SR90 Series

Instruction manual

https://www.shimaden.co.jp

SHIMADEN CO., LTD.

■ For questions, please contact
YOUR LOCAL AGENT or
exp-dept@shimaden.co.jp

MSR090-E53-E
Jun. 2023

■ Preface

Thank you for purchasing Shimaden product. Before using this product, make sure that you read thoroughly the precautions on safety, installation site and wiring in order to use it safely and correctly.
This manual contains the requisite minimum information. For parameter value, initial value, and other details, please refer to the Manual for Digital Controller SR90 series (SR91 / 92 / 93 / 94).
The Manual for Digital Controller SR90 series (SR91 / 92 / 93 / 94), and Communication Manual (optional) may be downloaded free from the company website https://www.shimaden.co.jp.

■ Accessories check

For any problem with the product, shortage of accessories or request for information, please contact our agent or our sales office in your neighborhood.

Instruction manual (A3 size paper × 2): 1 copy Termination resistor (With RS-485 option): 1 pc. Unit seals: 1 set	Current detector for heater break alarm (CT) (in case optional heater break alarm function is added) For 0-30A: Model QCC01:1 pc. For 0-50A: Model QCC02:1 pc.

■ Safety Precautions

Warning

The SR90 Series Digital Controllers are control instruments designed for industrial use to control temperature, humidity and other physical values.
You should either take appropriate safety measures or avoid using this product for control purposes where failure could have a serious effect on human life.
The manufacturer shall not be liable for accidents that result from use without taking appropriate safety measures.

- The digital controller should be used so the terminal elements in the control box, etc., are not touched by humans.
- Do not remove the controller from its case or insert your fingers or electric conductors inside the case. Doing so could result in electric shock or accident involving death or serious injury.
- Be sure to turn off power before wiring. Failure to do so could result in electric shock.
- Be certain that the protective conductor terminal (⏚) is properly grounded. Otherwise, an electric shock may result.
- After wiring, do not touch terminal elements or other charged parts while conducting electricity. Failure to do so could result in electric shock.

■ Consent on use

The warranty period for SR90 Series is one year after the purchase. In principle, avoid use of the product under the following places/conditions. Should you use the controller under the following places/situations, be sure to use it with the proper rating and level of performance and make sure to use the controller correctly while taking appropriate safety measures in order to avoid accidents.

- Outside
- Places exposed to chemical contamination, electrical disturbance, and/or mechanical stress
- Places which are not specified as an appropriate installation site in the instruction manual or catalog
- When used for nuclear facilities, air facilities, space facilities, railway facilities, vehicle facilities, medical equipment, and facilities which are controlled by separate regulations
- Facilities in which failure of the product would constitute a danger to human life or property
- When used in application or facilities which require a high level of safety

Caution

If there is danger of damage to any peripheral device or equipment due to failure of the controller, you should take appropriate safety measures such as mounting a fuse or overheating prevention device.
The manufacturer shall not be liable for an accident that results from use without taking appropriate safety measures.

- Controller labels and alert mark ⚠
  Alert marks ⚠ are printed on the terminal label of the case. **You could receive an electrical shock if you touch charged parts. The alert mark is provided to call your attention to this danger.**
- Provide a switch or breaker as a means of cutting off power for external power circuit connected to the power terminal of the controller.
  Mount a switch or breaker near the controller where the operator can access it easily and label it as an electrical breaker for the controller.
  Use a switch or breaker that conforms to requirements of IEC60947.
- Fuses
  The controller does not have a built-in fuse. Be sure to mount a fuse on the power circuit connected to the power terminal.
  Provide a fuse between the switch or breaker and the controller. Mount on the L side of the power terminal.
  Fuse rating/characteristics: 250 V AC, 0.5 A/medium time-lagged type or time-lagged type
  Use a fuse that conforms to requirements of IEC60127.
- Voltage/current of load connected to the output terminal and EV terminal should be within the rating.
  The output terminal should be connected with a device which meets the requirements of IEC61010.
- Do not apply voltage/current other than rated input to the input terminal. Doing so could shorten product life and lead to equipment failure. For rating, see "11. Specifications." In the case of voltage or current input, the input terminal should be connected to a device which meets IEC61010 requirements.
  The instrument is provided with a draft hole for heat discharge. Take care to prevent metal and other foreign matter from entering into it. Failure to do so may result in trouble with the instrument or may even cause a fire.
- Do not allow the ventilation holes to become clogged with dust, etc.
  Doing so could shorten the life of the product due to temperature rise or insulation deterioration and could result in equipment failure or fire.
- Repeating endurance tests such as dielectric strength, noise resistance and surge resistance could negatively affect the controller.
- The user should absolutely not modify or use the controller in any other way than it was intended.
- It takes 30 minutes to display the correct temperature after applying power to the digital controller.
  (Therefore, turn the power on more than 30 minutes prior to the operation.)
- To ensure safety and maintain the functions of this device, do not disassemble this device. If this device must be disassembled for replacement or repair, contact your dealer.
- This device is designed for mounting on the panel. Only the device mounted on the front of the panel facing outward is of protection class of IP66. Do not use for the device not facing outward or in environment where water or solids in excess of IEC60529 may get inside.

