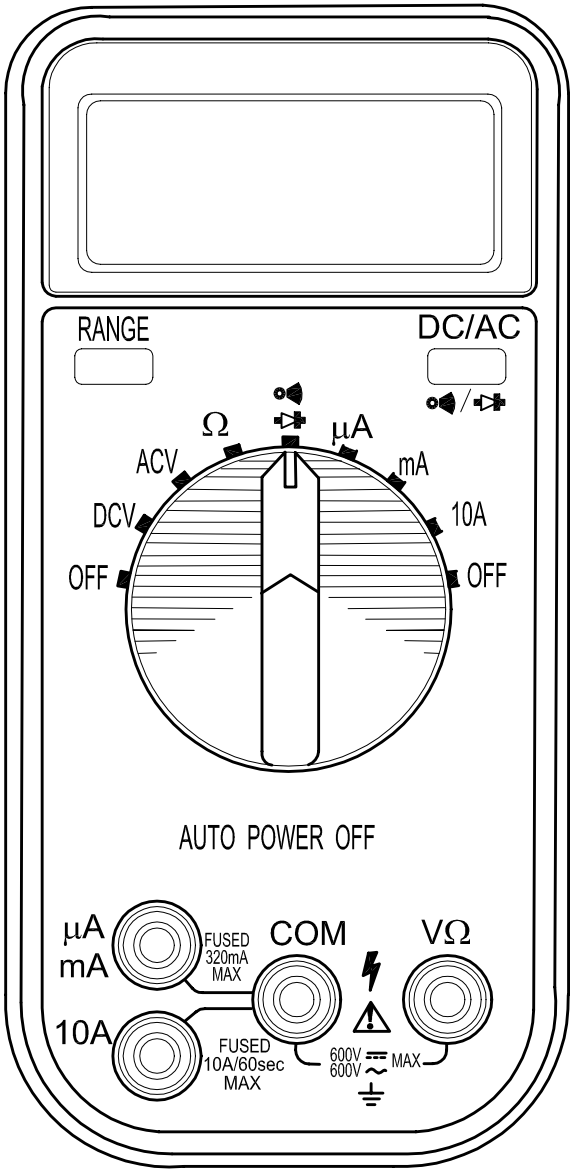
Laboratory for Fundamentals of Electrical Engineering (Labor Grundlagen der Elektrotechnik)

Equipment Manuals
for use in laboratory for measurement

REVISIONS			DOC. NO. SPC-F005 * Effective: 12/21/98 * DCP No: 680					
DCP #	REV	DESCRIPTION	DRAWN	DATE	CHECKD	DATE	APPRVD	DATE
522	A	RELEASED	JWM	6/26/00	JC	8/4/00	DJC	8/8/00



	Range	DC Accuracy	AC Accuracy	Input Impedance	Maximum Input
Voltage (50/60Hz)	320mV	±1.2% rdg + 1d	N/A	>1000MΩ	600VDC or 600VAC rms
	3.2V	±0.8% rdg + 1d	±2.0% rdg + 4d	11MΩ	
	32V	±1.2% rdg + 1d		10MΩ	
	320V				
	600V				
	Range	**DC Accuracy**	**AC Accuracy**	**Voltage Burden**	**Input Protection**
Current (50/60Hz)	320μA	±2.0% rdg + 1d	±2.5% rdg + 4d	0.2V	0.5A/250V Fuse
	3200μA			2V	
	32mA			0.2V	
	320mA			2V	
	10A	±3.0% rdg + 3d	±3.5% rdg + 4d	2V	10A/600V Fuse
	Range	**Resolution**	**Accuracy**	**Test Current**	**Input Protection**
OHM	320Ω	100mΩ	±2.0% rdg + 3d	<0.7mA	500VDC or 500VAC rms
	3.2kΩ	1Ω	±1.5% rdg + 3d	<0.13mA	
	32kΩ	10Ω		<13μA	
	320kΩ	100Ω		<1.3μA	
	3.2MΩ	1kΩ	±2.5% rdg + 3d	<0.13μA	
	30MΩ	10kΩ	±5% rdg + 5d		
Diode Test	0-2000	1mV	±10% rdg + 2d	0.5mA (Vf = 0.6V)	500VDC or AC rms
	Range	**Resolution**	Audible Indication	**Test Current**	**Input Protection**
Continuity Check	320Ω	100mΩ	<approx. 20Ω	<0.7 mA	500VDC or AC rms

