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 to 28° C (64.4 to 82.4° F)
- Relative humidity not exceeding 90% (non-condensing) (70% for 1,000 kΩ range and above)

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

FLUKE 45

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	0.02% + 2	0.025% + 2
3V	—	100 μV	1 mV	0.02% + 2	0.025% + 2
30V	—	1 mV	10 mV	0.02% + 2	0.025% + 2
300V	—	10 mV	100 mV	0.02% + 2	0.025% + 2
1000V	—	100 mV	1V	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
10V	100 μV	—	—	0.02% + 6	0.025% + 6
100V	1 mV	—	—	0.02% + 6	0.025% + 6
1000V	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 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

Range		Max Allowable Peak AC Voltage	Peak Normal Mode Signal	
			NMRR* >80 dB†	NMRR >60 dB†
300 mV	100 mV	20V	15V	15V
3V	1000 mV	20V	15V	15V
30V	10V	1000V	50V	300V
300V	100V	1000V	50V	300V
1000V	1000V	1000V	200V	1000V

* NMRR is the Normal Mode Rejection Ratio

† Normal Mode Rejection Ratio at 50 or 60 Hz ± 0.1%

Common Mode Rejection Ratio

>90 dB at dc, 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
3V	—	100 μV	1 mV
30V	—	1 mV	10 mV
300V	—	10 mV	100 mV
750V	—	100 mV	1V
100 mV	1 μV	—	—
1000 mV	10 μV	—	—
10V	100 μV	—	—
100V	1 mV	—	—
750V	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

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

* 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 or 60 Hz (1 kΩ unbalanced medium rate)

Maximum Input

750V rms, 1000V peak

2×10^7 Volt-Hertz product on any range, normal mode input

1×10^6 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.

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 10A range, the maximum frequency of the voltage input must be less than 2 kHz.

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DC CURRENT

Range	Resolution			Accuracy	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
10 A	—	1 mA	10 mA	0.2% + 5	0.25V
10 mA	100 nA	—	—	0.05% + 15	0.14V
100 mA	1 μA	—	—	0.05% + 5	1.4V
10 A	100 μA	—	—	0.2% + 7	0.25V
* Typical at full range					

Maximum Input

To be used in protected, low energy circuits only, not to exceed 250V 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 I, 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.

NOTE

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

FLUKE 45

AC CURRENT

Range	Resolution			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
10 A	100 μA	1 mA	10 mA	0.25V
* 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 250V 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 I, fast blow fuse

A 10A dc or ac rms continuous, or 20A dc or ac rms for 30 seconds maximum. Protected with a 15A, 250 V, 10,000A 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 Full Scale Voltage	Max Current Through the 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	0.3	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
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 μA
10 MΩ	100Ω	—	—	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 "+1E-9".

Open Circuit Voltage

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

Input Protection

500V dc or rms ac on all ranges

DIODE TEST/CONTINUITY

	Maximum Reading	Resolution
Slow	999.99 mV	10 μV
Medium	2.5V	100 μV
Fast	2.5V	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 volts 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 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	1V 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	10A	>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 to 64.4°F and 82.4 to 122°F)

Operating Temperature

0°C to 50°C (32 to 122°F)

Storage Temperature

-40°C to + 70°C (-40 to 158°F)

Elevated temperature storage of battery will accelerate battery self-discharge. Maximum storage time before battery must be recharged:

20 - 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 (95-122°F) except to 70% at 0°C to 50°C (32-122°F) for the 1000 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

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

1000V 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 to 264V ac (no switching required), 50 and 60 Hz < 15 VA maximum

Standards

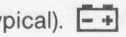
Complies with: IEC 348, UL1244, CSA Bulletin 566B
EMC: Part 15 subpart J of FCC Rules, and VDE 0871.

RS-232-C

Baud rates: 300, 600, 1200, 2400, 4800 and 9600
Odd, even or no parity
One stop bit

OPTIONS

Battery (Option -01K)

Type	8V, Lead-Acid
Operating Time	8 hours (typical).  lights when less than ½ 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, SR1, RL1, PP0, DC1, DT1, E1, TE0, LE0 and C0
External Trigger Input	
VIH	1.35 V minimum
VIL	1.25 V maximum
Input Threshold Hysteresis	0.6 V minimum