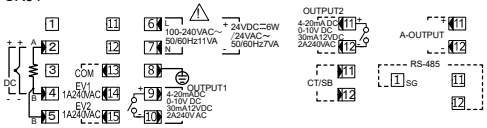
■ Wiring

Take the following precautions when wiring:

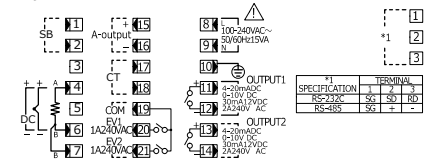
- Wire in accordance with the "terminal layout." After wiring, check and make sure the wiring is correct.
- Crimp-type terminals fit M3 screws. Use crimp-type terminals that are no wider than 6 mm.
- For thermocouple input, use a compensating lead wire that matches the type of thermocouple.
- For R.T.D. input, resistance for lead wires should be a maximum of 5Ω per wire. All 3 wires should have the same resistance.
- Input signal wires must not be accommodated with a strong electric circuit in the same conduit or duct.
- Using shielded wiring (single point grounding) is effective for static induction noise.
- Making input wiring short and twisting at regular intervals is effective for electromagnetic induction noise.
- For power supply, use wiring or cable with sectional area of at least 1 mm² that offers the same or higher performance as 600 V vinyl insulated wiring.
- Securely fasten the terminal element screw. Fastening torque: 0.5 N·m (5 kgf·cm)
- The wire for grounding must have a sectional area of 2 mm² or larger and must be grounded at a grounding resistance of 100Ω or less.
- If the instrument appears to be easily affected by power supply noise, use a noise filter to prevent malfunctioning. Mount the noise filter on the grounded panel and make the wire connection between the noise filter output and power line terminals of the controller as short as possible.
- Countermeasure against lightning surge will be required for signal line over 30m.

■ Terminal layout

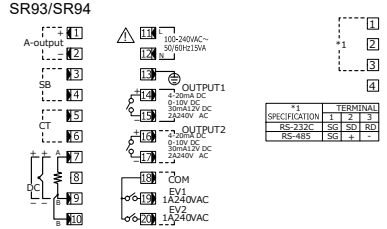
SR91



SR92



SR93/SR94



■ Installation site (environmental conditions)

Caution

Do not use the controller in the following locations. Doing so could lead to equipment failure, damage or fire.

- Places exposed to flammable or corrosive gases, oil mist, or excessive dust that could cause insulation to deteriorate.
- Places subject to strong vibration or impact
- Places near strong electrical circuit or places subject to inductive interference
- Places exposed to water dripping or direct sunlight
- Places where the controller is struck directly by air from heater or air conditioner

The controller is designed to be used under the following conditions. Observe the following environmental conditions:

- Indoor use
- Max. elevation: 2,000 m
- Ambient temperature: -10 to 50°C
- Ambient humidity: Max. 90%RH, no condensation
- Overvoltage category: II
- Pollution class: 2 (IEC 60664)

