Agilent 34410A and 34411A Multimeters

Setting the Standard for Next Generation Benchtop and System Testing

Product Overview



Agilent 34410A 6½-Digit High-Performance DMM

- 10,000 readings/s @ 5½-digits direct to PC
- 1,000 readings/s @ 6½-digits direct to PC
- 30 PPM 1-year Basic DC accuracy
- LAN, USB & GPIB standard
- DCV, ACV, DCI, ACI, 2-wire and 4-wire Resistance, Frequency, Period, Continuity, and Diode Test
- Capacitance & Temperature measurements
- Expanded measurement ranges
- Data logger with 50 k reading non-volatile memory

Agilent 34411A 6½-Digit Enhanced-Performance DMM

All the features of the 34410A, plus:

- 50,000 readings/s @ 4½-digits direct to PC
- 1 million volatile reading memory
- Analog level triggering
- Programmable Pre/Post triggering

The Best Just Got Better

The Agilent 34410A and 34411A 6½-Digit DMMs represent the latest generation of multimeters from Agilent Technologies. Building on the phenomenal success of the industry-standard Agilent 34401A, these new meters offer improved accuracy, expanded measurement capability, dramatically improved measurement speed and throughput, and modern computer interfaces including LAN and USB. The dual display offers both dual measurement capabilities and ease of use when setting up and configuring the DMM. Improvements have been made in every facet of the 34401A to make the best even better, whether you use it on the bench or in a system.

Dramatic Speed Improvements

Whether it's raw reading speed or fast system throughput, the 34410A sets a new benchmark in performance. Using a new A/D technology, the 34410A achieves an impressive 10,000 readings a second at 5½-digits, and can stream readings to your computer at this same speed! Triggering is fast and precise, with both trigger latency and trigger jitter less than 1 µs, while bus query response is less than 500 µs. ACV measurements are faster as well thanks to a digital measurement technique that additionally improves accuracy at high and low frequencies. For even greater reading speeds, select the 34411A, which achieves 50,000 readings a second at 4½-digits.

Enhanced Measurement Performance

The 34410A and 34411A offer Temperature and Capacitance capabilities, in addition to those measurements you have come to expect, such as DCV, ACV, DCI, ACI, 2-wire and 4-wire Resistance, Frequency, Period, Continuity and Diode Test. You also get Offset Compensated Ohms, allowing you to accurately measure resistance in the presence of voltages. Measurement ranges have been expanded as well; for example, DC and AC Current Ranges now go down to 100 µA, resulting in 100 pA resolution. Real-time math and statistics are included, and a peak-detect capability allows you to capture peaks as short as 20 µs.

Agilent Technologies

Even Greater Performance with the 34411A
The 34411A has all the features of the 34410A, plus additional performance that makes it even more powerful. With the ability to make 50,000 readings per second at 4½-digits, Analog Level Triggering, programmable Pre- and Post- Trigger and 1 million readings of volatile memory in addition to 50,000 reading of non-volatile memory, you now have the ability to capture low-frequency waveforms, characterize device performance and transfer results for analysis on your computer.

Data Logger Function
A front panel data logger function allows you to set the meter up to make unattended, paced measurements over a fixed time or number of events, then pull up the results later for review or transfer to a computer for analysis. Set the meter up to take measurements every 10 seconds for an hour, go have lunch, and check the results upon your return. The contextual front panel sequences make setup and read back a breeze.

Improved Ease of Use
From the inclusion of a second display to configuring setups for each of the measurement functions, these new DMMs offer significant improvements in usability. Simple things are simple; more complicated setups are easier than ever. There is even a new probe set designed to more easily probe today's fine-pitch components. Finally, there is a built-in Graphical Web Interface that allows you to interactively control the DMM without the hassle of programming at all!

Modern I/O for Improved Connectivity
When connecting to a computer, select LAN, USB or GPIB interfaces; all three are standard on the 34410A and 34411A. Concerned about the viability of your existing software programs? These new DMMs respond to Standard Commands for Programmable Instrumentation (SCPI), and there is even a 34401A Emulation Mode to ensure the easiest upgrade possible. Agilent's I/O Library Suite ships with the 34410A and 34411A to help you quickly establish an error-free connection between your PC and instrument. It provides robust instrument control and works with the software development environment you choose.

