

# Where Do I Find Everything I Need for Process Measurement and Control? OMEGA ... Of Course!

M-3477/0899

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## TEMPERATURE

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- ☐ Recorders, Controllers & Process Monitors
- ☐ Infrared Pyrometers

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- ☐ Recorders, Printers & Plotters

## HEATERS

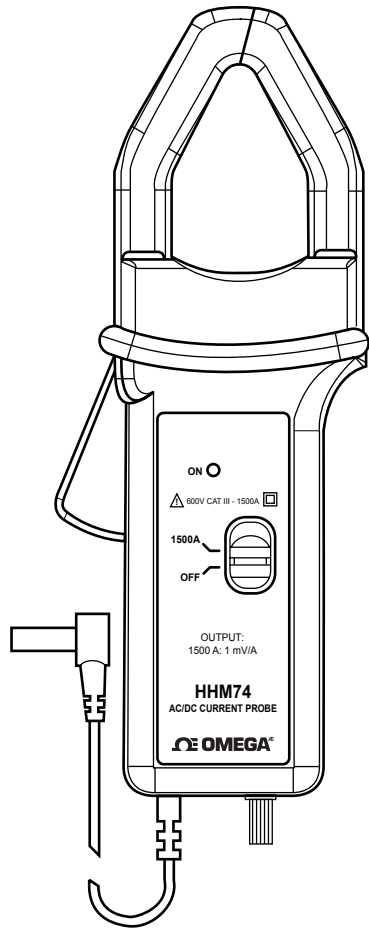
- ☐ Heating Cable
- ☐ Cartridge & Strip Heaters
- ☐ Immersion & Band Heaters
- ☐ Flexible Heaters
- ☐ Laboratory Heaters

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- ☐ Refractometers
- ☐ Pumps & Tubing
- ☐ Air, Soil & Water Monitors
- ☐ Industrial Water & Wastewater Treatment
- ☐ pH, Conductivity & Dissolved Oxygen Instruments



CE



<http://www.omega.com>  
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Model HHM71  
Model HHM74  
AC/DC Current Probes

## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA 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 should malfunction, 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 interfacing, 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 being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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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. P.O. 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. P.O. number to cover the COST of the repair,
2. Model and serial number of 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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Customer Service: 1-800-622-2378 / 1-800-622-BEST<sup>SM</sup>  
Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN<sup>SM</sup>  
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It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, patient connected applications.

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## Warning


These safety warnings are provided to ensure the safety of personnel and proper operation of the instrument.

- Read the instruction manual completely and follow all the safety information before attempting to use or service this instrument.
- Use caution on any circuit: Potentially high voltages and currents may be present and may pose a shock hazard.
- Read the Safety Specifications section prior to using the current probe. Never exceed the maximum voltage ratings given.
- Safety is the responsibility of the operator.
- NEVER open the back of the instrument while connected to any circuit or input.
- ALWAYS connect the current probe to the display device before clamping the probe onto the sample being tested.
- ALWAYS inspect the instrument, probe, probe cable, and output terminals prior to use. Replace any defective parts immediately.
- NEVER use the current probe on electrical conductors rated above 600 V in overvoltage category III (CAT III). Use extreme caution when clamping around bare conductors or bus bars.

## Notes:

## International Electrical Symbols

 This symbol signifies that the probes are protected by double or reinforced insulation. Use only specified replacement parts when servicing the instrument.

 This symbol signifies CAUTION! and requests that the user refer to the user manual before using the instrument.

## Receiving Your Shipment

Upon receiving your shipment, make sure that the contents are consistent with the packing list. Notify Omega of any missing items. If the equipment appears to be damaged, file a claim immediately with the carrier and notify Omega at once, giving a detailed description of any damage.

## Maintenance

### Warning

- For maintenance use only specified replacement parts.
- Avoid electrical shock: do not attempt to perform any servicing unless you are qualified to do so.
- Avoid electrical shock and/or damage to the instrument: do not get water or other foreign agents into the case. Turn the current probe OFF and disconnect the unit from all circuits before opening the case.
- Also see Warning on Page 2.

