FLUKE®

Multimeter mit Doppelanzeige Fluke 45

Maximale Vielseitigkeit in einem Gerät

Das vielseitige Fluke 45 mit der praktischen Doppelanzeige und einem Meßbereichsumfang von 100 000 Digits ermöglicht die Messung von 2 Parametern eines Meßsignals mit einer einzigen Meßverbindung. Gerade im Bereich der Fertigungsüberwachung, im Service, im Meßlabor und in der Qualitätssicherung bietet das Fluke 45 eine Vielzahl von Anwendungsmöglichkeiten. Serienmäßig ist ein RS-232-Interface eingebaut, mit dem Meßdaten per PC erfaßt werden können.

Echteffektiv

LISTED UL

- Die vakuumfluoreszierende Doppelanzeige ermöglicht die Messung von zwei verschiedenen Parametern eines Signals und die gleichzeitige Darstellung beider Meßwerte, z.B. eine Wechselspannung und die dazugehörige Frequenz
- Echte Effektivwert-Messung für Spannung und Strom (ac+dc)
- RS-232-Interface Standard, IEEE-488.2 optional
- Frequenzmessungen bis 1 MHz
- Pegelmessungen in dB mit wählbaren Referenzimpedanzen von 2W bis 8 kW und Audio-Leistungsmessungen von 2W bis 16W
- Vergleichsmessung (Hi/Lo/Pass) für schnelle Toleranzüberprüfung
- 0,05% Gleichstrom-Genauigkeit für 4-20 mA Einheits-Stromsignale Ω Touch Hold®, Diodentest/Durchgangsprüfung
- Relativ-Modus: Speichert Meßwerte und zeigt den Unterschied zwischen gespeicherten und folgenden Meßwerten
- Min/Max-Modus: Speichert den höchsten und niedrigsten Meßwert; die Werte können jederzeit abgerufen und angezeigt werden
- Kalibrierung bei geschlossenem Gehäuse. Die Kalibrierung kann über das RS-232-Interface (bzw. das optionale Interface IEE-488.2) oder manuell vom Bedienungsfeld aus erfolgen. Es sind keine internen Einstellungen erforderlich
- Quickstart™-Softwarepaket; ermöglicht schnelle Einstellung und problemlose Kommunikation zwischen dem Fluke 45 und einem IBM kompatiblen PC. Individuelle Testverfahren lassen sich schnell erzeugen, speichern und abrufen

Sicherheit

Alle Eingänge sind gemäss EN61010-1 CAT II 600V und CAT I 1000V gesichert. UL zertifiziert.

Merkmale

Vakuumfluoreszierende Doppelanzeige
Echte Effektivwertmessung für Spannung und Strom
0,05% Gleichstrom-Genauigkeit für 4-20 mA Einheits-Stromsignale
RS-232 Interface Standard
IEEE-488.2 Interface optional
Frequenzmessung bis 1 MHz
dB-Messungen
MIN/MAX-Modus
RELATIV-Modus
Vergleichsmessung (Hi/Lo/Pass-Funktion) für schnelle Toleranzüberprüfung
Kalibrierung bei geschlossenem Gehäuse
19"-Einbauadapter zusätzlich lieferbar
Touch Hold® (Automatischer Meßwertspeicher)
Diodentest/Durchgangsprüfung

Spezifikationen

Anzeigeumfang: 3000 Digits, 30 000 Digits, 100 000 Digits
Meßgeschwindigkeiten: Schnell (20 mal pro Sekunde), mittel (5 mal pro Sekunde), langsam (2,5 mal pro Sekunde)

Funktion	Bereich	Grundgenauigkeit (mittlere Meßgeschwindigkeit)	max. Auflösung
Gleichspannung	300mV-1000V	±0,025% + 2	1 µV-0,01V
Wechselspannung Echt-Effektiv (AC + DC) Freq. 20 Hz - 100 kHz	300mV-750V	±0,2% + 10	1 µV-0,01V
dB-Meßwert (600W Ref.) (Ref. Z 2W -8000W)	-34-+60	±0,08 dBm	0,01 dB-0,1 dB
Gleichstrom	30 mA-10A	±0,05% + 2	0,1 µA-10 mA
Wechselstrom Echt-Effektiv (AC + DC) Freq. 20 Hz-20 kHz	10 mA-10A	±0,5% + 10	0,1 µA-10 mA
Widerstand	300Ω-100 MΩ	±0,05% + 2	0,001Ω-1 MΩ
Frequenz	5 Hz->1 MHz	±0,05% + 1	0,01 Hz-1 kHz

