Agilent U1602A and U1604A Handheld Digital Oscilloscopes

Quick Start Guide

Agilent Technologies

Safety Information

Use the product only as specified by the manufacturer. Do not install substitute parts or perform any unauthorized modification to the product. Return the product to Agilent Technologies or a designated repair center for service to ensure that safety features are maintained.

The Agilent U1600A Series handheld digital oscilloscopes comply with the following standards.

- IEC 61010-1:2001 / EN61010-1:2001
- Canada: CSA C22.2 No. 61010-1:2004
- USA: UL 61010-1:2004

Safety Terms and Symbols

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.

CAUTION

A CAUTION notice denotes a hazard. It calls attention to 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.

Symbols


Earth Ground Terminal


Risk of electric shock


CAUTION
(refer to safety information in manual)


Equipotentiality

Direct and alternating current


Direct current


Double insulation


Caution, hot surface

CAT III Measurement Category III

Safety Information

WARNING

Prevention of fire or injury:

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

Maximum Input Voltages

- Input CH1 and CH2 direct (1:1 Probe) — 300 V CAT III
- Input CH1 and CH2 via 1:10 Probe — 600 V CAT III
- Input CH1 and CH2 via 1:100 Probe — 600 V CAT III
- Meter Input — 300 V CAT III, 600 V CAT II
- Scope Input — 300 V CAT III
- Voltage ratings are Vrms (50 Hz - 60 Hz) for AC sine wave and VDC for DC applications.

Maximum Floating Voltage

- From any terminal to ground — 300 Vrms CAT III (up to 400 Hz)

- Connect the scope probe or test leads to instrument before connecting to any active circuit for testing. Before disconnecting the active circuit from instrument, remove scope probe or test leads from active circuit.
- Do not connect the ground wire to voltages higher than 42 Vpeak (30 Vrms) from earth ground.
- Do not expose the circuit or operate the instrument without its cover or while power is being supplied.
- Do not use exposed metal BNC or banana plug connectors, use only the insulated voltage probes, test leads and adapters that come with the instrument.
- Do not supply any voltage when measuring resistance or capacitance in meter mode.
- Do not operate the instrument if it does not operate properly, have the instrument inspected by qualified service personnel.
- Do not operate the instrument in wet or damp environments.
- Do not operate the instrument in any environment in a risk of explosion.
- Maintain a clean and dry condition to the instrument's surface.

CAUTION

Prevention of electro-static discharge

- Electro-static discharge (ESD) can result in damage to the components in the instrument and accessories.
- Select a static-free working location when installing and removing sensitive components.
- Handle sensitive components to the minimum extent possible. Do not allow contacts between components and exposed connector pins.
- Transport and store in ESD preventive bag or container that protects sensitive components from static electricity.

