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**FLUKE®**

**787**  
ProcessMeter

**Users Manual**

April 1997, Rev.3, 12/01

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# ***Table of Contents***

<b>Title</b>	<b>Page</b>
Introduction.....	1
Contacting Fluke .....	1
Safety Information .....	2
How to Get Started.....	5
Getting Acquainted with the Meter .....	6
Measuring Electrical Parameters.....	17
Input Impedance.....	17
Ranges .....	17
Measuring a Composite Signal.....	17
Testing Diodes.....	18
Displaying Minimum, Maximum, and Average.....	18
Using TouchHold .....	19
Compensating for Test Lead Resistance.....	19
Using the Current Output Functions .....	20
Source Mode .....	20

Simulate Mode .....	22
Changing the Current Span .....	22
Producing a Steady mA Output.....	24
Manually Stepping the mA Output .....	25
Auto Ramping the mA Output .....	26
Power-Up Options.....	27
Battery Life.....	28
Using the Holster and Flex-Stand .....	28
Maintenance .....	28
General Maintenance.....	28
Calibration.....	28
Replacing the Battery.....	30
Replacing a Fuse .....	31
If the Meter does not Work.....	32
Replacement Parts and Accessories .....	33
Specifications.....	36

**Index**

# ***ProcessMeter***

## ***Introduction***

### **⚠ Warning**

**Read “Safety Information” before you use the meter.**

Your Fluke 787 ProcessMeter™ (referred to as “the meter”) is a handheld, battery-operated tool for measuring electrical parameters and supplying steady or ramping current to test process instruments. It has all the features of a digital multimeter, plus current output capability.

Your meter is shipped with a Flex-Stand™ holster, one set of TL75 test leads, one set of AC70A Alligator Clips, this manual, and a laminated Quick Reference Card that fits inside the holster.

If the meter is damaged or something is missing, contact the place of purchase immediately.

Contact your Fluke distributor for information about DMM accessories. To order replacement parts or spares, see Table 13 near the end of this manual.

## ***Contacting Fluke***

To order accessories, receive operating assistance, or get the location of the nearest Fluke distributor or Service Center, call:

USA : 1-888-99-FLUKE (1-888-993-5853)

Canada: 1-800-36-FLUKE (1-800-363-5853)

Europe: +31 402-678-200

Japan: +81-3-3434-0181

Singapore: +65-738-5655

Anywhere in the world: +1-425-446-5500

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The Netherlands

Or visit us on the World Wide Web: [www.fluke.com](http://www.fluke.com)

## **Safety Information**

The meter complies with IEC1010-1, ANSI/ISA S82.01-1994 and CAN/CSA C22.2 No. 1010.1-92 Overvoltage Category III. Use the meter only as specified in this manual, otherwise the protection provided by the meter may be impaired.

A **Warning** identifies conditions and actions that pose hazard(s) to the user; a **Caution** identifies conditions and actions that may damage the meter or the equipment under test.

International symbols used on the meter and in this manual are explained in Table 1.

### **⚠ Warning**

**To avoid possible electric shock or personal injury:**

- **Do not use the meter if it is damaged. Before you use the meter, inspect the case. Look for cracks or missing plastic. Pay particular attention to the insulation surrounding the connectors.**

- **Make sure the battery door is closed and latched before you operate the meter.**
- **Remove test leads from the meter before you open the battery door.**
- **Inspect the test leads for damaged insulation or exposed metal. Check test leads continuity. Replace damaged test leads before you use the meter.**
- **Do not use the meter if it operates abnormally. Protection may be impaired. When in doubt, have the meter serviced.**
- **Do not operate the meter around explosive gas, vapor, or dust.**
- **Use only a single 9V battery, properly installed in the meter case, to power the meter.**
- **When servicing the meter, use only specified replacement parts.**

### **Caution**

**To avoid possible damage to meter or to equipment under test:**

**Disconnect the power and discharge all high-voltage capacitors before testing resistance or continuity.**













**Use the proper jacks, function, and range for your measurement or sourcing application.**

To protect yourself, adhere to the following guidelines:

- Use caution when working above 30V ac rms, 42V ac pk, or 60V dc. Such voltages pose a shock hazard.
- When using the probes, keep your fingers behind the finger guards on the probes.
- Connect the common test lead before you connect the live test lead. When you disconnect test leads, disconnect the live test lead first.



