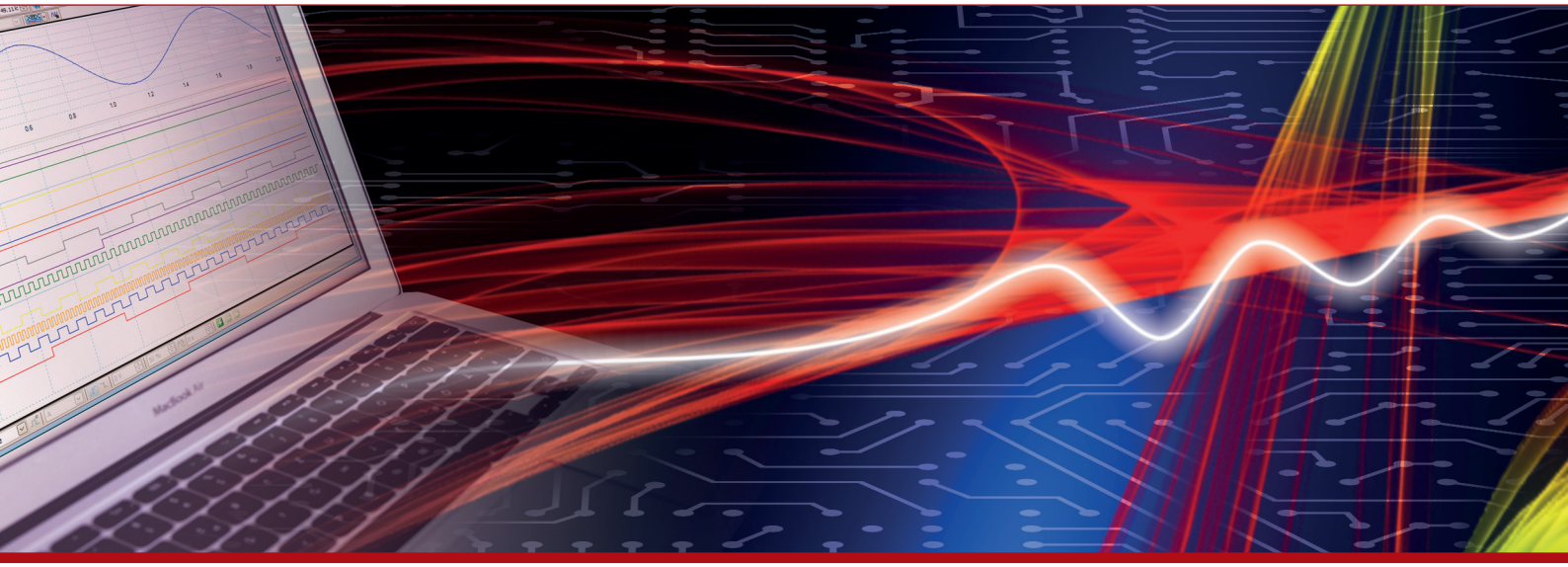
Product Datasheet - Technical Specifications



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DATA SHEET

U1610A/U1620A
Handheld Digital Oscilloscope

Indoor viewing mode

Night vision viewing mode

KEYSIGHT TECHNOLOGIES

Introduction

Retool your expectations in the world's first VGA display handheld oscilloscope with two isolated channels

The Keysight Technologies, Inc. U1610A/U1620A is the world's first handheld oscilloscope with a VGA display. This 100/200 MHz handheld oscilloscope offers a floating measurement capability with two CAT III 300 V isolated channels. With up to 2 GSa/s sam- pling rate and 2 Mpts memory depth, it captures more waveforms from signals such as pulse width modulated circuit, in rush, transient, and motor start up sequences. The benchtop-like display and dual window zoom allow you to easily identify problem areas and zoom in for more detailed analysis. Now, you can view signals in detail and detect glitches easily.

