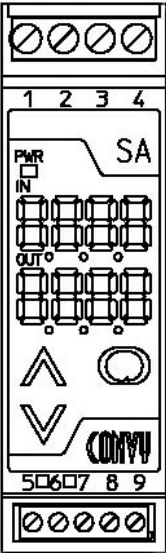# PROGRAMMABLE SIGNAL CONDITIONER

SA SERIES
SAW SERIES

INSTRUCTION MANUAL

CONVY

Preface

Thank you for purchasing the Programmable Signal Conditioner SA series and SWA series.
This manual contains instructions for the mounting, functions, operations and notes when operating the SA series and SWA series. To prevent accidents arising from the misuse of this instrument, please ensure the operator receives this manual.

Notes

- This instrument should be used in accordance with the specifications described in the manual.
  If it is not used according to the specifications, it may malfunction or cause fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- Specifications, external appearance of the SA series and SWA series and the contents of this instruction manual are subject to change without notice.
- Care has been taken to assure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our sales department.
- This instrument is designed to be installed on a DIN rail. If it is not, measures must be taken to ensure that the operator does not touch power terminals or other high voltage sections.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- Shinko Technos CO., LTD. is not liable for any damages or secondary damages incurred as a result of using this product, including any indirect damages.

SAFETY PRECAUTIONS (Be sure to read these precautions before using our products.)

The safety precautions are classified into categories: "Warning" and "Caution".
Depending on circumstances, procedures indicated by ⚠ Caution may be linked to serious results, so be sure to follow the directions for usage.

⚠ **Warning**   Procedures which may lead to dangerous conditions and cause death or serious injury, if not carried out properly.

⚠ **Caution**   Procedures which may lead to dangerous conditions and cause superficial to medium injury or physical damage or may degrade or damage the product, if not carried out properly.

⚠ Warning

- To prevent an electric shock or fire, only Shinko or qualified service personnel may handle the inner assembly.
- To prevent an electric shock, fire or damage to instrument, parts replacement may only be undertaken by Shinko or qualified service personnel.

⚠ Safety precautions

- To ensure safe and correct use, thoroughly read and understand this manual before using this instrument.
- This instrument is intended to be used for industrial machinery, machine tools and measuring equipment. Verify correct usage after consulting purpose of use with our agency or main office. (Never use this instrument for medical purposes with which human lives are involved.)
- External protection devices such as protection equipment against excessive temperature rise, etc. must be installed, as malfunction of this product could result in serious damage to the system or injury to personnel. Also proper periodic maintenance is required.
- This instrument must be used under the conditions and environment described in this manual. Shinko Technos Co., Ltd. does not accept liability for any injury, loss of life or damage occurring due to the instrument being used under conditions not otherwise stated in this manual.

Caution with respect to Export Trade Control Ordinance

To avoid this instrument from being used as a component in, or as being utilized in the manufacture of weapons of mass destruction (i.e. military applications, military equipment, etc.), please investigate the end users and the final use of this instrument.
In the case of resale, ensure that this instrument is not illegally exported.

1. Installation precautions

⚠ Caution

This instrument is intended to be used under the following environmental conditions (IEC61010-1): Overvoltage category Ⅱ, Pollution degree 2
Ensure the mounting location corresponds to the following conditions:
- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- No mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of -5 to 50℃ (23 to 131℉) that does not change rapidly
- An ambient non-condensing humidity of 35 to 85%RH
- No large capacity electromagnetic switches or cables through which large current is flowing
- No water, oil or chemicals or where the vapors of these substances can come into direct contact with the unit

Note • Do not install this instrument near flammable material even though the case of this instrument is made of flame resistant resin.
Avoid setting this instrument directly on flammable material.

2. Wiring precautions

⚠ Caution

- Do not leave bits of wire in the instrument, because they could cause fire and malfunction.
- When wiring terminals, use ferrules with an insulation sleeve and crimping pliers made by Phoenix Contact GMBH & CO. applicable to terminals.
- Tighten the terminal screw within the specified torque.
  If excessive force is applied to the screw when tightening, the screw or case may be damaged.
- This instrument has no built-in power switch, circuit breaker or fuse. It is necessary to install them near the instrument.
  (Recommended fuse: Time-lag fuse, rated voltage 250V AC, rated current 2A)
- For wiring of AC power source, be sure to use exclusive terminals as described in this manual. If AC power source is connected to incorrect terminals, the unit will burn out.
- For a 24V DC power source, do not confuse polarity.
- Do not apply a commercial power source to the sensor connected to the input terminal nor allow the power source to come into contact with the sensor, as the input circuit may burn out.
- Use a thermocouple, compensating lead wire and 3-wire system RTD according to the sensor input specifications of this unit.
- When using DC voltage and current input, do not confuse polarity when wiring.
- Keep the input wire (TC, RTD, etc.), power line and load wire away from one another.

3. Running and maintenance precautions

⚠ Caution

- Do not touch live terminals. This may cause electric shock or problems in operation.
- Turn the power supply to the instrument OFF when retightening the terminal and cleaning. Working or touching the terminal with the power switched ON may result in severe injury or death due to Electric Shock.
- Use a soft, dry cloth when cleaning the instrument.
  (Alcohol based substances may tarnish or deface the unit.)
- As the display section is vulnerable, do not strike or scratch it with a hard object or press hard on it.

Characters used in this manual

Indication	⁻	▯	¹	₂	₃	₄	₅	₆	⁷	₈	₉	₵	₣
Number, ℃/℉	-1	0	1	2	3	4	5	6	7	8	9	℃	℉
Indication	A	b	c	d	E	F	G	H	I	J	k	L	m
Alphabet	A	B	C	D	E	F	G	H	I	J	K	L	M
Indication	n	o	P	q	r	S	T	U	V	W	X	Y	Z
Alphabet	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

☐ means that no character is indicated (unlit) on the display.

--- CONTENTS ---

1. Model

1.1 Model

SA series

SA □ – □			Series name: SA
Signal conditioner type	U		Universal/DC (*)
	E		Thermocouple/DC
	R		RTD/DC
	A		DC current/DC
	V		DC voltage/DC
	P		Potentiometer/DC
	D		Current loop supply/DC
Power supply		0	100 to 240V AC
		1	24V AC/DC

(*) SAU (Universal transmitter) accepts all types of inputs (thermocouple, RTD, DC current, DC voltage and potentiometer) and outputs (DC current and DC voltage).

(e.g.) SAU-0

   Type: Universal transmitter,   Power supply: 100 to 240V AC

   Default value: Input: K -200 to 1370℃

               Output: 4 to 20mA DC

SAW series

SAW □ – □ □			Series name: SAW
Signal conditioner	U		2-output universal/DC (*)
	D		2-output current loop supply/DC
Power supply	0		100 to 240V AC
	1		24V AC/DC
Output 2		0	4 to 20mA DC
		1	0 to 20mA DC

(*) SAWU (2-output universal transmitter) accepts input types (thermocouple, RTD, DC current and DC voltage) and Output 1 (DC current and DC voltage).

(e.g.) SAWU-00

   Type: 2-output universal transmitter,   Power supply: 100 to 240V AC

   Default value: Input: K -200 to 1370℃

               Output 1: 4 to 20mA DC

               Output 2: 4 to 20mA DC (Depending on model)

1.2 How to read the model label

The model label is attached to left side of the case.

Model — SAU-0

Input (Enter a range selected during Input range selection.)
Output (Enter a range selected during Output selection.)

