

HP 3456A

6.5-Digit Digital Voltmeter



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Measurement accuracy: $\pm$ (% of reading + number of counts).
Auto-zero on and filter off.

	24 hour: 23°C $\pm$ 1°C		90 days: 23°C $\pm$ 5°C	
RANGE	6½ digit ($\geq$ 10 PLC)	6½ digit (1 PLC)	6½ digit ($\geq$ 10 PLC)	6½ digit (1 PLC)
0.1 V	.0022 + 24	0.0024 + 32	0.0034 + 24	0.0035 + 32
1.0 V	0.0009 + 4	0.0012 + 5	0.0024 + 4	0.0025 + 5
10.0 V	0.0008 + 2	0.0011 + 3	0.0023 + 2	0.0024 + 3
100.0 V	0.0011 + 3	0.0014 + 4	0.0026 + 3	0.0027 + 4
1000.0 V ¹	0.0011 + 2	0.0013 + 3	0.0024 + 2	0.0025 + 3

¹Add .012 $\left(\frac{\text{Input Voltage}}{1000} \right)^2$ % to % of reading.

Temperature coefficient: $\pm$ (% of reading + number of counts/°C)

5½ Digit Display

RANGE	0.1V	1.0V	10.0V	100.0V	1000.0V
Temp Coef.	0.0002 +0.2	0.0002 +0.2	.0002 +0.02	0.0002 +0.02	0.0002 +0.02

For 6½ digits, multiply counts by 10. For 4½ digits, multiply counts by .1

Auto-zero OFF: (5½ digit). For a stable environment $\pm$ 1°C, add 10 counts for 0.1 V range, 1 count for 1 V and 100 V ranges, and .1 count for 10 V and 1000 V ranges. For 6½ digits, multiply counts by 10. For 4½ digits, multiply counts for .1.

Filter ON: rejection is $>$ 60 dB at 50 Hz. Add 2 μ V to uncertainty for .1 V, 1.0 V and 10 V range and 200 μ V for 100 V and 1000 V range.

Response Time

Filter OFF: for preprogrammed settling times (0.0 seconds), error is $<$ 0.0005% of input voltage step.

Filter ON: for preprogrammed settling times (.65 seconds), error is $<$.01% of input voltage step.

NOISE REJECTION (dB) (1 k Ω unbalance in Lo)

	AC ¹ NMR	AC ¹ ECMR	DC ECMR
.01 PLC or .1 PLC	0	90	140
$>$ 1 PLC	60	150	140
$\geq$ 1 PLC with filter	120	160	140

¹For 50, 60 Hz (depending on option) $\pm$.09%

Resistance (2 W Ω , 4 W Ω , 2 WOC Ω , 4 WOC Ω)

Input Characteristics

RANGE	MAXIMUM READING (5½ digit)	6½ digit	RESOLUTION 5½ digit	4½ digit	CURRENT THROUGH UNKNOWN	MAXIMUM VALID READING VOLTAGE	MAXIMUM OPEN CIRCUIT VOLTAGE
100 Ω	119.999 Ω	100 $\mu\Omega$	1 m Ω	10 m Ω	1 mA	.12 V	5.5 V
1 k Ω	1199.99 Ω	1 m Ω	10 m Ω	100 m Ω	1 mA	1.2 V	5.5 V
10 k Ω	11.9999 k Ω	10 m Ω	100 m Ω	1 Ω	100 μ A	1.2 V	5.5 V
100 k Ω	119.999 k Ω	100 m Ω	1 Ω	10 Ω	50 μ A	6 V	9.5 V
1 M Ω	1199.99 k Ω	1 Ω	10 Ω	100 Ω	5 μ A	6 V	9.5 V
10 M Ω	11.9999 M Ω	10 Ω	100 Ω	1 k Ω	500 nA	6 V	9.5 V
100 M Ω	119.999 M Ω	100 Ω	1 k Ω	10 k Ω	$\leq$ 500 nA ¹	5 V	5.5 V
1 G Ω	1000.00 M Ω	1 k Ω	10 k Ω	100 k Ω	$\leq$ 500 nA ¹	5 V	5.5 V

¹Ohms source is a 500 nA current source in parallel with a 10 M Ω resistance.

Non-destructive overload: 350 V peak

Measurement accuracy: $\pm$ (% of reading + number of counts).
Auto-zero on, filter off, and 4-wire ohms.

