

**Beckman Industrial**<sup>™</sup>

**OPERATOR'S MANUAL**  
**for Digital Multimeters**  
**DM 800 and DM 850**

*pages 1 to 6*

**BEDIENUNGSANLEITUNG**  
**für Digitale Multimeter**  
**DM 800 und DM 850**

*Seiten 7 bis 11*

**MANUEL D'UTILISATION**  
**pour Multimètres Digitaux**  
**DM 800 et DM 850**

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Beckman Industrial Corporation, Instrumentation Products Division  
A Subsidiary of Emerson Electric Co. 630 Puente Street, Brea, CA 92621, USA

Beckman Industrial Corp. Brea, CA 92621  
Sept. 1985 3000-940-192 Printed in Taiwan

# OPERATOR'S MANUAL FOR DIGITAL MULTIMETERS DM 800 and DM 850

Note: The symbol  $\Delta$  on the front of the instruments means: "Refer to operating instructions."

## I. PRODUCT DESCRIPTION

Model DM 800 is an average sensing, and Model DM 850 a TRUE RMS 4 1/2 digit handheld digital multimeter. In addition to the standard multimeter functions of DCV, ACV, DCA, ACA and Resistance, both models also measure frequency up to 200 kHz. Diode Check, Continuity Check and Data Hold are additional features.

## II. WARNINGS

1. To prevent electrical shock hazard, turn off the multimeter and disconnect the test leads from any device under test and from the multimeter before removing the battery cover or disassembling the unit.
2. Voltages over 24 volts AC or DC can be hazardous. Use extreme care when working on or near such voltage sources.
3. To avoid electrical shock hazard and/or damage to the meter, do not attempt to measure voltages that might exceed 1200 Vdc or 850 Vac above earth ground (500 Vdc/350 Vac on 200 mV range).
4. Each time the instrument is to be used, examine the case and the test probe for cracks or breaks in the insulation. If defects are found, replace the item immediately. **DO NOT USE IN A DAMAGED CONDITION.**
5. To avoid electrical shock hazard, do not touch the test lead tips or the circuit being tested while power is applied to the circuit under test.
6. Measurement of AC power sources with inductive loads or AC power sources during electrical storms may result in extremely high-voltage, high-energy transients that could damage the meter and consequently expose the user to a dangerous shock hazard.
7. Extreme caution should be exercised when measuring constant-voltage transformers when an open-circuit may cause a voltage that exceeds 850 Vac  $\Delta$  the voltage rating of the meter.
8. Exceeding the maximum input overload limits can damage the multimeter.

## III. PRECAUTIONS

1. Before taking a measurement, make sure that the range switch is set at the correct position.
2. Watch the polarity of the input test leads, depending on the measurement function.

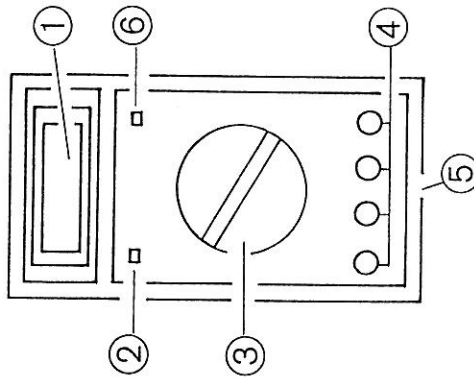


Fig. 1: Panel functions

- ① Display
- ② Power Switch
- ③ Range Switch
- ④ Input Terminals
- ⑤ Battery Cover
- ⑥ (Data Hold and Buzzer) Switch

N.B.

(2 + 10% (bases only))

A.C. CURRENT ACCURACY (SEE PAGE 4)

+ SHOULD READ - (1.2% RDG +30 DGT)

FREQUENCY COUNTER ACCURACY (SEE PAGE 4)

+ SHOULD READ - (1% RDG +3 DGT)

3. When changing the measurement range, either of the test leads should be disconnected from the circuit under test.

#### IV. MEASUREMENTS

##### Preliminary steps

1. When connecting or disconnecting test leads to or from a circuit, always first turn off power to the circuit under test and discharge all capacitors.
2. Always connect the black test lead to the "COM" input. For all measurements, except current measurements, connect the red test lead to the V-Q-F input.
3. Select the appropriate function/range. If the magnitude of the signal to be measured is unknown, first select the highest range and then reduce to obtain optimum resolution.
4. To start a measurement, set the "Data Hold/Buzzer" switch to the "OFF" position.

