

# 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.
- 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:

- Safety Information (page 2)
- International Electrical Symbols (page 4)
- Specifications (page 5)
- General Maintenance (page 9)
- Fuse Test (page 9)
- Performance Tests (page 12)
- Calibration Adjustment Procedure (page 16)
- Limited Lifetime Warranty (page 20)

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

## How to Contact Fluke

To contact Fluke, call one of the following telephone numbers:

- Technical Support USA: 1-800-99-FLUKE (1-800-993-5853)
- Calibration/Repair USA: 1-888-99-FLUKE (1-888-993-5853)
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31 402-675-200
- Japan: +81-3-3434-0181
- Singapore: +65-6799-5566
- Anywhere in the world: +1-425-446-5500

Or, visit Fluke's website at [www.fluke.com](http://www.fluke.com).

To register your product, visit <http://register.fluke.com>.


To view, print, or download the latest manual supplement, visit <http://us.fluke.com/usen/support/manuals>.

## 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**

	AC (Alternating Current)		Earth ground
	DC (Direct Current)		Fuse
	Hazardous voltage		Conforms to European Union directives.
	Risk of Danger. Important information. See Manual.		Diode
	Battery. Low battery when displayed.		Double insulated
	Continuity test or continuity beeper tone.		Capacitance
CAT III	IEC Overvoltage Category III CAT III equipment is designed to protect against transients in equipment in fixed-equipment installations, such as distribution panels, feeders and short branch circuits, and lighting systems in large buildings.	CAT IV	IEC Overvoltage Category IV CAT IV equipment is designed to protect against transients from the primary supply level, such as an electricity meter or an overhead or underground utility service.
	Conforms to ATEX directive.		Conforms to relevant Australian standards.
	Inspected and licensed by TÜV Product Services.		Conforms to CAN/CSA-C22.2 No. 61010-1 2 <sup>nd</sup> , + Amendment 1.
	Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.		

## General Specifications

<b>Maximum voltage between any terminal and earth ground</b> .....	1000 V rms
<b>▲ Fuse for mA inputs</b> .....	440 mA, 1000 V FAST Fuse
<b>▲ Fuse for A inputs</b> .....	11 A, 1000 V FAST Fuse
<b>Display</b> .....	6000 counts, updates 4/sec (19,999 counts in high-resolution mode).
<b>Altitude</b>	
Operating .....	2,000 meters
Storage .....	10,000 meters
<b>Temperature</b>	
Operating .....	-15 °C to 50 °C
Storage .....	-40 °C to +85 °C (without battery) -40 °C to +60 °C (with battery)
<b>Temperature coefficient</b> .....	0.05 X (specified accuracy) / °C (<18 °C or >28 °C)
<b>Electromagnetic Compatibility (EN 61326-1:2005)</b> ....	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
<b>Relative Humidity</b> .....	0 % to 80 % (0 °C to 35 °C) 0 % to 70 % (35 °C to 50 °C)
<b>Battery Type</b> .....	3 AAA Alkaline batteries, NEDA 24A IEC LR03
<b>Approved Batteries</b> .....	Duracell Procell MN2400 LR03 Duracell Plus MN2400 LR03 Varta Max Tech No. 4703 Varta Industrial Alkaline No. 4003 (min. operating temperature is -10 °C) Eveready Energizer No. E92 Rayovac Alkaline AAA (U.S. Type) Panasonic LR03XWA
<b>Battery Life</b> .....	400 hrs typical without backlight (Alkaline)
<b>Vibration</b> .....	Per MIL-PRF-28800 for a Class 2 instrument
<b>Shock</b> .....	1 Meter drop per IEC 61010 (3 Meter drop with holster)
<b>Size (H x W x L)</b> .....	4.57 cm x 10.0 cm x 21.33 cm (1.80 in x 3.95 in x 8.40 in)
<b>Size with Holster</b> .....	6.35 cm x 10.0 cm x 19.81 cm (2.50 in x 3.95 in x 7.80 in)
<b>Weight</b> .....	567.8 g (1.25 lb)
<b>Weight with Holster and Flex-Stand</b> .....	769.8 g (1.70 lb)
<b>Safety Compliance</b> .....	Complies with ANSI/ISA S82.01-2004, CAN/CSA C22.2 61010-1-04 to 600 V Measurement Category IV. Licensed by TÜV to EN61010-1, Pollution degree 2
<b>Certifications</b> .....	CSA, TÜV, CE,  ATEX, IECEx
<b>IP Rating</b> .....	67 (Non-operating. Protected against dust and the effect of immersion up to 1 m for 30 min.)

