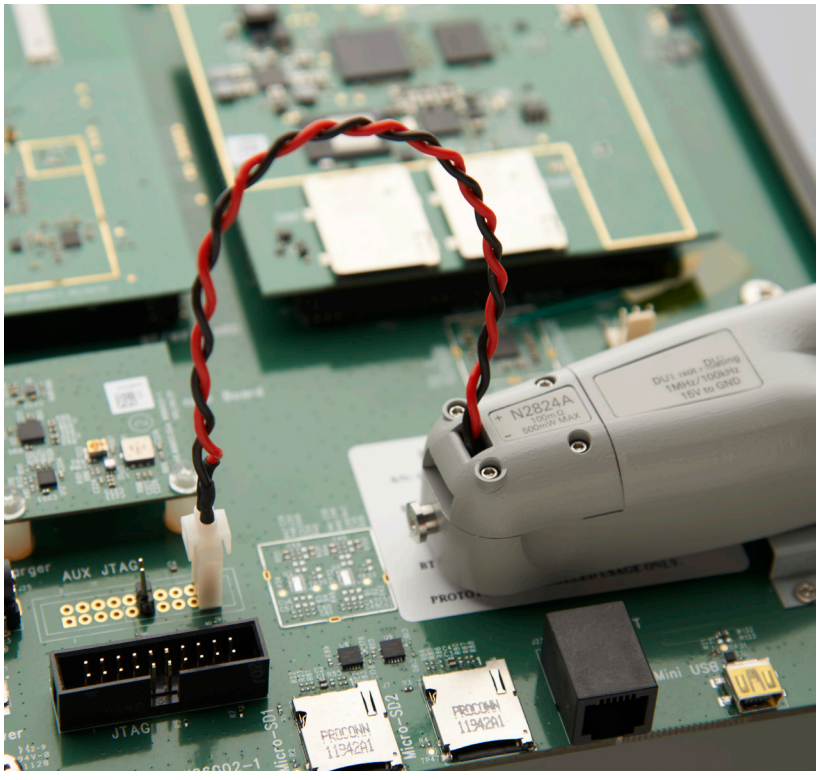
Keysight N2820A/21A

High-Sensitivity, High Dynamic Range Current Probes

See the details without losing sight of the big picture

Data Sheet



KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

Key features and specifications

- Measure current as low as 500 nA
- Measure current as high as 5 A
- Measure AC and DC
- Bandwidth
- 3 MHz - Zoom-Out channel
- 500 kHz - Zoom-In channel
- 2-channel vertical zoom mode enables accurate peak and idle current measurements
- New oscilloscope measurement current consumption over time (Charge)
- AutoProbe interface driving 1 MΩ input to oscilloscope
- Wide dynamic range – > 20,000:1 or 86 dB
- Probe accessories included with the probe or available separately: interchangeable Rsense heads (20 mΩ, 100 mΩ, and user-defined), MBB receptacles, headers, and hook-up wire

Industry's highest sensitivity, highest dynamic range AC/DC current probes

As modern battery-powered devices and integrated circuits become more 'green' and energy efficient, there is a growing need to make low level, wide dynamic range current measurements to ensure the current consumption of these devices is within acceptable limits.

The new N2820A Series high-sensitivity current probes address the need for high-sensitivity current measurements with a wide dynamic range. These probes also offer the advantage of small physical connections to the DUT because today's application environments require an extremely small form factor. The N2820A Series probes have higher sensitivity – up to 200X greater than existing clamp-on current probes with sub-milliampere low level sensitivity.

