FLUKE®

28 II Ex

Digital Multimeter

Calibration Information

Introduction

⚠⚠Warning

To prevent possible electrical shock, fire, or personal injury:

- **Read all safety information before you use the Product.**
- **Do not do the performance tests or calibration adjustment procedures unless qualified to do so.**
- **Read the entire *Users Manual* and the *Safety Instructions* before you use the Product.**
- **Carefully read all instructions.**

The 28 II Ex Calibration Information contains adjustment and performance test procedures for the Fluke Model 28 II Ex Digital Multimeter (the Product or Meter).

This document includes:

See the *28 II Ex Users Manual* for instructions on Product operation.

Safety Information

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

⚠⚠Warning

To prevent possible electrical shock, fire, or personal injury:

- **Use the Product only as specified, or the protection supplied by the Product can be compromised.**
- **The battery door must be closed and locked before you operate the Product.**
- **Replace the batteries when the low battery indicator ( ) shows to prevent incorrect measurements.**
- **Remove all probes, test leads, and accessories before the battery door is opened.**
- **Do not use test leads if they are damaged. Examine the test leads for damaged insulation, exposed metal, or if the wear indicator shows. Check test lead continuity.**
- **Do not apply more than the rated voltage, between the terminals or between each terminal and earth ground.**
- **Limit operation to the specified measurement category, voltage, or amperage ratings.**
- **Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.**
- **Do not touch voltages >30 V ac rms, 42 V ac peak, or 60 V dc.**
- **Use the correct terminals, function, and range for measurements.**
- **Do not work alone.**
- **Measure a known voltage first to make sure that the Product operates correctly.**
- **Use only cables with correct voltage ratings.**
- **Use only current probes, test leads, and adapters supplied with the Product.**
- **Do not exceed the Measurement Category (CAT) rating of the lowest rated individual component of a Product, probe, or accessory.**
- **Connect the common test lead before the live test lead and remove the live test lead before the common test lead.**
- **Examine the case before you use the Product. Look for cracks or missing plastic. Carefully look at the insulation around the terminals.**

- **Do not use and disable the Product if it is damaged.**
- **Do not use the Product if it operates incorrectly.**
- **Do not use the Product in damp or wet environments.**
- **Keep fingers behind the finger guards on the probes.**
- **Measure for hazardous voltage without the Low-Pass Filter.**

⚠Caution

To prevent possible damage to the Meter or to the equipment under test, follow these guidelines:

- **Disconnect circuit power and discharge all high-voltage capacitors before you do resistance, continuity, diodes, or capacitance tests.**
- **Use the correct terminals, function, and range for all measurements.**
- **Before you measure current, check the fuses of the Meter. (See *Fuse Test*.)**

Electrical Symbols

Table 1 is a list of electrical symbols that appear in this document and on the Meter.

Table 1. Symbols

⚠	WARNING - RISK OF DANGER. Consult user documentation.
⚠	WARNING. HAZARDOUS VOLTAGE. Risk of electric shock.
⧈	Double Insulated
~	AC (Alternating Current)
⎓	DC (Direct Current)
⏚	Earth
⏛	Fuse
▭+	Battery. Low battery when displayed.
)))	Continuity test or continuity beeper tone.
⊣⊢	Capacitance
▶⊣	Diode
CE	Conforms to European Union directives.
KC	Conforms to relevant South Korean EMC Standards.
Ex	Conforms to the European Explosive Atmospheres (ATEX) directive.
c SP us	Certified by CSA Group to North American safety standards.
TÜV SÜD	Certified by TÜV SÜD Product Service.
RCM	Conforms to relevant Australian Safety and EMC standards.
CAT II	Measurement Category II is applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of the low-voltage MAINS installation.
CAT III	Measurement Category III is applicable to test and measuring circuits connected to the distribution part of the building's low-voltage MAINS installation.
CAT IV	Measurement Category IV is applicable to test and measuring circuits connected at the source of the building's low-voltage MAINS installation.
	This product complies with the WEEE Directive marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste.

General Specifications

Maximum voltage between any terminal and earth ground ..... 1000 V rms

⚠ Fuse for mA inputs ..... 0.44 A, 1000 V IR 10 kA

⚠ Fuse for A inputs ..... 11 A, 1000 V IR 17 kA

Display ..... 6000 counts, updates 4/sec (19,999 counts in high-resolution mode).

