[1] SAFETY PRECAUTIONS – Be sure to read the following before use.

Thank you for purchasing our AC/DC Clamp Sensor model ACS101.

Before use, please read this manual thoroughly to ensure correct and safe use. After reading it, keep it together with the product for reference to it when necessary. Using the product in a manner not specified in this manual may cause damage to the protection function of the product. The instructions given under the headings of "A WARNING" and "A CAUTION" must be followed to prevent accidental burn and electric shock.

1-1 Explanation of Warning Symbols

The meanings of the symbols used in this manual and attached to the product are as follows:

- ♠: Very important instructions for safe use.
 - The warning messages are intended to prevent accidents to operating personnel such as burn and electric shock.
 - The caution messages are intended to prevent incorrect handling which may damage the product.

Explanation of warning symbols

- ⚠: Refer to Instruction Manual before use ☐: Potential of connection to a power line in live status
- : Double or reinforced insulation
- : Alternating current (AC) ● + −: Center position, polarity indications
- : Measured current direction

1-2 Warning Instructions for Safe Use

⚠ WARNING

To avoid physical injury such as burns or electric shock, be sure to observe the following instructions when using this instrument.

- 1. This instrument is a clamp sensor for low voltage applications. Do not use it with an electric circuit exceeding 600 V.
- 2. Never input signals exceeding the maximum rated input value (see 1-3). 3. Never use this instrument if it is damaged or if the output cable is damaged.
- 4. Do not use this instrument while the case or battery compartment cover is removed.
- 5. Never use the instrument when it is wet or when your hands are wet.
- 6. Do not attempt to repair or modify this instrument, except for battery
- 7. Perform start-up inspection and inspect the instrument at least once a year.
- 8. This instrument is for indoor use only.
- 9. When measuring equipment containing a hazardous charged part, it is required to wear protective gear for prevention of accidents. For details, please follow your local and national safety standards.
- 10.Do not use the instrument in a method other than specified. Otherwise, the protection function may be spoiled.

1-3 Overload Protection Input

Input	Maximum rated input	Maximum overload protection input
Clamp sensor	600 A AC/DC	600 A AC/DC

[2] APPLICATIONS AND FEATURES

2-1 Applications

This instrument is a clamp sensor that measures 0.5 to 600 A AC current and DC current.

It can be used to measure the current of electric circuits, electric equipment, and electric facilities with low voltage of 600 V or less

2-2 Features

- · Designed for both AC and DC currents
- Full-scale 600 mV AC/DC voltage output
- · Measured values displayed on a connected digital multimeter
- Provided with an auto power off function (approx. 20 min.) * Can be overridden.
- Button-operated DCA zero function

Measurement Category (Overload Category)

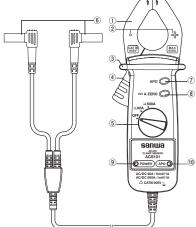
CAT. II: Line on the primary side of equipment with power cord to be connected to the receptacle.

CAT. III: Line from the primary side or branch of equipment which directly takes in electricity from a distribution board to the receptacle.

CAT. IV: Line from the service conductor to the distribution board.

_ 1 _

[3] NAMES OF PARTS



- 1) Clamp type current sensor (CT)
- (2) Centering marks for current measurement / Polarity marks for DC (DCA) measurement
- (3) Barrier
- (4) Trigger
- 5 Power switch / Range selector switch
- 6 Output terminals
- 7 Auto power off (APO) button
- (8) Zero adjustment (--- A ZERO) button 9 POWER lamp (red)
- 10 Auto power off (APO) lamp (green)

[4] DESCRIPTION OF FUNCTIONS

4-1 Power Switch / Range Selector Switch

Turns the power on and off. Is also used to select the measurement range.

4-2 POWER Lamp (Red)

When the power is turned on, this lamp lights up. When battery power is low and voltage drops below about 2.1 V, the light will start blinking. Replace the batteries if this lamp starts blinking (see 6-4).

4-3 Auto Power Off (APO) Lamp (Green)

This instrument is provided with an auto power off function. After 20 minutes of inactivity (no buttons are pressed), this function automatically turns off the power to minimize battery consumption. This lamp lights up when the auto power off function is engaged and goes out when it is disengaged. To restore power after it has been switched off by the auto power off function, set the power switch to the "OFF" position and then turn on the power again. Even when the auto power off function is activated, a small amount of current from the power supply continues to flow. Be sure to return the power switch to the "OFF" position when measurement is finished.

4-4 Auto Power Off (APO) Button

Engages and disengages the auto power off function. If the POWER lamp (red) is blinking and battery power is low, the auto power off function cannot be disengaged.

