FLUKE®

789
ProcessMeter

Calibration Manual

PN 1988891
September 2002

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789 ProcessMeter

Introduction

⚠⚠Warning

The information provided in this manual is for the use of qualified personnel only. Do not perform the calibration verification tests or calibration procedures described in this manual unless you are qualified to do so.

⚠Caution

The 789 ProcessMeter™ contains parts that can be damaged by static discharge. No procedure in this document requires the case to be opened. If you do so, follow the standard practices for handling static sensitive devices.

The *Calibration Manual* for the 789 ProcessMeter (hereafter, also referred to as "the ProcessMeter" or "the UUT") provides the following information:

- Precautions and Safety information
- Specifications
- Basic maintenance (cleaning, replacing the batteries and fuses)
- Calibration verification test procedures
- Calibration adjustment procedures
- Accessories and replaceable parts

For complete operating instructions, refer to the *789 ProcessMeter Users Manual* (on the CD-ROM provided).

Contacting Fluke

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Read First -Safety Information

Warnings and Cautions

In this manual, a **Warning** identifies conditions and actions that pose hazard(s) to the user; a **Caution** identifies conditions and actions that may damage the ProcessMeter or the test instruments.

⚠⚠Warning

To avoid possible electric shock or personal injury:

- **Do not use the ProcessMeter if it looks damaged.**
- **Examine the ProcessMeter before use. Look for cracks in the case, missing plastic, or damaged insulation around the connectors.**
- **Inspect the test leads for damaged insulation or exposed metal. Check for test lead continuity. Replace damaged test leads.**
- **Do not use the ProcessMeter if it operates abnormally. Protection provided by the ProcessMeter may be impaired. When in doubt, have the ProcessMeter serviced.**
- **Do not apply more than the rated voltage as marked on the ProcessMeter between terminals or between any terminal and earth ground.**
- **When using probes, keep fingers behind the finger guards on the probes.**
- **Use caution when working above 30 V ac rms, 42 V ac peak, or 60 V dc. Such voltages pose a shock hazard.**
- **Connect the common lead (COM) before connecting the live test lead. When disconnecting test leads, disconnect the live test lead first.**
- **Remove test leads from the ProcessMeter before opening the battery compartment door.**
- **Do not operate the ProcessMeter around explosive gas, vapor, or dust.**
- **During normal operation, use only type AA batteries, properly installed in the ProcessMeter case, to power the ProcessMeter.**
- **Make sure the battery compartment door is closed and latched before you operate the ProcessMeter.**
- **During calibration adjustment, use only specified calibration equipment listed in Table 2.**
- **When servicing the ProcessMeter, use only specified replacement parts.**
- **Before measuring current, check the ProcessMeter's fuses, see "Checking and Replacing the Fuses".**
- **To avoid false readings, which can lead to possible electric shock or personal injury, replace the batteries as soon as the low battery indicator ( ) appears.**

⚠Caution

To avoid possible damage to the ProcessMeter or the test equipment:

- **Disconnect the power and discharge all high voltage capacitors before testing resistance, diodes, or continuity.**
- **Use the proper terminals, switch setting, and range for the measurement or sourcing applications.**

Symbols

Symbols used on the ProcessMeter and in this calibration manual are explained in Table 1.

Table 1. Symbols

Symbol	Meaning	Symbol	Meaning
~	Alternating current	⏚	Earth ground
⎓	Direct current	⏛	Fuse
≂	Alternating or direct current	CE	Conforms to European Union directives
⚠	Risk of danger. Important information. See manual.	C SP US	Conforms to relevant Canadian Standards Association directives
⊣⊢	Battery	⧈	Double insulated
UL Listed 950 Z	Meets Underwriters' Laboratories safety requirements	TÜV PRODUCT SERVICE GS geprüfte Sicherheit	Inspected and licensed by TÜV Product Services
CAT III	Overvoltage (Installation) Category III, Pollution Degree 2 per EN61010 refers to the level of Impulse Withstand Voltage protection provided. Typical locations include: mains, wall outlets, main distribution levels connected closer to the supply system but less than the primary supply system (CAT IV).	✓ N10140	Conforms to relevant Australian standards

Specifications

All specifications apply from +18 °C to +28 °C unless stated otherwise.

All specifications assume a 5-minute warm-up period.

The standard specification interval is 1 year.

Note

"Counts" refers to the number of increments or decrements of the least significant digit.

DC Volts Measurement

Range (V dc)	Resolution	Accuracy, ±(% of Reading + Counts)
4.000	0.001 V	0.1 % + 1
40.00	0.01 V	0.1 % + 1
400.0	0.1 V	0.1 % + 1
1000	1 V	0.1 % + 1
Input impedance: 10 MΩ (nominal), < 100 pF *Normal mode rejection ratio: > 60 dB at 50 Hz or 60 Hz* *Common mode rejection ratio: > 120 dB at dc, 50 Hz, or 60 Hz* *Overvoltage protection: 1000 V*		

DC Millivolts Measurement

Range (mV dc)	Resolution	Accuracy, ±(% of Reading + Counts)
400.0	0. 1 mV	0.1 % + 2

AC Volts Measurement

Range (ac)	Resolution	Accuracy, ±(% of Reading + Counts)		
		50 Hz to 60 Hz	45 Hz to 200 Hz	200 Hz to 500 Hz
400.0 mV	0.1 mV	0.7 % + 4	1.2 % + 4	7.0 % + 4
4.000 V	0.001 V	0.7 % + 2	1.2 % + 4	7.0 % + 4
40.00 V	0.01 V	0.7 % + 2	1.2 % + 4	7.0 % + 4
400.0 V	0.1 V	0.7 % + 2	1.2 % + 4	7.0 % + 4
1000 V	1 V	0.7 % + 2	1.2 % + 4	7.0 % + 4
Specifications are valid from 5 % to 100 % of amplitude range. *AC conversion: true rms* *Maximum crest factor: 3 (between 50 and 60 Hz)* *For non-sinusoidal waveforms, add ±(2 % reading + 2 % f.s.) typical* *Input impedance: 10 MΩ (nominal), < 100 pF, ac-coupled* *Common mode rejection ratio: > 60 dB at dc, 50 Hz, or 60 Hz*				

AC Current Measurement

Range 45 Hz to 2 kHz	Resolution	Accuracy, ±(% of Reading + Counts)	Typical Burden Voltage
1.000 A (Note)	0.001 A	1 % + 2	1.5 V/A
Note: 440 mA continuous, 1 A 30 seconds maximum			
Specifications are valid from 5 % to 100 % of amplitude range. *AC conversion: true rms* *Maximum crest factor: 3 (between 50 and 60 Hz)* *For non-sinusoidal waveforms, add ±(2 % reading + 2 % f.s.) typical* *Overload protection 440 mA, 1000 V fast-blow fuse*			

DC Current Measurement

Range	Resolution	Accuracy ±(% of Reading + Counts)	Typical Burden Voltage
30.000 mA	0.001 mA	0.05 % + 2	14 mV/mA
1.000 A (Note)	0.001 A	0.2 % + 2	1.5 V/A
Note: 440 mA continuous, 1 A 30 seconds maximum			
Overload protection: 440 mA, 1000 V fast-blow fuse			

Ohms Measurement

Range	Resolution	Measurement Current	Accuracy ±(% of Reading + Counts)
400.0 Ω	0. 1 Ω	220 µA	0.2 % + 2
4.000 kΩ	0.001 kΩ	60 µA	0.2 % + 1
40.00 kΩ	0.01 kΩ	6.0 µA	0.2 % + 1
400.0 kΩ	0.1 kΩ	600 nA	0.2 % + 1
4.000 MΩ	0.001 MΩ	220 nA	0.35 % + 3
40.00 MΩ	0.01 MΩ	22 nA	2.5 % + 3
Overload protection: 1000 V *Open circuit voltage: < 3.9 V*			

Frequency Counter Accuracy

Range	Resolution	Accuracy ±(% of Reading + Counts)
199.99 Hz	0.01 Hz	0.005 % + 1
1999.9 Hz	0.1 Hz	0.005 % + 1
19.999 kHz	0.001 kHz	0.005 % + 1
Display updates 3 times/second at > 10 Hz		

Frequency Counter Sensitivity

Input Range	Minimum Sensitivity (rms Sinewave) 5 Hz to 5 kHz*	
	AC	DC (approximate trigger level 5 % of full scale)
400 mV	150 mV (50 Hz to 5 kHz)	150 mV
4 V	1 V	1 V
40 V	4 V	4 V
400 V	40 V	40 V
1000 V	400 V	400 V
**Usable 0.5 Hz to 20 kHz with reduced sensitivity.* *10^6 VHz max*		

Diode Test and Continuity Test

Diode test indication: Displays voltage drop across device, 2.0 V full scale. Nominal test current 0.2 mA at 0.6 V. Accuracy ±(2 % + 1 count).