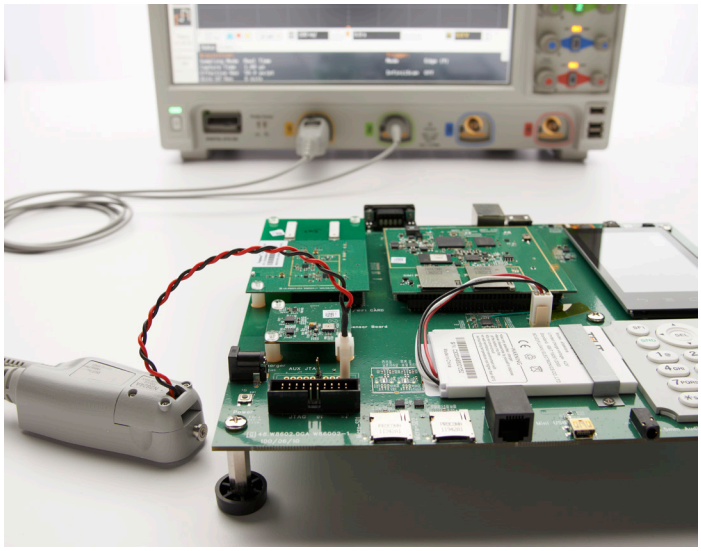


Figure 1. Keysight's ultra sensitive N2820A/N2821A current probes (with resolution as low as 50 µA) excel at measuring small current levels typically found in battery powered devices.

See the details without losing sight of the big picture

This N2820A current probe comes with two parallel amplifiers possessing different gain settings. The low gain side allows you to see the entire waveform (or the 'zoomed out' view) and the high gain amplifier provides a 'zoomed in' view.

The precision sense resistor is positioned in the interchangeable Rsense head that is plugged into the probe body. The probe body can be found at the same location as the differential amplifier. On the 'user-defined' sense head, there is no resistor, which allows the probe to be used with the user's sense resistor on the target. The user will need to enter the sense resistor value into the scope.

- 500 mW
- 250 µA to 5 A
- ± 1% tolerance
- For s maller voltage drop or lower burden on your circuit
- Order N2822A for replacement head

20 mΩ

- 500 mW
- 50 µA to 2.2 A
- ± 1% tolerance
- For higher sensitivity, bandwidth and lower noise
- Order N2824A for replacement head

100 mΩ

- Use your own sense R on your target
- Choose between 1 mΩ to 1 MΩ
- Check the resistor power rating ($P = I^2R$)
- Order N2825A for replacement head

User-defined

Figure 2. Types of sense resistor heads.

The supplied Make-Before-Break (MBB) connectors allow you to quickly probe multiple locations on your DUT without having to solder or unsolder the leads. The MBB header may be mounted on the user's target board. It fits into standard 0.1" spacing for 0.025" square pins. Users should plan their PCB layouts accordingly. The MBB can be used with all sense resistor probe heads including the user-defined probe head. The MBBs are a great way to easily connect and disconnect across multiple locations on the target board without interrupting the circuit under test.

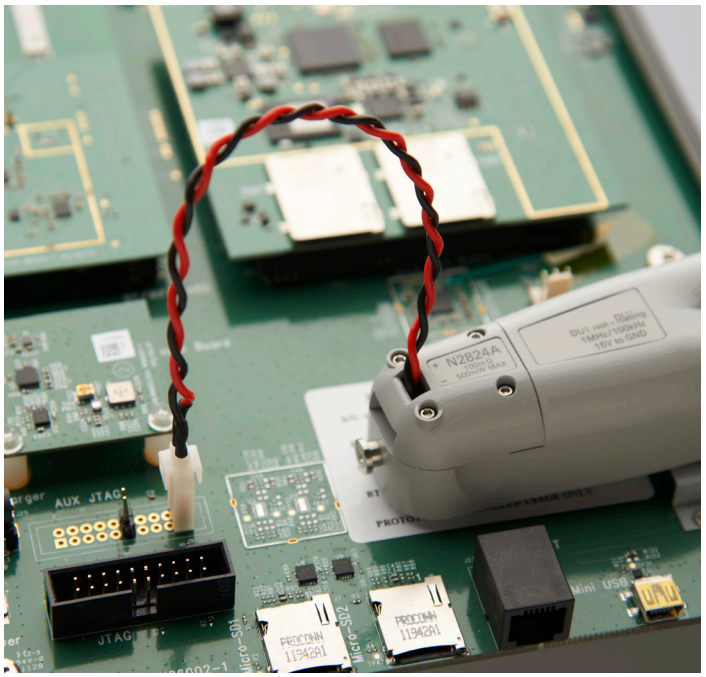


Figure 3. Probing with the MBB connector.

