

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 Program Controller FP93.

The Manual for Program Controller FP93 and Communication Manual 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.

- FP93 Program Controller
- Instruction manual (A3 size paper × 2): 1 copy
- Unit seals: 1 set
- External resistor 250Ω (For current input): 1 pc.
- Terminal resistor 120Ω (For RS485): 1 pc.

Safety Precautions



Warning

The FP93 Program 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.



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.

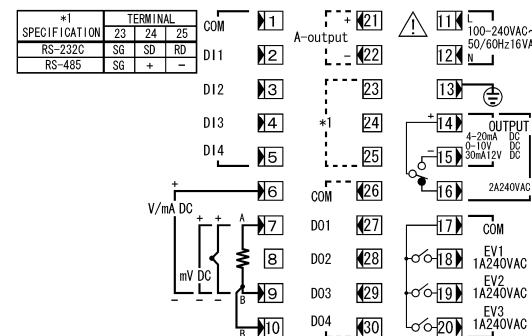
- Controller labels and alert mark Alert marks are printed on the terminal label of the case. **You could receive an electrical shock if you touch charged parts. The alert mark is provided to call your attention to this danger.**
- Provide a switch or breaker as a means of cutting off power for external 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 "9. 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 M3.5 screws. Use crimp-type terminals that are no wider than 7 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: 1.0 N·m (10 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



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 degree: 2 (IEC 60664)

Consent on use

The warranty period for FP93 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.

- 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

Check before Use

This product has been fully inspected for quality assurance prior to shipment. Nevertheless, you are requested to make sure that there is no error, damage or shortage of delivered items by checking the model codes and the external view of the product and the number of accessories.

Confirmation of Model Codes :

Check the model codes stuck to the case of the product to ascertain if the respective codes designate what were specified when you ordered it, referring to the following code table

CODE SELECTION TABLE

Item	Code	Specification
1. Series	FP93-	Program Controller
2. Input	8	Multi-input: thermocouple, R.T.D., voltage (mV), Voltage (V)
	4	Current (mA) (attached with an external resistor 250 Ω)
3. Control output	Y-	Contact
	I-	Current
	P-	SSR drive voltage
	V-	Voltage
4. Power supply	90-	100-240V AC
	0	Without
5. Status output (Do)	1	With
	0	Without
6. Analog output (Ao)	3	0~10mV DC
	4	4-20mA DC
	6	0-10V DC
	0	Without
7. Communication	5	RS-485
	7	RS-232C
	0	Without
8. Remarks	9	With

External dimensions and panel cutout

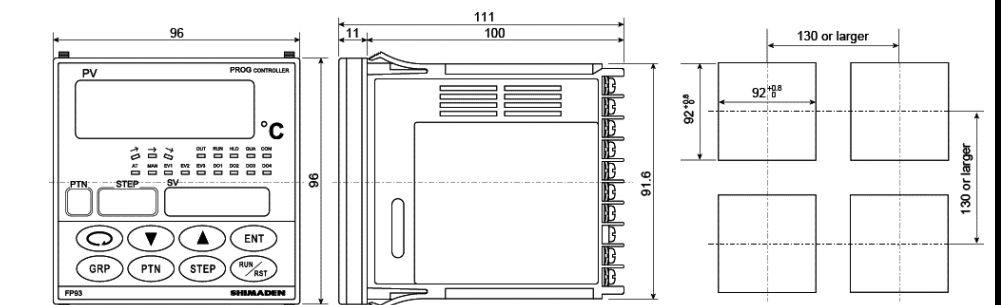


Caution

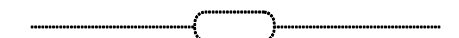
In order to maintain safety and function, do not remove the case from the controller.

If the case of the controller has to be removed for replacement/repair, contact your nearest Shimaden agent.

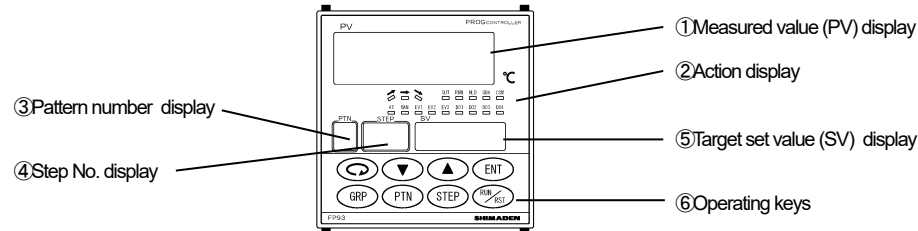
- Cut a hole for mounting the controller in the panel by referring to external dimensions and panel cutout.
- The panel thickness should be 1.0 to 4.0mm.
- The controller is provided with tabs for mounting. Insert as is from the front surface of the panel.
- Be sure to install this product with the attached gasket. In case if the gasket is broken or falls off, please replace it with the designated one.
- FP93 is designed for mounting on a panel: Be sure to mount the controller on a suitable panel.



