

KEYSIGHT TECHNOLOGIES (AGILENT HP)

3478A

The Keysight/Agilent/HP 3478A is a highly reliable 5.5-digit benchtop and system digital multimeter equipped with a standard HP-IB (GPIB) interface. It is designed for precise measurements of DC and AC voltage, DC and AC current, and 2-wire or 4-wire resistance, featuring electronic calibration and switchable front/rear input terminals.

SPECIFICATIONS

General

Interfaces	HP-IB (IEEE-488.1)
Display	12-character Liquid Crystal Display (LCD) with integrated annunciators
Ranging Modes	Auto and Manual
Power-on Self Test	Yes

Physical

Operating Temperature	0 to 55 °C °C
Dimensions (W×H×D)	212.3 mm W × 88.9 mm H × 275.6 mm D mm
Weight	3.0 kg kg

DC Voltage

DCV Ranges	30 mV, 300 mV, 3 V, 30 V, 300 V
DCV Maximum Resolution	100 nV (on 30 mV range)
DCV Input Resistance (≤ 3 V Ranges)	$> 10 \text{ G}\Omega$
DCV Input Resistance (30 V and 300 V Ranges)	$10 \text{ M}\Omega \pm 1\%$
DCV Maximum Input Voltage	300 V DC or peak AC (HI to LO)
Input Bias Current	$< 20 \text{ pA}$ at 25 °C

AC Voltage

ACV Ranges	300 mV, 3 V, 30 V, 300 V
ACV Measurement Type	True RMS (AC-coupled)
ACV Frequency Range	20 Hz to 100 kHz
ACV Input Impedance	$1 \text{ M}\Omega \pm 1\%$ shunted by $< 60 \text{ pF}$
ACV Maximum Input Voltage	300 V RMS, 450 V peak
ACV Maximum Resolution	$1 \text{ }\mu\text{V}$ (on 300 mV range)
ACV Crest Factor	4:1 at full scale

DC Current

DCI Ranges	300 mA, 3 A
DCI Maximum Resolution	1 μ A (on 300 mA range)
DCI Protection Fuse	3 A, 250 V (rear panel)
DCI Maximum Continuous Input	3 A
DCI Burden Voltage (300 mA Range)	< 0.3 V
DCI Burden Voltage (3 A Range)	< 1.0 V

AC Current

ACI Ranges	300 mA, 3 A
ACI Measurement Type	True RMS (AC-coupled)
ACI Maximum Resolution	1 μ A (on 300 mA range)
ACI Frequency Range	20 Hz to 20 kHz
ACI Protection Fuse	3 A, 250 V
ACI Burden Voltage (300 mA Range)	< 0.3 V
ACI Burden Voltage (3 A Range)	< 1.0 V

Resistance

Ohms Measurement Types	2-wire and 4-wire ohms
Ohms Ranges	30 Ω , 300 Ω , 3 k Ω , 30 k Ω , 300 k Ω , 3 M Ω , 30 M Ω
Ohms Maximum Resolution	100 $\mu\Omega$ (on 30 Ω range)
Ohms Test Current (30 Ω , 300 Ω Ranges)	1 mA
Ohms Test Current (3 k Ω Range)	1 mA
Ohms Test Current (30 k Ω Range)	100 μ A
Ohms Test Current (300 k Ω Range)	10 μ A
Ohms Test Current (3 M Ω Range)	1 μ A
Ohms Test Current (30 M Ω Range)	100 nA
Ohms Input Protection	Protected to 250 V RMS
Max. Lead Resistance (4-wire ohms)	100 Ω in any lead (10 Ω on 30 Ω range)
Ohms Open Circuit Voltage	< 6.5 V

Measurement Rates and Performance

Display Resolution Modes	3.5, 4.5, or 5.5 digits
Maximum Reading Rate (3.5 digits)	71 readings per second (at 60 Hz)
Maximum Reading Rate (4.5 digits)	33 readings per second (at 60 Hz)
Maximum Reading Rate (5.5 digits)	1.4 readings per second (at 60 Hz)
Integration Time / Power Line Cycles (5.5 digits)	10 NPLC
Integration Time / Power Line Cycles (4.5 digits)	1 NPLC
Integration Time / Power Line Cycles (3.5 digits)	0.1 NPLC
A/D Converter Technology	Multi-slope II integrating A/D

