Agilent 34420A
NanoVolt/Micro-Ohm Meter

Data Sheet

- 7½ digits resolution
- 100 pV, 100 nΩ sensitivity
- 1.3 nVrms, 8 nVpp noise performance
- Built-in low noise 2 channel scanner
- Direct SPRT, RTD, Thermistor, and Thermocouple measurements

Nanovolt Performance at a Microvolt Price
The Agilent Technologies 34420A nanoVolt/micro-Ohm meter is a high-sensitivity multimeter optimized for performing low-level measurements. It combines low-noise voltage measurements with resistance and temperature functions, setting a new standard in low-level flexibility and performance.

Take the Uncertainty Out of Your Low-Level Measurements
Low-noise input amplifiers and a highly tuned input protection scheme bring reading noise down to 8 nVpp. Combine this with 7½ digits of resolution, selectable analog and digital filtering, 2 ppm basic 24-hour dcV accuracy, and a shielded, copper pin connector and you’ve got accurate, repeatable measurements you can count on.

Two Input Channels
An integral two-channel programmable scanner simplifies voltage comparisons. Built-in ratio and difference functions enable automated two channel measurements without the need for an external nanoVolt scanner. Both channels share the same low noise specifications to ensure accurate comparisons.

Built-In Resistance and Temperature
The 34420A combines its low-noise nanoVolt input circuits with a high-stability current source to provide precise low-level resistance measurements — no more hassling with the cost and complexity of an external current source. Three resistance modes are included:
- Standard
- Low-power
- Voltage-limited for dry-circuit testing
Offset compensation is also provided to minimize thermal EMFs and associated errors.

SPRT Measurements
Built-in ITS-90 conversion routines accept the calibration coefficients from your SPRT probe for direct temperature measurement and conversion. Thermocouples, thermistors, and RTDs are also supported.

Unequaled Versatility
The 34420A gives you the versatility to tackle your most challenging tasks, both on the benchtop and in your automated system. Standard features include RS-232 and GPIB interfaces, SCPI and Keithley 181 programming language, 1024-reading memory, scaling and statistics, and a chart recorder analog output.

Agilent IntuiLink: Easy Data Access
The included Agilent IntuiLink software allows your captured data to be put to work easily, using PC applications such as Microsoft Excel® or Word® to analyze, interpret, display, print, and document the data you get from the 34420A. You can specify the meter setup and take a single reading or log data to the Excel spreadsheet in specified time intervals. To find out more about IntuiLink visit www.agilent.com/find/intuilink

Quality You Can Count On
The 34420A gives you the quality and reliability you expect from Agilent Technologies. From the product’s proven >150,000 hour Mean Time Between Failure, to its standard 1-year warranty, Agilent stands behind you to bring a new level of confidence to your low-level measurements.
### Specifications

**Accuracy Specifications ±(% of reading + % of range)**

<table>
<thead>
<tr>
<th>Function</th>
<th>Range</th>
<th>Test Current</th>
<th>24 Hour 23 °C ± 1 °C</th>
<th>90 Day 23 °C ± 5 °C</th>
<th>1 Year 23 °C ± 5 °C</th>
<th>Temperature Coefficient 0 °C—18 °C 28 °C—55 °C</th>
<th>Maximum per LeadResistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>dc Voltage</td>
<td>1.000000 mV</td>
<td>10 mA</td>
<td>0.0025 + .0002</td>
<td>0.0040 + .0002</td>
<td>0.0050 + .0002</td>
<td>0.0004 + .0001</td>
<td>1 Ω</td>
</tr>
<tr>
<td></td>
<td>10.000000 mV</td>
<td>10 mA</td>
<td>0.0015 + .0003</td>
<td>0.0030 + .0004</td>
<td>0.0040 + .0004</td>
<td>0.0004 + .0006</td>
<td>10 Ω</td>
</tr>
<tr>
<td></td>
<td>1.000000 V</td>
<td>100 µA</td>
<td>0.0020 + .0001</td>
<td>0.0030 + .0004</td>
<td>0.0040 + .0004</td>
<td>0.0004 + .0004</td>
<td>100 Ω</td>
</tr>
<tr>
<td>Resistance</td>
<td>1.000000 Ω</td>
<td>1 mA</td>
<td>0.0015 + .0002</td>
<td>0.0040 + .0002</td>
<td>0.0060 + .0002</td>
<td>0.0005 + .0001</td>
<td>1 KΩ</td>
</tr>
<tr>
<td></td>
<td>100.00000 Ω</td>
<td>5 µA</td>
<td>0.0020 + .0003</td>
<td>0.0050 + .0004</td>
<td>0.0070 + .0004</td>
<td>0.0006 + .0003</td>
<td>1 KΩ</td>
</tr>
<tr>
<td>Low Power Resistance</td>
<td>1.000000 Ω</td>
<td>10 mA</td>
<td>0.0015 + .0002</td>
<td>0.0050 + .0002</td>
<td>0.0070 + .0002</td>
<td>0.0005 + .0002</td>
<td>1 Ω</td>
</tr>
<tr>
<td></td>
<td>100.00000 Ω</td>
<td>1 mA</td>
<td>0.0015 + .0002</td>
<td>0.0040 + .0002</td>
<td>0.0060 + .0002</td>
<td>0.0005 + .0001</td>
<td>10 KΩ</td>
</tr>
<tr>
<td>Voltage Limited Resistance</td>
<td>1.000000 Ω</td>
<td>5 µA</td>
<td>0.0015 + .0012</td>
<td>0.0040 + .0015</td>
<td>0.0070 + .0015</td>
<td>0.0011 + .0002</td>
<td>1 KΩ</td>
</tr>
<tr>
<td>Channel 1 / Channel 2 (dcV Ratio) Ratio Error in % = Channel 1 accuracy in % + Channel 2 accuracy in %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channel 1-Channel 2 (dcV Difference) Difference Error = Channel 1 (% of reading + % of range) + Channel 2 (% of reading + % of range)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature (resolution = 0.001 °C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channel 1 Channel 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DC Voltage Noise**

