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User's Guide

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HHM660/701
Clamp Meters

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INTRODUCTION

Thank you for purchasing Omega Engineering HHM660 or HHM701 Rugged Auto Ranging True RMS AC/DC Clamp Meter. Please read this user's manual carefully and thoroughly before using the instrument.

Each meter combines the functions of a voltmeter and a clamp-type ammeter. The meters are designed for use in an industrial setting by HVAC/R contractors, building maintenance technicians, MRO (maintenance, repair and operations) personnel at process and power plants, electricians and electrical/electronic technicians.

The only difference between the HHM660 and HHM701 involves their current measurement range and resolution. Where the HHM660 has a 0 to 600A measurement range and a maximum current resolution of 0.01A, the HHM701 has a 0 to 1000A measurement range and a maximum resolution of 0.1A.

Both clamp meters are easy to use and ruggedly built. Each meets the ETL CAT III 600V, CAT II 1000V safety standard.

KEY FEATURES

- 16 functions, 49 ranges
- Measures AC/DC current, AC/DC voltage, resistance, capacitance, frequency and duty cycle
- Also measures temperature from -58° to 1112°F (-50° to 600°C) using included "K" type stem thermocouple
- Uses beeper to verify integrity of diodes and check circuits for continuity
- 0 to 200μA/2000μA AC/DC ranges for measuring flame rod current with 0.1μA/1μA resolution using included test leads

- Built-in Non-Contact Voltage (NCV) detector with four sensitivity settings and audible and visual alerts
- Large backlit digital LCD with two 6000-count readouts for simultaneous display of real-time current or voltage on primary readout and line frequency on secondary readout
- Fast-response analog bar graph
- Bright LED work light
- Manual ranging and MIN/MAX display options
- Data HOLD and REL (zero) buttons
- INRUSH mode for measuring surge current during motor startup
- 1.65 in. (42mm) jaw opening (largest in its class) for conductors up to 550 MCM resists side torque
- Rugged housing can survive multiple drops onto concrete from height of 5 ft. (1.6m)
- 20-minute Auto Power Off (APO) function can be disabled
- ETL certified CAT III 600V, CAT II 1000V
- 3 year limited warranty

WHAT'S IN THE BLISTER PACK

The meter is supplied in a blister pack with a cavity in the rear for a soft black nylon carrying pouch. Inside the pouch are a set of double-insulated test leads with screw-on alligator clips, a "K" type stem thermocouple probe and plug adapter, 3 "AAA" batteries and this user's manual.

PRODUCT OVERVIEW

Fig. 1 shows the labels and positions of the controls, indicators and physical structures of the HHM660 and HHM701. Fig. 2 shows all possible indications on the LCD of either unit. Familiarize yourself with the functions and meanings of these controls, indicators and connectors before moving on to the Setup Instructions and Operating Instructions.

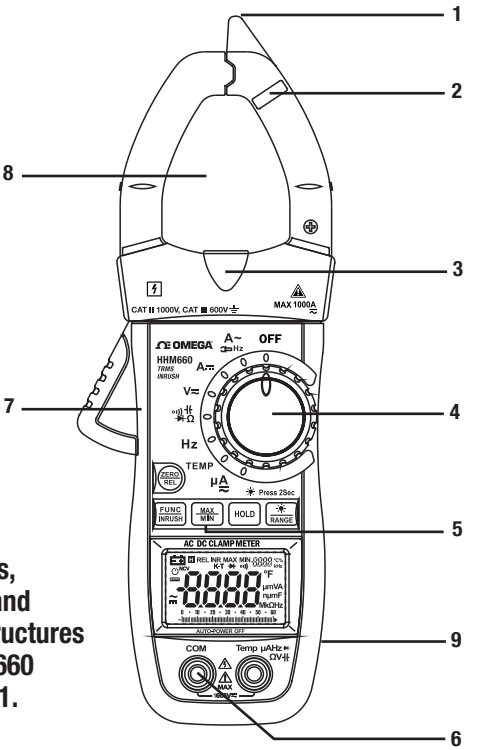


Fig. 1.
The controls, indicators and physical structures of the HHM660 and HHM701.