Features

- 100/200 MHz bandwidth with two isolated channels
- 5.7-inch VGA TFT LCD display with 3 selectable viewing modes (indoor, outdoor and night vision)
- 2 Mpts memory depth and 2 GSa/s sampling rate allows detailed analysis of captured glitches
- 10,000-count resolution on DMM display
- Channel-to-channel isolation with CAT III 300 V safety ratings
- Data logging capability to PC
- 10 selectable languages on the User Interface (UI) system

5.7-inch VGA display with 3 selectable viewing modes

Visualizing electrical waveforms has never been in such clarity. Our U1610A/U1620A oscilloscope comes with a 5.7-inch VGA TFT LCD display that enables clear viewing of measurements on-site and on the field. With the option of up to three viewing modes, users can now view waveforms under all lighting conditions, including in indoor, outdoor or dark environments. All three viewing modes have predefined contrast levels for customized lighting conditions and optimized battery life.

Indoor mode

The indoor mode has high contrast and brightness levels to clearly distinguish waveforms under an indoor light environment. Engineered with a VGA TFT LCD screen, users can now view the display across wide viewing angles for more efficient troubleshooting task.

Outdoor mode

When performing field work in an outdoor environment, users can easily switch to this viewing mode via a set of accessible soft keys. This mode works in an anti-glare mechanism; it filters out excessive sunlight, hence reducing the risk of misreading or misinterpreting measurements.

Night vision mode

The night vision mode is tailored to be viewable under subdued lighting by enabling high contrast levels between the screen background and waveforms. With a single press of button, this mode is activated and the screen automatically adjusts with proper colour correction- creating clear contrasts between the wave- forms against the dark environment. This mode is useful when measuring high speed signals, particularly in non-repetitive signals.

Figure 1. Indoor mode for clear distinct readings

Figure 2. Outdoor mode that is sunlight viewable

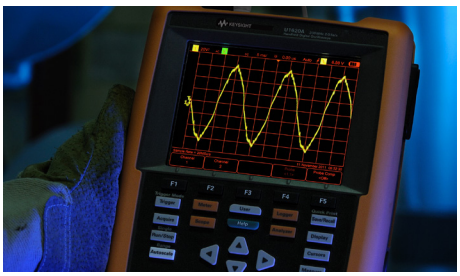


Figure 3. Night vision mode for performing tasks in a poorly lit environment

2 Mpts memory depth and 2 GSa/s sampling rate allows detailed analysis of captured glitches

A good oscilloscope must be accompanied with even better specifications for an in-depth analysis of captured glitches. With deep memory of 2 Mpts and sampling rate of 2 GSa/s, non-repeating signals can be captured over a wider time base. What's more, its dual window zoom feature allows you to work more productively by simultaneously viewing signals captured over a period of time and zooming into the most subtle details.

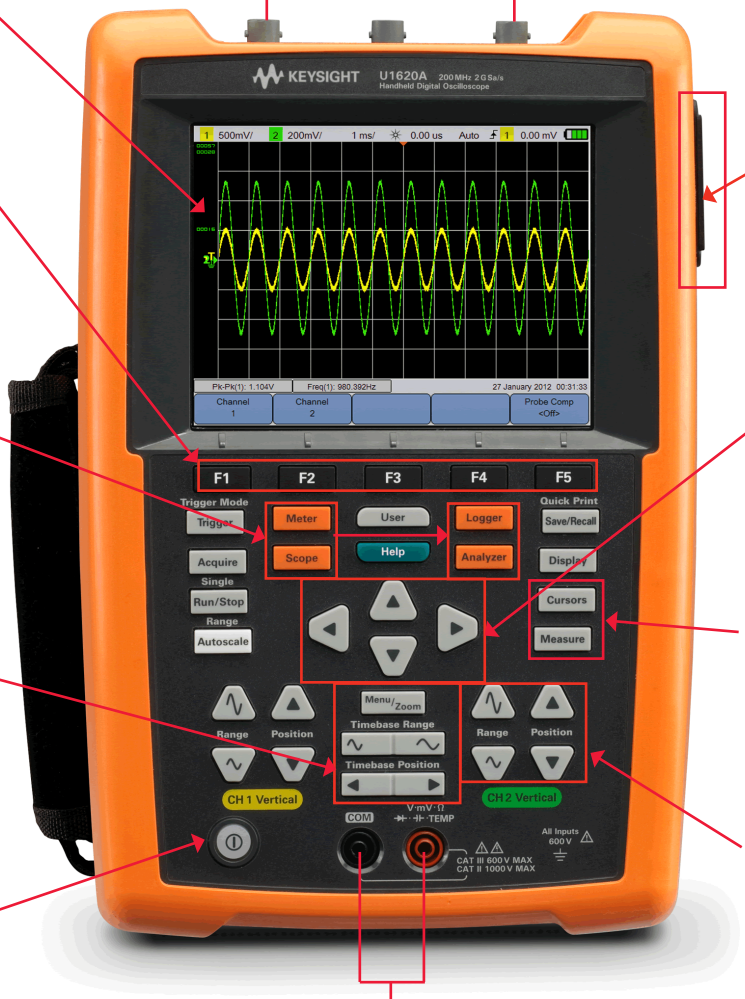
Channel-to-channel isolation with CAT III 300 V safety ratings