Two channel versus one channel

Keysight offers two current probe models in the N2820A Series: N2820A two-channel and N2821A one-channel. The N2821A looks identical to the N2820A probe but does not include the secondary cable that is shown in Figure 4. The N2820A probe connects to two oscilloscope channels to provide simultaneous low and high gain views for wider dynamic range measurement, while the N2821A probe provides one user-selectable view at a time.

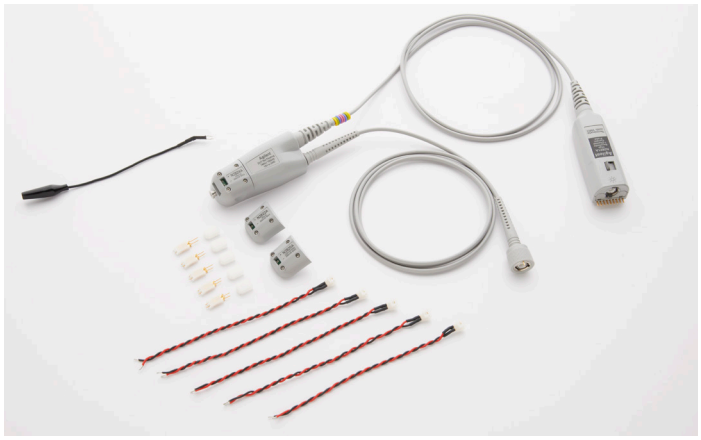


Figure 4. The N2820A 2-channel high-sensitivity current probe. The N2821A does not include the secondary cable.

Current consumption over time measurement

With current waveforms captured, you now want to calculate the average current consumption of the system over time. Keysight's Infiniium oscilloscopes provide an area under the curve measurement (Charge) where you can easily calculate the integrated current consumptions over time.

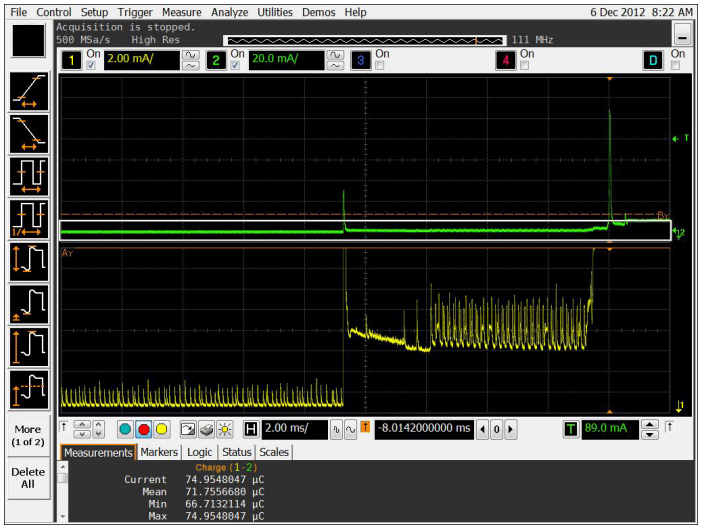


Figure 5. Infiniium oscilloscope coupled with the N2820A current probe provides the area under the curve measurement for accurate current consumption measurement.

Oscilloscope compatibility

The N2820A and N2821A current probes are compatible with Keysight oscilloscopes shown in the characteristics table. The N2820A Series current probes, together with Keysight's Infiniium 9000 H-Series high-definition oscilloscopes, deliver the ultimate high definition measurement solution, letting users view and resolve small current details not traditionally seen on 8-bit oscilloscopes.

