

Instructions Manual

Tektronix

DMM157

Digital Multimeter

Serial Numbers Above TW80000

070-9933-00

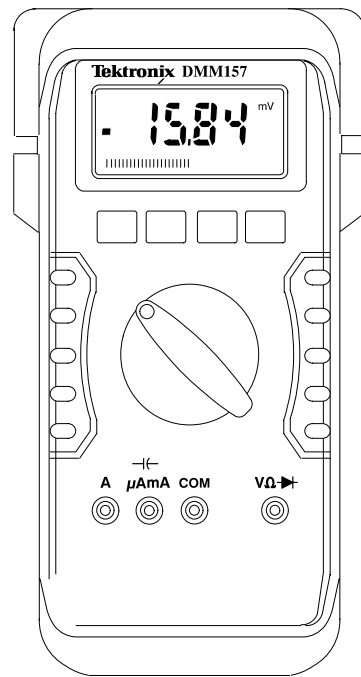


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DMM157 Digital Multimeter

The DMM157 is a rugged, handheld digital multimeter that allows you to make accurate measurements quickly and easily. Whether you are a professional or hobbyist, this instrument provides a useful range of features.



- Shock-absorbing holster
- Tilt stand, holster hook, and probe holders
- 3200 count LCD display
- Autorange (volts, ohms) and manual range selection
- Measurement hold
- Measures DC and AC voltage, DC and AC current, resistance, and capacitance
- Diode and continuity tester with audible signal
- Overvoltage and overload protection
- Alarm that warns of improper connections to the current inputs
- Recessed input jacks for safety
- Automatic power off after ten minutes prolongs battery life
- Low-battery indicator
- Uses two standard AAA 1.5 V batteries

Figure 1: DMM157 Digital Multimeter

DMM157 Specifications

All specifications are warranted unless noted typical.

Stated accuracies are \pm (% reading + number of counts) at 23° C \pm 5° C, at less than 75% R.H. (relative humidity).

Table 1: General specifications


Characteristics	Description
Display	3200 count Liquid Crystal Display (LCD) with a 65 segment analog bargraph
Polarity indication	Automatic; positive implied, negative indicated
Overrange indication	"OL" or "-OL" displayed
Low battery indication	The battery symbol displays when the battery voltage drops below the operating voltage level
Sampling rate	2 times/second
Power supply	Two standard AAA, IEC LR03, or ANSI/NEDA 24A 1.5 V batteries
Battery life (typical)	600 hours (alkaline batteries)
Maximum input voltage	600 VDC or 600 VAC _{RMS} CAT II between V and COM terminals
Maximum floating voltage	600 VDC or 600 VAC _{RMS} CAT II between any terminal and earth GND
Maximum open circuit voltage (current/capacitance inputs)	240 VDC or 240 VAC _{RMS} between current inputs and COM terminals
Overload protection	
V connector	600 VDC or 600 VAC _{RMS}
A connector	13 A (240 V) fast blow fuse (type AGX or 8AG) Tektronix part number 159-0357-00
μ A/mA connector	1 A (240 V) fast blow fuse (type AGX or 8AG) Tektronix part number 159-0355-00
TL60 test lead set	Rated 1000 V  ANS/ISA S82.02-1988 CSA 22.2 No 231.1 M89 C/NRTL LR100328
Operating altitude	2000 m (6561 ft.), maximum
Operating temperature	0° C to +50° C, 0–80% R.H.
Storage temperature	-20° C to +60° C, 0–80% R.H. with batteries removed from the meter
Dimension (H \times W \times D) with holster	165 mm \times 85 mm \times 40 mm (6.5 in. \times 3.3 in. \times 1.5 in.)