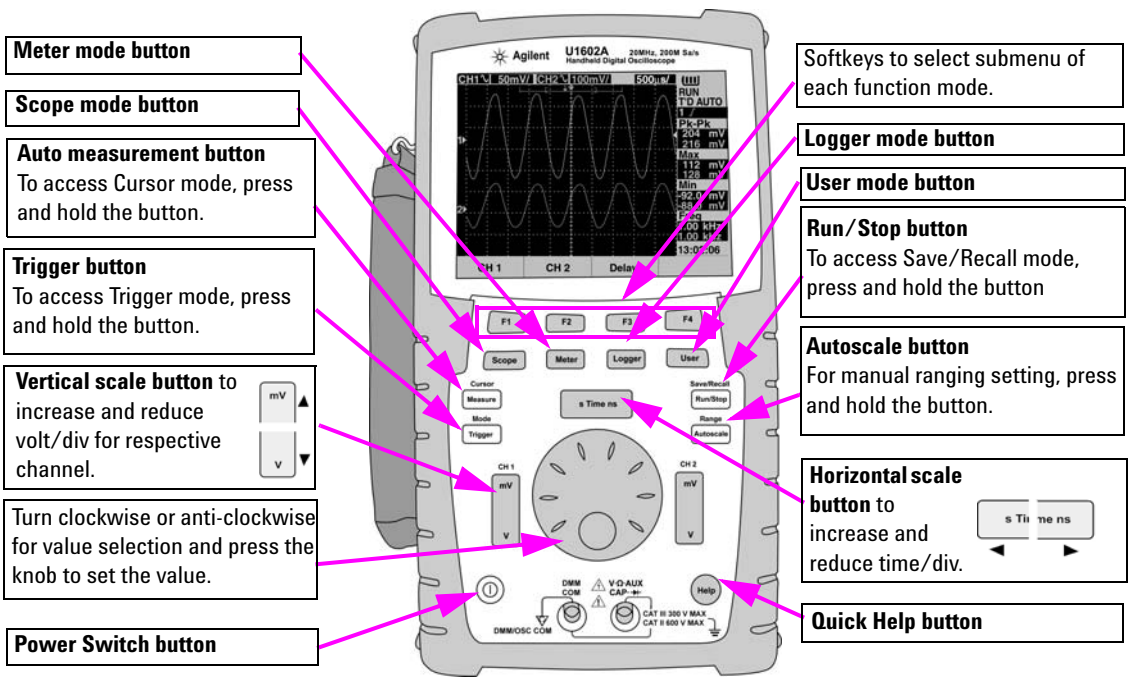
Table of Contents

A new rechargeable battery comes in a discharged condition and must be charged before use (refer to the U1602A and U1604A User's and Service Guide for charging instructions). Upon initial use (or after a prolonged storage period) the rechargeable battery may require three to four charge/discharge cycles before achieving maximum capacity. To discharge, simply run the oscilloscope using the

Introduction

This quick start guide provides the basic information, front panel functions and general specifications of Agilent U1600A Series handheld digital oscilloscopes. The U1600A Series can also function as a digital multimeter (DMM) and data logger. With its 4.5-inch LCD color display, it is capable of clearly distinguishing waveforms from two channels. The U1600A Series handheld digital oscilloscopes are high performance troubleshooting tools in multi-industrial automation, process control, facility maintenance and automotive-service industries. The U1600A Series comprises two models: U1602A and U1604A, with 20 MHz and 40 MHz bandwidths, respectively. Both models are dual-channel scopes with real-time sampling rate of up to 200 MSa/s. Users can use the Dual Waveform Math (DWM) and Fast Fourier Transform (FFT) functions (in U1604A) to perform a quick waveform analysis in both time and frequency domain. The U1600A Series with built-in 6000-count resolution and true RMS comes with an auto range function that allows users to perform quick and accurate DMM measurements. Additionally, with data logger function, users can perform automatic data logging for all DMM measurements.

