

Agilent

U1600A Series Handheld Digital Oscilloscopes

Data Sheet

Delivering more functionality and performance
with a handheld digital oscilloscope



Agilent Technologies

Features

- **Three-in-one solution : Dual channel oscilloscope, True RMS DMM and Real-Time Data Logger**
- **Large 4.5" color LCD display**
- **Up to 40 MHz bandwidth with advanced triggering**
- **Up to 200 MSa/s sampling rate**
- **125,000 points/channel of waveform memory depth (maximum record length)**
- **6000 count DMM resolution with 22 automatic measurement functions**
- **11 built-in measurement functions including voltmeter, ohmmeter and auxiliary meter**
- **Zoom and Dual Waveform Math functions (additional FFT function with four windowing techniques available in U1604A)**
- **Full remote control and data transfer via PC Link application software**
- **USB 2.0 full speed interface connectivity**
- **Multi-language Quick Help support**

Introduction

The U1600A series handheld digital oscilloscope has a 4.5-inch LCD color display that is capable of clearly distinguishing waveforms between two channels. This U1600A series offers a high performance troubleshooting and quality assurance tool for technical professionals in the installation, maintenance, service and automotive industries. The U1600A series consists of two models: U1602A – 20 MHz oscilloscope and U1604A – 40 MHz oscilloscope. Each model has 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 quick waveform analysis in both time and frequency domains. The built-in 6000 resolution count true RMS digital multimeter (DMM) comes with auto-range feature that gives users the flexibility to perform quick and accurate meter measurement functions inclusive of voltage, resistance and auxiliary -

measurements. In addition to this, the U1600A series also comes standard with data logging functionality that allows users to consolidate a sequence of data points for data recording purposes.

A scope, true RMS DMM and real-time data logger in one instrument

The U1600A series is a robust, high performance and reliable handheld waveform and meter measurement tool for today's challenging industrial environment. This instrument not only provides full featured oscilloscope functions, but a 6000 count true RMS DMM with real-time data logger. The DMM consists of 11 measurement functions including voltmeter (for DC voltage, AC voltage and true RMS AC + DC voltage measurements), ohmmeter (for 2-wire resistance, capacitance, diode and continuity test) and auxiliary meter (for temperature, ampere, humidity and pressure measurements).

Clearly distinguish your waveform

The U1600A series models comes with a color display to allow you to quickly and clearly identify your signal between two channels. The large size LCD display – 4.5” with 320 x 240 resolution extends the simplicity and makes it easier for you to see more information.

Capture signal deviations, glitches and dropouts effectively

The U1600A series offers the best product specification for users. This instrument provides real-time sampling rate of up to 200 MSa/s. Use U1600A series to capture both instantaneous and repetitive signal anomalies effectively.

High precision zoom-in capability in deep memory

With 125 kilobytes of memory depth per channel, now you can capture long time spans and non-repeating signals while maintaining a maximum sampling rate of 200 MSa/s. Deep memory allows you to quickly zoom in the segment of interest and uncover even the most subtle details of the signal at a given time base setting.

Isolate and analyze the signal you want to see

The U1600A series comes with flexible triggering capabilities that allow you to isolate and capture the condition you want to characterize. The advanced triggering includes edge, pulse width, pattern and video signal triggering that are essential for quick isolation of critical events.