## 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  $\pm([\% \text{ of Reading}] + [\text{Number of least-significant digits}])$ . 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.

Range	Resolution	Accuracy					
		45 – 65 Hz	30 – 200 Hz	200 – 440 Hz	440 Hz – 1 kHz	1 – 5 kHz	5 – 20 kHz
600.0 mV	0.1 mV	$\pm(0.7 \% + 4)$	$\pm(1.0 \% + 4)$			$\pm(2 \% + 4)$	$\pm(2 \% + 20)^{[1]}$
6.000 V	0.001 V					$\pm(2 \% + 4)^{[2]}$	Unspecified
60.00 V	0.01 V						Unspecified
600.0 V	0.1 V					Unspecified	Unspecified
1000 V	1 V	$\pm(0.7 \% + 2)$	$\pm(1.0 \% + 4)^{[1]}$	+1.0 % + 4 -6.0 % - 4 <sup>[3]</sup>	Unspecified	Unspecified	Unspecified
Low-Pass Filter							

[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

Function	Range	Resolution	Accuracy
mV dc	600.0 mV	0.1 mV	$\pm(0.1 \% + 1)$
V dc	6.000 V	0.001 V	$\pm(0.05 \% + 1)$
	60.00 V	0.01 V	
	600.0 V	0.1 V	
	1000 V	1 V	
$\Omega$	600.0 $\Omega$	0.1 $\Omega$	$\pm(0.2 \% + 2)^{[2]}$
	6.000 k $\Omega$	0.001 k $\Omega$	$\pm(0.2 \% + 1)$
	60.00 k $\Omega$	0.01 k $\Omega$	
	600.0 k $\Omega$	0.1 k $\Omega$	$\pm(0.6 \% + 1)$
	6.000 M $\Omega$	0.001 M $\Omega$	
	50.00 M $\Omega$	0.01 M $\Omega$	$\pm(1.0 \% + 3)^{[1,3]}$
nS	60.00 nS	0.01 nS	$\pm(1.0 \% + 10)^{[1,2,3]}$

[1] Add 0.5 % of reading when measuring above 30 M $\Omega$  in the 50 M $\Omega$  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 <sup>[1,2]</sup>
-200 °C to +1090 °C	0.1 °C	$\pm(1.0 \% + 10)$
-328 °F to +1994 °F	0.1 °F	$\pm(1.0 \% + 18)$

[1] Does not include error of the thermocouple probe.  
 [2] Accuracy specification assumes ambient temperature stable to  $\pm 1$  °C. For ambient temperature changes of  $\pm 5$  °C, rated accuracy applies after 2 hours.

### AC Current

Function	Range	Resolution	Burden Voltage	Accuracy
				(45 Hz – 2 kHz) <sup>[1]</sup>
<b>μA ac</b>	600.0 μA	0.1 μA	100 μV/μA	±(1.0 % + 2)
	6000 μA	1 μA	100 μV/μA	
<b>mA ac</b>	60.00 mA	0.01 mA	1.8 mV/mA	
	400.0 mA <sup>[2]</sup>	0.1 mA	1.8 mV/mA	
<b>A ac</b>	6.000 A	0.001 A	0.03 V/A	
	10.00 A <sup>[3,4]</sup>	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 % of 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
<b>μA dc</b>	600.0 μA	0.1 μA	100 μV/μA	±(0.2 % + 4)
	6000 μA	1 μA	100 μV/μA	±(0.2 % + 2)
<b>mA dc</b>	60.00 mA	0.01 mA	1.8 mV/mA	±(0.2 % + 4)
	400.0 mA <sup>[1]</sup>	0.1 mA	1.8 mV/mA	±(0.2 % + 2)
<b>A dc</b>	6.000 A	0.001 A	0.03 V/A	±(0.2 % + 4)
	10.00 A <sup>[2,3]</sup>	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) <sup>[1]</sup>
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) <sup>[1]</sup>
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 ( $\leq 140$ kHz)	4 V
600 V	30 V	70 V ( $\leq 14.0$ kHz)	40 V
1000 V	100 V	200 V ( $\leq 1.4$ kHz)	100 V

### Duty Cycle (Vdc and mVdc)

Range	Accuracy
0.0 % to 99.9 % <sup>[1]</sup>	Within $\pm (0.2$ % per kHz + 0.1 %) for rise times <1 $\mu$ s.

