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M-3481/0899

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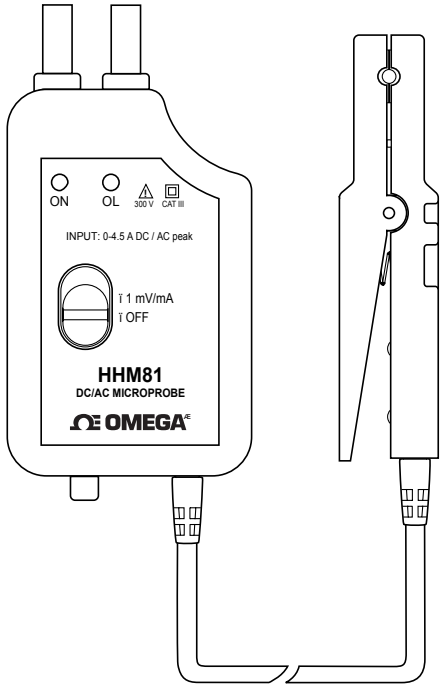
CE

User's



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Model HHM81
Model HHM82
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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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. 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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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.

Maintenance

⚠ Warning

For maintenance use only specified replacement parts.

- To avoid electrical shock, do not attempt to perform any servicing unless you are qualified to do so.
- To avoid electrical shock and/or damage to the instrument, do not get water or other foreign agents into the case. Turn the Model HHM81/HHM82 OFF and disconnect the unit from all circuits before opening the case.
- Also see warning on page 2.

Battery Replacement

- Remove probe from any conductor and place it away from any active conductors, circuitry, etc.
- Unplug electronic module from display device (e.g., DMM, oscilloscope).
- Remove the screws from the bottom cover of the electronic module.
- Replace battery with a new 9 V alkaline type.
- Replace bottom cover and re-attach with screws.

Cleaning

To ensure optimum performance, it is important to keep the probe jaw mating surfaces clean at all times. Failure to do so may result in increased earth's field susceptibility and overall errors in readings. The following is the recommended procedure for cleaning the probe sensor:

1. Apply a few drops of isopropyl alcohol to an ordinary sheet of white photocopy paper.
2. Open probe to expose the mating surfaces of the sensor and insert the sheet of paper into the jaws. Allow the jaws to close.
3. With the jaws closed, pull free the end of the paper through the jaws until it releases.
4. Repeat step (3) several times, using a new (dry) section of paper each time.
5. Open probe and inspect mating surfaces. They should be free of dust particles or any other contamination. Otherwise, repeat the cleaning process starting again at step (1).

Table of Contents

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 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 adapter 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 probe on electrical conductors rated above 300 V in overvoltage category II (CAT II).

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.

- Make sure that probe jaw mating surfaces are free of dust and contamination. Contaminants cause air gaps between sensor halves, making the Model HHM81/HHM82 susceptible to external magnetic fields which can contribute to measurement errors. See page 16 for cleaning procedure.
- Do not allow probe jaws to abruptly snap closed from the open state. This can lead to residual readings. If this happens, the probes will need to be rezeroed.
- Beware of short-circuit currents. Large in-rush 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 zero. If not, it will be necessary to rezero the Models HHM81 and HHM82.
- When using the probes to measure AC currents, keep in mind the maximum current ratings and the frequency response curves shown in the electrical specifications section. Dynamic currents that contain large step discontinuities and/or frequency constituents near or beyond the measurement passband are subject to measurements errors and waveform distortion (oscilloscope display). If the red LED comes on during measurement, the output signal may be in error.
- Many DVMs provide null (relative) measurement capability. A DVM placed in the null mode displays the difference between a stored null value and the input signal.
- You can use a DVM's null function in place of the external DC zero control to cancel any DC offset from the Models HHM81/HHM82. The DVM null function should be enabled with the probe removed from the conductor immediately before measurement.
- You can use a DVM's null function to display changes in measured current from a fixed (constant) level. In this application, the DVM null function is enabled with the probe connected to the conductor.
- When making null (relative) measurements, the probe aperture current (not displayed current) must not exceed the maximum ratings set forth in the specifications section.