Features

1. Display: 3 ½ digit LCD with max. reading of 3200
2. Measurement Rate: 2 times per second, nominal
3. Analog Bar Graph: 34 segments, measurements 12 times per second
4. Operating Environment: 0°C to 50°C @ <70 % rel. humidity
5. Dimensions: 147mm x 70mm x 39mm
6. Weight: Approx., 11.8 oz. including holster

CE

DISCLAIMER:
ALL STATEMENTS AND TECHNICAL INFORMATION CONTAINED HEREIN ARE BASED UPON INFORMATION AND/OR TESTS WE BELIEVE TO BE ACCURATE AND RELIABLE. SINCE CONDITIONS OF USE ARE BEYOND OUR CONTROL, THE USER SHALL DETERMINE THE SUITABILITY OF THE PRODUCT FOR THE INTENDED USE AND ASSUME ALL RISK AND LIABILITY WHATSOEVER IN CONNECTION THEREWITH.

TENMA®

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DRAWN BY:	DATE:
Jeff McVicker	6/26/00
CHECKED BY:	DATE:
JOHN COLE	8/4/00
APPROVED BY:	DATE:
Daniel Carey	8/8/00

DRAWING TITLE: Digital Multimeter

SIZE	DWG. NO.	ELECTRONIC FILE	REV
A	72-2050	92F5407.dwg	A

SCALE: NTS | U.O.M.: INCHES [mm] | SHEET: 1 OF 1

SPC-F005.DWG

Gossen, Metrawatt, Camille Bauer

METRAHit 15S

System measures no TRMS values.

Function

The function selector switch is coupled with the automatic socket blocking system.

Range selection

Auto ranging is selected after switching the meter on. You can switch off auto ranging and select one of the fix ranges manually.

Liquid crystal display

The digital display shows the measured value with the correct location of decimal the point and sign, with measuring unit and function. The analog indication always shows a full scale value of 30 scale units.

"DATA" hold and "MIN/MAX" storage facility

The DATA and MIN/MAX functions are not often used and will not be explained just now.

Voltage measurement

Set the function selector switch to **V~** or **V—** for zero adjustment select 30mV— range and push down the yellow button.

Current measurement

Set the function selector switch to **A—** or **mA —**for AC current push down the yellow button., the display shows the selected function.

Resistance measurement

When measuring small resistance values on the 30Ω range you can eliminate the resistance of the leads and transient resistances by zero adjustment.

Capacitance measurement

Set the function selector to **F** and connect only the discharged device .

Frequency measurement

Frequency measurement is possible on all voltage measuring ranges by briefly pushing down the yellow button.

Temperatur measurement

To choose the sensor PT 100 or PT 1000 set the function selector to **Ω,** connect the sensor and push down the yellow button then set the function selector to **°C.**

