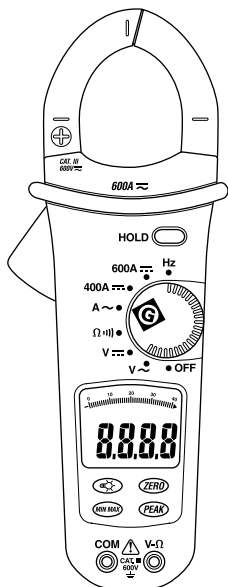


INSTRUCTION MANUAL



CM-900 • CM-950 Digital Clamp-on Meters



Read and understand all of the instructions and safety information in this manual before operating or servicing this tool.

Lea y entienda todas las instrucciones y la información sobre seguridad que aparecen en este manual, antes de manejar estas herramientas o darles mantenimiento.

Lire attentivement et bien comprendre toutes les instructions et les informations sur la sécurité de ce manuel avant d'utiliser ou de procéder à l'entretien de cet outil.

Description

The Greenlee CM-900 and CM-950 Digital Clamp-on Meters are hand-held testing devices with the following measurement capabilities: AC and DC voltage, AC and DC current, frequency, and resistance. They also verify continuity. The CM-950 is a true RMS reading meter.

Specialized functions and capabilities include:

- Auto ranging
- Backlit display
- Auto power off
- Data hold
- MIN MAX hold
- Peak hold
- 42-segment bar graph

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 Greenlee CM-900 and CM-950 Digital Clamp-on Meters.

Keep this manual available to all personnel.

Replacement manuals are available upon request at no charge.

All specifications are nominal and may change as design improvements occur.

Greenlee Textron shall not be liable for damages resulting from misapplication or misuse of its products.

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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 can result in an accident causing serious injury or death.

Important Safety Information



⚠ WARNING

Electric shock hazard:

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

⚠ 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 can result in severe injury or death.

⚠ WARNING

Electric shock hazard:

- Do not apply more than the rated voltage between any two input terminals, or between any input terminal and earth ground.
- Do not contact the test lead tips or any uninsulated portion of the accessory.

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

Important Safety Information

⚠ WARNING

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

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

⚠ CAUTION

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

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

⚠ CAUTION

- 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 can result in injury and can damage the unit.


IMPORTANT

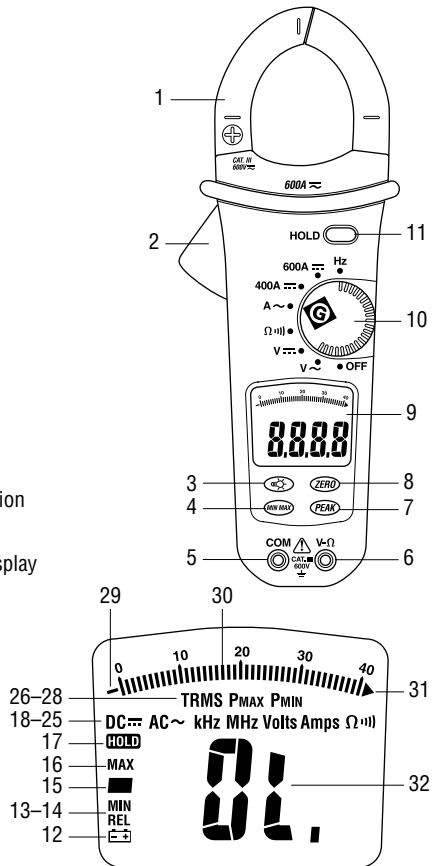
- Unless measuring voltage, current, or frequency, shut off and lock out power. Make sure that all capacitors are discharged. Voltage must not be present.
- Using this unit near equipment that generates electromagnetic interference can result in unstable or inaccurate readings.