Residual Readings Following Severe Overloads

- Large short-circuit and transient currents outside the operating range of the probe may cause large residual readings. In extreme cases they will not zero. If this happens:
  - Remove the probe from the test conductor.
  - Open the probe and release, allowing the jaws to snap back. Repeat this step several times.
  - Rezero the instrument before making successive measurements.

Tips For Making Precise Measurements

- The Models HHM81 and HHM82 are capable of making measurements of DC and low frequency currents over a wide range. Here are some key considerations for getting the most accuracy from your displaying instrument:
- When using the probes with a meter, it is important to select the range that provides the best resolution. Failure to do this may result in measurement errors. The following examples use an ordinary 3-1/2 digit DMM with the probes, to measure 16.7 mA DC:

Model HHM81

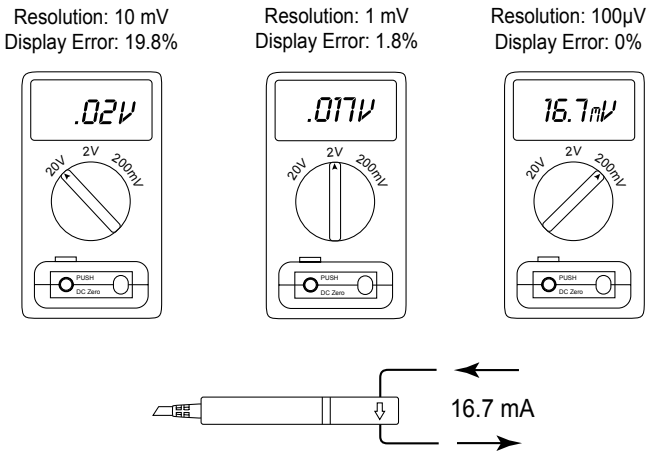


Figure 10

Model HHM82

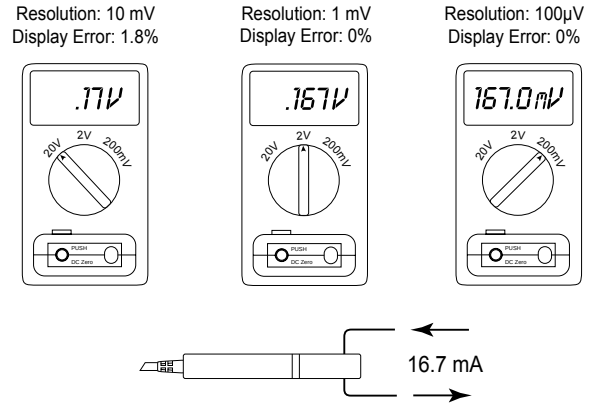


Figure 11

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.

Packaging

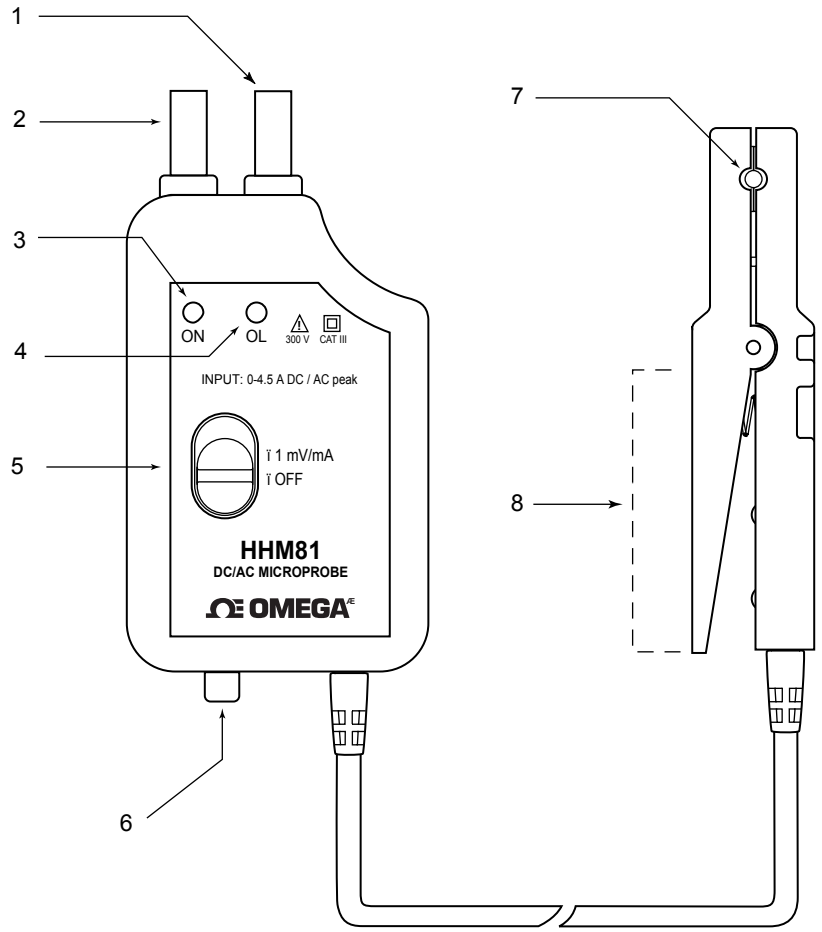
The Models HHM81 and HHM82 include a electronic plug-in module with an attached current probe, 9 V battery, and user manual.