Meßbereiche (Auflösung): im 100,000 mV-Bereich wird auf 0,001 V aufgelöst
Größe (BxHxT): 216 mm x 93 mm x 286 mm
Gewicht: Netto 2,4 kg; mit Batterie 3,2 kg
Ein Jahr Gewährleistung: Empfohlener Kalibrierzyklus: 12 Monate

Zubehör und Bestellinformationen

Lieferumfang
Netzkabel, TL70A-Testleitungen, Bedienungshandbuch und Kurzanleitung.
Optionen
Vom Kunden installierbar: Aufladbare Batterieeinheit Fluke 45-01K
IEEE-488.2 Interface-Satz Fluke 45-05K
Zubehör
C40 Tragetasche
M00-200-634 Gestellmontagesatz
RS40 6' RS-232 Kabel
RS41 6' RS-232 Modemkabel
S45 QuickStart™ 45-Software
Bestellinformationen
FLUKE 45 Multimeter mit Doppelanzeige
FLUKE 45-01 mit eingebauter Batterieeinheit
FLUKE 45-05 mit IEEE-488.2-Interface
FLUKE mit Batterie und IEEE-488.2-Interface

Appendix A
Specifications

Introduction

Appendix A contains the specifications of the Fluke 45 Dual Display Multimeter.

These specifications assume:

- A 1-year calibration cycle
- An operating temperature of 18 °C to 28 °C (64.4 °F to 82.4 °F)
- Relative humidity not exceeding 90 % (non-condensing) (70 % for 1,000 kΩ range

Accuracy is expressed as +(percentage of reading + digits).

Display Counts and Reading Rates

Rate	Readings per Second	Full Range Display Counts
Slow	2.5	99,999*
Medium	5	30,000
Fast	20	3,000
* Ohms full range will typically be 98,000 counts		

RS-232 and IEEE-488 Reading Transfer Rates

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

Response Times

Refer to Section 4 for detailed information.

DC Voltage

Range	Resolution			Accuracy	
	Slow	Medium	Fast	(6 Months)	(1 Year)
300 mV	—	10 µV	100 µV	002 % + 2	0.025 % + 2
3 V	—	100 µV	1 mV	0.02 % + 2	0.025 % + 2
30 V	—	1 mV	10 mV	0.02 % + 2	0.025 % + 2
300 V	—	10 mV	100 mV	0.02 % + 2	0.025 % + 2
1000 V	—	100 mV	1 V	0.02 % + 2	0.025 % + 2
100 mV	1 µV	—	—	0.02 % + 6	0.025 % + 6
1000 mV	10 µV	—	—	0.02 % + 6	0.025 % + 6
10 V	100 µV	—	—	0.02 % + 6	0.025 % + 6
100 V	1 mV	—	—	0.02 % + 6	0.025 % + 6
1000 V	10 mV	—	—	0.02 % + 6	0.025 % + 6

Input Impedance

10 MΩ in parallel with <100 pF

Note

In the dual display mode, when the volts ac and volts dc functions are selected, the 10 MΩ dc input divider is in parallel with the 1 MΩ ac divider.

