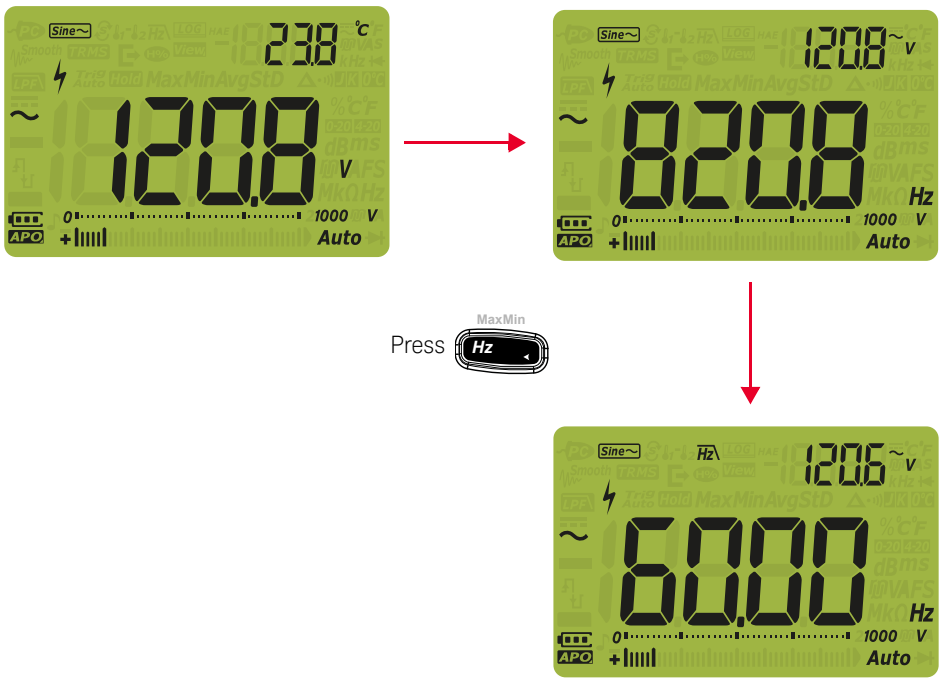

Figure 2-19 Low pass frequency filter function with averaging sense

Measuring Temperature

WARNING Do not connect the thermocouple to electrically live circuits. Doing so will potentially cause fire or electric shock.

CAUTION Do not bend the thermocouple leads at sharp angles. Repeated bending over a period of time can break the leads.

The multimeter uses a type-K (default setting) or a type-J (U1242C only) temperature probe for measuring temperature. To measure temperature 1 (T1), set up your multimeter as shown in **Figure 2-21**.

Table 2-12 Rotary switch position allowing temperature measurements

Legend	Default function	Function when View Esc Shift is pressed
	Temperature 1 (T1)	Cycles between – Temperature 2 (T2)[a] – T1–T2[a] – Scan[a], or – T1

[a] U1242C only.

Probe the test points and read the display. The primary display normally shows temperature or the message OL (open thermocouple). The open thermocouple message may be due to a broken (open) probe or because no probe is installed into the input terminals of the multimeter.

Figure 2-20 T1 temperature display

To measure temperature for T2 (U1242C only), connect the probe to the − T_2 + input terminal.

Press Auto Range for > 1 second to change the temperature units between °C or °F (you must first change the temperature unit to switch between °C and °F or °F and °C). Refer to "**Changing the temperature unit**" on page 128.

CAUTION The option to change the temperature unit is locked for certain regions. Always set the temperature unit display per the official requirements and in compliance with the National laws of your region.

NOTE

- Shorting the T_1 terminal to the **COM** terminal, or the **µ•mA** terminal to the **A** terminal will display the temperature T1 or T2 at the multimeter's terminals respectively.
- To change the default thermocouple type from type-K to type-J[a], see "**Changing the thermocouple type or setting the mV measurement**" on page 126.

[a] U1242C only.

NOTE

Temperature measurements via thermocouple sensors rely on cold junction compensation which reflects the ambient temperature. This ambient temperature is most important to ensure the accuracy of the thermocouple measurement. The multimeter must be placed in a stable operating environment for at least 1 hour to obtain a stable reference of the ambient temperature. The ambient temperature is shown on the secondary display for most measurements, which helps you to record the measurement reading and the ambient temperature as a controlled environment for checking a relative characteristic.

For applications with ambient temperature indication such as voltage reference, resistance temperature detector (RTD), thermistor, and poly-switch, the battery capacity or the measuring characteristic is referred on the operating temperature and additional temperature coefficients. Thus, the ambient temperature can only be used as a reference.

If you want to use a thermocouple other than the J or K type, you may use the DC 60 mV range with a 1 μV resolution and the ambient temperature in your application.

The bead-type thermocouple probe is suitable for measuring temperatures from –40 °C to 204 °C (399 °F) in PTFE-compatible environments. Above this temperature range, the probe may emit toxic gas. Do not immerse this thermocouple probe in any liquid. For best results, use a thermocouple probe designed for each specific application – an immersion probe for liquid or gel, and an air probe for air measurement.

Observe the following measurement techniques:

- Clean the surface to be measured and ensure that the probe is securely touching the surface. Remember to disable the applied power.
- When measuring above ambient temperatures, move the thermocouple along the surface until you get the highest temperature reading.
- When measuring below ambient temperatures, move the thermocouple along the surface until you get the lowest temperature reading.
- Place the multimeter in a stable operating environment for at least 1 hour to obtain a stable reference of the ambient temperature for cold junction compensation of thermocouple temperature measurements.
- Allow the multimeter to cool down after high current measurements.

NOTE For quick measurement, use the 0°C compensation to view the temperature variation of the thermocouple sensor. The 0°C compensation assists you in measuring relative temperature immediately.

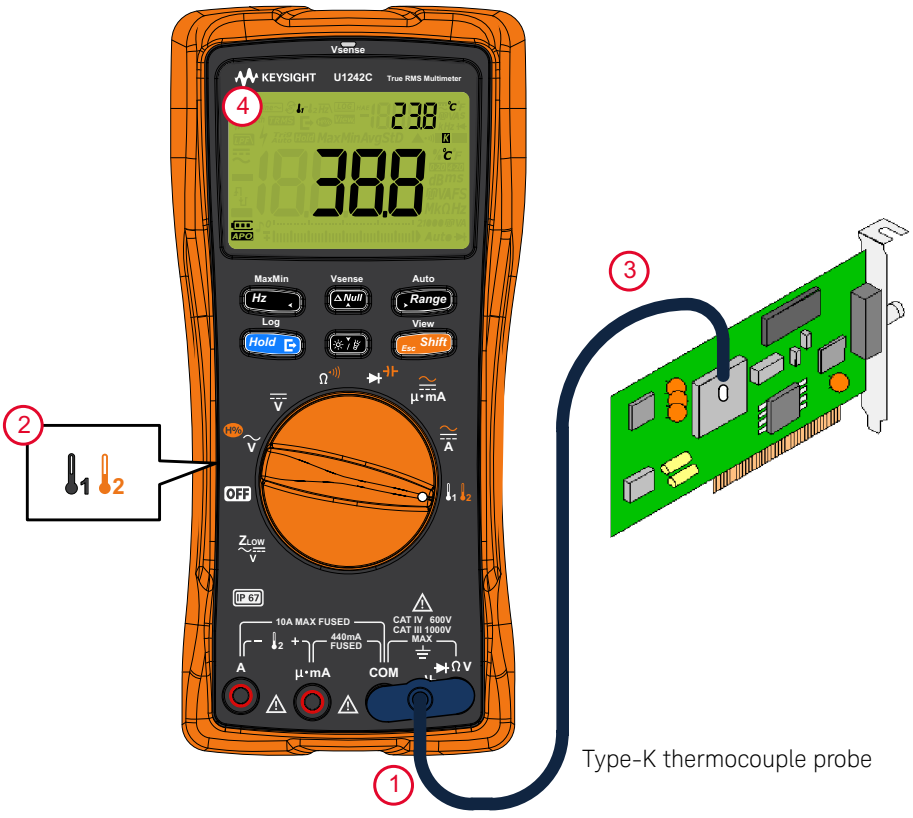

Figure 2-21 Measuring surface temperature (T1)