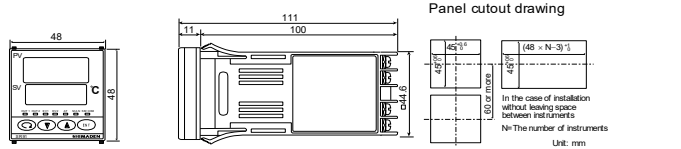
■ External dimensions and panel cutout

Caution

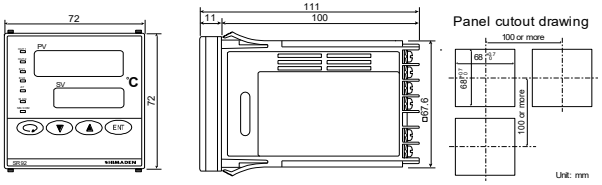
In order to maintain safety and function, do not remove the case from the controller.
If the case of the controller has to be removed for replacement/repair, contact your nearest Shimaden agent.

- Cut a hole for mounting the controller in the panel by referring to external dimensions and panel cutout.
- The panel thickness should be 1.0 to 4.0mm.
- The controller is provided with tabs for mounting. Insert as is from the front surface of the panel.
- SR90 Series controllers are designed for mounting on a panel: Be sure to mount the controller on a suitable panel.
- Be sure to install this product with the attached gasket. In case if the gasket is broken or falls off, please replace it with the designated one.

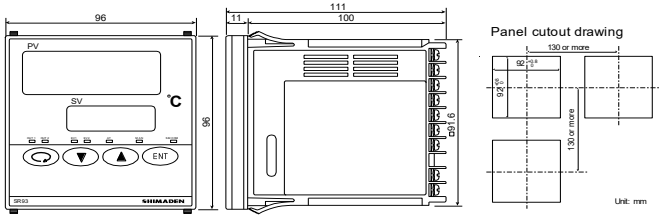
SR91



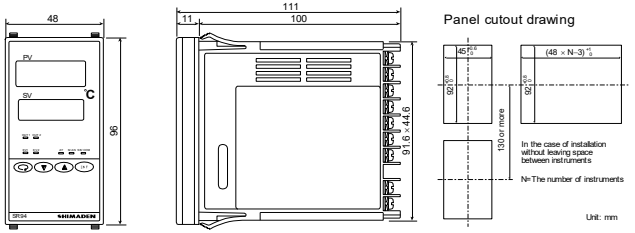
SR92



SR93



SR94



Terminal resistor for communication (optional):

■ For questions, please contact
YOUR LOCAL AGENT or
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■Product specification code check

Compare the specification code on the case with the following to make sure it is the product you ordered.

● **CODE SELECTION TABLE**

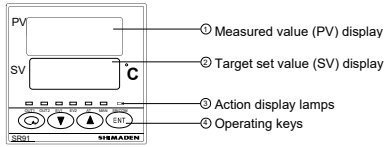
Item	Code	Specification
1. Series	SR91-	48×48 DIN size Digital Controller
2. Input	8	Universal input Thermocouple, R.T.D., Voltage (mV)
	4	Current (mA)
	6	Voltage (V)
3. Control output (1)	Y-	Contact
	I-	Current
	P-	SSR drive voltage
	V-	Voltage
4. Power supply	90-	100 to 240V AC ±10% 50/60Hz
	08-	24V AC/DC ±10% 50/60Hz
5. Event (Option)	0	None
	1	Event output
6. Option ● Control output (2) ● Heater break alarm ● Analog output ● Communication ● DI	N	None
	Y	Control output (2) Contact
	I	Control output (2) Current
	P	Control output (2) SSR drive voltage
	V	Control output (2) Current
	1	Heater break alarm 30A *1
	2	Heater break alarm 50A *1
	3	Analog output 0 to 10mV DC
	4	Analog output 4 to 20mA DC
	6	Analog output 0 to 10V DC
	5	Communication RS-485
	8	DI (set value bias, STBY, or ACT) 1 point
7. Remarks	0	Without
	9	With (Please consult before ordering)