### Battery Replacement

- When the probe is turned on, the green LED should light up. If it does not, replace the 9 V battery. Completely disconnect the probe from the circuit under test and from the oscilloscope or measuring instrument. Turn the probe “Off”, unscrew the battery compartment screw and remove cover. Replace the battery and put the cover back on.
- Do not replace the battery while the probe is in use.

### Cleaning

- Clean the body of the clamp with a cloth lightly moistened with soapy water. Wipe clean with a cloth moistened with clean water and dry. Do not use solvent.

## Packaging

The AC/DC Current Probes Model HHM71 and Model HHM74 include 9 V battery and user manual.

## Description

The Models HHM71 and HHM74 are the newest line of professional AC/DC current probes. They are designed to the latest safety and performance standards. Two different hook-shaped jaws are offered, both permitting the user to “pry” into or “hook” onto cables (will accept 2 x 500 MCM) or small bus bars.

Differing from traditional AC transformers, AC/DC current sensing is often achieved by measuring the strength of a magnetic field created by a current-carrying conductor in a semiconductor chip using the Hall effect principle. When a thin semiconductor is placed at right angles to a magnetic field, and a current is applied to it, a voltage is developed across the semiconductor. This voltage is known as the Hall voltage, named after the US scientist Edwin Hall who first reported the phenomenon. Since the Hall voltage is not dependent on a reversing magnetic field, but only on its strength, the device can be used for DC measurement. Second, when the magnetic field strength varies due to varying current flow in the conductor, response to change is instantaneous. Thus, complex AC wave forms may be detected and measured with high accuracy and low phase shift. The basic construction of a probe jaw assembly is shown Figure 1. (Note: one or two Hall generators are used depending on the type of current probe).

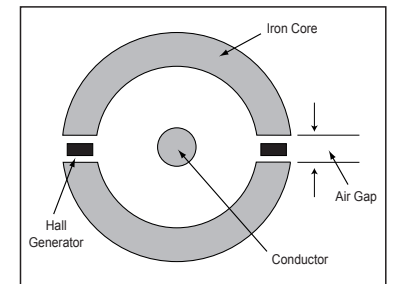


Figure 1

The electronics and batteries are self-contained in the handles. The output of the AC/DC probes is 1 mV/A. When taking DC measurements, a mechanical DC zero allows the user to adjust for any DC offset. There is no output filtering - True RMS with DC components is possible. Phase shift is excellent, making the MR series well suited for power and power quality applications.

Model HHM71 measures 400 A AC (600 A peak), 600 A DC. Model HHM74 measures 1000 A AC (1500 A peak), 1500 A DC. Both of the probes have proportional mV output for direct readings on multimeters, recorders, loggers and other instruments accepting banana plugs. An optional banana plug to BNC adaptor is available as an accessory.

## HHM71 Specifications

### ELECTRICAL

#### Measurement Range:

1 to 400 A AC (600 A Peak)  
1 to 600 A DC

#### Accuracy and Phase Shift\*:

1 to 100 A: 1.5% reading  $\pm$  1 A  
100 to 400 A: 2.0% reading  
400 to 600 A DC only:  
2.5% reading

#### Phase Shift:

45 to 65 Hz  
10 to 200 A:  $\leq$  2.5°  
200 to 400 A:  $\leq$  2°

#### Overload:

2000 A DC and 1000 A AC  
continuous up to 1 kHz

### MECHANICAL

#### Jaw Opening:

1.2" (31 mm)

#### Maximum Cable Diameter:

One 1.18" (30 mm) or two  
0.95" (24 mm) or two bus bars  
1.2 x 0.4" (31.5 x 10 mm)

#### Dimensions: (without zero knob)

8.8 x 3.82 x 1.73"  
(224 x 97 x 44 mm)

#### Weight:

15 oz (440 g)

\*Reference conditions: 18° to 28°C, 20 to 75% RH, external magnetic field <40 A/m, no DC component, no external current carrying conductor, test sample centered, 1 M $\Omega$   $\leq$  100 pF load, zero adjustment prior to measurement [DC only] DC to 65 Hz. Battery voltage 9 V  $\pm$  0.1 V.

