

U1600 Series Handheld Digital Oscilloscopes

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
- Up to 125 000 points recording length
- 22 automatic scope measurement functions available
- 6,000-count DMM resolution with 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/U1604B)
- 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 U1600 Series handheld digital oscilloscope has a 4.5-inch LCD color display, which helps to clearly distinguish waveforms between two channels. This U1600 Series provides a high performance troubleshooting and quality assurance tool for technical professionals in the installation, maintenance, service, and automotive industries. The U1600 Series consists of four models: U1602A/U1602B – 20 MHz oscilloscope and U1604A/U1604B – 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/U1604B 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 U1600 Series models also contain a data logger function.

The series' latest oscilloscopes, the U1602B and U1604B come in vivid orange cases, offering capabilities and functions equivalent to the U1600A Series.

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

The U1600 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 measurement functions include 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 measurement)*.

* additional accessories required and offered as optional



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Clearly distinguish your waveform

The U1600 Series models come with a color display, which allows you to quickly and clearly identify your signal between two channels. The large LCD display – 4.5" with 320 x 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 U1600 Series offers the best product specification for users. This instrument provides a real-time sampling rate of up to 200 MSa/s. Use the U1600 Series to capture both instantaneous and repetitive signal anomalies effectively.

High-precision zoom-in capability in deep memory

With 125 kilobytes of physical memory, you can capture non-repeating signals at a higher sampling rate over a wider time base. With up to 125 000 points recording length, you can 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 U1600 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, giving you the flexibility needed to best capture your signal.

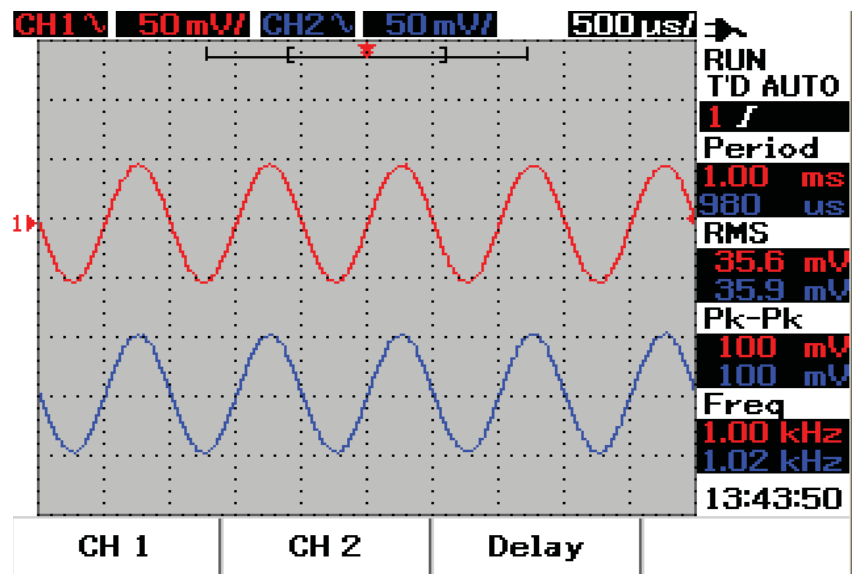


Figure 1 High-definition of color resolution in large 4.5" LCD display allows you to quickly distinguish and identify your signals and observe signal activity.