Item	Code	Specification
1. Series	SR92-	72×72mm DIN size Digital Controller
2. Input	8	Universal input Thermocouple, R.T.D., Voltage (mV)
	4	Current (mA)
	6	Voltage (V)
3. Control output (1)	Y-	Contact
	I-	Current
	P-	SSR drive voltage
	V-	Voltage
4. Control output (2)	N-	None
	Y-	Contact
	I-	Current
	P-	SSR drive voltage
	V-	Voltage
5. Power supply	90-	100 to 240V AC ±10% 50/60Hz
6. Event Event output + heater break alarm	0	None
	1	Event output
	2	Event output + heater break alarm 30A *1
	3	Event output + heater break alarm 50A *1
7. Analog output	0	None
	3	0 to 10mV DC
	4	4 to 20mA DC
	6	0 to 10V DC
8. Communication or DI	0	None
	5	RS-485
	7	RS-232C
	8	DI (set value bias, STBY, or ACT) 1 point
9. Remarks	0	Without
	9	With (Please consult before ordering)

Item	Code	Specification
1. Series	SR93-	96×96 DIN size Digital Controller
	SR94-	96×48 DIN size Digital Controller
2. Input	8	Universal input Thermocouple, R.T.D., Voltage (mV)
	4	Current (mA)
	6	Voltage (V)
3. Control output (1)	Y-	Contact
	I-	Current
	P-	SSR drive voltage
	V-	Voltage
4. Control output (2) (Option)	N-	None
	Y-	Contact
	I-	Current
	P-	SSR drive voltage
	V-	Voltage
5. Power supply	90-	100 to 240V AC ±10% 50/60Hz
6. Event Event output + heater break alarm (Option)	0	None
	1	Event output
	2	Event output + heater break alarm 30A *1
	3	Event output + heater break alarm 50A *1
7. Option ● Analog output ● DI ● Analog output + DI ● Communication	00	None
	30	Analog output 0 to 10mV DC
	40	Analog output 4 to 20mA DC
	60	Analog output 0 to 10V DC
	08	DI (set value bias, STBY, or ACT) 1 point
	38	Analog output 0 to 10mV DC + DI (set value bias, STBY, or ACT) 1 point
	48	Analog output 4 to 20mA DC + DI (set value bias, STBY, or ACT) 1 point
	68	Analog output 0 to 10V DC + DI (set value bias, STBY, or ACT) 1 point
	05	Communication RS-485
	07	Communication RS-232C
9. Remarks	0	Without
	9	With (Please consult before ordering)

*1: Selectable only when Control Output 1 is Y or P.