LXI - Class C
LAN Extensions for Instruments (LXI) provides the next generation I/O for system applications requiring the highest throughput. Transfer rates of over 250,000 readings/s are attainable ensuring even the most data intensive measurements are fast, without the overhead cost of an instrument cardcage. Both the 34410A and the 34411A are LXI - Class C compliant.

Built To Last
Our new DMMs were designed to high standards of ruggedness and reliability. From the robust package with its shock absorbing bumpers to careful selection of components and conservative circuit design, these meters are built to last. Calculated Mean Time Between Failure (MTBF) is in excess of 100,000 hours. Backed by a 1-year warranty and a worldwide network of service centers, you can buy with confidence.

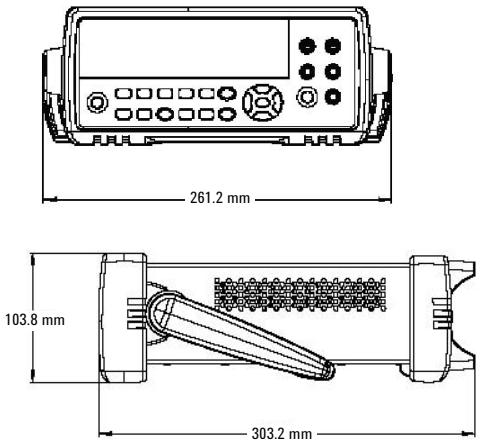
Go to the Web
For the latest information on these or other Agilent DMMs, go to **www.agilent.com/find/dmm**

Accessories Included:
- Test Lead Kit with probes and SMT attachments.
- Test report, power cord, and USB interface cable.

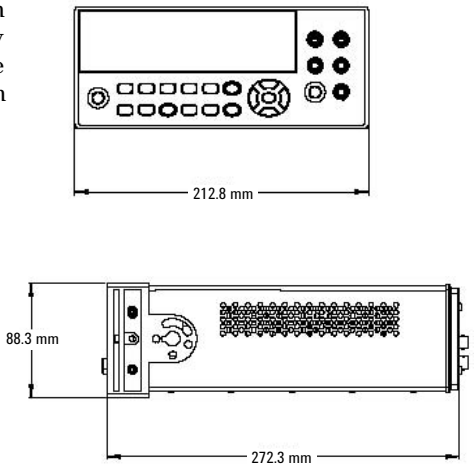
Product Reference CD-ROM with soft documentation and software:
- Programmer's Reference Help
- Quick Start Tutorial
- User's Guide
- Service Guide
- Programming Examples
- IntuiLink for Multimeters
- LabVIEW and IVI-COM drivers

Optional Printed Documentation:
- Quick Start Tutorial
- User's Guide
- Service Guide

Bench Dimensions:



System Dimensions:



Accuracy Specifications ± (% of reading + % of range)[1]

