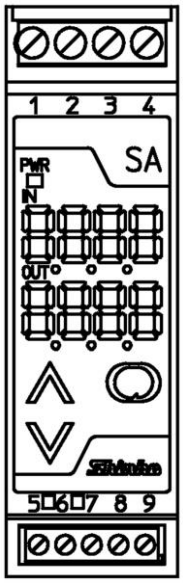
PULSE SCALER

SAF SERIES

SAFD

INSTRUCTION MANUAL



Shinko

Preface

Thank you for purchasing the Pulse Scaler SAFD.
This manual contains instructions for the mounting, functions, operations and notes when operating the SAFD. 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 a fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- Specifications of the SAFD 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 within a control panel. 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 damage or secondary damage(s) incurred as a result of using this product, including any indirect damage.

SAFETY PRECAUTIONS (Be sure to read these precautions before using our products.)
The safety precautions are classified into categories: “Warning” and “Caution”.
Depending on the circumstances, procedures indicated by ⚠ Caution may cause 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 other qualified service personnel may handle the inner assembly.
- To prevent an electric shock, fire or damage to the instrument, parts replacement may only be undertaken by Shinko or other 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 55℃ (23 to 131℉) that does not change rapidly, and no icing
- 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
- When installing this unit within a control panel, take note that ambient temperature of this unit as well as the control panel must not exceed 55℃ (131℉). Otherwise the life of electronic components (especially electrolytic capacitor) may be shortened.

Note • Avoid setting this instrument directly on or near flammable material even though the case of this instrument is made of flame-resistant resin.

2. Wiring precautions

⚠ Caution

- Do not leave wire remnants in the instrument, because they could cause a fire or a 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 using 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 when wiring.
- 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.
- Keep the input/output wires and power line separate.

3. Operation 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	0	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

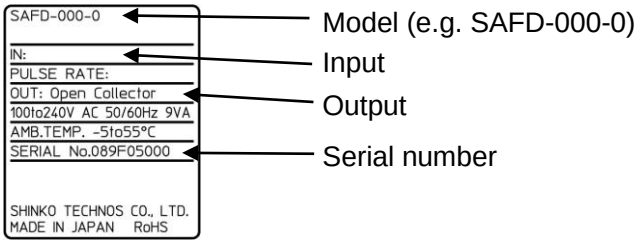
1.1 Model

SAFD - 0 □	□	- □	Series name: SAF
Input	0		Open collector
	1		Voltage pulse
	2		Line driver
Output		0	Open collector
		1	5V voltage pulse
		2	12V voltage pulse
Power supply			100 to 240V AC
			24V AC/DC

(Example) SAFD-000-0 Input frequency: 800Hz, Pulse rate: 1/50, Scaling: 0 to 800
Default value: Input frequency: 9999Hz
Pulse rate: 1/1
Scaling: 0 to 9999

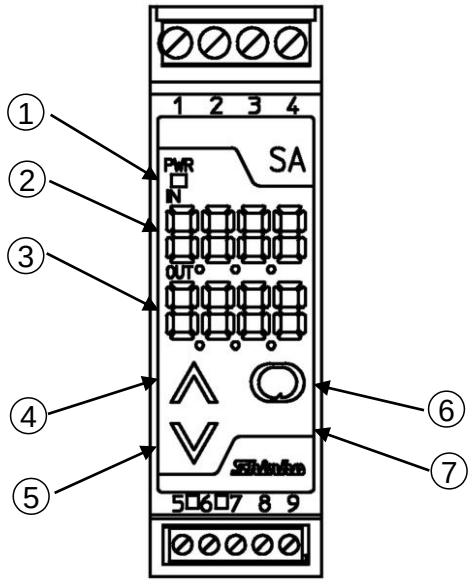
1.2 How to read the model label

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



(Fig. 1.2-1)

2. Name and functions of sections



(Fig.2.1)

①**Power indicator** (Green)
Lights 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 mode.

③**Output display** (Green)
Indicates output volume during Run mode.
Indicates set (or adjusted) value during Setup mode.

