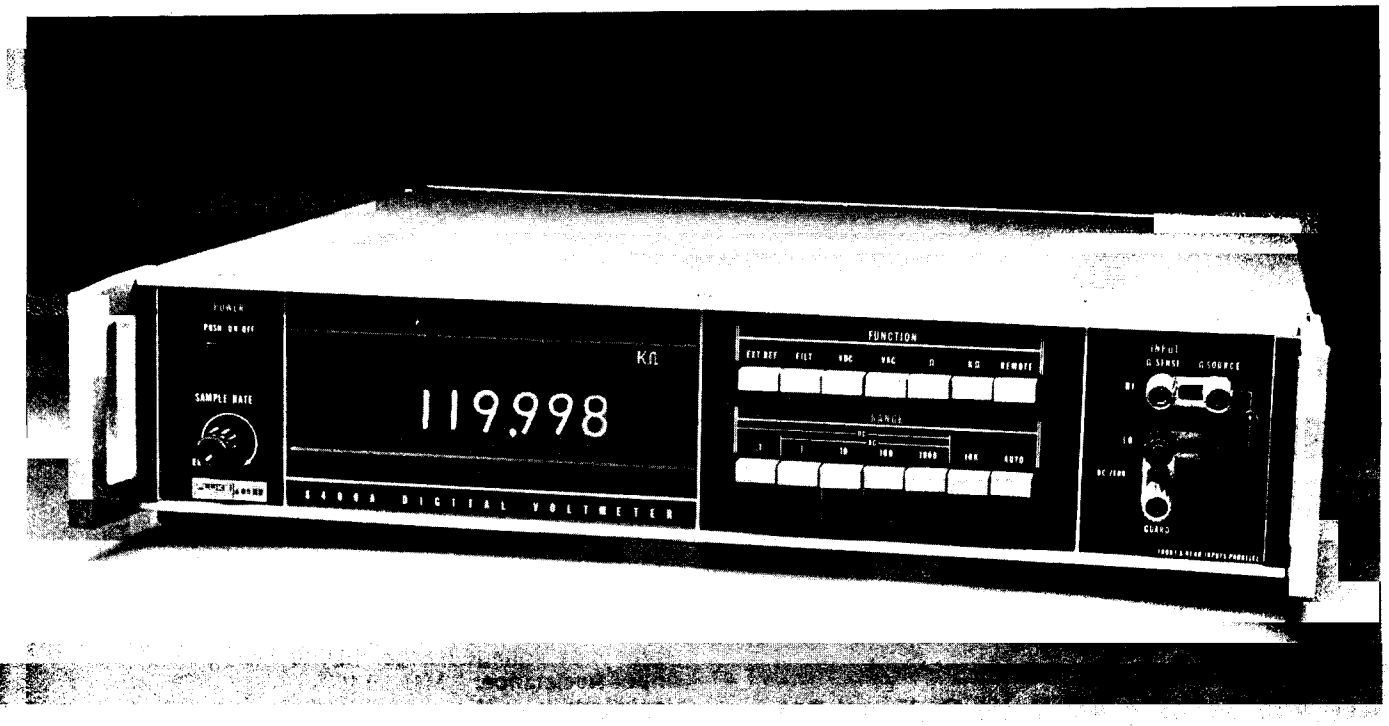
DIGITAL VOLTMETERS & DMM's

5½-Digit Bench/System
8400A



8400A

The 8400A, a 5½-digit, systems-oriented digital voltmeter, measures dc voltage on five ranges with sensitivity to 1 μV in its basic configuration. Optional add-ons are available to expand the unit's capabilities.

Fluke's patented Recirculating Remainder (R^2) a-d conversion technique, plus fully-guarded circuitry, ensures fast, accurate measurements. A switched four-pole filter eliminates the possibility of integrating interference errors into measurements. Ranging is switch-selectable or automatic, and 20% overranging is employed on all ranges except the 1000V range, which is limited to 1100V.

Options available for expanding the 8400A capabilities include both measurement and remote control functions. Details concerning each option are given under specifications.

Specifications

DC Voltage

Range	Impedance
±0.100000V	100 MΩ
±1.00000V	1000 MΩ
±10.0000V	10,000 MΩ
±100.000V	10 MΩ
±1000.00V	10 MΩ

Overrange: 20%, 1100V max on 1000V range
Range Selection: Manual, Automatic, Remote (optional)
Overload Protection: To 1100V dc or rms (1500V peak) continuous, all ranges, 100V dc or peak ac, "Lo" to "Guard", 1000V dc or peak ac, "Guard" to "Chassis"

Noise Rejection	DC	Filtered to 60 Hz	Unfiltered to 60 Hz
Common Mode: 1 kΩ unbalance	>140 dB	>140 dB	>100 dB
Normal Mode:		>65 dB at 60 Hz >60 dB at 50 Hz	