Description

These microprobes are low current measurement instruments that feature a compact, high sensitivity current probe. Unlike other instruments, the Model HHM81 exhibits a wide dynamic operating range, which extends from below 100µA to ± 4.5 A peak, from DC to 2.0 kHz*, without the need for ranging. The HHM82 has an operating range of 100µA to ± 450 mA Peak, from DC to 1500 Hz.

This series is designed to be operated in conjunction with a digital multimeter, oscilloscope or recording device. The microProbe outputs the current measured in the form of a voltage that is the image of the current, in shape and amplitude. The Model HHM81 outputs 1 mV per mA of measured current. The Model HHM82 outputs 10 mV per mA of measured current. To take advantage of the Model HHM82's high sensitivity, best results are obtained through 4-1/2 digit (or more) DMM with a relative zero function. The Model HHM82 was designed to provide the operator with enhanced low current linearity and accuracy, but is limited to 450 mA Peak current.

The microprobes always output a signal proportional to the total current (AC+DC) in the conductor under test. This has proven to be the most versatile signal output format, and allows the user to isolate and measure DC and AC components of measured current separately, if so desired. Typical applications include 4 to 20 mA loop measurements, automotive current applications, benchtop electronic current consumption in circuits, and other applications requiring very low current measurements in crowded areas.



1. Positive: Red banana plug (+)
2. Negative: Black banana plug (-)
3. Power ON indicator (green LED)
4. OVERLOAD indicator (red LED)
5. Power switch
6. Zero adjust knob (push in and turn to zero)
7. Probe window aperture
8. Probe handle

Oscilloscope Measurement Example (HHM82)

- Conductor carrying a 0.2 A peak AC waveform
- Model HHM82 connected to oscilloscope

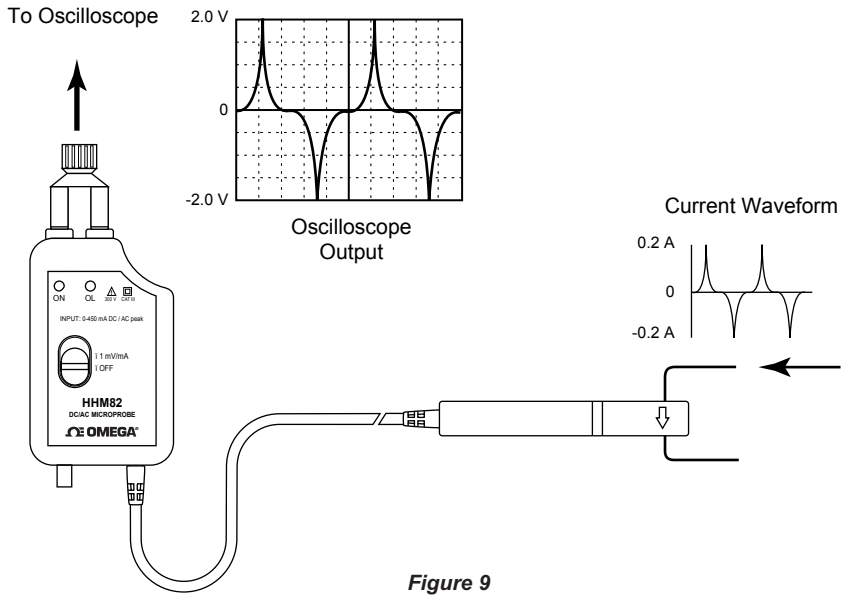


Figure 9

Measuring the DC Component of an (AC+DC) Waveform (HHM81)