Identification




1. Jaw
2. Lever
3. Backlight button
4. MIN MAX button
5. Common (COM) input terminal
6. Volts or resistance (V-Ω) input terminal
7. PEAK button
8. ZERO button
9. Display
10. Selector
11. HOLD button

Display Icons

12.  Low battery indicator
13. **REL** Status of DC current ZERO function
14. **MIN** MIN Hold function is enabled
15. **-** Polarity indicator for numeric display
16. **MAX** MAX Hold function is enabled
17. **HOLD** Hold function is enabled
18. **DC** DC measurement is selected
19. **AC** AC measurement is selected
20. **kHz** Kiloherztz
21. **MHz** Megahertz
22. **Volts** Voltage
23. **Amps** Amperes
24. **Ω** Ohms
25. **|||)** Continuity
26. **TRMS** True RMS (CM-950 only)
27. **P_{MAX}** MAX PEAK Hold function is enabled.
28. **P_{MIN}** MIN PEAK Hold function is enabled.
29. **-** Polarity indicator for bar graph
30. **|** Bar graph element
31. **▶** Overload indicator for bar graph
32. **OL.** Overload indicator for numeric display



Symbols on the Unit

-  Warning—Read the instruction manual
-  Double insulation
-  Battery

Using the Features



Press to backlight the display. Press again to turn off. The backlight automatically shuts off after approximately 1 minute.

- **HOLD Button**

Press momentarily to hold the present value on the display. Press again to return to normal mode.

- **Auto Power Off**

The unit automatically shuts off after approximately 30 minutes of inactivity.

To disable this feature, press **PEAK**, **MIN MAX**, or  while turning the meter on.

- **MIN MAX Button**

Press momentarily to begin recording the minimum and maximum values of input. Press momentarily to cycle through the display modes as shown in the table below. The meter uses its highest voltage or current range for this feature.

Icon	Display
MAX	Maximum recorded value
MIN	Minimum recorded value
MAX MIN (flashing)	Present measured value

Press and hold to exit this mode.

- **PEAK Button**

Press momentarily to begin recording the minimum and maximum peak values of AC inputs. Press momentarily to cycle through the display modes as shown in the table below. The meter uses its highest voltage or current range for this feature.

Icon	Display
P_{MAX}	Maximum recorded peak value
P_{MIN}	Minimum recorded peak value

Press and hold to exit this mode. "CAL" appears briefly on the display as internal circuitry is reset.

- **ZERO Button**

Press momentarily to compensate for the residual magnetism in the jaw. "REL" appears on the display. Press momentarily again to display the uncompensated measurement. The stored offset value is retained. "REL" will flash. Press and hold to clear the stored offset value and return to uncompensated measurement.

Repeat the procedure after changing DC current ranges.

AC Measurement

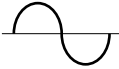
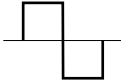
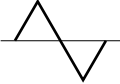

AC measurements are usually displayed as RMS (root mean square) values. The RMS value is equal to the value of a DC waveform, which would deliver the same power if it replaced the time-varying waveform. Two AC measurement methods are *average-responding RMS calibrated* and *true RMS-reading*.

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 Greenlee CM-900 is an average-responding meter.

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-950 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 can result in severe injury or death.

1. Set the selector according to the Settings Table. For DC current, start with the 600 A range.
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 (or batteries).
 - If the unit still does not function as expected, send the unit to Greenlee for repair. Refer to the instructions under the Warranty.
4. Take the reading from the circuit or component to be tested.
5. If it is a DC current reading, remove the clamp from the circuit and press the **ZERO** button. Clamp the jaw around the circuit again to measure the actual DC current.

If the resolution is not satisfactory on the 600 A range, remove the meter from the conductor and switch to the 400 A range. Repeat steps 4 and 5.

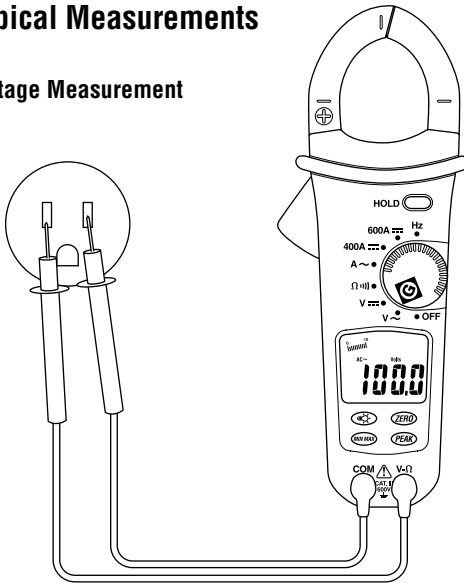
Settings Table

To measure this value ...	set the selector to this symbol ...	connect the red lead to ...	and connect the black lead to ...
Continuity*	Ω	V- Ω	COM
Resistance	Ω	V- Ω	COM
DC Voltage	V	V- Ω	COM
AC Voltage	V	V- Ω	COM
DC Current (600 A max.)	600A	Remove lead	Remove lead
DC Current (400 A max.)	400A	Remove lead	Remove lead
AC Current (600 A max.)	A	Remove lead	Remove lead
Frequency	Hz	Remove lead	Remove lead