1. Non-contact voltage (NCV) sensor

2. NCV visual indicator

3. LED work light

4. Rotary function switch

5. Multi-function buttons:

ZERO/REL—Used to 1) **Reset DC current measurement baseline** to 0A, 2) **Enter relative measurement mode**, in which main readout shows difference between real-time reading and stored reading shown on secondary readout, 3) **Disable meter's Auto Power Off** function.

FUNC/INRUSH—1) **Selects among** resistance measurement, capacitance measurement, diode integrity and continuity check modes with rotary function switch in position, 2) **Switches between AC and DC** with rotary function switch in V≂ or μA≂ position, 3) **Enters surge current measurement mode** with rotary function in A~ position, 4) **Enters NCV sensitivity set mode** if pressed and held when powering on the meter.

MAX/MIN—Pressed once, enters Max/Min mode. Meter displays maximum value recorded during current measurement session on secondary readout. **Pressed twice, switches to display minimum** value recorded during current measurement session on secondary readout. **Pressed a third time, exits Max/Min** mode.

HOLD—Pressed once, holds measured value(s) (freezes main and secondary readouts). **Pressed again**, releases both readouts.

RANGE —**Pressed briefly**, enters manual ranging mode in broadest range. Each subsequent button press switches to next-narrowest full-scale measurement range. Pressing button in narrowest range returns to auto ranging mode. **Pressed and held** for >2 seconds, activates display backlight (and LED work light if rotary function switch is in A~ or A⎓ position).

6. Test lead jacks

7. Clamp jaw release

8. Clamp jaw

9. Battery compartment (on back)

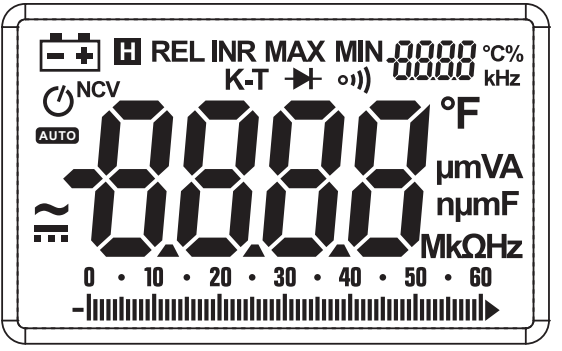


Fig. 2. All possible display indications

SAFETY INSTRUCTIONS

⚠⚠ Warning ⚠⚠

To avoid possible electric shock or personal injury, and to avoid damaging the meter or the equipment under test:

- Do not use the meter in any way not detailed in this manual or the meter's safety features may be compromised.
- Before using the meter, inspect the case. Do not use the meter if it is damaged. Look for cracks or missing plastic. Pay particular attention to the insulation around the connectors.
- ⚠**WARNING** Inspect the test leads for damaged insulation or exposed metal. Check the test leads for continuity. Replace damaged test leads before using the meter.
- Verify the meter's operation by measuring a known voltage. Do not use the meter if it operates abnormally. Protection may be impaired. When in doubt, have the meter serviced.
- ⚠**WARNING** Do not apply more than the rated voltage, as marked on the meter, between the terminals or between any terminal and ground.

- ⚠**WARNING** Do not measure voltages above 1000V in Category III installations.
- ⚠**WARNING** Do not measure voltage when the function switch points to the resistance (ohms), current, capacitance or temperature settings. Never measure current when the switch points to the resistance (ohms), capacitance or temperature settings.
- Use caution when working with voltages above $42VAC_{RMS}$, or 60VDC. These voltages pose a shock hazard.
- Use the proper terminals, function, and range for all measurements.
- ⚠**WARNING** Do not operate the meter around explosive gas, vapor, or dust.
- ⚠**WARNING** When using the probes, keep your fingers behind the finger guards. Do not touch the metal probes of the test leads when making a measurement.
- When making connections, connect the black (–) test lead before connecting the red (+) test lead; when disconnecting, disconnect the red (+) test lead before disconnecting the black (–) test lead.
- Disconnect circuit power and discharge all high-voltage capacitors before measuring/testing resistance, continuity, diodes, or capacitance.
- For all DC functions in both auto and manual ranging mode, to avoid the risk of shock due to possible improper reading verify the presence of any AC voltages by first using the AC function. Then select a DC voltage range equal to or greater than the AC range.
- Before measuring current, turn off power to the circuit before connecting the meter.
- Do not operate the meter with the case (or part of the case) removed.