The U1610/U1620A extends the maximum input rating to cater for high voltage measurement and transient voltages which are recordable via a handheld oscilloscope. Equipped with the most robust isolation topology, technicians can now mea- sure signals in the field and perform floating measurements. This type of isolation enables each channel to be individually isolated from one another and from other non-isolated system components.

Up to 10 selectable languages programmed in the scope

The U1610A/U1620A is programmed with up to 10 selectable languages (English, French, German, Italian, Spanish, Portuguese, Traditional and Simplified Chinese, Japanese and Korean) on the User Interface (UI) system and help menu. The diverse range of languages offered here gives users the choice to operate the unit in the language that they are most comfortable in.

Front panel description



Scope terminals

5.7 inch VGA color display

Function softkeys
To perform functions displayed above each softkey

Acquisition and function controls
To access the scope, meter, logger, system functions

Horizontal controls
To control the sweep speed (sec/div) and horizontal position of the waveform. Use Menu/Zoom to zoom into waveforms

Power on/off button

USB interface connector and DC power inlet

Directional keys

Measurement softkeys
To make quick measurements and place cursors on the waveform

Vertical controls
To set the vertical scaling (volt/div) and vertical offset

Meter terminals

Outdoor viewing mode as illustrated

Figure 4. The U1620A as shown

Specifications

Specification	U1610A	U1620A
Vertical system		
Bandwidth (-3 dB) [1]	100 MHz	200 MHz
DC vertical gain accuracy [1]	± 4% of full scale	
	Full scale is equivalent to 8 div	
Dual cursor accuracy [1]	± {DC vertical gain accuracy + 0.4% full scale (~1 least significant bit (LSB)}	
	± {4% full scale ± 0.4% full scale (~1 LSB)}	
Characteristic		
Acquisition		
Maximum Sampling Rate		
Single Chanel Operation	1 GSa/s interleave	2 GSa/s interleave
Dual Channel Operation	500 MS/s each channel	1 GS/s each channel
Maximum Recording Length		
Single Chanel Operation	120 Kpts interleave	2 Mpts interleave
Dual Channel Operation	60 Kpts each channel	1 Mpts each channel
Vertical resolution	8 bits	
Peak detection	> 10 ns	> 5 ns
Average	Selectable from 2 to 8192 in powers-of-2 increments	
Filter	10 kHz and 20 MHz bandwidth limiters	
Interpolation	(Sin x)/x	
Vertical system		
Analog channels	Channel 1 and Channel 2 simultaneous acquisition	
Calculated rise time	3.50 ns typical	1.75 ns typical
Vertical scale	2 mV/div to 50 V/div	
Maximum input ⚠	CAT III 600 V (with 10:1 probe)	
	CAT III 300 V (direct)	
Offset (position) range	± 4 div	
Dynamic range	± 8 div	
Input impedance	1 MΩ ± 1% ≈ 22 pF ± 3 Pf	
Coupling	DC, AC	
Bandwidth limit	10 kHz and 20 MHz (selectable)	
Channel-to-channel isolation (with channels at the same V/div) ⚠	CAT III 300 V	
Probes	U1560-60002 1:1 passive probe	
	U1561-60002 10:1 passive probe	
	U1562-60002 100:1 passive probe	
Probe attenuation factors	1x, 10x, 100x	
Probe compensation output	5 V_{pp}, 1 kHz	
Noise peak-to-peak (typical)	3% of full scale or 5 mV_{pp}, whichever greater	
DC vertical offset (position) accuracy	± 0.1 div ± 2 mV ±1.6% offset value	
Single cursor accuracy	± {DC vertical gain accuracy + DC vertical offset accuracy + 0.2% full scale (~1/2 least significant bit (LSB)}	
	± {4% full scale ± 0.1 div ± 2 mV ± 1.6% offset value + 0.2% full scale (~1/2 LSB)}	