<table>
<thead>
<tr>
<th>Range</th>
<th>2-Minute RMS Noise</th>
<th>2-Minute Peak-Peak Noise</th>
<th>24-Hour Peak-Peak Noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mV</td>
<td>1.3 nVrms</td>
<td>8 nVpp</td>
<td>12 nVpp</td>
</tr>
<tr>
<td>10 mV</td>
<td>1.5 nVrms</td>
<td>10 nVpp</td>
<td>14 nVpp</td>
</tr>
<tr>
<td>100 mV</td>
<td>10 nVrms</td>
<td>65 nVpp</td>
<td>80 nVpp</td>
</tr>
<tr>
<td>1 V</td>
<td>100 nVrms</td>
<td>650 nVpp</td>
<td>800 nVpp</td>
</tr>
<tr>
<td>10 V</td>
<td>450 nVrms</td>
<td>3 µVpp</td>
<td>3.7 µVpp</td>
</tr>
<tr>
<td>100 V</td>
<td>11 µVrms</td>
<td>75 µVpp</td>
<td>90 µVpp</td>
</tr>
</tbody>
</table>

**DC Voltage Noise vs Source Resistance**

<table>
<thead>
<tr>
<th>Source Resistance</th>
<th>Noise</th>
<th>Analog Filter</th>
<th>Digital Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Ω</td>
<td>1.3 nVrms</td>
<td>Off</td>
<td>Med</td>
</tr>
<tr>
<td>100 Ω</td>
<td>1.7 nVrms</td>
<td>Off</td>
<td>Med</td>
</tr>
<tr>
<td>1k Ω</td>
<td>4 nVrms</td>
<td>Off</td>
<td>Med</td>
</tr>
<tr>
<td>10kΩ</td>
<td>13 nVrms</td>
<td>Off</td>
<td>Med</td>
</tr>
<tr>
<td>100kΩ</td>
<td>41 nVrms</td>
<td>On</td>
<td>Med</td>
</tr>
<tr>
<td>1M Ω</td>
<td>90 nVrms</td>
<td>On</td>
<td>Slow</td>
</tr>
</tbody>
</table>
Measurement Characteristics

DC Voltage

Measurement Method:
Continuously integrating multi-slope III 
A-D Converter

A-D Linearity:
0.00008% of reading + 0.00005% of range

Input Resistance:
100V (Ch1 only): 10 MΩ ± 1%
1mV through 10V: > 10 GΩ, in parallel with < 3.6 nF

Input Bias Current: <50 pA at 25 °C

Input Protection: 150 V peak any input terminal
to Channel 1 LO, continuous

Channel-to-channel switching error (typical): 3 nV

Channel Isolation:
Isolation between input channels >10¹¹ Ω

Earth Isolation:
350 V peak any input terminal to earth.
Impedance from any input terminal to earth
is >10 GΩ and <400 pF

Maximum Voltage:
Channel 1 LO to Channel 2 LO, 150V peak

Resistance

Measurement Method:
Selectable 4-wire or 2-wire ohms. Current
Source referenced to Channel 1 LO input

Offset Compensation:
Used on all ranges except 100 kΩ and 1 MΩ.
Can be turned off if desired

Protection: 150 V peak

Open Circuit Voltage:
For Resistance and Low Power Resistance
<14 V. 20 mV, 100 mV, 500 mV selectable clamp

Temperature

SPRT:
ITS-90 calibrated temperature with the range
of -190°C to +660°C

Thermocouple:
ITS-90 conversions of Type B, E, J, K, N, R, S, T

Thermistor: 5 kΩ

RTD: Type α =.00385 and α =.00392. R0 from
4.9 Ω to 2.1 kΩ. ITS -90 (IEC-751) Callendar
Van Dusen conversion.

