



Ramp/Soak Controller

PZ400/PZ900
PZ401/PZ901

Instruction Manual



NOTICE

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for explanation purpose.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- RKC is not responsible for any damage and/or injury resulting from the use of instruments made by imitating this instrument.
- Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.
- Every effort has been made to ensure accuracy of all information contained herein. RKC makes no warranty, expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.
- No portion of this document may be reprinted, modified, copied, transmitted, digitized, stored, processed or retrieved through any mechanical, electronic, optical or other means without prior written approval from RKC.
- Various symbols are used on the equipment, and they have the following meaning.

~ : Alternating current

⎓ : Both direct and alternating current

◻ : Reinforced insulation

⚠ : Safety precaution

This symbol is used where the instruction manual needs to be consulted for the safety of both the operator and the equipment. Carefully read the cautions in this manual before using the instrument.

- Windows is a trademark of Microsoft Corporation.
- Modbus is a registered trademark of Schneider Electric.
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Safety Precautions

■ Pictorial Symbols (safety symbols)

Various pictorial symbols are used in this manual to ensure safe use of the product, to protect you and other people from harm, and to prevent damage to property. The symbols are described below.

Be sure you thoroughly understand the meaning of the symbols before reading this manual.

 **WARNING** : This mark indicates precautions that must be taken if there is danger of electric shock, fire, etc., which could result in loss of life or injury.

 **CAUTION** : This mark indicates that if these precautions and operating procedures are not taken, damage to the instrument may result.

 : This mark indicates that all precautions should be taken for safe usage.

WARNING

- To prevent injury to persons, damage to the instrument and the equipment, a suitable external protection device shall be required.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to the instrument and the equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to the instrument and the equipment.
- This instrument is not intended for use in locations subject to flammable or explosive gases.
- Do not touch high-voltage connections such as power supply terminals, etc. to avoid electric shock.
- RKC is not responsible if this instrument is repaired, modified or disassembled by other than factory-approved personnel. Malfunction may occur and warranty is void under these conditions.



CAUTION

- This product is intended for use with industrial machines, test and measuring equipment. (It is not designed for use with medical equipment and nuclear energy plant.)
- This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take additional measures.
- This instrument is protected from electric shock by reinforced insulation. Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.
- Be sure to provide an appropriate surge control circuit respectively for the following:
 - If input/output or signal lines within the building are longer than 30 meters.
 - If input/output or signal lines leave the building, regardless the length.
- This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock to operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- All wiring must be in accordance with local codes and regulations.
- To prevent instrument damage as a result of failure, protect the power line and the input/output lines from high currents with a suitable overcurrent protection device with adequate breaking capacity such as a fuse, circuit breaker, etc.
- A malfunction in this product may occasionally make control operations impossible or prevent alarm outputs, resulting in a possible hazard. Take appropriate measures in the end use to prevent hazards in the event of malfunction.
- Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.
- Tighten each terminal screw to the specified torque found in the manual to avoid electric shock, fire or malfunction.
- For proper operation of this instrument, provide adequate ventilation for heat dissipation.
- Do not connect wires to unused terminals as this will interfere with proper operation of the instrument.
- Turn off the power supply before cleaning the instrument.
- Do not use a volatile solvent such as paint thinner to clean the instrument. Deformation or discoloration may occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to the instrument display, do not rub with an abrasive material or push the front panel with a hard object.

For Proper Disposal

When disposing of each part used for this instrument, always follows the procedure for disposing of industrial wastes stipulated by the respective local community.



Symbols

■ Pictorial Symbols (safety symbols)



NOTE : This mark indicates important information on installation, handling and operating procedures.



: This mark indicates supplemental information on installation, handling and operating procedures.



: This mark indicates where additional information may be located.

■ Character Symbols

11-segment character

0	1	2	3	4	5	6	7	8	9	Minus	Period
0	1	2	3	4	5	6	7	8	9	-	.
A	B (b)	C	c	D (d)	E	F	G	H	I	J	K
A	b	C	c	d	E	F	G	H	I	J	K
L	M	N	n	O (o)	P	Q	R	S	T	t	U
L	M	N	n	o	P	Q	R	S	T	t	U
u	V	W	X	Y	Z	Degree	/	Prime	* (Asterisk)	→	
u	V	W	X	Y	Z	°	/	'	*	→	

7-segment character

0	1	2	3	4	5	6	7	8	9	Minus	Period
0	1	2	3	4	5	6	7	8	9	-	.
A	B (b)	C	c	D (d)	E	F	G	H	I	J	K
A	b	C	c	d	E	F	G	H	I	J	K
L	M	N (n)	O (o)	P	Q	R	S	T	t	U	u
L	M	N	O	P	Q	R	S	T	t	U	u
V	W	X	Y	Z	Degree	/	Prime	* (Asterisk)			
V	W	X	Y	Z	°	/	'	*			



■ Abbreviation symbols

These abbreviations are used in this manual:

Abbreviation symbols	Name	Abbreviation symbols	Name
PV	Measured value	TC (input)	Thermocouple (input)
SV	Set value	RTD (input)	Resistance temperature detector (input)
MV	Manipulated output value	V (input)	Voltage (input)
AT	Autotuning	I (input)	Current (input)
ST	Startup tuning	HBA (1, 2)	Heater break alarm (1, 2)
OUT (1 to 3)	Output (1 to 3)	CT (1, 2)	Current transformer (1, 2)
DI (1 to 6)	Digital input (1 to 6)	LBA	Control loop break alarm
DO (1 to 4)	Digital output (1 to 4)	LBD	LBA deadband
FBR	Feedback resistance		



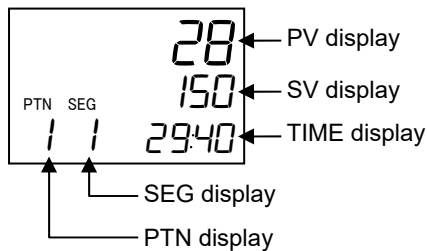
■ Screens used in this manual

Pictures of PZ400/900/401/901 displays are used for explanation in this manual. Please understand this manual is written with the below descriptive manner.

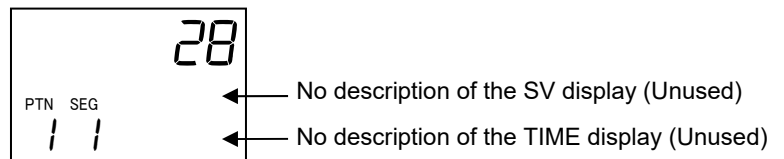
- On PZ400/900/401/901 display, there are also displays for the PV, SV, TIME, PTN and SEG. Those displays are always described on explanation pictures when they are necessary to be displayed for an operation. For example when only the PV and SV displays are necessary, the other displays are not described on explanation pictures.

[Example of all displays are described and used]

Monitor & Program setting mode
PV/SV monitor
(Program control mode)



Monitor & Program setting mode
PV/SV monitor
(Reset mode)



[Example of only the PV and SV displays are described and used for an operation]

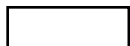
Engineering Mode
Function block
No. 00 [Program]



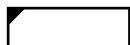
Proportional band
[heat-side]



- In the explanation of the operating navigation “**6. SELECTING PARAMETERS (P. 6-1)**,” such display frames as shown below are used to show the difference.



Parameters always displayed



Parameters that are displayed if the display requirements are satisfied.



Document Configuration

There are six manuals pertaining to this product. Please be sure to read all manuals specific to your application requirements.

The following manuals can be downloaded from the official RKC website:

<https://www.rkcinst.co.jp/english/download-center/>

Manual	Manual Number	Remarks
PZ400/PZ900/PZ401/PZ901 Installation Manual	IMR03B01-E□	This manual is enclosed with instrument. This manual explains the mounting and wiring.
PZ400/PZ900/PZ401/PZ901 Quick Operation Manual	IMR03B02-E□	This manual is enclosed with instrument. This manual explains the basic key operation, mode menu, and data setting.
PZ400/PZ900/PZ401/PZ901 Parameter List	IMR03B03-E□	This manual is enclosed with instrument. This list is a compilation of the parameter data of each mode.
PZ400/PZ900/PZ401/PZ901 Instruction Manual	IMR03B05-E6	This manual you are reading now. This manual describes installation, wiring, operation of each function, and troubleshooting.
PZ400/PZ900/PZ401/PZ901 Host Communication Instruction Manual	IMR03B06-E□	This manual explains RKC communication protocol (ANSI X3.28-1976) and Modbus relating to communication parameters setting.
PZ400/PZ900/PZ401/PZ901 PLC Communication Instruction Manual	IMR03B07-E□	This manual describes how to set up the instrument for communication with a programmable controller (PLC).



Read this manual carefully before operating the instrument. Please place the manual in a convenient location for easy reference.

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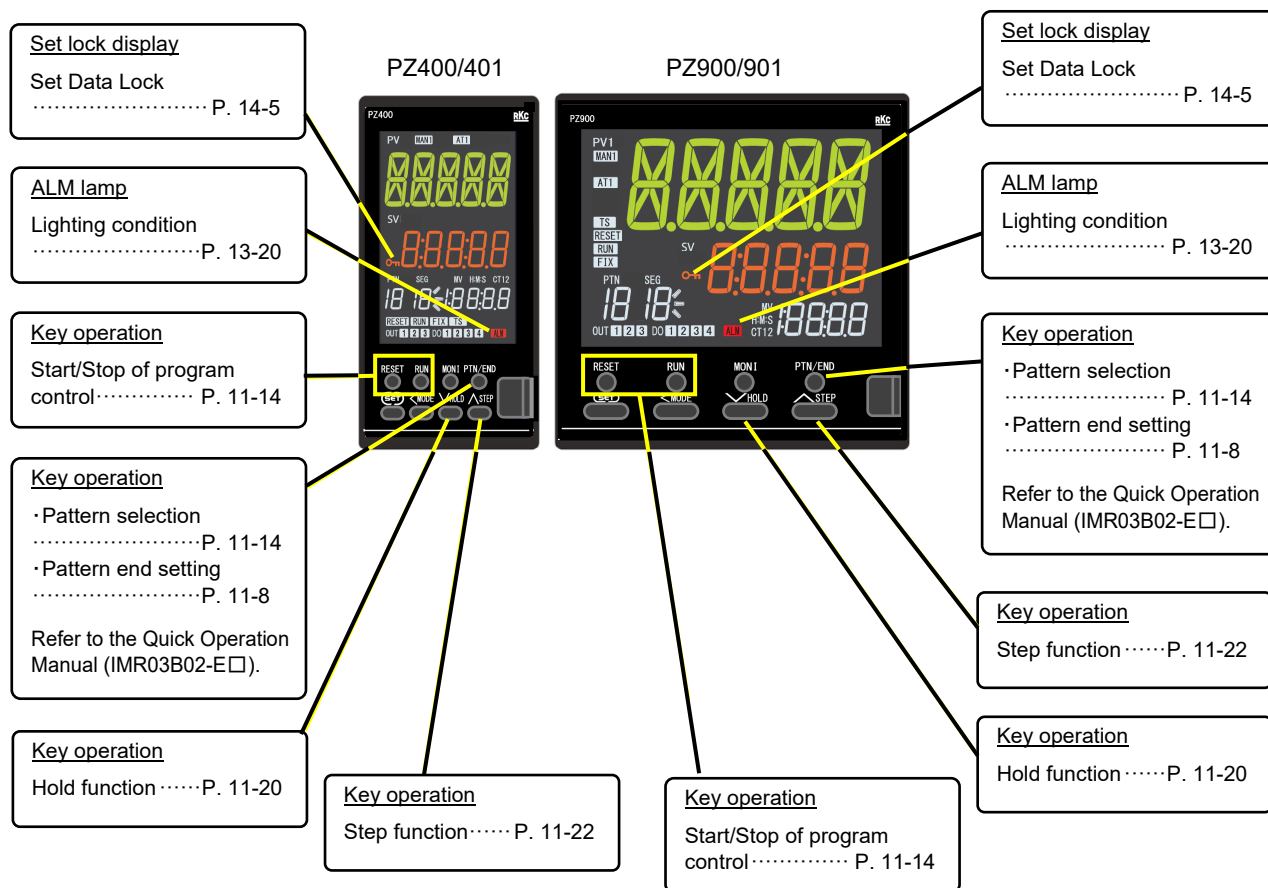
INDEX [Character order] B-7



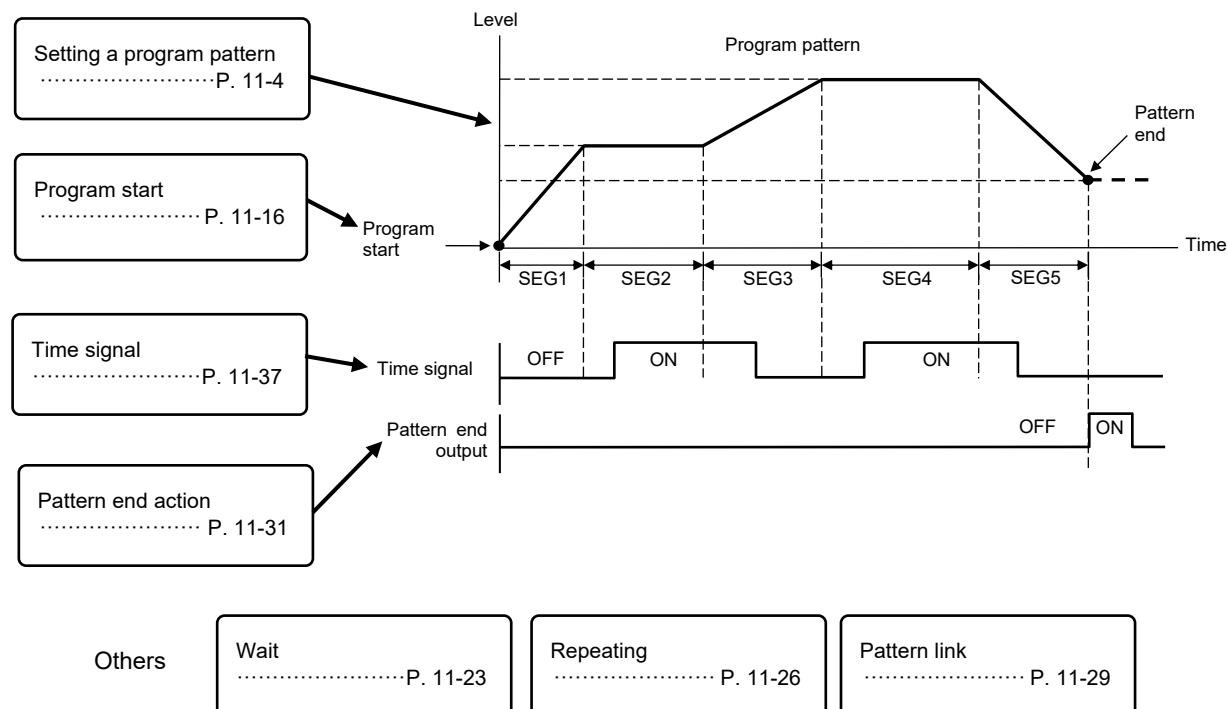
Pictorial table of contents

Pages that mainly describe the hardware are shown.

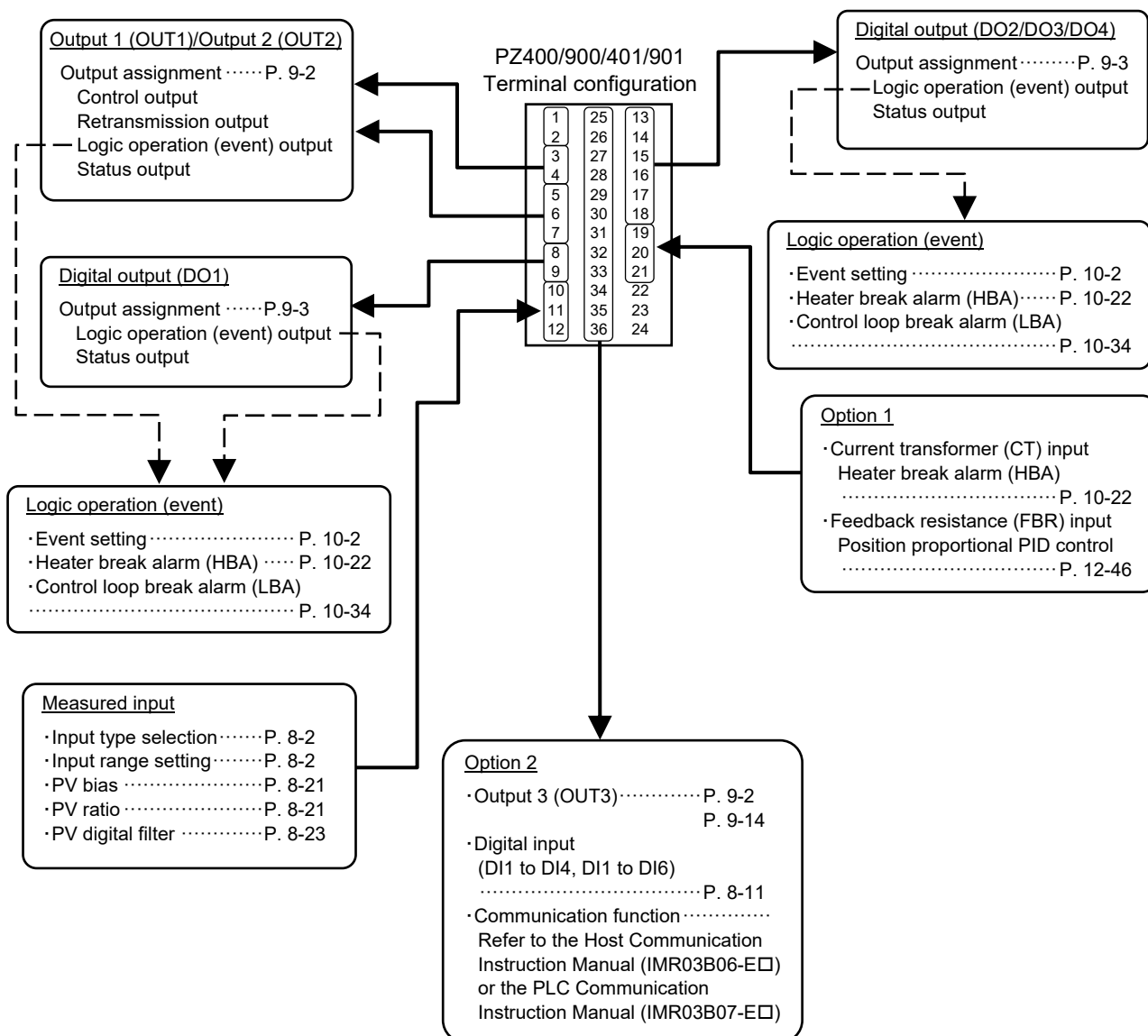
■ Front view



[Program]



■ Terminal block





OUTLINE

1

This chapter describes features, package contents, model code, etc.

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1.1 Features

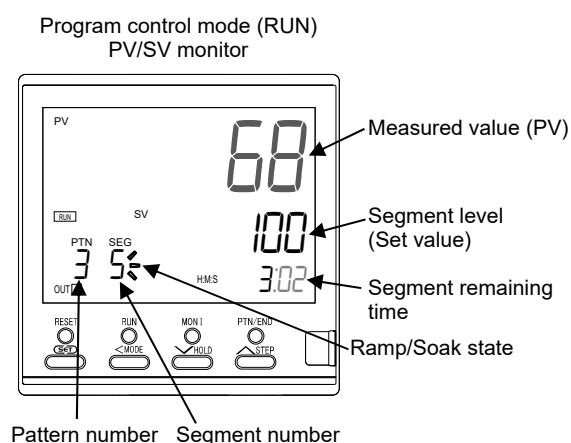
This Ramp/Soak Controller has the following features:

Display

Easy-to-read display

During the program operation, the following information can be easily checked on the PV/SV monitor screen.

- Program pattern No. in Execution
- Segment No. and Ramp/Soak status in the Program pattern now in Execution
- Measured value (PV)
- Segment level (Set value)
- Segment remaining time

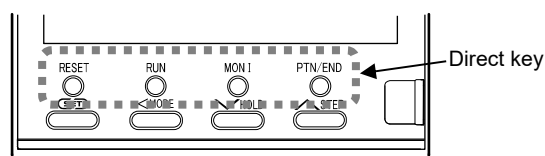


Overall level autotuning (AT)

All soak segments in the program pattern will be automatically searched by simple key operations and the Autotuning (AT) is executed. The calculated PID values will be automatically set to the instrument.

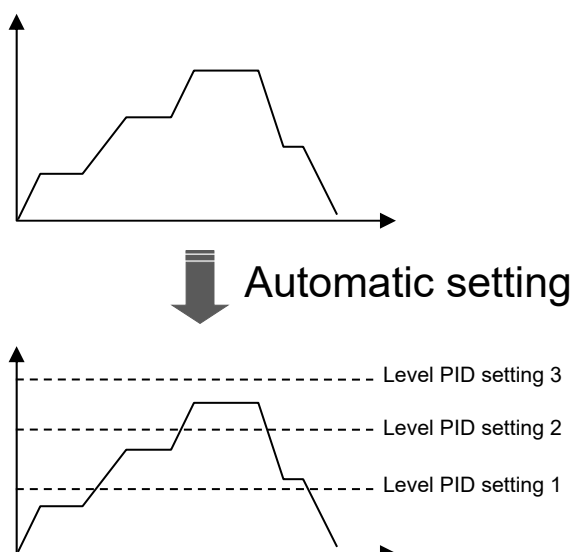
Improved operatability

Direct keys can be assigned to frequently used functions. For example, program operation can be started/stopped without switching the parameters.



Automatic setting of Level PID range

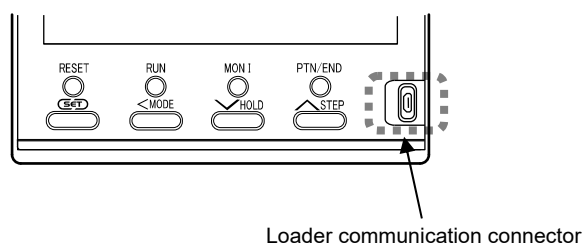
When a program pattern is preset, the level PID range (level PID set value) can be automatically set by simple key operations.



Communication

Loader communication connector is supplied as standard on the front panel (PZ400/900/401/901). Using our USB communication converter (COM-K2 or COM-KG) and our communication tool (PROTEM2)*, the loader communication is possible to easily store and copy the set values.

* Download the software from the official RKC website.





1.2 Checking the Product

Before using this product, check each of the following:

- Model code
- Check that there are no scratches or breakage in external appearance (case, front panel, or terminal, etc.)
- Check that all of the items delivered are complete. (Refer to below)

Accessories	Q'TY	Remarks	
☐ Instrument	1	_____	
☐ Mounting bracket (with screw)	2	PZ900/901 Waterproof/Dustproof type: 4	
☐ PZ400/PZ900/PZ401/PZ901 Installation Manual (IMR03B01-E□)	1	Enclosed with instrument	
☐ PZ400/PZ900/PZ401/PZ901 Quick Operation Manual (IMR03B02-E□)	1	Enclosed with instrument	
☐ PZ400/PZ900/PZ401/PZ901 Parameter List (IMR03B03-E□)	1	Enclosed with instrument	
☐ PZ400/PZ900/PZ401/PZ901 Instruction Manual (IMR03B05-E6)	1	This manual (sold separately)	This manual can be downloaded from the official RKC website.
☐ PZ400/PZ900/PZ401/PZ901 Host Communication Instruction Manual (IMR03B06-E□)	1	Sold separately	
☐ PZ400/PZ900/PZ401/PZ901 PLC Communication Instruction Manual (IMR03B07-E□)	1	Sold separately	
☐ Gasket KFB400-36 (PZ400/401) KFB900-36 (PZ900/901)	1	Optional (Waterproof/Dustproof type)	
☐ Terminal cover KFB400-58 (PZ400/900/401/901)	Depending on the order quantity	Optional (sold separately)	
☐ Front cover KRB400-36 (PZ400/401) KRB900-36 (PZ900/901)	Depending on the order quantity	Optional (sold separately)	
☐ CT (Current transformer for heater break alarm) CTL-6-P-Z [for 0.0 to 10.0 A] CTL-6-P-N [for 0.0 to 30.0 A] CTL-12-S56-10L-N [for 0.0 to 100.0 A]	Depending on the order quantity	Optional (sold separately)	



If any of the above are missing, damaged, or if your manual is incomplete, please contact RKC sales office or the agent.



1.3 Model Code

Check that the product received is correctly specified by referring to the following model code list:

If the product is not identical to the specifications, please contact RKC sales office or the agent.

1.3.1 Suffix code

PZ400

PZ900

PZ401

PZ901

□ □ □ □ — □ □ □ * □ □ □ □ / □
(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

PZ400/PZ900:
PV display: Green
PZ401/PZ901:
PV display: White

Specification		Suffix code									
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control method	PID control with AT (Reverse action)	F									
	PID control with AT (Direct action)	D									
	Heat/Cool PID control with AT	G									
	Heat/Cool PID control with AT (for Extruder [air cooling])	A									
	Heat/Cool PID control with AT (for Extruder [water cooling])	W									
	Position proportioning PID control with AT (Reverse action)	Z									
	Position proportioning PID control with AT (Direct action)	C									
Measured input and Range	Refer to Range Code Table (P. 1-10)	□□□									
Output 1 (OUT1) ¹	None			N							
	Relay contact output			M							
	Voltage pulse output (0/12 V DC)			V							
	Continuous voltage output (0 to 5 V DC)			4							
	Continuous voltage output (0 to 10 V DC)			5							
	Continuous voltage output (1 to 5 V DC)			6							
	Current output (0 to 20 mA DC)			7							
	Current output (4 to 20 mA DC)			8							
	Transistor output			B							
Output 2 (OUT2) ²	None			N							
	Relay contact output			M							
	Voltage pulse output (0/12 V DC)			V							
	Continuous voltage output (0 to 5 V DC)			4							
	Continuous voltage output (0 to 10 V DC)			5							
	Continuous voltage output (1 to 5 V DC)			6							
	Current output (0 to 20 mA DC)			7							
	Current output (4 to 20 mA DC)			8							
	Transistor output			B							
Power supply voltage	24 V AC/DC					3					
	100 to 240 V AC					4					
Digital output (DO) ³	Digital output [1 point] (DO1)						1				
	Digital output [4 points] (DO1 to DO4)						4				
Option 1	None							N			
	CT input [2 points] (CT1, CT2) [CTL-6-P-N] ⁴							T			
	CT input [2 points] (CT1, CT2) [CTL-12-S56-10L-N] ⁴							U			
	CT input [2 points] (CT1, CT2) [CTL-6-P-Z] ⁴							V			
	Feedback resistance (FBR) input							W			
Option 2	None								N		
	Output 3 (OUT3) ⁵								A		
	Digital input [6 points] (DI1 to DI6) ⁶								B		
	Communication (RS-422A) ⁷								C		
	Communication (RS-485) ⁷								D		
	Output 3 (OUT3) ⁵ + Digital input [6 points] (DI1 to DI6) ⁶								E		
	Output 3 (OUT3) ⁵ + Communication (RS-422A) ⁷								F		
	Output 3 (OUT3) ⁵ + Communication (RS-485) ⁷								G		
	Output 3 (OUT3) ⁵ + Digital input [4 points] (DI1 to DI4) ⁶ + Communication (RS-422A) ⁷								H		
	Output 3 (OUT3) ⁵ + Digital input [6 points] (DI1 to DI6) ⁶ + Communication (RS-485) ⁷								J		
Waterproof/Dustproof (optional)	None									N	
	Waterproof/Dustproof (IP65)									1	
Quick start code	Quick start code not specified										N
	Specify quick start code										1



- ¹ The function of Output 1(OUT1) is preset to "Control output [heat-side] or [open-side]."
- ² The function of Output 2 (OUT2) is preset as follows.

- When "PID control with AT" is selected for the control action:

Output 2 (OUT2)	OUT2 function
M: Relay contact output	Control output [heat-side] or [open-side]
V: Voltage pulse output (0/12 V DC)	
B: Transistor output	
4: Continuous voltage output (0 to 5 V DC)	Retransmission output (The output type of Retransmission output is preset to "Measured value (PV).")
5: Continuous voltage output (0 to 10 V DC)	
6: Continuous voltage output (1 to 5 V DC)	
7: Current output (0 to 20 mA DC)	
8: Current output (4 to 20 mA DC)	

- When "Heat/Cool PID control with AT" or "Position proportioning PID control with AT" is selected for the control action:
The function of Output 2 (OUT2) is preset to "Control output [cool-side] or "close side."

- ³ When the Initial setting code is not specified, the content of the digital output (DO) is set as follows.

Digital output (DO)	Output content
Digital output 1 (DO1)	Deviation high of the event 1
Digital output 2 (DO2)	Deviation low of the event 2
Digital output 3 (DO3)	Time signal 1
Digital output 4 (DO4)	Pattern end signal

- ⁴ Both CT1 and CT2 are assigned to Output 1 (OUT1).
When a current transformer (CT) input is not specified, CT is assigned to "None."
- ⁵ When OUT3 is selected, the output signal is set as follows.
Current output (4 to 20 mA DC), Retransmission output [The output type is measured value (PV).]
- ⁶ When Digital input (DI) is selected, the function of the DI is set as follows.

Digital input (DI)	DI function
Digital input 1 (DI1)	Reset mode (RESET) setting
Digital input 2 (DI2)	Program control mode (RUN) setting
Digital input 3 (DI3)	Step function
Digital input 4 (DI4)	Hold function
Digital input 5 (DI5)	Interlock release
Digital input 6 (DI6)	Set data unlock/lock transfer

- ⁷ When the Initial setting code is not specified, the communication protocol is preset to RKC communication.



1.3.2 Quick start code (Initial setting code)

Quick start code tells the factory to ship with each parameter preset to the values detailed as specified by the customer. Quick start code is not necessarily specified when ordering, unless the preset is requested.

These parameters are software selectable items and can be re-programmed in the field following procedures found in the manual.

□ □ □ □ — □
(1) (2) (3) (4) (5)

Specification		Initial setting code				
		(1)	(2)	(3)	(4)	(5)
Function selection of digital output (DO1)	None	N				
	Supplied. [Refer to the function code table of the Digital output (DO)] ²	□				
Function selection of digital output (DO2) ¹	None		N			
	Supplied. [Refer to the function code table of the Digital output (DO)] ³		□			
Function selection of digital output (DO3) ¹	None			N		
	Supplied. [Refer to the function code table of the Digital output (DO)] ⁴			□		
Function selection of digital output (DO4) ¹	None				N	
	Supplied. [Refer to the function code table of the Digital output (DO)] ⁵				□	
Communication protocol ⁶	None					N
	RKC communication (ANSI X3.28-1976)					1
	Modbus					2
	PLC communication: MITSUBISHI MELSEC series special protocol (QnA-compatible 3C frame format 4)					3

¹ "Digital output 1 point (DO1)" is specified at the time of order.

If Digital output 2 (DO2) to Digital output 4 (DO4)'s functions are selected at quick start code (initial setting code), no signal will be output. Since selected functions are available, ON/OFF states of DO2 to DO4 functions can be checked via communication function.

² When any one of A, B, C, D, E, F, G, H, J, K, L, V, W is selected in the Digital output (DO) function code table, output is provided from Event 1.

³ When any one of A, B, C, D, E, F, G, H, J, K, L, V, W is selected in the Digital output (DO) function code table, output is provided from Event 2.

⁴ When any one of A, B, C, D, E, F, G, H, J, K, L, V, W is selected in the Digital output (DO) function code table, output is provided from Event 3.

⁵ When any one of A, B, C, D, E, F, G, H, J, K, L, V, W is selected in the Digital output (DO) function code table, output is provided from Event 4.

⁶ When a "Communication" option is not selected, only "N: No communication function" is selectable.

Digital output (DO) function code

Code	Output content
N	None
A	Deviation high (Using SV monitor value)
B	Deviation low (Using SV monitor value)
C	Deviation high/low (Using SV monitor value)
D	Band (Using SV monitor value)
E	Deviation high with hold action (Using SV monitor value)
F	Deviation low with hold action (Using SV monitor value)
G	Deviation high/low with hold action (Using SV monitor value)
H	Process high
J	Process low
K	Process high with hold action
L	Deviation low with hold action
P	Heater break alarm 1 (HBA1)
Q	Heater break alarm 2 (HBA2)
R	Control loop break alarm (LBA)
S	Fail output
V	SV high (Using SV monitor value)
W	SV low (Using SV monitor value)
1	Time signal 1
2	Time signal 2
3	Time signal 3
4	Time signal 4
5	Logical OR of Time signal 1 and Time signal 2
6	Pattern end signal
7	Output of Program control mode (RUN) state

1.3.3 Range Code Table



The input range can be changed later within the range of the input range table even if the input range is specified at the time of order.



For details on changing the input range, refer to **8.1 Changing Input (P.8-2)**.

● Thermocouple (TC) input

Input type	Code	Range	See Note
K	K01	0 to 200 °C	4
	K02	0 to 400 °C	4
	K03	0 to 600 °C	4
	K04	0 to 800 °C	4
	K06	0 to 1200 °C	4
	K07	0 to 1372 °C	4
	K08	−199.9 to +300.0 °C	4
	K09	0.0 to 400.0 °C	4
	K10	0.0 to 800.0 °C	4
	K14	0 to 300 °C	4
	K41	−200 to +1372 °C	4
	K42	−200.0 to +1372.0 °C	5
	KA1	0 to 800 °F	4
	KA2	0 to 1600 °F	4
	KA3	0 to 2502 °F	4
J	J01	0 to 200 °C	4
	J02	0 to 400 °C	4
	J03	0 to 600 °C	4
	J04	0 to 800 °C	4
	J08	0.0 to 400.0 °C	4
	J29	−200.0 to +1200.0 °C	5
	JA1	0 to 800 °F	4
	JA3	0 to 2192 °F	4
	JA6	0 to 400 °F	4

Input type	Code	Range	See Note
T	T01	−199.9 to +400.0 °C	4
	T02	−199.9 to +100.0 °C	4
	T03	−100.0 to +200.0 °C	4
	T19	−200.0 to +400.0 °C	5
R	R01	0 to 1600 °C	4
	R07	−50 to +1768 °C	4
	R08	−50.0 to +1768.0 °C	5
	R09	0.0 to 1600.0 °C	5
S	S06	−50 to +1768 °C	4
	S07	−50.0 to +1768.0 °C	5
B	B03	0 to 1800 °C	4
	B04	0.0 to 1800.0 °C	5
E	E01	0 to 800 °C	4
	E23	0.0 to 800.0 °C	4
N	N02	0 to 1300 °C	4
	N05	0.0 to 1300.0 °C	5
W5Re/ W26Re	W03	0 to 2300 °C	4
PL II	A01	0 to 1300 °C	4
	A05	0.0 to 1300.0 °C	5
U	U01	−199.9 to +600.0 °C	4
L	L04	0.0 to 900.0 °C	4
PR40-20	F02	0 to 1800 °C	5
	FA2	0 to 3200 °F	5

● RTD input

Input type	Code	Range	See Note
Pt100	D01	−199.9 to +649.0 °C	4
	D04	−100.0 to +100.0 °C	4
	D05	−100.0 to +200.0 °C	4
	D06	0.0 to 50.0 °C	4
	D07	0.0 to 100.0 °C	4
	D08	0.0 to 200.0 °C	4
	D09	0.0 to 300.0 °C	4
	D10	0.0 to 500.0 °C	4
	D12	−199.9 to +600.0 °C	4

Input type	Code	Range	See Note
Pt100	D21	−200.0 to +200.0 °C	5
	D27	0.00 to 50.00 °C	4
	D34	−100.00 to +100.00 °C	5
	D35	−200.0 to +850.0 °C	5
	DA1	−199.9 to +999.9 °F	4
	DA9	0.0 to 500.0 °F	4
	P08	0.0 to 200.0 °C	4
JPt100	P29	−100.00 to +100.00 °C	5
	P30	−200.0 to +640.0 °C	5

● Voltage/Current input

Input type	Code	Range	See Note
0 to 10 mV DC	101	Programmable range −19999 to +99999 (Factory set value 0.0 to 100.0)	5
0 to 100 mV DC	201		5
0 to 1 V DC	301		5
0 to 5 V DC	401		5
0 to 10 V DC	501		5

Input type	Code	Range	See Note
1 to 5 V DC	601	Programmable range −19999 to +99999 (Factory set value 0.0 to 100.0)	5
0 to 20 mA DC	701		5
4 to 20 mA DC	801		5
−10 to +10 V DC	904		5
−5 to +5 V DC	905		5

Note The number of displayed digits of the measured value.

In case of RKC communication, if the displayed data is 4 digits, it is handled as 6-digit data. If the displayed data is 5 digits, it is handled as 7-digit data. In case of Modbus communication, the 4-digit display is handled as a “single word” and the 5-digit display is handled as a “double word *”.

* Order of data transfer: upper word to lower word



MEMO



MOUNTING

2

This chapter describes mounting cautions, dimensions and mounting procedures.

2.1 Mounting Cautions	2-2
2.2 Dimensions	2-3
2.3 Procedures of Mounting and Removing	2-4
■ The mounting position of the mounting brackets	2-4
■ Mounting procedures (Standard type).....	2-5
■ Mounting procedures (Waterproof/Dustproof type).....	2-6
■ Removal procedures	2-7



2.1 Mounting Cautions

WARNING

To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.

- (1) This instrument is intended to be used under the following environmental conditions. **(IEC 61010-1)**
[OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]
- (2) Use this instrument within the following environment conditions:
 - Allowable ambient temperature: -10 to $+55$ °C
 - Allowable ambient humidity: 5 to 95 %RH
(Absolute humidity: MAX.W.C 29 g/m³ dry air at 101.3 kPa)
 - Installation environment conditions: Indoor use
Altitude up to 2000 m
Short-term temporary overvoltage: 1440 V
Long-term temporary overvoltage: 490 V
- (3) Avoid the following conditions when selecting the mounting location:
 - Rapid changes in ambient temperature which may cause condensation.
 - Corrosive or inflammable gases.
 - Direct vibration or shock to the mainframe.
 - Water, oil, chemicals, vapor or steam splashes.
 - Excessive dust, salt or iron particles.
 - Excessive induction noise, static electricity, magnetic fields or noise.
 - Direct air flow from an air conditioner.
 - Exposure to direct sunlight.
 - Excessive heat accumulation.
- (4) Mount this instrument in the panel considering the following conditions:
 - Provide adequate ventilation space so that heat does not build up.
 - Ensure at least 50 mm space on top and bottom of the instrument for maintenance and environmental reasons.
 - Do not mount this instrument directly above the equipment that generates large amount of heat (heaters, transformers, thyristor units, large-wattage resistors.)
 - If the ambient temperature rises above 55 °C, cool this instrument with a forced air cooling fan, cooling unit, etc. Cooled air should not blow directly on this instrument.
 - In order to improve safety and the immunity to withstand noise, mount this instrument as far away as possible from high voltage equipment, power lines, and rotating machinery.
 - High voltage equipment: Do not mount within the same panel.
 - Power lines: Separate at least 200 mm.
 - Rotating machinery: Separate as far as possible.
 - For correct functioning mount this instrument in a horizontal position.
- (5) In case this instrument is connected to a supply by means of a permanent connection, a switch or circuit-breaker shall be included in the installation. This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment.



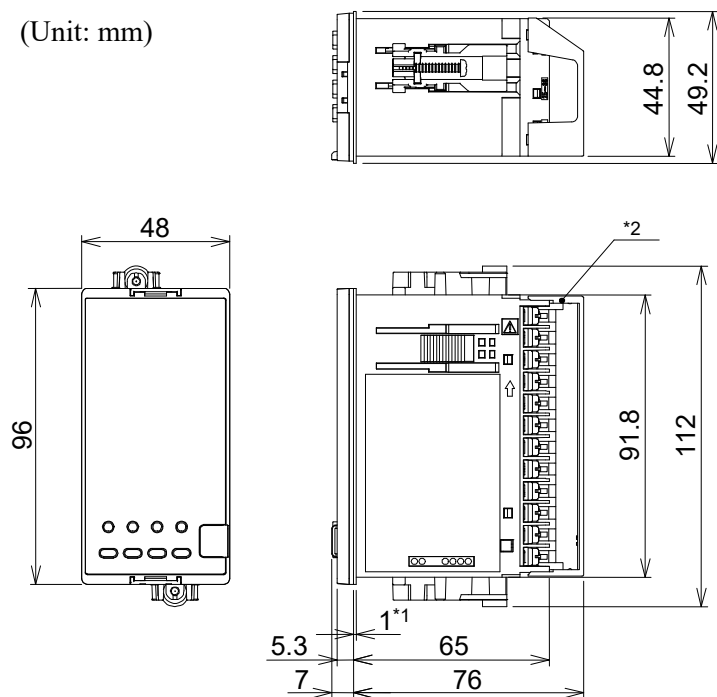
2.2 Dimensions

Panel thickness: 1 to 10 mm

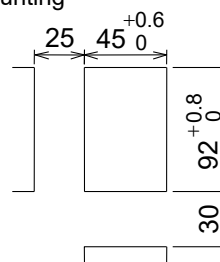
(When mounting multiple PZ400/900/401/901 controllers close together, the panel strength should be checked to ensure proper support.)

■ PZ400/PZ401

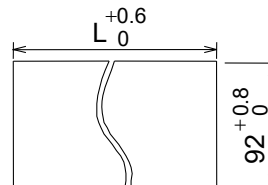
(Unit: mm)



Individual mounting ^{*3}



Close horizontal mounting ^{*4}

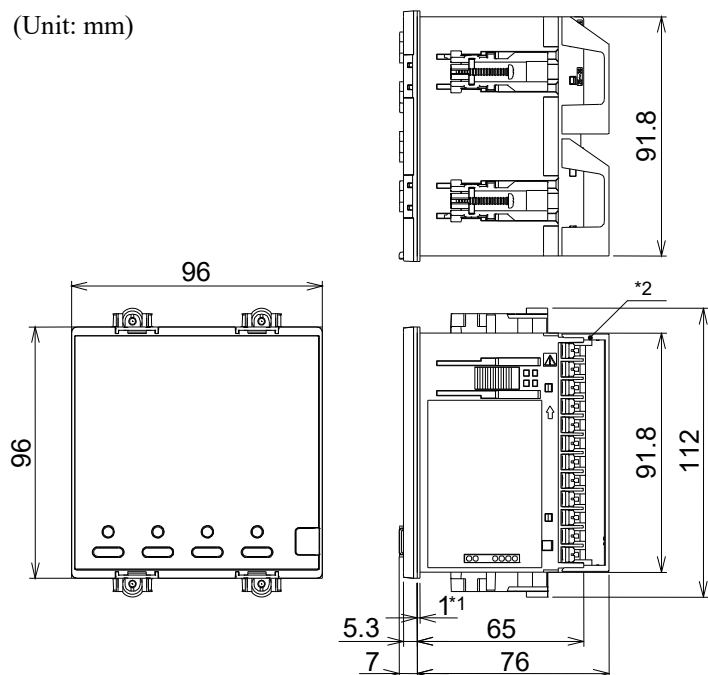


$$L = 48 \times n - 3$$

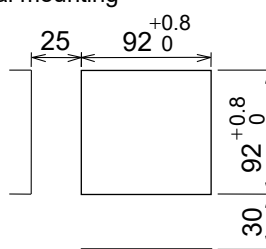
n = Number of controllers (2 to 6)

■ PZ900/PZ901

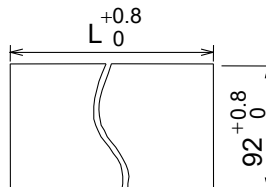
(Unit: mm)



Individual mounting ^{*3}



Close horizontal mounting ^{*4}



$$L = 96 \times n - 4$$

n = Number of controllers (2 to 6)

*1 Gasket (optional)

*2 Terminal cover (optional) [sold separately]

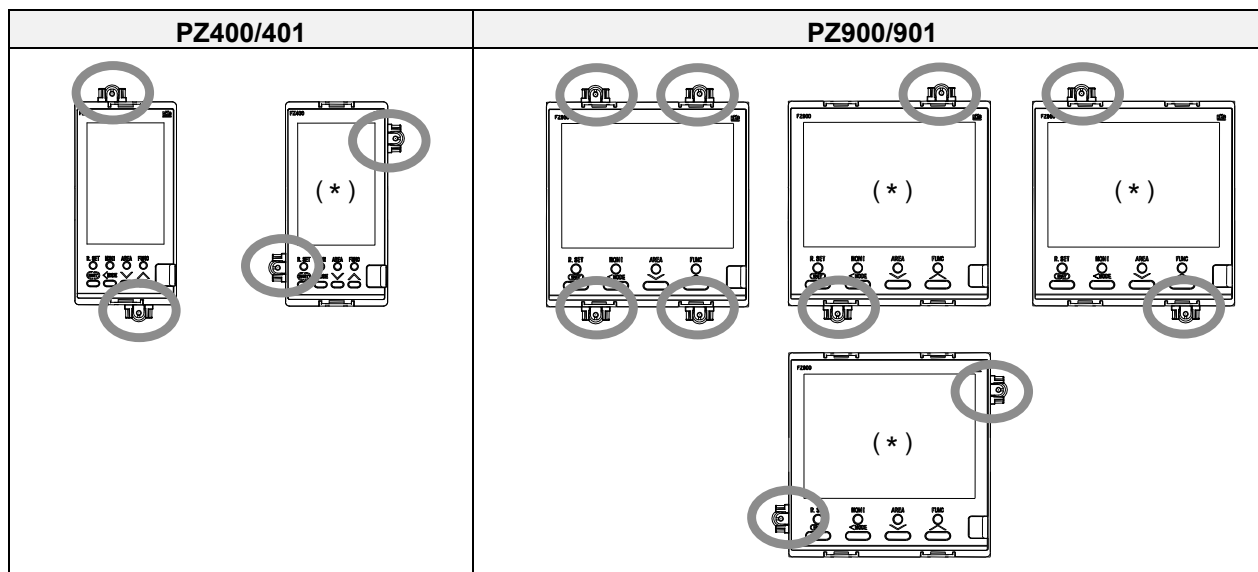
*3 To keep the instrument as waterproof as possible, make sure that the panel surface has no burr or distortion where the hole is to be cut out.

*4 Remove the gasket. When the PZ400/900/401/901 is mounted closely protection will be compromised and they will not meet IP65 standards.

2.3 Procedures of Mounting and Removing

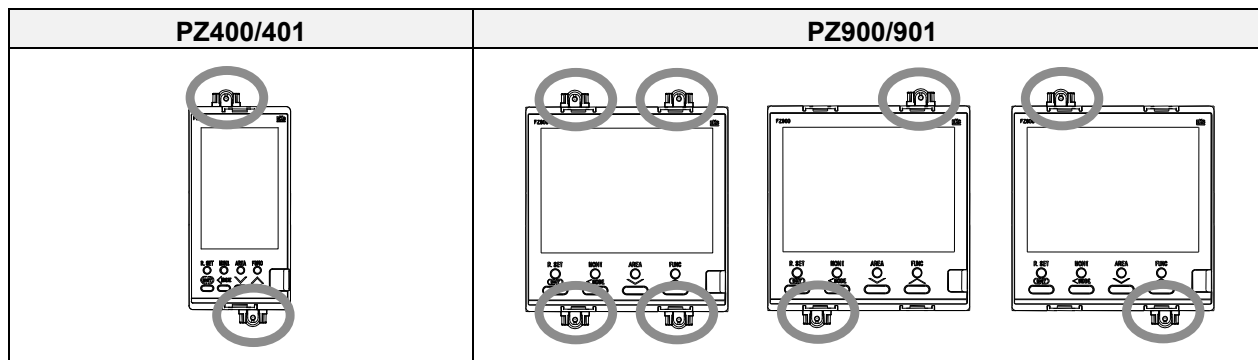
■ The mounting position of the mounting brackets

● Mounting positions for a single controller



(*) PZ400/401 with mounting brackets attached on the side and PZ900/901 mounted with two mounting brackets do not provide water and dustproof protection.

● Mounting positions for close mounting

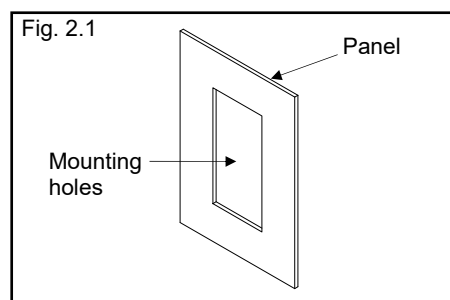


When mounted closely, the controllers are not waterproof or dustproof.

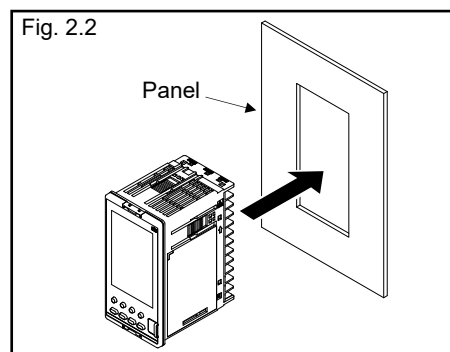
■ Mounting procedures (Standard type)

1. Prepare the panel cutout as specified in Fig. 2.1.
(Panel thickness: 1 to 10 mm)

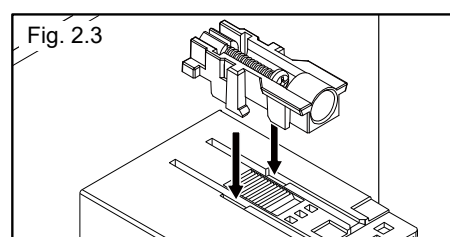
Refer to **2.2 Dimensions (P. 2-3)**.



2. Insert the instrument through the panel cutout. (Fig. 2.2)



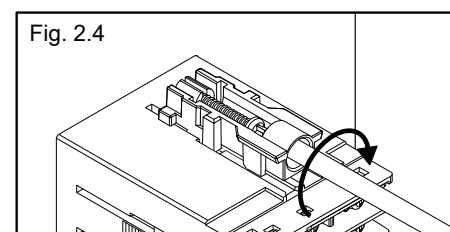
3. Insert the mounting bracket into the mounting groove of the instrument. (Fig. 2.3)
Do not push the bracket forcibly forward.



4. Tighten up the screw for the mounting bracket with a Phillips screwdriver so that the mounting bracket is firmly secured in place. (Fig. 2.4)
Give the screw another turn when the tip of the screw touches the panel.



Do not overtighten the screw. It may turn idle.
In case the screw has been overtightened to turn idle,
loosen the screw, then tighten the screw again until
the instrument is firmly fixed.



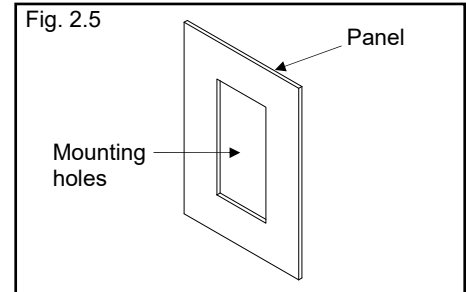
5. The other mounting bracket(s) should be installed in the same way as described in 3 and 4.

■ Mounting procedures (Waterproof/Dustproof type)

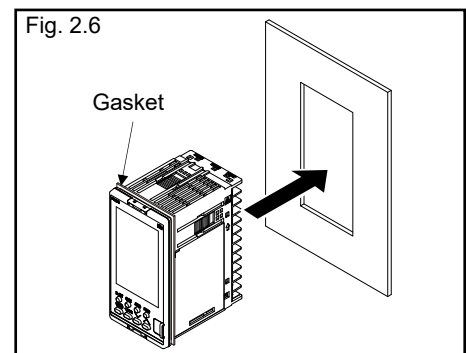
The front of the instrument conforms to **IP65** [Specify when ordering] when mounted on the panel. For effective Waterproof/Dustproof, the gasket must be securely placed between the instrument and the panel without any gap. If a gasket is damaged, please contact RKC sales office or the agent.

1. Prepare the panel cutout as specified in Fig. 2.5.
(Panel thickness: 1 to 10 mm)

Refer to **2.2 Dimensions (P. 2-3)**.



2. Set the waterproof/dustproof gasket (optional) on the case from the back side of the instrument as shown in Fig. 2.6. Insert the instrument through the panel cutout.

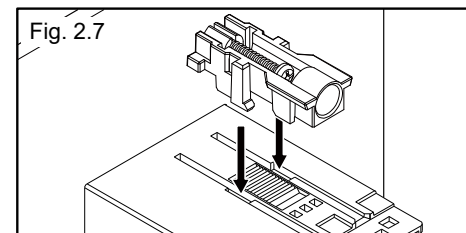


3. Insert the mounting bracket into the mounting groove of the instrument. (Fig. 2.7)
Do not push the bracket forcibly forward.



NOTE

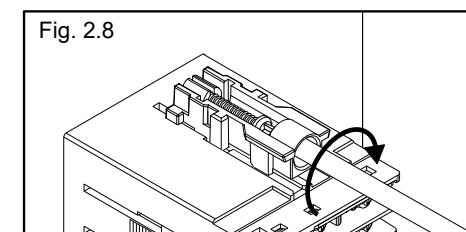
For waterproof and dustproof protection, two mounting brackets (P. 2-4) must be placed on the top and the bottom side of the instrument. If the mounting brackets are placed on the sides of the controller, waterproof and dustproof protection will not be guaranteed.



4. Tighten up the screw for the mounting bracket with a Phillips screwdriver so that the mounting bracket is firmly secured in place. (Fig. 2.8)
Give the screw another turn when the tip of the screw touches the panel.



Do not overtighten the screw. It may turn idle.
In case the screw has been overtightened to turn idle, loosen the screw, then tighten the screw again until the instrument is firmly fixed.



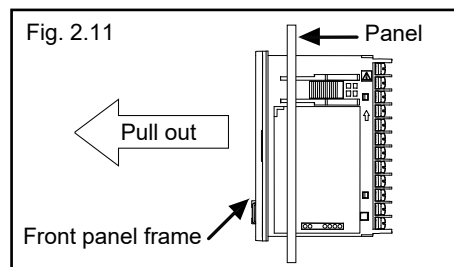
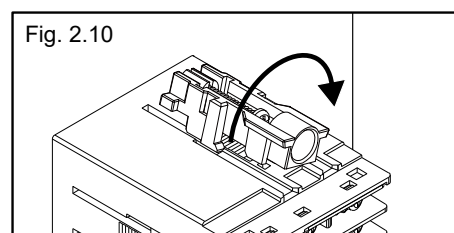
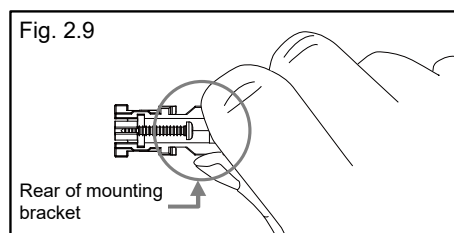
5. The other mounting bracket(s) should be installed in the same way as described in 3 and 4.



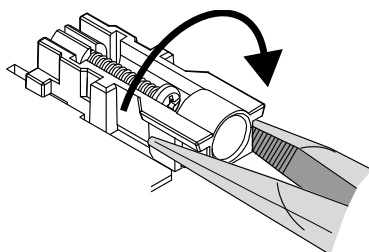
For replacing of the gasket, refer to **APPENDIX A.1 Replacing the Waterproof/Dustproof Gasket [Optional] (P. A-2)**.

■ Removal procedures

1. Turn the power OFF.
2. Remove the wiring.
3. Loosen the screw of the mounting bracket.
4. Hold the rear of the mounting bracket (Fig.2.9), and lift up one side to remove it from the case. (Fig. 2.10)
5. The other mounting bracket(s) should be removed in the same way as described in 3 and 4.
6. Pull out the instrument from the mounting cutout while holding the front panel frame of this instrument. (Fig. 2.11)



Use long-nose pliers to remove mounting brackets from the instrument that is installed in a narrow place or installed tightly in a vertical position.





MEMO



WIRING

3

This chapter describes wiring cautions, wiring layout and wiring of terminals.

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3.1 Wiring Cautions

WARNING

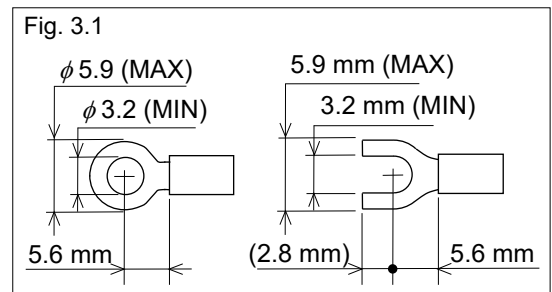
To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.

- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- Signal connected to Voltage input and Current input shall be low voltage defined as “SELV” circuit per IEC 60950-1.
- To avoid noise induction, keep input signal wire away from instrument power line, load lines and power lines of other electric equipment.
- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
 - Shorten the distance between the twisted power supply wire pitches to achieve the most effective noise reduction.
 - Always install the noise filter on a grounded panel. Minimize the wiring distance between the noise filter output and the instrument power supply terminals to achieve the most effective noise reduction.
 - Do not connect fuses or switches to the noise filter output wiring as this will reduce the effectiveness of the noise filter.
- Allow approximately 5 seconds for contact output when the instrument is turned on. Use a delay relay when the output line is used for an external interlock circuit.
- Power supply wiring must be twisted and have a low voltage drop.
- For an instrument with 24 V power supply input, supply power from “SELV” circuit defined as IEC 60950-1.
- This instrument is not provided with an overcurrent protection device. For safety install an overcurrent protection device (such as a fuse) with adequate breaking capacity close to the instrument.

Fuse type:	Time-lag fuse (Approved fuse according IEC 60127-2 and/or UL 248-14)
Fuse rating:	Rated voltage 250 V AC
	Rated current 0.5 A (24 V AC/DC type)
	1 A (100 to 240 V AC type)

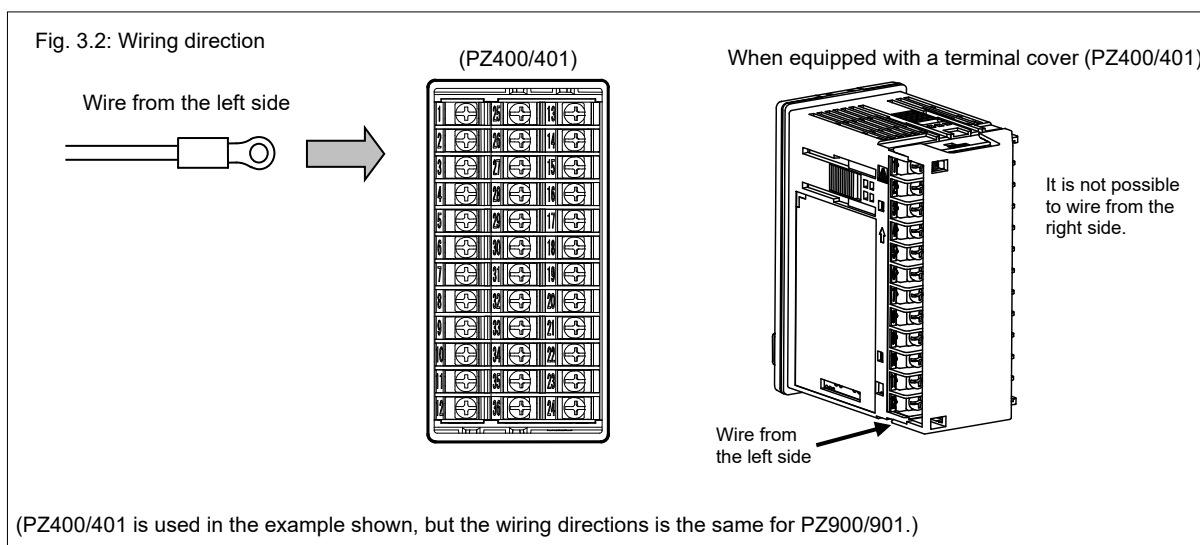
- Use the solderless terminal appropriate to the screw size.

Screw size:	M3 × 7 (with 5.8 × 5.8 square washer)
Recommended tightening torque:	0.4 N·m (4 kgf·cm)
Applicable wire:	Solid/twisted wire of 0.25 to 1.65 mm ²
Specified dimension:	Refer to Fig. 3.1
Specified solderless terminal:	Circular terminal with isolation
	V1.25-MS3
	Manufactured by J.S.T MFG CO., LTD.

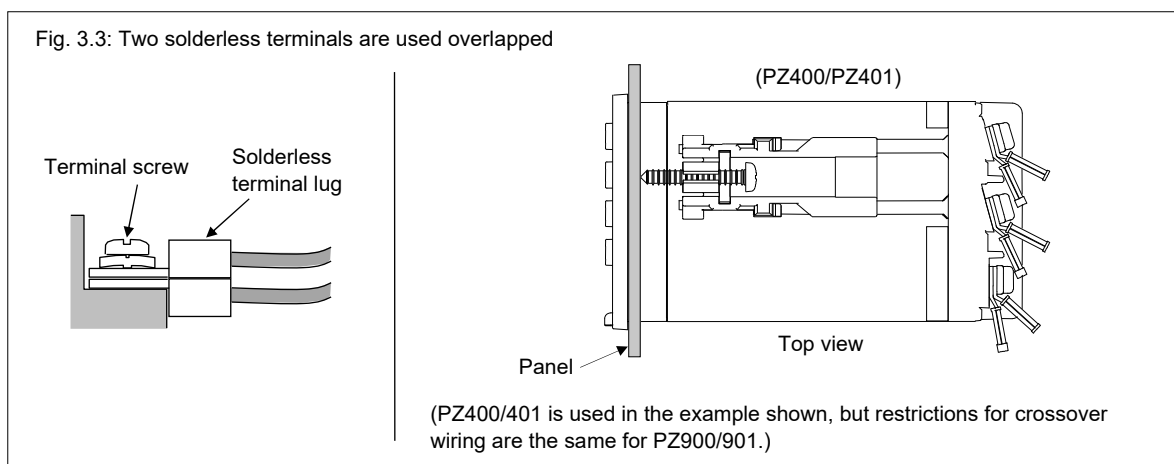


- Make sure that during field wiring parts of conductors cannot come into contact with adjacent conductive parts.

- When wiring PZ400/900/401/901 wire from the left direction toward the backside terminals as shown in Fig. 3.2. When using the terminal cover (Figs. 3.2, 3.4), it is not possible to wire from the right side. When wiring from the left and right with a close mounting, there are cases where adjacent instruments cannot be wired.



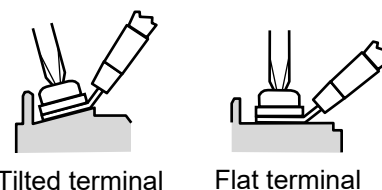
- Up to two solderless terminal lugs can be connected to one terminal screw. **The requirements of reinforced insulation can be still complied with in this condition.** When actually doing this, place one solderless terminal lug over the other as illustrated below.



If solderless terminal lugs other than the recommended dimensions are used, terminal screws may not be tightened. In that case, bend each solderless terminal lug before wiring. If the terminal screw is forcibly tightened, it may be damaged.



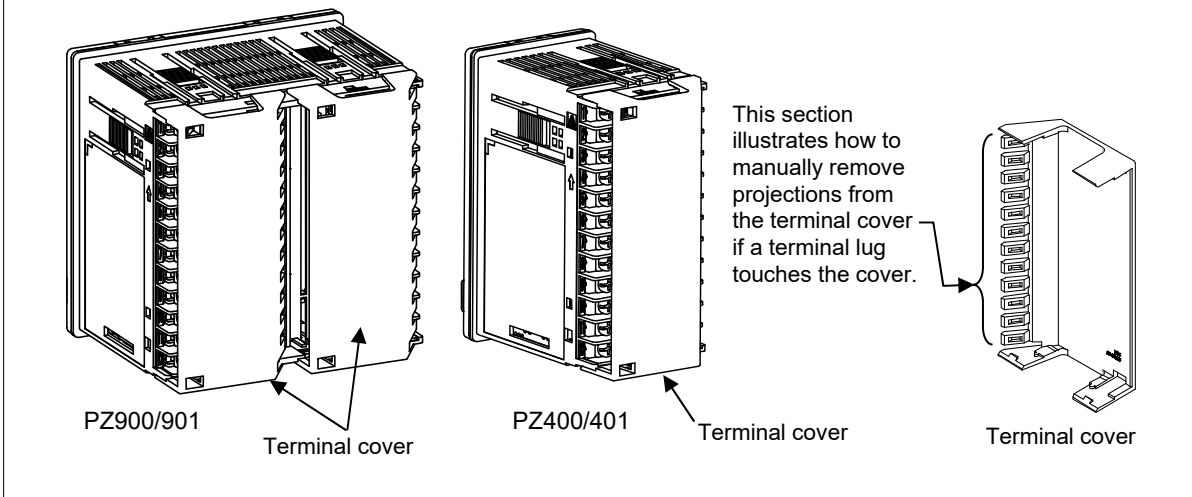
When tightening a screw of the instrument, make sure to fit the screwdriver properly into the screw head mounted tilted or flat as shown in the right figure. Tightening the screw with excessive torque may damage the screw thread.



- Caution for using the terminal cover:

- To prevent electric shock or instrument failure, always turn off the power before mounting or removing the terminal cover.
- When mounting and removing the terminal cover, apply pressure very carefully to avoid damage to the terminal cover.
- If a solderless terminal lug touches the PZ400/900/401/901 common terminal cover, remove the projection from the terminal cover by manually bending it back and forth until it breaks off. (Fig. 3.4)

Fig.3.4: Image of how to close the terminal board with the terminal cover and to remove projections



For the mounting and removing of the terminal cover, refer to **3.5 Handling of the Terminal Cover [Optional]** (P. 3-20).

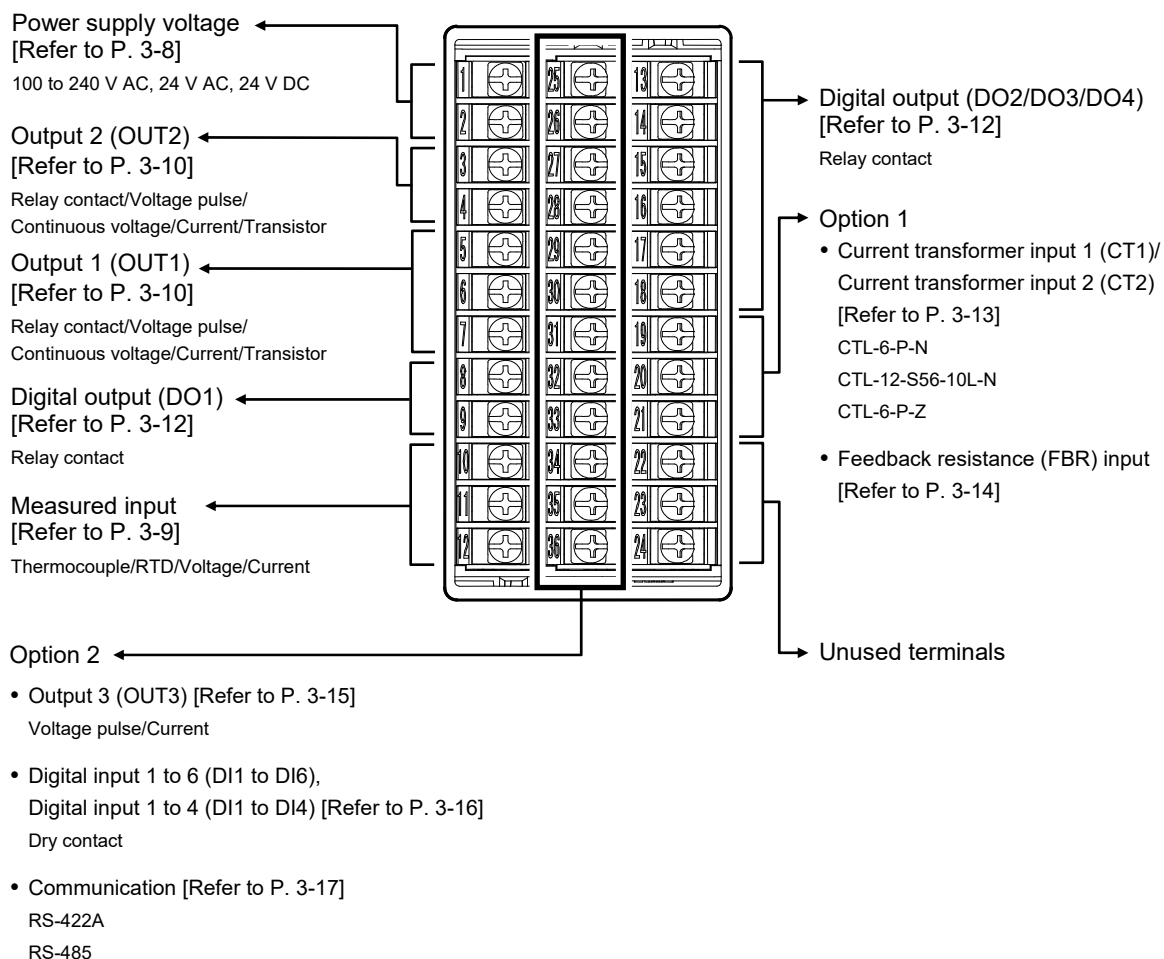
3.2 Terminal Layout

The terminal layout is as follows.



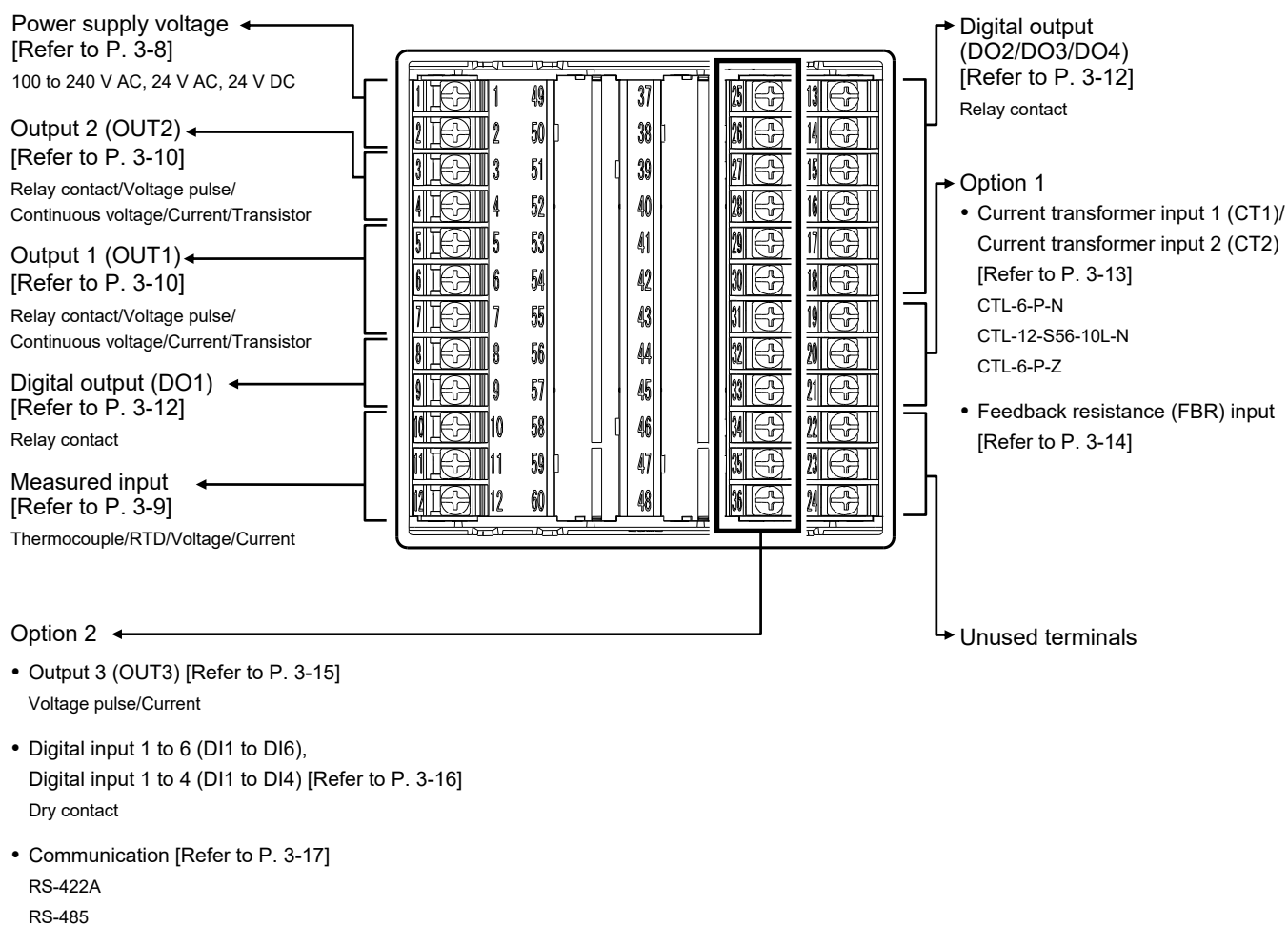
To prevent malfunctioning, do not connect wires to unused terminals.

■ PZ400/PZ401



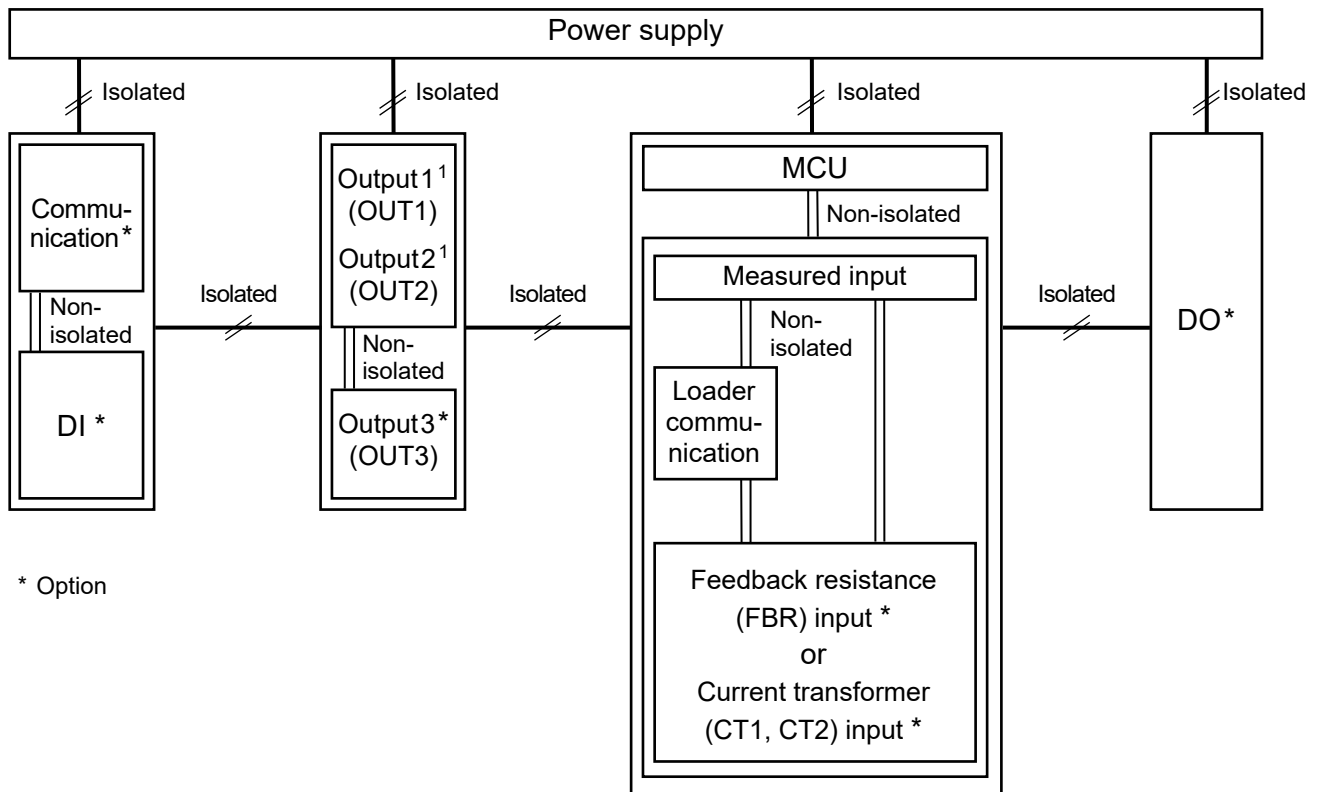


■ PZ900/PZ901



■ Isolations of input and output

For the Input/Output isolation block of this instrument, refer to the following:



¹ Outputs are isolated if either OUT1 or OUT2 is “relay contact output.”
If both outputs are not “relay contact output,” outputs are not isolated.

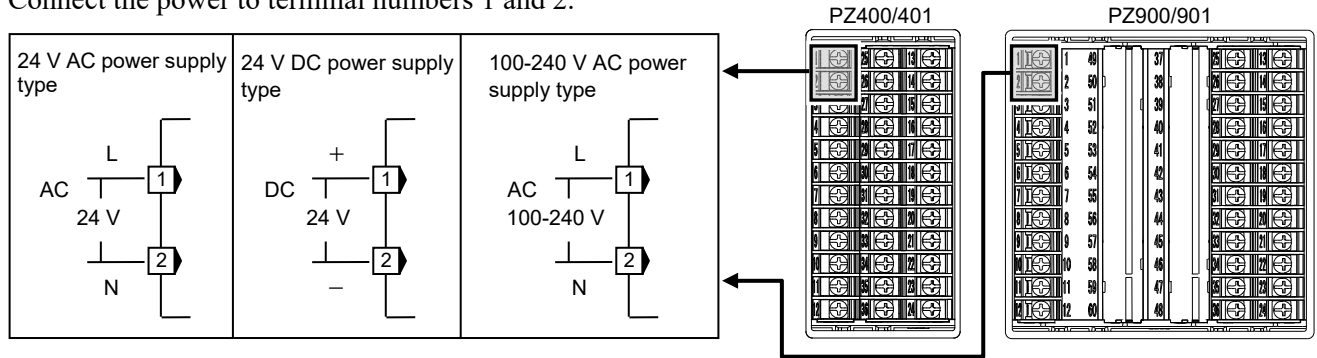


3.3 Wiring of Each Terminal

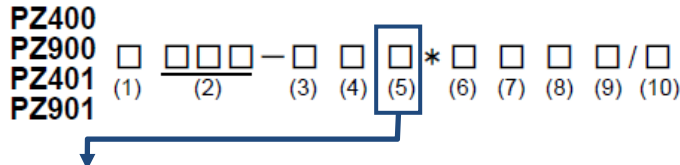
Always check the polarity of each terminal prior to wiring.

3.3.1 Power supply

- Connect the power to terminal numbers 1 and 2.



- Power supply voltage for the controller must be within the range shown below.



Suffix code	Power supply type	Power consumption	Rush current
3	20.4 to 26.4 V AC [Including power supply voltage variation] (Rated: 24 V AC) Power supply frequency: 50/60 Hz Frequency variation: 50 Hz (−10 to +5 %) 60 Hz (−10 to +5 %)	PZ400/401: 6.9 VA max. (at 24 V AC) PZ900/901: 7.4 VA max. (at 24 V AC)	16.3 A or less (at 24 V AC)
3	20.4 to 26.4 V DC [Including power supply voltage variation] (Rated: 24 V DC)	PZ400/401: 175 mA max. (at 24 V DC) PZ900/901: 190 mA max. (at 24 V DC)	11.5 A or less (at 24 V DC)
4	85 to 264 V AC [Including power supply voltage variation] (Rated: 100 to 240 V AC) Power supply frequency: 50/60 Hz Frequency variation: 50 Hz (−10 to +5 %) 60 Hz (−10 to +5 %)	PZ400/401: 6.8 VA max. (at 100 V AC) 10.1 VA max. (at 240 V AC) PZ900/901: 7.4 VA max. (at 100 V AC) 10.9 VA max. (at 240 V AC)	5.6 A or less (at 100 V AC) 13.3 A or less (at 240 V AC)

- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
- Power supply wiring must be twisted and have a low voltage drop.
- For an instrument with 24 V power supply input, supply power from “SELV” circuit defined as IEC 60950-1.
- This instrument is not provided with an overcurrent protection device. For safety install an overcurrent protection device (such as a fuse) with adequate breaking close to the instrument.

Fuse type: Time-lag fuse (IEC 60127-2, UL 248-14)

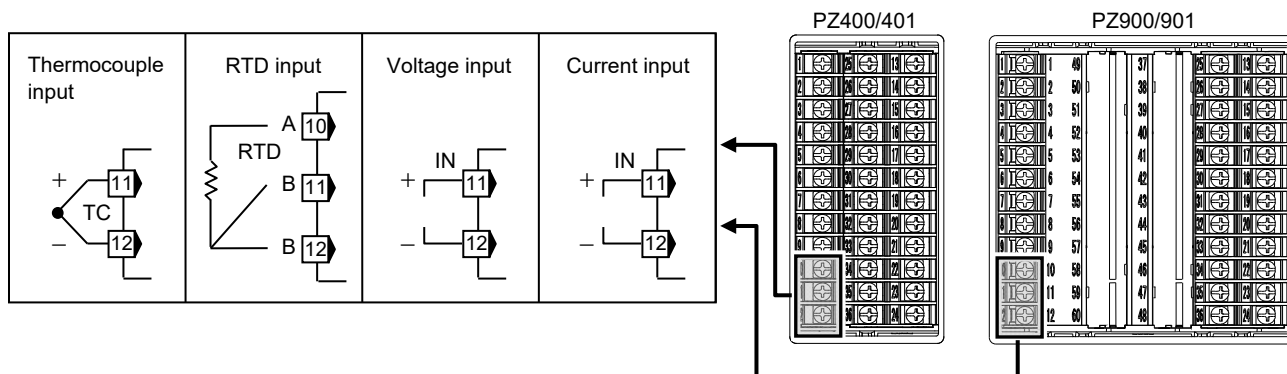
Fuse rating: Rated voltage 250 V AC

Rated current 0.5 A (24 V AC/DC type)

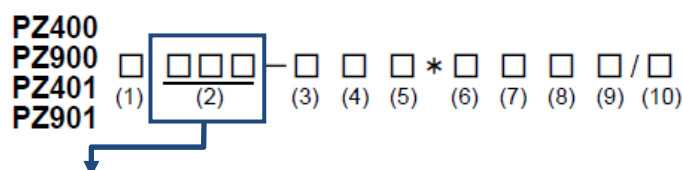
1 A (100 to 240 V AC type)

3.3.2 Measured input (Thermocouple/RTD/Voltage/Current)

- For the measured input type, terminals 10 through 12 are allocated to the measured input.



- The input types (input group) are as follows.



Suffix code	Input group	Input type
Refer to Range Code Table (P. 1-7)	Thermocouple (TC) input	K, J, T, S, R, E, B, N (JIS C1602-2015), PLII (NBS), W5Re/W26Re (ASTM-E988-96 [Reapproved 2002]), U, L (DIN43710-1985), PR40-20 (ASTM-E1751/E1751M-15)
	RTD input	Pt100 (JIS C1604-2013), JPt100 (JIS C1604-1997, Pt100 of JIS C1604-1981)
	Low voltage input	0 to 10 mV DC, 0 to 100 mV DC
	High voltage input	0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, -5 to +5 V DC, -10 to +10 V DC
	Current input	0 to 20 mA DC, 4 to 20 mA DC



NOTE

When the input type is changed from current or high voltage input to TC, RTD or low voltage input, remove the wirings of the measured input before attempting the input change. Changing the input type with the signal applied to the instrument may lead to a failure of the instrument.

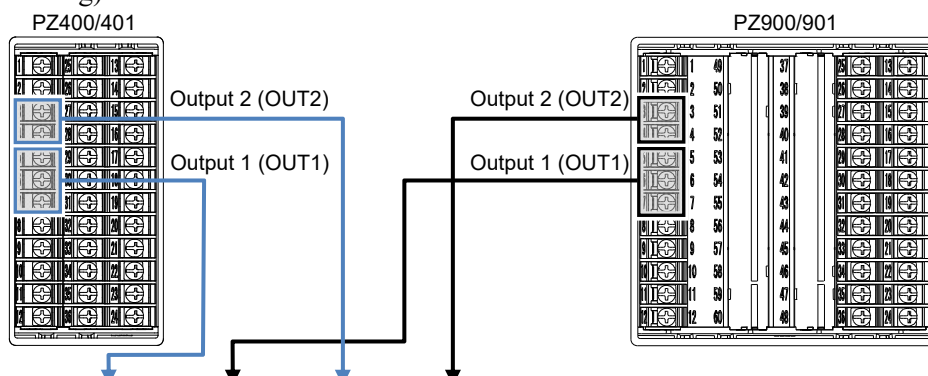


For details on changing the Input type, refer to the separate 8.1 Changing Input (P. 8-2).

- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- Signal connected to Voltage input and Current input shall be low voltage defined as “SELV” circuit per IEC 60950-1.
- To avoid noise induction, keep input signal wire away from instrument power line, load lines and power lines of other electric equipment.

3.3.3 Output 1 (OUT1)/Output 2 (OUT2)

- Terminals 5 through 7 are used for Output 1 (OUT1); and Terminal 3 and 4 are used for Output 2 (OUT2).
- Connect an appropriate load according to the output type of Output 1 (OUT1) and Output 2 (OUT2).
(Specify when ordering)



	Output 1 (OUT1)	Output 2 (OUT2)	Wiring example
Relay contact output			
★ Voltage pulse output			
★ Continuous voltage output Current output			
★ Transistor output			

NO: Normally open

NC: Normally close

★: To prevent malfunctioning, do not connect wires to unused terminals (terminal No. 7).

: The dotted box diagram describes the output state inside the instrument.

Continued on the next page.

- Outputs are isolated if Output 1 (OUT1) or Output 2 (OUT2) is relay contact output. If both outputs are not relay contact output, outputs are not isolated.
- Number of outputs and output types must be specified when ordering. The specifications of each output are as follows.

PZ400
PZ900 ☐ ☐ ☐ ☐ ☐ ☐ * ☐ ☐ ☐ ☐ / ☐
PZ401 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10)
PZ901

Suffix code		Output type	Specifications
Output 1 (OUT1)	Output 2 (OUT2)		
N	N	None	
M	M	Relay contact output	Contact type: c contact (OUT1) a contact (OUT2) Contact rating (Resistive load): 250 V AC 3 A, 30 V DC 1 A Electrical life: 300,000 times or more (Rated load) Mechanical life: 50 million times or more (Switching: 180 times/min)
V	V	Voltage pulse output	0/12 V DC (Allowable load resistance: 500 Ω or more)
4	4	Continuous voltage output	0 to 5 V DC (Allowable load resistance: 1 kΩ or more)
5	5		0 to 10 V DC (Allowable load resistance: 1 kΩ or more)
6	6		1 to 5 V DC (Allowable load resistance: 1 kΩ or more)
7	7	Current output	0 to 20 mA DC (Allowable load resistance: 500 Ω or less)
8	8		4 to 20 mA DC (Allowable load resistance: 500 Ω or less)
B	B	Transistor output	Allowable load current: 100 mA Load voltage: 30 V DC or less Voltage drop at ON: 2 V or less (at allowable load current) Leakage current at OFF: 0.1 mA or less

- The following output signals (function) can be assigned to each output (OUT, OUT2). Output signal (function) assignment is available in the Engineering mode.
 - Control output (Heat-side)
 - Control output (Cool-side)
 - Control output (Position proportioning) ¹
 - Logic calculation output (Event output)
 - Logic calculation output (Control loop break alarm (LBA) output)
 - Logic calculation output (Heater break alarm (HBA) output)
 - Logic calculation output (Input error)
 - Output of Program control mode (RUN) state
 - Output of Manual control mode (MAN) state
 - Autotuning (AT) state output
 - Output of the communication monitoring result
 - FAIL output
 - Retransmission output ²

¹ For Continuous voltage output or Current output, Control output (Position proportioning) will be invalid if it was selected.

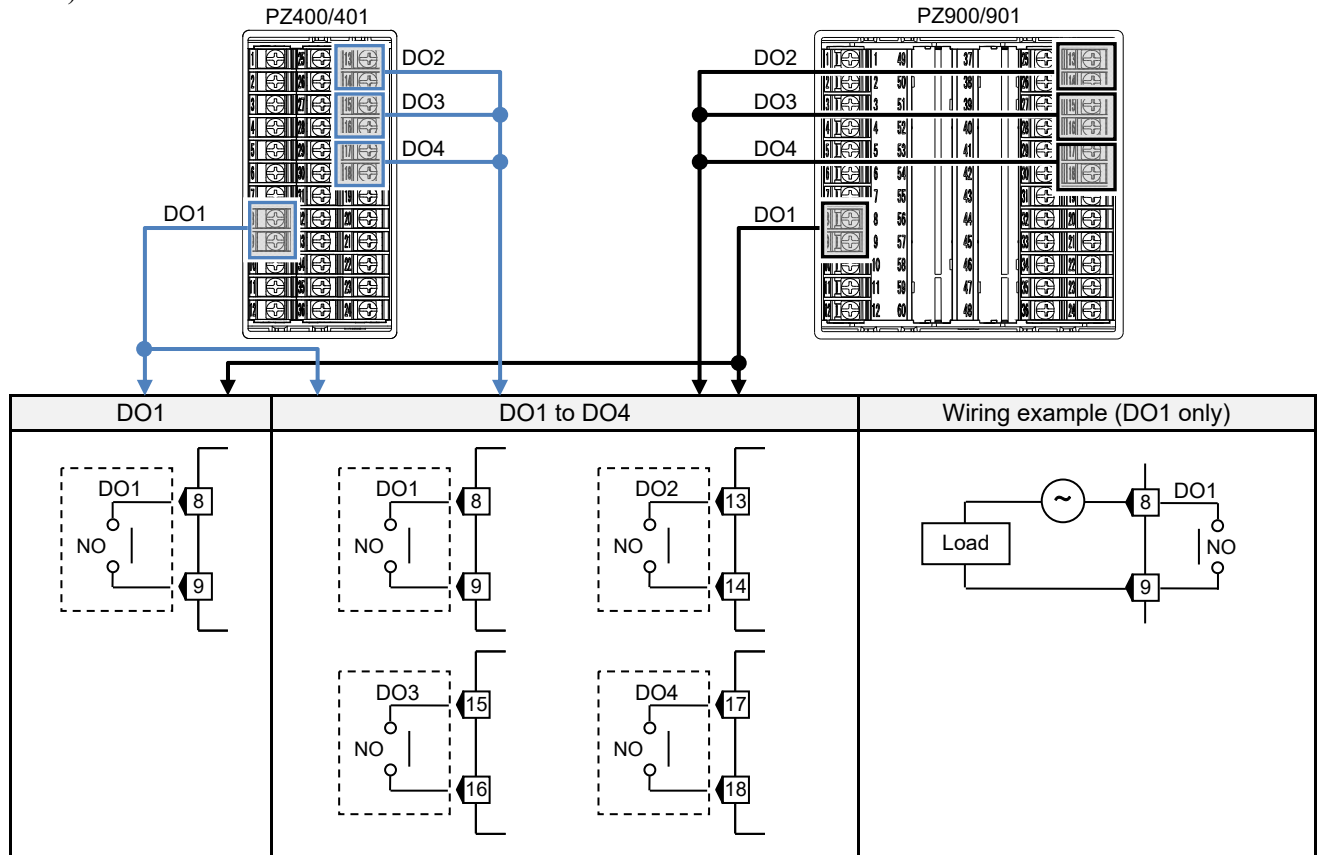
² For Relay contact output, Voltage pulse output, or Transistor output, Retransmission output is not selectable.