Specifications (continued)

Characteristic (continued)	U1610A	U1620A
Horizontal system		
Range	5 ns/div to 50 s/div	2 ns/div to 50 s/div
Resolution	100 ps for 5 ns/div	40 ps for 2 ns/div
Timebase accuracy	25 ppm	
Reference position	Left, center, right	
Delay range (pre-trigger)	1 screen width or 120 µs (whichever less)	1 screen width or 1 ms (whichever less)
Delay range (post-trigger)	50 ms to 500 s	20 ms to 500 s
Delay resolution	100 ps for 5 ns/div	40 ps for 2 ns/div
Delay time measurement accuracy	Same channel: ± 0.0025% reading ± 0.17% screen width ± 60 ps	
	Channel-to-channel: ± 0.0025% reading ± 0.17% screen width ± 120 ps	
Modes	Main, zoom, XY, roll	
Horizontal pan and zoom	Dual window zoom	
Trigger system		
Sources	Channel 1, Channel 2, External	
Modes	Normal, Single, Auto	
Types	Edge, Glitch, TV, Nth Edge, CAN, LIN	
Autoscale	Finds or displays active channels, sets the edge trigger type on the highest numbered channel, and sets the vertical sensitivity on the scope channel timebase to display ~2 periods	
	Requires > 10 mV_{pp} minimum voltage, 0.5% duty cycle, and > 50 Hz minimum frequency	
Holdoff time	60 ns to 10 s	
Range	± 6 div from center of screen	
Sensitivity	≥ 10 mV/div: 0.5 div	
	< 10 mV/div: greater of 1 div or 5 mV	
Trigger level accuracy	± 0.6 div	
Coupling modes	AC (~10 Hz), DC, LF-Reject (~35 kHz), HF-Reject (~35 kHz)	
External trigger		
– Input impedance	1 MΩ ≈ 10 pF	
– Maximum input	CAT III 300 V	
– Range	DC coupling: trigger level ± 5 V	
– Bandwidth	100 kHz	
Measurement		
Automatic measurements	Delay, duty cycle (+/–), fall/rise time, frequency, period, phase shift, T-max, T-min, width (+/–), amplitude, average, base, crest, cycle mean, maximum, minimum, overshoot, peak-to-peak, preshoot, standard deviation, top, Vrms (AC/DC), active/apparent/reactive power, power factor AC current (with U1583B/1146A), DC current (with 1146A)	
Waveform math functions	CH1 + CH2, CH1 – CH2, CH2 – CH1, CH1 × CH2, CH1/CH2, CH2/CH1, d/dt (CH1), d/dt (CH2), ∫(CH1)dt, ∫(CH2)dt, FFT	
Cursors	Delta V: Voltage difference between cursors	
	Delta T: Time difference between cursors	
FFT points	1024	
FFT windows	Rectangular, Hamming, Hanning, Blackman-Harris, Flattop	

Specifications (continued)

Characteristic (continued)	U1610A	U1620A
Display system		
Display	5.7" TFT LCD VGA Color (outdoor readable)	
Resolution	VGA (screen area): 640 vertical by 480 horizontal	
Control	Vectors on/off, sin x/x interpolation on/off, infinite persistence on/off, backlight intensity, color scheme, clear display	
Real-time clock	Date and time (adjustable)	
Language	10 languages (selectable)	
Built-in help system	Functional quick help displayed by pressing the [Help] button	
Storage system		
Save/recall (non-volatile)	10 setups and waveforms can be saved and recalled internally	
Storage mode	USB 2.0 full speed host port (Support up to 4GB USB drive)	
	Image formats: .bmp (8-bit, 24-bit) and .png (24-bit)	
	Data format: .csv	
I/O	USB 2.0 full-speed host, USB 2.0 full-speed client	
Printer compatibility	PCL Inkjet, PCL Laser	