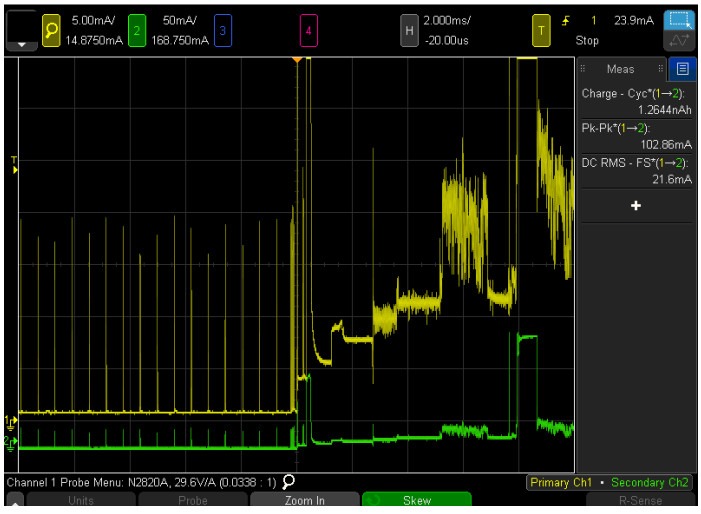


Figure 6. The InfiniiVision 3000 X- or 4000 X-Series oscilloscope can also be paired with the N2820A/21A current probes to provide the same simultaneous low- and/or high-gain views for wider dynamic range current measurement.

Probe characteristics		
Bandwidth (–3 dB)	Zoom-out channel: DC to 3 MHz	
	Zoom-in channel: DC to 500 kHz	
Risetime (Tr = 0.35/bandwidth, 10 to 90%)	Zoom-out channel: < 0.116 µsec	
	Zoom-in channel: < 0.7 µsec	
Minimum measurable current [1]	250 µA (with N2822A 20 mΩ, 500 mW)	
	50 µA (with N2824A 100 mΩ, 500 mW)	
	5 mA (with N2825A user-defined 1 mΩ, 500 mW)	
	500 nA (with N2825A user-defined 1 kΩ, 500 mW)	
Maximum measurable current	5 A (with N2822A 20 mΩ, 500 mW)	
	2.2 A (with N2824A 100 mΩ, 500 mW)	
	5 A [2] (with N2825A user-defined 1 mΩ, 500 mW)	
	1.2 mA [2] (with N2825A user-defined 1 kΩ, 500 mW)	
Gain [5]	Zoom-in channel: 300 ± 3%	
	Zoom-out channel: 1.97 ± 3%	
Output voltage rate	Zoom-in channel: 6 V/A (with N2822A 20 mΩ)	
	30 V/A (with N2824A 100 mΩ)	
	Zoom-out channel: 0.04 V/A (with N2822A 20 mΩ)	
	0.2 V/A (with N2824A 100 mΩ)	
DC amplitude accuracy	± 3% or 10 µA (whichever is greater)	
Max input voltage	± 12 V	
Burden voltage (voltage drop on Rsense)	Measured current [1] Rsense	
Dynamic range	20,000:1, 86 dB (N2820A)	
	1,000:1, 60 dB (N2821A)	
Output impedance	1 MΩ	
Noise (ACrms)	150 µA (with N2822A 20 mΩ, hi res mode on) [3]	
	240 µA (with N2822A 20 mΩ, hi res mode off)	
	30 µA (with N2824A 100 mΩ, hi res mode on) [3]	
	50 µA (with N2824A 100 mΩ, hi res mode off)	
Sensor resistor accuracy	± 1% (N2822A, N2824A)	
Sensor resistor power rating	500 mW (N2822A, N2824A)	
Temperature coefficient of sensor resistor	< 20 ppm/°C	
Cable lengths	Sensor leads: 16 cm	
	Probe cable: 1.2 m	
Temperature	Operating: 0 to +40 °C	
	Non-operating: –40 to +70 °C	
Humidity	Operating: tested at 95% RH at +40 °C	
	Non-operating: tested at 90% RH, +65 °C	
ESD	8 kV HBM	
Standard accessories	1 each 20 mΩ resistor sensor head	5 each MBB headers
	1 each 100 mΩ resistor sensor head	5 each MBB receptacles
	1 each user defined resistor sensor head	1 each ground lead
	5 each twisted leads (22 AWG) with sockets	1 each screw driver
	5 each twisted leads (22 AWG) without sockets	1 each passive cable (with N2820A only)
		1 each user guide manual (English)
Compatible oscilloscopes	InfiniiVision 3000 X-Series (with software version 2.30 or higher)	
	InfiniiVision 4000 X-Series (with software version 3.10 or higher) and 6000 X-Series	
	Infiniium S, 9000A, 9000 H-Series (with software version 4.20 or higher) [4]	