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

### Input Characteristics

Function	Overload Protection	Input Impedance (nominal)	Common Mode Rejection Ratio (1 k $\Omega$ unbalance)	Normal Mode Rejection						
$\bar{V}$	1000 V rms	10 M $\Omega$ <100 pF	> 120 dB at dc, 50 Hz or 60 Hz	> 60 dB at 50 Hz or 60 Hz						
$\bar{mV}$	1000 V rms		> 120 dB at dc, 50 Hz or 60 Hz	> 60 dB at 50 Hz or 60 Hz						
$\tilde{V}$	1000 V rms	10 M $\Omega$ < 100 pF (ac-coupled)	> 60 dB, dc to 60 Hz							
		Open Circuit Test Voltage	Full Scale Voltage		Typical Short Circuit Current					
			To 6 M $\Omega$	5 M $\Omega$ or 60 nS	600 $\Omega$	6 k $\Omega$	60 k $\Omega$	600 k $\Omega$	6 M $\Omega$	50 M $\Omega$
$\Omega$	1000 V rms	<7.0 V dc	<1.7 V dc	<1.9 V dc	500 $\mu$ A	100 $\mu$ A	10 $\mu$ A	1 $\mu$ A	0.4 $\mu$ A	0.2 $\mu$ A
$\rightarrow$	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 $\pm 12$ counts for changes >200 ms in duration
120 ms to 80 % (ac functions)	Specified accuracy $\pm 40$ counts for changes >350 ms and inputs >25 % of range
250 $\mu$ s (peak) <sup>[1]</sup>	Specified accuracy $\pm 100$ counts for changes >250 $\mu$ s in duration (add $\pm 100$ counts for readings over 6000 counts) (add $\pm 100$ 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.

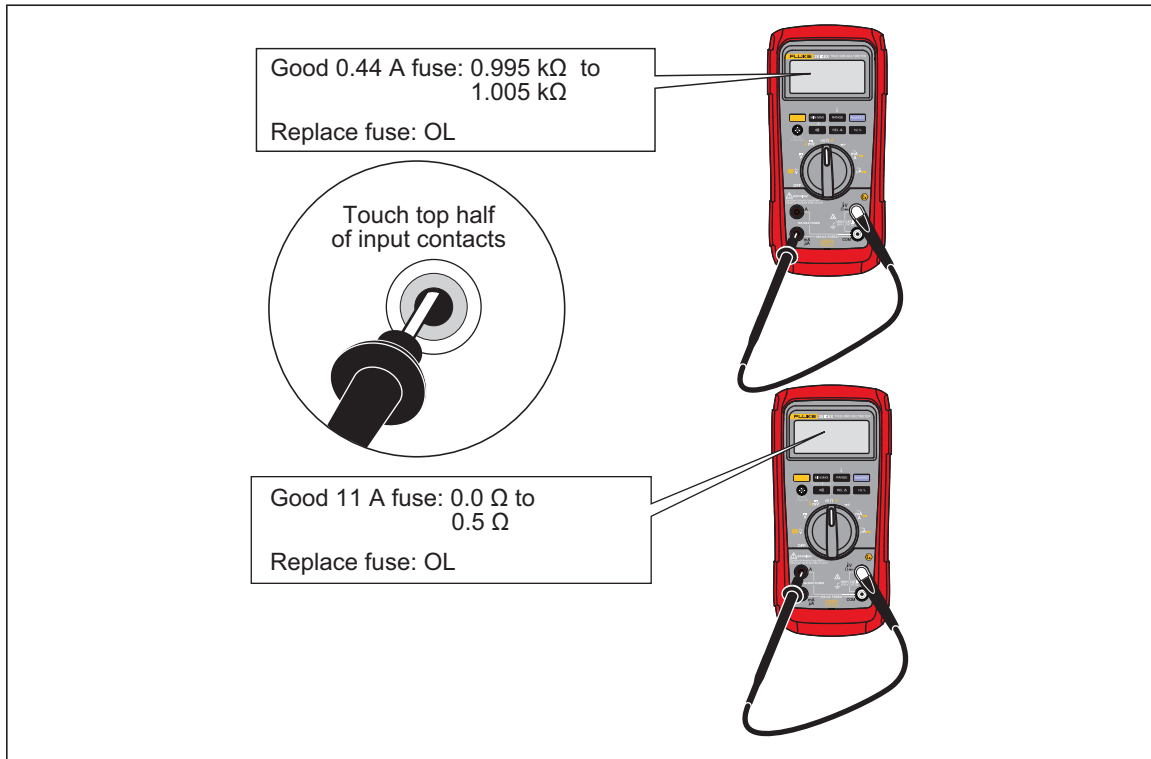
It is recommended that the Product be calibrated by Fluke in 2 year intervals.