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

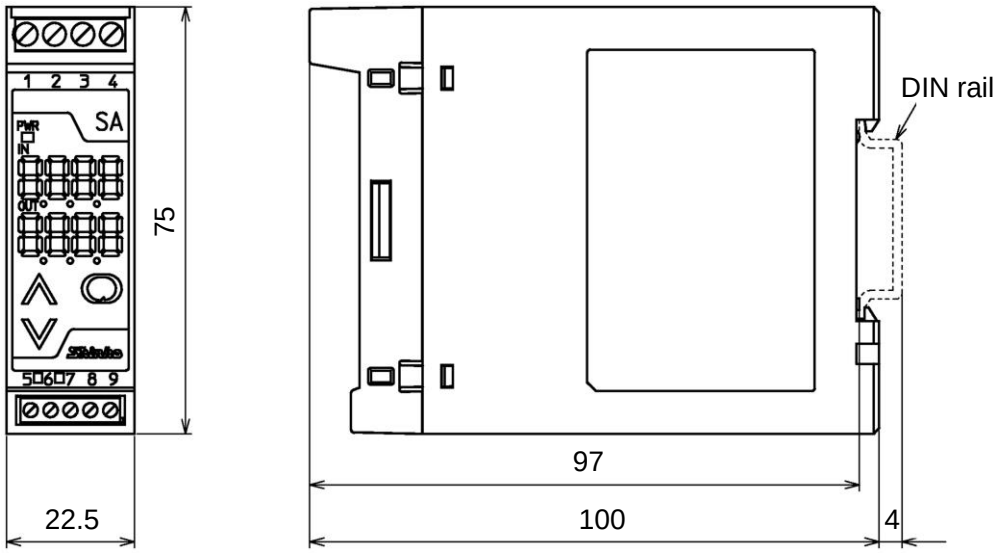
⑤**Down key** (∨)
Decreases the numeric value, or switches the selection items.

⑥**Mode key** (○)
Switches the setting mode and registers the set (or selected) value.

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

3. Mounting

3.1 External dimensions (Scale: mm)



(Fig. 3.1-1)

3.2 Mounting and removal to/from the DIN rail

⚠ Caution

- **Mount the DIN rail horizontally.**
- **To remove this instrument, a flat blade 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 if it is in a position susceptible to vibration or shock.**

Recommended fastening plate

Manufacturer	Model
Omron Corporation	End plate PFP-M
IDEC Corporation	Fastening plate BNL6
Panasonic Electric Works Co., Ltd.	Fastening plate ATA4806

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

First, hook ① of the instrument on the upper side of the DIN rail.

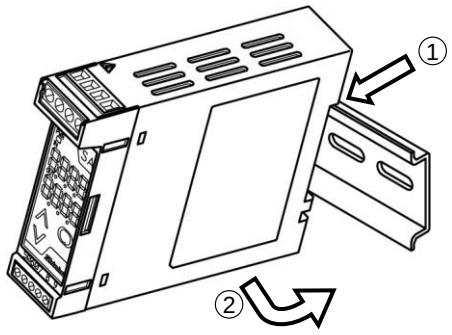
Second, making ① part of the instrument as a support, fit the lower part ② of the instrument to the DIN rail.

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

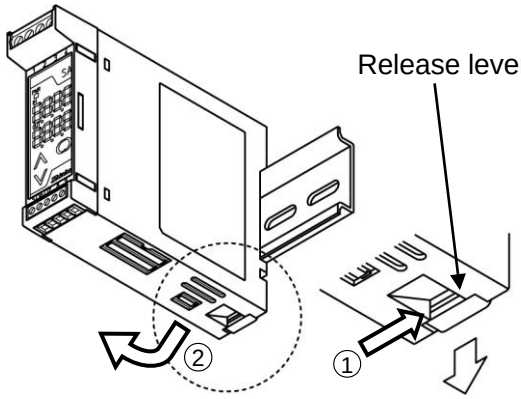
Removal from the DIN rail (Fig.3.2-2)

First, insert a flat blade screwdriver into the release lever (①).