1. Vsupply is equal to 5 V, solder attached.
2. Max current varies with max resistor power rating. The examples in the table assume 500 mW power rating.
3. With scope with high resolution mode on, sampling rate < 2.5 MSa/s, 20 MHz low pass filter on.
4. Infiniium V, 90000A, 90000 X-, and 90000 Q-Series are not compatible with N2820A/21A current probe.
5. Denotes warrantied specification after 20-minute warm up. All others entries in the table are characteristics.

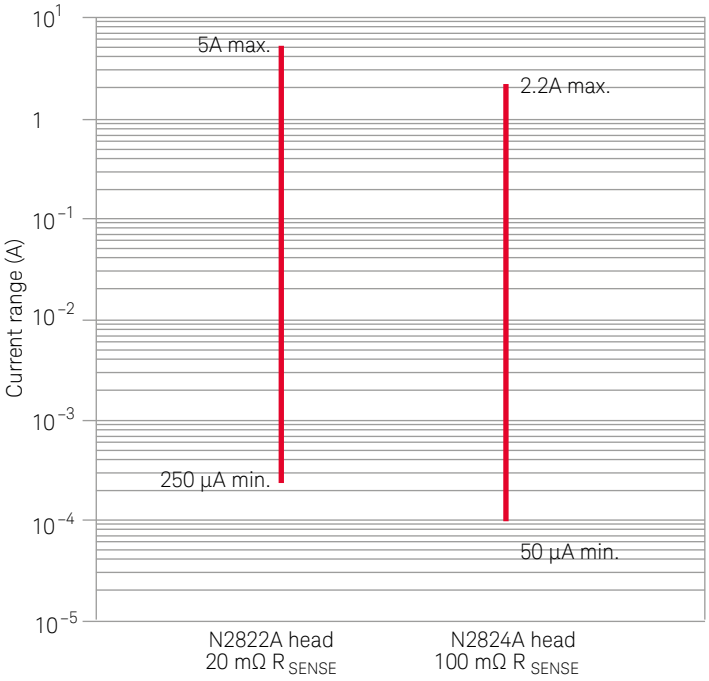


Figure 7. Minimum/Maximum current range with N2822A/N2824A head, 500 mW sense R, solder attached, High resolution mode on.

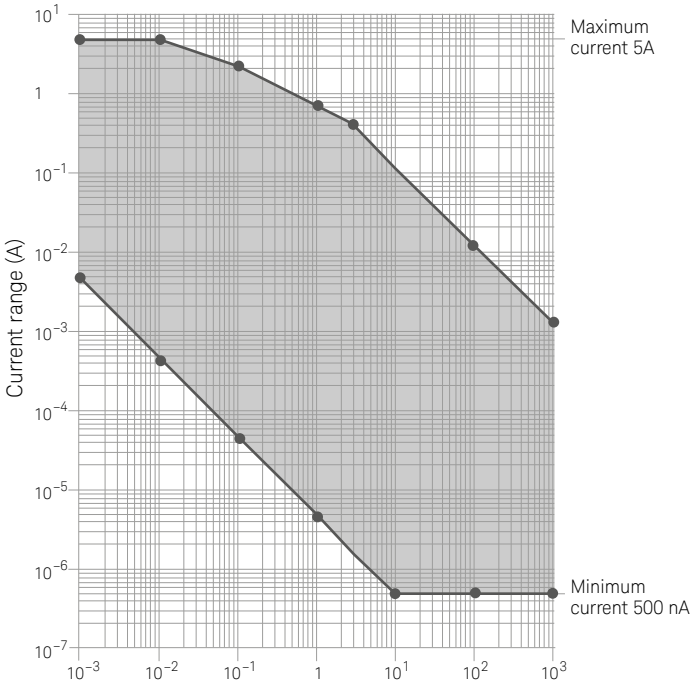


Figure 8. N2825A head.