Function	Range[3]	Frequency, Test Current or Burden Voltage	24 Hour[2] Tcal ±1°C	90 Day Tcal ±5°C	1 Year Tcal ±5°C	Temperature Coefficient/°C 0°C to (Tcal -5°C) (Tcal +5°C) to 55°C
DC Voltage	100.0000 mV		0.0030 + 0.0030	0.0040 + 0.0035	0.0050 + 0.0035	0.0005 + 0.0005
	1.000000 V		0.0020 + 0.0006	0.0030 + 0.0007	0.0035 + 0.0007	0.0005 + 0.0001
	10.00000 V		**0.0015 + 0.0004**	**0.0020 + 0.0005**	**0.0030 + 0.0005**	**0.0005 + 0.0001**
	100.0000 V		0.0020 + 0.0006	0.0035 + 0.0006	0.0040 + 0.0006	0.0005 + 0.0001
	1000.000 V[4]		0.0020 + 0.0006	0.0035 + 0.0006	0.0040 + 0.0006	0.0005 + 0.0001
True RMS AC Voltage[5]	100.0000 mV to 750.000 V	3 Hz – 5 Hz	0.50 + 0.02	0.50 + 0.03	0.50 + 0.03	0.010 + 0.003
		5 Hz – 10 Hz	0.10 + 0.02	0.10 + 0.03	0.10 + 0.03	0.008 + 0.003
		10 Hz – 20 kHz	**0.02 + 0.02**	**0.05 + 0.03**	**0.06 + 0.03**	**0.005 + 0.003**
		20 kHz – 50 kHz	0.05 + 0.04	0.09 + 0.05	0.10 + 0.05	0.010 + 0.005
		50 kHz – 100 kHz	0.20 + 0.08	0.30 + 0.08	0.40 + 0.08	0.020 + 0.008
		100 kHz – 300 kHz	1.00 + 0.50	1.20 + 0.50	1.20 + 0.50	0.120 + 0.020
Resistance[6]	100.0000 Ω	1 mA	0.0030 + 0.0030	0.008 + 0.004	0.010 + 0.004	0.0006 + 0.0005
	1.000000 kΩ	1 mA	0.0020 + 0.0005	0.007 + 0.001	0.010 + 0.001	0.0006 + 0.0001
	10.00000 kΩ	**100 µA**	**0.0020 + 0.0005**	**0.007 + 0.001**	**0.010 + 0.001**	**0.0006 + 0.0001**
	100.0000 kΩ	10 µA	0.0020 + 0.0005	0.007 + 0.001	0.010 + 0.001	0.0006 + 0.0001
	1.000000 MΩ	5 µA	0.0020 + 0.0010	0.010 + 0.001	0.012 + 0.001	0.0010 + 0.0002
	10.00000 MΩ	500 nA	0.0100 + 0.0010	0.030 + 0.001	0.040 + 0.001	0.0030 + 0.0004
	100.0000 MΩ	500 nA || 10 MΩ	0.200 + 0.001	0.600 + 0.001	0.800 + 0.001	0.1000 + 0.0001
	1.000000 GΩ	500 nA || 10 MΩ	2.000 + 0.001	6.000 + 0.001	8.000 + 0.001	1.0000 + 0.0001
DC Current	100.0000 µA	< 0.03 V	0.010 + 0.020	0.040 + 0.025	0.050 + 0.025	0.0020 + 0.0030
	1.000000 mA	**< 0.3 V**	**0.007 + 0.006**	**0.030 + 0.006**	**0.050 + 0.006**	**0.0020 + 0.0005**
	10.00000 mA	< 0.03 V	0.007 + 0.020	0.030 + 0.020	0.050 + 0.020	0.0020 + 0.0020
	100.0000 mA	< 0.3 V	0.010 + 0.004	0.030 + 0.005	0.050 + 0.005	0.0020 + 0.0005
	1.000000 A	< 0.8 V	0.050 + 0.006	0.080 + 0.010	0.100 + 0.010	0.0050 + 0.0010
	3.000000 A	< 2.0 V	0.100 + 0.020	0.120 + 0.020	0.150 + 0.020	0.0050 + 0.0020
True RMS AC Current[7]	100.0000 µA to 3.00000 A	**3 Hz – 5 kHz**	**0.10 + 0.04**	**0.10 + 0.04**	**0.10 + 0.04**	**0.015 + 0.006**
		5 kHz – 10 kHz	0.20 + 0.04	0.20 + 0.04	0.20 + 0.04	0.030 + 0.006
Frequency or Period	100 mV to 750 V	3 Hz – 5 Hz	0.070 + 0.000	0.070 + 0.000	0.070 + 0.000	0.005 + 0.000
		5 Hz – 10 Hz	0.040 + 0.000	0.040 + 0.000	0.040 + 0.000	0.005 + 0.000
		10 Hz – 40 Hz	0.020 + 0.000	0.020 + 0.000	0.020 + 0.000	0.001 + 0.000
		40 Hz – 300 kHz	**0.005 + 0.000**	**0.006 + 0.000**	**0.007 + 0.000**	**0.001 + 0.000**
Capacitance[8]	1.0000 nF	500 nA	0.50 + 0.50	0.50 + 0.50	0.50 + 0.50	0.05 + 0.05
	10.000 nF	1 µA	0.40 + 0.10	0.40 + 0.10	0.40 + 0.10	0.05 + 0.01
	100.00 nF	10 µA	0.40 + 0.10	0.40 + 0.10	0.40 + 0.10	0.01 + 0.01
	1.0000 µF	10 µA	0.40 + 0.10	0.40 + 0.10	0.40 + 0.10	0.01 + 0.01
	10.000 µF	100 µA	0.40 + 0.10	0.40 + 0.10	0.40 + 0.10	0.01 + 0.01
Temperature[9]						
RTD	-200°C to 600°C		0.06°C	0.06°C	0.06°C	0.003°C
Thermistor	-80°C to 150°C		0.08°C	0.08°C	0.08°C	0.002°C
Continuity	1000.0 Ω	1 mA	0.002 + 0.010	0.008 + 0.020	0.010 + 0.020	0.0010 + 0.0020
Diode Test[10]	1.0000 V	1 mA	0.002 + 0.010	0.008 + 0.020	0.010 + 0.020	0.0010 + 0.0020

1 Specifications are for 90 minute warm-up and 100 PLC..

2 Relative to calibration standards..

3 20% overrange on all ranges, except DCV 1000 V, ACV 750 V, DCI and ACI 3 A ranges.