### Warning

To prevent possible electrical shock or personal injury, use only specified replacement fuses with the amperage, voltage, and speed ratings shown in Table 3.

## Fuse Test

As shown in Figure 1, with the Product in the  $\Omega$  function, put a test lead into the  $\Omega$  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  $\Omega$  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.



gaq105.eps


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 the table on the subsequent page for a list of approved batteries. All cells are to be replaced at the same time with same part number cells in fresh air locations only.

Replace the batteries as follows, 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.

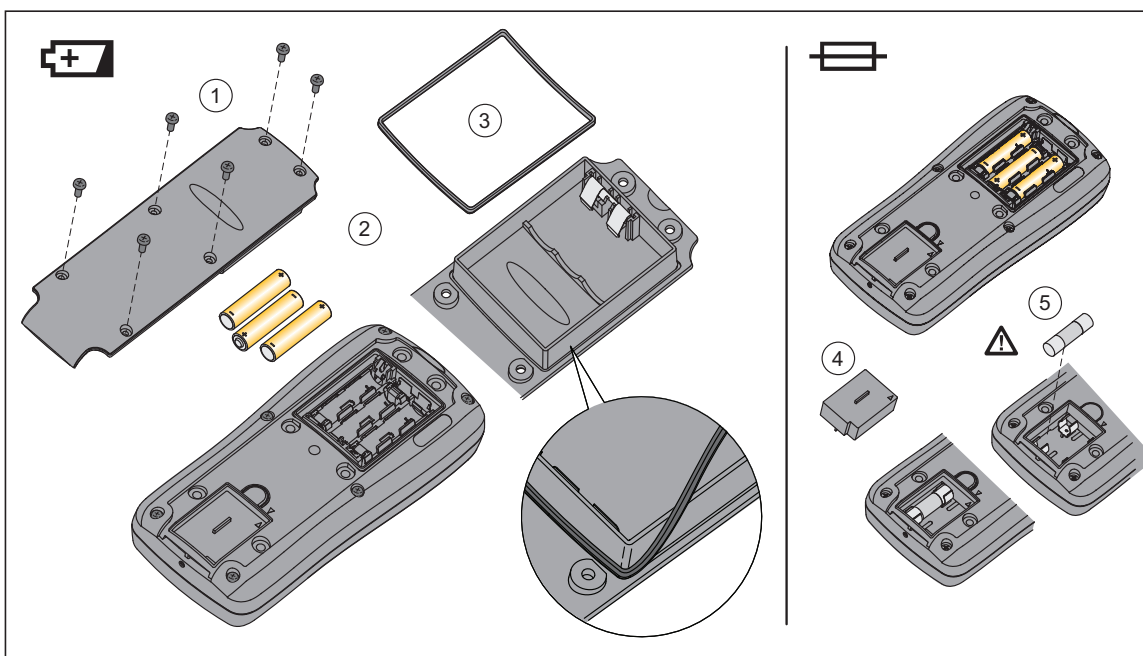
*Note*

*It is recommended the batteries be removed from the Product for long periods of storage.*

**Table 2. Approved Batteries**

Battery Description	Manufacturer
Duracell Procell MN2400 LR03	Duracell
Duracell Plus MN2400 LR03	
Max Tech No. 4703	Varta
Industrial Alkaline No. 4003 <sup>[1]</sup>	
Eveready Energizer No. E92	Eveready
Rayovac Alkaline AAA (U.S. Type)	Rayovac
Panasonic LR03XWA	Panasonic

[1] Minimum operating temperature is -10 °C.



