

# DIGITAL VOLTMETERS

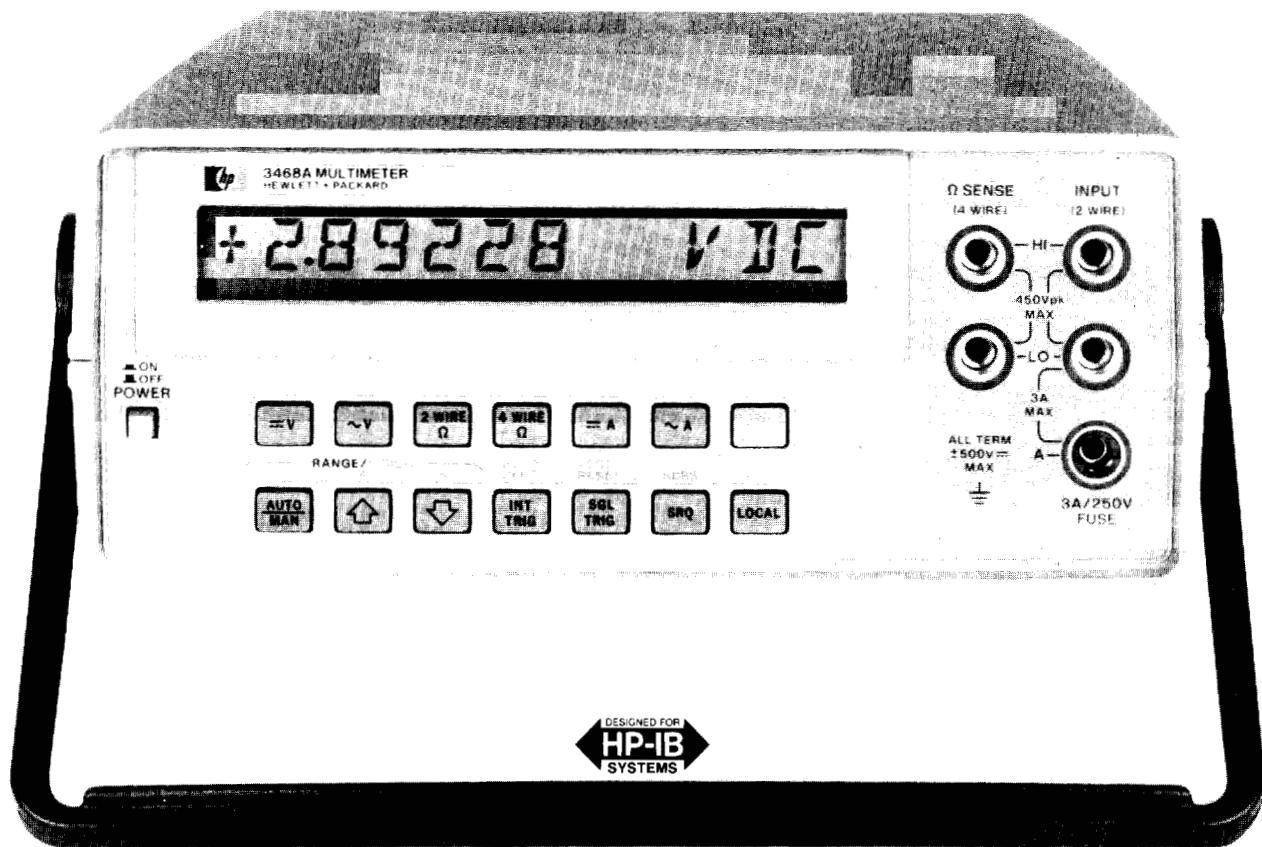
5½ to 3½ digit, HP-IL

Model 3468A



- Five Functions
- HP-IL Programmable

- Electronic Calibration
- 5½ to 3½ Digits



## Description

The 3468A is an autoranging 5½ to 3½ digit DMM with the five functions of dc volts, true RMS ac volts, 2 and 4-wire ohms, dc current and true RMS ac current. It interfaces with HP-IL (Hewlett-Packard Interface Loop) providing complete programmability of functions, ranges and modifiers. The 3468A can also be completely calibrated electronically without any adjustments either from the front panel or remotely in an automatic calibration system. It is available with a rechargeable battery and battery charging circuitry for portable measurements.

## HP-IL

The 3468A is fully programmable with HP-IL, a new two-wire serial interface, and the HP 41C/CV handheld calculators or the more powerful HP series 80 computers. HP-IL provides automatic measurements and adds computational power to a bench DMM. For example, to measure temperature, the HP 41 can linearize a transducer device and display the results in degrees C or degrees F right on the display of the 3468A. For audio and telecommunication applications, the 3468A can measure ac voltage and the HP 41 can convert to dBm referenced to any impedance. Or the HP 41 can be programmed to get data from the 3468A and perform a % error calculation, then display the results in percent on the 3468A display.