Second, 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

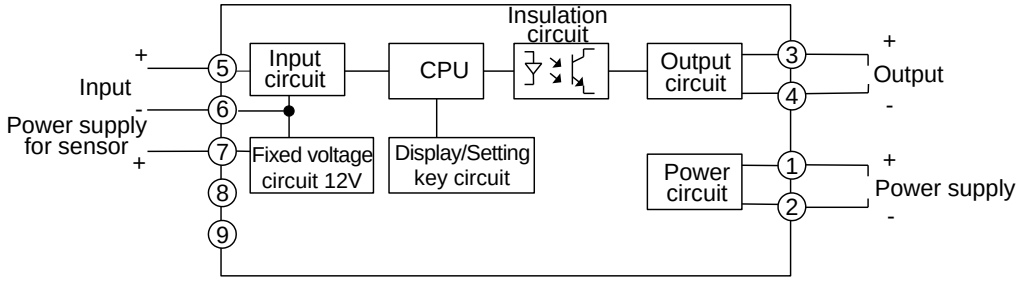
When using ferrules, use the following recommended ferrules and crimping pliers made by Phoenix Contact GMBH &CO. See (Table 4.1-1)

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

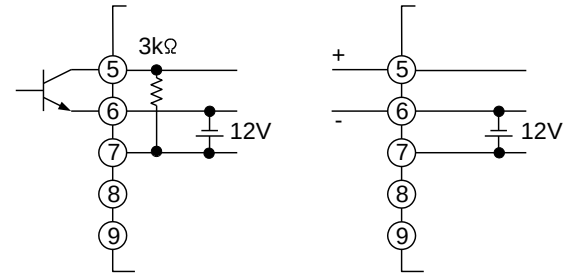
(Table 4.1-1)

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 CRIMPFOX UD 6
		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		
		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		

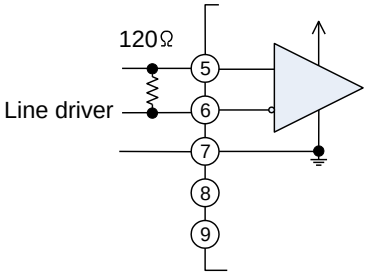
4.2 Terminal arrangement and circuit configuration



Input connection example



Open collector　　Voltage pulse



(Fig. 4.2-1)

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.