Continuity test indication: Continuous audible tone for test resistance < 100 Ω

Open circuit voltage: < 2.9 V

Short circuit current: 220 µA typical

Overload protection: 1000 V rms

Loop Power Supply

Loop Power Supply: Minimum 24 V@ 24 mA into 1200 Ω load

DC Current Output

Source mode:

Span: 0 mA or 4 mA to 20 mA, with overrange to 24 mA

Accuracy: 0.05 % of span[1] (span: 0 to 20 mA)

Compliance voltage: 28 V with battery voltage > ~4.5 V

[1]0.1 x specified accuracy per °C for temperatures < 18 °C or > 28 °C

Simulate Mode:

Span: 0 mA or 4 mA to 20 mA, with overrange to 24 mA

Accuracy: 0.05 % of span[1] (span: 0 to 20 mA)

Loop voltage: 24 V nominal, 48 V maximum, 15 V minimum

Compliance voltage: 21 V for 24 V supply

Burden voltage: < 3 V

[1]0.1 x specified accuracy per °C for temperatures < 18 °C or > 28 °C

General Specifications

Maximum voltage applied between any jack and earth ground: 1000 V

Storage temperature: -40 °C to 60 °C

Operating temperature: -20 °C to 55 °C

Operating altitude: 2000 meters maximum

Temperature coefficient: 0.05 x specified accuracy per °C for temperatures < 18 °C or > 28 °C

Accuracy adders for use in RF Fields: In an RF field of 3 V/m, change the accuracy specifications as follows:

For AC Volts Measurement, add 0.25 % of range
For DC Current Measurement, 30.000 mA range, add 0.14 % or range
For DC Current Output, add 0.32 % of span

Accuracy for all ProcessMeter functions is not specified in RF fields > 3 V/m.

Relative humidity: 95 % up to 30 °C, 75 % up to 40 °C, 45 % up to 50 °C, and 35 % up to 55 °C

Vibration: Random 2 g, 5 to 500 Hz

Shock: 1 meter drop test

Safety: Complies with EN61010, ANSI/ISA S82.01-1994 and CAN/CSA C22.2 No. 1010.1-92 Overvoltage Category III.

Certifications:

Power requirements: Four AA batteries (alkaline recommended)

Size: 10.0 cm X 20.3 cm X 5.0 cm (3.94 in X 8.00 in X 1.97 in)

Weight: 610 g (1.6 lbs)

Required Equipment

Equipment and software required to perform the procedures in this manual are identified in Table 2.

If the recommended equipment model is not available, in some cases other equipment can be substituted as long as it meets the specifications indicated.

⚠⚠Warning

To avoid safety hazards and equipment damage during the calibration procedure, use the specified calibration equipment listed in Table 2. Using unspecified equipment can jeopardize the calibration verification test and pose safety hazards.

Note

Unless otherwise indicated, all connection diagrams for the calibration verification tests in this manual showing a calibrator or digital multimeter use a Fluke 5500A calibrator or Agilent 3458A.

If you are using a different calibrator or DMM, make the connections appropriate for that instrument.

Table 2. Required Equipment and Software

Equipment	Minimum Specifications	Recommended Model
Calibration Source	No Substitute	Fluke Model 5500A
Digital Process Meter or Digital Process Calibrator	No Substitute	Fluke 787 ProcessMeter 741,743, or 744 Process Calibrator
Digital Multimeter	No Substitute	Agilent 3458A
Test Leads, low leakage, RG-58/U type	Leakage resistance > than 1.0×10^{13} Ω at 45 °C and 75 % relative humidity	Fluke 5440A-7002 Low Thermal Test Leads

Basic Maintenance

Cleaning the ProcessMeter

⚠⚠Warning

To avoid electrical shock or damage, never allow water inside the case of the ProcessMeter.

If the ProcessMeter requires cleaning, wipe it down with a cloth that is lightly dampened with water or a mild detergent.

⚠Caution

Do not use aromatic hydrocarbons, chlorinated solvents, or methanol-based fluids when wiping down the ProcessMeter. To avoid damaging the case, never apply solvents to the case of the ProcessMeter.

Replacing the Batteries

⚠⚠Warning

To avoid electrical shock:

- **Remove test leads from the ProcessMeter before opening the battery compartment door.**
- **Close and latch the battery compartment door before using the ProcessMeter.**

Replace the batteries as follows. Refer to Figure 1. Use four AA alkaline batteries.

1. Remove the test leads and turn the ProcessMeter OFF.
2. With a standard blade hand screwdriver, turn each battery compartment door screw counterclockwise so that the slot is parallel with the screw picture molded into the case.
3. Lift off the battery compartment door.
4. Remove the ProcessMeter's batteries.
5. Replace with four new AA alkaline batteries.
6. Reinstall the battery compartment door and tighten screws.

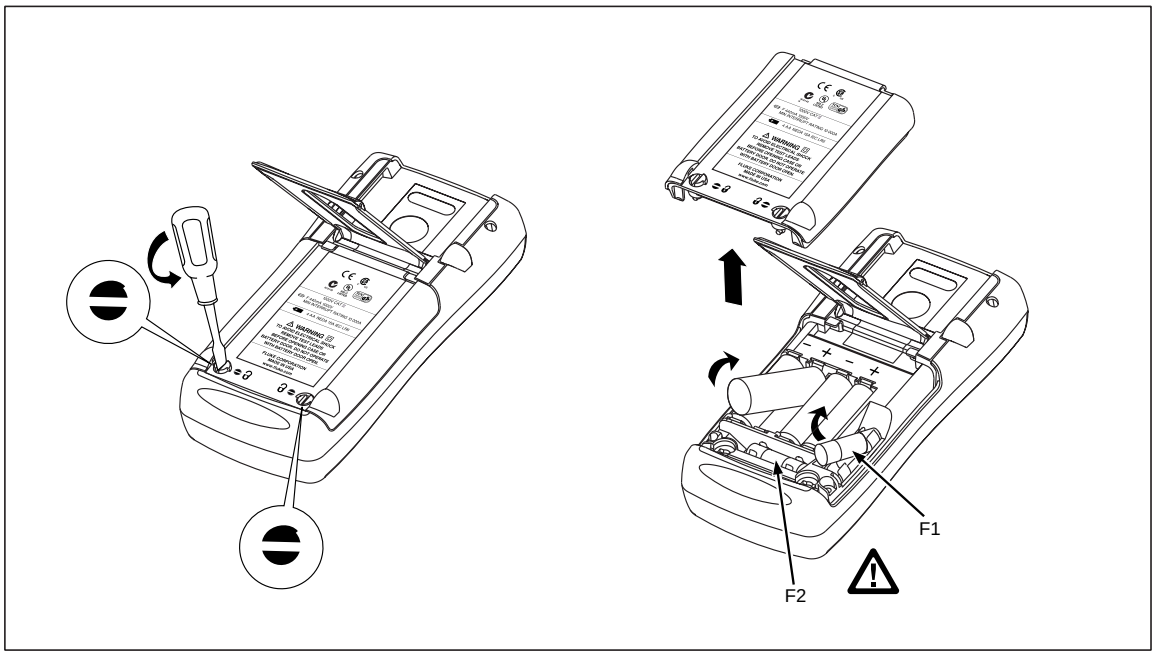

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Figure 1. Replacing the Batteries and Fuses

Battery Life

⚠⚠Warning

To avoid false readings, which can lead to possible electric shock or personal injury, replace the batteries as soon as the low battery indicator (+ ▬) appears.

The ProcessMeter is powered by four AA alkaline batteries.

Table 3 shows typical alkaline battery life. To preserve battery life:

- Use current simulation instead of sourcing when possible.
- Avoid using the backlight.
- Do not disable the automatic power-off feature.
- Turn the ProcessMeter off when not in use.

Table 3. Typical Alkaline Battery Life

ProcessMeter Operation	Hours
Measuring any parameter	140
Simulating Current	140
Sourcing 12 mA into 500 Ω	10

Checking and Replacing the Fuses

⚠⚠Warning

To avoid personal injury or damage to the ProcessMeter, use only the specified replacement fuse, 440 mA 1000 V fast-blow, Fluke PN 943121.

Both current input jacks are fused with separate 440 mA fuses. To determine if a fuse is blown:

1. Turn the rotary function switch to mA A.
2. Plug the black test lead into COM, and the red test lead into the A input.
3. Using an ohmmeter, check the resistance between the ProcessMeter test leads. If the resistance is about 1 Ω, the fuse is good. An open reading means that fuse F1 is blown.
4. Move red test lead to mA.
5. Using an ohmmeter, check the resistance between the ProcessMeter test leads. If the resistance is about 14 Ω, the fuse is good. An open means that fuse F2 is blown.

If a fuse is blown, replace it as follows. Refer to Figure 1 as necessary:

1. Remove the test leads from the ProcessMeter and turn the ProcessMeter OFF.
2. With a standard blade hand screwdriver, turn each battery compartment door screw counterclockwise so that the slot is parallel with the screw picture molded into the case.
3. Remove either fuse by gently prying one end loose, then sliding the fuse out of its bracket.
4. Replace the blown fuse(s).
5. Replace the battery compartment door. Secure the door by turning the screws one-quarter turn clockwise.

Calibration Verification

⚠⚠Warning

Some of the calibration verification tests involve the use of high voltages and should be performed by qualified personnel only.

To avoid electrical shock, always place the calibrator in the Standby (STBY) mode between tests and before handling the test connections or test cables.

Calibration verification tests confirm the complete functionality of the ProcessMeter and check the accuracy of each ProcessMeter function against its specifications. If the ProcessMeter fails any calibration verification test, it needs calibration adjustment or repair.

The ProcessMeter's performance and accuracy are specified for one year after calibration at operating temperatures of +18 °C to +28 °C (64 °F to 82 °F), in relative humidity to 90 %. The specifications assume the ProcessMeter has been warmed up for 5 minutes before use.

To perform the calibration verification tests, it is not necessary to open the case; no adjustments are necessary. Merely make the required connections, source the designated values, and determine if the reading on the ProcessMeter or the multimeter falls within the acceptable range indicated.

These calibration verification test procedures assume that the person performing the tests has read the *789 Users Manual*, knows how to select functions and ranges on the ProcessMeter, and knows how to operate the required equipment.