Specifications METRAHit 15S

Measurement function	Measuring range	Resolution	Input impedance		Intrinsic error ± (... % of rdg + ... digits)	
V			=	~	=	~ (1)
	30,00 mV	10 µV	10GΩ//40pF	----------	0,5 + 35	----------
	300,0 mV	100 µV	10GΩ//40pF	----------	0,05 + 3	----------
	3,000 V	1 mV	11MΩ//40pF	11MΩ//40pF	0,25 + 1	0,75 + 1
	30,00 V	10 mV	10MΩ//40pF	10MΩ//40pF	0,25 + 1	0,75 + 1
	300,0 V	100 mV	10MΩ//40pF	10MΩ//40pF	0,25 + 1	0,75 + 1
	1000 V	1 V	10MΩ//40pF	10MΩ//40pF	0,35 + 1	0,75 + 1
A			**Voltage drop approx.**			
	3,000 mA	1 µA	150 mV	150 mV	1,5 + 2	1,0 + 2
	300,0 mA	100 µA	1 V	1 V	1,5 + 2	1,5 + 2
	10,00 A	10 mA	270 mV	270 mV	1,5 + 5	1,5 + 2
Ω			**No-load voltage**			
	30,00 Ω	10 mΩ	max. 3,2 V		0,5 + 30	
	300,0 Ω	100 mΩ	max. 3,2 V		0,5 + 3	
	3,000 kΩ	1 Ω	max. 1,25 V		0,4 + 1	
	30,00 kΩ	10 Ω	max. 1,25 V		0,4 + 1	
	300,0 kΩ	100 Ω	max. 1,25 V		0,4 + 1	
	3,000 MΩ	1 kΩ	max. 1,25 V		0,6 + 1	
	30,00 MΩ	10 kΩ	max. 1,25 V		0,2 + 1	

(1) Effect of frequency

While using Voltage- or Current Measurement function within any frequency > 65 Hz .... 1kHz you get an intrinsic error of **2% of rdg + 3 digits**.

While using the current measuring range 300mA the input impedance is not constant value.

Effect of waveform

While doing AC measurements there are no TRMS values showed.

Gossen, Metrawatt, Camille Bauer

Metra Hit 18S

System measures TRMS values.

Messfunktion

The function selector switch is coupled with the automatic socket blocking system.

Range selection

Auto-ranging is selected after switching the meter on. You can switch off auto-ranging and select one of the fixed ranges manually.

Liquid crystal display

The digital display shows the measured value with correct location of the decimal point and sign, with measuring unit and function.
The analog indication gives the dynamic response of a moving-coil movement.

"DATA" hold and "MIN/MAX" storage facility

The DATA and MIN/MAX functions are not often used and will not be explained just now.

Voltage measurement

Set the function selector switch to **V~, V—** or **(AC +DC)** voltage. For zero adjustment select the 300mV— range, shorten the leads and press the yellow button.

Current measurement

Set the function selector switch to **A—** or **mA—** for **AC** measurement press the yellow button, the display shows the selected function.

Capacitance measurement

Set the function selector to **F** and connect only the discharged device .

Frequency measurement

Frequency measurement is possible on all voltage measuring ranges by briefly pushing down the yellow button.

Temperature measurement

To choose the sensor PT 100 or PT 1000 set the function selector to **Ω,** connect the sensor and press the yellow button then set the function selector to **°C.**

Specifications MetraHit 18S

Measurement function	Measuring range	Resolution	Input Impedance		Intrinsic error ± (... % of rdg + ... digits)	
V			=	~ ≅	=	~ ≅ (1)
	300,00 mV	10 µV	>10 GΩ	5 MΩ //40pF	0,05 + 20	0,5 + 30
	3,0000 V	100 µV	11 MΩ	1 MΩ //40pF	0,05 + 3	0,3 + 30
	30,000 V	1 mV	10 MΩ	1 MΩ //40pF	0,05 + 3	0,3 + 30
	300,00 V	10 mV	10 MΩ	1 MΩ //40pF	0,05 + 3	0,3 + 30
	1000,0 V	100 mV	10 MΩ	1 MΩ //40pF	0,05 + 3	0,3 + 30
A			**Voltage drop approx.**			
	300,00 µA	10 nA	15 mV	15 mV	0,2 + 20	0,5 + 30
	3,0000 mA	100 nA	150 mV	150 mV	0,2 + 10	0,5 + 30
	30,000 mA	1 µA	30 mV	30 mV	0,05 + 10	0,5 + 30
	300,00 mA	10 µA	300 mV	300 mV	0,2 + 10	0,5 + 30
	3,0000 A	100 µA	150 mV	150 mV	0,5 + 10	0,75 + 30
	10,000 A	1 mA	400 mV	400 mV	0,5 + 10	0,75 + 30
Ω			**No-load voltage**	**Short-circuit current**		
	300,00 Ω	10 mΩ	Max. 4,00 V	max. 1 mA	0,1 + 30	
	3,0000 kΩ	100 mΩ	Max. 1,25 V	max. 100 µA	0,1 + 6	
	30,000 kΩ	1 Ω	Max. 1,25 V	max. 10 µA	0,1 + 6	
	300,00 kΩ	10 Ω	Max. 1,25 V	max. 1 µA	0,1 + 6	
	3,0000 MΩ	100 Ω	Max. 1,25 V	max. 0,1µA	0,4 + 6	
	30,000 MΩ	1 kΩ	Max. 1,25 V	max. 0,1µA	3,0 + 6	