## High Performance

The 3468A has 5 functions with selectable 5½, 4½ or 3½ digit resolution. DC and true RMS ac voltage measurements are provided

from 0.3 volt full scale range with 1  $\mu$ V sensitivity up to 300 volts. The bandwidth of the true RMS ac converter is from 20 Hz to 100 kHz on all ranges and up to 300 kHz on the 30 V range. Either 2 or 4-wire ohms measurements can be selected with a maximum range of 30 M $\Omega$ . Both dc and true RMS ac current capability is provided up to 3 A. All functions on the 3468A incorporate a fast autoranging. The 3468A uses an integrating analog to digital conversion technique for high noise rejection. The selectable 3½, 4½ or 5½ digits of resolution allows flexibility for choosing speed or noise rejection.

## Electronic Calibration

Complete calibration of the 3468A is done electronically, either manually from the front panel or remotely in an automatic calibration system. There are no internal adjustments. Complete calibration of all functions is done without removal of the instrument's covers, thus saving valuable time and reducing cost. The calibration procedure for the 3468A involves connecting a calibration standard to the input, then pressing three keystrokes to store one calibration constant in CMOS RAM for each range and function. When the 3468A makes a measurement, each reading is corrected according to the calibration constants that have been stored. The internal CMOS RAM used in the 3468A is powered by a lithium battery to create a non-volatile memory capable of holding the calibration constants for more than ten years.

## Battery

The optional battery pack includes a rechargeable battery and the battery charger circuitry for up to five hours of continuous measurements.



## DC Voltage

### Input characteristics:

Range	Maximum Reading (5½ digit)	Resolution		
		5½ digit	4½ digit	3½ digit
.3 V	±.301000 V	1 µV	10 µV	100 µV
3 V	±3.01000 V	10 µV	100 µV	1 mV
30 V	±30.1000 V	100 µV	1 mV	10 mV
300 V	±301.000 V	1 mV	10 mV	100 mV

**Input resistance:** .3 V, 3 V ranges:  $>10^{10} \Omega$   
30 V, 300 V ranges:  $10 M\Omega \pm 1\%$

**Maximum input voltage** (non-destructive):

Hi to Lo: 301 Vrms or 450 V peak

Hi or Lo to Earth Ground: ±500 V peak

**Measurement accuracy:** ±(% of reading + number of counts).  
Auto zero ON. 5½ digits.

### 5½ Digit Mode:

Range	T <sub>Cal</sub> * ± 1°C 24 Hour	T <sub>Cal</sub> * ± 5°C	
		90 Day	1 Year
.3 V	0.005 + 4	0.009 + 5	0.02 + 5
3 V	0.0035 + 2	0.007 + 2	0.018 + 2
30 V	0.005 + 3	0.009 + 3	0.02 + 3
300 V	0.0055 + 2	0.009 + 2	0.02 + 2

\*T<sub>Cal</sub> is the temperature of the environment where the 3468A was calibrated. Calibration should be performed with the temperature of the environment between 20°C and 30°C.

**Temperature coefficient:** 0°C to 55°C, 5½ digits, auto zero ON.  
± (% of reading + number of counts)/°C.

Range	Temperature Coefficient
.3 V, 30 V	0.0008 + .5
3 V, 300 V	0.0007 + .05

**Noise rejection:** In dB, with 1 kΩ imbalance in Lo lead. AC rejection for 50, 60 Hz ± 0.1%. Auto zero ON.

Display	AC NMR	AC ECMR	DC CMR
5½ digits	80	150	140
4½ digits	59	130	140
3½ digits	0	70	140

### Reading rates:

**Maximum reading rate with HP 85A:** 32 readings/sec

**Maximum reading rate with 41 CV:** 2 readings/sec

## Resistance (2-wire Ω, 4-wire Ω)

### Input Characteristics:

Range	Maximum Reading (5½ digit)	Resolution		
		5½ digit	4½ digit	3½ digit
300 Ω	301.000 Ω	1 mΩ	10 mΩ	100 mΩ
3 kΩ	3.01000 kΩ	10 mΩ	100 mΩ	1 Ω
30 kΩ	30.1000 kΩ	100 mΩ	1 Ω	10 Ω
300 kΩ	301.000 kΩ	1 Ω	10 Ω	100 Ω
3 MΩ	3.01000 MΩ	10 Ω	100 Ω	1 kΩ
30 MΩ	30.1000 MΩ	100 Ω	1 kΩ	10 kΩ

**Input protection:** (non-destructive): ± 350 V peak

**Measurement accuracy:** ± (% of reading + number of counts).  
Auto zero ON. 5½ digit display. 4-wire ohms.

Range	T <sub>Cal</sub> * ± 1°C 24 Hour	T <sub>Cal</sub> * ± 5°C	
		90 Day	1 Year
300 Ω	0.004 + 4	0.012 + 4	0.017 + 5
3 kΩ–300 kΩ	0.004 + 2	0.011 + 2	0.016 + 2
3 MΩ	0.005 + 2	0.011 + 2	0.016 + 2
30 MΩ	0.036 + 2	0.066 + 2	0.078 + 2