Note

Calibration verification tests for the ProcessMeter can be performed manually, or they can be computer-automated (using Fluke's MET/CAL® Calibration Software). *This document provides the procedures necessary to perform the calibration verification test manually.*

Preparing to Perform Calibration Verification

Note

Throughout the calibration verification tests, "UUT" (unit under test) refers to the ProcessMeter; the word "multimeter" is reserved for the digital multimeter identified in the required equipment listed in Table 2.

Unless otherwise indicated, all connection diagrams for the calibration verification tests in this manual showing a calibrator or digital multimeter use a Fluke 5500A calibrator or HP 3458A.

If using a different calibrator or DMM make the connections appropriate for your instrument.

To prepare the UUT for the calibration verification tests:

1. Make sure that the required equipment is available (see Table 2).
2. Make sure that the fuses in the UUT are intact. See "Checking and Replacing a Fuse" earlier in this manual.
3. Make sure the UUT has fresh batteries. See "Replacing the Batteries" earlier in this manual.

4. Warm up the calibrator and multimeter as required by their specifications.
5. Remove all input cables from the front of the UUT.
6. Make sure that the UUT is in a stable ambient temperature between 18 °C and 28 °C (64.4 °F and 82.4 °F) and that it has been warmed up for 5 minutes.

Loop Power

1. Connect the UUT **SOURCE + (A⎓)** terminal to the **SIMULATE + (⎓mA)** jack of the 789.
2. Connect the UUT **SOURCE - (mA⎓)** terminal to the **SIMULATE - (COM)** jack of the 787.
3. Enable the dc volts autorange function of the HP3458A multimeter.
4. Connect the voltage input terminals of the multimeter to the **SOURCE +** and **SOURCE -** terminals of the UUT as shown in Figure 2.
5. Select the **OUTPUT** $\overline{\overline{\text{mA}}}$ rotary position of the 787 multimeter and turn the rotary knob of the UUT to **LOOP POWER** (the UUT provides loop power and acts as a current source).
6. Use the **% STEP** key on the 787 to simulate 24 mA.
7. Verify that the voltage read by the multimeter is greater than 30 V.
8. Push ◯(BLUE) on the 789 to switch to its internal 250 Ω.
9. Verify that the voltage read by the multimeter is greater than 24 V.

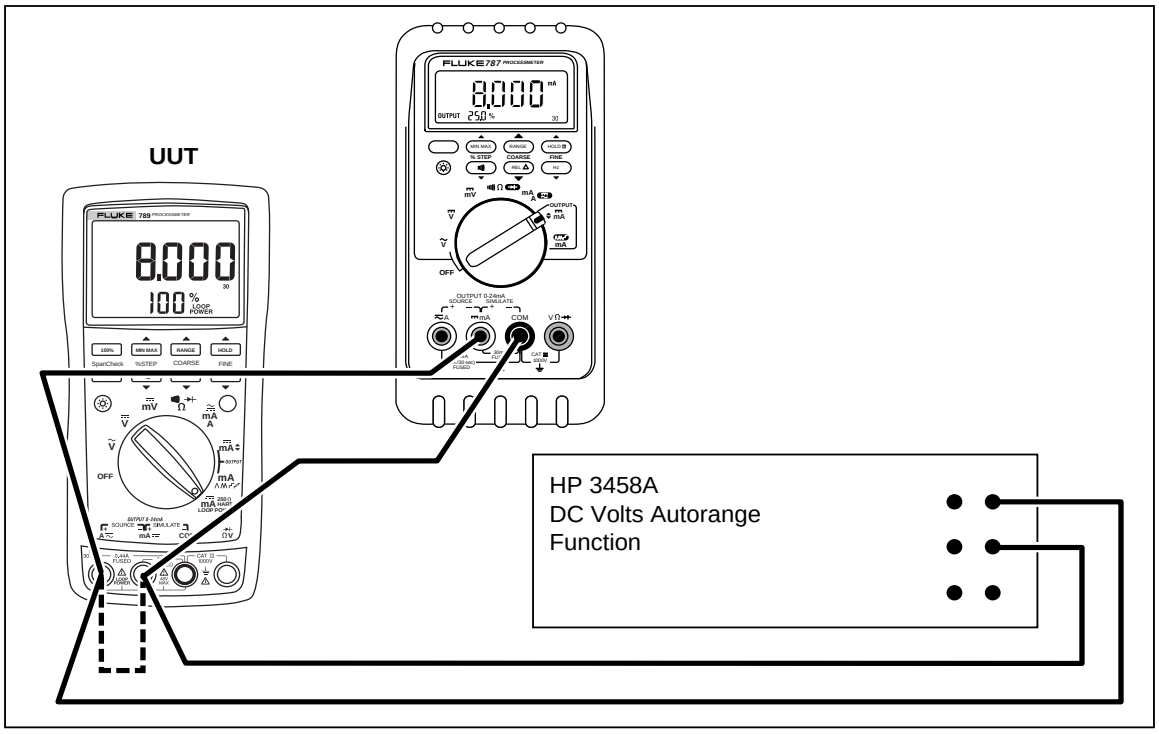

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Figure 2. Verifying Loop Power

Current Sourcing

1. Put the calibrator in Standby (**STBY**) mode.
2. Connect the **SOURCE** + (**A**⎓) and – (**mA**⎓) terminals on the UUT to the current terminals on the multimeter as shown in Figure 3.
3. Put the multimeter in the dc mA mode and manually select the 100 mA range. (Do not allow the multimeter to autorange.)
4. Turn the UUT rotary switch in the **OUTPUT mA position.**
5. Use the **% STEP** and **COARSE** keys on the UUT to apply the values shown in Table 4 and compare the readings on the multimeter to the acceptable readings shown.

Table 4. Current Sourcing Test

787 Range	787 Output Current	Minimum Acceptable Multimeter Reading	Maximum Acceptable Multimeter Reading
No Range Switching	4.000 mA	3.990 mA	4.010 mA
No Range Switching	12.000 mA	11.990 mA	12.010 mA
No Range Switching	20.000 mA	19.990 mA	20.010 mA

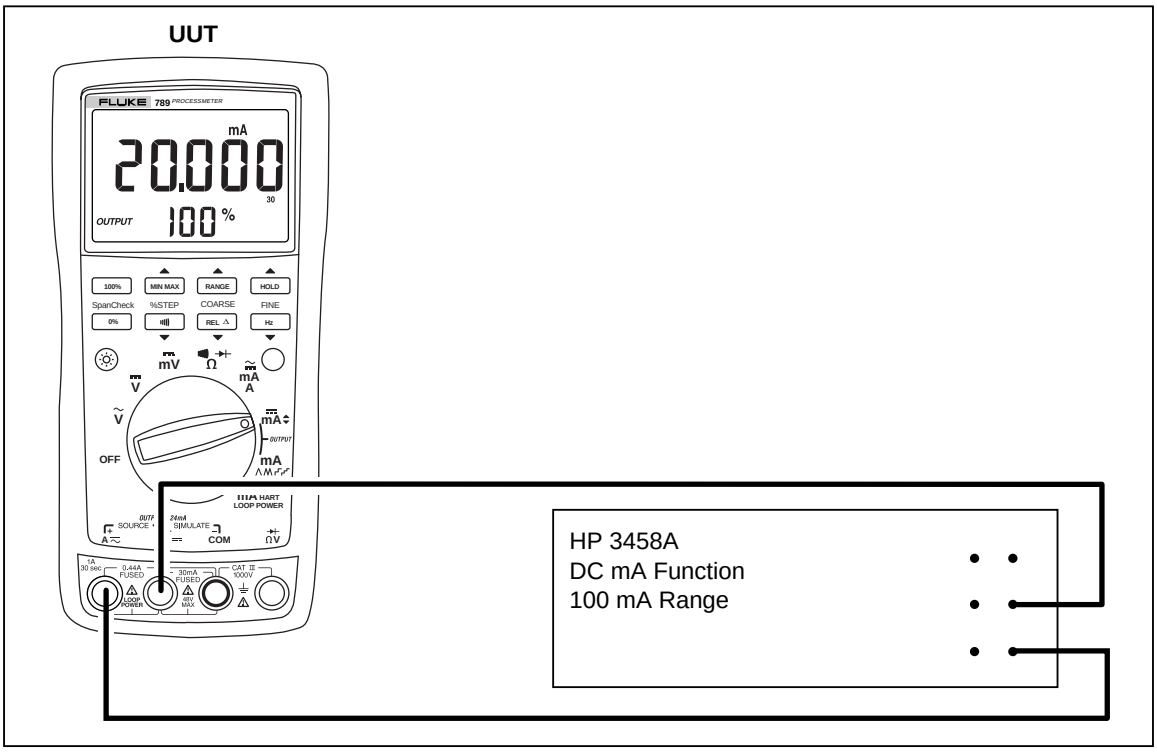

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Figure 3. Current Sourcing Connections Using the HP 3458A

Current Measurement

1. Put the calibrator in Standby (**STBY**) mode.
2. Put the UUT rotary switch in the mA A position.
3. Connect the calibrator to the **COM** and **mA⎓** terminals on the UUT as shown in Figure 4.
4. Apply the values from the calibrator shown in Table 5 and compare the readings on the UUT to the acceptable readings shown.
5. Connect the calibrator to the **COM** and **A≂** terminals on the UUT.
6. Apply the values from the calibrator shown in Table 5 and Table 6 and compare the readings on the UUT to the acceptable readings shown.
7. Press ◯(BLUE) on the UUT to toggle to ac amps.
8. Apply the values from the calibrator shown in Table 7 and compare the readings on the UUT to the acceptable readings shown.