The Front Panel at a Glance



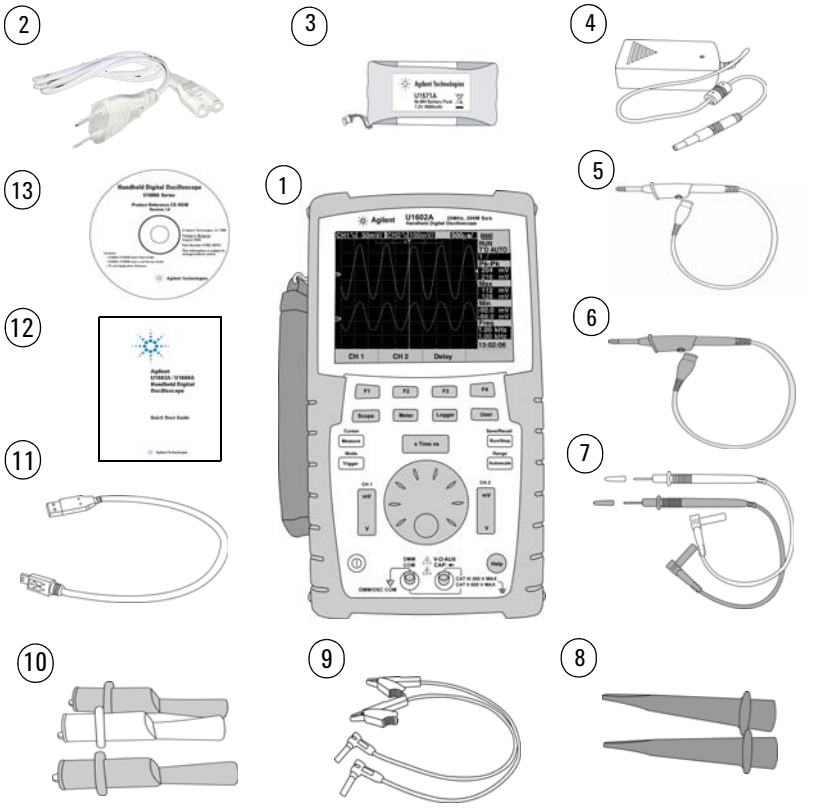
Getting Started

To Inspect Package Contents

Inspect and verify the following items for the standard purchase of U1602A or U1604A, and any optional accessories you may have

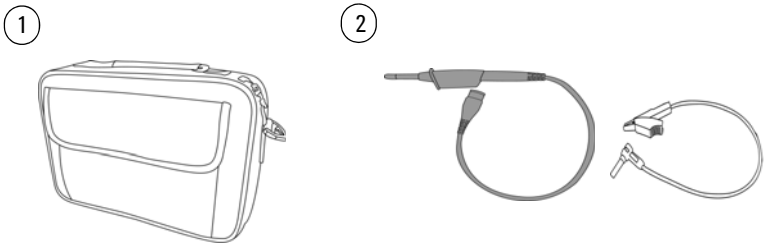
Standard Item and Accessories

1. Handheld digital oscilloscope
2. Power cable
3. Ni-MH battery pack, 7.2 V
4. AC adapter
5. Scope probe (1:1) CAT III 300 V
6. Scope probe (10:1) CAT III 600 V
7. DMM test lead
8. Hook Clip
9. Ground alligator clip
10. Medium jaw alligator clip
11. USB cable
12. Quick Start Guide
13. Product Reference CD-ROM



Optional Accessories

1. Soft casing
2. Scope probe (100:1) CAT III 600 V with ground alligator clip



To Charge a Battery

Upon delivery of the unit, the rechargeable battery is required to be fully charged for approximately 25 hours with the designated Agilent AC adapter. Ensure that you have the correct line power cord. The AC adapter converts input line voltages ranging from 100 VAC to 240 VAC to output voltage 12 VDC.

Input: 100 V – 240 VAC
Output: 12 VDC, 2 A,
50/60 Hz

To Power On the Handheld Scope

⏻	To turn on or off the scope, press and hold the power switch button for three seconds. A basic self-test shall be executed automatically upon power up. The scope will be loaded with the last configuration setup of the scope.

To Reset to Factory Default Setting

To recall the factor default settings:

Save/Recall Run/Stop	Open Save/Recall menu by pressing and holding the button
F1	Open Save/Recall Setup menu
F4	Select MORE 1/4 page menu
F1	Restore factory default settings
F1	Enter for "Restore OK?"

To Perform Self-Calibration

To ensure the scope is operating properly, perform the self-calibration. Before proceeding to the next step, ensure the scope passes self-calibration.

User	Open User menu
F4	Open Utility menu
F4	Select MORE 3/4 page menu
F1	Self-calibration start

⚠ Disconnect all probe and meter connections to the input terminal before starting self-calibration.

To Set Time and Date

User	Open User menu
F4	Open Utility menu
F4	Select MORE 2/4 page menu
F1	Select time format in MM/DD/YY or YY/MM/DD
F2	Select time set for Year, Month, Day, Hour, Minute or Second
◎	Turn rotary switch to set the time display

To Set Auto Power Off

User	Open User menu
F4	Open Utility menu
F4	Select MORE 1/4 page menu
F1	Select preference time (5 min/10 min/ 30 min/ 1 hr/ 2 hrs/ 4 hrs) or turn off the auto power off function

To Select Language for Quick Help

User	Open User menu
F4	Open Utility menu
F4	Select MORE 1/4 page menu
F2	Select language (English/French/Italian/ Portuguese/German/Spanish/Korean/ Japanese/Traditional Chinese/Simplified Chinese)