■Names and functions of parts on front panel

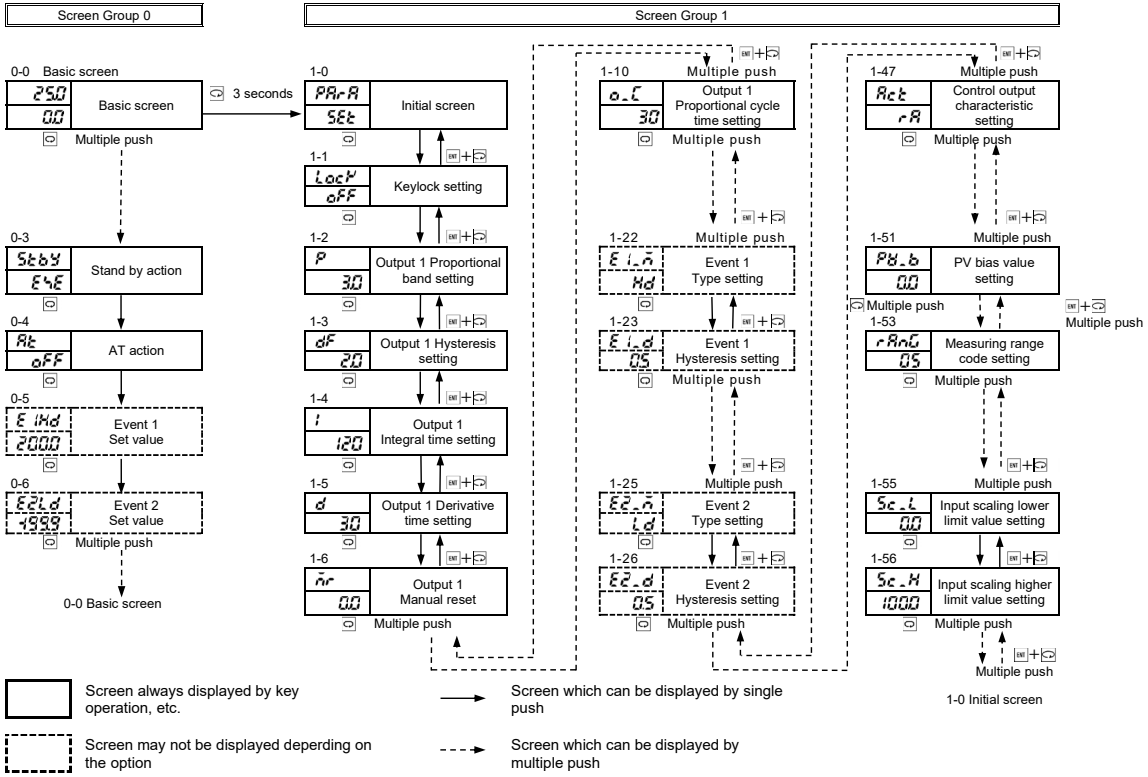


Name	Function
① Measured value (PV) display:	(1) Present measured value (PV) is displayed on the screen group 0, basic screen and output display screens (OUT1 and OUT2). (red) (2) Type of parameter is shown on each parameter screen. (3) The decimal point at the lowest digit flashes when the controller is in standby (STBY) mode.
② Target set value (SV) display:	(1) Target set value (SV) is displayed on the basic screen of the screen group 0. (green) (2) Present output value is displayed by % on control output monitor screens (OUT1, OUT2) of the screen group 0. (3) Selected item and set value are displayed on each parameter screen.
③ Action display lamps:	(1) Control output indicators: OUT1 and OUT2 (option) (green) - OUT1 lights up when output turns ON and goes out when it turns OFF during contact or SSR drive voltage output. - The brightness changes in proportion to output increase/decrease during current or voltage output. - OUT2 functions only if the option is added. (2) Event output indicators: EV1/EV2 (option) (orange) - Light up when assigned events (including heater break/heater loop alarm) turn ON if event option is added. (3) Auto tuning action indicator: AT (green) - Flashes when ON is selected by ▲ key on the AT action selection screen and AT is executed by ENT key, and goes out when AT terminates automatically or is released. (4) Manual control output action indicator: MAN (green) - Flashes when manual control output is selected on control output display screens (OUT1, OUT2). Goes out when automatic (PID) control output is executed. (5) Set value bias/communication indicator: SB/COM (option) (green) - Lights up when optional DI function is added, SB (set value bias) is assigned to it, and at the time of shorting across the DI terminal (set value bias in action). - Lights up when optional communication function is added and COM mode is selected. Goes out when Local is selected for communication mode.
④ Operating keys:	(1) ↺ (parameter) key - Pressing this key on any screen of the screen group 0 and the screen group 1 calls the next screen onto display. - When pressed continuously for 3 seconds, this key functions to move between the basic screen of screen group 0 and the initial screen of screen group 1. - Pressing this key simultaneously with ENT key in the screen group 1 calls the preceding screen onto display. (2) ▼ (down) key - When pressed on a parameter screen, the decimal point at the lowest digit flashes and the set data decreases or moves backward. (3) ▲ (up) key - When pressed on a parameter screen, the decimal point at the lowest digit flashes and the set data increases or moves forward. (4) ENT (entry/registration) key - Used to register a set data changed by means of ▲ or ▼ key on a parameter screen. - Pressing this key simultaneously with ↺ key on a screen of the screen group 1 calls the preceding screen onto display. - When pressed continuously for 3 seconds on the control output screens (OUT1, OUT2), or pressing ENT + ▲ key functions to switch between automatic output and manual output.

■ Parameter Schematic Diagram

This instruction manual explains easy operation about SR90 series. Please download the Instruction Manual (Detailed Version) from our website to refer to all except for following setting.

- Measuring rang setting
- Event output setting (Deviation alarm/Absolute value Alarm)
- Operation mode setting (PID control mode, ON/OFF (2-position control mode))
- Output characteristics switching
- Measured value (PV) correction



Measuring Range Codes

Select a measuring range from the following table.
A change of the code will initialize all date related to the measuring range.