- Conductor carrying 20.0 mA DC + 15.0 mA AC
- Voltmeter placed in DC Volts mode
- Voltmeter displays 20.0 mV

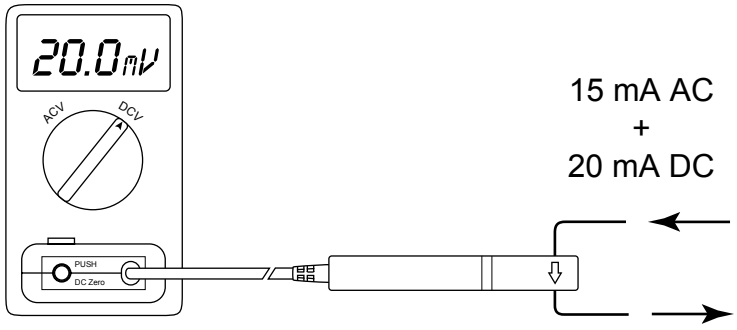


Figure 7

Measuring the AC Component of an (AC+DC) Waveform (HHM81)

- Conductor carrying 20.0 mA DC + 15.0 mA AC
- Voltmeter placed in AC Volts mode
- Voltmeter displays 15.0 mV

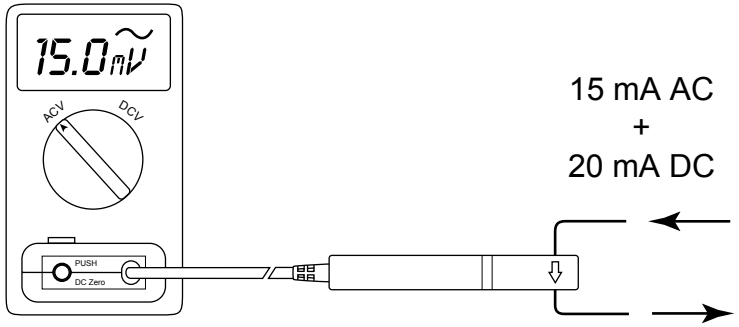


Figure 8

HHM81 Specifications

ELECTRICAL

Current Range:
0 to ± 4.5 A DC
0 to 3 Arms (sinusoidal)

Output (Vout): 1 mV/mA

Resolution:
DC: 50µA typical
AC: 100µA typical

Accuracy:
DC: 1% reading ± 200µA
AC: 2% reading ± 200µA

Output Noise:
< 100µV, DC to 5 kHz

Frequency Response:
DC to 2 kHz (@ -3 dB sine)

Zero Adjust:
± 25 mA

HHM82 Specifications

ELECTRICAL

Current Range:
0 to ± 450 mA DC
0 to 300 mA rms

Output (Vout): 10 mV/mA

Resolution:
DC: 50µA typical,
AC: 100µA typical

Accuracy:
DC: 0.5% reading ± 150µA
AC: 0.8% reading ± 200µA

Output Noise:
<100µV, DC to 5 kHz

Frequency Response:
DC to 1500 Hz (@ -3 dB sine)

Zero Adjust:
± 15 mA

COMMON SPECIFICATIONS

ELECTRICAL

Rise Time: < 200µS, 10% to 90% Vout

Fall Time: < 200µS, 90% to 10% Vout

Output Impedance: 200Ω

Probe Inductance: <1µH

Influence of Adjacent Conductor: < 50µA/A

Influence of Earth's Field: < 120µA, null to maximum

*Reference Conditions: Temperature 23°C, 20 to 75% RH; battery voltage 9 V ± 0.1 V; earth's magnetic field < 40 A/m; absence of AC fields; input impedance of display device ≥ 1 MΩ/100 pF; DC or sinusoidal AC current 45 - 65 Hz.

Common Specifications (cont.)