**Table 1. International Symbols**

Symbol	Meaning	Symbol	Meaning
	Alternating current		Earth ground
	Direct current		Fuse
	Alternating or direct current		Conforms to European Union directives
	Refer to the manual for information about this feature.		Conforms to relevant Canadian Standards Association directives
	Battery		Double insulated
	Meets Underwriters' Laboratories safety requirements		Inspected and licensed by TÜV Product Services
CAT III	Overvoltage (Installation) Category III, Pollution Degree 2 per IEC1010-1 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).		

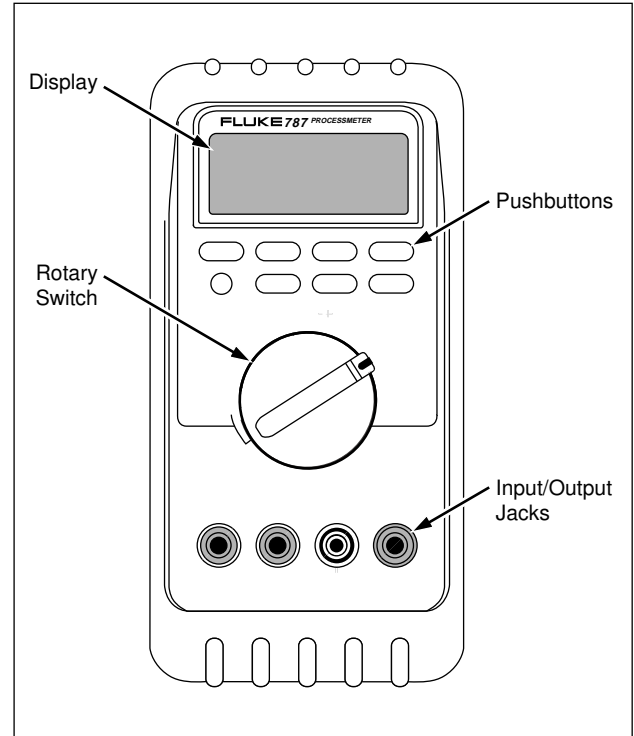
## **How to Get Started**

If you are familiar with the Fluke 80 Series DMM, read “Using the Current Output Functions,” review the tables and figures in “Getting Acquainted with the Meter,” and begin using your meter.

If you are unfamiliar with Fluke 80 Series DMMs, or DMMs in general, read “Measuring Electrical Parameters” in addition to the sections referenced in the previous paragraph.

The sections following “Using the Current Output Functions” contain information about the power-up options, and battery and fuse replacement instructions.

Later, use the Quick Reference Card to refresh your memory about the various functions and features that you can use.



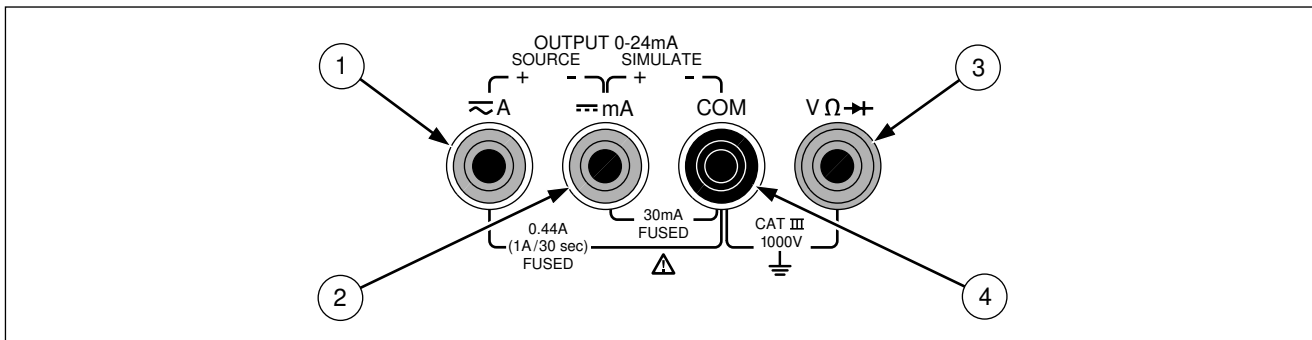
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**Figure 1. Fluke 787 ProcessMeter**