For the details of Output signals (function) assignment, refer to the **9.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output, FAIL, Time Signal, Pattern End Signal] (P. 9-2)**.



3.3.4 Digital output (DO1/DO2/DO3/DO4)

- Terminal 8 and 9 are used for DO1; and Terminals 13 through 18 are used for DO2 to DO4.
- Connect the load(s) according to the number of output (specify when ordering) of Digital outputs (DO1 to DO4).



- Output type is only relay contact output.

PZ400
PZ900 ☐ ☐ ☐ ☐ - ☐ ☐ ☐ * ☐ ☐ ☐ ☐ / ☐
PZ401 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10)
PZ901

Suffix code	Number of output	Specifications
1	Digital output [1 point] (DO1)	Contact type: a contact Contact rating (Resistive load): 250 V AC 1 A, 30 V DC 0.5 A
4	Digital output [4 points] (DO1 to DO4)	Electrical life: 150,000 times or more (Rated load) Mechanical life: 20 million times or more (Switching: 300 times/min)

- The following output signals (function) can be assigned to each Digital output (DO1 to DO4). Output signal (function) assignment is available in the Engineering mode.
 - Logic calculation output (Event output)
 - Logic calculation output (Control loop break alarm (LBA) output)
 - Logic calculation output (Heater break alarm (HBA) output)
 - Logic calculation output (Input error)
 - Output of Program control mode (RUN) state
 - Output of Manual control mode (MAN) state
 - Autotuning (AT) state output
 - Output of the communication monitoring result
 - FAIL output
 - Time signal
 - Pattern end signal

For the details of Output signals (function) assignment, refer to the 9.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output, FAIL, Time Signal, Pattern End Signal] (P. 9-2).

3.3.5 Option 1

- Terminal Nos. 19 to 21 are for Option 1.
- The Option 1 types are as follows.

PZ400
PZ900 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
PZ401 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10)
PZ901

Suffix code	Contents of Option 1
N	None
T	CT input [2 points] (CT1, CT2) [CTL-6-P-N]
U	CT input [2 points] (CT1, CT2) [CTL-12-S56-10L-N]
V	CT input [2 points] (CT1, CT2) [CTL-6-P-Z]
W	Feedback resistance (FBR) input

■ Current transformer input 1 (CT1), Current transformer input 2 (CT2)

- Terminal 19 and 20 are used for Current transformer input 1 (CT1); and Terminal 19 and 21 are used for Current transformer input 2 (CT2).
Connect the current transformer (CT) specified at the time of order to the relevant terminal.

Current transformer model code:

When the suffix code “T” is specified: CTL-6-P-N

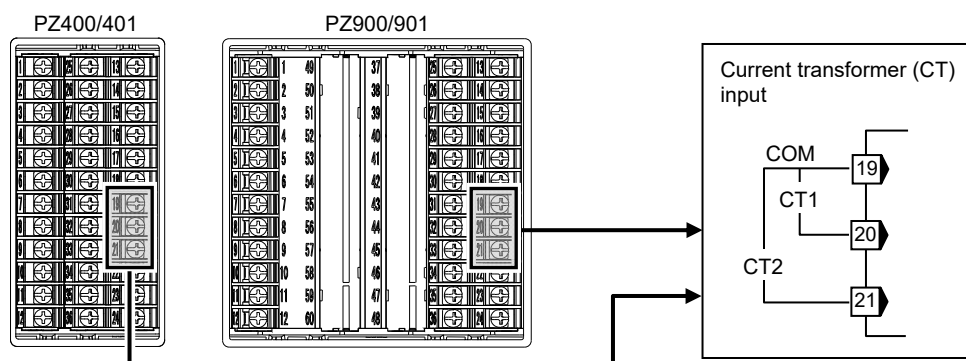
[Measurable current range: 0.0 to 30.0 A] (sold separately)

When the suffix code “U” is specified: CTL-12-S56-10L-N

[Measurable current range: 0.0 to 100.0 A] (sold separately)

When the suffix code “V” is specified: CTL-6-P-Z

[Measurable current range: 0.0 to 10.0 A] (sold separately)

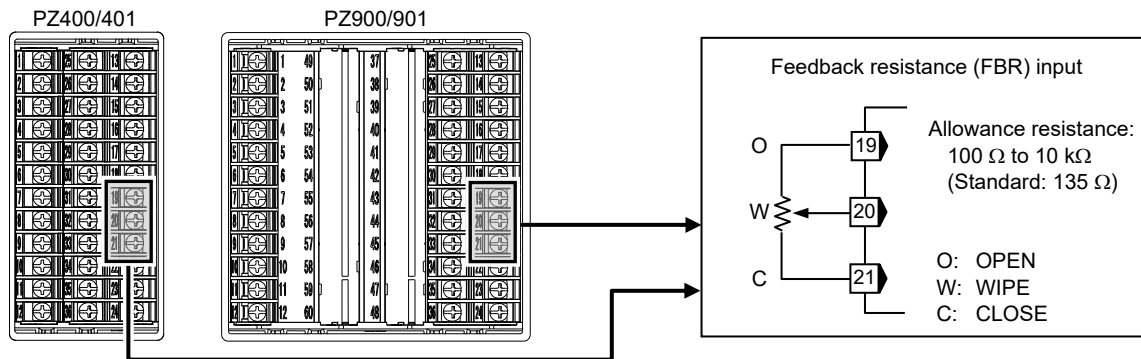


- Current transformer input 1 (CT1) and Current transformer input 2 (CT 2) is not isolated from the Measured input.
- Even after the delivery of the instrument, the type of the current transformer 1 (CT1) and the current transformer 2 (CT2) can be changed at “CT1 type” and “CT2 type” in the Engineering mode.
 For details on changing the CT type, refer to **10.2.4 Changing the Current transformer (CT) type (P. 10-31)**.
- When using Heater break alarm (HBA), set the same output for the control output detected by the current transformer (CT) [to be configured at “CT1 assignment,” “CT2 assignment”] and the control output of the instrument. “CT1 assignment” and “CT2 assignment” can be done in the Engineering mode.
 For the Heater break alarm (HBA) function, refer to the separate **10.2 Using Heater Break Alarm (HBA) (P. 10-22)**.

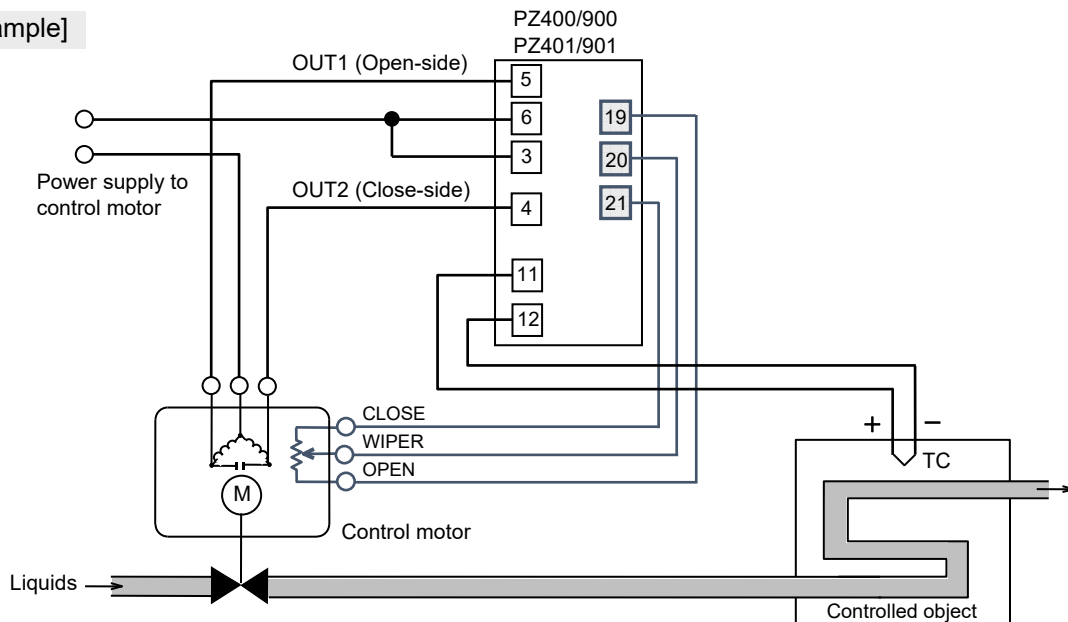


■ Feedback resistance (FBR) input

- Terminals 19 through 21 are used for Feedback resistance (FBR) input.
Connect a potentiometer at the relevant terminal.



[Example]



- Feedback resistance (FBR) input is not isolated from the Measured input.

3.3.6 Option 2

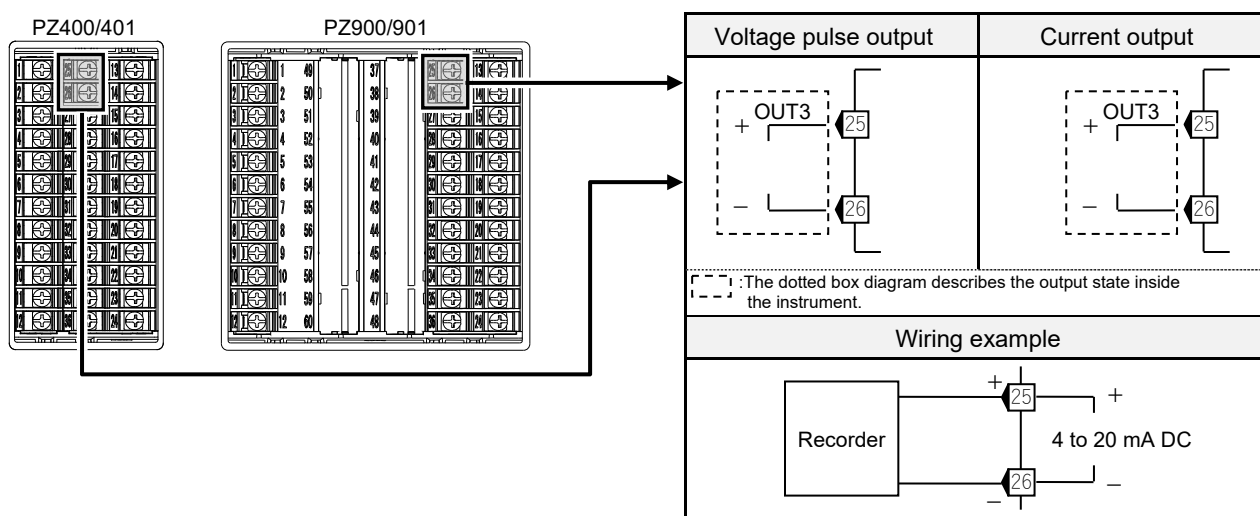
- Terminal Nos. 25 to 36 are for Option 2.
- The Option 2 types are as follows.

PZ400
PZ900 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
PZ401 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10)
PZ901

Suffix code	Contents of Option 2
N	None
A	Output 3 (OUT3)
B	Digital input [6 points] (DI1 to DI6)
C	Communication (RS-422A)
D	Communication (RS-485)
E	Output 3 (OUT3)+Digital input [6 points] (DI1 to DI6)
F	Output 3 (OUT3)+Communication (RS-422A)
G	Output 3 (OUT3)+Communication (RS-485)
H	Output 3 (OUT3)+Digital input [4 points] (DI1 to DI4)+Communication (RS-422A)
J	Output 3 (OUT3)+Digital input [6 points] (DI1 to DI6)+Communication (RS-485)

■ Output 3 (OUT3)

- Terminal 25 and 26 are used for Output 3 (OUT3).
- Connect a recorder, a load, etc according to the Output type of Output 3 (OUT3).



- Output 3 (OUT3) is a universal output. Even after the delivery of the instrument, the output type (see the table below) can be changed at “Universal output type selection (OUT3)” in the Engineering mode.

For the details of changing the Output 3 (OUT3), refer to the separate **9.2 Changing Output Type of OUT3 (P. 9-14)**

OUT3 type	Specifications
Voltage pulse output	0/14 V DC (Allowable load resistance: 600 Ω or more)
Current output	4 to 20 mA DC (Allowable load resistance: 500 Ω or less) [Factory set value]
Current output	0 to 20 mA DC (Allowable load resistance: 500 Ω or less)

Continued on the next page.



- The following output signal (function) can be assigned to Output 3 (OUT3). Output signal (function) assignment is available in the Engineering mode.

– Control output (Heat-side)	– Logic calculation output (Input error)
– Control output (Cool-side)	– Output of Program control mode (RUN) state
– Control output (Position proportioning) ¹	– Output of Manual control mode (MAN) state
– Logic calculation output (Event output)	– Autotuning (AT) state output
– Logic calculation output (Control loop break alarm (LBA) output)	– Output of the communication monitoring result
– Logic calculation output (Heater break alarm (HBA) output)	– FAIL output
	– Retransmission output ²

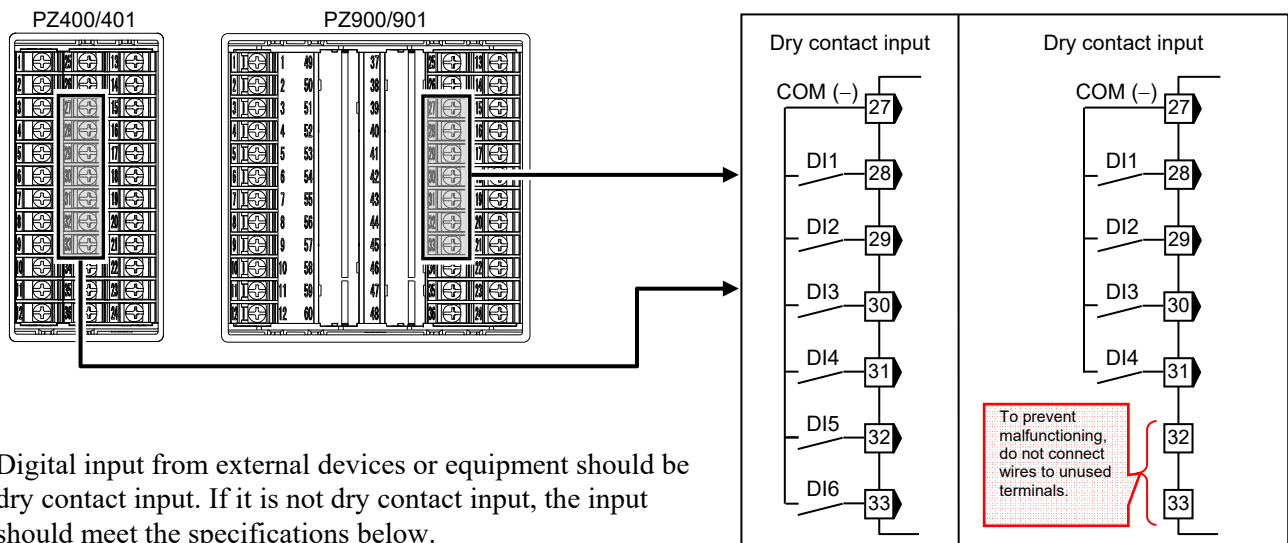
¹ Assignment to current output is not available.

² Assignment to voltage pulse output is not available.

☞ For the details of Output signal (function) assignment, refer to **9.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output, FAIL, Time Signal, Pattern End Signal]** (P. 9-2).

■ Digital input 1 to 6 (DI1 to DI6), Digital input 1 to 4 (DI1 to DI4)

- Terminals 27 through 33 are used for Digital inputs 1 to 6 (DI1 to DI6).
- Terminals 27 through 31 are used for Digital inputs 1 to 4 (DI1 to DI4).



- Digital input from external devices or equipment should be dry contact input. If it is not dry contact input, the input should meet the specifications below.

Contact specifications:

At OFF (contact open): 50 kΩ or more

At ON (contact closed): 1 kΩ or less

Contact current: 3.3 mA DC or less

Capture judgment time: Within 200 ms

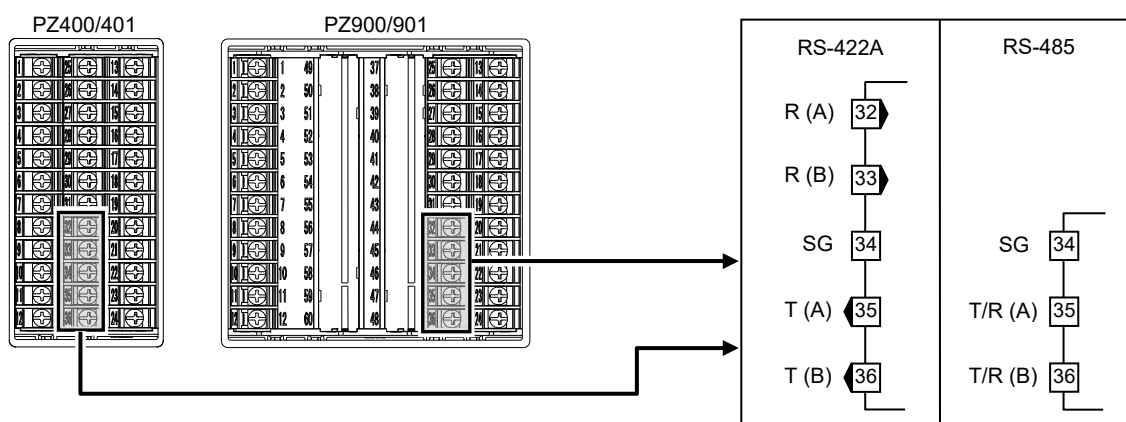
- The following functions can be assigned to Digital inputs (DI). Function assignment of Digital inputs (DI) can be done in the Engineering mode.

– Reset mode (RESET) setting	– Peak/Bottom hold reset
– Program control mode (RUN) setting	– Autotuning (AT)
– Step function	– Set data unlock/lock transfer
– Hold action	– Direct/Reverse action transfer
– Interlock release	– Program pattern No. switching

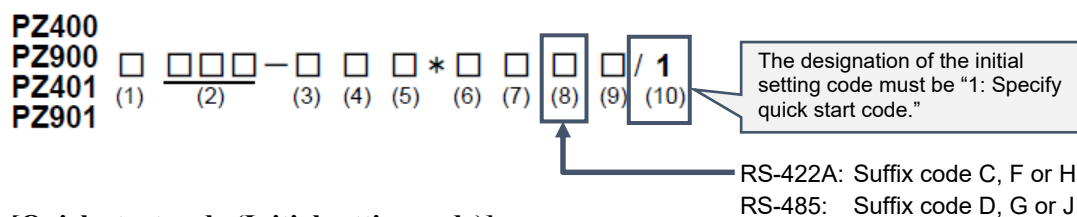
☞ For the details of function assignment of Digital input (DI), refer to **8.2 Switching Functions Using Digital Inputs (DI)** (P. 8-11).

■ Communication (RS-422A, RS-485)

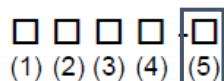
- Terminals 32 through 36 are used for Communication (RS-422A).
- Terminals 34 through 36 are used for Communication (RS-485).



- The Communication protocol is either specified by Quick start code (Initial setting code) when the order is placed, or set in Engineering mode.



[Quick start code (Initial setting code)]



Code	Communication protocol
N	None
1	RKC communication (ANSI X3.28-1976) *
2	Modbus
3	PLC communication: MITSUBISHI MELSEC series special protocol (QnA-compatible 3C frame format 4)

* Factory set value when the Initial setting code (10) is "N: None."

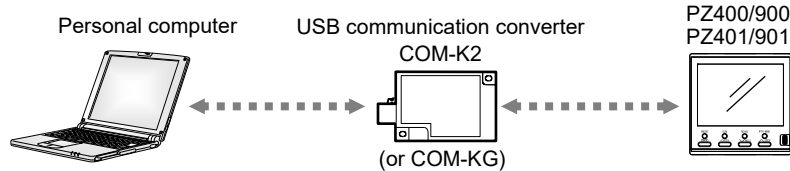
- ☞ For the details of communication (For example, protocol setting in the Engineering mode), refer to the following manuals.

PZ400/PZ900/PZ401/PZ901 Host Communication Instruction Manual

PZ400/PZ900/PZ401/PZ901 PLC Communication Instruction Manual

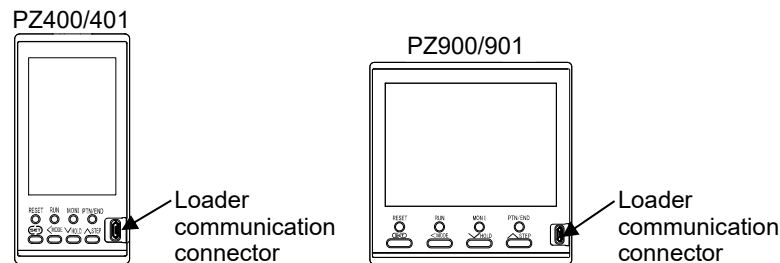
3.4 Connections for Loader Communication

The data of the instrument (PZ400/900/401/901) can be set via the loader communication using our “Communication tool PROTEM2.” To connect the instrument to the personal computer, the USB communication converter COM-K2 or COM-KG (RKC product, sold separately), the loader communication cable and the USB cable are required.



■ Position of loader communication connector

The loader communication connector can be found on the front of the instrument. In the following picture the connector cover is open.



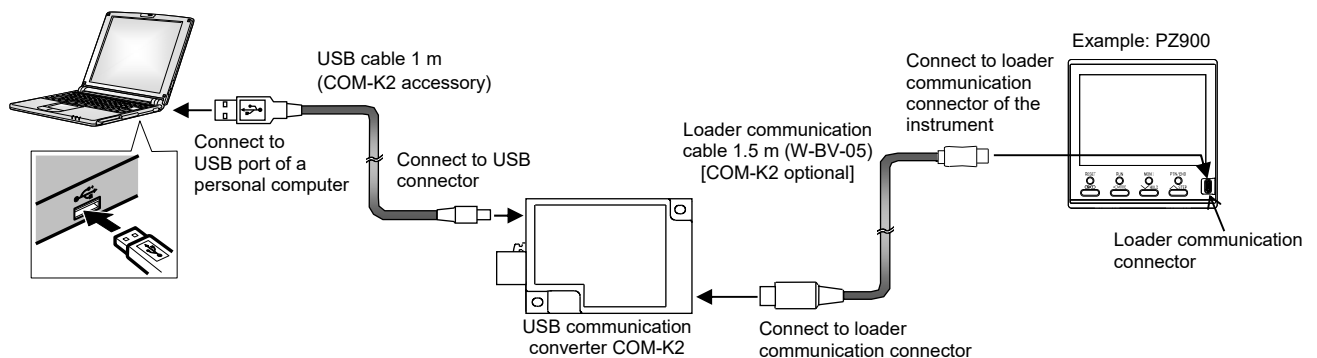
■ Wiring method

Connect the PZ400/900/401/901, COM-K2 (or COM-KG), and personal computer using a USB cable and a loader communication cable. Make sure the connectors are oriented correctly when connecting.



NOTE

The Loader port is only for parameter setup. Not used for data logging during operation.



Connection example of loader communication

- Communication Tool
PROTEM2
Software operation environment:
Consult the manual that you downloaded
- Communication settings on the computer
(The following values are all fixed)
Communication speed: 38400 bps
Start bit: 1
Data bit: 8
Parity bit: None
Stop bit: 1
- Communication port of host computer
USB port: Based on USB Ver. 2.0



- The device address of the loader communication is fixed at “0.” The setting of the device address is disregarded.
- The loader communication corresponds to the RKC communication protocol “Based on ANSI X3.28-1976 subcategories 2.5 and A4.”
- Loader communication can be used on a PZ400/900/401/901 even when the Communication function (optional) is not installed.

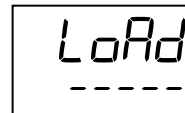


For the COM-K2, refer to the **COM-K2 Instruction Manual**.
For the COM-KG, refer to the **COM-KG Instruction Manual**.

 When using the loader communication, USB driver for COM-K2 must be installed on the personal computer. The USB driver can be downloaded the official RKC website. Installation of the USB driver is not necessary when the COM-KG is used on Windows 10.

 When the instrument is powered off, power can be supplied to the instrument from COM-K2 (or COM-KG). This function is exclusive for parameter setting, and the instrument functions as follows.

- Control is stopped (Output is off, relay remains open).
- Host communication is stopped.
- The PV/SV monitor shows “LoAd” for the PV display and “-----” for the SV display. The LCD backlight is partially turned off.



 While the instrument is powered by COM-K2 (or COM-KG), if power is applied to the instrument, the instrument will be reset and starts for normal operation.

 When the instrument is normally powered, the host communication can be used simultaneously.

3.5 Handling of the Terminal Cover [Optional]

When mounting and removing the terminal cover, take the following steps:

WARNING

To prevent electric shock or instrument failure, always turn off the power before mounting or removing the terminal cover.

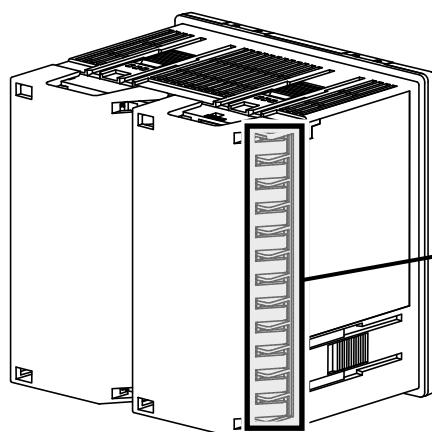
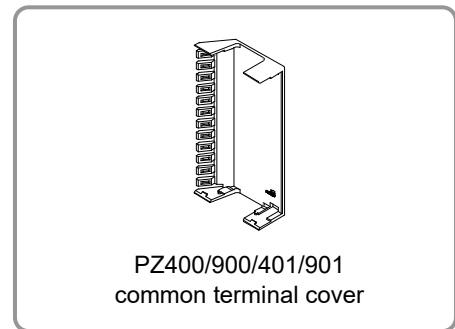
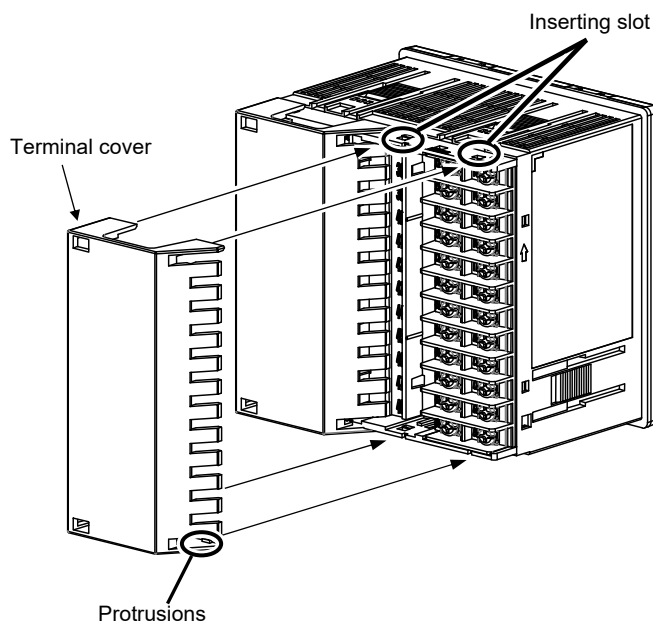


NOTE

When mounting and removing the terminal cover, apply pressure very carefully to avoid damage to the terminal cover.

■ Mounting procedures

1. Check the mounting direction of the terminal cover.
2. Push the protrusions of terminal cover into the insertion slots for mounting the terminal cover.

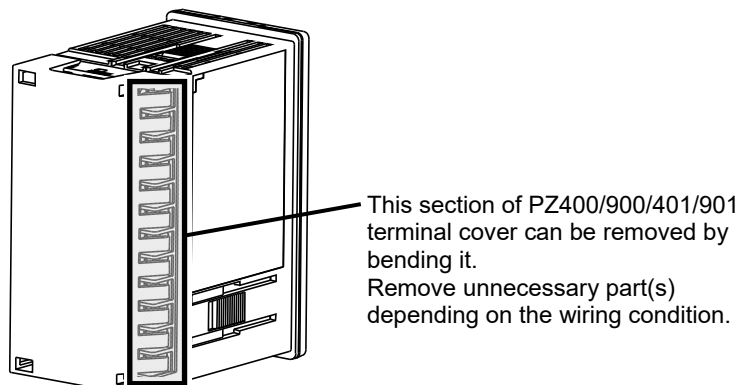


This section of PZ400/900/401/901 terminal cover can be removed by bending it. Remove unnecessary part(s) depending on the wiring condition.



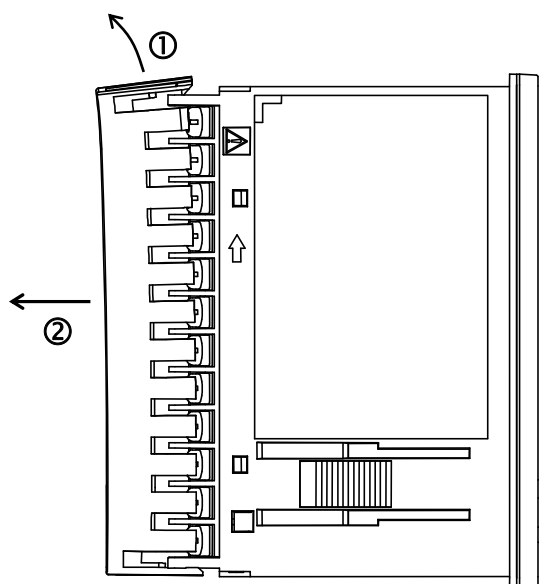
PZ900/901 is used in the explanatory drawing. The above mounting procedures in the example shown are the same for PZ400/401.

Drawing of PZ400/401 with terminal cover



■ Removal procedures

Release the protrusions of terminal cover from the insertion slots (①) shown in the following figure, and then pull the terminal cover (②) to remove it from the case.





MEMO



PARTS DESCRIPTION AND BASIC OPERATION

4

This chapter describes name of parts, setting and modifying values and other basic operations.

4.1 Parts Description.....	4-2
4.2 Changing Set Value	4-5
4.3 Segment No. Selection	4-6
4.4 Selection of Program Pattern Number Used for Control	4-7

4.1 Parts Description

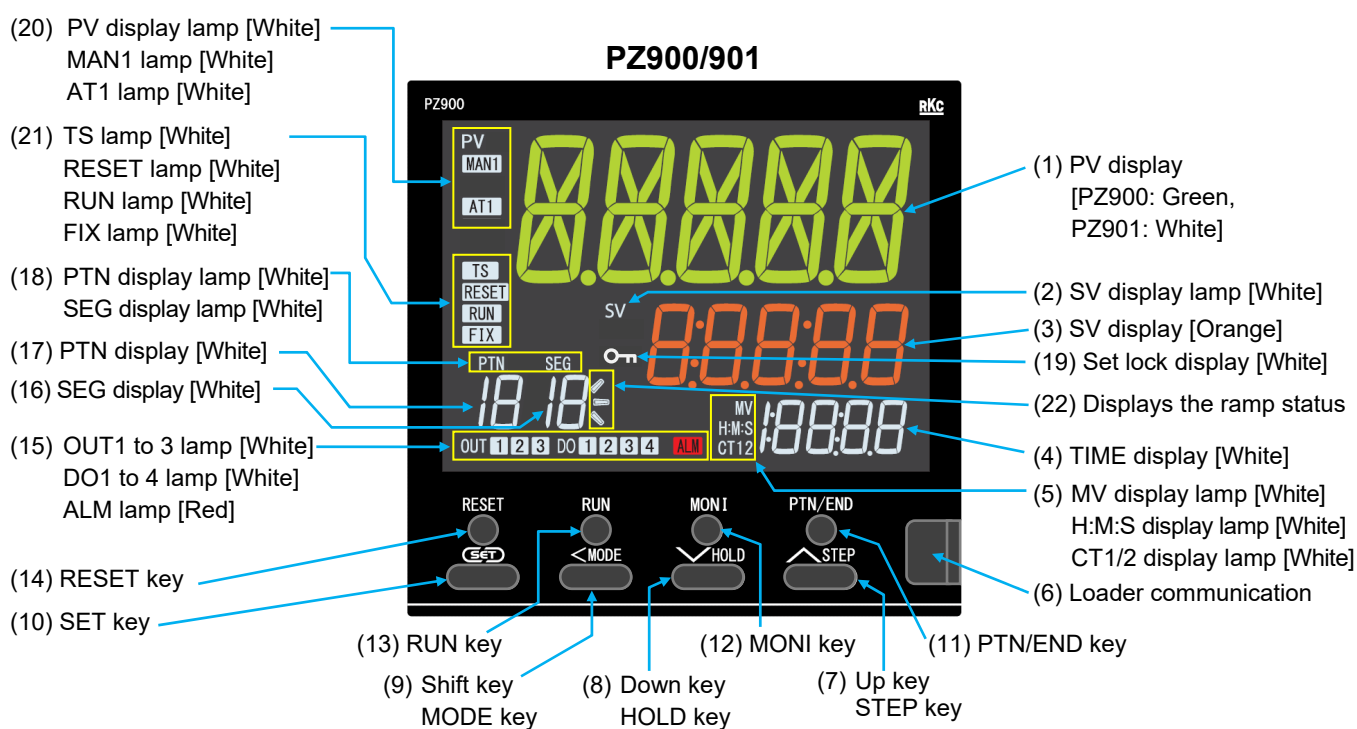
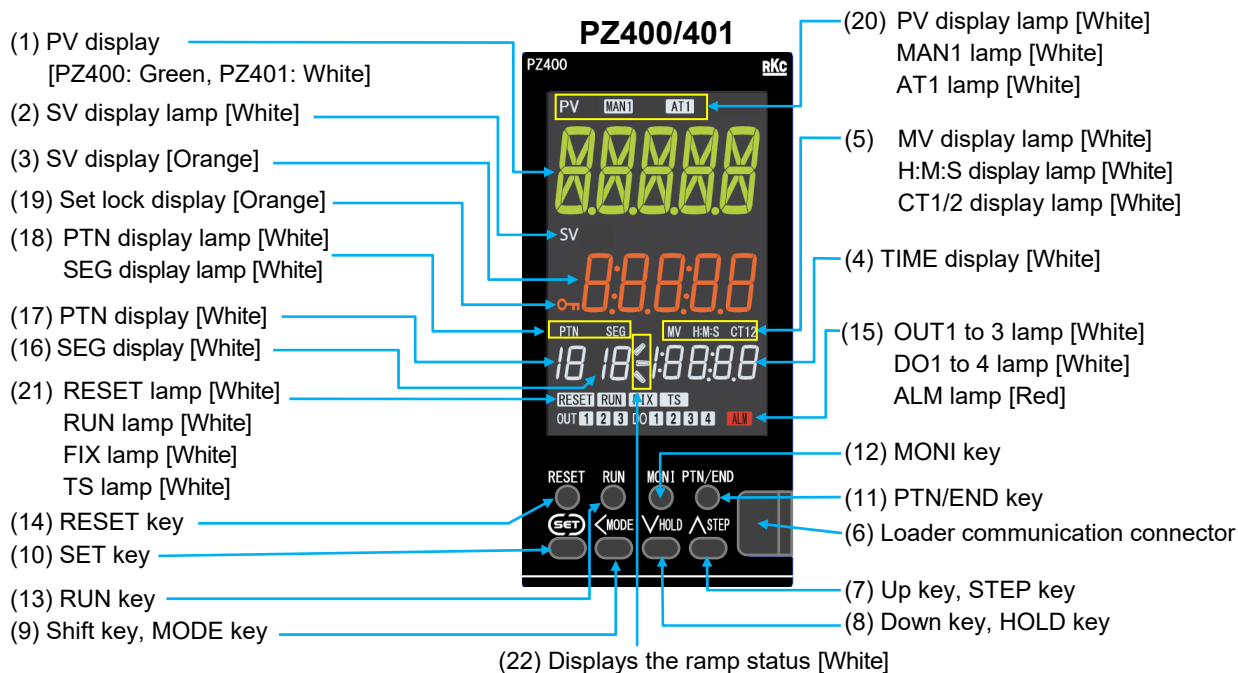
This section describes various display units and the key functions.



NOTE

To avoid damage to the instrument, never use a sharp object to press keys.

■ Front panel view





(1)	PV display	[PZ400/900: Green, PZ401/901: White]	Displays Measured value (PV) or various parameter symbols.
(2)	SV display lamp	[White]	Lights while the Segment level or the Set value (SV) in Fixed set point control mode is displayed on the SV display.
(3)	SV display	[Orange]	Displays a Segment level, a Set value (SV) in Fixed set point control mode or a set value of the various parameters.
(4)	TIME display	[White]	Displays the Segment time, the Remaining segment time, the Manipulated output (MV) value or the input value from the current transformer (CT).
(5)	MV display lamp	[White]	Lights when Manipulated output value (MV) is displayed on the TIME display.
	H:M:S display lamp	[White]	Lights when time (hour: minute: second) is displayed on the TIME display.
	CT1/2 display lamp	[White]	- CT1 lights when the Current transformer 1 (CT1) input value is displayed on the TIME display. - CT2 lights when the Current transformer 2 (CT2) input value is displayed on the TIME display.
(6)	Loader communication connector		Setting and monitoring on a computer (PC) is possible if the controller is connected with our cable to a PC via our USB communication converter COM-K2 or COM-KG (sold separately) ^a . Our communication software ^b must be installed on the PC. ^a For the COM-K2 or COM-KG, refer to the official RKC website. ^b Only available as a download from the official RKC website.
(7)		Up key	Increases numerals. Used to switch the group of each modes.
	STEP	STEP key	During the Program control mode (RUN), segments in the program pattern now in execution can be advanced.
(8)		Down key	Decreases numerals. Used to switch the group of each modes.
	HOLD	HOLD key	During the Program control mode (RUN), the program progress can be suspended (held temporarily). When this key is pressed during the Hold, the Hold function is released.
(9)		Shift key	Shifts digits when settings are changed.
	MODE	MODE key	Used to switch the modes.
(10)		SET key	Used to switch the modes, for calling up parameters and set value registration.
(11)		PTN/END key	- During the Reset mode (RESET), the pattern to be executed can be selected. The pattern number increases by one every time PTN/END key is pressed. When the pattern number is already the maximum, the pattern number returns to 1. When the PTN/END key is pressed for 2 seconds or more, the screen is switched to the Execution pattern selecting display. - This key is used to set/release the program pattern end at the time of program pattern setting. - The End segment No. can be checked in the Program control mode (RUN). The End segment No. will be displayed on the SEG display unit only while the PTN/END key is pressed.
(12)		MONI key	Used to switch screens. When the MONI key is pressed while any screen other than Monitor & Program setting mode is displayed, the screen returns the PV/SV monitor.
(13)		RUN key	The mode is switched to the Program control mode (RUN) to execute the program.
(14)		RESET key	The mode is switched to the Reset (RESET) mode and the control is stopped.



4. PARTS DESCRIPTION AND BASIC OPERATION

(15)	OUT1 to 3 lamp	[White]	Lights when Outputs 1 to 3 (OUT1 to 3)* are turned on.
	DO1 to 4 lamp	[White]	Lights when Digital outputs 1 to 4 (DO1 to 4)* are turned on.
	ALM lamp	[Red]	Lights when any of the following occurs. • Event 1 to 4 • Heater break alarm (HBA) 1 or 2 • Control loop break alarm (LBA) • Input error
(16)	SEG display	[White]	Displays the segment number. Reset mode (RESET): Segment No. before operation start Program control mode (RUN): Segment No. in execution
(17)	PTN display	[White]	Displays the Program pattern number Reset mode (RESET): Program pattern No. currently selected Program control mode (RUN): Program pattern No. in execution
(18)	PTN display lamp	[White]	Lights when Program pattern No. is displayed on the PTN display unit.
	SEG display lamp	[White]	Lights when Segment No. is displayed on the SEG display unit.
(19)	Set lock display [PZ400/401: Orange, PZ900/901: White]		Lights when the settings are locked. Lights when the settings are locked or when “Parameter select direct registration” is on.
(20)	PV display lamp	[White]	PV Lights when the Measured value (PV) is displayed on the PV display unit.
	MAN1 lamp	[White]	Lights when Input is in Manual control mode (MAN). When lit, the SV display shows a Manual manipulated output value.
	AT1 lamp	[White]	• Flashes when Autotuning (AT) is activated. (After AT is completed: AT lamp will go out) • Lights when Startup tuning (ST) is activated. (After ST is completed: AT lamp will go out)
(21)	TS lamp	[White]	Lights during the Time signal (TS) operation.
	RESET lamp	[White]	Lights during the Reset mode (RESET).
	RUN lamp		Lights during the Program control mode (RUN).
	FIX lamp		Lights during the Fixed set point control mode (FIX).
(22)	Displays the ramp status	[White]	Displays the segment level ramp status (up, soak, down) during the Program control (RUN) mode. Rise:  Soak:  Fall: 

* Outputs, such as control output, retransmission output, event output, are assigned to Outputs 1 to 3 (OUT1 to 3) and Digital outputs 1 to 4 (DO1 to 4). (Control output can be assigned to OUT1 to 3 only.) Outputs are assigned in Engineering mode.

4.2 Changing Set Value

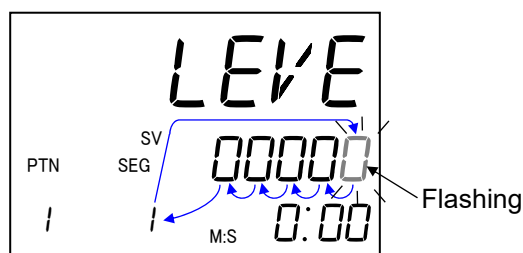
- The flashing digit indicates which digit can be set. Press **MODE** key to go to a different digit. Every time the shift key is pressed, the flashing digit moves as follows.

A Monitor & Program setting mode

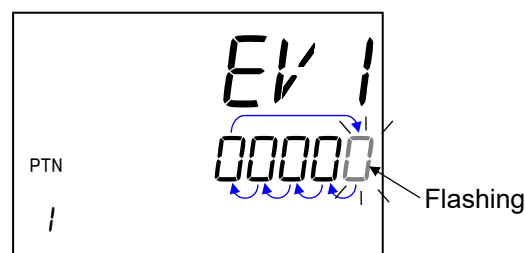
Reset mode (RESET)

Segment 1 to 16 level screen

Segment 1 to 16 time screen

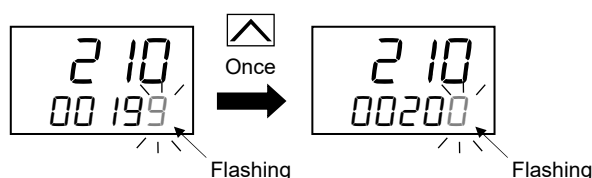


Changes in other screens except the left one.

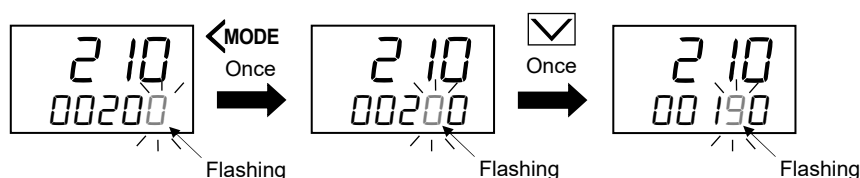


- The following is also available when changing the set value.

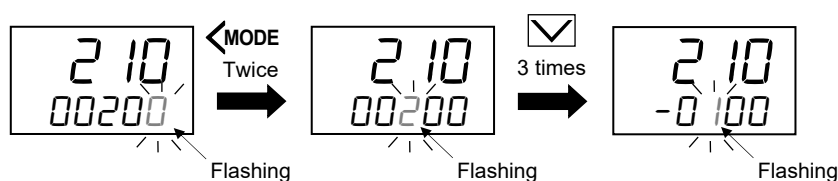
Increase SV from 199 °C to 200 °C:



Decrease SV from 200 °C to 190 °C:



Decrease SV from 200 °C to -100 °C:



- To store a new value for the parameter, always press the **SET** key.** The display changes to the next parameter and the new value will be stored.
The modified data will not be stored only by operating the and keys.
- In case no operation is performed within 60 seconds after the change of the setting, the mode will return to **A** Monitor & Program setting mode (PV/SV monitor screen). The modified data will not be registered in this case.



4.3 Segment No. Selection

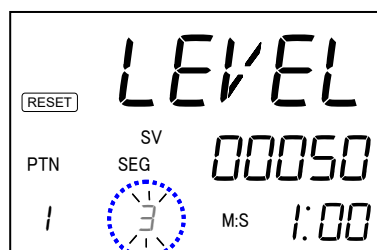
On the “Segment level 1 to 16” screens and “Segment time 1 to 16” screens the segment number can be changed using the  and the  keys while the SEG display is flashing.

To blink the SEG display unit, press the MODE key several times until it starts blinking.

A Monitor & Program setting mode

Reset mode (RESET)

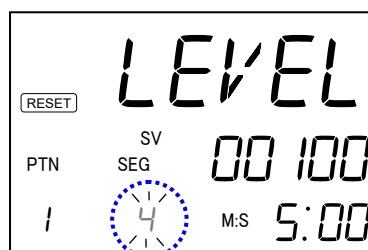
Segment 3 level screen



Flashing



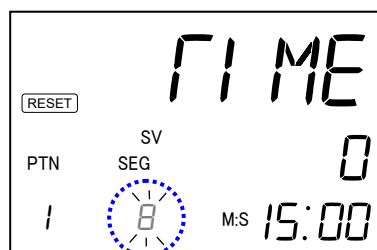
Segment 4 level screen



A Monitor & Program setting mode

Reset mode (RESET)

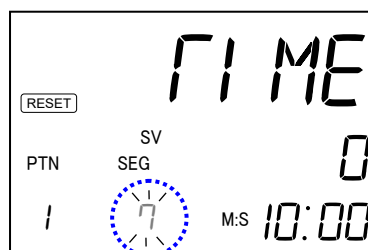
Segment 8 time screen



Flashing



Segment 7 time screen



When registered in the Parameter select mode

“Segment level 1 to 16” and “Segment time 1 to 16” screens can be registered in the Parameter select mode. Even if Segment No. is registered in the Parameter select mode, Segment No. can be switched to the others by blinking the SEG display unit.

4.4 Selection of Program Pattern Number Used for Control

Program pattern used for the program control can be selected in the Reset mode (RESET).

Select a pattern on the following parameter screens.

- PV/SV monitor screen of Monitor & Program setting mode
- Execution pattern selection screen of Pattern transfer mode



To switch to Reset mode (RESET) state, press the RESET key.

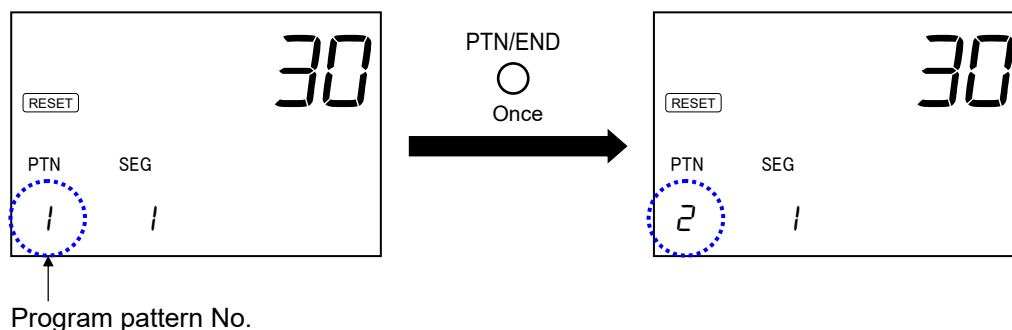
■ Switching pattern one by one

When the PV/SV monitor screen is displayed in the Reset mode (RESET) and the PTN key is pressed, program pattern number will be moved ahead.

A Monitor & Program setting mode

Reset mode (RESET)

PV/SV monitor



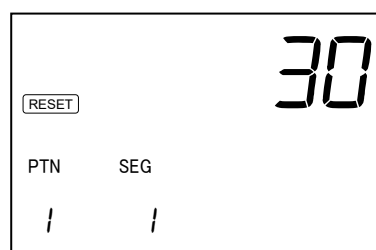
■ Switching to the desired pattern

Switch the screen to the Execution pattern selecting display in the Pattern switching mode, and select the desired pattern.

A Monitor & Program setting mode

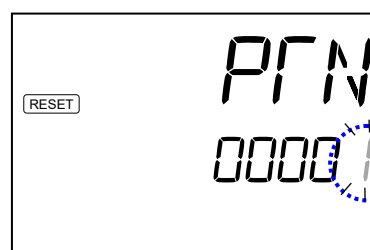
Reset mode (RESET)

PV/SV monitor



E Pattern transfer mode

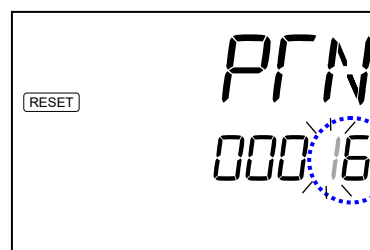
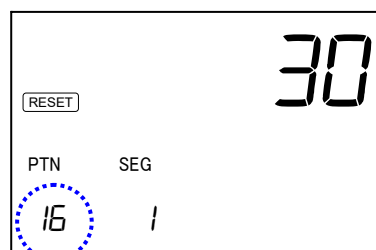
Execution pattern selection



A Monitor & Program setting mode

Reset mode (RESET)

PV/SV monitor



Set the optional pattern number by the , , or keys.



MEMO



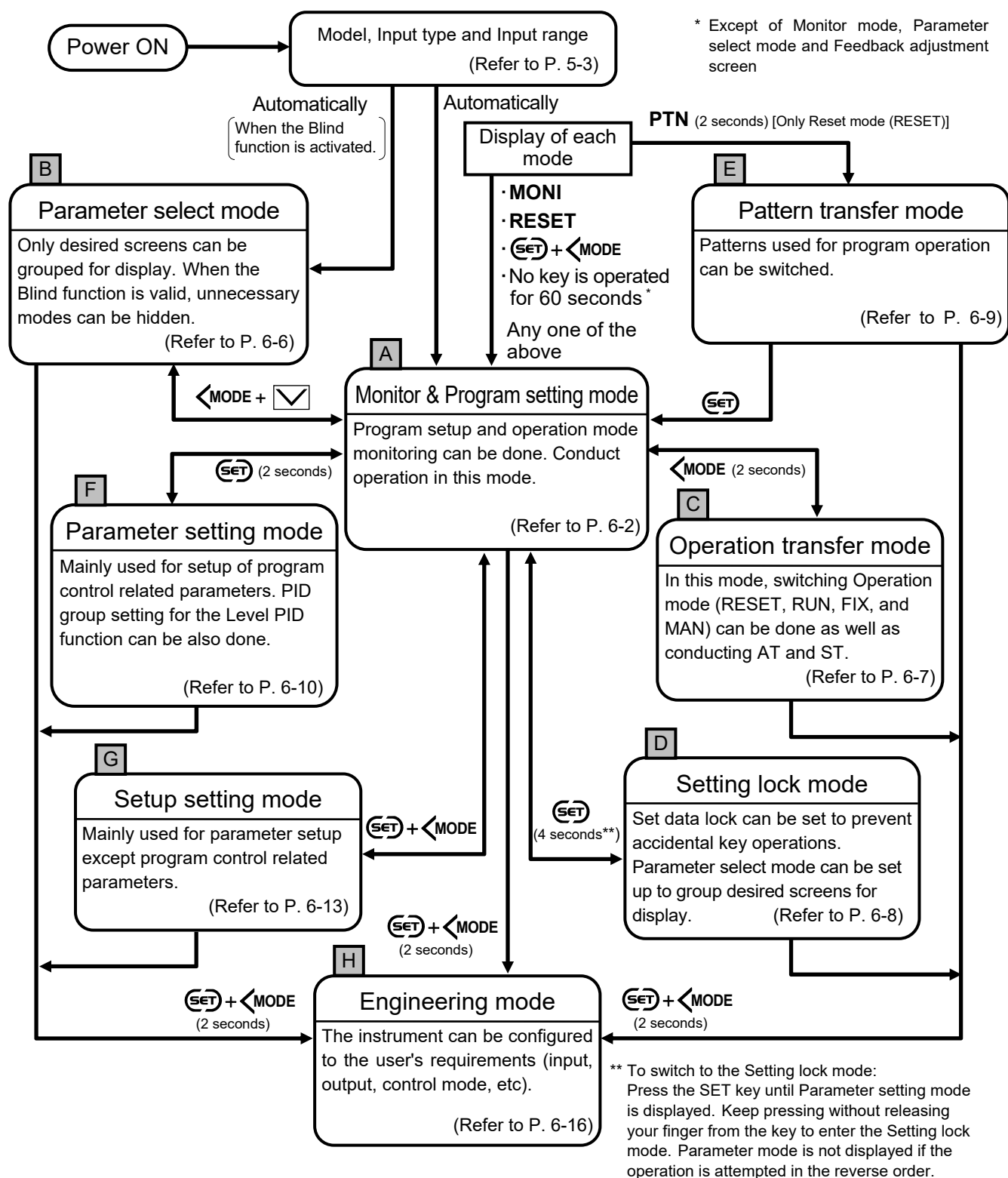
MODE SWITCHING

This chapter describes various modes and how to switch between them.

5.1 Parameter Mode Switching	5-2
5.2 Operation Mode Switching	5-4

5.1 Parameter Mode Switching

The instrument has eight types Parameter mode. Modes can be switched through the key operation of **SET** and **MODE** keys.



Legend X: Press X key once X+Y: Press X and Y key simultaneously
X (n times): Press X key n times
X (n seconds): Press and hold X key for n seconds or more
X+Y (n seconds): Press and hold X and Y keys simultaneously for n seconds

■ Model, Input type, Unit and Input range

Immediately after the instrument is powered, the input type, the unit symbol and the input range will be displayed.

Example: Thermocouple input (type K) and -200 to $+1372$ °C

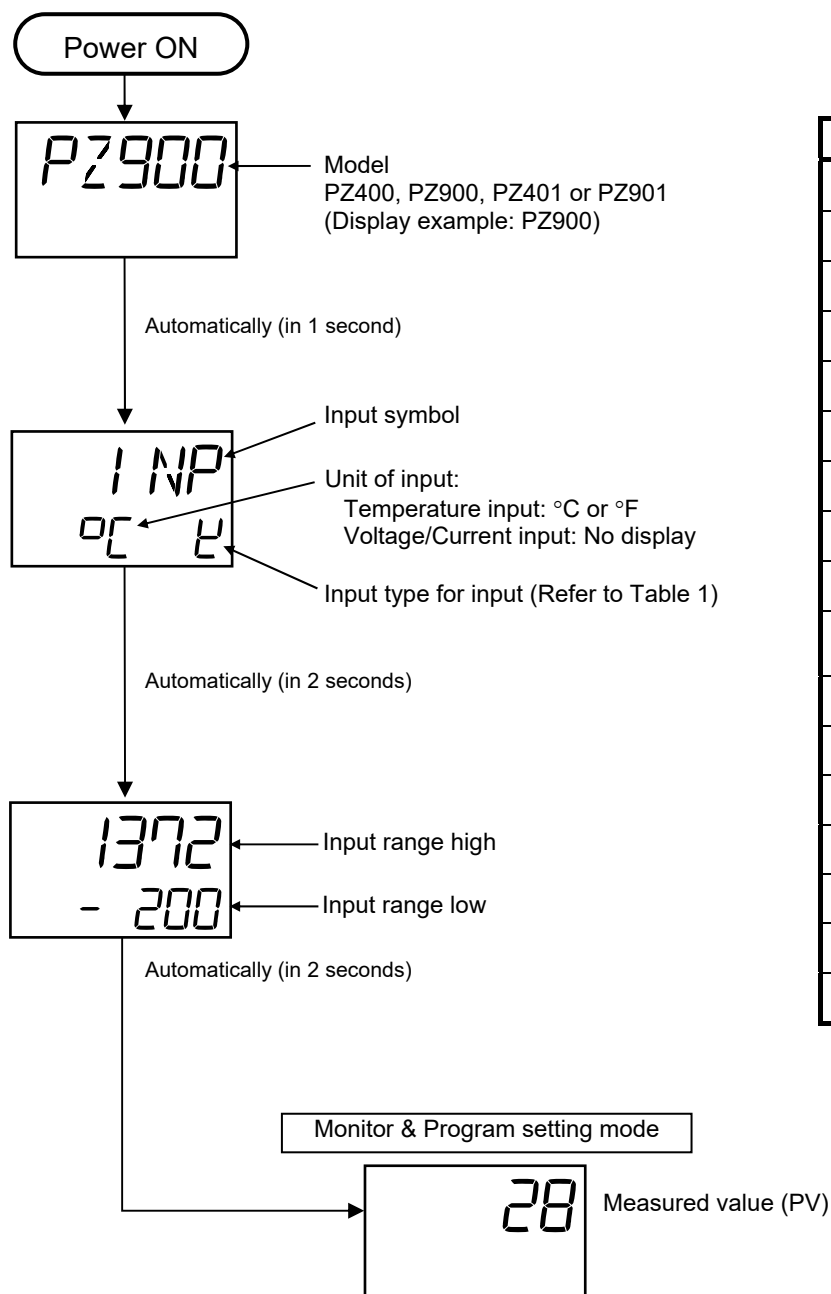


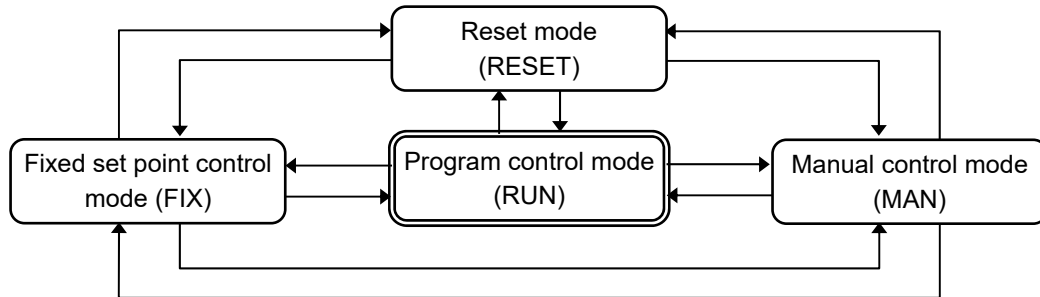
Table 1 Input type symbol

Symbol	Input type
<i>K</i>	Thermocouple K
<i>J</i>	Thermocouple J
<i>T</i>	Thermocouple T
<i>S</i>	Thermocouple S
<i>R</i>	Thermocouple R
<i>E</i>	Thermocouple E
<i>B</i>	Thermocouple B
<i>N</i>	Thermocouple N
<i>P</i>	Thermocouple PLII
<i>W</i>	Thermocouple W5Re/W26Re
<i>U</i>	Thermocouple U
<i>L</i>	Thermocouple L
<i>Pr</i>	Thermocouple PR40-20
<i>Pt</i>	RTD Pt100
<i>JP</i>	RTD JPt100
<i>V</i>	Voltage
<i>I</i>	Current

5.2 Operation Mode Switching

■ Type of Operation mode

PZ400/900/401/901 offers 4 types of Operation modes. The modes can be switched among one another.



● Reset mode (RESET)

When the operation mode is switched to the Reset mode, control stops and the manipulated output value in the Reset mode set in advance will be output. By setting “Reset mode output action”, Retransmission output, Logical operation (event) output, and Instrument status output can be output continuously.

● Program control mode (RUN)

Controls based on the program pattern being set.

● Fixed set point control mode (FIX)

Controls with the Set value (SV) being set at the Fixed set point control mode.

● Manual control mode (MAN)

Set Manipulated output value manually.

■ Action at Operation mode switching

Refer to the table below for the action at Operation mode switching.

Operation mode after switching	Operation mode before switching			
	Reset mode (RESET)	Program control mode (RUN) ¹	Fixed set point control mode (FIX)	Manual control mode (MAN)
Reset mode (RESET)		Produces the Manipulated output value in Reset mode (RESET).		
Program control mode (RUN)	Action starts based on the Control computation result.		Action continues with the SV in the Program control mode. ¹	Action continues with Manual manipulated output value. (Bumpless transfer ²)
Fixed set point control mode (FIX)		Action continues with the SV in the Fixed set point control mode.		
Manual control mode (MAN)	Action starts from the manipulated output in the Reset mode ³	Depends on the action of the selected Manual manipulated output.		

¹ When the mode is switched from the Program control mode (RUN) to the Fixed set point control mode (FIX) or to the Manual control mode (MAN), the program pattern, the segment, and the elapsed time at the time of switching are stored. When the mode is switched from the Fixed set point control mode (FIX) or Manual control mode (MAN) to the Program control mode (RUN), the program resumes from the stored program pattern, the segment and the elapsed time.

² Even in the bumpless transfer (that suppresses abrupt change of control output), the output may bump (that is, abrupt change of control output) when the changed control action is P, PD, or on/off action.

³ In case of Heat/Cool PID control, the output value is determined by the following condition.

- ① When the set value of the Manipulated output value in Reset mode [heat-side] exceeds 0.0 %:
Manipulated output value in Reset mode [heat-side]
- ② When the set value of the Manipulated output value in Reset mode [heat-side] is 0.0 % or less, and when the set value of the Manipulated output value in Reset mode [cool-side] exceeds 0.0 %: Manipulated output value in Reset mode [cool-side]
- ③ The set value of the Manipulated output value in Reset mode [heat-side] is 0.0 % or less, and when the Manipulated output value in Reset mode [cool-side] is 0.0 % or less: 0.0 %



For selection of manual manipulated output value, refer to the **9.8 Suppressing Sudden Change in Output (Balanceless Bumpless) (P. 9-33)**.

■ Switching procedure of Operation mode

4 types of mode switching procedures:

- Parameter for Operation mode switching
- Direct key for Operation mode switching
- Digital input (DI) for Operation mode switching
- Host communication for Operation mode switching



NOTE

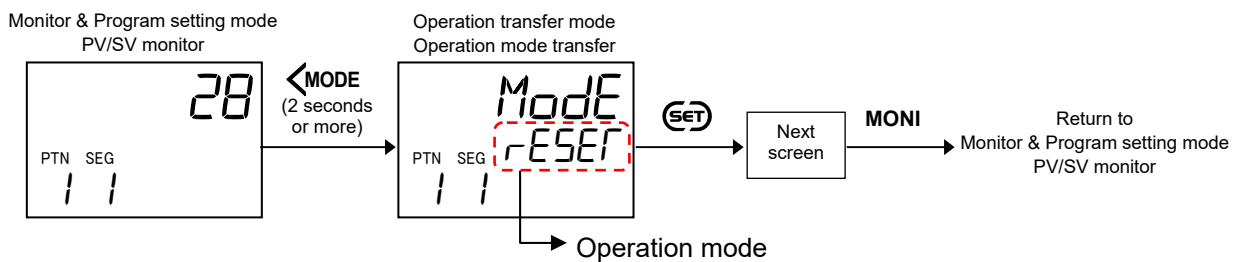
Switching procedure does not affect the Operation mode. The Operation mode selected last is validated. Operation mode cannot be changed by the Operation mode switching parameter, the Direct key or the Host communication when RESET or RUN of Digital input (DI) is ON (contact closed).

● When switching by the Operation mode switching parameter

Switch the Operation mode by using key or key at the Operation mode transfer screen.



Release the Set data lock before changing the Operation mode.

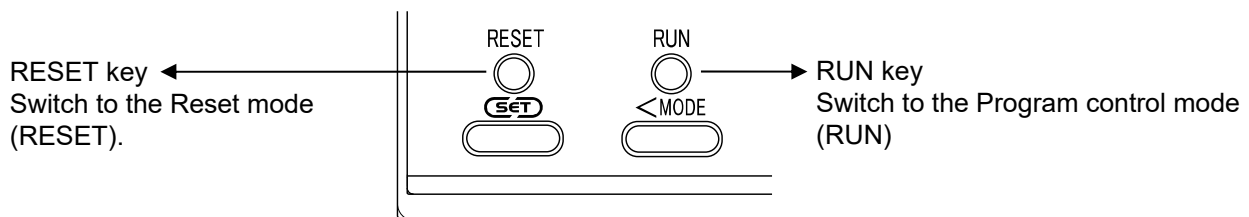


Use key or key to change the Operation mode.

- Reset mode (RESET)
- Program control mode (RUN)
- Fixed set point control mode (FIX)
- Manual control mode (MAN)

● When switching by the Direct key

Use the front direct key. Switchable operation modes are Reset mode (RESET) and Program control mode (RUN).



● When switching by the Digital input (DI)

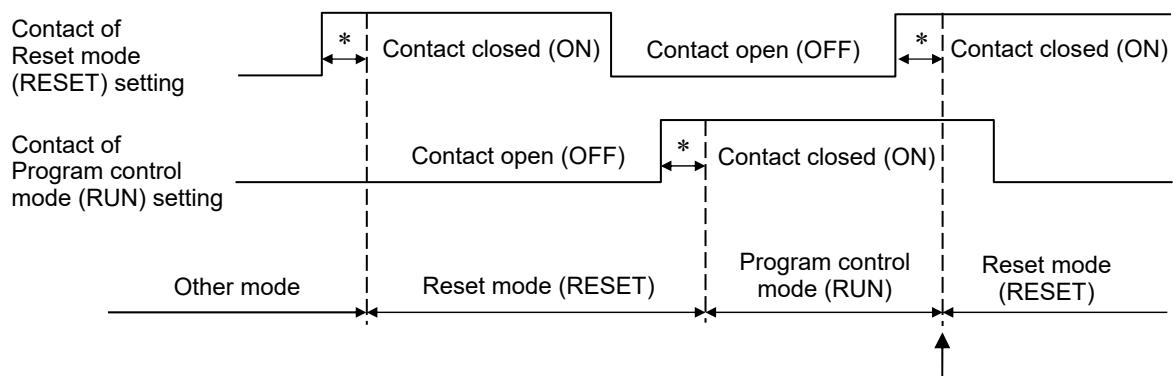
Digital input (DI) switching is only available when switching to the Reset mode (RESET) or the Program control mode (RUN).

- To use Digital input (DI), one of B, E, H, or J needs to be selected at Option 2 of the model code.
As factory setting, Reset mode (RESET) is assigned to DI1 and Program control mode (RUN) is assigned to DI2.
- The assignment of DI can be changed by yourself. The change of the setting can be done in the Engineering mode: Function selection of DI1 to DI6 at Function block No.23.



For details, refer to **8.2 Switching Functions Using Digital Inputs (DI) (P. 8-11)**.

Transfer timing of Operation mode



*After the contact is transferred, it takes “Within 200 ms” until the action of this instrument is actually selected.

Even while the contact for the Program control mode (RUN) setting is closed, when the contact of the Program control mode (RUN) gets closed, the instrument will enter the Reset mode (RESET).

● When switching by the Host communication

Refer to the communication data below when switching the Operation mode by the Host communication [RKC communication or Modbus (double word)].

- Communication data

Name	RKC communication		Modbus				Attribute	Data range	Factory set value
	Identifier	Digits	HEX		DEC				
			Low	High	Low	High			
Operation mode transfer	XM	7 or 6	0060	0061	96	97	R/W	0: Reset mode (RESET) 1: Program control mode (RUN) 2: Fixed set point control mode (FIX) 3: Manual control mode (MAN)	0



For details of the host communication, refer to **PZ400/PZ900/PZ401/PZ901 Host Communication Instruction Manual (IMR03B06-E□)**.



MEMO



SELECTING PARAMETERS

6

This chapter describes various parameter types and how to switch between them.

6.1 Monitor & Program Setting Mode [A].....	6-2
6.2 Parameter Select Mode [B]	6-6
6.3 Operation Transfer Mode [C].....	6-7
6.4 Setting Lock Mode [D]	6-8
6.5 Pattern Transfer Mode [E]	6-9
6-6 Parameter Setting Mode [F]	6-10
6.7 Setup Setting Mode [G]	6-13
6.8 Engineering Mode [H]	6-16

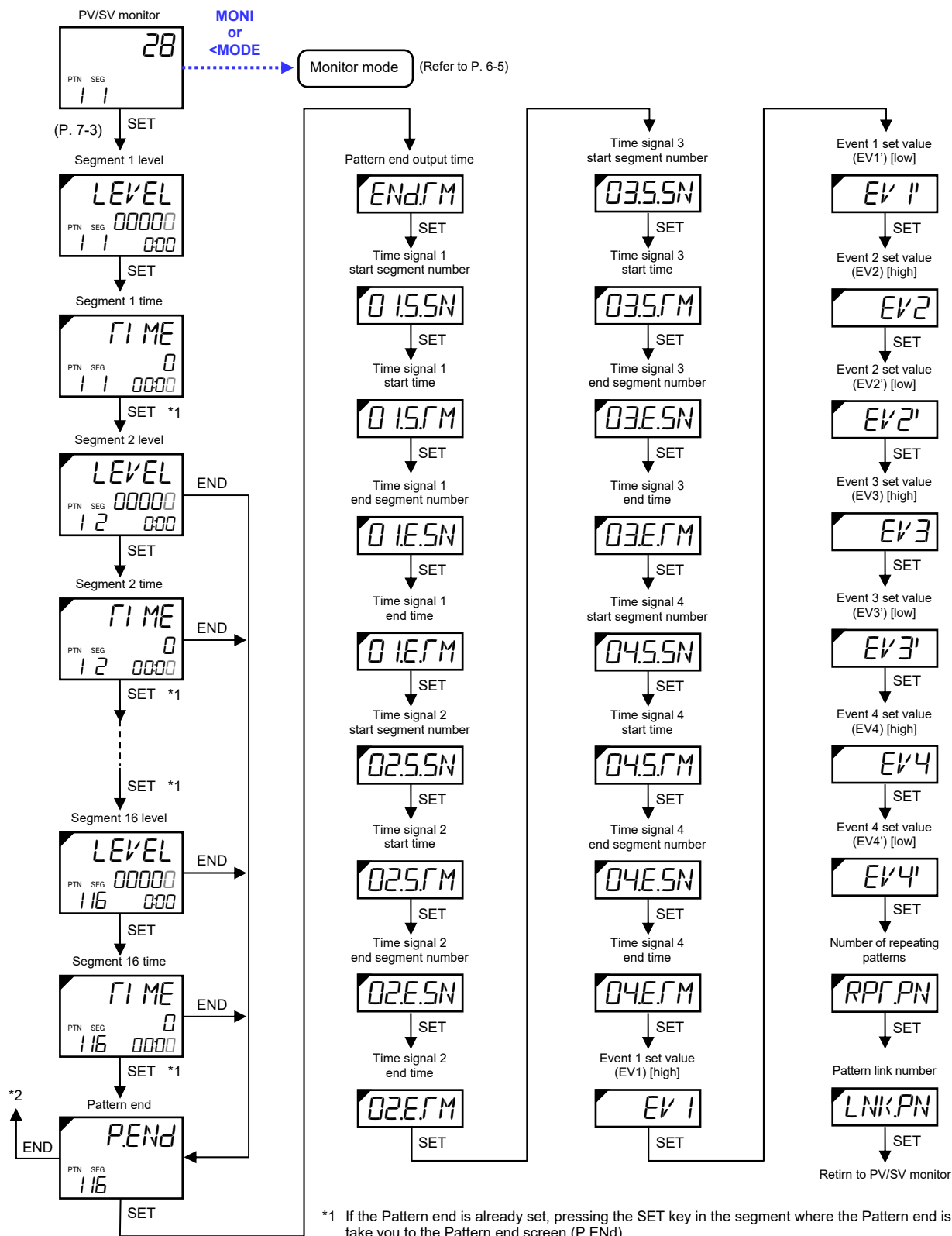


6.1 Monitor & Program Setting Mode [A]

The screen in the Monitor & Program setting mode depends on the operation mode [Reset mode (RESET), Program control mode (RUN), Fixed set point control mode (FIX), and Manual control mode (MAN)].

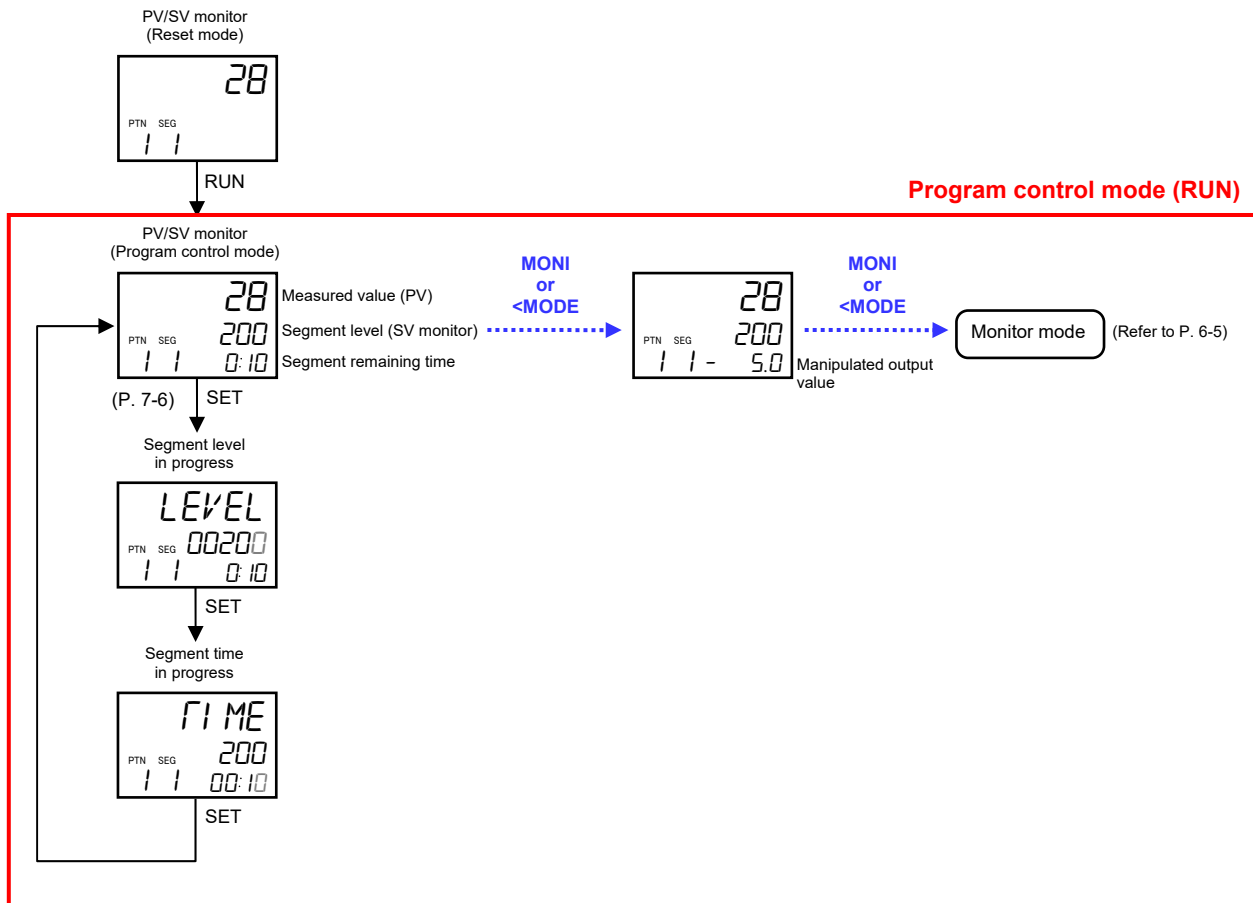
■ Reset mode (RESET)

When the RESET key is pressed, the instrument enters the Reset mode (RESET), and the control is stopped.



Program control mode (RUN)

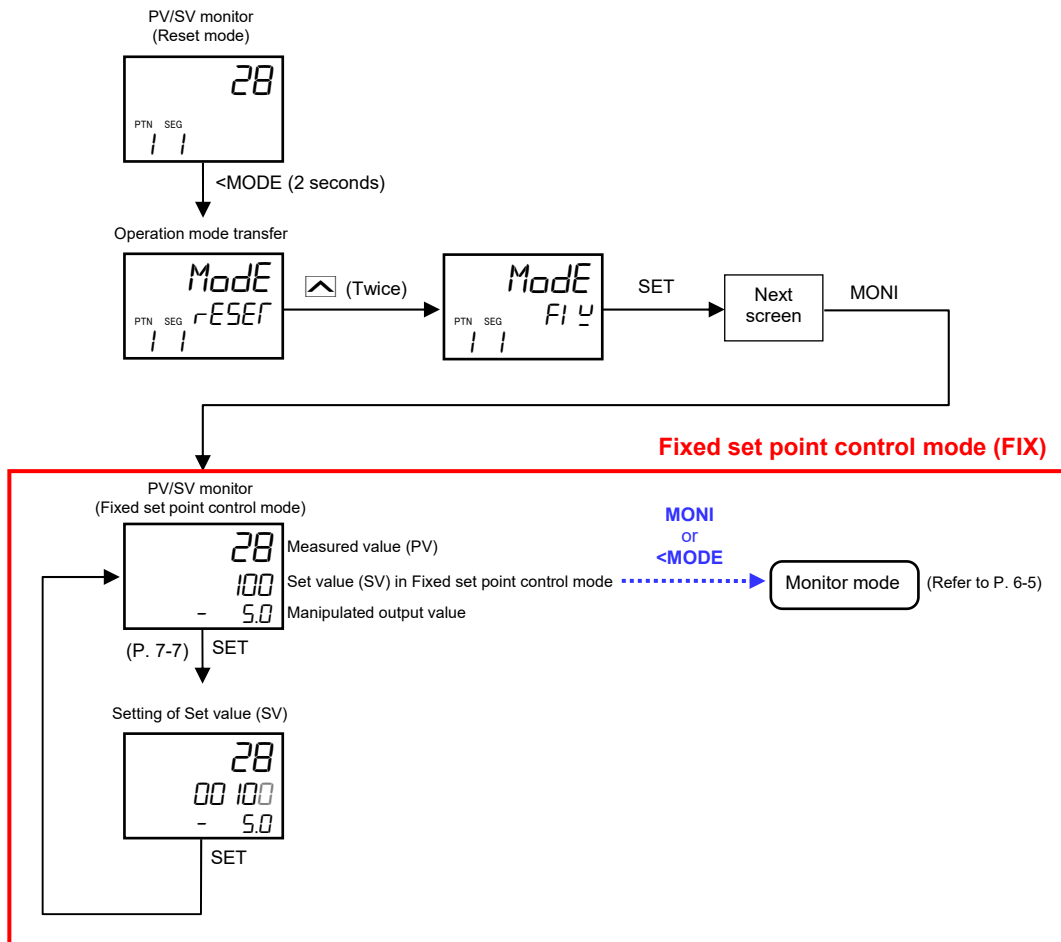
When the RUN key is pressed, the Program control mode (RUN) will start.





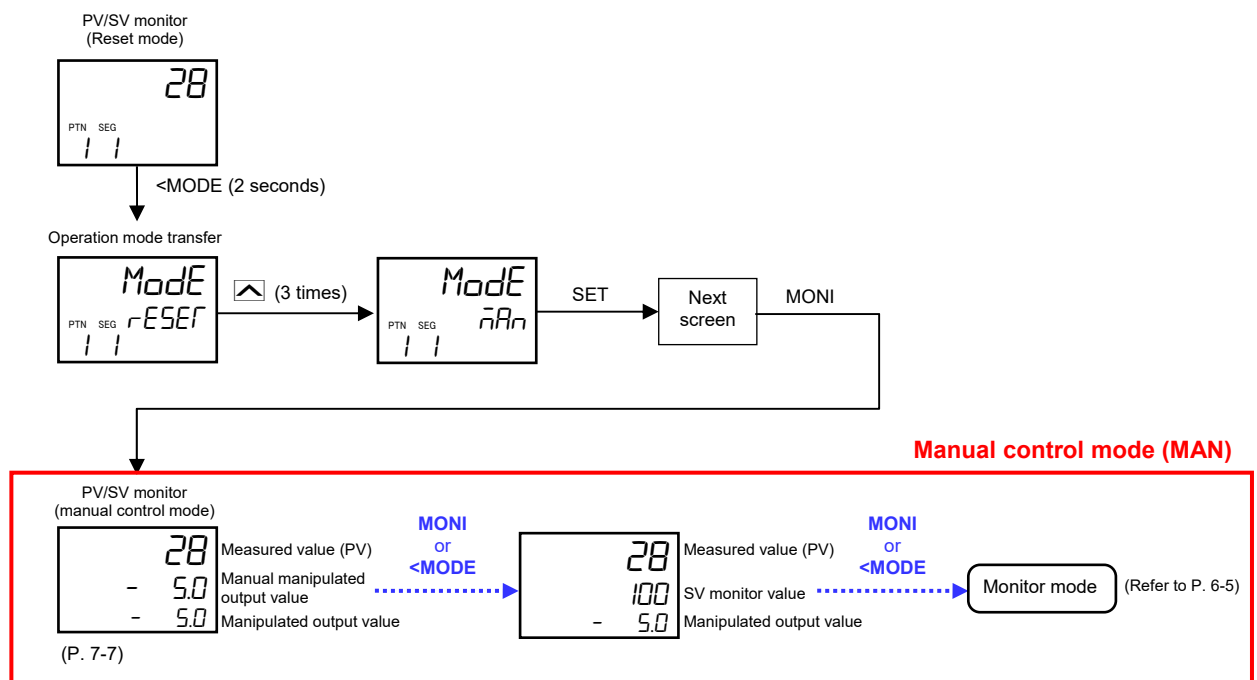
■ Fixed set point control mode (FIX)

Switch the operation mode to the Fixed set point control mode (FIX) on the Operation mode transfer screen.

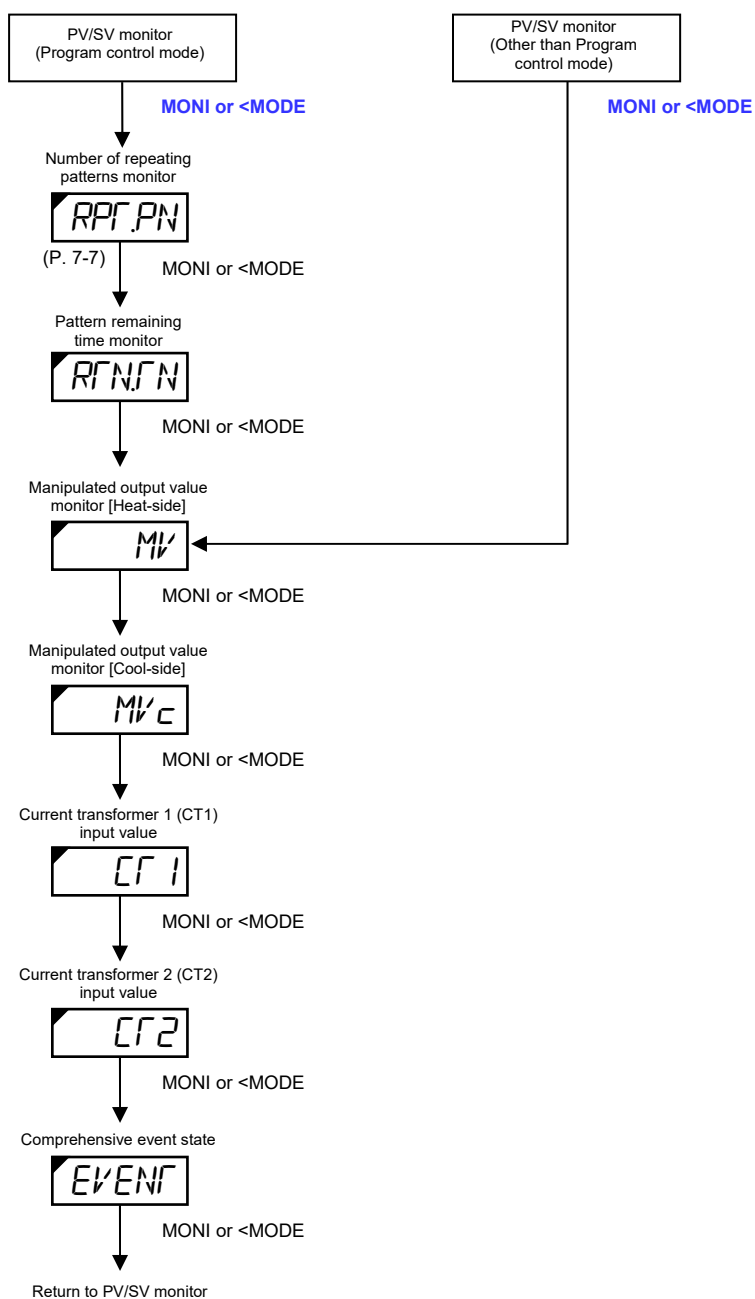


■ Manual control mode (MAN)

Switch the operation mode to the Manual control mode (MAN) on the Operation mode transfer screen.



Monitor mode

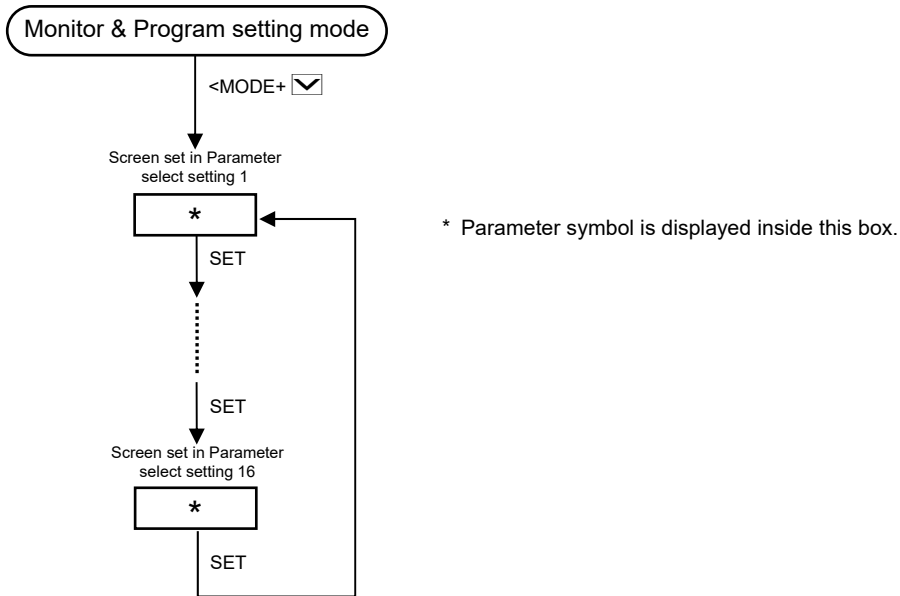


When SET key is pressed in the Monitor mode, the display will switch to the PV/SV monitor screen.



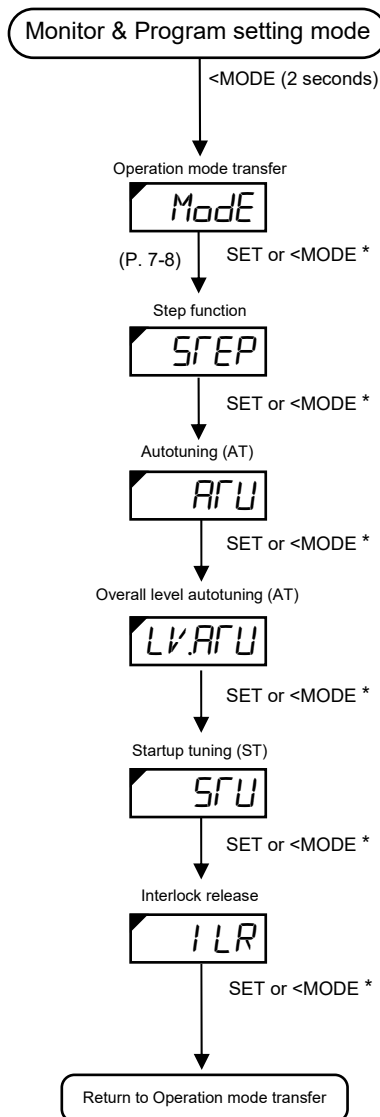
6.2 Parameter Select Mode [B]

Displays the screens registered in Parameter select setting.



While the Blind function is valid, only Parameter select setting screen, Set data lock mode, and Monitor & Program setting mode screens are displayed. The instrument starts from the Parameter select mode after powered on.

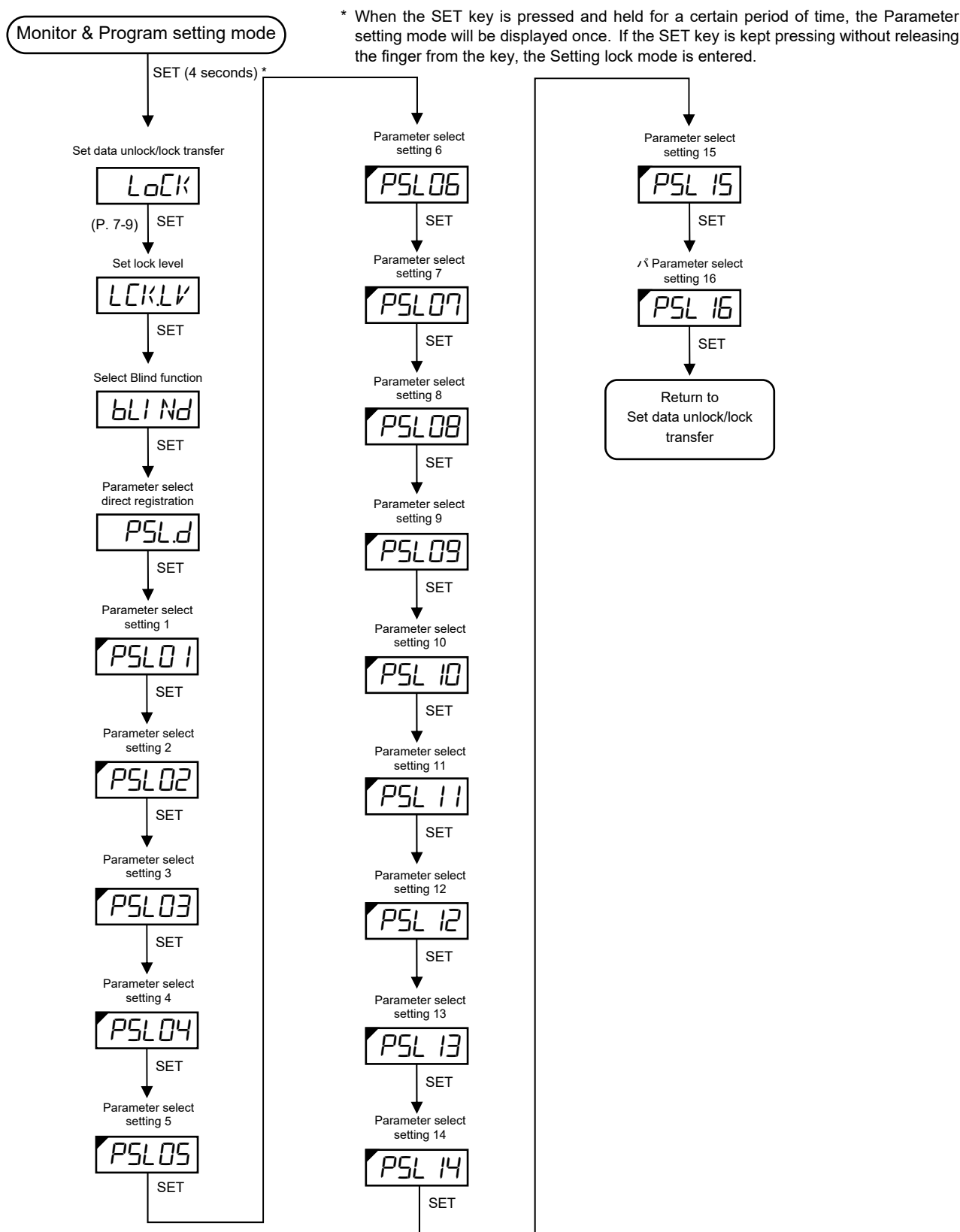
6.3 Operation Transfer Mode [C]



* Press SET key to activate the set value.

