

Bench Multimeters

45 Dual Display Multimeter



Fluke 45

- _____ Multifunction Vacuum Fluorescent Dual Display
- _____ True-RMS Voltage and Current, Including ac + dc
- _____ RS-232C Interface Standard, GPIB/IEEE-488.2 Optional
- _____ Frequency Measurement to 1 MHz
- _____ dB Measurements with Selectable Reference Impedances of 2Ω to 8000Ω and Audio Power from 2Ω to 16Ω
- _____ Compare (Hi/Lo/Pass) Function for Quick In-Tolerance Tests
- _____ 0.05% dc Current Accuracy for 4-20 mA Current Loop Service
- _____ Touch Hold®, Relative and Min Max
- _____ Audible Continuity and Diode Test
- _____ Optional Rechargeable Battery, Carrying Case, Rack Mount Kit & PC Software Package
- _____ Closed-Case Calibration

The Fluke 45 is a feature-rich 5 digit, 100,000 count DMM with a unique multi-function dual display, allowing measurement of two signal parameters from a single test connection. The Fluke 45 offers high performance and versatility for manufacturing test, depot and field service, and research and development. A standard RS-232C makes it ideal for PC instrument applications.

Dual Display

The Fluke 45 is the first DMM with a multifunction "dual display," allowing the user to select a wide variety of measurement combinations. It is particularly useful in applications requiring two different measurements of the same signal; i.e. power supply testing, where Vdc output can be viewed on the primary display while the Vac ripple is shown on the secondary display.

Standard RS-232C Interface

The RS-232C interface, standard in each instrument, allows measurement data to be filed, manipulated, printed or transmitted by modem. The print mode automatically formats measurement data for printing on an RS-232C printer. Rates for automated printing over RS-232C are adjustable from 1 reading every 70 ms to 1 reading every 5.6 hours. The optional QuickStart 45™ Software Package allows automated communications and filing of measurements with the Fluke 45 and an IBM-PC or compatible via RS-232C.

dB Measurement

The Fluke 45 provides digital readout of decibels with front panel selection of any of twenty-one reference impedances from 2Ω to 8000Ω. For 2Ω, 4Ω, 8Ω and 16Ω

impedances, the meter automatically calculates and displays audio power in watts.

Compare Function

The Fluke 45 has a compare function for fast in-tolerance limits testing. Upper- and lower-limits are entered through the front panel. Readouts show both a Hi/Lo/Pass evaluation and measured value.

Touch Hold Relative and Min/Max

Touch Hold captures the measurement, beeps and locks it on the digital display until you are ready to view it. It automatically updates with each new stable measurement. The Relative mode remembers a reading and shows the change (difference) between it and any readings that follow. Min/Max records the highest and lowest values measured. Either can be recalled and displayed at any time.

Optional Battery and Case

An optional rechargeable battery and soft carrying case are available for precision field service applications. These options, coupled with a 30 mA dc current range and 0.05% accuracy, allow calibration of 4-20 mA loops in process control applications. The battery is available as a factory installed option or can be user-installed at a later date.

Optional GPIB/IEEE-488.2 and Rack Mount

The Fluke 45 may be used with GPIB/IEEE-488.2 systems, including existing IEEE-488 implementations. The IEEE-488.2 option is available as a factory installed option, or can be user installed and does not require removal of the RS-232C interface. A rack mount kit is also available.

Closed-Case Calibration

Calibration can be performed via the RS-232C (or optional IEEE-488.2) interface or manually from the front panel. No internal adjustments are required.

Standard Equipment

Each Fluke 45 Dual Display Multimeter includes an operator's manual, quick reference guide, line cord, and test leads.

Specifications

Technical Specifications

Accuracy specifications are given as ± [% of reading] + [number of least significant digits] at 18°C to 28°C with relative humidity up to 90%, for a period of one year after calibration. Six months specifications are also provided for dc volts. AC inputs are ac-coupled and True-RMS responding.