Normal Mode Rejection Ratio

>80 dB at 50 Hz or 60 Hz, slow and medium rates

>54 dB for frequencies between 50-440 Hz, slow and medium rates

>60 dB at 50 Hz, fast rate (Note: Fast rate has no filtering)

Maximum Allowable AC Voltage While Measuring DC Voltage or (AC + DC) Voltages

Range		Max Allowable Peak AC Voltage	Peak Normal Mode Signal	
			NMRR* >80 dB†	NMRR >60 dB†
300 mV	100 mV	15 V	15 V	15 V
3 V	1000 mV	15 V	15 V	15 V
30 V	10 V	1000 V	50 V	300 V
300 V	100 V	1000 V	50 V	300 V
1000 V	1000 V	1000 V	200 V	1000 V

* NMRR is the Normal Mode Rejection Ratio
† Normal Mode Rejection Ratio at 50 Hz or 60 Hz ±0.1 %

Common Mode Rejection Ratio

>90 dB at do, 50 or 60 Hz, (1 kΩ unbalanced, medium and slow rates)

Maximum Input

1000V dc or peak ac on any range

True RMS AC Voltage, AC-Coupled

Range	Resolution		
	Slow	Medium	Fast
300 mV	—	10 µV	100 µV
3 V	—	100µV	1 mV
30 V	—	1 mV	10 mV
300 V	—	10 mV	100 mV
750 V	—	100 mV	1 V
100 mV	1 µV	—	—
1000 mV	10 µV	—	—
10 V	100 µV	—	—
100 V	1 mV	—	—
750 V	10 mV	—	—

Accuracy

Frequency	Linear Accuracy			dB Accuracy		Power*	Max Input at Upper Freq
	Slow	Medium	Fast	Slow/Med	Fast		
20-50 Hz	1 % + 100	1 % + 10	7 % + 2	0.15	0.72	2 % + 10	750 V
50 Hz-10 kHz	0.2 % + 100	0.2 % + 10	0.5 % + 2	0.08	0.17	0.4 % + 10	750 V
10-20 kHz	0.5 % + 100	0.5 % + 10	0.5 % + 2	0.11	0.17	1 % + 10	750 V
20-50 kHz	2 % + 200	2 % + 20	2 % + 3	0.29	0.34	4 % + 20	400 V
50-100 kHz	5 % + 500	5 % + 50	5 % + 6	0.70	0.78	10 % + 50	200 V
* Error in power mode will not exceed twice the linear accuracy specification							

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

Slow Reading Rate: Between 15,000 and 99,999 counts (full range)
Medium Reading Rate: Between 1,500 and 30,000 counts (full range)
Fast Reading Rate: Between 150 and 3,000 counts (full range)

Decibel Resolution

Resolution	
Slow & Medium	Fast
0.01 dB	0.1 dB

Decibel Reference Resistance

8000 Ω	500 Ω	124 Ω	8 Ω†
1200 Ω	300 Ω	110 Ω	4 Ω†
1000 Ω	250 Ω	93 Ω	2 Ω†
900 Ω	150 Ω	75 Ω	
800 Ω	135 Ω	50 Ω	
600 Ω*	125 Ω	16 Ω†	

* Default resistance
† Reading displayed in watts (POWER)

Input Impedance

1 MΩ in parallel with <100 pF

Maximum Crest Factor

3.0

Common Mode Rejection Ratio

>60 dB at 50 Hz or 60 Hz (1 kΩ unbalanced medium rate)

Maximum Input

750 V rms, 1000 V peak

2 X 107 Volt-Hertz product on any range, normal mode input

1 x 106 Volt-Hertz product on any range, common mode input

(AC + DC) Voltage Accuracy

Total Measurement Error will not exceed the sum of the separate ac and dc accuracy specifications, plus 1 display count. Refer to the table under "Maximum Allowable AC Voltage while Measuring DC Voltage or (AC + DC) Voltages" located on page A3.

Note

When measuring ac + dc, (or any dual display combination of ac and dc) in the fast reading rate, the Fluke 45 may show significant reading errors. This results from a lack of filtering on the dc portion of the measurement for the fast reading rate. To avoid this problem, use only the "slow" and "medium" reading rates for ac + dc or ac and dc combinations.

Maximum Frequency of AC Voltage Input While Measuring AC Current

When the meter makes ac current and ac voltage measurements using the dual display, the maximum frequency of the voltage input is limited to the maximum frequency of the current function. For example, if you are making an ac current measurement on the 10 A range, the maximum frequency of the voltage input must be less than 2 kHz.