(1) Effect of frequency

These intrinsic error are only for the frequency range: 45 Hz .... 65 Hz,
while using the voltage ranges within any frequency: 15 Hz .... 45 Hz / 65 Hz 20kHz,
while using the Current ranges within any frequency: 15 Hz .... 45 Hz / 65 Hz .... 1 kHz
You will get an intrinsic error of **1% of rdg + 20 Digit**.

Effect of waveform

AC measurements are TRMS values.
at a waveform within a CF 1...3 there is a variation of ± **1% of rdg**
at a waveform within a CF 3...5 there is a variation of ± **3% of rd**

Gossen, Metrawatt, Camille Bauer

Metra Hit 29S

Function

The function selector switch is coupled with the automatic socket blocking system.

Range selection

Auto-ranging is selected after switching the meter on. You can switch off auto-ranging and select one of the fixed ranges manually.

Liquid crystal display

The digital display shows the measured value with correct location of the decimal point and sign, with measuring unit and function.

"DATA" hold and "MIN/MAX" storage facility

The DATA and MIN/MAX functions are not often used and will not be explained just now.

Voltage measurement

Set the function selector switch to **V~, V—** or **(AC +DC)** voltage.
For zero adjustment select the 300mV— range, shorten the leads and press the yellow button.

Current measurement

Set the function selector switch to **A—** or **mA—** for **AC** measurement press the yellow button, the display shows the selected function.

Capacitance measurement

Set the function selector to **F** and connect only the discharged device .

Resistance measurement

When measuring small resistance values on the 300Ω and 3kΩ range you can eliminate the resistance of the leads and transient resistances by zero adjustment.

Frequency measurement / Temperature measurement

Choose like the multimeter METRAHit 18 S.

Power measurement

In a 1phase DC- and AC-Currentsystem it is possible to measure following values:
true power, reactive power, apparent power, cos φ, energy, min- and max of power.
How to be done, have a look at the manual METRAHit 29S.