Temperature measurement without ambient compensation

If you are working in a constantly varying environment, where ambient temperatures are not constant, do the following:

1 Press Auto Range to select 0°C compensation. This allows a quick measurement of the relative temperature.

2 Avoid contact between the thermocouple probe and the surface to be measured.

3 After a constant reading is obtained, press Vsense Null to set the reading as the relative reference temperature.

4 Touch the surface to be measured with the thermocouple probe and read the display.

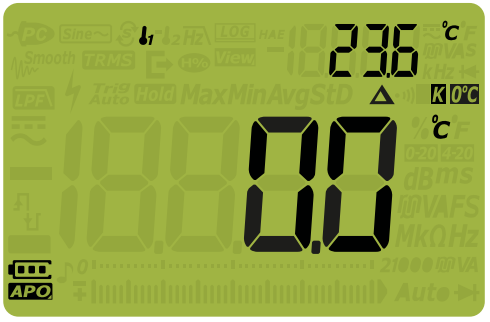

Figure 2-22 Temperature measurement without ambient compensation

Dual temperature measurement for refrigeration applications

You can perform T1 and T2 temperature measurements to measure the efficiency of a condensor for an air conditioning unit as follows:

1 Plug the adapter with thermocouple probe into the T_1 and **COM** terminals (T1) and the **µ•mA** and **A** terminals (T2) respectively.

2 Touch the condenser to be measured with the T1 thermocouple probe, and the air surrounding the condenser with the T2 thermocouple probe. Read the display.

Scanning temperature measurements (U1242C only)

This scanning temperature measurement function allows you to measure and display temperature T1, T2, and T1–T2 sequentially.

1 Press View Esc Shift to step to the Scan mode.

2 In the Scan mode, the multimeter will scan through and display the values of T1, T2, and T1–T2 periodically.

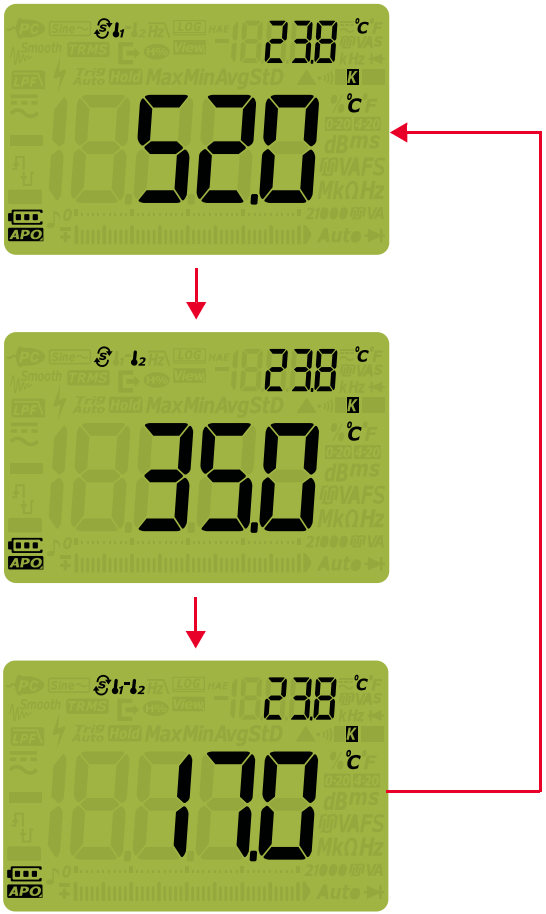

Figure 2-23 Scan mode for temperature measurements

Measuring AC or DC Current

WARNING Never attempt an in-circuit current measurement where the open-circuit potential to earth is greater than 1000 V. Doing so will cause damage to the multimeter and possible electric shock or personal injury.

CAUTION To avoid possible damage to the multimeter or to the equipment-under-test:

- Check the multimeter's fuses before measuring current.
- Use the proper terminals, function, and range for your measurement.
- Never place the probes across (in parallel with) any circuit or component when the leads are plugged into the current terminals.

Current can be measured at 440 mA continuously, and > 440 mA to 600 mA for 20 hours maximum. After measuring > 440 mA current, cool down the multimeter for twice the measuring time taken and use the Null function (see "**Making Relative Measurements (Null)**" on page 98) to zero the thermal effect before proceeding for low current measurement.

Current can be measured at 10 A continuously, and 10 A ~ 20 A for 30 seconds maximum. After measuring > 10 A current, cool down the multimeter for twice the measuring time taken before proceeding for low current measurement.

Set up your multimeter to measure AC or DC current as shown in **Figure 2-26** and **Figure 2-27**. Open the circuit path to be tested. Probe the test points and read the display.

Table 2-13 Rotary switch positions allowing current measurements

Legend	Default function	Function when View Esc Shift is pressed
≂ A	DC A	Cycles between – AC A (true rms) – AC A (averaging sense)[a], or – DC A
≂ µ•mA	DC mA (or µA)	Cycles between – % scale of 4-20 mA (or 0-20 mA) with DC mA (or µA) – AC mA (or µA) (true rms) – AC mA (or µA) (averaging sense)[a], or – DC mA (or µA)

[a] U1242C only.

NOTE

- To measure current, you must open the circuit-under-test, and then place the multimeter in series with the circuit.
- Turn off power to the circuit. Discharge all high-voltage capacitors. Insert the black test lead into the **COM** terminal. Insert the red test lead in an input appropriate for the measurement range.
  - If you are using the **A** terminal, set the rotary switch to ≂ A.
  - If you are using the **µ•mA** terminal, set the rotary switch to ≂ µ•mA for current < 440 mA, or ≂ A for current ≥ 440 mA.
- Press View Esc Shift to cycle through different current measurements as stated in **Table 2-13**.
- Reversing the leads will produce a negative reading, but it will not damage the multimeter.

Figure 2-24 DC current display

CAUTION

- To avoid blowing the multimeter's 440 mA fuse, use the μ•mA terminal only if you are sure the current is < 440 mA. See **Figure 2-27** for test lead connections and function selection. Refer to the **Alerts and warnings during measurement** section for information on the alerts the multimeter uses for hazardous current or when leads are not used correctly during current measurement.
- Placing the probes across (in parallel with) a powered circuit when a lead is plugged into a current terminal can damage the circuit you are testing and blow the multimeter's fuse. This happens because the resistance through the multimeter's current terminals are very low, resulting in a short circuit.

NOTE

Press MaxMin Hz to enable the frequency test mode for current measurements.

Refer to "**Measuring Frequency**" on page 75.