Serial number

INPUT
OUTPUT
100to240V AC 50/60Hz 6VA
AMB.TEMP. –5to55°C
SERIAL No.123456

(Fig. 1.2-1)

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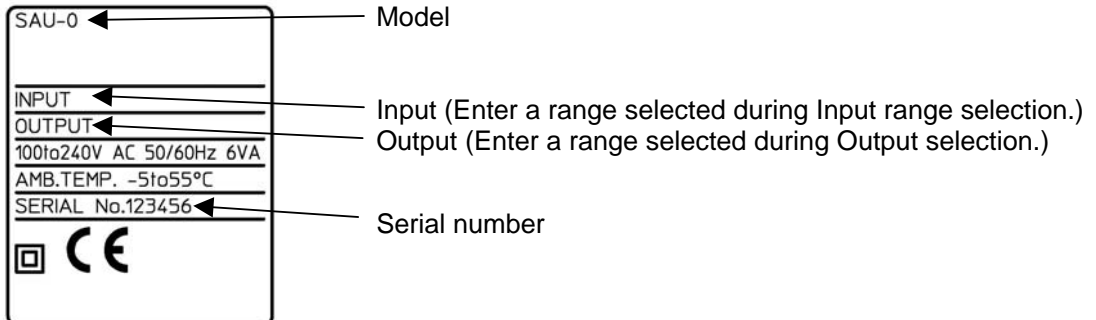
2. Name and functions of the sections
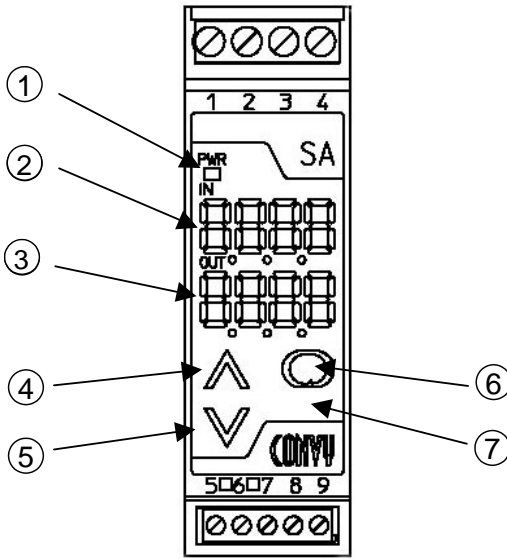
(Fig.2.1)

①**Power indicator** (Green)
A green LED lights up when the power to the instrument is turned on.

②**Input display** (Red)
Indicates the input value during Run mode.
Indicates characters of setting or adjustment item during Setup and Adjustment mode.

③**Output display** (Green)
Indicates the output value (%) during Run mode.
Indicates set value or adjusted value during Setup and Adjustment mode.

④**Up key** (∧)
Increases the numeric value, or switches the selection items

⑤**Down key** (∨)
Decreases the numeric value, or switches the selection items

⑥**Mode key** (○)
By holding down this key for approx. 3 seconds, the mode proceeds to the Adjustment mode.
Switches the setting mode and registers the set (selected) value.

⑦**Sub-mode key** (⬚)
If the Mode key is pressed while holding down this key, the mode proceeds to the Setup mode.

3. Mounting

3.1 External dimensions (unit: mm)

DIN rail

75

22.5

97

100

(4)

(Fig. 3.1-1)

6
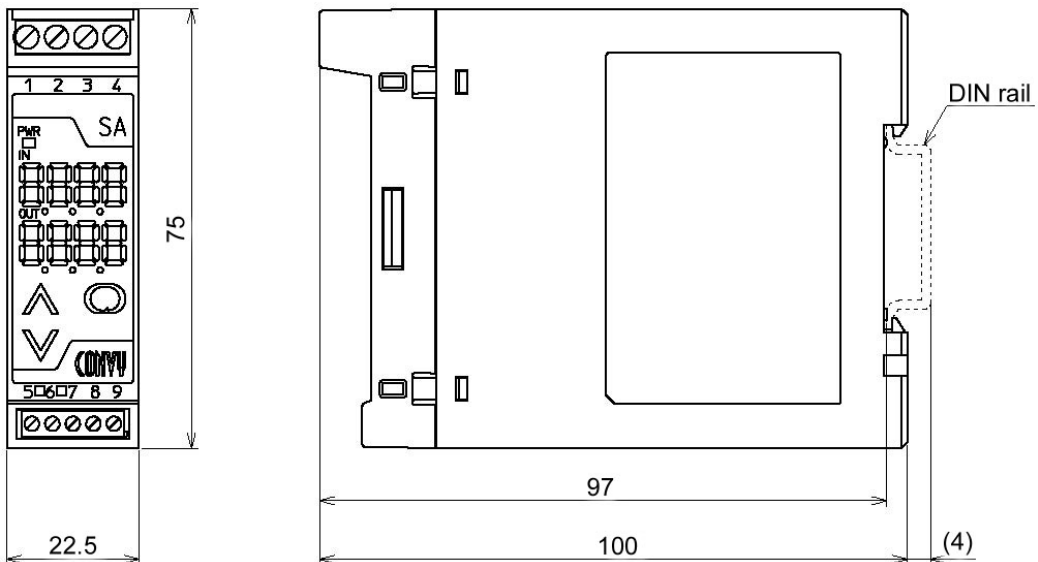
3.2 Mounting to and removal from the DIN rail

> # ⚠ **Caution**
>
> - **Mount the DIN rail horizontally.**
> - **To remove this instrument, the flat bladed screwdriver is required for pulling down the lever.**
>   **Never turn the screwdriver when inserting it into the release lever.**
>   **If excessive power is applied to the lever, it may break.**
> - **Be sure to use commercially available fastening plates at both ends of the unit in a position susceptible to vibration or shock.**
>
> **Recommended fastening plate**
>
> | Manufacturer | Model |
> |---|---|
> | Omron corporation | End plate   PFP-M |
> | IDEC corporation | Fastening plate BNL6P, BNL8P |
> | Matsushita electric works, LTD. | Fastening plate ATA4806 |

Mounting to the DIN rail (Fig. 3.2-1)

- Hook ① of the instrument on the upper side of the DIN rail.
- Making ① part of the instrument as a support, fit the lower part ② of the instrument to the DIN rail.

  The unit will be completely fixed to the DIN rail when a "Click" sound is heard.

Removal from the DIN rail (Fig.3.2-2)

- Insert a flat bladed screwdriver into the release lever (①).
- Remove the instrument from the DIN rail by pulling down the lever (②).
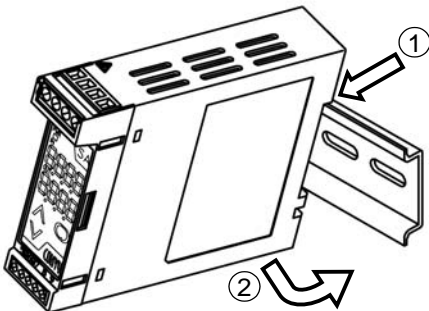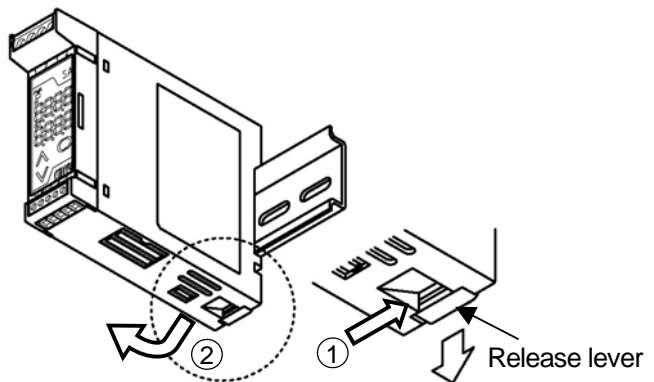
(Fig. 3.2-1) Mounting   (Fig. 3.2-2) Removal

4. Wiring

> # ⚠ **Warning**
>
> **Turn the power supply to the instrument off before wiring.**
> **Working or touching the terminal with the power switched on may result in severe injury or death due to Electric Shock.**

4.1 Recommended ferrules

When using ferrules, use the following recommended ferrules and crimping pliers made by Phoenix Contact GMBH &CO. See (Table 4.1-1) on page 8.

Take note that screw size and tightening torque differ depending on the terminal number.