4 For each additional volt over ± 500 V add 0.02 mV of error.

5 Specifications are for sinewave input > 0.3% of range and > 1 mVrms. Add 30 uV error for frequencies below 1 kHz. 750 VAC range limited to 8 x 10^7 Volts-Hz. For each additional volt over 300 Vrms add 0.7 mVrms of error.

6 Specifications are for 4-wire resistance measurements, or 2-wire using Math Null. Without Math Null, add 0.2 Ω additional error in 2-wire resistance measurements.

7 Specifications are for sinewave input > 1% of range and > 10 µArms. Frequencies > 5 kHz are typical for 1 A and 3 A ranges.

8 Specifications are for 1-hour warm-up using Math Null. Additional errors may occur for non-film capacitors.

9 For total measurement accuracy, add temperature probe error.

10 Accuracy specifications are for the voltage measured at the input terminals only. 1 mA test current is typical. Variation in the current source will create some variation in the voltage drop across a diode junction.

A-to-D Converter Noise Performance

Integration Time (NPLC)	Resolution (ppm of range)[1]	Normal Mode Rejection (dB)[2]	Readings/Second[4]
0.001[5]	30	0	50,000
0.002[5]	15	0	25,000
0.006	6	0	10,000
0.02	3	0	3,000
0.06	1.5	0	1,000
0.2	0.7	0	300
1	0.3	55	60 (50)
2	0.2	110[3]	30 (25)
10	0.1	110[3]	6 (5)
100	0.03	110[3]	0.6 (0.5)

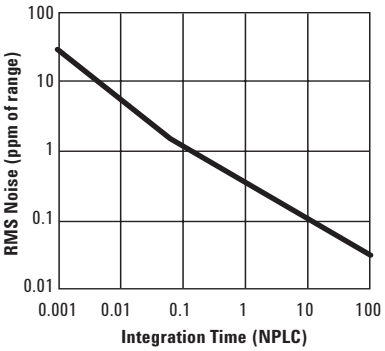
[1] Resolution is defined as the typical DCV 10 V range RMS noise.
Auto-zero on for NPLC ≥ 1. See manual for additional noise characteristics.

[2] Normal mode rejection for power line frequency ± 0.1%.

[3] For power-line frequency ± 1% 75 dB and for ± 3% 55 dB.

[4] Maximum rate with auto-zero off for 60 Hz and (50 Hz) operation.

[5] Only available for the 34411A.



System Reading and Throughput Rates

DMM memory to PC (Maximum reading rate out of memory)[1]
Drawing – Path B

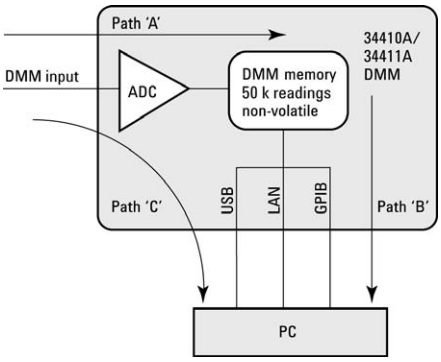
Reading Format	GPIB Readings/s	USB 2.0 Readings/s	LAN (VXI-11) Readings/s	LAN (Sockets) Readings/s
ASCII	4,000	8,500	7,000	8,500
32-bit Binary	89,000	265,000	110,000	270,000
64-bit Binary	47,000	154,000	60,000	160,000

Direct I/O Measurements (Single reading – measure and I/O time)[1]
Drawing – Path C

Function	Resolution (NPLC)	GPIB ms	USB 2.0 ms	LAN (VXI-11) ms	LAN (Sockets) ms	Maximum Reading Rate into Memory or to Direct I/O (Readings/s) Drawing – Path A or C
DCV/2-wire Resistance	0.006 (0.001)	2.6	2.9	4.6	3.2	10,000 (50,000)
ACV/ Frequency	Fast Filter 1 ms Gate	10.0	10.0	10.0	10.0	500

[1] 1/2 scale input signal, immediate trigger, trigger delay 0, auto-zero off, auto-range off, no math, null off, 60 Hz line frequency. Specifications are for 34410A or (34411A). See manual for performance on other functions.

