

THE SC and S3C SERIES
AC/DC HALL-EFFECT CURRENT CLAMPS

OPERATION MANUAL

OM-S3C

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Pittsburgh, PA 15213

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PART NUMBER OM-S3C

1.0 **INTRODUCTION**

This manual includes information and instructions for the operation and maintenance of the SC and S3C 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. Unless agreed upon in advance by a special warranty, 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 obtaining 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. If the product is found to be defective as a result of misuse, improper repair or abnormal operating conditions, operation outside the environmental specifications of the product, 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 SC and S3C current measuring transformers are designed for measuring either AC or DC currents. The transformers 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 can accurately measure AC currents up to 2,000 amperes DC or 1,400 AAC Sinewave with a maximum of 4,000 amperes Peak-to-Peak. The Model SC is a single range clamp and the Model S3C is a dual-range clamp providing an output signal of 1 Millivolt per ampere of primary current in the high range and 10 Millivolts per ampere in the low range.

These clamps 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 accessories such as test leads or a spare battery.

The signal conditioning circuitry of the SC and S3C clamps is incorporated in the handle and, therefore, does not require an external electronic signal conditioner. It only requires low level power from an internal 9-volt battery. The frequency range is from DC to 10,000 Hz. The amplitude of the output signal is ± 2 volts for a primary current of $\pm 2,000$ amperes on the high range, and ± 2 Volts for a primary current of ± 200 Amperes on the low range. The clamps can accommodate current conductors as large as 52mm in diameter (2.0").

The standard package includes the following items:

- 1 Model SC or S3C clamp
- 1 9-volt Battery
- 1 Operation Manual

The following optional items are available when ordered with the transducers:

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

4.0 **SPECIFICATIONS**

The specifications of the S3C current clamp are subject to change without notice. Accuracy is specified at constant room temperature of 20°C.

Low Current Range:	2 to 200 ADC, and 5 to 140 AAC sinusoidal
High Current Range:	20 to 2000 ADC, and 14 to 1400 AAC sinusoidal (Up to 4,000 Peak-to-Peak)
Transformer Ratio:	1000 / 1
Conversion Ratio:	$\pm 2,000A/\pm 2V$, $\pm 200A/\pm 2V$
Output Signal:	1 mV / ampere, 10 mV / Ampere (Load 100K minimum load)
DC Accuracy:	$\pm 1\%$ from 200 to 2000 ADC $\pm 1.5\%$ from 20 to 200 ADC $\pm 2\%$ from 10 to 20 ADC $\pm 4\%$ from 5 to 10 ADC
AC Accuracy at 50/60 Hz: (sinusoidal)	$\pm 1\%$ from 20 to 1400 AAC $\pm 1.5\%$ from 10 to 20 AAC $\pm 4\%$ from 5 to 10 AAC
Current Overrange:	100 % Continuous
Operating Frequency: (+/-3db)	DC to 5,000 Hz at 20 A DC to 3,000 Hz at 200 A DC to 600 Hz at 2,000 A
Maximum Operating Voltage:	600 Volts
Operating Temperature:	14 to -122°F (-10 to +50°C)
Safe Storage Temperature:	5-149°F (-20-65°C)
Diameter Opening:	2.0" (52mm)
Weight:	1.1 lb (500g)
Power:	9-Volt Battery (Located in the handle)
Battery life:	75 hours typical

The SC current clamp has the same specifications as those listed above; however, it is a single-range clamp.

1.0 **SAFETY PRECAUTIONS**

The SC and S3C current clamps are designed for operation in a laboratory environment. 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 on 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 S3C Clamp**

6.1 **INTRODUCTION**

This section provides information for using an S3C clamp. The outside dimensions of the current clamps are shown in Figure 6-1. The following list is a description of the components of the clamp as shown in Figure 6-2:

- (I_p) Primary current being measured
- (1) Closing surfaces of the clamp jaws
- (2) Clamp Jaws
- (3) Arrow indicating direction of current flow
- (4) Multi-turn ZERO OFFSET potentiometer
- (5) Three position switch:
 - Test Bat. In this position, the battery voltage can be tested
 - STOP: Clamp power is OFF
 - ON: Clamp power is ON
- (6) Battery power LED indicator
- (8) Output banana-type terminals
- (9) Battery compartment cover
- (10) Current conductor outside the jaws
- (11) Current conductor inside the jaws
- (A) Output terminal handle
- (B) Battery compartment handle
- (G) Safety barrier

For DC application, the ZERO OFFSET must be set prior to measurement. For AC applications, the setting is immaterial.