4-5 Zero Adjustment (--- A ZERO) Button

Performs zero adjustment of DC (DCA). While zero adjustment is operating, the auto power off (APO) lamp (green) blinks.

Note: Pressing any button for 5 seconds or more will turn off the power.

[5] MEASUREMENT PROCEDURE

⚠ WARNING

- 1. Do not apply an input signal exceeding the maximum rated input value. 2. Do not connect this instrument to a circuit with a voltage to ground
- exceeding 600 V.
- 3. During measurement, do not hold the instrument at any point on the other side of the barrier
- 4. Be sure to check the selected range before each measurement

⚠ CAUTION

- 1. To improve measuring accuracy, position the conductor at the center of the clamp type current sensor (CT).
- 2. Always clamp only one wire at a time. Accurate measurement is impossible if two or more wires, a cable with multiple conductors, or parallel cord is clamped.
- 3. Accurate measurement is impossible if the CT is not closed completely.
- 4. Accurate measurement is sometimes impossible near a source of strong magnetic field such as a transformer or high-current line, near a source of electromagnetic waves such as radio equipment, or near a charged object.

5-1 Start-up Inspection

Perform the following pre-operational check for safety.

- Check the external appearance. Check that the instrument is free of abnormality or damage due to dropping, etc.
- Make sure the output cable and output terminals are not disconnected, cracked, or otherwise damaged.
- · Make sure the batteries are inserted correctly before using this instrument for the first time. After turning on the instrument, confirm that the POWER lamp (red) does not blink and that battery power is not low. If the lamp blinks, replace the batteries with new ones. If the lamp does not light, the batteries may be completely exhausted (see 6-4).
- Make sure that the instrument is dry and that your hands are not wet.

5-2 Measurement Preparation

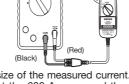
Have a measuring device ready that can measure 600 mV AC/DC. The following instructions are applicable to a digital multimeter with 6000 counts.

(1) Connect the output terminals of this instrument to the multimeter. Red plug → V terminal

Black plug → COM terminal

(2) Turn on the multimeter and set it as follows.

DC (DCA) measurement → 600.0 mV DC range AC (ACA) measurement → 600.0 mV AC range



(3) Set the range selector switch according to the size of the measured current. If the size of the current is unknown, first select the 600 A range and then change the range according to the measured value.

Note: • It is recommended to use a digital multimeter with 6000 counts and AC mV/DC mV ranges. Use V ranges if AC mV/DC mV ranges are not available.

· Waveform observation using an oscilloscope is not possible.

5-3 DC (DCA) Measurement

- (1) Once you have completed your measurement preparation, press the zero adjustment button to perform zero adjustment (see 4-5). Check that the display on the multimeter shows a value less than 1.0 mV. Since the zero point is likely to vary in DCA measurement, perform zero adjustment again when a major change has been made in the direction of this instrument.
- 2) Push the trigger on this instrument to open the clamp type current sensor (CT). Clamp one wire of the conductor you are measuring and close the CT completely. Now align the direction of the measured current with the direction of the arrow on the CT. If the direction is wrong, the multimeter displays a negative (-) polarity.
- (3) Multiply the value displayed on the multimeter by one of the factors in the table above and read it in the "A".

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Multimeter range ACS101	100 to 600 mV range	1 to 6 V range
60 A range	0.1x	100x
600 A range	1x	1000x

[Reading example]

If the multimeter displays "59.0 set to the 60 A range and the multimeter is set to the 600.0 mV range, the current value is $59.0 \times 0.1 = 5.90$ [A].

5-4 AC (ACA) Measurement

- 1) Once you have completed your measurement preparation, push the trigger on this instrument to open the CT. Clamp one wire of the conductor you are measuring and close the CT completely.
- (2) In the same way as in DCA measurement, multiply the value displayed on the multimeter by an appropriate factor in the table above and read it in the "A".

Note: To measure the AC current of two-core cables for home electric appliances, use the optionally available LS11 Line Separator (see 8-2).

[6] MAINTENANCE

⚠ WARNING

- 1. This section is very important for safety. Read and understand the following instructions fully and maintain your instrument properly.
- 2. For securing safety and accuracy, inspect and calibrate the instrument at least every year.

6-1 Maintenance and Inspection

- 1) Appearance:
- •Check that the exterior of the instrument is not damaged by dropping it.
- 2) Output cable and terminals

•Check that the cable and terminals are normal. Make sure that there is no damage to the coating and that no part of the conductor is exposed. If any of the troubles above is found, do not use the instrument and call for service.

