

User Manual

Tektronix

**CDM250
Digital Multimeter**

070-6736-03

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

Injury Precautions

To avoid potential hazards, use the product only as specified.

Use Proper Power Cord

To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload

To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

Ground the Product

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Do Not Operate Without Covers

To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Use Proper Fuse

To avoid fire hazard, use only the fuse type and rating specified for this product.

General Safety Summary

Do Not Operate in Wet/Damp Conditions

To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in Explosive Atmosphere

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Product Damage Precautions

Use Proper Voltage Setting

Before applying power, ensure that the line selector is in the proper position for the power source being used.

Provide Proper Ventilation

To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures

If you suspect there is damage to this product, have it inspected by qualified service personnel.

Safety Terms and Symbols

Terms in This Manual

These terms may appear in this manual:



WARNING. Warning statements identify conditions or practices that could result in injury or loss of life.



CAUTION. Caution statements identify conditions or practices that could result in damage to this product or other property.

Terms on the Product

These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product

The following symbols may appear on the product:



DANGER
High Voltage



Protective Ground
(Earth) Terminal



ATTENTION
Refer to
Manual



Double
Insulated

Certifications and Compliances

CSA Certified Power Cords

CSA Certification includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.

General Safety Summary



Getting Started

The Tektronix CDM250 Digital Multimeter measures analog quantities and displays them in digital form. The CDM250 takes the following measurements:

- Direct and alternating current from 0 A to 10 A in six ranges
- AC and DC voltage from 200 mV to 500 V in five ranges
- Resistance from 0 Ω to 20 M Ω in six ranges

All values are displayed on a $3\frac{1}{2}$ digit, light-emitting diode (LED) indicator. Alternating voltages and currents are displayed in RMS values.

The Tektronix CDM250 has a locking, multiposition handle that folds under the instrument to allow stacking with other instruments of the same series. The CDM250 is delivered with a set of test leads, a 115 V power cord, an installed line fuse for 115 V operation, and this manual.

Preparing the Digital Multimeter for Use

Check the following items prior to operating the CDM250 Digital Multimeter for the first time (see Figure 1 for locations of items):

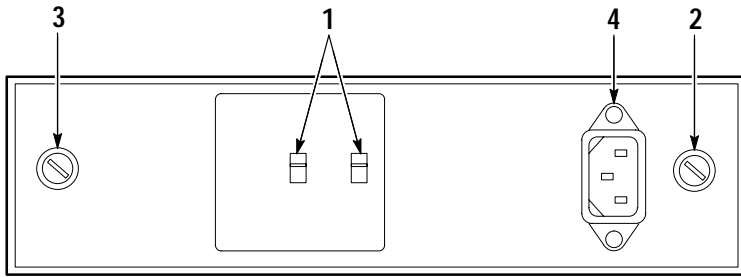


Figure 1: Line Voltage Selectors, Power Input, and Fuse Locations



CAUTION. To prevent damage to the instrument, set the line voltage selectors to the proper voltage setting and install the correct line voltage fuse before operating the equipment.

1. Set the line voltage selectors to the input line voltage. These selectors connect internal wiring for various line voltages. This product is intended to operate from a power source that does not supply more than 250 V_{RMS} between the supply conductors or between either supply conductor and ground. For line voltage ranges, refer to *Appendix A: Specifications* on page 11.



WARNING. To prevent electrical shock, unplug the power cord and disconnect the test leads from any voltage source before checking or replacing the fuses.

2. Check that the correct line fuse is installed. The line fuse provides protection if the equipment malfunctions or an overload occurs. Refer to *Appendix C: Replaceable Parts* on page 21 for fuse part numbers.

3. Check that the correct function fuse is installed. The function fuse provides protection when using the the 2 A input jacks. Refer to *Appendix C: Replaceable Parts* on page 21 for fuse part number.