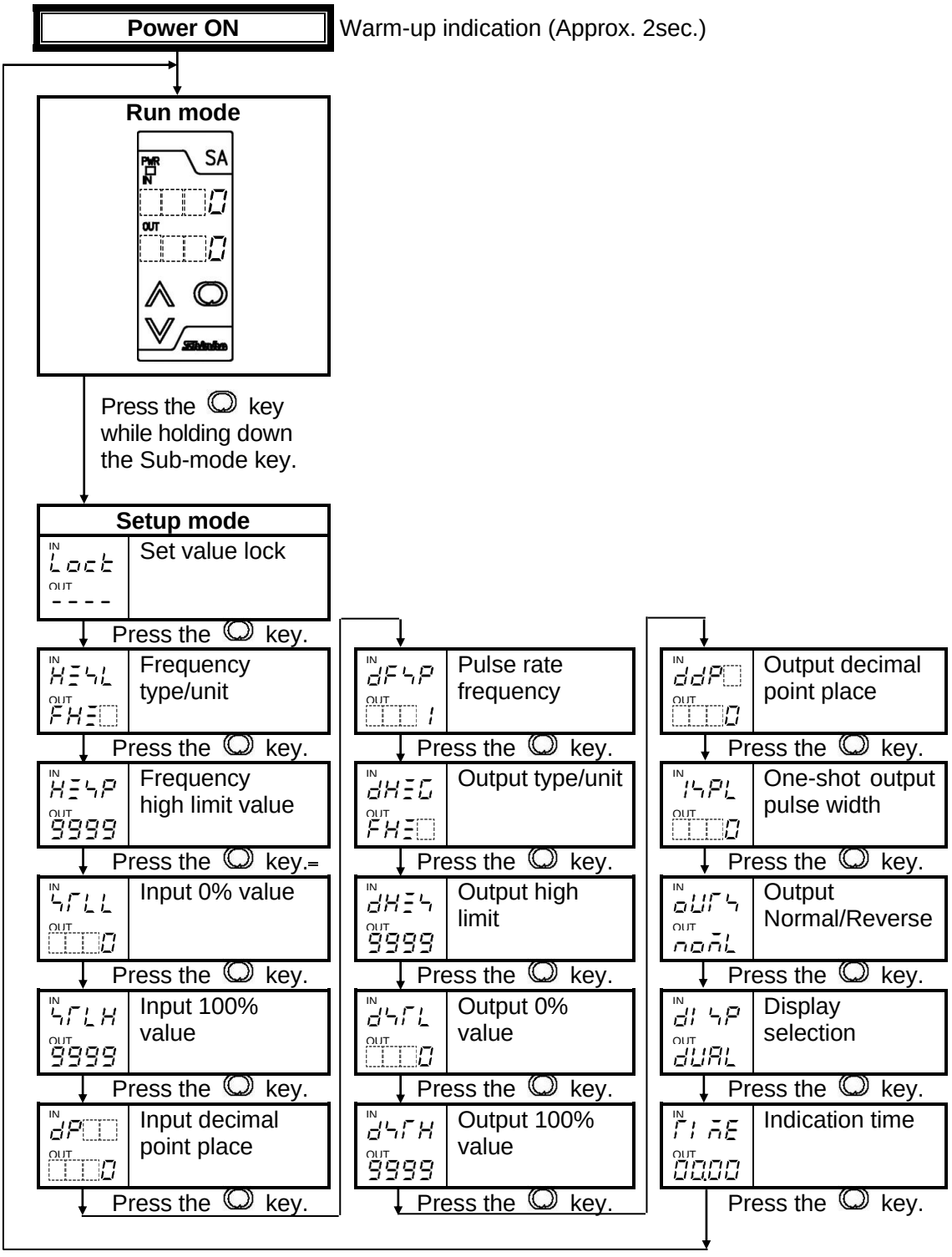
4.3.2 Output wiring

Use terminals ③(+) and ④(-) for the output wiring.

4.3.3 Input wiring

Terminals for wiring differ depending on the input specifications.
Refer to (Fig. 4.2-1).

5. Operation flowchart



6. Setup

Setup should occur before using this unit, to set the Frequency type/unit, Frequency high limit value, Input 0% value, Input 100% value, Pulse rate frequency, One-shot output pulse width, Output 0% value, Output 100% value, Output Normal/Reverse, etc. according to the users' specifications.

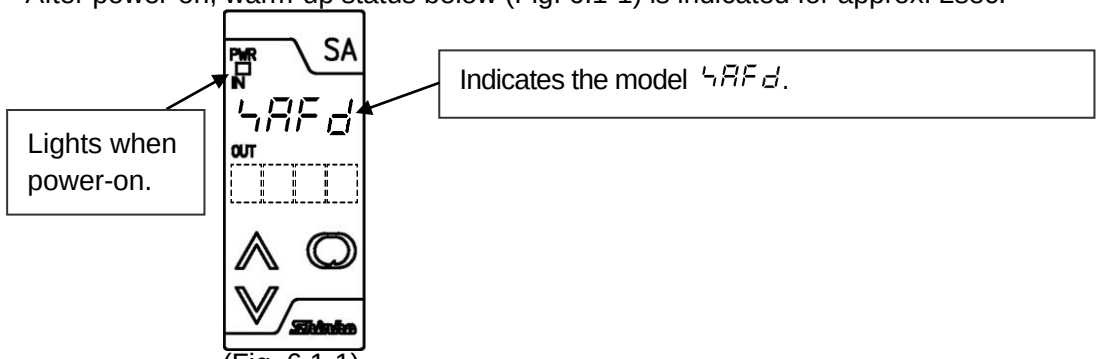
If the users' specifications are the same as the default value of the instrument, or if setup has already been completed, it is not necessary to set up the instrument. Proceed to Section "7. Unit operation".