## Getting Acquainted with the Meter

To become familiar with the features and functions of the meter, study the following figures and tables.




- Figure and Table 2 describe the input/output jacks.
- Figure and Table 3 describe the input functions you get with the first five rotary switch positions.
- Figure and Table 4 describe the output functions you get with the last two rotary switch positions.
- Figure and Table 5 describe the functions of the pushbuttons.
- Figure and Table 6 explain what all the elements of the display indicate.



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**Figure 2. Input/Output Jacks**

**Table 2. Input/Output Jacks**

Item	Jack	Measurement Functions	Source Current Function	Simulate Transmitter Function
①	 A	Input for current to 440 mA continuous. (1A for up to 30 seconds.) Fused with a 440 mA fuse.	Output for dc current to 24 mA.	
②	 mA	Input for current to 30 mA. Fused with a 440 mA fuse.	Common for dc current output to 24 mA.	Output for transmitter simulation to 24 mA. (Use in series with an external loop supply.)
③	V $\Omega$ 	Input for voltage to 1000V, $\Omega$ , continuity, and diode test.		
④	COM	Common for all measurements.		Common for transmitter simulation to 24 mA. (Use in series with an external loop supply.)

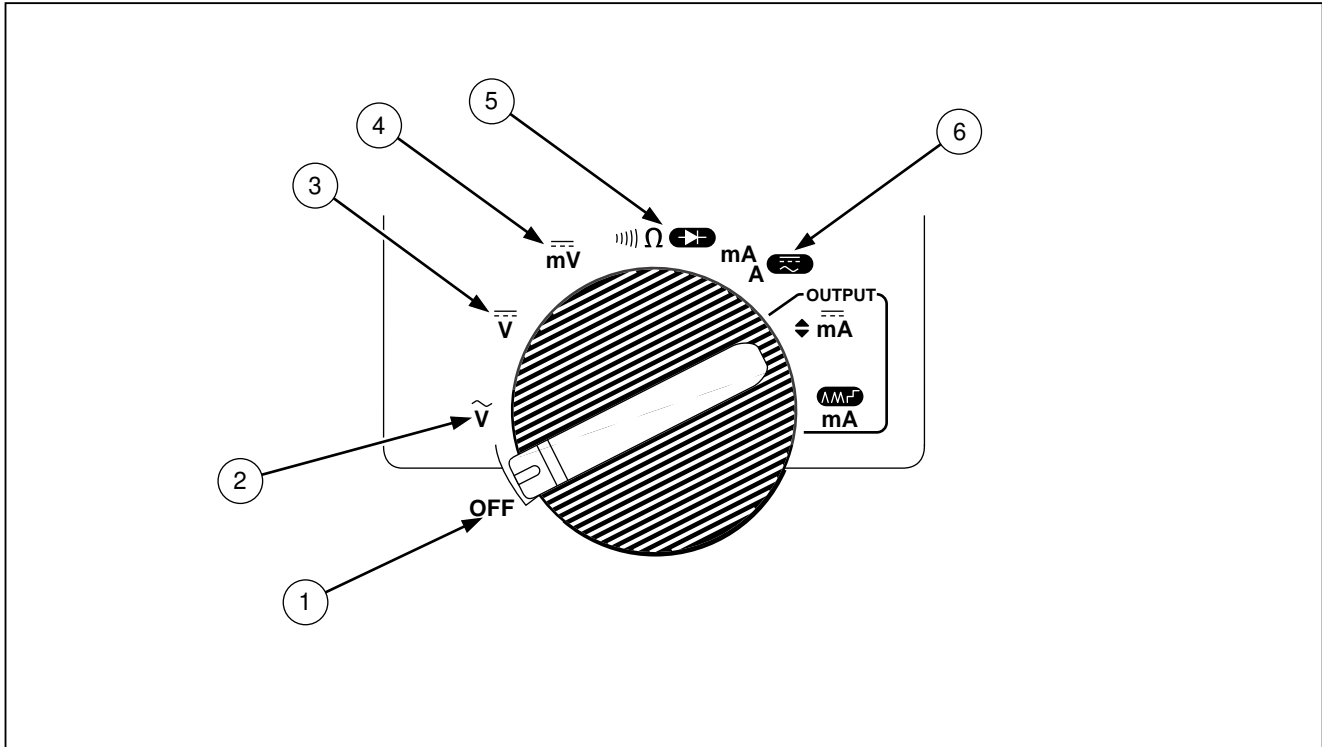













Figure 3. Rotary Switch Positions for Measurements

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**Table 3. Rotary Switch Positions for Measurements**

No.	Position	Function(s)	Pushbutton Actions
①	OFF	Meter off	
②	V ~	Default: measure ac V   Hz Frequency counter	 Selects a MIN, MAX, or AVG action (see pg. 18)  Selects a fixed range (hold 1 second for auto range)  Toggles TouchHold  Toggles relative reading (sets a relative zero point)
③	= V	Measure dc V	Same as above
④	= mV	Measure dc mV	Same as above
⑤	 Ω 	Default: measure Ω   for continuity BLUE  test	Same as above, except diode test has only one range
⑥	mA A 	<i>High test lead in</i>  A: measure A dc  BLUE selects ac  <i>High test lead in</i> = mA: measure mA dc	Same as above, except there is only one range for each input jack position, 30 mA or 1A

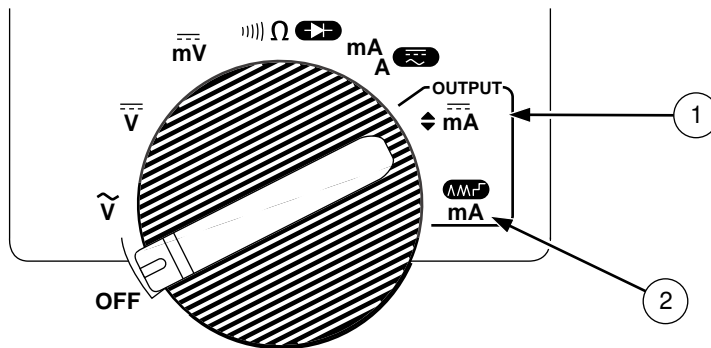



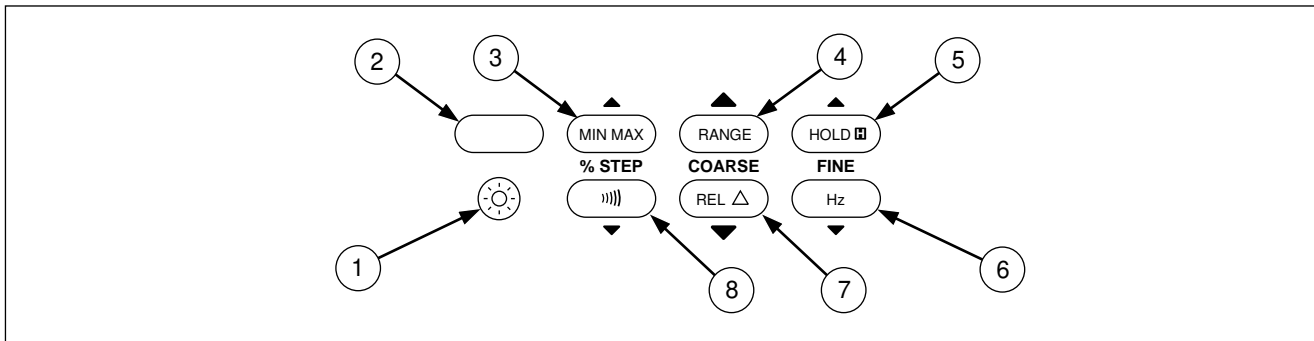
Figure 4. Rotary Switch Positions for mA Output