- Use only three “AAA” batteries, properly installed in the battery compartment, to power the meter. Do not use rechargeable batteries.
- Replace the batteries as soon as the low battery indicator “  ” appears. Operated with weak batteries, the meter might produce false readings that could lead to electric shock and personal injury.
- Remove the test leads from the meter before opening the meter case or battery compartment.

Electrical Symbols Used On the Meter and In This Manual

Symbol	Description	Symbol	Description
	AC (Alternating Current)		Fuse
	DC (Direct Current)		Double Insulated
	Caution, risk of electric shock. Hazardous voltage.		Risk of danger. Important information. Refer to the manual.
	Battery (Low battery) when shown on display		Earth ground
	Diode		Continuity Beeper
	AC or DC		AC/DC

Symbol	Description	Symbol	Description
	Application and removal from hazardous live conductors permitted	CAT II	For measurements made on building equipment such as distribution panels, feeders and short branch circuits, and on lighting systems in large buildings.
	Auto Power Off function	CAT IV	For measurements on circuits connected directly to the source of power for a given building (for example, on the cable to the power transformer ahead of a building's circuit breakers). Very high levels of energy available at CAT IV level make arc flash possible.

SETUP INSTRUCTIONS

INSTALL BATTERIES

The battery compartment of the HHM660/701 is located at the back of the meter.

To open the compartment, use a small Phillips-head screwdriver to remove the single screw securing the battery compartment cover. Be careful not to lose the small screw. Put the screw and the cover to the side.

Install the three supplied "AAA" batteries in the battery compartment. Use the polarity marks stenciled inside the compartment as a guide.

Replace the battery compartment cover and secure it with the Phillips-head screw.

OPERATING INSTRUCTIONS
OMEGA INSTRUCTIONS

The HHM660/701 provides several functions that can be applied to measurements and displays of multiple parameters.

Ranging Options. By default, the meter automatically chooses the measurement range that maximizes the resolution of its current, voltage, resistance, capacitance, frequency and temperature measurements. The term **AUTO**—in reverse type on the left side of the LCD—indicates operation in auto ranging mode.

To switch to manual ranging for any measurement other than frequency, press the ☀ RANGE button once. This will make the AUTO term disappear and cause the meter to enter the broadest full-scale range available for that parameter (see the Specifications section on pp. 24 to 27 for a list of the measurement ranges available for each parameter).

Once the meter is in manual ranging mode, each subsequent press of the ☀ RANGE button will narrow the full-scale range by an order of magnitude (a factor of 10). For example, pressing the ☀ RANGE button with the meter operating in the 0 to 600μF full-scale manual range will narrow the full-scale range to 0 to 60μF (and improve measurement resolution). The next press of the button will narrow the range to 0 to 6μF. When the narrowest full-scale range has been reached, the next press of the button will cause the meter to re-enter Auto Ranging mode.

Holding readings. Pressing the **HOLD** button "freezes" the values on both the primary and secondary readouts and causes a reverse-type "H" (**H**) to appear on the top of the LCD. Pressing the **H** button again releases the hold and removes the **H**.

Tracking Max and Min Readings. Pressing the **MAX/MIN** button once switches the secondary

readout to show the *largest* value of the parameter being measured since entering that measurement mode. The primary display and the analog bar graph below it will continue to show real-time readings.

Pressing the **MAX/MIN** button a second time switches the secondary readout to show the *smallest* value of the parameter being measured since entering that measurement mode. The primary display and the analog bar graph below it will continue to show real-time readings.

Pressing the **MAX/MIN** button a third time resumes "normal" display operation, with different values in the primary and secondary readouts.

When the **MAX/MIN** button is pressed, the meter will automatically exit Auto Ranging mode and enter Manual ranging mode using the full-scale range in effect at that moment.

Making Relative Measurements. Pressing the **ZERO/REL** button during measurement of a current, voltage, resistance or capacitance freezes the value being measured at that moment on the secondary readout. The term **REL** will appear on the top line of the LCD to indicate operation in this special mode. In **REL** mode, the primary readout will show the *difference* between ongoing measurements and the frozen value. **REL** mode is useful for tracking changes in dynamic processes or deviations from baseline readings.