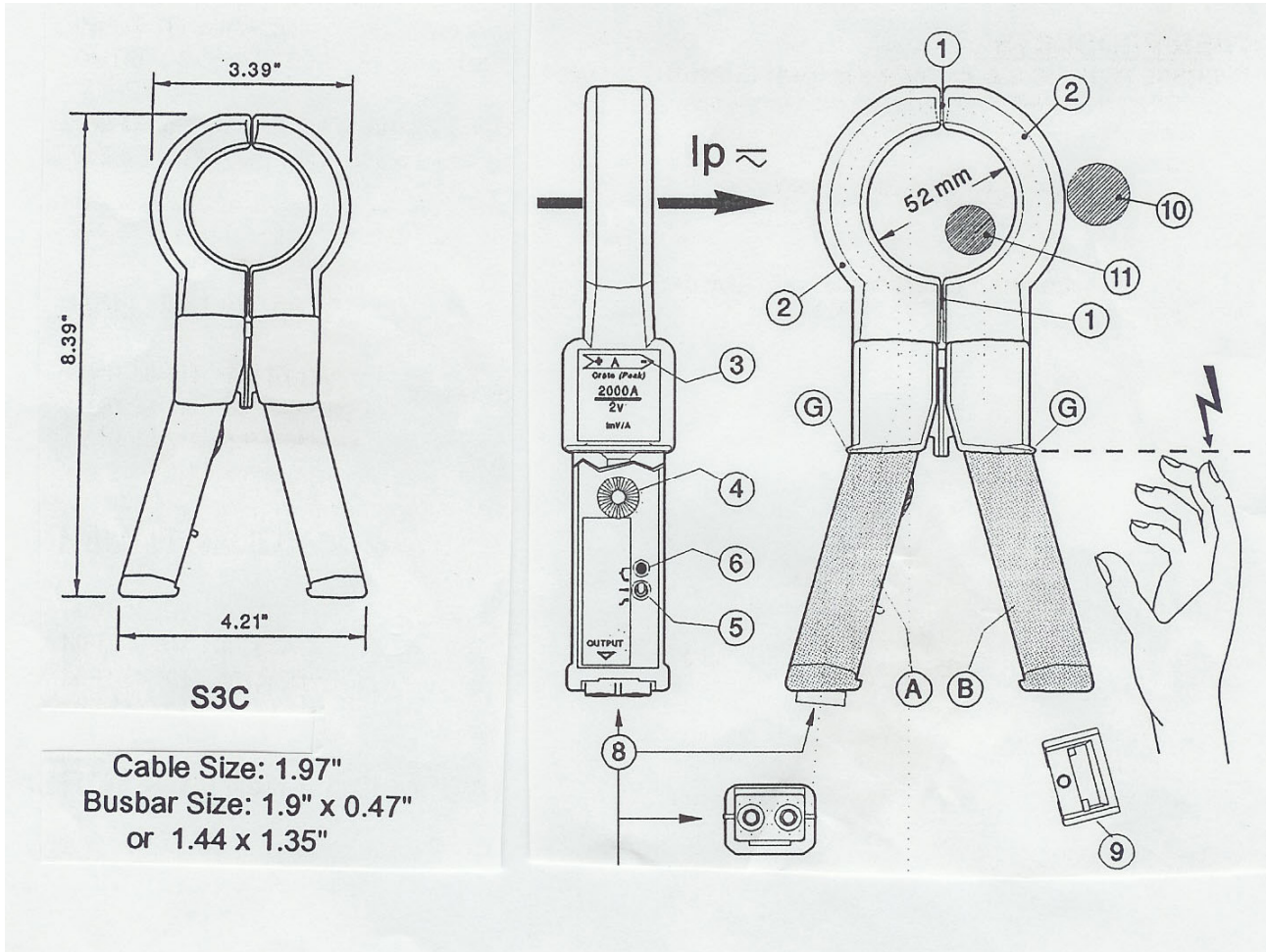


FIGURE 6-1 DIMENSIONS

FIGURE 6-2 DESCRIPTION

6.2 OUTPUT SIGNAL CONNECTIONS

The output signal terminals are located on the handle of the transformer. The OUTPUT voltage is present at these terminals. 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 BATTERY TEST

Set the battery switch to the ABAT Test@ position and hold it for a maximum of 10 seconds. If the LED remains lit for 10 seconds, the battery is good for 60 hours. If it is turned off, it should be changed. This test consumes battery life; it should be used sparingly.