Altitude

Operating ..... 2000 meters

Storage ..... 10 000 meters

Operating Temperature ..... Different temperature ranges for T_{amb} are fixed by type-approved batteries (see separate *Safety Instructions* for a list of approved batteries)

Temperature coefficient ..... 0.05 X (specified accuracy) / °C (<18 °C or >28 °C)

Electromagnetic Compatibility (EN 61326-1:2005) .... In an RF field of 3 V/M, accuracy = specified accuracy +20 counts, except 600 µA dc range total accuracy = specified accuracy +60 counts. Temperature not specified

Relative Humidity ..... 0 % to 80 % (0 °C to 35 °C)
0 % to 70 % (35 °C to 50 °C)

Battery Type ..... 3 AAA Alkaline batteries, NEDA 24A IEC LR03 (see separate *Safety Instructions* for a list of approved batteries)

Battery Life ..... 400 hrs typical without backlight (Alkaline)

Vibration ..... Per MIL-PRF-28800 for a Class 2 instrument

Shock ..... 1 Meter drop per IEC 61010 (3 Meter drop with holster)

Size (H x W x L) ..... 4.57 cm x 10.0 cm x 21.33 cm (1.80 in x 3.95 in x 8.40 in)

Size with Holster ..... 6.35 cm x 10.0 cm x 19.81 cm (2.50 in x 3.95 in x 7.80 in)

Weight ..... 567.8 g (1.25 lb)

Weight with Holster and Flex-Stand ..... 769.8 g (1.70 lb)

Safety

General ..... IEC 61010-1: Pollution Degree 2

Measurement ..... IEC 61010-2-033: CAT IV 600V / CAT III 1000V

Ingress Protection ..... IEC 60529: IP67, non-operating

Electromagnetic Compatibility (EMC) ..... In an RF field of 3 V/M, accuracy = specified accuracy +20 counts, except 600 µA dc range total accuracy = specified accuracy +60 counts. Temperature not specified.

International ..... IEC 61326-1: Portable Electromagnetic Environment

IEC 61326-2-2 CISPR 11: Group 1, Class A

Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself.

Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.

Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Korea (KCC) ..... Class A Equipment (Industrial Broadcasting & Communication Equipment)

Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.

USA (FCC) ..... 47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.

Detailed Specifications

For all detailed specifications:

Accuracy is specified for 2 years after calibration, at operating temperatures of 18 °C to 28 °C, with relative humidity at 0 % to 80 %. Accuracy specifications take the form of ±([% of Reading] + [Number of least-significant digits]). In the 4 ½-digit mode, multiply the number of least-significant digits (counts) by 10.

AC Voltage

AC conversions are ac-coupled and valid from 3 % to 100 % of range.

<table>
<tr><th rowspan="2">Range</th><th rowspan="2">Resolution</th><th colspan="6">Accuracy</th></tr>
<tr><th>45 – 65 Hz</th><th>30 – 200 Hz</th><th>200 – 440 Hz</th><th>440 Hz – 1 kHz</th><th>1 – 5 kHz</th><th>5 – 20 kHz</th></tr>
<tr><td>600.0 mV</td><td>0.1 mV</td><td rowspan="2">±(0.7 % + 4)</td><td colspan="3" rowspan="3">±(1.0 % + 4)</td><td rowspan="2">±(2 % + 4)</td><td rowspan="2">±(2 % + 20) [1]</td></tr>
<tr><td>6.000 V</td><td>0.001 V</td></tr>
<tr><td>60.00 V</td><td>0.01 V</td><td rowspan="4">±(0.7 % + 2)</td><td rowspan="2">±(2 % + 4) [2]</td><td>Unspecified</td></tr>
<tr><td>600.0 V</td><td>0.1 V</td><td>Unspecified</td></tr>
<tr><td>1000 V</td><td>1 V</td><td colspan="3"></td><td>Unspecified</td><td>Unspecified</td></tr>
<tr><td colspan="2">Low-Pass Filter</td><td>±(1.0 % + 4) [1]</td><td>+1.0 % + 4
-6.0 % - 4 [3]</td><td>Unspecified</td><td>Unspecified</td><td>Unspecified</td></tr>
</table>

[1] Below 10 % of range, add 12 counts.

[2] Frequency range: 1 kHz to 2.5 kHz

[3] Specification increases from -1 % to -6 % at 440 Hz when filter is used.

DC Voltage, Conductance, and Resistance

<table>
<tr><th>Function</th><th>Range</th><th>Resolution</th><th>Accuracy</th></tr>
<tr><td>mV dc</td><td>600.0 mV</td><td>0.1 mV</td><td>±(0.1 % + 1)</td></tr>
<tr><td rowspan="4">V dc</td><td>6.000 V</td><td>0.001 V</td><td rowspan="4">±(0.05 % + 1)</td></tr>
<tr><td>60.00 V</td><td>0.01 V</td></tr>
<tr><td>600.0 V</td><td>0.1 V</td></tr>
<tr><td>1000 V</td><td>1 V</td></tr>
<tr><td rowspan="6">Ω</td><td>600.0 Ω</td><td>0.1 Ω</td><td>±(0.2 % + 2) [2]</td></tr>
<tr><td>6.000 kΩ</td><td>0.001 kΩ</td><td rowspan="2">±(0.2 % + 1)</td></tr>
<tr><td>60.00 kΩ</td><td>0.01 kΩ</td></tr>
<tr><td>600.0 kΩ</td><td>0.1 kΩ</td><td rowspan="2">±(0.6 % + 1)</td></tr>
<tr><td>6.000 MΩ</td><td>0.001 MΩ</td></tr>
<tr><td>50.00 MΩ</td><td>0.01 MΩ</td><td>±(1.0 % + 3) [1,3]</td></tr>
<tr><td>nS</td><td>60.00 nS</td><td>0.01 nS</td><td>±(1.0 % + 10) [1,2,3]</td></tr>
</table>