For more information about calibration and inspection, please contact Sanwa's authorized agent/distributor service provider, listed on our website (see 7-3).

6-3 Cleaning and Storage

⚠ CAUTION

- 1. The panel and case are not resistant to volatile solvent and must not be cleaned with thinner or alcohol. If the instrument gets dirty, wipe with a soft cloth moistened with a small amount of water.
- 2. The panel and case are not resistant to heat. Do not place the instrument near heat-generating devices
- 3. Do not store the instrument anywhere it may be subject to vibrations or 4. When storing the instrument, avoid hot, cold, or humid locations, locations exposed to direct sunlight, or locations where condensation
- 5. When the instrument is not going to be used for an extend period of time, be sure to remove the batteries.

6-4 Battery Replacement

- ⚠ WARNING 1. To avoid electric shock, do not remove the battery compartment cover when input is applied to the
- CT or when measurement is being performed. 2. Confirm that the power switch is at the "OFF" position before replacing the batteries.
- (1) Using a Phillips screwdriver, remove the fixing screw
- 2 Remove the battery compartment cover.
- 3 Replace both of the two batteries in the battery compartment with new ones by taking care of the polarity.
- (4) Place the battery compartment cover and tighten the fixing screw.

(x1) from the battery compartment cover. Do not remove

from battery

[7] AFTER-SALE SERVICE

7-1 Warranty and Provision

Sanwa offers comprehensive warranty services to its end-users and to its product resellers. Under Sanwa's general warranty policy, each instrument is warranted to be free from defects in workmanship or material under normal use for the period of one (1) year from the date of purchase.

This warranty policy is valid within the country of purchase only, and applied only to the product purchased from Sanwa authorized agent or distributor. Sanwa reserves the right to inspect all warranty claims to determine the extent to which the warranty policy shall apply. This warranty shall not apply to disposables batteries, or any product or parts, which have been subject to one of the following causes:

- 1.A failure due to improper handling or use that deviates from the instruction manual. 2.A failure due to inadequate repair or modification by people other than Sanwa service personnel.
- 3.A failure due to causes not attributable to this product such as fire, flood and other natural disaster.
- 4. Non-operation due to a discharged battery. 5.A failure or damage due to transportation, relocation or dropping after the purchase.
- 7-2 Repair

Customers are asked to provide the following information when requesting services:

1. Customer name, address, and contact information

- 3 -

- 2.Description of problem
- 3. Description of product configuration

- mV" when this instrument is

4. Model Number

5. Product Serial Number

6. Proof of Date-of-Purchase

7. Where you purchased the product

- 1) Prior to requesting repair, please check the following:
- Capacity and installation polarity of the batteries.
- Continuity of the test leads.
- 2) Repair during the warranty period:

The failed instrument will be repaired in accordance with the conditions stipulated in "7-1 Warranty and Provision".

Please contact Sanwa authorized agent, distributor, or service provider, listed in

our website, in your country with above information. An instrument sent to Sanwa

agent or distributor without those information will be returned to the customer.

3) Repair after the warranty period has expired:

In some cases, repair and transportation cost may become higher than the price of the product. Please contact Sanwa authorized agent or service provider in advance. The minimum retention period of service functional parts is six (6) years after the discontinuation of manufacture. This retention period is the repair warranty period. Please note, however, if such functional parts become unavailable for reasons of discontinuation of manufacture, etc., the retention period may become shorter accordingly.

To ensure the safety of the product during transportation, place the product in a box that is larger than the product 5 times or more in volume and fill cushion materials fully and then clearly mark "Repair Product Enclosed" on the box surface. The cost of sending and returning the product shall be borne by the customer.