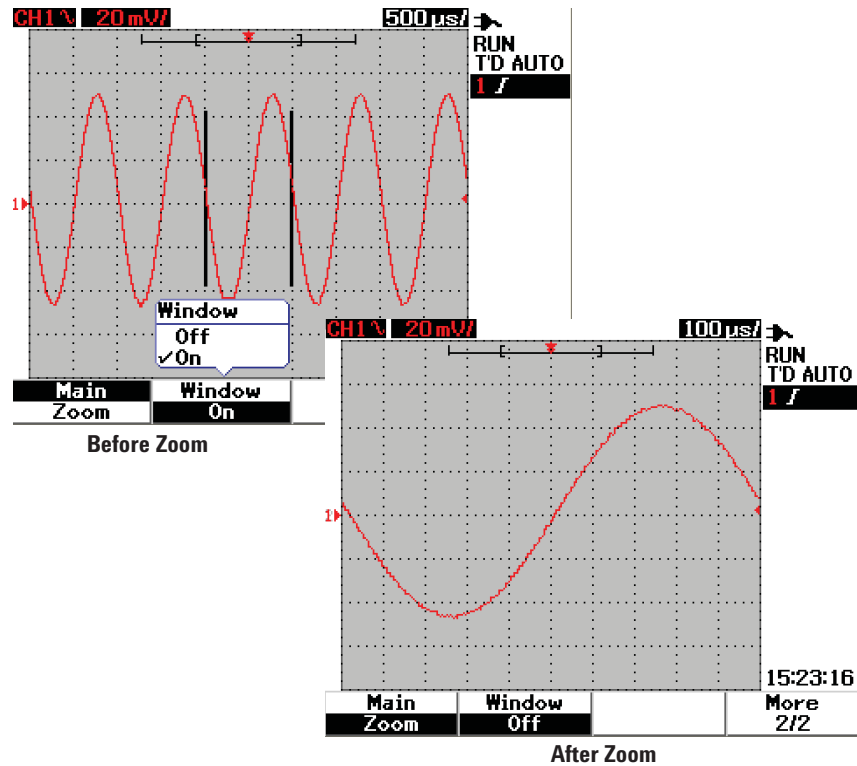


Figure 2 With up to 125 000 points recording length, use the zoom-in function to magnify a signal to the segment of your interest and scrutinize subtle details of your signals.

FFT (U1604A/U1604B only) and Dual Waveform Math functions for waveform analysis

Besides of the standard Dual Waveform Math (DWM) function in U1600 Series, the U1604A/U1604B 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.

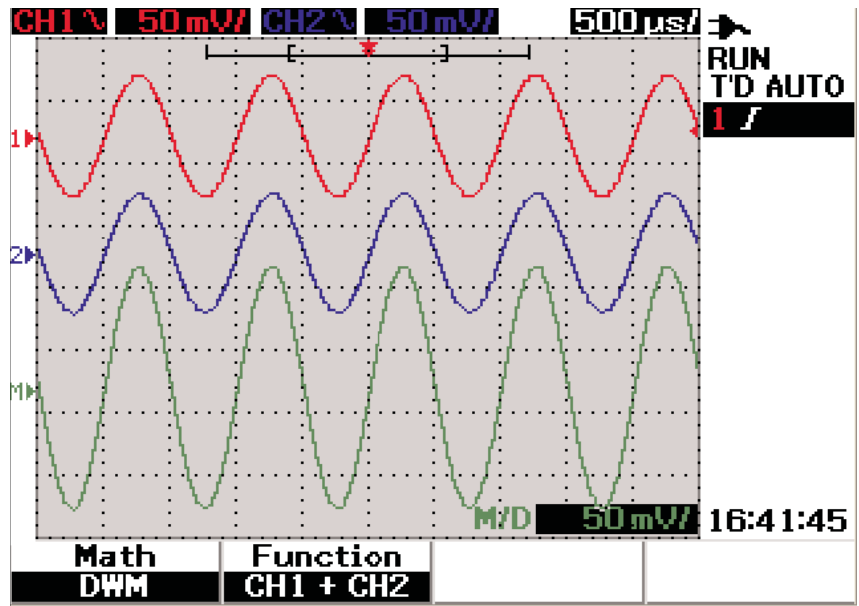


Figure 3 The U1600 Series comes equipped with DWM features, allowing you to perform spectrum analyses and evaluate signal additions and subtractions from multiple channels.

Easy, straightforward connectivity

The U1600 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. This PC Link application software is available for you to control the instrument remotely from a PC, retrieve your waveform and print it using a connected printer. Connect a USB flash drive via the USB host port to store your waveform and configuration setup. This feature is available as an option (option 001) to users.