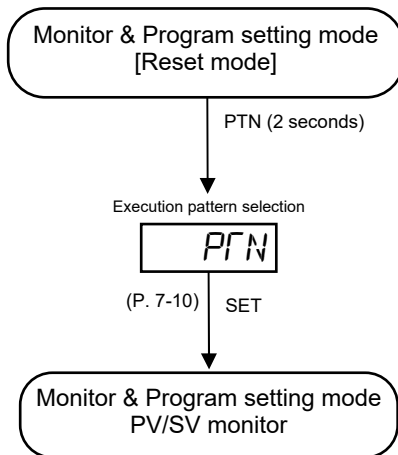


6.4 Setting Lock Mode [D]

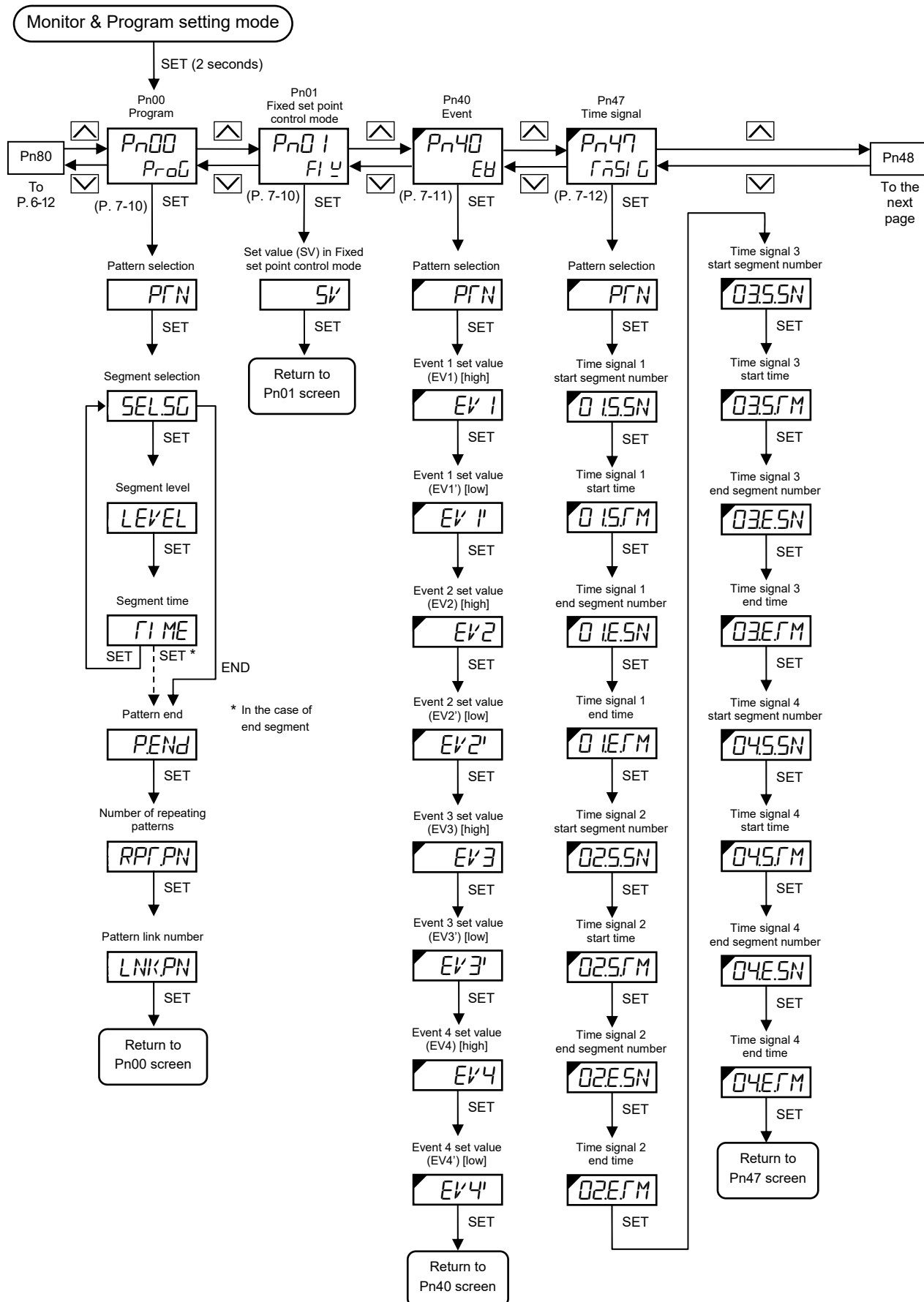


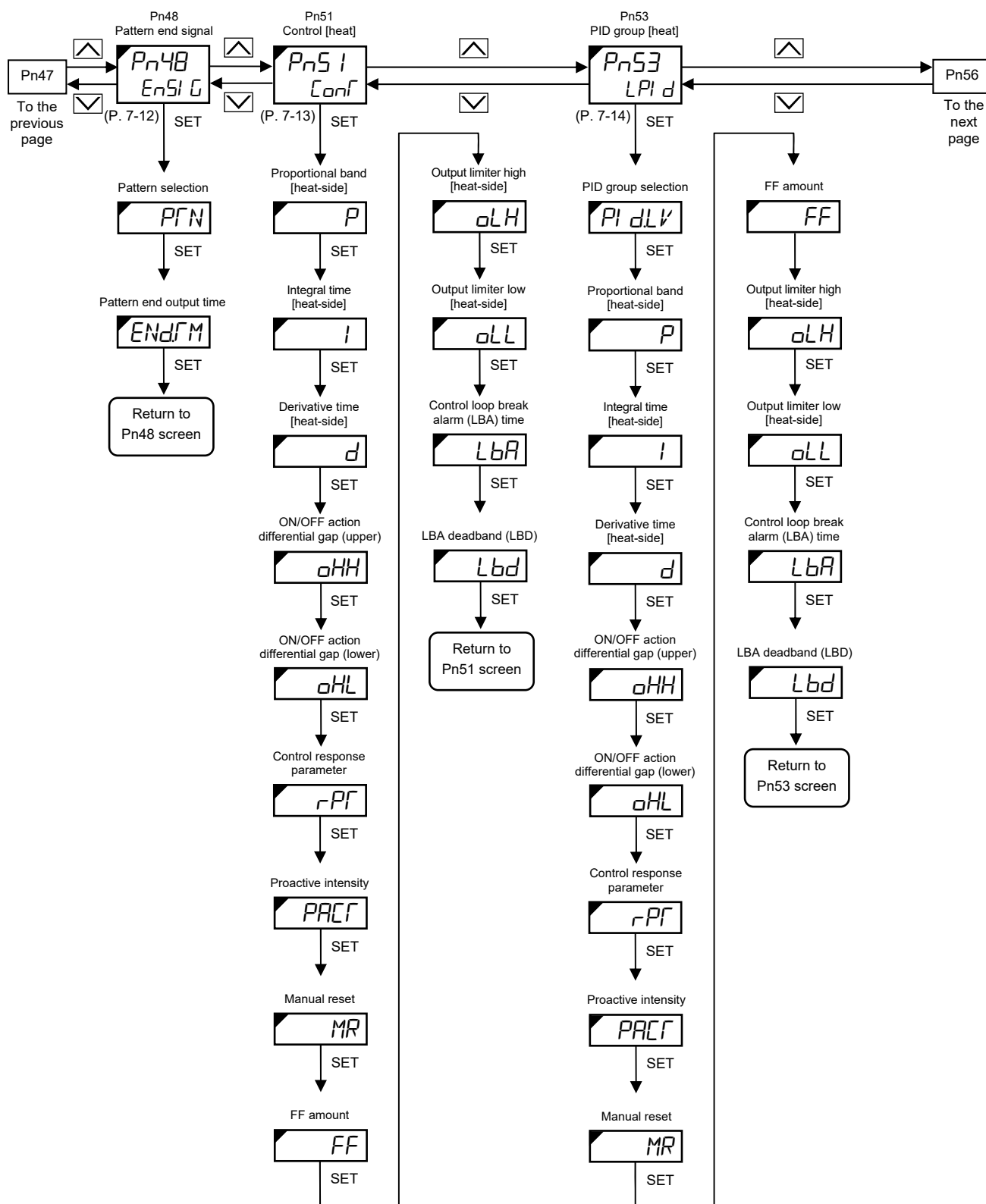


6.5 Pattern Transfer Mode [E]



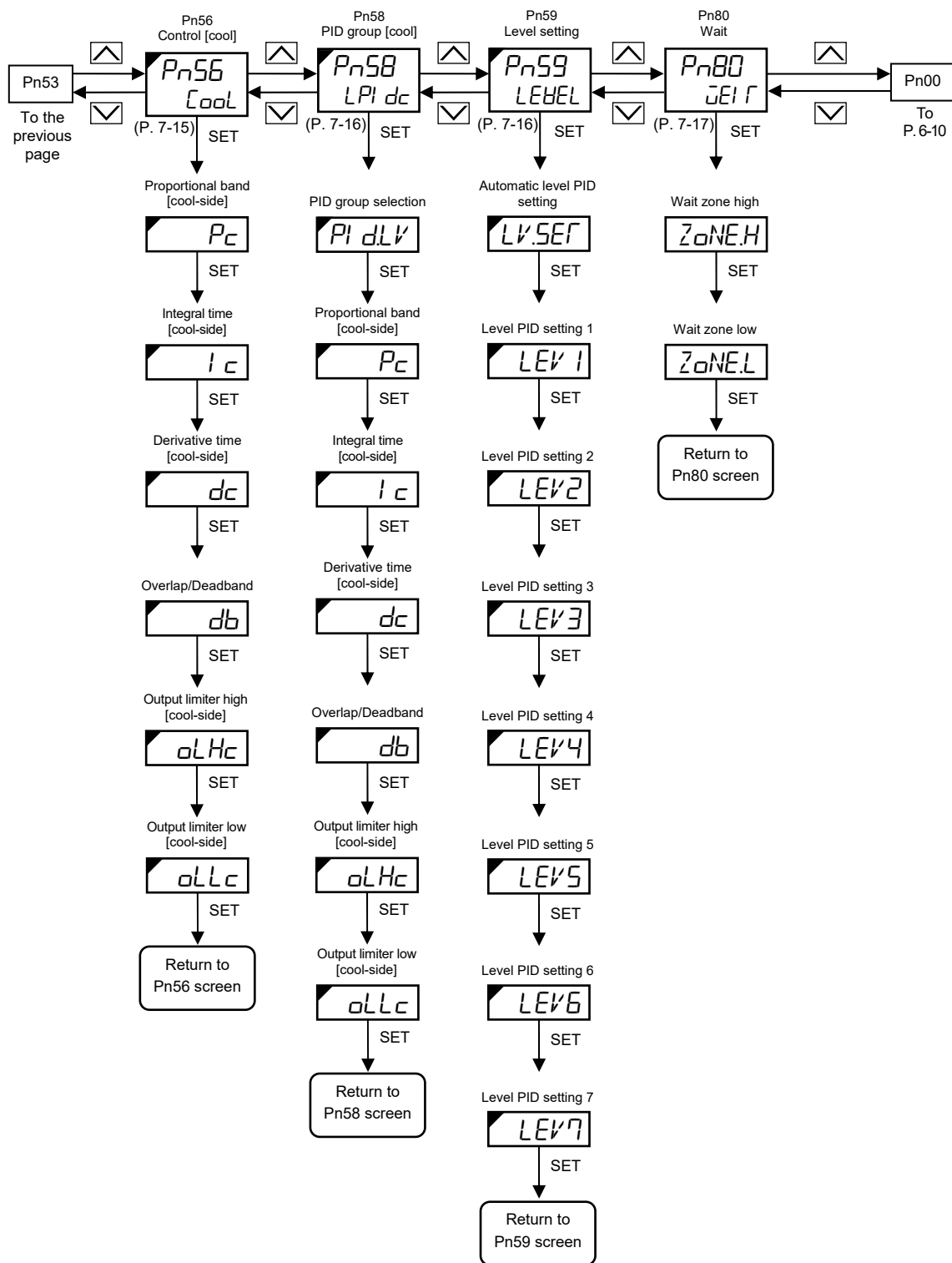
6.6 Parameter Setting Mode [F]



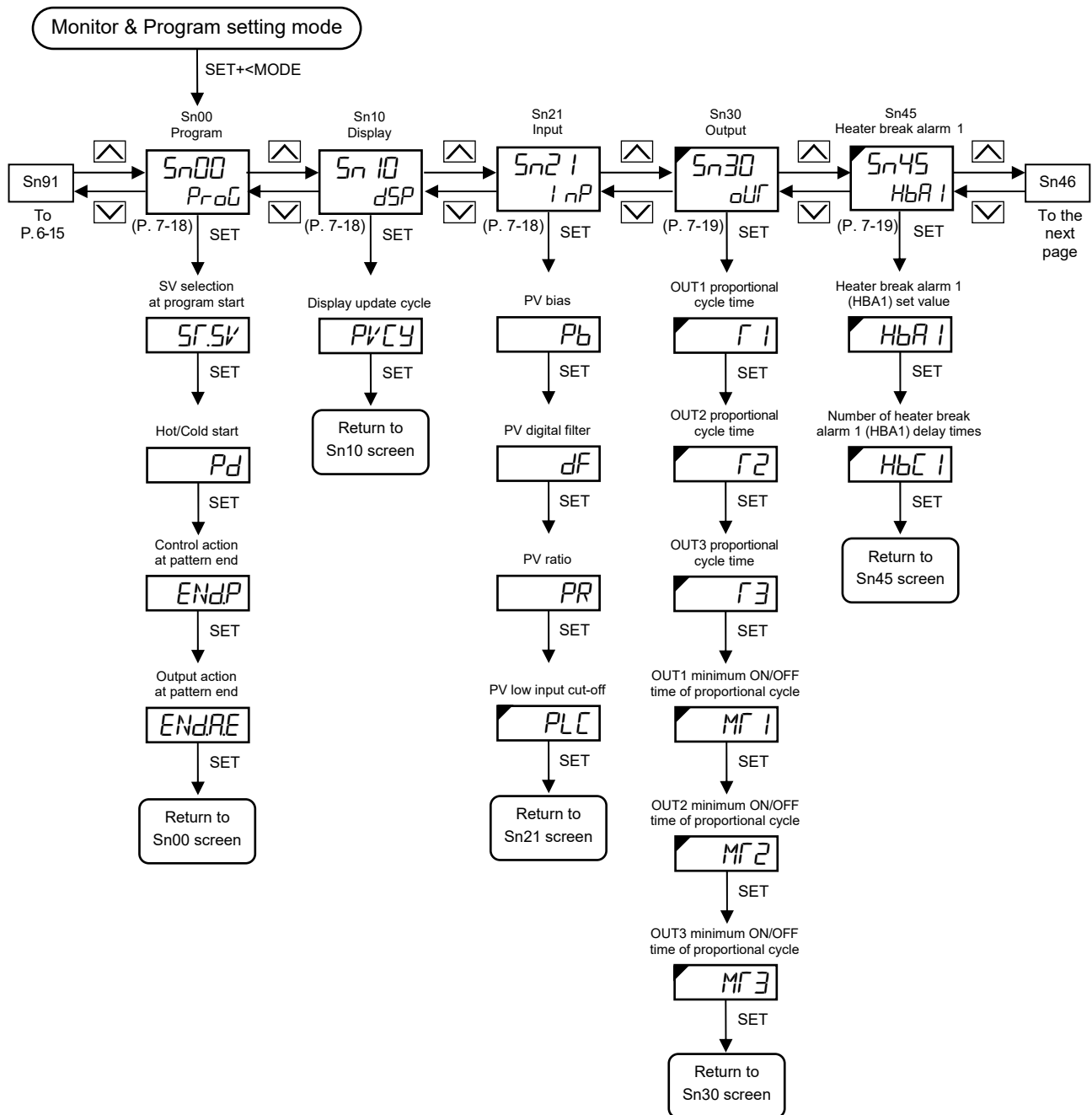




6. SELECTING PARAMETERS [Parameter setting mode]

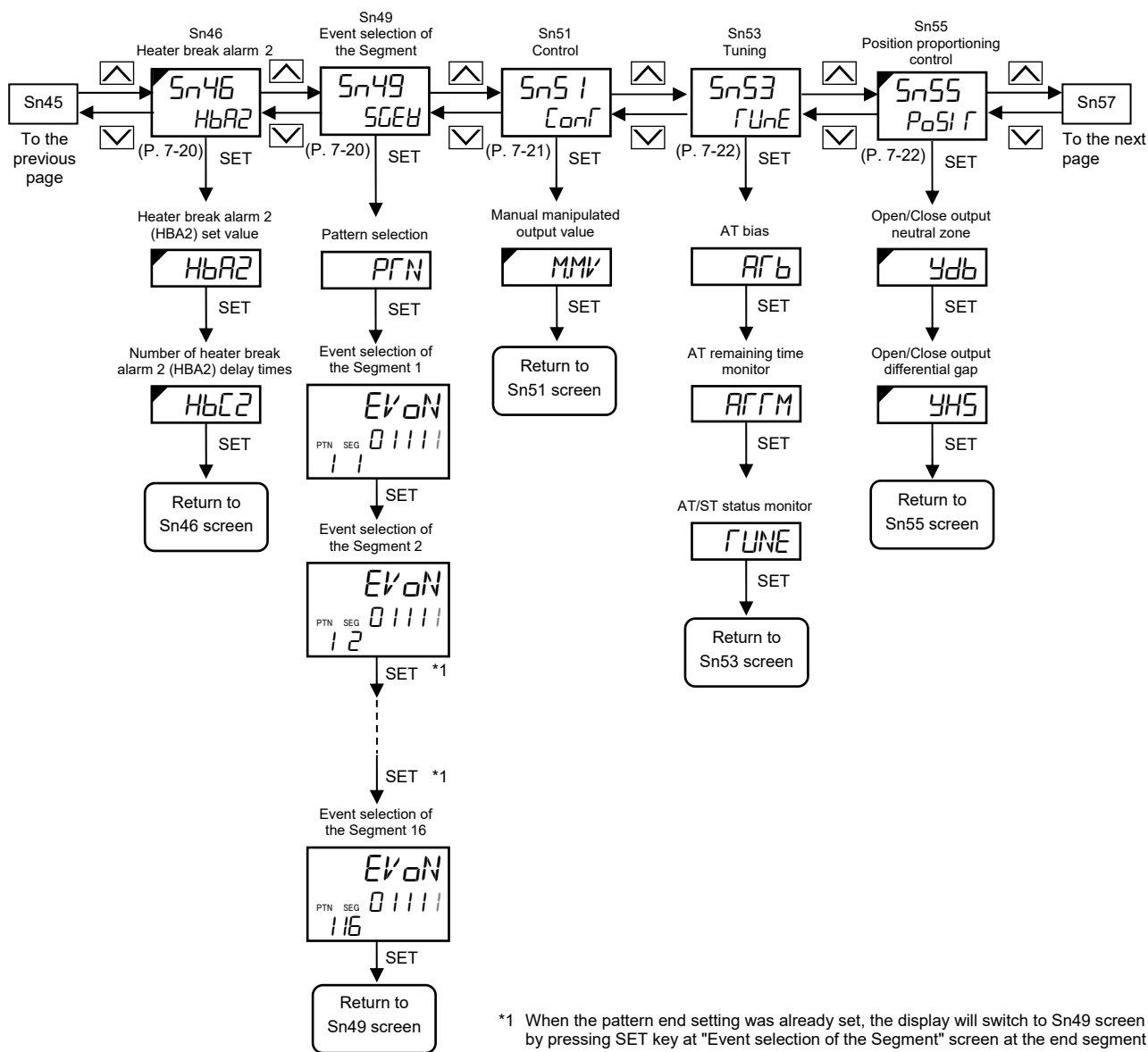


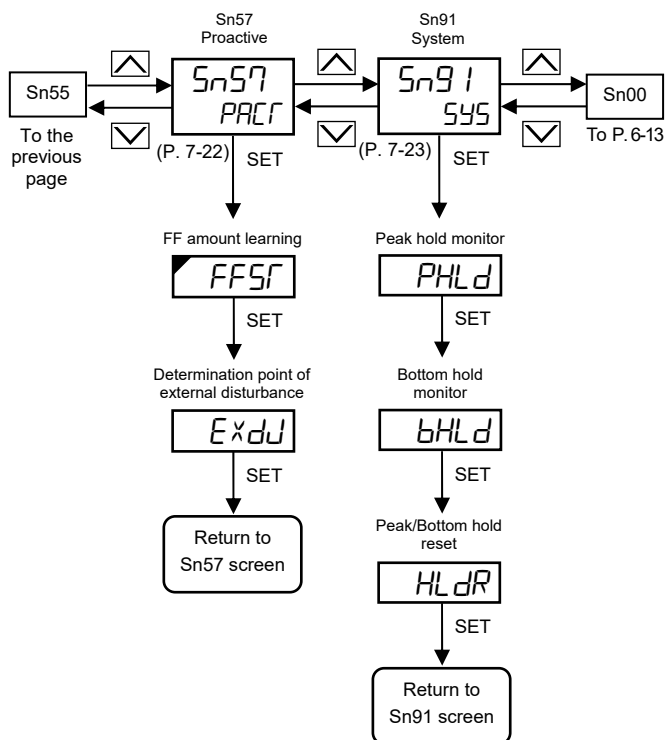
6.7 Setup Setting Mode [G]



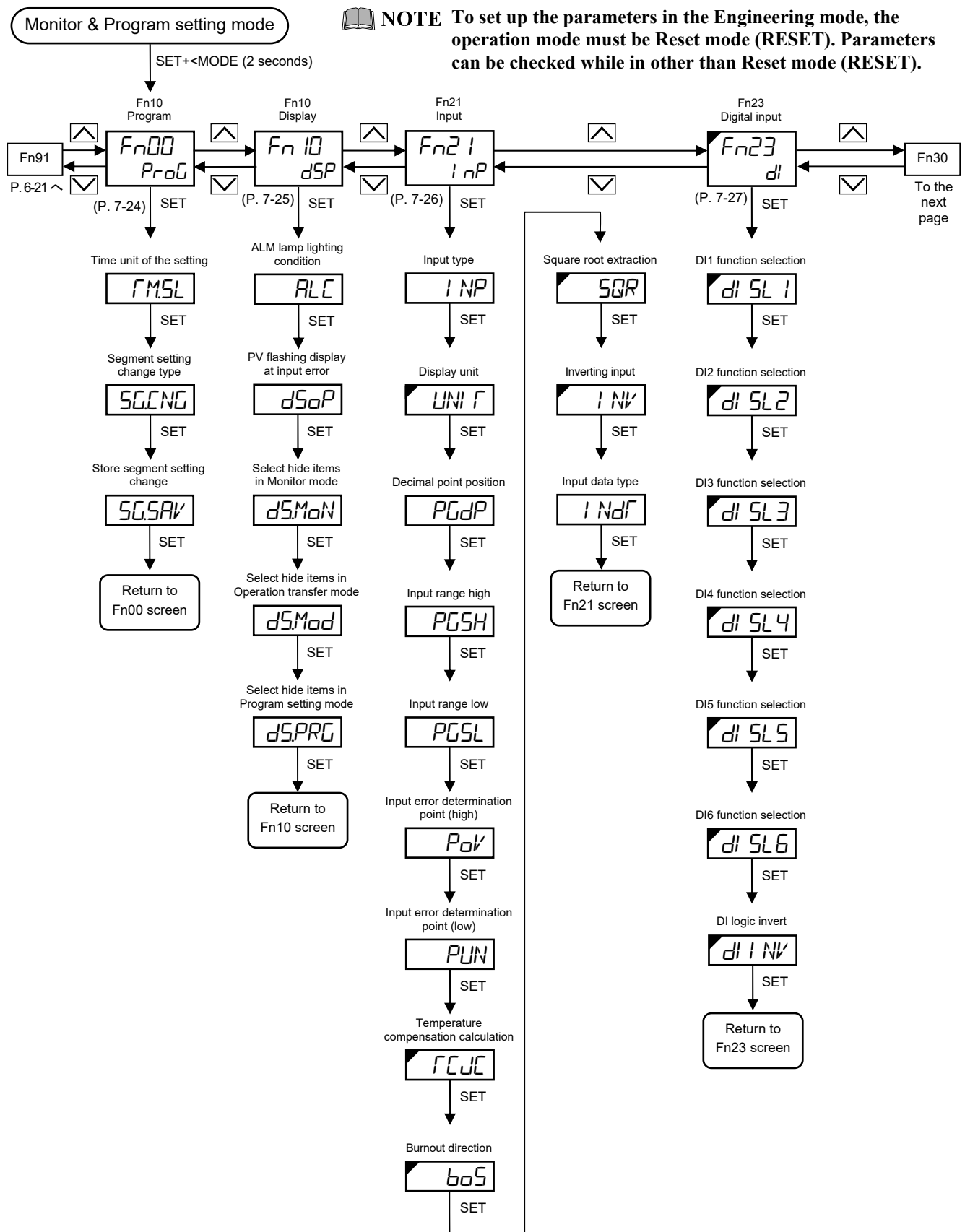


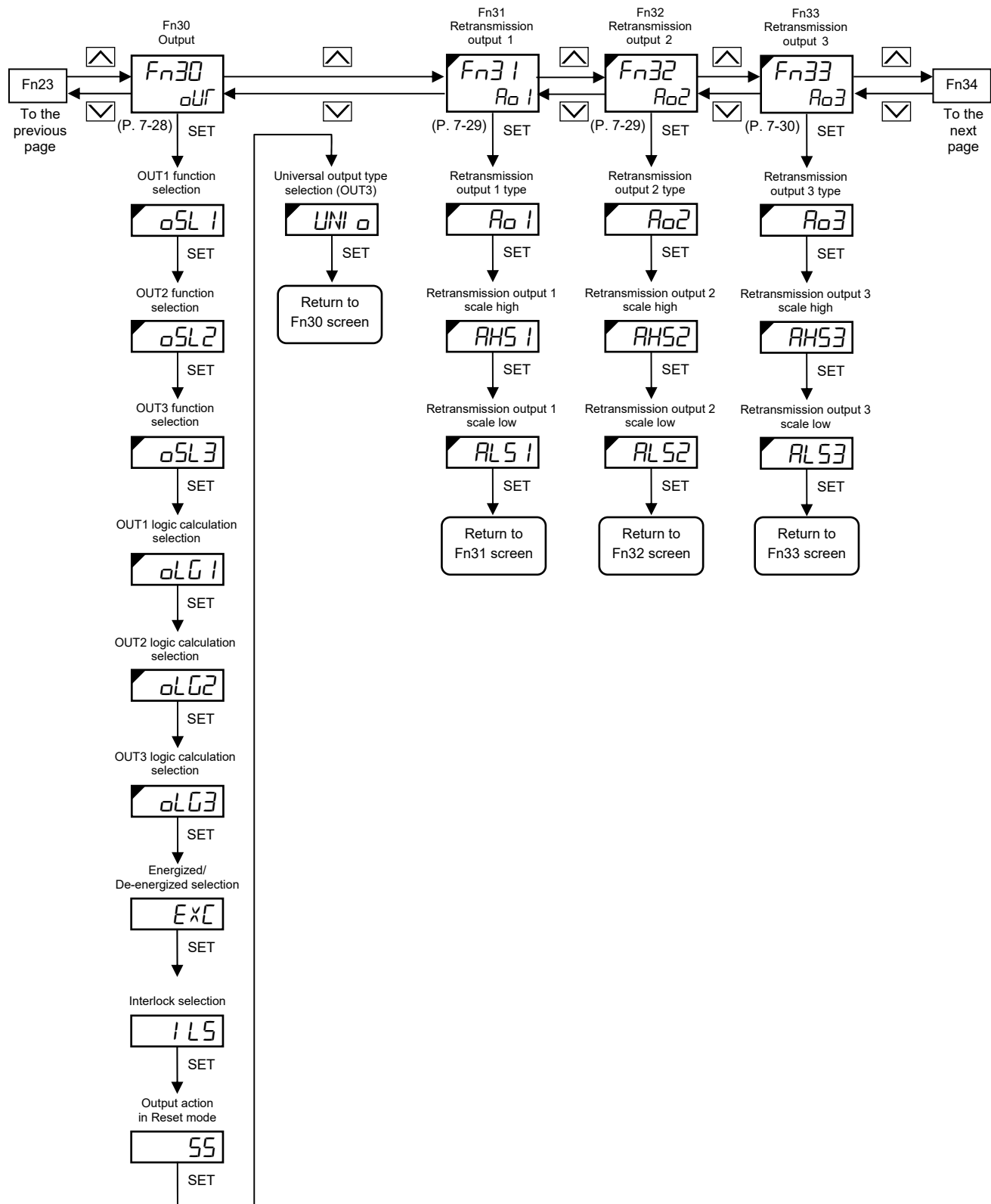
6. SELECTING PARAMETERS [Setup setting mode]





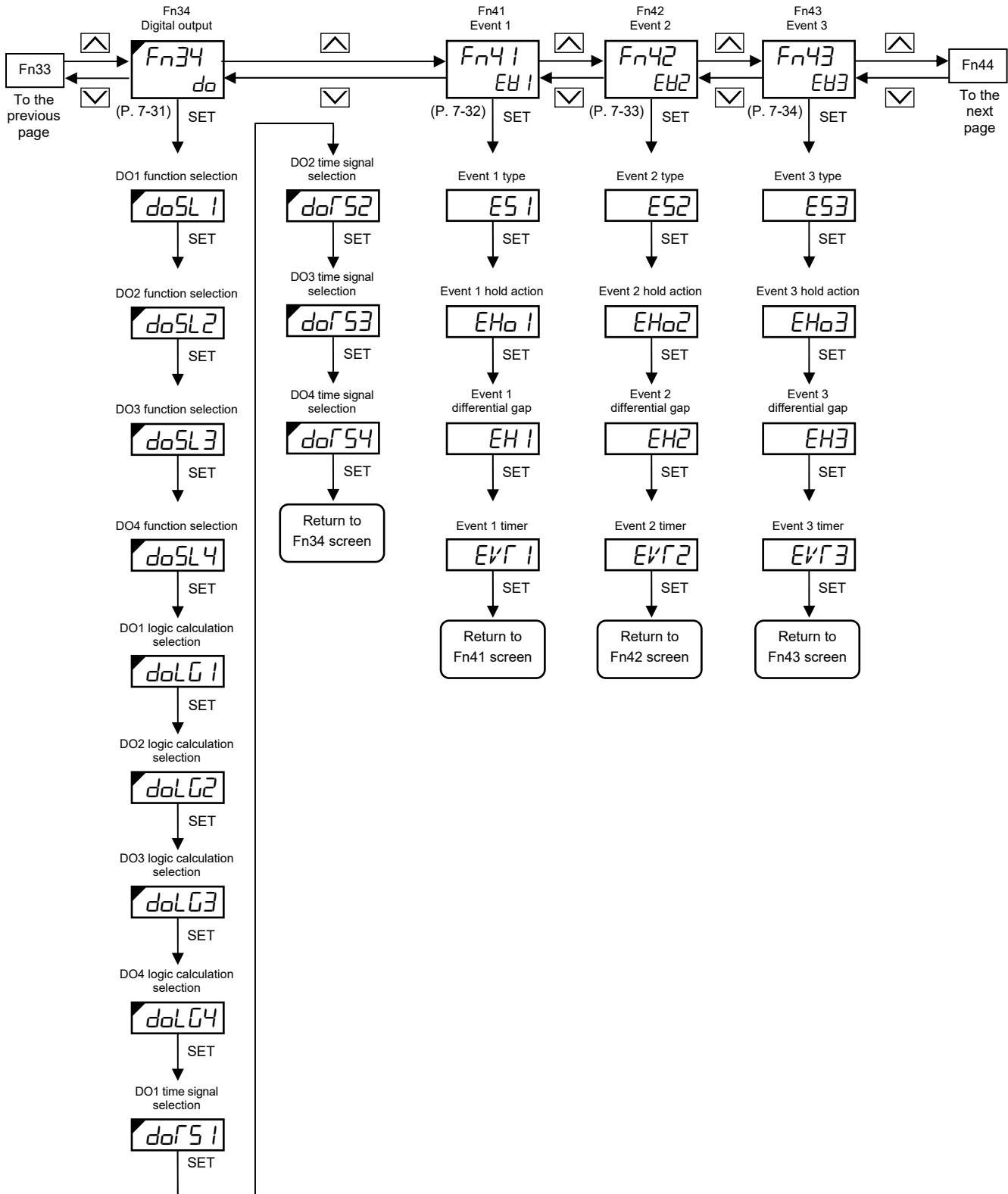
6.8 Engineering Mode [H]

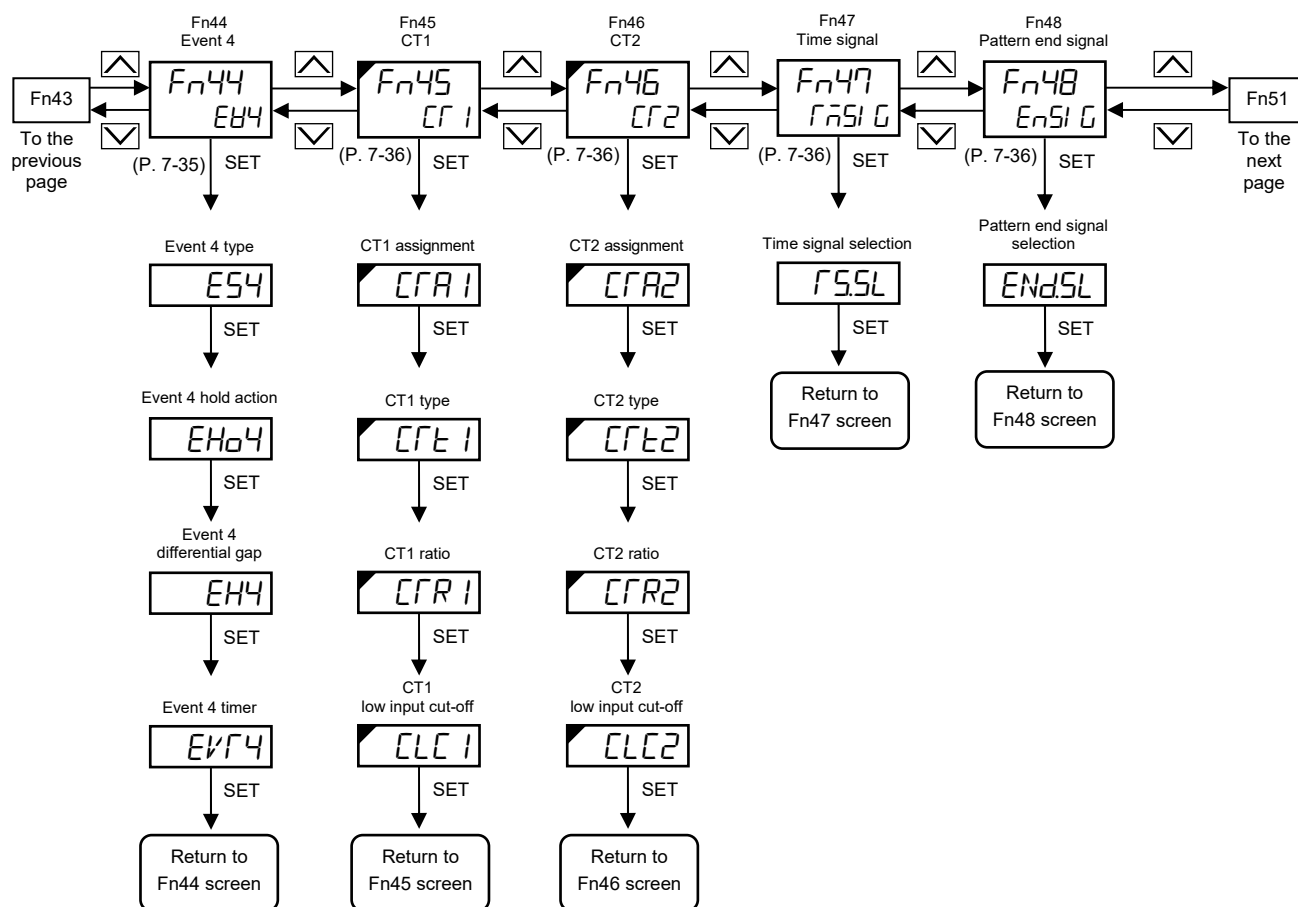


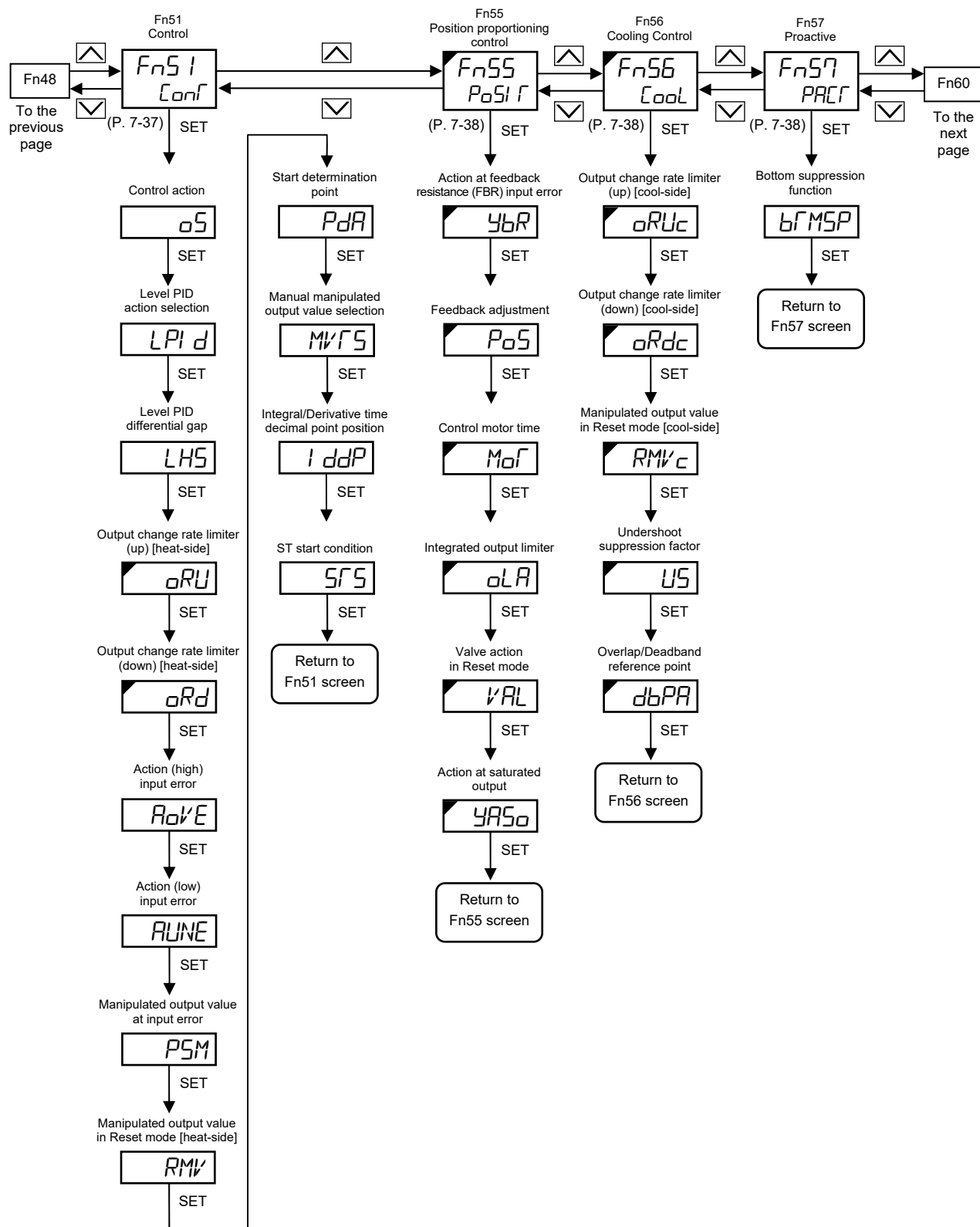


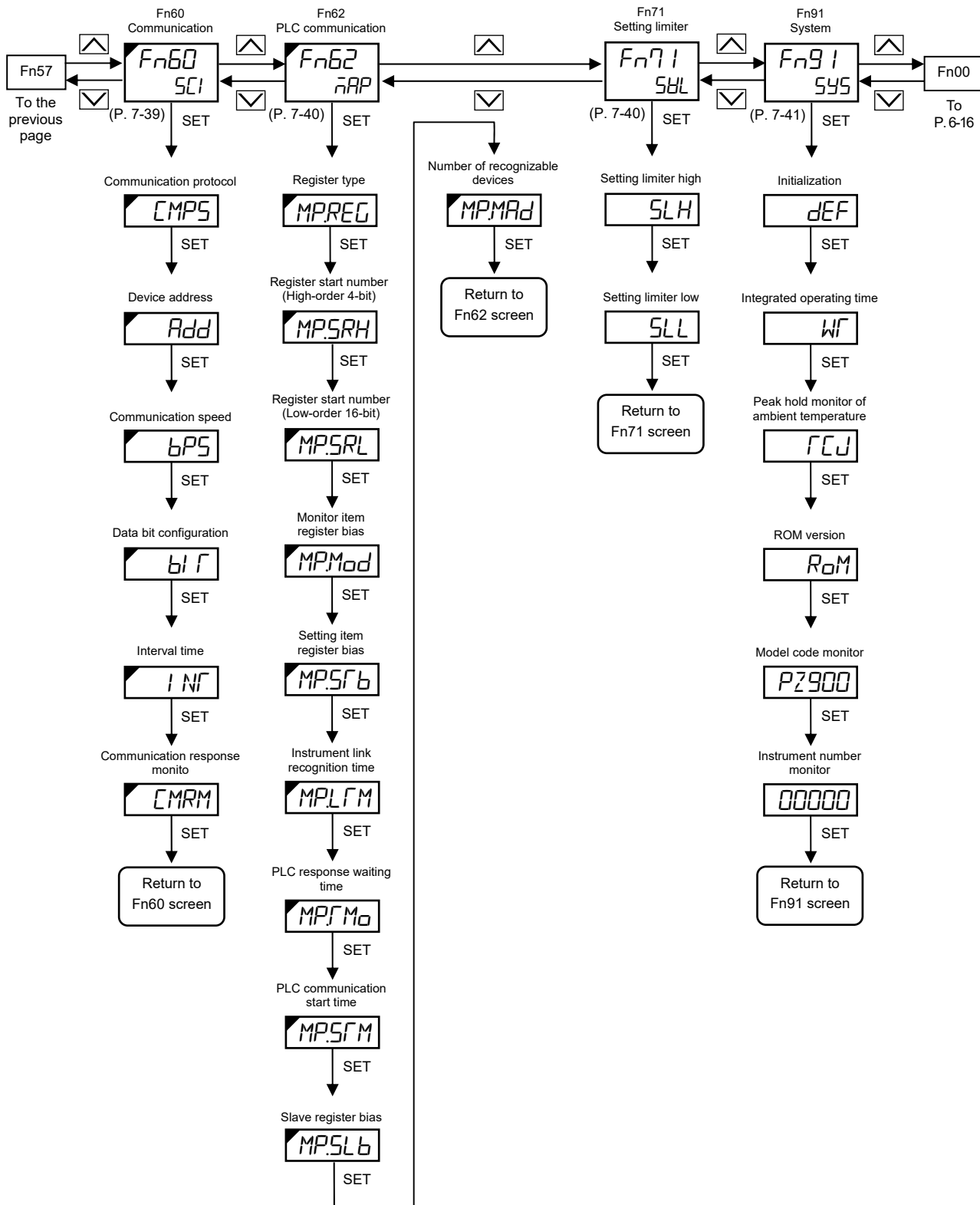


6. SELECTING PARAMETERS [Engineering mode]











MEMO



PARAMETER LIST

This chapter describes displays, names and data ranges of each parameter.

7.1 How to Read the Table	7-2
7.2 Monitor & Program Setting Mode [A].....	7-3
7.3 Parameter Select Mode [B]	7-8
7.4 Operation Transfer Mode [C].....	7-8
7.5 Setting Lock Mode [D].....	7-9
7.6 Pattern Transfer Mode [E].....	7-10
7.7 Parameter Setting Mode [F]	7-10
7.8 Setup Setting Mode [G].....	7-18
7.9 Engineering Mode [H]	7-24



7.1 How to Read the Table

(1) ↓	(2) ↓	(3) ↓	(4) ↓	(5) ↓	(6) ↓
No.	Symbol	Name	Data range	Factory set value	User set value

- (1) No. :** This is a screen number used to register screens displayed in the Parameter select mode. The screen number can be registered in the Parameter select setting screen. Parameters without the number can not be registered in Parameter select setting screen. If there are two items with the same number, one of them will be displayed according to the display requirements.
- (2) Symbol:** 11-segment parameter symbols shown on the PV display.
- (3) Name:** Name of parameter
- (4) Data range:** Data range of parameter
- (5) Factory set value:** Factory set value of parameters
- (6) User set value:** Stores parameter values set by the user. This may be useful when the data is initialized.



7.2 Monitor & Program Setting Mode [A]

■ Reset mode (RESET)

Symbols described as “LEVEL” and “TIME” in the following table will be displayed on the PV display.

The number (1 to 16) below the symbol indicates Segment No. and it will be displayed on the SEG display.

No.	Symbol	Name	Data range	Factory set value	User set value
1	—	PV/SV monitor	PV display unit: Input range low – (5 % of input span) to Input range high + (5 % of input span) [Varies with the setting of the Decimal point position.] PTN display unit: Pattern number SEG display unit: Segment number	—	—
16	LEVEL 1	Segment 1 level ¹	Setting limiter low to Setting limiter high [Varies with the setting of the Decimal point position.]	0	
17	TIME 1	Segment 1 time ¹	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds [Time unit depends on the time unit of the setting]	0:00 (0 hour 00 minutes)	
16	LEVEL 2	Segment 2 level ^{1,2}	Same as segment 1 level		
17	TIME 2	Segment 2 time ^{1,2}	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds 200:00: Continuous ** (Fl 0 is displayed) ** Settable only in Soak segments [Time unit depends on the time unit of the setting]	0:00 (0 hour 00 minutes)	
16	LEVEL 3	Segment 3 level ^{1,2}	Same as segment 1 level		
17	TIME 3	Segment 3 time ^{1,2}	Same as segment 2 time		
16	LEVEL 4	Segment 4 level ^{1,2}	Same as segment 1 level		
17	TIME 4	Segment 4 time ^{1,2}	Same as segment 2 time		
16	LEVEL 5	Segment 5 level ^{1,2}	Same as segment 1 level		
17	TIME 5	Segment 5 time ^{1,2}	Same as segment 2 time		
16	LEVEL 6	Segment 6 level ^{1,2}	Same as segment 1 level		
17	TIME 6	Segment 6 time ^{1,2}	Same as segment 2 time		
16	LEVEL 7	Segment 7 level ^{1,2}	Same as segment 1 level		
17	TIME 7	Segment 7 time ^{1,2}	Same as segment 2 time		

¹ Displayed when “Show all” is set at Select hide items in Program setting mode.

² When the PTN/END key is pressed on this screen, this and the following screens (Segment level, Segment time) will not be displayed afterwards.



Reset mode (RESET)

No.	Symbol	Name	Data range	Factory set value	User set value
16	LEVEL 8	Segment 8 level ^{1,2}	Setting limiter low to Setting limiter high [Varies with the setting of the Decimal point position.]	0	
17	TIME 8	Segment 8 time ^{1,2}	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds 200:00: Continuous ** (F1 0 is displayed) ** Settable only in Soak segments [Time unit depends on the time unit of the setting]	0:00 (0 hour 00 minutes)	
16	LEVEL 9	Segment 9 level ^{1,2}	Same as segment 8 level		
17	TIME 9	Segment 9 time ^{1,2}	Same as segment 8 time		
16	LEVEL 10	Segment 10 level ^{1,2}	Same as segment 8 level		
17	TIME 10	Segment 10 time ^{1,2}	Same as segment 8 time		
16	LEVEL 11	Segment 11 level ^{1,2}	Same as segment 8 level		
17	TIME 11	Segment 11 time ^{1,2}	Same as segment 8 time		
16	LEVEL 12	Segment 12 level ^{1,2}	Same as segment 8 level		
17	TIME 12	Segment 12 time ^{1,2}	Same as segment 8 time		
16	LEVEL 13	Segment 13 level ^{1,2}	Same as segment 8 level		
17	TIME 13	Segment 13 time ^{1,2}	Same as segment 8 time		
16	LEVEL 14	Segment 14 level ^{1,2}	Same as segment 8 level		
17	TIME 14	Segment 14 time ^{1,2}	Same as segment 8 time		
16	LEVEL 15	Segment 15 level ^{1,2}	Same as segment 8 level		
17	TIME 15	Segment 15 time ^{1,2}	Same as segment 8 time		
16	LEVEL 16	Segment 16 level ^{1,2}	Same as segment 8 level		
17	TIME 16	Segment 16 time ^{1,2}	Same as segment 8 time		

¹ Displayed when "Show all" is set at Select hide items in Program setting mode.² When the PTN/END key is pressed on this screen, this and the following screens (Segment level, Segment time) will not be displayed afterwards.



Reset mode (RESET)

No.	Symbol	Name	Data range	Factory set value	User set value
18	<i>P.END</i>	Pattern end ¹	1 to 16 The last segment No. of the program pattern will be displayed on the SEG display.	16	
46	<i>END.TM</i>	Pattern end output time ^{1,2}	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds 0:00: Output remains on [Time unit depends on the time unit of the setting]	0:00 (0 hour 00 minutes)	
30	<i>01.S.SN</i>	Time signal 1 start segment number ^{1,3}	1 to 16	1	
31	<i>01.S.TM</i>	Time signal 1 start time ^{1,3}	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds [Time unit depends on the time unit of the setting]	0:00 (0 hour 00 minutes)	
32	<i>01.E.SN</i>	Time signal 1 end segment number ^{1,3}	1 to 16	1	
33	<i>01.E.TM</i>	Time signal 1 end time ^{1,3}	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds [Time unit depends on the time unit of the setting]	0:00 (0 hour 00 minutes)	
34	<i>02.S.SN</i>	Time signal 2 start segment number ^{1,4}	Same as Time signal 1 start segment number		
35	<i>02.S.TM</i>	Time signal 2 start time ^{1,4}	Same as Time signal 1 start time		
36	<i>02.E.SN</i>	Time signal 2 end segment number ^{1,4}	Same as Time signal 1 end segment number		
37	<i>02.E.TM</i>	Time signal 2 end time ^{1,4}	Same as Time signal 1 end time		
38	<i>03.S.SN</i>	Time signal 3 start segment number ^{1,5}	Same as Time signal 1 start segment number		
39	<i>03.S.TM</i>	Time signal 3 start time ^{1,5}	Same as Time signal 1 start time		
40	<i>03.E.SN</i>	Time signal 3 end segment number ^{1,5}	Same as Time signal 1 end segment number		
41	<i>03.E.TM</i>	Time signal 3 end time ^{1,5}	Same as Time signal 1 end time		
42	<i>04.S.SN</i>	Time signal 4 start segment number ^{1,6}	Same as Time signal 1 start segment number		
43	<i>04.S.TM</i>	Time signal 4 start time ^{1,6}	Same as Time signal 1 start time		
44	<i>04.E.SN</i>	Time signal 4 end segment number ^{1,6}	Same as Time signal 1 end segment number		
45	<i>04.E.TM</i>	Time signal 4 end time ^{1,6}	Same as Time signal 1 end time		
22	<i>EV I</i>	Event 1 set value (EV1) ^{1,7} Event 1 set value (EV1) [high] ^{1,7,8}	<u>Deviation:</u> —Input span to +Input span [Varies with the setting of the Decimal point position.] <u>Input value or Set value:</u> Input range low to Input range high [Varies with the setting of the Decimal point position.] ----- <u>Manipulated output value:</u> —5.0 to +105.0 %	TC/RTD inputs: 10 V/I inputs: 5 % of input span ----- 50.0	
23	<i>EV L</i>	Event 1 set value (EV1') [low] ^{1,7,8}	<u>Deviation:</u> —Input span to +Input span [Varies with the setting of the Decimal point position.] <u>Input value:</u> Input range low to Input range high [Varies with the setting of the Decimal point position.]	TC/RTD inputs: —10 V/I inputs: 5 % of —input span	

¹ Displayed when "Show all" is set at Select hide items in Program setting mode.² Displayed when "Used" is selected at Pattern end signal selection.³ Displayed when "Used" is set to Time signal 1 at Time signal selection.⁴ Displayed when "Used" is set to Time signal 2 at Time signal selection.⁵ Displayed when "Used" is set to Time signal 3 at Time signal selection.⁶ Displayed when "Used" is set to Time signal 4 at Time signal selection.⁷ Displayed when Event 1 is valid.⁸ Displayed when Event 1 type is high/low with individual setting.



Reset mode (RESET)

No.	Symbol	Name	Data range	Factory set value	User set value
24	<i>EV2</i>	Event 2 set value (EV2) ^{1,2} Event 2 set value (EV2) [high] ^{1,2,3}	<u>Deviation:</u> –Input span to +Input span [Varies with the setting of the Decimal point position.] <u>Input value or Set value:</u> Input range low to Input range high [Varies with the setting of the Decimal point position.] <u>Manipulated output value:</u> –5.0 to +105.0 %	TC/RTD inputs: 10 V/I inputs: 5 % of input span 50.0	
25	<i>EV2'</i>	Event 2 set value (EV2') [low] ^{1,2,3}	<u>Deviation:</u> –Input span to +Input span [Varies with the setting of the Decimal point position.] <u>Input value:</u> Input range low to Input range high [Varies with the setting of the Decimal point position.]	TC/RTD inputs: –10 V/I inputs: 5 % of –input span	
26	<i>EV3</i>	Event 3 set value (EV3) ^{1,4} Event 3 set value (EV3) [high] ^{1,4,5}	Same as Event 2 set value (EV2)/Event 2 set value (EV2) [high]		
27	<i>EV3'</i>	Event 3 set value (EV3') [low] ^{1,4,5}	Same as Event 2 set value (EV2') [low]		
28	<i>EV4</i>	Event 4 set value (EV4) ^{1,6} Event 4 set value (EV4) [high] ^{1,6,7}	Same as Event 2 set value (EV2)/Event 2 set value (EV2) [high]		
29	<i>EV4'</i>	Event 4 set value (EV4) [low] ^{1,6,7}	Same as Event 2 set value (EV2') [low]		
19	<i>RPT.PN</i>	Number of repeating patterns ¹	1 to 1000 times 1000: Continuous operation	1	
20	<i>LNK.PN</i>	Pattern link number ¹	0 to 16 0: No link	0	

¹ Displayed when "Show all" is set at Select hide items in Program setting mode.² Displayed when Event 2 is valid.³ Displayed when Event 2 type is high/low with individual setting.⁴ Displayed when Event 3 is valid.⁵ Displayed when Event 3 type is high/low with individual setting.⁶ Displayed when Event 4 is valid.⁷ Displayed when Event 4 type is high/low with individual setting.

■ Program control mode (RUN)

No.	Symbol	Name	Data range	Factory set value	User set value
1	—	PV/SV monitor	PV display unit: Input range low – (5 % of input span) to Input range high + (5 % of input span) [Varies with the setting of the Decimal point position.] SV display unit: Segment level (SV monitor) TIME display unit: • Segment remaining time * • Manipulated output value PTN display unit: Pattern number SEG display unit: Segment number	—	
—	<i>LEVEL</i>	Segment level in progress	Setting limiter low to Setting limiter high [Varies with the setting of the Decimal point position.]	0	
—	<i>TIME</i>	Segment time in progress	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds 200:00: Continuous ** (F1 is displayed) ** "200:00: Continuous" can be set only in the Soak segment. However, Segment 1 cannot be set to "200:00: Continuous." [Time unit depends on the time unit of the setting]	0:00 (0 hour 00 minutes)	

* Remaining time of Pattern end output will be displayed if the pattern end signal is valid in the pattern end mode.



■ Fixed set point control mode (FIX)

No.	Symbol	Name	Data range	Factory set value	User set value
1	—	PV/SV monitor	PV display unit: Input range low – (5 % of input span) to Input range high + (5 % of input span) [Varies with the setting of the Decimal point position.] SV display unit: Set value (SV) in Fixed set point control mode TIME display unit: Manipulated output value	—	
—	—	Set value (SV) in Fixed set point control mode	Setting limiter low to Setting limiter high [Varies with the setting of the Decimal point position.]	0	

■ Manual control mode (MAN)

No.	Symbol	Name	Data range	Factory set value	User set value
1	—	PV/SV monitor	PV display unit: Input range low – (5 % of input span) to Input range high + (5 % of input span) [Varies with the setting of the Decimal point position.] SV display unit: Manual manipulated output value (Settable): –5.0 to +105.0 % TIME display unit: Manipulated output value	—	
—	—	PV/SV monitor *	PV display unit: Input range low – (5 % of input span) to Input range high + (5 % of input span) [Varies with the setting of the Decimal point position.] SV display unit: SV monitor value before being switched to the Manual control mode (MAN) TIME display unit: Manipulated output value		

* Refer to the screen flowchart of Manual control mode (MAN) (P. 6-4).

■ Monitor mode

Parameters in the Monitor mode will be displayed when “Show all” is set at Select hide items in Monitor mode.

No.	Symbol	Name	Data range	Factory set value	User set value
2	<i>RPF.PN</i>	Number of repeating patterns monitor ¹	1 to 1000 times 1000: Continuous operation	—	
3	<i>RFN.FM</i>	Pattern remaining time monitor ¹	0 hours 00 minutes to 999 hours 59 minutes or 0 minutes 00 seconds to 999 minutes 59 seconds [Time unit depends on the time unit of the setting]	—	
4	<i>MV</i>	Manipulated output value monitor [heat-side] ²	–5.0 to +105.0 %	—	
5	<i>MVC</i>	Manipulated output value monitor [cool-side] ³	–5.0 to +105.0 %	—	
6	<i>CT1</i>	Current transformer 1 (CT1) input value monitor ⁴	0.0 to 100.0 A	—	
7	<i>CT2</i>	Current transformer 2 (CT2) input value monitor ⁴	0.0 to 100.0 A	—	
8	<i>EVENT</i>	Comprehensive event state	When an event occurs, the character of the occurring event is displayed on the SV display. If two or more events occur at the same time, the relevant characters are displayed alternately every 0.5 seconds. <i>EBF1</i> : Event 1 <i>EBF3</i> : Event 3 <i>EBF2</i> : Event 2 <i>EBF4</i> : Event 4 <i>HbA1</i> : Heater break alarm 1 (HBA1) <i>HbA2</i> : Heater break alarm 2 (HBA2) <i>LbA</i> : Control loop break alarm (LBA) <i>INP.HP</i> : Input error high <i>INP.LN</i> : Input error low	—	

¹ Displayed when the operation mode is the Program control mode (RUN).

² Not displayed the Control action is a Position proportioning PID control without Feedback resistance (FBR) input. Feedback resistance (FBR) input value is displayed when the Control action is a Position proportioning PID controller with Feedback resistance (FBR) input.

³ Displayed when Input is Heat/Cool PID control.

⁴ Displayed when Current transformer (CT) input is supplied.



7.3 Parameter Select Mode [B]

Up to 16 screens registered on the Parameter select setting screen (Set data lock mode) by the user can be displayed.

7.4 Operation Transfer Mode [C]

No.	Symbol	Name	Data range	Factory set value	User set value
10	<i>Mode</i>	Operation mode transfer ¹	<i>rESEf</i> : Reset mode (RESET) <i>rUn</i> : Program control mode (RUN) <i>Fix</i> : Fixed set point control mode (FIX) <i>MAN</i> : Manual control mode (MAN)	<i>rESEf</i>	
11	<i>STEP</i>	Step function ¹	<i>oFF</i> : Normol state <i>on</i> : Step	<i>oFF</i>	
12	<i>ATU</i>	Autotuning (AT) ¹	<i>oFF</i> : PID control <i>on</i> : Start Autotuning When the Autotuning (AT) is finished, the control will automatically return to "oFF."	<i>oFF</i>	
13	<i>LV.ATU</i>	Overall level autotuning (AT) ^{1,2}	<i>oFF</i> : Overall level autotuning (AT) OFF <i>on</i> : Overall level autotuning (AT) ON When the Overall level autotuning (AT) is finished, the control will automatically return to "oFF."	<i>oFF</i>	
14	<i>STU</i>	Startup tuning (ST) ^{1,3}	<i>oFF</i> : ST unused <i>on 1</i> : Execute once * <i>on 2</i> : Execute always * When the ST is finished, the control will automatically return to "oFF."	<i>oFF</i>	
15	<i>ILR</i>	Interlock release ⁴	<i>oFF</i> : Interlock release <i>on</i> : Interlock state	<i>oFF</i>	

¹ Displayed when "Show all" is set at Select hide items in Operation transfer mode.

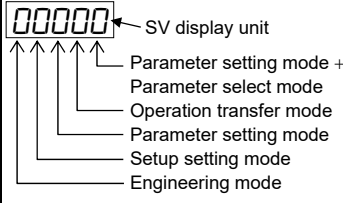
² Displayed when any item other than "No Level PID" is set at Level PID action selection.

³ Displayed when the Control action is not a Position proportioning PID control.

⁴ Displayed when any item other than "OFF" is set at Interlock selection.



7.5 Setting Lock Mode [D]

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>LOCK</i>	Set data unlock/lock transfer	<i>oFF</i> : Unlock state <i>on</i> : Lock state	<i>oFF</i>	
—	<i>LCKLV</i>	Set lock level	0: Unlock 1: Lock  Set Lock/Unlock at each digit.	00000	
—	<i>BLIND</i>	Select Blind function	<i>oFF</i> : Blind function: OFF <i>on</i> : Blind function: ON	<i>oFF</i>	
—	<i>PSLd</i>	Parameter select direct registration	<i>oFF</i> : Direct registration: OFF <i>on</i> : Direct registration: ON	<i>oFF</i>	
—	<i>PSL01</i>	Parameter select setting 1	0 to 254 (Screen No.) 0: No registration	0	
—	<i>PSL02</i>	Parameter select setting 2			
—	<i>PSL03</i>	Parameter select setting 3			
—	<i>PSL04</i>	Parameter select setting 4			
—	<i>PSL05</i>	Parameter select setting 5			
—	<i>PSL06</i>	Parameter select setting 6			
—	<i>PSL07</i>	Parameter select setting 7			
—	<i>PSL08</i>	Parameter select setting 8			
—	<i>PSL09</i>	Parameter select setting 9			
—	<i>PSL10</i>	Parameter select setting 10			
—	<i>PSL11</i>	Parameter select setting 11			
—	<i>PSL12</i>	Parameter select setting 12			
—	<i>PSL13</i>	Parameter select setting 13			
—	<i>PSL14</i>	Parameter select setting 14			
—	<i>PSL15</i>	Parameter select setting 15			
—	<i>PSL16</i>	Parameter select setting 16			

7.6 Pattern Transfer Mode [E]

This parameter allows switching to Pattern transfer mode [E] in the Reset mode (RESET).

No.	Symbol	Name	Data range	Factory set value	User set value
9	<i>PFN</i>	Execution pattern selection	1 to 16	1	

7.7 Parameter Setting Mode [F]

■ Parameter group No. 00: Program (*P_{roG}*)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>P_n00</i>	Parameter group No. 00	This is the first parameter symbol of Parameter group No. 00.	—	—
—	<i>PFN</i>	Pattern selection	1 to 16	1	
—	<i>SEL.SG</i>	Segment selection	1 to 16	1	
16	<i>LEVEL</i>	Segment level ¹	Setting limiter low to Setting limiter high [Varies with the setting of the Decimal point position.]	0	
17	<i>TIME</i>	Segment time ^{1, 2}	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds 200:00: Continuous * (<i>Fl</i> $\frac{1}{2}$ is displayed) * "200:00: Continuous" can be set only in the Soak segment. When the segment was switched to a ramp segment from a soak segment, the Segment time is automatically set to 199 hours 59 minutes or 199 minutes 59 seconds. However, Segment 1 can not be set to "200:00: Continuous." [Time unit depends on the time unit of the setting]	0:00 (0 hour 00 minutes)	
18	<i>P.END</i>	Pattern end	1 to 16 Displays the last segment of the pattern.	16	—
19	<i>RPT.PN</i>	Number of repeating patterns	1 to 1000 times 1000: Continuous operation	1	
20	<i>LNK.PN</i>	Pattern link number	0 to 16 0: No link	0	

¹ Segment No. can be shifted while the SEG display is blinking. (Refer to P. 4-6)

² When SET key is pressed in the Segment No.16, the screen will switch to the pattern end screen.

■ Parameter group No. 01: Fixed set point control (*Fl* $\frac{1}{2}$)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>P_n01</i>	Parameter group No. 01	This is the first parameter symbol of Parameter group No. 01.	—	—
21	<i>SV</i>	Set value (SV) in Fixed set point control mode	Setting limiter low to Setting limiter high [Varies with the setting of the Decimal point position.]	0	



■ Parameter group No. 40: Event (EH)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Pn40</i>	Parameter group No. 40 ¹	This is the first parameter symbol of Parameter group No. 40.	—	—
—	<i>PFN</i>	Pattern selection ¹	1 to 16	1	
22	<i>EV1</i>	Event 1 set value (EV1) ² Event 1 set value (EV1) [high] ^{2,3}	<u>Deviation:</u> –Input span to +Input span [Varies with the setting of the Decimal point position.] <u>Input value or Set value:</u> Input range low to Input range high [Varies with the setting of the Decimal point position.] <u>Manipulated output value:</u> –5.0 to +105.0 %	TC/RTD inputs: 10 V/I inputs: 5 % of input span ----- 50.0	
23	<i>EV1'</i>	Event 1 set value (EV1') [low] ^{2,3}	<u>Deviation:</u> –Input span to +Input span [Varies with the setting of the Decimal point position.] <u>Input value:</u> Input range low to Input range high [Varies with the setting of the Decimal point position.]	TC/RTD inputs: –10 V/I inputs: –5 % of input span	
24	<i>EV2</i>	Event 2 set value (EV2) ⁴ Event 2 set value (EV2) [high] ^{4,5}	Same as Event 1 set value (EV1)/Event 1 set value (EV1) [high]		
25	<i>EV2'</i>	Event 2 set value (EV2') [low] ^{4,5}	Same as Event 1 set value (EV1') [low]		
26	<i>EV3</i>	Event 3 set value (EV3) ⁶ Event 3 set value (EV3) [high] ^{6,7}	Same as Event 1 set value (EV1)/Event 1 set value (EV1) [high]		
27	<i>EV3'</i>	Event 3 set value (EV3') [low] ^{6,7}	Same as Event 1 set value (EV1') [low]		
28	<i>EV4</i>	Event 4 set value (EV4) ⁸ Event 4 set value (EV4) [high] ^{8,9}	Same as Event 1 set value (EV1)/Event 1 set value (EV1) [high]		
29	<i>EV4'</i>	Event 4 set value (EV4') [low] ^{8,9}	Same as Event 1 set value (EV1') [low]		

¹ Not displayed when "None" (No event) is set at all of the Event type parameters (Event type1 to 4).

² Displayed when Event 1 is valid.

³ Displayed when Event 1 type is high/low with individual setting.

⁴ Displayed when Event 2 is valid.

⁵ Displayed when Event 2 type is high/low with individual setting.

⁶ Displayed when Event 3 is valid.

⁷ Displayed when Event 3 type is high/low with individual setting.

⁸ Displayed when Event 4 is valid.

⁹ Displayed when Event 4 type is high/low with individual setting.



■ Parameter group No. 47: Time signal (F_{NSI} G)

No.	Symbol	Name	Data range	Factory set value	User set value
—	P _n 47	Parameter group No. 47 ¹	This is the first parameter symbol of Parameter group No. 47.	—	—
—	P _{FN}	Pattern selection ¹	1 to 16	1	
30	01.5.SN	Time signal 1 start segment number ²	1 to 16	1	
31	01.5.FM	Time signal 1 start time ²	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds [Time unit depends on the time unit of the setting]	0:00 (0 hour 00 minutes)	
32	01.E.SN	Time signal 1 end segment number ²	1 to 16	1	
33	01.E.FM	Time signal 1 end time ²	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds [Time unit depends on the time unit of the setting]	0:00 (0 hour 00 minutes)	
34	02.5.SN	Time signal 2 start segment number ³	Same as Time signal 1 start segment number		
35	02.5.FM	Time signal 2 start time ³	Same as Time signal 1 start time		
36	02.E.SN	Time signal 2 end segment number ³	Same as Time signal 1 end segment number		
37	02.E.FM	Time signal 2 end time ³	Same as Time signal 1 end time		
38	03.5.SN	Time signal 3 start segment number ⁴	Same as Time signal 1 start segment number		
39	03.5.FM	Time signal 3 start time ⁴	Same as Time signal 1 start time		
40	03.E.SN	Time signal 3 end segment number ⁴	Same as Time signal 1 end segment number		
41	03.E.FM	Time signal 3 end time ⁴	Same as Time signal 1 end time		
42	04.5.SN	Time signal 4 start segment number ⁵	Same as Time signal 1 start segment number		
43	04.5.FM	Time signal 4 start time ⁵	Same as Time signal 1 start time		
44	04.E.SN	Time signal 4 end segment number ⁵	Same as Time signal 1 end segment number		
45	04.E.FM	Time signal 4 end time ⁵	Same as Time signal 1 end time		

¹ Not displayed when "Unused" (No time signal) is set to all time signals at the Time signal selection.

² Displayed when "Used" is set to Time signal 1 at Time signal selection.

³ Displayed when "Used" is set to Time signal 2 at Time signal selection.

⁴ Displayed when "Used" is set to Time signal 3 at Time signal selection.

⁵ Displayed when "Used" is set to Time signal 4 at Time signal selection.

■ Parameter group No. 48: Pattern end signal (E_{NSI} G)

No.	Symbol	Name	Data range	Factory set value	User set value
—	P _n 48	Parameter group No. 48*	This is the first parameter symbol of Parameter group No. 48.	—	—
—	P _{FN}	Pattern selection*	1 to 16	1	
46	END.FM	Pattern end output time*	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds 0:00: Output remains on [Time unit depends on the time unit of the setting]	0:00 (0 hour 00 minutes)	

* Not displayed when "Unused" is selected at Pattern end signal selection.



■ Parameter group No. 51: Control [heat] (Control)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Pn51</i>	Parameter group No. 51 ¹	This is the first parameter symbol of Parameter group No. 51	—	—
47	<i>P</i>	Proportional band [heat-side] ¹	TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 1000.0 % of Input span 0 (0.0, 0.00): ON/OFF action	TC/RTD inputs: 30 V/I inputs: 3.0	
48	<i>I</i>	Integral time [heat-side] ^{1, 2}	PID control or Heat/Cool PID control: 0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PD action Position proportioning PID control: 1 to 3600 seconds, 0.1 to 3600.0 seconds or 0.01 to 360.00 seconds [Varies with the setting of the Integral/Derivative time decimal point position.]	240	
49	<i>D</i>	Derivative time [heat-side] ^{1, 2}	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action [Varies with the setting of the Integral/Derivative time decimal point position.]	60	
50	<i>oHH</i>	ON/OFF action differential gap (upper) ^{1, 3}	TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.]	TC/RTD inputs: 1	
51	<i>oHL</i>	ON/OFF action differential gap (lower) ^{1, 3}	Voltage (V)/Current (I) inputs: 0.0 to 100.0 % of Input span	V/I inputs: 0.1	
52	<i>rPF</i>	Control response parameter ¹	0: Slow 1: Medium 2: Fast [When the P or PD action is selected, this setting becomes invalid]	2	
53	<i>PACF</i>	Proactive intensity ^{1, 2, 4}	0 to 4 0: No function	2	
54	<i>MR</i>	Manual reset ^{1, 5}	−100.0 to +100.0 %	0.0	
55	<i>FF</i>	FF amount ^{1, 2, 4, 6, 7}	−100.0 to +100.0 %	0.0	
56	<i>oLH</i>	Output limiter high [heat-side] ^{1, 8}	Output limiter low [heat-side] to 105.0 %	105.0	
57	<i>oLL</i>	Output limiter low [heat-side] ^{1, 8}	−5.0 % to Output limiter high [heat-side]	−5.0	
58	<i>LbA</i>	Control loop break alarm (LBA) time ¹	0 to 7200 seconds 0: No function	LBA function is specified: 480 LBA function is not specified: 0	
59	<i>Lbd</i>	LBA deadband (LBD) ¹	0 to Input span [Varies with the setting of the Decimal point position.]	0	

¹ Displayed when "No Level PID" is set at Level PID action selection.

² Displayed when the "Proportional band [heat-side]" is other than 0 (0.0, 0.00).

³ Displayed when the "Proportional band [heat-side]" is 0 (0.0, 0.00).

⁴ Displayed when the "Integral time [heat-side]" is other than 0 (0.0, 0.00).

⁵ Displayed in the following cases:

- When the "Proportional band [heat-side]" is other than 0 (0.0, 0.00)
- When the "Integral time [heat-side]" or "Integral time [cool-side]" is 0 (0.0, 0.00)

⁶ Displayed when Bottom suppression function is valid.

⁷ Displayed when the "Control action" is other than Position proportioning PID control.

⁸ Not displayed when the "Control action" is Position proportioning PID control AND Feedback resistance (FBR) input is not supplied.



■ Parameter group No. 53: PID group [heat] (LPI d)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Pn53</i>	Parameter group No. 53 ¹	This is the first parameter symbol of Parameter group No. 53	—	—
—	<i>PI dLV</i>	PID group selection ¹	1 to 8	1	
60	<i>P</i>	Proportional band [heat-side] ¹	TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 1000.0 % of Input span 0 (0.0, 0.00): ON/OFF action	TC/RTD inputs: 30 V/I inputs: 3.0	
61	<i>I</i>	Integral time [heat-side] ^{1,2}	PID control or Heat/Cool PID control: 0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PD action Position proportioning PID control: 1 to 3600 seconds, 0.1 to 3600.0 seconds or 0.01 to 360.00 seconds [Varies with the setting of the Integral/Derivative time decimal point position.]	240	
62	<i>d</i>	Derivative time [heat-side] ^{1,2}	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action [Varies with the setting of the Integral/Derivative time decimal point position.]	60	
63	<i>oHH</i>	ON/OFF action differential gap (upper) ^{1,3}	TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.]	TC/RTD inputs: 1	
64	<i>oHL</i>	ON/OFF action differential gap (lower) ^{1,3}	Voltage (V)/Current (I) inputs: 0.0 to 100.0 % of Input span	V/I inputs: 0.1	
65	<i>rPF</i>	Control response parameter ¹	0: Slow 1: Medium 2: Fast [When the P or PD action is selected, this setting becomes invalid]	2	
66	<i>PACF</i>	Proactive intensity ^{1,4}	0 to 4 0: No function	2	
67	<i>MR</i>	Manual reset ^{1,5}	−100.0 to +100.0 %	0.0	
68	<i>FF</i>	FF amount ^{1,2,4,6,7}	−100.0 to +100.0 %	0.0	
69	<i>oLH</i>	Output limiter high [heat-side] ^{1,8}	Output limiter low [heat-side] to 105.0 %	105.0	
70	<i>oLL</i>	Output limiter low [heat-side] ^{1,8}	−5.0 % to Output limiter high [heat-side]	−5.0	
71	<i>LbA</i>	Control loop break alarm (LBA) time ¹	0 to 7200 seconds 0: No function	LBA function is specified: 480 LBA function is not specified: 0	
72	<i>LbD</i>	LBA deadband (LBD) ¹	0 to Input span [Varies with the setting of the Decimal point position.]	0	

¹ Displayed when any item other than "No Level PID" is set at Level PID action selection.

² Displayed when a proportional band (heat-side) in the same PID group is set other than 0 (0.0, 0.00).

³ Displayed when a proportional band (heat-side) in the same PID group is set (0.0, 0.00).

⁴ Displayed when a Integral time (heat-side) in the same PID group is set other than 0 (0.0, 0.00).

⁵ It is displayed under the following conditions.

- When a proportional band (heat-side) in the same PID group is set other than 0 (0.0, 0.00).
- When an integral time [heat-side] or integral time [cool-side] in the same PID group is set 0 (0.0, 0.00).

⁶ Displayed when Bottom suppression function is valid.

⁷ Displayed when the "Control action" is other than Position proportioning PID control.

⁸ Not displayed when the "Control action" is Position proportioning PID control AND Feedback resistance (FBR) input is not supplied.

**■ Parameter group No. 56: Control [Cool] (C_{ool})**

No.	Symbol	Name	Data range	Factory set value	User set value
—	P_{n56}	Parameter group No. 56 ^{1, 2}	This is the first parameter symbol of Parameter group No. 56	—	—
74	P_c	Proportional band [cool-side] ^{1, 2, 3}	TC/RTD inputs: 1 (0.1, 0.01) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.1 to 1000.0 % of Input span	TC/RTD inputs: 30 V/I inputs: 3.0	
75	I_c	Integral time [cool-side] ^{1, 2, 3}	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PD action [Varies with the setting of the Integral/Derivative time decimal point position.]	240	
76	d_c	Derivative time [cool-side] ^{1, 2, 3}	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action [Varies with the setting of the Integral/Derivative time decimal point position.]	60	
77	db	Overlap/Deadband ^{1, 2}	TC/RTD inputs: –Input span to +Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: –100.0 to +100.0 % of Input span Minus (–) setting results in Overlap. However, the overlapping range is within the proportional range.	TC/RTD inputs: 0 V/I inputs: 0.0	
78	oLH_c	Output limiter high [cool-side] ^{1, 2}	Output limiter low [cool-side] to 105.0 %	105.0	
79	oLL_c	Output limiter low [cool-side] ^{1, 2}	–5.0 % to Output limiter high [cool-side]	–5.0	

¹ Displayed when any item other than “No Level PID” is set at Level PID action selection.² Displayed when the “Control action” is Heat/Cool PID control.³ Displayed when the “Proportional band [heat-side]” is other than 0 (0.0, 0.00).



■ Parameter group No. 58: PID group [cool] (*LPI dc*)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Pn58</i>	Parameter group No. 58 ^{1,2}	This is the first parameter symbol of Parameter group No. 58	—	—
—	<i>PI dLV</i>	PID group selection ^{1,2}	1 to 8	1	
80	<i>Pc</i>	Proportional band [cool-side] ^{1,2,3}	TC/RTD inputs: 1 (0.1, 0.01) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.1 to 1000.0 % of Input span	TC/RTD inputs: 30 V/I inputs: 3.0	
81	<i>Ic</i>	Integral time [cool-side] ^{1,2,3}	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PD action [Varies with the setting of the Integral/Derivative time decimal point position.]	240	
82	<i>dc</i>	Derivative time [cool-side] ^{1,2,3}	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action [Varies with the setting of the Integral/Derivative time decimal point position.]	60	
83	<i>db</i>	Overlap/Deadband ^{1,2}	TC/RTD inputs: –Input span to +Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: –100.0 to +100.0 % of Input span Minus (–) setting results in Overlap. However, the overlapping range is within the proportional range.	TC/RTD inputs: 0 V/I inputs: 0.0	
84	<i>oLHc</i>	Output limiter high [cool-side] ^{1,2}	Output limiter low [cool-side] to 105.0 %	105.0	
85	<i>oLLc</i>	Output limiter low [cool-side] ^{1,2}	–5.0 % to Output limiter high [cool-side]	–5.0	

¹ Displayed when any item other than “No Level PID” is set at Level PID action selection.

² Displayed when Heat/Cool PID control is set at Control action.

³ Displayed when Proportional band [heat-side] in the same PID group is set to a value other than 0 (0.0, 0.00).

■ Parameter group No. 59: Level setting (*LEVEL*)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Pn59</i>	Parameter group No. 59*	This is the first parameter symbol of Parameter group No. 59	—	—
86	<i>LV.SET</i>	Automatic level PID setting*	<i>oFF</i> : Automatic setting OFF <i>oN</i> : Automatic setting ON <i>LoRd</i> : Recover setting before change	<i>oFF</i>	
87	<i>LEV1</i>	Level PID setting 1*	Input range low to Input range high [Varies with the setting of the Decimal point position.]	Input range high	
88	<i>LEV2</i>	Level PID setting 2*			
89	<i>LEV3</i>	Level PID setting 3*			
90	<i>LEV4</i>	Level PID setting 4*			
91	<i>LEV5</i>	Level PID setting 5*			
92	<i>LEV6</i>	Level PID setting 6*			
93	<i>LEV7</i>	Level PID setting 7*			

* Displayed when any item other than “No Level PID” is set at Level PID action selection.

**■ Parameter group No. 80: Wait (WAIT)**

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Pn80</i>	Parameter group No. 80	This is the first parameter symbol of Parameter group No.80	—	—
94	<i>ZONE.H</i>	Wait zone high	TC/RTD inputs 0 (0.0, 0.00) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs 0.0 to 100.0 % of Input span 0 (0.0, 0.00): Wait zone high OFF	0	
95	<i>ZONE.L</i>	Wait zone low	TC/RTD inputs – Input span to 0 (0.0, 0.00) (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs –100.0 to 0.0 % of Input span 0 (0.0, 0.00): Wait zone low OFF	0	



7.8 Setup Setting Mode [G]

■ Setting group No. 00: Program (Prog)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Sn00</i>	Setting group No. 00	This is the first parameter symbol of Setting group No. 00	—	—
96	<i>SV.SV</i>	SV selection at program start	0: Zero start 1: PV start 2: PV start (time saving)	0	
97	<i>Pd</i>	Hot/Cold start	0: Hot start 1 1: Hot start 2 2: Cold start 3: Reset start	0	
98	<i>END.P</i>	Control action at pattern end	PID control, Heat/Cool PID control or Position proportioning PID control (With FBR input): 0: Control continued 1: Control stop Position proportioning PID control (When there is no FBR input or the FBR input is break): 0: Control continued 1: Open-side output OFF, Close-side output OFF 2: Open-side output OFF, Close-side output ON 3: Open-side output ON, Close-side output OFF	0	
99	<i>END.A.E</i>	Output action at pattern end	0 to 7 0: OFF +1: Logic calculation output: Action continues +2: Retransmission output: Action continues +4: Instrument status output: Action continues	7	

■ Setting group No. 10: Display (dSP)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Sn 10</i>	Setting group No. 10	This is the first parameter symbol of Setting group No. 10	—	—
100	<i>PV CY</i>	Display update cycle	1: 50 ms 5: 250 ms 9: 450 ms 2: 100 ms 6: 300 ms 10: 500 ms 3: 150 ms 4: 200 ms 8: 400 ms	1	

■ Setting group No. 21: Input (InP)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Sn21</i>	Setting group No. 21	This is the first parameter symbol of Setting group No. 21	—	—
101	<i>Pb</i>	PV bias	– Input span to +Input span [Varies with the setting of the Decimal point position.]	0	
102	<i>dF</i>	PV digital filter	0.0 to 100.0 seconds 0.0: Filter OFF	0.0	
103	<i>PR</i>	PV ratio	0.500 to 1.500	1.000	
104	<i>PLC</i>	PV low input cut-off *	0.00 to 25.00 % of Input span	0.00	

* This parameter is displayed when Input is Voltage/Current and when Square root extraction is valid.



■ Setting group No. 30: Output (OUT)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Sn30</i>	Setting group No. 30 ¹	This is the first parameter symbol of Setting group No. 30	—	—
105	<i>r1</i>	OUT1 proportional cycle time ²	0.1 to 100.0 seconds	Relay contact output: 20.0 Voltage pulse output, Transistor output: Note1	
106	<i>r2</i>	OUT2 proportional cycle time ³		Relay contact output: 20.0 Voltage pulse output, Transistor output: Note2	
107	<i>r3</i>	OUT3 proportional cycle time ⁴		Voltage pulse output: Note3	
108	<i>MF1</i>	OUT1 minimum ON/OFF time of proportional cycle ²	0 to 1000 ms	0	
109	<i>MF2</i>	OUT2 minimum ON/OFF time of proportional cycle ³			
110	<i>MF3</i>	OUT3 minimum ON/OFF time of proportional cycle ⁴			

Note1: In case OUT1 function selection is "Control output [cool-side]" AND Control action is "Heat/Cool PID control [air cooling] or [water cooling]": 20.0,
Other cases: 2.0

Note2: In case OUT2 function selection is "Control output [cool-side]" AND Control action is "Heat/Cool PID control [air cooling] or [water cooling]": 20.0,
Other cases: 2.0

Note3: In case OUT3 function selection is "Control output [cool-side]" AND Control action is "Heat/Cool PID control [air cooling] or [water cooling]": 20.0,
Other cases: 2.0

¹ Displayed when any one of OUT1 to OUT3 is Relay contact output, Voltage pulse output or Transistor output.

² Displayed when OUT1 is Relay contact output, Voltage pulse output or Transistor output.

³ Displayed when OUT2 is Relay contact output, Voltage pulse output or Transistor output.

⁴ Displayed when OUT3 is supplied and "Universal output type selection" is "Voltage pulse output."

■ Setting group No. 45: Heater break alarm 1 (HbA1)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Sn45</i>	Setting group No. 45	This is the first parameter symbol of Setting group No. 45	—	—
111	<i>HbA1</i>	Heater break alarm 1 (HBA1) set value ^{1,2}	0.0 to 100.0 A 0.0: HBA function OFF	0.0	
112	<i>HbC1</i>	Number of heater break alarm 1 (HBA1) delay times ¹	0 to 255 times	5	

¹ Displayed when Current transformer (CT) input is supplied. Not displayed in the following cases.

• CT1 assignment is "None."

• The output type of CT1 assignment is Current output or Continuous voltage output.

² Current transformer 1 (CT1) input is displayed on the TIME display.



■ Setting group No. 46: Heater break alarm 2 (*HbA2*)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Sn46</i>	Setting group No. 46 ¹	This is the first parameter symbol of Setting group No. 46	—	—
113	<i>HbA2</i>	Heater break alarm 2 (HBA2) set value ^{1,2}	0.0 to 100.0 A 0.0: HBA function OFF	0.0	
114	<i>HbC2</i>	Number of heater break alarm 2 (HBA2) delay times ¹	0 to 255 times	5	

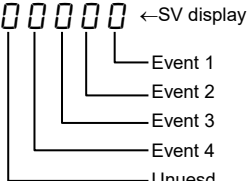
¹ Displayed when two Current transformer (CT) inputs are supplied. Not displayed in the following cases.

- CT2 assignment is "None."
- The output type of CT2 assignment is Current output or Continuous voltage output.

² Current transformer 2 (CT2) input is displayed on the TIME display.

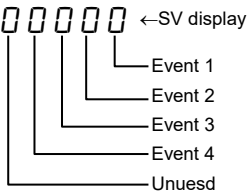
■ Setting group No. 49: Event selection of the Segment (*SEEH*)

"*EVON*" symbols on the below chart are displayed on the PV display. The numbers below "*EVON*" are segment Nos. Number (1 to 16) indicates Segment No. and it will be displayed on the SEG display.

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Sn49</i>	Setting group No. 49	This is the first parameter symbol of Setting group No. 49	—	—
—	<i>PFN</i>	Pattern selection	1 to 16	1	
115	<i>EVON</i> 1	Event selection of the Segment 1	0: Unused 1: Used 	1111	
115	<i>EVON</i> 2	Event selection of the Segment 2 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> 3	Event selection of the Segment 3 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> 4	Event selection of the Segment 4 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> 5	Event selection of the Segment 5 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> 6	Event selection of the Segment 6 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> 7	Event selection of the Segment 7 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> 8	Event selection of the Segment 8 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> 9	Event selection of the Segment 9 *	Same as Event selection of the Segment 1		

* Screens for the Event selection of the Segment (Segment Nos.2 to 16) will be displayed until the segment number where Pattern end is set.



No.	Symbol	Name	Data range	Factory set value	User set value
115	<i>EVON</i> <i>10</i>	Event selection of the Segment 10 *	0: Unused 1: Used 	1111	
115	<i>EVON</i> <i>11</i>	Event selection of the Segment 11 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> <i>12</i>	Event selection of the Segment 12 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> <i>13</i>	Event selection of the Segment 13 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> <i>14</i>	Event selection of the Segment 14 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> <i>15</i>	Event selection of the Segment 15 *	Same as Event selection of the Segment 1		
115	<i>EVON</i> <i>16</i>	Event selection of the Segment 16 *	Same as Event selection of the Segment 1		

* Screens for the Event selection of the Segment (Segment Nos.2 to 16) will be displayed until the segment number where Pattern end is set.

■ Setting group No. 51: Control (*CONF*)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>SN51</i>	Setting group No. 51 ¹	This is the first parameter symbol of Setting group No. 51	—	—
116	<i>MMV</i>	Manual manipulated output value ¹	PID control, Position proportioning PID control: Output limiter low [heat-side] to Output limiter high [heat-side] ----- Heat/Cool PID control ² : -Output limiter high [cool-side] to +Output limiter high [heat-side]	-5.0 0.0	

¹ Not displayed on a Position proportioning PID controller without Feedback resistor (FBR).

² In case of Heat/Cool PID control, the data range has such exceptional conditions as shown below.

