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# Agilent U1600A Series Handheld Digital Oscilloscope

## Data Sheet

Delivering more functionality and performance  
with a handheld digital oscilloscope



## 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)**
- **6,000-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, which is able to clearly distinguish waveforms between two channels. This U1600A Series provides 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 a 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 the U1604A model) to perform quick waveform analyses in both time and frequency domains. The built-in 6000 resolution count true RMS digital multimeter (DMM) comes with an auto-range feature that gives users the flexibility to perform quick and accurate meter measurements including voltage, resistance, and auxiliary measurements. In addition,

the standard versions of the U1600A Series models also contain a data logger function.

### **A scope, true RMS DMM, a 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 environments. Not only do these instruments provide fully featured oscilloscope functions, but also a 6,000-count true RMS DMM with real-time data logger. The DMM consists of 11 measurement functions including a voltmeter (for DC voltage, AC voltage and true RMS AC + DC voltage measurements), an ohmmeter (for 2-wire resistance, capacitance, diode and continuity tests), and an auxiliary meter (for temperature, ampere, *humidity*<sup>[1]</sup> and *pressure*<sup>[2]</sup> measurements).

[1] To perform humidity measurements, you will need a separate adapter, which is not available at the moment. This particular accessory will be available soon.

[2] To perform pressure measurements, you will need a separate adapter, which is not available at the moment. This particular accessory will be available soon.

## Clearly distinguish your waveform

The U1600A Series models come with a color display, which allow you to quickly and clearly identify your signal between two channels. The large LCD display – 4.5” with 320 × 240 resolution – makes it much easier for you to view more pieces of information at one glance.

## Capture signal deviations, glitches and dropouts effectively

The U1600A Series offers the best product specification for users. This instrument provides a real-time sampling rate of up to 200 MSa/s. Use the 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, you can now 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 function includes edge, pulse width, pattern, and video signal triggering, which are essential for the quick isolation.

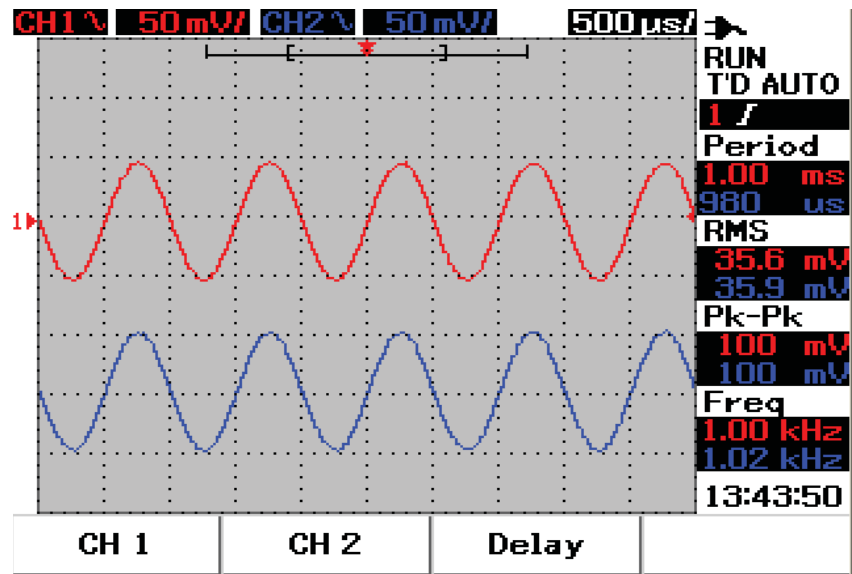


Figure 1 High-definition of color resolution in large 4.5” LCD display allows you to quickly distinguish and identify your signals and observe signal activity.