System Reading Architecture



System Performance

	Function Change (ms)[1]	Range Change (ms)[2] LAN/GPIB	Auto-range (ms)[3]	Maximum External Trigger Rate	Maximum Internal Trigger Rate[4]
DCV/2-wire Resistance	22	3.9/2.6	7.5	5,000/s	10,000/s (50,000/s)
ACV/ Frequency	37	6.5/6.4	19	500/s	500/s

[1] Time to change from 2-wire Resistance to this specified function, or DCV to 2-wire Resistance using the SCPI "FUNC" command.

[2] Time to change from one range to the next higher range, ≤ 10 V, ≤ 10 MΩ.

[3] Time to automatically change one range and be ready for the new measurement, ≤ 10 V, ≤ 10 MΩ.

[4] Specifications are for 34410A or (34411A).

Measurement Characteristics

DC Voltage

Measurement Method:
Continuously integrating
multi-slope IV A/D converter

Linearity: 0.0002% of reading
(10 V range) + 0.0001% of range

Input Resistance:

0.1 V, 1 V, 10 V Ranges	10 MΩ or > 10 GΩ (Selectable)
100 V, 1000 V Ranges	10 MΩ ±1% (Fixed)

Input Bias Current: < 50 pA at 25°C

Input Protection: 1000 V

DC CMRR: 140 dB[1]

True RMS AC Voltage

Measurement Method:
AC-coupled True RMS measurement.
Digital sampling with anti-alias filter.

Crest Factor:
No additional error for crest factors < 10.
Limited by peak input and 300 kHz bandwidth.

Peak Input:
300% of range or 1100 V

Overload Ranging:
Will select higher range if peak input overload is detected during auto range. Overload is reported in manual ranging.

AC CMR: 70 dB[2]

Maximum Input: 400 Vdc, 1100 Vpk

Input Impedance:
1 MΩ ± 2% in parallel with < 150 pF

Input Protection: 750 Vrms all ranges

Resistance

Measurement Method:
Selectable 2-wire or 4-wire.
Current source referenced to LO input.

Offset Compensation:
Selectable on the 100 Ω, 1 kΩ, and 10 kΩ ranges

Max. Lead Resistance (4-wire):
10% of range per lead for 100 Ω, 1 kΩ.
1 kΩ per lead on all other ranges

Input Protection:
1000 V on all ranges

DC Current

Current Shunt:
200 Ω for 100 µA, 1 mA
2 Ω for 10 mA, 100 mA
0.1 Ω for 1 A, 3 A

Input Protection: 3 A, 250 V fuse

True RMS AC Current

Measurement Method:
AC-coupled True RMS measurement.
Directly coupled to the fuse and shunt.
Digital sampling with anti-alias filter.

Current Shunt:
200 Ω for 100 µA, 1 mA
2 Ω for 10 mA, 100 mA
0.1 Ω for 1 A, 3 A

Maximum Input:
The peak value of the DC + AC current must be <300% of range. The RMS current must be <3 A including the DC current content.

Input Protection: 3 A, 250 V fuse

Frequency and Period

Measurement Method:
Reciprocal-counting technique. AC-coupled input using the AC voltage measurement function.

Input Impedance:
1 MΩ ± 2% in parallel with < 150 pF

Input Protection: 750 Vrms all ranges

Capacitance

Measurement Method:
Current input with measurement of resulting ramp.

Connection Type: 2-wire

Temperature

Thermistor:
2.2 kΩ, 5 kΩ, and 10 kΩ

RTD: $\alpha = 0.00385$
R_0 from 49 Ω to 2.1 kΩ

Continuity/Diode Test

Response Time:
300 samples/sec with audible tone

Continuity Threshold: Fixed at 10 Ω

Operating Characteristics
Maximum readings/second

	Digits		
Function[3]	4.5	5.5	6.5
DCV	50 k[4]	10 k	1 k
2-wire Ω	50 k[4]	10 k	1 k
DCI	50 k[4]	10 k	1 k
Frequency	500	90	10
Period	500	90	10
Filter setting	fast	med	slow
ACV	500	150	50
ACI	500	150	50