## HHM74 Specifications

### ELECTRICAL

#### Measurement Range:

1 to 1000 A AC (1500 A Peak)  
1 to 1500 A DC

#### Accuracy and Phase Shift\*:

1 to 100 A: 1.5% reading  $\pm$  1 A  
100 to 800 A: 2.5% reading  
800 to 1000 A: 4.0% reading  
1000 to 1500 A DC only:  
4.0% reading

#### Phase Shift:

45 to 65 Hz  
10 to 200 A:  $\leq$  2.5°  
200 to 1000 A:  $\leq$  2°

#### Overload:

3000 A DC and 2000 A AC  
continuous up to 1 kHz

### MECHANICAL

#### Jaw Opening:

1.55" (40 mm)

#### Maximum Cable Diameter:

One 1.5" (39 mm) or one bus bar  
1.96 x 0.49 (50 x 12.5 mm) or  
Two 0.98" (25 mm) or two bus bars  
1.96 x 0.19" (50 x 5 mm)

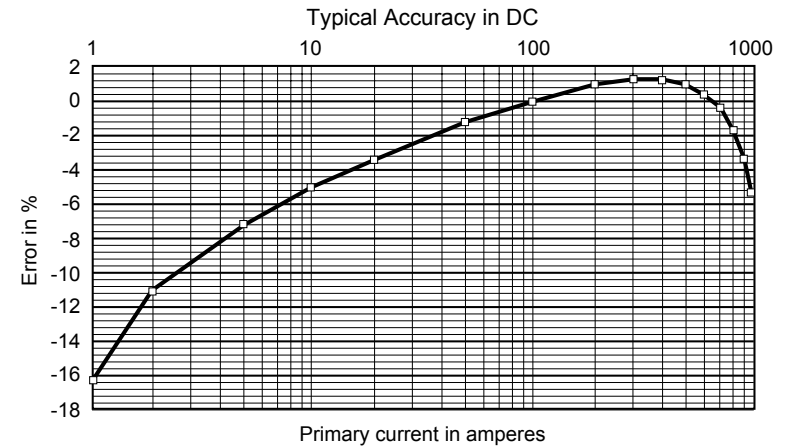
#### Dimensions: (without zero knob)

9.31 x 3.82 x 1.73"  
(236.5 x 97 x 44 mm)

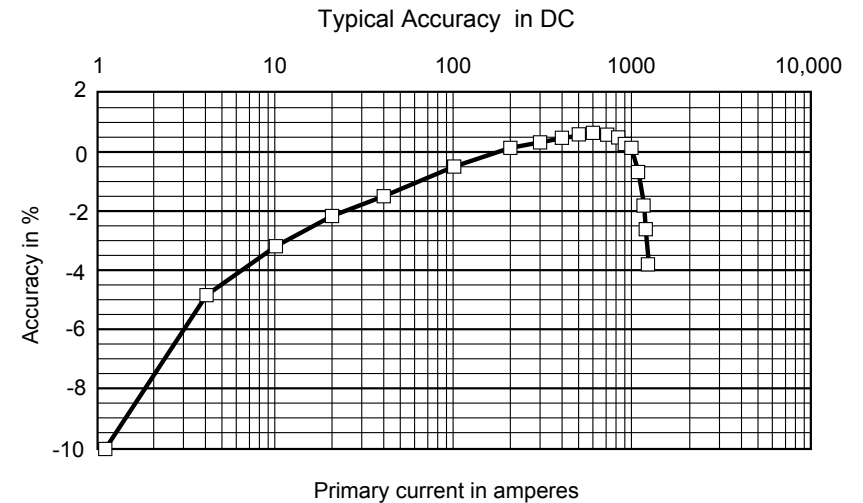
#### Weight: 1.06 lb (480 g)

## Typical Response Curves

### Model HHM71



### Model HHM74



## Tips for Getting the Best Accuracy

These probes are capable of measuring DC and frequency currents over a wide range. Here are some key considerations for getting the most accuracy from your display instrument:

- When using the Models HHM71 and HHM74 with a DMM or other meter, it is important to select the range that provides the best resolution.
- Make sure that probe jaw mating surfaces are free of dust and contamination.
- Beware of short-circuit currents. Large in-rush DC currents (which can occur when power is first applied in a circuit) and large high-current transients may cause varying degrees of residual readings. If in doubt of a particular reading, remove the probe from the conductor under test and check to see that the display device returns to zero. If not, it will be necessary to rezero the probe.