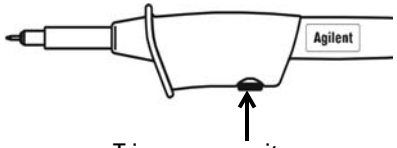
To Adjust Contrast of Display

User	Open User menu
F1	Open Display menu
F4	Select MORE 1/2 page menu
F2	Enter once to release the fixed contrast value
	Turn rotary switch clockwise to reduce brightness (contrast value shows increment from 20 to 79) and vice versa
F2	Enter once to fix the contrast value

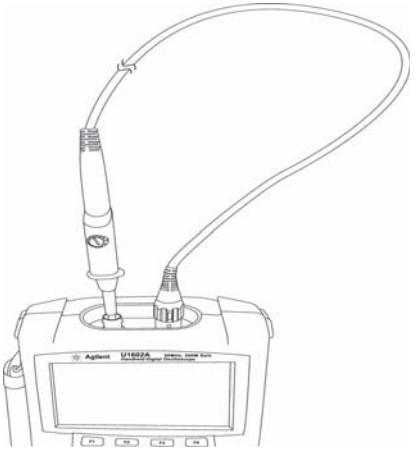
To Compensate Scope Probe

To compensate the probe characteristic to the scope's channel, perform probe adjustment. This step must be performed whenever a passive probe is first attached to the input channel. Connect the passive probe to channel 2 and probe contact to channel 1 to obtain input signal 3 Vp-p with 1 kHz.

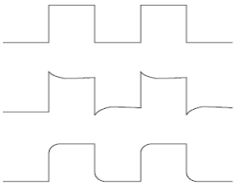
User	Open User menu
F4	Open Utility menu
F4	Select MORE 3/4 page menu
F2	Enter probe calibration
F1	Select probe attenuation
F4	Enter to start probe adjustment



Trimmer capacitor



Ensure the shape of the displayed pulse is properly compensated. If not, adjust the trimmer capacitor to obtain the flattest square wave possible.



Proper compensated

Over compensated

Under compensated

Scope Screen Display

Agilent U1600A Series offers a 320×240 color LCD display.

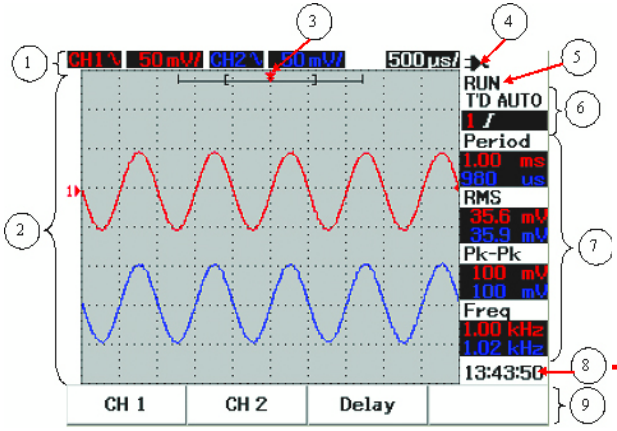


Figure 1 Oscilloscope display

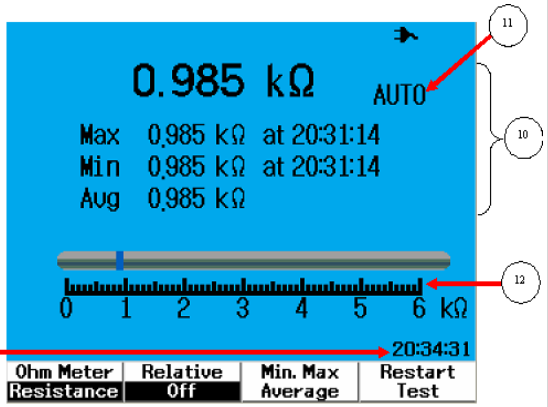


Figure 2 Multimeter display

Table 1 Descriptions of the handheld digital oscilloscope main display

No.	Description / Function
1	To display the status of channel 1 and channel 2 in volt/div and time/div
2	To display input waveform from channel 1 and channel 2
3	To trigger position in window
4	To show the battery level and to indicate battery charging when connected to AC line power
5	To display signal acquisition status
6	To display signal triggering mode and the status of the triggering
7	To display resulting auto measurement values
8	To display time
9	To display menu of the functions by pressing the respective buttons and softkeys
10	To display numeric measurement value in meter mode
11	To indicate the meter is in auto ranging mode
12	To display analogue bar graph for measurement value

Scope

Scope Connection Configuration

Connect the scope in either single or dual channels with scope probes as shown in figure 3.