Input type			Code	Measuring range (°C)	Measuring range (°F)
Universal Input	Thermocouple	B *1	01	0 to 1800	0 to 3300
		R	02	0 to 1700	0 to 3100
		S	03	0 to 1700	0 to 3100
		K	04 *2	−199.9 to 400.0	−300 to 750
			05	0.0 to 800.0	0 to 1500
			06	0 to 1200	0 to 2200
		E	07	0 to 700	0 to 1300
		J	08	0 to 600	0 to 1100
		T	09 *2	−199.9 to 200.0	−300 to 400
		N	10	0 to 1300	0 to 2300
		PL II *3	11	0 to 1300	0 to 2300
		C(WRe5-26)	12	0 to 2300	0 to 4200
		U *4	13 *2	−199.9 to 200.0	−300 to 400
		L *4	14	0 to 600	0 to 1100
	Kelvin	K	15 *5	10.0 to 350.0 K	10.0 to 350.0 K
		AuFe-Cr	16 *6	0.0 to 350.0 K	0.0 to 350.0 K
		K	17 *5	10 to 350 K	10 to 350 K
		AuFe-Cr	18 *6	0 to 350 K	0 to 350 K
	R.T.D.	Pt100	31	−200 to 600	−300 to 1100
			32	−100.0 to 100.0	−150.0 to 200.0
			33	−50.0 to 50.0	−50.0 to 120.0
			34	0.0 to 200.0	0.0 to 400.0
		JPt100	35	−200 to 500	−300 to 1000
			36	−100.0 to 100.0	−150.0 to 200.0
			37	−50.0 to 50.0	−50.0 to 120.0
			38	0.0 to 200.0	0.0 to 400.0
	mV	−10 to 10mV	71	Initial value: 0.0 to 100.0 digit Input scaling setting range: −1999 to 9999 digit Span: 10 to 5000 digit Position of decimal point: None 1, 2 or 3 decimal places Lower limit value < higher limit value	
		0 to 10mV	72		
		0 to 20mV	73		
		0 to 50mV	74		
		10 to 50mV	75		
		0 to 100mV	76		
	Voltage	−1 to 1V	81	Initial value: 0.0 to 100.0 digit Input scaling setting range: −1999 to 9999 digit Span: 10 to 5000 digit Position of decimal point: None 1, 2 or 3 decimal places Lower limit value < higher limit value	
	V	0 to 1V	82		
		0 to 2V	83		
		0 to 5V	84		
		1 to 5V	85		
		0 to 10V	86		
	Current	mA	0 to 20mA	91	
			4 to 20mA	92	

Thermocouple: B, R, S, K, E, J, T, N, C(WRe5-26): JIS/IEC
R.T.D.: Pt100: JIS/IEC, JPt100: Former JIS

*1 Thermocouple B: Accuracy guarantee not applicable to 400°C (752°F) and below.
*2 Thermocouple K, T, U: Accuracy of those whose readings are below −100°C is ±(0.7% FS+ 1digit)
*3 Thermocouple PLII: Platinel
*4 Thermocouple U, L: DIN 43710
*5 Thermocouple K: Accuracy is as follows;

10.0 to 30.0 K	±(2.0%FS	+ 40°C+1digit)
30.0 to 70.0 K	±(1.0%FS	+ 14°C+1digit)
70.0 to 170.0 K	±(0.7%FS	+ 6°C+1digit)
170.0 to 270.0 K	±(0.5%FS	+ 3°C+1digit)
270.0 to 350.0 K	±(0.3%FS	+ 2°C+1digit)

*6 Thermocouple AuFe-Cr: Accuracy is as follows;

0.0 to 30.0 K	±(0.7%FS	+ 6°C+1digit)
30.0 to 70.0 K	±(0.5%FS	+ 3°C+1digit)
70.0 to 170.0 K	±(0.3%FS	+ 2.4°C+1digit)
170.0 to 280.0 K	±(0.3%FS	+ 2°C+1digit)
280.0 to 350.0 K	±(0.5%FS	+ 2°C+1digit)

NOTE: Do not use the above sensors (current/voltage, thermocouple, R.T.D.) for the measurement of power supply line.