WARNING. *To prevent electrical shock, connect the power cord to a properly grounded power source. The outside (ground) of this connector is connected through the equipment to the power source ground. Do not remove the ground lug from the power cord for any reason.*

4. Connect the input power cord. Use only power cords that are equipped with a third conductor that provide a safety ground connection. Use only the power cords specified for this equipment. Refer to *Appendix C: Replaceable Parts* on page 21 for power cord part numbers.

Front Panel

Figure 2 shows the front-panel controls, connectors, and indicators with brief descriptions of the items following the figure.

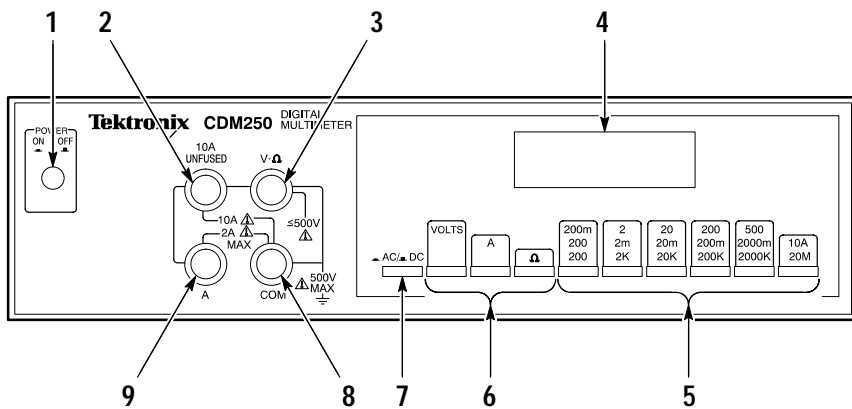


Figure 2: Front Panel

1. POWER button. Powers the CDM250 on or off. Power ON is indicated by the LED display.
2. 10 A UNFUSED jack. Input connector for positive (red) test lead when instrument is used to measure high current (over 2 A but less than 10 A).
3. V- Ω Input connector for positive (red) test lead. Used for AC volts, DC volts, and ohms (Ω) functions.
4. LED Display. Shows voltage, current, or resistance value. Display shows the number 1 at the extreme left in an overrange condition. Negative voltages or currents are indicated automatically with a minus (-) sign at the extreme left of the display.
5. RANGE buttons. Push to select the highest value of the voltage, current, or resistance to be measured.

6. **FUNCTION** buttons. Push in only one button to select **VOLTS** (voltage), **A** (current), or Ω (resistance). Only one function will work at a time.
7. **AC/DC** button. Push in to measure alternating current or AC voltage; reset to the out position for direct current or DC voltage. The **AC/DC** button may be in either position when the meter is used for checking resistance.
8. **COM** jack. Input connector for common (black) test lead. Used for AC or DC volts, ohms, and current functions. This connector is not connected to the power source ground through the instrument.
9. **2 A** jack. Input connector for positive (red) test lead when instrument is used to measure current values up to 2 A.

Getting Started



Reference

This section of the manual explains how to take the following measurements:

- AC or DC voltage
- AC or DC current
- Resistance

It also explains how use the CDM250 Digital Multimeter to check diodes.

Preparations for Measurement

1. Be sure that the CDM250 Digital Multimeter is connected to a specified power source and that the LINE VOLTAGE SELECTORS are set to the proper position. Refer to *Preparing the Digital Multimeter for Use* on page 2.
2. Check that the FUNCTION and RANGE buttons are in the correct position. If the value to be measured is unknown, start at the highest range.
3. Be sure the red test lead is in the proper input jack for the measurement to be made.

Measuring AC or DC Voltage

1. Connect the black test lead to the black **COM** jack.
2. Connect the red test lead to the red **V-Ω** jack.
3. For DC voltage, set the **AC/DC** function button to the out position. For AC voltage set the **AC/DC** function switch to the in position.
4. Push the **VOLTS** function button in to lock it.

5. Determine the highest anticipated voltage, and push in the corresponding range button. When the voltage is unknown, select the highest range.
6. Push the **POWER** button to the **ON** position.

NOTE. Voltage readings are taken in parallel with the component or device being measured.