1. *Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and within ± 10 °C of last calibration temperature.*

Maximum input voltages and channel isolation

	U1610A and U1620A
Maximum input voltages	
Input CH1 and CH2 direct (1:1 probe)	300 V CAT III
Input CH1 and CH2 (1:10 probe)	600 V[1] CAT III, 1000 V[1] CAT II
Input CH1 and CH2 (1:100 probe)	600 V[1] CAT II, 1000 V[1] CAT II, 3540 V[1] CAT I
Meter input	600 V CAT III, 1000 V CAT II
Scope input	300 V CAT III
Voltage ratings	Vrms 50–60 Hz (AC sine wave), VDC (DC applications)
Channel isolation	
From any terminal to earth ground	300 Vrms CAT III

1. *Refer to the respective probe's manual for more information on the specification*

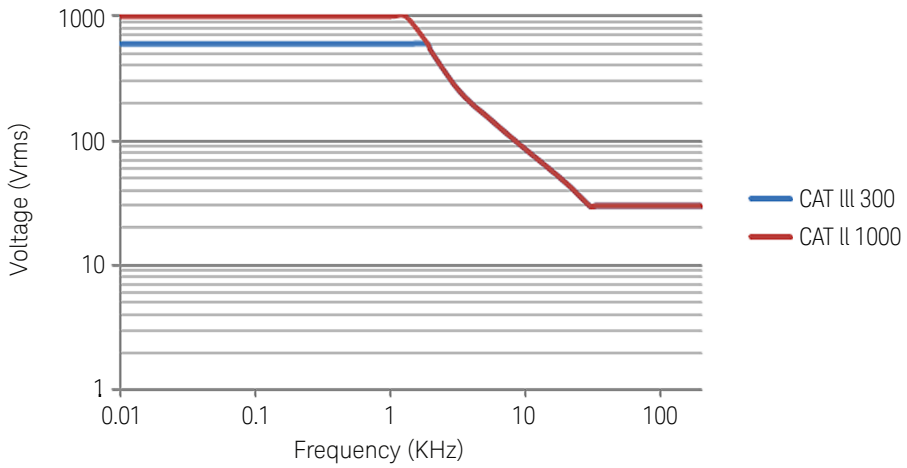


Figure 5. Maximum safety voltage for scope reference to earth

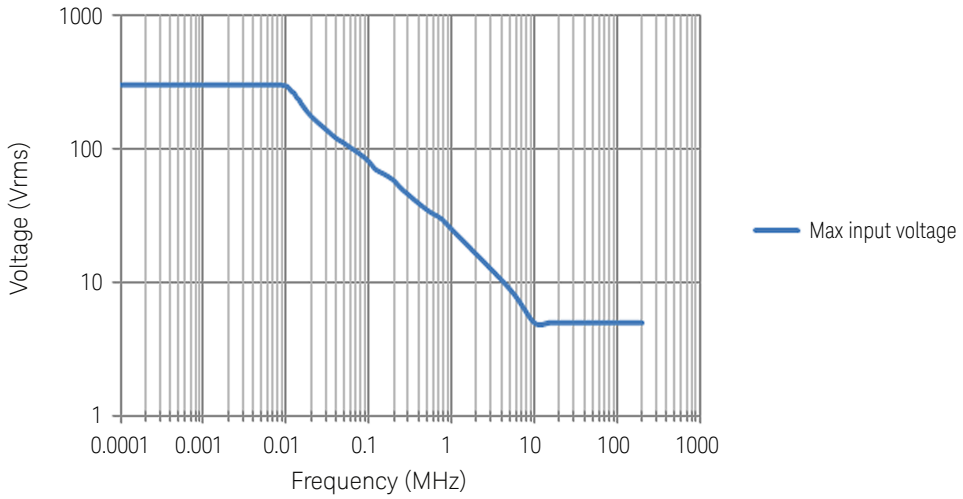


Figure 6. Maximum input voltage

Digital multimeter specifications

- Accuracy is given as ± (% of reading + counts of least significant digit) at 23 ± 5 °C, with relative humidity < 80 RH.
- AC V specifications are AC coupled, true RMS and are valid from 5% to 100% of range.
- Temperature coefficient is given as 0.1 × (specified accuracy) / °C (from 0 to 18 °C or 28 to 50 °C).
- Common mode rejection ratio (CMRR) is > 90 dB at DC, 50/60 Hz ± 0.1% (1 kΩ unbalanced).
- Normal mode rejection ratio (NMRR) is > 60 dB at 50/60 Hz ± 0.1%.

Maximum reading	**10,000 counts with automatic polarity indication**				
Voltage[1]	**CAT II 1000 V or CAT III 600 V**				
Function	Range	Resolution	Accuracy	Input impedance (nominal)	Test current
DCV	100.00 mV[2]	0.01 mV	0.1% + 5	> 1 GΩ	
	1000.0 mV	0.1 mV	0.09% + 5	11.11 MΩ	
	10.000 V	0.001 V	0.09% + 2	10.10 MΩ	
	100.00 V	0.01 V		10.01 MΩ	
	1000.0 V[3]	0.1 V	0.15% + 5		