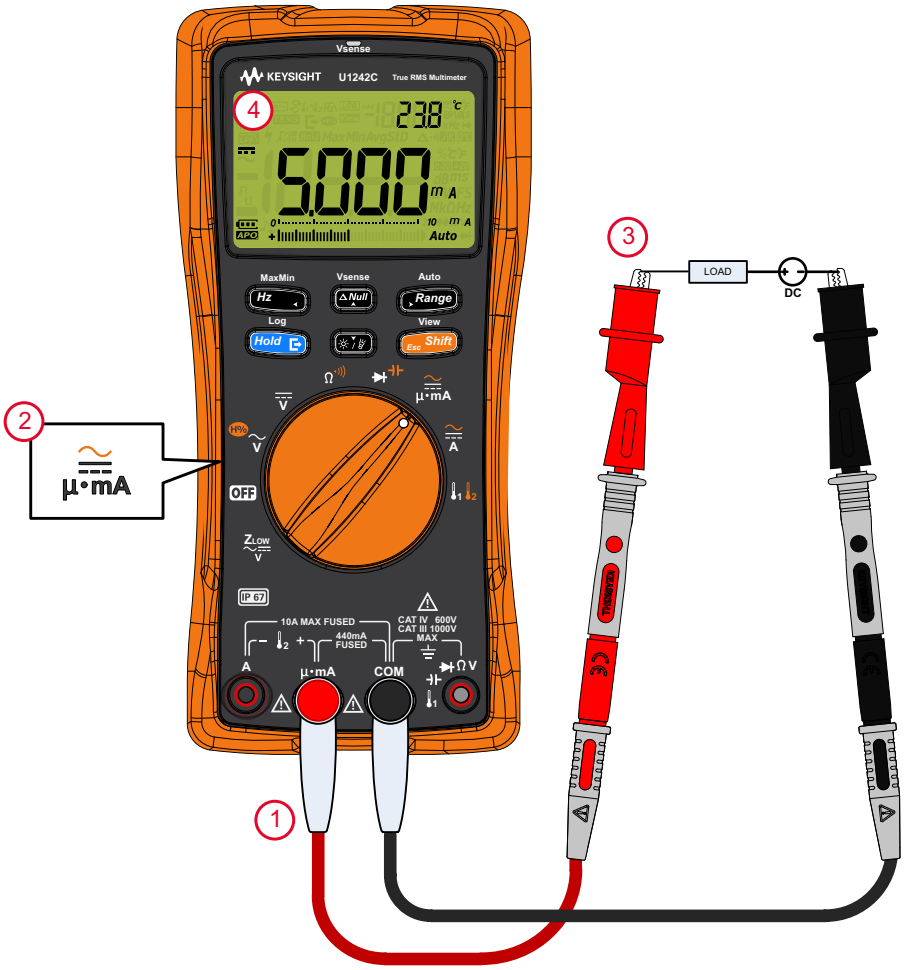

Figure 2-25 Measuring DC current

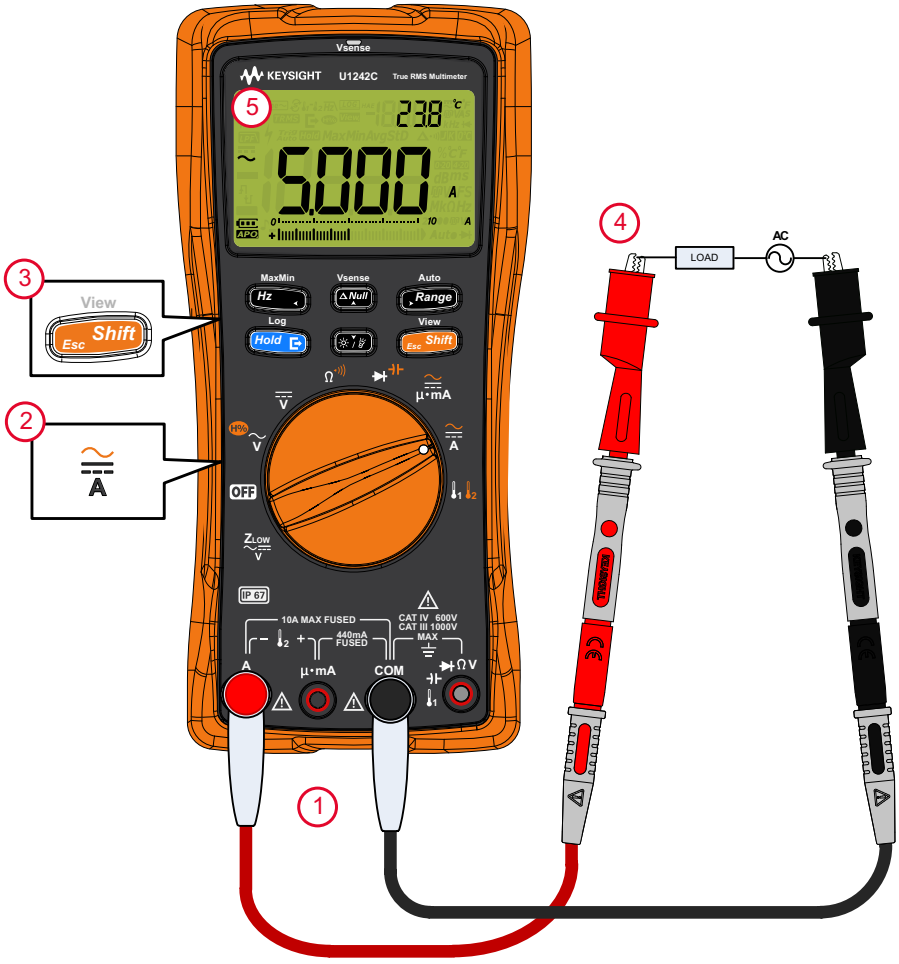

Figure 2-26 Measuring AC current

Figure 2-27 Current measurement setup

% Scale of 4-20 mA or 0-20 mA

To display the current measurement in % scale, position your multimeter's rotary switch to  and set up your multimeter to measure DC current by following the steps listed in "**Measuring AC or DC Current**" on page 85.

Table 2-14 Rotary switch positions allowing current measurements

Legend	Default function	Function when View Esc Shift is pressed
	DC mA (or μA)	Cycles between – % scale of 4-20 mA (or 0-20 mA) with DC mA (or μA) – AC mA (or μA) (true rms) – AC mA (or μA) (averaging sense)[a], or – DC mA (or μA)

[a] U1242C only.

NOTE

The 4-20 mA current loop output from a transmitter is a type of electrical signal that is used in a series circuit to provide a robust measurement signal that is proportional to the applied pressure, temperature, or flow in process control. The signal is a current loop where 4 mA represents the 0% signal and 20 mA represents the 100% signal.

The % scale for 4-20 mA or 0-20 mA in this multimeter is calculated using its corresponding DC mA measurement. The multimeter will automatically optimize the best resolution for the selected measurement. Two ranges are available for the % scale as shown in **Table 2-15**.

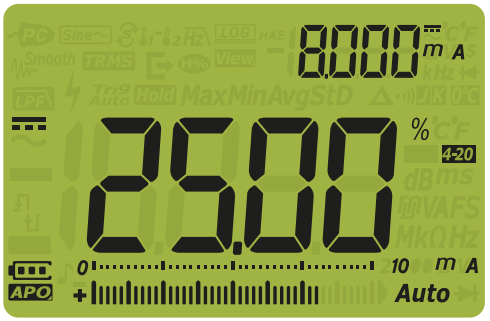

Figure 2-28 4-20 mA % scale display

The analog bar graph displays the current measurement value. (In the example above, 8 mA is represented as 25% in the 4-20 mA % scale.)

Table 2-15 % scale measurement range

% scale of 4-20 mA or 0-20 mA	DC mA measurement range
999.99%	~1000 mA[a]
9999.9%	

[a] Applies to both autoranging and manual range selection.

You can change the % scale range (4-20 mA or 0-20 mA) by accessing the multimeter's setup. Refer to "**Changing the % scale range**" on page 139.

Use the % scale with a pressure transmitter, a valve positioner, or other output actuators to measure pressure, temperature, flow, pH, or other process variables.