7. Connect the test leads, and read the displayed value.

NOTE. Remove the red test lead from the circuit or component being tested before changing ranges.

Measuring AC or DC Current

1. Connect the black test lead to the black **COM** jack.
2. For current up to 2 A, connect the red test lead to the white **2A** jack. For current between 2 A and 10 A, connect the red test lead to the white **10A UNFUSED** jack.



CAUTION. The 10 A UNFUSED jack is not protected. Excess current may damage the instrument.

3. To measure alternating current (AC), set the **AC/DC** button to the in position. To measure direct current (DC), set the **AC/DC** button to the out position.
4. Push the **A** (amperes) button in.
5. Determine the highest anticipated current, and push in the corresponding range button. When the current value is unknown, start at the highest range.

***NOTE.** Current readings are taken in series with the component or device being measured.*

6. Push the **POWER** button to the **ON** position.
7. Connect the test leads, and read the display value.

***NOTE.** Remove the red test lead from the circuit or component being tested before changing ranges.*

Measuring Resistance

1. Connect the black test lead to the black **COM** jack.
2. Connect the red test lead to the red **V-Ω** jack.
3. Push the **Ω** (ohms) function button.
4. Determine the highest anticipated resistance on the range scale, and press the corresponding range button.



***CAUTION.** To prevent damage to the equipment, turn off all power to the circuit or component being measured.*

5. Push the **POWER** button to the **ON** position.
6. Connect the test leads, and read the display value.

***NOTE.** When the component being tested is in a circuit where parallel current paths offer low resistance, the above test may require disconnecting one end of the component from the circuit.*

Checking Diodes

1. Connect the black test lead to the black **COM** jack.
2. Connect the red test lead to the red **V-Ω** jack.
3. Push in the **Ω** (ohms) function button.
4. Simultaneously push the **200** and the **2K** range buttons to the in position.



CAUTION. To prevent damage to the equipment, turn off all power to the circuit or component being measured.

5. Connect the red test lead to the anode and the black test lead to the cathode of the diode.
6. Push the **POWER** button to the **ON** position. A reading of about 25.0 to 90.0 should appear on the display. Multiply the result by 10 to arrive at the forward voltage drop in millivolts. If the reading on the display is 1 (overrange indicator), the diode may be defective (open). If the reading is 00.0, the diode is defective (shorted).
7. Connect the black test lead to the anode and the red test lead to the cathode of the diode. A reading of 1 (overrange indicator) should appear on the display. If any other value is displayed, the diode is defective. On some diodes the meter might flash a high number for a very short period of time, but the reading should go to the overrange indicator.

NOTE. When the diode being tested is in a circuit where parallel current paths offer low resistance, the above tests may require disconnecting one end of the component from the circuit.

Appendix A: Specifications

Table 1: General Characteristics

Display	3 ¹ / ₂ digit LED displays to ±1999 counts, positive polarity assumed, minus (-) sign for negative polarity and the number 1 at the extreme left as the over range indicator
Measurements	AC and DC voltages, AC and DC currents, and resistance
Maximum Common Mode Voltage	500 V (DC + AC peak)
Zero Adjustment	Automatic
Sampling Rate	2.5 measurements per second, nominal

Table 2: Physical Characteristics

Width	240 mm (9.4 in)
Height	64 mm (2.5 in)
Depth	230 mm (9.0 in)
Weight	1.8 kg (4.0 lb)

Table 3: Environmental Characteristics

Storage Temperature	-10° C to 60° C, 80% RH
Operating Temp	+10° C to 40° C, 0 to 75% RH

Appendix A: Specifications

Table 4: Electrical Characteristics

Line Voltage Range	90 to 110, 108 to 132, 198 to 242, and 216 to 250 VAC at 50–60 Hz
Power Consumption	10 VA, 6 W maximum
Ground Isolation	Maximum of 500 V from earth ground

NOTE. Accuracy is specified for a temperature range of 18° C to 28° C, 75 % RH.