**Figure 2. Battery and Fuse Replacement**

gaq10.eps

## 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 3. 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 3. 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 its 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 4 is a list of the equipment necessary to do performance tests on the Meter.

**Table 4. Required Equipment**

Recommended Equipment	Measurement Function	Accuracy
Calibrator (Fluke 5520A or equivalent)	DC Volts	0 V to 1000 V $\pm 0.012\%$
	DC Current	350 $\mu$ A to 2 A $\pm 0.05\%$
	AC Volts	0 V to 1000 V $\pm 0.15\%$ @ 60 Hz to 20 kHz $\pm 3\%$
	AC Current	350 $\mu$ A to 2 A $\pm 0.39\%$ @ 60 Hz to 1 kHz
	Resistance	1 $\Omega$ to 100 M $\Omega$ $\pm 0.06\%$
	Capacitance	9 $\mu$ F to 900 $\mu$ F $\pm 0.475\%$
	Frequency	19.999 kHz to 199.99 kHz, $\pm 0.0137\%$ 150 mV to 6 Vrms, $\pm 5\%$
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 5. Make sure the UUT measurement is between the low and high limit shown in the table.

**Table 5. Accuracy Tests**



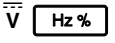
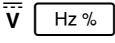




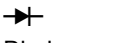
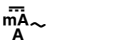
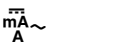
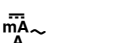





Step	Test Function	Range	Calibrator Output	UUT Measurement	
				Low Limit	High Limit
1	 AC Volts	600 mV	60 mV, 60 Hz	59.2 mV	60.8 mV
2		600 mV	330 mV, 60 Hz	327.3 mV	332.7 mV
3		600 mV	600 mV, 13 kHz	586.0 mV	614.0 mV
4		6 V	675 mV, 60 Hz	0.666 mV	0.684 mV
5		6 V	3.3 V, 60 Hz	3.273 V	3.327 V
6		6 V	3.3 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 5. Accuracy Tests (cont.)


Step	Test Function	Range	5520A Output	UUT Measurement	
				Low Limit	High Limit
14		600 mV	150 mV, 99.95 kHz	99.93 mV	99.97 mV
15	AC Volts Frequency	600 mV	150 mV, 199.50 kHz	199.48 mV	199.52 mV
16	Sensitivity	6 V	0.7 V, 99.95 kHz	99.93 V	99.97 V
17		60 V	7 V, 99.95 kHz	99.93 V	99.97 V
18	 Trigger level	6 V	3.4 V, 1 kHz Sq. Wave	999.8 V	1000.2 V
19	 Duty Cycle	6 V	5 V, 1 kHz, DC offset 2.5 V Square Wave	49.7 %	50.3 %
20	 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	 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	 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	 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	 AC Amps	6 A	3.0 A, 60 Hz	2.968 A	3.032 A
35	 DC Amps	6 A	3.0 A	2.990 A	3.010 A
36	 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	 DC Milliamp	60 mA	33 mA	32.89 mA	33.11 mA
39		400 mA	330 mA	329.1 mA	330.9 mA
40	 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 5. Accuracy Tests (cont.)**

Step	Test Function	Range	5520A Output	UUT Measurement	
				Low Limit	High Limit
42	 DC Microamps	600 $\mu$ A	330 $\mu$ A	328.9 $\mu$ A	331.1 $\mu$ A
43		6000 $\mu$ A	3300 $\mu$ A	3291 $\mu$ A	3309 $\mu$ A
44	 Capacitance	10 nf	Open input <sup>[1]</sup>	0.28 nf	0.48 nf
45		100 nf	5 nf <sup>[2]</sup>	4.7 nf	5.3 nf
46		100 $\mu$ f	9.5 $\mu$ f	9.2 nf	9.8 nf
47	 Low Pass Filter	1000 V	400 V, 400 Hz	372 V	408 V
48		1000 V	400 V, 800 Hz <sup>[3]</sup>	226 V	340 V
49	<b>VDC Peak Min/Max</b>	6 V	8 Vpp, 500 Hz Sq. Wave, DC offset 2 V	-1.898 V to -2.102 V	5.896 V to 6.104 V
50	mVdc Temperature <sup>[4]</sup>		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 6 is a list of the Meter buttons and their function for the calibration adjustment procedure.