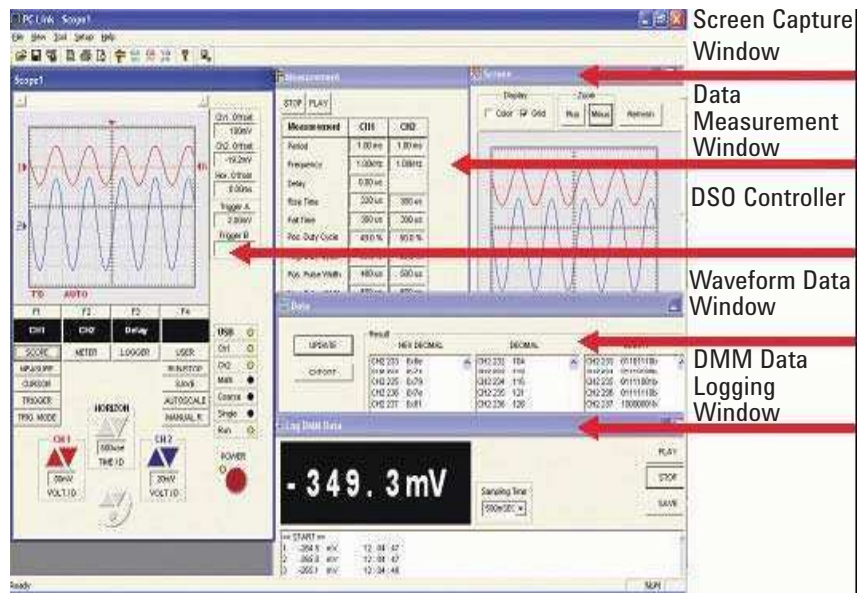


Figure 4 PC Link application software is available to enable data collection, storage and documentation needs via USB full-speed remote control from PC.

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.

Save and recall waveform and setup memories capability

Up to 10 waveforms and configuration setups can be stored in the instrument and recalled at any time for future use and reference.

Log data for any DMM measurement

The sophisticated logger mode allows you to record and consolidate a sequence of data points for data plotting purposes.

SCOPE SPECIFICATIONS^[1]

| Vertical System: Scope Channels | |
|---------------------------------|--|
| Bandwidth (–3 dB) | U1602A/U1602B: DC to 20 MHz U1604A/U1604B: 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/U1602B: 5 MHz to 20 MHz – 1 division U1604A/U1604B: 5 MHz to 40 MHz – 1 division |

SCOPE CHARACTERISTICS^[2]

| Acquisition: Scope Channels | |
|-----------------------------|---|
| Maximum sample rate | 100 MSa/s per channel (50 s/div to 250 ns/div) ³ 200 MSa/s single channel and interleaved (125 ns/div) ⁴ |
| Equivalent sample rate | U1604A/U1604B: 2.5 GSa/s (125 ns/div to 10 ns/div) |
| Vertical resolution | 8 bits |
| Maximum recording length: | U1602A/U1604A: Up to 11 100 points, viewable on screen with zoom function U1602B/U1604B: Up to 125 000 points, viewable on screen with zoom function |
| 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/U1602B: DC to 20 MHz U1604A/U1604B: DC to 40 MHz |
| AC coupled | < 10 Hz without probe < 1 Hz with 10 M Ω 10:1 probe |
| Rise time | U1602A/U1602B: < 17.5 ns U1604A/U1604B: < 8.8 ns |
| Single shot bandwidth | U1602A/U1602B: 20 MHz U1604A/U1604B: 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 |

[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.

[3] Maximum sampling rates are shown here. Sampling rate will vary according to selected time base. For more information, please refer to User's and Service Guide.