(Table 4.1-1)

Terminal number	Terminal screw	Ferrules with insulation sleeve	Conductor cross sections	Tightening torque	Crimping pliers
1 to 4	M2.6	AI 0.25-8 YE	0.2 to 0.25mm^2	0.5 to 0.6N•m	CRIMPFOX ZA 3
		AI 0.34-8 TQ	0.25 to 0.34mm^2		
		AI 0.5-8 WH	0.34 to 0.5mm^2		
		AI 0.75-8 GY	0.5 to 0.75mm^2		CRIMPFOX UD 6
		AI 1.0-8 RD	0.75 to 1.0mm^2		
		AI 1.5-8 BK	1.0 to 1.5mm^2		
5 to 9	M2.0	AI 0.25-8 YE	0.2 to 0.25mm^2	0.22 to 0.25N•m	
		AI 0.34-8 TQ	0.25 to 0.34mm^2		
		AI 0.5-8 WH	0.34 to 0.5mm^2		

4.2 Terminal arrangement and circuit configuration

SA series
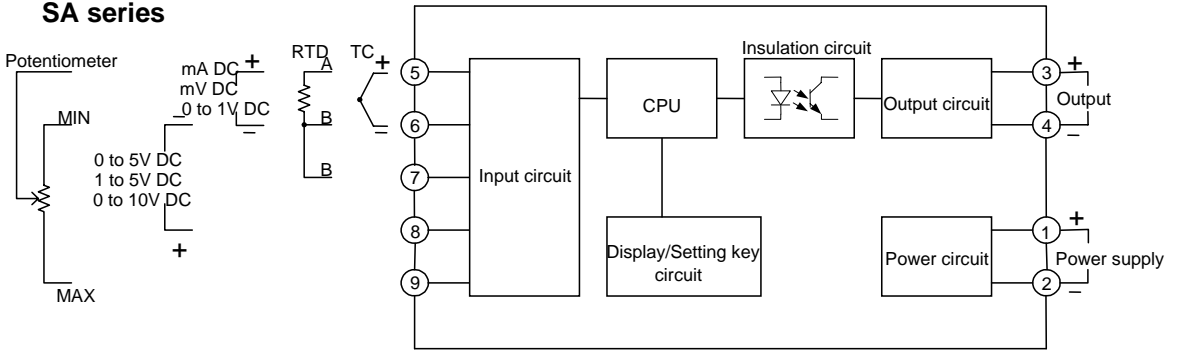
(Fig. 4.2-1)

SAD

(Fig. 4.2-2)

SAWU

(Fig. 4.2-3)

8
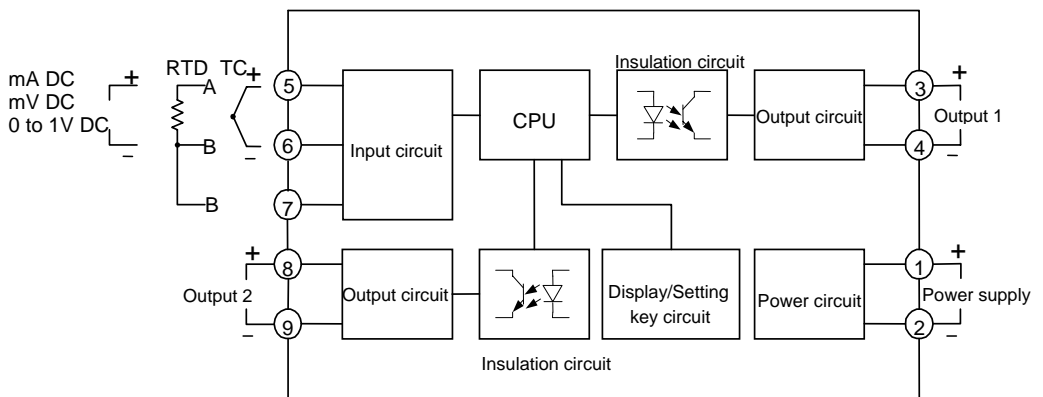
SAWD
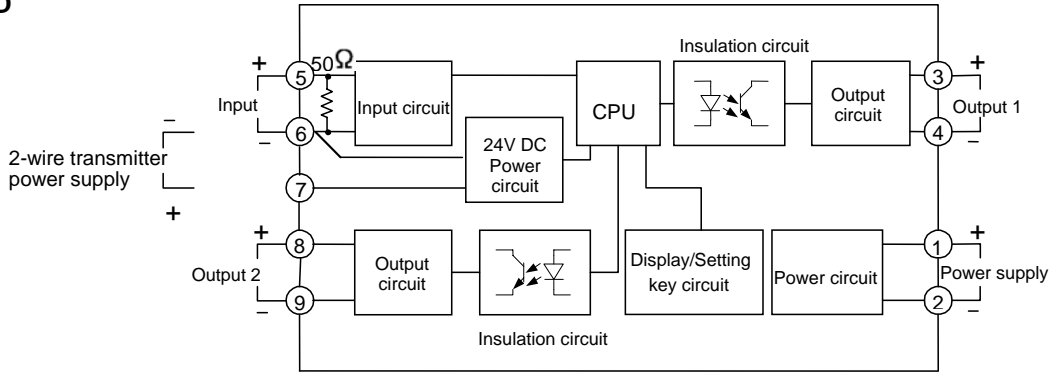
(Fig. 4.2-4)

4.3 Wiring of terminals
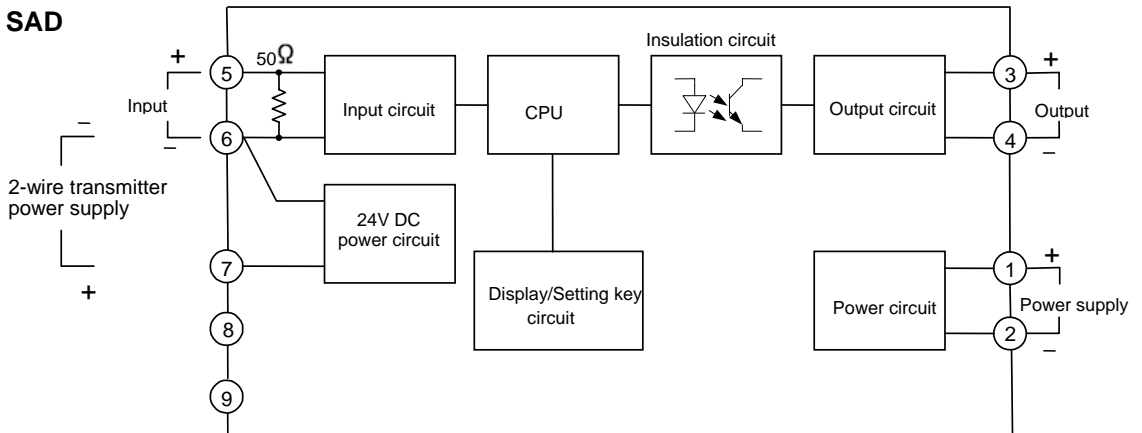
> ## ⚠ **Warning**
> • For 100 to 240V AC, if AC power source is connected to incorrect terminals, this instrument will burn out.
> • For a 24V DC power source, do not confuse polarity when wiring.

4.3.1 Power source wiring
Use terminals ①(+) and ②(-) for the power supply to the instrument.

4.3.2 Output wiring
Use terminals ③(+) and ④(-) for the output wiring.
For the SAW series, use terminals ③(+) and ④(-) for Output 1, and ⑧(+) and ⑨(-) for Output 2.