Termination resistor for communication (optional)



Names and Functions of Parts on Front Panel

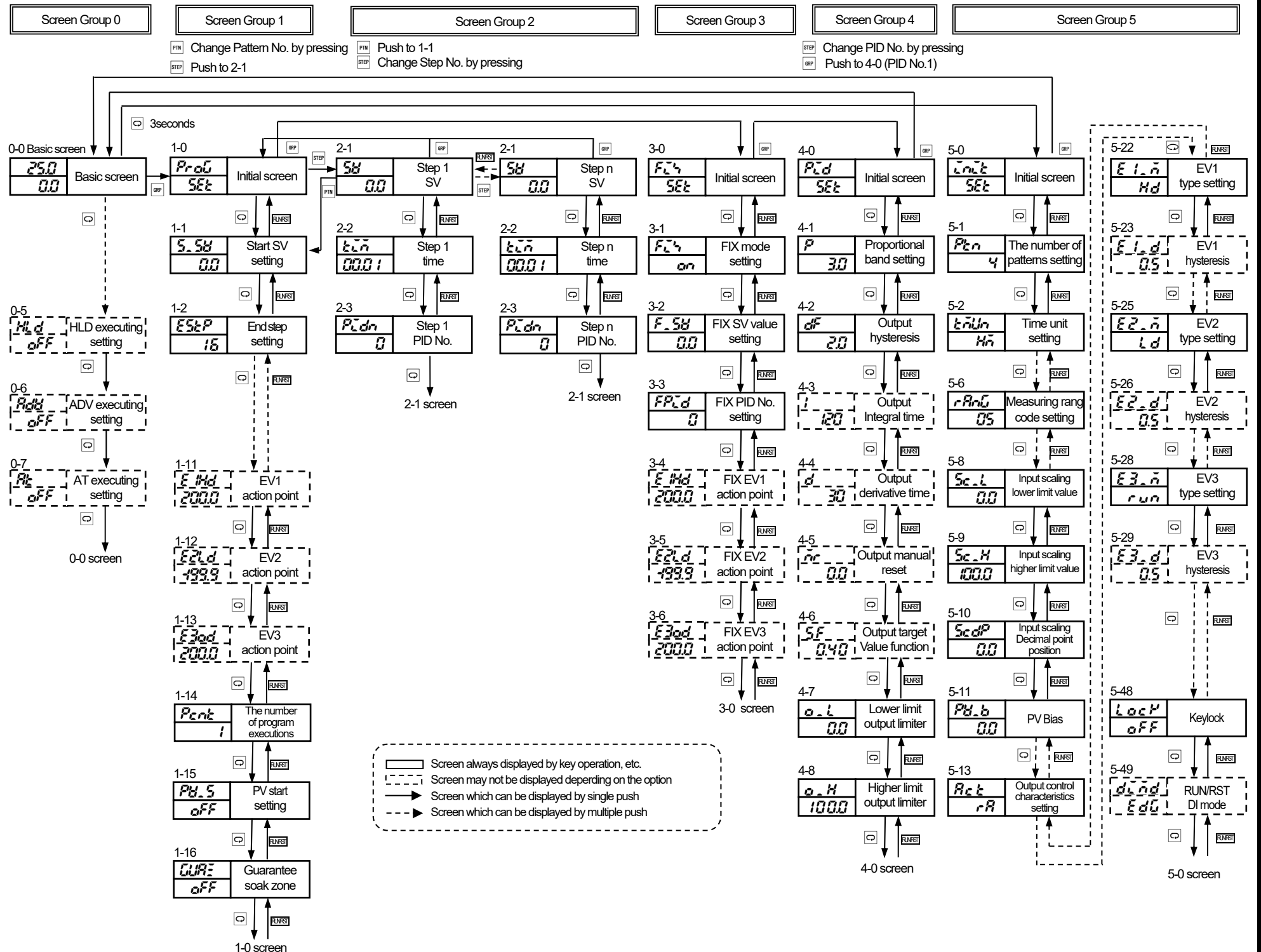


Name	Function
① Measured value (PV) display	(1) Present measured value is displayed in the screen group 0. (red) (2) Type of parameter is shown on each parameter screen.
② Action display	(1) (green) Ascending action lamp • Lights while ascending step is in execution. (2) (green) Level action lamp • Lights while level step is in execution. (3) (green) Descending action lamp • Lights while descending step is in execution. (4) OUT (green) Control output lamp • Lights when contact or SSR drive voltage output is ON, goes out when output turns OFF. • For current or voltage output, brightness increases or decreases in proportion to output. (5) RUN (green) RUN action lamp • Lights while program is in execution. • Blinks while FIX is in execution. (6) HLD (green) HLD action lamp • Lights when a brief suspension (Hold) is set while program is in execution. (7) GUA (green) GUA action lamp • Lights in case PV value does not reach a set range of deviation values when moving to level step during program execution (guarantee soak). (8) COM (green) Communication action lamp • Lights when COM mode is selected in case the instrument includes the communication option. The lamp does not light if local is selected as communication mode. (9) AT (green) Auto tuning action lamp • Blinks while AT is in execution. The lamp lights during standby for AT and goes out when AT action comes to an end or is terminated. (10) MAN (green) Manual control output action lamp • Blinks when manual control output is selected on output screen. The lamp remains extinct during automatic control output. (11) EV1 (orange) Event output 1 output action lamp. Lights when event output 1 turns ON. EV2 (orange) Event output 2 output action lamp. Lights when event output 2 turns ON. EV3 (orange) Event output 3 output action lamp. Lights when event output 3 turns ON. (12) DO1 (green) Status output 1 action lamp. Lights when status output 1 turns ON. DO2 (green) Status output 2 action lamp. Lights when status output 2 turns ON. DO3 (green) Status output 3 action lamp. Lights when status output 3 turns ON. DO4 (green) Status output 4 action lamp. Lights when status output 4 turns ON.
③ Pattern number display	(1) Pattern No. currently selected is displayed. (green)
④ Step No. Display	(1) Step No. currently in execution is displayed. (green) (2) Step No. currently set in screen group 2 is displayed. (3) PID No. currently set in screen group 4 is displayed.