- (1) Output limiter high [cool-side] is $\leq 0.0\%$
 - Output limiter low [heat-side] is $\leq 0.0\%$: 0.0% to +Output limiter high [heat-side]
 - Output limiter low [heat-side] is $> 0.0\%$: Output limiter low [heat-side] to Output limiter high [heat-side]
- (2) Output limiter high [heat-side] is $\leq 0.0\%$
 - Output limiter low [cool-side] is $\leq 0.0\%$: -Output limiter high [cool-side] to 0.0%
 - Output limiter low [cool-side] is $> 0.0\%$: -Output limiter high [cool-side] to -Output limiter low [cool-side]
- (3) Fixed at 0.0% in the following cases:
Output limiter high [cool-side] $\leq 0.0\%$, AND Output limiter high [heat-side] $\leq 0.0\%$



■ Setting group No. 53: Tuning (Γ_{UNE})

No.	Symbol	Name	Data range	Factory set value	User set value
—	S_{n53}	Setting group No. 53	This is the first parameter symbol of Setting group No. 53	—	—
117	ATb	AT bias	– Input span to +Input span [Varies with the setting of the Decimal point position.]	0	
118	$ATRM$	AT remaining time monitor	0 hours 00 minutes to 48 hours 00 minutes	—	—
119	Γ_{UNE}	AT/ST status monitor	0: AT/ST complete 1: AT running now 2: ST running now –1: Aborted. Setting changed. –2: Aborted. Abnormal input. –3: Aborted. Timeout. –4: Aborted. Abnormal calculated values.	—	—

■ Setting group No. 55: Position proportioning control ($P_{o51}\Gamma$)

No.	Symbol	Name	Data range	Factory set value	User set value
—	S_{n55}	Setting group No. 55 *	This is the first parameter symbol of Setting group No. 55	—	—
120	ydb	Open/Close output neutral zone *	0.1 to 10.0 % of output	2.0	
121	$yH5$	Open/Close output differential gap *	0.1 to 5.0 % of output	1.0	

* Displayed when the control action is Position proportioning PID control.

■ Setting group No. 57: Proactive ($PAC\Gamma$)

No.	Symbol	Name	Data range	Factory set value	User set value
—	S_{n57}	Setting group No. 57	This is the first parameter symbol of Setting group No. 57	—	—
122	$FF5\Gamma$	FF amount learning *	0 to 1 0: No learning +1: Learn	0	
123	$E \times dJ$	Determination point of external disturbance	– Input span to +Input span [Varies with the setting of the Decimal point position.]	–1	

* Displayed when Bottom suppression function is valid.

**■ Setting group No. 91: System (545)**

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Sn91</i>	Setting group No. 91	This is the first parameter symbol of Setting group No. 91	—	—
124	<i>PHLd</i>	Peak hold monitor	Input range low – (5 % of input span) to Input range high + (5 % of input span) [Varies with the setting of the Decimal point position.]	—	—
125	<i>bHLd</i>	Bottom hold monitor			—
126	<i>HLdR</i>	Peak/Bottom hold reset	<i>HoLd</i> : Hold <i>rESEt</i> : Reset Returns to Hold state automatically after reset.	<i>HoLd</i>	—



7.9 Engineering Mode [H]

WARNING

Parameters in the Engineering mode should be set according to the application before setting any parameter related to operation. Once the parameters in the Engineering mode are set correctly, no further changes need to be made to parameters for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. RKC will not bear any responsibility for malfunction or failure as a result of improper changes in the Engineering mode.



NOTE

Parameters in Engineering mode are settable only when the controller is in Reset mode (RESET). Note that just checking the set values will not affect the operation mode.

■ Function block No. 00: Program (dSP)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_{n00}</i>	Function block No. 00	This is the first parameter symbol of Function block No. 00	—	—
127	<i>FM.SL</i>	Time unit of the setting	0: Hour : Minute 1: Minute : Second	0	
128	<i>SG.CNG</i>	Segment setting change type	0: Change type 1 1: Change type 2	0	
129	<i>SG.SAV</i>	Store segment setting change	0: Store setting 1: Do not store setting	0	

Function block No. 10: Display (*dSP*)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n 10</i>	Function block No. 10	This is the first parameter symbol of Function block No. 10	—	—
130	<i>ALC</i>	ALM lamp lighting condition	0 to 511 0: OFF +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Heater break alarm 1 (HBA1) +32: Heater break alarm 2 (HBA2) +64: Control loop break alarm (LBA) +128: Input error high +256: Input error low To select two or more functions, sum each value.	127	
131	<i>dSoP</i>	PV flashing display at input error	0: Flashing display 1: Non-flashing display	0	
132	<i>dSMoN</i>	Select hide items in Monitor mode	0 to 31 0: Show all +1: Number of repeating patterns monitor +2: Pattern remaining time monitor +4: Manipulated output value (MV) monitor +8: Current transformer (CT) monitor ¹ +16: Comprehensive event state ² To select two or more functions, sum each value.	0	
133	<i>dSMod</i>	Select hide items in Operation transfer mode	0 to 31 0: Show all +1: Operation mode transfer +2: Step function +4: Autotuning (AT) +8: Overall level autotuning (AT) +16: Startup tuning (ST) To select two or more functions, sum each value.	0	
134	<i>dSPRG</i>	Select hide items in Program setting mode	0 to 31 0: Show all +1: Segment setting +2: Pattern end output time +4: Time signal setting +8: Event setting +16: Repeat and link setting To select two or more functions, sum each value.	0	

¹ Both Manipulated output value (MV) monitor [heat-side] and Manipulated output value (MV) monitor [cool-side] will not be displayed when this is selected.

² Both Current transformer 1 (CT1) input value monitor and Current transformer 2 (CT2) input value monitor will not be displayed when this is selected.



■ Function block No. 21: Input 1 (I nP)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F n 2 1</i>	Function block No. 21	This is the first parameter symbol of Function block No. 21	—	—
135	<i>I n P</i>	Input type	0: TC input K 13: RTD input Pt100 1: TC input J 14: RTD input JPt100 2: TC input R 15: Current input 0 to 20 mA DC 3: TC input S 16: Current input 4 to 20 mA DC 4: TC input B 17: Voltage input 0 to 10 V DC 5: TC input E 18: Voltage input 0 to 5 V DC 6: TC input N 19: Voltage input 1 to 5 V DC 7: TC input T 20: Voltage input 0 to 1 V DC 8: TC input 21: Voltage input W5Re/W26Re –10 to +10 V DC 9: TC input PLII 22: Voltage input –5 to +5 V DC 10: TC input U 23: Voltage input 0 to 100 mV DC 11: TC input L 24: Voltage input 0 to 10 mV DC 12: TC input PR40-20	Same as the input type of the input range code specified at the time of order.	
136	<i>UNI T</i>	Display unit ¹	0: °C 1: °F	Same as the display unit of the input range code specified at the time of order.	
137	<i>P G d P</i>	Decimal point position	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places TC input: W5Re/W26Re, PR40-20: 0 (fixed) Thermocouples other than those shown above: 0 to 1 RTD input: 0 to 2 Voltage (V)/Current (I) input: In case of Input data type 0: 0 to 4 In case of Input data type 1: 0 to 3	Same as the decimal point position of the input range code specified at the time of order. For V/I inputs: 1	
138	<i>P G S H</i>	Input range high	(Input range low + 1 digit) to Maximum value of input range [Varies with the setting of the Decimal point position.]	High limit value of the input range code specified at the time of order. For V/I inputs: 100.0	
139	<i>P G S L</i>	Input range low	Minimum value of input range to (Input range high – 1 digit) [Varies with the setting of the Decimal point position.]	Low limit value of the input range code specified at the time of order. For V/I inputs: 0.0	
140	<i>P o V</i>	Input error determination point (high)	Input error determination point (low) to Input range high + (5 % of input span) [Varies with the setting of the Decimal point position.]	Input range high + (5 % of input span)	
141	<i>P U N</i>	Input error determination point (low)	Input range low – (5 % of input span) * to Input error determination point (high) [Varies with the setting of the Decimal point position.] * When Input type is RTD, low limit value is about 2 Ohms. (Pt100: –245.5 °C [–409.8 °F], JPt100: –237.6 °C [–395.7 °F])	Input range low – (5 % of input span)	
142	<i>T C C</i>	Temperature compensation calculation ²	0: No temperature compensation calculation 1: With temperature compensation calculation	1	
143	<i>b o S</i>	Burnout direction ³	0: Upscale 1: Downscale	0	

¹ Displayed when "Input type" is either Thermocouple (TC) or RTD.

² Displayed when "Input type" is Thermocouple (TC).

³ Displayed when "Input type" is Thermocouple (TC) or Low voltage input (0 to 100 mV DC and 0 to 10 mV DC).

Continued on the next page.

Function block No. 21: Input 1

No.	Symbol	Name	Data range	Factory set value	User set value
144	<i>SQR</i>	Square root extraction *	0: Unused 1: Used	0	
145	<i>INV</i>	Inverting input *	0: Unused 1: Used	0	
146	<i>INDT</i>	Input data type	0: Number of measured value digits: 5 Number of RKC communication digits: 7 Modbus: Double word PLC communication: Double word (System data: Single word) 1: Number of measured value digits: 4 Number of RKC communication digits: 6 Modbus: Single word PLC communication: Single word When Input data type is changed from 0 to 1, the 5-digit input range (e.g. Input range high: 1372.0) needs to be changed to a 4-digit input range in advance.	Conforms to Input range code to specified at the time of ordering	

* Displayed when Input type is Voltage (V)/Current (I).

■ Function block No. 23: Digital input (*dI*)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_{n23}</i>	Function block No. 23 ¹	This is the first parameter symbol of Function block No. 23	—	—
147	<i>dI SL1</i>	DI1 function selection ¹	0: No function 1: Reset mode (RESET) setting 2: Program control mode (RUN) setting 3: Step function 4: Hold function 5: Interlock release 6: Peak/Bottom hold reset 7: Autotuning (AT) 8: Set data unlock/lock transfer 9: Direct/Reverse action transfer 10: Program pattern No. switching (2 patterns without SET) 11: Program pattern No. switching (8 patterns without SET) 12: Program pattern No. switching (8 patterns with SET) 13: Program pattern No. switching (16 patterns without SET) 14: Program pattern No. switching (16 patterns with SET)	1	
148	<i>dI SL2</i>	DI2 function selection ¹	0 to 9 Same as DI1 function selection (0 to 9)	2	
149	<i>dI SL3</i>	DI3 function selection ¹	0 to 9 Same as DI1 function selection (0 to 9)	3	
150	<i>dI SL4</i>	DI4 function selection ¹	0 to 9 Same as DI1 function selection (0 to 9)	4	
151	<i>dI SL5</i>	DI5 function selection ²	0 to 9 Same as DI1 function selection (0 to 9)	5	
152	<i>dI SL6</i>	DI6 function selection ²	0 to 9 Same as DI1 function selection (0 to 9)	8	
153	<i>dI INV</i>	DI logic invert ¹	0 to 3 0: No logic invert +1: Set data unlock/lock transfer +2: Direct/Reverse action transfer To select two or more functions, sum each value.	0	

¹ Displayed when Digital input function is supplied.

² Displayed when six Digital inputs (DI) are supplied.



■ Function block No. 30: Output (OUT)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n30</i>	Function block No. 30	This is the first parameter symbol of Function block No. 30	—	—
154	<i>oSL1</i>	OUT1 function selection ¹	0: No assignment 1: Control output [heat-side] or [open-side] 2: Control output [cool-side] or [close-side] 3: Retransmission output 4: Logic calculation output (Event, HBA, LBA, Input error) 5: Output of Program control mode (RUN) state 6: Output of Manual control mode (MAN) state 7: Autotuning (AT) state output 8: Output of the communication monitoring result 9: FAIL output (Permanently configured to be de-energized)	Based on Model code	
155	<i>oSL2</i>	OUT2 function selection ²			
156	<i>oSL3</i>	OUT3 function selection ³		3	
157	<i>oLG1</i>	OUT1 logic calculation selection ¹	0 to 511 0: OFF +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Heater break alarm 1 (HBA1) +32: Heater break alarm 2 (HBA2) +64: Control loop break alarm (LBA) +128: Input error high +256: Input error low To select two or more functions, sum each value.	0	
158	<i>oLG2</i>	OUT2 logic calculation selection ²			
159	<i>oLG3</i>	OUT3 logic calculation selection ³			
160	<i>EXC</i>	Energized/De-energized selection	0 to 127 0: All outputs are energized +1: OUT1 de-energized +2: OUT2 de-energized +4: OUT3 de-energized +8: DO1 de-energized +16: DO2 de-energized +32: DO3 de-energized +64: DO4 de-energized To select two or more functions, sum each value.	0	
161	<i>ILS</i>	Interlock selection	0 to 511 0: Unused +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Heater break alarm 1 (HBA1) +32: Heater break alarm 2 (HBA2) +64: Control loop break alarm (LBA) +128: Input error high +256: Input error low To select two or more functions, sum each value.	0	
162	<i>SS</i>	Output action in Reset mode	0 to 7 0: OFF +1: Logic calculation output: Action continues +2: Retransmission output: Action continues +4: Instrument status output: Action continues To select two or more functions, sum each value.	0	
163	<i>UNI o</i>	Universal output type selection (OUT3) ³	0: Voltage pulse output 1: Current output (4 to 20 mA DC) 2: Current output (0 to 20 mA DC)	1	

¹ Displayed when OUT1 is supplied.

² Displayed when OUT2 is supplied.

³ Displayed when OUT3 is supplied.

■ Function block No. 31: Retransmission output 1 (R_{o1})

No.	Symbol	Name	Data range	Factory set value	User set value
—	F_{n31}	Function block No. 31 ¹	This is the first parameter symbol of Function block No. 31	—	—
164	R_{o1}	Retransmission output 1 type ¹	0: No retransmission output 1: Measured value (PV) 2: Segment level or Set value (SV) in Fixed set point control mode 3: SV monitor value ² 4: Deviation 5: Manipulated output value [heat-side] 6: Manipulated output value [cool-side] 7: Current transformer 1 (CT1) input value ³ 8: Current transformer 2 (CT2) input value ³	0	
165	R_{H51}	Retransmission output 1 scale high ¹	No retransmission output, Measured value (PV), Segment level, Set value (SV) in Fixed set point control mode, and SV monitor value: Input range low to Input range high [Varies with the setting of the Decimal point position.] Deviation: –Input span to +Input span [Varies with the setting of the Decimal point position.] Manipulated output value: –5.0 to +105.0 % Current transformer (CT) input value: 0.0 to 100.0 %	Input range high +Input span 100.0	
166	R_{L51}	Retransmission output 1 scale low ¹	No retransmission output, Measured value (PV), Segment level, Set value (SV) of Fixed set point control mode, and SV monitor value: Input range low to Input range high [Varies with the setting of the Decimal point position.] Deviation: –Input span to +Input span [Varies with the setting of the Decimal point position.] Manipulated output value: –5.0 to +105.0 % Current transformer (CT) input value: 0.0 to 100.0 %	Input range low –Input span 0.0	

¹ Displayed when OUT1 type is Current output or Continuous voltage output.

² In Program control mode (RUN): The SV monitor value is a monitor value of segment level.
In Fixed set point control mode (FIX): The SV monitor value is a monitor value of "Set value (SV) in Fixed set point control mode."

³ Setting will be ignored if Current transformer (CT) input is not specified at the time of order.

■ Function block No. 32: Retransmission output 2 (R_{o2})

No.	Symbol	Name	Data range	Factory set value	User set value
—	F_{n32}	Function block No. 32 [*]	This is the first parameter symbol of Function block No. 32	—	—
167	R_{o2}	Retransmission output 2 type [*]	Same as Retransmission output 1 type	Based on Model code	
168	R_{H52}	Retransmission output 2 scale high [*]	Same as Retransmission output 1 scale high		
169	R_{L52}	Retransmission output 2 scale low [*]	Same as Retransmission output 1 scale low		

^{*} Displayed when OUT2 type is Current output or Continuous voltage output.



■ Function block No. 33: Retransmission output 3 (*R_{o3}*)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_{n33}</i>	Function block No. 33 ¹	This is the first parameter symbol of Function block No. 33	—	—
170	<i>R_{o3}</i>	Retransmission output 3 type ¹	0: No retransmission output 1: Measured value (PV) 2: Segment level or Set value (SV) in Fixed set point control mode 3: SV monitor value ² 4: Deviation 5: Manipulated output value [heat-side] 6: Manipulated output value [cool-side] 7: Current transformer 1 (CT1) input value ³ 8: Current transformer 2 (CT2) input value ³	Based on Model code	
171	<i>RH₅₃</i>	Retransmission output 3 scale high ¹	No retransmission output, Measured value (PV), Segment level, Set value (SV) in Fixed set point control mode, and SV monitor value: Input range low to Input range high [Varies with the setting of the Decimal point position.] Deviation: –Input span to +Input span [Varies with the setting of the Decimal point position.] Manipulated output value: –5.0 to +105.0 % Current transformer (CT) input value: 0.0 to 100.0 %	Input range high +Input span 100.0 100.0	
172	<i>RL₅₃</i>	Retransmission output 3 scale low ¹	No retransmission output, Measured value (PV), Segment level, Set value (SV) of Fixed set point control mode, and SV monitor : Input range low to Input range high [Varies with the setting of the Decimal point position.] Deviation: –Input span to +Input span [Varies with the setting of the Decimal point position.] Manipulated output value: –5.0 to +105.0 % Current transformer (CT) input value: 0.0 to 100.0 %	Input range low –Input span 0.0 0.0	

¹ Displayed when OUT3 is supplied and "Universal output type selection" is "Current output."

² In Program control mode (RUN): The SV monitor value is a monitor value of segment level.
In Fixed set point control mode (FIX): The SV monitor value is a monitor value of "Set value (SV) in Fixed set point control mode."

³ Setting will be ignored if Current transformer (CT) input is not specified at the time of order.

Function block No. 34: Digital output (*do*)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n34</i>	Function block No. 34 ¹	This is the first parameter symbol of Function block No. 34	—	—
173	<i>doSL1</i>	DO1 function selection ¹	0: No assignment 1: Logic calculation output (Event, HBA, LBA, Input error) 2: Output of Program control mode (RUN) state 3: Output of Manual control mode (MAN) state 4: Autotuning (AT) state output 5: Output of the communication monitoring result 6: FAIL output (Permanently configured to be de-energized) 7: Time signal 8: Pattern end signal	Based on Model code	
174	<i>doSL2</i>	DO2 function selection ²			
175	<i>doSL3</i>	DO3 function selection ²			
176	<i>doSL4</i>	DO4 function selection ²			
177	<i>doLG1</i>	DO1 logic calculation selection ¹	0 to 511 0: OFF +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Heater break alarm 1 (HBA1) +32: Heater break alarm 2 (HBA2) +64: Control loop break alarm (LBA) +128: Input error high +256: Input error low To select two or more functions, sum each value.	Based on Model code	
178	<i>doLG2</i>	DO2 logic calculation selection ²			
179	<i>doLG3</i>	DO3 logic calculation selection ²			
180	<i>doLG4</i>	DO4 logic calculation selection ²			
181	<i>doFS1</i>	DO1 time signal selection ³	0: Unused 1: Used 	Based on Model code	
182	<i>doFS2</i>	DO2 time signal selection ⁴			
183	<i>doFS3</i>	DO3 time signal selection ⁵			
184	<i>doFS4</i>	DO4 time signal selection ⁶			

¹ Displayed when Digital output (DO) is supplied.

² Displayed when four Digital outputs (DO) are supplied.

³ Displayed when "Time signal" is set at DO1 function selection.

⁴ Displayed when "Time signal" is set at DO2 function selection.

⁵ Displayed when "Time signal" is set at DO3 function selection.

⁶ Displayed when "Time signal" is set at DO4 function selection.



■ Function block No. 41: Event 1 (EH I)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n41</i>	Function block No. 41	This is the first parameter symbol of Function block No. 41	—	—
185	<i>ES I</i>	Event 1 type	0: None 1: Deviation high (Using SV monitor value) ^a 2: Deviation low (Using SV monitor value) ^a 3: Deviation high/low (Using SV monitor value) ^a 4: Band (Using SV monitor value) ^a 5: Deviation high/low (Using SV monitor value) [High/Low individual setting] ^a 6: Band (Using SV monitor value) [High/Low individual setting] ^a 7: SV high (Using SV monitor value) 8: SV low (Using SV monitor value) 9: Process high ^b 10: Process low ^b 11: Deviation high (Using segment level) ^a 12: Deviation low (Using segment level) ^a 13: Deviation high/low (Using segment level) ^a 14: Band (Using segment level) ^a 15: Deviation high/low (Using segment level) [High/Low individual setting] ^a 16: Band (Using segment level) [High/Low individual setting] ^a 17: SV high (Using segment level) 18: SV low (Using segment level) 19: MV high [heat-side] ^{b, c} 20: MV low [heat-side] ^{b, c} 21: MV high [cool-side] ^b 22: MV low [cool-side] ^b 23: Process high/low [High/Low individual setting] ^b 24: Process band [High/Low individual setting] ^b ^a Event hold and re-hold action is available. ^b Event hold action is available. ^c When the instrument is specified as position proportioning PID control with feedback resistance, this item becomes Feedback resistance (FBR) input.	If the Event type is specified by the digital output function selection of initial setting code when ordering, that Event type will be the factory set value. If the Event type is not specified by the digital output function selection of initial setting code: 1	
186	<i>EHo I</i>	Event 1 hold action	0: Hold action OFF 1: Hold action ON 2: Re-hold action ON Setting hold or re-hold action on the event that is not available with hold and re-hold actions will just be ignored.	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital output function selection of initial setting code: 0	
187	<i>EH I</i>	Event 1 differential gap	Deviation, Process and SV: 0 to Input span [Varies with the setting of the Decimal point position.] ----- MV: 0.0 to 110.0 %	TC/RTD inputs: 2 V/I inputs: 0.2 % of input span ----- 0.2	
188	<i>EVT I</i>	Event 1 timer	0.0 to 600.0 seconds	0.0	



Function block No. 42: Event 2 (EH2)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n42</i>	Function block No. 42	This is the first parameter symbol of Function block No. 42	—	—
189	<i>ES2</i>	Event 2 type	0: None 1: Deviation high (Using SV monitor value) ^a 2: Deviation low (Using SV monitor value) ^a 3: Deviation high/low (Using SV monitor value) ^a 4: Band (Using SV monitor value) ^a 5: Deviation high/low (Using SV monitor value) [High/Low individual setting] ^a 6: Band (Using SV monitor value) [High/Low individual setting] ^a 7: SV high (Using SV monitor value) 8: SV low (Using SV monitor value) 9: Process high ^b 10: Process low ^b 11: Deviation high (Using segment level) ^a 12: Deviation low (Using segment level) ^a 13: Deviation high/low (Using segment level) ^a 14: Band (Using segment level) ^a 15: Deviation high/low (Using segment level) [High/Low individual setting] ^a 16: Band (Using segment level) [High/Low individual setting] ^a 17: SV high (Using segment level) 18: SV low (Using segment level) 19: MV high [heat-side] ^{b, c} 20: MV low [heat-side] ^{b, c} 21: MV high [cool-side] ^b 22: MV low [cool-side] ^b 23: Process high/low [High/Low individual setting] ^b 24: Process band [High/Low individual setting] ^b ^a Event hold and re-hold action is available. ^b Event hold action is available. ^c When the instrument is specified as position proportioning PID control with feedback resistance, this item becomes Feedback resistance (FBR) input.	If the Event type is specified by the digital output function selection of initial setting code when ordering, that Event type will be the factory set value. If the Event type is not specified by the digital output function selection of initial setting code: 2	
190	<i>EHo2</i>	Event 2 hold action	0: Hold action OFF 1: Hold action ON 2: Re-hold action ON Setting hold or re-hold action on the event that is not available with hold and re-hold actions will just be ignored.	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital output function selection of initial setting code: 0	
191	<i>EH2</i>	Event 2 differential gap	Deviation, Process and SV: 0 to Input span [Varies with the setting of the Decimal point position.] ----- MV: 0.0 to 110.0 %	TC/RTD inputs: 2 V/I inputs: 0.2 % of input span ----- 0.2	
192	<i>EVt2</i>	Event 2 timer	0.0 to 600.0 seconds	0.0	



■ Function block No. 43: Event 3 (EH3)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n43</i>	Function block No. 43	This is the first parameter symbol of Function block No. 43	—	—
193	<i>ES3</i>	Event 3 type	0: None 1: Deviation high (Using SV monitor value) ^a 2: Deviation low (Using SV monitor value) ^a 3: Deviation high/low (Using SV monitor value) ^a 4: Band (Using SV monitor value) ^a 5: Deviation high/low (Using SV monitor value) [High/Low individual setting] ^a 6: Band (Using SV monitor value) [High/Low individual setting] ^a 7: SV high (Using SV monitor value) 8: SV low (Using SV monitor value) 9: Process high ^b 10: Process low ^b 11: Deviation high (Using segment level) ^a 12: Deviation low (Using segment level) ^a 13: Deviation high/low (Using segment level) ^a 14: Band (Using segment level) ^a 15: Deviation high/low (Using segment level) [High/Low individual setting] ^a 16: Band (Using segment level) [High/Low individual setting] ^a 17: SV high (Using segment level) 18: SV low (Using segment level) 19: MV high [heat-side] ^{b, c} 20: MV low [heat-side] ^{b, c} 21: MV high [cool-side] ^b 22: MV low [cool-side] ^b 23: Process high/low [High/Low individual setting] ^b 24: Process band [High/Low individual setting] ^b ^a Event hold and re-hold action is available. ^b Event hold action is available. ^c When the instrument is specified as position proportioning PID control with feedback resistance, this item becomes Feedback resistance (FBR) input.	If the Event type is specified by the digital output function selection of initial setting code when ordering, that Event type will be the factory set value. If the Event type is not specified by the digital output function selection of initial setting code: 0	
194	<i>EH03</i>	Event 3 hold action	0: Hold action OFF 1: Hold action ON 2: Re-hold action ON Setting hold or re-hold action on the event that is not available with hold and re-hold actions will just be ignored.	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital output function selection of initial setting code: 0	
195	<i>EH3</i>	Event 3 differential gap	Deviation, Process and SV: 0 to Input span [Varies with the setting of the Decimal point position.] ----- MV: 0.0 to 110.0 %	TC/RTD inputs: 2 V/I inputs: 0.2 % of input span ----- 0.2	
196	<i>EV73</i>	Event 3 timer	0.0 to 600.0 seconds	0.0	

Function block No. 44: Event 4 (EH4)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n44</i>	Function block No. 44	This is the first parameter symbol of Function block No. 44	—	—
197	<i>ES4</i>	Event 4 type	0: None 1: Deviation high (Using SV monitor value) ^a 2: Deviation low (Using SV monitor value) ^a 3: Deviation high/low (Using SV monitor value) ^a 4: Band (Using SV monitor value) ^a 5: Deviation high/low (Using SV monitor value) [High/Low individual setting] ^a 6: Band (Using SV monitor value) [High/Low individual setting] ^a 7: SV high (Using SV monitor value) 8: SV low (Using SV monitor value) 9: Process high ^b 10: Process low ^b 11: Deviation high (Using segment level) ^a 12: Deviation low (Using segment level) ^a 13: Deviation high/low (Using segment level) ^a 14: Band (Using segment level) ^a 15: Deviation high/low (Using segment level) [High/Low individual setting] ^a 16: Band (Using segment level) [High/Low individual setting] ^a 17: SV high (Using segment level) 18: SV low (Using segment level) 19: MV high [heat-side] ^{b, c} 20: MV low [heat-side] ^{b, c} 21: MV high [cool-side] ^b 22: MV low [cool-side] ^b 23: Process high/low [High/Low individual setting] ^b 24: Process band [High/Low individual setting] ^b ^a Event hold and re-hold action is available. ^b Event hold action is available. ^c When the instrument is specified as position proportioning PID control with feedback resistance, this item becomes Feedback resistance (FBR) input.	If the Event type is specified by the digital output function selection of initial setting code when ordering, that Event type will be the factory set value. If the Event type is not specified by the digital output function selection of initial setting code: 0	
198	<i>EH04</i>	Event 4 hold action	0: Hold action OFF 1: Hold action ON 2: Re-hold action ON Setting hold or re-hold action on the event that is not available with hold and re-hold actions will just be ignored.	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital output function selection of initial setting code: 0	
199	<i>EH4</i>	Event 4 differential gap	Deviation, Process and SV: 0 to Input span [Varies with the setting of the Decimal point position.] ----- MV: 0.0 to 110.0 %	TC/RTD inputs: 2 V/I inputs: 0.2 % of input span ----- 0.2	
200	<i>ET4</i>	Event 4 timer	0.0 to 600.0 seconds	0.0	



■ Function block No. 45: CT1 (CT1)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n45</i>	Function block No. 45 *	This is the first parameter symbol of Function block No. 45	—	—
201	<i>CTA1</i>	CT1 assignment *	0: None 1: OUT1 2: OUT2 3: OUT3	1	
202	<i>CTL1</i>	CT1 type *	0: CTL-6-P-N 1: CTL-12-S56-10L-N 2: CTL-6-P-Z	Based on Model code	
203	<i>CTR1</i>	CT1 ratio *	0 to 9999 When the CT type is changed, the following value will be automatically set. CTL-6-P-N: 800 CTL-12-S56-10L-N: 1000 CTL-6-P-Z: 800	If CTL-6-P-N or CTL-6-P-Z is specified for the Current transformer (CT) type: 800 If CTL-12-S56-10L-N is specified for the Current transformer (CT) type: 1000	
204	<i>CLC1</i>	CT1 low input cut-off *	0.0 to 1.0 A	0.0	

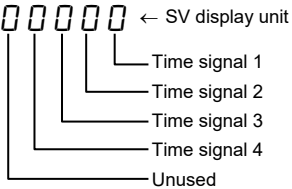
* Displayed when Current transformer (CT) input is supplied.

■ Function block No. 46: CT2 (CT2)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n46</i>	Function block No. 46 *	This is the first parameter symbol of Function block No. 46	—	—
205	<i>CTA2</i>	CT2 assignment *	Same as CT1 assignment		
206	<i>CTL2</i>	CT2 type *	Same as CT1 type		
207	<i>CTR2</i>	CT2 ratio *	Same as CT1 ratio		
208	<i>CLC2</i>	CT2 low input cut-off *	Same as CT1 low input cut-off		

* Displayed when two Current transformer (CT) inputs are supplied.

■ Function block No. 47: Time signal (TS1 G)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n47</i>	Function block No. 47 *	This is the first parameter symbol of Function block No. 47	—	—
209	<i>TS.SL</i>	Time signal selection	0: Unused 1: Used 	Based on Model code	

■ Function block No. 48: Pattern end signal (END.SL G)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n48</i>	Function block No. 48 *	This is the first parameter symbol of Function block No. 48	—	—
210	<i>END.SL</i>	Pattern end signal selection	0: Unused 1: Used	Based on Model code	

Function block No. 51: Control (Conf)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>Fns1</i>	Function block No. 51	This is the first parameter symbol of Function block No. 51	—	—
211	<i>as</i>	Control action	0: Brilliant II PID control (direct action) 1: Brilliant II PID control (reverse action) 2: Brilliant II Heat/Cool PID control [water cooling] 3: Brilliant II Heat/Cool PID control [air cooling] 4: Brilliant II Heat/Cool PID control [Cooling linear type] 5: Brilliant II Position proportioning PID control (reverse action) 6: Brilliant II Position proportioning PID control (direct action).	Control action specified at the time of order.	
212	<i>LPI d</i>	Level PID action selection	0: No Level PID 1: Switching by Set value (SV) (Level PID action) ¹ 2: Switching by Measured value (PV) (Level PID action)	0	
213	<i>LHS</i>	Level PID differential gap	0 to Input span [Varies with the setting of the Decimal point position.]	TC/RTD inputs: 2 V/I inputs: 0.2	
214	<i>oRU</i>	Output change rate limiter (up) [heat-side] ²	0.0 to 1000.0 %/seconds of manipulated output 0.0: OFF	0.0	
215	<i>oRd</i>	Output change rate limiter (down) [heat-side] ²	0.0 to 1000.0 %/seconds of manipulated output 0.0: OFF	0.0	
216	<i>RoVE</i>	Action (high) input error	0: Control continues (with the latest output) 1: Manipulated output value at input error [Manual control mode (MAN)] The operation mode is switched to the Manual control mode (MAN) and the Manipulated output value at input error is output.	2	
217	<i>RUNE</i>	Action (low) input error	2: Manipulated output value at input error [Program control mode (RUN), Fixed set point control mode (FIX)] The operation mode remains in the Program control mode (RUN) or Fixed set point control mode (FIX) and the Manipulated output value at input error of is output. When the error is recovered, the operation mode is switched to the PID control.		
218	<i>PSM</i>	Manipulated output value at input error	PID control, Position proportioning PID control: -5.0 to +105.0 % ----- Heat/Cool PID control: -105.0 to +105.0 %	-5.0 ----- 0.0	
219	<i>RMV</i>	Manipulated output value in Reset mode [heat-side]	-5.0 to +105.0 %	-5.0	
220	<i>PdR</i>	Start determination point	0 to Input span 0: Operation starts from any start state selected by Hot/Cold start [Varies with the setting of the Decimal point position.]	3 % of Input span	
221	<i>MVFS</i>	Manual manipulated output value selection	0: Last manipulated output value (Balanceless-bumpless function) 1: Manual manipulated output value	0	
222	<i>IdDP</i>	Integral/Derivative time decimal point position	0: No decimal place 1: One decimal place 2: Two decimal places	0	
223	<i>SFS</i>	ST start condition	0: Activate the Startup tuning (ST) function when the power is turned on; when transferred from RESET to RUN/FIX; or when the Set value (SV) is changed. 1: Activate the Startup tuning (ST) function when the power is turned on; or when transferred from RESET to RUN/FIX. 2: Activate the Startup tuning (ST) function when the Set value (SV) is changed.	0	

¹ Switching operation is invalid in the Reset mode (RESET).

² Not displayed when Control action is Position proportioning PID action



■ Function block No. 55: Position proportioning control ($P_{OSI} \Gamma$)

No.	Symbol	Name	Data range	Factory set value	User set value
—	F_{n55}	Function block No. 55 ¹	This is the first parameter symbol of Function block No. 55	—	—
225	y_{BR}	Action at feedback resistance (FBR) input error ^{1,2}	0: Action depending on the Value action in Reset mode 1: Control action continued	0	
226	P_{OS}	Feedback adjustment ^{1,2}	When the <MODE key is pressed and held for 5 seconds, Feedback adjustment is automatically started. Adj : Adjustment end $oPEn$: During adjustment on the open-side $CLoSE$: During adjustment on the close-side Err : Adjustment error	Adj	—
227	M_{ot}	Control motor time ¹	5 to 1000 seconds	10	
228	oLR	Integrated output limiter ¹	0.0 to 200.0 % of control motor time 0.0: OFF	150.0	
229	v_{AL}	Valve action in Reset mode ¹	0: Close-side output OFF, Open-side output OFF 1: Close-side output ON, Open-side output OFF 2: Close-side output OFF, Open-side output ON	0	
230	y_{ASo}	Action at saturated output ^{1,2}	0: Invalid (The close-side [or open-side] output turns to OFF when the valve position is fully closed [or opened]). 1: Valid (The close-side [or open-side] output remains ON state when the valve position is fully closed [or opened]).	0	

¹ Displayed when the Control action is a Position proportioning PID control.

² Displayed when a Feedback resistance (FBR) input is supplied.

■ Function block No. 56: Cooling control (C_{oOL})

No.	Symbol	Name	Data range	Factory set value	User set value
—	F_{n56}	Function block No. 56 *	This is the first parameter symbol of Function block No. 56	—	—
231	$oRUC$	Output change rate limiter (up) [cool-side] *	0.0 to 1000.0 %/seconds of manipulated output 0.0: OFF	0.0	
232	$oRdc$	Output change rate limiter (down) [cool-side] *	0.0 to 1000.0 %/seconds of manipulated output 0.0: OFF	0.0	
233	RMV_c	Manipulated output value in Reset mode [cool-side] *	−5.0 to +105.0 %	−5.0	
234	US	Undershoot suppression factor *	0.000 to 1.000	Water cooling: 0.100 Air cooling: 0.250 Cooling linear: 1.000	
235	$dbPR$	Overlap/Deadband reference point *	0.0 to 1.0	0.0	

* Displayed when the Control action is Heat/Cool PID control.

■ Function block No. 57: Proactive ($P_{AC} \Gamma$)

No.	Symbol	Name	Data range	Factory set value	User set value
—	F_{n57}	Function block No. 57 *	This is the first parameter symbol of Function block No. 57	—	—
236	b_{FMSP}	Bottom suppression function *	0: No function 1: FF amount is added by level 2: FF amount is forcibly added	0	

* Displayed when the Control action is other than Position proportioning PID control.

Function block No. 60: Communication (5C1)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n60</i>	Function block No. 60 *	This is the first parameter symbol of Function block No. 60	—	—
237	<i>CMPS</i>	Communication protocol *	0: RKC communication 1: Modbus (Order of data transfer: upper word to lower word) 2: Modbus (Order of data transfer: lower word to upper word) 3: PLC communication (MITSUBISHI MELSEC series special protocol QnA-compatible 3C frame [format 4])	When the communication protocol is specified at the time of order, the specified communication protocol will be the factory preset value. With communication, communication protocol not specified: 0	
238	<i>Addr</i>	Device address *	RKC communication: 0 to 99 Modbus: 1 to 99 PLC communication: 0 to 30	RKC communication: 0 Modbus: 1 PLC communication: 0	
239	<i>bps</i>	Communication speed *	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps 4: 38400 bps 5: 57600 bps	3	
240	<i>bit</i>	Data bit configuration *	0 to 11 Refer to Data bit configuration table	0	
241	<i>INT</i>	Interval time *	0 to 250 ms	10	
242	<i>CMRM</i>	Communication response monitor *	0000 ← SV display unit — Communication response monitor 0: Normal response 1: Overrun error 2: Parity error 4: Framing error 8: Receive buffer overflow If two or more errors occur, the error values are summed up. Errors are displayed in the hexadecimal format (0 to F). 0 (fixed) — Reception status monitor * — Transmission status monitor * * Each time signal is sent or received, 0 and 1 are displayed in turns. — Lights off	—	—

* Displayed when Communication function is supplied.

Data bit configuration table

Set value	Data bit	Parity bit	Stop bit
0	8	None	1
1	8	None	2
2	8	Even	1
3	8	Even	2
4	8	Odd	1
5	8	Odd	2

Set value	Data bit	Parity bit	Stop bit
6	7	None	1
7	7	None	2
8	7	Even	1
9	7	Even	2
10	7	Odd	1
11	7	Odd	2

: Not settable for Modbus



■ Function block No. 62: PLC communication ($\bar{P}AP$)

No.	Symbol	Name	Data range	Factory set value	User set value
—	F_{n62}	Function block No. 62 *	This is the first parameter symbol of Function block No. 62	—	—
243	$MP.REG$	Register type *	Mitsubishi PLC 0: D register (data register) 1: R register (file register) 2: W register (link register) 3: ZR register (Method of specifying consecutive numbers when 32767 of R register is exceeded.)	0	
244	$MP.SRH$	Register start number (High-order 4-bit) *	0 to 15	0	
245	$MP.SRL$	Register start number (Low-order 16-bit) *	0 to 65535	1000	
246	$MP.Mod$	Monitor item register bias *	12 to 65535	12	
247	$MP.Sfb$	Setting item register bias *	0 to 65535	0	
248	$MP.LFM$	Instrument link recognition time *	0 to 255 seconds	5	
249	$MP.FMo$	PLC response waiting time *	0 to 3000 ms	255	
250	$MP.SFM$	PLC communication start time *	1 to 255 seconds	5	
251	$MP.SLb$	Slave register bias *	0 to 65535	140	
252	$MP.MAd$	Number of recognizable devices *	0 to 30	8	

* Displayed when both Communication function and PLC communication protocol are supplied.

■ Function block No. 71: Setting limiter (SbL)

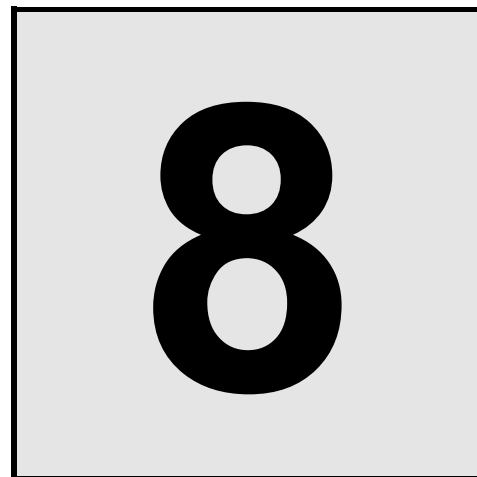
No.	Symbol	Name	Data range	Factory set value	User set value
—	F_{n71}	Function block No. 71	This is the first parameter symbol of Function block No. 71	—	—
253	SLH	Setting limiter high	Setting limiter low to Input range high [Varies with the setting of the Decimal point position.]	Input range high	
254	SLL	Setting limiter low	Input range low to Setting limiter high [Varies with the setting of the Decimal point position.]	Input range low	

■ Function block No. 91: System (595)

No.	Symbol	Name	Data range	Factory set value	User set value
—	<i>F_n91</i>	Function block No. 91	This is the first parameter symbol of Function block No. 91	—	—
—	<i>DEF</i>	Initialization	1225: Start initialization Other values: Set values are maintained After the initialization, this instrument is restarted. This setting will automatically go back to zero.	0	—
—	<i>WT</i>	Integrated operating time	0 to 65535 hours	—	—
—	<i>TCU</i>	Peak hold monitor of ambient temperature	–120 to +120 °C	—	—
—	<i>ROM</i>	ROM version	The installed ROM version is displayed	—	—
—	<i>PZ900</i>	Model code monitor	Model code is displayed. Use the UP or DOWN key to scroll the display horizontally (left or right).	—	—
—	<i>00000</i> The serial number of the instrument is displayed.	Instrument number monitor	Instrument number is displayed.	—	—



MEMO



INPUT FUNCTION

This chapter describes input related functions, setting contents and setting procedure based on the key words related to inputs.

8.1 Changing Input	8-2
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8.3 Correcting Input (PV Bias and PV Ratio)	8-21
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8.1 Changing Input

Measured input can be changed at following parameters. Set the input according to the sensor and the application.

- Input type
- Display unit
- Decimal point position
- Input range high/Input range low
- Input data type

■ Description of function

Input type

Input type can be easily configured to thermocouple, RTD, current or voltage only by changing the settings.

- TC input type: K, J, R, S, B, E, N, T, W5Re/W26Re, PL II, U, L, PR40-20
- RTD input type: Pt100, JPt100
- Current input type: 0 to 20 mA DC, 4 to 20 mA DC
- Voltage input type: 0 to 10 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 1 V DC, –10 to +10 V DC, –5 to +5 V DC, 0 to 100 mV DC, 0 to 10 mV DC

Display unit

In case of thermocouple or RTD input, the measurement unit can be selected from °C and °F.

Decimal point position

The decimal point position depends on the input type.

- TC input: K, J, R, S, B, E, N, T, PL II, U, L: No decimal place or One decimal place
Thermocouples other than those shown above: No decimal place (fixed)
- RTD input: No decimal place, One decimal place or Two decimal places
- Voltage/Current input: In case of Input data type 0: No decimal place, One decimal place, Two decimal places, Three decimal places or Four decimal places
In case of Input data type 1: No decimal place, One decimal place, Two decimal places or Three decimal places



For the Input data type, refer to **Input range table (P. 8-7)**.

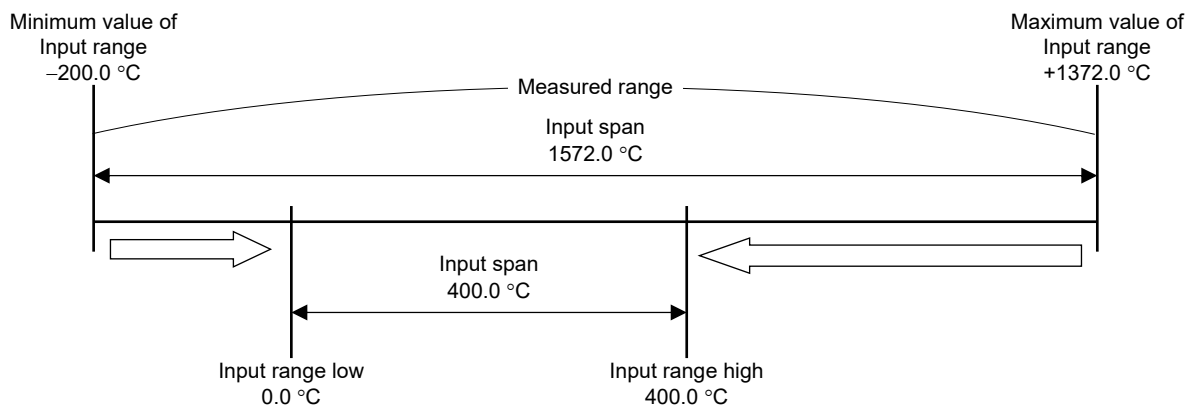
Input range high/low

In the case of temperature input (TC and RTD), input ranges can be changed. In the case of voltage (V) and current (I) inputs, the display range is programmable within –19999 and +99999.

(The input range specified when ordered can be changed by setting the input range high and low.)

Example of input change 1:

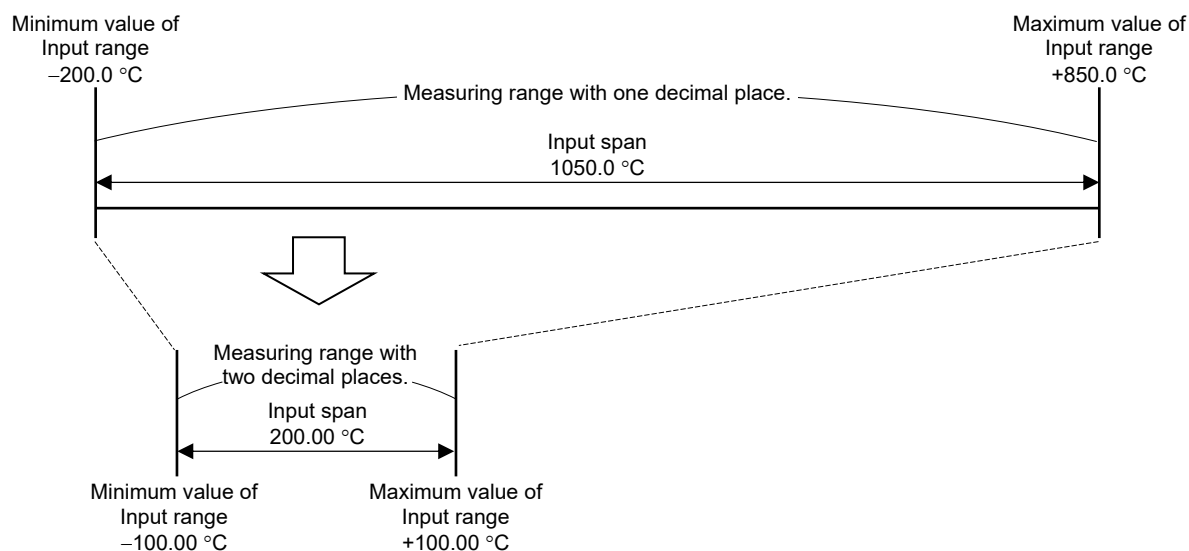
Changing thermocouple K “–200.0 to +1372.0 °C” to “0.0 to 400.0 °C”



Example of input change 2:

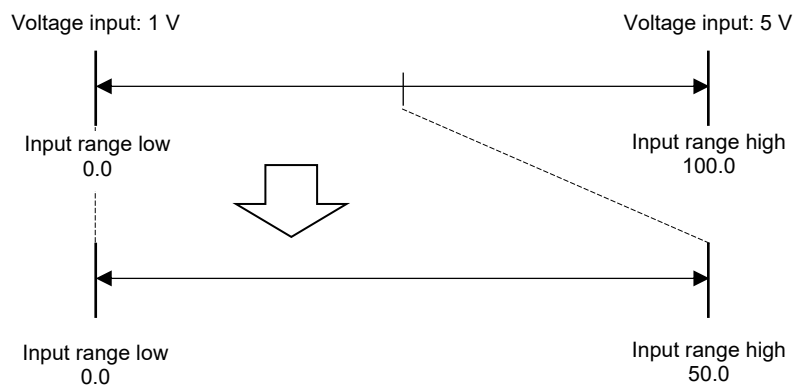
When the input range is -200.0 to $+850.0$ °C (Input type: RTD Pt100), changing the decimal point position to 2 from 1 will change the input range to -100.00 to $+100.00$ °C.

The maximum range with an RTD Pt100 input with two decimal places is -100.00 to $+100.00$ °C. Accordingly setting beyond this range is not possible.



Example of input change 3:

In the case of Voltage input (1 to 5 V DC), the input range has been reduced from “0.0 to 100.0” to “0.0 to 50.0.”



Input data type

The number of digits of the Measured value (PV), the number of data digits in RKC communication, the data type in Modbus communication (double word or single word) can be changed.



■ Parameter setting

-  Refer to the **Input range table (P. 8-7)** for the input range of each input type.
-  For the input range code, refer to **Input range code table (P. 8-9)**.

● Input type

[Engineering Mode: Function block No. 21 (F_{n2} I)]

Parameter symbol	Data range		Factory set value
I NP	0: TC input K 1: TC input J 2: TC input R 3: TC input S 4: TC input B 5: TC input E 6: TC input N 7: TC input T 8: TC input W5Re/W26Re 9: TC input PL II 10: TC input U 11: TC input L 12: TC input PR40-20 13: RTD input Pt100 14: RTD input JPt100	15: Current input 0 to 20 mA DC 16: Current input 4 to 20 mA DC 17: Voltage input 0 to 10 V DC 18: Voltage input 0 to 5 V DC 19: Voltage input 1 to 5 V DC 20: Voltage input 0 to 1 V DC 21: Voltage input -10 to +10 V DC 22: Voltage input -5 to +5 V DC 23: Voltage input 0 to 100 mV DC 24: Voltage input 0 to 10 mV DC	Same as the input type of the input range code specified at the time of order.



NOTE

When the input type is changed from current or high voltage input * to TC, RTD or low voltage input *, remove the wirings of the measured input before attempting the input change. Changing the input type with the signal applied to the instrument may lead to a failure of the instrument.

* High voltage input: 0 to 10 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 1 V DC, -10 to +10 V DC, -5 to +5 V DC
Low voltage input: 0 to 100 mV DC, 0 to 10 mV DC



Refer to “**15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)**” for the parameters that are initialized or changed when the input type is changed.

● Display unit

[Engineering Mode: Function block No. 21 (F_{n2} I)]

Parameter symbol	Data range	Factory set value
UNIT	0: °C 1: °F	Same as the display unit of the input range code specified at the time of order.



To show “Display unit,” thermocouple or RTD must be selected at Input type in Function block No. 21 in the Engineering mode.



Refer to “**15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)**” for the parameters that are initialized or changed when the display unit is changed.

● Decimal point position

[Engineering Mode: Function block No. 21 (F_{n2} I)]

Parameter symbol	Data range	Factory set value
$PGDP$	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places TC input: W5Re/W26Re, PR40-20: 0 (fixed) Thermocouples other than those shown above: 0 to 1 RTD input: 0 to 2 Voltage (V)/Current (I) input: In case of Input data type 0: 0 to 4 In case of Input data type 1: 0 to 3	Same as the decimal point position of the input range code specified at the time of order. For V/I inputs: 1

Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized or automatically converted when the decimal point position is changed.

● Input range high

[Engineering Mode: Function block No. 21 (F_{n2} I)]

Parameter symbol	Data range	Factory set value
$PGSH$	(Input range low + 1 digit) to Maximum value of input range [Varies with the setting of the Decimal point position.] Refer to the Input range table (P. 8-7) for the input range of each input type.	High limit value of the input range code specified at the time of order. For V/I inputs: 100.0

Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are automatically converted when the Input range high is changed.

● Input range low

[Engineering Mode: Function block No. 21 (F_{n2} I)]

Parameter symbol	Data range	Factory set value
$PGSL$	Minimum value of input range to (Input range high – 1 digit) [Varies with the setting of the Decimal point position.] Refer to the Input range table (P. 8-7) for the input range of each input type.	Low limit value of the input range code specified at the time of order. For V/I inputs: 0.0

Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are automatically converted when the Input range low is changed.

**● Input data type****[Engineering Mode: Function block No. 21 (F_{n2} I)]**

Parameter symbol	Data range	Factory set value
I Ndf	0: Number of measured value digits: 5 Number of RKC communication digits: 7 Modbus: Double word PLC communication: Double word (System data: Single word) 1: Number of measured value digits: 4 Number of RKC communication digits: 6 Modbus: Single word PLC communication: Single word When changing the Input data type from 0 to 1 and when the present Input range has 5 digits (example: Input range high: 1372.0), you need to configure the Input range to have 4 digits beforehand.	Conforms to Input range code to specified at the time of ordering



Refer to “**15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)**” for the parameters that are automatically converted when the Input data type is changed.

Input range table

The input range may vary with the Input data type.

The Input data types are as follows.

- Measured value (PV): 5 or 4 digits for the display
- RKC communication: 7 or 6 digits for the data
- Modbus: Double word or single word
- PLC communication: Double word or single word



The Input data type can be changed at “Input data type” in Function block No. 21 in the Engineering mode.



The input resolution may vary with the selected input range, display unit, and decimal point position.

TC input

Input type	Decimal point position	In case of Input data type 0 Number of measured value digits: 5 Number of RKC communication digits: 7 Modbus: Double word PLC communication: Double word		In case of Input data type 1 Number of measured value digits: 4 Number of RKC communication digits: 6 Modbus: Single word PLC communication: Single word	
		°C	°F	°C	°F
K	No decimal place	–200 to +400 °C	–328 to +752 °F	–200 to +400 °C	–328 to +752 °F
		–200 to +1372 °C	–328 to +2502 °F	–200 to +1372 °C	–328 to +2502 °F
	One decimal place	–200.0 to +400.0 °C	–328.0 to +752.0 °F	–199.9 to +400.0 °C	–199.9 to +752.0 °F
		–200.0 to +1372.0 °C	–328.0 to +2502.0 °F	–199.9 to +999.9 °C	–199.9 to +999.9 °F
J	No decimal place	–200 to +400 °C	–328 to +752 °F	–200 to +400 °C	–328 to +752 °F
		–200 to +1200 °C	–328 to +2192 °F	–200 to +1200 °C	–328 to +2192 °F
	One decimal place	–200.0 to +400.0 °C	–328.0 to +752.0 °F	–199.9 to +400.0 °C	–199.9 to +752.0 °F
		–200.0 to +1200.0 °C	–328.0 to +2192.0 °F	–199.9 to +999.9 °C	–199.9 to +999.9 °F
T	No decimal place	–200 to +400 °C	–328 to +752 °F	–200 to +400 °C	–328 to +752 °F
	One decimal place	–200.0 to +400.0 °C	–328.0 to +752.0 °F	–199.9 to +400.0 °C	–199.9 to +752.0 °F
S *	No decimal place	–50 to +1768 °C	–58 to +3214 °F	–50 to +1768 °C	–58 to +3214 °F
	One decimal place	–50.0 to +1768.0 °C	–58.0 to +3214.0 °F	–50.0 to +999.9 °C	–58.0 to +999.9 °F
R *	No decimal place	–50 to +1768 °C	–58 to +3214 °F	–50 to +1768 °C	–58 to +3214 °F
	One decimal place	–50.0 to +1768.0 °C	–58.0 to +3214.0 °F	–50.0 to +999.9 °C	–58.0 to +999.9 °F
E *	No decimal place	–200 to +1000 °C	–328 to +1832 °F	–200 to +1000 °C	–328 to +1832 °F
	One decimal place	–200.0 to +1000.0 °C	–328.0 to +1832.0 °F	–199.9 to +999.9 °C	–199.9 to +999.9 °F
B *	No decimal place	0 to 1800 °C	0 to 3272 °F	0 to 1800 °C	0 to 3272 °F
	One decimal place	0.0 to 1800.0 °C	0.0 to 3272.0 °F	0.0 to 999.9 °C	0.0 to 999.9 °F
N *	No decimal place	0 to 1300 °C	0 to 2372 °F	0 to 1300 °C	0 to 2372 °F
	One decimal place	0.0 to 1300.0 °C	0.0 to 2372.0 °F	0.0 to 999.9 °C	0.0 to 999.9 °F
W5Re/W26Re	No decimal place	0 to 2300 °C	0 to 4200 °F	0 to 2300 °C	0 to 4200 °F
PL II *	No decimal place	0 to 1390 °C	0 to 2534 °F	0 to 1390 °C	0 to 2534 °F
	One decimal place	0.0 to 1390.0 °C	0.0 to 2534.0 °F	0.0 to 999.9 °C	0.0 to 999.9 °F
U	No decimal place	–200 to +600 °C	–328 to +1112 °F	–200 to +600 °C	–328 to +1112 °F
	One decimal place	–200.0 to +600.0 °C	–328.0 to +1112.0 °F	–199.9 to +600.0 °C	–199.9 to +999.9 °F
L	No decimal place	0 to 900 °C	0 to 1652 °F	0 to 900 °C	0 to 1652 °F
	One decimal place	0.0 to 900.0 °C	0.0 to 1652.0 °F	0.0 to 900.0 °C	0.0 to 999.9 °F
PR40-20	No decimal place	0 to 1800 °C	0 to 3200 °F	0 to 1800 °C	0 to 3200 °F

* The least significant digit (LSD) may flicker when the display resolution is set to 0.1°C (0.1°F).



If there is no decimal point, there is no difference in the input range by Input data type.



Thermocouple inputs K, J, T, S, R, E, B, N, PL II, U, and L are settable to one decimal place.



8. INPUT FUNCTION

● RTD input

Input type	Decimal point position	In case of Input data type 0 Number of measured value digits: 5 Number of RKC communication digits: 7 Modbus: Double word PLC communication: Double word		In case of Input data type 1 Number of measured value digits: 4 Number of RKC communication digits: 6 Modbus: Single word PLC communication: Single word	
		°C	°F	°C	°F
Pt100	No decimal place	–200 to +850 °C	–328 to +1562 °F	–200 to +850 °C	–328 to +1562 °F
		–100 to +100 °C	–148 to +212 °F	–100 to +100 °C	–148 to +212 °F
		0 to 50 °C	32 to 122 °F	0 to 50 °C	32 to 122 °F
	One decimal place	–200.0 to +850.0 °C	–328.0 to +1562.0 °F	–199.9 to +850.0 °C	–199.9 to +999.9 °F
		–100.0 to +100.0 °C	–148.0 to +212.0 °F	–100.0 to +100.0 °C	–148.0 to +212.0 °F
		0.0 to 50.0 °C	32.0 to 122.0 °F	0.0 to 50.0 °C	32.0 to 122.0 °F
JPt100	No decimal place	–200 to +649 °C	–328 to +1184 °F	–200 to +649 °C	–328 to +1184 °F
		–100 to +100 °C	–148 to +212 °F	–100 to +100 °C	–148 to +212 °F
		0 to 50 °C	32 to 122 °F	0 to 50 °C	32 to 122 °F
	One decimal place	–200.0 to +649.0 °C	–328.0 to +1184.0 °F	–199.9 to +649.0 °C	–199.9 to +999.9 °F
		–100.0 to +100.0 °C	–148.0 to +212.0 °F	–100.0 to +100.0 °C	–148.0 to +212.0 °F
		0.0 to 50.0 °C	32.0 to 122.0 °F	0.0 to 50.0 °C	32.0 to 122.0 °F
	Two decimal places	–100.00 to +100.00 °C	–148.00 to +212.00 °F	–19.99 to +99.99 °C	–19.99 to +99.99 °F
		0.00 to 50.00 °C	32.00 to 122.00 °F	0.00 to 50.00 °C	32.00 to 99.99 °F



If there is no decimal point, there is no difference in the input range by Input data type.

● Voltage/Current input

Input type	Decimal point position	In case of Input data type 0 Number of measured value digits: 5 Number of RKC communication digits: 7 Modbus: Double word PLC communication: Double word		In case of Input data type 1 Number of measured value digits: 4 Number of RKC communication digits: 6 Modbus: Single word PLC communication: Single word	
Voltage/Current	No decimal place	–19999 to +99999		–1999 to +9999	
	One decimal place	–1999.9 to +9999.9		–199.9 to +999.9	
	Two decimal places	–199.99 to +999.99		–19.99 to +99.99	
	Three decimal places	–19.999 to +99.999		–1.999 to +9.999	
	Four decimal places	–1.9999 to +9.9999			

Input range code table (can be specified when ordering)



The Input range code table is a list of input range codes so that a user can specify the input range at the time of ordering. Even if the input range has been specified when ordered, the input range can be changed later within the measured range.

● TC Input

Type	Code	Range	See Note
K	K01	0 to 200 °C	4
	K02	0 to 400 °C	4
	K03	0 to 600 °C	4
	K04	0 to 800 °C	4
	K06	0 to 1200 °C	4
	K07	0 to 1372 °C	4
	K08	−199.9 to +300.0 °C	4
	K09	0.0 to 400.0 °C	4
	K10	0.0 to 800.0 °C	4
	K14	0 to 300 °C	4
	K41	−200 to +1372 °C	4
	K42	−200.0 to +1372.0 °C	5
	KA1	0 to 800 °F	4
	KA2	0 to 1600 °F	4
	KA3	0 to 2502 °F	4
J	J01	0 to 200 °C	4
	J02	0 to 400 °C	4
	J03	0 to 600 °C	4
	J04	0 to 800 °C	4
	J08	0.0 to 400.0 °C	4
	J29	−200.0 to +1200.0 °C	5
	JA1	0 to 800 °F	4
	JA3	0 to 2192 °F	4
	JA6	0 to 400 °F	4

Type	Code	Range	See Note
T	T01	−199.9 to +400.0 °C	4
	T02	−199.9 to +100.0 °C	4
	T03	−100.0 to +200.0 °C	4
	T19	−200.0 to +400.0 °C	5
R	R01	0 to 1600 °C	4
	R07	−50 to +1768 °C	4
	R08	−50.0 to +1768.0 °C	5
	R09	0.0 to 1600.0 °C	5
S	S06	−50 to +1768 °C	4
	S07	−50.0 to +1768.0 °C	5
B	B03	0 to 1800 °C	4
	B04	0.0 to 1800.0 °C	5
E	E01	0 to 800 °C	4
	E23	0.0 to 800.0 °C	4
N	N02	0 to 1300 °C	4
	N05	0.0 to 1300.0 °C	5
W5Re/ W26Re	W03	0 to 2300 °C	4
PL II	A01	0 to 1300 °C	4
	A05	0.0 to 1300.0 °C	5
U	U01	−199.9 to +600.0 °C	4
L	L04	0.0 to 900.0 °C	4
PR40-20	F02	0 to 1800 °C	5
	FA2	0 to 3200 °F	5

● RTD input

Type	Code	Range	See Note
Pt100	D01	−199.9 to +649.0 °C	4
	D04	−100.0 to +100.0 °C	4
	D05	−100.0 to +200.0 °C	4
	D06	0.0 to 50.0 °C	4
	D07	0.0 to 100.0 °C	4
	D08	0.0 to 200.0 °C	4
	D09	0.0 to 300.0 °C	4
	D10	0.0 to 500.0 °C	4
	D12	−199.9 to +600.0 °C	4

Type	Code	Range	See Note
Pt100	D21	−200.0 to +200.0 °C	5
	D27	0.00 to 50.00 °C	4
	D34	−100.00 to +100.00 °C	5
	D35	−200.0 to +850.0 °C	5
	DA1	−199.9 to +999.9 °F	4
	DA9	0.0 to 500.0 °F	4
JPt100	P08	0.0 to 200.0 °C	4
	P29	−100.00 to +100.00 °C	5
	P30	−200.0 to +640.0 °C	5

● Voltage/Current input

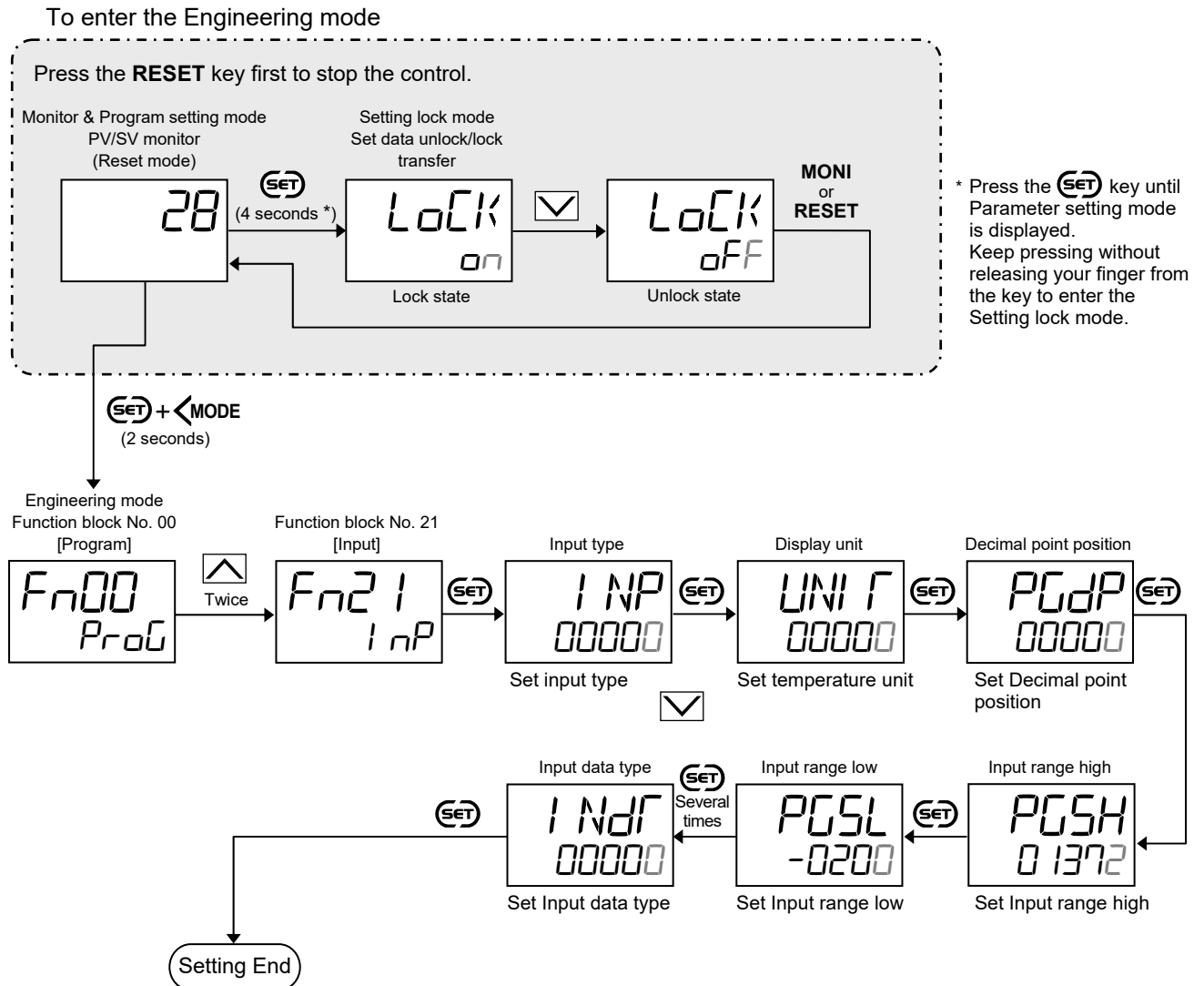
Type	Code	Range	See Note
Voltage/ Current	101	0 to 10 mV DC	5
	201	0 to 100 mV DC	5
	301	0 to 1 V DC	5
	401	0 to 5 V DC	5
	501	0 to 10 V DC	5

Type	Code	Range	See Note
Voltage/ Current	601	1 to 5 V DC	5
	701	0 to 20 mA DC	5
	801	4 to 20 mA DC	5
	904	−10 to +10 V DC	5
	905	−5 to +5 V DC	5

Note The number of displayed digits of the measured value.

In case of RKC communication, if the displayed data is 4 digits, it is handled as 6-digit data. If the displayed data is 5 digits, it is handled as 7-digit data. In case of Modbus communication, the 4-digit display is handled as a “single word” and the 5-digit display is handled as a “double word”.

Setting procedure



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

8.2 Switching Functions Using Digital Inputs (DI)

With the use of Digital input (DI), switching between the following functions is available.

- Reset mode (RESET) setting
- Program control mode (RUN) setting
- Step function
- Hold function
- Interlock release
- Peak/Bottom hold reset
- Selection of Autotuning (AT)
- Set data Unlock/Lock
- Direct/Reverse action transfer
- Program pattern No. switching

■ Number of Digital input (DI)

Maximum 6 points (None, 4, or 6)

■ Functional setting of Digital input (DI)

Set the desired function at each Digital input (DI).

Setting	DI1	DI2	DI3	DI4	DI5	DI6
0	No function	No function	No function	No function	No function	No function
1	RESET	RESET	RESET	RESET	RESET	RESET
2	RUN	RUN	RUN	RUN	RUN	RUN
3	STEP	STEP	STEP	STEP	STEP	STEP
4	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD
5	Interlock release	Interlock release	Interlock release	Interlock release	Interlock release	Interlock release
6	Hold reset	Hold reset	Hold reset	Hold reset	Hold reset	Hold reset
7	AT ON/OFF	AT ON/OFF	AT ON/OFF	AT ON/OFF	AT ON/OFF	AT ON/OFF
8	Unlock/Lock	Unlock/Lock	Unlock/Lock	Unlock/Lock	Unlock/Lock	Unlock/Lock
9	Direct/Reverse action	Direct/Reverse action	Direct/Reverse action	Direct/Reverse action	Direct/Reverse action	Direct/Reverse action
10	2 pattns without SET					
11	8 patterns without SET					
12	8 pattns with SET					
13	16 pattns without SET					
14	16 pattns with SET					

: The Setting range of DI2 to DI6 is from 0 to 9. Values 10 or larger cannot be set.

: When any of 11, 12, 13, and 14 is set for DI1, DI2 to DI5 (which are crossed out above) are used for switching the patterns and cannot be used for other purposes.

Continued on the next page.



Continued from the previous page.

[Explanation of functional setting]

RESET:	Reset mode (RESET) setting
RUN:	Program control mode (RUN) setting
STEP:	Step function
HOLD:	Hold function
Interlock release:	Release of Interlock
Hold reset:	Reset of Peak or Bottom hold value
AT ON/OFF:	Autotuning (AT) ON/OFF
Unlock/Lock:	Set data unlock/lock
Direct/Reverse action:	Switching between direct and reverse actions ¹
2 patterns without SET:	Program pattern No. switching 2 points (without area set signal)
8 patterns without SET:	Program pattern No. switching 8 points (without area set signal) ² DI2 and DI3 are not settable in this setting.
8 patterns with SET:	Program pattern No. switching 8 points (with area set signal) ² DI2, DI3 and DI4 are not settable in this setting.
16 patterns without SET:	Program pattern No. switching 16 points (without area set signal) ² DI2, DI3 and DI4 are not settable in this setting.
16 patterns with SET:	Program pattern No. switching 16 points (with area set signal) ³ DI2, DI3, DI4 and DI5 are not settable in this setting.

¹ Effective if setting of control action is any of 0, 1, 5, and 6. (Refer to P. 12-5)

² Effective if four or more Digital inputs (DI) are available

³ Effective if six or more Digital inputs (DI) are available

■ Factory set value of Digital input (DI)

4 points of DI are selected at the time of ordering.

Setting	DI1 to DI4
1	Reset mode (RESET) setting
2	Program control mode (RUN) setting
3	Step function
4	Hold function

6 points of DI are selected at the time of ordering.

Setting	DI1 to DI6
1	Reset mode (RESET) setting
2	Program control mode (RUN) setting
3	Step function
4	Hold function
5	Interlock release
6	Set data Unlock/Lock transfer

■ Open/Close action of Digital Input (DI)

● RUN/STOP transfer, Auto/Manual transfer, Remote/Local transfer, Set data unlock/lock transfer and Direct/Reverse action transfer

Functions are switched over at the detection of close status. Functions are selected as follows using the open/close action of the contact.

Function	Contact close	Contact open
Reset mode (RESET) setting	Reset mode (RESET)	Reset mode (RESET) is maintained.
Set data unlock/lock transfer	Lock	Unlock
Direct/Reverse action transfer	Direct action	Reverse action



Switching between Direct and Reverse actions is available only in the Reset mode (RESET). Switching is not available during the Program control mode (RUN). Presetting the contact state during the Program control mode (RUN) enables switching to the mode appropriate for the contact state during the Reset mode (RESET). For example, when control action setting in Control action (Function block No. 51 in the Engineering mode) is “0: Brilliant II PID control (direct action)” or “1: Brilliant II PID control (reverse action),” PID action is switched between direct and reverse actions.

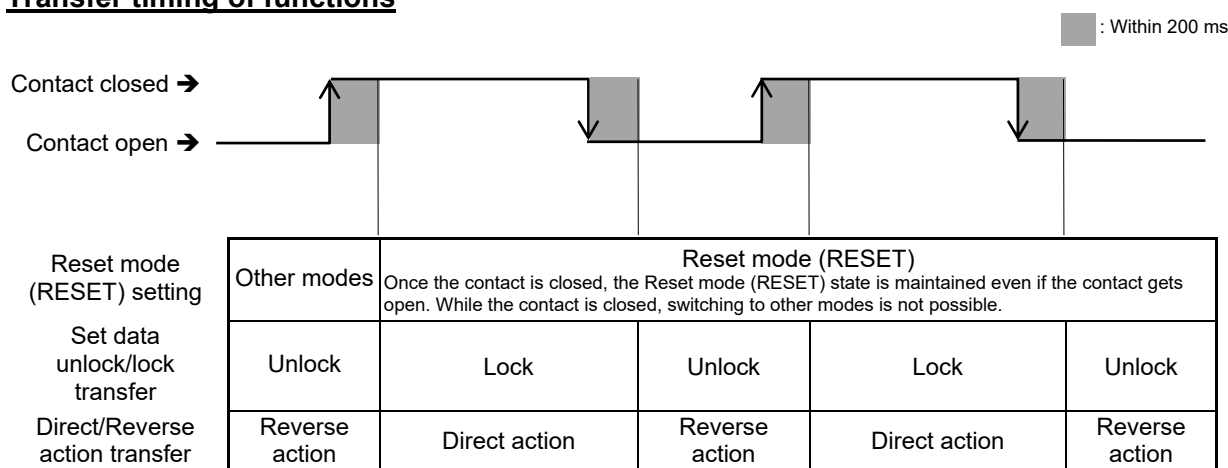
In the case of “5: Brilliant II Position proportioning PID control (reverse action)” or “6: Brilliant II Position proportioning PID control (direct action),” Position proportioning PID action is switched between reverse and direction actions.



It is possible to reverse the actions at the time of contact open and close for “Set data unlock/lock transfer” and “Direct/Reverse action transfer.”

This setting can be done in DI logic invert (Function block No. 23 in the Engineering mode).

Transfer timing of functions



NOTE

After the contact is transferred, it takes “Within 200 ms” until the action of this instrument is actually selected.



While the contact of the Reset mode (RESET) setting is closed, the operation mode cannot be switched to the other modes by the front key operation.



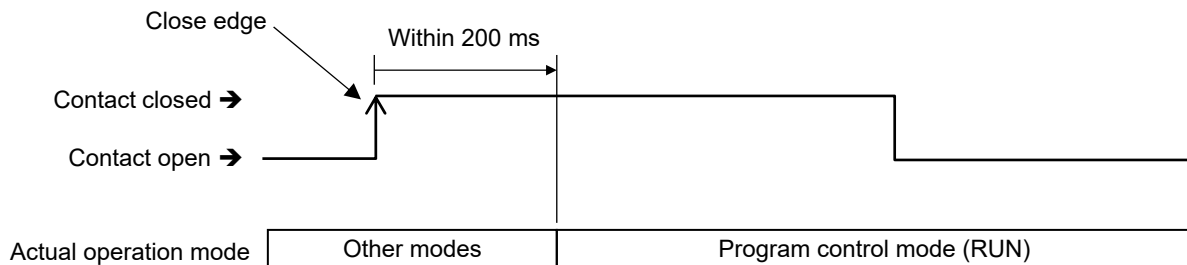
While the contact of the Reset mode (RESET) setting is closed, the operation mode cannot be switched to the other modes by communication function. The NAK message will be sent to the host computer by PZ400/900/401/901.



● Program control mode (RUN) setting

Through the detection of the close edge, the mode is changed to the Program control mode (RUN).

Transfer timing of Program control mode (RUN)



NOTE

After the contact is transferred, it takes “Within 200 ms” until the action of this instrument is actually selected.



Once the contact is closed, Program control mode (RUN) remains regardless of whether the contact is opened.



When the power to the instrument is turned off under the following condition, as long as the contact is closed at power on (at the power recovery), the mode is switched to the Program control mode (RUN).

- When the instrument is in the Reset mode (RESET) and the contact of the DI is open.

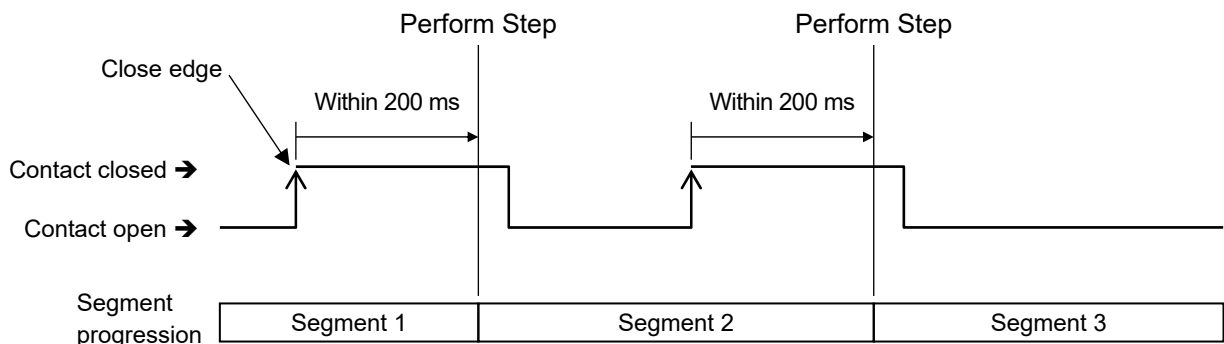
● Step function

Through the detection of the close edge, the Step function is activated and the current segment is skipped. To activate the Step function again, open the contacts once, then close them.

Step function is operative when

- the contacts for Reset mode (RESET) setting are open.
- operation mode is in the Program control mode (RUN).
- Hold function is OFF.
- the contacts for Hold function are open.

Transfer timing of segment



NOTE

After the contact is transferred, it takes “Within 200 ms” until the action of this instrument is actually selected.



If the contact of the Hold function or it of the Reset mode (RESET) mode are closed, step via communication function is not possible. The NAK message will be sent to the Host computer by PZ400/900/401/901.

● Hold function

The Hold function is activated at the detection of the contact close state, and the program progress is temporarily suspended. The Hold function is valid only while the contact is closed. The Hold state is released through the detection of the open edge.

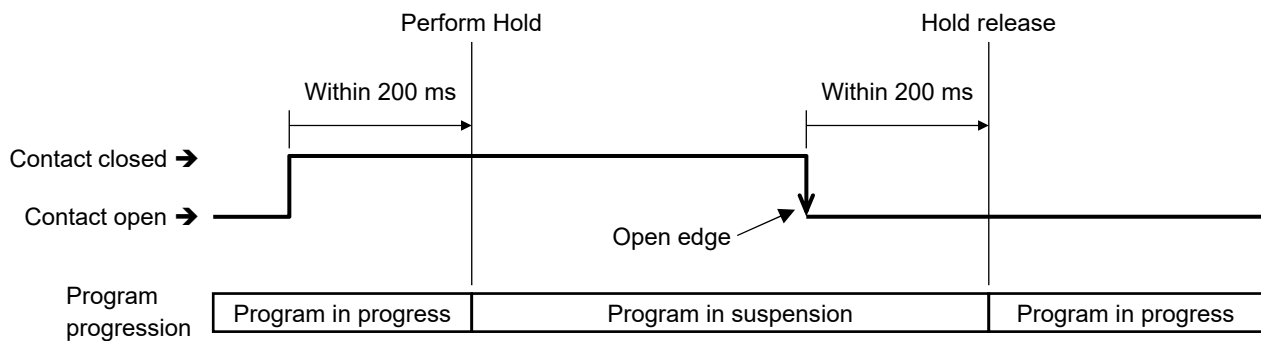
Operating condition to perform Hold function:

- The contacts for Reset mode (RESET) setting are open.
- Operation mode is in the Program control mode (RUN).

Operating condition to release Hold function:

- The contacts for Reset mode (RESET) setting are open.

Transfer timing of hold state



NOTE

After the contact is transferred, it takes “Within 200 ms” until the action of this instrument is actually selected.



Hold function cannot be performed by the front key operation when the contacts are closed.



Hold function cannot be performed by communication when the contacts are closed. The NAK message will be sent to the Host computer by PZ400/900/401/901.



When the power to the instrument is disconnected while the contact is closed, as long as the contact is open at power on, the Hold state is released.

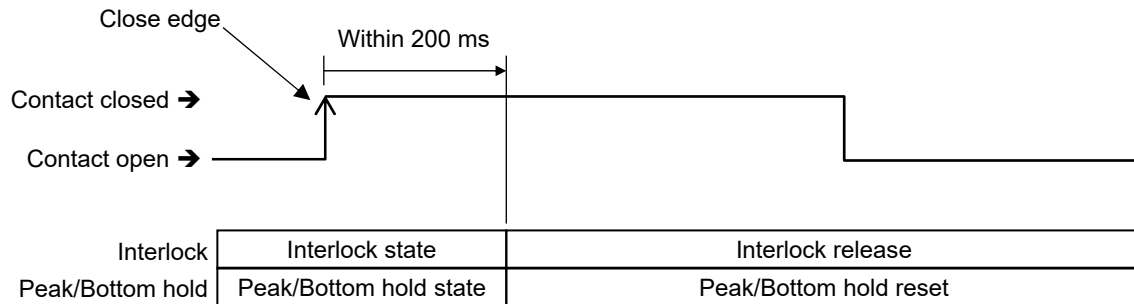
When the Hold function is assigned to multiple DI terminals, as long as all the DI contacts, to which the Hold function is assigned, are open at power on, the Hold state is released.



● Interlock release, Peak/Bottom hold reset

Through the detection of close edge (rising edge), Interlock state and Peak (or Bottom) hold values are reset.

Timing chart for Interlock release and peak/bottom hold reset



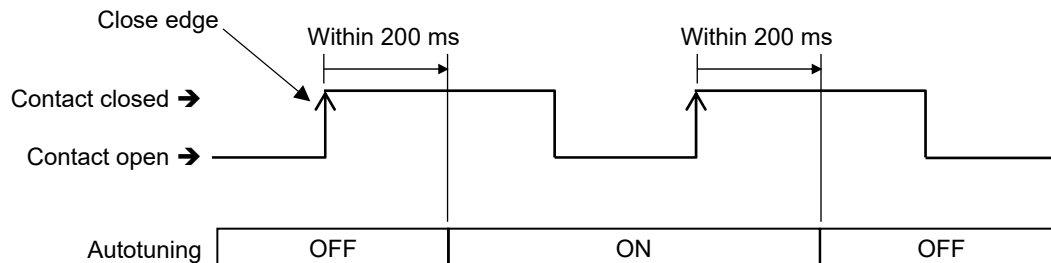
NOTE

After the contact is transferred, it takes “Within 200 ms” until the action of this instrument is actually selected.

● Autotuning (AT) ON/OFF

Through the detection of the close edge, Autotuning (AT) ON/OFF is switched.

ON/OFF timing chart of Autotuning (AT)



NOTE

After the contact is transferred, it takes “Within 200 ms” until the action of this instrument is actually selected.

● Program pattern No. switching

Selection of Program pattern No. can be obtained through such contact status as shown below.

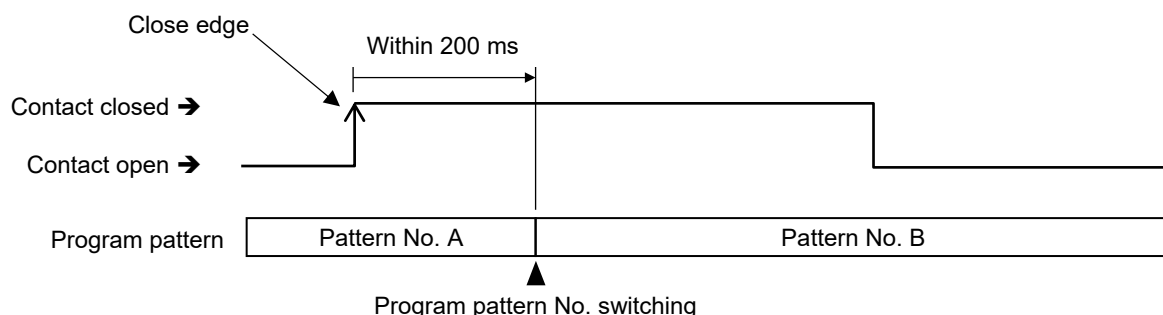
Pattern No.	DI1	DI2	DI3	DI4
1	—	—	—	—
2	x	—	—	—
3	—	x	—	—
4	x	x	—	—
5	—	—	x	—
6	x	—	x	—
7	—	x	x	—
8	x	x	x	—
9	—	—	—	x
10	x	—	—	x
11	—	x	—	x
12	x	x	—	x
13	—	—	x	x
14	x	—	x	x
15	—	x	x	x
16	x	x	x	x

—: Open
x: Closed

 : Areas used by DI for 2 patterns.
 : Areas used by DI for 8 patterns.
  : Areas used by DI for 16 patterns.

Program pattern No. switching timing

- With SET signal · First, change the contact status to a desired No. referring to the above table, and use a Close edge (Rising edge) of the pattern SET signal.
The pattern SET signal contact is: DI4 for 8 patterns and DI5 for 16 patterns.



NOTE

After the contact is transferred, it takes “Within 200 ms” until the action of this instrument is actually selected.

- Without SET signal · When the desired pattern number is to be selected, 500 ms or more may be required after the last switching action (closure or opening) before the pattern number is actually switched to the selected number.



When you have selected the program pattern switching without the SET signal, the program pattern cannot be switched via the front key or through the communication.



Program pattern switching can be activated only in the RESET mode. An attempt to switch the pattern in the mode other than the Reset mode will not actually switch the pattern number. However, switching to the Reset mode without changing the DI contact state will cause the following.

With SET signal: Closing the contacts of the SET signal after the switching to the Reset mode will cause switching to the preset pattern number within 200 ms.

Without SET signal: Switching to the preset pattern will take place 500 ms after the switching to the Reset mode.



■ Relation between Digital Input (DI) and Setting via front keys (or through communication)

● Set data unlock/lock transfer

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status
Unlock state	Unlock state	Unlock state
	Lock state	Lock state
Lock state	Unlock state	
	Lock state	

Priority is given to lock status

● Direct/Reverse action transfer

Setting via front keys or through communication	Setting via Digital Input (DI)	Instrument status
Reverse action	Reverse action	Reverse action
	Direct action	Direct action
Direct action	Reverse action	Reverse action
	Direct action	Direct action



While the contact of the Reset mode (RESET) setting is closed, switching to the other modes by the front key operation or by the communication is not possible.



While the contact of the Hold function is closed, switching to the other modes by the front key operation or by the communication is not possible.



The following DI functions basically remain as set by each operation.

- Program control mode (RUN) setting
- Step function
- Interlock release
- Peak/Bottom hold reset
- Autotuning (AT)

■ Parameter setting

● DI1 function selection to DI6 function selection

[Engineering mode: Function block No. 23 (F_{n23})]

Parameter symbol	Data range	Factory set value
$dI\ SL\ 1$	0: No function 1: Reset mode (RESET) setting 2: Program control mode (RUN) setting 3: Step function 4: Hold function 5: Interlock release 6: Peak/Bottom hold reset 7: Autotuning (AT) 8: Set data unlock/lock transfer 9: Direct/Reverse action transfer 10: Program pattern No. switching (2 patterns without SET) 11: Program pattern No. switching (8 patterns without SET) 12: Program pattern No. switching (8 patterns with SET) 13: Program pattern No. switching (16 patterns without SET) 14: Program pattern No. switching (16 patterns with SET)	1
$dI\ SL\ 2$	0 to 9 Same as DI1 function selection (0 to 9)	2
$dI\ SL\ 3$	0 to 9 Same as DI1 function selection (0 to 9)	3
$dI\ SL\ 4$	0 to 9 Same as DI1 function selection (0 to 9)	4
$dI\ SL\ 5$	0 to 9 Same as DI1 function selection (0 to 9)	5
$dI\ SL\ 6$	0 to 9 Same as DI1 function selection (0 to 9)	8



To display “DI function selection,” Digital input must be specified at the time of order.

- DI1 to DI4: Displayed when B, E, H or J is specified for Option 2 at the time of ordering.
- DI5, DI6: Displayed when B, E or J is specified for Option 2 at the time of ordering.