## Common Specifications (HHM71 & HHM74)

### ELECTRICAL

**Output Signal:**

1 mV/A

**Frequency Range:**

DC to 10 kHz @ -3 dB

**Noise:**

DC to 1 kHz:  $\leq 1$  mV peak to peak.

DC to 5 kHz:  $\leq 1.5$  mV peak to peak.

0.1 Hz to 5 kHz:  $\leq 500\mu\text{V}$  peak to peak.

**Rise and Fall Time:**

Rise:  $\leq 100\mu\text{s}$  from 10 to 90% Vout

Fall:  $\leq 120\mu\text{s}$  from 10 to 90% Vout

**Load Impedance:**  $>100$  k $\Omega$ /100 pF

**Insertion Impedance:**

0.39 m $\Omega$  @ 50 Hz, 58 m $\Omega$  @1000 Hz

**Working Voltage:** 600 Vrms

**Common Mode Voltage:** 600 Vrms

**Influence of Adjacent Conductor:**

$< 10$  mA/A at 50 Hz at 23 mm from the probe

**Influence of Conductor in Jaw Opening:**

0.5% reading (DC to 440 Hz)

**Battery:**

9 V alkaline (NEDA 1604A, IEC 6LR61), 6LF22

**Low Battery:**

Green LED on when battery voltage  $\geq 6.5$  V

**Battery Life:**

Approx. 120 hours with alkaline battery



## Common Specifications Continued

### MECHANICAL

**Output:** Double insulated 5 ft. (1.5 m) lead with safety banana plugs

**Operating Temperature Range:** 14° to 131°F (-10° to +55°C)

**Storage Temperature Range:** -40° to 176°F (-40° to +80°C)

**Temperature Influence:**

≤ 100° ppm/°K or 1%/10°K

≤ 0.3 A/°K on Zero

**Operating Relative Humidity:**

10° to 35°C: 90 ± 5% RH (without condensation)

40° to 55°C: 70 ± 5% RH (without condensation)