(Table 6-1)

Setting item	Default value
Set value lock	Unlock
Frequency type/unit	Frequency measurement Hz
Frequency high limit value	9999Hz
Input 0% value	0
Input 100% value	9999
Input decimal point place	No decimal point
Pulse rate frequency	1
Output type/unit	Frequency measurement Hz
Output high limit value	9999
Output 0% value	0
Output 100% value	9999
Output decimal point place	No decimal point
One-shot output pulse width	0ms
Output Normal/Reverse	Normal
Display selection	Input/Output indication
Indication time	00.00 (Continuous)

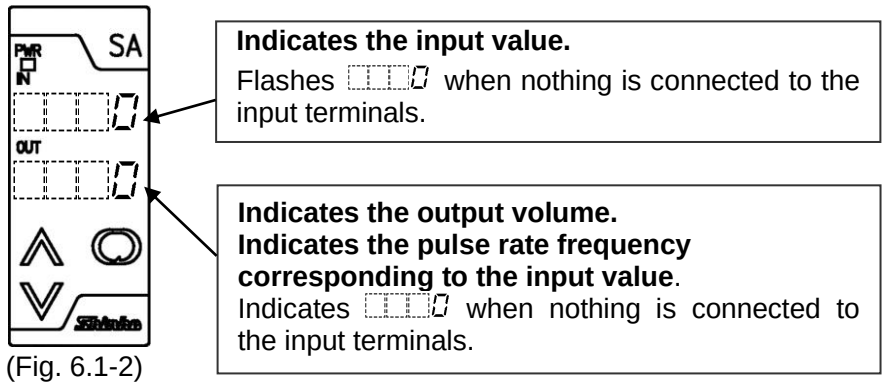
6.1 Indication after power-on

After power-on, warm-up status below (Fig. 6.1-1) is indicated for approx. 2sec.



(Fig. 6.1-1)

After that, the unit switches to the Run mode as shown below (Fig. 6.1-2).



(Fig. 6.1-2)

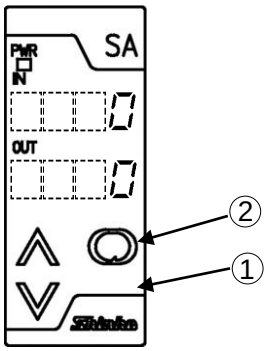
6.2 Basic operation of setup

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)

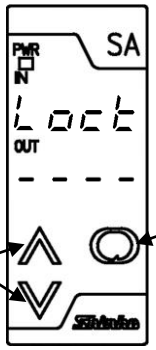
(1) Run mode



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



To set (or select) each item, use these keys.

To proceed to each setting item and to register the set (selected) value, use this key.

(Fig. 6.2-2)

6.3 Setup of the unit

The following shows all setup 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**	Unlock
	Locks the set values to prevent setting errors. ----: Unlock Lock: Lock (None of the set values can be changed.)	
IN HzL OUT FHz□	**Frequency type/unit**	Frequency measurement Hz
	Sets input frequency type (Low pulse/Frequency) and unit [mHz/Hz(Low pulse)/Hz/kHz]. PmHz: Pulse measurement mHz (Low pulse) PHz□: Pulse measurement Hz (Low pulse) FHz□: Frequency measurement Hz FtHz: Frequency measurement kHz	
IN HzH OUT 9999	**Frequency high limit value**	9999Hz
	Sets input frequency high limit value. (Frequency low limit value is fixed.) Pulse measurement mHz (Low pulse) : 10 to 9999mHz Pulse measurement Hz (Low pulse) : 1 to 100Hz Frequency measurement Hz : 50 to 9999Hz Frequency measurement kHz : 1 to 15kHz	
IN 0%L OUT □□□0	**Input 0% value**	0
	Sets the value (indicated on the Input display) at 0% input. Setting range: -1999 to Input 100% value	
IN 100H OUT 9999	**Input 100% value**	9999
	Sets the value (indicated on the Input display) at 100% input. Setting range: Input 0% value to 9999	
IN dP□□ OUT □□□0	**Input decimal point place**	No decimal point
	Selects decimal point place for input. □□□0: No decimal point □□0.0: 1 digit after decimal point □0.00: 2 digits after decimal point 0.000: 3 digits after decimal point	
IN dFcP OUT □□□1	**Pulse rate frequency**	1
	Sets pulse rate frequency. Pulse rate is shown in the equation below. $\text{Pulse rate} \left(\frac{1}{XX}\right) = \frac{1}{\text{Pulse rate frequency}}$ Pulse unit is selected during Frequency type/unit selection. Setting range: 1 to 9999	
IN dHzO OUT FHz□	**Output type/unit**	Frequency measurement Hz
	Sets output frequency type (Low pulse/Frequency) and unit [mHz/Hz(Low pulse)/Hz/kHz]. PmHz: Pulse measurement mHz (Low pulse) PHz□: Pulse measurement Hz (Low pulse) FHz□: Frequency measurement Hz FtHz: Frequency measurement kHz	