● DI logic invert

[Engineering mode: Function block No. 23 (F_{n23})]

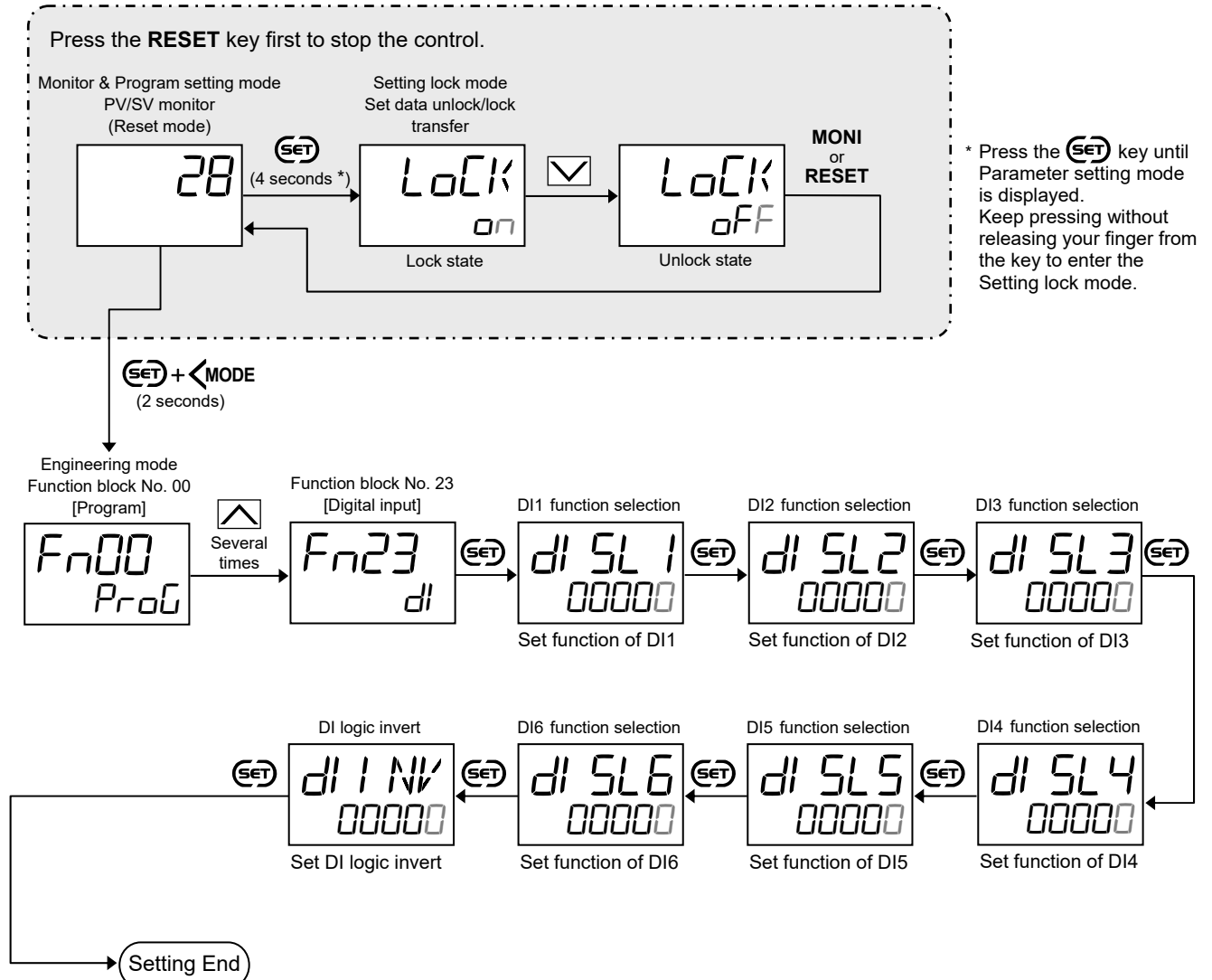
Parameter symbol	Data range	Factory set value
$dI\ I\ NV$	0 to 3 0: No logic invert +1: Set data unlock/lock transfer +2: Direct/Reverse action transfer To select two or more functions, sum each value.	0



To display “DI logic invert,” Digital input must be specified at the time of order.

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

8.3 Correcting Input (PV Bias and PV Ratio)

PV bias and PV ratio can be used for Input correction. The PV bias is used to compensate the individual variations of the sensors or correct the difference between the Measured value (PV) of other instruments.

■ Description of function

● PV bias

PV bias adds bias to the Measured value (PV).

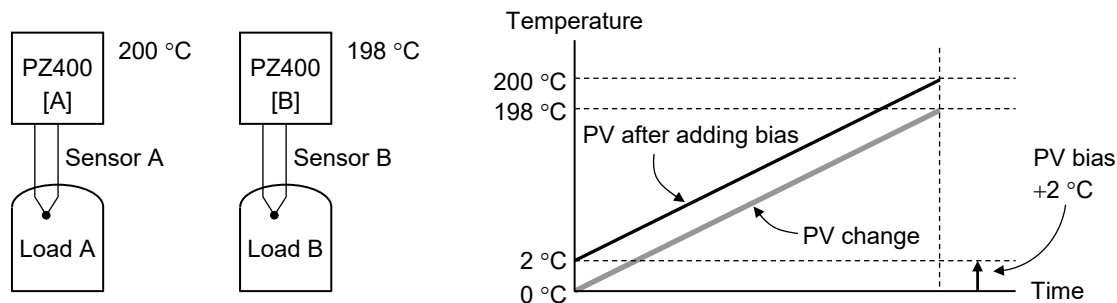
Setting example of PV bias:

When measuring the same type of load by using different sensors, the Measured value (PV) will be displayed differently based on the features of sensors:

PZ400 [A]: 200 °C PZ400 [B]: 198 °C

To correct the Measure value (PV) of PZ400 [B], add bias of +2 °C by PV bias:

Displayed value = Measured value (PV) + PV bias = 198 °C + 2 °C = 200 °C



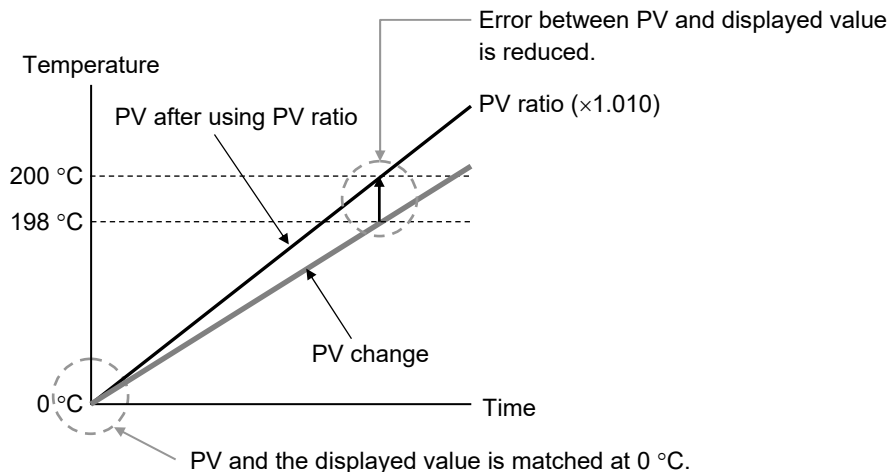
● PV ratio

PV ratio is a multiplier to be applied to the Measured value (PV).

Setting example of PV ratio:

PV ratio can be used to display 200 °C by adding 2 °C when the actual Measured value (PV) is 198 °C but the displayed value remains 0 °C when the actual PV is 0 °C. (The displayed value changes from 0 °C to 2 °C by PV bias setting.)

Displayed value = Measured value (PV) × PV ratio = 198 °C × 1.010 = 199.98 °C



● When setting PV bias and PV ratio at the same time

[Example]

When PV bias = 15 °C and

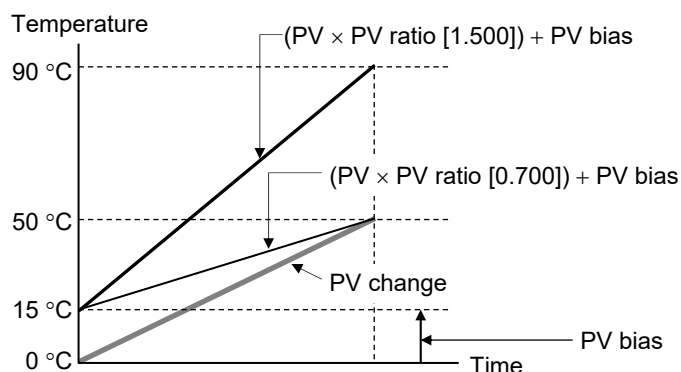
Measured value (PV) = 50 °C

If PV ratio = 0.700

$$\begin{aligned}\text{Displayed value} &= 50 \times 0.700 + 15 \\ &= 50\text{ °C}\end{aligned}$$

PV ratio = 1.500

$$\begin{aligned}\text{Displayed value} &= 50 \times 1.500 + 15 \\ &= 90\text{ °C}\end{aligned}$$



■ Parameter setting

● PV bias

[Setup Setting Mode: Setting group No. 21 (5n2 I)]

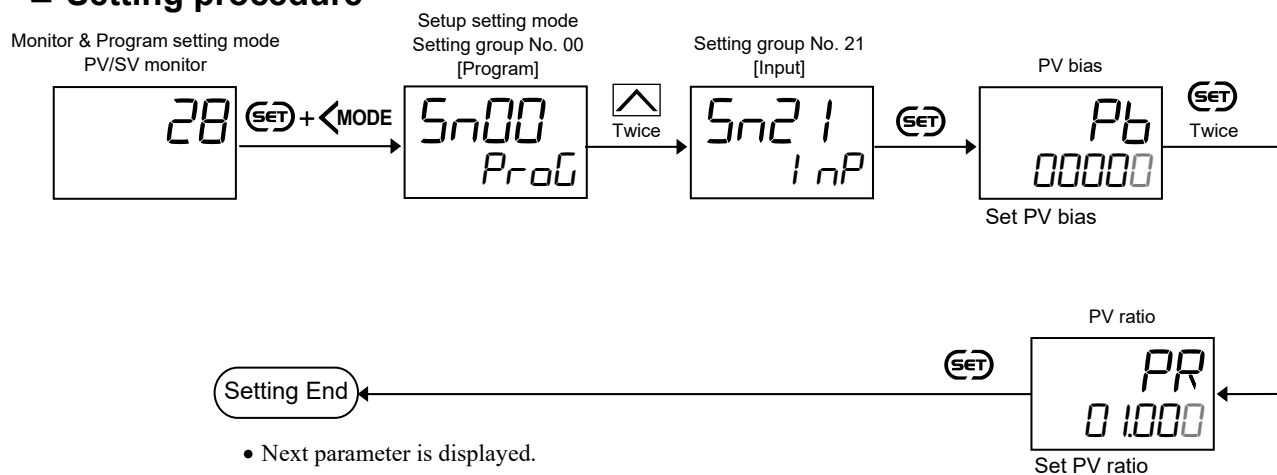
Parameter symbol	Data range	Factory set value
<i>Pb</i>	-Input span to + Input span Varies with the setting of the Decimal point position.	0

● PV ratio

[Setup Setting Mode: Setting group No. 21 (5n2 I)]

Parameter symbol	Data range	Factory set value
<i>PR</i>	0.500 to 1.500	1.000

■ Setting procedure



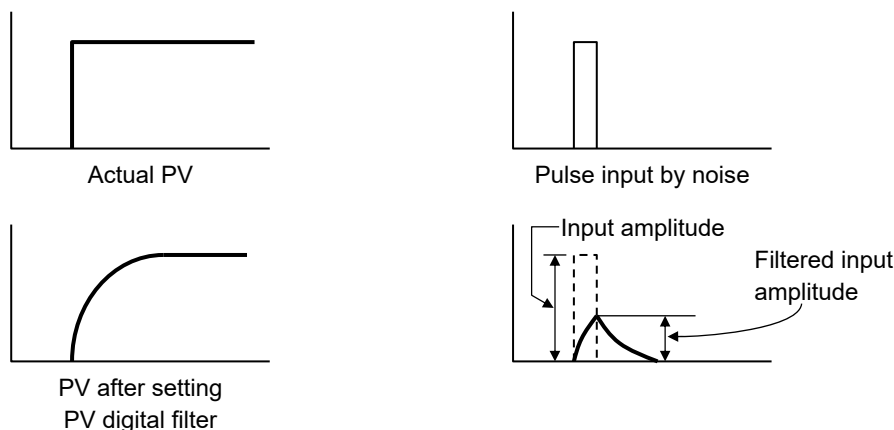
- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.

8.4 Preventing the Input Flicker

To prevent the input flicker, PV digital filter with the first-order lag calculation is provided.

■ Description of function

PV digital filter is software designed to reduce variance of PV caused by noise. Effect of Input noise can be reduced by setting time constant of PV digital filter based on the controlled object requirement and its level of noise. Setting a value too small leads to a poor result of PV digital filter; just as an input response will be poor when setting a value too large.



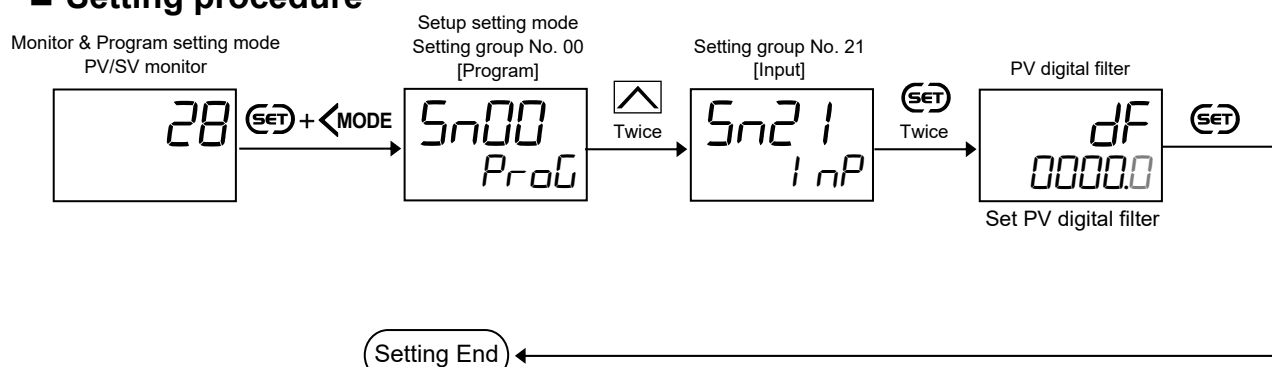
■ Parameter setting

● PV digital filter

[Setup Setting Mode: Setting group No. 21 (Sn2 I)]

Parameter symbol	Data range	Factory set value
<i>df</i>	0.0 to 100.0 seconds 0.0: Filter OFF	0.0

■ Setting procedure



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.



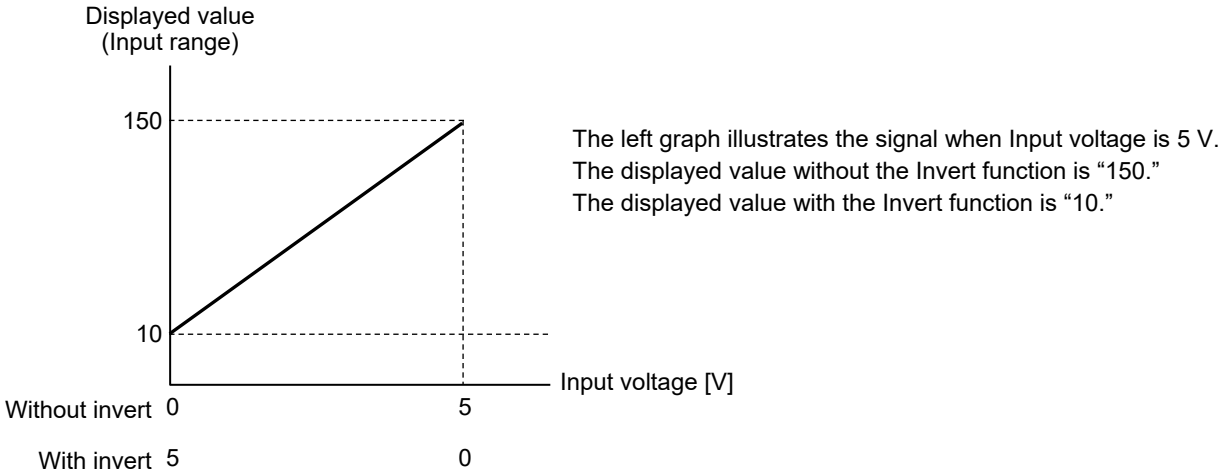
8.5 Inverting the Input

If the instrument is a current/voltage input type, the proportional relation between the input current (voltage) and the displayed value can be inverted.

■ Description of function

Reverse setting (Input range high < Input range low) of Input range high and low is not available on the instrument. However, with the Input invert function, the display relation to the input can be inverted.

Example: with/without invert function for voltage input 0 to 5 V



■ Parameter setting

● Inverting input

[Engineering mode: Function block No. 21 ($F_{n2} I$)]

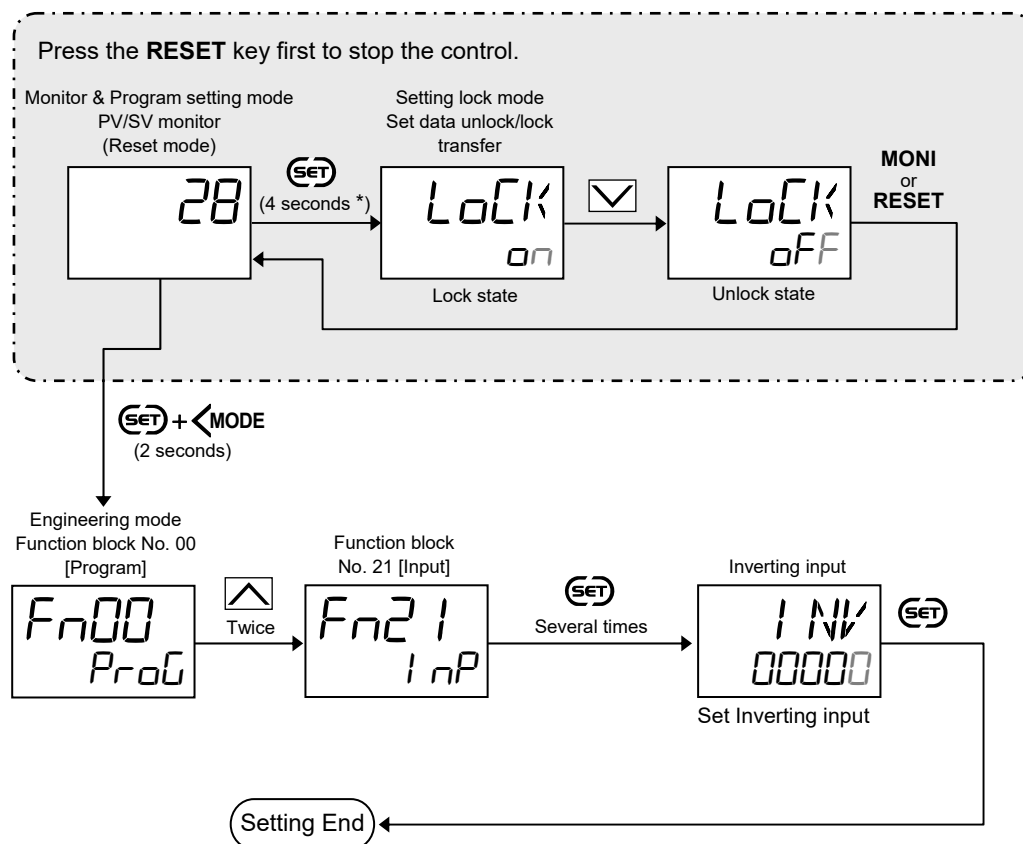
Parameter symbol	Data range	Factory set value
$I \quad NV$	0: Unused 1: Used	0



To show "Inverting input," current or voltage must be selected at Input type in Function block No. 21 in the Engineering mode.

Setting procedure

To enter the Engineering mode



* Press the **SET** key until Parameter setting mode is displayed. Keep pressing without releasing your finger from the key to enter the Setting lock mode.

- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



8.6 Extracting Square Root of Input

Square root extraction can control flow by sending the output signal directly from a differential pressure type flow transmitter to instrument. By setting PV low input cut-off, Square root extraction will not be performed for the Measured value below the set value of PV low input cut-off.

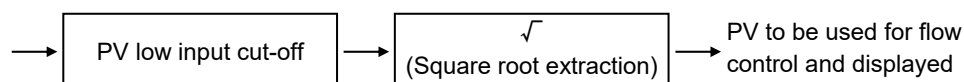
■ Description of function

● Square root extraction

When using a differential pressure type flow transmitter, the Measured value (PV) is computed by Square root extraction.

$$\text{Equation: Measured value (PV)} = \sqrt{\text{Input value}^*} \times \text{PV ratio} + \text{PV bias}$$

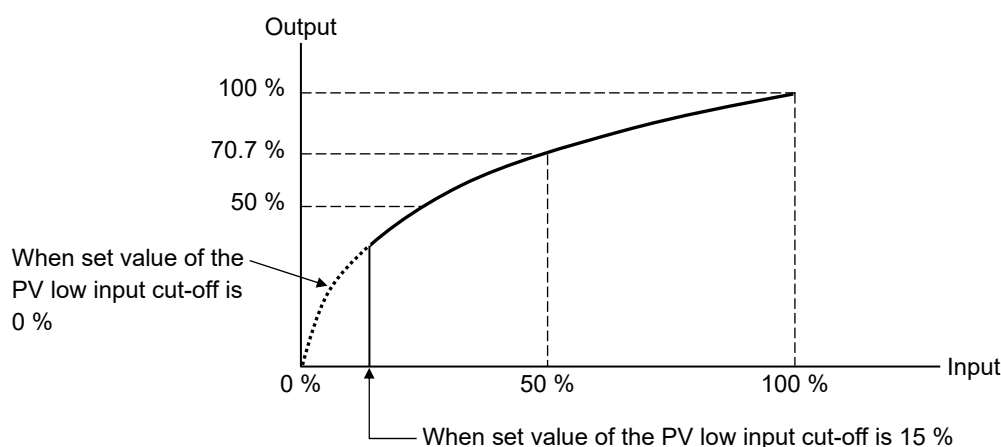
* Output from differential pressure type flow transmitter



● PV low input cut-off

The result of square root extraction become “0” when the Measured value (PV) drops below the set value of the PV low input cut-off. Output is not produced when the result of square root extraction is zero (0).

When input signal square root extraction is used for in flow control, etc., the Square root extraction result varies widely at the Low measured value range. The Measured value less than the PV low input cut-off is ignored to compute control output in order to prevent control disturbance caused by input variation at Low measured value range.



■ Parameter setting

● Square root extraction

[Engineering mode: Function block No. 21 (F_{n2} I)]

Parameter symbol	Data range	Factory set value
SQR	0: Unused 1: Used	0



To show “Square root extraction,” current or voltage must be selected at Input type in Function block No. 21 in the Engineering mode.



- **PV low input cut-off**

[Setup Setting Mode: Setting group No. 21 (5m² l)]

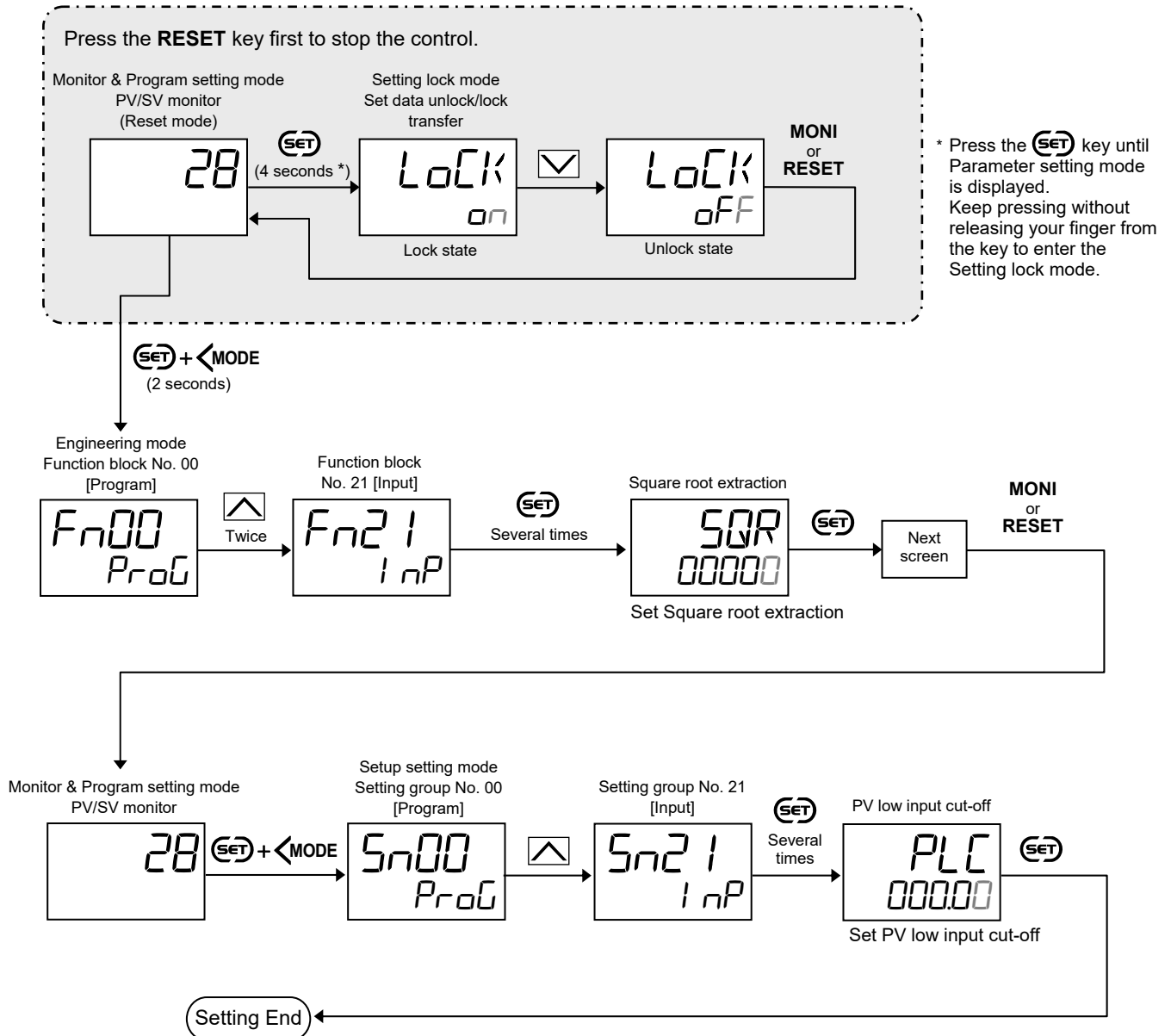
Parameter symbol	Data range	Factory set value
<i>PLC</i>	0.00 to 25.00 % of Input span	0.00



To display “PV low input cut-off,” input type is Voltage/Current input, AND “Square root extraction” in Function block No. 21 in the Engineering mode must be set to “Used.”

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

8.7 Changing Error Handling at Input Error

The measures for input errors can be selected from Input burnout direction, Input error determination point, Manipulated output value at Input error, PV flashing display at input error, and Input error status output.

■ Description of function

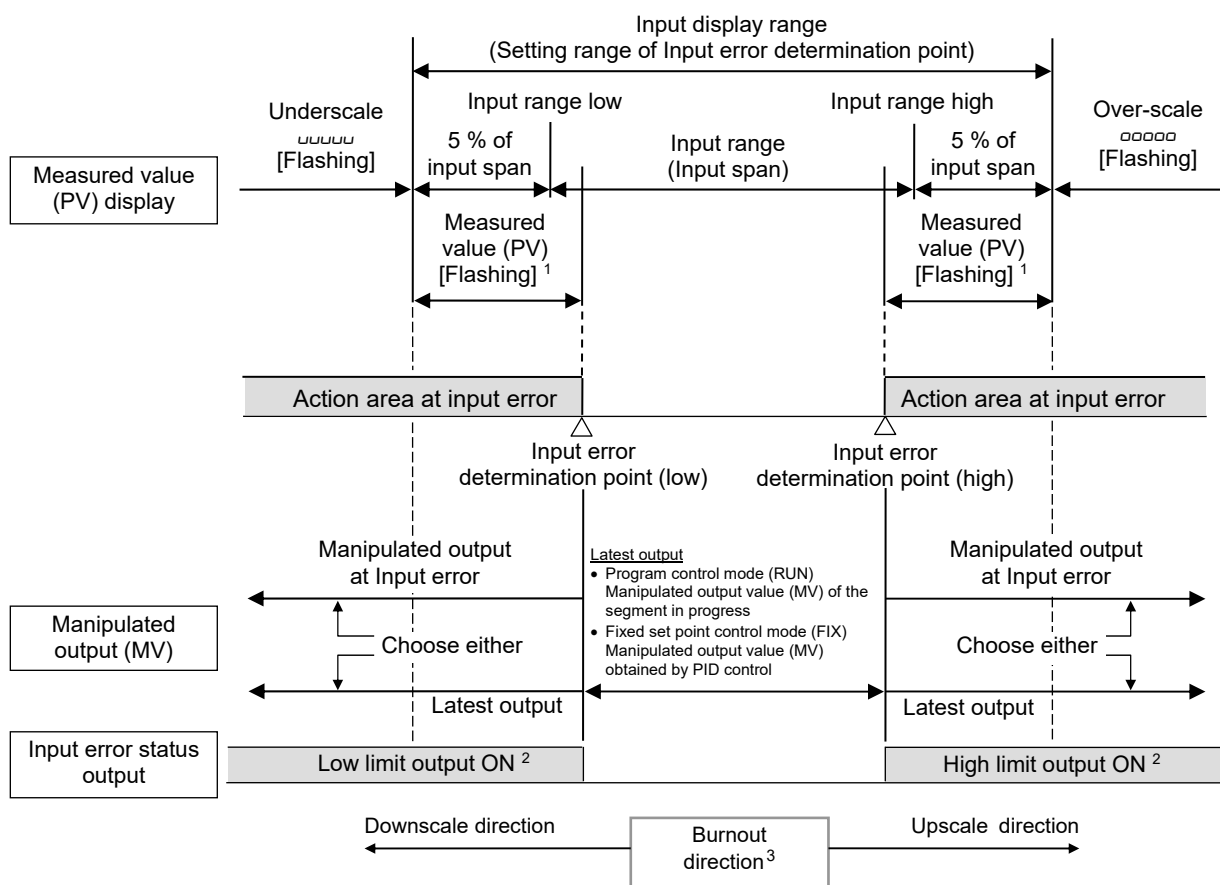
If the measured value (PV) exceeds the Input error determination point (high or low), the action predefined at “Action (high and low) input error” will be taken. Input error status signal can be output from OUT1 to OUT3 and DO1 to DO4.



NOTE

In Manual control mode (MAN) and Reset mode (RESET), action and output will not be taken for input errors.

● Input error determination point is set within the input range



¹ Flashing can be suppressed by setting “PV flashing display at input error” (Function block No. 10 in the Engineering mode).

² For Input error status output, refer to ● Details of OUT1 to 3 as well as DO1 to 4 logic calculation selection (P. 9-4).

³ Setting Burnout direction is valid for thermocouple input and low voltage input (0 to 10 mV DC, 0 to 100 mV DC). Actions of other input types are fixed as follows.

RTD input:

Upscale

High voltage/Current inputs:Downscale (Indicates value near 0)



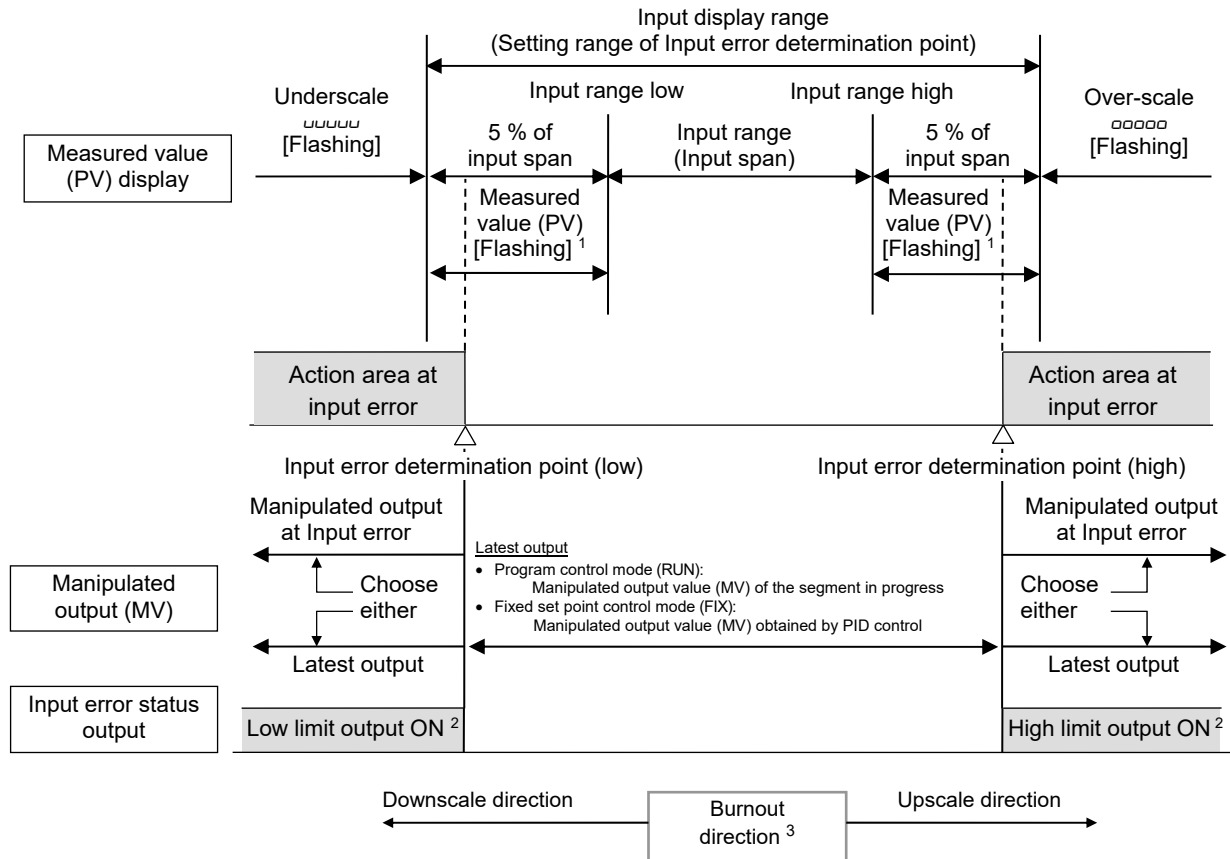
Refer to the **Input range table (P. 8-7)** for the input range of each input.



For details of Input error status output, refer to **9.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output, FAIL, Time Signal, Pattern End Signal] (P. 9-2).**



● **Input error determination point is set outside the input range**



¹ Flashing can be suppressed by setting "PV flashing display at input error" (Function block No. 10 in the Engineering mode).

² For Input error status output, refer to ● **Details of OUT1 to 3 as well as DO1 to 4 logic calculation selection (P. 9-4)**.

³ Setting Burnout direction is valid for thermocouple input and low voltage input (0 to 10 mV DC, 0 to 100 mV DC). Actions of other input types are fixed as follows.
 RTD input: Upscale
 High voltage/Current inputs: Downscale (Indicates value near 0)



Refer to the **Input range table (P. 8-7)** for the input range of each input.



For details of Input error status output, refer to **9.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output, FAIL, Time Signal, Pattern End Signal] (P. 9-2)**.

Parameter setting

PV flashing display at input error

[Engineering mode: Function block No. 10 (F_{n10})]

Parameter symbol	Data range	Factory set value
$d50P$	0: Flashing display 1: Non-flashing display	0

Input error determination point (high)

[Engineering mode: Function block No. 21 (F_{n21})]

Parameter symbol	Data range	Factory set value
P_{oh}	Input error determination point (low) to Input range high + (5 % of input span) Varies with the setting of the Decimal point position.	Input range high + (5 % of input span)

Input error determination point (low)

[Engineering mode: Function block No. 21 (F_{n21})]

Parameter symbol	Data range	Factory set value
P_{un}	Input range low – (5 % of input span) * to Input error determination point (high) Varies with the setting of the Decimal point position. * When Input type is RTD, low limit value is about 2 Ohms. (Pt100: –245.5 °C [–409.8 °F], JPt100: –237.6 °C [–395.7 °F])	Input range low – (5 % of input span)

Burnout direction

[Engineering mode: Function block No. 21 (F_{n21})]

Parameter symbol	Data range	Factory set value
b_{os}	0: Upscale 1: Downscale	0



To show “Burnout direction,” thermocouple or voltage (low) [0 to 100 mV DC, 0 to 10 mV DC] must be selected at Input type in Function block No. 21 in the Engineering mode.

Action (high) input error

[Engineering mode: Function block No. 51 (F_{n51})]

Parameter symbol	Data range	Factory set value
A_{ohE}	0: Control continues (with the latest output) 1: Manipulated output value at input error [Manual control mode (MAN)] The operation mode is switched to the Manual control mode (MAN) and the Manipulated output value at input error is output. 2: Manipulated output value at input error [Program control mode (RUN) or Fixed set point control mode (FIX)] The operation mode remains in the Program control mode (RUN) or Fixed set point control mode (FIX) and the Manipulated output value at input error of is output. When the error is recovered, the operation mode is switched to the PID control.	2

**● Action (low) input error****[Engineering mode: Function block No. 51 (Fn5 I)]**

Parameter symbol	Data range	Factory set value
RUNE	0: Control continues (with the latest output) 1: Manipulated output value at input error [Manual control mode (MAN)] The operation mode is switched to the Manual control mode (MAN) and the Manipulated output value at input error is output. 2: Manipulated output value at input error [Program control mode (RUN) or Fixed set point control mode (FIX)] The operation mode remains in the Program control mode (RUN) or Fixed set point control mode (FIX) and the Manipulated output value at input error is output. When the error is recovered, the operation mode is switched to the PID control.	2

● Manipulated output value at input error**[Engineering mode: Function block No. 51 (Fn5 I)]**

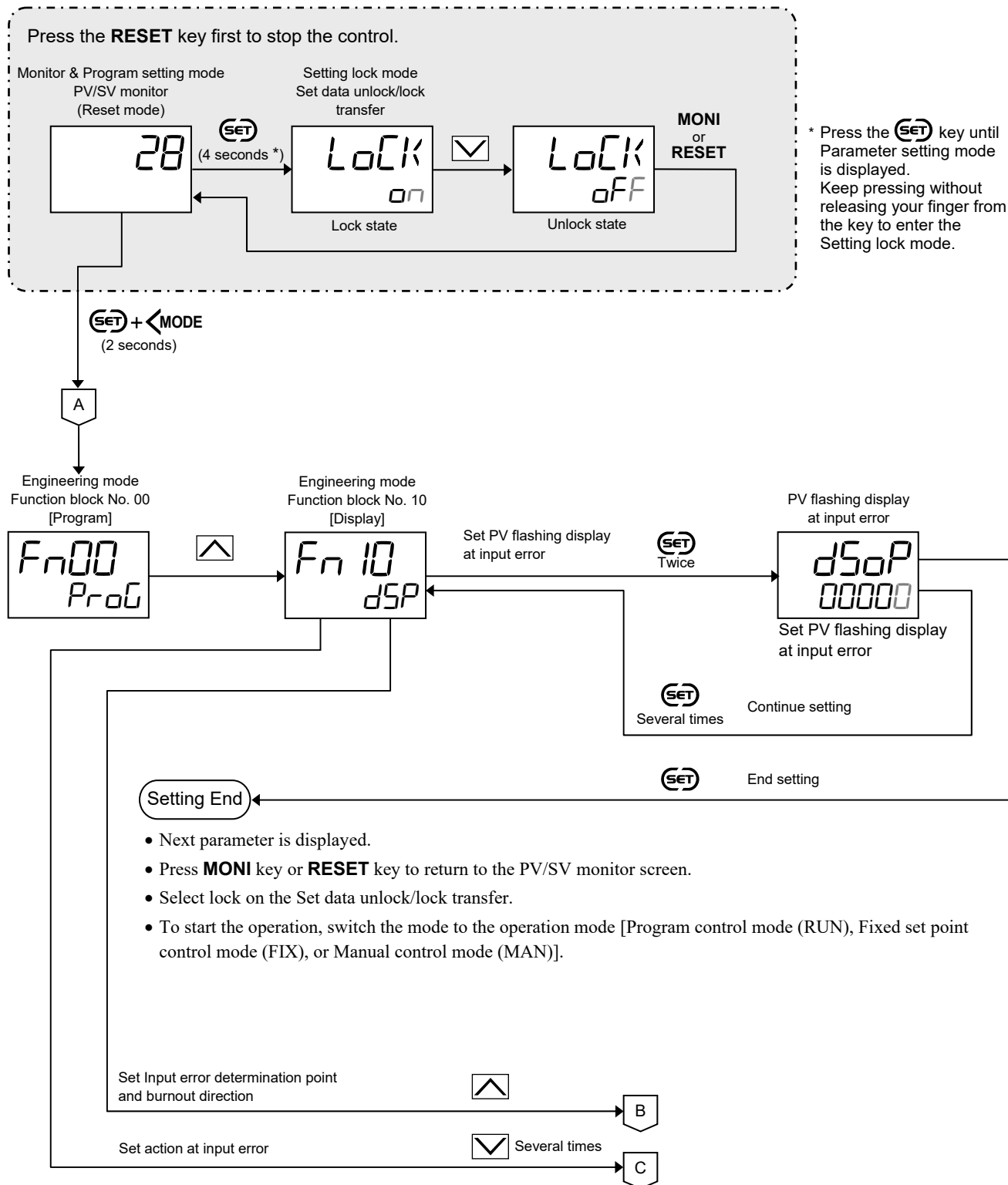
Parameter symbol	Data range	Factory set value
PSM	PID control, Position proportioning PID control: -5.0 to +105.0 % Heat/Cool PID control: -105.0 to +105.0 %	-5.0 0.0



For Heat/Cool PID control, output is produced from the heat side if the setting is positive (+) and output is produced from the cool side if the setting is negative (-).

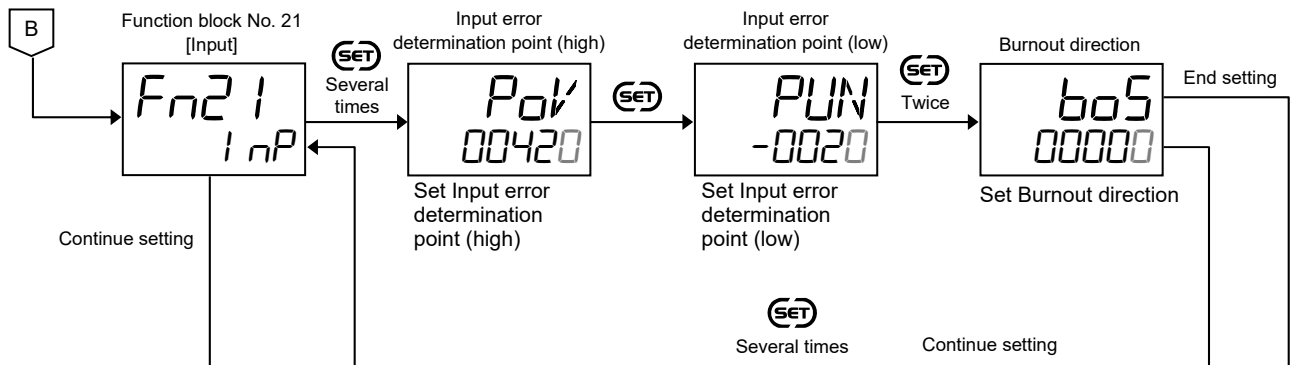
Setting procedure

To enter the Engineering mode



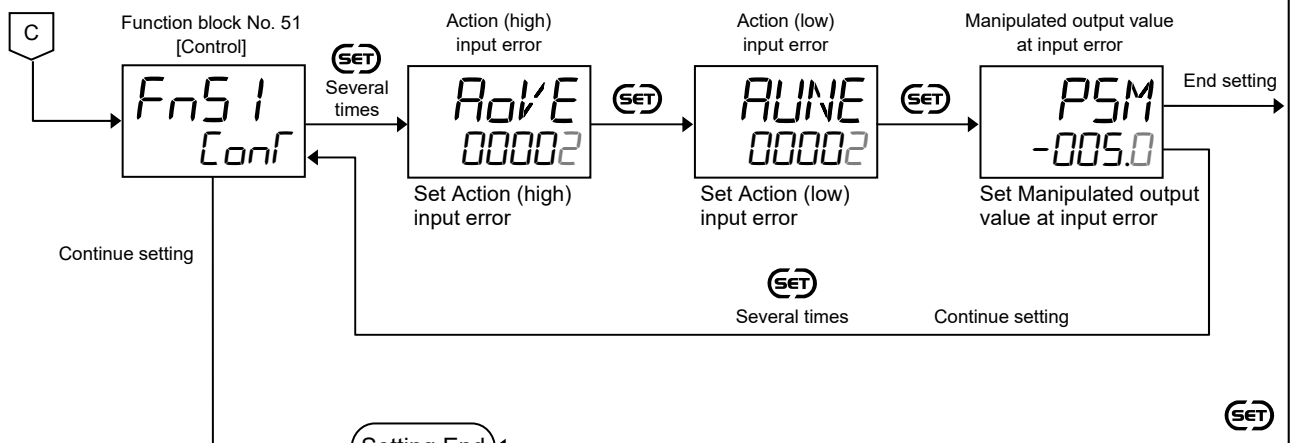


8. INPUT FUNCTION



Press or keys according to the setting item.

Proceed to or , whichever is appropriate.



Setting End

- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

Press or keys according to the setting item.

Proceed to or , whichever is appropriate.



9

OUTPUT FUNCTION

This chapter describes output related functions, setting contents and setting procedure based on the key words related to outputs.

9.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output, FAIL, Time Signal, Pattern End Signal]	9-2
9.2 Changing Output Type of OUT3	9-14
9.3 Using Retransmission Output	9-16
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9.6 Limiting Output.....	9-26
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9.8 Suppressing Sudden Change in Output (Balanceless Bumpless)	9-33
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9.10 Monitoring Manipulated Output Value	9-39



9.1 Changing Output Assignment

[Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output, FAIL, Time Signal, Pattern End Signal]

PZ400/900/401/901 has such hardware outputs as shown below.

- OUT1 to 3 (max. 3)
- DO1 to 4 (max. 4)

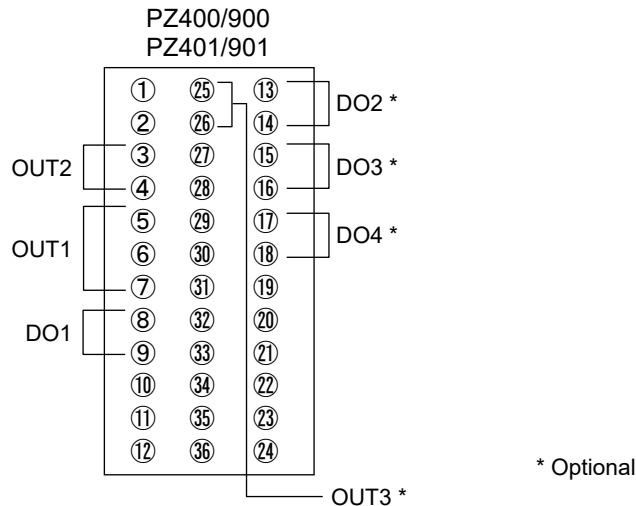
The following output signals are assigned to each output terminal.

- Control output (Settable form OUT1 to OUT3 only.)
- Retransmission output (Settable form OUT1 to OUT3 only.)
- Logic calculation output
[Event, Heater break alarm (HBA), Control loop break alarm (LBA), Input error status]
- Instrument status output
[Program control mode (RUN), Manual control mode (MAN), Autotuning (AT), Communication monitoring result]
- FAIL
- Time signal, Pattern end signal (Settable only between DO1 and DO4)

■ Description of function

Output signals [Control output, Retransmission output, Logic calculation output, Instrument status output, FAIL, Time signal or Pattern end signal] are assigned to the output terminals (OUT1 to 3, DO1 to 4).

- Position of output terminals



- Details of functions assigned to OUT1 to 3

Set value	Assigned functions
0	No assignment
1	Control output [heat-side] or [open-side]
2	Control output [cool-side] or [close-side]
3	Retransmission output
4	Logic calculation output [Event, HBA, LBA, Input error status]
5	Output of Program control mode (RUN) state
6	Output of Manual control mode (MAN) state
7	Autotuning (AT) state output
8	Output of the communication monitoring result
9	FAIL output (Permanently configured to be de-energized)

Continued on the next page.

[Explanation of the setting]

- Control output [heat-side] or [open-side]:
If Heat/Cool PID control is selected, this output is used as heating output. If Position proportioning PID control is selected, this output is used as an opening output.
- Control output [cool-side] or [close-side]:
This output is available if Heat/Cool PID control is selected.
If Heat/Cool PID control is selected, this output is used as a cooling output. If Position proportioning PID control is selected, this output is used as a closing output.
- Retransmission output:
Retransmission output type needs to be specified later. Retransmission output scaling is also available.
 For more details of Retransmission output, refer to **9.3 Using Retransmission Output (P. 9-16)**.
- Logic calculation output [Event, HBA, LBA, Input error status]:
Logic calculation needs to be specified separately. Multiple outputs can be output from a single output terminal as logical *OR* relation.
 Refer to the next page (**P. 9-4**) for Logic calculation selection.
- Output of Program control mode (RUN) state:
Output turns on while the instrument is in Program control mode (RUN).
- Output of Manual control mode (MAN) state:
Output turns on while the instrument is in Manual control mode (MAN).
- Autotuning (AT) state output:
Output turns on while the instrument is in the Autotuning (AT).
- Output of the communication monitoring result:
Valid only when the communication function is supplied. Output turns on if improper communication continues for 10 seconds.
- FAIL output:
Output turns on when the instrument is in FAIL state.
When FAIL is selected, the output terminal is fixed to de-energizing, and the previous setting of energizing and de-energizing gets invalid.

• Details of functions assigned to DO1 to 4

Set value	Assigned functions
0	No assignment
1	Logic calculation output [Event, HBA, LBA, Input error status]
2	Output of Program control mode (RUN) state
3	Output of Manual control mode (MAN) state
4	Autotuning (AT) state output
5	Output of the communication monitoring result
6	FAIL output (Permanently configured to be de-energized)
7	Time signal
8	Pattern end signal

[Explanation of the setting]

- Time signal:
When Time signal turns ON in the program control, the output will turn on. In addition to this, you need to set the Time signal selection and the DO time signal selection.
 For Time signal, refer to **11.9 Outputting a Signal According to the Progress of a Program (Time Signal) (P. 11-37)**.
- Pattern end signal:
At the end of the pattern during the program control, the output will turn on when the Pattern end signal gets on.

Except for the above, refer to [Explanation of the setting] (**P. 9-3**) for OUT1 to 3

● Details of OUT1 to 3 as well as DO1 to 4 logic calculation selection

Multiple functions can be selected in the logic operation. The selected functions are *OR*-output. To select multiple functions, add the numbers of the desired functions.

Set value	Assigned functions
0	No assignment
1	Event 1
2	Event 2
4	Event 3
8	Event 4
16	Heater break alarm 1 (HBA1)
32	Heater break alarm 2 (HBA2)
64	Control loop break alarm (LBA)
128	Input error high
256	Input error low

Example

To select Event 1 output, Heater break alarm 1 (HBA1) output and Input error output high, set as follows.

- Event 1 = 1
- Heater break alarm 1 (HBA1) = 16
- Input error high = 128

$$1 + 16 + 128 = 145$$

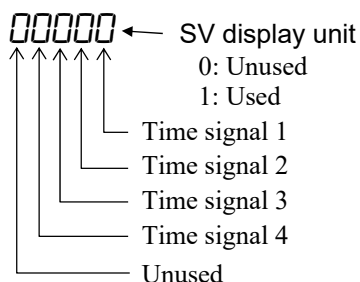
So, set 145

[Explanation of the setting]

- Event: Output turns on when the instrument is in the event state.
You also need to set Event type, Event hold action, Event differential gap, Event timer, and Event set value.
 For details of Event, refer to **10.1 Using Event Function (P. 10-2)**.
- Heater break alarm (HBA): Output turns on when the instrument is in Heater break alarm (HBA) state.
You also need to set CT assignment, HBA set value, and HBA delay time.
 For details of Heater break alarm (HBA), refer to **10.2 Using Heater Break Alarm (HBA) (P. 10-22)**.
- Control loop break alarm (LBA): Output turns on when the instrument is in Control loop break alarm (LBA) state.
You also need to set LBA time and LBA deadband.
 For details of Control loop break alarm (LBA), refer to **10.3 Using Control loop break alarm (LBA) (P. 10-34)**.
- Input error high: Output turns on when the Measured value (PV) exceeds the Input error determination point (high).
- Input errorlow: Output turns on when the Measured value (PV) exceeds the Input error determination point (low).

● Details of time signal function to DO1 to 4

Multiple time signals can be selected at each DO. The selected multiple time signals will be *OR*-output.



Setting example

To provide Event 1 to Event 4 from DO1 as a logic *OR* output.

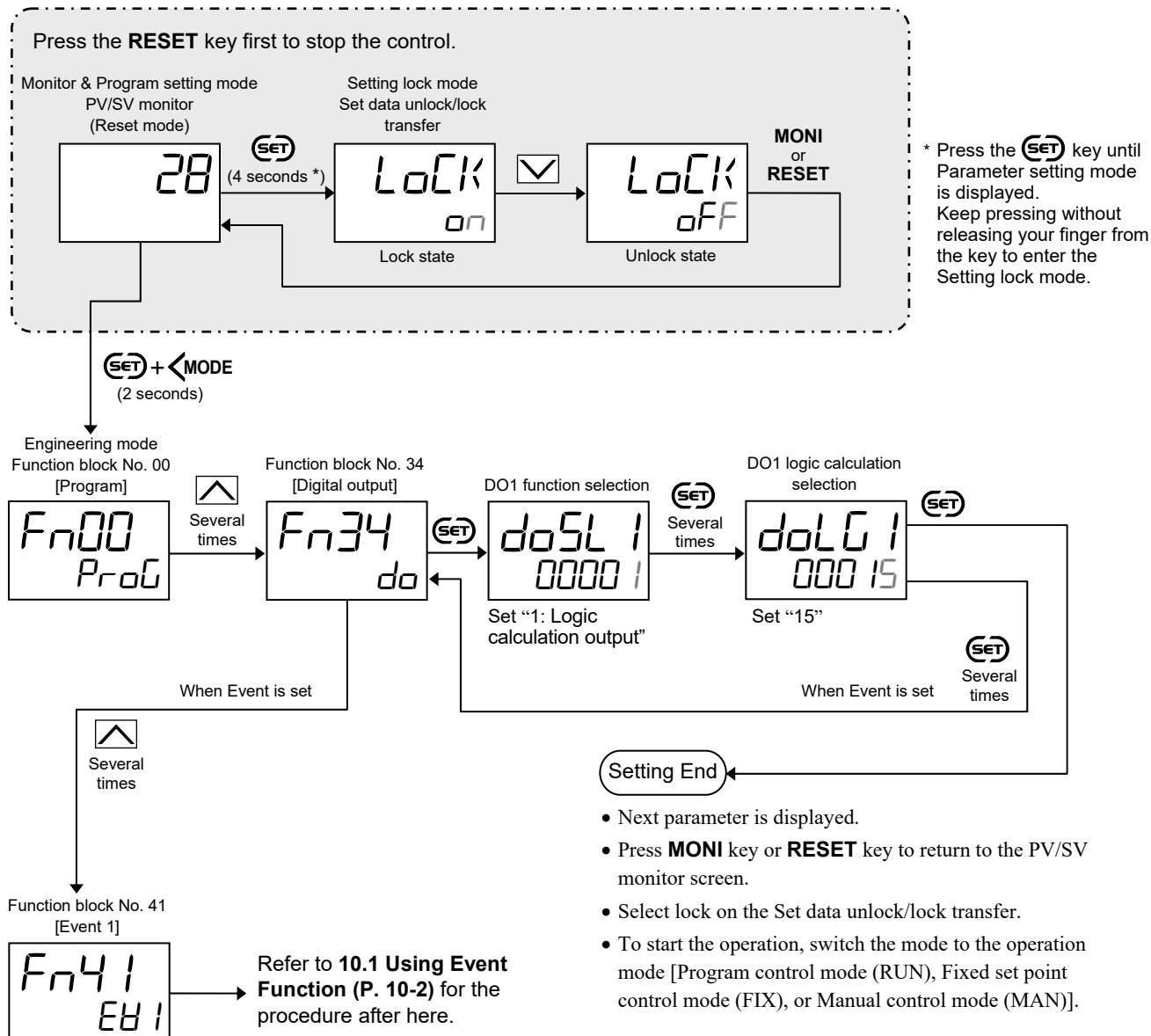
1. Select “1: Logic calculation output” in DO1 assignment.

2. Set “15” for DO1_logic calculation selection.

Enter “1” to output Event 1, “2” for Event 2, “4” for Event 3, and “8” for Event 4. Add the sum of these numbers (15), then the outputs of Event 1 to 4 are produced as a logical *OR*.

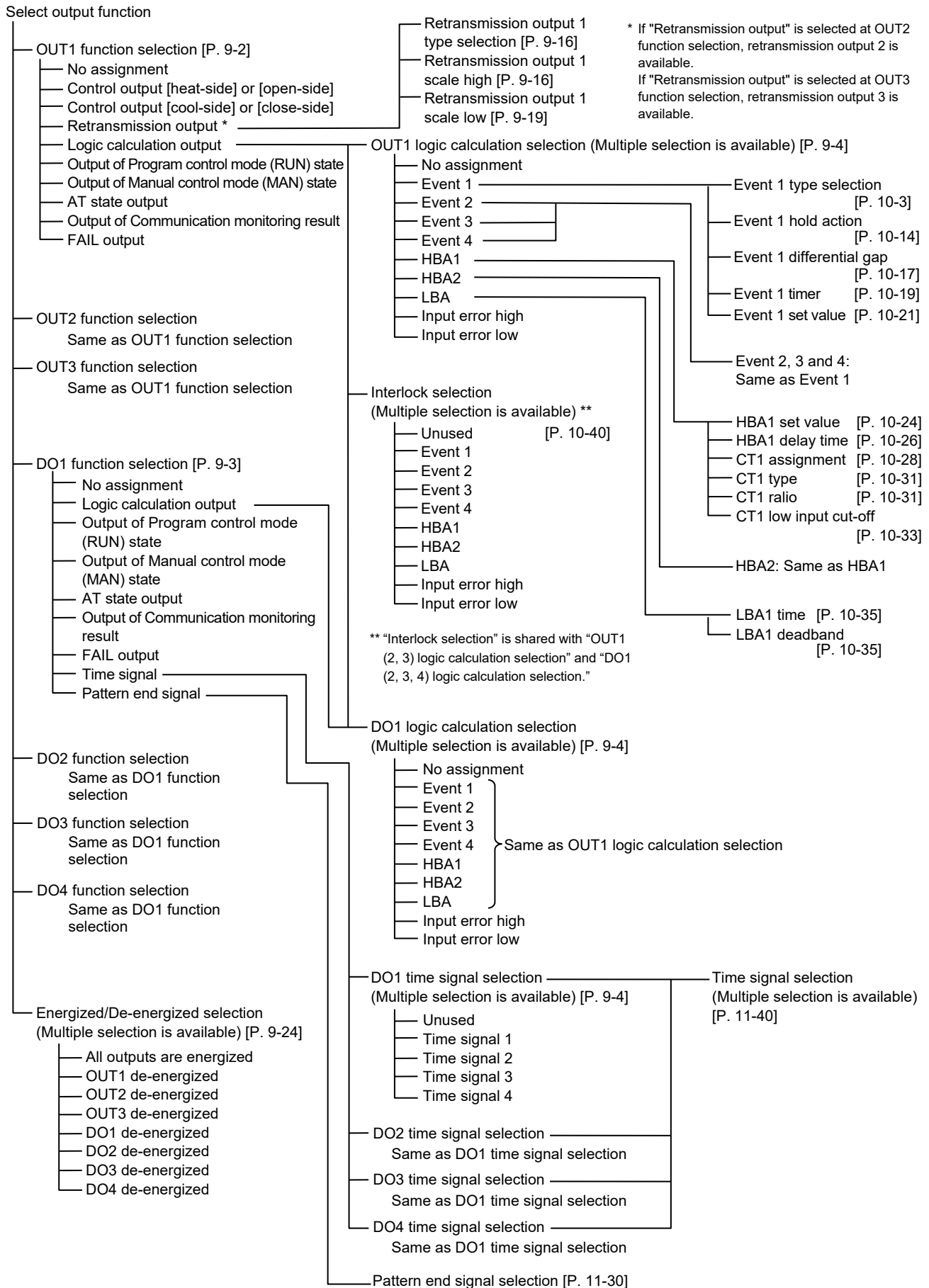
[Setup procedures]

To enter the Engineering mode





● Output function map



■ Parameter setting

● OUT1 function selection

[Engineering Mode: Function block No. 30 (Fn30)]

Parameter symbol	Data range	Factory set value
o5L1	0: No assignment 1: Control output [heat-side] or [open-side] 2: Control output [cool-side] or [close-side] 3: Retransmission output 4: Logic calculation output (Event, HBA, LBA, Input error) 5: Output of Program control mode (RUN) state 6: Output of Manual control mode (MAN) state 7: Autotuning (AT) state output 8: Output of the communication monitoring result 9: FAIL output (Permanently configured to be de-energized)	Based on Model code



To display “OUT1 function selection,” you need to specify the output type other than “None” at Output 1 (OUT1) at the time of order.



Refer to “**15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)**” for the parameters that are initialized when the OUT1 function selection is changed.

● OUT2 function selection

[Engineering Mode: Function block No. 30 (Fn30)]

Parameter symbol	Data range	Factory set value
o5L2	Same as OUT1 function selection	Based on Model code



To display “OUT2 function selection,” you need to specify the output type other than “None” at Output 2 (OUT2) at the time of order.



Refer to “**15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)**” for the parameters that are initialized when the OUT2 function selection is changed.

● OUT3 function selection

[Engineering Mode: Function block No. 30 (Fn30)]

Parameter symbol	Data range	Factory set value
o5L3	Same as OUT1 function selection	3



To display “OUT3 function selection,” you need to specify the output type OUT3 at the time of order.



Refer to “**15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)**” for the parameters that are initialized when the OUT3 function selection is changed.

**● DO1 function selection****[Engineering Mode: Function block No. 34 (Fn34)]**

Parameter symbol	Data range	Factory set value
doSL1	0: No assignment 1: Logic calculation output (Event, HBA, LBA, Input error) 2: Output of Program control mode (RUN) state 3: Output of Manual control mode (MAN) state 4: Autotuning (AT) state output 5: Output of the communication monitoring result 6: FAIL output (Permanently configured to be de-energized) 7: Time signal 8: Pattern end signal	Based on Model code

● DO2 function selection**[Engineering Mode: Function block No. 34 (Fn34)]**

Parameter symbol	Data range	Factory set value
doSL2	Same as DO1 function selection	Based on Model code



To display “DO2 function selection,” you have to specify 4 digital outputs (DO) at the time of order.

● DO3 function selection**[Engineering Mode: Function block No. 34 (Fn34)]**

Parameter symbol	Data range	Factory set value
doSL3	Same as DO1 function selection	Based on Model code



To display “DO3 function selection,” you have to specify 4 digital outputs (DO) at the time of order.

● DO4 function selection**[Engineering Mode: Function block No. 34 (Fn34)]**

Parameter symbol	Data range	Factory set value
doSL4	Same as DO1 function selection	Based on Model code



To display “DO4 function selection,” you have to specify 4 digital outputs (DO) at the time of order.

● OUT1 logic calculation selection

[Engineering Mode: Function block No. 30 (Fn30)]

Parameter symbol	Data range	Factory set value
oL01	0 to 511 0: OFF +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Heater break alarm 1 (HBA1) +32: Heater break alarm 2 (HBA2) +64: Control loop break alarm (LBA) +128: Input error high +256: Input error low To select two or more functions, sum each value.	0



To display “OUT1 logic calculation selection,” you need to specify the output type other than “None” at Output 1 (OUT1) at the time of order.

● OUT2 logic calculation selection

[Engineering Mode: Function block No. 30 (Fn30)]

Parameter symbol	Data range	Factory set value
oL02	Same as OUT1 logic calculation selection	0



To display “OUT2 logic calculation selection,” you need to specify the output type other than “None” at Output 2 (OUT2) at the time of order.

● OUT3 logic calculation selection

[Engineering Mode: Function block No. 30 (Fn30)]

Parameter symbol	Data range	Factory set value
oL03	Same as OUT1 logic calculation selection	0



To display “OUT3 logic calculation selection,” you need to specify the output type OUT3 at the time of order.

● DO1 logic calculation selection

[Engineering Mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
doL01	Same as OUT1 logic calculation selection	Based on Model code



● DO2 logic calculation selection

[Engineering Mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
doL02	Same as OUT1 logic calculation selection (P. 9-9)	Based on Model code



To display “DO2 logic calculation selection,” you have to specify 4 digital outputs (DO) at the time of order.

● DO3 logic calculation selection

[Engineering Mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
doL03	Same as OUT1 logic calculation selection (P. 9-9)	Based on Model code



To display “DO3 logic calculation selection,” you have to specify 4 digital outputs (DO) at the time of order.

● DO4 logic calculation selection

[Engineering Mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
doL04	Same as OUT1 logic calculation selection (P. 9-9)	Based on Model code



To display “DO4 logic calculation selection,” you have to specify 4 digital outputs (DO) at the time of order.

● DO1 time signal selection

[Engineering Mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
doT51	Set Used/Unused at each digit. SV display 0: Unused 1: Used Time signal 1 Time signal 2 Time signal 3 Time signal 4 Unused	Based on Model code



To display “DO1 time signal selection,” time signal must be selected at DO1 function selection in Function block No. 34 in the Engineering mode.

● DO2 time signal selection

[Engineering Mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
doF52	Same as DO1 time signal selection (P. 9-10)	Based on Model code



To display “DO2 time signal selection,” time signal must be selected at DO2 function selection in Function block No. 34 in the Engineering mode.

● DO3 time signal selection

[Engineering Mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
doF53	Same as DO1 time signal selection (P. 9-10)	Based on Model code



To display “DO3 time signal selection,” time signal must be selected at DO3 function selection in Function block No. 34 in the Engineering mode.

● DO4 time signal selection

[Engineering Mode: Function block No. 34 (Fn34)]

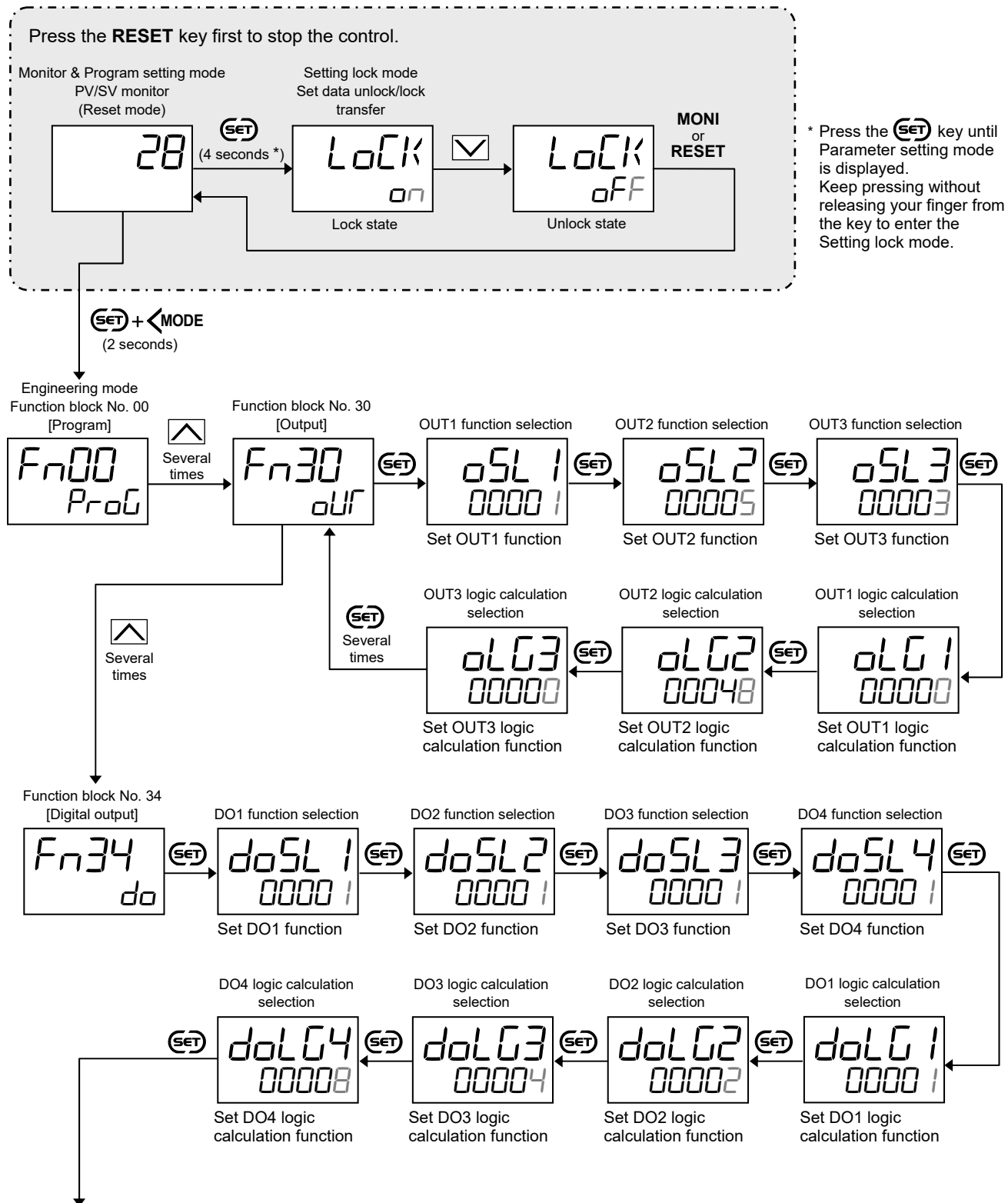
Parameter symbol	Data range	Factory set value
doF54	Same as DO1 time signal selection (P. 9-10)	Based on Model code



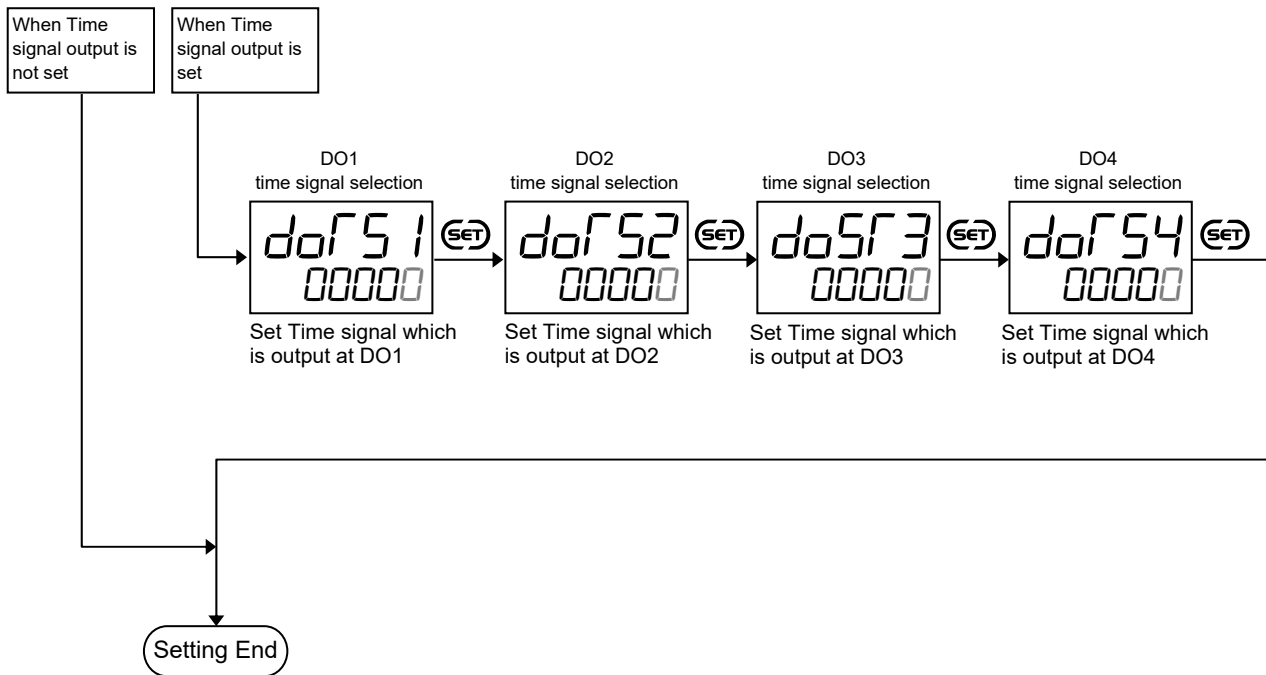
To display “DO4 time signal selection,” time signal must be selected at DO4 function selection in Function block No. 34 in the Engineering mode.

Setting procedure

To enter the Engineering mode



Continued from the previous page.



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



For detailed settings of the Time signal, refer to **11.9 Outputting a Signal According to the Progress of a Program (Time Signal) (P. 11-37)**.



9.2 Changing Output Type of OUT3

OUT3 (optional) is available as a universal output. Output type can be changed even after the purchase.

■ Description of function

Output 3 (optional) may be selected from the following three types. The output can be modified without changing the hardware.

- Voltage pulse output (0/14 V DC)
- Current output (4 to 20 mA DC)
- Current output (0 to 20 mA DC)



OUT3 is not produced under the following conditions:

When the instrument with the Universal output type selection is set to “0: Voltage pulse output” and the OUT3 function selection of is set to “3: Retransmission output.”

■ Parameter setting

● Universal output type selection (OUT3)

[Engineering Mode: Function block No. 30 (Fn30)]

Parameter symbol	Data range	Factory set value
	0: Voltage pulse output 1: Current output (4 to 20 mA DC) 2: Current output (0 to 20 mA DC)	1



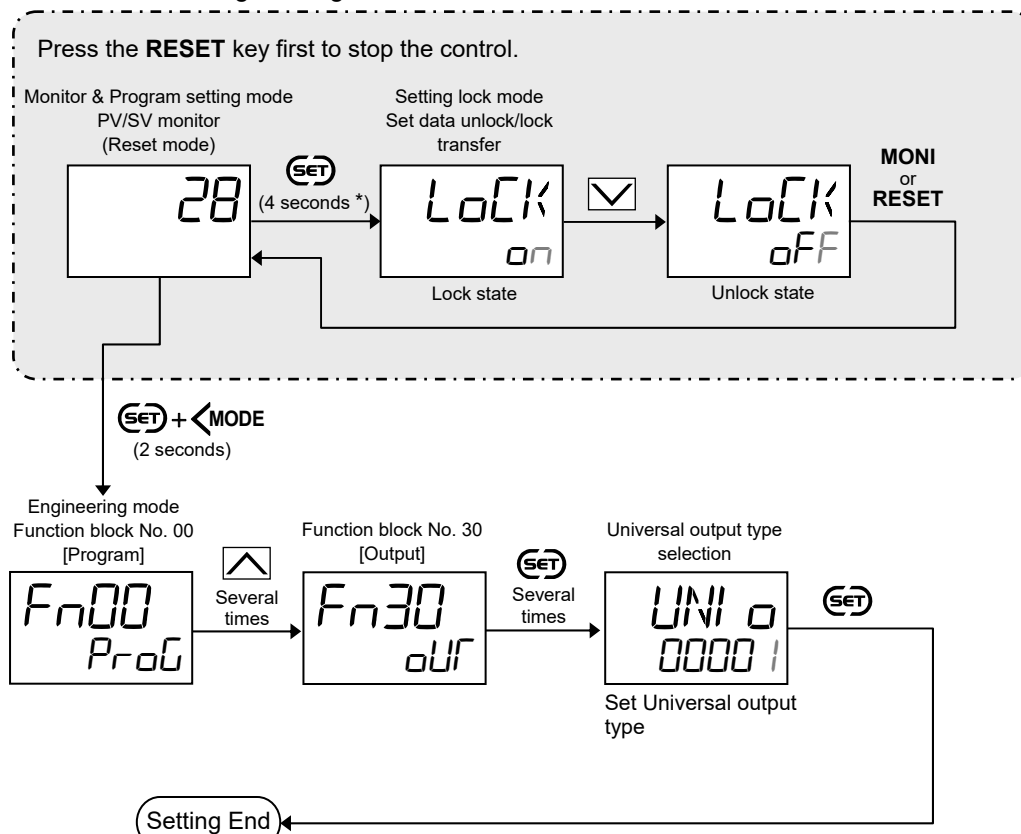
To display “Universal output type selection (OUT3),” you need to specify the output type OUT3 at the time of order.



Refer to “**15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)**” for the parameters that are initialized when the Universal output type selection (OUT3) is changed.

Setting procedure

To enter the Engineering mode



* Press the **SET** key until Parameter setting mode is displayed. Keep pressing without releasing your finger from the key to enter the Setting lock mode.

- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



9.3 Using Retransmission Output

Retransmission output can be provided from OUT1 to 3. To use the Retransmission output, the output type must be current or continuous voltage output.

■ Description of function

To use the Retransmission output, select Retransmission output at OUT1 to 3 function selection.

If Retransmission output is selected at the OUT1 function selection, the output is provided as Retransmission output 1.

If Retransmission output is selected at the OUT2 function selection, the output is provided as Retransmission output 2.

If Retransmission output is selected at the OUT3 function selection, the output is provided as Retransmission output 3.



For details OUT1 to 3 function selection, refer to **9.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output, FAIL, Time Signal, Pattern End Signal] (P. 9-2)**.

● Details of Retransmission output type

Set value	Assigned functions
0	No retransmission output
1	Measured value (PV) Measured value (PV) is output.
2	Segment level or Set value (SV) The Segment level of the Program control mode (RUN) or the Set value (SV) in Fixed set point control mode is output. In the ramp segment, the set segment level will be output. (Output value does not change according to the program.)
3	SV monitor value The Segment level of the Program control mode (RUN) or the monitoring value of the "Set value (SV) in Fixed set point control mode" is output. In the ramp segment, the monitoring value of the segment level changes according to the program.
4	Deviation [Measured value (PV) – SV monitor value] is output.
5	Manipulated output value [heat-side] Manipulated output value [heat-side] is output.
6	Manipulated output value [cool-side] Manipulated output value [cool-side] is output.
7	Current transformer 1 (CT1) input value * Current transformer 1 (CT1) input value is output.
8	Current transformer 2 (CT2) input value * Current transformer 2 (CT2) input value is output.

* Valid if Current transformer (CT) input is supplied.



The output will be 0 % when the Retransmission output type not provided on the instrument is set.

● Scaling the Retransmission output

Set high and low limits for the Retransmission output. The scale range depends on the type of the selected Retransmission output.

No retransmission output, Measured value (PV), Segment level or Set value (SV) and SV monitor value:

Input range low to Input range high

[Varies with the setting of the Decimal point position.]

Deviation:

–Input span to +Input span

[Varies with the setting of the Decimal point position.]

Manipulated output value:

–5.0 to +105.0 %

Current transformer (CT) input value:

0.0 to 100.0 %

■ Parameter setting

● Retransmission output 1 type

[Engineering Mode: Function block No. 31 (Fn3 I)]

Parameter symbol	Data range	Factory set value
Ro1	0: No retransmission output 1: Measured value (PV) 2: Segment level or Set value (SV) in Fixed set point control mode 3: SV monitor value 4: Deviation 5: Manipulated output value [heat-side] 6: Manipulated output value [cool-side] 7: Current transformer 1 (CT1) input value 8: Current transformer 2 (CT2) input value	0



To display “Retransmission output 1 type,” Output type on OUT1 must be specified as Current output or Continuous voltage output at the time of order.



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized when the Retransmission output 1 type is changed.

● Retransmission output 1 scale high

[Engineering Mode: Function block No. 31 (Fn3 I)]

Parameter symbol	Data range	Factory set value
RHS1	No retransmission output, Measured value (PV), Segment level, Set value (SV) in Fixed set point control mode, and SV monitor value: Input range low to Input range high [Varies with the setting of the Decimal point position.] Deviation: –Input span to +Input span [Varies with the setting of the Decimal point position.] Manipulated output value: –5.0 to +105.0 % Current transformer (CT) input value: 0.0 to 100.0 %	No retransmission output, Measured value (PV), Segment level, Set value (SV) in Fixed set point control mode, and SV monitor value: Input range high Deviation: +Input span Manipulated output value, and Current transformer (CT) input value: 100.0



To display “Retransmission output 1 scale high,” Output type on OUT1 must be specified as Current output or Continuous voltage output at the time of order.

● Retransmission output 1 scale low

[Engineering Mode: Function block No. 31 (Fn3 I)]

Parameter symbol	Data range	Factory set value
ALS1	Same as Retransmission output 1 scale high	No retransmission output, Measured value (PV), Segment level, Set value (SV) in Fixed set point control mode, and SV monitor value: Input range low Deviation: –Input span Manipulated output value, and Current transformer (CT) input value: 0.0



To display “Retransmission output 1 scale low,” Output type on OUT1 must be specified as Current output or Continuous voltage output at the time of order.

**● Retransmission output 2 type****[Engineering Mode: Function block No. 32 (Fn32)]**

Parameter symbol	Data range	Factory set value
Ro2	Same as Retransmission output 1 (P. 9-17)	Based on Model code



To display “Retransmission output 2 type,” Output type on OUT2 must be specified as Current output or Continuous voltage output at the time of order.



Refer to “**15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)**” for the parameters that are initialized when the Retransmission output 2 type is changed.

● Retransmission output 2 scale high**[Engineering Mode: Function block No. 32 (Fn32)]**

Parameter symbol	Data range	Factory set value
RH52	Same as Retransmission output 1 scale high (P. 9-17)	Same as Retransmission output 1 scale high



To display “Retransmission output 2 scale high,” Output type on OUT2 must be specified as Current output or Continuous voltage output at the time of order.

● Retransmission output 2 scale low**[Engineering Mode: Function block No. 32 (Fn32)]**

Parameter symbol	Data range	Factory set value
RL52	Same as Retransmission output 1 scale low (P. 9-17)	Same as Retransmission output 1 scale low



To display “Retransmission output 2 scale low,” Output type on OUT2 must be specified as Current output or Continuous voltage output at the time of order.

● Retransmission output 3 type**[Engineering Mode: Function block No. 33 (Fn33)]**

Parameter symbol	Data range	Factory set value
Ro3	Same as Retransmission output 1 (P. 9-17)	1



To display “Retransmission output 3 type,” OUT3 must be specified at the time of order, and Current output must be set up in “Universal output type selection” in Function block No. 30 in Engineering mode.



Refer to “**15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)**” for the parameters that are initialized when the Retransmission output 3 type is changed.

● Retransmission output 3 scale high

[Engineering Mode: Function block No. 33 (Fn33)]

Parameter symbol	Data range	Factory set value
PH53	Same as Retransmission output 1 scale high (P. 9-17)	Same as Retransmission output 1 scale high



To display “Retransmission output 3 scale high,” OUT3 must be specified at the time of order, and Current output must be set up in “Universal output type selection” in Function block No. 30 in Engineering mode.

● Retransmission output 3 scale low

[Engineering Mode: Function block No. 33 (Fn33)]

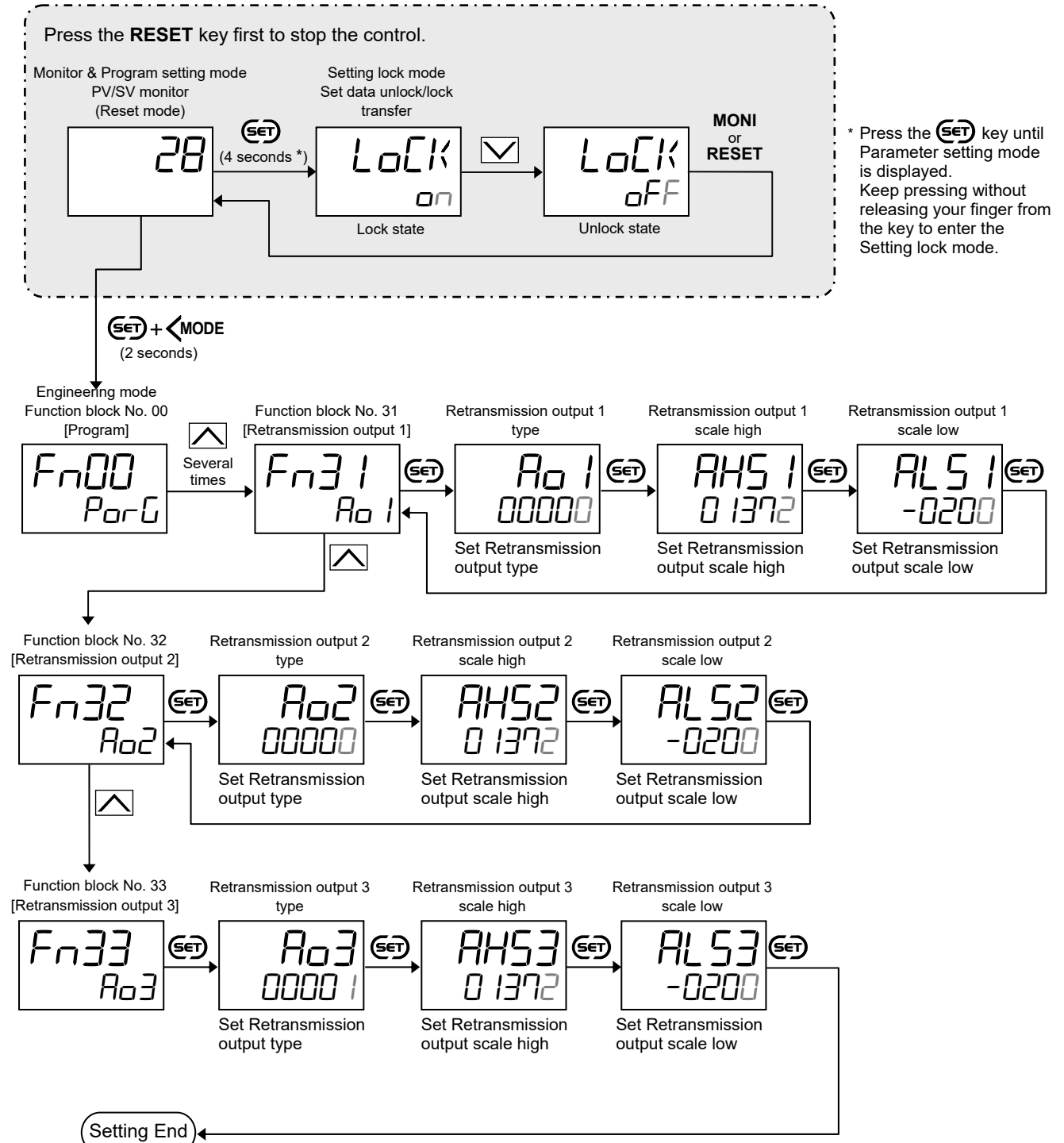
Parameter symbol	Data range	Factory set value
PL53	Same as Retransmission output 1 scale low (P. 9-17)	Same as Retransmission output 1 scale low



To display “Retransmission output 3 scale low,” OUT3 must be specified at the time of order, and Current output must be set up in “Universal output type selection” in Function block No. 30 in Engineering mode.

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

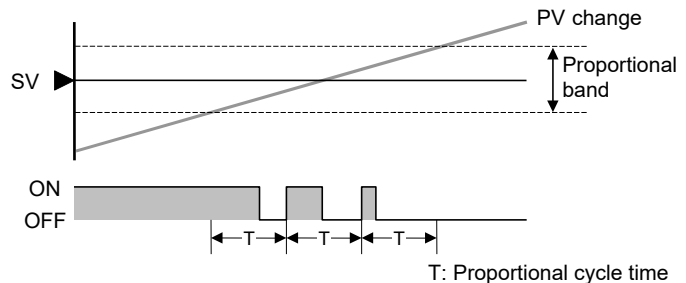
9.4 Changing Proportional Cycle Time

When time proportioning output (relay output, voltage pulse output or transistor output) is specified at the time of ordering, Proportional cycle time and Minimum ON/OFF time of proportional cycle can be changed.

■ Description of function

● Proportional cycle time

Manipulated output value turns ON and OFF in a certain cycle (Proportional cycle time) when the Measured value (PV) reaches within the Proportional band at Time proportioning action. More precise control can be achieved by shortening Proportional cycle time, however, the life of operating unit (Relay etc.) can be shortened based on the feature of the specific controlled object



● Minimum ON/OFF time of proportioning cycle

Minimum ON/OFF time of proportioning cycle can be used to compensate relay life by acquiring the minimum OF/OFF time.

Minimum ON time of proportioning cycle:

Manipulated output does not turn ON when the duration of the computed ON output is shorter than the Minimum ON time of proportioning cycle being set.

Manipulated output remains ON the same amount of time as the computed ON output when the computed ON output is longer than the Minimum ON time of proportioning cycle being set.

(Minimum ON time of proportioning cycle is valid when the computed ON output exceeds 0 %.)

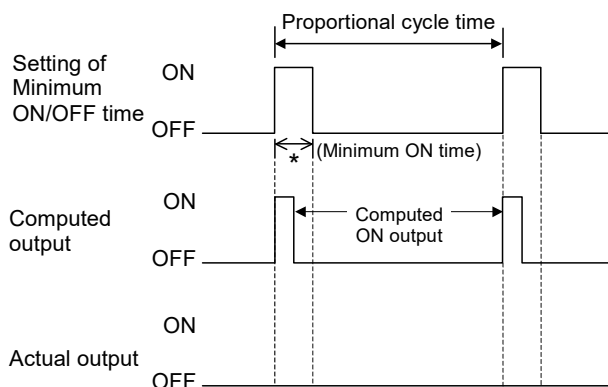
Minimum OFF time of proportioning cycle:

Manipulated output remains OFF the same amount of time as the Minimum OFF time set when the computed OFF output is shorter than the Minimum OFF time being set.

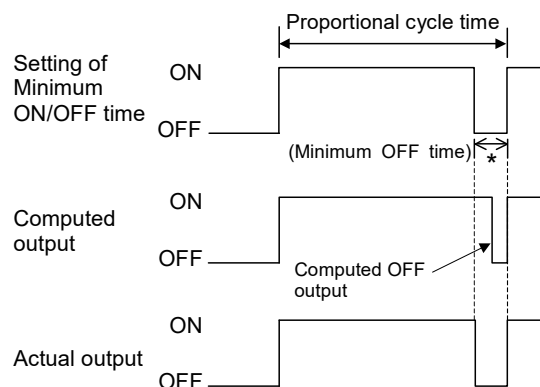
Manipulated output remains OFF the same amount of time as the computed OFF output when the computed OFF output is longer than the Minimum OFF time being set.

(Minimum OFF time of proportioning cycle is valid when the computed OFF output is below 100 %.)

When the computed ON output exceeds 0 %



When the computed OFF output is below 100 %



* When a long minimum ON/OFF time is required for the relay, set a time longer than that time.



Minimum ON/OFF time of proportioning cycle is not operative if the Proportioning cycle is set shorter than the Minimum ON/OFF time of proportioning cycle (Proportioning cycle < Minimum ON/OFF proportioning time).



■ Parameter setting

● OUT1 proportional cycle time

[Setup Setting Mode: Setting group No. 30 (5n30)]

Parameter symbol	Data range	Factory set value
	0.1 to 100.0 seconds	Relay contact output: 20.0 Voltage pulse output, Transistor output: Note

Note: In case OUT1 function selection is “Control output [cool-side]” AND Control action is “Heat/Cool PID control [air cooling] or [water cooling]”: 20.0, Other cases: 2.0



To display “OUT1 proportional cycle time,” Output type on OUT1 must be specified at the time of order as Relay contact output, Voltage pulse output, or Transistor output.

● OUT2 proportional cycle time

[Setup Setting Mode: Setting group No. 30 (5n30)]

Parameter symbol	Data range	Factory set value
	0.1 to 100.0 seconds	Relay contact output: 20.0 Voltage pulse output, Transistor output: Note

Note: In case OUT2 function selection is “Control output [cool-side]” AND Control action is “Heat/Cool PID control [air cooling] or [water cooling]”: 20.0, Other cases: 2.0



To display “OUT2 proportional cycle time,” Output type on OUT2 must be specified at the time of order as Relay contact output, Voltage pulse output, or Transistor output.