[1] Add 0.5 % of reading when measuring above 30 MΩ in the 50 MΩ range, and 20 counts below 33 nS in the 60 nS range.

[2] When using the rel function to compensate for offsets.

[3] >40 °C temperature coefficient is 0.1 x (specified accuracy)/°C.

Temperature

Range	Resolution	Accuracy [1,2]
-200 °C to +1090 °C	0.1 °C	±(1.0 % + 10)
-328 °F to +1994 °F	0.1 °F	±(1.0 % + 18)

[1] Does not include error of the thermocouple probe.

[2] Accuracy specification assumes ambient temperature stable to ± 1 °C. For ambient temperature changes of ± 5 °C, rated accuracy applies after 2 hours.

AC Current

Function	Range	Resolution	Burden Voltage	Accuracy (45 Hz – 2 kHz) [1]
µA ac	600.0 µA	0.1 µA	100 µV/µA	±(1.0 % + 2)
	6000 µA	1 µA	100 µV/µA	
mA ac	60.00 mA	0.01 mA	1.8 mV/mA	
	400.0 mA [2]	0.1 mA	1.8 mV/mA	
A ac	6.000 A	0.001 A	0.03 V/A	
	10.00 A [3,4]	0.01 A	0.03 V/A	

[1] AC conversions are ac coupled, true rms responding, and valid from 3 % to 100 % of range, except 400 mA range. (5 % to 100 % of range) and 10 A range (15 % to 100 % or range).

[2] 400 mA continuous. 600 mA for 18 hr maximum.

[3] ⚠ 10 A continuous up to 35 °C. <20 minutes on, 5 minutes off at 35 °C to 55 °C. >10 A to 20 A for 30 seconds maximum, 5 minutes off.

[4] >10 A accuracy unspecified.

DC Current

Function	Range	Resolution	Burden Voltage	Accuracy
µA dc	600.0 µA	0.1 µA	100 µV/µA	±(0.2 % + 4)
	6000 µA	1 µA	100 µV/µA	±(0.2 % + 2)
mA dc	60.00 mA	0.01 mA	1.8 mV/mA	±(0.2 % + 4)
	400.0 mA [1]	0.1 mA	1.8 mV/mA	±(0.2 % + 2)
A dc	6.000 A	0.001 A	0.03 V/A	±(0.2 % + 4)
	10.00 A [2,3]	0.01 A	0.03 V/A	±(0.2 % + 2)

[1] 400 mA continuous; 600 mA for 18 hr maximum.

[2] ⚠ 10 A continuous up to 35 °C. <20 minutes on, 5 minutes off at 35 °C to 55 °C. >10 A to 20 A for 30 seconds maximum, 5 minutes off.

[3] >10 A accuracy unspecified.

Capacitance

Range	Resolution	Accuracy
10.00 nF	0.01 nF	±(1.0 % + 2) [1]
100.0 nF	0.1 nF	
1.000 µF	0.001 µF	±(1.0 % + 2)
10.00 µF	0.01 µF	
100.0 µF	0.1 µF	
9999 µF	1 µF	

[1] With a film capacitor or better, using the rel mode to zero residual.

Diode

Range	Resolution	Accuracy
2.000 V	0.001 V	±(2.0 % + 1)

Frequency

Range	Resolution	Accuracy
199.99 Hz	0.01 Hz	±(0.005 % + 1) [1]
1999.9 Hz	0.1 Hz	
19.999 kHz	0.001 kHz	
199.99 kHz	0.01 kHz	
>200 kHz	0.1 kHz	Unspecified

[1] From 0.5 Hz to 200 kHz and for pulse widths >2 µs.