When the **REL** button is pressed, the meter will automatically exit Auto Ranging mode and enter Manual ranging mode using the full-scale range in effect at that moment.

To exit **REL** mode and resume operation in "normal" display operation, press the **ZERO/REL** button again.

Disabling Auto Power Off (APO). By default, the meter will automatically power itself off if no front-panel buttons are pressed within any span of 20 minutes.

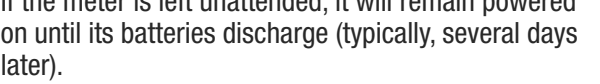
The ⏻ icon on the left side of the LCD indicates that the APO function is enabled.

Once the APO function has activated and powered the meter off, you cannot reactivate the meter simply by turning the rotary function switch to a different position. You must either rotate the switch to the **OFF** position and then to another position, or press a button—any button.

To disable the **APO** function, you must power on the meter in a special way—by pressing and holding the **ZERO/REL** button while turning the rotary function switch to a position other than **OFF**. If the meter is powered on in this way, the ⏻ icon will not appear. If the meter is left unattended, it will remain powered on until its batteries discharge (typically, several days later).

Using the Analog Bar Graph

The bar graph at the bottom of the LCD (see below) provides an analog representation of every measurement shown in digital form on the primary readout above it.



The key feature of the bar graph is its fast response time. It can reflect a change in a measured value 10 times more quickly than the digital readout can. Accordingly, it is useful for tracking parameters that change very rapidly (a voltage or current, for example).

Turning On the Backlight

Pressing and holding the ☀ RANGE button for at least 3 seconds turns on the LCD's bright white backlight, making measurements much easier to read in dark spaces. If the rotary function switch is in the A~ or A⎓ position, pressing and holding the ☀ RANGE button also turns on the bright white LED work light at the base of the clamp jaw (Fig. 1, Callout 3).

To avoid having the backlight drain the meter's batteries, the backlight (and work light, if activated) automatically extinguishes in 20 seconds.

MEASURING AC OR DC CURRENT

⚠⚠ Warning ⚠⚠

Before making current measurements, make certain that all test leads are disconnected from the meter terminals.

(1) Set the rotary function switch to the **A~** (AC current) or **A⎓** (DC current) position to match the type of current you wish to measure. The corresponding ~ or ⎓ symbol will appear on the left side of the LCD. Before measuring DC current, press the **ZERO/REL** button to reset the DC current measurement baseline to **0A**.

(2) Squeezing the clamp jaw release to open the jaw, place it around the conductor whose current you wish to measure. Be sure to enclose only one conductor (see figure below). Enclosing both conductors of a pair will produce a reading of 0.

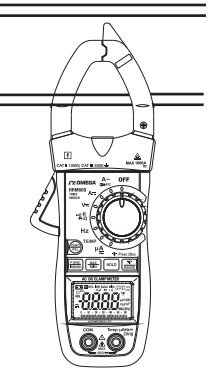
Notes:

Clamp the jaw around one conductor only.

Close the jaw completely.

Center the wire in the jaw for highest accuracy.

When measuring DC currents, observe the "+" polarity mark on the right jaw to avoid negative readings.



(3) Read the measured value(s) from the display. During measurements of AC current, the primary readout in the center of the LCD shows the measured current value, while the secondary readout in the upper right corner shows the frequency of the current.

Notes:

A. Omega's HHM301 Flex Clamp Adapter (optional) makes it possible to enclose a thick or hard-to-reach conductor, a bundle of conductors, or a busbar carrying up to 3000A. The accessory uses induction to convert current readings to millivolt values that can be displayed by the HHM660 or HHM701. For more information or to order, visit www.omega.com and enter "HHM301" in the SEARCH box.

Measuring AC Inrush Current

To measure the inrush current of a motor during startup, press the **FUNC/INRUSH** button with the rotary function switch in the position. The term **INR** will appear on the top line of the LCD and the primary readout will show the motor's surge current (to a maximum of 600A for the HHM660 and 1000A for the HHM701). For this application, the current is measured by the clamp jaw, after **A~** has been placed around one conductor of the motor's power supply line.

To return to AC current measurement mode, press the **FUNC/INRUSH** button again.