Display

Dual vacuum fluorescent displays, 99,999 counts each display. Annunciators: m, M, k, V, A, Ω (ohms), Hz, ? + diode test, (audible continuity), REMOTE, EXT TRIG, SMF (reading rates), MAX, MIN, dB, HOLD, REL, AUTO, - + (low battery). Resolution and accuracy are dependent on selectable reading rates of 2.5 (slow), 5 (medium) or 20 (fast) readings per second.

Rate	Readings Per Second	Full Range Display Counts
Slow	2.5	99,999
Medium	5	30,000
Fast	20	3000



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RS-232C and IEEE-488 Reading Transfer Rates

Internal Trigger Operation (TRIGGER 1)	
Rate	Readings Per Second
Slow	2.5
Medium	4.5
Fast	4.5
External Trigger Operation (TRIGGER 4)	
Rate	Readings Per Second
Slow	1.5
Medium	2.4
Fast	3.8
Print Mode Operation (Print set at 1)	
Rate	Readings Per Second
Slow	2.5
Medium	5.0
Fast	13.5

Maximum Input: To be used in protected, low-energy circuits only, not to exceed 250V or 4800 volt-amperes

mA: 300 mA dc or ac rms. Protected with a 500 mA, 250V, IEC 127 sheet 1 fast blow fuse

A: 10A dc or ac rms continuous or 20A dc or ac rms for 30 seconds maximum. Protected with a 15A, 250V, 10,000A interrupt rating fast blow fuse.

Diode Test/Continuity

Accuracy	Maximum Reading	Resolution
Slow	999.99 mV	10 μ V
Medium	2.5V	100 μ V
Fast	2.5V	1 mV

Test Current: Approximately 0.7 mA when measuring forward bias junction

Audible Tone: Continuous tone for continuity. Brief tone for normal forward biased diode or semiconductor junction

Open Circuit Voltage: 3.2V maximum

Continuity Capture Time: 50 μ s maximum, 10 μ s typical

Input Protection: 500V dc or ac rms

DC Voltage

Range	Resolution			Accuracy (6 Month)	Accuracy (1 Year)
	Slow	Medium	Fast		
300 mV	—	10 μ V	100 μ V	0.02% + 2	0.025% + 2
3V	—	100 μ V	1 mV		
30V	—	1 mV	10 mV		
300V	—	10 mV	100 mV		
1000V	—	100 mV	1V		
100 mV	1 μ V	—	—	0.02% + 6	0.025% + 6
1000 mV	10 μ V	—	—		
10V	100 μ V	—	—		
100V	1 mV	—	—		
1000V	10 mV	—	—		

Input Impedance: 10 M Ω in parallel with <100 pF

Normal Mode Rejection Ratio: >80 dB at 50 or 60 Hz, slow and medium rates; >54 dB for frequencies between 50 and 440 Hz, slow and medium rates; >60 dB at 50 Hz, fast rate

Common Mode Rejection Ratio: >90 dB at dc, 50 or 60 Hz (1 k Ω unbalanced, slow & medium rates)

Maximum Input: 1000V dc or peak ac on any range

AC Voltage (True-RMS, ac coupled)

Range	Linear Resolution			Range	Linear Resolutions		
	Slow	Medium	Fast		Slow	Medium	Fast
300 mV	—	10 μ V	100 μ V	100 mV	1 μ V	—	—
3V	—	100 μ V	1 mV	1000 mV	10 μ V	—	—
30V	—	1 mV	10 mV	10V	100 μ V	—	—
300V	—	10 mV	100 mV	100V	1 mV	—	—
750V	—	100 mV	1V	750V	10 mV	—	—
Decibels Resolution							
Slow/Medium				Fast			
0.01 dB				0.1 dB			

Frequency	Linear Accuracy			dB Accuracy		Power*	Max Input Upper Freq
	Slow	Medium	Fast	Slow/Med	Fast		
20-50 Hz	1%+100	1%+10	7%+2	0.15	0.72	2%+10	750V
50 Hz-10 kHz	0.2%+100	0.2%+10	0.5%+2	0.08	0.17	0.4%+10	750V
10-20 kHz	0.5%+100	0.5%+10	0.5%+2	0.11	0.17	1%+10	750V
20-50 kHz	2%+200	2%+20	2%+3	0.29	0.34	4%+20	400V
50-100 kHz	5%+500	5%+50	5%+6	0.70	0.78	10%+50	200V

