

THE M2-1C
AC and DC HALL-EFFECT
CURRENT MICROCLAMPS

OPERATION MANUAL

OM-M2-1C

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Pittsburgh, PA 15213

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PART NUMBER OM-M2-1C

1.0 INTRODUCTION

This manual includes information and instructions for the operation and maintenance of the M2-1C Clamp-On current measuring transformers.

2.0 WARRANTY

The AYA-Instruments products are warranted against defects in workmanship and material for a one-year period after the date of purchase. During this period, AYA-Instruments will repair or replace, at its own option, any components found to be defective under normal use. AYA's obligation under this warranty is limited only to repairing any such instrument which, in AYA's opinion, is found to be defective within the scope of the warranty when returned to the factory or to an AYA authorized service center. Transportation to and from the main office or the service center will be paid by the purchaser. Buyer shall pay all duties and taxes for products returned to AYA or to its service center from another country. Shipment should not be made without a **Returned Material Authorization** from AYA.

This warranty will not apply to products repaired or modified by persons not authorized by AYA or not in accordance with instructions furnished by AYA. For products found to be defective due to misuse, improper repair or abnormal operating conditions, operation outside the environmental specifications, or improper installation or maintenance, repairs will be billed at cost. AYA assumes no liability for secondary charges or consequential damages associated with the misuse of its products.

3.0 GENERAL DESCRIPTION

The M2-1C current measuring clamps are designed for measuring either AC or DC currents. These clamps incorporate HALL-EFFECT sensors with associated circuitry that generate an analog output signal proportional to the strength of the magnetic field generated by the primary current passing through the clamp. They provide an output signal of 10 mV per Ampere. Three basic models are available:

The **M2-1C-200-2B** can accurately measure AC currents up to 200 amperes DC or 140 AAC Sinewave with a maximum of 400 amperes Peak-to-Peak. It is powered by a 9-Volt battery which is located in a battery pack that is attached to the clamp.

The **M2-1C-200-2** can accurately measure AC currents up to 200 amperes DC or 140 AAC Sinewave with a maximum of 400 amperes Peak-to-Peak. It requires an external 9-Volt battery or a 9 to 12 Volts DC power supply.

The **M2-1C-300-3** can accurately measure AC currents up to 300 amperes DC or 200 AAC Sinewave with a maximum of 600 amperes Peak-to-Peak. It requires an

external 15-Volt DC power supply.

These AC/DC microclamps are ideally suited for electrical installation and maintenance work. Their rugged, thermoplastic construction provides the durability required for the most demanding applications. The current clamps are designed for use with common analog or digital multimeters, power analyzers, oscilloscopes and chart recorders having an input impedance greater than 100,000 Ohms. An optional carrying case is available with space for test leads or a spare battery.

The signal conditioning circuitry of the M2-1C microclamps is incorporated in the clamp. Therefore, it does not require an external electronic signal conditioner. It only requires low level power from the battery pack or from an external battery. The frequency range is from DC to 5,000 Hz. The amplitude of the output signal is ± 2 volts for a primary current of ± 200 amperes in the case of the Model M2-1C-200-2, and ± 3 Volts for a primary current of ± 300 Amperes in the case of the Model M2-1C-300-3. The clamps can accommodate current conductors as large as 0.59" in diameter.

The standard package includes the following items:

- 1 Hall-Effect Microclamp
- 1 Operation Manual

The following optional items are available:

- Male-to-Male cable set
- Male-to-Female cable set
- Male-to-BNC cable set

4.0 SPECIFICATIONS

The specifications of the M2-1C-200-2 and M2-1C-200-2B microclamp are subject to change without notice. Accuracy is specified at constant room temperature of 20°C.

Current Range:	1 to 200 ADC, and 1 to 140 AAC sinusoidal (Up to 400 Peak-to-Peak)
Transformer Ratio:	100 / 1
Conversion Ratio:	$\pm 200A/\pm 2V$
Output Signal:	10 mV / Ampere (Load 100K minimum load)
DC Accuracy:	$\pm 1\%$ from 50 to 200 ADC $\pm 2\%$ from 2 to 50 ADC
AC Accuracy (sinusoidal):	$\pm 2\%$ from 0 to 1000 Hz $\pm 3\%$ from 0 to 2000 Hz
Current Overrange:	300 ADC or 300 AAC Continuous
Operating Frequency:	DC to 5,000 Hz
Maximum Operating Voltage:	650 Volts meeting the IEC STANDARD 348, Class II. Tested at 4,000 Volts
Operating Temperature Range:	14 to -122°F (-10 to +50°C)
Safe Storage Temperature:	5-149°F (-20-65°C)
Diameter Opening:	0.59" (15mm)
Weight:	0.37 lb (170g)
Power: M2-1C-200-2B	9-Volt Battery (Located in a battery pack attaché to the microclamp)
M2-1C-200-2	External 9-Volt supply
Battery life:	75 hours typical

The M2-1C-300-3 microclamp has the same listed specifications. However, its full scale range is 300 Amperes DC with a 3-Volt output, and it requires an external supply voltage of 12 to 15 Volts.