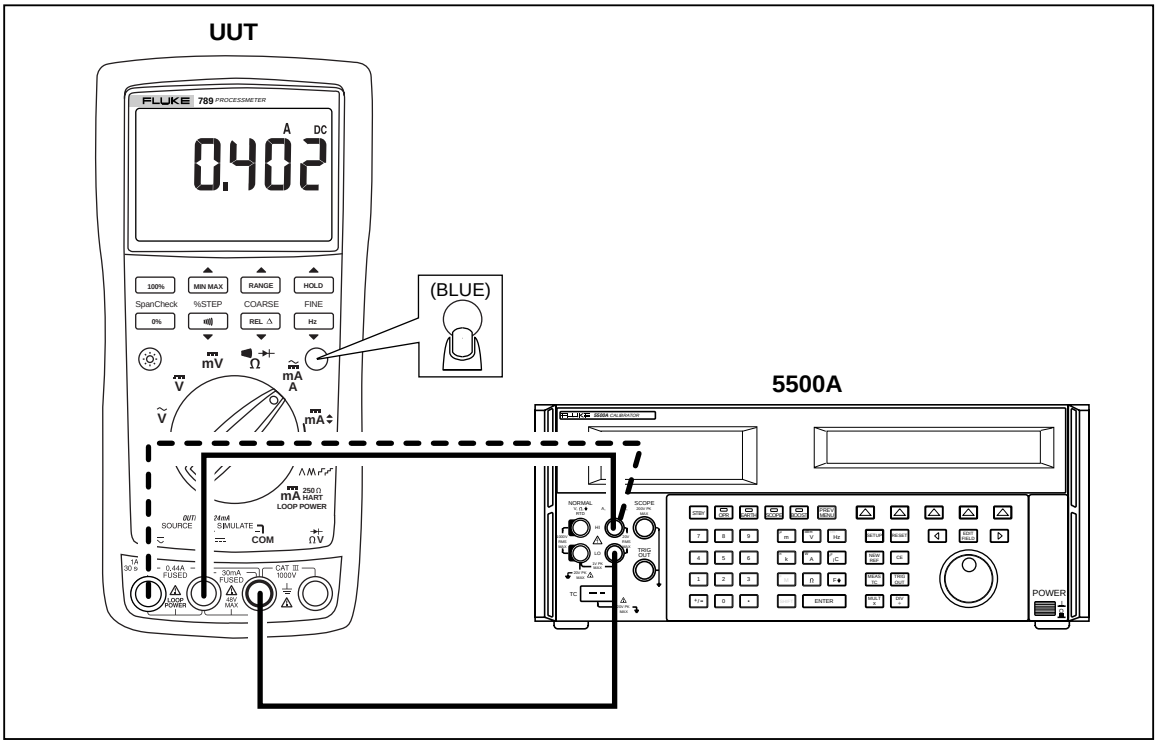

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Figure 4. Current Measurement Test Connections

Table 5. DC mA Test

789 Range	Calibrator DC Current	Minimum Acceptable Reading	Maximum Acceptable Reading
No Range Switching	4.000 mA	3.996 mA	4.004 mA
No Range Switching	12.000 mA	11.992 mA	12.008 mA
No Range Switching	20.000 mA	19.988 mA	20.012 mA

Table 6. DC Amp Test

789 Range	Calibrator DC Current	Minimum Acceptable Reading	Maximum Acceptable Reading
No Range Switching	0.100 A	0.098 A	0.102 A
No Range Switching	0.400 A	0.397 A	0.403 A

Table 7. AC Amp Test

789 Range	Calibrator AC Current and Frequency	Minimum Acceptable Reading	Maximum Acceptable Reading
No Range Switching	0.100 A @ 60 Hz	0.097 A	0.103 A
No Range Switching	0.400 A @ 60 Hz	0.394 A	0.406 A

Checking the Diode Test Function

1. Put the calibrator in Standby (**STBY**) mode.
2. Turn the UUT rotary switch in the Ω position.
3. Press ◯ (BLUE) to select diode test (**→|**).
4. Connect the calibrator to the **COM** and Ω**V** terminals on the UUT as shown in Figure 5.
5. Apply 2.0 V dc from the calibrator.
6. The UUT should read between 1.959 V and 2.041 V.
7. Put the calibrator in Standby (**STBY**) mode; then disconnect the calibrator from the UUT.
8. Put the multimeter in the dc mA (autorange) function.
9. Connect the current terminals of the multimeter to the **COM** and Ω**V** terminals on the UUT.
10. The multimeter should read close to 0.2 mA. (There is no tolerance specification for this current. This test just makes sure that the diode test current source is operating.)

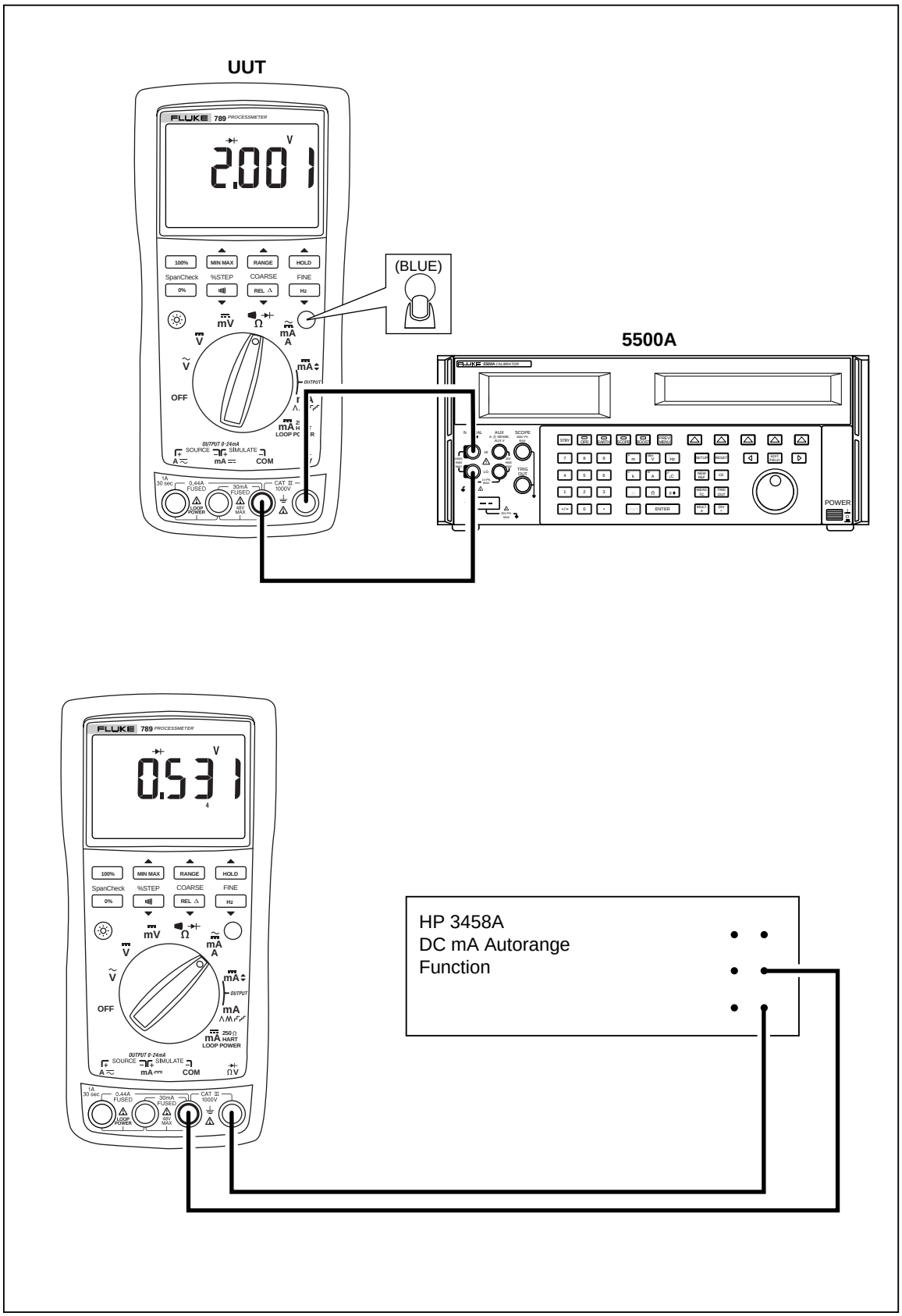

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Figure 5. Diode Test Connections

Checking the Continuity Test Function

1. Put the calibrator in Standby (**STBY**) mode, and turn the UUT rotary switch to the Ω position.
2. Connect the calibrator to the **COM** and ΩV terminals on the UUT as shown in Figure 6.
3. Press [ ] (continuity beeper) on the UUT to select the continuity test.
4. Using the calibrator, apply a resistance output of 230 ± 20 Ω. The beeper should stay off.
5. Using the calibrator, apply a resistance output of 120 ± 20 Ω. The beeper should turn on.