MECHANICAL

Connectors: Two 4 mm banana jacks, standard 3/4" (19 mm) spacing

Maximum Conductor Diameter: 3/16”, 0.180" (4.5 mm)

Overload LED (Red): Indicates momentary or continuous overload

Power LED (Green): Indicates power ON and good battery

Battery: 9 V alkaline, NEDA 1604 or IEC 6 LF22

Dimensions (Probe): 4.4 x 0.6 x 1.0" (111 x 15 x 25 mm)

Dimensions (Electronic Module): 4.9 x 2.5 x 1.1" (124 x 64 x 28 mm)

Cable Length: 5 ft (1.5 m)

Weight: 9 oz (250 g)

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

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

Humidity: < 95% @ ≥ 35°C, 75% @ 55°C

SAFETY SPECIFICATIONS CE

The MicroProbes are designed to be used in conjunction with a digital multimeter or other instrument for the purpose of displaying measured readings. The Models HHM81 and HHM82 are safety rated as voltage probes. The user should ensure that they are connected to an instrument properly rated to international safety standards and/or agency approvals.

Working Voltage: 300 V per IEC 1010-1 Cat. II

Immunity (EN 50082-1), IEC 1000-4-3 aptitude criteria A:
DC: 15mV @ 0, AC (60Hz): 2dB from 10 mA to 4.5A

Emmissivity (EN 50081-1): negligible

Drop Test: 1 m per IEC 1010

Shocks: 100 G per IEC 68-2-27

Vibrations: IEC 529

Protection Index: IP 40 per IEC 529

Electromagnetic Compatibility: EN 50082-1 class A EN 50081-1

Oscilloscope Measurement Example (HHM81)

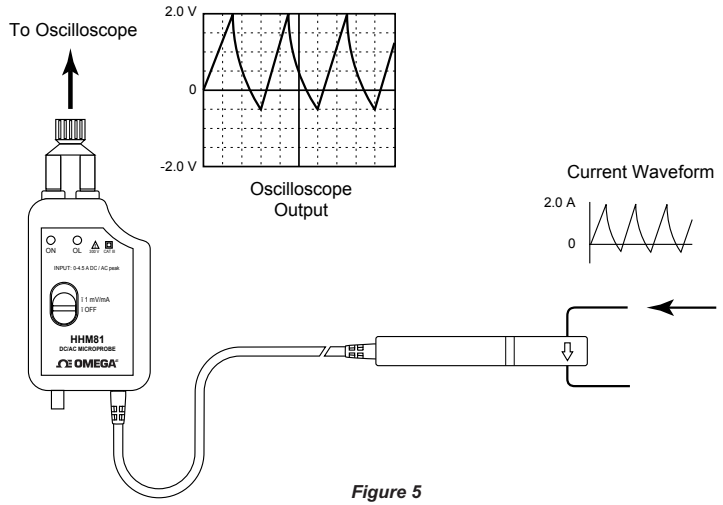


Figure 5

Maximum Step Discontinuity Example (HHM81)

- Conductor carrying non-sinusoidal AC
- Model HHM81 connected to oscilloscope
- Max allowable step-discontinuity 2 A

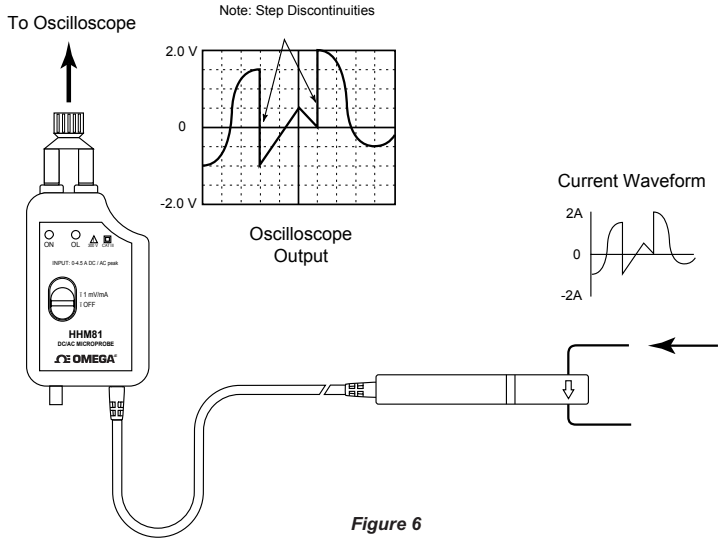


Figure 6

Two-Wire Sum-of-Currents Example (HHM81)