Specifications METRA Hit 29S

Function	Range	Resolution	Input Impedance		Intrinsic error ± (... % of Range +...% of rdg +... Digit)	
V		=	=	≅		± (... % of rdg + ... Digit)
					=	≅
	300,00 mV	1 µV	>20 MΩ	5 MΩ //<50pF	0,02 +0,005+ 5	0,5 + 30
	3,0000 V	10 µV	11 MΩ	5 MΩ //<50pF	0,02 +0,005+ 5	0,2 + 30
	300,00 V	100 µV	10 MΩ	5 MΩ //<50pF	0,02 +0,005+ 5	0,2 + 30
	300,00 V	1 mV	10 MΩ	5 MΩ //<50pF	0,02 +0,005+ 5	0,2 + 30
	1000,0 V	10 mV	10 MΩ	5 MΩ //<50pF	0,02 +0,005+ 5	0,3 + 30
A		=	**Voltage drop approx.**			
	300,00 µA	1 nA	160 mV	160 mV	0,05 +0,02+ 5	0,5 + 30
	3,0000 mA	10 nA	160 mV	160 mV	0,05 +0,01+ 5	0,5 + 30
	30,000 mA	100 nA	170 mV	170 mV	0,05 +0,01+ 5	0,5 + 30
	300,00 mA	1 µA	300 mV	300 mV	0,1 +0,01+ 5	0,5 + 30
	3,0000 A		110 mV	110 mV	0,2 +0,01+ 5	0,5 + 30
	10,000 A		350 mV	350 mV	0,2 +0,01+ 5	0,5 + 30
Ω			**No-load voltage**	**Short-circuit current**	after Zero- Adjust)	
	300,00 Ω	1 mΩ	0,6 V	max. 250 µA	0,05 + 0,01+ 5	
	3,0000 kΩ	10 mΩ	0,6 V	max. 45 µA	0,05 + 0,01+ 5	
	30,000 kΩ	100 mΩ	0,6 V	max. 4,5 µA	0,05 + 0,01+ 5	
	300,00 kΩ	1 Ω	0,6 V	Max. 1,5 µA	0,05 + 0,02 + 5	
	3,0000 MΩ	10 Ω	0,6 V	max. 0,15µA	0,1 + 0,02 + 5	
	30,000 MΩ	100 Ω	0,6 V	max. 0,15µA	1 + 0,2 + 5	

Effect of frequency

This effect depends on the Measurement function, the Measuring range and the used frequency, cause there are very different values have a look into the manual.

Effect of waveform

AC measurements are TRMS values.
The Intrisic error depends on the crest factor**:**
there is a variation of ± **1% of Rdg** at a waveform within a CF 1...3
and a variation of ± **3% of Rdg** at a waveform within a CF 3...5.

Wavetek Model 39

Universal Functions-Generator

Manual extraction

Specifications

Digital controlled
All parameter settings are displayed on the
LCD screen.
Pressing the front panel keys dispays screens which list parameters or choices relative to the key pressed. Selections are then made using the display soft-keys and numeric values are changed using the numeric keys or rotary control.

Keyboard

"WAVE SELECT"	selection of "STD" or "ARB" waveforms
"FREQ uenz" \	
"AMPL itude" \	creation of screens for setting parameters
"OFFSET" /	
"MODE" /	
"Numeric keys"	for directly setting of parameters
"WAVE EDIT "	creation of screens for generating new waveforms

In- Outputs

"VCA/SUM IN"	input used for remote control
"TRIG IN"	input used for synchronisation
"SYNC OUT"	multifuntion output on TTL/CMOS logic level
"MAIN OUT "	output impedance: 50 Ω , amplitude: 5mV to $20V_{SS}$ open circuit

Burster 4107

Decade Resistor

Manual extraction
Specifications

7 decade-step resistor with precision resistors made of Manganin or Isa-Ohm

Zero resistance of each decade	1 mΩ
Zero resistance of total decade resistor	<10 mΩ
Power limit of each resistor	0,4 W

Maximum current of used decade:

Range	Intrinsic error	Rated current
10 x 0,1 Ω	0,5 %	2000 mA
10 x 1 Ω	0,1 %	630 mA
10 x 10 Ω	0,05 %	200 mA
10 x 100 Ω	0,02 %	60 mA
10 x 1 kΩ	0,02 %	20 mA
10 x 10 kΩ	0,02 %	6,3 mA
10 x 100 kΩ	0,02 %	2,0 mA