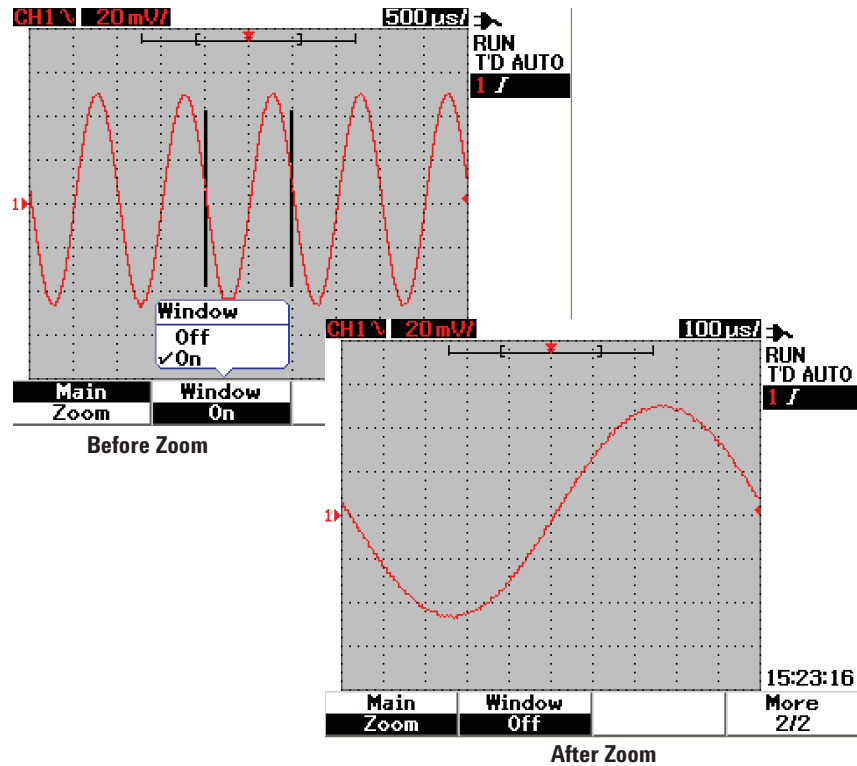


Figure 2 With a deep memory of 125 kilobytes per channel, use the zoom-in function to magnify a signal to the segment of your interest and scrutinize subtle details of your signals.

### 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 a FFT (Fast Fourier Transform) function. This function allows you to view the waveform in a frequency domain using four windowing techniques (Rectangular, Hanning, Hamming, Black-Harris). Use the DWM function to perform math functions for 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 collection, storage and documentation needs from instrument via USB 2.0 full-speed connection. You can control the instrument remotely from a 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 model. 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.

### 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.

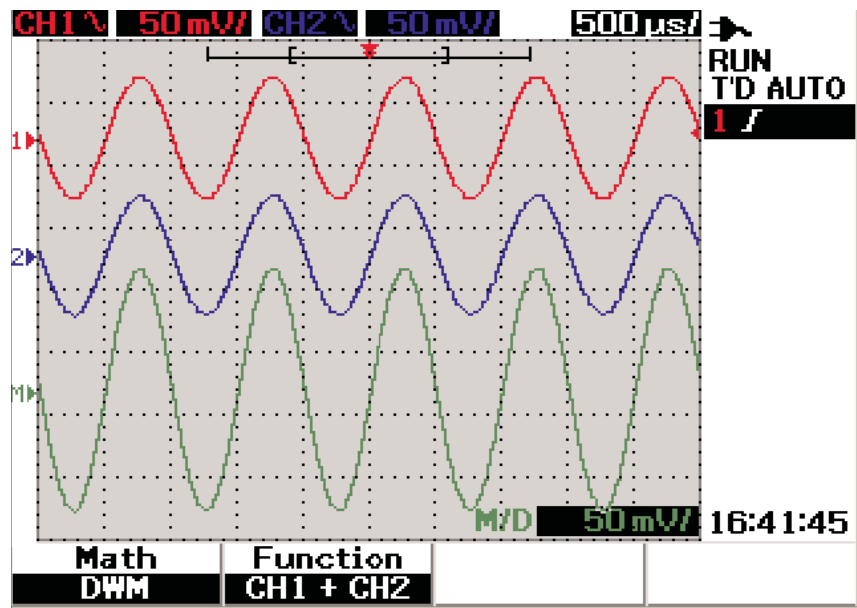


Figure 3 The U1600A Series comes equipped with DWM features, allowing you to perform spectrum analyses and evaluate signal additions and subtractions from multiple channels.