**Humidity Influence:** 10 to 90% RH @ reference temperature ≤ 0.1% R

**Altitude:**

Operating: 0 to 2000 m

Non-operating: 0 to 12,000 m

**Zero Adjustment:** ± 10 A approx. by 10 turn knob at base of case

**Case Protection:** IP30 per IEC 529

**Drop Test:**

1.0 m on 38 mm of oak on concrete; test according to IEC 1010

**Mechanical Shock:** 100 G, test per IEC 68-2-27

**Vibration:** Test per IEC 68-2-6

**Frequency Range:**

5 to 15 Hz, Amplitude: 1.5 mm

15 to 25 Hz, Amplitude: 1 mm

25 to 55 Hz, Amplitude: 0.25 mm

**Handle:** UL 94 V0

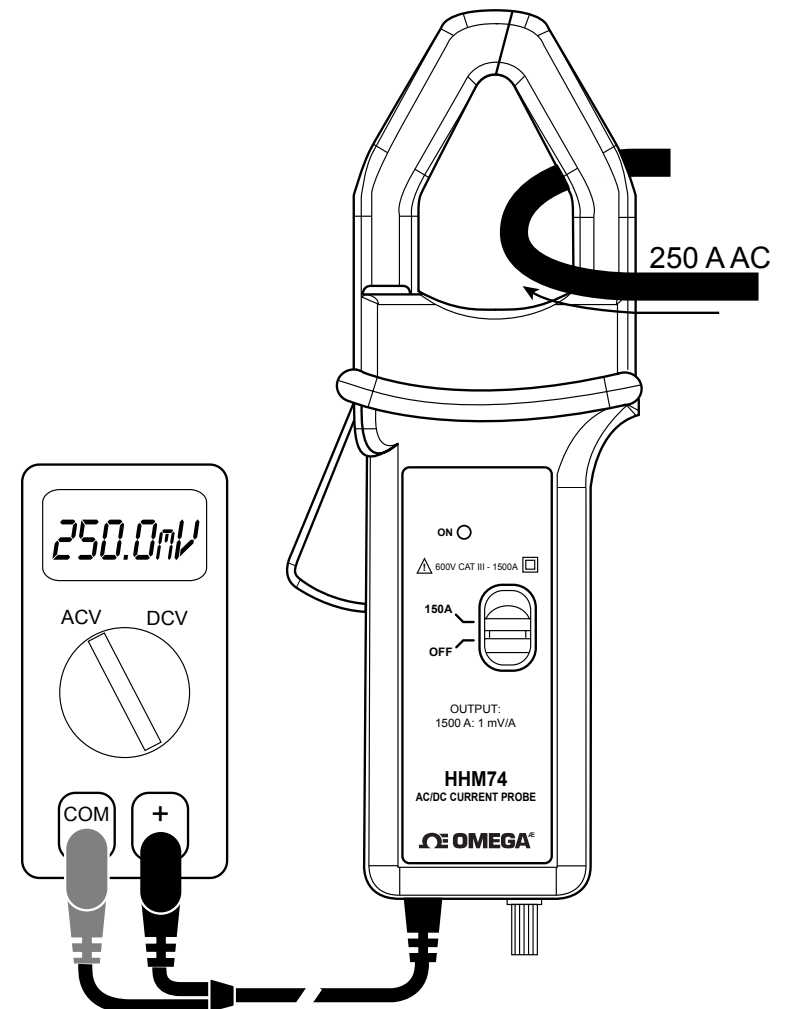
**Jaws:** UL 94 V0

**Color:** Dark gray with red jaws

## Operation Examples

**Measuring the AC Component of an (AC+DC) Waveform for the Model HHM74**

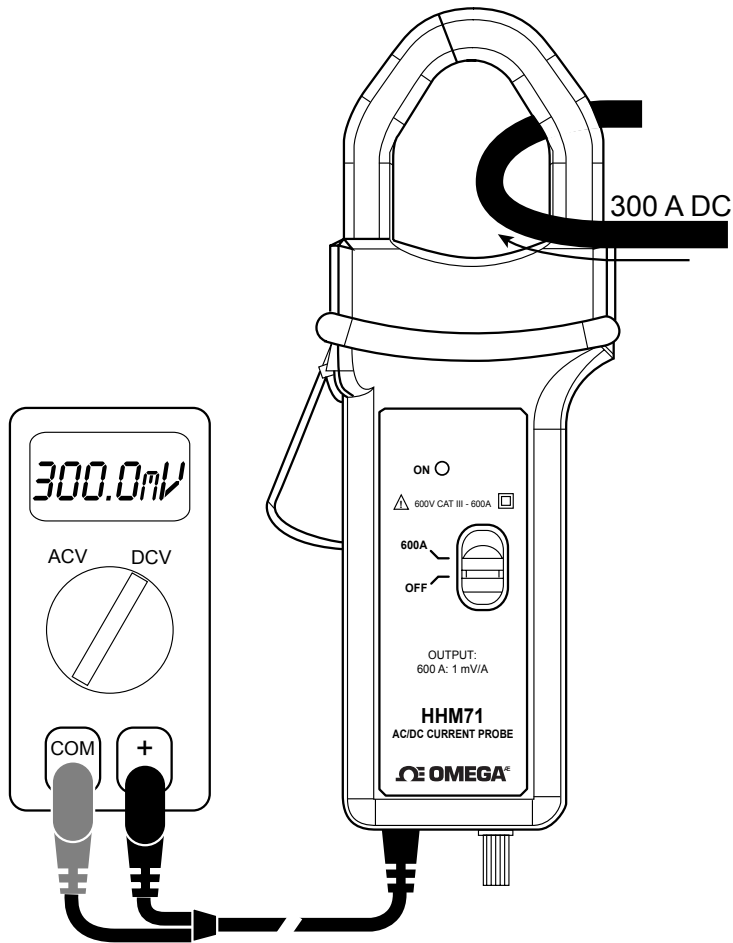
- Conductor carrying 20 A DC + 250 A AC
- Voltmeter placed in AC volts mode
- Voltmeter displays 250.0 mV AC = 250 A AC



