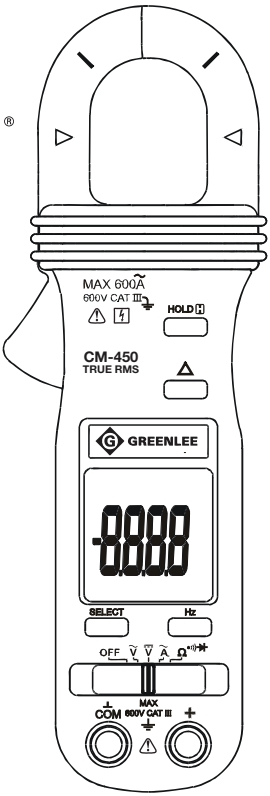
INSTRUCTION MANUAL

GREENLEE®
A Textron Company

CM-450

Digital Clamp-on Meter



Description

The Greenlee CM-450 Digital Clamp-on Meter is a hand-held testing device capable of measuring up to 600 amps of alternating current, in addition to measuring AC or DC voltage, frequency, and resistance. It also checks diodes and verifies continuity. The CM-450 is a true RMS-reading meter.

Safety

Safety is essential in the use and maintenance of Greenlee tools and equipment. This instruction manual and any markings on the tool provide information for avoiding hazards and unsafe practices related to the use of this tool. Observe all of the safety information provided.

Purpose of This Manual

This instruction manual is intended to familiarize all personnel with the safe operation and maintenance procedures for the Greenlee CM-450 Digital Clamp-on Meter.

Keep this manual available to all personnel.

Replacement manuals are available upon request at no charge at www.greenlee.com.

Do not discard this product or throw away!
For recycling information, go to www.greenlee.com.

Lifetime Limited Warranty

Greenlee Textron Inc. warrants to the original purchaser of these goods for use that these products will be free from defects in workmanship and material for their useful life, excepting normal wear and abuse. This warranty is subject to the same terms and conditions contained in Greenlee Textron Inc.'s standard one-year limited warranty.

For all Test Instrument repairs, contact Customer Service at 800-435-0786 and request a Return Authorization.

For items not covered under warranty (such as items dropped, abused, etc.), a repair cost quote is available upon request.

Note: Prior to returning any test instrument, please check replaceable batteries or make sure the battery is at full charge.

KEEP THIS MANUAL

Important Safety Information

SAFETY ALERT SYMBOL

This symbol is used to call your attention to hazards or unsafe practices which could result in an injury or property damage. The signal word, defined below, indicates the severity of the hazard. The message after the signal word provides information for preventing or avoiding the hazard.

⚠DANGER

Immediate hazards which, if not avoided, WILL result in severe injury or death.

⚠WARNING

Hazards which, if not avoided, COULD result in severe injury or death.

⚠CAUTION

Hazards or unsafe practices which, if not avoided, MAY result in injury or property damage.

⚠WARNING

Read and **understand** this material before operating or servicing this equipment. Failure to understand how to safely operate this tool could result in an accident causing serious injury or death.

⚠WARNING

Electric shock hazard:

Contact with live circuits could result in severe injury or death.

Important Safety Information

⚠WARNING

Electric shock and fire hazard:

- Do not expose this unit to rain or moisture.
- Do not use the unit if it is wet or damaged.
- Use test leads or accessories that are appropriate for the application. Refer to the category and voltage rating of the test lead or accessory.
- Inspect the test leads or accessory before use. They must be clean and dry, and the insulation must be in good condition.
- Use this unit for the manufacturer's intended purpose only, as described in this manual. Any other use can impair the protection provided by the unit.

Failure to observe these warnings could result in severe injury or death.

⚠WARNING

Electric shock hazard:

- Do not operate with the case open.
- Before opening the case, remove the test leads (or jaw) from the circuit and shut off the unit.

Failure to observe these warnings could result in severe injury or death.

⚠WARNING

Electric shock hazard:

- Using this unit near equipment that generates electromagnetic interference can result in unstable or inaccurate readings.
- Unless measuring voltage or current, shut off and lock out power. Make sure that all capacitors are discharged. Voltage must not be present.

Failure to observe these warnings could result in severe injury or death.

Important Safety Information

⚠CAUTION

Electric shock hazard:

- Do not attempt to repair this unit. It contains no user-serviceable parts.
- Do not expose the unit to extremes in temperature or high humidity. Refer to "Specifications."

Failure to observe these precautions may result in injury and can damage the unit.