ACV	100.0 mV	0.01 mV	1% + 5 (40 Hz to 2 kHz)	> 1 GΩ	
	1000.0 mV	0.1 mV	1% + 5 (40 to 500 Hz)	10.00 MΩ	
			2% + 5 (500 Hz to 1 kHz)		
	10.000 V 100.00 V	0.001 V 0.01V	1% + 5 (40 to 500 Hz)		
			1% + 5 (500 Hz to 1 kHz)		
			2% + 5 (1 to 2 kHz)		
	1000.0 V[3]	0.1 V	1% + 5 (40 to 500 Hz)		
			1% + 5 (500 Hz to 1 kHz)		
ACV + DC V	100.0 mV[2]	0.01 mV	1.1% + 5 (40 Hz to 2 kHz)	> 1 GΩ	
	1000.0 mV	0.1 mV	1.1% + 10 (40 to 500 Hz)	10.00 MΩ	
			2.1% + 10 (500 Hz to 1 kHz)		
	10.000 V 100.00 V	0.001 V 0.01 V	1.1% + 7 (40 to 500 Hz)		
			1.1% + 7 (500 Hz to 1 kHz)		
			2% + 5 (1 to 2 kHz)		
	1000.00 V[3]	0.1 V	1.2% + 10 (40 to 500 Hz)		
			1.2% + 10 (500 Hz to 1 kHz)		
Diode[4]	1 V	0.001 V	0.3% + 2		~0.5 mA
	Beeper < ~50 mV, single tone for normal forward-biased diode or semiconductor junction of 0.3 V ≤ reading ≤ 0.8 V[5] Overload protection: 1000 Vrms for short circuit with < 0.3 A Open voltage: < +2.8 VDC				

1. *Only allowed to measure up to CAT III 600 V if referring to GND.*
2. *In an open connection, the reading shown on the display is noise pickup due to the high input impedance at the input terminal.*
3. *Only allowed for floating voltage*
4. *Denotes typical specifiations, all others are warranted.*
5. *Denotes characteristics.*
6. *The accuracy is specified after the Null function is used to subtract the test lead resistance and thermal effect.*
7. *RH is specified for < 60%. The temperature coefficient is 0.15 × specified accuracy as > 50 MΩ.*
8. *The accuracy is based on film capacitors or better and uses the Relative mode for residual values.*

NOTE: Keysight recommends using the U1586B temperature adapter for temperature measurement.
Refer to http://literature.cdn.keysight.com/litweb/pdf/5990-9523EN for more information on the U1586B specifications.