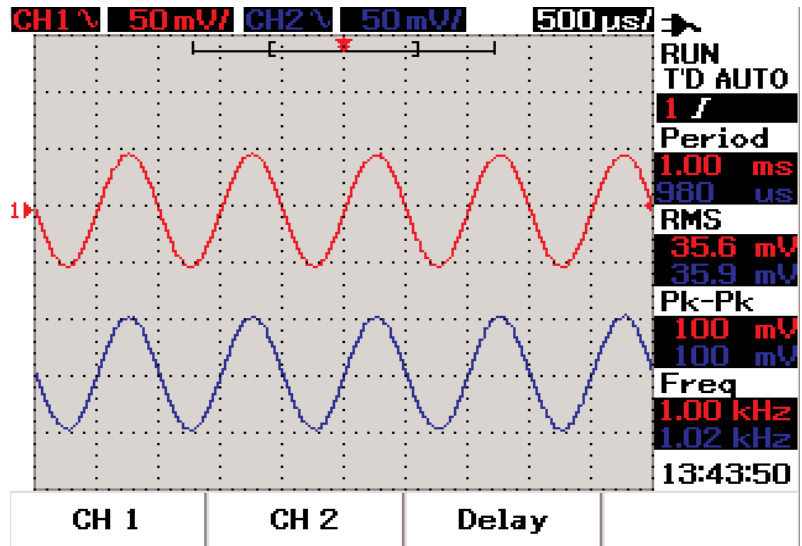


Figure 1 High-definition of color resolution in large 4.5” LCD display allows you to quickly distinguish and identify your signals and observe signal activity.

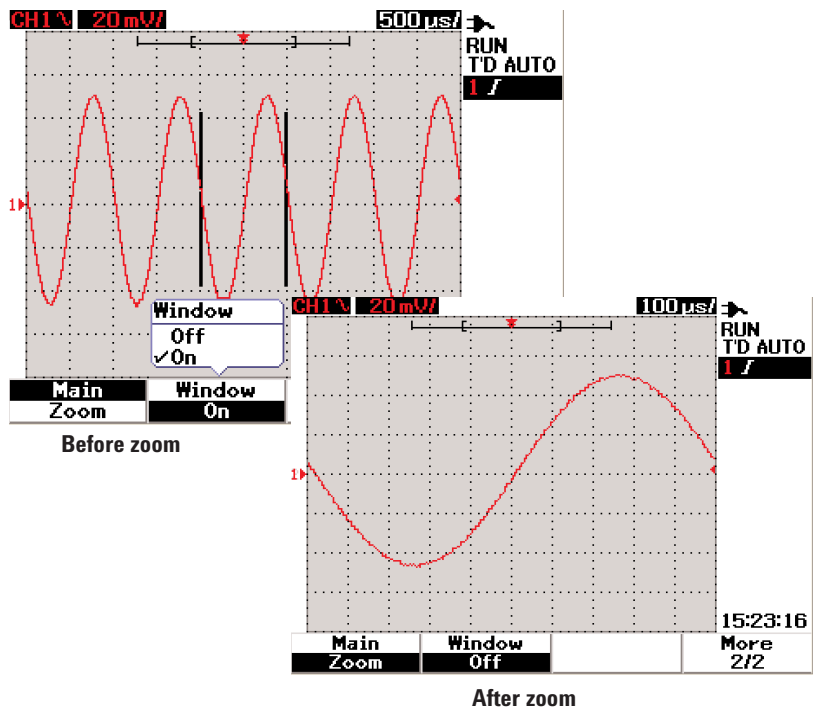


Figure 2 With deep memory of 125 kilobytes per channel, use the zoom-in function to magnify signal to the segment of your interest and scrutinize subtle details of your signal.

FFT (U1604A only) and Dual Waveform Math functions for waveform analysis

Besides the standard Dual Waveform Math (DWM) function in U1600A series, the U1604A model is equipped with an FFT (Fast Fourier Transform) function. This function allows you to view the waveform in frequency domain using four windowing techniques (Rectangular, Hanning, Hamming, Blackman-Harris). Use the DWM function to perform math functions for signal addition and subtraction from multiple channels.