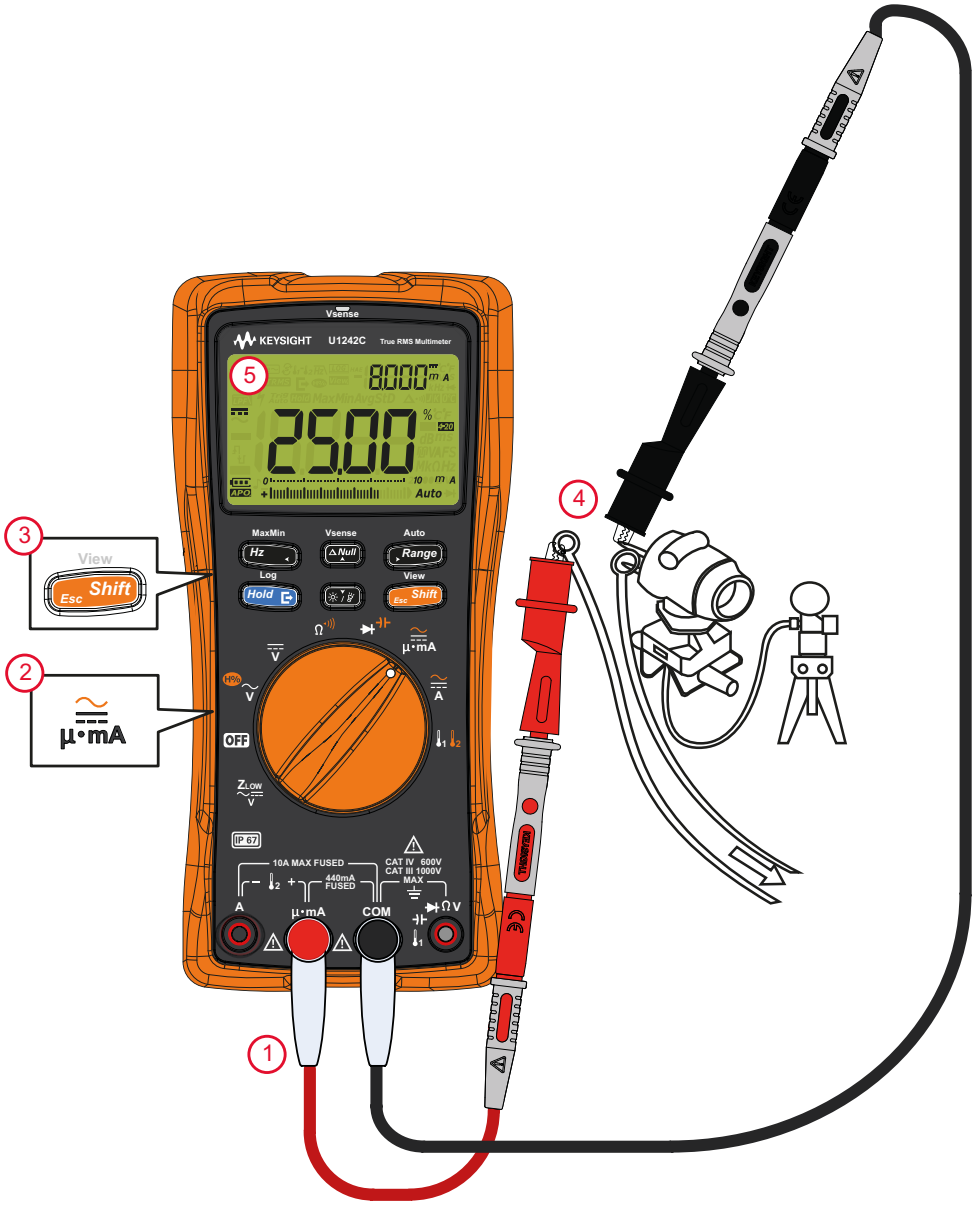

Figure 2-29 Measuring DC current using the 4-20 mA % scale

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3 Multimeter Features

Detecting AC Voltage Presence (Vsense) (U1242C only) 96
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The following sections describe the additional features available in your multimeter.

Detecting AC Voltage Presence (Vsense) (U1242C only)

The Vsense detector is a non-contact voltage detector that detects the presence of AC voltages nearby.

WARNING

- You are advised to test on a known live circuit within the rated AC voltage range of this multimeter before and after each use to ensure that the Vsense detector works.
- Voltage could still be present even if there is no Vsense alert indication. Do not rely on the Vsense detector with shielded wires. Never touch live voltage or conductor without the necessary insulation protection, or power off the voltage source.
- The Vsense detector may be affected by differences in socket design, insulation thickness, and insulation type.

CAUTION

You are advised to measure voltage by using test leads through the Z_{LOW}, AC V, or DC V function after using the Vsense function, even if there is no alert indication.

Press and hold Vsense △Null for > 1 second to enable or disable the Vsense function (on any position of the rotary switch except **OFF**).

NOTE

If the presence of AC voltage is sensed, the multimeter's beeper will sound, the red LED indicator will light up, and ϟ will be displayed. The audible and visual alerts allow you to easily sense nearby AC voltage presence.

No resolution and accuracy of voltage measurement will be displayed in this mode.

Press Auto Range to toggle the Vsense detector's sensitivity between HI SE (high sensitivity) or LoSE (low sensitivity).

Figure 3-1 High Vsense sensitivity display

Figure 3-2 Low Vsense sensitivity display

NOTE

- Place the top of the multimeter (with the Vsense indicator) close to a conductor when sensing for AC voltages (as low as 24 V in the Hi .5E setting).
- The low sensitivity setting can be used on flush mounted wall sockets or outlets and various power strips or cords.
- The high sensitivity setting allows for AC voltage sensing on other styles of recessed power connectors or sockets where the actual AC voltage is recessed within the connector itself.

Making Relative Measurements (Null)

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

One possible application is to increase the accuracy of a resistance measurement by nulling the test lead resistance. Nulling the leads is also particularly important prior to making capacitance measurements.

NOTE **Null can be set for both auto and manual range settings, but an overload reading cannot be stored as a null value.**

1 To activate the relative mode, press Vsense Δ Null. The measurement value at the time that when Null (Δ) is enabled, is stored as the reference value.

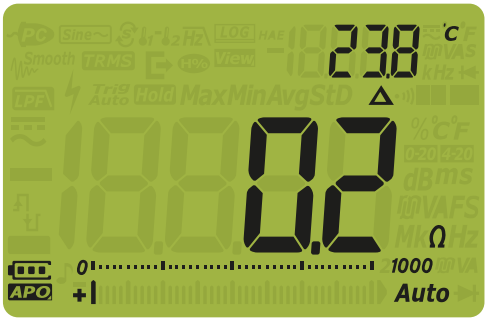


Figure 3-3 Null display

2 Press Vsense Δ Null again to view the stored reference value (Δ flashes). The display will return to normal after 3 seconds.

3 To disable the Null function, press Vsense Δ Null while the stored reference value is shown.

NOTE

- In resistance measurement, the multimeter will read a non-zero value even when the two test leads are in direct contact, because of the resistance of these leads. Use the null function 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 Vsense Δ Null when the displayed value is stable to zero-adjust the display.

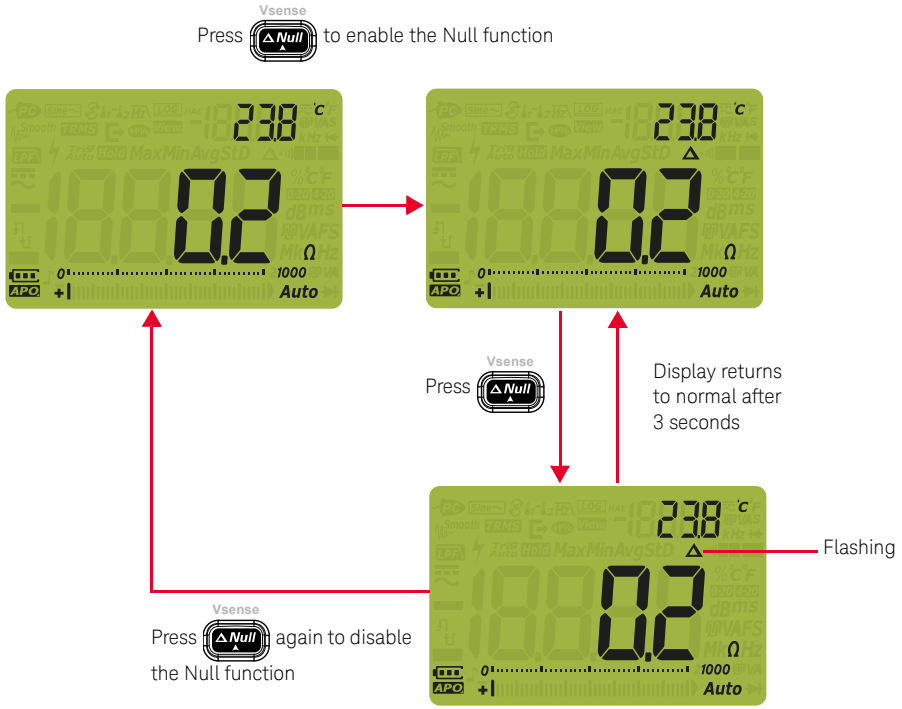


Figure 3-4 Null operation

Capturing Maximum and Minimum Values (MaxMin)

The MaxMin operation stores the maximum, minimum, and average input values during a series of measurements.