4.3.3 Input wiring
Terminals for wiring are different depending on the input specifications.
Refer to (Fig. 4.2-1), (Fig. 4.2-2), (Fig. 4.2-3) and (Fig. 4.2-4).
When using the SAD and SAWD as a current loop supply or as an isolator, be sure to wire the unit as follows.
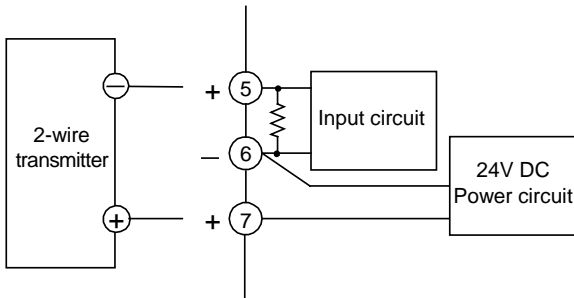
As a current loop supply   **As an isolator**
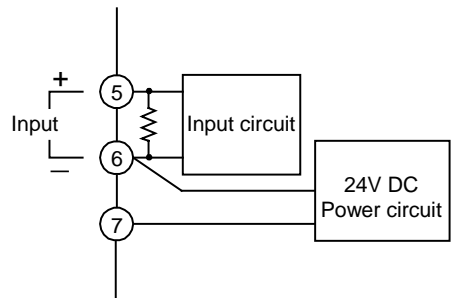
(Fig. 4.3.3-1)   (Fig. 4.3.3-2)

For the SAA, SAU(DC current input), SAWU (DC current input): Use terminals ⑤(+), ⑥(-) for input wiring and shunt resistor (sold separately) connection. (See Table 4.3.3-1)
(Table 4.3.3-1)

Input	Shunt resistor	
	Model	Specification
4 to 20mA DC, 0 to 20mA DC, 0 to 16mA DC	RES-S02-050	50Ω ±0.1%
2 to 10mA DC, 0 to 10mA DC	RES-S02-100	100Ω ±0.1%
1 to 5mA DC	RES-S02-200	200Ω ±0.1%
0 to 1mA DC	RES-S02-01K	1kΩ ±0.1%

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5. Operation flowchart

Power ON — Warm-up indication (Approx. 3sec.)

Run mode

- ⌐ ̄ ̄ ̄ ̄ ̄ ̄¬ The items with dotted lines are not indicated depending on the specification.
- To return from Adjustment to Run mode, press ◎ key for approx. 3sec. From any setting item in adjustment mode, it is possible to return to Run mode.

(*1): For SAW series, Output 1 zero or Output 1 span adjustment
(*2): Not available for SA series.
(*3): Differs depending on Input selection.
(*4): Selects Output 1 for SAW series.

PWR SA
IN
25
OUT
14.3

Hold down ◎ key for approx. 3sec.

Press the ◎ key while holding down the Sub-mode key.

Adjustment mode		**Setup mode**	
IN oᶻr1 OUT 0.00	Output zero adjustment (*1)	IN Lock OUT ----	Set value lock selection

Press the ◎ key.

IN oᵴP1 OUT 0.00	Output span adjustment (*1)	IN 5En5 OUT rc	Input selection	IN 5o OUT 0.0	Sensor correction setting

Press the ◎ key.

IN oᶻr2 OUT 0.00	Output 2 zero adjustment (*2)	IN rc OUT t□c	Input range selection (*3)	IN oUrP OUT 420A	Output selection (*4)

Press the ◎ key.

IN oᵴP2 OUT 0.00	Output 2 span adjustment (*2)	IN dP OUT 0	Decimal point place selection	IN oUrᵴ OUT noﾠL	Output status selection

Press the ◎ key.

IN 1ᶻEr OUT -1999	Potentiometer input zero adjustment	IN ᵴrLL OUT -200	Output 0% value setting	IN bUrn OUT UP	Burnout selection

Press the ◎ key.

IN 1ᵴPA OUT 9999	Potentiometer input span adjustment	IN ᵴrLH OUT 1370	Output 100% value setting	IN di5P OUT dUAL	Display selection

Press the ◎ key.

		IN F1Lr OUT 0.0	Filter time constant setting	IN r1ﾠE OUT 00.00	Indication time setting

Press the ◎ key.

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6. Setup

Setup should occur before using this unit, to set the Input type (for the SAU, SAWU only), Input range, Output 0% value, Output 100% value, Output etc. according to the users' conditions. If the users' specification is the same as the default value of the instrument, or if setup has already been completed, it is not necessary to set up the instrument. Proceed to Chapter "7. Adjustment". (Table 6-1)

Setting item	Default value	
Set value lock selection	Unlock	
Input selection	Thermocouple (only for SAU, SAWU)	
Input range selection	SAE, SAU, SAWU	K, -200 to 1370℃
	SAR	Pt100, -200 to 850℃
	SAA	4 to 20mA DC
	SAV	1 to 5V DC
	SAP	Not available
	SAD, SAWD	Not available
Decimal point place selection	No decimal point	
Output 0% value setting	SAE, SAU, SAWU, SAR	-200℃
	SAA, SAV, SAP, SAD, SAWD	-1999
Output 100% value setting	SAE, SAU, SAWU	1370℃
	SAR	850℃
	SAA, SAV, SAP, SAD, SAWD	9999
Filter time constant setting	0.0 seconds	
Sensor correction setting	0.0℃	
Output selection	4 to 20mA DC (Output 1 selection for SAW series)	
Output status selection	Normal	
Burnout selection	Upscale (when thermocouple or RTD is selected during Input selection for the SAE, SAR and SAU)	
Display selection	Input/Output indication	
Indication time setting	00.00 (Continuous)	

6.1 Indication after power-on

After power to the unit is turned on, warm-up status below (Fig. 6.1-1) is indicated for approx. 3sec.

Lights up when power-on

Indicates the input range.
Indicates $\vdash\square\square\complement$ for the SAU (Default, K: -200 to 1370℃).

Indicates the output type.
Indicates $420A$ for the default value 4 to 20mA DC.

(Fig. 6.1-1)

After that, the mode switches to the Run mode as shown below.

Indicates the input value.
Indicates the input value from the thermocouple for the SAU (Default, K: -200 to 1370℃).
Indicates $----$ when nothing is connected to the input terminals.

Indicates the output value corresponding to the input value in a percentage form (%).
Indicates 110.0 (110.0%) when nothing is connected to the input terminals.
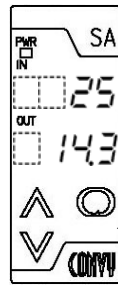
(Fig. 6.1-2)

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6.2 Basic operation of setup

Setup is conducted in the Setup mode.

To enter the Setup mode, press the ○ key while holding down the Sub-mode key in the Run mode. (Fig. 6.2-1)

To set (select) each item, use the ∧ or ∨ key, and register the value with the ○ key. (Fig. 6.2-2)

(1) Run mode

To enter the Setup mode, press the ○ key ② while holding down the Sub-mode key ① in the Run mode.

(Fig. 6.2-1)

(2) Setup mode

Used for setting or selection in each setting mode.

Used to proceed to each setting item and to register the set (selected) value.

(Fig. 6.2-2)

6.3 Setup of the unit

The following show all setting items. Set up the unit referring to the explanation of each item.

Display	Name, Function, Setting range	Default value
IN Lock OUT - - - -	**Set value lock selection**	Unlock

	Locks the set values to prevent setting errors.
	    - - - -: Unlock
	    Lock: Lock (None of the set value and adjusted value can be changed.)	

IN SEnS OUT Tc□□	**Input selection**	Thermocouple

	Selects an input type.
	Available only for the SAU and SAWU.
	    Tc□□: Thermocouple
	    rTd□: RTD
	    dcA□: DC current
	    dcU□: DC voltage
	    PoT□: Potentiometer (Input range selection item is not indicated.)
	        The SAWU has no potentiometer input.	

IN Tc□□ OUT t□□C	**Thermocouple input range selection**	K: -200 to 1370℃(SAE, SAU, SAWU)

	Selects the input range of thermocouple.
	Available for the SAE, SAU/SAWU (thermocouple input)
	    t□□C: K -200 to 1370℃
	    t□2C: K (*) -200 to 200℃
	    t□4C: K (*) 0 to 400℃
	    J□□C: J -200 to 1000℃
	    J□2C: J (*) -200 to 200℃
	    J□4C: J (*) 0 to 400℃
	    r□□C: R -50 to 1760℃
	    S□□C: S -50 to 1760℃
	    b□□C: B 0 to 1820℃
	    E□□C: E -200 to 800℃	