	24 hour: 23°C $\pm$ 1°C		90 days: 23°C $\pm$ 5°C	
RANGE	6½ digit ($\geq$ 10 PLC)	6½ digit (1 PLC)	6½ digit ($\geq$ 10 PLC)	6½ digit (1 PLC)
100 Ω	0.003 + 24	0.003 + 32	0.004 + 24	0.004 + 32
1 k Ω	0.002 + 4	0.003 + 5	0.003 + 4	0.004 + 5
10 k Ω	0.002 + 4	0.003 + 5	0.003 + 4	0.004 + 5
100 k Ω	0.002 + 2	0.003 + 3	0.003 + 2	0.004 + 3
1 M Ω	0.006 + 2	0.006 + 3	0.007 + 2	0.007 + 3
10 M Ω	0.041 + 2	0.041 + 3	0.042 + 2	0.042 + 3
100 M Ω	1.3 + 1	1.3 + 1	1.8 + 1	1.8 + 1
1 G Ω	11 + 1	11 + 1	16 + 1	16 + 1

AC RMS Voltage (ac, ac + dc)

Input Characteristics

RANGE	MAXIMUM READING (5½ digit)	6½ digit	RESOLUTION 5½ digit	4½ digit	INPUT IMPEDANCE	MAXIMUM INPUT VOLTAGE
1.0 V	1.19999 V	1 μ V	10 μ V	100 μ V	1 M Ω $\pm$ 5% shunted by <90 pF	$\pm$ 1000 V peak (700 V rms) 10 ⁶ VHz
10.0 V	11.9999 V	10 μ V	100 μ V	1 mV		
100.0 V	119.999 V	100 μ V	1 mV	10 mV		
1000.0 V	700.00 V	1 mV	10 mV	100 mV		

Measurement accuracy: $\pm$ (% of reading + number of counts).
Auto-zero on, $>$ 1% of scale, and dc component $<$ 10% of ac component.

90 days: 23°C $\pm$ 5°C

Filter OFF Filter ON	FREQUENCY IN Hz				
	10 to 30	400-20k 30-20k	20k to 50k 20k to 50k	50k to 100k 50k to 100k	100k to 250k 100k to 250k
6½ digit ($\geq$ 1 PLC) ²	.47 + 450	.07 + 730	.17 + 1700	.55 + 2900	5.0 + 6500
5½ digit (.1 PLC)	.48 + 90	.08 + 73	.18 + 173	.56 + 293	5.0 + 653
4½ digit (.01 PLC)	.56 + 10	.13 + 9	.23 + 9	.61 + 31	5.1 + 67

¹Frequencies $>$ 100 kHz are specified for 1.0 V and 10 V ranges only.

²Integration Time in Power Line Cycles (PLC). For 5½ digits, multiply counts by 0.1. For 4½ digits, multiply counts by 0.01.

Guard to chassis: $\pm$ 500 V peak

Guard to low: $\pm$ 200 V peak

Temperature coefficient: $\pm$ (% of reading + number of counts)/°C. (5½ digit) $\pm$ (.008 + 6)/°C for DC component $<$ 10% ac component. Otherwise add $\pm$ (.008 + 12)/°C. For 6½ digit, multiply counts by 10. For 4½ digit, multiply counts by .1.

DC component $>$ 10% of ac component: (5½ digit) Add $\pm$ (.5% of Reading + 50 counts) to accuracy. For 6½ digit, multiply counts by 10. For 4½ digit, multiply counts by .1. For signals with no ac component, use the 1 kHz ac spec.

Crest factor: $>$ 7:1 at full scale.

Common mode rejection (1 k Ω Lo unbalance): $>$ 90dB dc to 60 Hz.

Auto-zero OFF: for stable environment $\pm$ 1°C no accuracy change.

Response time: for preprogrammed settling times, error is $<$.1% of input voltage step.

Filter OFF: 0.06 seconds

Filter ON: .80 seconds

2-Wire ohms accuracy: Same as 4-wire ohms except add a maximum of .2 ohm offset.

Auto-zero OFF accuracy: (5½ digit). For a stable environment $\pm$ 1°C, add 10 counts for 100 Ω range, 1 count for 1 k Ω and 10 k Ω range, and .2 counts for $\geq$ 100 k Ω range. Changes in lead resistance are not corrected in 4-wire ohms. For 4½ digit, multiply counts by .1. For 6½ digit, multiply counts by 10.

VOLTMETERS, DIGITAL & ANALOG

3½ to 6½ Digital DVM for Bench/System Applications

Model 3456A (cont.)

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Offset compensated ohms accuracy: same as 2-wire and 4-wire except maximum reading may be reduced by 9% for large offset voltages.

Response time: with preprogrammed settling time and <200 pF of capacitance, first reading is in specification.

Filter is not operational in ohms.

Temperature coefficient: (5½ digits) ±(% of Reading + Number of Counts)/°C

RANGE	100 Ω	1 kΩ	1 MΩ	10 MΩ	100 MΩ	1 GΩ
Temp Coef.	.0004 +2	.0004 +02	.0004 +004	.0010 +004	.16 +0	1.6 -0

4½ digit: multiply counts by 0.1; 6½ digit: multiply counts by 10.

Ratio

Type: dc/dc, ac/dc, or (ac + dc)/dc

Method: 4-wire with Volts Lo input common

$$\text{Ratio} = \frac{\text{Signal Voltage}}{\text{Ref. Hi Voltage} - \text{Ref. Lo Voltage}}$$

Signal measurement: Same as dc Volts, ac Volts, or ac + dc Volts

Reference measurement: automatically selects .1 V, 1 V, or 10 V dc. Volts range and a 0.0 ms. settling time. Filter is off.