⚠CAUTION

Electric shock hazard:

Do not change the measurement function while the test leads are connected to a component or circuit.

Failure to observe this precaution may result in injury and can damage the unit.

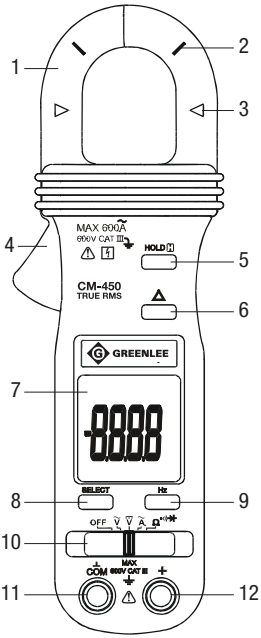
Statement of Conformity

Greenlee Textron Inc. is certified in accordance with ISO 9000 (2000) for our Quality Management Systems.

The instrument enclosed has been checked and/or calibrated using equipment that is traceable to the National Institute for Standards and Technology (NIST).

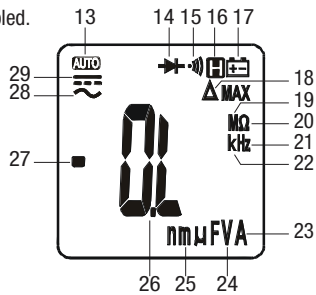
Identification

1. Jaw
2. Position error marks
3. Jaw center marks
4. Lever
5. Hold button
6. Relative measurement button
7. Display
8. Select button
9. Frequency button
10. Selector switch
11. Negative, common (COM), or ground input terminal
12. Volts or resistance (VΩ) input terminal



Display Icons

13. AUTO Auto ranging is enabled.
14. Diode test
15. Continuity mode
16. H Hold function is enabled.
17. Low battery indicator
18. Δ Relative measurement is enabled.
19. **M** Mega (10^6)
20. **Ω** Ohms
21. **Hz** Hertz
22. **k** kilo (10^3)
23. **A** Amps
24. **V** Volts
25. **m** milli (10^{-3})
26. ***O.L.*** Overload indicator
27. **–** Negative polarity indicator
28. ~ AC measurement is selected.
29. ⎓ DC measurement is selected.



Note: Unidentified icons are not used on this model.

Symbols on the Unit

- ⚠ Warning—Read the instruction manual
- Risk of electric shock
- Double insulation
- Recycle product in accordance with manufacturer's directions

Using the Features

Selector Switch

- Slide switch to desired mode of operation:
  - $\widetilde{V}$ AC voltage
  - $\overline{\overline{V}}$ DC voltage
  - $\widetilde{A}$ AC current
  - Ω •))) ⊣◀ ohms/continuity/diode
- Return switch to **OFF** position when not in use.

Select Button (SELECT)

- Momentarily press to select resistance, continuity, or diode test when the Selector switch is set to Ω •))) ⊣◀.

Frequency Button (Hz)

- Press to measure frequency.

Note: The sensitivity of the frequency measurement function varies with the measurement range. To automatically select a sensitivity level, measure the voltage level first, and then press **Hz**. *Pressing* **Hz** *before making a measurement may give higher sensitivity. Reading may be zero when sensitivity is too low. Electrical noise may cause unstable readings.*

Hold Button (HOLD H)

- Press momentarily to hold the present value on the display. **H** will appear on the display.
- Press again to return to normal mode.

Relative Measurement Button (Δ)

This feature finds the difference between two measurements.

- While taking a measurement, press **Δ** to set the display to zero. **Δ** will appear on the display.
- Take the second measurement. The value on the display will be the difference between the two measurements.
- Press again to exit this mode.

Auto Power Off

To extend battery life, the meter will shut itself off after approximately 30 minutes of inactivity. To restore power, press any button.

AC Measurement

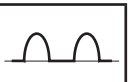
AC measurements are usually displayed as RMS (root mean square) values. The RMS value is equal to the value of a DC waveform, which would deliver the same power if it replaced the time-varying waveform. Two AC measurement methods are *average-responding RMS calibrated and true RMS-reading*.

The average-responding RMS calibrated method takes the average value of the input signal after full wave rectification, multiplies it by 1.11, and displays the result. This method is accurate if the input signal is a pure sine wave.

The true RMS-reading method uses internal circuitry to read the true RMS value. This method is accurate, within the specified crest factor limitations, whether the input signal is a pure sine wave, square wave, triangle wave, half wave, or signal with harmonics. The ability to read true RMS provides much more measurement versatility. The Greenlee CM-450 is a true RMS meter.