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	$\Gamma\square\square\square\mathcal{C}$: T (*)	-200 to 400℃
	$n\square\square\square\mathcal{C}$: N	-200 to 1300℃
	$PL2C$: PL-Ⅱ	0 to 1390℃
	$\subset\square\square\mathcal{C}$: W5Re/W26Re	0 to 2315℃
	$d\square\square\mathcal{C}$: W3Re/W25Re	0 to 2315℃
	$t\square\square F$: K	-328 to 2498℉
	$t\square2F$: K (*)	-328 to 392℉
	$t\square4F$: K (*)	32 to 752℉
	$J\square\square F$: J	-328 to 1832℉
	$J\square2F$: J (*)	-328 to 392℉
	$J\square4F$: J (*)	32 to 752℉
	$\Gamma\square\square F$: R	-58 to 3200℉
	$4\square\square F$: S	-58 to 3200℉
	$b\square\square F$: B	32 to 3308℉
	$E\square\square F$: E	-328 to 1472℉
	$\Gamma\square\square F$: T (*)	-328 to 752℉
	$n\square\square F$: N	-328 to 2372℉
	$PL2F$: PL-Ⅱ	32 to 2534℉
	$\subset\square\square F$: W5Re/W26Re	32 to 4199℉
	$d\square\square F$: W3Re/W25Re	32 to 4199℉

IN $r\Gamma d\square$ OUT $P\Gamma\square C$	**RTD input range selection**	Pt100, -200 to 850℃(SAR, SAU, SAWU)
	Selects RTD input range. Available for the SAR, SAU/SAWU (RTD input)	
	$P\Gamma\square C$: Pt100	-200 to 850℃
	$P\Gamma\ 1C$: Pt100 (*)	-100 to 100℃
	$JP\Gamma C$: JPt100	-200 to 500℃
	$P\Gamma\square F$: Pt100	-328 to 1562℉
	$P\Gamma\ 1F$: Pt100 (*)	-148 to 212℉
	$JP\Gamma F$: JPt100	-328 to 932℉

IN $dcA\square$ OUT $420A$	**DC current input range selection**	4 to 20mA DC (SAA, SAU, SAWU)
	Selects DC current input range. Available for the SAA, SAU/SAWU (DC current input)	
	$420A$: 4 to 20mA DC	-1999 to 9999
	$020A$: 0 to 20mA DC	-1999 to 9999
	$0\ 16A$: 0 to 16mA DC	-1999 to 9999
	$2\ 10A$: 2 to 10mA DC	-1999 to 9999
	$0\ 10A$: 0 to 10mA DC	-1999 to 9999
	$\square5A$: 1 to 5mA DC	-1999 to 9999
	$0\square\ 1A$: 0 to 1mA DC	-1999 to 9999

IN $dcU\square$ OUT $\square5U$ or $0\ 1\bar{n}U$	**DC voltage input range selection**	1 to 5V DC (SAV) 0 to 10mA DC (SAU, SAWU)
	Selects DC voltage input range. Available for the SAV, SAU/SAWU (DC voltage input)	
	$0\ 1\bar{n}U$: 0 to 10mV DC	-1999 to 9999
	$+1\bar{n}U$: -10 to 10mV DC	-1999 to 9999
	$05\bar{n}U$: 0 to 50mV DC	-1999 to 9999
	$06\bar{n}U$: 0 to 60mV DC	-1999 to 9999
	$00.1U$: 0 to 100mV DC	-1999 to 9999
	$0\square\ 1U$: 0 to 1V DC	-1999 to 9999
	$0\square5U$: 0 to 5V DC	-1999 to 9999 (Not available for SAWU)
	$\square5U$: 1 to 5V DC	-1999 to 9999 (Not available for SAWU)
	$0\ 10U$: 0 to 10V DC	-1999 to 9999 (Not available for SAWU)

IN $dP\square$ OUT $\square\square\square0$	**Decimal point place selection**	No decimal point
	Selects the decimal point place. Available for the SAA, SAV, SAP, SAU (DC current, DC voltage, potentiometer input) and SAWU (DC current, DC voltage input). Available when (*) range is selected during Input range selection for the SAE, SAR, SAU and SAWU. (p.12, 13) For thermocouple and RTD input, "No decimal point" or "1 digit after decimal point" can be selected. 　　$\square\square\square0$: No decimal point 　　$\square\square0.0$: 1 digit after decimal point 　　$\square0.00$: 2 digits after decimal point 　　0.000: 3 digits after decimal point	
IN $5rLL$ OUT -200	**Output 0% value setting**	SAE, SAU, SAWU, SAR: -200℃ SAA, SAV, SAP, SAD, SAWD: -1999
	Sets the temperature (indicated on the Input display) at 0% output for the SAE, SAR and SAU/SAWU (thermocouple, RTD input). Sets the value (indicated on the Input display) at 0% output for the SAA, SAV, SAP and SAU (DC current, DC voltage, potentiometer input) and SAWU (DC current, DC voltage input). Setting range: -1999 to Output 100% value	
IN $5rLH$ OUT 1370	**Output 100% value setting**	SAE, SAU, SAWU: 1370℃ SAR: 850℃ SAA, SAV, SAP, SAD, SAWD: 9999
	Sets the temperature (indicated on the Input display) at 100% output for the SAE, SAR, SAU/SAWU (thermocouple, RTD input). Sets the value (indicated on the Input display) at 100% output for the SAA, SAV, SAP, SAU (DC current, DC voltage, potentiometer input) and SAWU (DC current, DC voltage input). Setting range: Output 0% value to 9999	
IN $FILr$ OUT $\square\square0.0$	**Filter time constant setting**	0.0 seconds
	Sets the filter time constant. Reduces input fluctuation caused by noise. Setting range: 0.0 to 10.0 seconds	
IN $5o\square$ OUT $\square\square0.0$	**Sensor correction setting**	0.0℃
	Sets the sensor correction value. Input value = Current input value + Sensor correction value Setting range: Thermocouple, RTD: -100.0 to 100.0℃(℉) 　　　　　　　DC current, DC voltage, potentiometer: -1000 to 1000	
IN $oUrP$ OUT $420A$	**Output selection**	4 to 20mA DC
	Selects the output type. Selects Output 1 for SAW series. 　$420A$: 4 to 20mA DC　　　0_1V: 0 to 1V DC 　$020A$: 0 to 20mA DC　　　0_5V: 0 to 5V DC 　0_12A: 0 to 12mA DC　　　1_5V: 1 to 5V DC 　0_10A: 0 to 10mA DC　　0_10V: 0 to 10V DC 　1_5A: 1 to 5mA DC	

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IN ｏ𝘶𝗿4 OUT ｎｏ𝘮𝘭	**Output status selection**	Normal
	Selects either Normal mode (0.0 to 100.0%) or Reverse mode (100.0 to 0.0%) for output status. ｎｏ𝘮𝘭: Normal 𝗿𝘌𝘉4: Reverse	
IN 𝘣𝘜𝗿ｎ OUT 𝘜𝘗☐	**Burnout selection**	Upscale
	Selects Upscale (110.0%) or Downscale (-10.0%) output when input indicates burnout. Available for the SAE, SAR, SAU/SAWU (thermocouple, RTD input) 𝘜𝘗☐: Upscale 𝘥ｏ𝘶ｎ: Downscale	
IN 𝘥𝘪 4𝘗 OUT 𝘥𝘜𝘙𝘓	**Display selection**	Input/Output indication
	Selects an indication type on the display. 𝘥𝘜𝘙𝘓: Input/Output indication 𝘐 ｎ☐: Input indication ｏ𝘜𝗿☐: Output indication ｎｏｎ𝘌: No indication (Only power indicator is lit.)	
IN 𝗧𝘐 𝘮𝘌 OUT 00.00	**Indication time setting**	00.00 (Continuous)
	Sets the indication time of the display after the final key operation. Not available if No indication is selected during Display selection (Only power indicator is lit) After the indication time has elapsed, the displays go off (Only power indicator is lit.). If power is turned on again, or if any of the keys $\wedge$, $\vee$, $\bigcirc$ and the Sub-mode key is pressed while displays are unlit, the displays will light up again. 00.00: Continuous 00.01 (1 second) to 60.00 (60 minutes) [Minute.Second]	

6.3.1 When using this unit as a signal converter
Set the filter time constant to 0.0 seconds, and set the Output status selection to "Normal".

### 6.3.2 When using the Reverse function
This function reverses the output (100 to 0%) that corresponds to the input (0 to 100%).
Set the Output status selection to "Reverse".