##### IV-1 DC and AC Voltage

Follow the preliminary steps, connect the test leads to the circuit and read the displayed value.

##### IV-2 DC and AC Current

Connect the red test lead to the 2 A input for current measurements up to 2 A and to the 10 A input for measurements between 2 A and 10 A. Follow the preliminary steps, connect the test leads in series with the circuit to be tested, apply power to the circuit and read the displayed value. (Warning: For current measurements, never connect the test leads in parallel to the circuit, or otherwise apply a voltage to the inputs!)

##### IV-3 Resistance

Follow the preliminary steps, connect the test leads across the resistance or circuit to be measured and read the displayed value.

##### IV-4 Continuity

Proceed as for resistance measurement. Switch the "Data-Hold/Buzzer" switch to "ON" position. Threshold limit for continuity indication is 10 % of range for all resistance ranges, except the 200  $\Omega$  range, where it is 100 %.

##### IV-5 Diode Check

Follow the preliminary steps. Connect test leads to the diode (red test lead to anode, black test lead to cathode). Normally the forward voltage drop of a good silicon diode is shown between 0.5000 to 0.9000 V. If the diode under test is defective, "0000" (short

circuit) or "1" (Non-Conductance) is displayed. Reverse check of diode: If the diode under test is good, "1" is displayed. If the diode is defective, "0000" or other values are displayed.

##### IV-6 Frequency Measurement

Follow the preliminary steps. Connect the test leads to the circuit and read the displayed value.

##### IV-7 Display Hold

The measurement shown on the display may be "held" if the Data Hold/Buzzer switch is shifted to the "ON" position before removing the test leads from the circuit under test. Shifting this switch to the "OFF" position will return the instrument to normal operation.

#### V. WARRANTY INFORMATION

In the United States, the limited warranty period is 90 days. For further warranty information or for the warranty period in other countries, please contact your local Beckman Industrial distributor or authorized representative.

#### VI. IN CASE OF DIFFICULTIES

In the case of improper operation of the meter, first check the condition of the batteries, as the meter will not work properly with bad batteries. If this is not the problem, review the operating instructions for possible errors in operation. As a last resort, the meter may be returned for repair or calibration. Please contact your local Beckman Industrial Distributor or Beckman Industrial for information regarding in- and out-of-warranty repairs.

#### VII. SHIPPING INSTRUCTIONS

A multimeter returned for calibration or repair should be shipped with the following information or items: company name, customer's name, address, telephone number, proof of purchase (warranty repairs), a description of the problem or service required, and the appropriate service charge. Consult your Beckman Industrial representative.

### VIII. SPECIFICATIONS

Accuracies are  $\pm$  (% reading + No of digits) at 23°C  $\pm$  5°C less than 75 % RH

#### DC VOLTAGE

<sup>1)</sup> Range	<sup>2)</sup> Resolution	<sup>3)</sup> Accuracy	<sup>4)</sup> Overvoltage Protection
200 mV	10 $\mu$ V	$\pm$ (0.05 % rdg + 3 dgt)	DC 500 V AC 350 V
2 V	100 $\mu$ V		
20 V	1 mV		
200 V	10 mV		DC 1200 V AC 850 V
1000 V	100 mV		

Input impedance : 10 M $\Omega$

#### AC VOLTAGE

Average sensing for Model 800, calibrated in RMS of a sine wave. True RMS for Model 850, AC coupled 10 % to 100 % of range.

<sup>1)</sup> Range	<sup>2)</sup> Resolution	<sup>3)</sup> Accuracy	<sup>4)</sup> Overvoltage Protection
200 mV	10 $\mu$ V	40 Hz-1 kHz : $\pm$ (0.75 % rdg + 10 dgt) 1 kHz-2 kHz : $\pm$ (1.5 % rdg + 20 dgt) 2 kHz-5 kHz : $\pm$ (6.0 % rdg + 30 dgt) <sup>1)</sup>	DC 500 V AC 350 V
2 V	100 $\mu$ V		
20 V	1 mV		
200 V	10 mV		DC 1200 V AC 850 V
750 V	100 mV		40 Hz - 1 kHz : $\pm$ (1.0 % rdg + 10 dgt)