Measuring Microamp Currents

The HHM660/701 provides two dedicated ranges (0 to 200μA, and 0 to 2000μA) for measuring minute amounts of AC or DC current (such as from a furnace flame rod). For this application, the test leads are placed in series with the device conducting the current.

To measure a microamp current:

1. Turn the rotary function switch to the μA position.
2. Plug the red and black test leads into the red and black jacks at the bottom front of the meter.
3. Connect the test leads in series with the device whose current flow you wish to measure.
4. Read the measured current amplitude on the primary readout.

MEASURING AC OR DC VOLTAGE

⚠⚠ Warning ⚠⚠

Do not measure voltage higher than 1000V. Doing so may damage the meter's internal circuitry. If the voltage is over 1000V, the beeper will sound continuously, indicating an over-range measurement.

(1) Set the rotary function switch to the V≂ position. By default, when the switch is set to this position the meter will measure AC voltage. To measure DC voltage, press the **FUNC/INRUSH** button to change the icon at the lower left of the LCD from ∼ to ⎓.

(2) Plug the red and black test leads into the red and black jacks at the bottom front of the meter.

(3) Touch or clip the black test lead to the lower-potential point of the circuit under test, and the red test lead to the higher-potential point.

(4) Read the measured voltage on the display. If the test leads are reversed, a minus sign will appear at the left of the displayed value.

Using the Non-contact Voltage Detector

The NCV function provides a safe (non-contact) way to check whether a line, cable or AC outlet is "hot" (energized). At the tip of the clamp jaw (Fig. 1, Callout 1) is an NCV sensor that can detect from a short distance the electromagnetic field created by AC voltage. If voltage is detected, the meter produces audible and visual alarms (a beeping sound, and a

flashing white light behind a red lens near the tip (Fig. 1, Callout 2)).

Even unloaded AC circuits generate electromagnetic fields. Although these fields are extremely weak, their constantly changing nature means that they generate some current. A sensitive NCV detector can sense this current via induction, in much the same way that a sensitive radio receiver can sense weak radio waves.

NCV detectors cannot detect DC voltages, such as those present in automotive electrical systems. In addition, the HHM660/701 typically cannot detect 120VAC from a distance of more than 0.25 in. (6.2mm), and never through a wall or metal conduit.

Unlike other NCV detectors with only one sensitivity level—and therefore the ability to detect only one range of voltages (typically 50 to 600VAC)—the detector in the HHM660 and HHM701 has four sensitivity levels. They were chosen to optimize voltage detection over four practical ranges: 12 to 25VAC, 70 to 125VAC, 150 to 240VAC and 250 to 600VAC.

The ability to detect the presence of 12VAC in noncontact fashion comes in very handy during troubleshooting of branch circuits and process plant and industrial automation systems and equipment such as gas and water valves, fans, lights, relays, inverters, solenoids and horns. 12VAC is also commonly used to power hardwired commercial and residential building doorbells/buzzers and thermostats. Separately, the HHM660/701's ability to detect 480V using its lowest sensitivity range makes troubleshooting and installing generators and fluorescent lighting ballasts easier, faster and safer.

User-adjustable sensitivity does more than make the NCV detector in the HHM660/701 more versatile. It also improves the instrument's performance. The value of the detector's highest sensitivity level (12 to 25VAC)

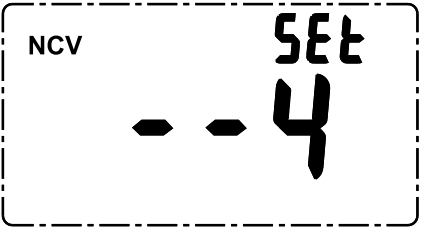
is obvious: it allows non-contact detection of 12VAC, an ability that most other NCV detectors lack. However, the detector's lower sensitivity levels, which cover common AC power voltages, also have great value, for the following reason.

Merely detecting the presence of 120VAC near a bundle of wires does not tell you which wire of the bundle is the "hot" wire; any of the wires could be activating the alarms. The NCV detector in the HHM660/701 can help you isolate the hot wire. This application calls for turning down the sensitivity in stages after the NCV detector senses voltage. As you reduce sensitivity, at some stage only the energized wire will produce a field strong enough to activate the NCV's alarms. In this way, the adjustable sensitivity of the HHM660/701's NCV detector takes the guesswork out of identifying the "hot" wire of a bundle.