Frequency Counter Sensitivity and Trigger Levels

Input Range	Minimum Sensitivity (RMS Sine Wave)		Approximate Trigger Level (DC Voltage Function)
	5 Hz – 20 kHz	0.5 Hz – 200 kHz	
600 mV dc	70 mV (to 400 Hz)	70 mV (to 400 Hz)	40 mV
600 mV ac	150 mV	150 mV	-
6 V	0.3 V	0.7 V	1.7 V
60 V	3 V	7 V (≤140 kHz)	4 V
600 V	30 V	70 V (≤14.0 kHz)	40 V
1000 V	100 V	200 V (≤1.4 kHz)	100 V

Duty Cycle (Vdc and mVdc)

Range	Accuracy
0.0 % to 99.9 % [1]	Within ± (0.2 % per kHz + 0.1 %) for rise times <1 µs. [2]

[1] 0.5 Hz to 200 kHz, pulse width >2 µs. Pulse width range is determined by the frequency by the frequency of the signal.

[2] For 6 V dc range, accuracy is unspecified.

Input Characteristics

Function	Overload Protection	Input Impedance (nominal)	Common Mode Rejection Ratio (1 kΩ unbalance)	Normal Mode Rejection					
V⎓	1000 V rms	10 MΩ <100 pF	>120 dB at dc, 50 Hz or 60 Hz	>60 dB at 50 Hz or 60 Hz					
mV⎓	1000 V rms		>120 dB at dc, 50 Hz or 60 Hz	>60 dB at 50 Hz or 60 Hz					
V~	1000 V rms	10 MΩ <100 pF (ac-coupled)	>60 dB, dc to 60 Hz						
		Open Circuit Test Voltage	Full Scale Voltage		Typical Short Circuit Current				
			To 6 MΩ	5 MΩ or 60 nS	600 Ω	6 kΩ	60 kΩ	600 kΩ	6 MΩ	50 MΩ
Ω	1000 V rms	<7.0 V dc	<1.7 V dc	<1.9 V dc	500 µA	100 µA	10 µA	1 µA	0.4 µA	0.2 µA
⧫	1000 V rms	<7.0 V dc	2.200 V dc		1.0 mA typical					

MIN MAX Recording

Nominal Response	Accuracy
100 ms to 80 % (dc functions)	Specified accuracy ±12 counts for changes >200 ms in duration
120 ms to 80 % (ac functions)	Specified accuracy ±40 counts for changes >350 ms and inputs >25 % of range
250 µs (peak) [1]	Specified accuracy ±200 counts for changes >250 µs in duration (add ±100 counts for readings over 6000 counts) (add ±100 counts for readings in Low Pass mode)

[1] For 6 V range: 1 ms

Basic Maintenance

⚠⚠Warning

To prevent possible electrical shock, fire, or personal injury:

- **Have the Product repaired by ECOM Instruments GmbH or an ECOM authorized service center to keep Product certification.**
- **Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.**

General Maintenance

⚠⚠Warning

To prevent possible electrical shock, fire, or personal injury,

- **Remove the input signals before you clean the Product.**
- **Use only specified replacement parts.**

To clean the external surfaces of the Product, wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents.

Dirt or moisture in the terminals can cause incorrect measurements and can falsely set off the Input Alert feature. Clean the terminals as follows:

1. Turn off the Product and remove all test leads.
2. Shake out dirt that can be in the terminals.
3. Soak a clean swab with mild detergent and water. Move the swab around in each terminal. Dry each terminal with canned air to push the water and detergent out of the terminals.

It is recommended that the Product be calibrated by Fluke in 2-year intervals.

⚠⚠Warning

To prevent possible electrical shock or personal injury, use only specified replacement fuses with the amperage, voltage, and speed ratings shown in Table 2.

Fuse Test

As shown in Figure 1, with the Product in the))) Ω ⊣⊢ function, put a test lead into the V Ω ⊣⊢ jack and place the probe tip on the other end of the test lead against the metal of the current input jack. If LEAd appears in the display, the probe tip has been inserted too far into the amps input jack. Lift the lead out a bit until the message no longer shows in the display and OL or a resistance measurement shows in the display. The resistance value must be as shown in Figure 1. If the tests give measurements other than those shown, have the Product serviced.