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**Table 4. Rotary Switch Positions for mA Output**

No.	Position	Default Function	Pushbutton Actions
①	OUTPUT ◆ mA	<i>Test leads in</i> <b>SOURCE:</b> Source 0% mA  <i>Test leads in</i> <b>SIMULATE:</b> Sink 0% mA	% STEP ▲ or ▼: Adjusts output up or down to the next 25% step  COARSE ▲ or ▼: Adjusts output up or down 0.1 mA  FINE ▲ or ▼: Adjusts output up or down 0.001 mA
②	OUTPUT mA 	<i>Test leads in</i> <b>SOURCE:</b> Source repeating 0% -100%-0% slow ramp (∧)  <i>Test leads in</i> <b>SIMULATE:</b> Sink repeating 0% -100%-0% slow ramp (∧)	BLUE cycles through: <ul style="list-style-type: none"> <li>• Fast repeating 0% -100% - 0% ramp (∧ on display)</li> <li>• Repeating 0% -100% - 0% ramp in 25% steps (┌ on display)</li> <li>• Slow repeating 0% -100% - 0% ramp (∧ on display)</li> </ul>

















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Figure 5. Pushbuttons

Table 5. Pushbuttons

No.	Pushbutton	Function(s)
①		Toggles the backlight
②	 (BLUE)	Rotary switch in mA A  position and test lead plugged into  A jack: Toggles between ac and dc ampere measure Rotary switch in  Ω  position: Selects diode test function () Rotary switch in OUTPUT mA  position: Cycles through <ul style="list-style-type: none"> <li>• Slow repeating 0% -100% - 0% ramp ( on display)</li> <li>• Fast repeating 0% -100% - 0% ramp ( on display)</li> <li>• Repeating 0% -100% - 0% ramp in 25% steps ( on display)</li> </ul>

**Table 5. Pushbuttons (cont.)**

No.	Pushbutton	Function(s)
③	  % STEP	<i>Measuring:</i> Selects a MIN, MAX, or AVG action (see pg. 18) <i>mA Output:</i> Adjusts mA output up to the next higher 25% step
④	  COARSE	<i>Measuring:</i> Selects a fixed range (hold for 1 second for auto range) <i>mA Output:</i> Adjusts output up 0.1 mA
⑤	  FINE	<i>Measuring:</i> Toggles TouchHold, or in MIN MAX recording, suspends recording <i>mA Output:</i> Adjusts output up 0.001 mA
⑥	FINE  	<i>Measuring:</i> Toggles between frequency counter and ac voltage measurement functions <i>mA Output:</i> Adjusts output down 0.001 mA
⑦	COARSE  	<i>Measuring:</i> Toggles relative reading (sets a relative zero point) <i>mA Output:</i> Adjusts output down 0.1 mA
⑧	% STEP  	<i>Measuring:</i> Toggles between $\Omega$ measure and continuity functions <i>mA Output:</i> Adjusts mA output down to the next lower 25% step