Table 2: Measurement characteristics

Characteristics	Description
DC Volts	
Ranges	300 mV, 3 V, 30 V, 300 V, 600 V
Accuracy	$\pm(0.5\% \text{ reading} + 2 \text{ counts})$
Input impedance (typical)	
300 mV	Near infinite resistance paralleled by less than 100 pF
3 V, 30 V, 300 V, 600 V	10 M Ω to 11 M Ω paralleled by less than 100 pF
Resolution (by range)	
300 mV	100 μ V
3 V	1 mV
30 V	10 mV
300 V	100 mV
600 V	1 V
AC Volts	
Ranges	3 V, 30 V, 300 V, 600 V
Accuracy	$\pm(1.5\% \text{ reading} + 5 \text{ counts})$
Frequency response	40 Hz to 500 Hz (3 V range is 40 Hz to 300 Hz)
Input impedance (typical)	10 M Ω to 11 M Ω paralleled by less than 100 pF
Resolution (by range)	
3 V	1 mV
30 V	10 mV
300 V	100 mV
600 V	1 V
AC conversion type	Average sensing RMS indication
DC current	
Ranges	300 μ A, 3 mA, 30 mA, 300 mA, 10 A (10 A range: 30 seconds maximum above 10 A input up to 20 A)
Accuracy (by range)	
300 μ A, 30 mA	$\pm(0.9\% \text{ reading} + 2 \text{ counts})$
3 mA, 300 mA	$\pm(1.2\% \text{ reading} + 2 \text{ counts})$
10 A	$\pm(2.5\% \text{ reading} + 5 \text{ counts})$
Resolution (by range)	
300 μ A	0.1 μ A
3 mA	1 μ A
30 mA	10 μ A
300 mA	100 μ A
10 A	10 mA

Table 2: Measurement characteristics (cont.)

Characteristics	Description
AC current	
Ranges	300 μ A, 3 mA, 30 mA, 300 mA, 10 A (10 A range: 30 seconds maximum above 10 A input up to 20 A)
Accuracy (by range)	
300 μ A, 3 mA, 30 mA	$\pm(1.5\%$ reading + 4 counts)
300 mA	$\pm(2\%$ reading + 4 counts)
10 A	$\pm(2.9\%$ reading + 5 counts)
Frequency response	40 Hz to 500 Hz
Resolution (by range)	
300 μ A	0.1 μ A
3 mA	1 μ A
30 mA	10 μ A
300 mA	100 μ A
10 A	10 mA
AC conversion type	Average sensing RMS indication
Resistance	
Ranges	300 Ω , 3 k Ω , 30 k Ω , 300 k Ω , 3 M Ω , 30 M Ω
Accuracy (by range)	
300 Ω , 3 M Ω	$\pm(1\%$ reading + 4 counts)
30 M Ω	$\pm(2\%$ reading + 5 counts)
Other ranges	$\pm(0.8\%$ reading + 2 counts)
Test voltage	Approximately 1.3 V open-circuit
Resolution (by range)	
300 Ω	0.1 Ω
3 k Ω	1 Ω
30 k Ω	10 Ω
300 k Ω	100 Ω
3 M Ω	1 k Ω
30 M Ω	10 k Ω
Capacitance	
Ranges	3 μ F, 30 μ F, 300 μ F, 3000 μ F
Accuracy (by range)	
3 μ F, 30 μ F	$\pm(1.9\%$ reading + 5 counts)
300 μ F	$\pm(1.9\%$ reading + 10 counts)
3000 μ F	$\pm(2.9\%$ reading + 20 counts)

Table 2: Measurement characteristics (cont.)

Characteristics	Description
Resolution (by range)	
3 μ F	1 nF
30 μ F	10 nF
300 μ F	100 nF
3000 μ F	1 μ F
Test frequency	
3 μ F, 30 μ F	82 Hz
300 μ F, 3000 μ F	8.2 Hz
Test voltage	3.3 V peak
Continuity check	
Threshold	The beeper sounds if the resistance of the circuit measured is < 100 Ω
Beeper frequency (typical)	2 kHz
Diode test	
Test current	1.5 mA maximum
Test voltage	3.3 V maximum open circuit
Auto power off	The meter automatically shuts off in about ten minutes from the last function or mode change. The meter turns on again when any button is pressed.