[1] For 1 kΩ unbalanced in LO lead, ± 500 V peak maximum

[2] For 1 kΩ unbalanced in LO lead and <60 Hz, ± 500 V peak maximum

[3] Maximum rate for DCV, DCI, and resistance functions (using zero settling delay, autozero off, manual range)

[4] 34411A only

Additional 34411A Specifications

Resolution: See table on page 4

Overall Bandwidth, DCV & DCI:
15 kHz typical @ 20 µs aperture (-3 dB)

Triggering: Pre/Post, Int/Ext, Pos/Neg

Timebase Resolution: 19.9524 µs 0.01% accuracy

Trigger Jitter:
2 µs (p-p), 20 µs (p-p) when pre-triggered

Spurious-Free Dynamic Range & Signal to Noise Distortion Ratio

Function DCV	Range	Spur-Free	SNDR
	1 V	-75 dB	60 dB
	10 V[1]	-70 dB	60 dB
	100 V	-75 dB	60 dB

[1] 10 V range: 2 V (p-p) <signal < 16 V (p-p)

Triggering and Memory

Reading Hold Sensitivity: 1% of reading

Samples per Trigger:
1 to 50,000 (34410A)
1 to 1,000,000 (34411A)

Trigger Delay: 0 to 3600 s (20 µs step size)

External Trigger:
Programmable edge, Low-power TTL compatible
Delay: < 1 µs **Max rate:** 5,000/s
Jitter: < 1 µs **Min Pulsewidth:** 1 µs

Voltmeter Complete: 3 V Logic output, 2 µs pulse with programmable edge

Nonvolatile Memory: 50,000 readings

Volatile Memory:
50,000 readings (34410A)
1,000,000 readings (34411A)

Sample Timer:
Range: 0 to 3600 s (20 µs step sizes)
Jitter: < 100 ns

General Specifications

Power Supply:
100 V/120 V/220 V/240 V ±10%

Power Line Frequency:
45 Hz to 66 Hz and 360 Hz to 440 Hz, Automatically sensed at power-on

Power Consumption: 25 VA peak (16 W average)

Operating Environment: Full accuracy for 0°C to 55°C, 80% R.H. at 40°C non-condensing

Storage Temperature: -40°C to 70°C

Weight: 3.72 kg (8.2 lbs)

Safety: IEC 61010-1, EN 61010-1, UL 61010-1, CAN/CSA-C22.2 No. 61010-1, Refer to Declarations of Conformity for current revisions. Measurement CAT II 300 V, CAT I 1000 V. Pollution Degree 2

EMC: IEC 61326, EN 61326, CISPR 11, ICES-001, AS/NZS 2064.1, Refer to Declaration of Conformity for current revisions.

Vibration & Shock: MIL-T-28800E, Type III, Class 5 (Sine Only)

LXI Compliance: LXI Class C, ver. 1.0

Warranty: 1 year

Ordering Information
Agilent 34410A and 34411A Multimeters

Accessories included
Test Lead Kit with probes and SMT attachments, test report, power cord, and USB interface cable.

Product Reference CD-ROM with soft documentation and software:
- Programmer's Reference Help
- Quick Start Tutorial
- User's Guide
- Service Guide
- Programming Examples
- IntuiLink for Multimeters
- LabVIEW and IVI-COM drivers

Options

Opt. 1CM
Rack Mount Kit

Opt. ABA
Printed Manual Set (English)

Opt. 0B0
Delete printed Manual Set (full documentation included on CD ROM)

Opt. A6J
ANSI Z540 compliant calibration

Agilent Accessories

11059A	Kelvin Probe set
11060A	Surface Mount Device (SMD) test probes
11062A	Kelvin clip set
34131A	Hard transit case
34162A	Accessory pouch
34171A/B	Input terminal connector (sold in pairs)
34172A/B	Input calibration short (sold in pairs)
34330A	30 A current shunt
E2308A	5 kΩ thermistor probe

* For racking two side-by-side, order both items below:

Lock link kit (P/N 5061-9694)
Flange kit (P/N 5063-9212)

Remove all doubt

Our repair and calibration services will get your equipment back to you, performing like new, when promised. You will get full value out of your Agilent equipment throughout its lifetime. Your equipment will be serviced by Agilent-trained technicians using the latest factory calibration procedures, automated repair diagnostics and genuine parts. You will always have the utmost confidence in your measurements.

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LXI

www.lxistandard.org
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