* Tone sounds if the measured resistance is less than approximately 30 Ω .

Typical Measurements

Voltage Measurement

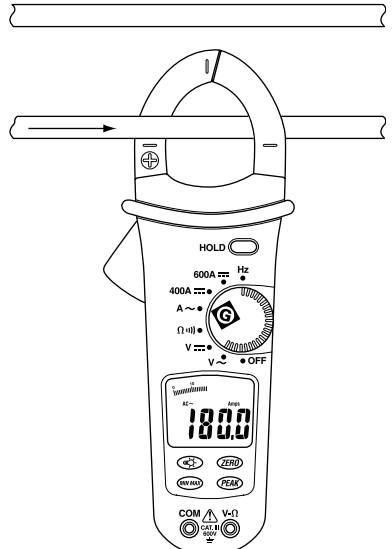


Current Measurement— Clamp Around Wire

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.

Note: For DC measurements, current flowing through the jaw in the direction indicated by the arrow produces a positive reading. Position the jaw for a positive reading for highest accuracy.

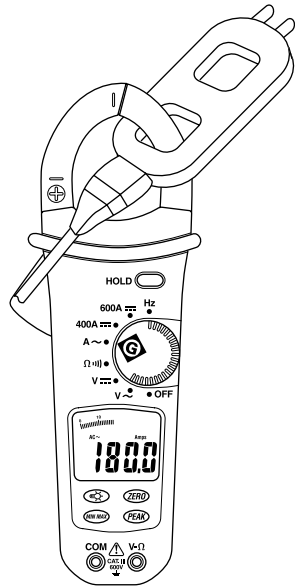


Typical Measurements

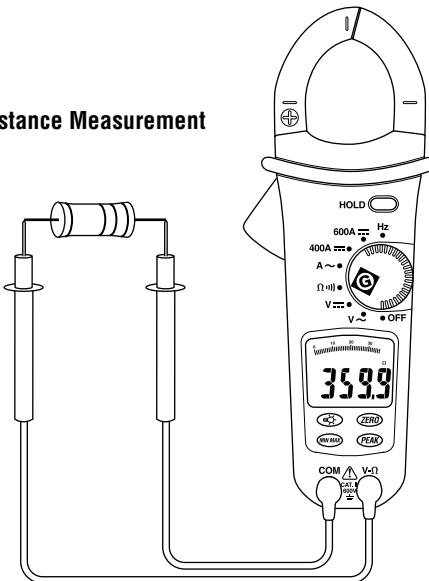
Current Measurement— Clamp Around Line Splitter

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.

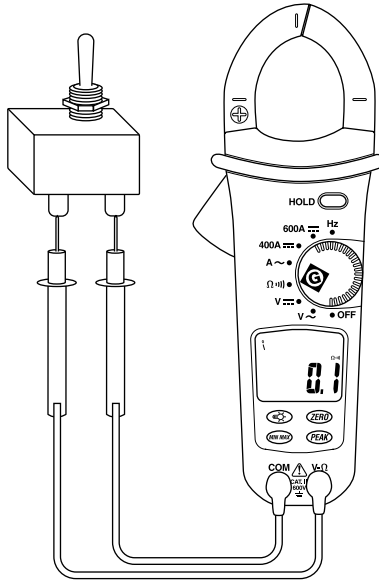


Resistance Measurement



Typical Measurements

Continuity Check



Accuracy

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

Accuracy is specified as follows: \pm (a percentage of the reading + a fixed amount) at 18 °C to 28 °C (64 °F to 82 °F), 0% to 80% relative humidity