Input impedance : 10 M $\Omega$ ,  $\leq$  100 pF <sup>1)</sup> exc. 200 V range/Ausg. 200 V Bereich/exc. calibre 200 V

#### DC CURRENT

<sup>1)</sup> Range	<sup>2)</sup> Resolution	<sup>3)</sup> Accuracy	<sup>4)</sup> Voltage Burden
200 $\mu$ A	10 nA	$\pm$ (0.3 % rdg + 3 dgt)	250 mV rms Max
2 mA	100 nA		
20 mA	1 $\mu$ A		
200 mA	10 $\mu$ A		
2 A	100 $\mu$ A		
10 A	1 mA		

Overload protection : 2 A (250 V) fast blowing fuse except for 10 A range.

### AC CURRENT

Average sensing for DM 800, calibrated in RMS of a sine wave  
True RMS for DM 850, AC coupled 10% to 100% of range

(1) Range	(2) Resolution	(3) Accuracy		(4) Voltage Burden
		40 Hz-400 Hz	400 Hz-1 kHz	
200 $\mu$ A	10 nA	$\pm$ (0.75% rdg + 10 dgt)	$\pm$ (0.75% rdg + 20 dgt)	250 mV rms Max
2 mA	100 nA			
20 mA	1 $\mu$ A			
200 mA	10 $\mu$ A			
2 A	100 $\mu$ A			
10 A	1 mA	—	—	700 mV rms Max

Overload protection: 2 A (250 V) fast blowing fuse except for 10 A.

### RESISTANCE

(1) Range	(2) Resolution	(3) Accuracy	(4) Test Current	(5) Open Circuit Voltage
200 $\Omega$	0.01 $\Omega$	$\pm$ (0.2% rdg + 5 dgt + 0.04 $\Omega$ )	1 mA	3.5 V
2 k $\Omega$	0.1 $\Omega$		1 mA	
20 k $\Omega$	1 $\Omega$	$\pm$ (0.1% rdg + 3 dgt)	100 $\mu$ A	
200 k $\Omega$	10 $\Omega$		10 $\mu$ A	
2 M $\Omega$	100 $\Omega$		1 $\mu$ A	
20 M $\Omega$	1 k $\Omega$	$\pm$ (0.5% rdg + 3 dgt)	100 nA	

Overload protection 250 V DC/AC

### FREQUENCY COUNTER

(1) Range	(2) Resolution	Accuracy $V_{rms}$ Max.
20 kHz	1 Hz	$\pm$ (0.5% rdg + 3 dgt)
200 kHz	10 Hz	

Sensitivity: 60 mV min.  
Min. input frequency: 20 Hz  
Overvoltage protection: 250 V

### DIODE TEST

The display will indicate the approximate forward voltage drop of a diode.

### CONTINUITY TEST

Ranges: All resistance ranges.

Threshold: Nominally, 10% of range for 2 k $\Omega$ , 20 k $\Omega$ , 200 k $\Omega$ , 2 M $\Omega$ , 20 M $\Omega$ , 200 M $\Omega$ , and 100% for 200  $\Omega$  range.

Display indication: Continuity and horizontal bar across the bottom of the display and/or sound.

### DATA HOLD FUNCTION

Hold display reading for AC/DC voltage and Amperes.

### GENERAL

Display: 4 1/2 digit liquid crystal display (LCD) with a maximum reading of 19999.

Polarity: Automatic, (-) negative polarity indication.

Overload indication: Indication of "1" or "—".

Low battery indication: (Lo Bat) is displayed when the battery voltage drops below the operating voltage.

Continuity indication: " " continuity"

Measurement rate: 2 measurements per second, nominal.

Operating temperature: 0°C to +35°C, 0-80% RH; +35°C to +50°C, 0-70% RH

Power: Single standard 9 V battery, NEDA 1604, JIS 006P, IEC6F22

Battery life: 100 hours typical.