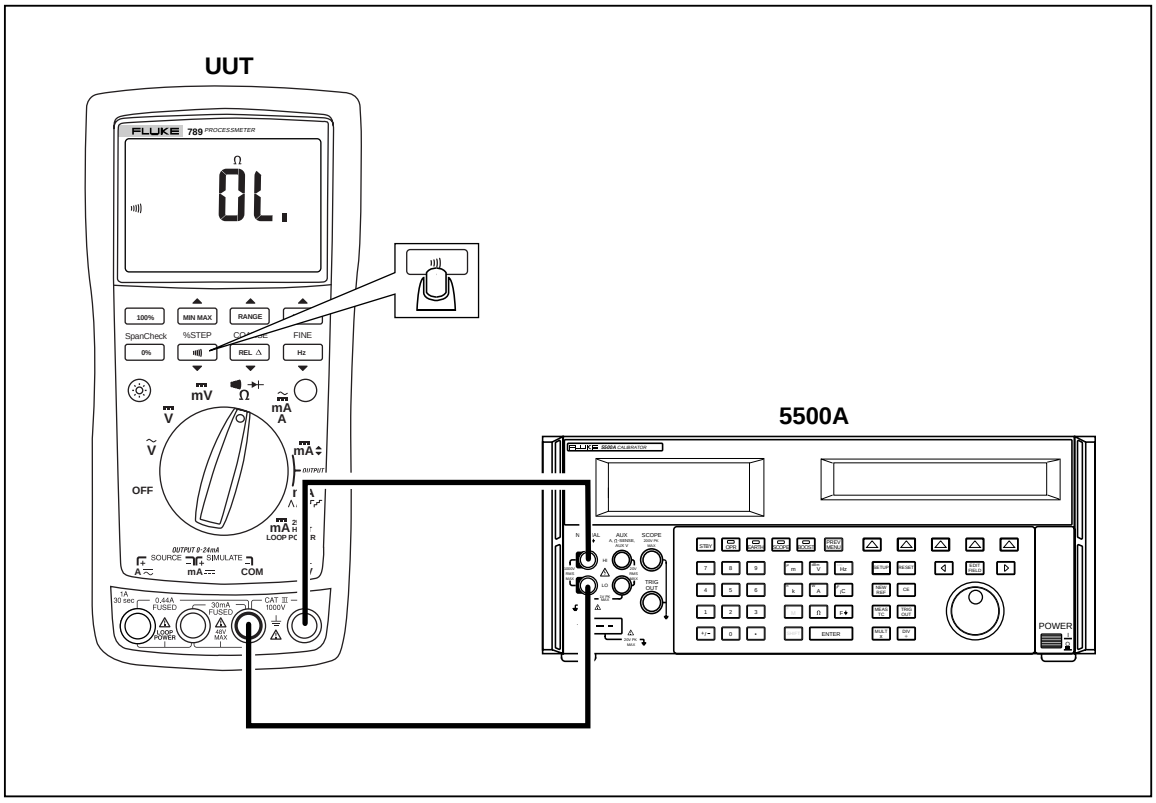

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Figure 6. Continuity Test Connections

Resistance Measurement Test

1. Put the calibrator in Standby (**STBY**) mode.
2. Put the UUT rotary switch in the Ω position.
3. Connect the **OUTPUT** and **SENSE** leads of the calibrator to the UUT as shown by the solid and dotted lines in Figure 7.
4. Apply the calibrator resistance values in Table 8 in the 789 400 Ω to 40 kΩ range. Compare the readings on the UUT to the acceptable readings shown.
5. Change the connections to the UUT. Using the Fluke 5440A-7002 low thermal leads, connect the calibrator to the UUT as shown by the solid lines in Figure 7.
6. Apply the rest of the calibrator resistance values in Table 8 (400 kΩ range and above). Compare the readings on the UUT to the acceptable readings shown.

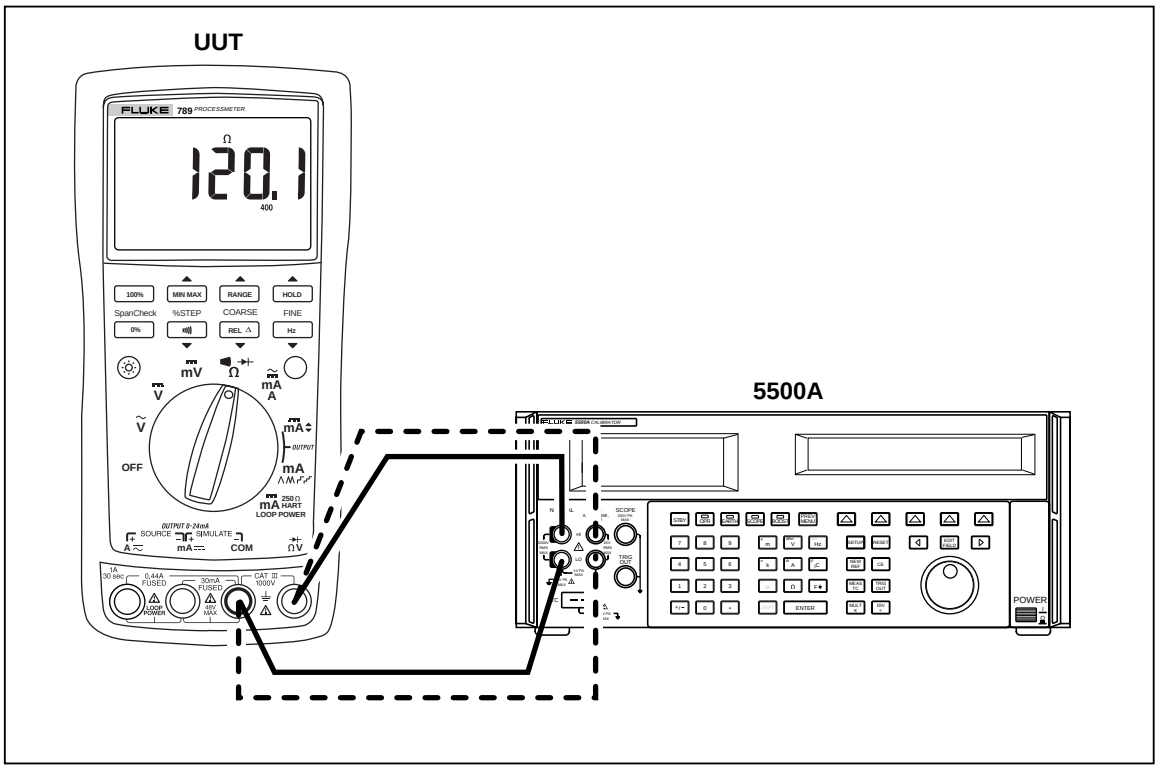

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Figure 7. Resistance Measurement Test Connections

Table 8. Resistance Measurement Test Using a 5500A or 5520A Calibrator

789 Range	Calibrator Resistance	Calibrator Compensation Mode	Minimum Reading	Maximum Reading
400 Ω	120 Ω	2-Wire	119.6 Ω	120.4 Ω
400 Ω	300 Ω	2-Wire	299.2 Ω	300.8 Ω
4 kΩ	1.2 kΩ	2-Wire	1.197 kΩ	1.203 kΩ
4 kΩ	3 kΩ	2-Wire	2.993 kΩ	3.007 kΩ
40 kΩ	12 kΩ	2-Wire	11.97 kΩ	12.03 kΩ
40 kΩ	30 kΩ	2-Wire	29.93 kΩ	30.07 kΩ
400 kΩ	120 kΩ	OFF	119.7 kΩ	120.3 kΩ
400 kΩ	200 kΩ	OFF	199.5 kΩ	200.5 kΩ
400 kΩ	300 kΩ	OFF	299.3 kΩ	300.7 kΩ
4 MΩ	1.2 MΩ	OFF	1.993 MΩ	1.207 MΩ
4 MΩ	3.0 MΩ	OFF	2.986 MΩ	3.014 MΩ
40 MΩ	12 MΩ	OFF	11.67 MΩ	12.33 MΩ
40 MΩ	30 MΩ	OFF	29.22 MΩ	30.78 MΩ

DC Millivolts Measurement Test

1. Put the calibrator in Standby (**STBY**) mode.
2. Put the UUT rotary switch in the mV position.
3. Connect the calibrator to the **COM** and Ω terminals on the UUT as shown in Figure 8.
4. Apply the values from the calibrator shown in Table 9 and compare the readings on the UUT to the acceptable readings shown.

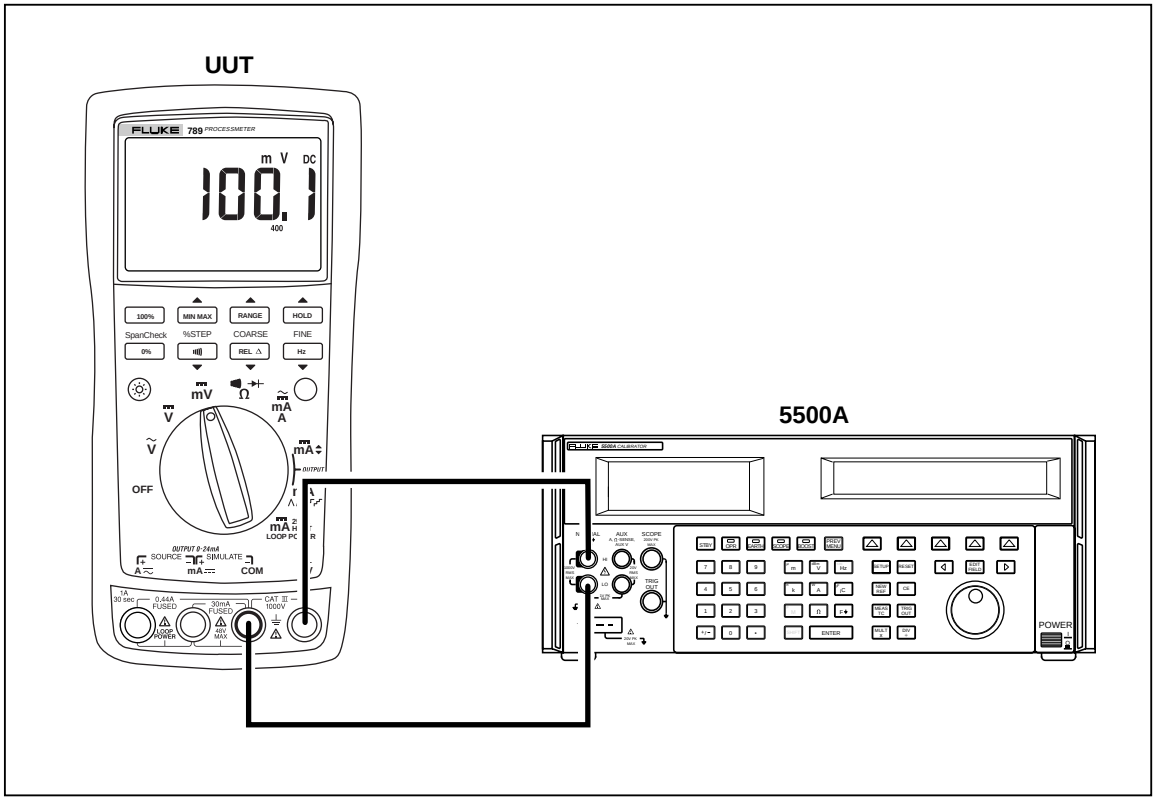

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Figure 8. DC mV Measurement Test Connections