5.0 SAFETY PRECAUTIONS

The M2-1C microclamps are designed for operation in a field and in laboratory environments. Care must be taken to operate them according to the instructions described in this manual. Disassembly of the clamp should not be attempted by field personnel. High voltage present in the clamp when it is located around a current carrying conductor is dangerous and could cause injury.

AYA-Instruments, Inc. assumes no responsibility for any damage to its products or any injury or death resulting from misuse or deviation from specified instructions.

CAUTION:

The clamp will be damaged if any voltage is applied to the output terminals.

6.0 PREPARATION FOR USE OF THE M2-1C Microclamp

6.1 INTRODUCTION

This section provides information for using an M2-1C microclamp. The dimensions of the current clamp are shown in Figure 6-1. Note the following components of the microclamp as shown in Figure 6-1:

- * The current carrying conductor marked(AC-DC)
- * Arrow indicating direction of current flow
- * Multi-turn ZERO OFFSET potentiometer
- * battery power LED indicator

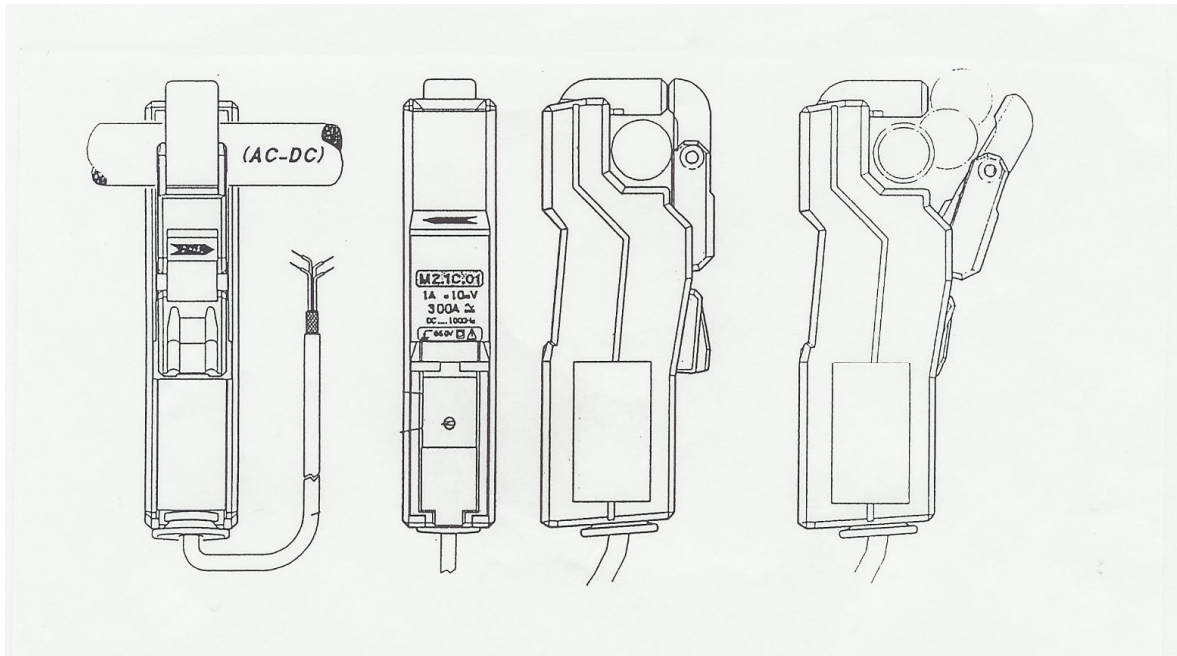
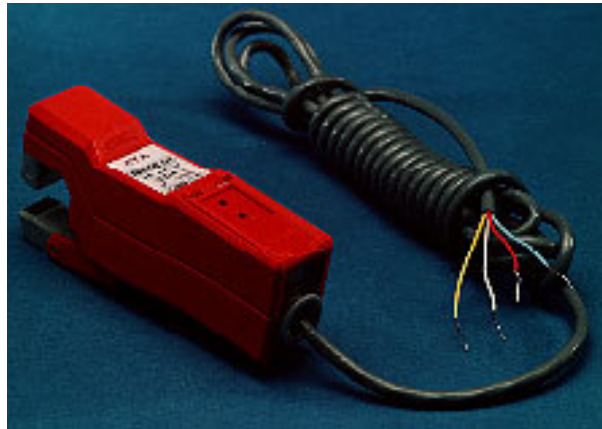
In addition, the battery pack attached to the microclamp has a three-position OFF-ON-OFF switch:

For DC application, the ZERO OFFSET must be set prior to measurement.