AC Current

Range	Input Value	Accuracy (50 to 60 Hz)	Accuracy (61 to 400 Hz)
400.0 A	0.0 to 320.0 A	$\pm (1.5\% + 0.5 \text{ A})$	$\pm (2.0\% + 0.5 \text{ A})$
	320.0 to 400.0 A	$\pm (3.1\% + 0.5 \text{ A})$	$\pm (3.6\% + 0.5 \text{ A})$
600 A	400 to 600 A	$\pm (2.0\% + 7 \text{ A})$	$\pm (2.5\% + 7 \text{ A})$

$\pm 1.0\%$ position error

AC Voltage

Range	Accuracy	Frequency Response	Input Impedance
400.0 V	$\pm (1.0\% + 0.5 \text{ V})$	50 to 500 Hz	1 M Ω < 100 pF
600 V	$\pm (1.0\% + 5 \text{ V})$		

CM-900 is average sensing, RMS calibrated.

CM-950 is true RMS sensing. Accuracy is specified for sine waves at full scale and non-sine waves below half scale. For non-sine waves, add the following crest factor corrections:

- Crest factor 1.4 to 2.0, add 1.0%
- Crest factor 2.0 to 2.5, add 2.5%
- Crest factor 2.5 to 3.0, add 4.0%

Maximum crest factor is 3 at 400 A or 400 V, and 2 at 600 A or 600 V.

Accuracy (cont'd)

DC Current

Range	Accuracy
400.0 A	$\pm (1.2\% + 0.5 \text{ A})$
600 A	$\pm (1.9\% + 7 \text{ A})$

Position error: 1%

Remanence Error: 1% of current crest

DC Voltage

Range	Accuracy	Input Impedance
400.0 V	$\pm (0.7\% + 0.2 \text{ V})$	1 M Ω
600 V	$\pm (0.7\% + 2 \text{ V})$	

Resistance

Range	Accuracy
400.0 Ω	$\pm (1.0\% + 0.3 \Omega)$

600 V overload protection

Frequency (Current Mode)

Range	Accuracy	Minimum Input
0.020 to 0.400 kHz	$\pm (0.1\% + 0.002 \text{ kHz})$	3 A RMS

Peak Hold

Accuracy of held value is $\pm (3\% + 15 \text{ digits})$.

Accuracy is unspecified above 600 V peak and above 600 A peak.

Min Max

Add ± 15 digits to AC/DC current specification.

The meter switches to the 600 V or 600 A range when Peak Hold or MIN MAX is activated.

Specifications

Display: 3-3/4–digit LCD (4000 maximum count) and 42-segment bar graph

Sampling Rate:

Numeric Display: 1.5 per second

Bar Graph Display: 13 per second

Jaw Opening: 35 mm (1.38")

Measurement Category: Category III, 600 V

Temperature Coefficient: 0.2 x (Accuracy) per °C above 28 °C or below 18 °C

Operating Conditions:

Temperature:

0 °C to 30 °C (32 °F to 86 °F), 0% to 80% relative humidity, noncondensing

30 °C to 40 °C (86 °F to 104 °F), 0% to 75% relative humidity, noncondensing

40 °C to 50 °C (104 °F to 122 °F), 0% to 45% relative humidity, noncondensing

Altitude: 2000 m (6500') maximum

Indoor use only.

Storage Conditions: –20 °C to 60 °C (–4 °F to 131 °F),

0% to 80% relative humidity, noncondensing

Remove battery.

Pollution Degree: 2

Battery: One 9 V battery (NEDA 1604, JIS 006P, or IEC 6F22)

Battery Life: Approximately 200 hours with alkaline battery

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

- 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 can result in injury and can damage the unit.

Battery Replacement

WARNING

Before removing the battery cover, remove the test leads (or jaw) from the circuit and shut off the unit.

Failure to observe this warning can result in severe injury or death.

1. Disconnect the unit from the circuit.
2. Remove the screw from the battery cover.
3. Remove the battery cover.
4. Replace the battery. Observe polarity.
5. Replace the cover and the screw.

Cleaning

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

Distributed by: All-Spec Industries
5228 US Hwy 421 N
Wilmington, NC 28401
sales@all-spec.com
www.all-spec.com
PH: 800-537-0351
FX: 800-379-9903