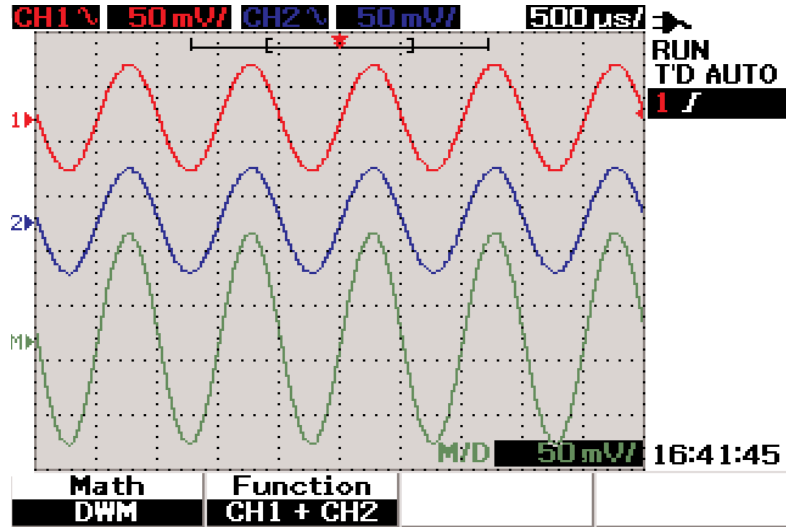


Figure 3 The U1600A series comes equipped with DWM features, allowing you to perform spectrum analysis and evaluate signal addition and subtraction from multiple channels.

Easy, straightforward connectivity

The U1600A series expands the oscilloscope’s capability with the PC Link application software that caters for data gathering, storage and documentation needs from instrument via USB 2.0 full speed. You can control the instrument remotely from PC, retrieve your waveform and print it using a connected printer. This PC Link application software is bundled with the purchase of any U1600A series. As an option, you can connect a USB flash drive via the USB host port to store your waveform and configuration setup from the instrument.

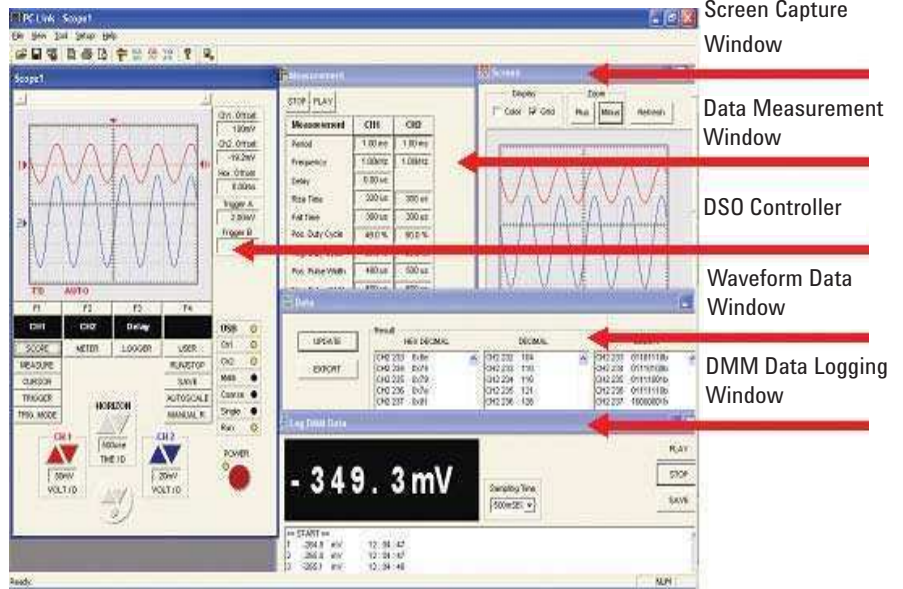


Figure 4 The U1600A series comes with a PC Link application software that caters for data gathering, storage and documentation needs via USB full speed remote control from PC.

Built-in multi-lingual Quick Help menu provides instant assistance

Need assistance while operating the instrument? The built-in multi-lingual Quick Help menu helps to minimize downtime in the event that you need help to set up scope and DMM functions. The supported languages include English, German, Italian, Spanish, Portuguese, French, Korean, Traditional Chinese, Simplified Chinese and Japanese.

The U1600A Series Features

Oscilloscope Mode

The U1600A series handheld digital oscilloscopes offer the following standard and advanced features to make your analysis and troubleshooting tasks easier and faster.

Deep memory

The U1600A series comes standard with 125 kilobytes of memory depth.

Autoscale

Autoscale enables the instrument to quickly display any active signals, and automatically adjust the vertical and horizontal settings with trigger control for the best signal display.

Dual Waveform Math (DWM) and Fast Fourier Transform (FFT)

The U1600A series offers analysis functions including addition and subtraction for DWM, as well as FFT with four windowing techniques (Rectangular, Hanning, Hamming and Blackman-Harris). FFT function is only available for the U1604A model.