NOTE: Unless otherwise specified, the measuring range listed below will be set as the factory default.

Input	Specification/Rating	Measuring Range
Universal input	K thermocouple	0.0 to 800.0°C
Voltage (V)	0 to 10V DC	0.0 to 100.0
Current (mA)	4 to 20mA DC	0.0 to 100.0

■ Setting of Various Parameters

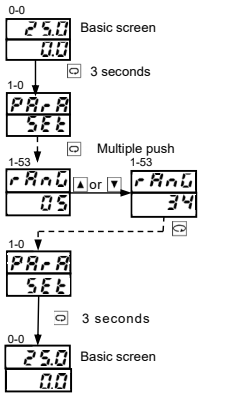
Display the various parameters, select the desired value through ▲, ▼ keys and confirm through ENT key.

● MEASURING RANGE SETTING

Input type and scaling are set according to the sensor connected to this equipment.

By changing these parameters, registered data are initialized.

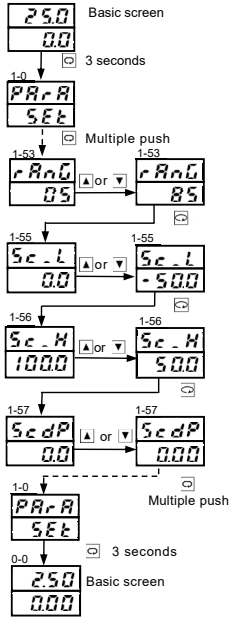
Example 1) When input is Pt100, 0.0–200.0˚C:



Select Pt100, 0.0–200.0˚C (34) from Measuring Range Codes and press ENT key.

If you return to the basic screen, the setting is complete.

Example 2) When input is 1–5 V DC, and scaling is -5.00–5.00:



Select 1-5 V (85) from Measuring Range Codes and press ENT key.

Input the lower limit value of scaling (-50.0). The position of decimal point for input scaling is set on 1-57 screen. Only the numerical value is put on this screen. If thermocouple or R.T.D., this screen will not be changed.

Input the higher limit value of scaling (50.0). The position of decimal point for input scaling is set on 1-57 screen. Only the numerical value is put on this screen. If thermocouple or R.T.D., this screen will not be changed.

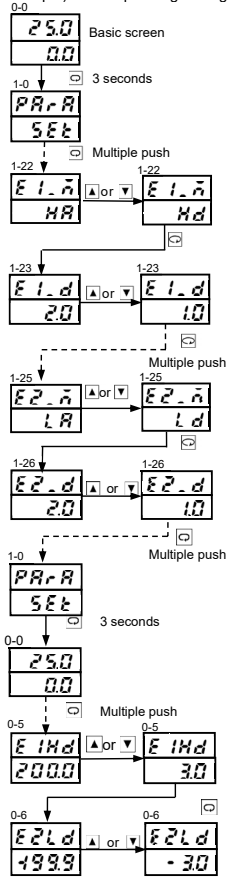
Change the position of decimal point. If thermocouple or R.T.D., this screen will not be changed.

If you return to the basic screen, the setting is complete.

● Event Output Setting

This shows event action mode setting and action position setting method.

Example) When operating the higher/lower deviation alarm at ±3˚C



The type of event to be selected as event 1 is selected “Higher limit deviation” (Hd)

ON-OFF hysteresis is set for event 1. The ON point is a start point for a hysteresis. The value from an ON point to the OFF point is set.

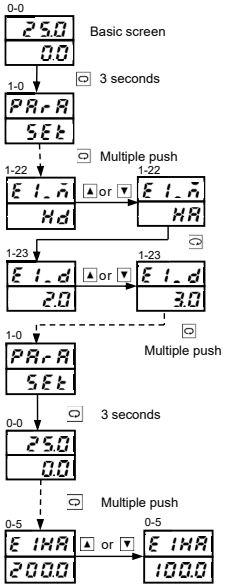
The type of event to be selected as event 2 is selected “Lower limit deviation” (Ld)

ON-OFF hysteresis is set for event 2. The ON point is a start point for a hysteresis. The value from an ON point to the OFF point is set.

The action point of the assigned alarm type is set event 1.
An alarm’s setting sets the value which changed from the value set on 0-0 screen in case of “deviation alarm action”.