When the input goes below the recorded minimum value or above the recorded maximum value, the multimeter beeps and records the new value. The elapsed time since the recording session was started is stored and shown on the display at the same time. The multimeter also calculates an average of all readings taken since the MaxMin mode was activated.

From the multimeter's display, you can view the following statistical data for any set of readings:

- **Max**: highest reading since the MaxMin function was enabled
- **Min**: lowest reading since the MaxMin function was enabled
- **Avg**: average or mean of all readings since the MaxMin function was enabled
- **MaxMinAvg**: present reading (actual input signal value)

1 Press 

for > 1 second to enable the MaxMin operation.

Figure 3-5 MaxMin display

2 Press 

for > 1 second to exit the MaxMin operation.

3 Press 

again to cycle through the **Min**, **Avg**, **MaxMinAvg** (present), or **Max** input values.

4 The elapsed time is shown on the secondary display. Press 

to restart the recording session.

NOTE

- Changing the range manually will also restart the recording session.
- The multimeter beeps when a new maximum or minimum value is recorded.
- If an overload is recorded, the averaging function will be stopped. OL is shown in place of the average value.
- The auto power-off (APO) function is disabled when MaxMin is enabled.
- The maximum recording time is 19999 seconds (5 hours, 33 minutes, 19 seconds). OL is shown if the recording exceeds the maximum time.

This mode is useful for capturing intermittent readings, recording minimum and maximum readings unattended, or recording readings while equipment operation keeps you from observing the multimeter display.

The average value displayed is the true arithmetic mean of all readings taken since the start of recording. The average reading is useful for smoothing out unstable inputs, calculating power consumption, or estimating the percentage of time a circuit is active.

Freezing the Display (TrigHold and AutoHold)

TrigHold operation

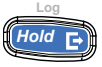
Press 

to freeze the display for any function only if:

- the **AH** (AutoHold) Setup menu entry is disabled (refer to "**Changing the variation count**" on page 119).
- the multimeter is not in the MaxMin or data logging recording modes.

To exit, press 

for > 1 second.

In the TrigHold mode, press 

to manually trigger the holding of the next measured value. The ***Trig*** icon flashes before the display is updated.

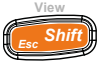
AutoHold operation

Press 

to activate the AutoHold mode only if:

- the **AH** (AutoHold) Setup menu entry is enabled (refer to "**Changing the variation count**" on page 119).
- the multimeter is not in the MaxMin or data logging recording modes.

To exit, press 

again or press 

for > 1 second.

The AutoHold operation monitors the input signal and updates the display and, if enabled, emits a beep, whenever a new stable measurement is detected. The ***Auto*** icon flashes before the display is updated. The AutoHold mode will be triggered when the input signal varies more than a selected adjustable (AutoHold threshold) variation count (default 50 counts).

To change the default AutoHold threshold count, refer to "**Changing the variation count**" on page 119.

The reading value will not be updated if the reading is below the following threshold counts:

- Voltage: 50 counts
- Resistance: OL or Open
- Capacitance: 50 counts

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

Recording Measurement Data (Data Logging)

The Data Logging function provides you 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 multimeter is turned OFF or if the battery is replaced.

The Data Logging feature collects measurement information over a user-specified duration. There are four data logging options that can be used to capture measurement data: manual (HAnd), interval (AUto), event (tri G), or export ( ).

- A manual log stores an instance of the measured signal each time 

is pressed for > 1 second. See **page 105**.
- An interval log stores a record of the measured signal at a user-specified interval. See **page 106**.
- An event log stores a record of the measured signal each time a trigger condition is satisfied. See **page 107**.
- An export log stores a record of the measured signal and exports it via the multimeter's optical communication port each time 

is pressed. See **page 109**.

Table 3-1 Data logging maximum capacity

Data logging option	Maximum capacity for saving
Export ( )	100
Manual (HAnd)	100
Interval (AUto)	2000
Event (tri G)	*Shares the same memory with Interval logging*

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

To change the data logging option, refer to "**Changing the recording option**" on page 124.

Performing manual logs (HAnd)

Ensure that HAnd is selected as the data logging option in the multimeter's Setup.

1 Press Log Hold for > 1 second to store the present input signal value.

LOG H and the log entry number are displayed at the top of the display. The display will return to normal after a short while (≈ 1 second).

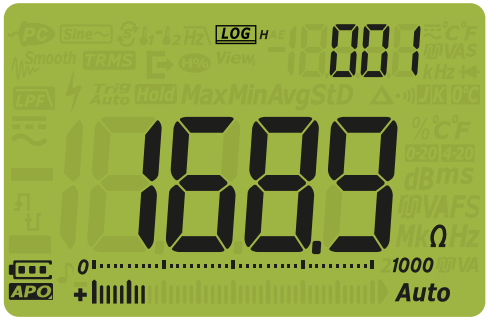


Figure 3-6 Manual log display

2 Repeat **step 1** 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, FULL will be shown when Log Hold is pressed for > 1 second.

See **Reviewing Previously Recorded Data (View)** to review or erase the recorded entries.

Performing interval logs (AUto)

Ensure that AUto is selected as the data logging option in the multimeter's setup.

The default recording interval duration is 1 second. To change the recording interval duration, refer to "**Changing the sample interval duration**" on page 125.

The duration set in the multimeter's 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 multimeter's memory.

Start the interval log mode

1 Press Log Hold for > 1 second to start the interval log mode.

LOG A and the log entry number are displayed at the top of the display. Subsequent readings are automatically recorded into the multimeter's memory at the interval specified in the Setup menu.

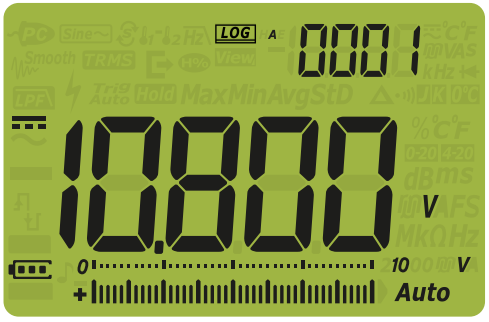


Figure 3-7 Interval log display

2 Press Log Hold for > 1 second to exit the interval log mode.

The maximum number of readings that can be stored for the interval log is 2000 entries. When all entries are occupied, FULL will be shown.

The interval and event log share the same memory buffer. Increased usage of the interval log entries will lead to the decrease of the maximum entries for the event log, and vice versa.

See **Reviewing Previously Recorded Data (View)** to review or erase the recorded entries.

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

Performing event logs (triG)

Ensure that tri G is selected as the data logging option in the multimeter's Setup.