● OUT3 proportional cycle time

[Setup Setting Mode: Setting group No. 30 (5n30)]

Parameter symbol	Data range	Factory set value
	0.1 to 100.0 seconds	Voltage pulse output: Note

Note: In case OUT3 function selection is “Control output [cool-side]” AND Control action is “Heat/Cool PID control [air cooling] or [water cooling]”: 20.0, Other cases: 2.0



To display “OUT3 proportional cycle time,” OUT3 must be specified at the time of order, and Voltage pulse output must be set up in “Universal output type selection” in Function block No. 30 in Engineering mode.

● OUT1 minimum ON/OFF time of proportional cycle

[Setup Setting Mode: Setting group No. 30 (5n30)]

Parameter symbol	Data range	Factory set value
	0 to 1000 ms	0



To display “OUT1 minimum ON/OFF time of proportional cycle,” Output type on OUT1 must be specified at the time of order as Relay contact output, Voltage pulse output, or Transistor output.

● OUT2 minimum ON/OFF time of proportional cycle

[Setup Setting Mode: Setting group No. 30 (5n30)]

Parameter symbol	Data range	Factory set value
MF2	0 to 1000 ms	0



To display “OUT2 minimum ON/OFF time of proportional cycle,” Output type on OUT2 must be specified at the time of order as Relay contact output, Voltage pulse output, or Transistor output.

● OUT3 minimum ON/OFF time of proportional cycle

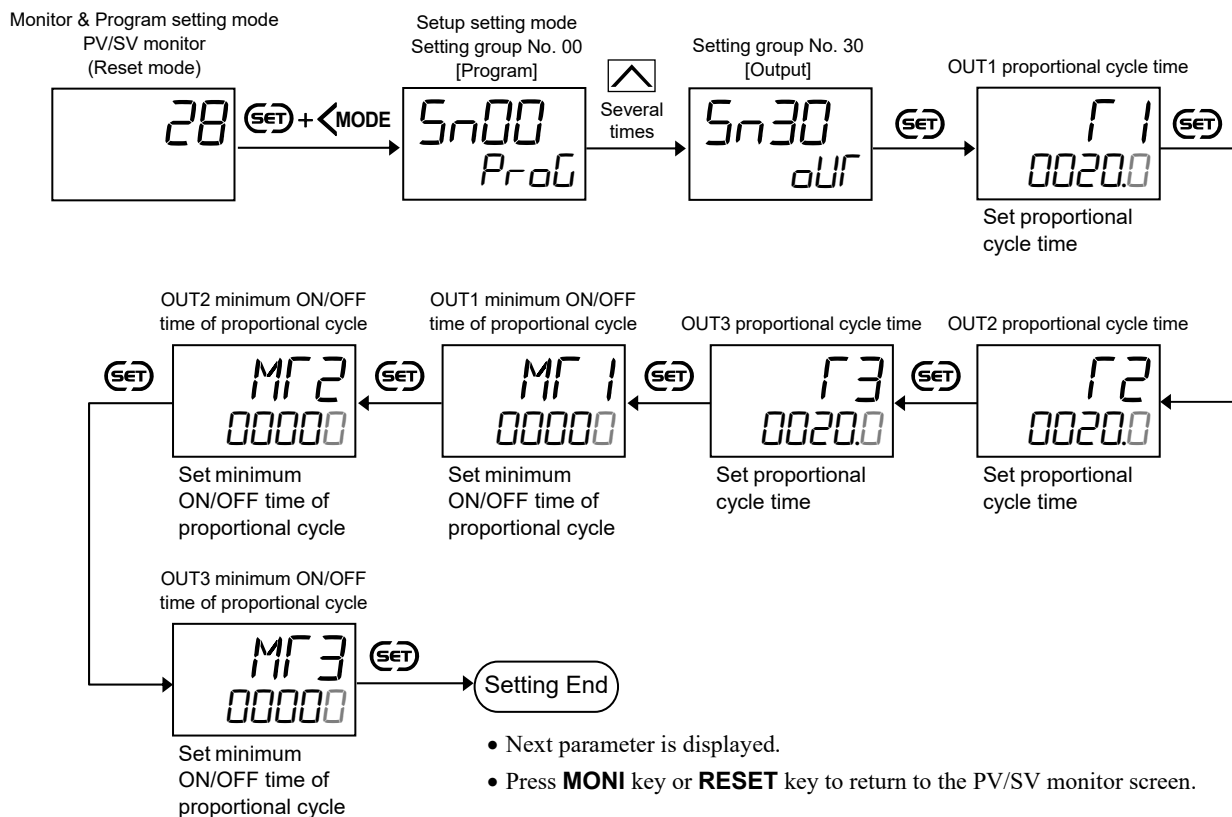
[Setup Setting Mode: Setting group No. 30 (5n30)]

Parameter symbol	Data range	Factory set value
MF3	0 to 1000 ms	0



To display “OUT3 minimum ON/OFF time of proportional cycle,” OUT3 must be specified at the time of order, and Voltage pulse output must be set up in “Universal output type selection” in Function block No. 30 in Engineering mode.

■ Setting procedure



9.5 Changing Energizing/De-energizing Output

Each output (OUT 1 to 3, DO1 to 4) can be individually set to energize or de-energize.



Setting energize/de-energize at Control output, Retransmission output, or Output terminal to which FAIL is assigned is ignored. (FAIL is fixed as de-energize)

■ Description of function

● Outputs selectable to energize or de-energize

Logic calculation output: Event, Heater break alarm (HBA), Control loop break alarm (LBA), Input error status

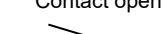
Instrument Status Output: Program control mode (RUN), Manual control mode (MAN), Autotuning (AT), Communication monitoring result

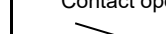
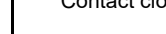
Time signal, Pattern end signal

● Explanation of energizing and de-energizing outputs

Output type		Output state	
		Status when the function assigned to the output is ON	Status when the function assigned to the output is OFF
Relay contact output	Energize	Contact close	Contact open
	De-energize	Contact open	Contact close
Voltage pulse output	Energize	ON	OFF
	De-energize	OFF	ON
Current output	Energize	Outputs the maximum output current (100 %)	Outputs the minimum output current (0 %)
	De-energize	Outputs the minimum output current (0 %)	Outputs the maximum output current (100 %)
Continuous voltage output	Energize	Outputs the maximum output current (100 %)	Outputs the minimum output current (0 %)
	De-energize	Outputs the minimum output current (0 %)	Outputs the maximum output current (100 %)
Transistor output	Energize	ON	OFF
	De-energize	OFF	ON

Example: Relay contact output

	Status when the function assigned to the output is ON	Status when the function assigned to the output is OFF
Energize	Contact close 	Contact open 

	Status when the function assigned to the output is ON	Status when the function assigned to the output is OFF
De-energize	Contact open 	Contact close 

● Output state in Reset mode (RESET)

Irrespective of setting Energize/De-energize, the output state in Reset mode (RESET) is as follows.

If “Output action in Reset mode” (Function block No. 30 in Engineering mode) is set to continue the action, setting of Energize/De-energize remains valid.

Output type	Output state
Relay contact output	Contact open
Voltage pulse output	OFF
Current output	Outputs the minimum output current (0 %)
Continuous voltage output	Outputs the minimum output current (0 %)
Transistor output	OFF

■ Parameter setting

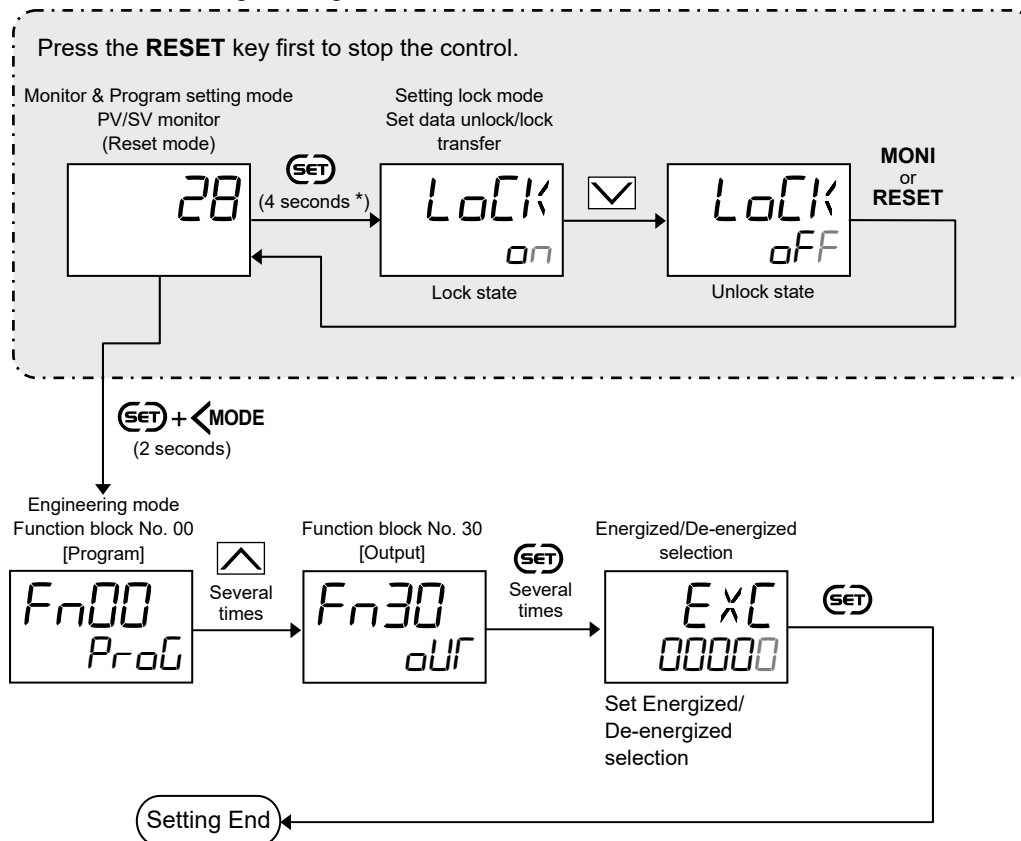
● Energized/De-energized selection

[Engineering Mode: Function block No. 30 (Fn30)]

Parameter symbol	Data range	Factory set value
EXC	0 to 127 0: All outputs are energized +1: OUT1 de-energized +2: OUT2 de-energized +4: OUT3 de-energized +8: DO1 de-energized +16: DO2 de-energized +32: DO3 de-energized +64: DO4 de-energized To select two or more functions, sum each value.	0

■ Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

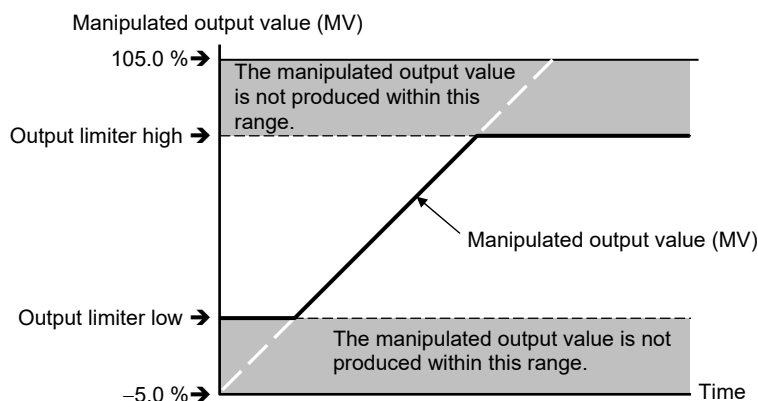


9.6 Limiting Output

Use output limiter to limit the output.

■ Description of function

This is the function which restricts the high and low limits of Manipulated output values (MV).



Output limiter is also effective in ON/OFF control.

■ Parameter setting

● Output limiter high [heat-side]

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
oLH	Output limiter low [heat-side] to 105.0 %	105.0



Not displayed when the Control action is a Position proportioning PID control without Feedback resistance (FBR) input.



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are automatically converted when the Output limiter high [heat-side] is changed.

● Output limiter low [heat-side]

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
oLL	-5.0 % to Output limiter high [heat-side]	-5.0



Not displayed when the Control action is a Position proportioning PID control without Feedback resistance (FBR) input.



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are automatically converted when the Output limiter low [heat-side] is changed.

● Output limiter high [cool-side]

[Parameter Setting Mode: Parameter group No. 56 (P_{n56})]

[Parameter Setting Mode: Parameter group No. 58 (P_{n58})]

Parameter symbol	Data range	Factory set value
$oLHc$	Output limiter low [cool-side] to 105.0 %	105.0



To display “Output limiter high [cool-side],” specify Heat/Cool PID control at the time of order, or select Heat/Cool PID control at “Control action” (Function block No. 51 in Engineering mode).



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are automatically converted when the Output limiter high [cool-side] is changed.

● Output limiter low [cool-side]

[Parameter Setting Mode: Parameter group No. 56 (P_{n56})]

[Parameter Setting Mode: Parameter group No. 58 (P_{n58})]

Parameter symbol	Data range	Factory set value
$oLLc$	–5.0 % to Output limiter high [cool-side]	–5.0



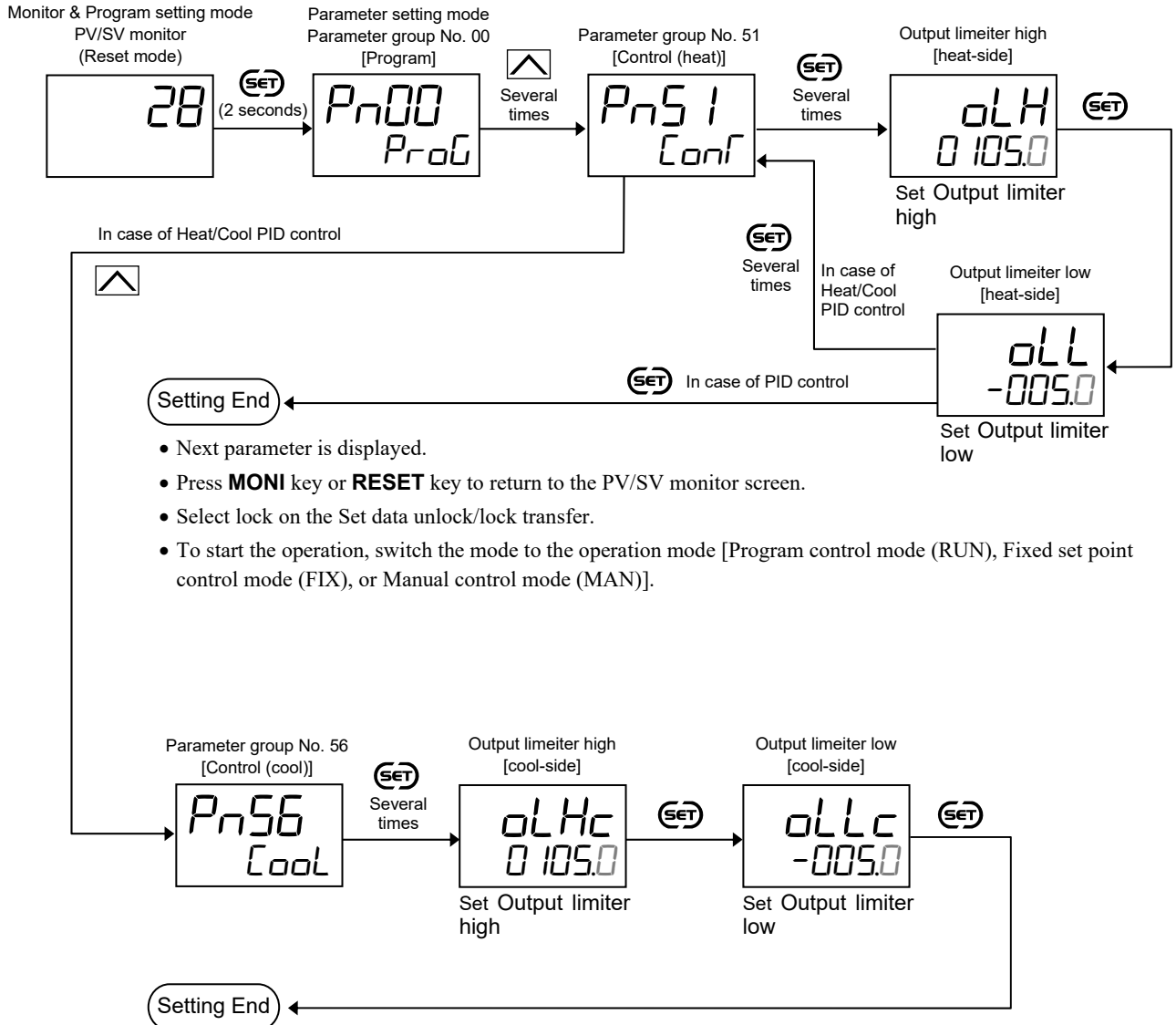
To display “Output limiter low [cool-side],” specify Heat/Cool PID control at the time of order, or select Heat/Cool PID control at “Control action” (Function block No. 51 in Engineering mode).



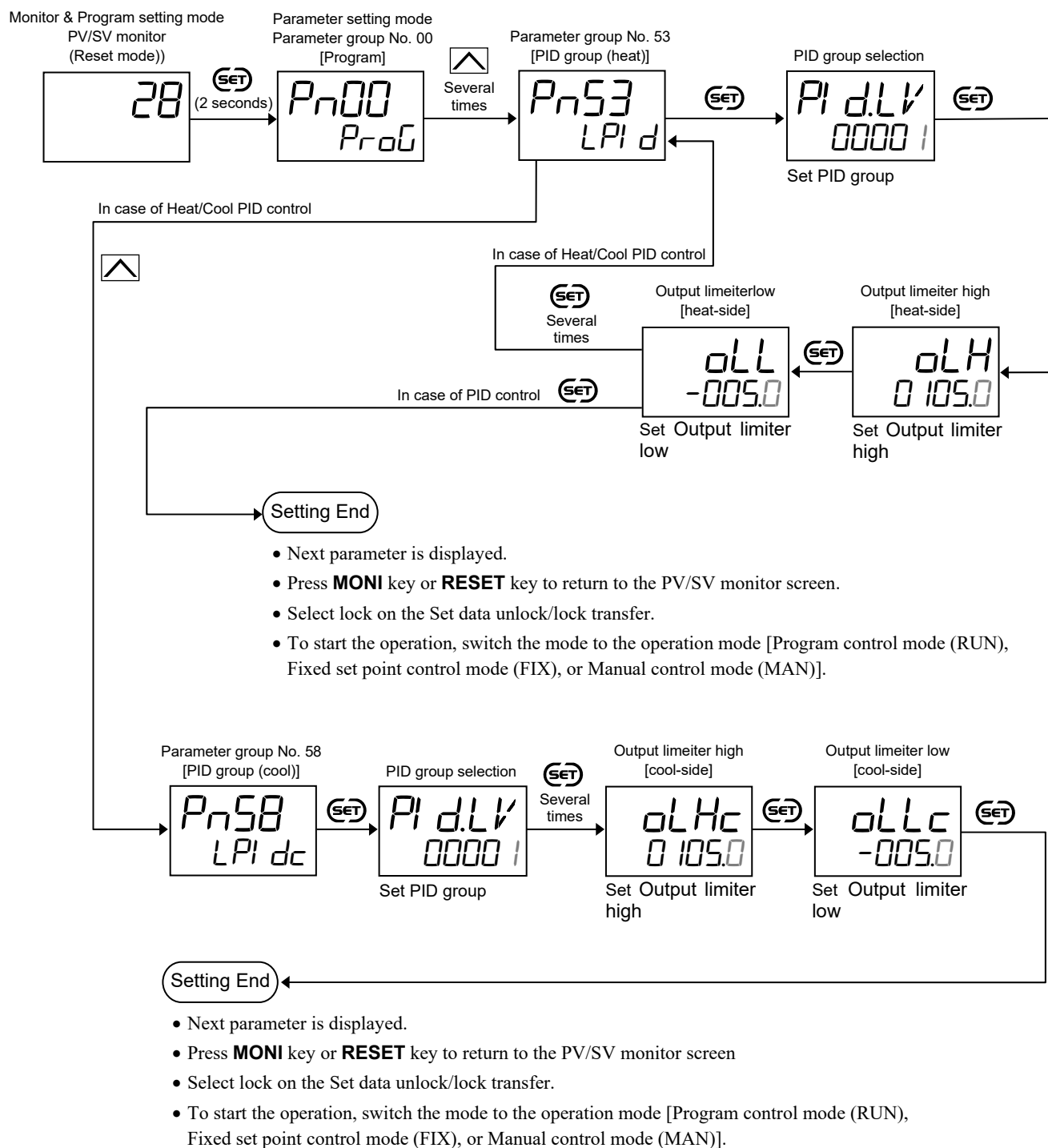
Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are automatically converted when the Output limiter low [cool-side] is changed.

Setting procedure

[without Level-PID]



[with Level-PID]



9.7 Suppressing Sudden Change in Output (Output Change Rate Limiter)

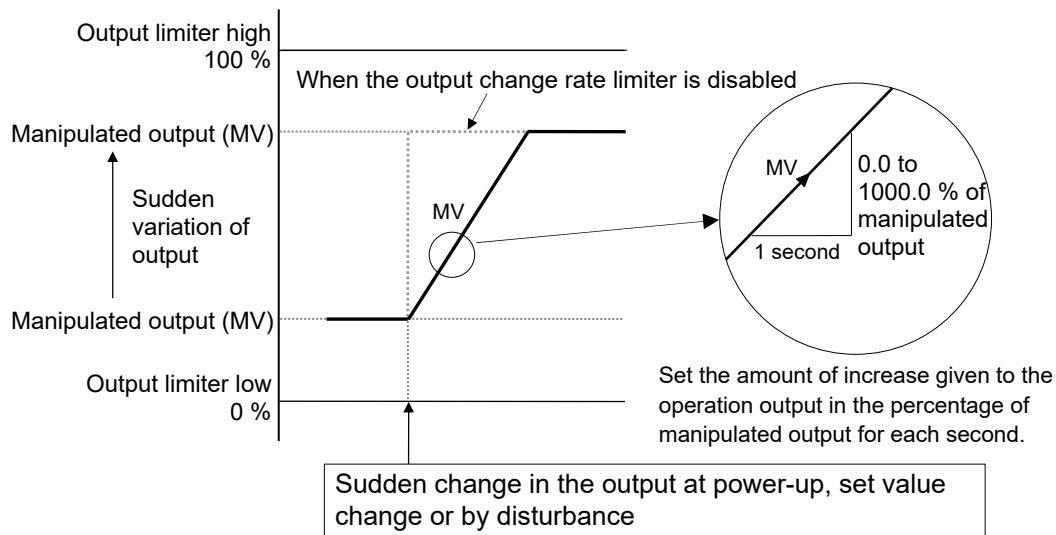
Output change rate limiter may be used to suppress sudden change in output at power on or at the time of set value change.

■ Description of function

The Output change rate limiter limits the variation of Manipulated output (MV) per second. This function is suitable for an application in which a sudden MV change is not acceptable.

Example: The Output change rate limiter is effective.

- The MV reaches 100 % when the power is turned on to the controller and such a sudden output change is not acceptable in the application.
- A sudden output change occurs at the SV change and it is not acceptable in the application.



The output changes at specific rates set by Output change rate limiter (up) even under the situations where a sudden output change would occur without Output change rate limiter function. There is also independent Output change rate limiter (down).



If the output change rate is set smaller, it will cause slow control response and affect Derivative action.



When the Output change rate limiter is used, you may not be able to obtain appropriate PID constants by Autotuning.



The Output change rate limiter is particularly effective when a sudden MV change may create uncontrollable situation cause a large current flow. Also, it is very effective current output or voltage output is used as control output.



Output change rate limiter may be also effective in Program control mode (RUN), Fixed set point control mode (FIX) and Manual control mode (MAN). Output change rate limiter also functions when output changes suddenly due to manipulated manual output at input error.



When the instrument recovers from power failure in Hot start 1, the Output change rate limiter starts from the value before the power failure.



The Output change rate limiter becomes invalid when control is in Reset mode (RESET), ON/OFF control and Position proportioning PID control.

■ Parameter setting

● Output change rate limiter (up) [heat-side]

[Engineering Mode: Function block No. 51 (Fn51)]

Parameter symbol	Data range	Factory set value
oRU	0.0 to 1000.0 %/seconds of manipulated output 0.0: OFF	0.0



Not displayed when the Control action is a Position proportioning PID control without Feedback resistance (FBR) input.

● Output change rate limiter (down) [heat-side]

[Engineering Mode: Function block No. 51 (Fn51)]

Parameter symbol	Data range	Factory set value
oRd	0.0 to 1000.0 %/seconds of manipulated output 0.0: OFF	0.0



Not displayed when the Control action is a Position proportioning PID control without Feedback resistance (FBR) input.

● Output change rate limiter (up) [cool-side]

[Engineering Mode: Function block No. 56 (Fn56)]

Parameter symbol	Data range	Factory set value
oRUc	0.0 to 1000.0 %/seconds of manipulated output 0.0: OFF	0.0



To display “Output change rate limiter (up) [cool-side],” specify Heat/Cool PID control at the time of order, or select Heat/Cool PID control at “Control action” (Function block No. 51 in Engineering mode).

● Output change rate limiter (down) [cool-side]

[Engineering Mode: Function block No. 56 (Fn56)]

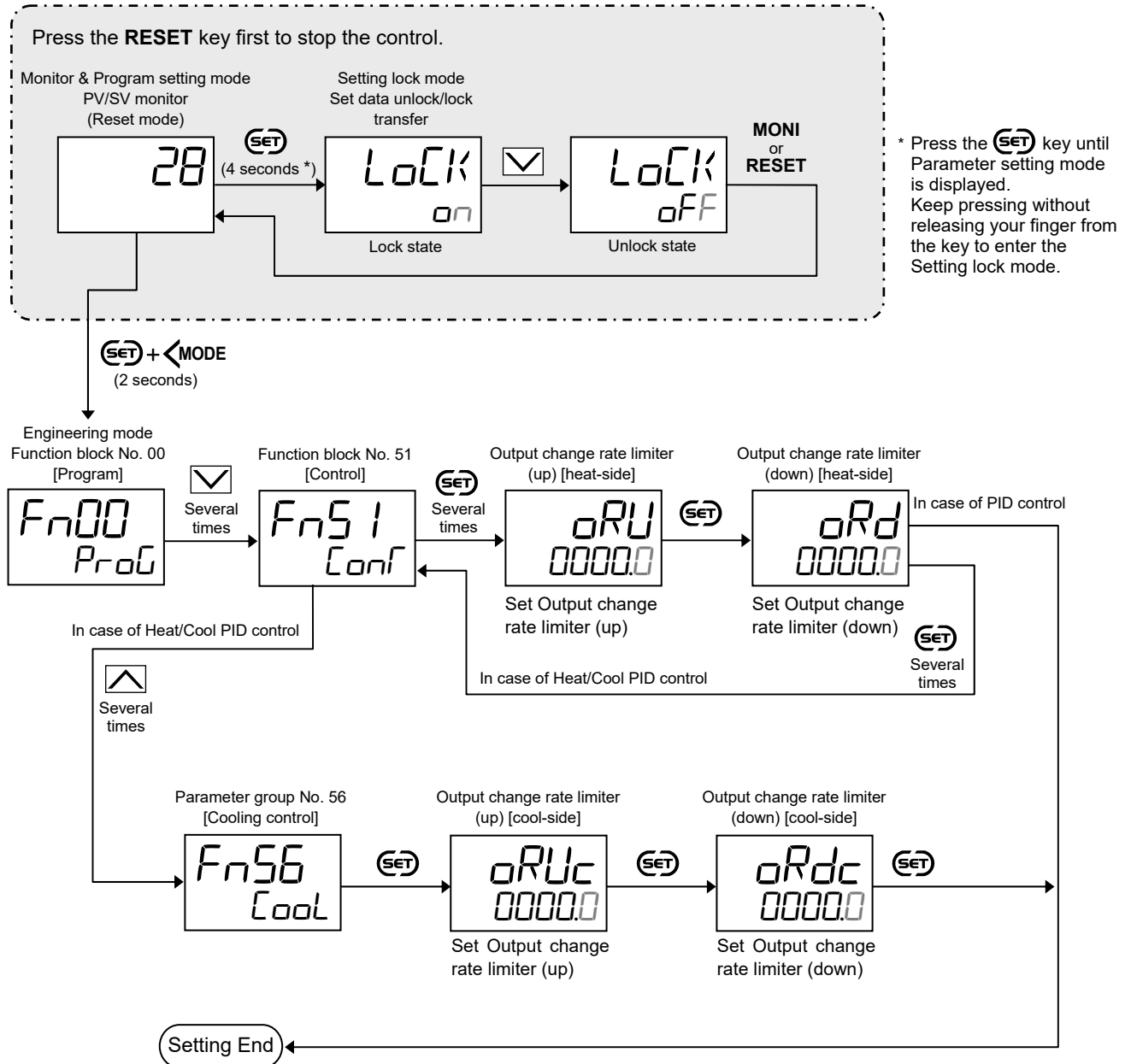
Parameter symbol	Data range	Factory set value
oRdc	0.0 to 1000.0 %/seconds of manipulated output 0.0: OFF	0.0



To display “Output change rate limiter (down) [cool-side],” specify Heat/Cool PID control at the time of order, or select Heat/Cool PID control at “Control action” (Function block No. 51 in Engineering mode).

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

9.8 Suppressing Sudden Change in Output (Balanceless Bumpless)

A function of Balanceless bumpless is provided to suppress abrupt change of output under the following conditions:

When the Operation mode is switched from the Program control mode (RUN) or the Fixed set point control mode (FIX) to the Manual control mode (MAN), or from the Manual control mode (MAN) to the Program control mode (RUN) or the Fixed set point control mode (FIX).

■ Description of function

Manipulated output value, when transferred from Program control mode (RUN) or Fixed set point control mode (FIX) to Manual control mode (MAN), depends on the setting of “Manual manipulated output value selection.” Selection of “Use the most recent manipulated output value” (balanceless bumpless function) or “Use the Manual manipulated output value *” (bump action) can be selected in “Manual manipulated output value selection.”

* The Manual manipulated output value is the last manipulated output value in Manual control mode (MAN) before the mode is transferred from Program control mode (RUN) or Fixed set point control mode (FIX) to Manual control mode (MAN).

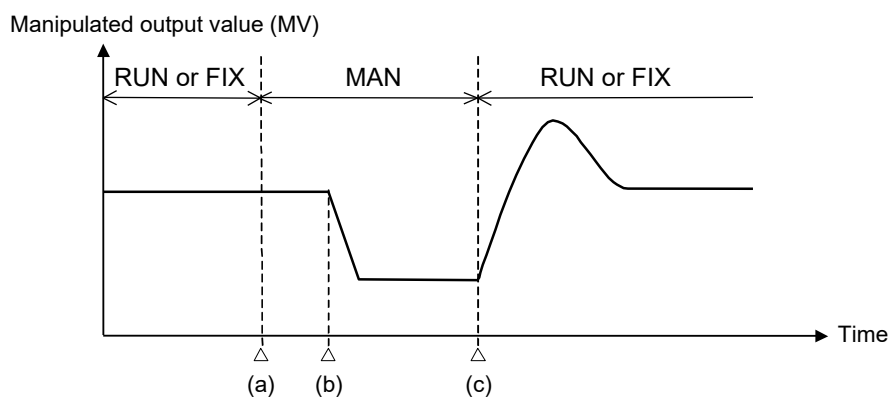
Note that the Manual manipulated output value can be preset in advance in the Setup setting mode before the mode is transferred to Manual control mode (MAN).



When the mode is transferred from Manual control mode (MAN) to Program control mode (RUN) or Fixed set point control mode (FIX), the balanceless bumpless function is always activated.

● Balanceless bumpless function

This function is used to prevent overload caused by the Manipulated output value (MV) suddenly changing when Program control mode (RUN) or Fixed set point control mode (FIX) is transferred to Manual control mode (MAN) and vice versa.



- (a) Transfer from Program control mode (RUN) or Fixed set point control mode (FIX) to Manual control mode (MAN).

However, when the mode is transferred to Manual control mode (MAN), the Manipulated output value used in Program control mode (RUN) or Fixed set point control mode (FIX) will be used as the manual output value in Manual control mode (MAN).

- (b) The manipulated output value is changed [Manual control mode (MAN) function]
- (c) Transfer from Manual control mode (MAN) to Program control mode (RUN) or Fixed set point control mode (FIX).

When the mode is transferred to Program control mode (RUN) or Fixed set point control mode (FIX), the controller starts PID control based on the MV used in Manual control mode (MAN).



■ Parameter setting

● Manual manipulated output value selection

[Engineering Mode: Function block No. 51 (Fn5 I)]

Parameter symbol	Data range	Factory set value
MVFS	0: The last manipulated output value (Balanceless bumpless function) 1: Manual manipulated output value	0

● Manual manipulated output value

[Setup Setting Mode: Setting group No. 51 (Sn5 I)]

Parameter symbol	Data range	Factory set value
MMV	PID control, Position proportioning PID control: Output limiter low [heat-side] to Output limiter high [heat-side] Heat/Cool PID control: –Output limiter high [cool-side] to +Output limiter high [heat-side]	PID control, Position proportioning PID control: –5.0 Heat/Cool PID control: 0.0

* Heat/Cool PID control has exceptional conditions as follows for the data range.

(1) Output limiter high [cool-side] is $\leq 0.0\%$

- Output limiter low [heat-side] is $\leq 0.0\%$: 0.0 % to +Output limiter high [heat-side]
- Output limiter low [heat-side] is $> 0.0\%$: Output limiter low [heat-side] to Output limiter high [heat-side]

(2) Output limiter high [heat-side] is $\leq 0.0\%$

- Output limiter low [cool-side] is $\leq 0.0\%$: –Output limiter high [cool-side] to 0.0 %
- Output limiter low [cool-side] is $> 0.0\%$: –Output limiter high [cool-side] to –Output limiter low [cool-side]

(3) Fixed at 0.0% in the following cases:

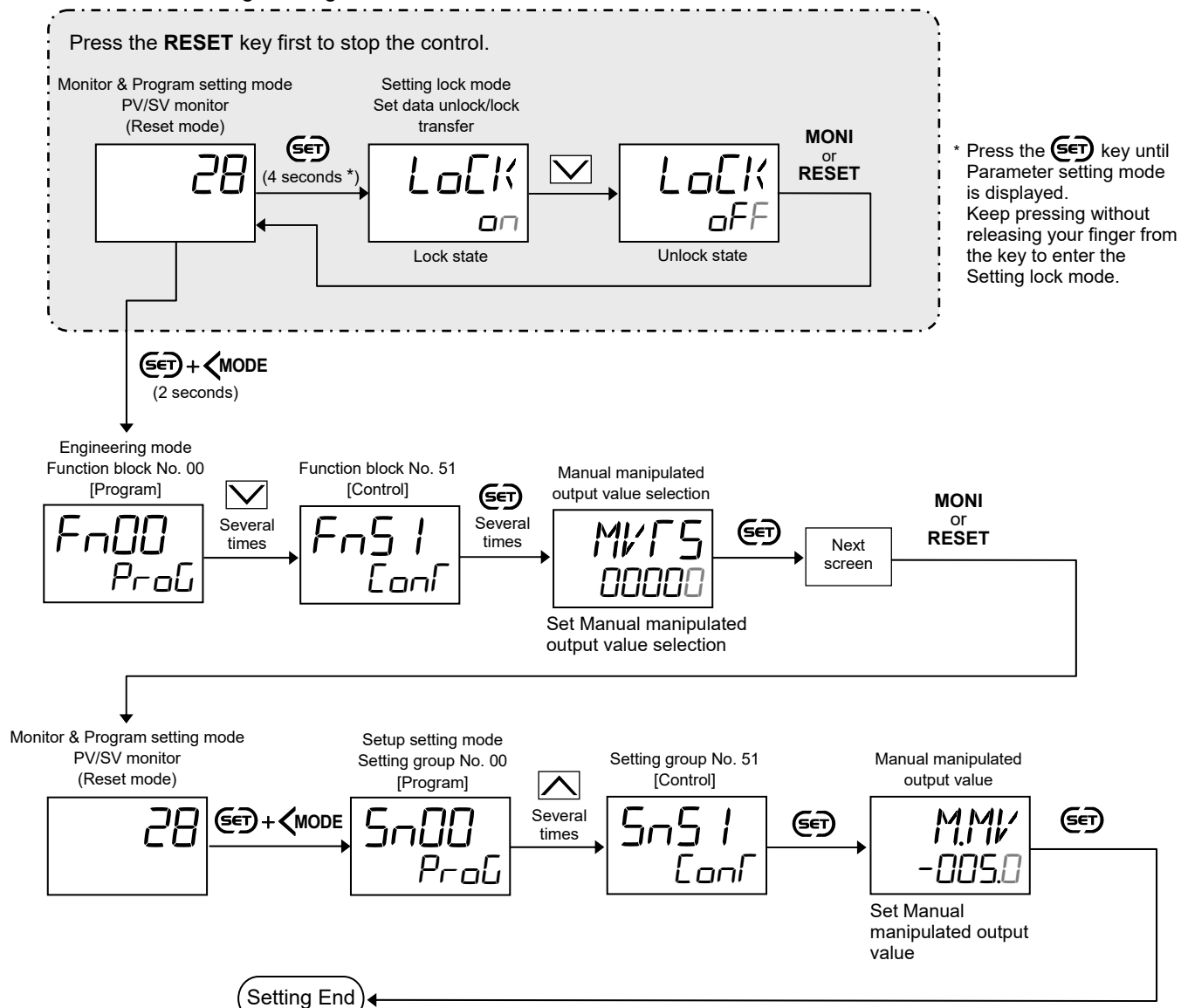
Output limiter high [cool-side] $\leq 0.0\%$, AND Output limiter high [heat-side] $\leq 0.0\%$



Not displayed when the Control action is a Position proportioning PID control without Feedback resistance (FBR) input.

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



9.9 Changing the Output Action in Reset Mode

This instrument can continue supplying Retransmission output and Event outputs, or Manipulated output value, even while Operation mode is Reset mode (RESET).

■ Description of function

The following three types can be continued to output even while in Reset mode (RESET). Multi types can be selected.

- Retransmission output
- Logic calculation output [Event, Heater break alarm (HBA), Input error status]
- Instrument status output [Program control mode (RUN), Manual control mode (MAN), Autotuning (AT), Communication monitoring result]



Continued output types while in Reset mode (RESET) cannot be selected by the output.

For example, this combination is not available:

Event 1: Continue to output even while in Reset mode (RESET). Event 2: Output to be stopped while in Reset mode (RESET).

Selection can be made in the unit of Retransmission output, Logic operation output, and Instrument status output.



Selecting “Logic calculation output: Action continues” as “Output action in Reset mode” will not include Control loop break alarm (LBA).

● Manipulated output value in Reset mode

Manipulated output value in Reset mode is a function to produce the preset manipulated output value in Reset mode (RESET). In the case of Heat/Cool PID control, Manipulated output value in Reset mode can be set on both sides of heating and cooling.

■ Parameter setting

● Output action in Reset mode

[Engineering Mode: Function block No. 30 (*F_{n30}*)]

Parameter symbol	Data range	Factory set value
<i>SS</i>	0 to 7 0: OFF +1: Logic calculation output: Action continues +2: Retransmission output: Action continues +4: Instrument status output: Action continues To select two or more functions, sum each value.	0

● Manipulated output value in Reset mode [heat-side]

[Engineering Mode: Function block No. 51 (*F_{n51}*)]

Parameter symbol	Data range	Factory set value
<i>RMV</i>	−5.0 to +105.0 %	−5.0

- **Manipulated output value in Reset mode [cool-side]**
[Engineering Mode: Function block No. 56 (*F_n56*)]

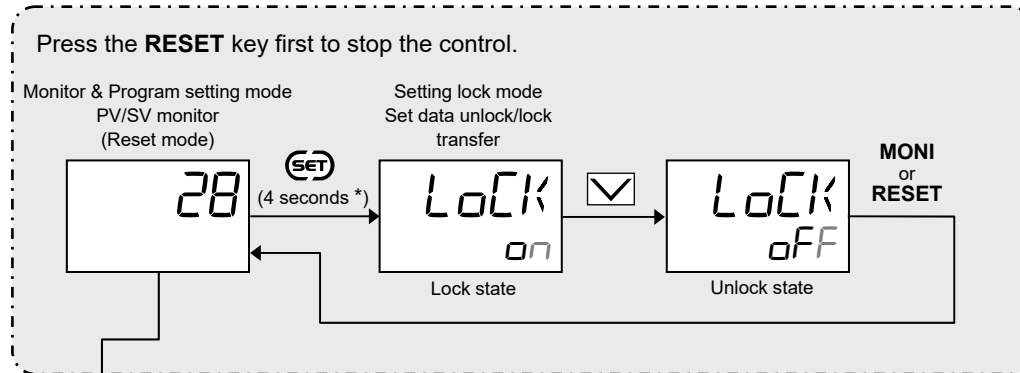
Parameter symbol	Data range	Factory set value
<i>RMV_c</i>	−5.0 to +105.0 %	−5.0



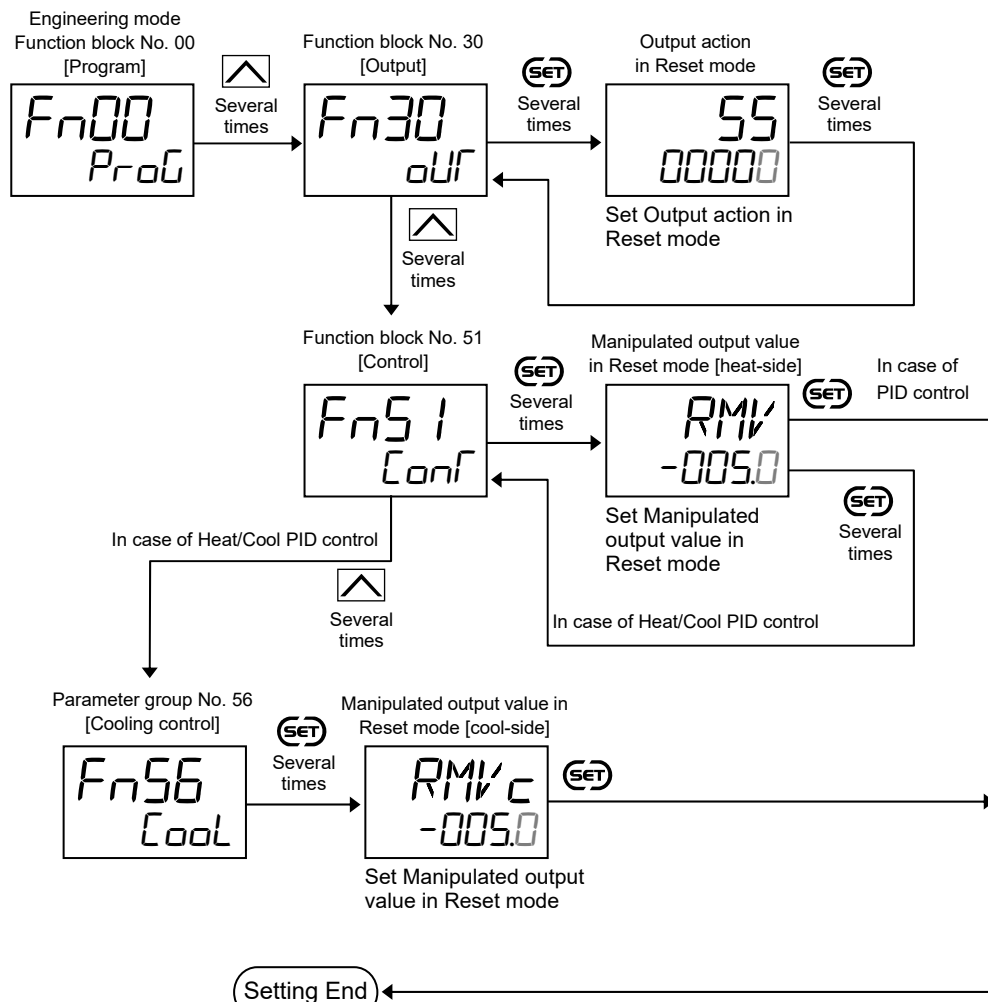
To display “Manipulated output value in Reset mode [cool-side],” specify Heat/Cool PID control at the time of order, or select Heat/Cool PID control at “Control action” (Function block No. 51 in Engineering mode).

Setting procedure

To enter the Engineering mode



* Press the **SET** key until Parameter setting mode is displayed. Keep pressing without releasing your finger from the key to enter the Setting lock mode.



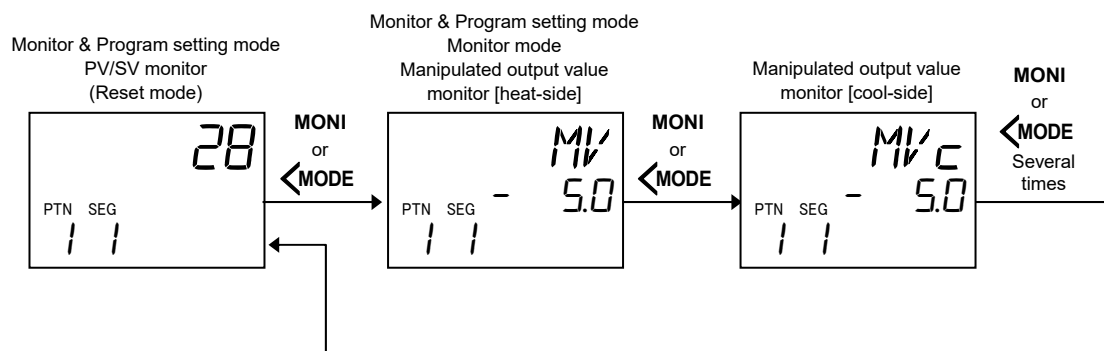
- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

9.10 Monitoring Manipulated Output Value

Manipulated output value can be monitored on this instrument.

■ Display of manipulated output value in each mode

● Reset mode (RESET)

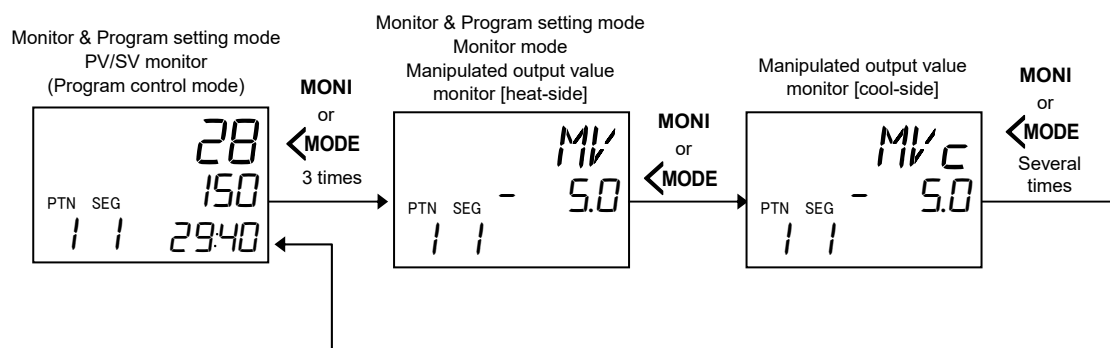


When the manipulated output value in the Reset mode is set, that value is displayed on the Manipulated output value monitor screen.

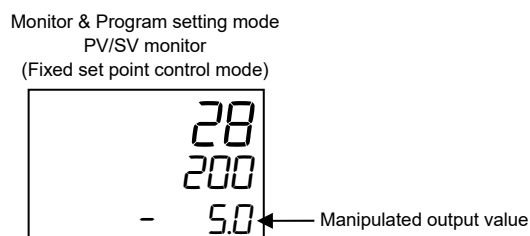


For details of Output action in Reset mode and Manipulated output value in Reset mode, refer to **9.9 Changing the Output Action in Reset Mode (P. 9-36)**.

● Program control mode (RUN)



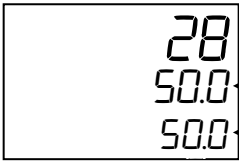
● Fixed set point control mode (FIX)





● **Manual control mode (MAN)**

Monitor & Program setting mode
PV/SV monitor
(Manual control mode)



Manual manipulated output value

Manipulated output value

■ **Display contents**

● **Manipulated output value monitor [heat-side]
[Monitor & Program Setting Mode]**

Parameter symbol	Data range	Factory set value
<i>MV</i>	-5.0 to +105.0 %	



Not displayed when the Control action is a Position proportioning PID control without Feedback resistance (FBR) input.



Feedback resistance (FBR) input value is displayed when the Control action is a Position proportioning PID control with Feedback resistance (FBR) input.

● **Manipulated output value monitor [cool-side]
[Monitor & Program Setting Mode]**

Parameter symbol	Data range	Factory set value
<i>MV C</i>	-5.0 to +105.0 %	



To display “Manipulated output value monitor [cool-side],” specify Heat/Cool PID control at the time of order, or select Heat/Cool PID control at “Control action” (Function block No. 51 in Engineering mode).



10

EVENT FUNCTION

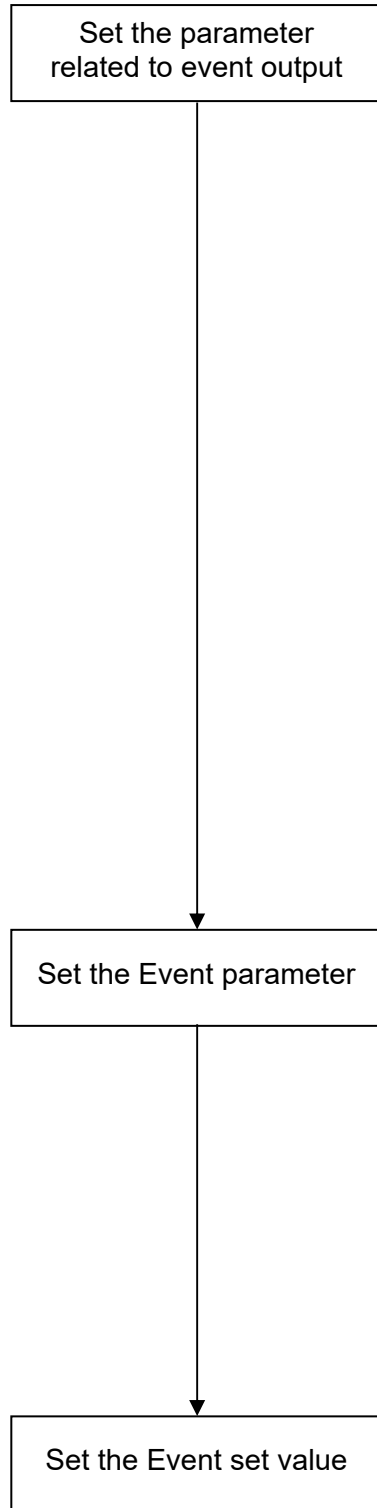
This chapter describes event related functions, setting contents and setting procedure based on the key words related to events.

10.1 Using Event Function	10-2
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10.1.2 Adding hold action to the event action	10-14
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10.1 Using Event Function

■ Setting procedure for event function

Set event as follows:



Set the parameter related to Event output.

- OUT1 to 3 function selection
- DO1 to 4 function selection
- OUT1 to 3 logic calculation selection
- DO1 to 4 logic calculation selection
- Energized/De-energized selection
- Interlock selection
- Output action in Reset mode
- Output action at pattern end

For OUT1 to 3 function selection, DO1 to 4 function selection, OUT1 to 3 logic calculation selection and DO1 to 4 logic calculation selection, refer to **9.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output, FAIL, Time signal, Pattern end output]** (P. 9-2).

For Energized/De-energized selection, refer to **9.5 Changing Energizing/De-energizing Output** (P. 9-24).

For Interlock function, refer to **10.5 Keeping the Event State (Interlock Function)** (P. 10-40) and **10.6 Releasing the Event State (Interlock Release)** (P. 10-42).

For selecting the action at the time of Reset mode, refer to **9.9 Changing the Output Action in Reset Mode** (P. 9-36).

For selecting the output action at the time of pattern end, refer to **11.8 Changing the Action When Program Control Ends (Pattern End)** (P. 11-31).

Set the following parameters:

- Event type
- Event hold action
- Event differential gap
- Event timer

For event type, refer to **10.1.1 Changing event type** (P. 10-3).

For event hold action, refer to **10.1.2 Adding hold action to the event action** (P. 10-14).

For event differential gap, refer to **10.1.3 Setting a differential gap in event action** (P. 10-17).

For event timer, **10.1.4 Preventing event from turning on due to a transient abnormal input** (P. 10-19).

Set the Event set value.

For event set value, refer to **10.1.6 Changing the event set value** (P. 10-21).

10.1.1 Changing event type

There are 24 types of event in total.

● Event type

Set value	Event type	Initial setting code
0	None	N
1	Deviation high (using SV monitor value) ¹	A, E (with hold action)
2	Deviation low (using SV monitor value) ¹	B, F (with hold action)
3	Deviation high/low (using SV monitor value) ¹	C, G (with hold action)
4	Band (using SV monitor value) ¹	D
5	Deviation high/low (using SV monitor value) [High/Low individual setting] ¹	—
6	Band (using SV monitor value) [High/Low individual setting] ¹	—
7	SV high (using SV monitor value)	V
8	SV low (using SV monitor value)	W
9	Process high ²	H, K (with hold action)
10	Process low ²	J, L (with hold action)
11	Deviation high (using Segment level) ¹	—
12	Deviation low (using Segment level) ¹	—
13	Deviation high/low (using Segment level) ¹	—
14	Band (using Segment level) ¹	—
15	Deviation high/low (using Segment level) [High/Low individual setting] ¹	—
16	Band (using Segment level) [High/Low individual setting] ¹	—
17	SV high (using Segment level)	—
18	SV low (using Segment level)	—
19	MV high [heat-side] ^{2, 3}	—
20	MV low [heat-side] ^{2, 3}	—
21	MV high [cool-side] ²	—
22	MV low [cool-side] ²	—
23	Process high/low [High/Low individual setting] ²	—
24	Process band [High/Low individual setting] ²	—

¹ Event hold and re-hold action is available.

² Event hold action is available.

³ The Manipulated output value (MV) corresponds to the Feedback resistance (FBR) input value when the Control action is a Position proportioning PID control with Feedback resistance (FBR) input.



Deviation action and event at set value action (set value 1 to 8 and 11 to 18) are selectable even in the Manual control mode (MAN). The SVs in those events vary dependent on the operation mode before being switched to the Manual control mode (MAN).

● Set value 1 to 8 (SV monitor value)

Operation mode before being switched to the Manual control mode (MAN)	SV to be used
Reset mode (RESET)	Segment level of Segment 1
Program control mode (RUN)	Monitor value of the segment level at switching
Fixed set point control mode (FIX)	Set value (SV) in Fixed set point control mode

● Set value 11 to 18 (Segment level)

Operation mode before being switched to the Manual control mode (MAN)	SV to be used
Reset mode (RESET)	Segment level of Segment 1
Program control mode (RUN)	Segment level in execution
Fixed set point control mode (FIX)	Set value (SV) in Fixed set point control mode



■ Description of function

● Deviation action

When the deviation ($PV - SV$ *) reaches the Event set value, event ON occurs.

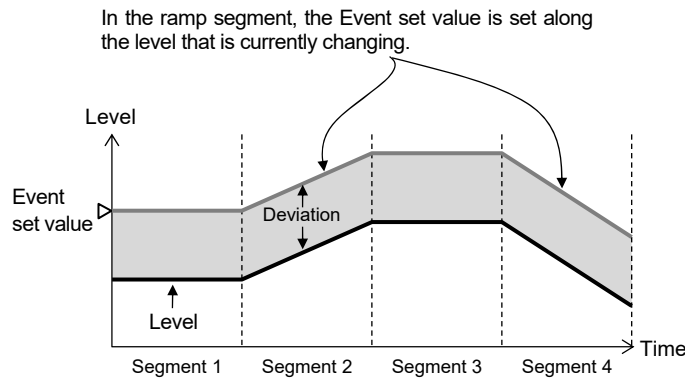
There are two types of deviation action; SV monitor value type and Segment level/Set value (SV) type.

* The Set value (SV) means a Segment level or a Set value (SV) of the fixed set point control mode.

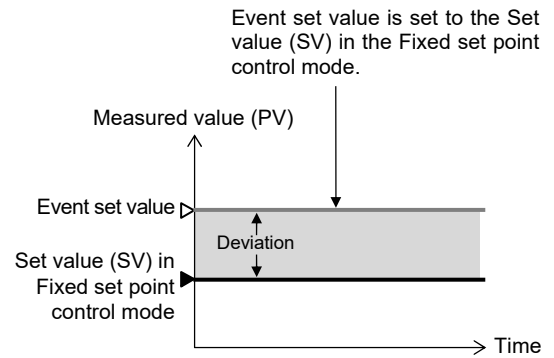
SV monitor value type

The value set at the Event set value is used as a deviation from the changing level or the Set value (SV) in Fixed set point control mode.

• Program control mode (RUN)



• Fixed set point control mode (FIX)

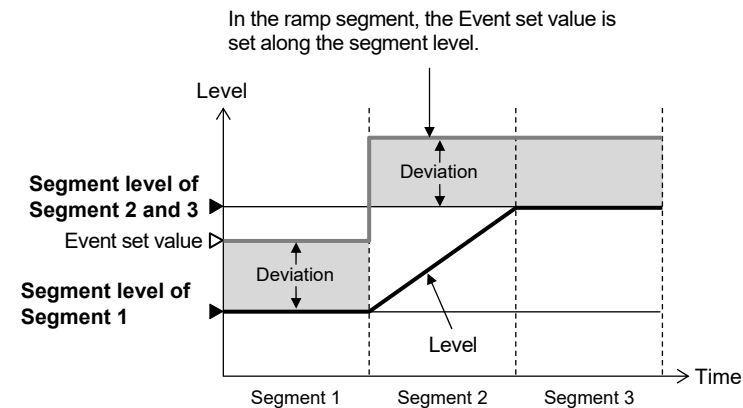


Note: The above figure illustrates the case of deviation high.

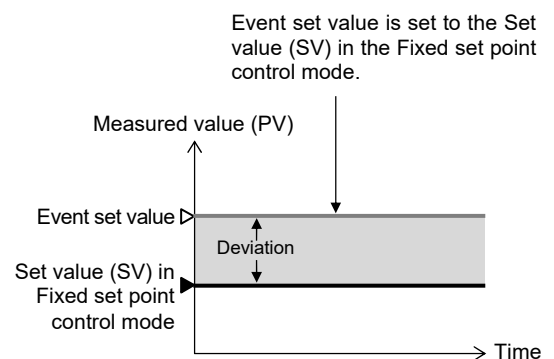
Segment level/Set value (SV) type

The value set at the Event set value is set as a deviation from the Segment level or the Set value (SV) of the fixed set point control mode.

• Program control mode (RUN)



• Fixed set point control mode (FIX)



Note: The above figure illustrates the case of deviation high.



In the Fixed set point control mode (FIX), either SV monitor value type or Segment level/Set value (SV) type may be selected, whichever is selected, the event set value will be set.

Diagrams of the Deviation action type are shown in the following:

ON: Event action turned on

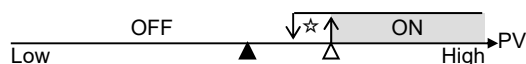
OFF: Event action turned off (▲ : Set value (SV)* Δ : Event set value ☆: Event differential gap)

* The Set value (SV) means a Segment level or a Set value (SV) of the fixed set point control mode.

Deviation high

When the deviation ($PV - SV$) is more than the Event set value, the event ON occurs.

(Event set value is greater than 0.)



(Event set value is less than 0.)



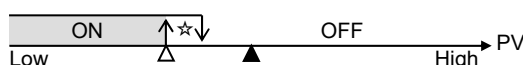
Deviation low

When the deviation ($PV - SV$) is less than the Event set value, the event ON occurs.

(Event set value is greater than 0.)



(Event set value is less than 0.)



Deviation high/low

Two types of Deviation high/low action are available.

Without high/low individual setting:

When the absolute deviation $|PV - SV|$ is more/less than the Event set value, the event ON occurs.

With high/low individual setting:

High action: When the deviation ($PV - SV$) is more than the Event set value [high], the event ON occurs.

Low action: When the deviation ($PV - SV$) is less than the Event set value [low], the event ON occurs.

(Without High/Low individual setting)



(With High/Low individual setting)



Band

Two types of Band action are available.

Without high/low individual setting:

When the absolute deviation $|PV - SV|$ is within the Event set value, the event ON occurs.

With high/low individual setting:

High action: When the deviation ($PV - SV$) is less than the Event set value [high], the event ON occurs.

Low action: When the deviation ($PV - SV$) is more than the Event set value [low], the event ON occurs.

(Without High/Low individual setting)



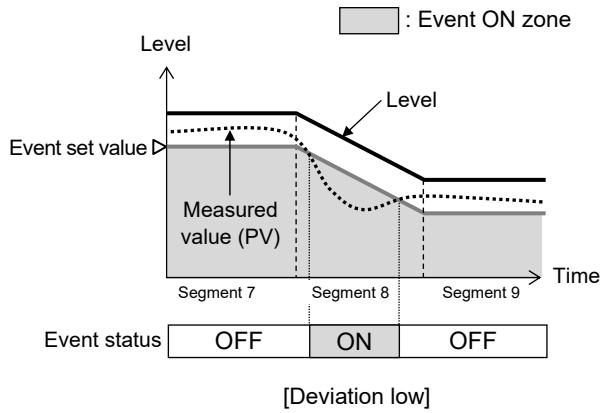
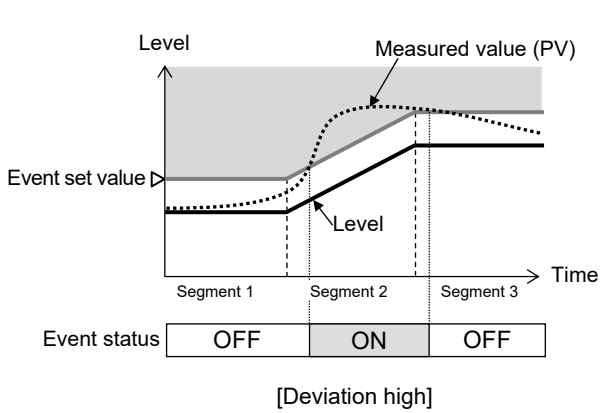
(With High/Low individual setting)



Examples of Deviation high limit and Deviation low limit.

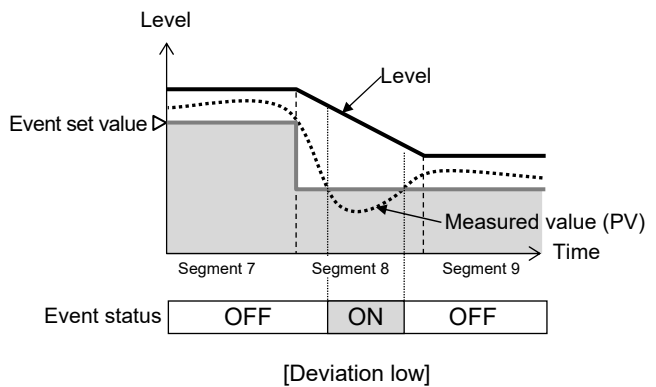
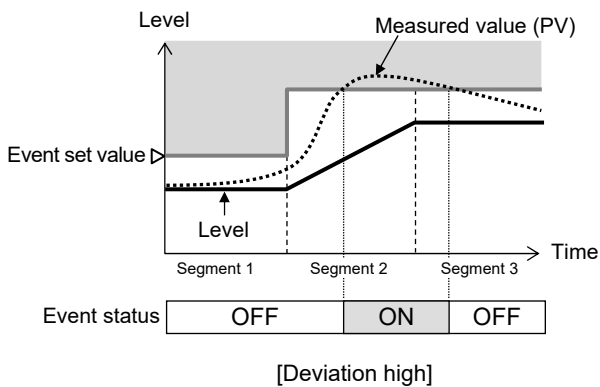
SV monitor value type

- Program control mode (RUN)

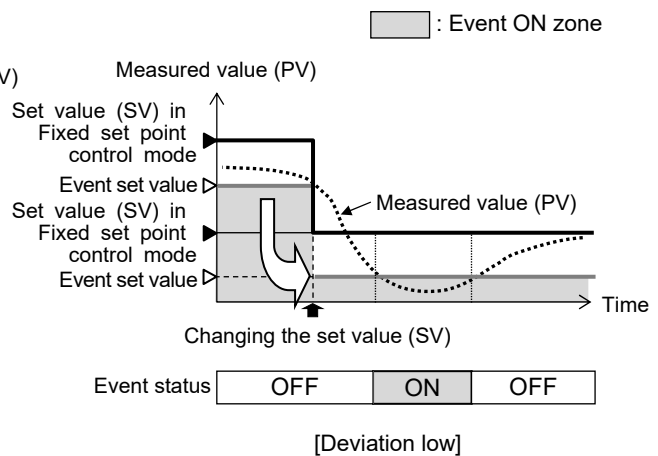
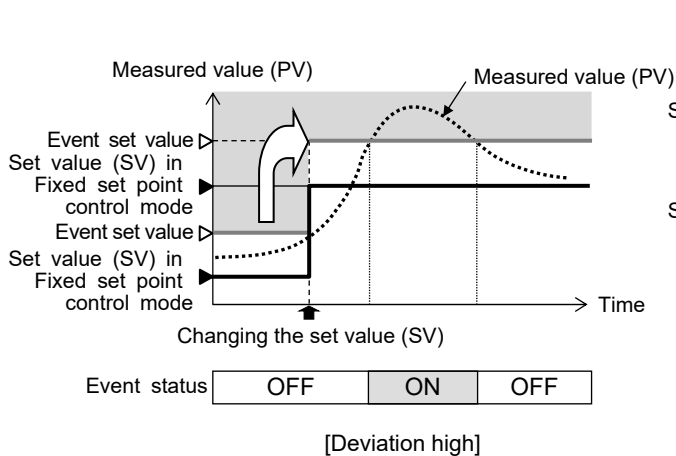


Segment level/Set value (SV) type

- Program control mode (RUN)



- Fixed set point control mode (FIX)



Event turns ON or OFF in accordance with the differential gap setting. For Event differential gap, refer to **10.1.3 Setting a differential gap in event action (P. 10-17)**.

● Set value action

When the Set value (SV)* reaches the Event set value, event ON occurs.

There are two types of Set value actions; SV monitor value type and Segment level/Set value (SV) type.

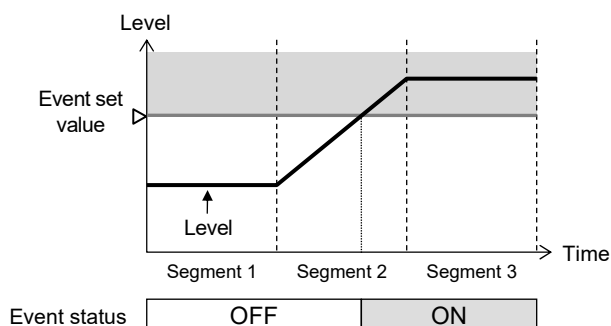
* The Set value (SV) means a Segment level or a Set value (SV) of the fixed set point control mode.

SV monitor value type

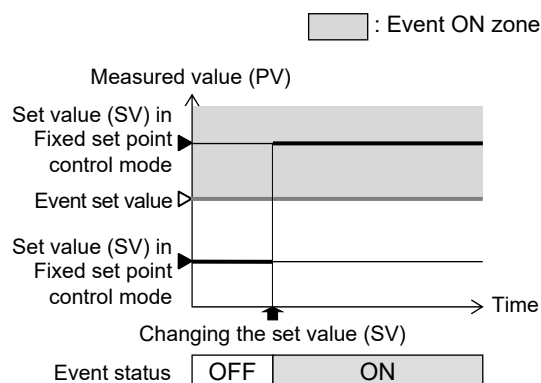
In the Program control mode (RUN), when the changing level reaches the Event set value, the Event becomes ON-state.

In the Fixed set point control mode (FIX), when the set value (SV) reaches the Event set value, the event turns on.

• Program control mode (RUN)



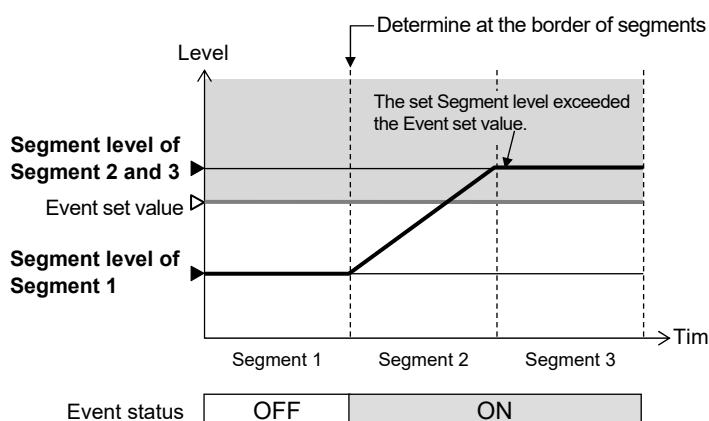
• Fixed set point control mode (FIX)



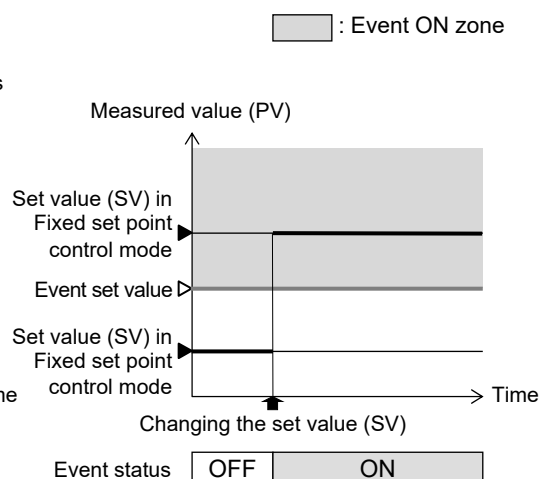
Segment level/Set value (SV) type

When the set Segment level reaches the Event set value, the event turns on. In the Program control mode (RUN), the event turns on when the segment is switched to the next one. If the Fixed set point control mode (FIX), if the set value (SV) is set in the event area the event turns on.

• Program control mode (RUN)



• Fixed set point control mode (FIX)



Event turns ON or OFF in accordance with the differential gap setting. For Event differential gap, refer to 10.1.3 Setting a differential gap in event action (P. 10-17).



10. EVENT FUNCTION

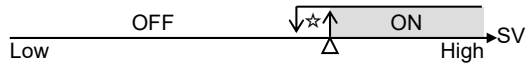
Diagrams of the Set value action type are shown in the following:

ON: Event action turned on

OFF: Event action turned off (Δ : Event set value $\star$: Event differential gap)

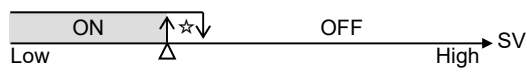
SV high

When the Set value (SV) is more than the Event set value, the event ON occurs.



SV low

When the Set value (SV) is less than the Event set value, the event ON occurs.



● Input value action

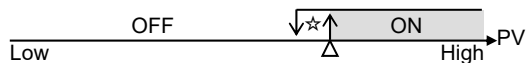
When the Measured value (PV) reaches the Event set value, event ON occurs.

ON: Event action turned on

OFF: Event action turned off (Δ: Event set value ☆: Event differential gap)

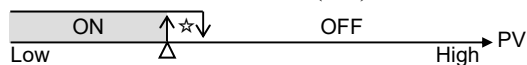
Process high

When the Measured value (PV) is more than the Event set value, the event ON occurs.



Process low

When the Measured value (PV) is less than the Event set value, the event ON occurs.



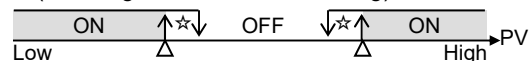
Process high/low

Process high/low action can be modified to high and low individual setting.

High action: When the Measured value (PV) is more than the Event set value [high], the event ON occurs.

Low action: When the Measured value (PV) is less than the Event set value [low], the event ON occurs.

(With High/Low individual setting)



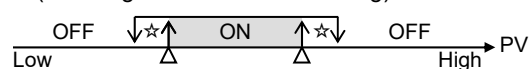
Process band

Process band action can be modified to high and low individual setting.

High action: When the Measured value (PV) is less than the Event set value [high], the event ON occurs.

Low action: When the Measured value (PV) is more than the Event set value [low], the event ON occurs.

(With High/Low individual setting)





● Manipulated output value action

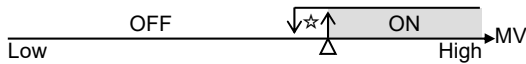
When a Manipulated output value (MV) reaches the Event set value, the event ON occurs.

ON: Event action turned on

OFF: Event action turned off (Δ: Event set value ☆: Event differential gap)

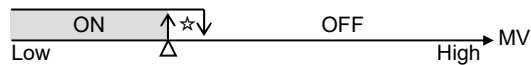
MV high

When the Manipulated output value (MV) is more than the Event set value, the event ON occurs.



MV low

When the Manipulated output value (MV) is less than the Event set value, the event ON occurs.



■ Parameter setting

● Event 1 type

[Engineering Mode: Function block No. 41 (Fn4 I)]

Parameter symbol	Data range	Factory set value
ES1	0: None 1: Deviation high (Using SV monitor value) ^a 2: Deviation low (Using SV monitor value) ^a 3: Deviation high/low (Using SV monitor value) ^a 4: Band (Using SV monitor value) ^a 5: Deviation high/low (Using SV monitor value) [High/Low individual setting] ^a 6: Band (Using SV monitor value) [High/Low individual setting] ^a 7: SV high (Using SV monitor value) 8: SV low (Using SV monitor value) 9: Process high ^b 10: Process low ^b 11: Deviation high (Using Segment level) ^a 12: Deviation low (Using Segment level) ^a 13: Deviation high/low (Using Segment level) ^a 14: Band (Using Segment level) ^a 15: Deviation high/low (Using Segment level) [High/Low individual setting] ^a 16: Band (Using Segment level) [High/Low individual setting] ^a 17: SV high (Using Segment level) 18: SV low (Using Segment level) 19: MV high [heat-side] ^{b, c} 20: MV low [heat-side] ^{b, c} 21: MV high [cool-side] ^b 22: MV low [cool-side] ^b 23: Process high/low [High/Low individual setting] ^b 24: Process band [High/Low individual setting] ^b ^a Event hold and re-hold action is available. ^b Event hold action is available. ^c When the instrument is specified as position proportioning PID control with feedback resistance, this item becomes Feedback resistance (FBR) input.	If the Event type is specified by the digital output function selection of initial setting code when ordering, that Event type will be the factory set value. If the Event type is not specified by the digital output function selection of initial setting code: 1



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized when the Event 1 type is changed.

● Event 2 type

[Engineering Mode: Function block No. 42 (Fn42)]

Parameter symbol	Data range	Factory set value
E52	Same as Event 1 type (P. 10-10)	If the Event type is specified by the digital output function selection of initial setting code when ordering, that Event type will be the factory set value. If the Event type is not specified by the digital output function selection of initial setting code: 2



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized when the Event 2 type is changed.

● Event 3 type

[Engineering Mode: Function block No. 43 (Fn43)]

Parameter symbol	Data range	Factory set value
E53	Same as Event 1 type (P. 10-10)	If the Event type is specified by the digital output function selection of initial setting code when ordering, that Event type will be the factory set value. If the Event type is not specified by the digital output function selection of initial setting code: 0



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized when the Event 3 type is changed.

● Event 4 type

[Engineering Mode: Function block No. 44 (Fn44)]

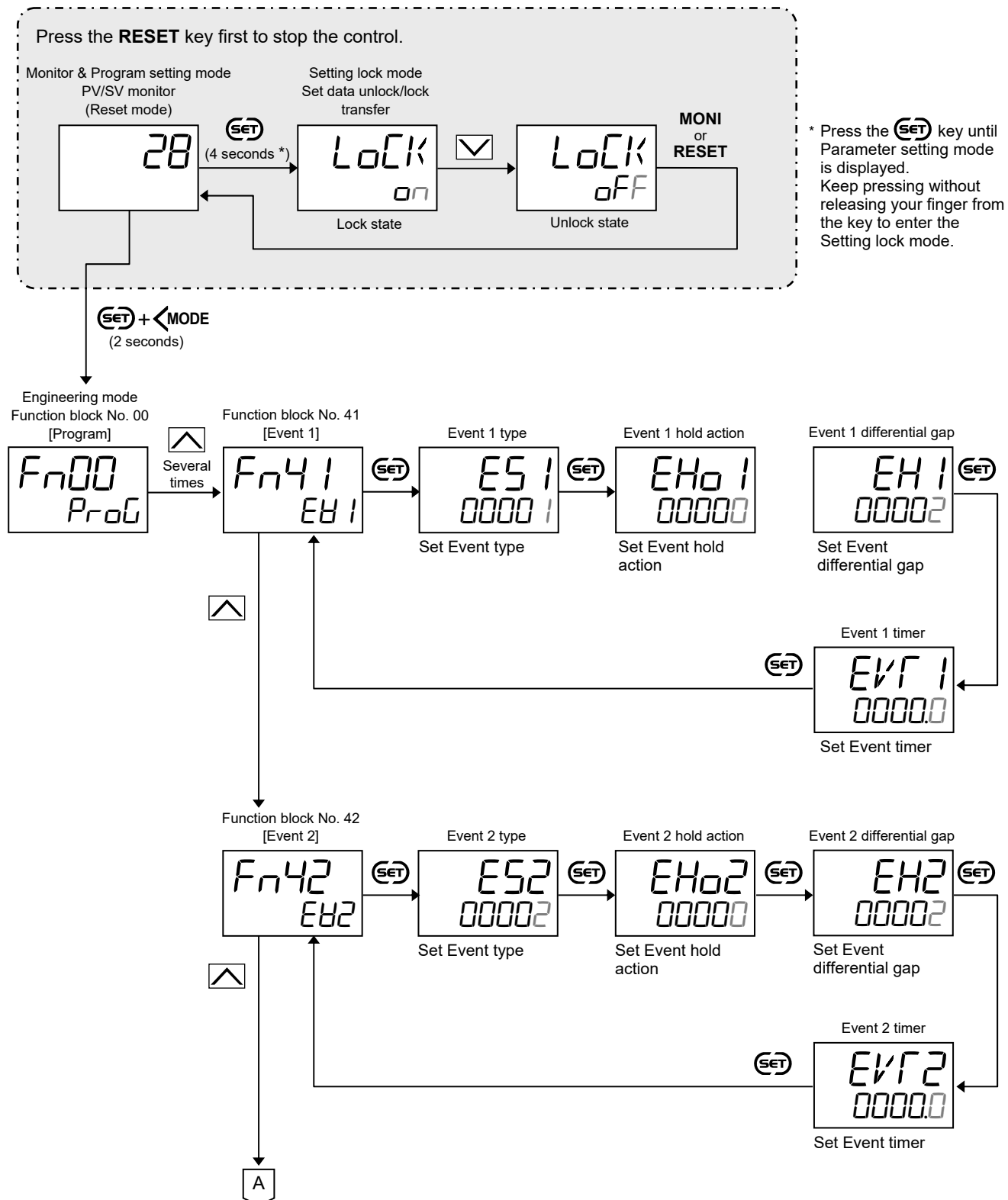
Parameter symbol	Data range	Factory set value
E54	Same as Event 1 type (P. 10-10)	If the Event type is specified by the digital output function selection of initial setting code when ordering, that Event type will be the factory set value. If the Event type is not specified by the digital output function selection of initial setting code: 0



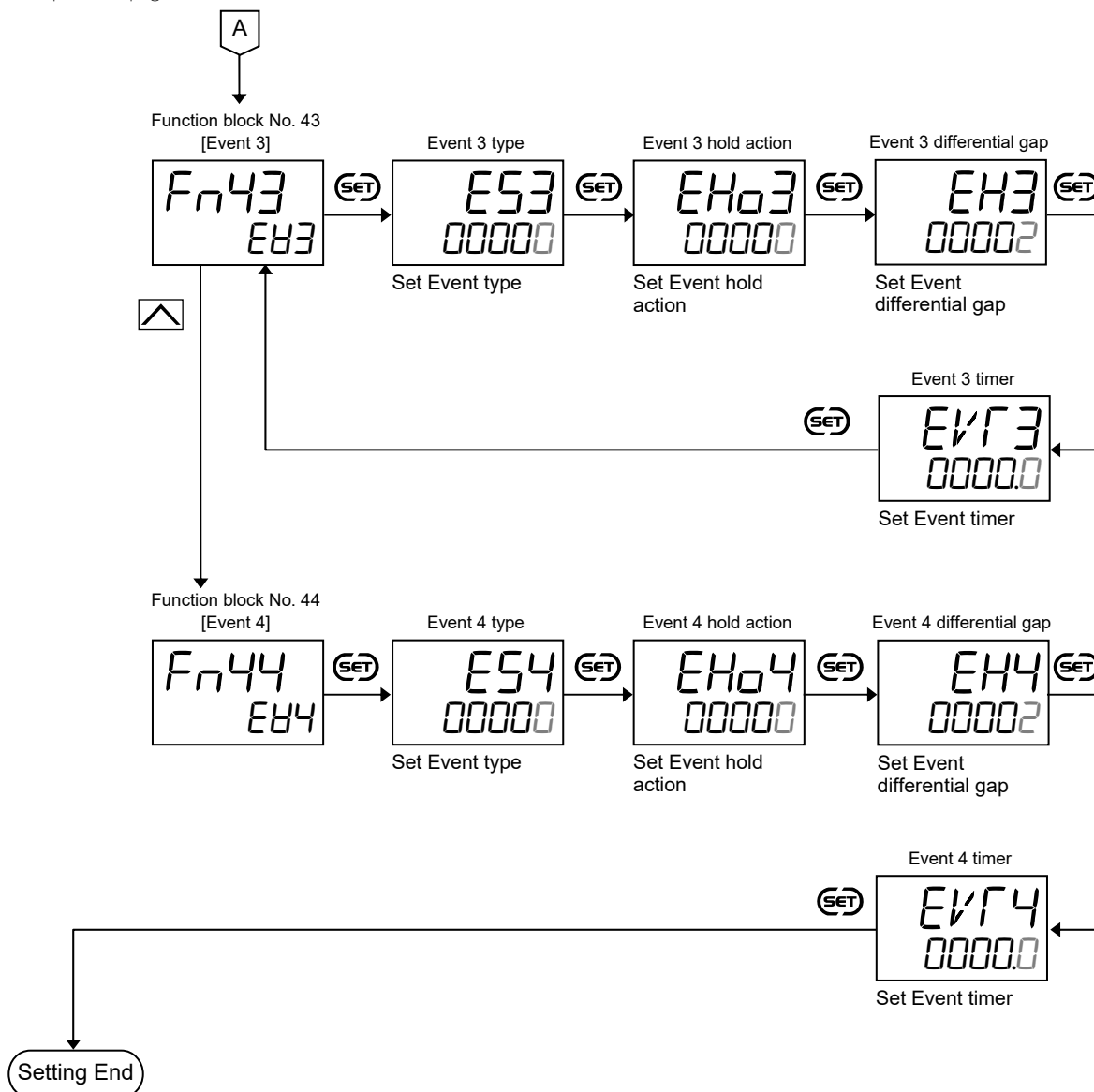
Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized when the Event 4 type is changed.

Setting procedure

To enter the Engineering mode



Continued from the previous page.



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

10.1.2 Adding hold action to the event action

On this instrument hold action or re-hold action can be added to the Event action.



Some event actions may not be available with hold and re-hold actions. Setting hold or re-hold action on the event that is not available with hold and re-hold actions will just be ignored.



Refer to Setting of Event types (P.10-10) for those events that are available with hold or re-hold action.

■ Description of function

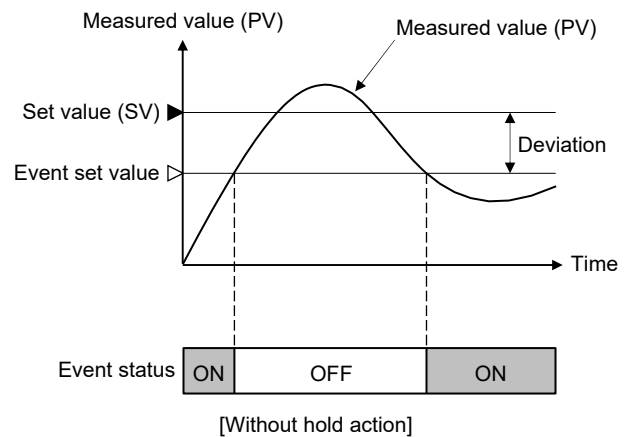
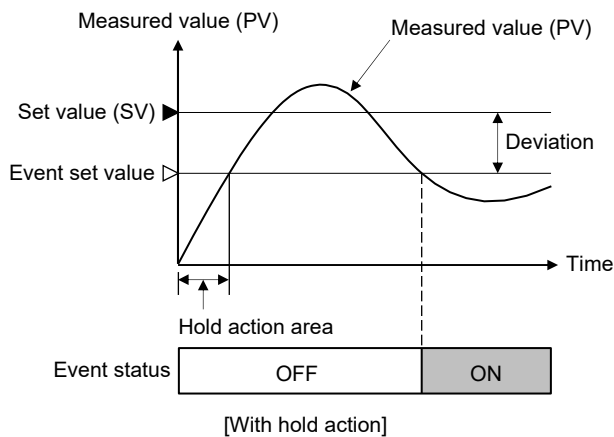
● Hold action

When the following operation is conducted, the Hold action deactivates the event function until the measured value (PV) leaves the event state once.

The Hold action is released when the measured value (PV) enters the Event OFF area.

- When the instrument is powered on
- When the mode is switched from Reset mode (RESET) or Manual control mode (MAN) to the Program control mode (RUN).
- When the mode is switched from Reset mode (RESET) or Manual control mode (MAN) to the Fixed set point control mode (FIX).

[Example] Difference between Deviation low “with Hold action” and “without Hold action”



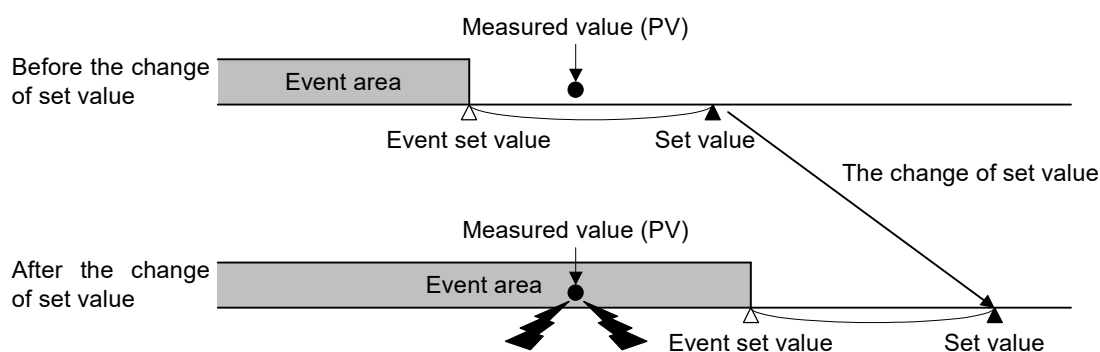
● Re-hold action

When Re-hold action is ON, the event action is also suppressed at the Set value (SV) change until the Measured value (PV) has entered the non-event range.

Action condition	Hold action	Re-hold action
When the power is turned on	Works	Works
When the mode is switched from Reset mode (RESET) or Manual control mode (MAN) to the Program control mode (RUN).	Works	Works
When the mode is switched from Reset mode (RESET) or Manual control mode (MAN) to the Fixed set point control mode (FIX).	Works	Works
When the Set value (SV) is changed	Does not work	Works

[Example] When Event 1 type is the deviation low:

When re-hold action is OFF and event output type is deviation, the event output is produced due to the Set value (SV) change. The re-hold action suppresses the alarm output until the measured value has entered the non-event range again.



NOTE

When high alarm with hold action/re-hold action is used for Event function, alarm does not turn on while hold action is in operation. Take measures to prevent overheating which may occur if the control device fails.



■ Parameter setting

● Event 1 hold action

[Engineering Mode: Function block No. 41 (Fn41)]

Parameter symbol	Data range	Factory set value
EHo1	0: Hold action OFF 1: Hold action ON 2: Re-hold action ON Setting hold or re-hold action on the event that is not available with hold and re-hold actions will just be ignored.	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital output function selection of initial setting code: 0

● Event 2 hold action

[Engineering Mode: Function block No. 42 (Fn42)]

Parameter symbol	Data range	Factory set value
EHo2	Same as Event 1 hold action (P. 10-16)	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital output function selection of initial setting code: 2

● Event 3 hold action

[Engineering Mode: Function block No. 43 (Fn43)]

Parameter symbol	Data range	Factory set value
EHo3	Same as Event 1 hold action (P. 10-16)	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital output function selection of initial setting code: 0

● Event 4 hold action

[Engineering Mode: Function block No. 44 (Fn44)]

Parameter symbol	Data range	Factory set value
EHo4	Same as Event 1 hold action (P. 10-16)	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital output function selection of initial setting code: 0

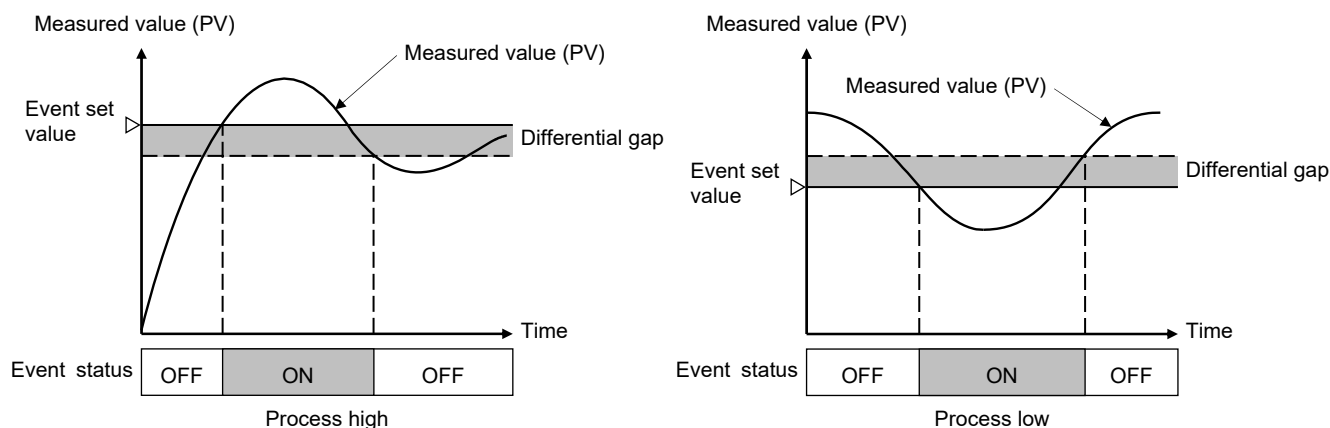
■ Setting procedure

Refer to the operation on P. 10-12.