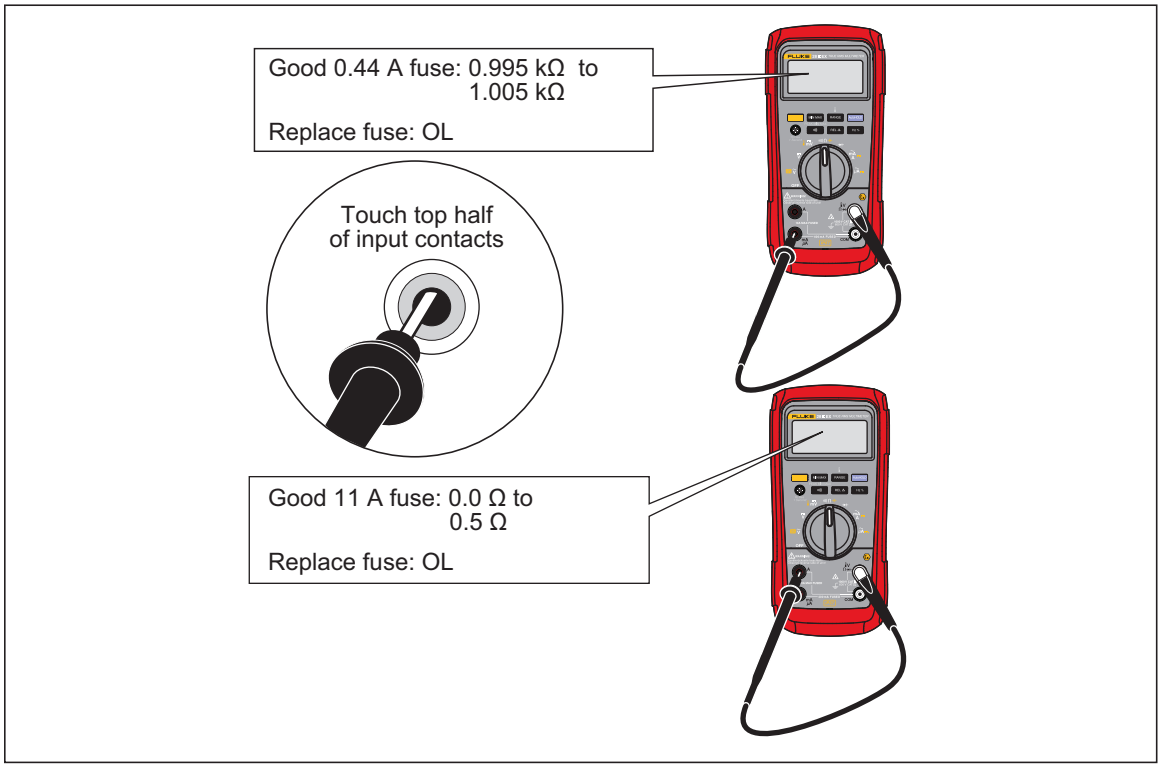

Figure 1. Current Fuse Test

Battery Replacement

Replace the batteries with three AAA batteries (NEDA 24A IEC LR03).

⚠⚠Warning

To prevent possible electrical shock, fire, or personal injury:

- **Replace the batteries when the low battery indicator (🔋) shows to prevent incorrect measurements. If the display shows "batt" the Product will not function until the batteries are replaced.**
- **Use only three AAA 1.5-volt batteries, correctly installed to power the Product. See item 5.1 in the *Safety Information* for a list of approved batteries. All batteries are to be replaced at the same time with same part number batteries outside the Ex-hazardous area.**

Replace the batteries as follows and refer to Figure 2:

1. Turn the rotary switch to **OFF** and remove the test leads from the terminals.
2. Remove the six Torx-head screws from the case bottom and remove the battery door (item ①).

Note

When you lift the battery door, make sure the rubber gasket stays attached to the battery compartment barrier.

3. Remove the three batteries and replace all three with AAA Alkaline batteries (item ②).

4. Make sure the battery compartment gasket (item ③) is properly installed around the outside edge of the battery compartment barrier.
5. Align the battery compartment barrier with battery compartment while you replace the battery door.
6. Attach the door with the six Torx-head screws.

Note

Fluke recommends that you remove the batteries from the Product for long periods of storage.