**2-Wire ohms accuracy:** Same as 4-wire ohms, except add a maximum of 100 mΩ offset.

### Current through unknown:

Range	300 Ω	3 kΩ	30 kΩ	300 kΩ	3 MΩ	30 MΩ
Current	1 mA	1 mA	100 µA	10 µA	1 µA	100 nA

**Maximum open circuit voltage:** 6.5 V

## AC Voltage (true RMS responding)

### Input Characteristics:

Range	Maximum Reading (5½ digit)	Resolution		
		5½ digit	4½ digit	3½ digit
.3 V	.301000 V	1 µV	10 µV	100 µV
3 V	3.01000 V	10 µV	100 µV	1 mV
30 V	30.1000 V	100 µV	1 mV	10 mV
300 V	301.000 V	1 mV	10 mV	100 mV

**Input impedance:** 1 MΩ ± 1% shunted by <60 pF.

**Maximum input voltage** (non-destructive): 300 Vrms or 450 V peak.

**Measurement accuracy:** ± (% of reading + number of counts).  
Auto zero ON. 5½ digit display. Accuracy is specified for sinewave inputs only, >10% of full scale.

### 1 Year, T<sub>Cal</sub> ± 5°C.

Frequency	Ranges		
	.3V	3 V, 30 V	300 V
20-50 Hz	1.14 + 163	1.14 + 102	1.18 + 102
50-100 Hz	0.46 + 163	0.46 + 103	0.5 + 102
100 Hz-20 kHz	0.29 + 163	0.26 + 102	0.33 + 102
20-50 kHz	0.56 + 247	0.41 + 180	0.55 + 180
50-100 kHz	1.74 + 882	1.05 + 825	1.26 + 825
100 k-300 kHz		10.1 + 3720 (30 V range only)	

**Crest factor:** >4:1 at full scale.

## DC Current

### Input characteristics:

Range	Maximum Reading (5½ digit)	Resolution		
		5½ digit	4½ digit	3½ digit
3 A	±3.01000 A	10 µA	100 µA	1 mA

**Maximum input** (non-destructive): 3 A from <250 V source; fuse protected.

**Measurement accuracy:** ± (% of reading + number of counts).  
Auto zero ON. 5½ digit display.

Range	T <sub>Cal</sub> ± 5°C	
	90 Days	1 Year
3 A, <1 A input	0.14 + 6	0.17 + 6
3 A, >1 A input	1.0 + 30	1.0 + 30

## AC Current (true RMS responding)

### Input characteristics:

Range	Maximum Reading (5½ digit)	Resolution		
		5½ digit	4½ digit	3½ digit
.3 A	.301000 A	1 µA	10 µA	100 µA
3 A	3.01000 A	10 µA	100 µA	1 mA

**Maximum input** (non-destructive): 3 A from <250 V source; fuse protected.

**Measurement accuracy:** ± (% of reading + number of counts).  
Auto zero ON. 5½ digit display. Accuracy specified for sinewave inputs only, >10% of full scale.

### 1 Year, T<sub>Cal</sub> ± 5°C

Frequency	Ranges	
	.3 A	3 A
20-50 Hz	1.77 + 163	2.5 + 163
50-1 kHz	1.1 + 163	1.8 + 163
1 k-10 kHz	1.0 + 163	1.7 + 163
10 k-20 kHz	1.14 + 163	1.84 + 163

## General Information

**Operating temperature:** 0 to 55°C

**Humidity Range:** 95% R.H., 0 to 40°C

**Power:** AC line 48 to 440 Hz, 86 to 250 V, (see configuration)

**Battery:** (Opt 001) Rechargeable lead-acid; minimum continuous operation for 5 hours at 25°C; recharge time is 16 hours with 3468A off and 36 hours with 3468A on.

**Size:** 98.4 mm H x 238.1 mm W x 276.2 mm D (3.88 H x 9.38 W x 10.88 D).

**Weight:** 3468A—2.1 kg (4.63 lbs); 3468A with Opt 001—3.1 kg (6.83 lbs).

**Configuration:** Order one power and frequency option at no charge from below.

**Opt 315:** 100 V, 50 Hz; **Opt 335:** 220 V, 50 Hz

**Opt 316:** 100 V, 60 Hz; **Opt 336:** 220 V, 60 Hz

**Opt 325:** 120 V, 50 Hz; **Opt 345:** 240 V, 50 Hz

**Opt 326:** 120 V, 60 Hz; **Opt 346:** 240 V, 60 Hz

**Price**

\$695

3468A DMM with HP-IL and Test Probes

\$125

3468A Opt 001, add Rechargeable Battery Pack