Cursor measurement

Use cursor function to manually or automatically place readout of the waveform's voltage at any desired vertical or horizontal point.

22 automatic measurements

Up to 22 automatic available measurements. You can make and display four different measurements simultaneously.

Advanced triggering

Advanced triggering includes edge, pulse width, pattern and video to help you isolate the signal you want to see.

Easy connectivity

The PC Link application software is bundled with the purchase of any U1600A series handheld digital oscilloscope. This software provides flexibility for data gathering, storage and documentation needs via USB connectivity. USB flash drive is also available to you as an option to save and retrieve configuration setups or waveforms to and from the USB flash drive.

Save and recall waveform and setup memories

Up to 10 waveforms and configuration setups can be stored and recalled at anytime for future use and reference.

Logger mode

The U1600A series allows you to customize your data logging for any DMM measurement. This sophisticated function allows you to record and consolidate a sequence of data points for data plotting purposes.

Digital Multimeter (DMM) Mode

Auto-range

All meter measurements come in auto-range mode – instrument will auto-select the most appropriate range for measurement.

Voltmeter

Voltmeter measurement includes DC voltage, AC voltage and AC+DC voltage with auto-measurement of minimum, maximum and average value.

Ohmmeter

Ohmmeter measurement consists of resistance, capacitance, diode test and continuity test. The auto-measurement of minimum, maximum and average value applies only to resistance and continuity test.

Auxiliary meter

Auxiliary meter involves temperature, ampere, humidity and pressure measurements. Similarly, the auto-measurement of minimum, maximum and average value is also available in this mode.

SCOPE SPECIFICATIONS^[1]

Vertical System : Scope Channels

Bandwidth (-3 dB)	U1602A : DC to 20 MHz U1604A : DC to 40 MHz
DC vertical gain accuracy	5 mV/div to 20 mV/div: $\pm 5\%$ full scale 50 mV/div to 100 V/div: $\pm 3\%$ full scale

Scope Channel Triggering

Trigger sensitivity	DC to 5 MHz: 0.8 divisions U1602A: 5 MHz to 20 MHz — 1 division U1604A: 5 MHz to 40 MHz — 1 division
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SCOPE CHARACTERISTICS^[2]

Acquisition : Scope Channels

Maximum sample rate	U1602A : 200 MSa/s interleaved, 100 MSa/s each channel (50 s/div to 125 ns/div) U1604A : 200 MSa/s interleaved, 100 MSa/s each channel (50 s/div to 250 ns/div)
Equivalent sample rate	U1604A : 2.5 GSa/s (125 ns/div to 10 ns/div)
Vertical resolution	8 bits
Maximum memory depth	125 kilobytes/channel
Peak detection	5 ns
Average	Selectable in average number of 2, 4, 8, 16, 32, 64, 128, 256

Vertical System : Scope Channels

Analog channels	Channel 1 and Channel 2 simultaneous acquisition
Bandwidth (-3 dB)	U1602A : DC to 20 MHz U1604A : DC to 40 MHz
AC coupled	< 10 Hz without probe < 1 Hz with 10 M Ω 10:1 probe
Rise time	U1602A : < 17.5 ns U1604A : < 8.8 ns
Single shot bandwidth	U1602A : 20 MHz U1604A : 40 MHz
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)
Maximum input	CAT III 300 Vrms (up to 400 Hz) from terminal to ground
Offset/Dynamic range	± 5 div
Input impedance	1 M Ω < 20 pF
Coupling	AC, DC, GND
Probes	U1560-60001: 1:1 passive probe U1561-60001: 10:1 passive probe U1562-60001: 100:1 passive probe
Probe attenuation factors	1x, 10x, 100x
Coupling	3 Vp-p, ~ 1 kHz
Maximum probe input	1x CAT III 300 VAC 10x, 100x CAT III 600 VAC
Noise peak-to-peak	3% of full scale or 5 mV, whichever is greater
DC vertical offset accuracy	± 0.1 div ± 2 mV $\pm 0.5\%$ offset value
Single cursor accuracy	4% full scale
Dual cursor accuracy	4% full scale

[1] All specifications are warranted. Specifications are valid after a 30-minute warm-up period and within ± 10 °C from firmware calibration temperature.