DC Current

Range	Resolution			Accuracy	Burden Voltage
	Slow	Medium	Fast		
30 mA	—	1 µA	10 µA	0.05 % + 3	0.45 V
100 mA	—	10 µA	100 µA	0.05 % + 2	1.4 V
10 A	—	1 mA	10 mA	0.2 % + 5	0.25 V
10 mA	100 nA	—	—	0.05 % +	0.14 V
100 mA	1 µA	—	—	50.05 % + 5	1.4 V
10 A	100 µA	—	—	0.2 % + 7	0.25 V
* Typical at full range					

Maximum Input

To be used in protected, low energy circuits only, not to exceed 250 V or 4800 Volt-Amps. (IEC 664 Installation Category II.)

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

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

Note

Resistance between the COM binding post and the meter's internal measuring circuits is approximately .003 Ω.

AC Current

Range	Resolution			Burden Voltage*
	Slow	Medium	Fast	
10 mA	100 nA	—	—	0.14 V
30 mA	—	1 µA	10 µA	0.45 V
100 mA	1 µA	10 µA	100 µA	1.4 V
10 A	100 µA	1 mA	10 mA	0.25 V
* Typical at full range				

Accuracy

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

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

Slow Reading Rate:	Between 15,000 and 99,999 counts (full range)
Medium Reading Rate:	Between 1,500 and 30,000 counts (full range)
Fast Reading Rate:	Between 150 and 3,000 counts (full range)

Maximum Crest Factor

3.0

Maximum Input

To be used in protected, low energy circuits only, not to exceed 250 V or 4800 Volt-Amps. (IEC 664 Installation Category II.)

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

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

Note

Resistance between the COM binding post and the meter's internal measuring circuits is approximately .003Ω.

Ohms

Range	Resolution			Accuracy	Typical Full Scale Voltage	Max Current Through the Unknown
	Slow	Medium	Fast			
300 Ω	—	10 mΩ	100 MΩ	0.05 % + 2 + 0.02Ω	0.25	1 mA
3 kΩ	—	100 MΩ	1 Ω	0.05 % + 2	0.24	120μA
30 kΩ	—	1 Ω	10 Ω	0.05 % + 2	0.29	14 μA
300 kΩ	—	10 Ω	100 Ω	0.05 % + 2	0.29	1.5 μA
3 MΩ	—	100 Ω	1 kΩ	0.06 % + 2	0.3	150 μA
30 MΩ	—	1 kΩ	10 kΩ	0.25 % + 3	2.25	320 μA
300 MΩ*	—	100 kΩ	1 MΩ	2 %	2.9	320 μA
100 Ω	1 mΩ	—	—	0.05 % + 8 + 0.02 Ω	0.09	1 mA
1000 Ω	10 mΩ	—	—	0.05 % + 8 + 0.02Ω	0.10	120 μA
10 kΩ	100 mΩ	—	—	0.05 %+8	0.11	14 μA
100 kΩ	1 Ω	—	—	0.05 % + 8	0.11	1.5 μA
1000 kΩ	10 Ω	—	—	0.06 % + 8	0.12	150 μA
10 MΩ	100 Ω	—	—	0.25 % + 6	1.5	150 μA
100 MΩ*	100 kΩ	—	—	2 % + 2	2.75	320 μA

*Because of the method used to measure resistance, the 100 MΩ (slow) and 300 MΩ (medium and fast) ranges cannot measure below 3.2 MΩ and 20 MΩ, respectively. "UL" (underload) is shown on the display for resistances below these nominal points, and the computer interface outputs "+1 E-9".

Open Circuit Voltage

3.2 V maximum on the 100 Ω, 300 Ω, 30 MΩ, 100 MΩ, and 300 MΩ ranges, 1.5 V maximum on all other ranges.

Input Protection

500 V dc or rms ac on all ranges

Diode Test/Continuity

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

Test Current

Approximately 0.7 mA when measuring a forward biased junction.

Audible Tone

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

Open Circuit Voltage

3.2 V maximum

Continuity Capture Time

50 us maximum, 10 us typical

Input Protection

500 volts dc or rms ac

Note

When the meter is set to measure frequency and there is no input signal (i.e., input terminals are open), the meter may read approximately 25 kHz (rather than the expected zero). This is due to internal capacitive pickup of the inverter power supply into the high-impedance, input circuitry. With source impedance of <2 kΩ, this pickup will not affect the accuracy or stability of the frequency a reading.