## Operation Examples

### Measuring the DC Component of an (AC+DC) Waveform for the Model HHM71

- Conductor carrying 300 A DC + 25.0 A AC
- DMM placed in DC volts mode
- DMM displays 300.0 mV DC = 300 A DC



## Common Specifications Continued

### SAFETY



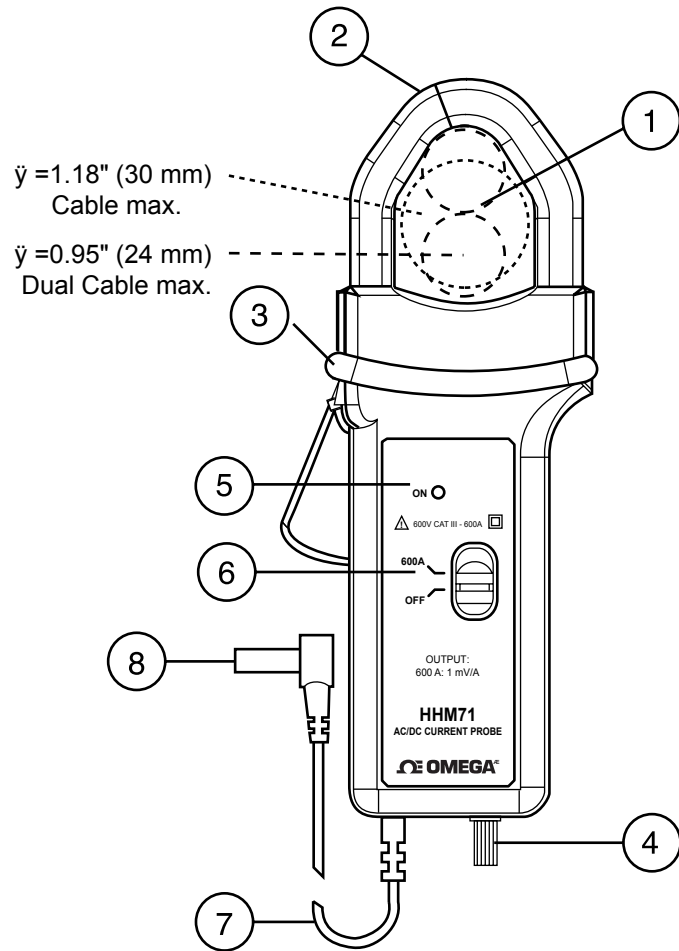
Double insulation or reinforced insulation between primary, secondary and outer case of handle per IEC 1010-2-032.

- 600 V Category III, Pollution Degree 2

### **Electromagnetic Compatibility:**

- Susceptibility in accordance with EN 50082-2 and EN 50082-1
- Electrostatic discharge IEC 1000-4-2  
Test voltages: 4 kV level 2 in contact, aptitude criteria B  
8 kV level 3 in the air, aptitude criteria B
- Radiated Field IEC 1000-4-3 (1995)  
with max. interference of 5% of the measurement range:  
3 V/m level 3, aptitude criteria A
- Fast transients IEC 1000-4-4 (1995):  
Test voltage: 1 kV level 2, aptitude criteria B
- Magnetic fields at the frequency of the network to  
IEC 1000-4-8 (1995) with a max. distortion of 0.5 A:  
30 A/m 50 Hz level 4, aptitude criteria A
- Emissions in accordance with EN 50081-1
- Radiated emission through the case to EN 55022 (1994): class B
- Conducted emission to EN 55022 (1994): class B