When using the Hall-Effect microclamps without a battery pack (Models M2-1C-200-2 or M2-1C-300-3), the external connections are as follows:

RED wire:	+ of the Power Supply
BLUE wire:	- of the power supply
WHITE wire:	+ of the output signal (S1)
YELLOW wire:	- of the output signal (S2)

CAUTION: Neither side of the power supply should be connected to S1 or S2. The power supply is used as excitation of a bridge and cannot be grounded to the signal output.



SPECIAL CABLES and CONNECTORS ARE AVAILABLE.

MODEL	CURRENT RANGE	OUTPUT	MAX CURRENT	LOAD (Ohms)	SUPPLY	FREQUENCY RANGE (Hz)	
						For 3%	For -3db
M2-1C-200-2 (External 9 VDC required)	1 to 200 ADC or 2 to 400 AAC P-T-P	2VDC 4V P-T-P	300 ADC 600 A P-T-P	>30K	9 VDC 4 mADC	DC to 2,000	DC to 5,000
M2-1C-200-2B (Includes Battery Pack)	1 to 200 ADC or 2 to 400 AAC P-T-P	2VDC 4V P-T-P	300 ADC 600 A P-T-P	>30K	9 VDC Battery	DC to 2,000	DC to 5,000
M2-1C-300-3 (External 15VDC Required)	3 to 300 ADC or 3 to 600 AAC P-T-P	3VDC 6V P-T-P	450 ADC 900 A P-T-P	>30K	15 VDC 6 mADC	DC to 2,000	DC to 5,000

FIGURE 6-1 VIEWS OF THE M2-1C HALL-EFFECT MICROCLAMP

6.2 OUTPUT SIGNAL CONNECTIONS

The output signal terminals are available on a cable that is attached to the battery pack. To obtain the specified accuracy, DO NOT LOAD the OUTPUT with any resistance that is lower than 50,000 Ohms. Pay attention to the polarity of the output signal.

6.3 DC MEASUREMENT

- * Set the switch to the ON position.
- * Check that the LED is ON.
- * Connect the measuring instrument, paying attention to the polarity.
- * Set the measuring instrument to a 2 VDC range.
- * Check the ZERO signal and adjust it if necessary.
(The output zero offset may change due to environmental factors. To adjust the output voltage to zero, place the clamps as far as possible from any magnetic field. Connect a DC voltmeter to the output and adjust the ZERO knob until the output is 0 ± 5 mVDC.)
- * Place the clamp around the conductor, making sure that the two surfaces of the clamp jaws make good contact with each other. The output DC voltage is an accurate measurement of the DC current. A positive voltage indicates that the current is in the direction of the arrow as shown in the diagram.
- * (These instructions should be used for measuring a complex current that includes both AC and DC components.)

6.4 AC MEASUREMENT

- * Set the switch to the ON position.
- * Check that the LED is ON.
- * Connect the measuring instrument.
- * Set the measuring instrument to a 2 VAC range. Place the clamp as far as possible from any magnetic field. The output voltage should be ZERO.
(The position of the Zero offset knob is not important when measuring only AC currents.)
- * Place the clamp around the conductor and measure the current.

7.0 **THEORY OF OPERATION**

This section includes the theory of operation of the M2-1C current clamps.

The heart of the system is a high-quality split-core transformer which consists of two split-core sections. The HALL-EFFECT sensors are located in the magnetic field that is generated by the primary current. The HALL-EFFECT sensors are located in pairs to cancel any errors that may be present due to signals that are not generated by the primary currents under measurement.

The signals generated by the sensors are then amplified and processed by the electronic signal conditioning circuit. The output voltage is proportional to the flux density that is generated by the primary current.

The clamp is calibrated at the factory to set the gain of the signal conditioner for a scale factor of 10mV per ampere. A zero offset potentiometer enables the operator to set the output voltage to zero when the primary current is zero.

8.0 **MAINTENANCE**

The maintenance of the M2-1C microclamps is simple and straight forward. The clamp must be kept clean and dusted periodically.

Depending on the frequency of usage and on the environment where the instrument is located, it may be desirable to clean the clamp periodically using alcohol, to visually inspect it and to remove any accumulation of dust and dirt using an air pressure blower.

Periodically check that the battery is not low.

9.0 **BATTERY REPLACEMENT**

When the LED indicator remains lit, it indicates that the battery voltage is higher than 6 Volts. When the battery voltage is low, the LED goes off and the battery should be replaced. The battery replacement is easy. The battery compartment cover is located on the surface of the battery pack.

CAUTION: Before opening the battery compartment, make sure that the clamp is not near any high voltage line and that it is not placed around a current carrying conductor. Disconnect the output of the clamp from any external equipment.

10.0 **DISASSEMBLY AND REASSEMBLY**

Disassembly of the clamp will automatically void its warranty.

11.0 **STORAGE INSTRUCTIONS**

When not in use for extended periods of time, the clamp should be stored without the battery in a packing enclosure to protect it from exposure to dust or other environmental effects. Care should be taken to ensure that environmental storage conditions are not exceeded. The temperature should be between -20°C and +65°C, and the humidity should be between 20% and 80% relative humidity non-condensing.