6.3.3 When using the first order lag filter function
The value is outputted by performing the first order lag computation using the filter time constant T. (Fig. 6.3.3-1)
Set the filter time constant to a random value (0.0 to 10.0 seconds).
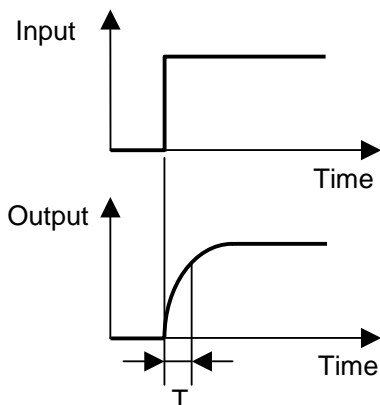
(Fig. 6.3.3-1)

7. Adjustment

Perform the output zero and span adjustments.

For the SAP and SAU (potentiometer input), perform potentiometer input zero and span adjustments as well.

Connect an mV generator or Dial resistor to the input terminals of this instrument.

Connect a digital multimeter to output terminals.

7.1 Basic operation of adjustment

Perform adjustment in the Adjustment mode.

To enter Adjustment mode, hold down the ⚪ key for approx. 3 seconds in the Run mode. (Fig. 7.1-1)

For output adjustment, use the ⋀ or ⋁ key, and register the value with the ⚪ key. (Fig. 7.1-2)

For the SAP and SAU (potentiometer input), potentiometer input adjustment is operable.

For potentiometer input zero adjustment, the value is automatically adjusted with the ⋁ key. Pressing the ⚪ key registers the value. (Fig. 7.1-2)

For potentiometer input span adjustment, the value is automatically adjusted with the ⋀ key. Pressing the ⚪ key registers the value. (Fig. 7.1-2)

To revert to the Run mode, press the ⚪ key again for approximately 3 seconds.

(1) Run mode
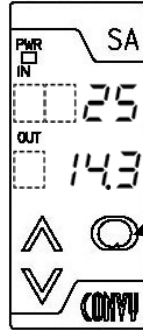
To enter Adjustment mode, please hold down the ⚪ key for approx. 3 seconds.

(Fig. 7.1-1)

(2) Adjustment mode

Please use these keys for adjustment.

To proceed to each adjustment item in the Adjustment mode and to register the adjusted value, please use this key.

(Fig. 7.1-2)

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7.2 Adjustment

The following show all setting items. Adjust values referring to explanation of each item below.

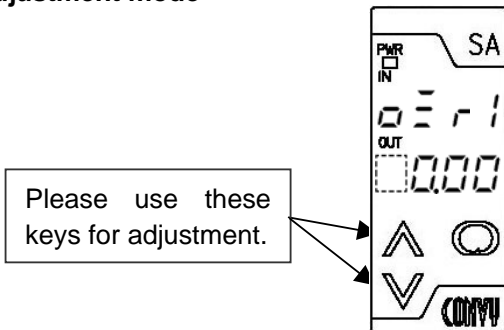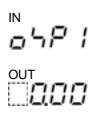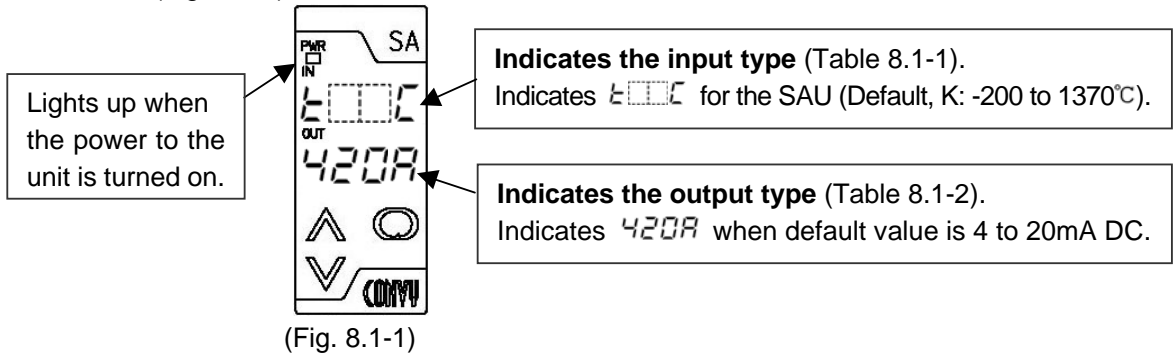| Display	Name, Function, Setting range	Default value
IN o͟ʐr1 OUT □0.00	**Output zero adjustment**	0.00%

	Adjusts output zero.
	For SAW series, adjusts output 1 zero.
	Input the value corresponding to 0% output, then adjust the value with the $\wedge$ or $\vee$ key while viewing the output value (on the digital multimeter).
	When the output range lower limit is zero, (even if zero adjustment results in a negative value), output value will not indicate a negative value.
	Setting range: -5.00 to 5.00%
	  Effective range of adjustment differs depending on the output types.
	  4 to 20mA DC: -5 to 5% 0 to 1V DC : 0 to 5%
	  0 to 20mA DC: 0 to 5% 0 to 5V DC : 0 to 5%
	  0 to 12mA DC: 0 to 5% 1 to 5V DC : -5 to 5%
	  0 to 10mA DC: 0 to 5% 0 to 10V DC: 0 to 5%
	  1 to 5mA DC : -5 to 5%	

IN oSP1 OUT □0.00	**Output span adjustment**	0.00%
	Adjusts output span. For SAW series, adjusts output 1 span. Input the value corresponding to 100% output, then adjust the value with the $\wedge$ or $\vee$ key while viewing the output value (on the digital multimeter). Setting range: -5.00 to 5.00% Effective range of adjustment is 95 to 105%.	
IN oʐr2 OUT □0.00	**Output 2 zero adjustment**	0.00%

	Adjusts output 2 zero.
	Not available for SA series.
	Input the value corresponding to 0% output, then adjust the value with the $\wedge$ or $\vee$ key while viewing the output 2 value (on the digital multimeter).
	When the output range lower limit is zero, (even if zero adjustment results in a negative value), output 2 value will not indicate a negative value.
	Setting range: -5.00 to 5.00%
	  Effective range of adjustment differs depending on the output types.
	  4 to 20mA DC: -5 to 5%
	  0 to 20mA DC: 0 to 5%	

IN oSP2 OUT □0.00	**Output 2 span adjustment**	0.00%
	Adjusts output 2 span. Not available for SA series. Input the value corresponding to 100% output, then adjust the value with the $\wedge$ or $\vee$ key while viewing the output 2 value (on the digital multimeter). Setting range: -5.00 to 5.00% Effective range of adjustment is 95 to 105%.	
IN iʐEr OUT -1999	**Potentiometer input zero adjustment**	-1999
	Performs potentiometer input zero adjustment. Available for the SAP, SAU (potentiometer input). Set the potentiometer to the Minimum side, and press the $\vee$ key once. Automatic adjustment is performed.	
IN iSPA OUT 9999	**Potentiometer input span adjustment**	9999
	Performs potentiometer input span adjustment. Available for the SAP, SAU (potentiometer input) Set the potentiometer to the Maximum side, and press the $\wedge$ key once. Automatic adjustment is performed.	

8. Running

8.1 Indication after power-on

After the power to the unit is turned on, the following warm-up indication is indicated for 3 seconds (Fig. 8.1-1).


Lights up when the power to the unit is turned on.

Indicates the input type (Table 8.1-1).
Indicates $t\square\square C$ for the SAU (Default, K: -200 to 1370℃).

Indicates the output type (Table 8.1-2).
Indicates $420A$ when default value is 4 to 20mA DC.