⑤ Target set value (SV) display	(1) Target set value is displayed on the basic screen of screen group 0. (green) (2) Present output value is displayed in % on the output monitor screen of screen group 0. (3) Selected item and set value are displayed on each parameter screen.
⑥ Operating keys	(1) (parameter) key • Pressing this key on any screen calls the next screen onto display. • Pressing this key continuously for 3 seconds calls the initial screen of screen group 5. (2) (up) key • Used to increase a numerical value on a numerical value setting screen. • Used to select an item on an item selection screen. (3) (down) key • Used to decrease a numerical value on a numerical value setting screen. • Used to select an item on an item selection screen. (4) (entry) key • Used to register a set data changed by means of the (up) or (down) key on each screen (the decimal point of the rightmost digit goes out). • When pressed for 3 seconds continuously on output (OUT) screen, this key switches between automatic output and manual output. (5) (group) key • When pressed in the middle of setting in screen groups 1, 3, 4 or 5, the initial screen of the group is called onto display. • When pressed in the screen group 2, the initial screen of screen group 1 is called onto display. • When pressed on the basic screen, the display moves to screen group 1, screen group 3, screen group 4 and the basic screen in the order mentioned. • When pressed on the initial screen of screen group 5, the basic screen is called. (6) (pattern) key • When pressed during stop (RST) on the basic screen, a starting pattern can be selected. It is registered by pressing the (pattern) key • This key is used to move to other screen groups. For details, refer to "5-1. Parameter Flow" or "5-5. Explanation of Screen Group 0 and Setting." (7) (step) key • This key is used to move to other screen groups. For details, refer to "5-1. Parameter Flow" or "5-5. Explanation of Screen Group 0 and Setting." (8) (run/reset) key • When pressed continuously for 3 seconds on the basic screen, execution (RUN) and stop (RST) are switched. • When pressed in any of screen groups 1-5, the preceding screen is returned onto display.

Parameter Schematic Diagram

This instruction manual explains easy operation about FP93 Please download the Instruction Manual (Detailed Version) from our website to refer to all except for following setting.

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



Measuring Range Codes Table

Select a measuring range from the following table.

Note: A change of a measuring range code will initialize all data related to the measuring range.