Characteristic Values

Meas. Function	Measuring Range	Resolution at Upper Range Limit			Input Impedance —			Intrinsic Deviation at max. Resolution under Reference Conditions		Overload Capacity [7]		Sampling Rate		
								±(... % of rdg. + ... d)	±(... % of rdg. + ... d)					
		30000 [1]	3000		22...24/26	25S	~ / ≂	—	~ / ≂ [8]	Value	Duration	—	≂	~
V [4]	300 mV	10 µV			> 20MΩ	10 MΩ	5 MΩ // < 50 pF	0.05 + 3 [7]	0.5 + 30 (> 300 d)	1000 V DC AC eff sine	cont.	50 ms (22M/ 26M: 1 ms)	0.5 s	1 s
	3 V	100 µV			11MΩ	5 MΩ	5 MΩ // < 50 pF	0.05 + 3	0.2 + 30 (> 300 d)					
	30 V	1 mV			10MΩ	5 MΩ	5 MΩ // < 50 pF	0.05 + 3	0.2 + 30 (> 300 d)					
	300 V	10 mV			10MΩ	5 MΩ	5 MΩ // < 50 pF	0.05 + 3	0.2 + 30 (> 300 d)					
	1000 V	100 mV			10MΩ	5 MΩ	5 MΩ // < 50 pF	0.05 + 3	0.2 + 30 (> 300 d)					
dB	see table on next page				—		same as for V ≂	—	± 0.1 dB [11]			1 s		
					Voltage Drop at Upper R. Limit		Load	—	~ / ≂ [8]			—	≂	
A [4]	300 µA	10 nA			160 mV		500 Ω	0.1 + 5	0.5 + 30	0.36 A	cont.	50 ms	0.5 s	
	3 mA	100 nA			160 mV		50 Ω	0.1 + 5	0.5 + 30					
	30 mA	1 µA			200 mV		6 Ω	0.05 + 5	0.5 + 30					
	300 mA	10 µA			300 mV		1.1 Ω	0.5 + 5	0.5 + 30					
	3 A	100 µA			110 mV		35 mΩ	0.5 + 10	0.75 + 30	10 A [9]	cont.			
	10 A	1 mA			350 mV		35 mΩ	0.5 + 10	0.75 + 30					
					Open-Circuit Voltage		Meas. Current at Upper R. Limit	±(... % of rdg. + ... d)						
Ω	300 Ω	10 mΩ			0.6 V		max. 250 µA	0.1 + 5 [10]		1000 V DC AC eff sine	5 min.	0.5 s		
	3 kΩ	100 mΩ			0.6 V		max. 45 µA	0.1 + 5 [10]						
	30 kΩ	1 Ω			0.6 V		max. 4.5 µA	0.1 + 5						
	300 kΩ	10 Ω			0.6 V		max. 1.5 µA	0.1 + 5						
	3 MΩ	100 Ω			0.6 V		max. 150 nA	0.1 + 5						
	30 MΩ	1 kΩ			0.6 V		max. 15 nA	2 + 5						
Ω 🔊	300 Ω		0.1 Ω		max. 3 V		max. 1.2 mA	1 + 3						
→+ 🔊	3 V [6]		1 mV		max. 3 V		max. 1.2 mA	0.2 + 5				50 ms		
→+	3 V [6]	100 µA			max. 3 V		max. 1.2 mA	0.2 + 3				50 ms		
					Discharge Resist.		$U_{0\ max}$	±(... % of rdg. + ... d)						
F	3 nF		1 pF		10 MΩ		3 V	1 + 6 [10]		1000 V DC AC eff sine	5 min.	2 s		
	30 nF		10 pF		10 MΩ		3 V	1 + 6 [10]						
	300 nF		100 pF		1 MΩ		3 V	1 + 6						
	3 µF		1 nF		100 kΩ		3 V	1 + 6						
	30 µF		10 nF		11 kΩ		3 V	1 + 6						
	300 µF		100 nF		2 kΩ		3 V	5 + 6						
	3000 µF		1 µF		2 kΩ		3 V	5 + 6				2 ... 7 s		
	30000 µF		1 µF		2 kΩ		3 V	5 + 60				2 ... 14 s		
					f_{min} [3]			±(... % of rdg. + ... d)	max. measuring voltage					
Hz	300.00 Hz	0.01 Hz			1 Hz			0.1 + 1 [11]	1000 V	1000 V	cont.	1 s		
	3.0000 kHz	0.1 Hz							1000 V					
	100.00 kHz	10 Hz							< 30 kHz: 300 V					
									> 30 kHz: 30 V					
⏱	100 min [2]	100 ms (1/10 s)						±15 d						
								±(... % of rdg. + ... d)						
°C/°F	Pt 100/ Pt 1000	– 200.0 ... – 100.0 °C	0.1 °C					1 K [12]		1000 V DC/AC eff sine	5 min.	0.5 s		
		– 100.0 ... + 100.0 °C						0.8 K + 3 [12]						
		+ 100.0 ... +850.0 °C						0.5 + 3 [12]						