Table 9. DC mV Test

789 Range	Calibrator DC Voltage	Minimum Reading	Maximum Reading
No Range Switching	100 mV	99.8 mV	100.2 mV
No Range Switching	300 mV	299.6 mV	300.4 mV

DC Volts Measurement Tests

⚠⚠Warning

To avoid possible electrical shock or personal injury:

- **Some of the calibration verification tests involve the use of high voltages and should be performed by qualified personnel only.**
- **Always place the calibrator in the Standby (**STBY**) mode between tests and before handling the test connections or test cables.**

1. Put the calibrator in Standby (**STBY**) mode.
2. Put the UUT rotary switch in the $\overline{\overline{V}}$ position; select the autoranging mode.
3. Connect the calibrator to the **COM** and $\Omega\overline{\overline{V}}$ terminals on the UUT as shown in Figure 9.
4. Apply the values from the calibrator shown in Table 10 and compare the readings on the UUT to the acceptable readings shown.

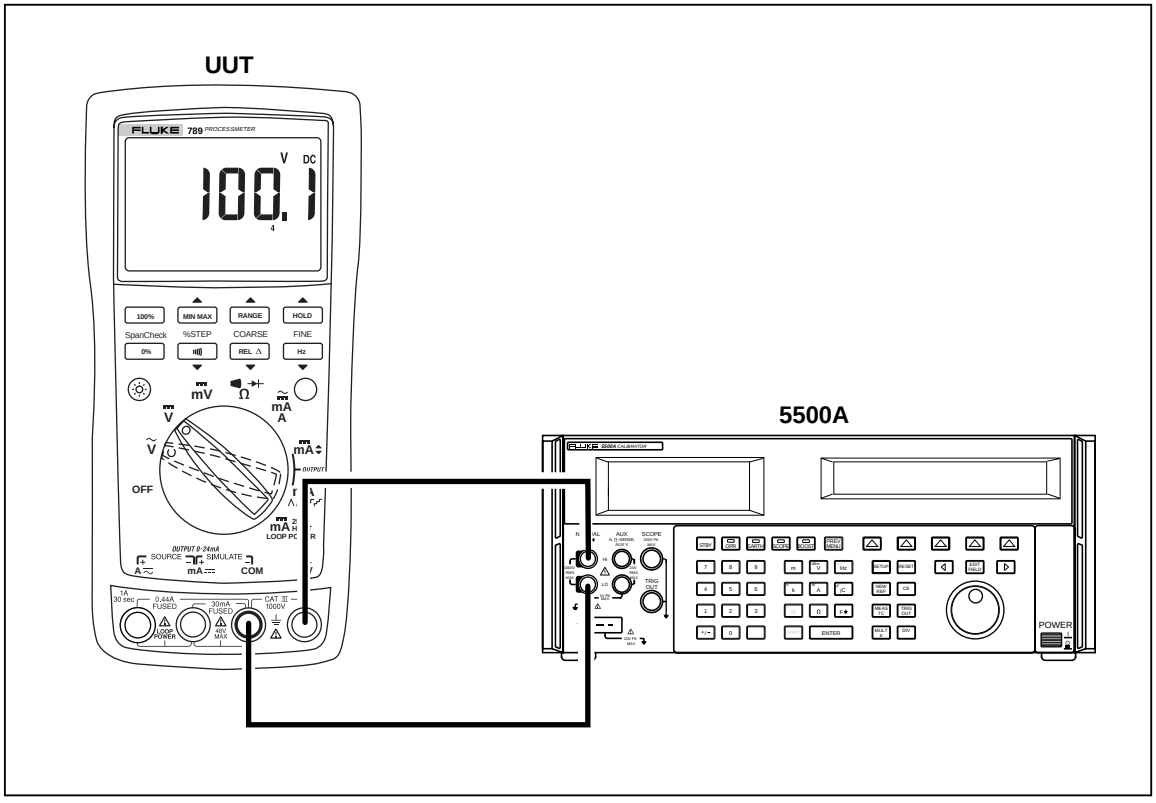

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Figure 9. AC/DC Voltage Measurement Test Connections

Table 10. DC Volts Test

789 Range	Calibrator DC Voltage	Minimum Reading	Maximum Reading
4 V dc	1 V	0.998 V	1.002 V
4 V dc	3 V	2.996 V	3.004 V
40 V dc	10 V	9.98 V	10.02 V
40 V dc	30 V	29.96 V	30.04 V
400 V dc	100 V	99.8 V	100.2 V
400 V dc	300 V	299.6 V	300.4 V
1000 V dc	100 V	99	101
1000 V dc	800 V	798	802

AC Volts Measurement Test

⚠⚠Warning

To avoid possible electrical shock or personal injury:

- **Some of the calibration verification tests involve the use of high voltages and should be performed by qualified personnel only.**
- **Always place the calibrator in the Standby (**STBY**) mode between tests and before handling the test connections or test cables.**

1. Put the calibrator in Standby (**STBY**) mode.
2. Put the UUT rotary switch in the $\widetilde{V}$ position.
3. Connect the calibrator to the **COM** and ΩV terminals on the UUT as shown in Figure 9.
4. Apply the values from the calibrator shown in Table 11 and compare the readings on the UUT to the acceptable readings shown.

Table 11. AC Volts Test

789 Range	Calibrator Voltage and Frequency	Minimum Acceptable Reading	Maximum Acceptable Reading
400 mV ac	100 mV @ 60 Hz	98.9 mV	101.1 mV
400 mV ac	300 mV @ 60 Hz	297.5 mV	302.5 mV
4 V ac	1 V @ 60 Hz	0.991 V	1.009 V
4 V ac	2 V @ 60 Hz	1.984 V	2.016 V
4 V ac	3 V @ 60 Hz	2.977 V	3.023 V
40 V ac	10 V @ 60 Hz	9.91 V	10.09 V
40 V ac	30 V @ 60 Hz	29.77 V	30.23 V
400 V ac	100 V @ 60 Hz	99.1 V	100.9 V
400 V ac	300 V @ 60 Hz	297.7 V	302.3 V
1000 V ac	100 V @ 60 Hz	97	103
1000 V ac	800 V @ 60 Hz	792	808

Frequency Measurement Test

1. Put the calibrator in Standby (**STBY**) mode.
2. Put the UUT rotary switch in the $\tilde{V}$ (ac volts) position.
3. Press Hz to toggle to the frequency measurement function.
4. Connect the calibrator to the **COM** and $\Omega\,V$ terminals on the UUT as shown in Figure 10.
5. Apply the values from the calibrator shown in Table 12 and compare the readings on the UUT to the acceptable readings shown.

Table 12. Frequency Measurement Test

789 Range	Calibrator Voltage and Frequency	Minimum Acceptable Reading	Maximum Acceptable Reading
199.99 Hz	5 V @ 100 Hz	99.98 Hz	100.02 Hz
1999.9 Hz	5 V @ 1000 Hz	999.8 Hz	1000.2 Hz
19.999 kHz	5 V @ 10 kHz	9.998 kHz	10.002 kHz