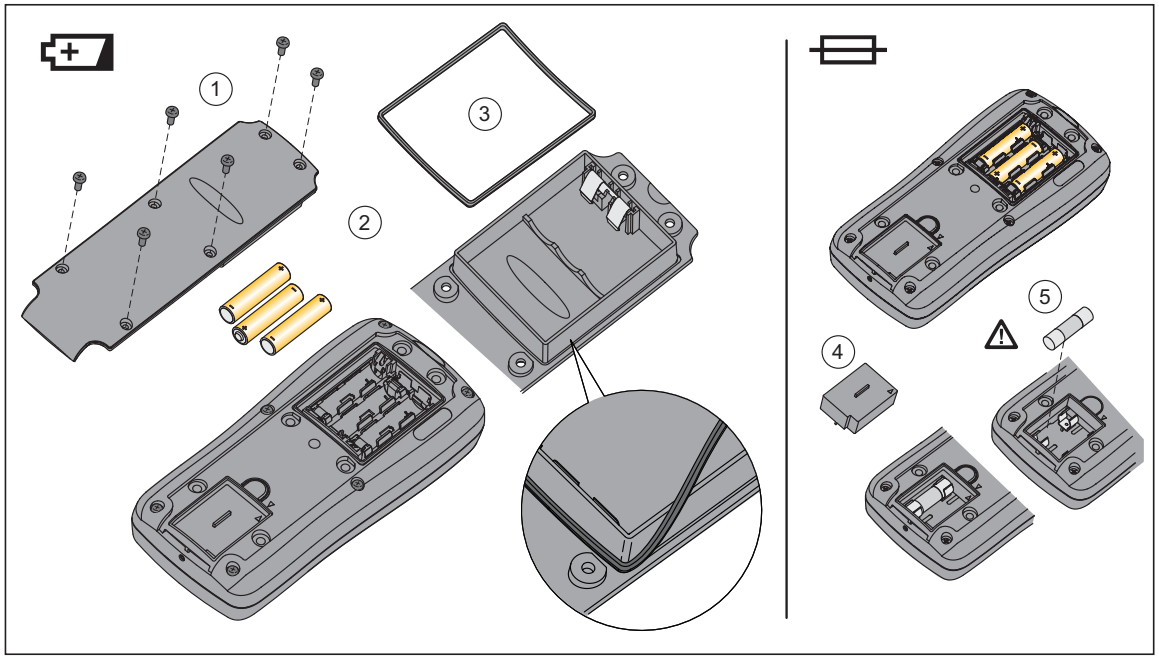

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Figure 2. Battery and Fuse Replacement

Fuse Replacement

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, use only specified replacement fuses.

Examine or replace the fuses in the Product as follows (See Figure 2):

1. Turn the rotary switch to **OFF** and remove the test leads from the terminals.
2. Refer to step 2 in the “How to Replace the Batteries” section to remove the battery door.
3. Carefully lift out the fuse assembly (item ④) from the fuse compartment.
4. Pry one end of the 11 A fuse loose, then lift the fuse out of its bracket (item ⑤).
5. Install ONLY specified replacement fuses with the amperage, voltage, and speed ratings shown in Table 2. The 440 mA fuse is attached to the fuse assembly. You must use a new fuse assembly to replace the 440 mA fuse.
6. Install the fuse assembly into the fuse compartment.
7. Refer to steps 4 through 6 in the “How to Replace the Batteries” section above to replace the battery door.

Table 2. Fuse Replacement

Description	Qty.	Fluke Part or Model Number
⚠ Fuse, 11 A, 1000 V, FAST	1	803293
28 II Ex Fuse Assembly	1	4016494
⚠ To ensure safety, use exact replacement only.		

Performance Tests

⚠⚠Warning

To prevent possible electrical shock, do not do the performance test procedures unless the Product is fully assembled.

The performance tests verify the complete operation of the Meter and the accuracy of each function against its specifications. Do the performance tests bi-annually to make sure the Meter operates to it specifications. If one or more of the tests shows a measurement that is not between the high and low limits, do the adjustment procedure. See the “Calibration Adjustments” section.

Note

In the performance tests, the Meter is referred to as the Unit Under Test (UUT).

Required Equipment

Table 3 is a list of the equipment necessary to do performance tests on the Meter.

Table 3. Required Equipment

Recommended Equipment	Measurement Function	Accuracy
Calibrator (Fluke 5520A or equivalent)	DC Volts	0 V to 1000 V ±0.012 %
	DC Current	350 µA to 2 A ±0.05 %
	AC Volts	0 V to 1000 V ±0.15 % @ 60 Hz to 20 kHz ±3 %
	AC Current	350 µA to 2 A ±0.39 % @ 60 Hz to 1 kHz
	Resistance	1 Ω to 100 MΩ ±0.06 %
	Capacitance	9 µF to 900 µF ±0.475 %
	Frequency	19.999 kHz to 199.99 kHz, ±0.0137 % 150 mV to 6 Vrms, ±5 %
K-type Thermocouple, mini-plug on both ends	Temperature	

Accuracy Test

To measure the accuracy of the Meter, set the Calibrator to the Calibrator output parameters shown in Table 4. Make sure the UUT measurement is between the low and high limit shown in the table.

Table 4. Accuracy Tests

Step	Test Function	Range	Calibrator Output	UUT Measurement	
				Low Limit	High Limit
1	LO V~	600 mV	60 mV, 60 Hz	59.2 mV	60.8 mV
2	AC Volts	600 mV	330 mV, 60 Hz	327.3 mV	332.7 mV
3		600 mV	600 mV, 13 kHz	586.0 mV	614.0 mV
4		6 V	675 mV, 60 Hz	0.666 mV	0.684 mV
5		6 V	3.3 V, 60 Hz	3.273 V	3.327 V
6		6 V	3.3 V, 20 kHz	3.214 V	3.386 V
7		60 V	6.75 V, 60 Hz	6.68 V	6.82 V
8		60 V	33 V, 60 Hz	32.75 V	33.25 V
9		600 V	67.5 V, 60 Hz	66.8 V	68.2 V
10		600 V	330 V, 60 Hz	327.5 V	332.5 V
11		600 V	330 V, 2.5 kHz	323.0 V	337.0 V
12		1000 V	100 V, 60 Hz	97 V	103 V
13		1000 V	1000 V, 1 kHz	986 V	1014 V

Table 4. Accuracy Tests (cont.)