Input type	Code	Measuring range				
		°C	°F			
Thermocouple	B *1	0 to 1800	0 to 3300			
	R	0 to 1700	0 to 3100			
	S	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		
		07	0 to 700	0 to 1300		
	J	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		
Multi-input 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		
		35	-200 to 500	-300 to 1000		
	JPt100	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		
			0 to 10mV	72		
0 to 20mV	73					
0 to 50mV	74					
10 to 50mV	75					
V	0 to 100mV	76				
	-1 to 1V	81				
	0 to 1V	82				
	0 to 2V	83				
	0 to 5V	84				
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: JIS

*1 Thermocouple B: Accuracy guarantee not applicable to 400°C or 750°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: Platine

*4 Thermocouple U, L: DIN 43710

● When not designated, factory-set measuring range is Code 05 [K thermocouple (0.0-800.0°C)].

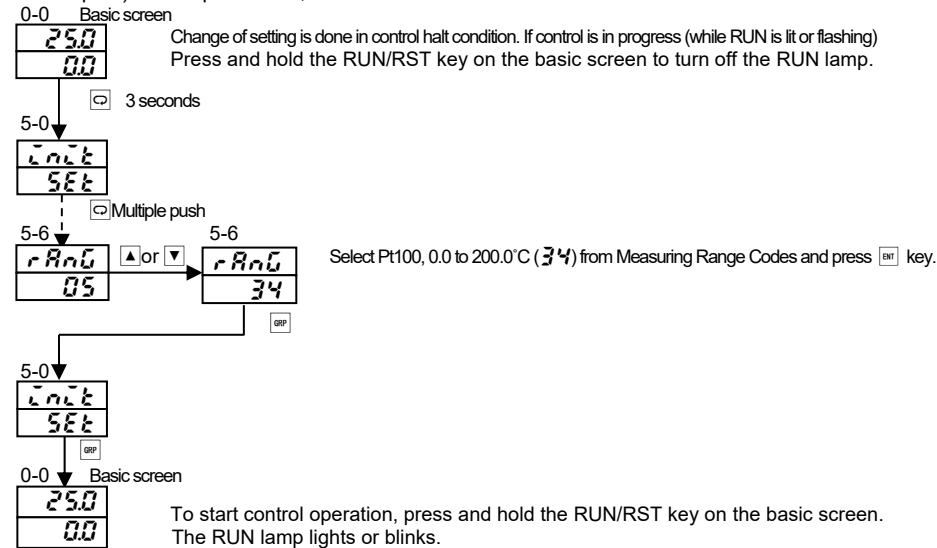
Setting of Various Parameters

Display the various parameters, select the desired value through Δ ∇ keys and confirm through ENT key.