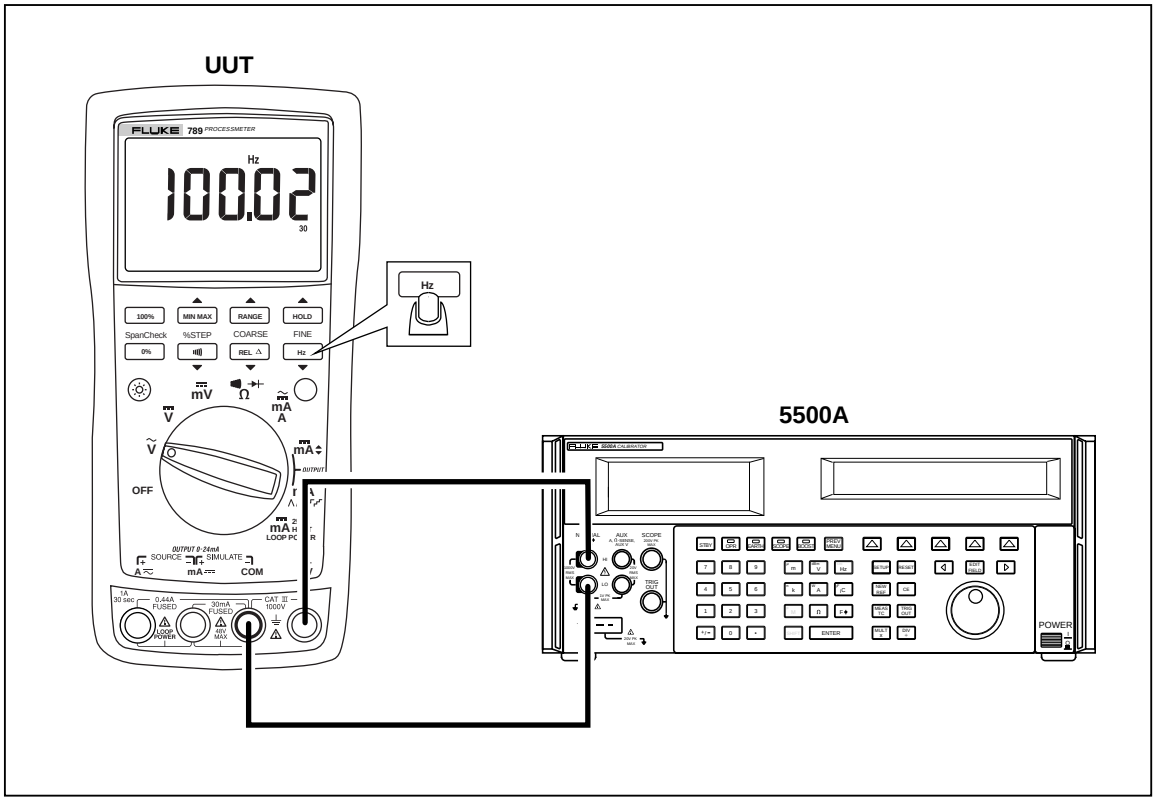

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Figure 10. Frequency Measurement Test Connections

Calibration Adjustment

The Processmeter is calibrated using a closed-case procedure.

Calibrate the ProcessMeter once a year to ensure that it performs according to its specifications.

Preparing for Calibration Adjustment

⚠⚠Warning

To avoid possible electric shock or personal injury:

- **Do not use the ProcessMeter if it looks damaged.**
- **Inspect the ProcessMeter for damage, especially around the input terminals. Inspect the test leads and test connections for damaged insulation or exposed metal.**
- **Look for cracks, missing plastic or damaged insulation. If damage is detected, do not continue; contact Fluke to have the ProcessMeter serviced.**
- **Make sure that the battery compartment door on the ProcessMeter is closed and latched before using it.**
- **Check the test leads for continuity. Replace damaged test leads as necessary.**
- **Do not use the ProcessMeter if it appears to operate abnormally. Protection designed into the ProcessMeter might be impaired. If in doubt, have the ProcessMeter serviced.**
- **To avoid electrical shock, always place the calibrator in the Standby (STBY) mode between tests and before handling the test connections or test cables.**
- **Some of the calibration adjustment procedures involve the use of high voltages and should be performed by qualified personnel only.**

Note

The calibration adjustment procedures assume that the person performing them knows how to use the ProcessMeter and the required equipment. Do not attempt to calibrate the ProcessMeter unless you are qualified to do so.

Throughout the following, "UUT" (unit under test) refers to the ProcessMeter; the word "multimeter" is reserved for the digital multimeter identified in the required equipment listed in Table 2.

Calibration adjustment should be performed in an RF field < 1 V/m such as a laboratory environment.

To prepare for calibration adjustment, do the following:

1. Make sure that you have the required equipment available (see Table 2).
2. Make sure that both fuses in the UUT are intact. See "Checking and Replacing the Fuses" earlier in this manual.
3. Turn on and warm up the calibrator as required by its specifications.
4. Remove all input cables from the front of the UUT.
5. Make sure that the UUT is in an ambient temperature between 18 °C and 28 °C (64.4 °F and 82.4 °F).

AC Voltage Adjustment

1. Connect the Processmeter to the volt/ohm output of the 5500A calibrator.
2. Turn the UUT's switch to $\tilde{V}$.
3. The calibration button is located on the backside of the Processmeter, under the Calibration Seal. Use a small probe to break the seal.
4. Press and hold the Calibration Button for approximately 2 seconds. The unit will beep (see Figure 11).

Note

Pressing the Calibration Button puts the Processmeter into and out of calibration mode. The Processmeter will remain in calibration mode until the unit is turned off or the calibration button is pressed a second time.

CAL *appears in the bottom display when the Processmeter is in calibration mode.*

5. Apply the voltages listed below as prompted by the Processmeter.
6. Press [0%] after each sourced value appears. Do not alter the sourced value while the display reads **Busy**.

   Applied voltages:

   - 4 mV @ 60 Hz
   - 40 mV @ 60 Hz
   - 400 mV @ 60 Hz
   - 4 V @ 60 Hz
   - 40 V @ 60 Hz
   - 400 V @ 60 Hz
   - 1000 V @ 60 Hz
7. When **Store** is displayed, press [100%] to store the calibration value.

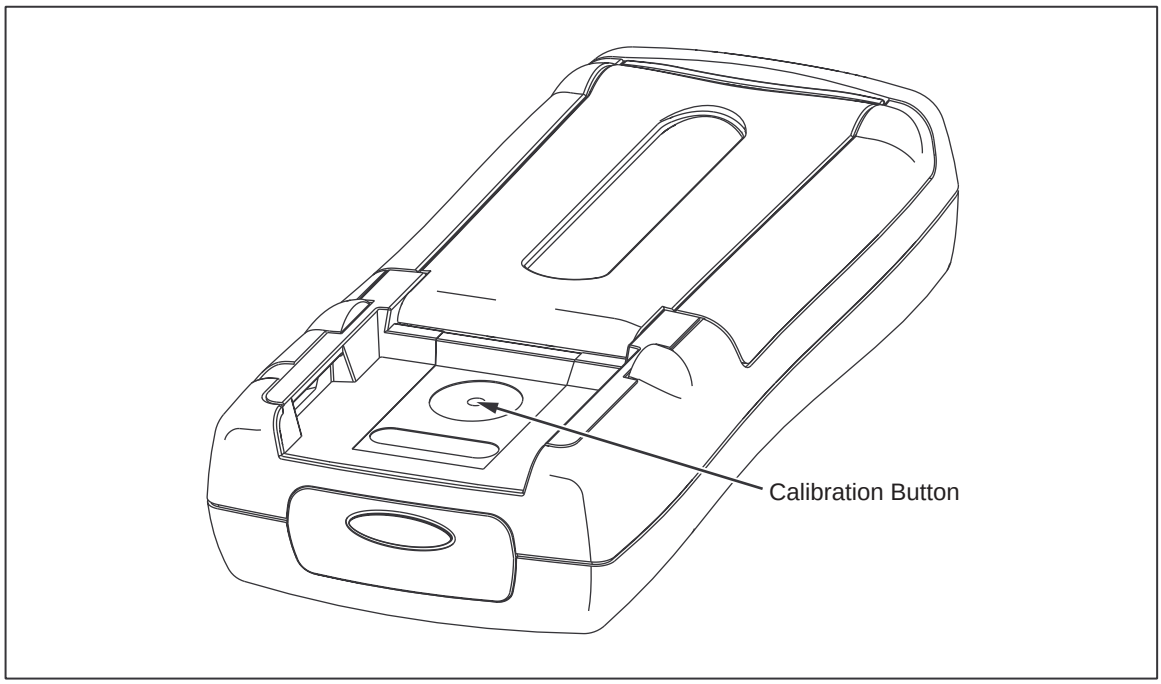

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Figure 11. Calibration Button Access

Frequency Adjustment

1. Connect the Processmeter to the volt/ohm output of the 5500A calibrator.
2. Turn the UUT's switch to $\widetilde{V}$.
3. Push Hz.
4. Press and hold the Calibration Button for approximately 2 seconds. The unit will beep (see Figure 11).

Note

Pressing the Calibration Button puts the Processmeter into and out of calibration mode. The Processmeter will remain in calibration mode until the unit is turned off or the calibration button is pressed a second time.

CAL *appears in the bottom display when the Processmeter is in calibration mode.*

5. Apply 4 V @ 5000 Hz.
6. Press 0% after the sourced value appears. Do not alter the sourced value while the display reads **Busy**.
7. When **Store** is displayed, press 100% to store the calibration value.

DC Voltage Adjustment

1. Connect the Processmeter to the volt/ohm output of the 5500A calibrator.
2. Turn the UUT's switch to $\overline{\overline{\mathbf{V}}}$.
3. Press and hold the Calibration Button for approximately 2 seconds. The unit will beep (see Figure 11).

Note

Pressing the Calibration Button puts the Processmeter into and out of calibration mode. The Processmeter will remain in calibration mode until the unit is turned off or the calibration button is pressed a second time.

CAL *appears in the bottom display when the Processmeter is in calibration mode.*

4. Press [0%] after each sourced value appears. Do not alter the sourced value while the display reads **Busy**.

   Applied voltages:

   - 0 V
   - 4 V
   - 40 V
   - 400 V
   - 1000 V

5. When **Store** is displayed, press [100%] to store the calibration value.

DC Millivolts Adjustment

1. Connect the Processmeter to the volt/ohm output of the 5500A calibrator.
2. Turn the UUT's switch to mV⎓.
4. Press and hold the Calibration Button for approximately 2 seconds. The unit will beep (see Figure 11).

Note

Pressing the Calibration Button puts the Processmeter into and out of calibration mode. The Processmeter will remain in calibration mode until the unit is turned off or the calibration button is pressed a second time.

CAL *appears in the bottom display when the Processmeter is in calibration mode.*

3. Apply 0 V. Press [0%] after the sourced value appears. Do not alter the sourced value while the display reads **Busy**.
4. Apply 400 mV. Press [0%] after the sourced value appears. Do not alter the sourced value while the display reads **Busy**.
5. When **Store** is displayed, press [100%] to store the calibration value.