Event logs are used only with the following modes:

- TrigHold and AutoHold (**page 102** and **page 102**)
- MaxMin recording (**page 100**)

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

Table 3-2 Event log trigger conditions

Mode	Trigger condition
	The input signal value is recorded:
TrigHold	Each time Log Hold is pressed for > 1 second.
AutoHold	When the input signal changes more than the variation count.
MaxMin	When a new maximum (or minimum) value is recorded. The average and present readings are not recorded in the Event log.

Start the event log mode

1 Select one of the modes stated in **Table 3-2**.

2 Press Log Hold for > 1 second to start the event log mode.

LOG E and the log entry number are displayed at the top of the display. The display will return to normal after a short while (≈ 1 second) but with LOG E being displayed. Press Log Hold to record subsequent readings into the multimeter's memory every time the trigger condition specified in **Table 3-2** is satisfied.

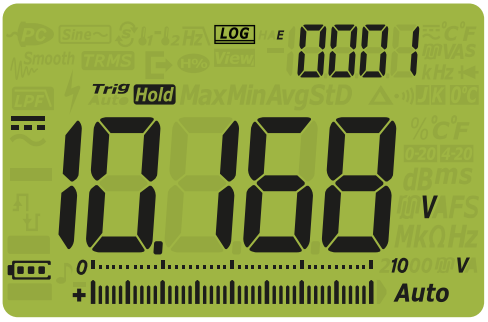


Figure 3-8 Event log display

3 Press Log Hold for > 1 second to exit the event log mode.

The maximum number of readings that can be stored for the event log is 2000 entries. When all entries are occupied, FULL will be shown when Log Hold is pressed.

The event and interval log share the same memory buffer. Increased usage of the event log entries will lead to the decrease of the maximum entries for the interval log, and vice versa.

See **Reviewing Previously Recorded Data (View)** to review or erase the recorded entries.

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

Performing export logs

1 Press Log Hold during measurement to store the present input signal value.

LOG, , and the log entry number are displayed at the top of the display, along with Trig Hold. The display will return to normal after a short while (≈ 1 second).

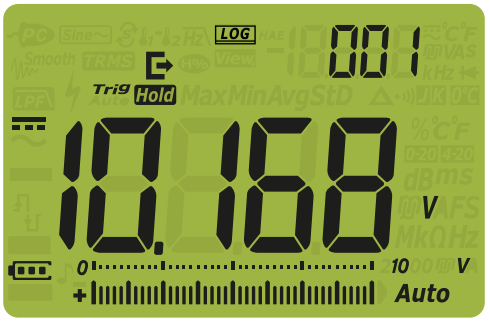


Figure 3-9 Export log display

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

The maximum number of readings that can be stored for the export log is 100 entries. When all entries are occupied, FULL will be shown when Log Hold is pressed.

See **Reviewing Previously Recorded Data (View)** to review or erase the recorded entries.

Reviewing Previously Recorded Data (View)

Viewing data stored in the multimeter's memory is performed through the View Esc Shift key. TrigHold or AutoHold must be disabled during this mode.

1 Press View Esc Shift for > 1 second to enter the multimeter's View mode. Press View Esc Shift again to cycle through the manual (**H**), interval (**A**), event (**E**), or export ( ) previously stored records.

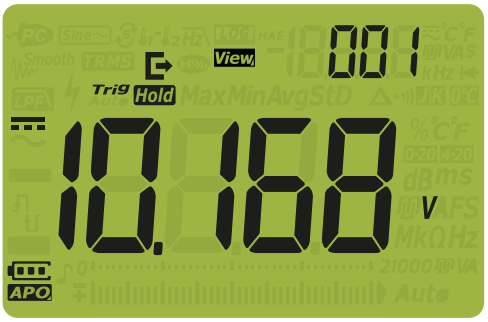


Figure 3-10 View display

If nothing has been recorded, the secondary display will show horizontal lines instead.

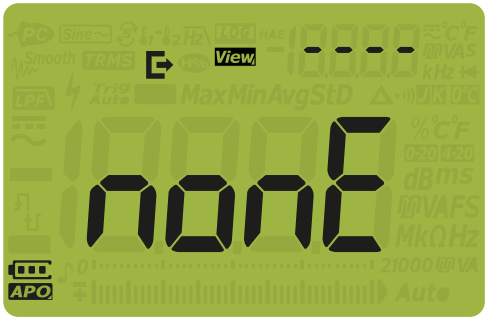
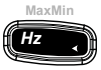


Figure 3-11 Empty view display

2 Select the desired recording category to view its entries.

i Press 

to jump to the first stored entry.

ii Press 

to jump to the last stored entry.

iii Press 

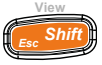
to view the next stored entry. The index number increases by one.

iv Press  to view the previous stored entry. The index number decreases by one.

v Press 

for > 1 second to clear all entries for the selected log type. Press 

to clear the last stored entry only.

3 Press 

for > 1 second to exit the View mode.

Sanitizing the log memories

You have the option to sanitize the log memories of your multimeter. This operation erases the log memories of your multimeter thoroughly. The data stored in the multimeter'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**), event (**E**), or export ( ) entries have been cleared (see **step v**). Then press 

for > 1 second to sanitize the log memories.

CAUTION **The data sanitization operation may take up to 1 - 2 minutes to complete. Do not press any keys, turn the rotary switch, or turn off the multimeter until the data sanitization operation is completed.**

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4 Multimeter Setup Options

Using the Setup Menu 114
Setup Menu Summary 116
Setup Menu Items 119

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

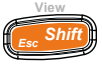
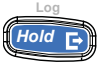
Using the Setup Menu

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

- 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.

To contents of the Setup menu are summarized in **Table 4-2**.

Table 4-1 Setup menu key functions

Legend	Description
	Press and hold  while turning the rotary switch (from OFF to on) to access the Setup menu. Press  for > 1 second to exit the Setup menu. While the menu item is flashing, press  to discard your changes.
	Press  or  to step through the menu items.
	Press  or  to edit the selected menu item. The menu item's value will flash to indicate that you can now change the value shown. Press  or  again to switch between two values, to cycle through multiple values from a list, or to decrease or increase a numerical value.
	While the menu item is flashing, press  to save your changes.

NOTE The Setup menu mode will automatically return to normal operation after 30 seconds if there is no activity.

Editing numerical values

When editing numerical values, use 

and 

to position the cursor on a numerical digit.

– Press 

to move the cursor to the left, and

– Press 

to move the cursor to the right.

When the cursor is positioned over a digit, use 

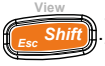
and 
to change the numerical digit.

– Press 

to increment the digit, and

– Press 
to decrement the digit.

When you have completed your changes, save the new numerical value by pressing 

. (Alternatively, if you wish to discard the changes you made, press 

.)

Setup Menu Summary

The Setup menu items are summarized in the table below.

Table 4-2 Setup menu item descriptions

Legend	Available settings	Description	Learn more on:
AH	001.d to 1999.d 001.E to 1999.E	Set the multimeter's AutoHold threshold count from 001 to 1999 (multiplied by 10). You can also disable this feature (d). Default is disabled (005.d).	page 119
tiME	001.d to 1999.d 001.E to 1999.E	Set the smooth time from 001 to 1999. You can also disable this feature (d). Default is disabled (009.d).	page 120
AoFF	01.d to 99.d minutes 01.E to 99.E minutes	Set the auto power off timer period from 1 to 99 minutes. You can also disable this feature (d). Default is 15 minutes (15.E).	page 121
bLit	01.d to 99.d seconds 01.E to 99.E seconds	Set the LCD and keypad backlight timeout period from 1 to 99 seconds. You can also disable this feature (d). Default is 15 seconds (15.E).	page 121
b-L	Lo, 02, 03, ME, 05, 06, and Hi	Set the LCD and keypad backlight brightness level of low (Lo), 2, 3, medium (ME), 5, 6, or high (Hi). Default is high (Hi).	page 123
tLit	01.d to 99.d seconds 01.E to 99.E seconds	Set the LCD flashlight timeout period from 1 to 99 seconds. You can also disable this feature (d). Default is 15 seconds (15.E).	page 121
t-L	Lo, 02, 03, ME, 05, 06, and Hi	Set the LCD flashlight brightness level of low (Lo), 2, 3, medium (ME), 5, 6, or high (Hi). Default is high (Hi).	page 123
tYPE	HAnd, AUto, or triG	Set the multimeter's data logging option (HAnd: manual log, AUto: interval log, or triG: event log). Default is manual log (HAnd).	page 124