*Error in power mode will not exceed twice the linear accuracy specification

Accuracy specifications apply within the following limits, based on reading rate:

Slow: Between 15,000 counts and full range

Medium: Between 1,500 counts and full range

Fast: Between 150 counts and full range

Input Impedance: 1 M Ω in parallel with <100 pF

Maximum Crest Factor: 3.0

Common Mode Rejection Ratio: >60 dB at 50 or 60 Hz (1 k Ω unbalanced medium rate)

Maximum Input: 750V rms, 1000V peak

2 \times 10⁷ volt-hertz product on any range, normal mode input

1 \times 10⁶ volt-hertz product on any range, common mode input

AC + DC Voltage (calculated)

Total measurement error will not exceed the sum of the separate ac and dc accuracy specifications, plus one display count.

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Ohms

Range	Resolution			Accuracy	Typical Full Scale Voltage	Max Current Thru Unknown
	Slow	Medium	Fast			
300Ω	—	10 mΩ	100 mΩ	0.05% + 2 + 0.02Ω	0.25	1 mA
3 kΩ	—	100 mΩ	1Ω	0.05% + 2	0.24	120 μA
30 kΩ	—	1Ω	10Ω	0.05% + 2	0.29	14 μA
300 kΩ	—	10Ω	100Ω	0.05% + 2	0.29	1.5 μA
3 MΩ	—	100Ω	1 kΩ	0.06% + 2	0.30	150 nA
30 MΩ	—	1 kΩ	10 kΩ	0.25% + 3	2.25	320 nA
300 MΩ	—	100 kΩ	1 MΩ	2%	2.90	320 nA
100Ω	1 mΩ	—	—	0.05% + 8 + 0.02Ω	0.09	1 mA
1000Ω	10 mΩ	—	—	0.05% + 8 + 0.02Ω	0.10	120 μA
10 kΩ	100 mΩ	—	—	0.05% + 8	0.11	14 μA
100 kΩ	1Ω	—	—	0.05% + 8	0.11	1.5 μA
1000 kΩ	10Ω	—	—	0.06% + 8	0.12	150 nA
10 MΩ	100Ω	—	—	0.25% + 6	1.50	150 nA
100 MΩ	100 kΩ	—	—	2% + 2	2.75	320 nA

Open Circuit Voltage: 3.2V max on 100Ω, 300Ω, 30 MΩ, 100 MΩ & 300 MΩ ranges; 1.5V max on all other ranges

Input Protection: 500V dc or ac rms on all ranges

DC Current

Range	Resolution			Accuracy	Typical Full Scale Burden Voltage
	Slow	Medium	Fast		
30 mA	—	1 μA	10 μA	0.05% + 3	0.45V
100 mA	—	10 μA	100 μA	0.05% + 2	1.4V
10A	—	1 mA	10 mA	0.2% + 5	0.25V
10 mA	100 nA	—	—	0.05% + 20	0.14V
100 mA	1 μA	—	—	0.05% + 5	1.4V
10A	100 μA	—	—	0.2% + 7	0.25V

Maximum Crest Factor: 30

Maximum Input: To be used in protected, low-energy circuits only, not to exceed 250V or 4800 volt-amps

mA: 300 mA dc or ac rms. Protected with a 500 mA, 250V, IEC 127 sheet 1 fast blow fuse.

A: 10A dc or ac rms continuous or 20A dc or ac rms for 30 seconds maximum. Protected with a 15A, 250V, 10,000A interrupt rating fast blow fuse.