Digital multimeter specifications (continued)

Maximum reading	**10,000 counts with automatic polarity indication**				
Voltage [1]	**CAT II 1000 V or CAT III 600 V**				
Function	Range	Resolution	Accuracy	Input impedance (nominal)	Test current
Instant continuity[4]			Continuous beep when resistance < 10 Ω [5]		
Resistance	1000.00 Ω [6]	0.1 Ω	0.3% + 3		0.5 mA
	10.000 kΩ [6]	0.001 kΩ			50 µA
	100.00 kΩ	0.01 kΩ			4.91 µA
	1000.0 kΩ	0.1 kΩ			447 nA
	10.000 MΩ	0.001 MΩ	0.8% + 3		112 nA
	100.00 MΩ [7]	0.01 MΩ	1.5% + 3		112 nA
Capacitance	1000.0 nF	0.1 nF	1.2% + 4 [8]		
	10.000 µF	0.001 µF			
	100.00 µF	0.01 µF			
	1000.0 µF	0.1 µF	2% + 4 [8]		
	10.000 mF	0.001 mF			
Frequency[4]	100.00 Hz	0.01 Hz	0.03% + 3		
	1000.0 Hz	0.1 Hz			
	10.000 kHz	0.001 kHz			
	100.00 kHz	0.01 kHz			
	1000.0 kHz	0.1 kHz			

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2. *In an open connection, the reading shown on the display is noise pickup due to the high input impedance at the input terminal.*
3. *Only allowed for floating voltage.*
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Data logger specifications

	Scope and meter logger
Range	1 s/div – 86400 s/div (1 day/div)
Recording time span	8 days
Memory depth	691200 points
Recording mode	Continuous (Range will change according to the time elapsed)
Sampling rate	1 sample/s

General specifications

Power supply	
Power adapter	Line voltage range: 50/60 Hz, 100 to 240 VAC, 1.6 A
	Output voltage: 15 VDC, 4 A
	Installation Category II
Battery	Li-Ion rechargeable battery pack, 10.8 V
	Operating time: Up to 3 hours
Operating environment	
Temperature	0 to 50 °C (with battery or power adapter)
	0 to 40 °C (with battery and power adapter)
Humidity	0 to 80% RH (0 to 35 °C)
	0 to 50% RH (35 to 40/50 °C)
	Altitude up to 2000 m
	Pollution degree 2
Storage compliance	
Temperature	-20 to 70 °C
Humidity	0 to 80% RH
	Altitude up to 15000 m
Shock	Tested to IEC 60068-2-27
Vibration	Tested to IEC 60068-2-6, IEC 60068-2-64
Safety compliance	IEC 61010-1:2001/EN 61010-1:2001
	Canada: CAN/CSA-C22.2 No. 61010-1-04
	USA: ANSI/UL 61010-1:2004
EMC compliance	IEC 61326-1:2005/EN 61326-1:2006
	Australia/New Zealand: AS/NZS CISPR 11:2004
	Canada: ICES/NMB-001:ISSUE 4, June 2006
IP rating	IP 41 ingress protection according to IEC 60529
Dimensions (W × H × D)	183 x 270 x 65 mm
Weight	< 2.5 kg
Warranty	3 years for main unit
	3 months for standard shipped accessories unless otherwise stated

Ordering information

Standard shipped items

– Quick start guide, power adapter, Li-Ion battery pack, USB cable, test lead, 10:1 probe (2 sets), Certificate of Calibration (CoC).

Recommended accessories

Item
1146B
Probe - 100 kHz, 100A AC/DC current probe
U1161A
Test lead kit, extended 
U1162A
Alligator clip 
U1163A
Grabbers, SMT 
U1164A
Test probes, fine tip 
U1168B
Test lead kit 
U1169A
Test probe leads (with 19-mm tips and 4-mm tips)
U1176A
LED flash light
U1554B
Probe tip, CAT III 1000V, CAT IV 600V 
U1560B
Scope probe - X1, CAT III 600V 
U1561B
Scope probe - X10, CAT III 1000V 
U1562B
Scope probe - X100, CAT III 1000V 

Item
U1572A
Li-Ion battery pack 
U1573A
Desktop charger and Li-Ion battery pack 
U1574A
AC/DC adapter
U1575A
Desktop charger 
U1577A
USB cable
U1580A
DMM terminal test lead set 
U1583B
AC current clamp
U1586B
Temperature module
U1591A
Soft carrying case