https://www.sanwa-meter.co.jp

8-1 General Specifications

E-mail: exp_sales@sanwa-meter.co.jp

Measurement range: Output voltage	60 A AC/DC: 10 mV/1 A, 600 A AC/DC: 1 mV/1 A	
Output impedance	100 Ω (internal impedance of connectable device: ≥1 M Ω)	
Low battery warning	POWER lamp (red) blinks when battery voltage drops below approx. 2.1 V	
Clamp clearance	Approx. ø30 mm or 10 x 35 mm max.	
Output cable length	Approx. 1500 mm	
Operating environmental conditions	<2000 m altitude, indoor use, pollution degree II	
Withstand voltage	2000 V AC between iron core and rear case	
Accuracy assurance temperature/humidity range	23 ± 5 °C, 80 % RH max. (no condensation)	
Operating temperature/ humidity range	Temperature: 5 to 40 °C (no condensation) Humidity: 80 % RH (max.) at 5 to 31 °C and linear decrease from 80 % RH to 50 % RH at 31 to 40 °C	
Storage temperature/ humidity range	-10 to 40 °C, ≤80 % RH (no condensation) 40 to 50 °C, ≤70 % RH (no condensation) Remove batteries when stored for long periods of non-use.	
Temperature coefficient	Below 18 °C and above 28 °C: Accuracy x 0.1 should be added to output voltage tolerance % per °C	
Power supply	AAA (R03 manganese or LR03 alkaline) battery 1.5 V x 2	
Auto power off	Approx. 20 min. of inactivity (no buttons pressed)	
Power consumption	Approx. 10 mA during operation Approx. 0.1 μA during auto power off	
Battery life (continuous operation)	Approx. 100 hours with alkaline batteries (LR03); approx. 45 hours with manganese batteries (R03)	
Dimensions, mass	190 (H) x 71 (W) x 37 (D) mm, approx. 260 g (including batteries)	
Provided accessories	Instruction manual, carrying case (C201), AAA battery (R03) x 2	

• LS11 Line Separator: Rated voltage 125 V AC, 10 A

8-3 Measurement Range and Accuracy "rdg" stands for reading

60 A AC/DC range: 10 mV/1 A

600 A AC/DC range: 1 mV/1 A

	Measurement range		Measurement range	Output voltage tolerance
$(CA~0.5 \sim 60~A)$ $(1.5~\% rda + 1.0~m)) ACA~1 \sim 600~A$	CA 0.5 \sim 60 A	$.5 \sim 60 \text{ A}$	ACA 1 \sim 600 A	± (1.5 %rdg + 1.0 mV)
OCA 0.5 ~ 60 A ± (1.5 %rdg + 1.0 mV) DCA 1 ~ 600 A ± (1.5 %rdg + 1.0 mV)	CA 0.5 ~ 60 A	$1.5 \sim 60 \text{ A}$	DCA 1 ∼ 600 A	

•It is assumed that the conductor you are measuring is at the center of the CT. •The ACA values are sine wave AC current of 400 Hz or less.

The DCA values are those after zero adjustment has been performed.

•The values do not include errors generated by the connected measuring device.

Accuracy calculation method*

: ±(100.0 mV x 1.5 % + 1.0 mV) = ±2.5 mV

The product specifications described in this manual and its appearance are subject to change without notice for improvement or other reasons.

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4) Precautions when sending the product to be repaired:

7-3 SANWA Website

[8] SPECIFICATIONS

Output impedance	100 Ω (internal impedance of connectable device: ≥1 MΩ)
Low battery warning	POWER lamp (red) blinks when battery voltage drops belo approx. 2.1 V
Clamp clearance	Approx. ø30 mm or 10 x 35 mm max.
Output cable length	Approx. 1500 mm
Operating environmental conditions	<2000 m altitude, indoor use, pollution degree II
Withstand voltage	2000 V AC between iron core and rear case
Accuracy assurance temperature/humidity range	23 ± 5 °C, 80 % RH max. (no condensation)
Operating temperature/ humidity range	Temperature: 5 to 40 °C (no condensation) Humidity: 80 % RH (max.) at 5 to 31 °C and linear decrease from 80 % RH to 50 % RH at 31 to 40 °C
Storage temperature/ humidity range	-10 to 40 °C, ≤80 % RH (no condensation) 40 to 50 °C, ≤70 % RH (no condensation) Remove batteries when stored for long periods of non-use.
Temperature coefficient	Below 18 °C and above 28 °C: Accuracy x 0.1 should be added output voltage tolerance % per °C
Power supply	AAA (R03 manganese or LR03 alkaline) battery 1.5 V x 2
Auto power off	Approx. 20 min. of inactivity (no buttons pressed)
Power consumption	Approx. 10 mA during operation Approx. 0.1 μA during auto power off
Battery life (continuous operation)	Approx. 100 hours with alkaline batteries (LR03); approx. 45 hour with manganese batteries (R03)
Dimensions, mass	190 (H) x 71 (W) x 37 (D) mm, approx. 260 g (including batteries)
Provided accessories	Instruction manual, carrying case (C201), AAA battery (R03) x 2

AC

DO

E.g., 60 A DC range Displayed value :100.0 mV (600 mV DC range on multimeter)

Output voltage tolerance: ±(1.5 % rdg + 1.0 mV)

Output voltage 100.0 mV ± 2.5 mV : 10 A ± 0.25 A (within range of 9.75 to 10.25 A) * Errors generated by the connected measuring device are added