Table 3: Certifications and compliances

EC Declaration of Conformity	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility and Low Voltage Directive 73/23/EEC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EMC Directive 89/336/EEC: EN 55011 Class B Radiated and Conducted Emissions EN 50082-1 Immunity: IEC 801-2 Electrostatic Discharge Immunity IEC 801-3 RF Electromagnetic Field Immunity Low Voltage Directive 73/23/EEC as amended by 93/68/EEC: EN 61010-1/A2 Safety requirements for electrical equipment for measurement, control, and laboratory use
Certifications	Listed UL3111-1 and CAN/CSA C22.2 No. 1010.1.
Overvoltage Category	Category: Examples of Products in this Category: CAT III Distribution-level mains, fixed installation CAT II Local-level mains, appliances, portable equipment CAT I Signal levels in special equipment or parts of equipment, telecommunications, electronics
Pollution Degree 2	Do not operate in environments where conductive pollutants may be present.

DMM157 Performance Verification

This section contains procedures to verify that the DMM157 Digital Multimeter performs as warranted. If an instrument fails any of these checks, it needs adjustment and or repair.

The performance verification procedures provide a valid confirmation of instrument electrical characteristics and function under the following conditions:

- The multimeter operates in an 18° to 28° C (64° to 82° F) ambient environment with a relative humidity of less than 75%.
- The multimeter stabilizes in the stated ambient temperature for one hour.
- The multimeter warms up for five minutes.
- For AC measurements, allow the multimeter to settle to its final value before taking the measurement.
- The multimeter remains fully assembled and in the holster.

The DMM157 performance verification consists of the checks listed in Table 4.

Table 4: Performance verification checks

AC Volts Check
DC Volts Check
Ω Check
Continuity Check
Capacitance Check
DC Microampere Check
DC Milliampere Check
AC Microampere Check
AC Milliampere Check
DC Ampere Check
AC Ampere Check

The performance verification procedure should be performed annually or after every 2000 hours of operation if used infrequently.

Test Equipment

The performance verification procedures use external traceable test equipment to directly check warranted characteristics.

Alternative test equipment must meet or exceed the intended minimum requirements specified in Table 5. If you substitute equipment, you may need to modify the procedures.

NOTE. Before beginning the performance verification procedures, warm up the test equipment according to the manufacturer's recommendations.

Table 5: Test equipment

Description	Minimum requirements	Example product
Universal Calibration System	Resolution & accuracy 4 times greater than the multimeter display reading.	Wavetek 9100
	AC and DC volts measurement ¹ AC and DC current measurement	
	Resistance measurement ¹ Capacitance measurement	
Capacitance Standard		Optional

¹ Choose 4-wire measurement setup if available.

Set Up

To prepare for the performance verification checks, do the following steps.

1. Allow the multimeter to stabilize at the ambient temperature for one hour before testing.
2. Turn the multimeter on by rotating the function switch to any position other than OFF.

NOTE. You need to keep the multimeter powered on throughout the warm-up period and throughout the entire verification procedure.

3. Warm up the multimeter for five minutes.
4. Photocopy the test record on pages 15 through 17 to record your test results.

Verification Procedure

Implement the following checks to verify the performance of your DMM157 multimeter.



WARNING. To avoid electric shock, avoid touching exposed connections.

AC Volts Check

Perform the following steps to verify the AC voltage measurement accuracy.

1. Set the multimeter dial to $V \approx$.
2. Push the BLUE button to select AC volts.
3. Connect the calibrator outputs to the multimeter $V \Omega \rightarrow$ and COM input connectors.
4. Set the calibrator to each of the values in the AC volts test record and verify that the multimeter reads within the specified Display minimum and maximum limits.
5. Set the calibrator output to OFF.
6. Disconnect the calibrator from the multimeter.

DC Volts Check

Perform the following steps to verify the DC volts measurement accuracy.