The action point of the assigned alarm type is set event 2.
An alarm’s setting sets the value which changed from the value set on 0-0 screen in case of “deviation alarm action”.

Example) when operating the higher/lower absolute value alarm at 100.0˚C



The type of event to be selected as event 1 is selected “Higher limit absolute value alarm” (HA)

The ON point is a start point for a hysteresis. The value from an ON point to the OFF point is set.

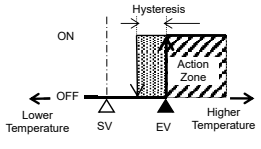
The action point of the assigned alarm type is set event 1.

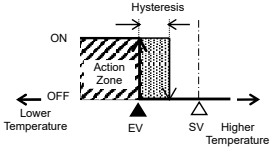
*Table of Event TYPE (Alarm Type) Codes
(USE IN1-22 SCREEN AND 1-25 SCREEN)

Code	Type of event	Remarks
oFF	No selection	
Hd	Higher limit deviation	Initial value of event 1
Ld	Lower limit deviation	Initial value of event 2
od	Outside higher/lower limit deviation	
id	Within higher/lower limit deviations	
HA	Higher limit absolute value	
LA	Lower limit absolute value	
So	Scaleover	Standby action is invalid.
Hb	Heater break/loop alarm	Displayed only when the option is added.

Lower limit deviation Alarm Action Configuration (Ld)

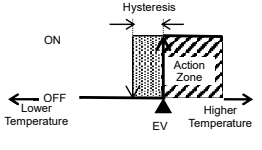
Higher limit deviation Alarm Action Configuration (Hd)

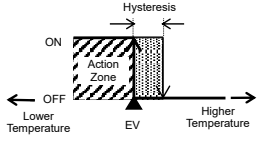




Lower limit absolute value Alarm Action Configuration (LA)

Higher limit absolute value Alarm Action Configuration (HA)



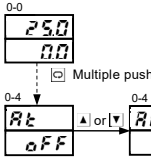


●OPERATION MODE SETTING

This shows PID control mode setting and ON/OFF (2-position) control mode setting method.

■ PID control mode

The operation mode already set PID control mode at Factory-set.
When using by a PID control mode, please carry out auto-tuning of following procedure.

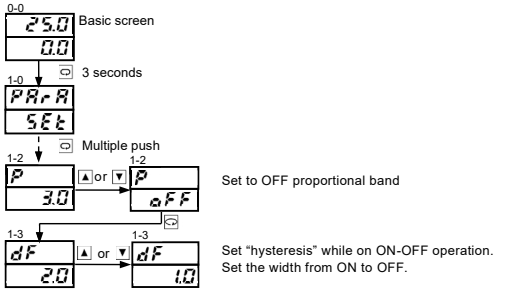


While in AT execution, AT lamp flashing and system operation is actually executed.
Execute under the condition that all systems are operable.

When AT lamp lights out, it is a sign that AT has ended. After AT ends, P/I/D/MR parameter is overwritten with the appropriate value.

■ ON/OFF (2-position) control mode

To change to ON-OFF (2-position) action, set proportional band to OFF.

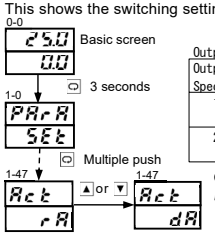


Set to OFF proportional band

Set “hysteresis” while on ON-OFF operation. Set the width from ON to OFF.

■ Output characteristics switching

This shows the switching setting method of control output characteristics.



Output characteristics

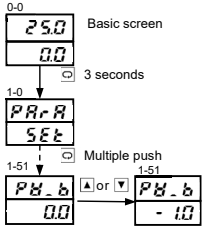
Output Specification	characteristic	OUT1	OUT2
1-output	rA	Heating	None
	dA	Cooling	None
2-output	rA	Heating	Cooling
	dA	Heating	Heating

Changing control output characteristics from rA to dA.

■ Measured value (PV) correction

This shows the correction method of measured value (PV).

Example) When making a subtraction correction by +1.0˚C



When a bias is used, control is also carried out with a corrected value (in this case is -1.0).