10.1.3 Setting a differential gap in event action

■ Description of function

It prevents chattering of event output due to the measured value fluctuation around the Event set value.



■ Parameter setting

● Event 1 differential gap

[Engineering Mode: Function block No. 41 (Fn41)]

Parameter symbol	Data range	Factory set value
EH1	Deviation, Process and SV: 0 to Input span [Varies with the setting of the Decimal point position.] MV: 0.0 to 110.0 %	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 % of input span MV: 0.2

● Event 2 differential gap

[Engineering Mode: Function block No. 42 (Fn42)]

Parameter symbol	Data range	Factory set value
EH2	Same as Event 1 differential gap (P. 10-17)	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 % of input span MV: 0.2

**● Event 3 differential gap****[Engineering Mode: Function block No. 43 (Fn43)]**

Parameter symbol	Data range	Factory set value
EH3	Deviation, Process and SV: 0 to Input span [Varies with the setting of the Decimal point position.] MV: 0.0 to 110.0 %	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 % of input span MV: 0.2

● Event 4 differential gap**[Engineering Mode: Function block No. 44 (Fn44)]**

Parameter symbol	Data range	Factory set value
EH4	Same as Event 3 differential gap (P. 10-18)	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 % of input span MV: 0.2

■ Setting procedure

Refer to the operation on P. 10-12.

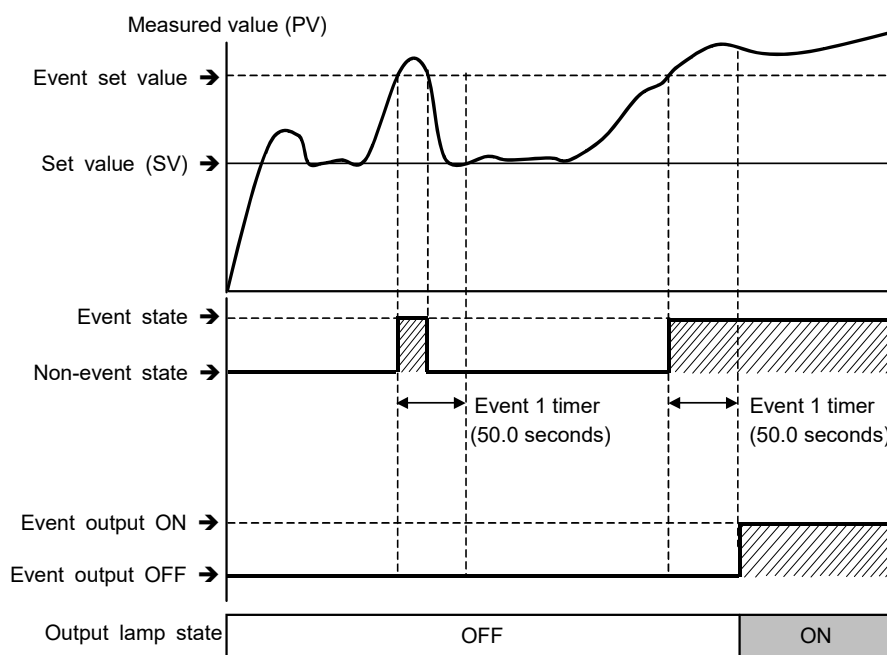
10.1.4 Preventing event from turning on due to a transient abnormal input

Event timer can be used to prevent event from turning on for the event state shorter than the set time.

■ Description of function

When an event condition becomes ON, the output is suppressed until the Event timer set time elapses. If the event output is still ON after time is up, the output will resume.

Example: When the setting of Event 1 timer is 50.0 seconds



The Event timer is also activated for the following reasons:

- When set to the event state simultaneously with power turned on
- The event state occurs simultaneously when the instrument enters the following mode from the Reset mode (RESET)
 - Program control mode (RUN)
 - Fixed set point control mode (FIX)
 - Manual control mode (MAN)



In the event wait state, no event output is turned on even after the Event timer preset time has elapsed.



The Event timer is reset for the following reasons:

- When power failure occurs while the Event timer is being activated
- When control is changed to RESET (Reset mode) from RUN (Program control mode) while the Event timer is being activated *
- Cancellation of Event state

* Event timer will not be reset by switching to the Reset mode (RESET) when logical operation output (OUT1 to OUT3 logic calculation selection) is selected for an Event and "logic calculation output: Action continues" is set for the Output action in Reset mode.



■ Parameter setting

● Event 1 timer

[Engineering Mode: Function block No. 41 (Fn41)]

Parameter symbol	Data range	Factory set value
EV1	0.0 to 600.0 seconds	0.0

● Event 2 timer

[Engineering Mode: Function block No. 42 (Fn42)]

Parameter symbol	Data range	Factory set value
EV2	0.0 to 600.0 seconds	0.0

● Event 3 timer

[Engineering Mode: Function block No. 43 (Fn43)]

Parameter symbol	Data range	Factory set value
EV3	0.0 to 600.0 seconds	0.0

● Event 4 timer

[Engineering Mode: Function block No. 44 (Fn44)]

Parameter symbol	Data range	Factory set value
EV4	0.0 to 600.0 seconds	0.0

■ Setting procedure

Refer to the operation on P. 10-12.

10.1.5 Changing event output assignment

Event output assignment can be changed through OUT1 to 3 function selection, DO1 to 4 function selection, OUT1 to 3 logic calculation selection, and DO1 to 4 logic calculation selection.

Depending on the ordered specifications, there may be some restrictions in the event output assignment.



For Event output assignment, refer to **9.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output, FAIL, Time Signal, Pattern End Signal]** (P. 9-2).

10.1.6 Changing the event set value

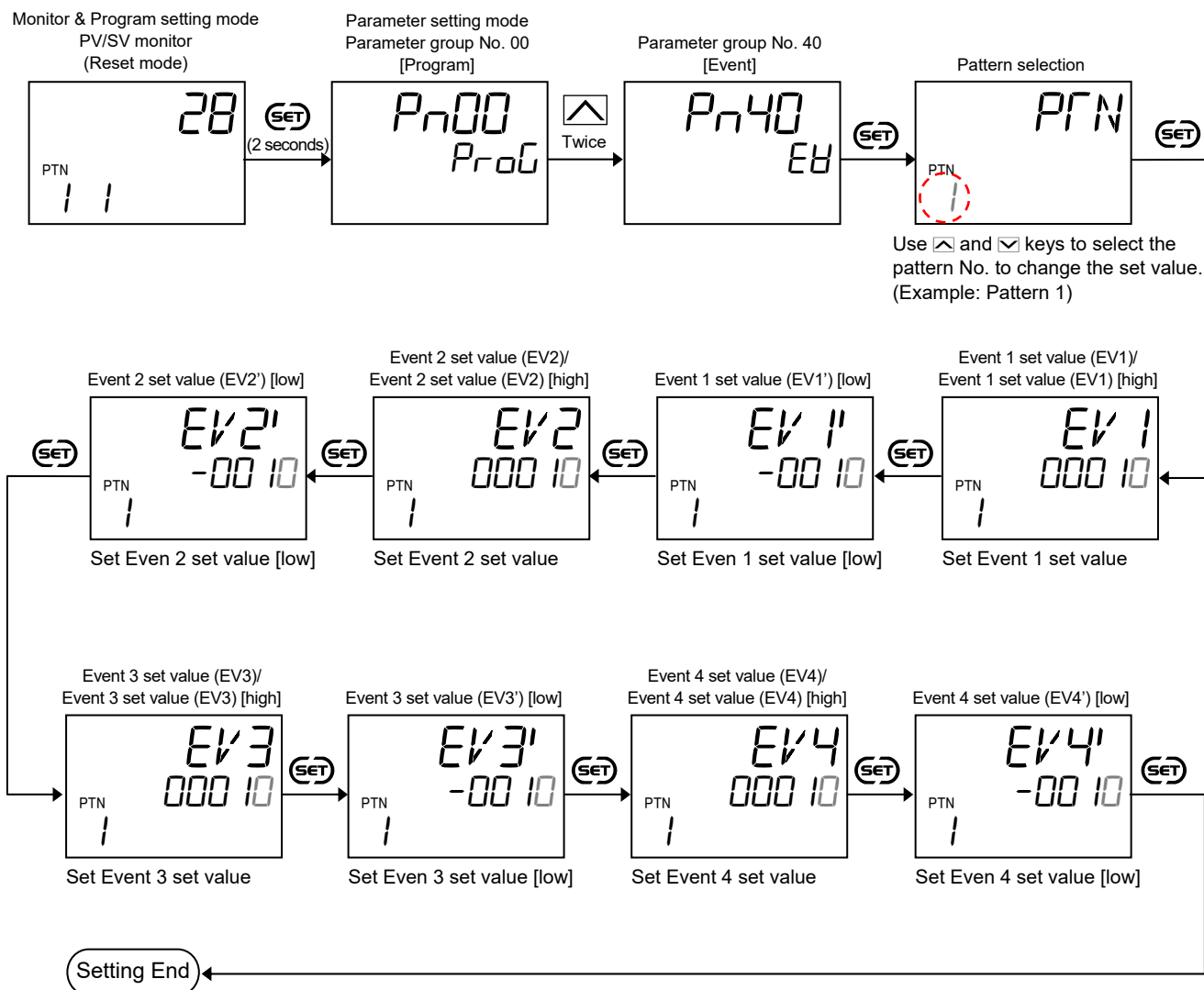
The Event set value can be set in Parameter group No. 40 in the Parameter setting mode.

The Event set value needs to be set for each pattern.



The Event set value for the Fixed set point control mode (FIX) and the Manual control mode (MAN) is the Event set value in the pattern No. selected for the operation mode (RESET, RUN) before switching.

■ Setting procedure

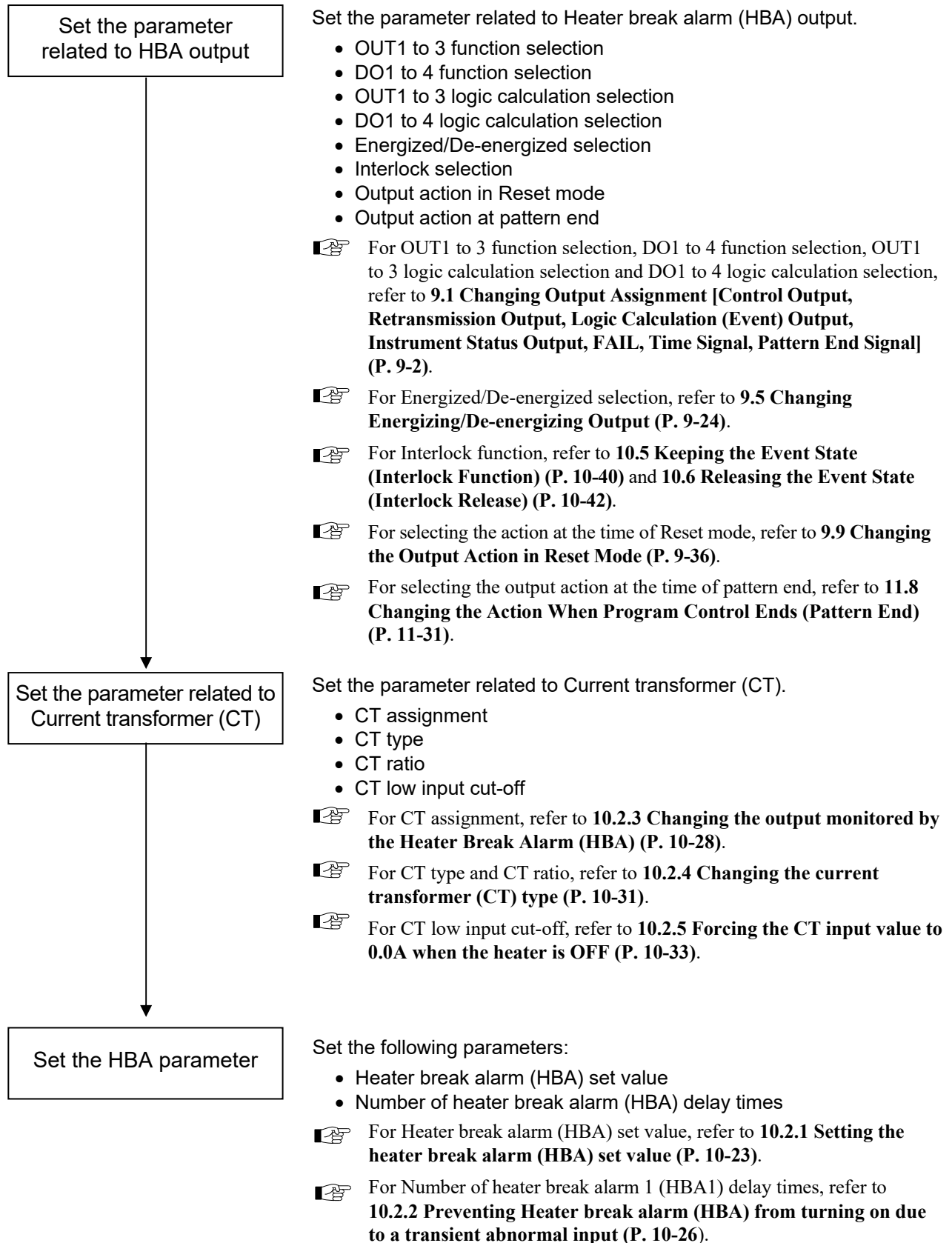


- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Setting range of Event 1 to 4 set value (EV1 to 4)/Event 1 to 4 set value (EV1 to 4) [high]
 - Deviation: -Input span to +Input span
 - Input value or Set value: Input range low to Input range high
 - Manipulated output value: -5.0 to +105.0 %
- Setting range of Event 1 to 4 set value (EV1' to 4') [low]
 - Deviation: -Input span to +Input span
 - Input value: Input range low to Input range high

10.2 Using Heater Break Alarm (HBA)

■ Setting procedure for Heater break alarm (HBA)

Set Heater break alarm (HBA) as follows:



10.2.1 Setting the Heater break alarm (HBA) set value

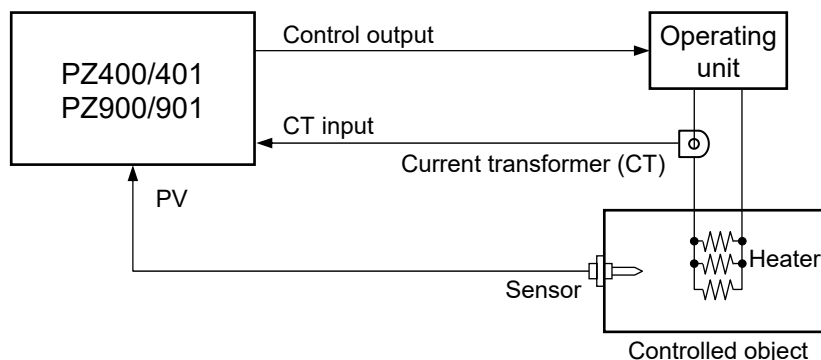
■ Description of function

● Heater break alarm (HBA)

Heater break alarm (HBA) can only be used with time-proportional control output (relay or voltage pulse output). The Heater break alarm (HBA) function monitors the current flowing through the load by a dedicated current transformer (CT), then compares the measured value with the Heater break alarm (HBA) set values, and detects a fault in the heating circuit.

The Heater break alarm (HBA) function is activated for the following cases:

- ① Low or No current flow (Heater break, malfunction of the control device, etc.):
When the control output is ON and the CT input value is equal to or less than the heater break determination point for the preset number of consecutive sampling cycles, an alarm is activated.
- ② Over current or short-circuit:
When the control output is OFF and the CT input value is equal to or greater than the heater break determination point for the preset number of consecutive sampling cycles, an alarm is activated.



[Setting Heater Break Alarm]

Set the HBA set value to approximately 85 % of the maximum reading of the CT input.

Set the HBA set value to a slightly smaller value to prevent a false alarm if the power supply becomes unstable. When more than one heater is connected in parallel, the HBA set value may need to be increased to detect a single heater failure.

Current transformer (CT) input value can be checked from the set value of the Heater break alarm 1 (HBA1) or the Heater break alarm 2 (HBA2) value setting screen on the TIME display. Use as a reference for setting Heater break alarm (HBA) set value.

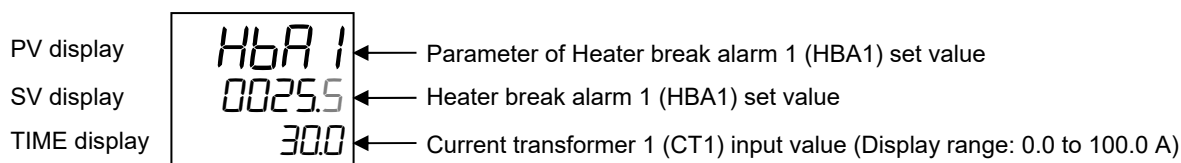
TIME display on “Heater break alarm 1 (HBA1) set value” screen:

The Current transformer 1 (CT1) input value is displayed.

TIME display on “Heater break alarm 2 (HBA2) set value” screen:

The Current transformer 2 (CT2) input value is displayed.

[Display example] Heater break alarm 1 (HBA1) set value screen





■ Parameter setting

● Heater break alarm 1 (HBA1) set value

[Setup Setting Mode: Setting group No. 45 (5n45)]

Parameter symbol	Data range	Factory set value
HbA1	0.0 to 100.0 A 0.0: HBA function OFF	0.0



To display “Heater break alarm 1 (HBA1) set value,” “CT input” must be specified at the time of order.



This parameter is not displayed if “no assignment” is set at “CT1 assignment” in Function block 45 in Engineering mode. If the output type assigned at “CT1 assignment” is Current output or Continuous voltage output, this parameter will not be displayed.

● Heater break alarm 2 (HBA2) set value

[Setup Setting Mode: Setting group No. 46 (5n46)]

Parameter symbol	Data range	Factory set value
HbA2	0.0 to 100.0 A 0.0: HBA function OFF	0.0

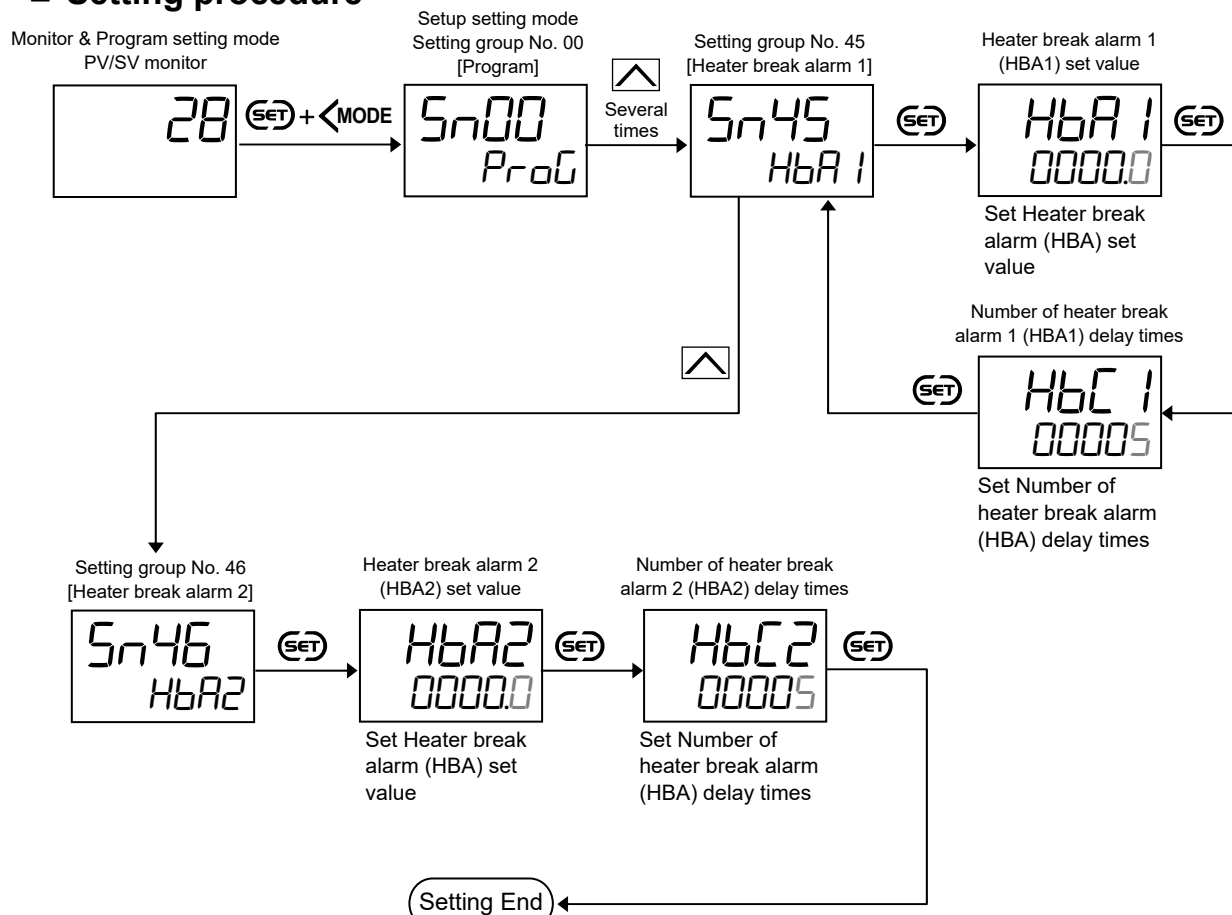


To display “Heater break alarm 2 (HBA2) set value,” “CT input” must be specified at the time of order.



This parameter is not displayed if “no assignment” is set at “CT2 assignment” in Function block 46 in Engineering mode. If the output type assigned at “CT2 assignment” is Current output or Continuous voltage output, this parameter will not be displayed.

Setting procedure



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.



10.2.2 Preventing Heater break alarm (HBA) from turning on due to a transient abnormal input

There is a function called HBA delay time which suppresses the alarm when the Heater break alarm (HBA) state is less than the setting (the number of sampling).

■ Description of function

● Number of HBA delay times

This is a function to allow the Heater break alarm (HBA) to turn on if the Heater break alarm (HBA) ON condition continues beyond the setting (the number of sampling).

Heater break alarm (HBA) delay times = Number of HBA delay times × Sampling time *

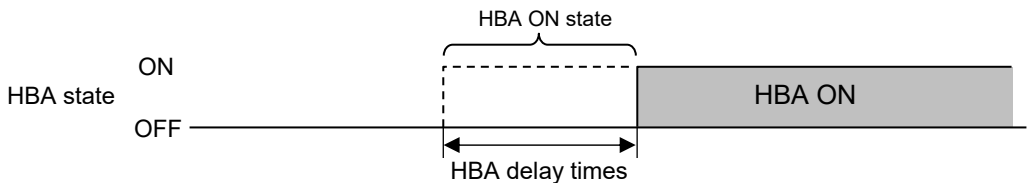
*The sampling cycle time is the shortest. It varies with the load factor (Output ON or OFF time).

Example:

Sampling cycle: 0.5 seconds

Number of HBA delay times: 5 times (Factory set value)

$$\text{HBA delay times} = 5 \text{ times} \times 0.5 \text{ seconds} = 2.5 \text{ seconds}$$



■ Parameter setting

● Number of heater break alarm 1 (HBA1) delay times

[Setup Setting Mode: Setting group No. 45 (5n45)]

Parameter symbol	Data range	Factory set value
HbC 1	0 to 255 times	5



To display “Number of heater break alarm 1 (HBA1) delay times,” “CT input” must be specified at the time of order.



This parameter is not displayed if “no assignment” is set at “CT1 assignment” in Function block 45 in Engineering mode. If the output type assigned at “CT1 assignment” is Current output or Continuous voltage output, this parameter will not be displayed.

● **Number of heater break alarm 2 (HBA2) delay times**
[Setup Setting Mode: Setting group No. 46 (5th46)]

Parameter symbol	Data range	Factory set value
HbC2	0 to 255 times	5



To display “Number of heater break alarm 2 (HBA2) delay times,” “CT input” must be specified at the time of order.



This parameter is not displayed if “no assignment” is set at “CT2 assignment” in Function block 46 in Engineering mode. If the output type assigned at “CT2 assignment” is Current output or Continuous voltage output, this parameter will not be displayed.

■ **Setting procedure**

Refer to the operation on P. 10-25.

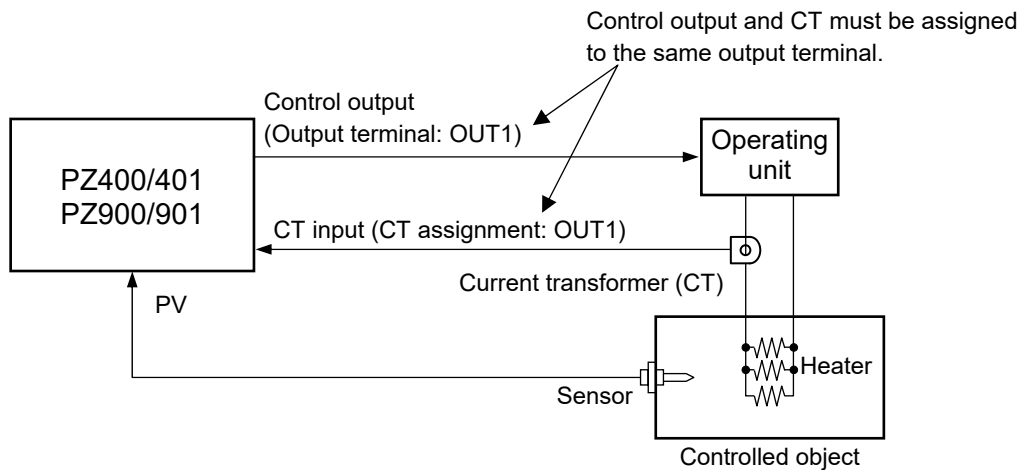
10.2.3 Changing the output monitored by the Heater break alarm (HBA)

Assignment of control output monitored by Current transformer (CT) used with Heater break alarm (HBA) can be changed.

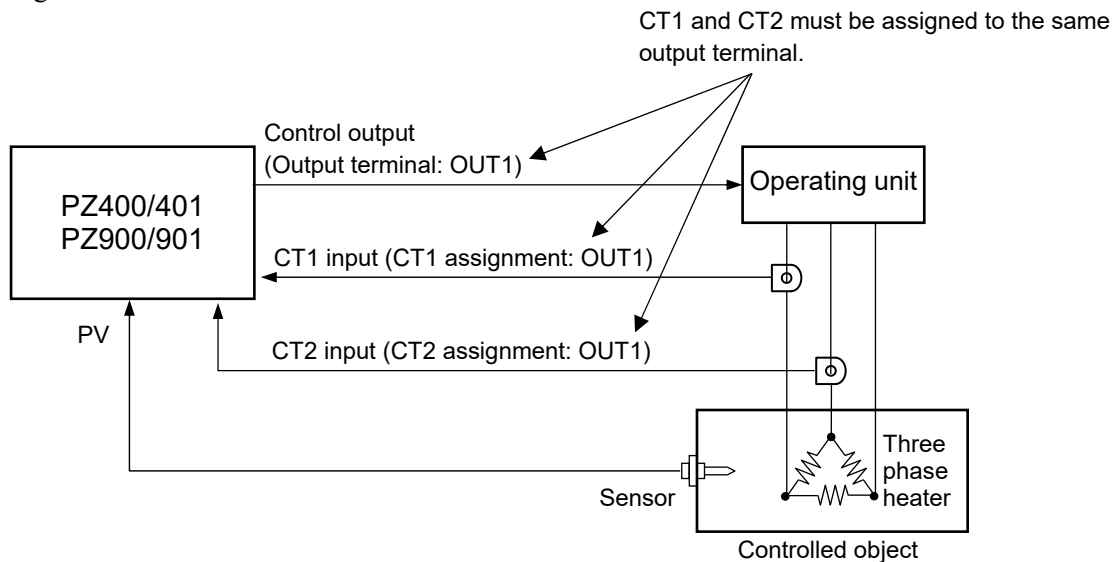
■ Description of function

● CT assignment

The Current transformer (CT) input used by the Heater break alarm (HBA) monitors the output from the output device controlled by the control output from the controller. If the output terminal of the control output from the instrument is changed, assignment of the CT needs to be changed accordingly.



When there are two CT inputs, to detect a break in three phase heater, CT1 and CT2 must be assigned to the same terminal.



■ Parameter setting

● CT1 assignment

[Engineering Mode: Function block No. 45 (F_{n45})]

Parameter symbol	Data range	Factory set value
$CFR1$	0: None 1: OUT1 2: OUT2 3: OUT3	1



To display “CT1 assignment,” “CT input” must be specified at the time of order.

● CT2 assignment

[Engineering Mode: Function block No. 46 (F_{n46})]

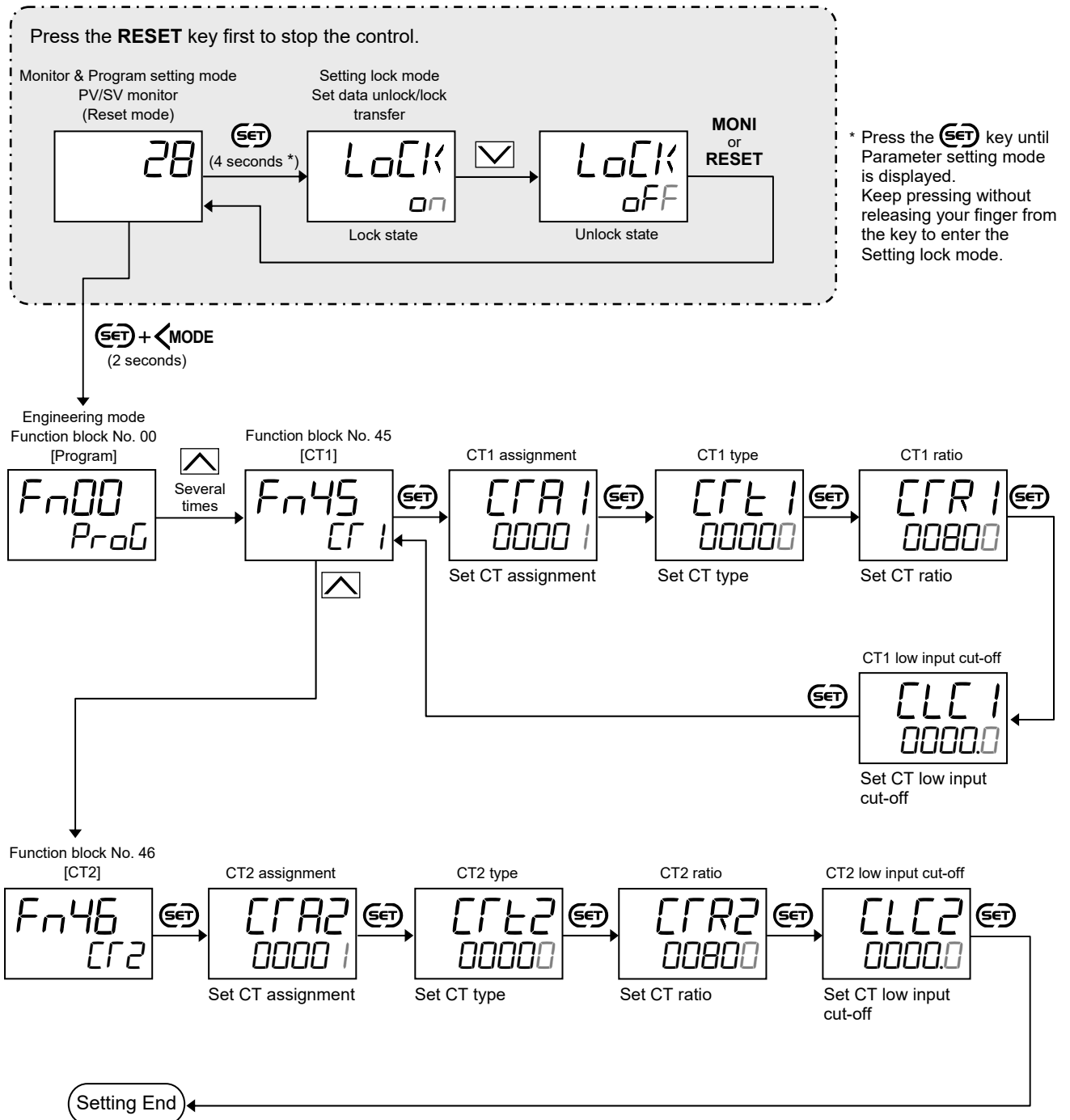
Parameter symbol	Data range	Factory set value
$CFR2$	0: None 1: OUT1 2: OUT2 3: OUT3	1



To display “CT2 assignment,” “CT input” must be specified at the time of order.

Setting procedure

To enter the Engineering mode



* Press the **SET** key until Parameter setting mode is displayed. Keep pressing without releasing your finger from the key to enter the Setting lock mode.

- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

10.2.4 Changing the Current transformer (CT) type

When a Current transformer (CT) type is changed, change the CT type on the instrument.

Input range of Current transformer (CT)

- CTL-6-P-N: 0 to 30 A
- CTL-12-S56-10L-N: 0 to 100A
- CTL-6-P-Z: 0 to 10 A

■ Parameter setting

● CT1 type

[Engineering Mode: Function block No. 45 (F_{n45})]

Parameter symbol	Data range	Factory set value
 CTE1	0: CTL-6-P-N 1: CTL-12-S56-10L-N 2: CTL-6-P-Z	Based on Model code



To display “CT1 type,” “CT input” must be specified at the time of order.



After “CT1 type” is changed, the value of “CT1 ratio” is initialized and set to an appropriate CT type.

- CT ratio value
- CTL-6-P-N: 800
 - CTL-12-S56-10L-N: 1000
 - CTL-6-P-Z: 800



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized when the CT1 type is changed.

● CT1 ratio

[Engineering Mode: Function block No. 45 (F_{n45})]

Parameter symbol	Data range	Factory set value
 CTR1	0 to 9999 When the CT type is changed, the following value will be automatically set. CTL-6-P-N: 800 CTL-12-S56-10L-N: 1000 CTL-6-P-Z: 800	If CTL-6-P-N or CTL-6-P-Z is specified for the Current transformer (CT) type: 800 If CTL-12-S56-10L-N is specified for the Current transformer (CT) type: 1000



To display “CT1 ratio,” “CT input” must be specified at the time of order.



● CT2 type

[Engineering Mode: Function block No. 46 (Fn46)]

Parameter symbol	Data range	Factory set value
CT2	0: CTL-6-P-N 1: CTL-12-S56-10L-N 2: CTL-6-P-Z	Based on Model code



To display “CT2 type,” “CT input” must be specified at the time of order.
(When CT input is specified on PZ400/900/401/901, two CT inputs are supplied.)



After “CT2 type” is changed, the value of “CT2 ratio” is initialized and set to an appropriate CT type.

CT ratio value

- CTL-6-P-N: 800
- CTL-12-S56-10L-N: 1000
- CTL-6-P-Z: 800



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized when the CT2 type is changed.

● CT2 ratio

[Engineering Mode: Function block No. 46 (Fn46)]

Parameter symbol	Data range	Factory set value
CT2	0 to 9999 When the CT type is changed, the following value will be automatically set. CTL-6-P-N: 800 CTL-12-S56-10L-N: 1000 CTL-6-P-Z: 800	If CTL-6-P-N or CTL-6-P-Z is specified for the Current transformer (CT) type: 800 If CTL-12-S56-10L-N is specified for the Current transformer (CT) type: 1000



To display “CT2 ratio,” “CT input” must be specified at the time of order.

■ Setting procedure

Refer to the operation on P. 10-30.

10.2.5 Forcing the CT input value to 0.0 A when the heater is OFF

If the Current transformer (CT) input value exceeds 0.0 A while the heater is off, the input value of the Current transformer (CT) can be forced to 0.0 A.

■ Description of function

● CT low input cut-off

The CT input value may exceed 0.0 A while the heater is OFF (control output is OFF). In such a case CT low input cut-off may be used. This is a function to force the CT input which is below the set value to 0.0 A.



Note that Heater break alarm (HBA) may not work properly if setting such as follows is made when the CT low input cut-off function is used.

CT low input cut-off set value > Heater break alarm (HBA) set value

[Example] CT low input cut-off set value: 1.0 A and Heater break alarm (HBA) set value: 0.5 A

- If the CT input value is 0.8 A when the control output is ON, the CT input value becomes 0.0 A, causing the Heater break alarm (HBA) to turn on.
→ Actually the CT input value is larger than the HBA set value and the HBA is OFF.
- If the CT input value is 0.8 A when the control output is OFF, the CT input value becomes 0.0 A, causing the Heater break alarm (HBA) to turn off.
→ Actually the CT input value is larger than the HBA set value and the HBA is ON.

If current larger than the CT low input cut-off set value is given, HBA functions properly.

■ Parameter setting

● CT1 low input cut-off

[Engineering Mode: Function block No. 45 (Fn45)]

Parameter symbol	Data range	Factory set value
	0.0 to 1.0 A	0.0



To display “CT1 low input cut-off,” “CT input” must be specified at the time of order.

● CT2 low input cut-off

[Engineering Mode: Function block No. 46 (Fn46)]

Parameter symbol	Data range	Factory set value
	0.0 to 1.0 A	0.0



To display “CT2 low input cut-off,” “CT input” must be specified at the time of order.

■ Setting procedure

Refer to the operation on P. 10-30.



10.3 Using Control Loop Break Alarm (LBA)

■ Setting procedure for Control loop break alarm (LBA)

Set Control loop break alarm (LBA) as follows:

Set the parameter
related to LBA output

Set the parameter related to LBA output.

- OUT1 to 3 function selection
- DO1 to 4 function selection
- OUT1 to 3 logic calculation selection
- DO1 to 4 logic calculation selection
- Energized/De-energized selection
- Interlock selection



For OUT1 to 3 function selection, DO1 to 4 function selection, OUT1 to 3 logic calculation selection and DO1 to 4 logic calculation selection, refer to **9.1 Changing Output Assignment [Control Output, Retransmission Output, Logic Calculation (Event) Output, Instrument Status Output, FAIL, Time Signal, Pattern End Signal] (P. 9-2)**.



For Energized/De-energized selection, refer to **9.5 Changing Energizing/De-energizing Output (P. 9-24)**.



For Interlock function, refer to **10.5 Keeping the Event State (Interlock Function) (P. 10-40)** and **10.6 Releasing the Event State (Interlock Release) (P. 10-42)**.

Set LBA time and LBD

Set the following parameters:

- Control loop break alarm (LBA) time
- LBA deadband (LBD)



For the parameter description, refer to **■ Description of function (P. 10-35)**.



For the data range of parameter, refer to **■ Parameter setting (P. 10-36)**.

Description of function

The Control loop break alarm (LBA) function is used to detect a load (heater) break or a failure in the external actuator (power controller, magnet relay, etc.), or a failure in the control loop caused by an input (sensor) break. The LBA function is activated when control output reaches 0 % (low limit with output limit function) or 100 % (high limit with output limit function). LBA monitors variation of the Measured value (PV) for the length of LBA time. When the LBA time has elapsed and the PV is still within the alarm determination range, the LBA will be ON.

[Alarm action]

LBA determination range: TC/RTD input: 2 °C [°F] (fixed)

Voltage /Current input: 0.2 % of input span (fixed)

● Heating control

		When the output reaches 0 % (low limit with output limit function)	When the output exceeds 100 % (high limit with output limit function)
LBA occurring condition	For reverse action	When the LBA time has passed and the Measured value (PV) has not fallen below the alarm determination range, the alarm will be turned on.	When the LBA time has passed and the Measured value (PV) has not risen beyond the alarm determination range, the alarm will be turned on.
	For direct action	When the LBA time has passed and the Measured value (PV) has not risen beyond the alarm determination range, the alarm will be turned on.	When the LBA time has passed and the Measured value (PV) has not fallen below the alarm determination range, the alarm will be turned on.

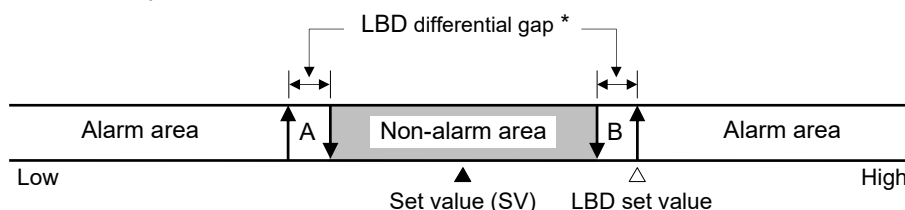
● Heat/Cool control

		When the heat-side output exceeds 100 % (high limit with heat-side output limit function) and the cool-side output reaches 0 % (A) *	When the heat-side output reaches 0 % and the cool-side output exceeds 100 % (high limit with cool-side output limit function) (B) *
LBA occurring condition		When the LBA time has passed and the Measured value (PV) has not risen beyond the alarm determination range, the alarm will be turned on.	When the LBA time has passed and the Measured value (PV) has not fallen below the alarm determination range, the alarm will be turned on.

* If conditions of (A) and (B) are both met, priority is given to (A).

● LBA deadband (LBD)

The Control loop break alarm (LBA) may malfunction due to external disturbances. To prevent malfunction due to external disturbance, LBA deadband (LBD) sets a neutral zone in which Control loop break alarm (LBA) is not activated. When the Measured value (PV) is within the LBA deadband (LBD) area, Control loop break alarm (LBA) will not be activated. If the LBA deadband (LBD) setting is not correct, the LBA will not work correctly.



* TC/RTD input: 0.8 °C [°F] (fixed)
Voltage/Current input: 0.8 % of input span (fixed)

A: During temperature rise: Alarm area During temperature fall: Non-alarm area
B: During temperature rise: Non-alarm area During temperature fall: Alarm area



LBA function is not available:

- when displaying Input type and Input range after turning ON the power.
- during Autotuning (AT).
- in the Reset mode (RESET).
- when Control loop break alarm (LBA) time is “0.”
- when Position proportioning PID control is used without specifying feedback resistance (FBR) at Option 1 at the time of ordering.
- when Feedback resistance (FBR) is not supplied on the Position proportioning PID control.



If the Control loop break alarm (LBA) setting time does not match the controlled object requirements, the Control loop break alarm (LBA) setting time should be lengthened. If setting time is not correct, the Control loop break alarm (LBA) will malfunction by turning on or off at inappropriate times or not turning on at all.



While the LBA is ON (under alarm status), the following conditions cancel the alarm status and LBA will be OFF.

- The Measured value (PV) rises beyond (or falls below) the LBA determination range within the LBA time.
- The Measured value (PV) enters within the LBA deadband (LBD).



If the Autotuning (AT) is used, the Control loop break alarm (LBA) time is automatically set twice as large as the integral time. The Control loop break alarm (LBA) time will not change even if the integral time is changed. If the Control loop break alarm (LBA) time is “0” and Autotuning (AT) is executed, the Control loop break alarm (LBA) will not be set.



If the Control loop break alarm (LBA) function detects an error occurring in the control loop, but cannot specify the location, the control loop should be checked. The Control loop break alarm (LBA) function does not detect the location which causes alarm status. If Control loop break alarm (LBA) is ON, check each device or wiring in the control loop.

■ Parameter setting

● Control loop break alarm (LBA) time

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
LBA	0 to 7200 seconds 0: No function	If the LBA is specified by the digital output function selection of initial setting code: 480 If the LBA is not specified by the digital output function selection of initial setting code: 0

● LBA deadband (LBD)

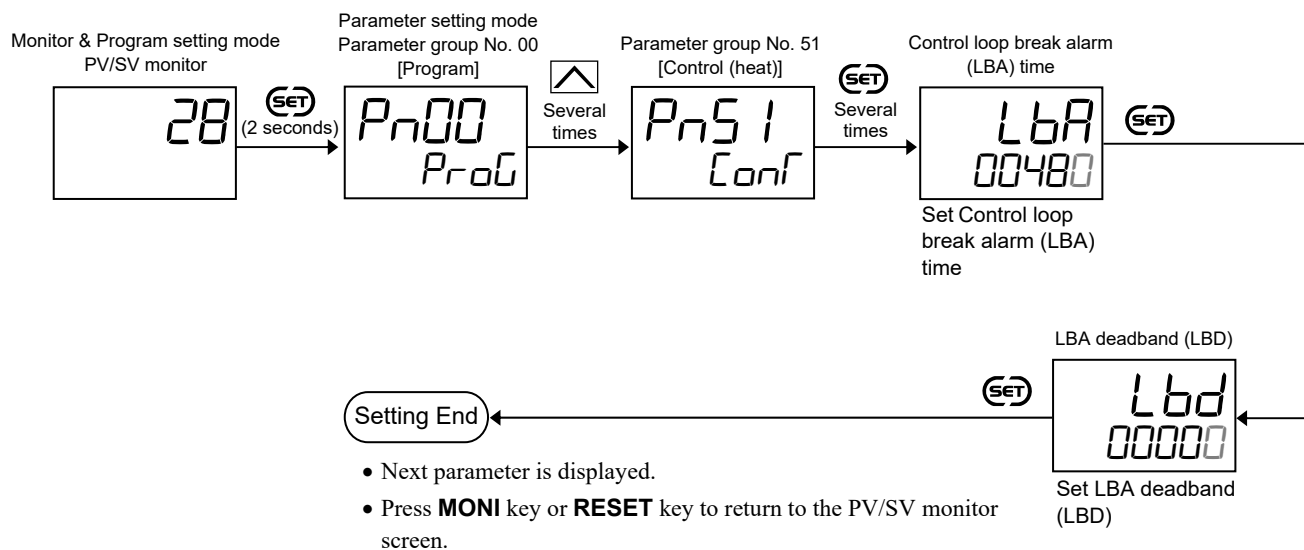
[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

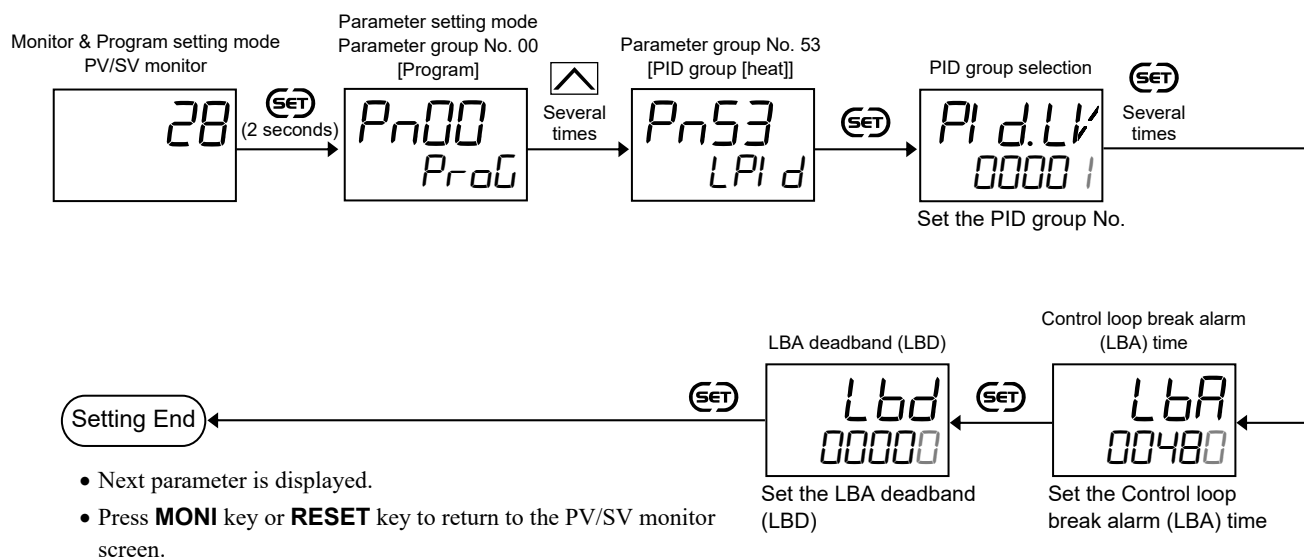
Parameter symbol	Data range	Factory set value
Lbd	0 to Input span [Varies with the setting of the Decimal point position.]	0

Setting procedure

[without Level-PID]



[with Level-PID]



10.4 Checking Event ON State

The event ON state can be checked with the ALM lamp or on the Comprehensive event state screen in the Monitor & Program setting mode.

■ Display contents

● ALM lamp

When the event is in the ON state, the ALM lamp turns on. ALM lamp lights by logical *OR*. ALM lamp lights on when any one of the selected events occurs. Combination of ALM lamp lighting condition can be set freely.

The setting can be done at ALM lamp lighting condition (Function block 10 in Engineering mode)

[Events that illuminate the lamp]

- Event 1
- Event 2
- Event 3
- Event 4
- Heater break alarm 1 (HBA1)
- Heater break alarm 2 (HBA2)
- Control loop break alarm (LBA)
- Input error high
- Input error low

Display example



● Comprehensive event state

When an event occurs, the character of the occurring event item is displayed on the SV display unit. If two or more events occur at the same time, the relevant characters are displayed alternately every 0.5 seconds.

[Event items]

- Event 1 [EVR 1]
- Event 2 [EVR 2]
- Event 3 [EVR 3]
- Event 4 [EVR 4]
- Heater break alarm 1 (HBA1) [HbA 1]
- Heater break alarm 2 (HBA2) [HbA2]
- Control loop break alarm (LBA) [LbA]
- Input error high [I nP.UP]
- Input error low [I nP.dn]

Display example



Parameter setting

ALM lamp lighting condition

[Engineering Mode: Function block No. 10 ($F_n 10$)]

Parameter symbol	Data range	Factory set value
ALC	0 to 511 0: OFF +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Heater break alarm 1 (HBA1) +32: Heater break alarm 2 (HBA2) +64: Control loop break alarm (LBA) +128: Input error high +256: Input error low To select two or more functions, sum each value.	127

For details of setting method, refer to **13.3 Changing the ALM Lamp Lighting Condition (P. 13-20)**.

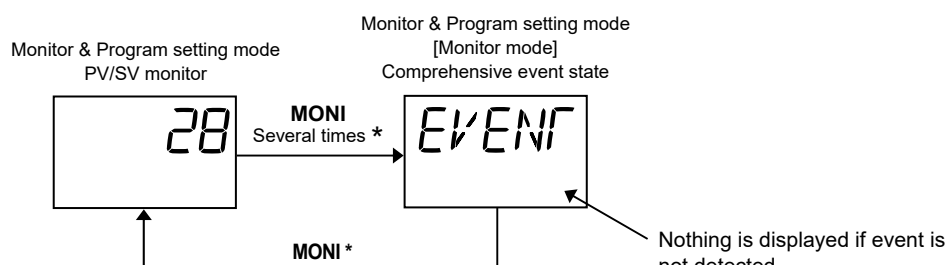
Comprehensive event state

[Monitor & Program Setting Mode]

Parameter symbol	Data range	Factory set value
EVENT	EV1 : Event 1 EV2 : Event 2 EV3 : Event 3 EV4 : Event 4 HbA1 : Heater break alarm 1 (HBA1) HbA2 : Heater break alarm 2 (HBA2) LbA : Control loop break alarm (LBA) IP.HI : Input error high IP.LO : Input error low	—

Display operation

[Comprehensive event state]



* MODE key may be used instead.

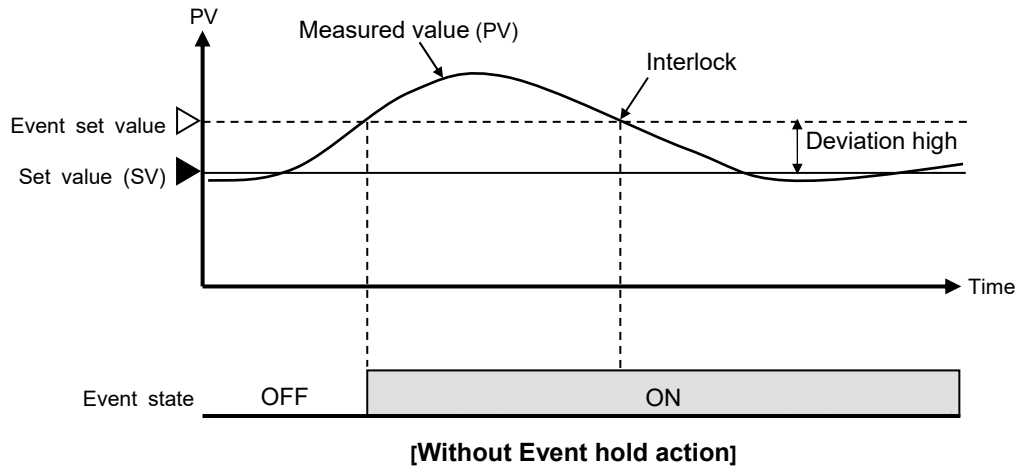
10.5 Keeping the Event State (Interlock Function)

■ Description of function

The Event interlock function holds the event state (including the HBA, the LBA and the input error) even if the Measured value (PV) is out of the event zone after it enters the event zone once.

Interlock can be set for the Event, Heater break alarm (HBA), Control loop break alarm (LBA) and Input error.

Example: When the Event interlock function is used for Deviation high



For the interlock release, refer to **10.6 Releasing the Event State (Interlock Release) (P. 10-42)**.

■ Parameter setting

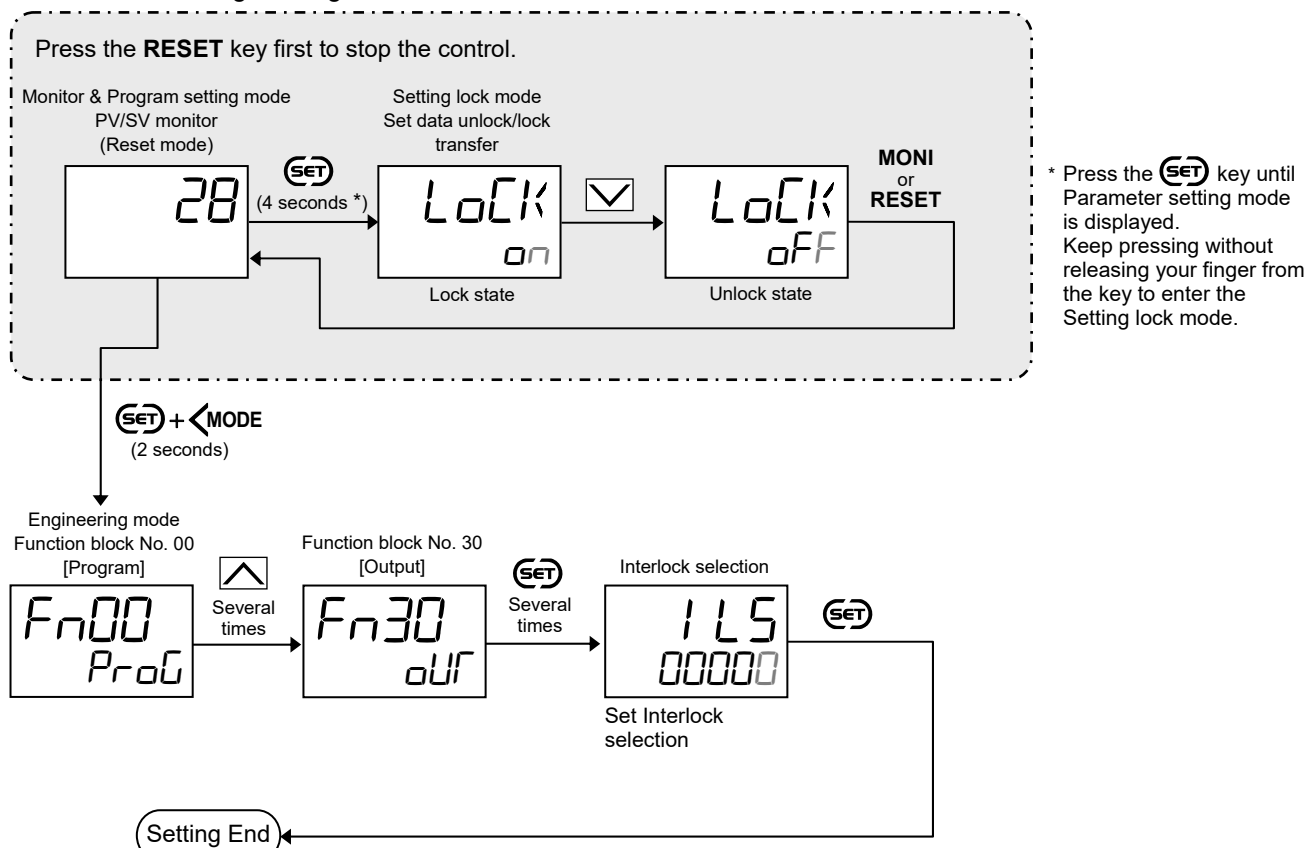
● Interlock selection

[Engineering Mode: Function block No. 30 (F_{n30})]

Parameter symbol	Data range	Factory set value
115	0 to 511 0: Unused +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Heater break alarm 1 (HBA1) +32: Heater break alarm 2 (HBA2) +64: Control loop break alarm (LBA) +128: Input error high +256: Input error low To select two or more functions, sum each value.	0

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

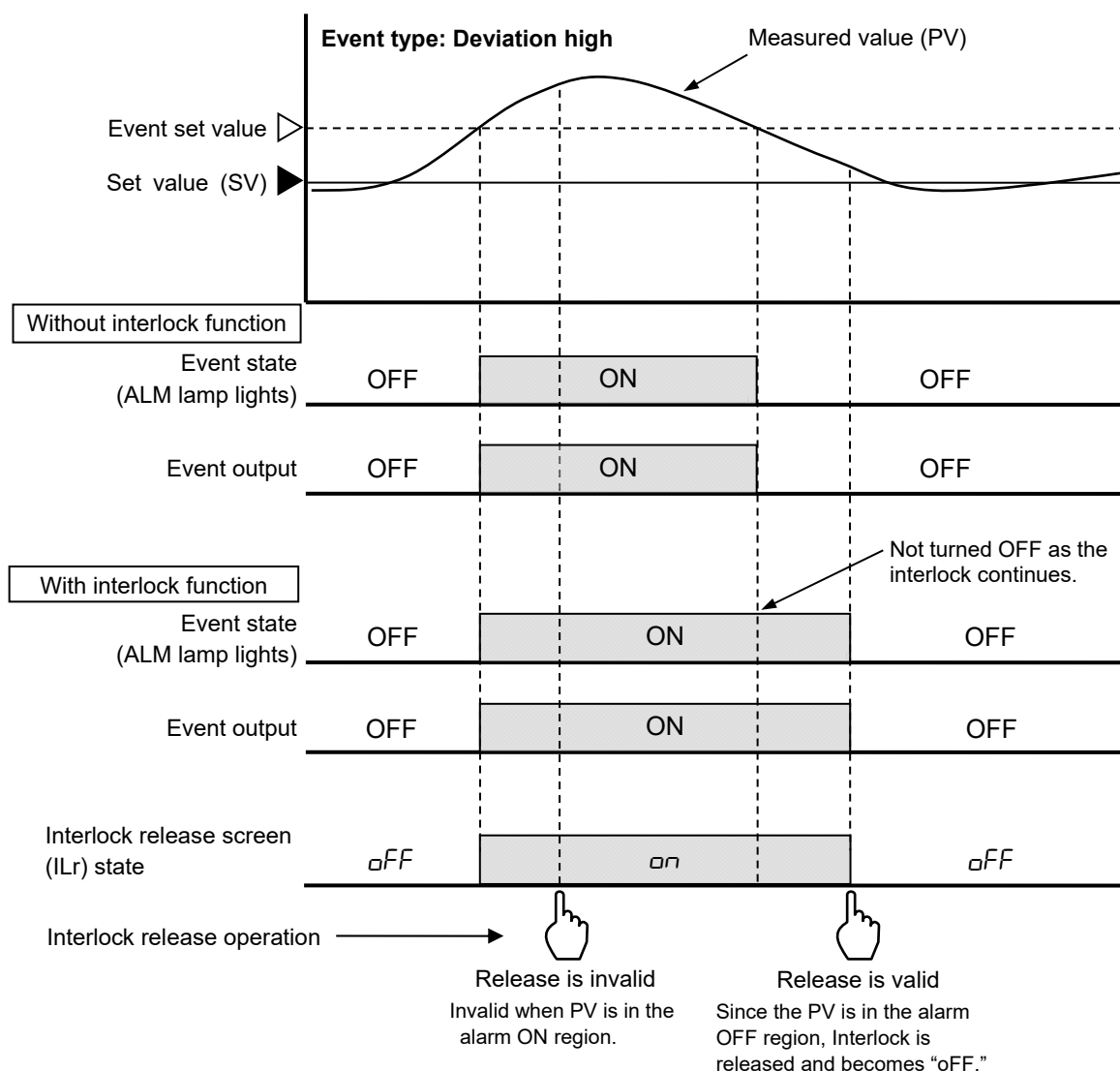
10.6 Releasing the Event State (Interlock Release)

■ Description of function

The Event interlock function holds the event state (including the HBA, the LBA and the input error) even if the Measured value (PV) is out of the event zone after it enters the event zone once.

The Interlock may be released by Digital input (DI) and Communication (optional) as well as key operation.

The following picture shows how to release the interlock.



The Interlock release has an influence to all events, Heater break alarm (HBA), Control loop break alarm (LBA) and input error that are in the interlock state and releases such events at one time whose interlock release conditions are met.



For Interlock release through Digital input (DI), refer to **8.2 Switching Functions Using Digital Inputs (DI)** (P. 8-11).



For Interlock release through Communication, refer to **PZ400/PZ900/PZ401/PZ901 Host Communication Instruction Manual (IMR03B06-E□)**.

■ Parameter setting

● Interlock release

[Operation Transfer Mode]

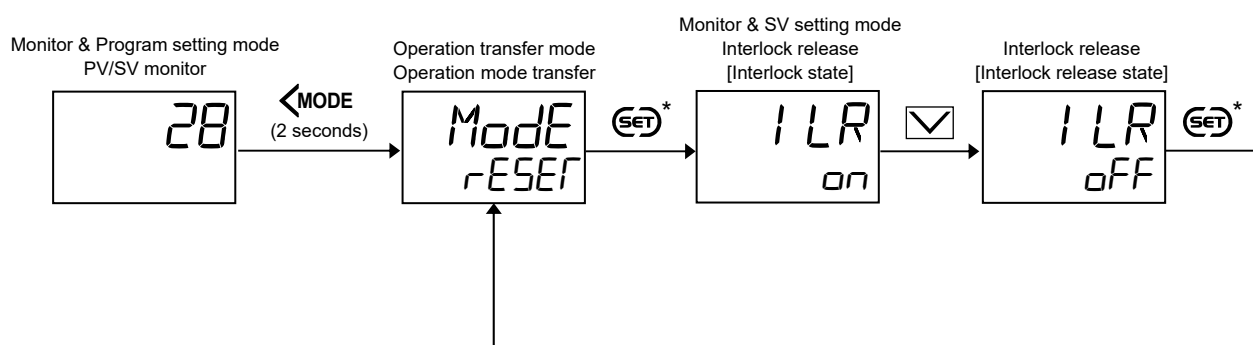
Parameter symbol	Data range	Factory set value
ILR	oFF: Interlock release oN: Interlock state	oFF



To display “Interlock release,” the Interlock selection must be set (Function block No. 30 in Engineering mode) other than “Unused.”

■ Setting procedure

After the Interlock is set, the Interlock release screen shows “oN” automatically.



* **MODE** key may be used instead.

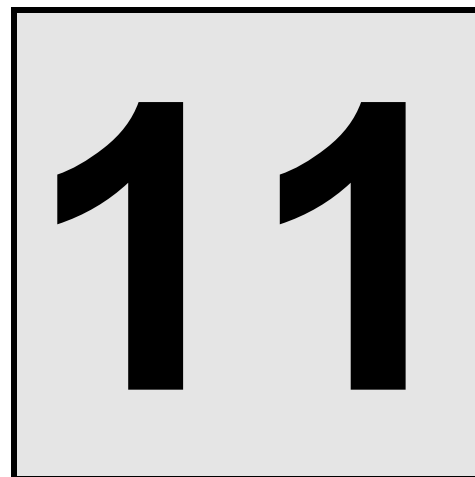
However, press the **SET** key to confirm the setting.



MEMO



FUNCTIONS RELATED TO PROGRAM CONTROL



This chapter focuses on operations relating to program control, and explains the functions, setting details, and setting operations for each one.

11.1 Executing Program Control	11-2
11.2 Changing the Level When Program Control Starts.....	11-16
11.3 Pausing a Program (Hold)	11-20
11.4 Moving a Program Forward by One Segment (Step).....	11-22
11.5 Waiting When a Measured Value Cannot Keep Up with a Program (Wait).....	11-23
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11.7 Using a Program with 16 or More Segments (Pattern Link)	11-29
11.8 Changing the Action When Program Control Ends (Pattern End)	11-31
11.9 Outputting a Signal According to the Progress of a Program (Time Signal).....	11-37
11.10 Changing the Settings Change Action During Program Control	11-46
11.11 Copying Program Pattern Data	11-50
11.12 Setting Event Used/Unused at Each Segment.....	11-52

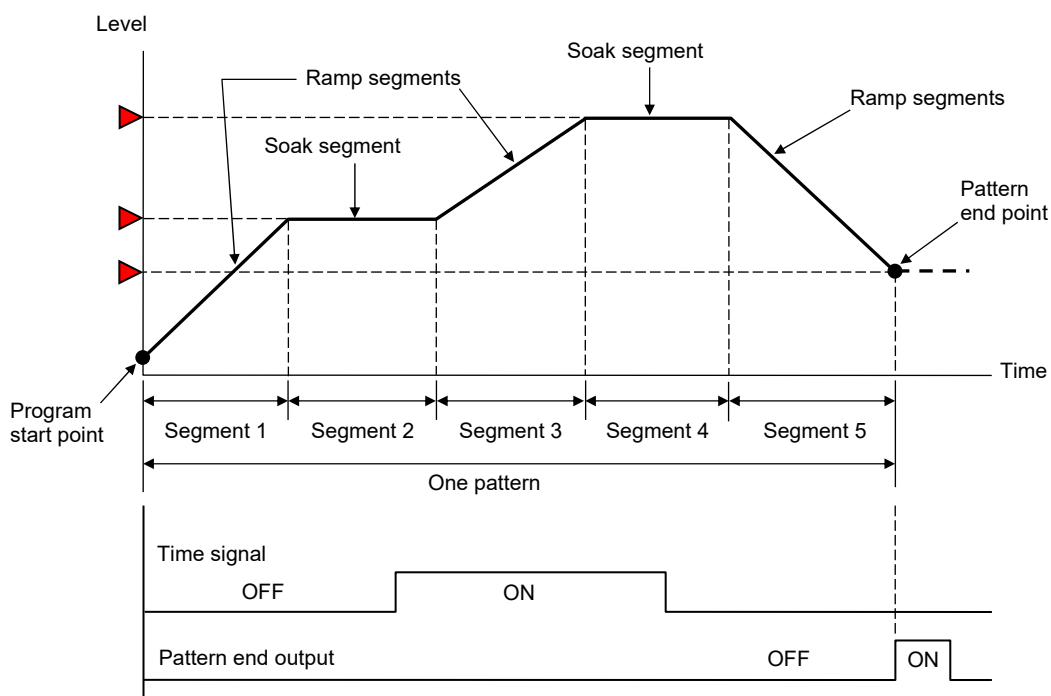


11.1 Executing Program Control

Program control operation is a form of operation where settings (a program) are made in advance so that a control target value is changed at scheduled times according to the subject for control, and control is implemented following the program.

11.1.1 Structural elements of a program

- The change in target value from the start of a program to the end is called a “pattern,” and a maximum of 16 patterns can be stored.
- A pattern is divided into units called “segments,” and a pattern is structured by setting a target value for each segment (the segment level) and the duration of time for the segment (a segment time).
A maximum of 256 segments (up to 16 segments per pattern) can be set.
- It is possible to set event functions and time signal functions for each pattern.
- The same PID value settings and wait functions are applied to all patterns. However, in the case of the level PID function, up to eight groups for PID value settings can be stored.
- The program control functions are; program control start selection, hold, step, wait, repeat, pattern link, pattern end, time signal, and pattern copy.



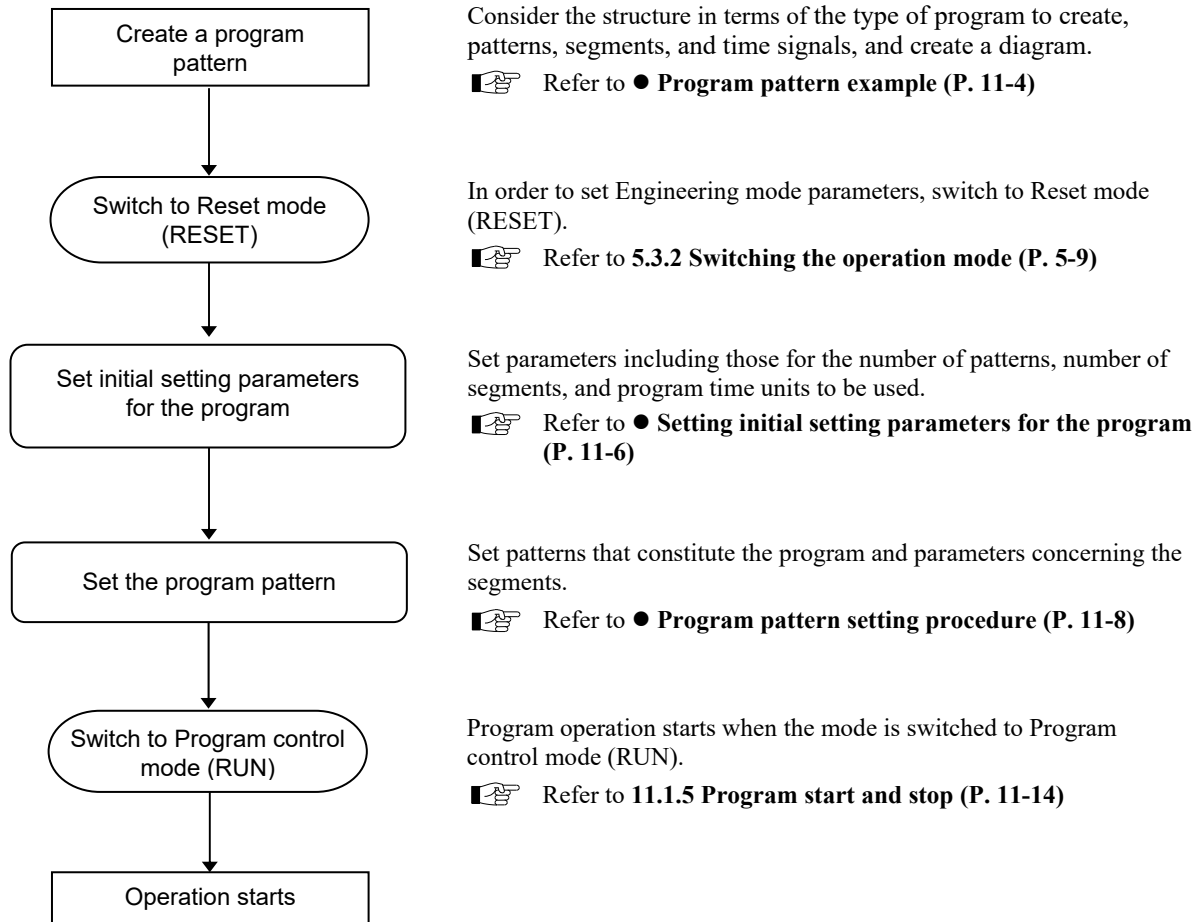
Program pattern structure example



If the target values for the previous and subsequent segments are different from each other the segment level will change, so the form of the segment level of the subsequent segment becomes inclined. Such segments are called **ramp segments**.

Furthermore, if the target values for the previous and subsequent segments are the same the segment level will not change, so the form of the segment level of the subsequent segment is horizontal. Such segments are called **soak segments**.

11.1.2 Operation procedure for program control

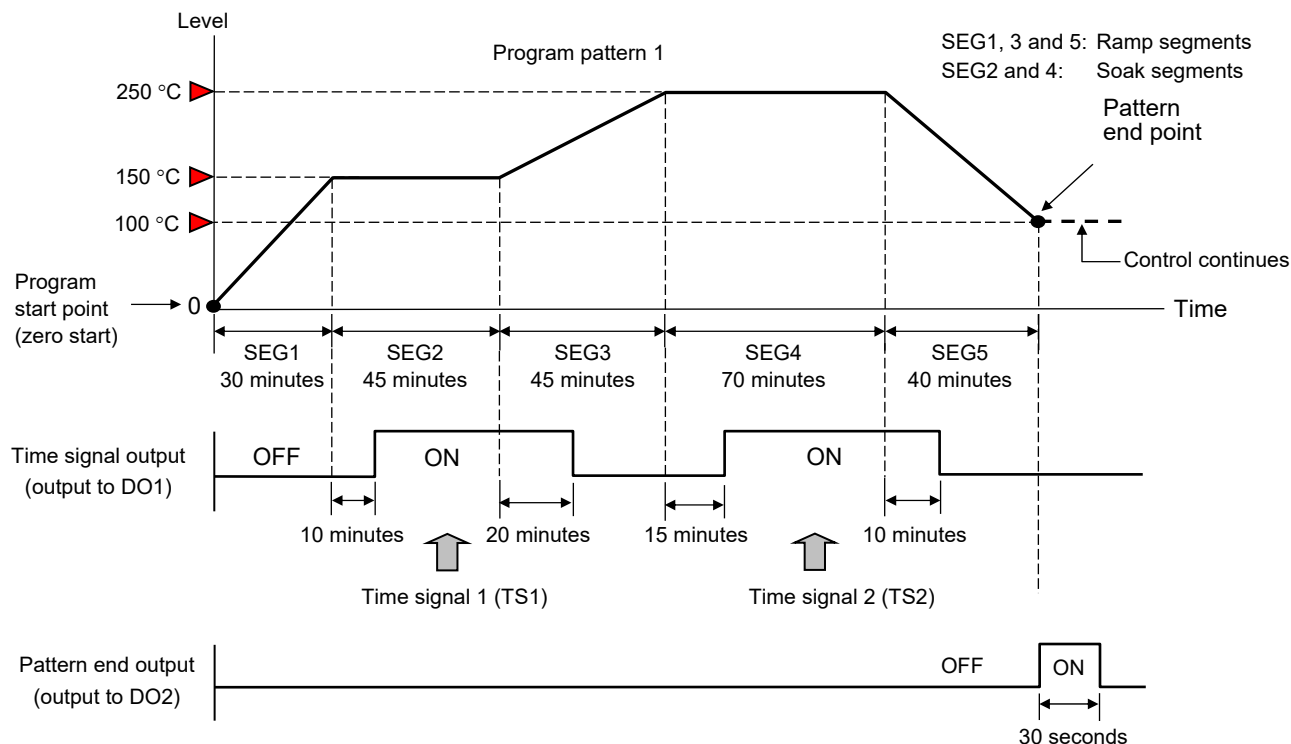




11.1.3 Creating a program pattern

● Program pattern example

This section describes the settings for each item of data concerning the type of program below.



The data for the program pattern above is as follows:

Pattern number	1				
Segment number	1	2	3	4	5
Segment level	150 °C	150 °C	250 °C	250 °C	100 °C
Segment time	30 minutes	45 minutes	45 minutes	70 minutes	40 minutes

Time signal number	1	2
Time signal start segment number	2	4
Time signal start time	10 minutes	15 minutes
Time signal end segment number	3	5
Time signal end time	20 minutes	10 minutes

Pattern end output time	30 seconds
Event 1 set value	10 °C
Number of repeating patterns	2
Pattern link number	0 (No link)



The value of parameters shown below shall be set for each pattern.

- Segment level
- Segment time
- Time signal start segment number
- Time signal start time
- Time signal end segment number
- Time signal end time
- Pattern end output time
- Event set value
- Number of repeating patterns
- Pattern link number
- Event selection of the Segment

For the program-related initial setting parameters, use the following values.

• Engineering mode

(Function explanation reference page)

Function block No. 00		
Time unit of the setting	1: min:sec	
Segment setting change type	0: Change action 1	P. 11-44
Store segment setting change	0: Keep setting change	P. 11-44
Function block No. 34		
DO1 function selection	7: Time signal	P. 9-2
DO2 function selection	8: Pattern end signal	P. 9-2
DO1 time signal selection	00011: Time signal 1: Valid Time signal 2: Valid Time signal 3: Invalid Time signal 4: Invalid	P. 9-2, 11-35
Function block No. 41		
Event 1 type	1: Deviation high (uses SV monitor value)	P. 10-3
Event 1 standby action	0: No standby	P. 10-14
Event 1 differential gap	2 °C	P. 10-17
Event 1 timer	0.0 seconds	P. 10-19
Function block No. 47		
Time signal selection	00011: Time signal 1: Used Time signal 2: Used Time signal 3: Unused Time signal 4: Unused	P. 11-37
Function block No. 48		
Pattern end signal selection	1: Used	P. 11-31

• Setup setting mode

Setting group No. 00		
SV selection at program start	0: Zero start	P. 11-16
Control action at pattern end	0: Control continues	P. 11-31
Output action at pattern end	7: Action continues (Logic calculation output, Retransmission output and Instrument status output)	P. 11-31

• Parameter setting mode

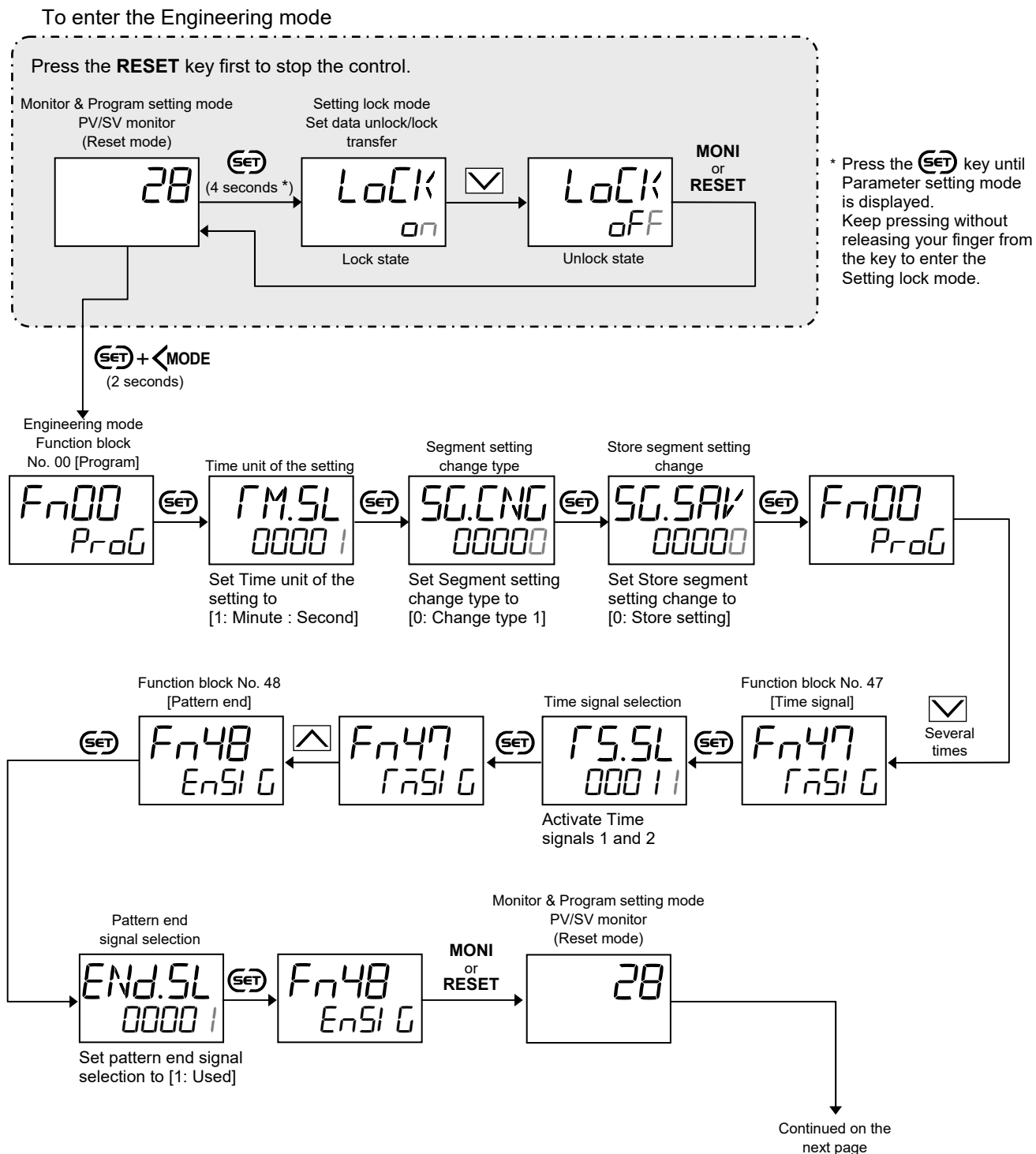
Parameter group No. 80		
Wait zone high	10 °C	P. 11-23
Wait zone low	−10 °C	P. 11-23



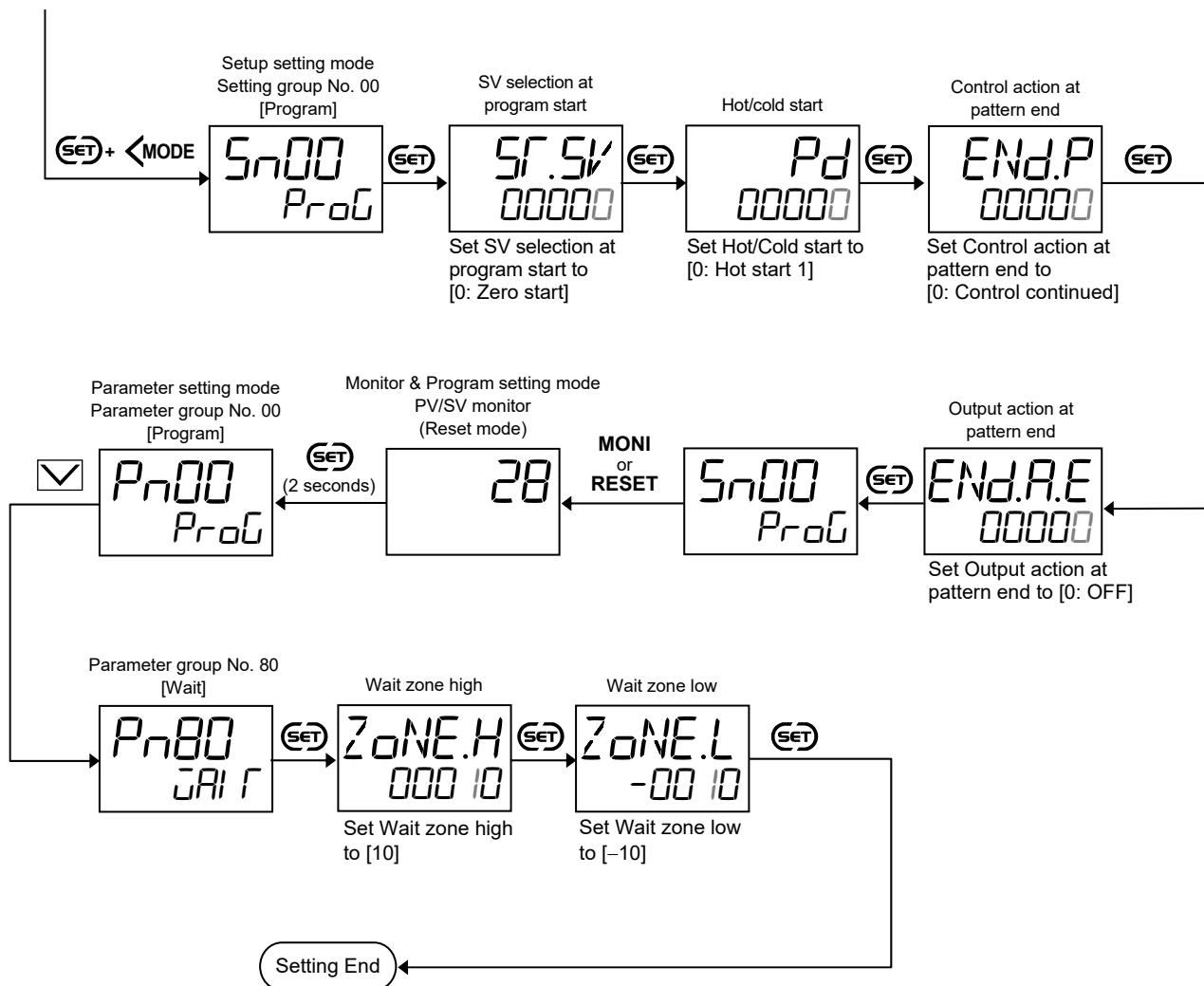
- Refer to **● Setting initial setting parameters for the program (P. 11-6)** for the program related initial setting parameters.
- For the output assignment, refer to **9.1 Changing Output Assignment (P. 9-2)**.
- For the event, refer to **10.1 Using Event Function (P. 10-2)**.
- For the time signal, refer to **11.8 Outputting a Signal According to the Progress of a Program (Time Signal) (P. 11-37)**.

● Setting initial setting parameters for the program

Set initial setting parameters for program control using the following procedure.



Continued from the previous page

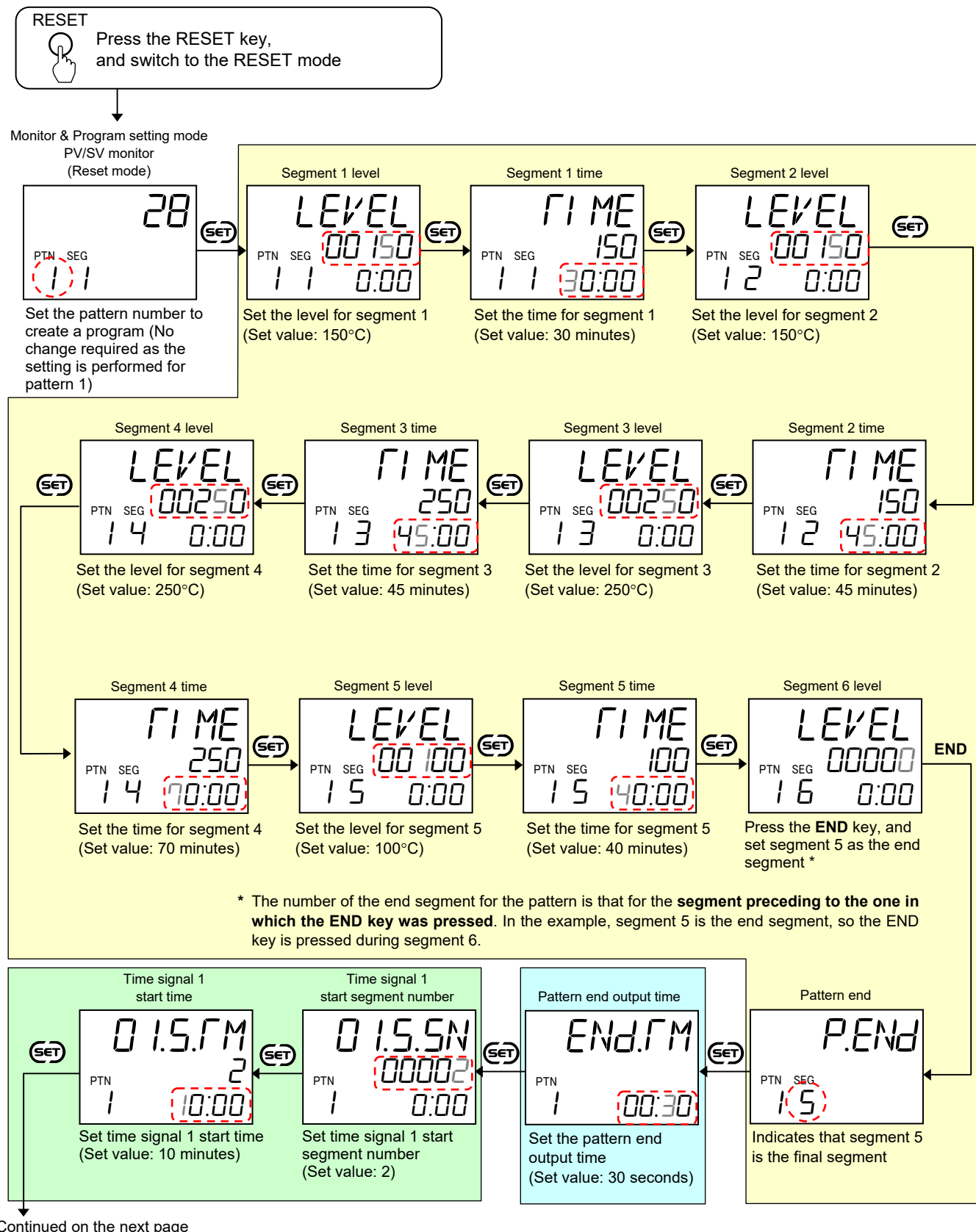


- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.