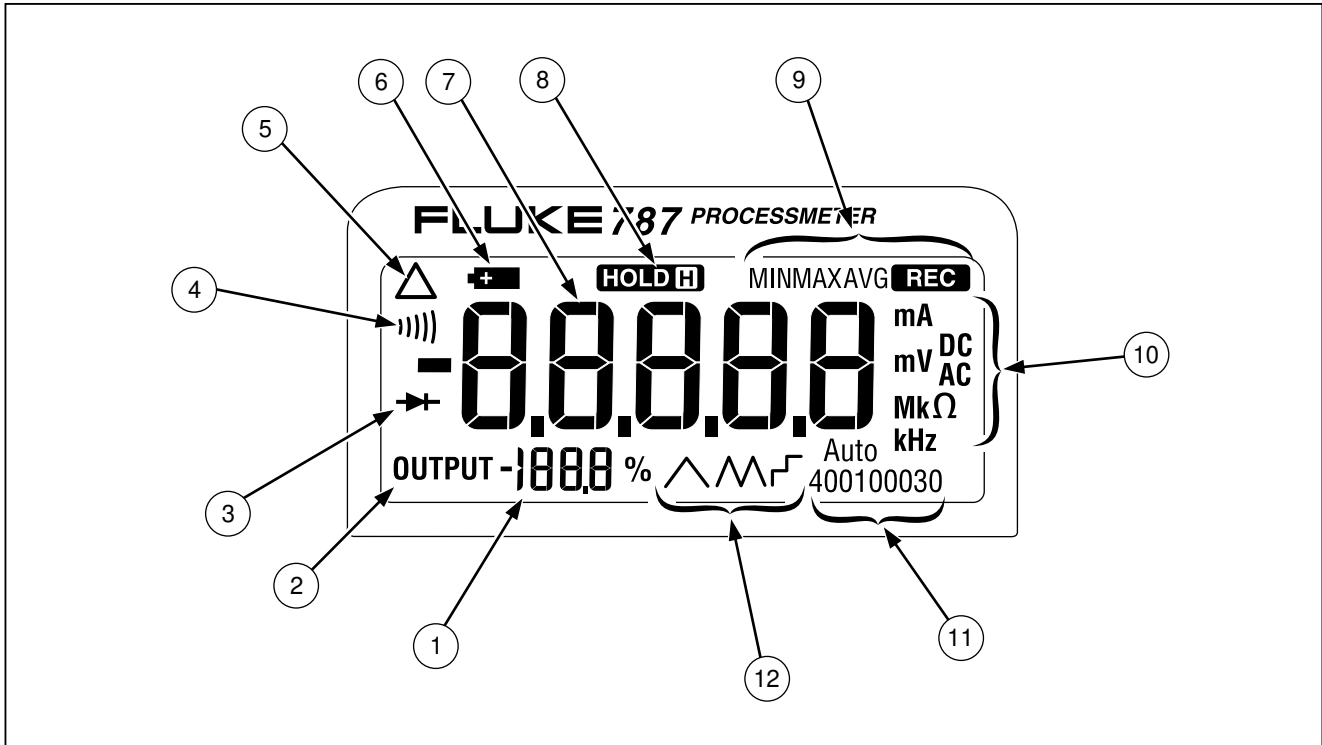


Figure 6. Elements of the Display

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**Table 6. Display**







No.	Element	Meaning
①	Percentage display	Shows the mA measured value or output level in %, in a 0-20 mA or 4-20 mA scale (change scales with power-up option)
②	OUTPUT	Lights when mA output (source or simulate) is active
③		Lights in diode test function
④	)))	Lights in continuity function
⑤	△	Lights when relative reading is on
⑥		Lights when the battery is low
⑦	Numerals	Show the input or output value
⑧		Lights when TouchHold is on
⑨	MINMAXAVG 	<p>MIN MAX recording status indicators:</p> <p>MIN means the display is showing the minimum recorded value.</p> <p>MAX means the display is showing the maximum recorded value.</p> <p>AVG means the display is showing the average value since starting recording (up to about 35 hours continuous recording time).</p> <p> means MIN MAX recording is on.</p>

Table 6. Display (cont.)