Frequency

Frequency Range

5 Hz to >1 MHz

Applicable Functions

Volts ac and Current AC

Range	Resolution		Accuracy
	Slow & Medium	Fast	
1000 Hz	.01 Hz	.1 Hz	05% + 2
10 kHz	.1 Hz	1 Hz	.05% + 1
100 kHz	1 Hz	10 Hz	.05% + 1
1000 kHz	10 Hz	100 Hz	.05% + 1
1 MHz*	100 Hz	1 kHz	Not Specified
* Specified to 1 MHz, but will measure above 1 MHz.			

Sensitivity of AC Voltage

Frequency	Level (sine wave)
5 Hz-100 kHz	30 mV rms
100 kHz - 300 kHz	100 mV rms
300 kHz - 1 MHz	1 V V rms
Above 1 MHz	Not specified

Sensitivity Level of AC Current

Frequency	Input	Level
5 Hz-20 kHz	100 mA	>3 mA rms
45 Hz-2 kHz	10 A	>3 A rms

Note

When the meter is set to measure frequency and there is no input signal (i.e., the input terminals are open), the meter may read approximately 25 kHz (rather than zero). This is due to internal capacitive pickup of the inverter power supply into the high-impedance, input circuitry. With source impedance of <2 kΩ, this pickup will not affect the accuracy or stability of the frequency reading.

Environmental

Warmup time	1 hour to rated specifications for warmup < 1 hour, add 0.005 % to all accuracy specifications.
Temperature Coefficient	<0.1 times the applicable accuracy specification per degree C for 0 °C to 18 °C and 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 – 25 °C 1000 days 50 °C 180 days 70 °C 40 days
Relative Humidity (non-condensing)	To 90 % at 0 °C to 28 °C (32-82.4 °F), To 80 % at 28 °C to 35 °C (82.4-95 °F), To 70 % at 35 ° C to 50 °C (95 °F -122 ° F) except to 70 % at 0 °C to 50 °C (32 °F -122 °F) for the1000 kΩ, 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
Electromagnetic Compatibility	In an RF field of 1 V/m on all ranges and functions: Total Accuracy = Specified Accuracy +0.4% of range. Performance above 1 V/m is not specified
Vibration	3 G @ 55 Hz
Shock	Half sine 40 G. Per Mil-T- 28800D, Class 3, Style E. Bench Handling. Per Mil-T-28800D, Class 3.

General

Common Mode Voltage	1000 V dc or peak ac maximum from any input to earth
Size	9.3 cm high, 21.6 cm wide, 28.6 cm deep (3.67 in high,8.5 in wide, 11.27 in deep)
Weight	Net, 2.4 kg (5.2 lbs) without battery; 3.2 kg (7.0 lbs) with battery; Shipping, 4.0 kg (8.7 lbs) without battery; 4.8 (10.5 lbs) with battery
Power	90 V to 264 V ac (no switching required), 50 Hz and 60 Hz < 15 VA maximum
Standards	Complies with: IEC 348, UL1244, CSA Bulletin 566B
RS-232-C	EMC: Part 15 subpart J of FCC Rules, and VDE 0871. Baud rates: 300, 600,1200,2400,4800 and 9600 Odd, even or no parity One stop bit

Options

Battery (Option -01 K)	Type	8 V, Lead-Acid
	Operating Time	8 hours (typical). lights when less than 1/2 hour of battery operation remains. Meter still meets specifications.
	Recharge Time	16 hours (typical) with meter turned off and plugged into line power. Battery will not charge when meter is turned on.
IEEE-488 (Option -05K)	Capability codes	SH1, AH1, T5, L4, SRI, RL1, PP0, DC1, DT1, E1, TED, LEO and C0
	External Trigger Input	
	VIH	1.35 V minimum
	VIL	1.25 V maximum
	Input Threshold Hysteresis	0.6 V minimum