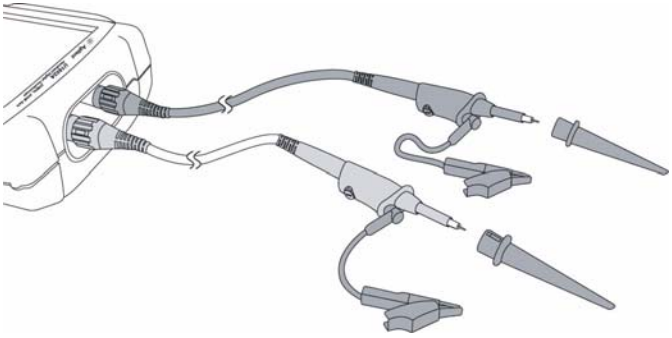


Figure 3 Connection for scope measurement

Table 2 Function descriptions of scope menu

Scope Menu	Sub Menu	Description
CH1 / CH2 MORE 1/2 page	**On/Off**	To turn on or off waveform display for channel 1 and channel 2
	Coupling	To select channel coupling: DC: To display both AC and DC component of the input waveform AC: DC offset voltage will be removed from the input waveform, only AC component will be shown GND: Input signal is grounded
	Position	To adjust the reference ground position, turn rotary switch clockwise to raise to positive position and vice versa To set the position, press rotary switch
CH1 / CH2 MORE 2/2 page	**Probe**	Select the probe attenuation 1X, 10X or 100X
	Invert	To turn on or off waveform invert function
	Position to 0	Reset the reference ground position to zero volt

Meter

Meter Connection Configuration

The U1600A Series offers high precision, rugged auto ranging in true RMS with analog bar graph display. Enter Meter mode to select Volt Meter, Ohm Meter or Auxiliary Meter. Refer to Figure 4 for meter measurement connection.

Figure 4 Connection for meter measurement

NOTE

Auto ranging is set as the default mode for all voltage and resistance measurements. To vary measurement range manually, press Autoscale button to enable manual ranging and select the preference range by pressing the same button. To enable the auto range function, press and hold the same button until beeper emitted.

Table 3 Measurement functions of each meter

Meter Menu	Sub Menu	Relative	Min, Max, Average	Restart Test
Volt Meter	DC	√	√	√
	AC+DC	√	√	√
	AC	√	√	√
Ohm Meter	Resistance	√	√	√
	Diode Test			
	Continuity		√	√
	Capacitance	√		
Aux Meter	Temperature Meter (^{o}C/^{o}F)	√	√	√
	Ampere Meter (AC/DC)	√	√	√
	Humidity Meter (%RH)	√	√	√
	Pressure Meter (psi/kPa)	√	√	√

Cursor

Measure

Cursor Measurement

Use cursor function to obtain a precise and accurate measurement in voltage and time at any desired point of a waveform. To enter cursor mode, press and hold the Measure button. To navigate cursor in a waveform, use rotary switch to move the horizontal or vertical cursor and press rotary switch to set the cursor position.

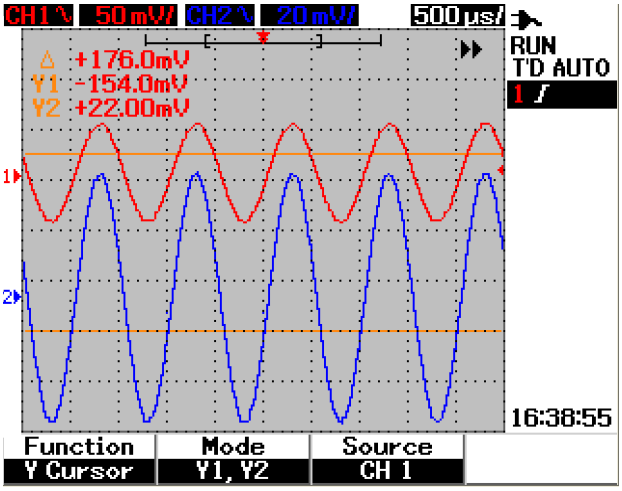


Figure 5 Y cursor measurement

Cursor measurement display

- The delta (symbol) indicates the difference between X1 and X2 or between Y1 and Y2 cursors
- For X cursor, the X cursors display the values (volts or amperes) and time relative to the cursors trigger point for the selected waveform source
- For Y cursor, the Y cursors display the values (volts or amperes) for the selected waveform source