1. Set the multimeter dial to $V \approx$.
2. Connect the calibrator outputs to the multimeter $V \Omega \rightarrow$ and COM input connectors.
3. Set the calibrator to each of the values in the DC volts test record and verify that the multimeter reads within the specified Display minimum and maximum limits.
4. Set the calibrator output to OFF.
5. Disconnect the calibrator from the multimeter.

- Ω Check** Perform the following steps to verify the resistance measurement accuracy in Ω mode.
1. Set the multimeter dial to Ω .
 2. Connect the calibrator outputs to the multimeter V Ω \rightarrow and COM input connectors.
 3. Set the calibrator to each of the values in the Ω test record and verify that the multimeter reads within the specified Display minimum and maximum limits.
 4. Set the calibrator output to OFF.
 5. Disconnect the calibrator from the multimeter.

- Continuity Check** Perform the following steps to verify the continuity check accuracy.
1. Set the multimeter dial to \rightarrow .
 2. Connect the calibrator outputs to the multimeter V Ω \rightarrow and COM input connectors.
 3. Set the calibrator to each of the values in the Continuity test record and verify proper operation.
 4. Set the calibrator output to OFF.
 5. Disconnect the calibrator from the multimeter.
 6. Insert the multimeter test leads into the V Ω \rightarrow and COM input connectors of the multimeter.
 7. Short the test leads together and check for proper operation.

- Capacitance Check** Perform the following steps to verify the capacitance measurement accuracy.
1. Set the multimeter dial to to the capacitance ranges indicated in the test record.
 2. Set the calibrator to each of the values in the Capacitance test record for each multimeter range and verify that the multimeter reads within the specified Display minimum and maximum limits.
 3. Set the calibrator output to OFF.
 4. Disconnect the calibrator from the multimeter.

- DC Microampere Check** Perform the following steps to verify the DC microampere measurement accuracy.
1. Set the multimeter dial to μA \approx .
 2. Connect the calibrator outputs to the multimeter μA mA \leftarrow and COM input connectors.
 3. Set the calibrator to each of the values in the DC microampere test record and verify that the multimeter reads within the specified Display minimum and maximum limits.
 4. Set the calibrator output to OFF.

- DC Milliampere Check** Perform the following steps to verify the DC milliampere measurement accuracy.
1. Set the multimeter dial to mA \approx .
 2. Connect the calibrator outputs to the multimeter μA mA \leftarrow and COM input connectors.
 3. Set the calibrator to each of the values in the DC milliampere test record and verify that the multimeter reads within the specified Display minimum and maximum limits.
 4. Set the calibrator output to OFF.
 5. Disconnect the calibrator from the multimeter.

- AC Microampere Check** Perform the following steps to verify the AC microampere measurement accuracy.
1. Set the multimeter dial to μA \approx .
 2. Push the BLUE button to select AC mode.
 3. Connect the calibrator outputs to the multimeter μA mA \leftarrow and COM input connectors.
 4. Set the calibrator to each of the values in the AC milliampere test record and verify that the multimeter reads within the specified Display minimum and maximum limits.
 5. Set the calibrator output to OFF.
 6. Disconnect the calibrator from the multimeter.

AC Milliampere Check Perform the following steps to verify the AC milliampere measurement accuracy.

1. Set the multimeter dial to mA \approx .
2. Push the BLUE button to select AC mode.
3. Connect the calibrator outputs to the multimeter μ A mA \leftarrow and COM input connectors.
4. Set the calibrator to each of the values in the AC milliampere test record and verify that the multimeter reads within the specified Display minimum and maximum limits.
5. Set the calibrator output to OFF.
6. Disconnect the calibrator from the multimeter.

DC Ampere Check Perform the following steps to verify the DC ampere measurement accuracy.

1. Set the multimeter dial to A \approx .
2. Connect the calibrator outputs to the multimeter A and COM input connectors.
3. Set the calibrator to each of the values in the DC ampere test record and verify that the multimeter reads within the specified Display minimum and maximum limits.
4. Set the calibrator output to OFF.
5. Disconnect the calibrator from the multimeter.