# HHM71

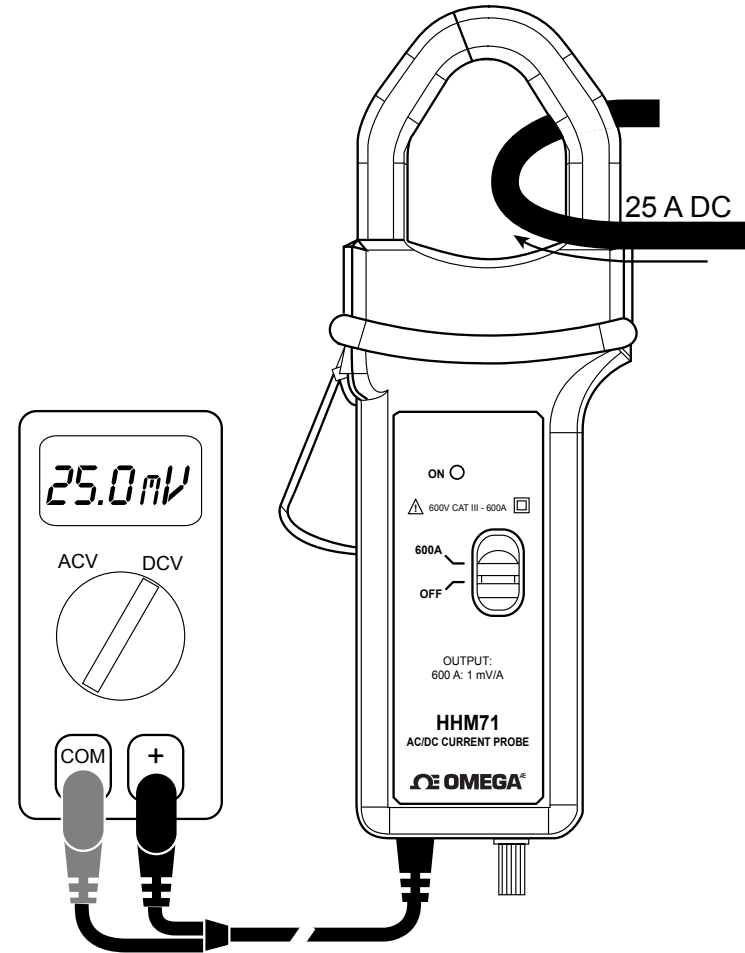


- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Conductor</li> <li>2. Jaws</li> <li>3. Protective non-slip guard</li> <li>4. DC adjustment knob</li> <li>5. Green light (on when battery voltage <math>\geq 6.5</math> V)</li> </ol> | <ol style="list-style-type: none"> <li>6. Two-position range selection switch:             <ul style="list-style-type: none"> <li>• On/Off</li> <li>• 600 A (1 mV/A)</li> </ul> </li> <li>7. Lead, 5 ft (1.5 m)</li> <li>8. Safety banana plug <math>\varnothing</math> 4 mm</li> </ol> |
|--|---|

## Operation Examples

### DC Current Measurement Example for the Model HHM71

- Conductor carrying 25 A DC in the direction of the arrow
- DMM placed in DC volts mode
- DMM displays 25.0 mV DC = 25 A DC