Step	Test Function	Range	5520A Output	UUT Measurement	
				Low Limit	High Limit
14	LO V~ AC Volts Frequency	600 mV	150 mV, 99.95 kHz	99.93 kHz	99.97 kHz
15		600 mV	150 mV, 199.50 kHz	199.48 kHz	199.52 kHz
16	Sensitivity	6 V	0.7 V, 99.95 kHz	99.93 kHz	99.97 kHz
17		60 V	7 V, 99.95 kHz	99.93 kHz	99.97 kHz
18	V Hz °₀ Trigger level	6 V	4.4 V, 1 kHz Sq. Wave	999.8 Hz	1000.2 Hz
19	V Hz % Duty Cycle	60 V	5 V, 1 kHz, DC offset 2.5 V Square Wave	49.7 %	50.3 %
20	V DC Volts	6 V	3.3 V dc	3.297 V	3.303 V
21		60 V	33 V dc	32.97 V	33.03 V
22		600 V	330 V dc	329.7 V	330.3 V
23		1000 V	1000 V dc	998 V	1002 V
24	mV DC Volts	600 mV	50 mV dc	49.8 mV	50.2 mV
25		600 mV	330 mV dc	329.6 mV	330.4 mV
26	Ω Ohms	600 Ω	330 Ω (Use 2 wire Comp)	329.1 Ω	330.9 Ω
27		6 kΩ	3.3 kΩ (Use 2 wire Comp)	3.292 kΩ	3.308 kΩ
28		60 kΩ	33 kΩ	32.92 kΩ	33.08 kΩ
29		600 kΩ	330 kΩ	327.2 kΩ	332.1 kΩ
30		6 MΩ	3.3 MΩ	3.279 MΩ	3.321 MΩ
31		50 MΩ	30 MΩ	29.67 MΩ	30.33 MΩ
32	nS Conductance	60 nS	100 MΩ	9.60 nS	10.40 nS
33	→| Diode	6 V	2.0 V dc	1.959 V	2.041 V
34	mA A~ AC Amps	6 A	3.0 A, 60 Hz	2.968 A	3.032 A
35	mA A DC Amps	6 A	3.0 A	2.990 A	3.010 A
36	mA A~ AC Milliamps	60 mA	33 mA, 60 Hz	32.65 mA	33.35 mA
37		400 mA	330 mA, 60 Hz	326.5 mA	333.5 mA
38	mA A DC Milliamp	60 mA	33 mA	32.89 mA	33.11 mA
39		400 mA	330 mA	329.1 mA	330.9 mA
40	µA~ AC Microamps	600 µA	330 µA, 60 Hz	326.5 µA	333.5 µA
41		6000 µA	3300 µA, 60 Hz	3265 µA	3335 µA

Table 4. Accuracy Tests (cont.)

Step	Test Function	Range	5520A Output	UUT Measurement	
				Low Limit	High Limit
42	µA~ DC Microamps	600 µA	330 µA	328.9 µA	331.1 µA
43		6000 µA	3300 µA	3291 µA	3309 µA
44	⊣⊢ Capacitance	10 nF	Open input [1]	0.70 nF	1.10 nF
45		100 nF	5 nF [2]	4.7 nF	5.3 nF
46		100 µF	9.5 µF	9.2 µF	9.8 µF
47	LO ~V Low Pass Filter	1000 V	400 V, 400 Hz	372 V	408 V
48		1000 V	400 V, 800 Hz [3]	226 V	340 V
49	**VDC** Peak Min/Max	6 V	6 Vpp, 500 Hz Sq. Wave, DC offset 1 V	-1.798 V to -2.202 V	3.797 V to 4.203 V
50	mVdc Temperature [4]		0 °C	-1.0 °C	1.0 °C
51			100 °C	98.0 °C	102.0 °C

[1] Remove test leads from unit.

[2] Use REL to compensate for internal Meter and lead capacitance (must disconnect test leads from calibrator before pushing REL)

[3] The Meter accuracy is not specified at this input signal frequency with Low-pass filter selected. The display reading shown, checks that the Low-pass filter is active and follows an expected roll-off curve.

[4] To ensure accurate measurement, the Meter and thermocouple adapter must be at the same temperature. After connecting the thermocouple adapter to the Meter allow for reading to stabilize before recording display reading.

Backlight Functional Test

A backlight test is done to make sure the backlight comes on with the first push of ⊛. The second push causes the backlight to be brighter and a third push turns off the backlight.

Calibration Adjustments

If one or more of the accuracy tests shows a measurement that is not between the high and low limits, you can do adjustments. This adjustment procedure sets the Meter to operate to its specifications.