The Waveforms and Crest Factors table shows some typical AC signals and their RMS values.

Waveforms and Crest Factors

Waveform				
RMS Value	100	100	100	100
Average Value	90	100	87	64
Crest Factor* (ξ)	1.414	1	1.73	2

* The crest factor is the ratio of the peak value to the RMS value; it is represented by the Greek letter ξ.

Operation

⚠WARNING

Electric shock hazard:

Contact with live circuits could result in severe injury or death.

1. Set the Selector switch according to the Settings Table. Momentarily press the **SELECT** button to select mode.
2. Refer to "Typical Measurements" for specific measurement instructions.
3. Test the unit on a known functioning circuit or component.
   - If the unit does not function as expected on a known functioning circuit, replace the battery.
   - If the unit still does not function as expected, call Greenlee for technical assistance at 800-435-0786.
4. Take the reading from the circuit or component to be tested.

Settings Table

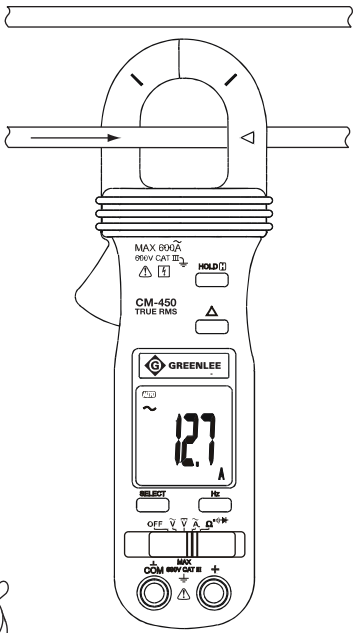
To measure this value …	Set the Selector switch to this symbol …	This icon will appear on the display …	Connect red lead to …	Connect black lead to …
AC Current* (600 A max.)	$\widetilde{A}$	~ and **A**	N/A	N/A
Frequency of a current (600 A max.)	$\widetilde{A}$ and press **Hz**	**Hz**	N/A	N/A
Voltage (600 V max.)	$\widetilde{V}$	~ and **V**	+	COM
	$\overline{\overline{V}}$	⎓ and **V**		
Frequency of a voltage signal	$\widetilde{V}$ or $\overline{\overline{V}}$ and press **Hz**	**Hz**	+	COM
Resistance	Ω •)) ⊣	**MΩ**	+	COM
Continuity**	Ω •)) ⊣ and press **SELECT**	Ω •))	+	COM
Diode	Ω •)) ⊣ and press **SELECT** 2 times	⊣ and **V**	+	COM

* AC current measurements are made using the jaw.

** Tone indicates continuity. The threshold is between 5 Ω and 120 Ω.

Typical Measurements

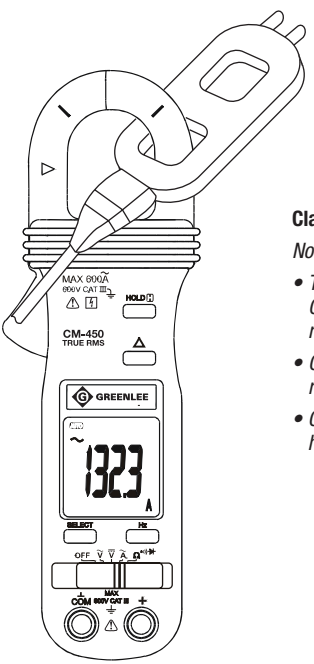
AC Amps



Clamp Around Wire

Notes:

- *Clamp the jaw around one conductor only.*
- *Close the jaw completely to ensure accurate measurement.*
- *Center the wire in the jaw for highest accuracy.*



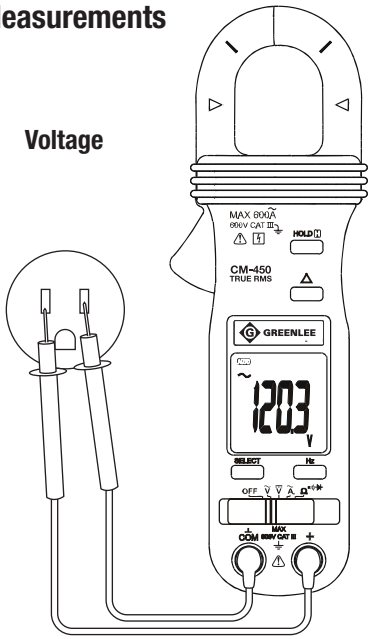
Clamp Around Line Splitter

Notes:

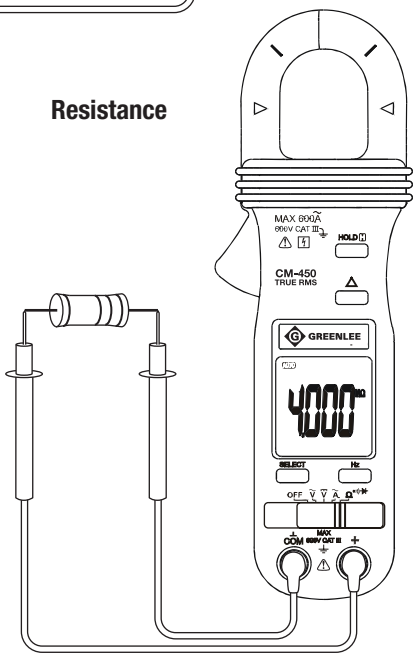
- *The Greenlee 93-30 Line Splitter is divided. One section renders amps; the other renders amps multiplied by 10.*
- *Close the jaw completely to ensure accurate measurement.*
- *Center the line splitter in the jaw for highest accuracy.*

Typical Measurements

Voltage

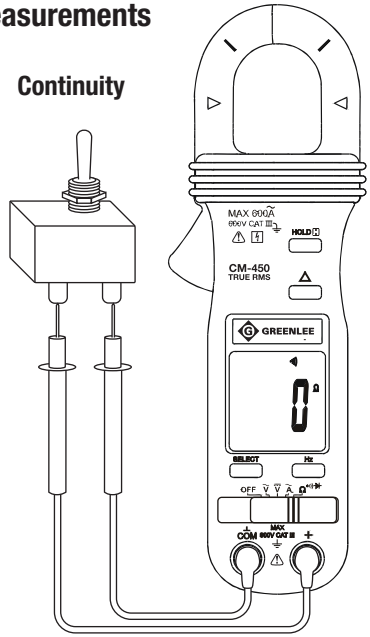


Resistance



Typical Measurements

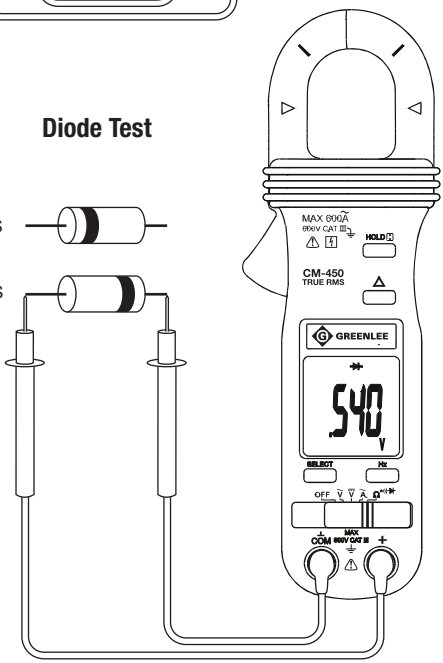
Continuity



Diode Test

Reverse Bias

Forward Bias



Accuracy

Refer to “Specifications” for operating conditions and temperature coefficient.

Accuracy is specified as follows: ± (a percentage of the reading + a fixed amount) at 23 °C ± 5 °C (73.4 °F ± 9 °F), 0% to 75% relative humidity.

True RMS readings: Voltage is specified from 5% to 100% of the range, and AC current is specified from 10% to 100% of the range, unless otherwise specified. Frequency must be within the specified bandwidth for non-sinusoidal waveforms. Crest factors are as follows:

- Crest Factor < 1.75 at full scale
- Crest Factor < 3.5 at half scale

AC Current

Measurement Range	Accuracy	Frequency Range
0.40 to 40.00 A	± (1.5% + 0.08 A)	50 to 60 Hz
40.0 to 400.0 A	± (1.5% + 0.8 A)	
400 to 600 A	± (1.5% + 8 A)	

- Adjacent conductor influence < 0.05 A/A
- Add 2% if the conductor is beyond the position error marks.
- Multiply the fixed error amount times 2 below 10% of range.