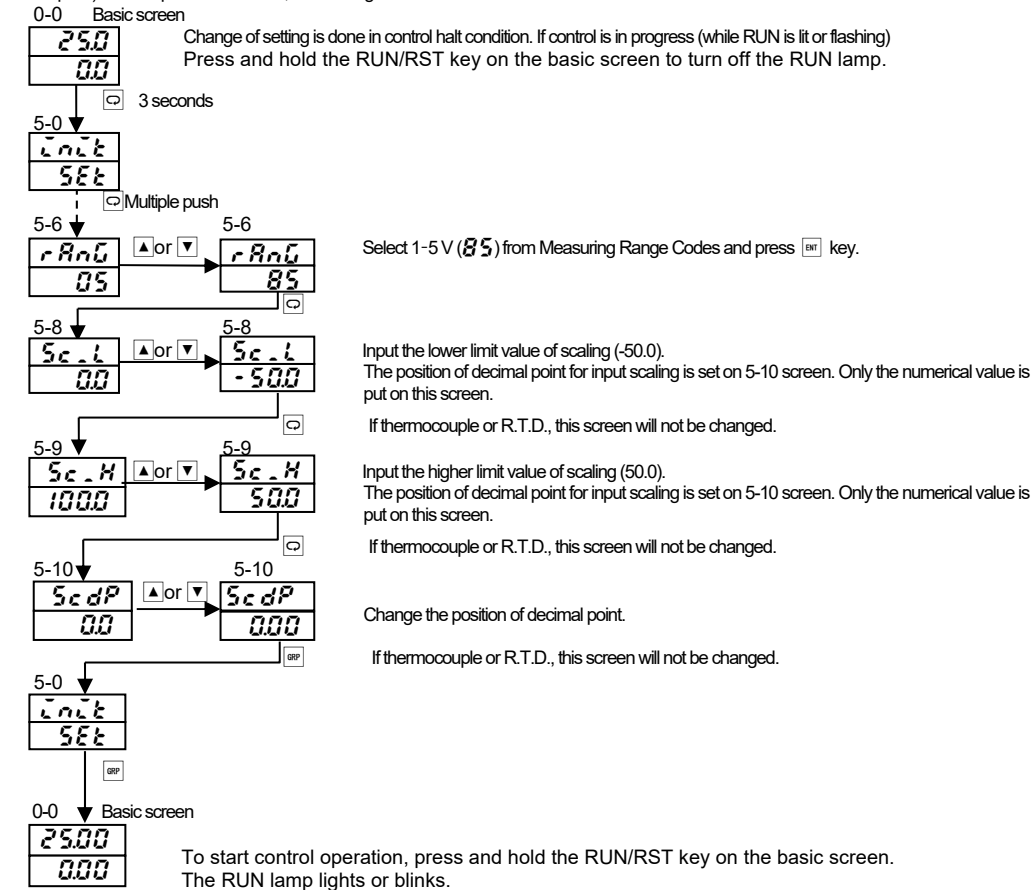
MEASURING RANGE SETTING

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 to 200.0°C:

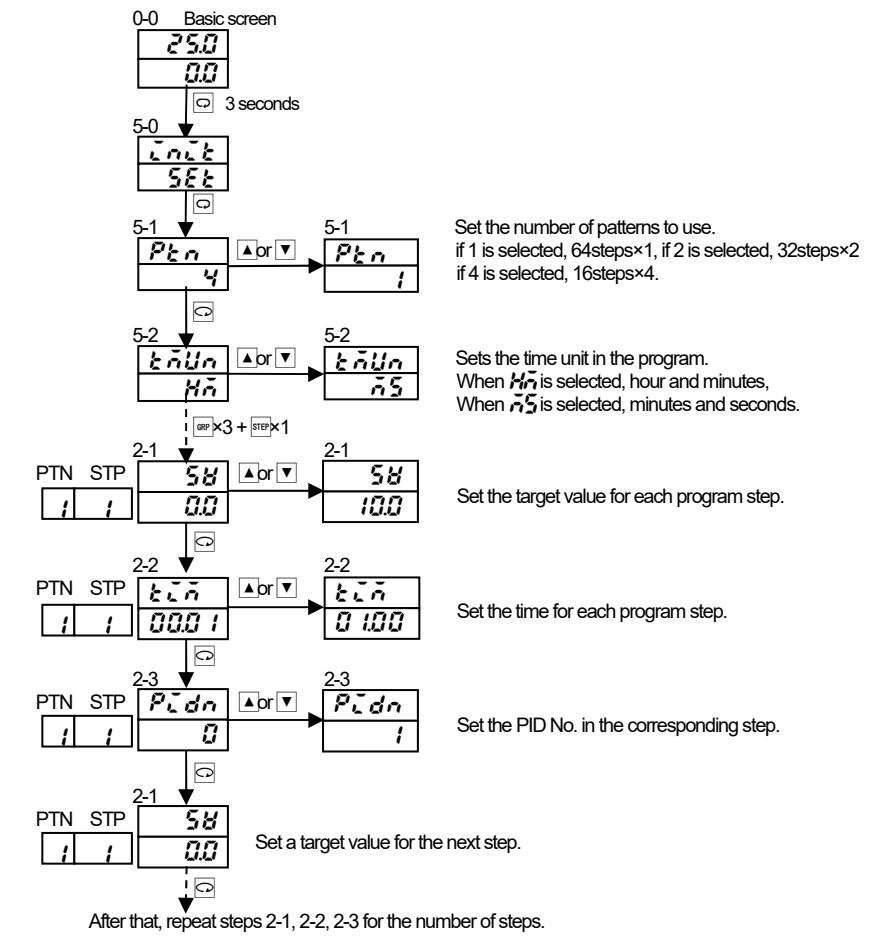


Example 2) When input is 1 to 5 V DC, and scaling is -5.00 to 5.00:



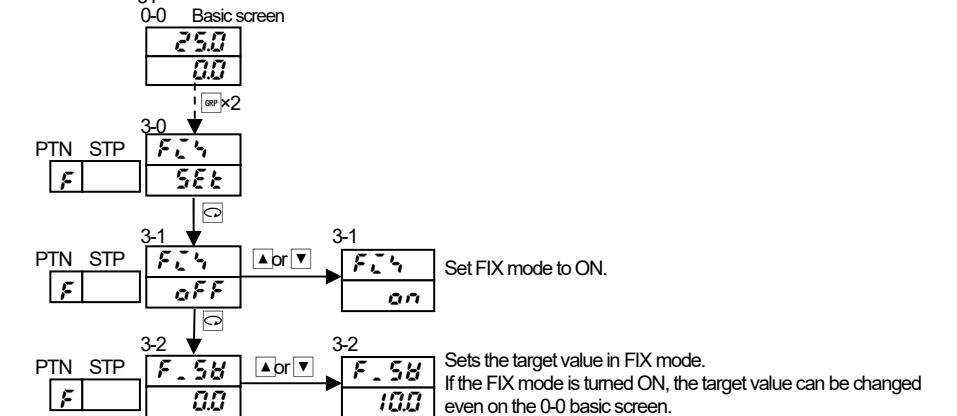
Program setting procedure

- Set the number of patterns and steps required for program operation. (5-1 screen)
- Set the program time unit. (5-2 screen)
- Set the target (SV) value in the program. (2-1 screen)
- Set the operating time in the program. (2-2 screen)
- Repeat steps 3 and 4 for the required number of steps.
- The program pattern to be executed can be selected with the PRG key on the basic screen.
- To run or stop the program, press the RUN/RST key for 3 seconds on the basic screen.



Fixed value control setting procedure

Fixed value control is a control method that does not use a program function (has no concept of time).
The setting procedure is as follows.