[4] 200 MS/s sampling rate is only available at 125 ns/div timebase

[5] Number of points displayed will vary according to time base selected. For more information, refer to User's and Service Guide

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

Horizontal System

| | |
|----------------------------|--|
| Range | U1602A/U1602B: 50 ns to 50 s/div U1604A/U1604B: 10 ns to 50 s/div |
| Resolution | U1602A/U1602B: 2 ns U1604A/U1604B: 400 ps |
| Reference position | Left, center, right |
| Delay range (pre-trigger) | 15 divisions |
| Delay range (post-trigger) | 1000 divisions |
| Analog Δt accuracy | ± 3% reading ± 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/U1602B: 5 MHz to 20 MHz – 1 division U1604A/U1604B: 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, Hanning, Hamming, Blackman-Harris |
| Amplitude display | Selectable in amplitude displays of 1 dB, 2 dB, 5 dB, 10 dB |

Digital Multimeter Specifications^[1] ± (% 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 | 6.000 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 |
| | 6.000 μF | | 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 |

[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.

Auxiliary Meter Specifications ± (% of reading + % of range)

| Function | Range | Frequency | 1 year Tcal ± 5 °C |
|---------------------------------|----------|---------------|--------------------|
| Temperature ^[2] , °C | 600.0 °C | | 0.3 + 0.08 |
| | 6000 °C | | 0.3 + 0.08 |
| Temperature ^[2] , °F | 600.0 °F | | 0.3 + 0.08 |
| | 6000 °F | | 0.3 + 0.08 |
| AC Current ^[3] | 60.00 A | 50 Hz – 1 kHz | 1.0 + 0.2 |
| | 600.0 A | 50 Hz – 1 kHz | 1.0 + 0.2 |

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 W in 600 W range |

Data Logger

| | |
|----------------|--|
| Source | Digital multimeter measurements |
| Range | 10 divisions |
| Record size | Up to 8800 data points (with option 001) |
| 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 |
| Built-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 |
|----------------------------|----------------------------|

[2] U1586B temperature module is needed to make measurements and is available as option.

[3] U1583B AC current clamp needed to make measurements and is available as option.

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 mAh
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 |
| | 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
Pollution degree 2
This instrument is rated for indoor use only.

Dimensions (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 for main unit
3 months for standard shipped accessories unless otherwise stated.

STANDARD SHIPPED ITEMS

| Item | U1602A/ U1604A | U1602B/ U1604B |
|----------------------------------|-------------------|-------------------|
| U1560A 1:1 Scope probe | x | - |
| U1561A 10:1 Scope probe | x | x (2 units) |
| U1580A Test leads | x | x |
| U1162A Alligator clips | x | x |
| USB cable | x | x |
| U1570A AC power adapter and cord | x | x |
| U1571A Ni-MH battery pack | x | x |
| Quick Start Guide | x | x |
| Certificate of calibration | x | x |

ORDERING INFORMATION:












U1602A



U1602B

U1604A

U1604B

OPTIONAL ACCESSORIES

| Item | Description |
|---|--|
|  <p>U1168A Standard test lead kit (with 19-mm and 4-mm probe tips)</p> | <ul style="list-style-type: none"> • Test leads: CAT III 1000 V, CAT IV 600 V, 15 A • Test probe (19-mm tips): CAT III 1000 V, CAT IV 600 V, 15 A • Test probe (4-mm tips): CAT III 1000 V, CAT IV 600 V, 15 A (highly recommended for CAT IV environment) • Alligator Clips: CAT III 1000 V, 10 A • Fine tip test probes: CAT II 300 V, 3 A • SMT grabber: CAT II 300 V, 3 A • Mini grabber (black only): CAT II 300V, 3 A |
|  <p>U1161A Extended test lead kit</p> | <ul style="list-style-type: none"> • Includes two test leads (red and black), two test probes, medium sized alligator clips and 4 mm banana plugs • Test leads: CAT III 1000 V, CAT IV 600 V, 15 A • Test Probes: CAT III 1000 V, 15 A • Medium Sized Alligator Clips: CAT III 600 V, 10 A • 4 mm Banana Plugs: CAT II 600 V, 10 A |
|  <p>U1162A Alligator clips</p> | <ul style="list-style-type: none"> • One pair of insulated alligator clips (red and black) • Recommended for use with Agilent standard test leads • Rated CAT III 1000 V, 10 A |
|  <p>U1163A SMT grabbers</p> | <ul style="list-style-type: none"> • One pair of SMT grabbers (red and black) • Recommended for use with Agilent standard test leads • Rated CAT II 300 V, 3 A |
|  <p>U1164A Fine-tip test probes</p> | <ul style="list-style-type: none"> • One pair of insulated alligator clips (red and black) • Recommended for use with Agilent standard test leads • Rated CAT II 300 V, 3 A |
|  <p>U1169A Test probe leads (with 19-mm tips and 4-mm tips)</p> | <ul style="list-style-type: none"> • Test leads: CAT III 1000 V, CAT IV 600 V, 15 A • Test probe (19-mm tips): CAT III 1000 V, CAT IV 600 V, 15 A • Test probe (4-mm tips): CAT III 1000 V, CAT IV 600 V, 15 A (highly recommended for CAT IV environment) |
|  <p>U1181A Immersion temperature probe</p> | <ul style="list-style-type: none"> • Type-K thermocouple for use in oil and other liquids temperature measurements • Measurement range: -50 °C to 700 °C • Temperature module (U1586A) is required to connect to DMM inputs of the handheld scope • U1184A Temperature probe adapter included for use with DMMs |
|  <p>U1182A Industrial surface temperature probe</p> | <ul style="list-style-type: none"> • Type-K thermocouple for use in still surface temperature measurements • Measurement range: -50 °C to 400 °C • Temperature module (U1586A) is required to connect to DMM inputs of the handheld scope • U1184A Temperature probe adapter included for use with DMMs |
|  <p>U1183A Air temperature probe</p> | <ul style="list-style-type: none"> • Type-K thermocouple for use in air and non-caustic gas temperature measurements • Measurement range: -50 °C to 800 °C • Temperature module (U1586A) is required to connect to DMM inputs of the handheld scope • U1184A Temperature probe adapter included for use with DMMs |

| Item | | Description |
|---|-----------------------------------|--|
|  | U1560A 1:1 Scope probe | <ul style="list-style-type: none"> • Includes ground alligator and hook clips • Rated CAT III 300 V • Frequency range from 0 to 45 MHz |
|  | U1561A 10:1 Scope probe | <ul style="list-style-type: none"> • Includes ground alligator and hook clips • Rated CAT III 600 V • Frequency range from 0 to 250 MHz |
|  | U1562A 100:1 Scope probe | <ul style="list-style-type: none"> • Includes ground alligator and hook clips • Rated CAT III 600 V • Frequency range from 0 to 300 MHz |
|  | U1570A AC power adapter | <ul style="list-style-type: none"> • AC power adapter for handheld scope • Includes AC power based on country |
|  | U1554A Hook clip for probe tip | <ul style="list-style-type: none"> • Rated CAT II 1000 V, CAT III 600 V |
|  | U1571A Ni-MH battery pack | <ul style="list-style-type: none"> • 4500 mA, 7.2 V |
|  | U1580A DMM terminal test lead set | <ul style="list-style-type: none"> • Includes DMM test probe leads and DMM alligator clips • Rated CAT III 1000 V |
|  | U1583B AC current clamp | <ul style="list-style-type: none"> • Dual range (40 A and 400 A) • Rated CAT III 600 V • BNC-to-banana plug provided, for use with DMMs or handheld scope |
|  | U1586B Temperature module | <ul style="list-style-type: none"> • Measure -50°C to 1000°C/-58°F to 1832°F • K-type bead probe supplied • Can be used with U1181A, U1182A, and U1183A |
|  | U1590A Soft carrying case | <ul style="list-style-type: none"> • Dimensions: 9.6" (H) x 13.0" (W) x 4.5" (T) • PVC leather material |

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