Product configuration

Model numbers	Descriptions
N2820A	High-sensitivity 2-ch current probe
N2821A	High-sensitivity 1-ch current probe

Replacement part numbers	
N2822A	20 mΩ resistor tips
N2824A	100 mΩ resistor tips
N2825A	User-defined resistor tips
N2826A	Replacement wires (15.5 cm, 22 AWG bare wires) (qty 5)
N2827A	Passive cable (for N2820A secondary channel)
N2828A	Replacement MBB (Make Before Break) headers (qty 5)
N2829A	Replacement MBB (Make Before Break) receptacles and 15.5 cm, AWG 22 socketed wires (qty 5 each)

www.axiestandard.org

AdvancedTCA® Extensions for Instrumentation and Test (AXIe) is an open standard that extends the AdvancedTCA for general purpose and semiconductor test. The business that became Keysight was a founding member of the AXIe consortium. ATCA®, AdvancedTCA®, and the ATCA logo are registered US trademarks of the PCI Industrial Computer Manufacturers Group.

www.lxistandard.org

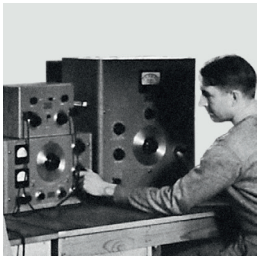
LAN eXtensions for Instruments puts the power of Ethernet and the Web inside your test systems. The business that became Keysight was a founding member of the LXI consortium.

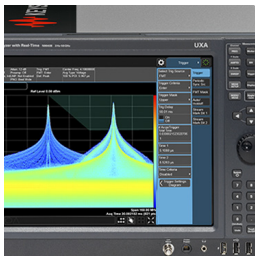
www.pxisa.org

PCI eXtensions for Instrumentation (PXI) modular instrumentation delivers a rugged, PC-based high-performance measurement and automation system.

Evolving

Our unique combination of hardware, software, support, and people can help you reach your next breakthrough. We are unlocking the future of technology.





From Hewlett-Packard to Agilent to Keysight

myKeysight

myKeysight
www.keysight.com/find/mykeysight
A personalized view into the information most relevant to you.

KEYSIGHT SERVICES
Accelerate Technology Adoption.
Lower costs.

Keysight Services
www.keysight.com/find/service
Our deep offering in design, test, and measurement services deploys an industry-leading array of people, processes, and tools. The result? We help you implement new technologies and engineer improved processes that lower costs.

STANDARD 3 YR WARRANTY

Three-Year Warranty
www.keysight.com/find/ThreeYearWarranty
Keysight's committed to superior product quality and lower total cost of ownership. Keysight is the only test and measurement company with three-year warranty standard on all instruments, worldwide. And, we provide a one-year warranty on many accessories, calibration devices, systems and custom products.

CALIBRATION WARRANTY UP TO 10 YEARS ASSURANCE PLANS

Keysight Assurance Plans
www.keysight.com/find/AssurancePlans
Up to ten years of protection and no budgetary surprises to ensure your instruments are operating to specification, so you can rely on accurate measurements.

Keysight Channel Partners
www.keysight.com/find/channelpartners
Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

www.keysight.com/find/N2820A

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at:
www.keysight.com/find/contactus

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 11 2626
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	800 000154
Sweden	0200 882255
Switzerland	0800 805353 Opt. 1 (DE) Opt. 2 (FR) Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-11-29-16)

DEKRA Certified
ISO9001 Quality Management System

www.keysight.com/go/quality
Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2015
Quality Management System

KEYSIGHT TECHNOLOGIES
Unlocking Measurement Insights

This information is subject to change without notice.
© Keysight Technologies, 2013 - 2017
Published in USA, January 31, 2017
5991-1711EN
www.keysight.com