No.	Element	Meaning
⑩	<b>mA, DC, mV, AC, M or kΩ, kHz</b>	Show the input or output units and multipliers associated with the numerals
⑪	<b>Auto 400100030</b>	Range status indicators: <b>Auto</b> means autoranging is on. The number plus the unit and multiplier indicate the active range.
⑫	∧ ∞ ⌋	One of these lights in mA ramping or step output (rotary switch position mA  ): ∧ means slow continuous 0% - 100% - 0% ramping. ∞ means fast continuous 0% - 100% - 0% ramping. ⌋ means ramping in 25% steps.

## Measuring Electrical Parameters

The proper sequence for taking measurements is as follows:

1. Plug the test leads into the appropriate jacks.
2. Set the rotary knob.
3. Touch the probes to the test points.

### Input Impedance

For the voltage measurement functions, input impedance is 10 M $\Omega$ . See the specifications for more information.

### Ranges

A measurement range determines the highest value the meter can measure. Most meter measurement functions have more than one range (see the Specifications).

Being in the right range is important:

- If the range is too low, the display shows **OL** (overload).
- If the range is too high, the meter will not be displaying its most accurate measurement .

The meter normally automatically selects the lowest range that will measure the applied input signal (Auto showing on the display). Press **RANGE** if you want to lock the range. Each time you press **RANGE** , the meter selects the next higher range.

If you have locked the range, the meter resumes auto ranging when you change to another measurement function or you press **RANGE** and hold it for 1 second.

### Measuring a Composite Signal




Because the input is dc-coupled, to measure an ac voltage or frequency with a dc bias, you must manually select the range specified in Table 7. For example, to measure 100 mV ac with 20 V dc superimposed, select the 4 V range.

**Table 7. Range Requirements for Measuring a Composite Signal**

Range (ac)	Max. Allowable AC + DC
400.0 mV	3 V
4.000 V	30 V
40.00 V	300 V
400.0 V	400 V
1000 V	1000 V


### Testing Diodes



To test a single diode:

1. Insert the red test lead into the  $V\Omega$   jack and black test lead into the COM jack.
2. Set the rotary switch to  $\Omega$   .
3. Press the BLUE pushbutton so that the  symbol is on the display.
4. Touch the red probe to the anode and the black probe to the cathode (side with band or bands). The meter should indicate the appropriate diode voltage drop.
5. Reverse the probes. The meter should display OL, indicating a high impedance.
6. The diode is good if it passes the tests in steps 4 and 5.



### Displaying Minimum, Maximum, and Average

MIN MAX recording stores the lowest and highest measurements, and maintains the average of all measurements.

Press  to turn on MIN MAX recording. Readings are stored until you turn the meter off, switch to another measurement or source function, or turn MIN MAX off. The beeper sounds when a new maximum or minimum is recorded. Auto power-off is disabled and auto ranging is turned off during MIN MAX recording.

Press  again to cycle through the MAX, MIN, and AVG displays. Press and hold  for 1 second to erase stored measurements and exit .

If MIN MAX recording is on continuously for over 40 hours, minimum and maximum readings are still recorded, but the displayed average no longer changes.

In MIN MAX recording, press  to suspend recording; press  again to resume recording.

## **Using TouchHold**

### *Note*

*You must have MIN MAX recording off to use TouchHold.*

### **Warning**

**To avoid possible electric shock, do not use TouchHold to determine if dangerous voltage is present. TouchHold will not capture unstable or noisy readings.**

Activate TouchHold<sup>®</sup> if you want the meter to freeze the display on each new stable reading (except in the frequency counter function). Press **HOLD** to activate TouchHold. This feature allows you to take measurements in situations in which it is difficult to look at the display. The meter beeps and updates the display with each new stable reading.

## **Compensating for Test Lead Resistance**

Use the relative reading feature ( $\Delta$  on the display) to set the present measurement as a relative zero. A common use for this is to compensate for test lead resistance when measuring  $\Omega$ .

Select the  $\Omega$  measure function, touch the test leads together, then press **REL $\Delta$** . Until you press **REL $\Delta$**  again, or switch to another measurement or source function, the readings on the display will subtract the lead resistance.