1) Display: 4¾ place, a different resolution and sampling rate can be selected for the storage and transmission of measured values in the rAtE menu.
2) Stopwatch: format: **mm:ss:h** where m = minutes, s = seconds and h = hundredths of a second, max.: 99:59.9; key-controlled only
3) Smallest measurable frequency for sinusoidal measurement signals symmetric to the zero point
4) METRA HIT | 26S/M and 25S: TRMS measurement
5) Without 16 A fuse
6) Display: up to max. 1.8 V, otherwise "OL" appears at the display
7) At 0° to + 40° C
8) Values of less than100 digits are suppressed.
15 (20) ... 45 ... 65 Hz ... 1/20/100 kHz sine, see page 4 for influences.
9) 12 A – 5 min., 16 A – 30 s, METRA HIT | 23S: 16 A 10 min.
10) ZERO appears at display when "zero balancing" function is activated.
11) The amplitude of the input voltage must not exceed/fall below the following values:

Frequency	Minimum voltage amplitude	Maximum voltage amplitude
≤ 1 kHz	10% of measuring range	100 % of the voltage measuring range; e.g. in the 3 V measuring range above 10 kHz: 0.2 V ... 3 V
1 kHz ... 10 kHz	15% of measuring range	
10 kHz ... 100 kHz	20% of measuring range	

12) Plus sensor error

Key: rdg. = reading, R = measuring range, d = digit(s)

Measuring Function	Measuring Range	22S/M	23S	24S	25S [4]	26S/M [4]
A	300 µA	—	•	•	•	•
	3 mA	—	•	•	•	•
	30 mA	—	•	•	•	•
	300 mA	—	•	•	•	•
	3 A	—	•	•	•	•
	10 A	—	16 A [5]	•	•	•
A ~∝	mA/A	—	•	•	•	•
A ~∝	mV/A	•	—	—	—	—

Fluke 175


FLUKE 179 TRUE RMS MULTIMETER
1000
V AC
0 Auto Range 1000
HOLD
MINMAX
RANGE
mV
Ω
Hz V
mA Hz
A Hz
OFF
400 mA
10A
FUSED
COM
600V CAT IV
1000V CAT III