- Two conductors in probe aperture (note orientations)
- Voltmeter placed in DC Volts mode
- Voltmeter displays 18.0 Mv

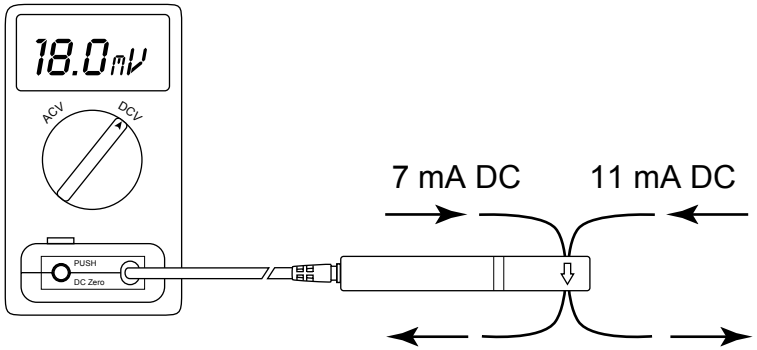


Figure 3

Two-Wire Current Differential Example (HHM81)

- Two conductors in probe aperture (note orientations)
- Voltmeter placed in DC Volts mode
- Voltmeter displays -4.0 mV

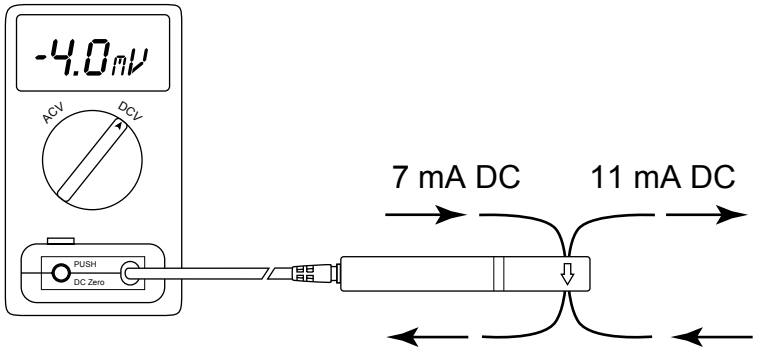
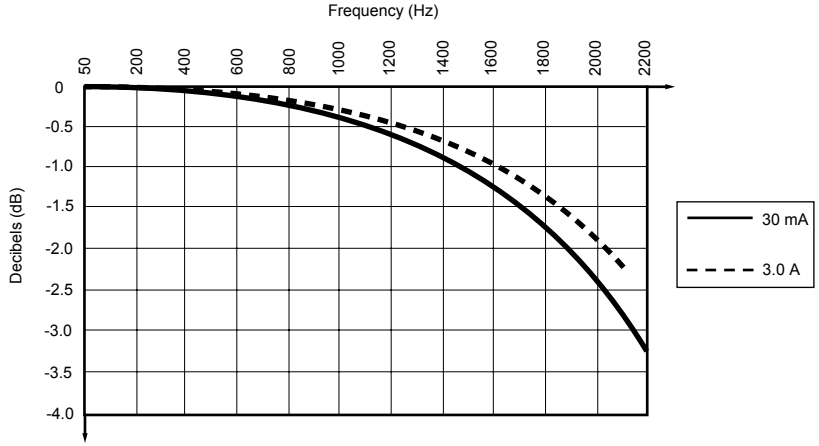