Table 4-2 Setup menu item descriptions (continued)

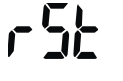
Legend	Available settings	Description	Learn more on:
	0001 to 19999 seconds	Set the logging duration for interval logs from 1 to 19999 seconds. Default is 1 second (0001).	**page 125**
	tYPE K, tYPE J[a], or tYPE mV	Set the multimeter's thermocouple type (type J or type K) or mV measurement for the T1 input. Default is tYPE K.	**page 126**
	°C/°F, °C, °F/°C, or °F	Set the multimeter's temperature unit (Celsius/Fahrenheit, Celsius, Fahrenheit/Celsius, or Fahrenheit). Default is °C (Celsius).	**page 128**
	4267 Hz, 4151 Hz, 4042 Hz, 3938 Hz, 3840 Hz, 3746 Hz, 3675 Hz, 3572 Hz, 3491 Hz, 3413 Hz, 3339 Hz, 3268 Hz, 3200 Hz, or oFF	Set the multimeter's beep frequency from 3200 Hz to 4267 Hz. You can also disable this feature (oFF). Default is 3840 Hz.	**page 129**
	bEEE, MELo, or oFF	Set the multimeter's startup sound to melody (MELo) or beep (bEEE). You can also disable this feature (oFF). Default is beep (bEEE).	**page 130**
	SHor, oPEn, or tonE	Set the multimeter's continuity type to short (SHor), open (oPEn), or tone (tonE). Default is short (SHor).	**page 131**
	bE.rL, bE.--, --.rL, or --.--	Set the multimeter's alert type to beeper (bE.--), flashing red LED (--.rL), both at once (bE.rL), or none (--.--). Default is both at once (bE.rL).	**page 132**
	Pri or SEC	Change the battery selection from primary (Pri) to secondary (SEC). Default is primary (Pri).	**page 133**
	YES or no	Reset the multimeter to its factory default settings. Default is (no).	**page 135**

Table 4-2 Setup menu item descriptions (continued)

Legend	Available settings	Description	Learn more on:
UPd	05 or 40	Set the multimeter's display refresh rate to 5 or 40 times/second. Default is 5 times/second.	**page 136**
inPUmV	10 MΩ or 1000 MΩ	Set the multimeter's input impedance for mV measurements to 10 MΩ or > 1000 MΩ. Default is 10 MΩ.	**page 137**
LPF	on or oFF	Enable the DC filter (LPF) for DC coupling of voltage measurements. Default is (oFF).	**page 138**
PErC	0-20 mA, 4-20 mA, or oFF	Set the multimeter's % scale selection (0-20 mA or 4-20 mA). You can also disable this feature (oFF). Default is 4-20 mA.	**page 139**

[a] U1242C only.

Setup Menu Items

Changing the variation count

This setting is used with the multimeter's AutoHold feature (see **page 102**). When the variation of the measured value exceeds the value of the variation count, the AutoHold feature will be ready to trigger. You can enable or disable variation count from the Setup menu.

The variation count is defined as the set value multiplied by 10, which means setting 001 to 1999 is equivalent to setting 10 to 19990 counts respectively.

Parameter	Range	Default setting
AH	(001.d to 1999.d) or (001.E to 1999.E)	005.d (disabled)

To change the variation count:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until AH is shown on the secondary display.

Figure 4-1 AH display

3 Press Vsense Null or and MaxMin Hz or Auto Range to set the variation count. To enable variation count, change the last digit shown from **d** (disabled) to **E** (enabled).

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter 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 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 multimeter 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 119). You can permanently enable or disable Smooth from the Setup menu.

Parameter	Range	Default setting
tiME	(001.d to 1999.d) or (001.E to 1999.E)	009.d (disabled)

To enable Smooth:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until tiME is shown on the secondary display and the Smooth icon appears to the left of the primary display.

Figure 4-2 tiME display - Smooth

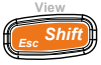
3 Press Vsense 

or  and MaxMin 

or Auto 

to set the Smooth refresh rate. To permanently enable Smooth, change the last digit shown from **d** (disabled) to **E** (enabled).

4 Press Log 

to save your changes or View 

to discard your changes.

5 Press and hold View 

until the multimeter restarts to return to normal operation.

Changing the auto power off (APO), backlight, and flashlight timeouts

The multimeter's automatic power off (see **page 26**), backlight (see **page 27**), and flashlight features use timers to determine when to turn off the backlight and flashlight, and when to automatically turn the multimeter off. You can enable or disable these features from the Setup menu.

Parameter	Range	Default setting
AoFF	(01.d to 99.d) or (01.E to 99.E) minutes	(15.E) - 15 minutes, enabled
bLit	(01.d to 99.d) or (01.E to 99.E) seconds	(15.E) - 15 seconds, enabled
tLit	(01.d to 99.d) or (01.E to 99.E) seconds	(15.E) - 15 seconds, enabled

To change the APO, backlight, or flashlight timeout period:

1 Press and hold View 

while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin 

or Auto 

until AoFF, bLit, or tLit is shown on the secondary display.

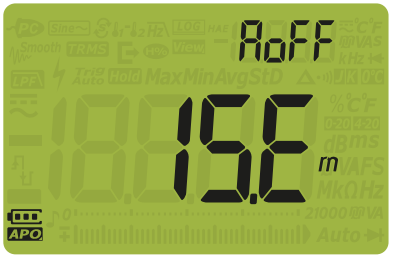


Figure 4-3 AoFF display

Figure 4-4 bLit display

Figure 4-5 tLit display

3 Press Vsense Null or  and MaxMin Hz or Auto Range to change the timeout period.
To disable the timeout feature, change the last digit shown from **E** (enabled) to **d** (disabled).

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Changing the backlight and flashlight brightness

You can manually control the brightness of the backlight and flashlight (the backlight and flashlight features must be enabled).

NOTE **If the Vsense detector is enabled, the brightness level for both the backlight and flashlight will always be set as Hi.**

Parameter	Range	Default setting
b-L or t-L	Lo, 02, 03, ME, 05, 06, and Hi	Hi

To change the backlight or flashlight brightness:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until b-L or t-L is shown on the secondary display.

Figure 4-6 b-L display

Figure 4-7 t-L display

3 Press Vsense Null or ☼ to change the brightness level.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Changing the recording option

The recording options are used with the multimeter's data logging feature (see **page 104**).

Parameter	Range	Default setting
tYPE	HAnd, AUto, or triG	HAnd

To change the recording option:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until tYPE is shown on the secondary display and the LOG icon appears to the left of the secondary display.

Figure 4-8 tYPE display - data logging

3 Press Vsense △Null or ☼ to set the recording option.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Changing the sample interval duration

This setting is used with the multimeter's interval data logging feature (see **page 106**). The multimeter will record a measurement value at the beginning of every sample interval.

Parameter	Range	Default setting
tiME	(0001 to 19999) seconds	(0001) - 1 second

To change the sample interval duration:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until ti nE is shown on the secondary display and the LOG icon appears to the left of the secondary display.

Figure 4-9 tiME display - data logging

3 Press Vsense Null or and MaxMin Hz or Auto Range to set the sample interval duration.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Changing the thermocouple type or setting the mV measurement

This setting is used with temperature measurements (see **page 79**) or for performing mV measurements (see **page 59**). Select a thermocouple type that matches the thermocouple sensor you are using for temperature measurements, or set the mV measurement function for the T1 input.