AC Voltage

Measurement Range	Accuracy	Frequency Range	Input Impedance
4.000 V	± (1.5% + 0.005 V)	50 to 500 Hz	10 MΩ // 30 pF nom.
40.00 V	± (1.5% + 0.05 V)		
400.0 V	± (1.5% + 0.5 V)		
600 V	± (2.0% + 5 V)		

DC Voltage

Measurement Range	Accuracy	Input Impedance
400.0 mV	± (0.3% + 0.4 mV)	1000 MΩ*
4.000 V	± (0.5% + 0.003 V)	10 MΩ
40.00 V	± (0.5% + 0.03 V)	
400.0 V	± (0.5% + 0.3 V)	
600 V	± (1.0% + 4 V)	

* The high impedance on this range will produce significant non-zero readings when the test leads are disconnected from a circuit.

Accuracy (con't)

Resistance

Measurement Range	Accuracy
400.0 Ω	± (0.8% + 0.8 Ω)
4.000 kΩ	± (0.6% + 0.004 kΩ)
40.00 kΩ	± (0.6% + 0.04 kΩ)
400.0 kΩ	± (0.6% + 0.4 kΩ)
4.000 MΩ	± (1.0% + 0.004 MΩ)
40.00 MΩ	± (2.0% + 0.04 MΩ)

Diode Tester

Test Current	Open Circuit Voltage
0.25 mA typical	1.6 VDC maximum

Frequency

Function	Sensitivity (Sine RMS)	Range
400.0 mV	350 mV	10 Hz to 2 kHz
4.000 V	1 V	10 Hz to 5 kHz
40.00 V	32 V	10 Hz to 100 kHz
400.0 V	100 V	10 Hz to 10 kHz
600 V	500 V	10 Hz to 5 kHz
400.0 A	60 A	40 Hz to 400 Hz

Accuracy of Frequency Ranges

Display Range	Accuracy
5.000 Hz	± (0.5% + 0.004 Hz)
50.00 Hz	± (0.5% + 0.04 Hz)
500.0 Hz	± (0.5% + 0.4 Hz)
5.000 kHz	± (0.5% + 0.004 kHz)
50.00 kHz	± (0.5% + 0.04 kHz)
500.0 kHz	± (0.5% + 0.4 kHz)

Specifications

Display: 3-3/4-digit LCD (4000 maximum reading)

Sampling Rate: 3 per second

Overrange Indication: "OL" appears on the display

Maximum Conductor Diameter: 26 mm (1.02")

Measurement Category: Category III, 600 V

Temperature Coefficient: 0.15 x (specified accuracy) per °C below 18 °C or above 28 °C

Operating Conditions:
At 0% ≤ 80% RH: 5 °C to 31 °C (41 °F to 86 °F)
Decreasing linearly to 50% RH at 40 °C (104 °F)
Altitude: 2000 m (6500') maximum
Indoor use only

Storage Conditions: -20 °C to 60 °C (-4 °F to 140° F), 0% to 80% relative humidity with battery removed

Pollution Degree: 2

Battery: 3 V standard button battery (IEC-CR2032; ANSI-NEDA-54004LC)

Measurement Categories

These definitions were derived from the international safety standard for insulation coordination as it applies to measurement, control, and laboratory equipment. These measurement categories are explained in more detail by the International Electrotechnical Commission; refer to either of their publications: IEC 61010-1 or IEC 60664.

Measurement Category I

Signal level. Electronic and telecommunication equipment, or parts thereof. Some examples include transient-protected electronic circuits inside photocopiers and modems.

Measurement Category II

Local level. Appliances, portable equipment, and the circuits they are plugged into. Some examples include light fixtures, televisions, and long branch circuits.

Measurement Category III

Distribution level. Permanently installed machines and the circuits they are hard-wired to. Some examples include conveyor systems and the main circuit breaker panels of a building's electrical system.

Measurement Category IV

Primary supply level. Overhead lines and other cable systems. Some examples include cables, meters, transformers, and other exterior equipment owned by the power utility.

Maintenance

⚠CAUTION

Electric shock hazard:

- Do not attempt to repair this unit. It contains no user-serviceable parts.
- Do not expose the unit to extremes in temperature or high humidity. Refer to "Specifications."

Failure to observe these precautions may result in injury and can damage the unit.

Battery Replacement

⚠WARNING

Electric shock hazard:

- Do not operate with the case open.
- Before opening the case, remove the test leads (or jaw) from the circuit and shut off the unit.

Failure to observe these warnings could result in severe injury or death.

1. Disconnect the unit from the circuit. Turn the unit **OFF**.
2. Remove the screws from the back cover.
3. Remove the back cover.
4. Replace the battery (observe polarity).
5. Replace the back cover and the screws.

Cleaning

Periodically wipe the case with a damp cloth and mild detergent; do not use abrasives or solvents.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