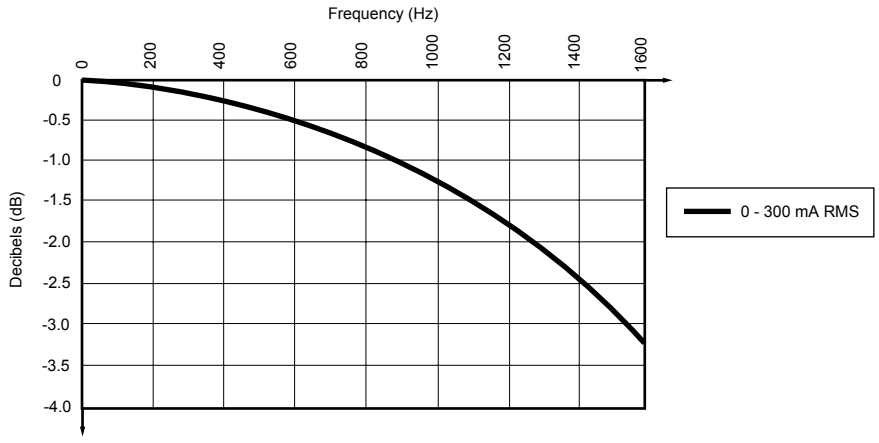
Figure 4

Typical Frequency Response

Model HHM81 Typical Frequency Response



Model HHM82 Typical Frequency Response



Operating Procedure

Making Measurements with the Models HHM81/HHM82

- Remove any conductor from within the probe jaws.
- Plug the electronic module into the displaying device (e.g., DMM, oscilloscope). Note the polarity of the module output banana plugs (red = positive [+], black = negative [-]).
- Select the appropriate range on displaying device (e.g., DMM, oscilloscope). Note that the module output is 1 mV/ mA for Model HHM81 and 10 mV/A for Model HHM82.
- Turn displaying device power ON. Turn on the probe: the green LED should be ON, and the red LED OFF.
- With the probe disconnected from test samples (no conductor in probe jaw window), adjust the zero control (push in the knob and turn) to read zero volts on the displaying device. In the unlikely event where the zero point is unobtainable, refer to “Residual Readings Following Severe Overloads” section (pg. 15). The probe may be temporarily magnetized.
- Clamp the probe around the conductor to be tested. The displaying device should now display the measured conductor current. In DC, a positive reading indicates current flowing in the direction of the arrow on the probe. A negative reading indicates current flow in the opposite direction of the arrow.

Indicator Lights - Green and Red LEDs

- The green LED 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.
- The red LED indicates a momentary or continuous overload of the instrument. Readings taken while the red LED is ON or FLASHING should be considered inaccurate. Momentary or continuous currents exceeding ± 4.7 A for Model HHM81 and 470 mA for Model HHM82, and dynamic currents with large step discontinuities will cause the red LED to turn ON.

Operation Examples

DC Current Measurement Example (HHM81)

- Conductor carrying 20.0 mA DC in the direction of the arrow
- Voltmeter placed in DC Volts mode
- Voltmeter displays 20.0 mV

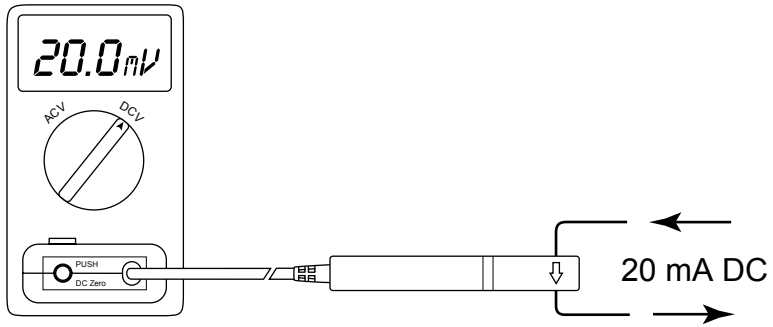


Figure 1

DC Current Measurement Example - Current Reversed (HHM81)

- Conductor carrying 20.0 mA DC in opposite direction of arrow
- Voltmeter placed in DC Volts mode
- Voltmeter displays -20.0 mV

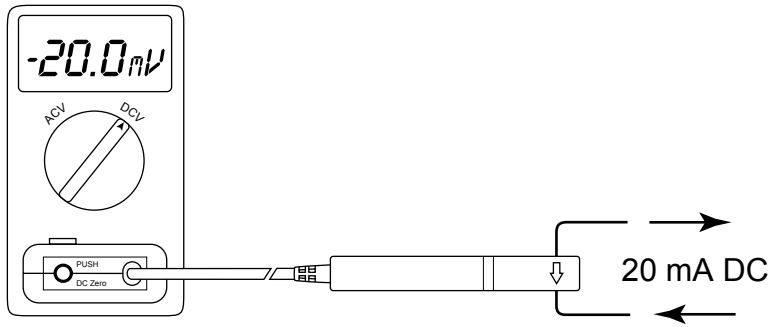


Figure 2