Ohms Adjustment

1. Connect the Processmeter to the volt/ohm output of the 5500A calibrator.
2. Turn the UUT's switch to Ω.
3. Press and hold the Calibration Button for approximately 2 seconds. The unit will beep (see Figure 11).

Note

Pressing the Calibration Button puts the Processmeter into and out of calibration mode. The Processmeter will remain in calibration mode until the unit is turned off or the calibration button is pressed a second time.

CAL *appears in the bottom display when the Processmeter is in calibration mode.*

4. Apply the resistances listed below. Press [0%] after each sourced value appears. Do not alter the sourced value while the display reads **Busy**.

   Applied resistances:

   - 0 Ω
   - 400 Ω
   - 4 kΩ
   - 40 kΩ
   - 400 kΩ
   - 4 MΩ
   - 40 MΩ

5. When **Store** is displayed, press [100%] to store the calibration value.

Diode Adjustment

1. Connect the Processmeter to the volt/ohm output of the 5500A calibrator.
2. Turn the UUT's switch to Ω→+.
3. Press ◯ (blue) to enter the diode function.
4. Press and hold the Calibration Button for approximately 2 seconds. The unit will beep (see Figure 11).

Note

Pressing the Calibration Button puts the Processmeter into and out of calibration mode. The Processmeter will remain in calibration mode until the unit is turned off or the calibration button is pressed a second time.

CAL *appears in the bottom display when the Processmeter is in calibration mode.*

Before applying 0 V dc, the 5500 must be range locked in the 3.3 V range. Impedance of 330 mV range changes the 0 V point.

5. Apply 0 V dc. Press [0%] after the sourced value appears. Do not alter the sourced value while the display reads **Busy**.
6. Apply 1 V dc. Press [0%] after the sourced value appears. Do not alter the sourced value while the display reads **Busy**.
7. When **Store** is displayed, press [100%] to store the calibration value.

Milliamps DC Adjustment

1. Connect the Processmeter to the mA output of the 5500A calibrator.
2. Turn the UUT's switch to mA A. Make sure the test leads are in the **mA ⎓** and **COM** inputs.
3. Press and hold the Calibration Button for approximately 2 seconds. The unit will beep (see Figure 11).

Note

Pressing the Calibration Button puts the Processmeter into and out of calibration mode. The Processmeter will remain in calibration mode until the unit is turned off or the calibration button is pressed a second time.

CAL *appears in the bottom display when the Processmeter is in calibration mode.*

4. Apply 0 mA dc. Press [0%] after the sourced value appears. Do not alter the sourced value while the display reads **Busy**.
5. Apply 30 mA dc. Press [0%] after the sourced value appears. Do not alter the sourced value while the display reads **Busy**.
6. When **Store** is displayed, press [100%] to store the calibration value.

Amps DC Adjustment

1. Connect the Processmeter to the A output of the 5500A calibrator.
2. Turn the UUT's switch to mA A. Make sure the test leads are in the **A** and **COM** jacks.
3. Press and hold the Calibration Button for 2 seconds (see Figure 11). The unit will beep.
4. Apply 0 A dc. Press 0% after the reading stabilizes.
5. Apply 1 A dc. Press 0% after the reading stabilizes.

⚠Caution

Remove 1 A from UUT promptly after storing calibration constant.
Fuse will blow after 30 seconds.

6. Store calibration constants by pressing 100%.

Amps AC Adjustment

1. Connect the Processmeter to the A output of the 5500A calibrator.
2. Turn the UUT's switch to mA A.
3. Press ◯ (blue) to enter the A ac function.
4. Press and hold the Calibration Button for 2 seconds (see Figure 11). The unit will beep.
5. Apply 0.05 A ac @ 60 Hz. Press 0% after the reading stabilizes.
6. Apply 1 A ac. Press 0% after the reading stabilizes.
7. Store calibration constants by pressing 100%.

⚠Caution

Remove 1 A from UUT promptly after storing calibration constant.
Fuse will blow after 30 seconds.

Milliamps Output Adjustment

1. Connect the Processmeter A output to the 3458 input.
2. UUT will output approximately 4 mA. Use the fine and coarse adjustments on the UUT to get a 4.000 mA reading on the 3458.
3. Press 0% after 4.000 mA reading is reached on the 3458.
4. UUT will output approximately 20 mA. Use the fine and coarse adjustments on the UUT to get a 20.000 on the 3458.
5. Press 0% after 20.000 mA reading is reached on the 3458.
6. Store calibration constants by pressing 100%.

Replacement Parts and Accessories

⚠⚠Warning

To avoid personal injury or damage to the ProcessMeter, use only the specified replacement fuse, 440 mA 1000 V fast-blow, Fluke PN 943121.

Note

When servicing the ProcessMeter, use only the replacement parts specified here.

Replacement parts and some accessories are shown in Figure 12 and listed in Table 13. Many more DMM accessories are available from Fluke. For a catalog, contact the nearest Fluke distributor.

To find out how to order parts or accessories use the telephone numbers or addresses shown in "Contacting Fluke".

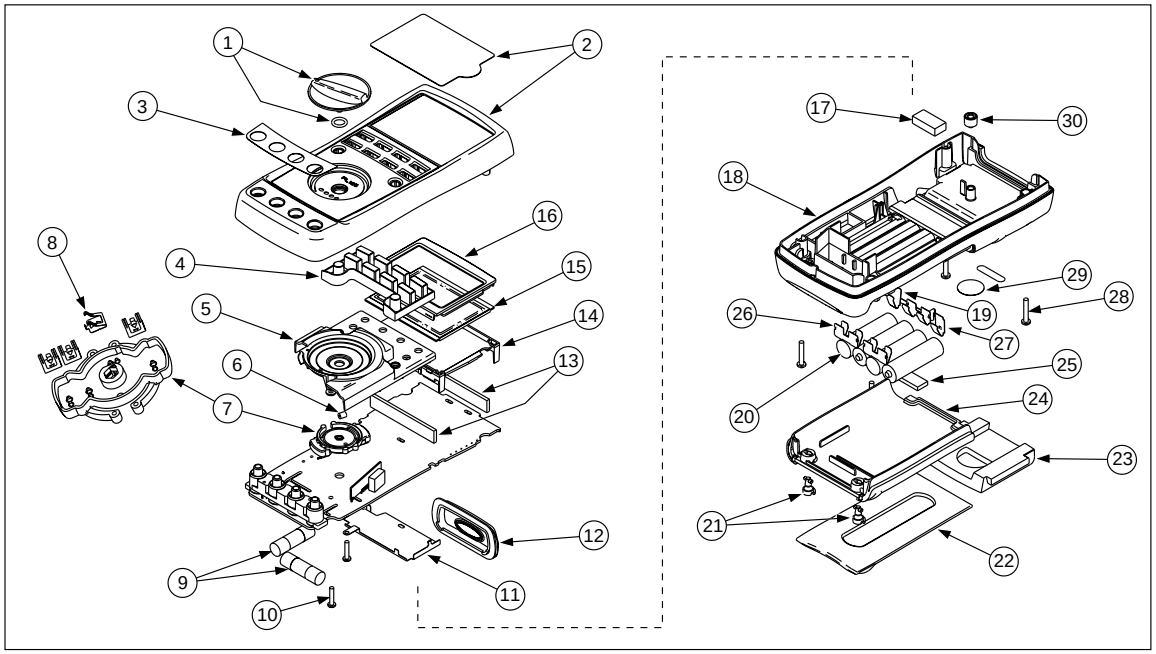

Figure 12. Replacement Parts

Table 13. Replacement Parts

Item Number	Reference Designator	Description	Fluke PN or Model no.	Quantity
1	MP14	Knob Assembly	658440	1
2	MP1	Top Case with Lens Protector	1622862	1
3	MP8	Decal, Top Case	1623923	1
4	MP6	Keypad	1622951	1
5	MP5	Top Shield	1622924	1
6	MP47	Top Shield Contact	674853	1
7	MP4	Contact Housing	1622913	1
8	MP28-31	RSOB Contact	1567683	4
9	⚠ F1, F2	Fuse, 440 mA, 1000 V fast-blow	943121	2
10	H7,8	PCB Screw	832220	2
11	MP9	Bottom Shield	1675171	1
12	MP12	IR Lens	658697	1
13	MP40,41	LCD Connectors, Elastomeric	1641965	2
14	MP7	Backlight/Bracket	1622960	1
15	P1	LCD Display	1883431	1
16	MP3	Mask	1622896	1
17	MP50	Shock Absorber	878983	1
18	MP11	Bottom Case	659042	1
19	MP20	Battery Contact, Negative	658382	1
20	BT1-4	Battery, 1.5 V, 0-15 mA, AA Alkaline	376756	4
21	H1-2	Fasteners, Battery/Fuse Access Door	948609	2
22	MP13	Tilt-Stand	659026	1
23	MP15	Accessory Mount with Probe Holders	658424	1
24	MP2	Access Door, Battery/Fuse	1622870	1
25	MP46	Shock Absorber	674850	1
26	MP16-18	Battery Contacts Dual	666435	3
27	MP19	Battery Contact, Positive	666438	1
28	H3-6	Case Screws	1558745	4
29	MP21	Calibration Label	948674	1
30	MP22	Calibration Keypad	658689	1
-	Not shown	TL71 Test Leads	1274382	1 (set of 2)
-	Not shown	AC72 Alligator Clips	1670095	1 (set of 2)
-	Not shown	789 Product Overview	1627890	1
-	Not shown	CD-ROM (Contains Users Manual)	1636493	1