6.4 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 at point (1) on the diagram make good contact with each other. The output DC voltage is an accurate measure 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.)

6.5 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

The heart of the SC series clamps is a high-quality split-core transformer which consists of two C-shaped semi-circle 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 1mV 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 SC and the S3C clamps 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 below 6 Volts, the LED automatically goes off and the battery should be replaced.

The instructions for battery replacement refer to Figure 9-1 which shows the three steps of removing the battery compartment cover, the removal of the battery from the clamp handle and the insertion of a new battery.

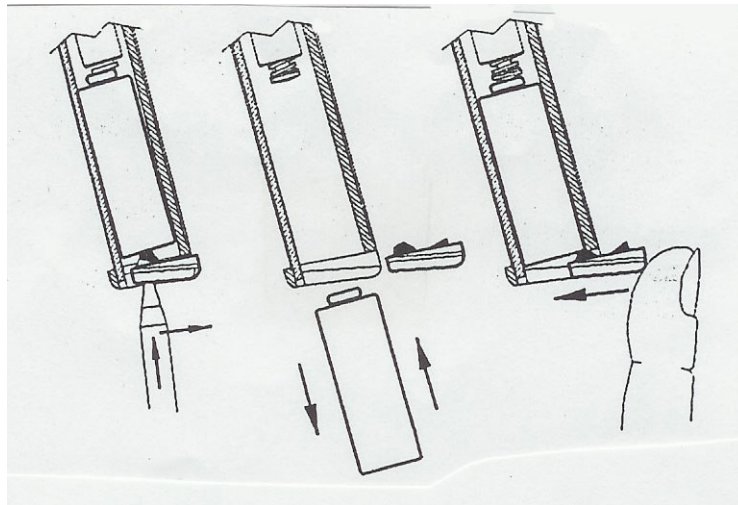


FIGURE 9-1 BATTERY REPLACEMENT

CAUTION: Before opening the battery compartment (B), 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.

Using a tool whose diameter is less than 4 mm, push the bottom of the hole of the battery cover and force the cover sideways until it is removed. Slide the old battery out and replace it with the new battery, observing the polarity. Slide the cover back into its groves at the bottom of the handle. Push the cover until it is bolted in place with a click. To maintain the warranty, use only an Alkaline 9-Volt battery.

9.0 **DISASSEMBLY AND REASSEMBLY**

Disassembly of the clamp will automatically void its warranty.

10.0 **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.

11.0 **S1C CLAMPS FOR EXTERNAL POWERING**

The S1C Hall-Effect current clamps are special versions of the SC series. They do not include a battery and they can be powered by an external voltage of 9 to 15 Volts DC. A 4-wire cable is provided at one of the handles of the clamp. The wires are color coded 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 to S2. The power supply is used as excitation of a bridge and cannot be grounded to the signal output.

If the power supply provides +_5 Volts and -5Volts in reference to ground, the output YELLOW wire can be grounded. In this case the output signal on the white wire is in reference to ground.

The following four models are available:

MODEL	CURRENT RANGE	OUTPUT
S1C-200-2	200 ADC	2 VDC
S1C-1000-1	1000 ADC	1 VDC
S1C-2000-2	2000 ADC	2 VDC
S1C-1500-1.5	1500 ADC	1.5 VDC

12.0 THE RA-202 EXCITATION/AMPLIFIER

The RA-202 Excitation/Amplifier is an optional accessory designed for use with the S1C Series Clamps. When wired to an S1C clamp, it provides a gain of 10 which increases the sensitivity of the clamp by a factor of 10:1. When used with an S1C-200-2 clamp, the output signal is 2 Volts DC at a full scale of 20 ADC. This combination is AYA Model **S1C-20-2DSP**

The front panel switch of the RA-202 unit has 3-positions: ON, OFF and BAT. In the BATTERY check position, the voltage of the external DC voltage source or battery is available on the output terminals. The power voltage should be between 10 and 12 Volts DC.

The RA-202 is designed to be permanently wired to the clamp. It also has a four-wire connector enabling the user to wire it to the external voltage source and to have access to the output signal. The wiring connections of the mating connector are shown in the attached drawing.