Display	Name, Function, Setting range	Default value
IN dHS OUT 9999	**Output high limit value**	9999
	Sets output frequency high limit value. (Frequency low limit value is fixed.) Pulse measurement mHz (Low pulse): 10 to 9999mHz Pulse measurement Hz (Low pulse) : 1 to 100Hz Frequency measurement Hz : 50 to 9999Hz Frequency measurement kHz : 1 to 15kHz	
dSrL OUT 0	**Output 0% value**	0
	Sets the value (indicated on the Output display) at 0% output. Setting range: -1999 to Output 100% value	
IN dSrH OUT 9999	**Output 100% value**	9999
	Sets the value (indicated on the Output display) at 100% output. Setting range: Output 0% value to 9999	
IN ddP□ OUT 0	**Output decimal point place**	No decimal point
	Selects the output decimal point place. 0: No decimal point 0.0: 1 digit after decimal point 0.00: 2 digits after decimal point 0.000: 3 digits after decimal point	
IN tmPL OUT 0	**One-shot output pulse width**	0ms
	If a pulse is entered, outputs “one-shot output pulse” during one-shot pulse width setting time. Not available when setting to 0. Setting range: 0 to 400ms	
IN oUtS OUT norL	**Output Normal/Reverse**	Normal
	Selects either Normal mode (0.0 to 100.0%) or Reverse mode (100.0 to 0.0%) for output status. norL : Normal rEVS: Reverse	
IN diSP OUT dUAL	**Display selection**	Input/Output indication
	Selects an indication type on the display. dUAL : Input/Output indication In□: Input indication oUt□: Output indication nonE: No indication (Only the power indicator is lit.)	
IN tiME OUT 00.00	**Indication time**	00.00 (Continuous)
	Sets the indication time of the display after the final key operation. Not available if No indication (Only the power indicator is lit) is selected during Display selection. After the indication time has elapsed, the displays go off (Only the power indicator is lit.). If power is turned on again, or if any of the ∧, ∨, ◎ or Sub-mode keys are pressed while displays are unlit, the displays will light again. Setting range: 00.00: Continuous 00.01 (1 second) to 60.00 (60 minutes) [Minutes.Seconds]	

6.3.1 When using this unit as a standard pulse scaler

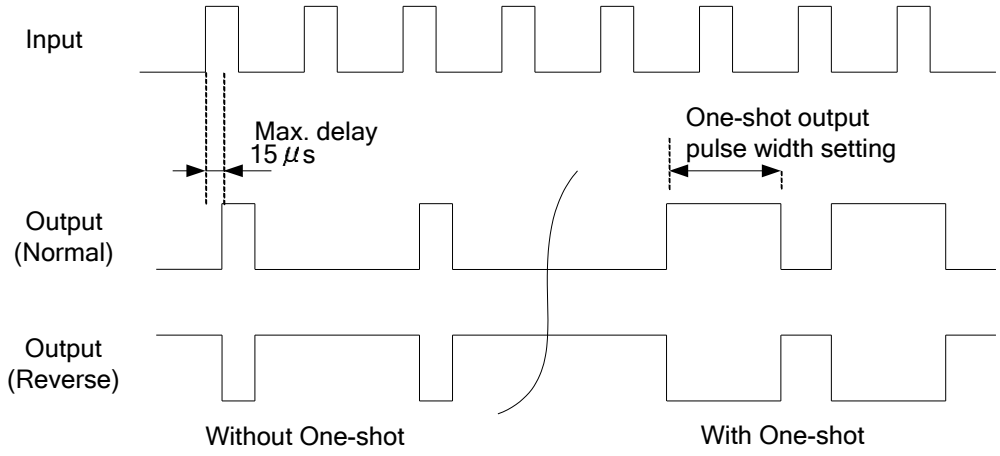
Set the Output Normal/Reverse selection to “Normal”. (Fig. 6.3-1)