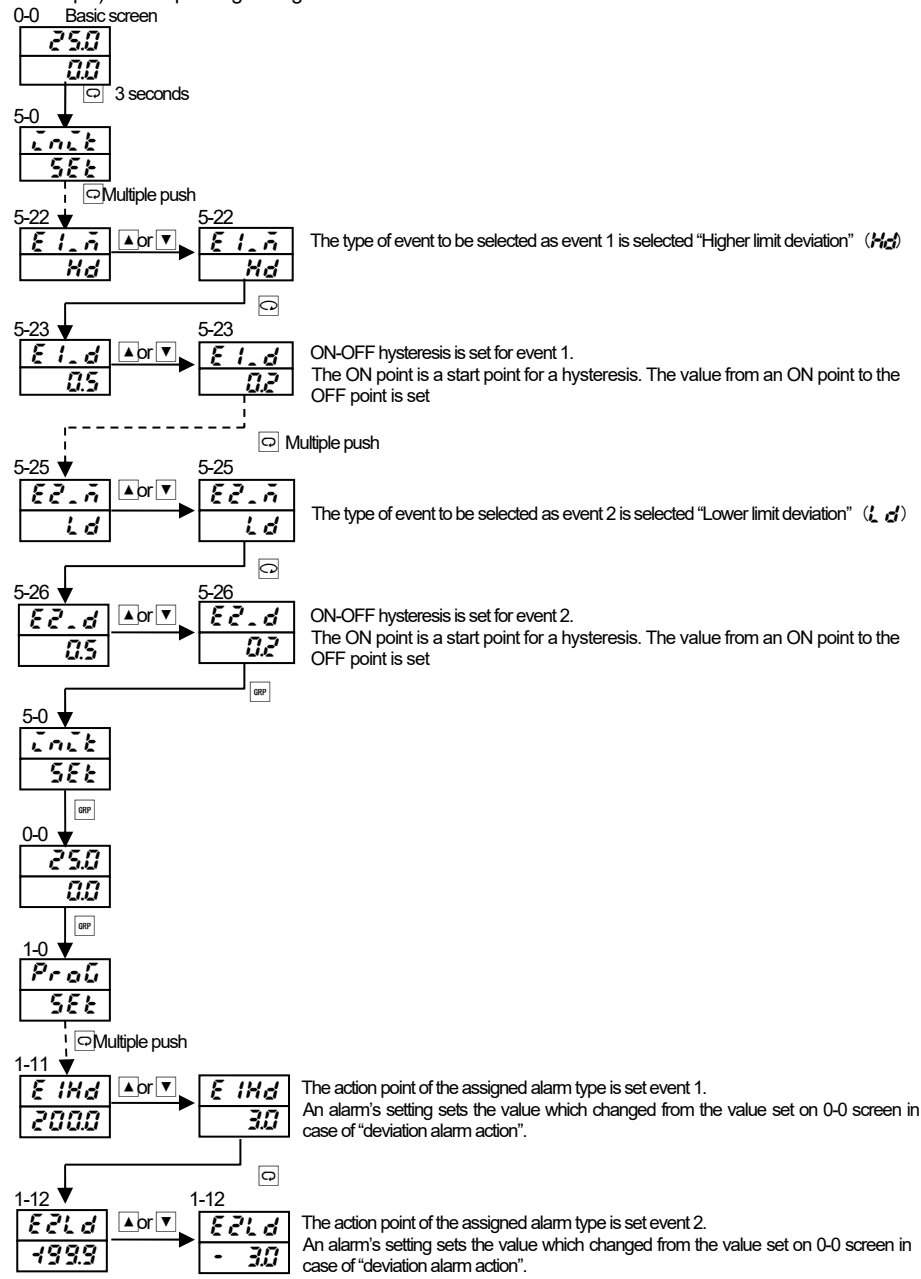


Event Output Setting

(The parameters to be set are different between program operation and fixed value operation)

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

Example) When operating the higher/lower deviation alarm at $\pm 3^\circ\text{C}$

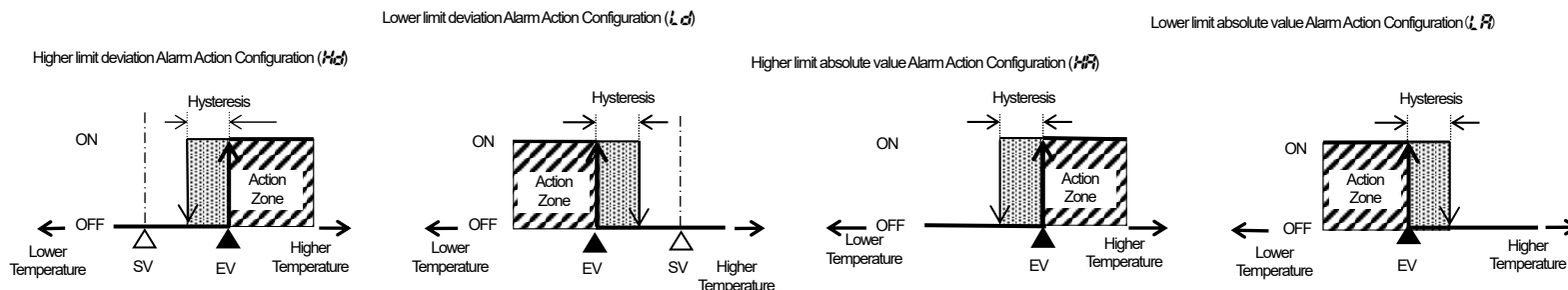


After that, repeat steps 2-1,2-2,2-3 for the number of steps.

Alarm Action Diagrams

The followings are diagrams showing alarm actions that can be selected as event 1 to event 3