[2] All characteristics are typical performance values and are not warranted. Characteristics are valid after a 30-minute warm-up period and within ± 10 °C from firmware calibration temperature.

Horizontal System

Range	U1602A : 50 ns to 50 s/div U1604A : 10 ns to 50 s/div
Resolution	U1602A : 2 ns U1604A : 400 ps
Reference position	Left, center, right
Delay range (pre-trigger)	15 divisions
Delay range (post-trigger)	1000 divisions
Analog Δt accuracy	$\pm 3\%$ reading $\pm 0.4\%$ screen
Modes	Main, XY, Roll
RMS Jitter	5% of horizontal scale or 5 ns whichever is higher

Trigger System

Source	Channel 1 and Channel 2
Modes	Auto, normal, single
Selections	Edge, pulse width, pattern, video
Edge	Trigger on a rising or falling edge of any source.
Pattern	Trigger at the beginning of a pattern of high, low levels and rising or falling edge established conditions of AND, OR, NOR and NAND between the channels.
Pulse width	200 ns to 10 s. Trigger when a positive or negative pulse width of any source larger than, less than, equal to or not equal to duration.
Video	Video trigger sensitivity : 0.7 division trigger level. Available to both Channel 1 and Channel 2. Analog progressive and interlaced video standards including NTSC, PAL and SECAM. Positive or negative sync pulse polarity. Modes — all fields, even fields, odd fields or line 5 – 263 within a field.
Range	± 4 divisions from center screen
Level accuracy	± 0.5 divisions
Trigger sensitivity	DC to 5 MHz : 0.8 divisions U1602A : 5 MHz to 20 MHz — 1 division U1604A : 5 MHz to 40 MHz — 1 division
Coupling	DC, AC (< 1 Hz), HF reject (> 50 kHz), LF reject (<30 kHz), Noise reject

Measurement System

Autoscale	Finds and displays all active scope channels, sets edge trigger mode on highest numbered channel, sets vertical sensitivity on scope channel. Requires voltage > 20 mVp-p, 0.5% duty cycle and frequency > 100 Hz.
Automatic measurement	Measurements continuously updated.
Voltage	Peak-to-peak, maximum, minimum, amplitude, top, base, +overshoot, –overshoot, preshoot, RMS, mean and one cycle mean.
Time	Frequency, period, +width, –width and +duty cycle and –duty cycle on any channel. Rise time, fall time, delay and phase shift.
Cursors	Manually place readout of horizontal (X, ΔX) and vertical (Y, ΔY).
Waveform math	CH1 + CH2, CH1 – CH2, CH2 – CH1

FFT^[1]

Window	Rectangular, Hamming, Hanning, Blackman-Harris
Amplitude Display	Selectable in amplitude display of 1 dB, 2 dB, 5 dB, 10 dB

[1] FFT function is only available for U1604A model.

DIGITAL MULTIMETER SPECIFICATIONS^[1] ± (% of reading + % of range)

Function	Range	Frequency, Test Current or Burden Voltage	1 year Tcal ± 5 °C
DC Voltage	600.0 mV		0.3 + 0.08
	6.000 V		0.3 + 0.08
	60.00 V		0.3 + 0.08
	600.0 V		0.3 + 0.08
AC Voltage	600.0 mV – 600.0 V	50 Hz – 1 kHz	1.0 + 0.2
		1 kHz – 30 kHz	3.0 + 0.2
AC + DC Voltage	6.0000 V – 600.0 V	50 Hz – 1 kHz	1.0 + 0.2
		1 kHz – 30 kHz	3.0 + 0.2
Resistance	600.0 Ω		0.5 + 0.2
	6.000 kΩ		0.5 + 0.2
	60.00 kΩ		0.5 + 0.2
	600.0 kΩ		0.5 + 0.2
	6.000 MΩ		0.5 + 0.2
	60.00 MΩ		1.0 + 0.2
Capacitance	60.00 nF		2.0 + 0.2
	600.0 nF		2.0 + 0.2
	6000 nF		2.0 + 0.2
	60.00 μF		2.0 + 0.2
	300.0 μF		2.0 + 0.2
Diode	1.000 V	0.5 mA	2.0 + 0.08