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 Normal/Reverse selection to “Reverse”. (Fig. 6.3-1)

Pulse width accuracy: 1ms

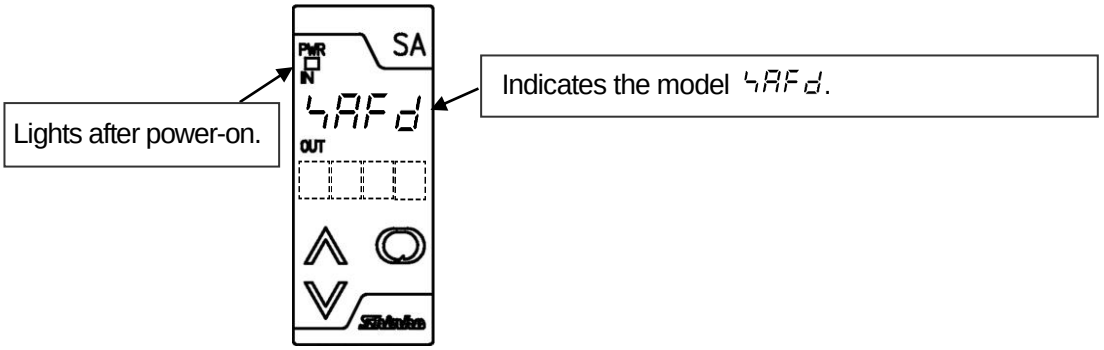


(Fig. 6.3-1)

7. Unit operation

7.1 Indication after power-on

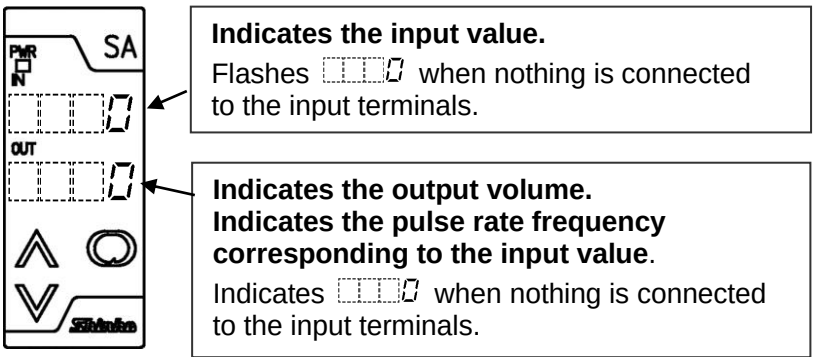
After power-on, the following warm-up status is indicated for 2 seconds (Fig. 7.1-1).



(Fig. 7.1-1)

7.2 Unit operation

The unit enters the Run mode after approx. 2-second warm-up as shown in (Fig. 7.2-1).
Outputs the input signal with the pulse rate set during Pulse rate frequency setting.

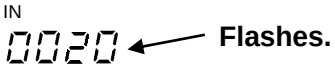


(Fig. 7.2-1)

- **Indication when input value is 10000 or more**

  For the indication of 10000 or more, the lower 4 digits of input value are flashing.

  (e.g.) Indication of 10020

- **Input display indication when pulse is absent**

  When pulse is absent, 0 (zero) flashes.

- **Overrange indication**

  In case of overrange (1.1 times frequency high limit value), "- - - -" flashes on the Input and Output displays.

- **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 ∧, ∨, ○ or the Sub-mode keys are pressed while displays are unlit, the displays will light again.