Maximum Superimposed AC Voltage: 50% of range, peak
Zero Stability: ≤5 μV for 90 days after 1 hour warmup
Offset Current: 23°C±5°C, ≤5pA, ≤±1 pA/°C
Response Time To Within ±0.005% of Final Value:
Filter out: ≤33 ms, ≤100 ms on 0.1V range
Filter in: 500 ms
Accuracy: ±(% of input + % of range)

Ranges	0.1V	1V	10V to 1000V
24 hours, 23°C±1°C	(0.003 +0.005)	(0.003 +0.002)	(0.002 +0.001)
90 days, 23°C±5°C	(0.005 +0.005)	(0.005 +0.002)	(0.004 +0.001)
1 year, 23°C±5°C	(0.02 +0.005)	(0.02 +0.002)	(0.01 +0.001)

True RMS AC Volts Option (-09)

Ranges: 1.00000V, 10.0000V, 100.000V, 1000.00V
Overrange: 20%, 1100V rms max on 1000V range
Range Selection: Manual, Automatic, Remote (optional)
Input Impedance: 1 MΩ shunted by ≤150 pF
Input Characteristics: AC or AC + DC, switch-selectable on circuit board
Overload Protection: To 1100V rms, ±1500V peak, on any range.
Common Mode Noise Rejection: ≥120 dB with 100Ω unbalance, dc to 60 Hz

DIGITAL VOLTMETERS & DMM's

5½-Digit Bench/System

8400A

Crest Factor: 7:1 at full scale, increasing down scale by 7x V Range ÷ V Input
Response Time To Within 0.1% of Range:
Filter out: 100 ms max
Filter in: 500 ms max
Accuracy: ±(% of input + % of range for 90 days, 18°C to 28°C *(1)*

Frequency	AC + DC	AC Only
dc	(0.1+0.03)	
10 Hz-20 Hz	(1.0+0.06)	(1.0+0.04)
20 Hz-50 Hz	(0.5+0.03)	(0.5+0.012)
50 Hz-10 kHz	(0.1+0.03)	(0.1+0.012)
10 kHz-30 kHz *(2)*	(0.2+0.06)	(0.2+0.04)
30 kHz-50 kHz *(2)*	(0.3+0.12)	(0.3+0.1)
50 kHz-100 kHz *(2)*	(1.0+0.3)	(1.0+0.3)
100 kHz-300 kHz *(2)*	(2.0+0.5)	(2.0+0.5)

(1) 0.001V to 1100V. With inputs above 500V multiply accuracy by (2000V + V input) and divide by 2000
(2) Input volt-Hertz, product should not exceed 2 x 10⁷

Average-Sensing AC Volts Option (-01)

Conversion: Average-responding, calibrated for rms
Ranges: 1.00000V, 10.0000V, 100.000V, 1000.00V
Overrange: 20%, 1100V rms max on 1000V range
Range Selection: Manual, Automatic, Remote (optional)
Input Impedance: 1.11 MΩ, shunted by ≤100 pF
Overload Protection: To 1100V rms, 1500V peak ac plus dc, on any range
Common Mode Noise Rejection: ≥120 dB with 100Ω unbalance, dc to 60 Hz
Accuracy: ±(% of input +% of range) for 90 days, 23°C ±5°C

Frequency *(1)*	0.001V to 500V	500V to 1100V
10 Hz-20 Hz	(1.0 + 0.01)	(1.0 + 0.01)
20 Hz-50 Hz	(0.5 + 0.005)	(0.5 + 0.005)
50 Hz - 10 kHz	(0.05 + 0.005)	(0.1 of input)
10 kHz-50 kHz	(0.1 + 0.005)	(0.15 of input)
50 kHz-100 kHz	(0.5 + 0.005)	N/A

(1) Input volt-Hertz product should not exceed 2 x 10⁷

Response Time To 0.05% of Final Value:
Filter out: 100 ms above 400 Hz
Filter in: 500 ms

Resistance Measurements Option (-02)

Accuracy: ±(% of input + % of range) for 90 days, 23°C ±5°C

Range	Source Current	Accuracy
10.0000Ω	10 mA	(0.01 + 0.01)
100.000Ω	10 mA	(0.01 + 0.003)
1,000.00Ω	1 mA	(0.01 + 0.003)
10,000.0Ω	100 μA	(0.01 + 0.003)
100.000 kΩ	100 μA	(0.01 + 0.002)
1,000.00 kΩ	10 μA	(0.01 + 0.002)
10,000.0 kΩ	1 μA	(0.05 + 0.002)

Range Selection: Manual, Automatic, Remote (optional)
Overrange: 20%, 12 MΩ on 10.000 kΩ range
Overload Protection: Fused on 10Ω to 10.000Ω ranges for 20V rms; on 100 kΩ to 10,000 kΩ ranges, 250V rms, continuous
Configuration: 4 terminal on 10Ω through 10,000Ω ranges

DC External Reference Options (-05, -07)

Ratio Ranges: ±0.01:1, ±0.1:1, ±1:1, ±10:1, ±100:1
Overrange: 20%(110:1 max on 100:1 range), % input range ÷ % reference range ≤1.2
Overload: ±1000V dc or rms, ±1500V peak, continuous
Reading: 10 x ratio
Accuracy: for 90 days, 23°C ±5°C