Table 4 Function descriptions of cursor menu

Cursor Menu	Sub Menu	Description
Cursor	**Function**	To turn off or select cursor measurement type: X cursor: To measure any point at time base (cursor is parallel to the vertical axis) Y cursor: To measure any point at voltage level (cursor is parallel to the horizontal axis)
	Mode	To select X1, X2 or X1+X2 cursor for X cursor function To select Y1, Y2 or Y1+Y2 cursor for Y cursor function
	Source	To select channel 1, channel 2 or Math for cursor measurement

Save/Recall

Run/Stop

Save/Recall Setup and Waveform

To enter Save/Recall mode, press and hold the Run/Stop button. This function allows you to save up to 10 waveforms and configuration settings into the unit's internal memory or an external USB flash memory device (optional).

Table 5 Function descriptions of save and recall menu with and without USB flash memory connected

Scenario	Sub Menu	Description
USB flash memory not connected	**Save/Load Setup**	Save or recall configuration setting
	Save/Load Waveform	Save or recall waveform
	Erase Setup	Delete stored configuration setting
	Erase Waveform	Delete stored waveform
USB flash memory connected	**Save**	Save waveform or configuration setting
	Recall	Download waveform or configuration setting from USB memory device
	Erase	Delete saved file
	Clear Waveform	Delete the recalled waveform and configuration setting display on screen

Trigger

Signal Triggering

This signal triggering function aims to obtain a stable and representative signal display from an unstable signal. This function triggers the scope when to start acquiring data and display a waveform based on the selected trigger type. To enter trigger menu, press Trigger button.

Table 6 Function descriptions of trigger menu

Trigger Menu	Sub Menu		Description
Edge Trigger	**More 1/2 page**	**Source**	To select channel source 1 or 2 for triggering
		Slope	To select rising and falling slope
	More 2/2 page	**Coupling**	To select input coupling to DC, AC, HF-Rej (High Frequency Reject), LF-Rej (Low Frequency Reject) or Noise-Rej (Noise Reject)
		Level	To set trigger level for Manual, TTL, ECL or Set to 50%. For manual adjustment, change the rigger level by turning rotary switch

Trigger Menu	Sub Menu		Description
Pattern Trigger	**More 1/3 page**	**Input 1 Logic**	To select input logic 1 as CH1 High or Low and CH2 High or Low
		Input 1 Level	To set trigger level for Manual, TTL, ECL or Set to 50%. For manual adjustment, change the rigger level by turning rotary switch
	More 2/3 page	**Input 2 Logic**	To select input logic 2 as CH1 High or Low and CH2 High or Low
		Input 2 Level	To set trigger level for Manual, TTL, ECL or Set to 50%. For manual adjustment, change the trigger level by turning rotary switch
	More 3/3 page	**Gate**	To set logic gate AND, OR, NAND or NOR
		Condition	To select trigger condition to Shorter, Longer, Between or Non-Between of a set value. To set the trigger value, turn and press the rotary switch
Pulse Trigger	**More 1/2 page**	**Source**	To select channel source 1 or 2 for triggering
		Level	To set trigger level for Manual, TTL, ECL or Set to 50%. For manual adjustment, change the trigger level by turning rotary switch
	More 2/2 page	**Polarity**	To set positive or negative polarity
		Condition	To select trigger condition to Shorter, Longer, Between or Non-Between of a set value. To set the trigger value, turn and press the rotary switch
Video Trigger	**More 1/2 page**	**Standard**	To select video signal type: 625/PAL, SECAM or 525/NTSC
		Source	To select channel source 1 or 2 for triggering
	More 2/2 page	**Even/Odd**	To select trigger for odd or even field of the video signal
		Line	To set the number of lines for the signal display

Automatic Measurements

Measure

The following automatic measurements can be accessed by pressing the Measure button. Up to four measurement menus with 22 measurement options can be selected by turning rotary switch. You can activate the individual softkey and press the rotary switch to set the measurement type.