By default, powering on the HHM660/701 enables the NCV function (indicated by the term NCV on the left side of the LCD) and sets it to a sensitivity of 3. At this level, the corresponding voltage detection range is 70 to 125VAC—optimum for detecting energized outlets in the U.S.

To disable the NCV function or change its sensitivity, you must first power off the meter and then power it back in special way—by pressing and holding the **FUNC/INRUSH** button while turning the rotary function switch to a position other than **OFF**.

Powering on the meter in this way produces the following display on the LCD.



To change the NCV sensitivity level, press the RANGE button one or more times. Pressing the RANGE button once from a starting sensitivity of 4 changes the level to 0, effectively disabling the NCV function. Pressing the RANGE button an additional one, two or three times changes the sensitivity level to 1, 2 and 3, respectively.

Once you have determined which level of NCV sensitivity suits your application, use the RANGE button to set it to that level. After you disable the NCV function or change its sensitivity level, you must then save the setting by pressing the **HOLD** button. The meter will remember this setting and resume operation at that sensitivity level the next time it is powered on, and even after a battery replacement.

⚠⚠ Warning ⚠⚠

The NCV detector in the HHM660/701 is designed to indicate the presence of AC voltage with an amplitude between 12VAC and 600VAC. Accordingly, do *not* assume that the absence of a positive indication means that the circuit under test is de-energized (not "hot"). Although they can cause shock and/or serious personal injury, voltages below 12V may not be detected by the HHM660/701. Whenever you have reason to suspect that a line or outlet is "hot", confirm your suspicion by measuring the voltage of the line or outlet using the test leads and with the meter's rotary function switch in the V≂ position.

To check whether a line, cable or AC outlet is "hot" (energized), touch it with the tip of the clamp jaw or bring the tip within 1/4 inch of it. If the beeper sounds repeatedly and the LED flashes rapidly, the line or outlet is energized.

MEASURING RESISTANCE

⚠⚠ Warning ⚠⚠

To avoid electrical shock or damage to the meter when measuring resistance or continuity in a circuit, make sure power to the circuit is turned off and all capacitors are discharged.

(1) Turn the rotary function switch to the position. By default, when the switch is initially set to this position with the test leads *not* plugged in, the meter will automatically enter the 60MΩ range, display **0.L** (indicating an open circuit) on the primary readout, and display the term **M**Ω above the right end of the bar graph at the bottom of the LCD.

(2) Plug the red and black test leads into the red and black jacks at the bottom front of the meter.

(3) Measure the resistance by touching or clipping the tips of the leads to the desired test points of the circuit or to the terminals of a component, as shown below.

(4) Read the measured resistance on the display. If the measured resistance value is greater than 60MΩ, **0.L** will appear on the primary readout. The meter will take a few seconds to stabilize when measuring resistances greater than 1MΩ.

CHECKING FOR CONTINUITY

(1) Turn the rotary function switch to the position. Press the **FUNC/INRUSH** button once to select the continuity check function. If test leads are not plugged into the meter's front-panel jacks, the primary readout will show **.0L**, with the icon of a continuity beeper ( ) above it.

(2) Plug the red and black test leads into the red and black jacks at the bottom front of the meter.

(3) Touch or clip the test leads to any two points of a circuit. The resistance between those two points will be shown on the primary readout. If the resistance is <50Ω, the beeper will sound continuously. If there is no continuity (an open circuit or a resistance greater than 600Ω between the two points), **0.L** will appear on the primary readout.

CHECKING THE INTEGRITY OF A DIODE

(1) Turn the function switch to the position. Press the **FUNC/INRUSH** button twice to select the diode check function. If test leads are not plugged into the meter's front-panel jacks, the primary readout will show **0.L**, with the icon of a diode ( ) above it.

(2) Plug the red and black test leads into the red and black jacks at the bottom front of the meter.

(3) Touch or clip the red test lead to the anode (positive terminal) of the diode to be tested, and the black test lead to its cathode (negative terminal).

(4) Read the forward bias voltage value on the display. A silicon diode typically has a forward bias voltage of 0.7V. A germanium diode typically has a forward bias voltage of 0.3V. A 0V reading in both directions indicates a shorted diode. An **.0L** reading indicates an open diode. In either case, the diode is defective and should be replaced.