Maximum Reference Voltages

Ref. Hi: ±12 V

Ref. Lo: ±9% of Ref. Hi

Ref. Hi-Ref. Lo: ±11.9999 V

Protection: ±340 V peak

Accuracy: total % signal error + total % reference error (same as .1 V, 1 V, or 10 V DC volts)

Reading Rate

Reading rates are with autorange, math, display and filter off. Output is to internal memory using internal trigger and packed mode. Packed output in place of internal memory adds 0.35 ms; ASCII output adds 2.3 ms per reading.

Rates vs. integration time and auto-zero: dc volts and 100 Ω thru 10 kΩ ranges with preprogrammed settling times (−0.0 s.). Also, ac or ac + dc volts and 100 kΩ thru 10 MΩ ranges with 0.0 s delay.

INTEGRATION TIME IN POWER LINE CYCLES (PLC)	RATES (rdgs/second)			
	Auto Zero OFF	50 Hz	60 Hz	Auto Zero ON
0.01 (4½ digit)	330	290	210	180
0.10 (5½ digit)	210	180	120	100
1.00 (6½ digit)	48	40	25	20
10.00 (6½ digit)	5.8	4.8	2.9	2.4
100.00 (6½ digit)	.57	.47	.29	.24

Memory

Reading store: can store up to 350 readings.

can be recalled from HP-IB interface or front panel

Program memory: can execute an internal program which controls instrument configuration and measurement sequence. Program is input from the HP-IB interface with up to 1400 ASCII characters.

Memory size: total size is 1400 bytes. Memory used is 1 byte per ASCII character + 4 bytes per reading stored.

Math Functions

General: math function specifications do not include error in X (instrument reading) or in entered values (R, L, U, Y, Z). Range of values input or output is 0.000000 × 10^{−9} to ±1999999 × 10⁹. Out of range values send "OL" to display and +1999999 × 10⁹ to HP-IB.

Pass/fail: displays "HI" for values > upper limit (U), "LO" for values < lower limit (L), and X for values between the limits, with no introduced error. SRQ mask can be programmed to respond to out-of-limit conditions.

Maximum execution time: 20 ms

Statistics

$$\text{Mean (M)} = X_1 + \frac{1}{C} \sum_{i=1}^C (X_i - X_1)$$

$$\text{Variance (V)} = \frac{\sum_{i=1}^C (X_i - X_1)^2 - \frac{1}{C} \left[\sum_{i=1}^C (X_i - X_1) \right]^2}{C - 1}$$

Maximum (U) and Minimum (L) are the most positive and negative instrument readings, respectively. X is displayed during calculation of statistics.

X₁ is the first reading taken after enabling statistics and is stored in the Z register. The number of readings taken (C) is stored in the count register.

Maximum execution time: 50 ms

Null: X − X₁ (X₁ is the first valid reading taken after enabling null and is stored in the Z register).

Maximum execution time: 15 ms

dBm(R):

$$10 \log \left| \frac{x^2/R}{1 \text{ mW}} \right| \quad R \text{ is the user-entered impedance.}$$

Output range: −280 to +340 dBm

Maximum execution time: 150 ms

Thermistor (F): converts resistance of thermistor HP0837-0164, YSI 44007, Omega UUA35J3, and Fenwal UUA35J1 to temperature in °F.

Output range: −112° to 302° F

Maximum execution time: 150 ms

Scale: (X − Z)/Y

Maximum execution time: 60 ms

$$\text{dB: } 20 \log \frac{X}{Y}$$

Output range: −620 to +620 dB

Maximum execution time: 100 ms

% Error: 100 × (X − Y)/Y

Maximum execution time: 60 ms

General

Operating temperature: 0 to 50°C

Warmup time: one hour to meet all specifications

Humidity range: 95% R.H., 0 to 40°C

Storage temperature: −40 to +75°C

Power: 100/120/240 V ±5%, −10%, 48 Hz to 66 Hz line operation, 60 VA; 220 V ±10%, 48 Hz to 66 Hz line operation, 60 VA.

Size: 88.9 mm H × 425.5 mm W × 527.1 mm D (3½" × 16¾" × 20¾")

Weight: net, 10.49 kg (23.13 lb.); shipping, 13.35 kg (29.38 lb.)

Ordering Information

	Price
HP 10833A: 1 Meter (39.37 in.) HP-IB Cable	\$80
HP 10833B: 2 Meter (78.74 in.) HP-IB Cable	\$90
HP 10833C: 4 Meter (157.48 in.) HP-IB Cable	\$100
HP 10833D: 0.5 Meter (19.69 in.) HP-IB Cable	\$80
03456-90001: Operating information supplement (one furnished with HP 3456A)	
HP 11002A: Test Leads, dual banana to probe and alligator	\$20
HP 34111A: High Voltage Probe, 40 kV	\$180
Opt 050: Noise rejection for 50 Hz	N/C
Opt 060: Noise rejection for 60 Hz	N/C
Opt 907: Front handle kit, P/N 5061-0088	+\$50
Opt 908: Rack flange kit, P/N 5061-0074	+\$30
Opt 909: Rack flange and front handle kit, HP P/N 5061-0075	+\$72.50
Opt 910: Extra operating & service manual	
HP 3456A Digital Voltmeter	\$3800

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