Table 5: DC Volts Measurement Specifications

Range	Resolution	Accuracy	Input Impedance
200 mV	100 μ V	$\pm(0.5\%$ of rdg + 1 digit)	10 M Ω
2 V	1 mV		
20 V	10 mV		
200 V	100 mV		
500 V	1 V		
Response Time	3 s		
Overload Protection	200 mV range: 500 VDC, 350 VAC 2 V to 500 V ranges: 500 VDC, 500 VAC		

Table 6: AC Volts Measurement Specifications

Manual Ranging Average responding, calibrated to read RMS value of sine wave			
Range	Resolution	Accuracy	Input Impedance
200 mV	100 μ V	$\pm(1.0\%$ of rdg + 4 digits) 45–500 Hz	10 M Ω < 100 pF
2 V	1 mV		
20 V	10 mV		
200 V	100 mV		
500 V	1 V		
Response Time		8 s	
Overload Protection		200 mV range: 500 VDC, 350 VAC 2 V to 500 V ranges: 500 VDC, 500 VAC	

Table 7: Direct Current Measurement Specifications

Manual Ranging				
Range	Resolution	Accuracy	Loading Error	Input Impedance
200 μ A	0.1 μ A	$\pm(1.0\%$ of rdg + 1 digit)	300 mV maximum	1 k Ω
2 mA	1 μ A			100 Ω
20 mA	10 μ A			10 Ω
200 mA	100 μ A			1 Ω
2000 mA	1 mA	$\pm(1.0\%$ of rdg + 3 digits)	1.1 V maximum	0.1 Ω
10 A	10 mA			.01 Ω
Response Time		3 s		
Overload Protection		2 A range: 2 A, 250 V, fast-blow fuse 10 A range: None		

Table 8: Alternating Current Measurement Specifications

Manual Ranging			
Range	Resolution	Accuracy	Loading Error
200 μ A	0.1 μ A	$\pm(1.5\%$ of rdg + 4 digits) 45–500 Hz	300 mV RMS maximum
2 mA	1 μ A		
20 mA	10 μ A		
200 mA	100 μ A		
2000 mA	1 mA		1.1 V RMS maximum
10 A	10 mA		
Response Time		8 s	
Overload Protection		2 A range: 2 A, 250 V, fast-blow fuse	
		10 A range: None	

Table 9: Resistance Measurement Specifications

Manual Ranging				
Range	Resolution	Accuracy	Maximum Test Current	Max. Open Circuit Voltage
200 Ω	0.1 Ω	$\pm(0.75\%$ of rdg + 4 digits)	2.5 mA	3.2 V
2 k Ω	1 Ω	$\pm(0.75\%$ of rdg + 1 digit)	250 μ A	.6 V
20 k Ω	10 Ω		50 μ A	
200 k Ω	100 Ω		5 μ A	
2000 k Ω	1 k Ω		500 nA	
20 M Ω	10 k Ω	$\pm(1.5\%$ of rdg + 5 digits)	50 nA	
Response Time		200 Ω to 2000 k Ω ranges		5 s
		20 M Ω range		15 s
Overload Protection		500 VDC or AC		

Table 10: Certifications and compliances

<p>EC Declaration of Conformity</p>	<p>Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:</p> <p>EN 55011 Class B Radiated and Conducted Emissions</p> <p>EN 50081-1 Emissions: EN 60555-2 AC Power Line Harmonic Emissions</p> <p>EN 50082-1 Immunity: IEC 801-2 Electrostatic Discharge Immunity IEC 801-3 RF Electromagnetic Field Immunity¹ IEC 801-4 Electrical Fast Transient/Burst Immunity IEC 801-5 Power Line Surge Immunity</p> <p>¹ The following degree of performance degradation is deemed acceptable by the manufacturer: Ambient RF fields of 3 V/m intensity may induce error up to 5% of reading.</p>
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Appendix B: Maintenance

This appendix provides information for the basic maintenance of the CDM250 Digital Multimeter.

Cleaning

To clean the digital multimeter, use a soft cloth dampened in a solution of mild detergent and water. Do not spray cleaner directly onto the instrument, since it may leak into the cabinet and cause damage.