Noise and Rejection

Normal Mode Rejection Ratio (NMRR)	> 80 dB at 50/60 Hz $\pm 0.1\%$ (in 5.5-digit mode)
Common Mode Rejection Ratio (CMRR) DC	> 140 dB at DC (with 1 k Ω imbalance in LO)
Common Mode Rejection Ratio (CMRR) AC	> 120 dB at 50/60 Hz (with 1 k Ω imbalance in LO)

System and Interface Configuration

HP-IB Interface Standard	IEEE-488.1 compliant
HP-IB Capability Codes	SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0, E1
HP-IB Address Selection	Rear-panel DIP switch-selectable
Calibration Method	Electronic, from front panel or over HP-IB (no internal hardware adjustments)
Calibration Security Lock	Rear panel hardware slide switch
Maximum Common Mode Voltage	500 V peak (LO to chassis ground)

Math and Control Functions

Front/Rear Input Switching	No rear input terminals / Front panel inputs only
Trigger Modes	Internal, External, Hold, Fast (bypasses settling delay)

Physical and Environmental

Storage Temperature Range	-40 °C to +75 °C
Warm-up Time	1 hour to rated specifications
Relative Humidity Limits	Up to 95% RH at 40 °C
Form Factor	Half-rack width benchtop / system cabinet

Power Requirements

AC Input Frequency Range	48 Hz to 66 Hz
AC Input Voltage Settings	100 V / 120 V / 220 V / 240 V AC $\pm 10\%$
Power Consumption	15 VA maximum
Line Frequency	48 Hz to 66 Hz
Line Fuse	0.15 A @ 115 V / 0.08 A @ 230 V (slow-blow)

DC Voltage Accuracy

DCV 1-Year Accuracy (3 V Range)	$\pm(0.0035\%$ of reading + 2 counts) (at 5.5 digits, $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$)
DCV 1-Year Accuracy (30 V / 300 V Ranges)	$\pm(0.004\%$ of reading + 2 counts) / $\pm(0.0045\%$ of reading + 2 counts) (at 5.5 digits, $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$)
DCV 1-Year Accuracy (300 mV Range)	$\pm(0.005\%$ of reading + 4 counts) (at 5.5 digits, $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$)

AC Voltage Accuracy

ACV 1-Year Accuracy (45 Hz - 20 kHz)	$\pm(0.16\%$ of reading + 110 counts) (3 V to 300 V ranges, at 5.5 digits, $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$)
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Resistance Accuracy

Ohms 1-Year Accuracy (3 k Ω to 300 k Ω Ranges)	$\pm(0.011\%$ of reading + 2 counts) (at 5.5 digits, $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$)
Ohms 1-Year Accuracy (30 Ω Range)	$\pm(0.012\%$ of reading + 35 counts) (with Null, at 5.5 digits, $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$)

DC Current Accuracy

DCI 1-Year Accuracy (300 mA Range)	$\pm(0.15\%$ of reading + 20 counts) (at 5.5 digits, $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$)
DCI 1-Year Accuracy (3 A Range)	$\pm(0.15\%$ of reading + 10 counts) (at 5.5 digits, $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$)

AC Current Accuracy

ACI 1-Year Accuracy (45 Hz - 20 kHz)	$\pm(0.8\%$ of reading + 120 counts) (300 mA range, at 5.5 digits, $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$)
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Input Protection

DCV/ACV Input Protection	300 V rms or 450 V peak continuous on all ranges
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Triggering

External Trigger Input Level	TTL compatible (negative-edge triggered)
External Trigger Minimum Pulse Width	1.5 μs
Voltmeter Complete Pulse Width	$\sim 1.5 \mu\text{s}$
Voltmeter Complete Output Level	TTL compatible (negative-going pulse)

Calibration

Calibration Storage	Internal non-volatile RAM (cal RAM) with lithium battery backup
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Data Storage

Reading Storage Memory	None (direct streaming via HP-IB)
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Display

Maximum Display Count	303,000 counts (except 300 V range)
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Compliance

Safety Compliance	Designed to comply with IEC 348 and UL 1244
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TECHNOLOGY

Multi-slope II integrating A/D conversion

APPLICATIONS

Benchtop electronic testing and automated system measurement

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