AC Ampere Check Perform the following steps to verify the AC ampere measurement accuracy.

1. Set the multimeter dial to A \approx .
2. Push the BLUE button to select AC mode.
3. Connect the calibrator outputs to the multimeter A and COM input connectors.
4. Set the calibrator to each of the values in the AC ampere test record and verify that the multimeter reads within the specified Display minimum and maximum limits.
5. Set the calibrator output to OFF.
6. Disconnect the calibrator from the multimeter.

DMM157 Test Record

Serial number	Procedure performed by	Date

DMM157 test record

Test input	Tolerance	Display minimum	Reading	Display maximum
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AC volts test

2.900 V	50 Hz	$\pm 1.5\% + 5$ counts	2.852 V	2.948 V
	300 Hz	$\pm 1.5\% + 5$ counts	2.852 V	2.948 V
29.00 V	50 Hz	$\pm 1.5\% + 5$ counts	28.52 V	29.48 V
	400 Hz	$\pm 1.5\% + 5$ counts	28.52 V	29.48 V
290.0 V	50 Hz	$\pm 1.5\% + 5$ counts	285.2 V	294.8 V
	400 Hz	$\pm 1.5\% + 5$ counts	285.2 V	294.8 V
600.0 V	50 Hz	$\pm 1.5\% + 5$ counts	586 V	614 V
	400 Hz	$\pm 1.5\% + 5$ counts	586 V	614 V

DC volts test

290.0 mV	$\pm 0.5\% + 2$ counts	288.4 mV	291.6 mV
2.900 V	$\pm 0.5\% + 2$ counts	2.884 V	2.916 V
29.00 V	$\pm 0.5\% + 2$ counts	28.84 V	29.16 V
290.0 V	$\pm 0.5\% + 2$ counts	286.4 V	291.6 V
600.0 V	$\pm 0.5\% + 2$ counts	595 V	605 V

Ω test

0.00 Ω	$\pm 1.0\% + 4$ counts	-0.4 Ω	0.4 Ω
300.0 Ω	$\pm 1.0\% + 4$ counts	296.6 Ω	303.4 Ω
3.000 k Ω	$\pm 0.8\% + 2$ counts	2.974 k Ω	3.026 k Ω
30.00 k Ω	$\pm 0.8\% + 2$ counts	29.74 k Ω	30.26 k Ω
300.0 k Ω	$\pm 0.8\% + 2$ counts	297.4 k Ω	302.6 k Ω
3.000 M Ω	$\pm 1.0\% + 4$ counts	2.966 M Ω	3.034 M Ω
30.00 M Ω	$\pm 2.0\% + 5$ counts	29.35 M Ω	30.65 M Ω

DMM157 test record (cont.)

Test input	Tolerance	Display minimum	Reading	Display maximum
Continuity test				
0.0 Ω		Beeper sounds		
200 Ω		Beeper does not sound		
Multimeter leads shorted		Beeper sounds		

Capacitance test¹

3.000 μF	$\pm 1.9\% + 5$ counts	2.938 μF		3.062 μF
30.00 μF	$\pm 1.9\% + 5$ counts	29.38 μF		30.62 μF
300.00 μF	$\pm 1.9\% + 10$ counts	293.3 μF		306.7 μF

¹ Variations in test equipment can cause erroneous readings. Use a fixed value capacitance standard if instability occurs.