MEASURING CAPACITANCE

⚠⚠ Warning ⚠⚠

To avoid possible damage to the meter or other equipment, turn off the power source and discharge all high-voltage capacitors.

(1) Disconnect the capacitor from power.

(2) Short the capacitor's terminals to discharge it.

(3) Disconnect any resistors between the terminals of the capacitor.

(4) Turn the function switch to the position. Press the **FUNC/INRUSH** button three times to select the capacitance measurement function. If test leads are not plugged into the meter's front-panel jacks, the primary readout will show **0.000 nF**.

(5) Plug the red and black test leads into the red and black jacks at the bottom front of the meter.

(6) Touch or clip the test leads to the terminals of the capacitor.

(7) Read the measured capacitance on the display.

MEASURING FREQUENCY AND DUTY CYCLE

Frequency measurements can be made with the rotary function switch in the A~, V≂ or **Hz** position. The most-accurate measurements over the widest range are made with the switch in the **Hz** position, with the input voltage or current provided by the test leads.

To measure frequency in this mode:

(1) Turn the rotary function switch to the **Hz** position.

(2) Plug the red and black test leads into the red and black jacks at the bottom front of the meter.

(3) Touch or clip the test leads to the voltage source or between loads.

(4) Read the measured frequency on the primary readout and the duty cycle (as a percentage) on the secondary readout in the upper right corner of the LCD.

With the rotary function switch in the Hz position, the meter can measure frequencies from 10Hz to 60MHz with an accuracy of ±(0.5% of the reading + 3 digits). For inputs at frequencies below 10Hz, the primary readout will show **00.00 Hz**. For inputs at frequencies above 60kHz, the accuracy of duty cycle measurements is not guaranteed.

Frequency measurements can be made with the rotary function switch in either the **A~** position (with input provided by current sensed by the clamp jaw) or the **V≂** position (with input provided by the test leads). In both cases:

- The measured frequency is displayed on the secondary readout in the upper right corner of the LCD.
- Measurement accuracy is limited to ±(1.5% of the reading + 3 digits).
- Measurement range is limited to 10Hz to 1kHz. With the rotary function switch in the **A~** position, the meter can measure the frequency of AC currents with amplitudes up to $1A_{RMS}$. With the switch in the **V≂** position, the meter can measure the frequency of AC voltages with amplitudes up to $20mV_{RMS}$.

MEASURING TEMPERATURE

To measure the temperature of a solid, liquid or gas:

(1) Turn the rotary function switch to the **TEMP** position. The term **K-T** will appear above the term **OL.** on the primary readout.

(2) Plug the included “K” thermocouple adapter into the red and black jacks at the bottom front of the meter. Make sure to insert the + (positive) plug of the adapter into the red jack and the **COM** plug into the black jack.

(3) Plug the included “K” type thermocouple (or a different “K” type thermocouple) into the adapter. Make sure to insert the slightly wider blade of the thermocouple into the – (negative) slot of the adapter.

SPECIFICATIONS

Parameter or Feature/Function	Specification	
AC voltage (True $_{RMS}$)	Measurement ranges	
	Measurement accuracy	
DC voltage	Measurement ranges	
	Measurement accuracy	
AC current (True $_{RMS}$)	Measurement ranges	
	Measurement accuracy	
Inrush current (True $_{RMS}$)	Measurement ranges	
	Measurement accuracy	
DC current	Measurement ranges	
	Measurement accuracy	
AC/DC microamp current (True $_{RMS}$)	Measurement ranges	
	Measurement accuracy	
Resistance	Measurement ranges	
	Measurement accuracy	
Frequency (through clamp jaw)	Measurement ranges	
	Measurement accuracy	
Frequency (in V≂ mode)	Measurement ranges	
	Measurement accuracy	

(4) To measure a surface temperature, firmly attach the tip or bead of the thermocouple to the surface. To measure the temperature of a liquid or gas (including ambient air), make sure that the tip of the thermocouple is within the fluid.

Read the measured temperature on the primary readout in degrees Fahrenheit and on the secondary readout in degrees Celsius.