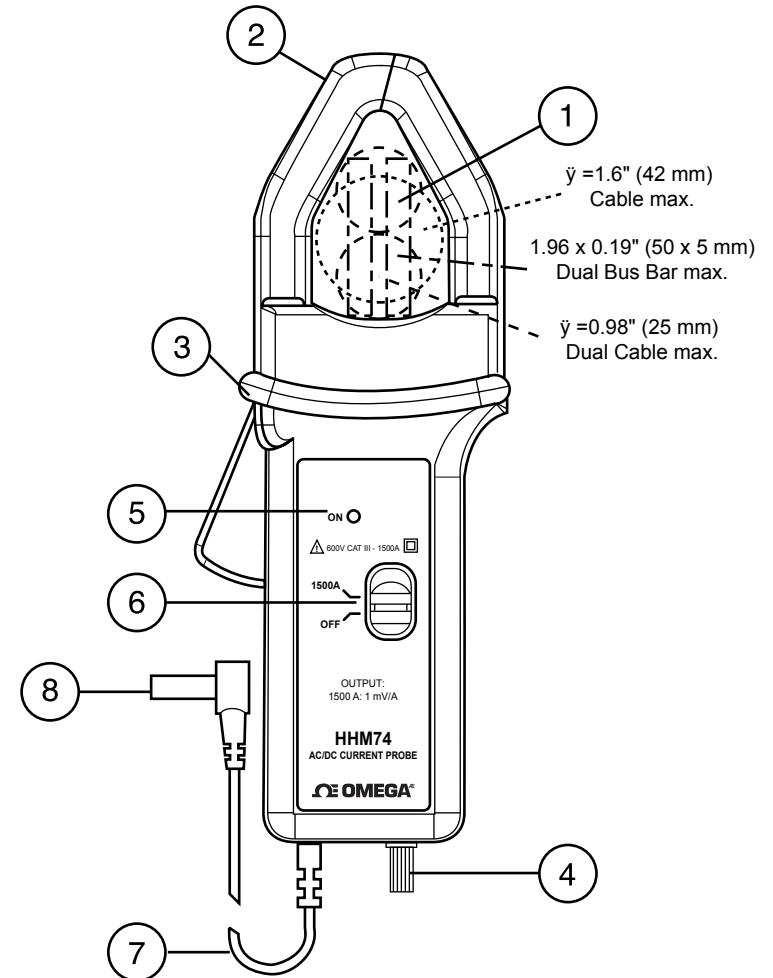
## AC Measurement

- Select the appropriate AC mV or V range on the DMM or measuring instrument.
- The DC zero adjustment is not required when measuring AC current with a voltmeter that is AC coupled. The DC zero adjustment is required if you are using a voltmeter that is DC coupled.
- Select the appropriate mV AC or V AC range on the DMM or measuring instrument.
- Clamp the probe around the conductor (1) to be tested. The display device should now display the measured conductor current. Apply the conversion ratio (1 mV/A) to get the value of the current.

## Indicator Lights: Green LED

- The green LED (5) indicates that the probe is on and that the battery is good. The green LED will not light under low battery conditions. Replace the 9 V battery if the green LED is not lit.

## HMM74



1. Conductor
2. Jaws
3. Protective non-slip guard
4. Zero adjustment knob
5. Green light (on when battery voltage  $\geq$  6.5 V)
6. Two-position range selection switch:
  - On/Off
  - 1500 A (1 mV/A)
- 7 Lead, 5 ft (1.5 m)
8. Safety banana plug  $\varnothing$  4 mm

## DMM/Display Compatibility

The Models HHM71 and HHM74 current probes are compatible with any multimeter, voltmeter or other voltage measuring instrument which has the following features:

- Input jack that accepts 4 mm safety banana plug
- Range and resolution capable of displaying 1 mV of output per amp of measured current
- Voltmeter accuracy of 0.3% or better to take full advantage of the probe accuracy
- Input impedance of 1 M $\Omega$ /100 pF or greater

When the probe is making a measurement, the current-carrying conductor is not broken and remains electrically isolated from the probe output. As a result, the probe output common may be either floated (isolated) or grounded.

## Warning: User Safety:

Always use a DMM, voltmeter or other displaying device, appropriately rated for safety.

Also see warning on page 2.

## Operating Procedure

### Making Measurements with the Models HHM71 and HHM74

- Plug the probe into the display device (e.g., DMM, logger). Note the polarity of the probe output banana plugs (red = positive [+], black = negative [-]).
- Select the appropriate range on the display device. Note that the probe's output is 1 mV/A.
- Turn display device power on. Turn on (6) the probe: the green LED (5) should be on. If the green indicator does not come on or goes off after a few minutes, it is necessary to replace the battery (see "Battery Replacement," pg. 18).

### DC Measurement

- Select the appropriate DC mV or V range on the DMM or measuring instrument.
- "Zero" the probe. With the probe disconnected from test samples (no conductor in probe jaw window), push in and turn the zero adjustment knob (4) to obtain a reading better than 0.5 mV on the DMM.
- For best accuracy, especially on low-level measurement, it is recommended that you zero the probe before each measurement.
- Clamp the probe around the conductor (1) to be tested. The DMM or display device should now display the measured conductor current. A positive reading indicates current flowing in the direction of the arrow located on the side of the jaw (2). A negative reading indicates current flow in the opposite direction of the arrow. Apply the conversion ratio (1mV/A) to get the value of the current. (eg. If the multimeter reading is 250 mV DC the measured current is 250 A DC.)