DC microampere test

0.0 μA	± 2 counts	-0.2 μA		0.2 μA
290.0 μA	$\pm 0.9\% + 2$ counts	287.2 μA		292.8 μA

DC milliampere test

2.900 mA	$\pm 1.2\% + 2$ counts	2.863 mA		2.936 mA
29.00 mA	$\pm 0.9\% + 2$ counts	28.72 mA		29.28 mA
290.0 mA	$\pm 1.2\% + 2$ counts	286.3 mA		293.6 mA

AC microampere test (50 Hz)

0.0 μA	± 4 counts	-0.4 μA		0.4 μA
290.0 μA	$\pm 1.5\% + 4$ counts	285.3 μA		294.7 μA

AC milliampere test (50 Hz)

2.900 mA	$\pm 1.5\% + 4$ counts	2.853 mA		2.947 mA
29.00 mA	$\pm 1.5\% + 4$ counts	28.53 mA		29.47 mA
290.0 mA	$\pm 2.0\% + 4$ counts	283.8 mA		296.2 mA

DMM157 test record (cont.)

Test input	Tolerance	Display minimum	Reading	Display maximum
DC ampere test				
10.000 A	2.5% + 5 counts	9.70 A		10.30 A
AC ampere test (60 Hz)				
10.000 A	±2.9% + 5 counts	9.66 A		10.34 A

DMM157 Adjustment Procedure

This section contains the procedure to adjust the DMM157 Digital Multimeter. Perform this procedure once a year or if the *DMM157 Performance Verification* procedure indicates the need for calibration.

In this section you will find the following information:

- A list of test equipment needed to make the adjustments
- Instructions on how to prepare the instrument for adjustment
- Adjustment procedure

The procedure in this section does not verify performance. To confirm that your multimeter meets factory specifications, perform the procedures in the *DMM157 Performance Verification* section.

Test Equipment

The test equipment listed in Table 5 on page 8 is a complete list of equipment needed for the adjustment procedure. This procedure assume that the test equipment is operating within tolerance.

Alternative test equipment must meet or exceed the intended minimum requirements specified in Table 5. If you substitute equipment, you may need to modify the procedures.

Preparation for Adjustment

The following guidelines apply to all DMM157 adjustments:

- Perform all adjustments in a 21° to 25° C ambient environment with a relative humidity of 75% or less.
- Warm up the multimeter for at least 15 minutes.
- Do not alter any setting without reading the entire adjustment procedure first.
- Do not alter a setting unless a performance characteristic cannot be met at the current setting.
- Read the *Safety Summary* at the beginning of this manual.

Open the Meter Case

You must open the multimeter case to access the internal adjustment. Use the following procedure to open the case.

1. Lay the meter face down on a flat work surface that cannot damage the multimeter face.
2. Remove the screw from the case bottom using a standard Philips-head screwdriver.
3. Gently lift the end of the case bottom at the end opposite from the display. Then lift the end nearest the display until it unsnaps from the case top.

To reassemble the multimeter following the adjustments, see page 22.

Adjustment

Perform the following steps to adjust the DC voltage calibration.

1. Set the multimeter dial to $V \approx$.
2. Connect the outputs of the calibrator to the $V \Omega \rightarrow$ and COM input connectors of the multimeter.
3. Set the calibrator to output 290.0 mVDC.
4. Adjust VR1 until the display shows 290.0 to 290.1 mVDC.
5. Turn the calibrator output off.
6. Disconnect the calibrator from the multimeter.

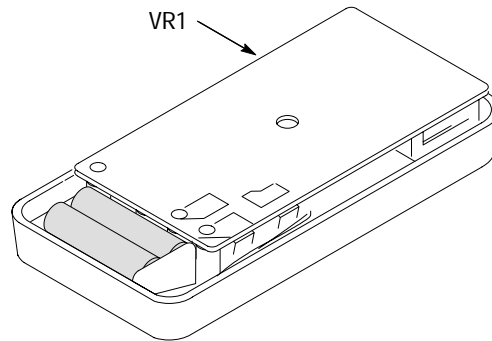


Figure 2: Adjustment location

Reassembling the Multimeter

1. Ensure that the rotary dial is properly aligned.
2. Align the tabs of the bottom case half with the slots in the top case half at the end of the meter near the input connectors.



CAUTION. *Before closing the case, check that the rotary dial is properly aligned and that the battery wires are not pinched.*

3. Close the case, snapping the case halves together.
4. Reinstall the screw.