Range	Accuracy
±1:1, ±10:1, & ±100:1	±(0.005% +0.02% of voltage range ÷ V ref)
±0.1:1	±(0.005% +0.04% of voltage range ÷ V ref)
±0.01:1	±(0.005% +0.1% of voltage range ÷ V ref)

Reference Voltage Range: +1V to +10.5V
Input Resistance: 1 MΩ ±0.1%
Isolation: Input Hi to input Lo plus input Lo to reference Lo not to exceed ±13V on 10V and lower voltage ranges
Input Configuration: True 4-wire
Noise Rejection At Ref Input: Normal Mode, 30 dB at 60 Hz; Common Mode, 120 dB with 10V ref
Reference Settling Time: 2s to 0.01% of range after step change of reference voltage

AC External Ref. Options (-01, -06, -07)

Ref Range	Ratio Range
1V	1:1, 10:1, 100:1, 1000:1
10V	0.1:1, 1:1, 10:1, 100:1
100V	0.01:1, 0.1:1, 1:1, 10:1

Reference Voltage: 10% to 105% of reference range
Overload Protection: 130V rms at reference input
Reference Input Impedance: 1 MΩ shunted by ≤100 pF
Reading vs. Ratio: 1V ref range, 1 x ratio; 10V ref range, 10 x ratio; 100V ref range, 100 x ratio
Accuracy: For 90 days, 23°C±5°C, to 120% of ratio range, 50 Hz to 10 kHz:
1:1 ratio with both inputs at same frequency:

$$(0.05\% \text{ of rdg} + 0.005\% \frac{\text{x ref range}}{\text{V ref}} \text{ of ac volts range})$$

At other ratios and inputs at different frequencies:

$$\pm(0.1\% \text{ of rdg} + 0.005\% \frac{\text{x ref range}}{\text{V ref}} \text{ of ac voltage range})$$

Specifications form 10 Hz-50 Hz and 10 kHz-100 kHz available on request
Reference Setting Time: 500 ms to 0.05% of range after step change of reference voltage

DIGITAL VOLTMETERS & DMM's

5½-Digit Bench/System
8400A

Isolated Data Output Option (-03)

Note: Two mating connectors are supplied
Data Available: Digits, polarity, range, functions
Coding: 8-4-2-1 BCD, digits and range
Logic Levels: 1 = +5V, 0 = 0V (Series 930 DTL with 6k pullup)
Maximum Trigger Rate: 30 per second
Flags: Digitizing, Remotely Controlled, Remotely Triggered, Busy, Overload, Sample Sync
Acquisition: Full parallel, or serial by character in multiples of 4 bits
Automatic Adaptive Timeouts: Automatic delays to allow for settling time of all analog inputs are enabled via a single logic input line

Isolated Remote Control Option (-04)

Note: Mating connector is supplied
Control Levels: 0 = function called, 1 = function inactive
Logic Levels: 0 = contact closure or 0V, 1 = open or +5V
Input Definition: Series 930 DTL
Control Command Storage: Continuous or addressed remote control of instrument. Triggered address control allows the 8400A to "latch" to input commands. Following latch, the commands may be removed but the functions and ranges commanded will continue to be in effect until the next address trigger
Interlocks: Incompatible functions or simultaneous ranges cannot be called
No Call: Volts dc and autorange called
Flags: Remote control Flag in Data Output Unit
Note: Requires +5V at 150 mA from Data Output Unit or external power supply which can be supplied as a special item. Contact factory for futher details

General

Temperature: 0°C to +50°C, operating; -40°C to +75°C, non-operating
Relative Humidity: ≤80% 0°C to +25°C; ≤70% +25°C to +50°C,
Altitude: To 10,000 ft. (3.048 kM) operating, or 50,000 ft. (15.25 kM), non-operating
Shock and Vibration: Meets requirements of MIL-T-21200L and MIL-E-16400F
Power: 115 or 230V ac, ±10% 50 to 440 Hz, <25W, including Options
Size: 8.9 cm H x 43.2 cm W x 43.8 cm D, (3½ in H x 17 in W x 17¼ in D)
Weight: ≤9.08 kg (≤20 lbs) including options
Warm-up Time: 20 min to 1 yr accuracy, 1 hr to full accuracy
MTBF: 10,000 hr

Model

8400A Digital Voltmeter

Options*

8400A-01 AC Converter 750
8400A-02 Ohms Converter 350
8400A-03 Data Output 500
8400A-04 Remote Control 200
8400A-05 DC External Reference 200
8400A-06 AC External Reference 750
8400A-07 Rear Input 100
8400A-09 True RMS Converter 750
**Some options may be combined. Order as separate line items. Options -01 and -09 cannot be combined and Option -07 must be ordered if ordering Options -05 or -06. For field installation add the suffix letter "K".*

Accessories

M03-205-600 3½" Rack Adapter 75
See page 152 for more accessory information.