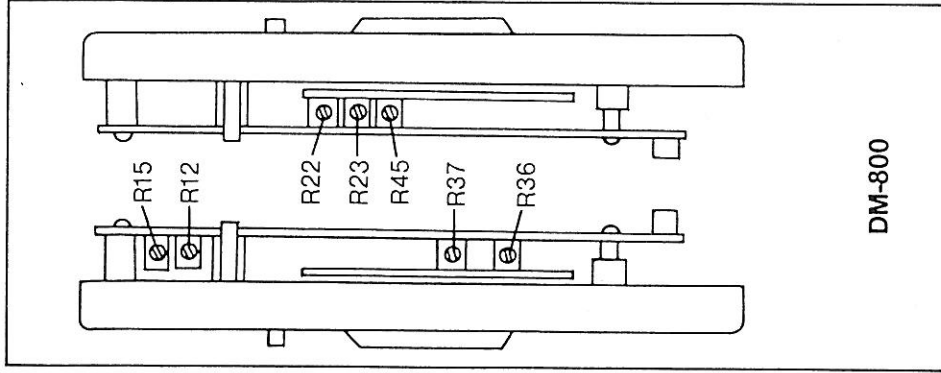
Dimensions: 174 mm (H) x 90 mm (W) x 36 mm (D)

Weight: 370 gr including battery

Accessories: test leads (pair), spare fuse (2 A), battery, instruction manual.

### IX. CALIBRATION

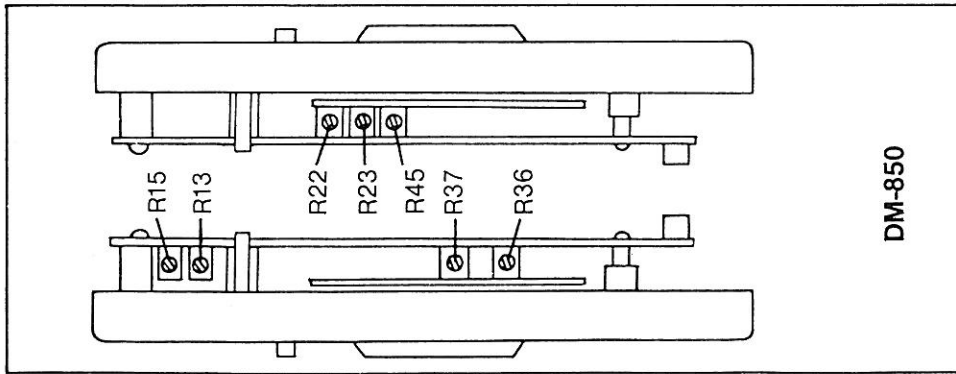
In order to maintain the specifications described in this manual, it is recommended that the millimeter be calibrated once each year. The equipment required for calibration is a DC/AC calibrator with a voltage range of 0 to 1000 V and an accuracy of 0.005%, as well as a function generator.



DM-800

Use the following procedures:

1. Perform calibration at an ambient temperature of  $23 \pm 2^\circ\text{C}$  and a relative humidity of 75% or less. Allow instrument to stabilize at this temperature for at least thirty minutes.
2. Remove the back cover from instrument by removing three screws and then lifting off



3. Set the output of the calibrator for 190 mV DC which you apply to the V- $\Omega$ -F and COM inputs.
4. Turn the Function/Range Switch on the multimeter to the 200 mV DC position.
5. Push the Data Hold Switch to the OFF position.
6. Using a small flat-tipped screwdriver, adjust potentiometer R36 for a display reading slightly greater than 190.00. Adjust potentiometer R37 for a display reading between 189.99 and 190.01.
7. Turn the Function/Range switch on the multimeter to the 200 mV AC position.
8. Short the V- $\Omega$ -F and COM inputs, and adjust potentiometer R15 for a display reading between 00.00 and 00.02 (DM 850 only).
9. Set the output of the calibrator for 190 mV AC, 1 kHz.
10. Adjust potentiometer R12 for a display reading between 189.99 and 190.01. (DM 850 only). Adjust potentiometer R15 for a display reading slightly greater than 190.00. Adjust potentiometer R13 for a display reading between 189.99 and 190.01 (DM 800 only).
11. Turn the Function/Range switch on the multimeter to the 200kHz F position.
12. Set the output of the frequency generator for a 190 kHz square wave, with  $V_{p-p} = 1\text{V}$ , which you connect to the V- $\Omega$ -F and COM inputs.
13. Adjust potentiometer R23 for a display reading slightly greater than 190.00. Adjust potentiometer R24 for a display reading between 189.80 and 190.20.
14. Turn the Function/Range switch on multimeter to the 20 kHz F position.
15. Set the output of the frequency generator for a 19 kHz square wave, with  $V_{p-p} = 1\text{V}$ .
16. Adjust potentiometer R45 for a display reading between 18.980 and 19.020.