Do not use chemicals containing benzene, benzene, toluene, xylene, acetone, or similar solvents.

Do not use abrasive cleaners on any portion of the digital multimeter.

Preparing for Shipment

If the original packaging is unfit for use or not available, use the following packaging guidelines:

1. Use a corrugated cardboard shipping carton having inside dimensions at least three inches greater than the instrument dimensions.
2. Put the instrument into a plastic bag or wrap to protect it from dampness and loose packing material.
3. Place the instrument into the box and firmly stabilize it with packing material.
4. Seal the carton with shipping tape.

Troubleshooting

Electronic maintenance on the CDM250 must be performed by a trained technician. However, any operator can perform some basic and routine maintenance. The CDM250 will give some indications of problems to aid the operator.

No Display with Power On

If the LED Display is not lighted, but the POWER button is pushed in and the CDM250 Digital Multimeter power cord is plugged into an outlet, do the following steps:



WARNING. To prevent electrical shock, unplug the power cord and disconnect the test leads from any voltage source before checking or replacing the fuses.

1. Check the line fuse. If the fuse is open, replace it.
2. If the line fuse is good, check the power outlet for proper voltage. If the outlet voltage is incorrect, call service personnel.
3. If outlet voltage is correct, check power cord continuity. If the power cord fails the continuity check, replace the power cord.

CDM250 Does Not Read Current (2A)

Check the function fuse. If the fuse is open, replace it.

Display On but CDM250 Not Displaying Reading

1. Check that the function and range button selections are correct.
2. If function and range buttons are correct, check that the test leads are connected properly.
3. If the test leads are connected properly, check the test leads for continuity. If a test lead fails the continuity check, replace the test lead.

Display On but CDM250 Does Not Read Current (10A)

1. Check that the function and range button selections are correct.
2. If function and range buttons are correct, contact the nearest Tektronix service center.

Appendix B: Maintenance

Appendix C: Replaceable Parts

Replaceable parts may be ordered directly from your authorized Tektronix dealer.

Standard Accessories

The following items are shipped with the CDM250 Digital Multimeter:

Table 11: Standard Accessories

Accessory	Tektronix Part Number
Fuse, 3AG, 0.125A, 250V, Slow Blow (90 – 132 V operation)	159-0313-XX
Fuse, 3AG, 2 A, 250V, Fast Blow	159-0021-XX
CDM250 User Manual	070-6736-XX
115V power cord	Refer to Table 13
Test Lead Set	196-3200-XX

Optional Accessories

The following items are available as optional accessories:

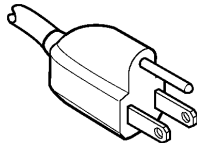
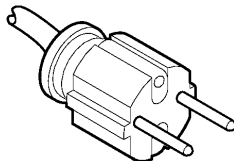
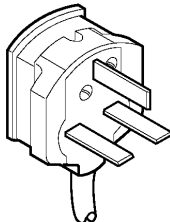
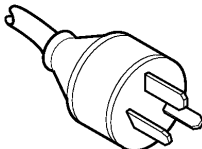
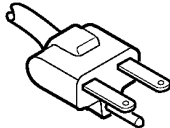
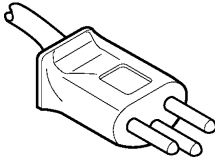
Table 12: Optional Accessories

Accessory	Tektronix Part Number
Fuse, 3AG, 0.062A, 250V, Slow Blow (198 – 250 V operation)	159-0051-XX
230V Power Cords	Refer to Table 13

Appendix C: Replaceable Parts

The following power cords are available.

Table 13: Accessory Power Cords

Plug Configuration	Normal Usage	Tektronix Part Number
	North America 115 V	161-0104-00
	Europe 230 V	161-0104-06
	United Kingdom 230 V	161-0104-07
	Australia 230 V	161-0104-05
	North America 230 V	161-0104-08
	Switzerland 230 V	161-0167-00