Measurement Characteristics

Full scale reading	6000 count
DC voltage, True RMS AC Voltage	Maximum input voltage, 600 Vrms CAT II, 300 Vrms CAT III DC coupled input coupling
Continuity	Beeper < 60 Ω in 600 Ω range

DATA LOGGER

Source	Digital multimeter measurements
Range	10 divisions
Record size	250 points
Time span	Auto range 150 seconds to 20 days
Time reference	Time from start
Record method	Selectable minimum, maximum and average

Display System

Display	4.5-inch diagonal color CSTN LCD
Resolution	320 x 240 pixels
Control	Contrast control, infinite persistence on/off
Build-in help system	Functional help displayed by pressing help button
Real time clock	Time and date (user adjustable)

Storage

Save/Recall (non-volatile)	Up to 10 setups and traces
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[1] For temperature between 0 °C to 18 °C and 28 °C to 50 °C , add 0.1% of reading + 0.02% of range for every degree Celsius.

GENERAL CHARACTERISTICS

Power Adapter

Line voltage range 50/60 Hz, 100 – 240 VAC
Output voltage 12 VDC

Battery

Ni-MH rechargeable battery pack 7.2 V, 4500 mA
Operating time : 4 hours
Charging time : 5 hours, measurement unit off
Allow ambient temperature during charging : 10 °C to 40 °C

Operating Environment

Temperature	Operating full accuracy	0 °C to 50 °C
	Non-operating	-20 °C to 70 °C
Humidity	Operating full accuracy	to 80% RH at 40 °C
Altitude	Operating	Up to 2000 m
	Non-operating	15000 m (50000 ft)
ESD tolerance	± 4 kV	

Safety Compliance

IEC 61010-1:2001/EN61010-1:2001
CSA C22.2 No. 61010-1:2004
UL 61010-1:2004
Pollution degree 2
This instrument is rated for indoor use only.

Dimension (HxWxD)

24.1 cm height x 13.8 cm width x 6.6 cm depth

Weight

1.5 kg

I/O

USB 2.0 full speed client (standard)
USB 2.0 full speed host (option #001)
Firmware upgrade through USB.

Warranty

3 years

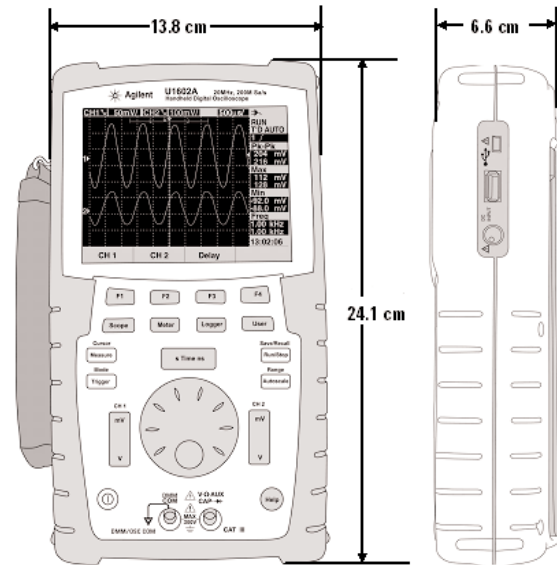
Accessories included:

- U1560A Scope probe (1:1) CAT III 300 V
- U1561A Scope probe (10:1) CAT III 600 V
- U1571A Ni-MH battery pack 7.2 V, 4500 mA
- U1580A DMM test lead
- Ground alligator clip
- Medium jaw alligator clip
- Hook Clip
- USB cable
- Power cord and AC adapter
- Quick Start Guide
- Product Reference CD-ROM containing User's and Service Guide, Quick Start Guide and PC Link Application Software
- Certificate of Calibration (CoC)
- Test Report

Optional Accessories:

- U1590A Soft casing
- U1562A Scope probe (100:1) CAT III 600 V with ground alligator clip

DIMENSIONS



Agilent Optional Accessories



Soft casing



Scope probe (100:1) CAT III 600 V with ground alligator clip