(Fig. 8.1-1)

(Table 8.1-1)

Input	Input display	
	℃	℉
K	$t\square\square C$: -200 to 1370℃	$t\square\square F$: -328 to 2498℉
K	$t\square 2C$: -200 to 200℃	$t\square 2F$: -328 to 392℉
K	$t\square 4C$: 0 to 400℃	$t\square 4F$: 32 to 752℉
J	$J\square\square C$: -200 to 1000℃	$J\square\square F$: -328 to 1832℉
J	$J\square 2C$: -200 to 200℃	$J\square 2F$: -328 to 392℉
J	$J\square 4C$: 0 to 400℃	$J\square 4F$: 32 to 752℉
R	$r\square\square C$: -50 to 1760℃	$r\square\square F$: -58 to 3200℉
S	$5\square\square C$: -50 to 1760℃	$5\square\square F$: -58 to 3200℉
B	$b\square\square C$: 0 to 1820℃	$b\square\square F$: 32 to 3308℉
E	$E\square\square C$: -200 to 800℃	$E\square\square F$: -328 to 1472℉
T	$r\square\square C$: -200 to 400℃	$r\square\square F$: -328 to 752℉
N	$n\square\square C$: -200 to 1300℃	$n\square\square F$: -328 to 2372℉
PL-Ⅱ	$PL2C$: 0 to 1390℃	$PL2F$: 32 to 2534℉
W5Re/W26Re	$c\square\square C$: 0 to 2315℃	$c\square\square F$: 32 to 4199℉
W3Re/W25Re	$d\square\square C$: 0 to 2315℃	$d\square\square F$: 32 to 4199℉
Pt100	$Pr\square\square C$: -200 to 850℃	$Pr\square\square F$: -328 to 1562℉
Pt100	$Pr\ 1C$: -100 to 100℃	$Pr\ 1F$: -148 to 212℉
JPt100	$JPr C$: -200 to 500℃	$JPr F$: -328 to 932℉
4 to 20mA DC	$420A$: -1999 to 9999	
0 to 20mA DC	$020A$: -1999 to 9999	
0 to 16mA DC	$0 16A$: -1999 to 9999	
2 to 10mA DC	$2 10A$: -1999 to 9999	
0 to 10mA DC	$0 10A$: -1999 to 9999	
1 to 5mA DC	$1 5A$: -1999 to 9999	
0 to 1mA DC	$0 1A$: -1999 to 9999	
0 to 10mV DC	$0 1mU$: -1999 to 9999	
-10 to 10mV DC	$-1 1mU$: -1999 to 9999	
0 to 50mV DC	$05mU$: -1999 to 9999	
0 to 60mV DC	$06mU$: -1999 to 9999	
0 to 100mV DC	$00.1U$: -1999 to 9999	
0 to 1V DC	$0 1U$: -1999 to 9999	
0 to 5V DC	$0 5U$: -1999 to 9999	
1 to 5V DC	$1 5U$: -1999 to 9999	
0 to 10V DC	$0 10U$: -1999 to 9999	

(Table 8.1-2)

Output	Output display
4 to 20mA DC	$420A$
0 to 20mA DC	$020A$
0 to 12mA DC	$0 12A$
0 to 10mA DC	$0 10A$
1 to 5mA DC	$1 5A$
0 to 1V DC	$0 1U$
0 to 5V DC	$0 5U$
1 to 5V DC	$1 5U$
0 to 10V DC	$0 10U$

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8.2 Running

The mode is in the Run mode as shown in (Fig. 8.2-1). The input signal selected during Input selection is converted to the output selected during Output selection.
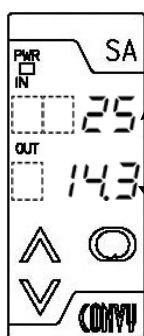
(Fig. 8.2-1)

Indicates the input value.
For the SAU (Default, K: -200 to 1370℃), an input value from the thermocouple is indicated.
If Upscale is selected during Burnout selection, and if nothing is connected to the input terminals, then ‾ ‾ ‾ ‾ is indicated.

Indicates the output value in percentage form (%).
Output value corresponding to the input value is indicated in a percentage form (%).
If Upscale is selected during Burnout selection, and if nothing is connected to the input terminals, then *I IO.O* (110.0%) is indicated.

• Indication when input value is -200.0 (-2000) or less

When the range has a decimal point: For the indication of -200.0 or less (up to –10% output), the input value and the minus (-) sign are indicated alternately.
For DC current or voltage input, the indication of -2000 or less is the same as the above.

(e.g.) Indication of -200.0

$$\text{IN } -\square\square\square \longleftrightarrow \text{IN } 200.0$$

• Indication when input value is 10000 or more

When DC current or voltage input is selected: For the indication of 10000 or more (up to 110% output), the lower 4 digits of input value are flashing.

(e.g.) Indication of 10020

$$\text{IN } 0020 \longleftarrow \textbf{Flashes.}$$

• Underrange, Overrange and Sensor burnout alarm indication

Underrange : "₋ ₋ ₋ ₋" flashes on the Input display.
Overrange : "‾ ‾ ‾ ‾" flashes on the Input display.

• Indication time setting

If indication time is set, the displays will go off after the indication time has elapsed.
(Only the power indicator is lit.)
If power is turned on again, or if any of the keys ∧, ∨, ○ and the Sub-mode key is pressed while displays are unlit, the displays will light up again.

9. Specifications

Input specifications
SAE, SAU/SAWU (thermocouple)

Input resistance: 1MΩ or more
External resistance: 100Ω or less, However, B: 40Ω or less
Burnout: Upscale, Downscale
Input signal:

Thermocouple	Input range	
K	-200 to 1370℃	-328 to 2498℉
J	-200 to 1000℃	-328 to 1832℉
R	-50 to 1760℃	-58 to 3200℉
S	-50 to 1760℃	-58 to 3200℉
B	0 to 1820℃	32 to 3308℉
E	-200 to 800℃	-328 to 1472℉
T	-200 to 400℃	-328 to 752℉
N	-200 to 1300℃	-328 to 2372℉
PL-Ⅱ	0 to 1390℃	32 to 2534℉
W5Re/W26Re	0 to 2315℃	32 to 4199℉
W3Re/W25Re	0 to 2315℃	32 to 4199℉

Minimum input span is 50℃ (100℉).

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SAR, SAU/SAWU (3-wire system RTD)

    Input detection current: Approx. 0.2mA
    Allowable lead wire resistance: 10Ω or less per wire
    Burnout: Upscale, Downscale
    Input signal:

RTD	Input range	
Pt100	-200 to 850℃	-328 to 1562℉
JPt100	-200 to 500℃	-328 to 932℉

Minimum input span is 50℃ (100℉).

SAA, SAU/SAWU (DC current)

Input	Shunt resistor
4 to 20mA DC	
0 to 20mA DC	50Ω
0 to 16mA DC	
2 to 10mA DC	100Ω
0 to 10mA DC	
1 to 5mA DC	200Ω
0 to 1mA DC	1kΩ

    Connect shunt resistor (sold separately) between input terminals.

SAV, SAU (DC voltage)

Input	Input resistance	Allowable signal source resistance
0 to 10mV DC		20Ω or less
-10 to 10mV DC		40Ω or less
0 to 50mV DC		
0 to 60mV DC		200Ω or less
0 to 100mV DC	1MΩ	
0 to 1V DC		2kΩ or less
0 to 5V DC		
1 to 5V DC		1kΩ or less
0 to 10V DC		

SAWU (DC voltage)

Input	Input resistance	Allowable signal source resistance
0 to 10mV DC		20Ω or less
-10 to 10mV DC		40Ω or less
0 to 50mV DC	1MΩ	
0 to 60mV DC		200Ω or less
0 to 100mV DC		
0 to 1V DC		2kΩ or less

SAP, SAU (potentiometer)

    Whole resistance value: 100Ω to 10kΩ
    Reference voltage: 1.0V DC

SAD, SAWD (Current loop supply)

Input	Shunt resistor
4 to 20mA DC	50Ω built-in

Output specifications

DC current (SAW series: Output 1)

Output	Allowable load resistance	Zero adjustment range	Span adjustment range
4 to 20mA DC	700Ω or less	-5 to 5%	95 to 105%
0 to 20mA DC	700Ω or less	0 to 5%	95 to 105%
0 to 12mA DC	1.2kΩ or less	0 to 5%	95 to 105%
0 to 10mA DC	1.2kΩ or less	0 to 5%	95 to 105%
1 to 5mA DC	2.4kΩ or less	-5 to 5%	95 to 105%

DC voltage (SAW series: Output 1)

Output	Allowable load resistance	Zero adjustment range	Span adjustment range
0 to 1V DC	100Ω or more	0 to 5%	95 to 105%
0 to 5V DC	500Ω or more	0 to 5%	95 to 105%
1 to 5V DC	500Ω or more	-5 to 5%	95 to 105%
0 to 10V DC	1kΩ or more	0 to 5%	95 to 105%

When the output range lower limit is zero, (even if zero adjustment results in a negative value), output value will not indicate a negative value.