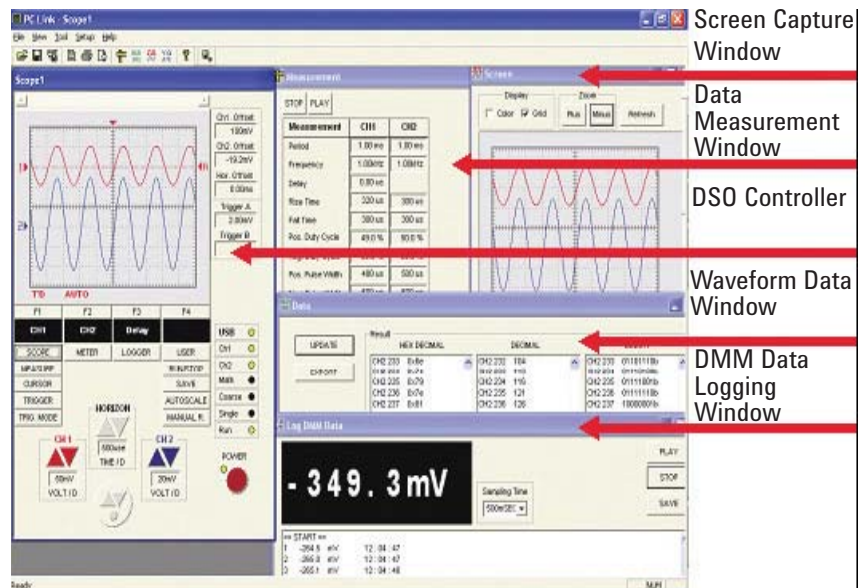


Figure 4 The U1600A Series comes with a PC Link application software that caters for data collection, storage and documentation needs via USB full-speed remote control from PC.

# U1600A Series Features

## Oscilloscope Mode

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

### Deep memory

By default, the U1600A Series model contain 125 kilobytes of memory depth.

### Autoscale

Autoscale enables the instruments to quickly display any active signals, and automatically adjust the vertical and horizontal settings with trigger control for best-possible 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). The FFT function is only available for the U1604A model.

### Cursor measurement

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

## 22 automatic measurements

Up to 22 automatic measurements are available. You can carry out and display four different measurements simultaneously.

### Advanced triggering

Advanced triggering includes edge, pulse width, pattern, and video functionality 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 collection, storage and documentation needs via USB connectivity. You can also use a USB flash drive 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 any time 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 – the instruments automatically select the most appropriate measurement range.

### Voltmeter

Voltemeter measurements include DC voltage, AC voltage, and AC + DC voltage with auto-measurement of minimum, maximum, and average values.

### Ohmmeter

Ohmmeter measurements include resistance, capacitance, diode test, and continuity test. The auto-measurement of minimum, maximum, and average values applies only to resistance and continuity tests.

### Auxiliary meter

The auxiliary meter carries out temperature, ampere, *humidity*<sup>[1]</sup> and *pressure*<sup>[2]</sup> measurements. Similarly, the auto-measurement of minimum, maximum, and average values is also available in this mode.

[1] To perform humidity measurements, you will need a separate adapter, which is not available at the moment. This particular accessory will be available soon.

[2] To perform pressure measurements, you will need a separate adapter, which is not available at the moment. This particular accessory will be available soon.

## SCOPE SPECIFICATIONS<sup>[1]</sup>

### 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: ± 5% full scale 50 mV/div to 100 V/div: ± 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<sup>[2]</sup>

### 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 $\Omega$ 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 $\Omega$    < 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 10 x, 100x CAT III 600 VAC

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

Noise peak-to-peak	3% of full scale or 5 mV, whichever is greater
DC vertical offset accuracy	$\pm 0.1\%$ div $\pm 2$ mV $\pm 0.5\%$ offset value
Single cursor accuracy	4% full scale
Dual cursor accuracy	4% full scale

### 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 $\Delta t$ 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	$\pm 4$ divisions from center screen
Level accuracy	$\pm 0.5$ 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<sup>(1)</sup>

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

## Digital Multimeter Specifications<sup>[1]</sup> ± (% reading + % 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	6,000-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 × 240 pixels
Control	Contrast control, infinite persistence on/off
Built-in help system	Functional help displayed by pressing help button
Real-time clock	Time and date (user-adjustable)

[1] For temperatures 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.

## Storage

Save/Recall (non-volatile) Up to 10 setups and traces

## 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 full accuracy	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.

### Dimensions (H×W×D)

24.1 cm height × 13.8 cm width × 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

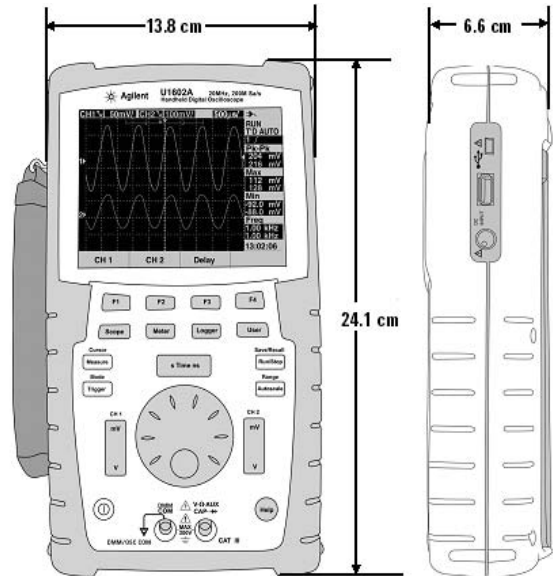
### Accessories included

- 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

### Optimal 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



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