Parameter	Range	Default setting
CoUP	tYPE K, tYPE J[a], or tYPE mV	tYPE K

[a] U1242C only.

To change the thermocouple type or to set the mV measurement function:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until CoUP is shown on the secondary display.

Figure 4-10 CoUP display

3 Press Vsense △Null or ☼ to change the thermocouple type or to set the mV measurement function.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Changing the temperature unit

CAUTION This setup item is locked for certain regions. Always set the temperature unit display per the official requirements and in compliance with the National laws of your region.

Press Log Hold for > 1 second to unlock this setting.

This setting is used with temperature measurements (see **page 79**). Four combinations of displayed temperature unit(s) are available:

- Celsius only: Temperature measured in °C.
- Fahrenheit/Celsius: During temperature measurements, press Auto Range for > 1 second to switch between °F and °C.
- Celsius/Fahrenheit: During temperature measurements, press Auto Range for > 1 second to switch between °C and °F.
- Fahrenheit only: Temperature measured in °F.

Parameter	Range	Default setting
Unit	°C, °F/°C, °C/°F, or °F	°C

To change the temperature unit:

1. Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.
2. Press MaxMin Hz or Auto Range until Unit is shown on the secondary display.

NOTE Press Log Hold for > 1 second to unlock this setting.

Figure 4-11 Unit display

3 Press Vsense △Null or ☼ to change the temperature unit.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Changing the beep frequency

The multimeter's beeper alerts you to the presence of circuit continuities, operator errors such as incorrect lead connections for the selected function, and newly sensed values for MaxMin recordings.

Parameter	Range	Default setting
bEEP	4267 Hz, 4151 Hz, 4042 Hz, 3938 Hz, 3840 Hz, 3746 Hz, 3675 Hz, 3572 Hz, 3491 Hz, 3413 Hz, 3339 Hz, 3268 Hz, 3200 Hz, and "oFF" Hz	3840 Hz

To change the beep frequency:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until bEEP is shown on the secondary display.

Figure 4-12 bEEP display

3 Press Vsense Null or ☼/ to change the beep frequency. Select oFF to disable the beeper feature.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Changing the startup sound

During startup, the multimeter emits a sound and displays the model number and the installed fimware version. You may change the sound or disable it.

Parameter	Range	Default setting
SoUn	bEEE, MELo, or oFF	bEEE

To change the startup sound:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until SoUn is shown on the secondary display.

Figure 4-13 SoUn display

3 Press Vsense Null or ☼/ to set the startup sound type. Select oFF to disable the startup sound.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Changing the continuity type

This setting is used to indicate the circuit type at which the alert sounds. You may choose the alert type under "**Changing the continuity alert type**" on page 132.

Parameter	Range	Default setting
tYPE	SHor, oPEn, or tonE[a]	SHor

[a] tonE is not applicable for the auto diode mode.

To change the continuity type:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until tYPE is shown on the secondary display and the •)) icon appears below the secondary display.

Figure 4-14 tYPE display - continuity

3 Press Vsense Null or ☼/ to set the continuity type.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Changing the continuity alert type

This setting is used to define the continuity alert. You may choose among the beeper, the red LED, or both, or disable the alert.

Parameter	Range	Default setting
Horn	(bE.rL), (bE.--), (--.rL), or (--.--)	(bE.rL) - both beeper and red LED

To change the continuity alert type:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until Horn is shown on the secondary display and the •)) icon appears below the secondary display.

Figure 4-15 Horn display

3 Press Vsense Null or ☼ to set the continuity alert type. Select - - - - to disable the alert.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Changing the battery type

This setting is used to change the battery type. The battery capacity indication is based on this setting.

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

Parameter	Range	Default setting
bAt	Pri or SEC	Pri

To change the battery type:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until bAt is shown on the secondary display.

Figure 4-16 bAt display

3 Press Vsense Null or ☼/ to change the battery type.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Resetting the multimeter's setup options

The multimeter's setup options can be reset to its default values through the setup menu.

Parameter	Range	Default setting
rSt	YES or no	no

To reset the setup options:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until rSt is shown on the secondary display.

Figure 4-17 rSt display

3 Press Vsense Null or ☼ to select YES.

4 Press Log Hold to perform the reset or View Esc Shift to discard your changes. Reset will not affect the temperature unit option.

5 The multimeter will beep once and return to the first setup menu item (AH).

Setting the data refresh rate

This setting is used to set the multimeter's data refresh rate for voltage, current, resistance, and diode measurements.

NOTE

To perform high-speed measurements of voltage, current, resistance, and diode, set the data refresh rate to 40 times per second. This will produce more than double the measurement speed for these measurements.

CMRR and NMRR rejections are not applicable for this high-speed measurement mode. Under this specialized condition, this mode provides reduced accuracy results at 40 readings per second.

In applications where sample-to-sample levels vary widely, a longer settling time is required for each new reading.

Parameter	Range	Default setting
UPd	(05 or 40) times per second	(05) - 5 times per second

To change the refresh rate:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until UPd is shown on the secondary display.

Figure 4-18 UPd display

3 Press Vsense Null or to set the data refresh rate.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Setting the input impedance

This setting is used with mV measurements. You can manually set the impedance for a 10 MΩ or >1 GΩ reading.

Parameter	Range	Default setting
inPU mV	10 MΩ or 1000 MΩ	10 MΩ

To change the input impedance:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until inPU mV is shown on the secondary display.

Figure 4-19 inPU mV display

3 Press Vsense  or  to set the input impedance.

4 Press Log  to save your changes or View  to discard your changes.

5 Press and hold View  until the multimeter restarts to return to normal operation.

Enabling the DC path filter

This filter is used with DC voltage measurements. The AC signal will be attenuated to the lowest possible, increasing the NMRR for DC measurements. This will result in reduced AC noise.

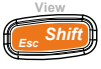
Parameter	Range	Default setting
LPF⎓	oFF or on	oFF

The filter is dependent on both frequency and range as shown below.

Table 4-3 Typical characteristics of the DC filter

Range	Typical attenuation			Example
	50 Hz	60 Hz	400 Hz	50 Hz
1000 mV	6.78	8.11	53.14	20.33 Vp / 6.78 = 2.99 Vp
10 V	1.21	1.30	5.53	36.37 Vp / 1.21 = 30.05 Vp
100 V	1.00	1.00	1.14	300 Vp / 1 = 300 Vp
1000 V	1.00	1.00	1.00	1500 Vp / 1 = 1500 Vp

To enable the DC path filter:

1 Press and hold View  while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin  or Auto  until  is shown on the secondary display.

Figure 4-20 LPF display - DC

3 Press Vsense Δ Null or ☼ to enable or disable the filter.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

Changing the % scale range

This setting is used with % scale current measurements (see **page 91**). The multimeter converts DC current measurements to a percentage scale readout of 0% to 100% based on the selected range in this menu. For example, a 25% readout represents a DC current of 8 mA on the 4-20 mA % scale, or a DC current of 5 mA on the 0-20 mA % scale.

Parameter	Range	Default setting
PErC	4-20 mA, 0-20 mA, or oFF	4-20 mA

To change the % scale range:

1 Press and hold View Esc Shift while turning the rotary switch (from OFF to on) to access the Setup menu.

2 Press MaxMin Hz or Auto Range until PErC is shown on the secondary display.

Figure 4-21 PErC display

3 Press Vsense Null or ☼ to change the % scale range. Select oFF to disable the % scale readout.

4 Press Log Hold to save your changes or View Esc Shift to discard your changes.

5 Press and hold View Esc Shift until the multimeter restarts to return to normal operation.

5 Characteristics and Specifications

For the characteristics and specifications of the U1241C/U1242C Handheld Digital Multimeter, refer to the datasheet at http://literature.cdn.keysight.com/litweb/pdf/5992-0848EN.pdf.

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