Table 6. 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
	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
	Push at the point where you type in the password to make a new password.	3
	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
	Use only as a password value.	7
	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  while you turn the rotary switch from **OFF** to   $\tilde{V}$ .  $\text{CAL}$  in the display shows you have set the Meter into the CAL mode.
2. Push  once to see the number of calibrations that have been completed.
3. Push  again to show  $\text{????}$  in the display.
4. Use the eight Meter buttons to type in the current password and push .

#### 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  $\text{????}$  in the display.*

5.  $\text{[-0]}$  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 7 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 7.
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 7. Calibration Adjustment Steps**






Function (Switch Position)	Adjustment Step	Input Value
 (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
 (DC Volts)	C-09	6.000 V
	C-10	60.00 V
	C-11	600.0 V
 (DC Millivolts)	C-12	600.0 mV
	C-13	60.00 mV
 (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

Table 7. Calibration Adjustment Steps (cont.)

Function (Switch Position)	Adjustment Step	Input Value
mA <sub>~</sub> A <sub>---</sub> (Amps)	C-22	6.000 A, 60 Hz
	C-23	6.000 A dc
mA <sub>~</sub> A <sub>---</sub> (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 <sub>~</sub> (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

### Change the Password

1. Push and hold down **MIN MAX** while you turn the rotary switch from **OFF** to **Ω**  $\tilde{V}$ . The Meter shows  $\Omega$   $\tilde{V}$  in the display.
2. Push **AutoHOLD** two times to show **????** in the display.
3. Use the eight Meter buttons to type in the current password, but do not push **AutoHOLD**.
4. Push **RANGE** to show " \_ \_ \_ \_ " in the display.
5. Use the eight Meter buttons to type in a new password.
6. Push **AutoHOLD** to save the new password.

### Set the Password to its Default Value

If the password was forgotten, it can be set to its default value (**1234**). See Figure 3.

1. Turn the rotary switch of the Meter to **OFF**.
2. Remove the bottom case and bottom shield of the Meter.
3. Apply a dc voltage between 3.5 V and 5 V at the test points marked "+" and "-" at the edge of the board. (See Figure 3, item 1).