## ***Using the Current Output Functions***

The meter provides steady, stepped, and ramped current output for testing 0-20 mA and 4-20 mA current loops.

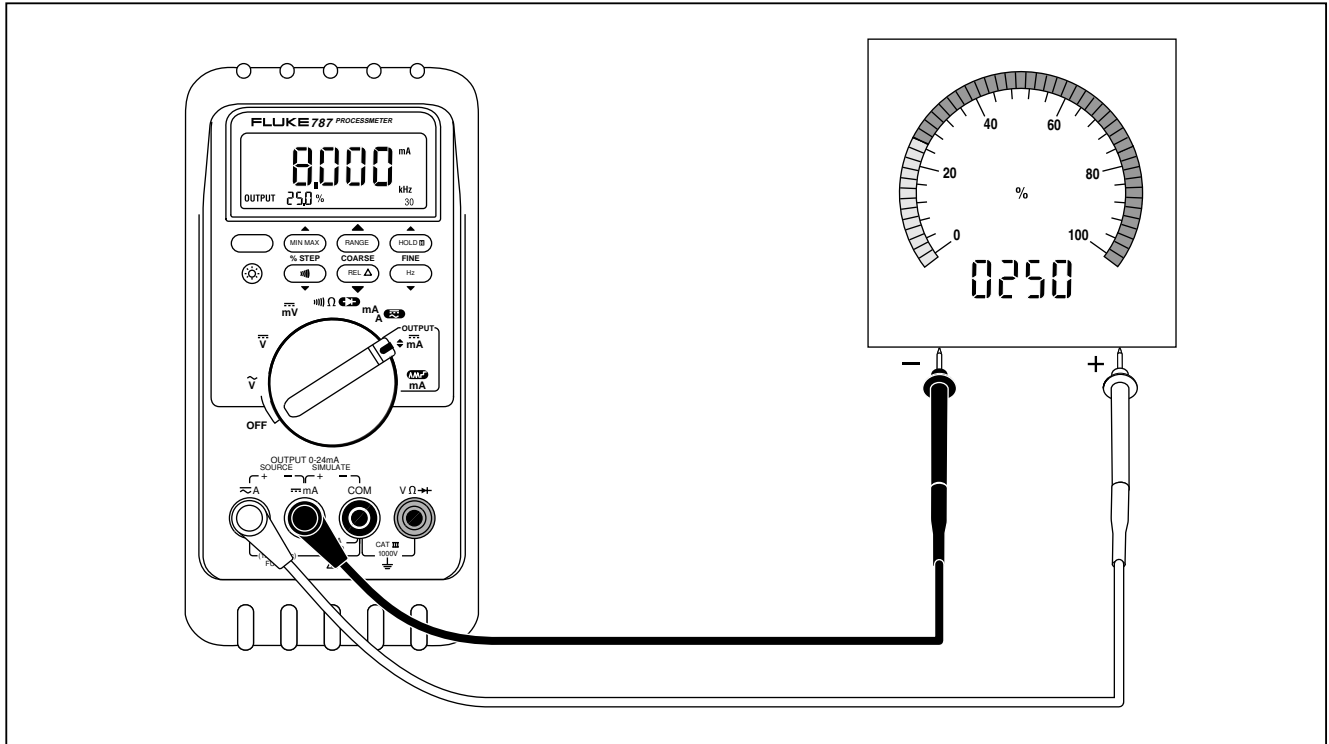
You can choose source mode, in which the meter supplies the current, or simulate mode, in which the meter regulates current in an externally-powered current loop.

### ***Source Mode***

Source mode is selected automatically by inserting the test leads into the SOURCE + and – jacks as shown in Figure 7. Use source mode whenever you need to supply

current into a passive circuit such as a current loop with no loop supply. Source mode depletes the battery faster than simulate mode, so use simulate mode whenever possible.

The display looks the same in source and simulate modes. The way to tell which mode is in use is to see which pair of output jacks is in use.



**Figure 7. Sourcing Current**

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