Table 7 List of automatic measurement options

Time Measurements	Voltage Measurements	Phase and Delay	Preshoot and Overshoot
• +Duty • –Duty • Frequency • Period • Rise Time • Fall Time • +Width • –Width	• Mean • Cycle Mean • Amplitude • Base • Maximum • Minimum • Peak-to-Peak • RMS • Top	• Phase • Delay	• Preshoot • +Overshoot • –Overshoot

Data Logger

Logger

The data logger acts as a recorder to log and plot input signal trend. This function is applicable to voltmeter, ohmmeter and auxiliary meter measurements. Refer to Table 3 for measurement functions of each meter.

Quick Help

Help

The U1600A Series includes built-in Quick Help support. To view the quick help for each function or subfunction, press the Help button. You can turn the rotary switch clockwise to go to the next page. Press the Help button again to exit the Quick Help. Quick Help in other languages are available in the accompanying product reference CD and need to be installed prior to usage. To view the installed Quick Help language, enter Utility mode in the User menu and press F2 on page 1/4 for language selection.

Refer to U1602A and U1604A User's and Service Guide for more detailed information of the product. All product documentation and software are included in the product reference CD-ROM.

Charging the Battery

A new rechargeable battery comes in a discharged condition and must be charged before use (refer to the *U1602A and U1604A User's and Service Guide* for charging instructions). Upon initial use (or after a prolonged storage period) the rechargeable battery may require three to four charge/discharge cycles before achieving maximum capacity. To discharge, simply run the oscilloscope using the rechargeable battery's power until it shuts down or until the low battery warning appears.

Performance Characteristics

Performance Characteristic	U1602A	U1604A
Bandwidth	20 MHz	40 MHz
Maximum Real Time Sample Rate	200 MSa/s	
Channels	2	
Memory depth	125 kbytes per channel	
Display	4.5" color LCD	
Vertical resolution	8 bits	
Vertical sensitivity	5 mV/div to 100 V/div (1:1 scope probe) 50 mV/div to 1 kV/div (10:1 scope probe) 500 mV/div to 10 kV/div (100:1 scope probe)	
Vertical zoom	Vertical expand	
Time base range	50 ns/div to 50 s/div	10 ns/div to 50 s/div
Input coupling	DC,AC, Ground	
True RMS Multimeter	6000 resolution counts for multimeter functions: • **Volt Meter:** VDC, VAC and VDC+VAC measurement • **Ohm meter**: Resistance, Diode Test, Continuity and Capacitance measurement • **Auxiliary meter**: Temperature, Ampere, Humidity and Pressure measurement	
FFT	Not Available	Rectangular, Hanning, Hamming, Black-Harris
Dual Waveform Math	CH1+CH2, CH1-CH2, CH2-CH1	
Acquisition modes	Normal, Average, Peak	
Trigger modes	Edge, Pulse, Pattern, Video	

Performance Characteristics

Data Logger	Automatic vertical scaling and time compression with maximum of 250 points record size. Data logging for voltage, ohm and auxiliary measurement in maximum, minimum and average data points.
I/O Interface to PC	USB 2.0 full speed

General Characteristics

Physical size	13.8 cm width × 24.1 cm height × 6.6 cm depth
Weight	1.5 kg
Battery Type	Agilent U1571A, Ni-MH battery pack, 7.2 V
Electrical Safety	IEC 61010-1:2001/ EN61010-1:2001 Canada: CSA C22.2 No. 61010-1:2004 USA: UL 61010-1:2004

Environment Characteristics

Operating temperature	0 °C to 50 °C
Storage temperature	–20 °C to 70 °C
Operating altitude	2000 meter

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Contact us
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China:
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(tel) 31 20 547 2111
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Product specifications and descriptions in this document subject to change without notice.

Printed in Malaysia
Third Edition, November 2011
U1602-90702

Agilent Technologies