8. Specifications

Input specifications

Pulse or frequency measurement via input signals

Open collector

Frequency range	: 0.001Hz to15kHz
Minimum pulse width	: 5μs or more (for ON and OFF)
Input detection voltage/current	: ON : Max. 30mA (30V or less)
	OFF: Residual voltage, 0.5V or less
Action input conditions	: ON : 200Ω or less
	OFF: 100kΩ or more
Max rated input frequency	: 20kHz

Voltage pulse

Frequency range	: 0.001Hz to 15kHz
Minimum pulse width	: 5μs or more (for High and Low)
Waveform	: Rectangular, sine waveform or similar
Detection level	: Low: 1V DC or less
	High: 2V DC or more
Input impedance	: 100kΩ or more
Input amplitude	: 2 to 50V_{p-p}
Max rated input frequency	: 20kHz

Line driver

AM26LS31 or equivalent	
Receiver	: AM26LS32 or equivalent
Terminator	: 120Ω

Output specifications

Open collector

Output rating	: 12V DC/30mA
Max. frequency	: 15kHz

Voltage pulse

Output rating	: 5V, 12V DC±10%
Allowable load resistance	: 500Ω or more
Max. frequency	: 15kHz

Performance

Reference accuracy	:Within ±0.1% (At 23℃ of ambient temperature)
Display accuracy	: Within Reference accuracy ±1 digit
Insulation resistance	: Input – Output – Power: 10MΩ or more, at 500V DC
Dielectric strength	: Input – Output – Power: 2.0kV AC for 1 minute

General structure

Case	: Flame-resistant resin, Color: Light gray
Front panel	: Membrane sheet
Setting	: By the front keypad
Displays, Indicator	: 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

Installation 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. 9VA
Power supply for sensor	: 12V DC±5%, 25mA
Ambient temperature	: -5 to 55℃ (23 to 131℉)
Ambient humidity	: 35 to 85%RH (Non-condensing)
Altitude	: 2,000 m or less
Weight	: Approx. 120g
Mounting	: DIN rail mounting
External dimensions	: W22.5 x H75 x D100mm

Attached functions

- 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 after turning all outputs off.
- Detecting unconnected sensor
  If pulse is not detected for a constant period (Low pulse: 1000sec or 100sec, Frequency: 1sec), the unit will revert to the initial status (0Hz).

9. Troubleshooting

9.1 Indication

Problem	Presumed cause and solution
The Input and Output displays are flashing "- - - -".	• Check whether the input exceeds 1.1 times frequency high limit value. Confirm the input signal source. • Check whether the sensor is securely connected to the input terminals of this instrument. Connect the sensor terminals to the input terminals of this instrument securely. • Check whether the signal source is correct. Check the input signal source.
Input value 0 (zero) is flashing.	• Check if pulse is absent. Confirm the input signal source
The indication of the Input display is irregular or unstable.	• 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.

9.2 Key operation

Problem	Presumed cause and solution
Setting is not possible.	• “Lock” is selected during Set value lock selection. Select “Unlock”.

9.3 Unit operation

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.
No output	• Check whether Output 100% and Output 0% value have been set to suitable values. • Check whether Output Normal/Reverse has been selected correctly during Output Normal/Reverse selection.

10. 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
Lock	Set value lock	Unlock	
HEAL	Frequency type/unit	Frequency measurement: Hz	
HEAP	Frequency high limit value	9999Hz	
AFLL	Output 0% value	0	
AFLH	Output 100% value	9999	
dP□	Input decimal point place	No decimal point	
dFAP	Pulse rate frequency	1	
dHEG	Output type/unit	Frequency measurement: Hz	
dHEA	Output high limit value	9999	
dAFL	Output 0% value	0	
dAFH	Output 100% value	9999	
ddP□	Output decimal point place	No decimal point	
1APL	One-shot output pulse width	0ms	
oUFA	Output Normal/Reverse	Normal	
di SP	Display selection	Input/Output indication	
FI nE	Indication time	00.00 (Continuous)	

******* Inquiries *******

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

(e.g.)

- Model .....……. SAFD-0□□-□
- Serial number …..... No. xxxxxx

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

SHINKO TECHNOS CO., LTD.

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