EEM66-	EEM70.
0 to 600mV/6V/60V/600V/1000V	
±(0.8% of reading + 3 digits)	
0 to 600mV/6V/60V/600V/1000V	
±(0.5% of reading + 3 digits)	
0 to 60A/600A	0 to 600A/1000A
±(1.8% of reading + 5 digits)	
10 to 60A/600A	10 to 600A/1000A
±(10% of reading + 5 digits)	
0 to 60A/600A	0 to 600A/1000A
±(3% of reading + 5 digits)	
0 to 200μA/2000μA	
±(1% of reading + 5 digits)	
0 to 600Ω/6kΩ/60kΩ/600kΩ/6MΩ/60MΩ	
±(0.8% of reading + 3 digits)@<1MΩ; ±(1.2% of reading + 3 digits)@≥1MΩ	
10Hz to 60Hz/600Hz/6kHz for inputs >1AAC$_{RMS}$	
±(1.5% of reading + 5 digits)	
10Hz to 60Hz/600Hz/6kHz/60kHz for inputs >20mAAC$_{RMS}$	
±(1.5% of reading + 5 digits)	

Frequency (in Hz mode)	Measurement ranges	
	Measurement accuracy	
Capacitance	Measurement ranges	
	Measurement accuracy	
Continuity	Threshold	
Diode integrity	Open circuit voltage	
Duty cycle	Measurement range	
	Measurement accuracy	
Temperature (via included "K" type stem thermocouple)	Measurement range	
	Measurement accuracy	
Overload protection level in resistance, continuity, diode integrity, capacitance and μA modes		
Input impedance		
Sampling time		
Safety rating		
Clamp jaw opening		
Display	No. of digits	
	Maximum count	
Auto power off trigger		
Operating temperature		
Storage temperature		
Maximum altitude		
Power source		
Dimensions		
Weight (including batteries)		

Note: Accuracy values are guaranteed for 1 year after factory calibration at an operating temperature between 64° and 82°F (18° and 28°C). All accuracy specifications must be derated (increased) by 5.5% for each degree F of operating temperature outside this range.

For example, an accuracy specification of ±3% between 64°F and 82°F would be derated to:

10Hz to 60Hz/600Hz/6kHz/60kHz/600kHz/6MHz/60MHz for 3V peak-to-peak square wave
±(0.3% of reading + 5 digits)
0 to 6nF/60nF/600nF/6μF/60μF/600μF/6mF/60mF
±(5% of reading+ 5 digits)@<10nF; ±(4% of reading+ 5 digits)@>10nF
≤ 50Ω
2.8V
1 to 99%
±3%
-58° to 1112°F (-50° to 600°C)
±(2% + 2 digits)
250VAC/DC_{RMS}
10MΩ
<250msec
ETL CAT III 600V, CAT II 1000V
1.65 in. (42mm)
3-3/4
6000
20 minutes of front-panel inactivity
14° to 122°F (-10° to 50°C)
-4° to 140°F (-20° to 60°C)
6562 ft. (2000m)
Three “AAA” batteries
8.86 x 3.31 x 1.30 in. (225 x 84 x 33mm)
14.8 oz. (420g)

- **±3.165%** (±3% + (3% x 5.5% x 1)) **for operation at 63°F and 83°F** (one degree outside the range)
- **±3.33%** (±3% + (3% x 5.5% x 2)) **for operation at 62°F and 84°F** (two degrees outside the range)
- **±3.495%** (±3% + (3% x 5.5% x 3)) **for operation at 61°F and 85°F** (three degrees outside the range) · etc.

OPERATING & MAINTENANCE TIPS

When the  icon appears at the upper left of the LCD, it's time to replace the three "AAA" batteries that power the meter (although measurements will remain valid for several hours after the icon first appears). To replace the battery, follow the instructions on p. 10.

Do not operate the HHM660/701 in the presence of flammable or explosive gas or near an arc welder or induction heater.

After subjecting the meter to a large change in ambient temperature, wait at least 30 minutes before making measurements to guarantee the accuracy of readings.

Remove the batteries when storing the meter or when you do not expect to use it for an extended period of time (months rather than weeks).

Do not disassemble the HHM660/701 or immerse it in water.

NOTES

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workman-ship for a period of **13 months** from date of purchase. OMEGA's Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfac-ing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibra-tion; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/ DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence. The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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