AC Current (True-RMS, ac coupled)

Range	Resolution			Typical Full Scale Burden Voltage
	Slow	Medium	Fast	
10 mA	100 nA	—	—	0.14V
30 mA	—	1 μA	10 μA	0.45V
100 mA	1 μA	10 μA	100 μA	1.4V
10A	100 μA	1 mA	10 mA	0.25V

Range	Frequency	Accuracy		
		Slow	Medium	Fast
mA	20-50 Hz	2% + 100	2% + 10	7% + 2
mA	50 Hz-10 kHz	0.5% + 100	0.5% + 10	0.8% + 2
mA	10-20 kHz	2% + 200	2% + 20	2% + 3
A (1A to 10A)	20-50 Hz	2% + 100	2% + 10	7% + 2
A (1A to 10A)	50 Hz-2 kHz	1% + 100	1% + 10	1.3% + 2
A (0.5A to 1A)	20-50 Hz	2% + 300	2% + 30	7% + 4
A (0.5A to 1A)	50 Hz-2 kHz	1% + 300	1% + 30	1.3% + 4

Accuracy specifications apply within the following limits, based on reading rate:

Slow: Between 15,000 counts and full range; **Medium:** Between 1,500 counts and full range; **Fast:** Between 150 counts and full range

Maximum Crest Factor: 3.0

Maximum Input: To be used in protected, low-energy circuits only, not to exceed 250V or 4800 volt-amps

mA: 300 mA dc or ac rms. Protected with a 500 mA, 250V, IEC 127 sheet 1 fast blow fuse.

A: 10A dc or ac rms continuous or 20A dc or ac rms for 30 seconds maximum. Protected with a 15A, 250V, 10,000A interrupt rating fast blow fuse.

Frequency

Frequency Range: 5 Hz to >1 MHz
Accuracy: 0.05% + 1, except 1000 Hz range, 0.05% + 2

Range	Resolution	
	Slow/Medium	Fast
1000 Hz	10 mHz	100 mHz
10 kHz	100 mHz	1 Hz
100 kHz	1 Hz	10 Hz
1000 kHz	10 Hz	100 Hz
1 MHz*	100 Hz	1 kHz

* Specified to 1 MHz, usable to 8 MHz when overdriven

Sensitivity of AC Voltage	
Frequency	Level
5 Hz-100 kHz	30 mV rms sinewave
100 kHz-300 kHz	100 mV rms sinewave
300 kHz-1 MHz	1V rms sinewave
Above 1 MHz	Not specified

Sensitivity Level of AC Current		
Frequency	Input	Level
5 Hz-20 kHz	100 mA	> 3 mA rms sinewave
45 Hz-2 kHz	10A	> 3A rms sinewave

General Specifications

Power Requirements

Power: 90 to 264V ac (no switching required), 50 and 60 Hz <15 VA minimum

Environmental Data

Maximum Common Mode Voltage: 1000V dc or peak ac from any input to earth

Warmup Time: 1 hour to rated specifications

Temperature Coefficient: <0.1 times the applicable accuracy specifications per degree C from 0°C to 18°C and from 28°C to 50°C, (32°F to 64.4°F and 82.4°F to 122°F)

Operating Temperature: 0°C to 50°C (32°F to 122°F)

Storage Temperature: -40°C to 70°C (-40°F to 158°F). Elevated temperature storage of battery will accelerate battery self-discharge. Maximum storage time before battery must be recharged:
 20°C to 25°C 1000 days
 50°C 180 days
 70°C 40 days

Relative Humidity (non-condensing): Up to 90%, 0°C to 28°C (32°F to 82.4°F); up to 80%, 28°C to 35°C (82.4°F to 95°F); up to 70%, 35°C to 50°C (95°F to 122°F), except 70%, 0°C to 50°C (32°F to 122°F) for the 1 MΩ, 3 MΩ, 10 MΩ, 30 MΩ, 100 MΩ and 300 MΩ ranges.

Altitude: Operating, 0 to 10,000 feet; non-operating, 0 to 40,000 feet

Vibration: 3G @ 55 Hz per MIL-T-28800D, Class 3, Style E

Shock: Half-sine 40G per MIL-T-28800D, Class 3, Style E. Bench handling.