Function	Range [1]	Resolution	Accuracy ±([% of Reading] + [Counts])		
			Model 175	Model 177	Model 179
AC Volts [2, 3]	600.0 mV 6.000 V 60.00 V 600.0 V 1000 V	0.1 mV 0.001 V 0.01 V 0.1 V 1 V	1.0 % + 3 (45 Hz to 500 Hz) 2.0 % + 3 (500 Hz to 1 kHz)	1.0 % + 3 (45 Hz to 500 Hz) 2.0 % + 3 (500 Hz to 1 kHz)	1.0 % + 3 (45 Hz to 500 Hz) 2.0 % + 3 (500 Hz to 1 kHz)
DC mV	600.0 mV	0.1 mV	0.15 % + 2	0.09 % + 2	0.09 % + 2
DC Volts	6.000 V 60.00 V 600.0 V	0.001 V 0.01 V 0.1 V	0.15 % + 2	0.09 % + 2	0.09 % + 2
	1000 V	1 V	0.15 % + 2	0.15 % + 2	0.15 % + 2
Continuity	600 Ω	1 Ω	Meter beeps at < 25 Ω, beeper turns off at > 250 Ω; detects opens or shorts of 250 µs or longer.		
Ohms	600.0 Ω 6.000 kΩ 60.00 kΩ 600.0 kΩ 6.000 MΩ 50.00 MΩ	0.1 Ω 0.001 kΩ 0.01 kΩ 0.1 kΩ 0.001 MΩ 0.01 MΩ	0.9 % + 2 0.9 % + 1 0.9 % + 1 0.9 % + 1 0.9 % + 1 1.5 % + 3	0.9 % + 2 0.9 % + 1 0.9 % + 1 0.9 % + 1 0.9 % + 1 1.5 % + 3	0.9 % + 2 0.9 % + 1 0.9 % + 1 0.9 % + 1 0.9 % + 1 1.5 % + 3
Diode test	2.400 V	0.001 V	1 % + 2		
Capacitance	1000 nF 10.00 µF 100.0 µF 9999 µF [4]	1 nF 0.01 µF 0.1 µF 1 µF	1.2 % + 2 1.2 % + 2 1.2 % + 2 10 % typical	1.2 % + 2 1.2 % + 2 1.2 % + 2 10 % typical	1.2 % + 2 1.2 % + 2 1.2 % + 2 10 % typical
AC Amps [5] (True RMS) (45 Hz to 1 kHz)	60.00 mA 400.0 mA[6] 6.000 A 10.00 A[7]	0.01 mA 0.1 mA 0.001 A 0.01 A	1.5 % + 3	1.5 % + 3	1.5 % + 3

1. All AC voltage and AC current ranges are specified from 5 % of range to 100 % of range.
2. Crest factor of ≤ 3 at full scale up to 500 V, decreasing linearly to crest factor ≤ 1.5 at 1000
3. For non-sinusoidal waveforms, add -(2% reading + 2% full scale) typical, for crest factors u
4. In the 9999 µF range for measurements to 1000 µF, the measurement accuracy is 1.2 % +
5. Amps input burden voltage (typical): 400 mA input 2 mV/mA, 10 A input 37 mV/A.
6. 400.0 mA accuracy specified up to 600 mA overload.
7. > 10A unspecified.

Function	Range [1]	Resolution	Accuracy ±([% of Reading] + [Counts])		
			Model 175	**Model 177**	**Model 179**
DC Amps[4]	60.00 mA 400.0 mA[6] 6.000 A 10.00 A[7]	0.01 mA 0.1 mA 0.001 A 0.01 A	1.0 % + 3	1.0 % + 3	1.0 % + 3
Hz (AC- or DC-coupled, V or A [2, 3] input)	99.99 Hz 999.9 Hz 9.999 kHz 99.99 kHz	0.01 Hz 0.1 Hz 0.001 kHz 0.01 kHz	0.1 % + 1	0.1 % + 1	0.1 % + 1
Temperature	-40 °C to +400 °C -40 °F to +752 °F	0.1 °C 0.1 °F	NA	NA	1 % + 10[5] 1 % + 18[5]
MIN MAX AVG	For DC functions, accuracy is the specified accuracy of the measurement function ±12 counts for changes longer than 350 ms in duration. For AC functions, accuracy is the specified accuracy of the measurement function ±40 counts for changes longer than 900 ms in duration.				

1. All AC voltage and AC current ranges are specified from 5 % of range to 100 % of range.
2. Frequency is specified from 2 Hz to 99.99 kHz in Volts and from 2 Hz to 30 kHz in Amps.
3. Below 2 Hz, the display shows zero Hz.
4. Amps input burden voltage (typical): 400 mA input 2 mV/A, 10 A input 37 mV/A.
5. Does not include error of the thermocouple probe.
6. 400.0 mA accuracy specified up to 600 mA overload.
7. > 10A unspecified.