Measurement Noise Rejection 60 (50) Hz

dc CMRR: 140 dB
ac CMRR: 70 dB

Integral Time Normal Mode
Rejection3
200 plc/3.335 s (4 s) 110 dB
100 plc/1.675 s (2 s) 105 dB
20 plc/33.3 ms (400 ms) 100 dB
10 plc/167 ms (200 ms) 95 dB
2 plc/33.3 ms (40 ms) 90 dB
1 plc/16.7 ms (20 ms) 60 dB
<1 plc 0

Operating Characteristics

Function	Digits	Integration Time	Readings/s 4
---

dcV 7/6	200 plc .15 (.125)
Thermocouple 7/6	100 plc .3 (.25)
6/6	20 plc 1.5 (1.25)
6/6	10 plc 3 (2.5)
5/5	1 plc 25 (20.8)
5/5	0.2 plc 100 (100)
4/4	0.02 plc 250 (250)

Resistance 7/6	200 plc .075 (.062)
dcV1/DCV2 7/6	100 plc .15 (.125)
dcV 1-2 6/6	20 plc .75 (.625)
RTD 6/6	10 plc 1.5 (1.25)
Thermistor 5/5	1 plc 12.5 (10.4)
0.2 plc 50 (50)
41/2 0.02 plc 125 (125)

System Speeds*

Configuration Rates: 26/s to 50/s
AutoRange Rate (Volts): >30/s
ASCII reading to RS-232: 55/s
ASCII reading to GPIB: 250/s
Max. Internal Trigger Rate: 250/s
Max. Ext. Trig. Rate to Memory: 250/s

Triggering and Memory

Reading HOLD Sensitivity:
10%, 1%, 0.1%, or 0.01% of range
Samples/Trigger: 1 to 50,000
Trigger Delay: 0 to 3600 s; 10 µs step size
External Trigger Delay: <1 ms
External Trigger Jitter: <500 µs
Memory: 1024 readings

Math Functions

NULL (Channel 1 dcV, Channel 2 dcV,
Difference, Resistance, Temperature)

STATS (Min, Max, Average, Peak-Peak,
Standard Deviation, Number of readings)

SCALE (Allows linear scaling as y = mx+b)

CHART NULL (Establishes zero for rear panel
output)

Filter (Analog or Digital or Both)

Analog:
Low pass 2 pole @ 13Hz, available for dcV
on
1 mV, 10 mV, 100 mV range

Digital:
Moving average filter, 10 (fast), 50 (medium),
or 100 (slow) reading averages.

Chart Out (Analog Out)

Maximum output: ± 3V

Resolution: 16 bits

Accuracy: ± 0.1% of output + 1 mV

Output Resistance: 1 kΩ ± 5%

Update rate: once per reading

Span and Offset: Adjustable

Standard Programming Languages

SCPI (IEEE 488.2), Keithley 181

Accessories Included

4 ft low thermal cable with copper spade lugs,
Kelvin clip set, 4-wire shorting plug, user’s man-
ual, service manual, test report, contact cleaner,
and power cord.

General Specifications

Front Panel Connection:
Shielded, low thermal, 99% copper contacts.

Power Supply:
100V/120V/220V/230V/240V ± 10%.

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

Power Consumption:
25VA peak (10W average).

Operating Environment:
Full accuracy for 0 °C to 55 °C. Full accuracy
to 80% R.H. up to 30 °C.

Storage Environment:
-40 °C to 75 °C.

Size: 254.4 mm W x 374.0 mm L x 103.6 mm H
(10.02" W x 14.72" L x 4.08" H)

Weight: 3 kg (6.5 lbs).

Safety:
Designed to CSA, UL-1244, IEC-1010.
RFI and ESD: CISPR 11.
Ordering Information

Includes low thermal input cable (34102A), low thermal shorting plug (34103A), Kelvin clip set (11062A), calibration certificate, power cord. Also includes CD with: IntuILink software, IVI and VXI PnP drivers, user’s guide, service guide, and data sheet.

Options

34420A-ABA English localization
34420A-ABD German localization: translated operating manual
34420A-ABF French localization: translated operating manual
34420A-ABJ Japanese localization: translated operating manual
34420A-A6J ANSI Z540 compliant calibration

Accessories

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>34102A</td>
<td>Low-thermal input cable (four-conductor) with copper spade lugs</td>
</tr>
<tr>
<td>34103A</td>
<td>Low-thermal shorting plug</td>
</tr>
<tr>
<td>34104A</td>
<td>Low-thermal input connector</td>
</tr>
<tr>
<td>34131A</td>
<td>Transit Case</td>
</tr>
<tr>
<td>34161A</td>
<td>Accessory pouch</td>
</tr>
<tr>
<td>34190A</td>
<td>Rackmount Kit: designed for use with only one instrument, mounted on either the left or the right side of the rack.</td>
</tr>
<tr>
<td>34191A</td>
<td>2U Dual Flange Kit: secures the instrument to the front of the rack. This kit can be used with the 34194A Dual Lock Link Kit to mount two half-width, 2U height instruments side-by-side.</td>
</tr>
<tr>
<td>34194A</td>
<td>Dual Lock Link Kit: recommended for side-by-side combinations and includes links for instruments of different depths. This kit can be used with the 34191A 2U Dual Flange Kit to mount two half-width, 2U height instruments side-by-side.</td>
</tr>
</tbody>
</table>

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