Δ : SV value \blacktriangle : Alarm action point



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

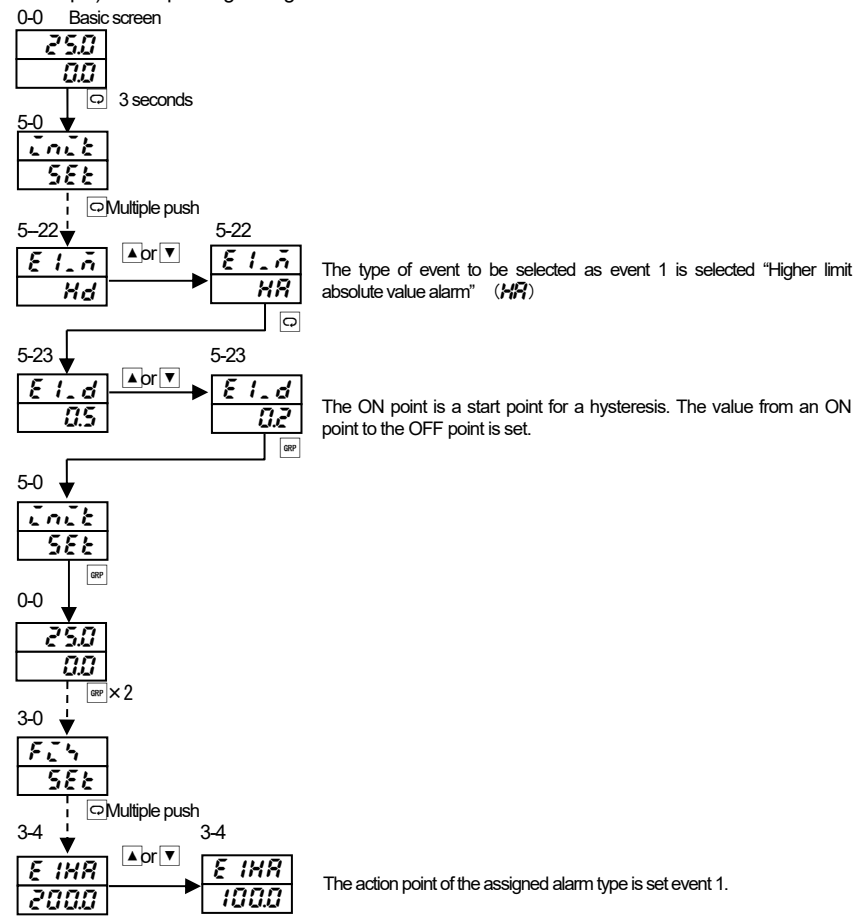


Table of Event TYPE (Alarm Type) Codes

Code	Type of event
nan	None
Hd	Higher limit deviation
Ld	Lower limit deviation
od	Outside higher/lower limit deviations
id	Within higher/lower limit deviations
HR	Higher limit absolute value
LR	Lower limit absolute value
So	Scaleover
Hold	Hold
GUA	Guarantee soak
ts1	Time signal 1
ts2	Time signal 2
run	RUN status
stp	Step signal
ends	End signal
FLY	Fixed value operation

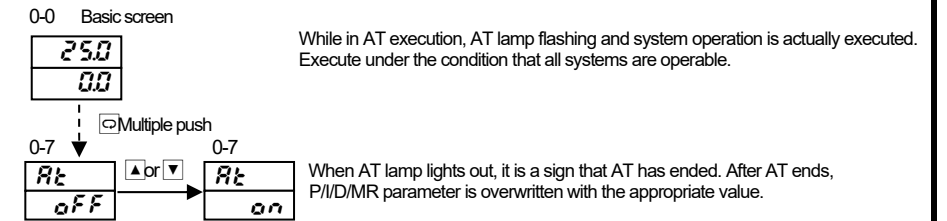
Operation mode setting

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

PID control mode (Auto tuning method)

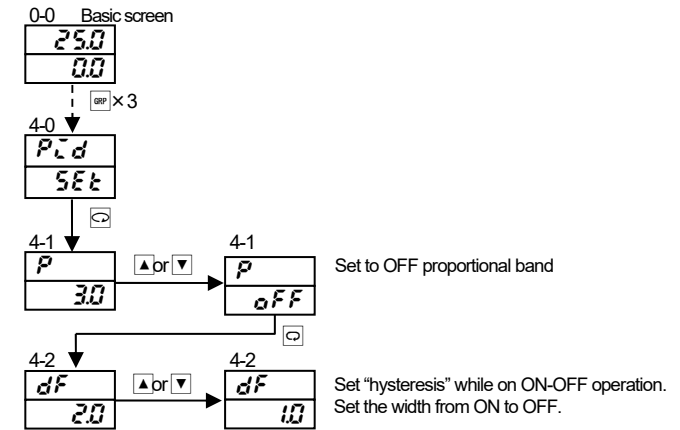
The operation mode already set PID control mode at Factory-set.

When using by a PID control mode, please carry out auto-tuning of following procedure.



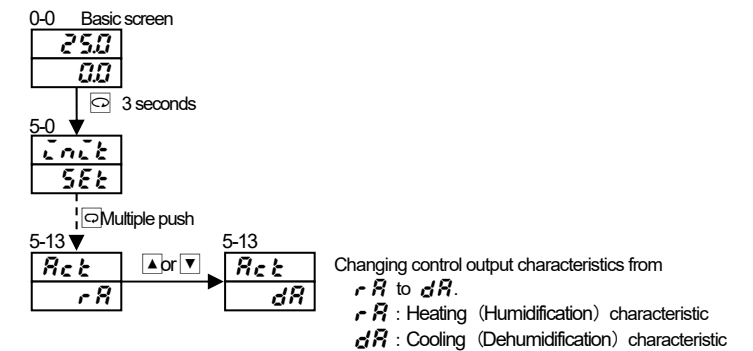
ON/OFF (2-position) control mode

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



Output characteristics switching

Set the characteristics of control output operation.



Measured value (PV) correction

This shows the correction method of measured value (PV).
 Example) When making a subtraction correction by $+1.0^\circ\text{C}$