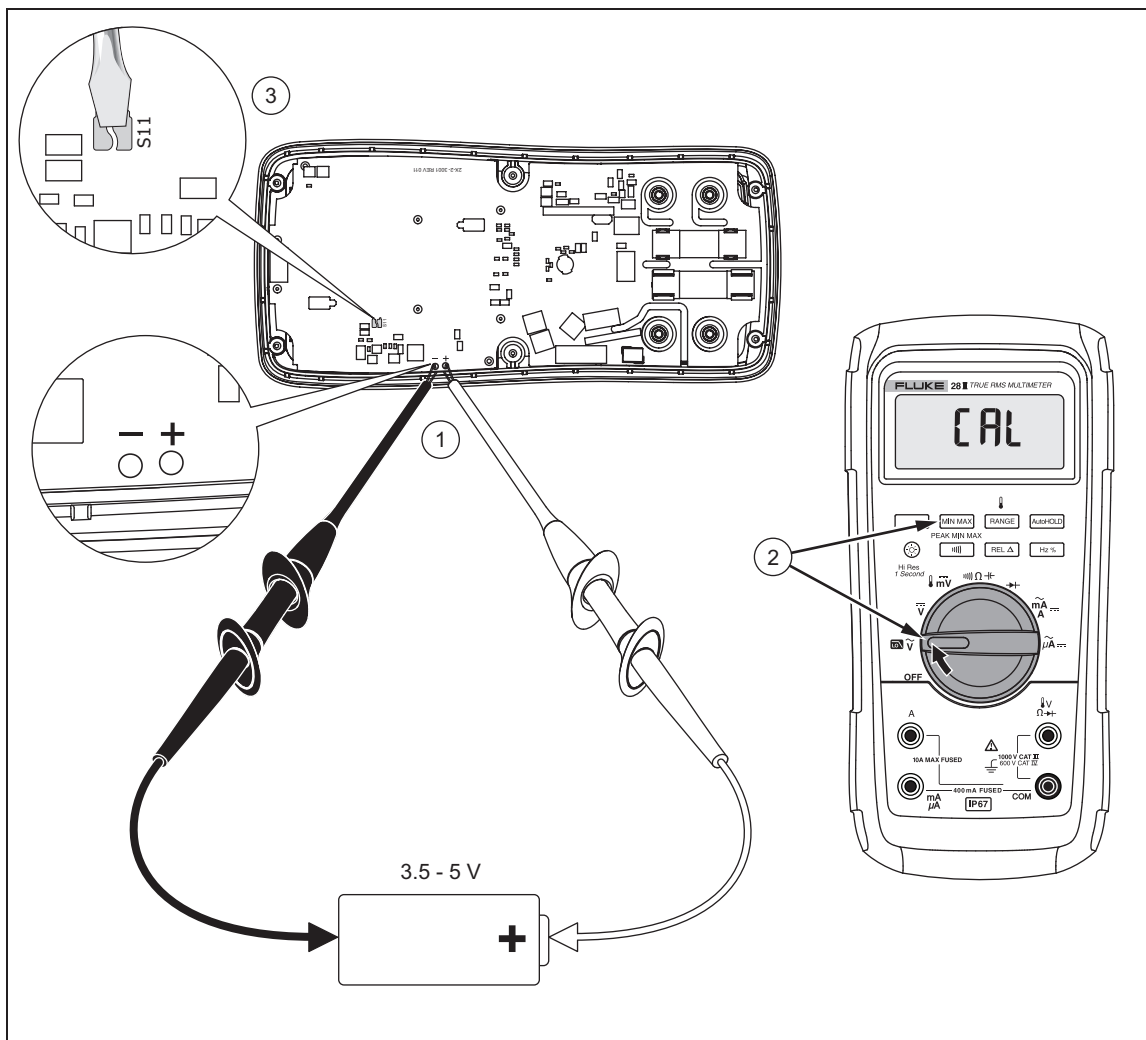


Figure 3. Reset the Password

grt102.eps

4. Push and hold **MIN/MAX** while you turn the rotary switch from **OFF** to **ACV**  $\tilde{V}$  (See Figure 3, item 2). The Meter shows  $\tilde{V}$  **CAL** in the display.
5. Short across keypad button S11 on the PCB (See Figure 3, item 3). The Meter will beep.
6. Turn the rotary switch one position counterclockwise to the **OFF** position.  
The password is set to the default value of 1234.
7. Replace the bottom shield and bottom case of the Meter before you do adjustments or tests.

## **Lifetime Limited Warranty**

Each Fluke 20, 70, 80, 170, 180 and 280 Series DMM will be free from defects in material and workmanship for its lifetime. As used herein, "lifetime" is defined as seven years after Fluke discontinues manufacturing the product, but the warranty period shall be at least ten years from the date of purchase. This warranty does not cover fuses, disposable batteries, damage from neglect, misuse, contamination, alteration, accident or abnormal conditions of operation or handling, including failures caused by use outside of the product's specifications, or normal wear and tear of mechanical components. This warranty covers the original purchaser only and is not transferable. For ten years from the date of purchase, this warranty also covers the LCD. Thereafter, for the lifetime of the DMM, Fluke will replace the LCD for a fee based on then current component acquisition costs.

To establish original ownership and prove date of purchase, please complete and return the registration card accompanying the product, or register your product on <http://www.fluke.com>. Fluke will, at its option, repair at no charge, replace or refund the purchase price of a defective product purchased through a Fluke authorized sales outlet and at the applicable international price. Fluke reserves the right to charge for importation costs of repair/replacement parts if the product purchased in one country is sent for repair elsewhere.

If the product is defective, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Fluke will pay return transportation for product repaired or replaced in-warranty. Before making any non-warranty repair, Fluke will estimate cost and obtain authorization, then invoice you for repair and return transportation.

THIS WARRANTY IS YOUR ONLY REMEDY. NO OTHER WARRANTIES, SUCH AS FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSED OR IMPLIED. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE OR THEORY. AUTHORIZED RESELLERS ARE NOT AUTHORIZED TO EXTEND ANY DIFFERENT WARRANTY ON FLUKE'S BEHALF. Since some states do not allow the exclusion or limitation of an implied warranty or of incidental or consequential damages, this limitation of liability may not apply to you. If any provision of this warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

Fluke Corporation  
P.O. Box 9090  
Everett, WA 98206-9090  
U.S.A.

Fluke Europe B.V.  
P.O. Box 1186  
5602 BD Eindhoven  
The Netherlands

5/07