Note

If the adjustment routine is stopped before you complete the procedure, no changes are made to the calibration constants in memory.

You must set the Meter to the CAL mode and type in a password to do calibration adjustments.

Cal Mode Button Functions

For the CAL mode, some of the buttons on the Meter have alternative functions. Some buttons function differently at different points in the calibration adjustment procedure. Table 5 is a list of the Meter buttons and their function for the calibration adjustment procedure.

Table 5. Button Functions for Calibration Adjustment

Button	CAL Function	Password Numeric Value
(Yellow)	Push and hold to show the measured value in the display. The measurement is not calibrated, so it can be inaccurate.	1
MIN MAX	Use to set the Meter to the CAL mode. In a calibration procedure, push and hold to show the necessary input level in the Meter display.	2
RANGE	Push at the point where you type in the password to make a new password.	3
AutoHOLD	Use as the “ENTER” key. Push to store the new calibration adjustment value and move to the subsequent step. This button is also used to exit the calibration adjustment mode after the calibration adjustment sequence is complete.	4
	Use only as a password value.	5
	Use only as a password value.	6
REL Δ	Use only as a password value.	7
Hz %	Push and hold to show the necessary frequency of the input signal in the Meter display.	8

Calibration Adjustment Procedure

Note

In the calibration adjustment procedure, some adjustment steps are longer to do than others (10 seconds to 15 seconds). For some of the steps, the Meter gives two beeps when the step is complete. Not all steps have this feature.

1. Push and hold down MIN MAX while you turn the rotary switch from **OFF** to LoZ Ṽ. CAL in the display shows you have set the Meter into the CAL mode.
2. Push AutoHOLD once to see the number of calibrations that have been completed.
3. Push AutoHOLD again to show 0000 in the display.
4. Use the eight Meter buttons to type in the current password and push AutoHOLD.

Note

The default factory password is 1234. See the “How to Change the Password” section to change the password. If the password you typed in is not correct, then the Meter will beep two times and show 0000 in the display.

5. C-01 in the display shows the CAL mode is set and the Meter is at the first calibration adjustment step.

⚠Caution

To prevent damage to the Meter, make sure the calibrator is in standby before you change its parameters, or change the function on the Meter.

6. Set the calibrator to the parameters shown in the Input Value column of Table 6 for the calibration step shown in the display.

Note

You can push MIN MAX *to show the necessary input signal level and* Hz % *to show the necessary input signal frequency for the calibration step.*

8. Turn on the output signal on the calibrator.
9. Push AutoHOLD to complete the step and move to the subsequent step.

   If the step shown in the display moves to the subsequent step, the adjustment was successful. If the Meter gives two beeps and does not move to the subsequent step, then the adjustment was not successful. Make sure the calibrator is set correctly and push AutoHOLD again. If the calibrator output is correct, then it is necessary to repair the Meter.

Note

If the calibration adjustment is not completed correctly, the Meter will not operate correctly.

10. Put the calibrator in standby.
11. Do steps 6 through 10 for each calibration step in Table 6.
12. After you complete the last adjustment step, End shows in the display. Push AutoHOLD to complete the calibration adjustment procedure and store the calibration constants in the Meter.

Table 6. Calibration Adjustment Steps

Function (Switch Position)	Adjustment Step	Input Value
LO V~ (AC Volts)	C-01	600.0 mV, 60 Hz
	C-02	600.0 mV, 20 kHz
	C-03	6.000 V, 60 Hz
	C-04	6.000 V, 20 kHz
	C-05	60.00 V, 60 Hz
	C-06	60.00 V, 20 kHz
	C-07	600.0 V, 60 Hz
	C-08	600.0 V, 10 kHz
V ⎓ (DC Volts)	C-09	6.000 V
	C-10	60.00 V
	C-11	600.0 V
mV ⎓ (DC Millivolts)	C-12	600.0 mV
	C-13	60.00 mV
Ω (Ohms)	C-14	600.0 Ω
	C-15	6.000 kΩ
	C-16	60.00 kΩ
	C-17	600.0 kΩ
	C-18	6.000 MΩ
	C-19	0.000 Ω
	C-20	50.0 MΩ
→ (Diode Test)	C-21	3.000 V
mA A~ ⎓ (Amps)	C-22	6.000 A, 60 Hz
	C-23	6.000 A dc
mA A~ ⎓ (Amps)	C-24	60.00 mA, 60 Hz
	C-25	400.0 mA, 60 Hz
	C-26	60.00 mA dc
	C-27	400.0 mA dc
μA~ ⎓ (Microamps)	C-28	600.0 μA, 60 Hz
	C-29	6000 μA, 60 Hz
	C-30	600.0 μA dc
	C-31	6000 μA dc

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