Output 2 (Fixed range, SAW series)

Output	Allowable load resistance	Zero adjustment range	Span adjustment range
4 to 20mA DC	300Ω or less	-5 to 5%	95 to 105%
0 to 20mA DC	300Ω or less	0 to 5%	95 to 105%

Performance

Basic accuracy
SAE, SAU/SAWU (thermocouple input) : Within ±0.1% of each input span
                R, S inputs, -50 to 200℃ (-58 to 392℉): Within ±6℃ (12℉)
                B input, 0 to 300℃ (32 to 572℉): Accuracy is not guaranteed.
                K, J, E, T, N inputs, 0℃ (32℉) or less: Within ±0.4% of each input span
SAR, SAU/SAWU (RTD input)   : Within ±0.1% of each input span
SAA, SAU/SAWU (DC current input) : Within ±0.1% of each input span
SAV, SAU/SAWU (DC voltage input) : Within ±0.1% of each input span
SAP, SAU (Potentiometer input)   : Within ±0.1% of each input span
SAD, SAWD (Current loop supply input): Within ±0.1% of each input span
Output   : Within ±0.1%
SAW series   Output 1 : Within ±0.1%
                    Output 2 : Within ±0.15%

Cold junction compensation accuracy: Within ±1℃ at -5 to 55℃
                [SAE, SAU/SAWU (thermocouple input)]
Indication accuracy   Within Basic input accuracy±1 digit
Response time   0.5 seconds (typical) (0 ➞ 90%)
                SAW series:
                Output 1: 0.5 seconds (typical) (0 ➞ 90%)
                Output 2: 1.0 seconds (typical) (0 ➞ 90%)
Temperature coefficient ±0.015%/℃
Insulation resistance   Input – Output – Power: 10MΩ or more, at 500V DC
                SAW series:
                Input – Output 1 – Output 2 – Power: 10MΩ or more, at 500V DC
Dielectric strength   Input – Output – Power   : 2.0kV AC for 1 minute
                SAW series:
                Input – Output 1 – Power   : 2.0kV AC for 1 minute
                Output 1 – Output 2 – Power: 2.0kV AC for 1 minute
                Input – Output 2   : 1.35kV AC for 1 minute
                For the input of SAD and SAWD, 5, 6 and 7 terminals (including power source of 2-wire transmitter) are used.

General structure

Case	Flame resistant resin,　Color: Light gray
Panel	Membrane sheet
Setting	Setting by the front keypad
Displays	Input display: 7 segments Red LED display 4 digits
	Character size: 7.4 x 4.0mm (H x W)
	Output display: 7 segments Green LED display 4 digits
	Character size: 7.4 x 4.0mm (H x W)
	Power indicator: Green LED

Grounding specifications

Power supply	100 to 240V AC　50/60Hz,　24V AC/DC　50/60Hz
Allowable voltage range	85 to 264V AC,　20 to 28V AC/DC
Power consumption	Approx. 6VA (SAD, SAWD: Approx. 7VA)
Ambient temperature	-5 to 55℃ (23 to 131℉)
Ambient humidity	35 to 85%RH (Non-condensing)
Weight	Approx. 120g
Mounting	DIN rail mounting
External dimensions	W22.5 x H75 x D100mm

Attached function

• Power failure countermeasure
  The setting data is backed up in the non-volatile IC memory.
• Self-diagnosis
  The CPU is monitored by a watchdog timer, and when an abnormal status is found on the CPU, the unit is switched to warm-up status with output off.
• Cold junction compensation
  Available only for the SAE and SAU/SAWU (thermocouple input).
  This detects the temperature at the connecting terminal between the thermocouple and the instrument, and always maintains it at the same status as when the reference junction is located at 0℃ (32℉).

10. Troubleshooting

10.1 Indication

Problem	Presumed cause and solution

Input display is flashing "‗ ‗ ‗ ‗", or "¯ ¯ ¯ ¯".	• The sensor may be burnt out.
	  Change each sensor.
	• Check whether the sensor is securely connected to the input terminals of the instrument.
	  Ensure that the sensor terminals are securely connected to the input terminals of the instrument.
	• Check the input signal source.
	• Check whether polarity of thermocouple or compensating lead wire is correct.
	  Check whether codes (A, B, B) of the RTD agree with the instrument terminals.
	  Ensure that they are wired properly.

The indication of the Input display is abnormal or unstable.	• Check whether the sensor input and temperature unit (℃/℉) setting are correct.
	  Ensure that sensor type and temperature unit (℃/℉) are set properly.
	• Check whether the sensor correcting value is suitable.
	  Set it to a suitable value.
	• AC leaks into the sensor circuit.
	  Use an ungrounded type sensor.
	• There may be equipment that interferes with or makes noise near the unit.
	  Keep equipment that interferes with or makes noise away from the unit.

10.2 Key operation

Problem	Presumed cause and solution
Setting or adjustment is impossible.	• "Lock" is selected during Set value lock selection. Select "Unlock".
The setting indication does not change within the input range even if the $\wedge$ or $\vee$ key is pressed, and new values are unable to be set.	• Output 100% value and Output 0% value may be set at the point where the value does not change. Set them to suitable values.

10.3 Running

Problem	Presumed cause and solution
Input value does not change.	• The sensor may be out of order. Change the sensor. • Check whether input and output wires are securely connected to the I/O terminals of the instrument. Ensure that input and output wires are securely connected to the I/O terminals. • Check whether the wiring of input and output is correct.
Does not output anything.	• Check whether Output 100% setting and Output 0% setting are suitable. Ensure that output 100% value and output 0% value has been set to suitable values. • Check whether Output and Output status have been selected correctly during Output selection and Output status selection.

11. Character table

All setting items are indicated in the following tables, however, some items will not be indicated depending on the specifications.

Setup mode

Display	Setting item	Default value	Data
Loct	Set value lock selection	Unlock	
5En5	Input selection	Thermocouple (only SAU, SAWU)	
Tc□□	Thermocouple input range selection	K, -200 to 1370℃(SAE,SAU,SAWU)	
rTd□	RTD input range selection	Pt100, -200 to 850℃ (SAR SAU,SAWU)	
dcA□	DC current input range selection	4 to 20mA DC (SAA, SAU, SAWU)	
dcU□	DC voltage input range selection	1 to 5V DC (SAV) 0 to 10mV DC (SAU,SAWU)	
dP□□	Decimal point place selection	No decimal point	
5TLL	Output 0% value setting	SAE, SAR, SAU, SAWU: -200℃ SAA, SAV, SAP, SAD, SAWD:-1999	
5TLH	Output 100% value setting	SAE, SAU, SAWU: 1370℃ SAR: 850℃ SAA, SAV, SAP, SAD, SAWD: 9999	
FILT	Filter time constant setting	0.0 seconds	
5o□□	Sensor correction setting	0.0℃	
oUTP	Output selection	4 to 20mA DC (Output 1 for SAW)	
oUT5	Output status selection	Normal	
bUrn	Burnout selection	Upscale	
di5P	Display selection	I/O indication	
TinE	Indication time setting	00.00 (Continuous)	

Adjustment mode

Display	Setting item	Default value	Data
oir1	Output zero adjustment	0.00% (Output 1 zero for SAW)	
o5P1	Output span adjustment	0.00% (Output 1 span for SAW)	
oir2	Output 2 zero adjustment	0.00% (SAW series)	
o5P2	Output 2 span adjustment	0.00% (SAW series)	
iiEr	Potentiometer input zero adjustment	-1999 (SAP, SAU)	
i5PA	Potentiometer input span adjustment	9999 (SAP, SAU)	

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Inquiry

For any inquiry about this unit, please contact the shop where you purchased the unit or our agency after checking the following.

<div align="center">(e.g.)</div>

- Model ....…............………. SA☐-☐
- Serial number …................... No. xxxxxx

In addition to the above, please let us know the details of malfunction, if any, and the operating conditions.