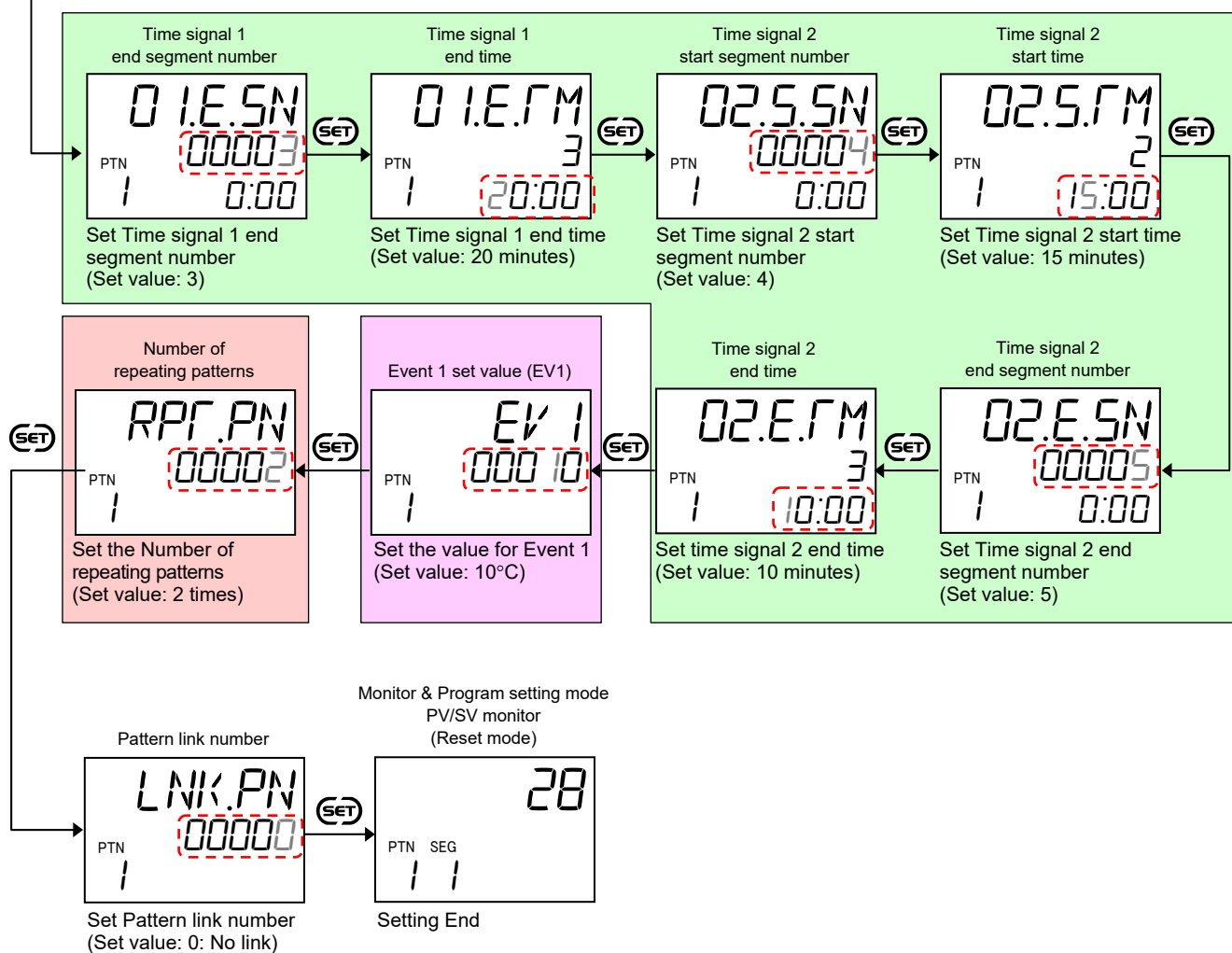


• Program pattern setting procedure

Set each parameter according to the program pattern setting example.



Continued from the previous page



Number of the time signal should be set in the Engineering mode in advance. Number of the event should be set in the Engineering mode in advance.



■ Parameter setting

● Time unit of the setting

[Engineering mode: Function block No. 00 (Fn00)]

Parameter symbol	Data range	Factory set value
FM.SL	0: Hour : Minute 1: Minute : Second	0

● Segment level

[Monitor & Program setting mode]

[Parameter setting mode: Parameter group No. 00 (Pn00)]

Parameter symbol	Data range	Factory set value
LEVEL	Setting limiter low to setting limiter high [Varies with the setting of the Decimal point position.]	0

● Segment time

[Monitor & Program setting mode]

[Parameter setting mode: Parameter group No. 00 (Pn00)]

Parameter symbol	Data range	Factory set value
TIME	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds 200 hours 00 minutes or 200 minutes 00 seconds: Continuous * (FIX is displayed) * Valid only for soak segments However, if a segment for which unlimited time is set becomes no longer a soak segment, 199 hours 59 minutes (or 199 minutes 59 seconds) is automatically set. Also for segment 1 it is not possible to set "Continuous."	0:00 (0 hours 00 minutes)



Time unit is set in Engineering mode: Function block No. 00 "Time unit of the setting."

● Time signals 1 to 4 start segment number

[Monitor & Program setting mode]

[Parameter setting mode: Parameter group No. 47 (Pn47)]

Parameter symbol	Data range	Factory set value
01.5.N	1 to 16	1
02.5.N		
03.5.N		
04.5.N		



To display "Time signals 1 to 4 start segment No.", it is necessary to activate the relevant time signal in "Time signal selection" of Function block No. 47 in Engineering mode.

**● Time signals 1 to 4 start time****[Monitor & Program setting mode]****[Parameter setting mode: Parameter group No. 47 (P_{n47})]**

Parameter symbol	Data range	Factory set value
01.S.FM	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds	0:00 (0 hours 00 minutes)
02.S.FM		
03.S.FM		
04.S.FM		



Time unit is set in Engineering mode: Function block No. 00 “Time unit of the setting.”



To display “Time signals 1 to 4 start time,” it is necessary to activate the relevant time signal in “Time signal selection” of Function block No. 47 in Engineering mode.

● Time signals 1 to 4 end segment number**[Monitor & Program setting mode]****[Parameter setting mode: Parameter group No. 47 (P_{n47})]**

Parameter symbol	Data range	Factory set value
01.E.SN	1 to 16	1
02.E.SN		
03.E.SN		
04.E.SN		



To display “Time signals 1 to 4 end segment No.,” it is necessary to activate the relevant time signal in “Time signal selection” of Function block No. 47 in Engineering mode.

● Time signals 1 to 4 end time**[Monitor & Program setting mode]****[Parameter setting mode: Parameter group No. 47 (P_{n47})]**

Parameter symbol	Data range	Factory set value
01.E.FM	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds	0:00 (0 hours 00 minutes)
02.E.FM		
03.E.FM		
04.E.FM		



Time unit is set in Engineering mode: Function block No. 00 “Time unit of the setting.”



To display “Time signals 1 to 4 end time,” it is necessary to activate the relevant time signal in “Time signal selection” of Function block No. 47 in Engineering mode.



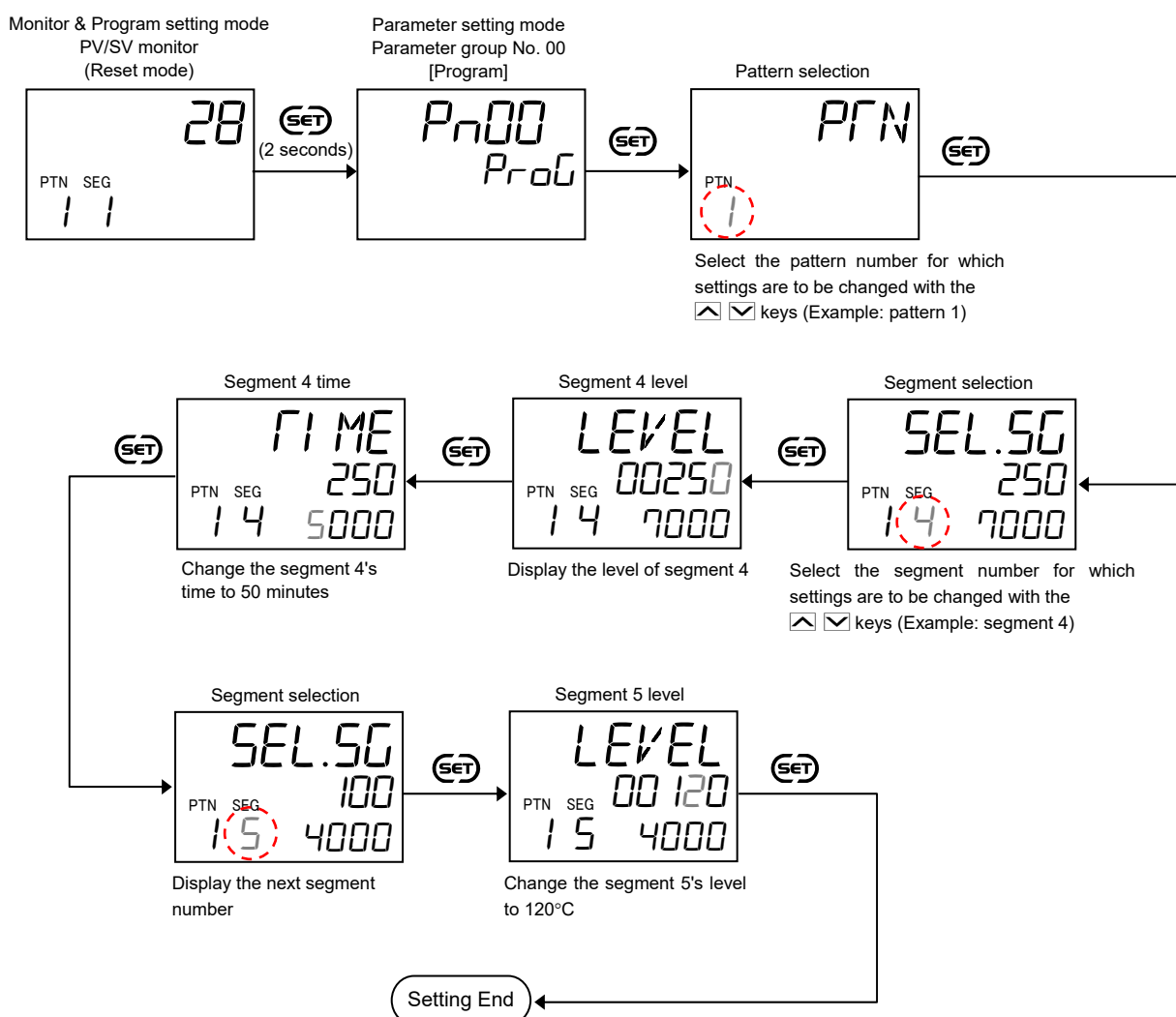
11.1.4 Changing a program pattern

● Changing a segment level/time

[Example] In the program pattern setting procedure (P. 11-6), when changing the segment time of segment 4 from 70 to 50 minutes, and changing the segment level of segment 5 from 100 °C to 120 °C, there are two methods.

- Pressing the SET key in Monitor & Program setting mode a number of times to display the relevant screen and making changes as in the operation example on P. 11-8
- Directly displaying the relevant screen and making changes in Parameter setting mode

The following explains the change method using Parameter setting mode.



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen. However, if the **RESET** key is pressed during control, control stops.



Event set value, time signal and pattern end output time can be changed by directly displaying the relevant screen in Parameter setting mode, in the same way as above.

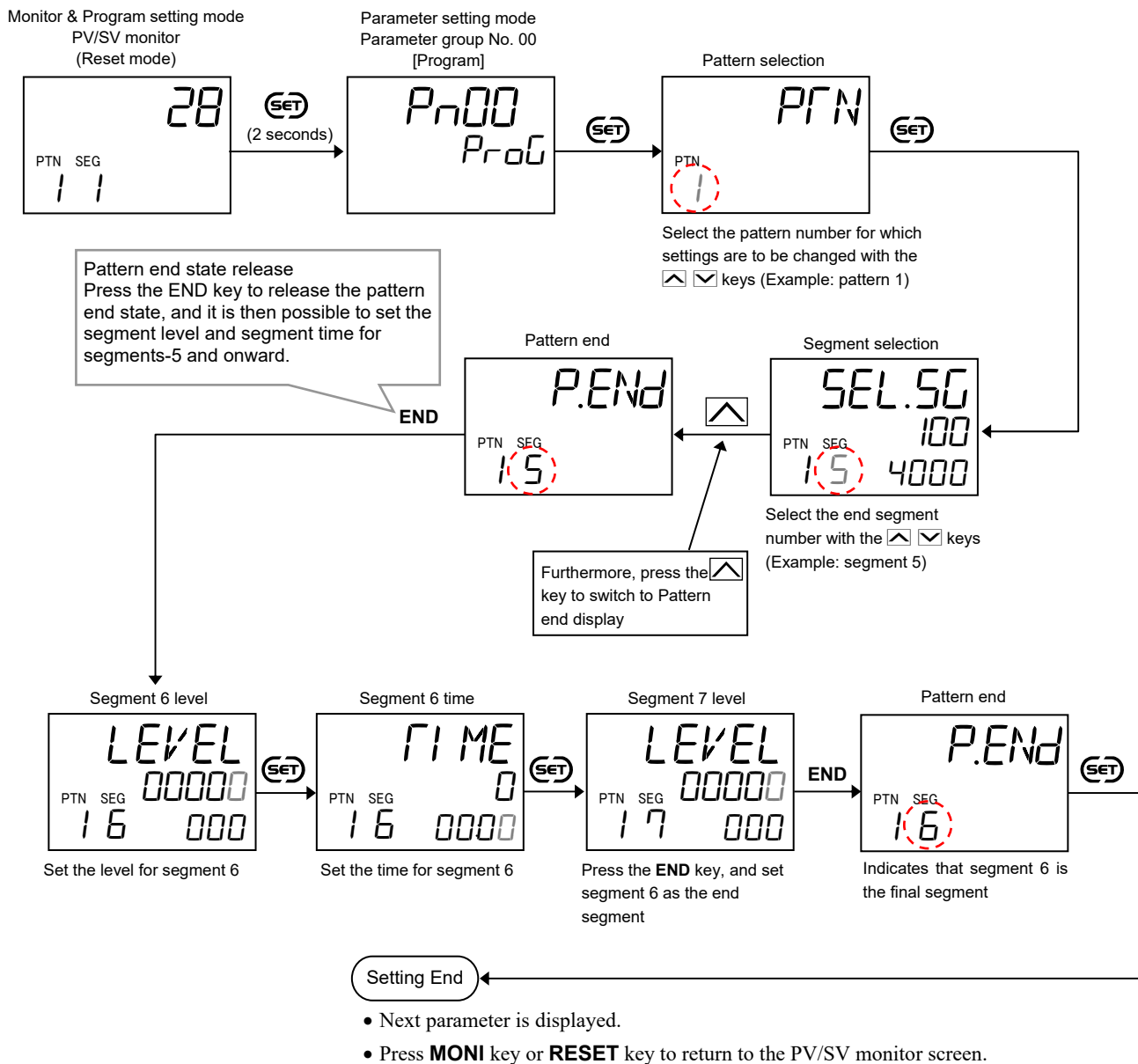
[Group number for Parameter setting mode for each set value]

- Event set value ... Parameter group No. 40
- Time signal ... Parameter group No. 47
- Pattern end output time ... Parameter group No. 48

● End segment change (Changing number of segments)

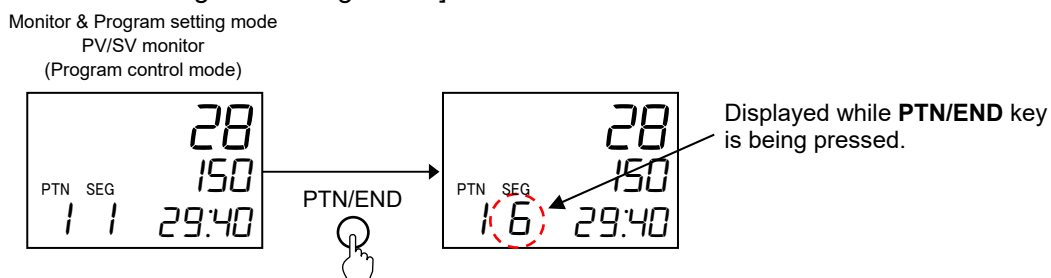
To change the end segment of a created program pattern, release the pattern end state and then change the end segment.

[Example] To release the pattern end state and change the end segment from 5 to 6



Users can check the end segment No. in the program control mode (RUN). Segment No. will be displayed on the Segment (SEG) display only while **PTN/END** key is being pressed.

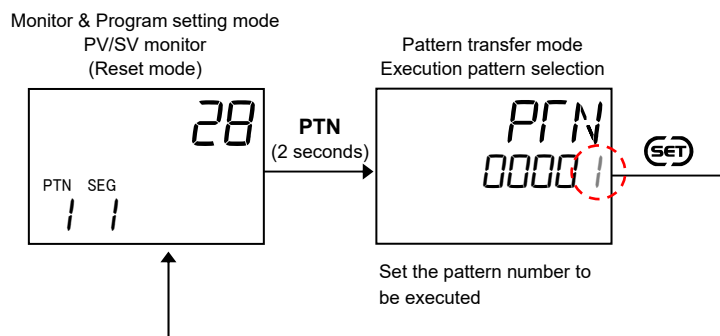
[When the end segment is segment 6]



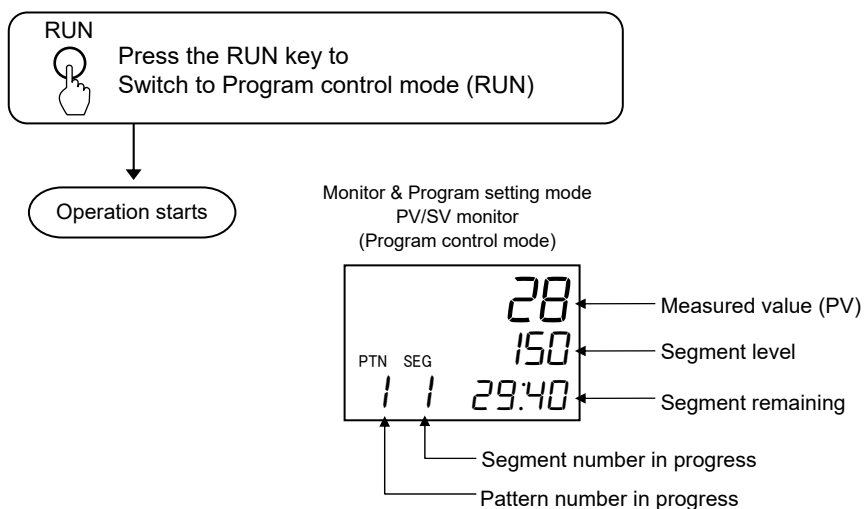
11.1.5 Program start and stop

■ Start program control

● Select a pattern to execute

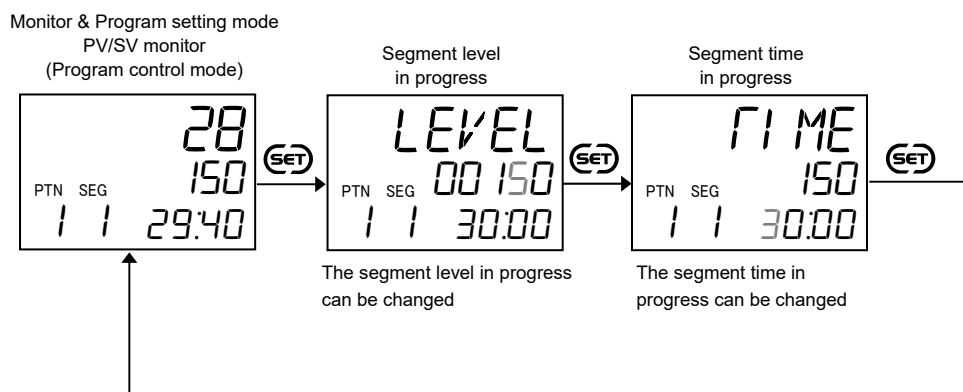


● Switching to Program control mode



● Changing a segment level/time in Program control mode (RUN)

Segment level and segment time can be changed for the segment in progress in Program control mode (RUN).

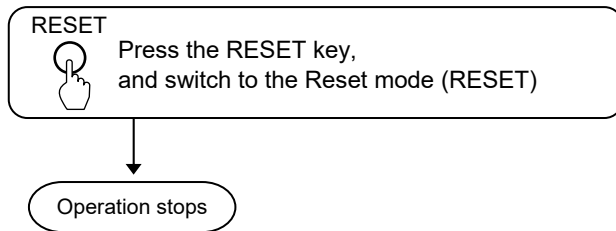


Also refer to 11.10 Changing the Settings Change Action During Program Control (P. 11-46) for changing the segment level/time in the Program control mode (RUN).

■ Stop program control

Pressing the RESET key will change the mode to the Reset mode (RESET), and the control will stop. However, manipulated output value etc. will be output depending on the settings of the following parameters.

- Output action in Reset mode
Set whether to continuously output logic calculation output, transmission output, and instrument state output in Reset mode.
- Manipulated output value in Reset mode
Outputs a preset operation output value when switching to Reset mode.



Use the hold function to temporarily stop program control. For the Hold function, refer to **11.3 Pausing a Program (Hold) (P.11-20)**.



For the Output action in Reset mode and Manipulated output value in Reset mode refer to **9.9 Changing the Output Action in Reset Mode (P. 9-36)**.



11.2 Changing the Level When Program Control Starts

The segment level at program control start can be selected.

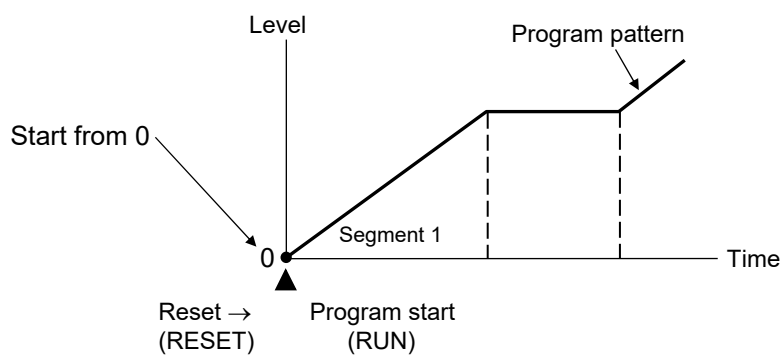
Two types of start can be selected.

Set this in “SV selection at program start” in Setup setting mode.

- Zero start (Factory set value)
- PV start
- PV start (time saving)

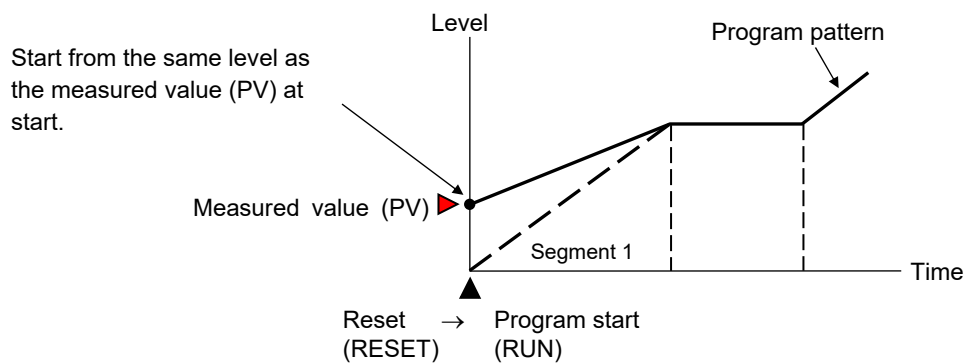
■ Zero start

Make the segment level “0” when program control starts.



■ PV start

Make the segment level “Measured value (PV)” when program control starts



If the Measured value (PV) exceeds the set limiter range upon start, the following actions are performed.

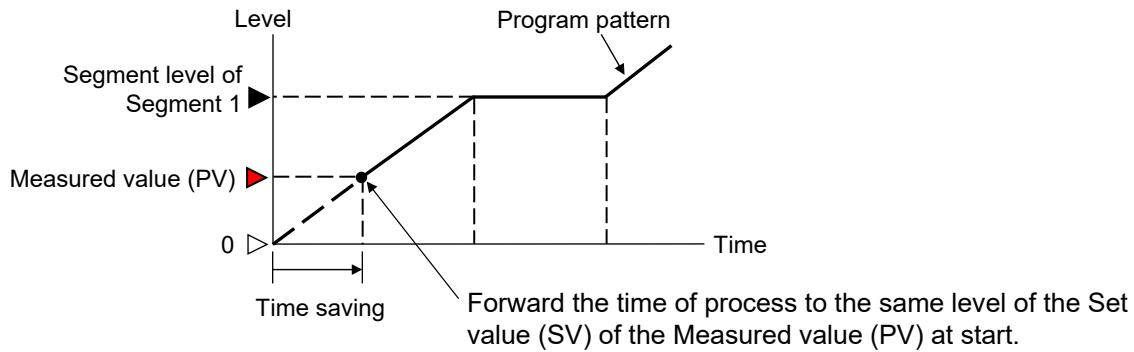
- Measured value (PV) > Setting limiter high: Start from the setting limiter high
- Measured value (PV) < Setting limiter low: Start from the setting limiter low

■ PV start (time saving)

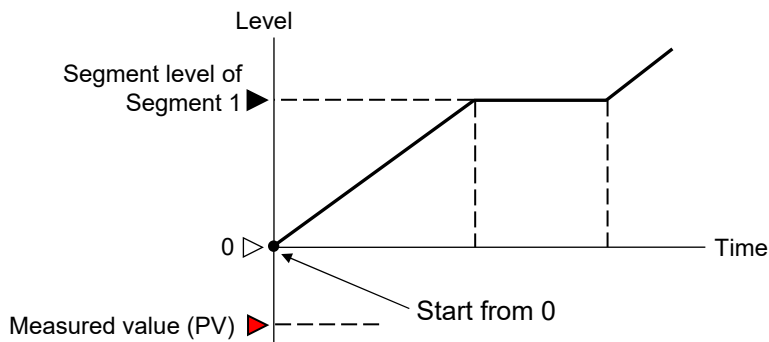
Start point varies by Measured value (PV) at start and Segment level of Segment 1.

● When the Segment level of the Segment 1 is larger than 0

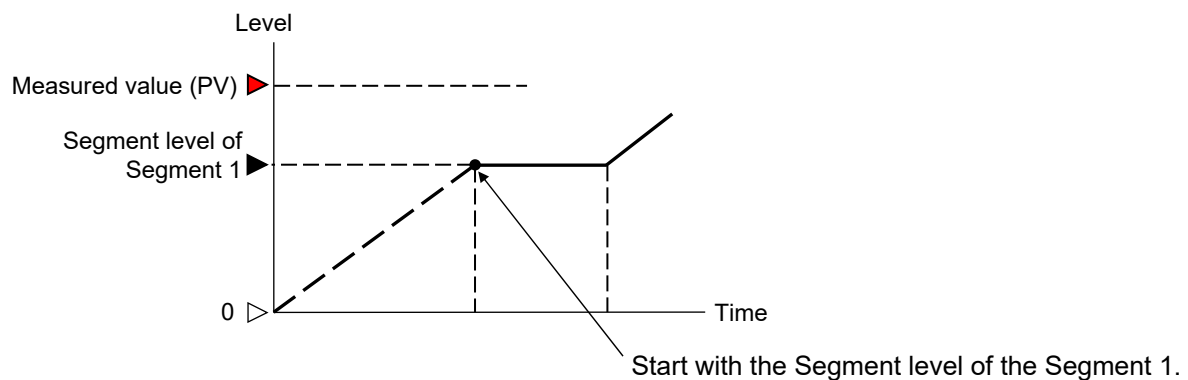
- Segment level of Segment 1 > Measured value (PV) > 0



- Measured value (PV) ≤ 0

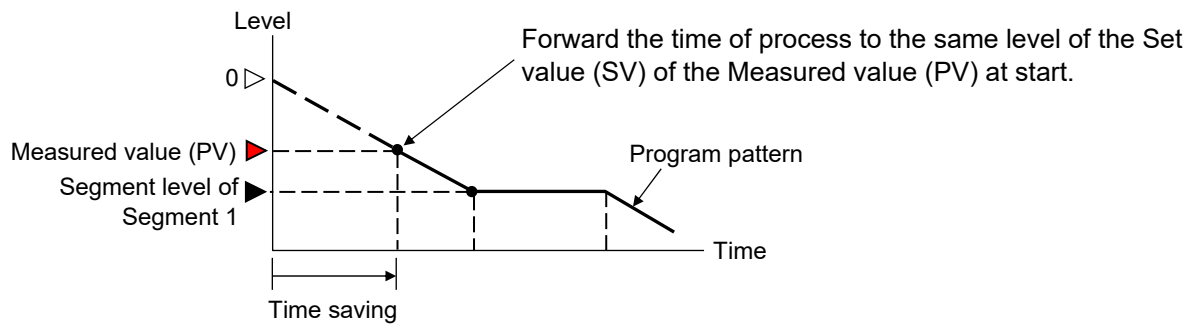


- Segment level of Segment 1 ≤ Measured value (PV)

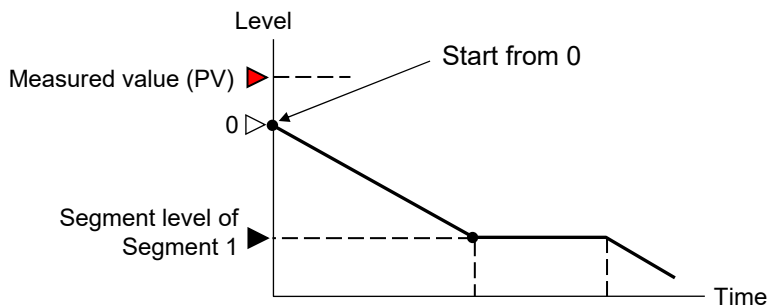


● When the Segment level of the Segment 1 is smaller than 0

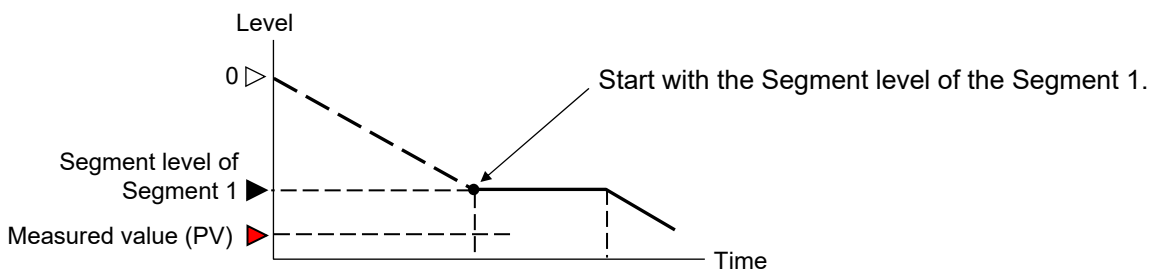
- Segment level of Segment 1 $\geq$ Measured value (PV) ≥ 0



- Measured value (PV) ≥ 0



- Segment level of Segment 1 $>$ Measured value (PV)





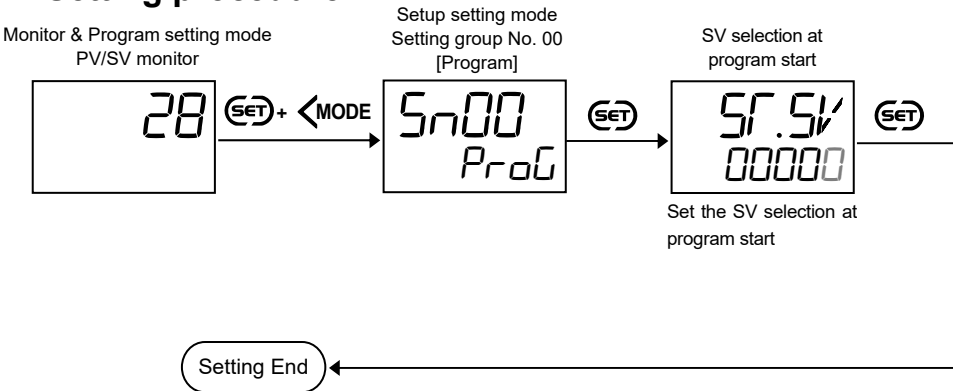
■ Parameter setting

● SV selection at program start

[Setup setting mode: Setting group No. 00 (5n00)]

Parameter symbol	Data range	Factory set value
5f.5v	0: Zero start 1: PV start 2: PV start (time saving)	0

■ Setting procedure



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
However, if the RESET key is pressed during control, control stops.

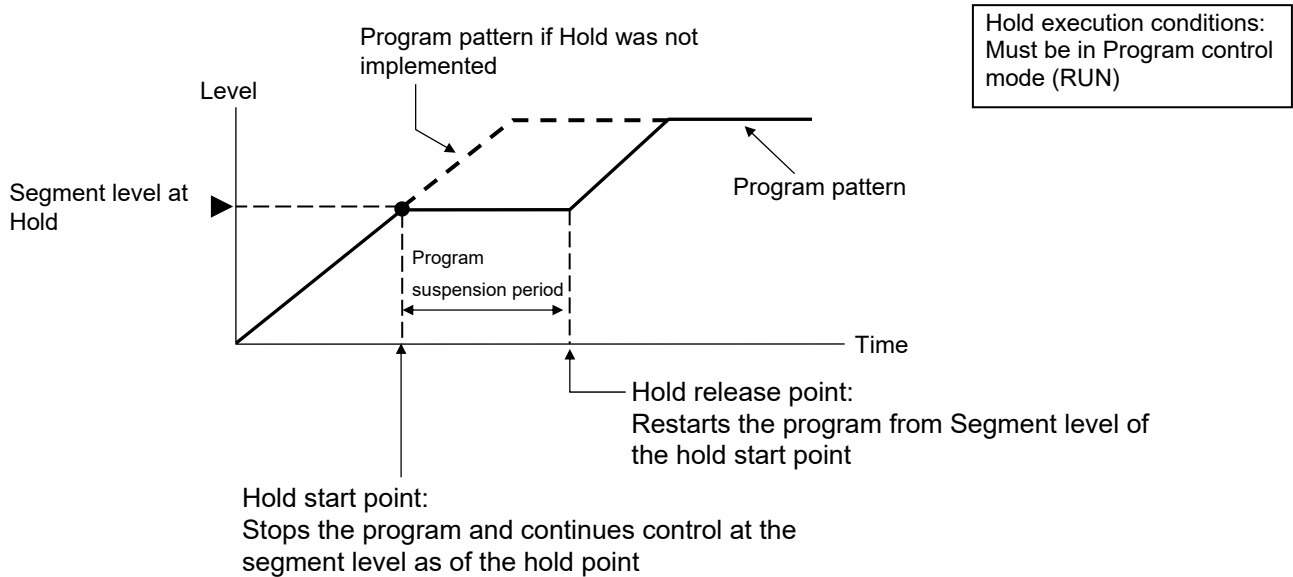


The changed value is valid even if the settings are changed during control but will only take effect when control is stopped and then restarted.

11.3 Pausing a Program (Hold)

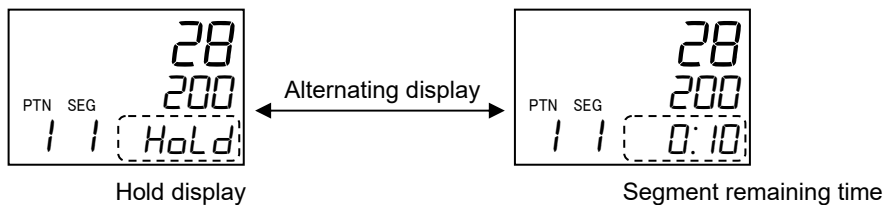
Hold is a function that temporarily stops a program during program control.

Starting and releasing Hold can be performed by key operation, digital input (DI), or communication.



■ Hold display

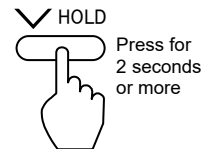
When in the hold state, the TIME display alternately displays *HoLd* (HOLD) and the remaining segment time.



■ Key operation

If the HOLD key is held for two seconds or more during program control, the system enters the hold state.

If the HOLD key is held for at least 2 seconds in the hold state, the hold state is released and program control continues.



Hold state cannot be released by switching to Fixed set point control mode (FIX) or Manual control mode (MAN). In order to release the hold state, temporarily return to Program control mode (RUN), and release the hold state. However, communication and digital input (DI) are not the case.



Hold state initiated by digital input (DI) cannot be released through key operation or communication.



If the Autotuning (AT) is executed during program control, the system enters and stays in the hold state during AT. However, *HoLd* is not displayed on the TIME display. Program control restarts when AT finishes.



During pattern end output (if the pattern end output remaining time is displayed), the hold function can be executed. In Hold, the remaining time count stops, and pattern end output stays ON. And if the pattern end output remaining time is 0, the hold function is disabled.

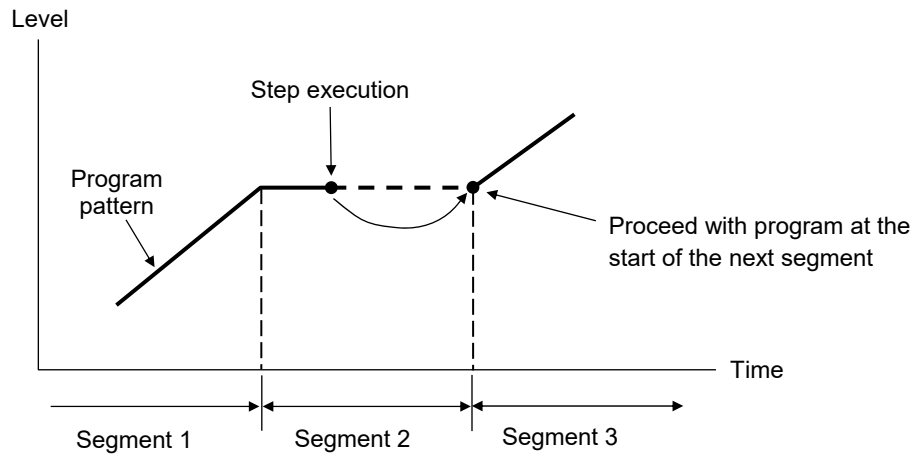


Refer to ● **Hold function (P. 8-15)** in **8.2 Switching Functions Using Digital Inputs (DI)** for the Hold function by digital input (DI).



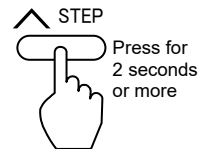
11.4 Moving a Program Forward by One Segment (Step)

Step is a function that moves execution of the program forward by one segment during program control. The step function can be performed by key operation, digital input (DI), or communication.



■ Key operation

If the STEP key is held for two seconds or more during program control, a step action is executed.



The step function does not work in the hold state. The step function also does not work in Reset mode (RESET), Fixed set point control mode (FIX), or Manual control mode (MAN).



If a step action is executed in the wait state, the wait state is released and the program moves to the next segment.



Refer to ● **Step function (P. 8-14)** in **8.2 Switching Functions Using Digital Inputs (DI)** for the Step function by digital input (DI).

11.5 Waiting When a Measured Value Cannot Keep Up with a Program (Wait)

Wait is a function that waits for a segment to advance with program control.

■ Description of function

When a Measured value (PV) cannot keep up with a program [when there is a difference (deviation) between the Measured value (PV) and segment level], the program is suspended at the end point of the segment time, and until the Measured value (PV) reaches the range of the wait zone, waits for the transition to the following segment.

Wait release conditions: Wait is released as soon as the Measured value (PV) enters the wait zone range.

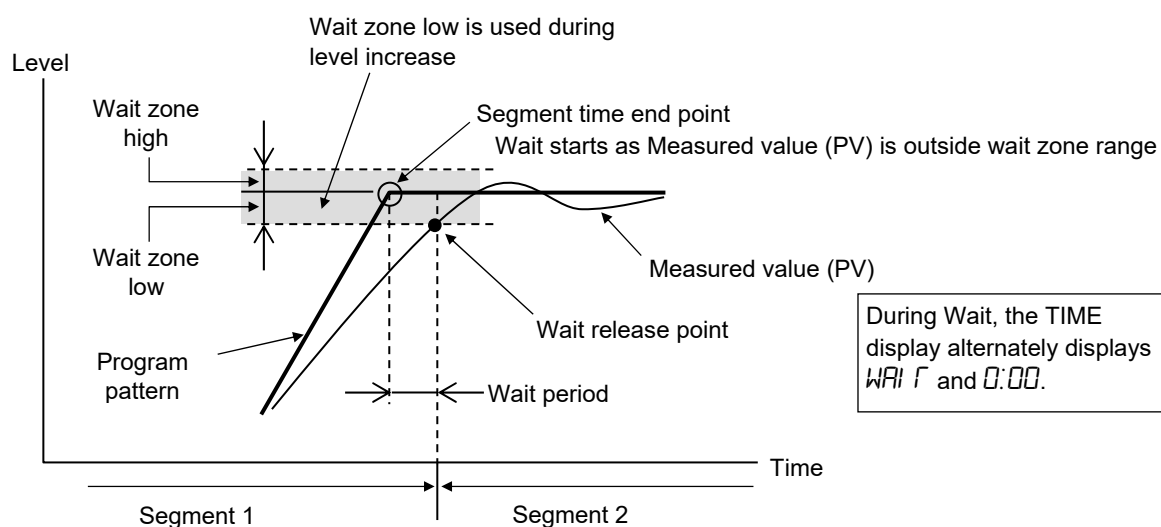


If a step action is executed in the wait state, the wait state is released and the program moves to the next segment. The wait state is also released when changes are made that increase the segment time of the waiting segment.

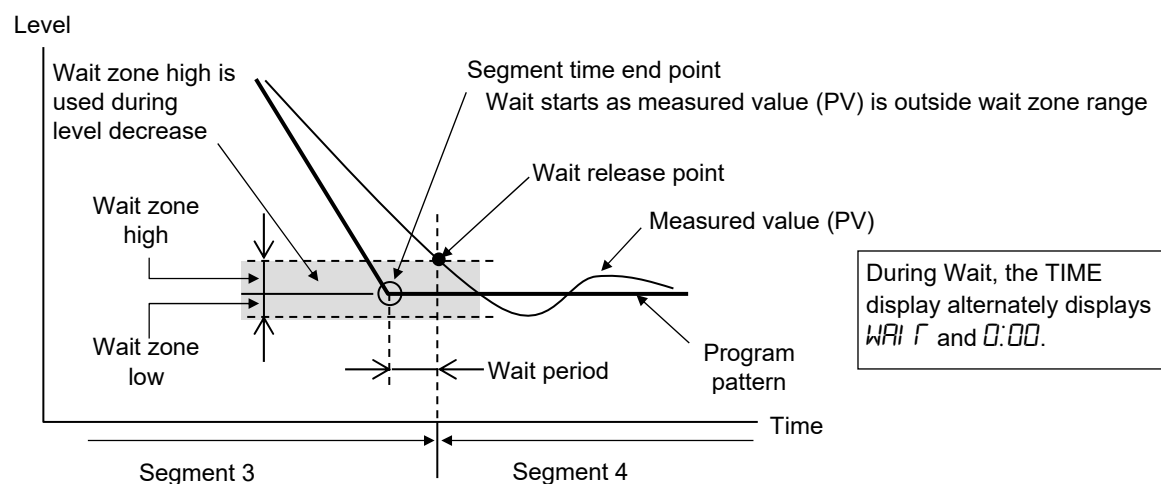


The same wait zone is applied to all program patterns.

[Example: During level increase]



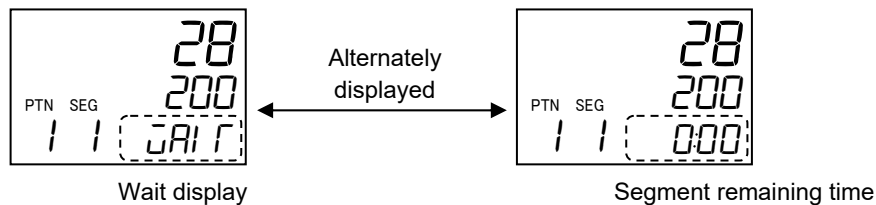
[Example: During level decrease]





■ Wait display

When in the wait state, the TIME display alternately displays WAIT and the remaining segment time “0:00.”



■ Parameter setting

● Wait zone high

[Parameter setting mode: Parameter group No. 80 (P₈₀)]

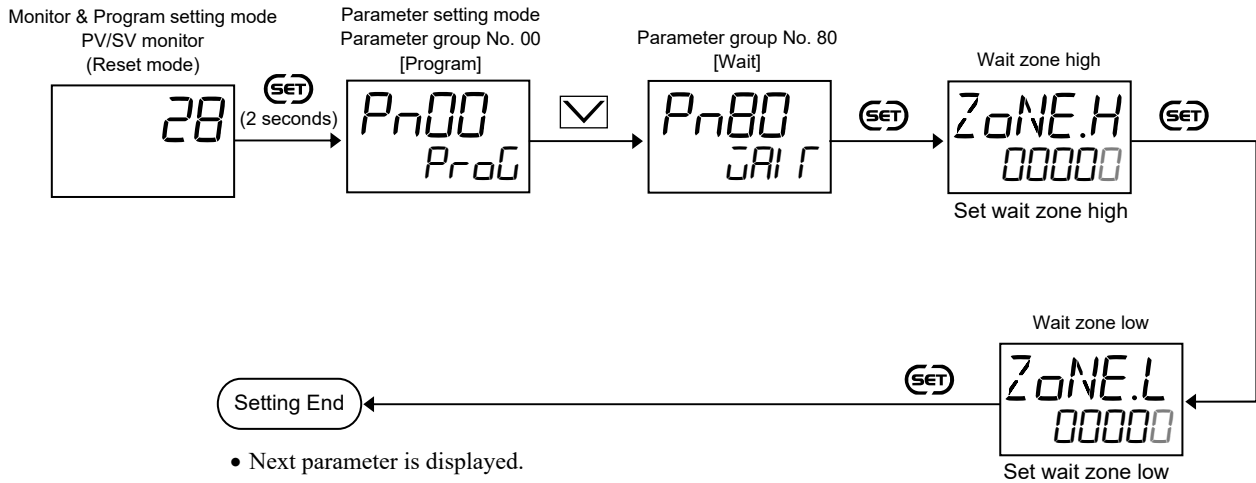
Parameter symbol	Data range	Factory set value
ZONE.H	Thermocouple (TC)/Resistance temperature detector (RTD) input: 0 (0.0, 0.00) to Input span (unit: °C [°F]) Varies with the setting of the Decimal point position. Voltage (V)/Current (I) input: 0.0 to 100.0 % of input span 0 (0.0, 0.00): Wait zone high OFF Deviation settings for segment level.	0

● Wait zone low

[Parameter setting mode: Parameter group No. 80 (P₈₀)]

Parameter symbol	Data range	Factory set value
ZONE.L	Thermocouple (TC)/Resistance temperature detector (RTD) input: –Input span to 0 (0.0, 0.00) (unit: °C [°F]) Decimal point position varies depending on its setting Voltage (V)/Current (I) input: –100.0 to 0.0 % of input span 0 (0.0, 0.00): Wait zone low OFF Deviation settings for segment level.	0

Setting procedure



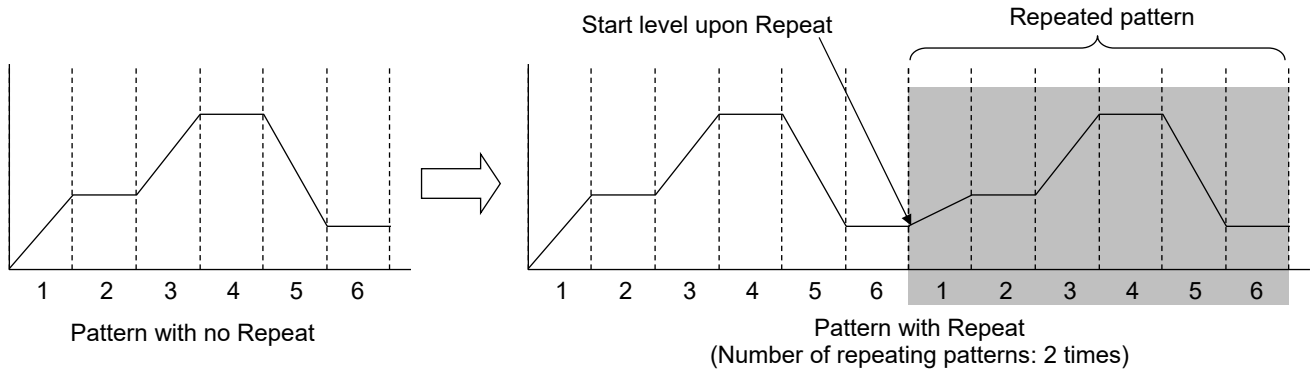
- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
However, if the **RESET** key is pressed during control, control stops.



11.6 Repeating a Program (Repeat)

Repeat is a function that iterates a program pattern a set number of times. The start level upon Repeat is the same as the pattern end level. Set the number of pattern execution (number of repeat) for each pattern. Set to 1,000 to repeat indefinitely.

Example: To repeat the following pattern

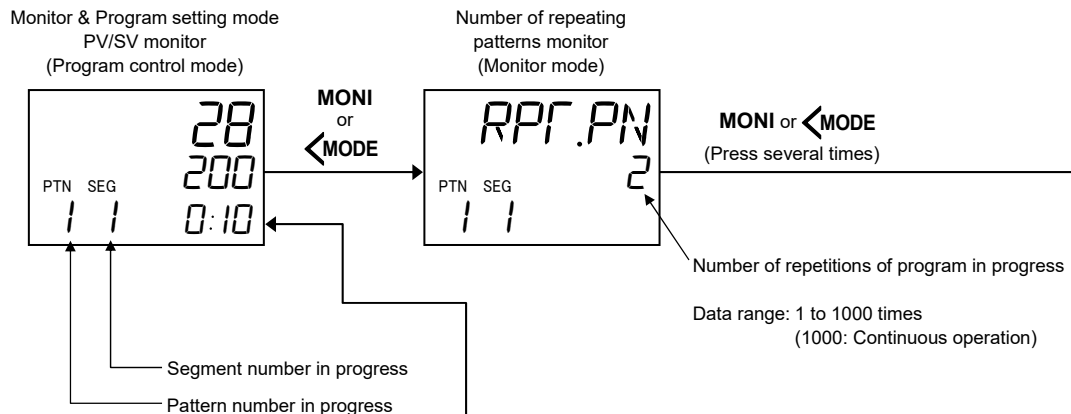


Pattern end output upon repeat is output after execution of the last program pattern.

For example, if the number of repeating patterns is set to two, the pattern end output is output after the second program pattern is executed.

■ Confirmation method for the number of executions

If the **MONI** key or **MODE** key is pressed during program control, the screen displays the “Number of repeating patterns monitor,” so it is possible to confirm the number of repetitions of program being executed so far.



Parameter setting

Settings for the Number of repeating patterns can be done in either Monitor & Program setting mode or Parameter setting mode.

Number of repeating patterns

[Monitor & Program setting mode]

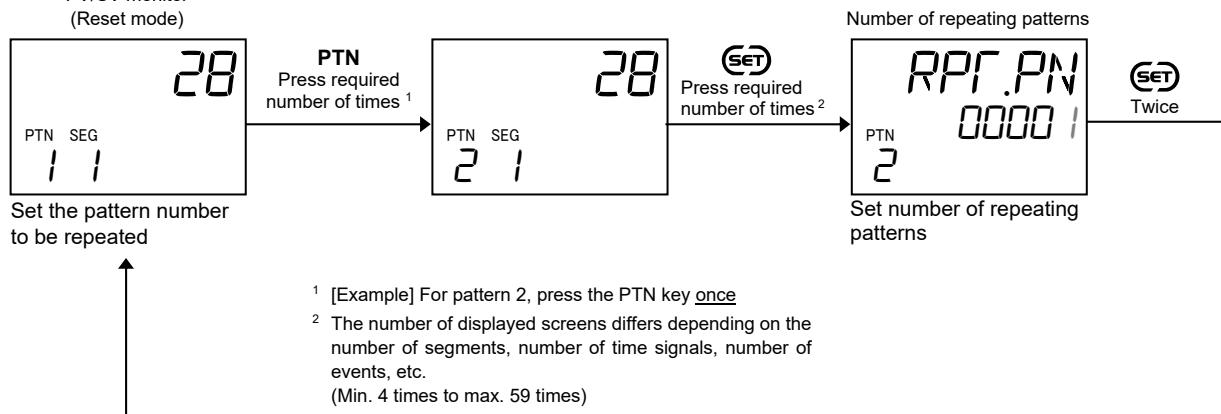
[Parameter setting mode: Parameter group No. 00 (P_{n00})]

Parameter symbol	Data range	Factory set value
$RPF.PN$	1 to 1000 times 1000: Continuous operation	1

Setting procedure

In Monitor & Program setting mode

Monitor & Program setting mode
PV/SV monitor
(Reset mode)



Monitor & Program setting mode
PV/SV monitor
(Reset mode)

Parameter setting mode
Parameter group No. 00
[Program]

Pattern selection

Set the pattern number to be repeated with the keys (Example: pattern 2)

Number of repeating patterns

Pattern end

Segment selection

Press required No. of times *

* Press the key to display up to segment number of pattern end. (Example: Pattern end No.5)

Setting End

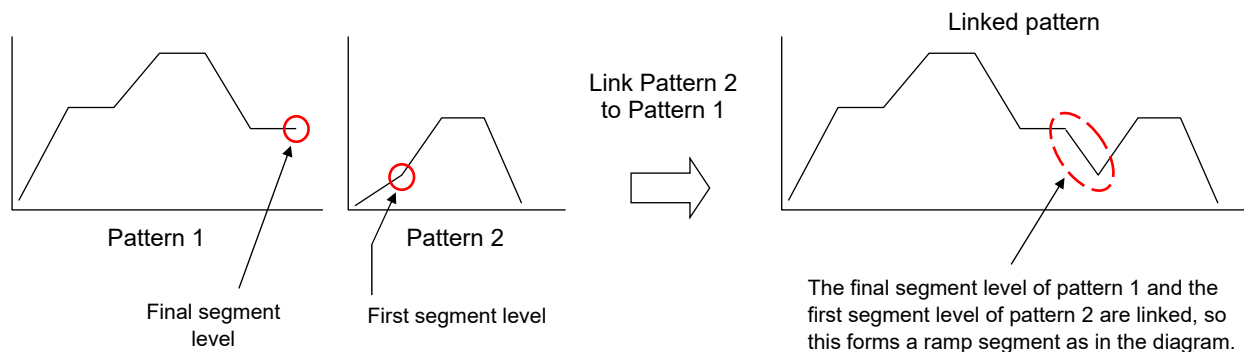
- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen. However, if the **RESET** key is pressed during control, control stops.

11.7 Using a Program with 16 or More Segments (Pattern Link)

The maximum number of segments per pattern with this instrument is 16, but if you wish to use programs with more than 16 segments it is possible to consolidate patterns for use. (Pattern link function)

Set pattern number to be linked for each pattern.

Example: To link the following patterns



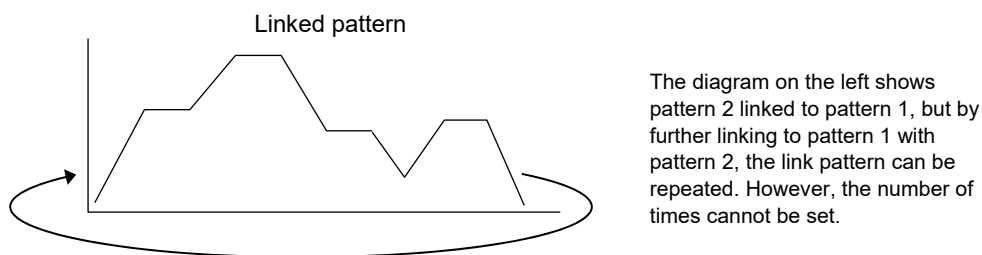
There are no restrictions on pattern links. Same pattern link is also possible.



Time signal settings remain active as is even if the patterns are linked. For pattern end output, the settings for the final pattern linked are active.



To consecutively repeat a linked pattern*, link the last linked pattern to the first linked pattern.



* The repeat function cannot be used to continuously repeat a linked pattern.

The number of repeating patterns is set for each pattern, so Repeat is executed for each individual pattern.

■ Parameter setting

Settings for the Pattern link number can be done in either Monitor & Program setting mode or Parameter setting mode.

● Pattern link number

[Monitor & Program setting mode]

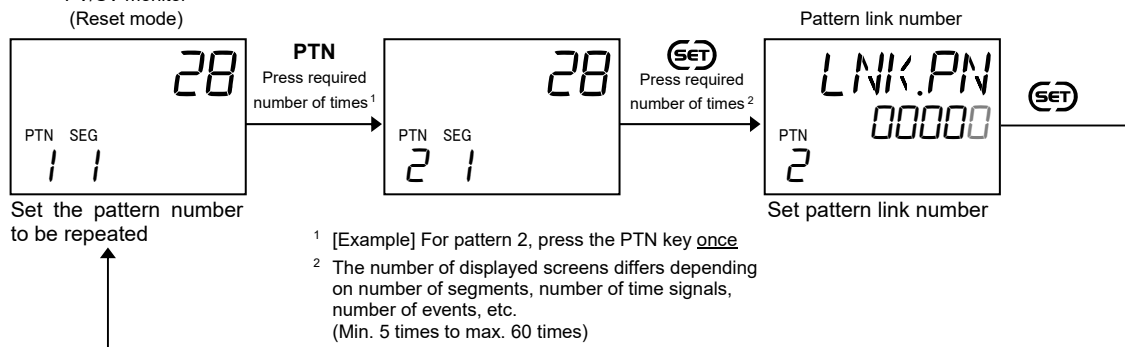
[Parameter setting mode: Parameter group No. 00 (P_{n00})]

Parameter symbol	Data range	Factory set value
LNK.PN	0 to 16 0: No link	0

Setting procedure

In Monitor & Program setting mode

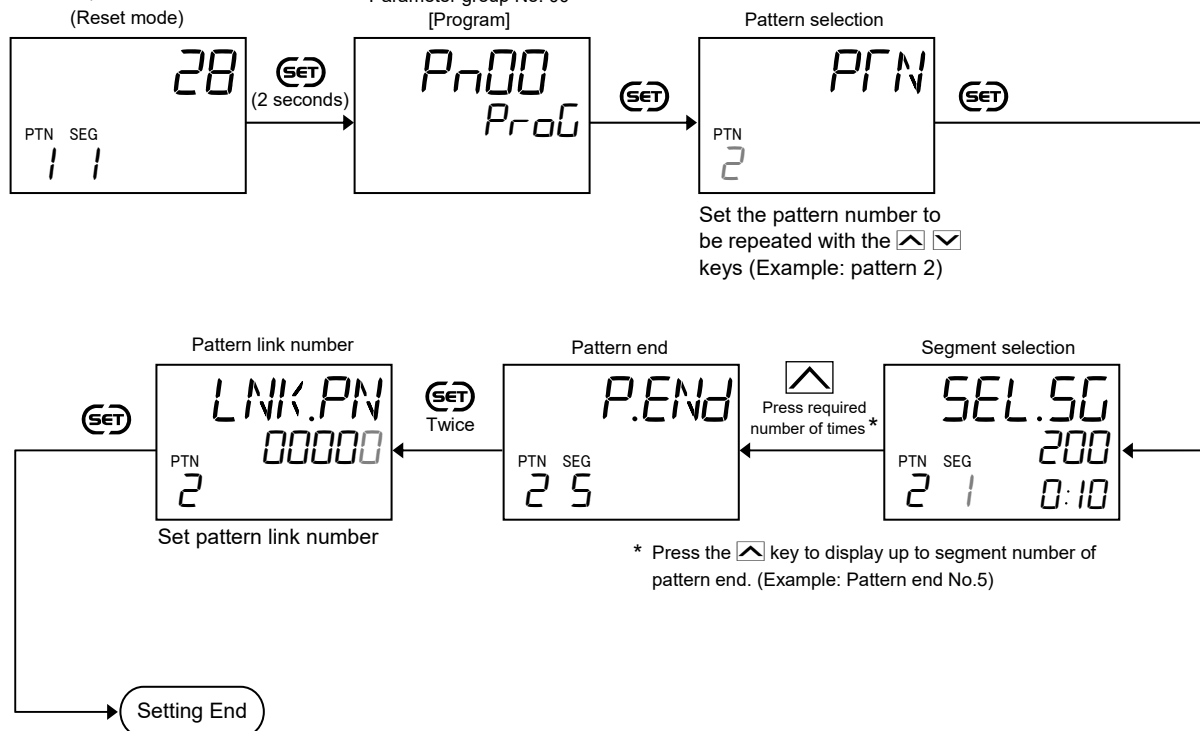
Monitor & Program setting mode
PV/SV monitor
(Reset mode)



In Parameter setting mode

Monitor & Program setting mode
PV/SV monitor
(Reset mode)

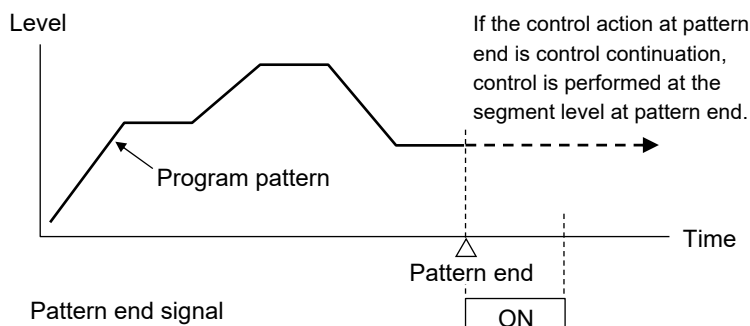
Parameter setting mode
Parameter group No. 00
[Program]



- Next parameter is displayed.
- Press the **MONI** key or **RESET** key to return to the PV/SV monitor screen. However, if the **RESET** key is pressed during control, control stops.

11.8 Changing the Action When Program Control Ends (Pattern End)

The function that outputs the pattern end signal when the program finishes is the pattern end. Control action at pattern end can also be selected.



■ Description of function

● Pattern end action

Pattern end signal: The pattern end signal can be output from digital output (DO).
Set the pattern end output time. If the output time is set to 0:00, output continues until the mode is switched to Reset mode (RESET).

Control action: If PID control, Heat/Cool PID control, Position proportioning PID control (with FBR input)
Control continues or stops

If position proportion PID control (without FBR input, or when FBR is broken)

- Control continues
- Open-side output: OFF, Close-side output: OFF
- Open-side output: OFF, Close-side output: ON
- Open-side output: ON, Close-side output: OFF

Output action: For the following output, action OFF/continue can be selected.

- Logic calculation output
[Events 1 to 4, Heater broken alerts (HBA) 1 to 2, Control loop break alarm (LBA), Input abnormality]
- Retransmission outputs 1 to 3
[Measured value (PV), Segment level, Set value (SV) in Fixed set point control mode, SV monitor value, Deviation value, Manipulated output value, Current transformer (CT) input value]
- Instrument state output
[Program control mode (RUN) state output, Manual control mode (MAN) state output, Autotuning (AT) state output, Output of the communication monitoring result]



In Pattern end output time settings, setting is not possible with no pattern end output specified. To suppress pattern end output, in the output assignment settings do not assign pattern end output.



Pattern end signal turns OFF after switching to Fixed set point control mode (FIX) or Manual control mode (MAN). It then returns to ON after switching to Program control mode (RUN) again. Furthermore, the pattern end signal turns OFF when switching to Reset mode (RESET).



Although the Control loop break alarm (LBA) is selected as the Logic calculation output and “Output action at the pattern end” is set as continuing action, the Control loop break alarm (LBA) will not be activated at the pattern end if “Control action at pattern end” is set to stop control.



When Output action at the pattern end is deactivated, the following functions will be deactivated at the Pattern end: Event, Heater break alarm (HBA), and Control loop break alarm (LBA).

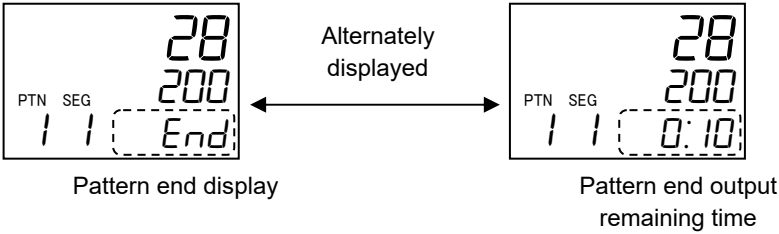


To assign pattern end output, refer to **9.1 Changing Output Assignment (P. 9-2)**.

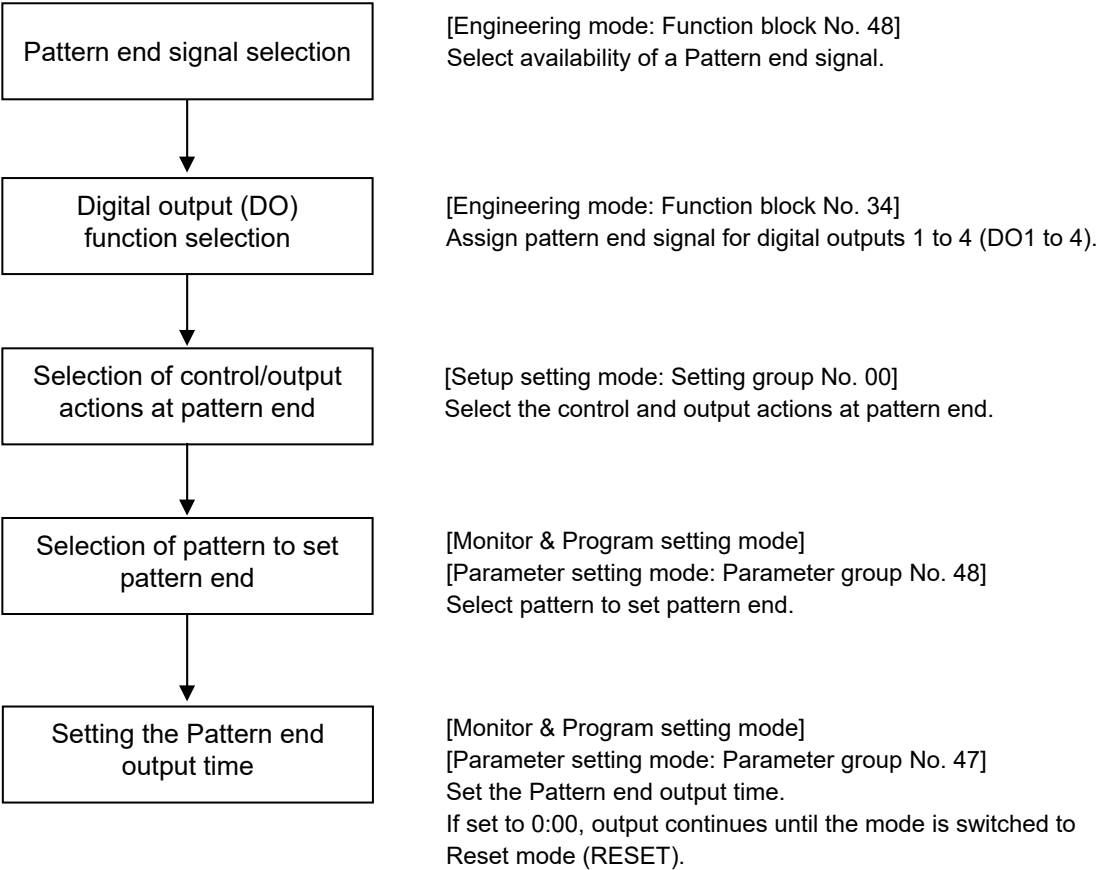


■ Pattern end display

After entering the pattern end state, the TIME display shows *End* (END).
When outputting pattern end output, the pattern end output remaining time and *End* are alternately displayed.
Only *End* is displayed flashing after the pattern end output time has elapsed.



■ Setting procedure



■ Parameter setting

● Pattern end signal selection

[Engineering mode: Function block No. 48 (F_{n48})]

Parameter symbol	Data range	Factory set value
$ENDSL$	0: Unused 1: Used	Based on Model code

● DO1 function selection

[Engineering mode: Function block No. 34 (F_{n34})]

Parameter symbol	Data range	Factory set value
$doSL1$	0: No assignment 1: Logic calculation output (Event, HBA, LBA, Input error) 2: Output of Program control mode (RUN) state 3: Output of Manual control mode (MAN) state 4: Autotuning (AT) state output 5: Output of the communication monitoring result 6: FAIL output (Permanently configured to be de-energized) 7: Time signal 8: Pattern end signal	Based on Model code

● DO2 function selection

[Engineering mode: Function block No. 34 (F_{n34})]

Parameter symbol	Data range	Factory set value
$doSL2$	Same as DO1 function selection	Based on Model code



To display “DO2 function selection,” four digital outputs (DO) must be specified upon order.

● DO3 function selection

[Engineering mode: Function block No. 34 (F_{n34})]

Parameter symbol	Data range	Factory set value
$doSL3$	Same as DO1 function selection	Based on Model code



To display “DO3 function selection,” four digital outputs (DO) must be specified upon order.

● DO4 function selection

[Engineering mode: Function block No. 34 (F_{n34})]

Parameter symbol	Data range	Factory set value
$doSL4$	Same as DO1 function selection	Based on Model code



To display “DO4 function selection,” four digital outputs (DO) must be specified upon order.



● Control action at pattern end

[Setup setting mode: Setting group No. 00 (5n00)]

Parameter symbol	Data range	Factory set value
END.P	PID control, Heat/Cool PID control or Position proportioning PID control (with FBR input): 0: Control continued 1: Control stop Position proportioning PID control (When there is no FBR input or the FBR input is break): 0: Control continued 1: Open-side output OFF, Close-side output OFF 2: Open-side output OFF, Close-side output ON 3: Open-side output ON, Close-side output OFF	0

● Output action at pattern end

[Setup setting mode: Setting group No. 00 (5n00)]

Parameter symbol	Data range	Factory set value
END.A.E	0 to 7 0: OFF +1: Logic calculation output: Action continues +2: Retransmission output: Action continues +4: Instrument status output: Action continues In the case of multiple selection, respective values are added	7



Set the details of digital output (DO) of logic calculation output in Engineering mode: Function block No. 34 “DO function selection” and “DO logic calculation selection.”



Set transmission output details in Engineering mode: Function block Nos. 31 to 33 “Retransmission output type.”



Set the details of instrument state output in Engineering mode: Function block No. 34 “DO function selection.”

● Pattern end output time

[Monitor & Program setting mode]

[Parameter setting mode: Parameter group No. 48 (Pn48)]

Pattern end output time can be set in either Monitor & Program setting mode or Parameter setting mode. Set Pattern end output time for each pattern.

Parameter symbol	Data range	Factory set value
END.FM	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds 0 hours (or minutes) 00 minutes (or seconds): Output remains on	0.00 (0 hours 00 minutes)

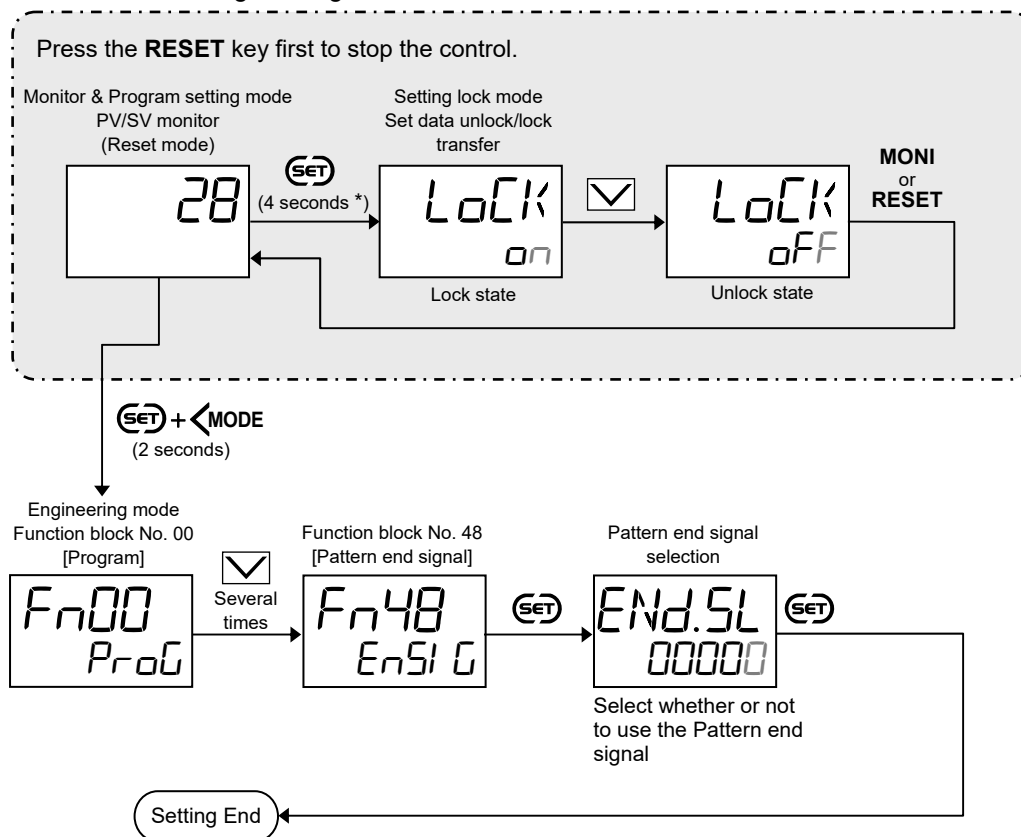


Time unit is set in Engineering mode: Function block No. 00 “Time unit of the setting.”

Setting procedure

Pattern end signal selection

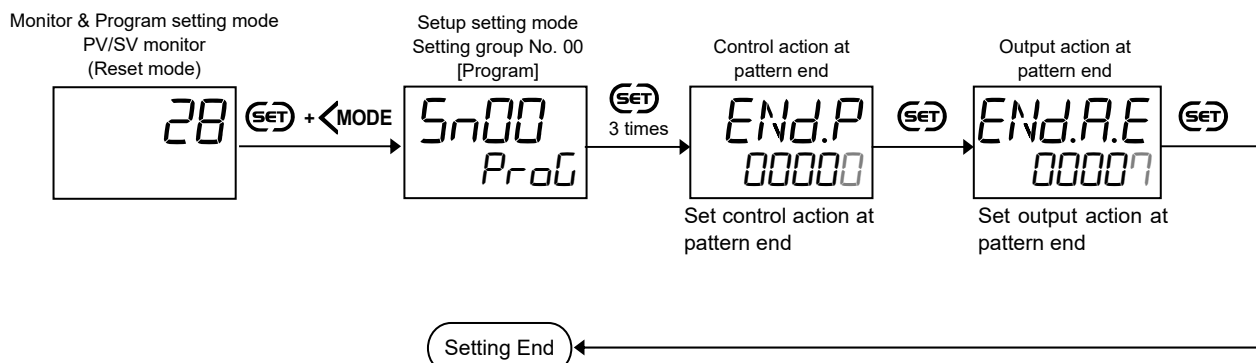
To enter the Engineering mode



* Press the **SET** key until Parameter setting mode is displayed. Keep pressing without releasing your finger from the key to enter the Setting lock mode.

- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

Control and output actions at pattern end



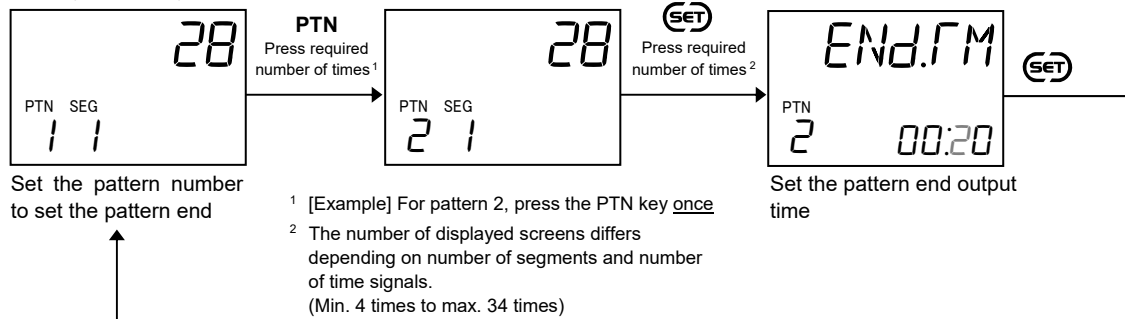
- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
However, if the **RESET** key is pressed during control, control stops.



● Pattern end output time

[In Monitor & Program setting mode]

Monitor & Program setting mode
PV/SV monitor
(Reset mode)

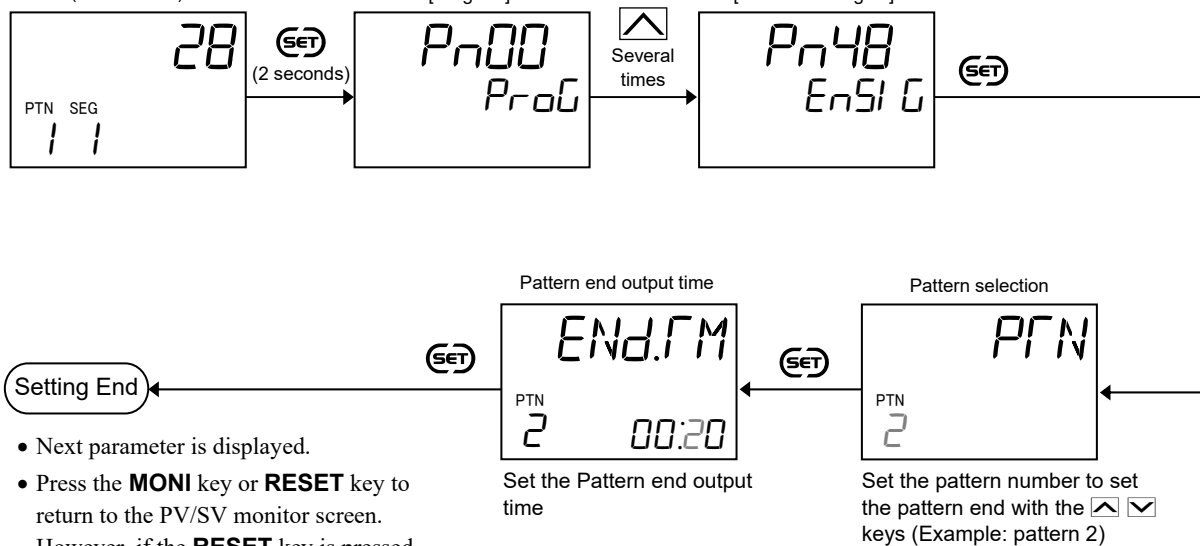


[In Parameter setting mode]

Monitor & Program setting mode
PV/SV monitor
(Reset mode)

Parameter setting mode
Parameter group No. 00
[Program]

Parameter setting mode
Parameter group No. 48
[Pattern end signal]



- Next parameter is displayed.
- Press the **MONI** key or **RESET** key to return to the PV/SV monitor screen. However, if the **RESET** key is pressed during control, control stops.

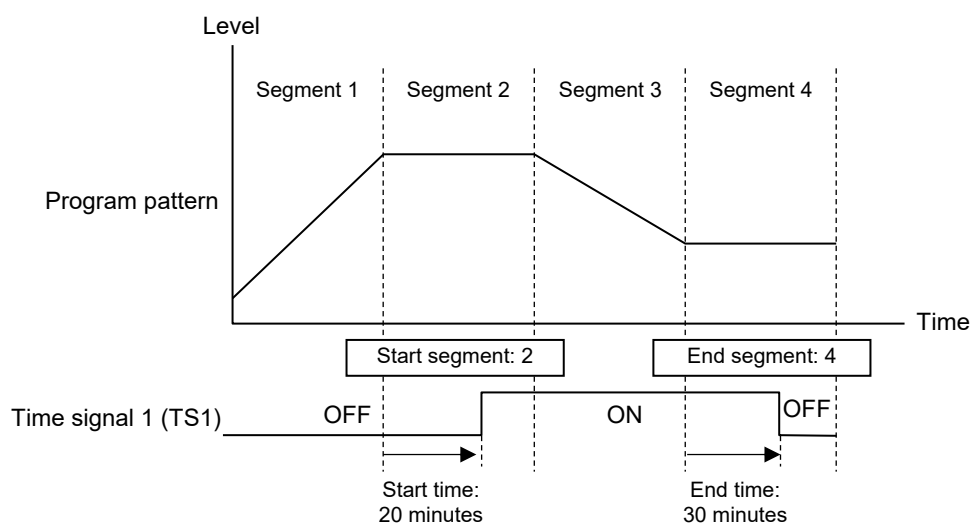
11.9 Outputting a Signal According to the Progress of a Program (Time Signal)

The time signal is a function that outputs the state of progress of a program to external instruments (sequencer, alarm unit, etc.) as an ON/OFF signal. Set the start/end segment of the time signal and the start/end time for each pattern.

■ Description of function

Depending on the start/end segment number settings, the signal can be output over a number of segments. The output start/end time also can be set.

[Time signal diagram]



● Time signal output

Scores in Time signal: Maximum 4 points (TS1 to TS4)

Time signal output destinations: Maximum 4 points (DO1 to DO4)



For the time signal, refer to **9.1 Changing Output Assignment (P. 9-2)**.



● Points for attention in time signal setting

- The segment number to start a time signal must be the same or smaller than the end segment number.

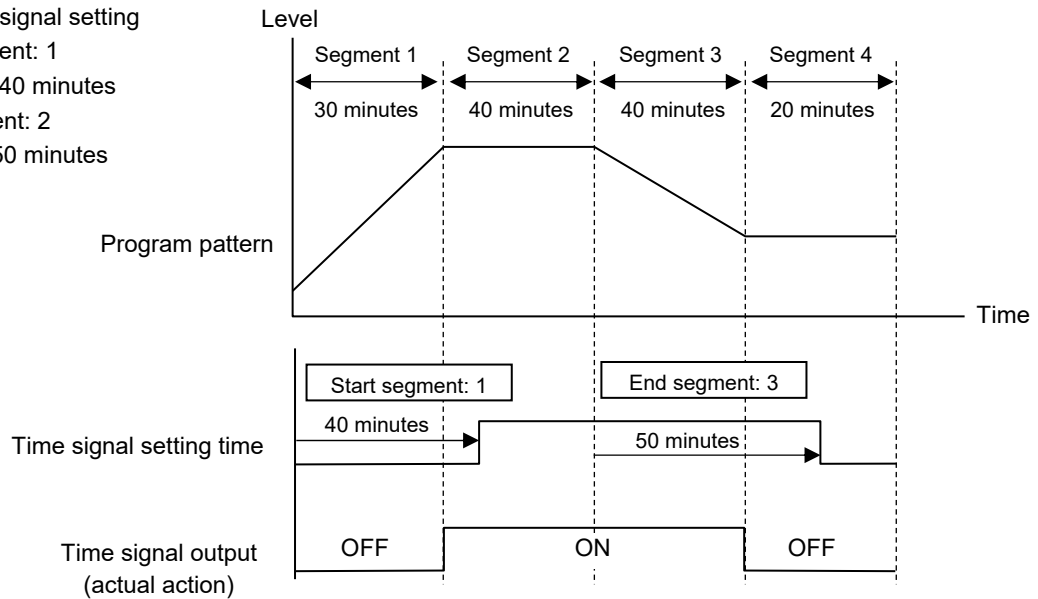
$$\text{Start segment number} \leq \text{end segment number}$$

However, when the start segment number and end segment number are the same and the end time is shorter than the start time, the time signal output does not turn ON.

- If the start time is longer than the segment time, the time signal turns ON from the following segment. If the end time is longer than the segment time, the time signal turns OFF from the following segment.

[Example] Time signal setting

Start segment: 1
Start time: 40 minutes
End segment: 2
End time: 50 minutes



If the end segment is set as the final segment, and the end time is set longer than the segment time of the final segment, the time signal will turn OFF in the pattern end state.

Also, if pattern link and pattern repeat are performed, the time signal action is continued as per the program.



If the time signal end time and the segment time of that segment are the same, the time signal is turned OFF when the wait function is executed. (Time extended in wait is not considered)

Furthermore, if the time signal end time is set longer than the segment time of that segment, the time signal is turned ON when the wait function is executed. (The program does not move on to the next segment, so time extended with wait is also in the scope of the time signal)

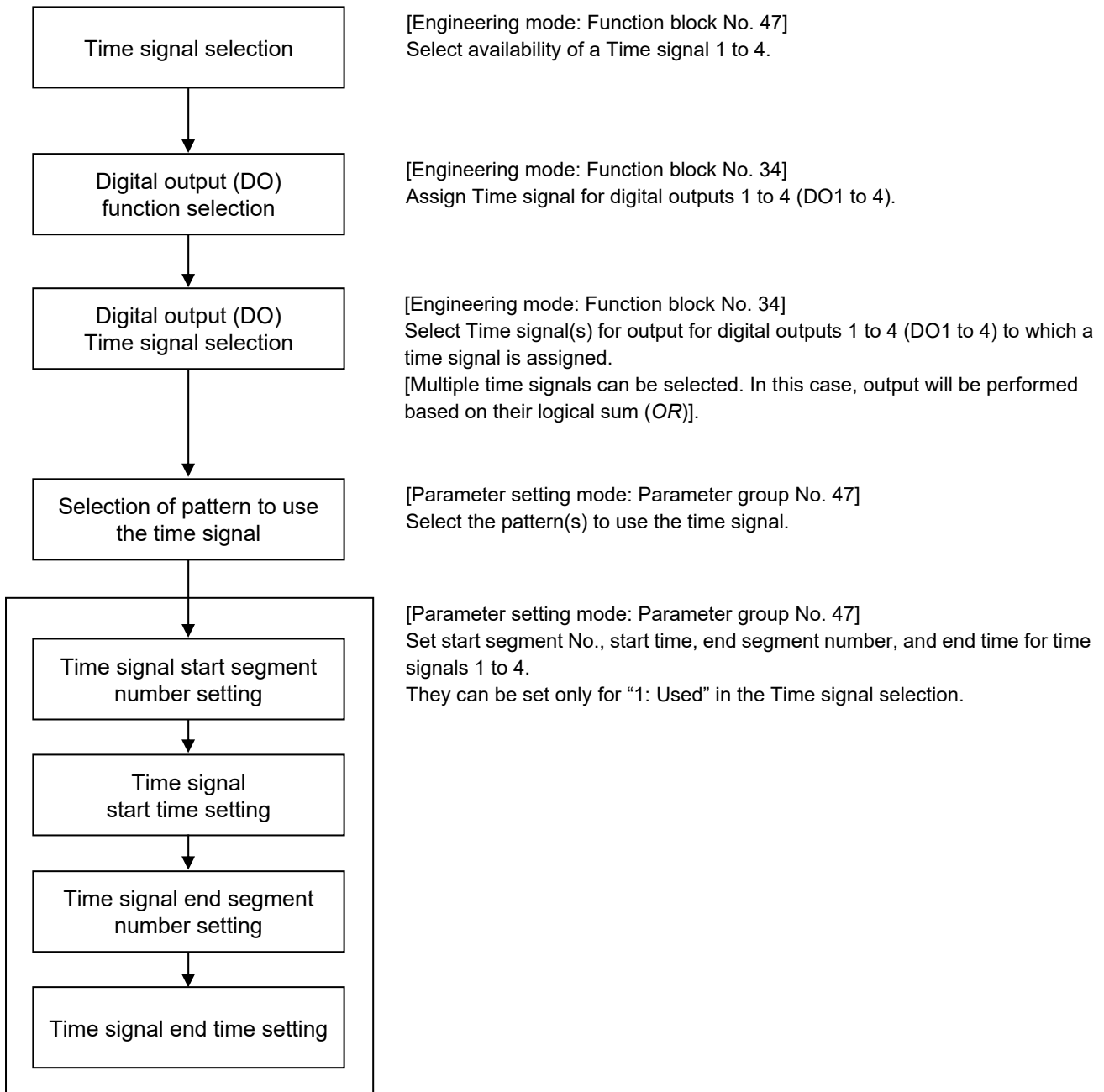


When time signal is ON, the time signal turns to OFF after switching to Fixed set point control mode (FIX) or Manual control mode (MAN). It then returns to ON after switching to Program control mode (RUN) again.



If Autotuning (AT) is executed in Program control mode (RUN), the program enters the hold state, so if AT is executed when the time signal is ON, the time signal ON state is maintained.

■ Setting procedure



Pattern selection, time signal start segment number, start time, end segment number, end time can be set also in Monitor & Program setting mode (Reset mode).



■ Parameter setting

● Time signal selection

[Engineering mode: Function block No. 47 (F_{n47})]

Parameter symbol	Data range	Factory set value
	Set 0 or 1 for each digit. 	Based on Model code

● DO1 function selection

[Engineering mode: Function block No. 34 (F_{n34})]

Parameter symbol	Data range	Factory set value
	0: No assignment 1: Logic calculation output (Event, HBA, LBA, Input error) 2: Output of Program control mode (RUN) state 3: Output of Manual control mode (MAN) state 4: Autotuning (AT) state output 5: Output of the communication monitoring result 6: FAIL output (Permanently configured to be de-energized) 7: Time signal 8: Pattern end signal	Based on Model code

● DO2 function selection

[Engineering mode: Function block No. 34 (F_{n34})]

Parameter symbol	Data range	Factory set value
	Same as DO1 function selection	Based on Model code



To display “DO2 function selection,” four digital outputs (DO) must be specified upon order.

● DO3 function selection

[Engineering mode: Function block No. 34 (F_{n34})]

Parameter symbol	Data range	Factory set value
	Same as DO1 function selection	Based on Model code



To display “DO3 function selection,” four digital outputs (DO) must be specified upon order.

● DO4 function selection

[Engineering mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
do5L4	Same as DO1 function selection	Based on Model code



To display “DO4 function selection,” four digital outputs (DO) must be specified upon order.

● DO1 time signal selection

[Engineering mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
do151	Set 0 or 1 for each digit.	Based on Model code



To display “DO1 time signal selection,” it is necessary to set the time signal in “DO1 function selection” of Function block No. 34 in Engineering mode.

● DO2 time signal selection

[Engineering mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
do152	Same as DO1 time signal selection	Based on Model code



To display “DO2 time signal selection,” it is necessary to set the time signal in “DO2 function selection” of Function block No. 34 in Engineering mode.

● DO3 time signal selection

[Engineering mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
do153	Same as DO1 time signal selection	Based on Model code



To display “DO3 time signal selection,” it is necessary to set the time signal in “DO3 function selection” of Function block No. 34 in Engineering mode.



● DO4 time signal selection

[Engineering mode: Function block No. 34 (Fn34)]

Parameter symbol	Data range	Factory set value
doF54	Same as DO1 time signal selection	Based on Model code



To display [DO4 time signal selection,] it is necessary to set the time signal in “DO4 function selection” of Function block No. 34 in Engineering mode.

● Pattern selection

[Parameter setting mode: Parameter group No. 47 (Pn47)]

Parameter symbol	Data range	Factory set value
PrN	1 to 16	1

● Time signal 1 to 4 start segment number

[Monitor & Program setting mode]

[Parameter setting mode: Parameter group No. 47 (Pn47)]

Parameter symbol	Data range	Factory set value
01.5.SN	1 to 16	1
02.5.SN		
03.5.SN		
04.5.SN		



To display “Time signal 1 to 4 start segment number,” it is necessary to activate the relevant time signal in “Time signal selection” of Function block No. 47 in Engineering mode.

● Time signal 1 to 4 start time

[Monitor & Program setting mode]

[Parameter setting mode: Parameter group No. 47 (Pn47)]

Parameter symbol	Data range	Factory set value
01.5.FM	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds	0:00 (0 hours 00 minutes)
02.5.FM		
03.5.FM		
04.5.FM		



Time unit is set in Engineering mode: Function block No. 00 “Time unit of the setting.”



To display “Time signals 1 to 4 start time,” it is necessary to activate the relevant time signal in “Time signal selection” of Function block No. 47 in Engineering mode.



- Time signal 1 to 4 end segment number

[Monitor & Program setting mode]

[Parameter setting mode: Parameter group No. 47 (P₀₄₇)]

Parameter symbol	Data range	Factory set value
01.E.SN	1 to 16	1
02.E.SN		
03.E.SN		
04.E.SN		



To display “Time signal 1 to 4 end segment number,” it is necessary to activate the relevant time signal in “Time signal selection” of Function block No. 47 in Engineering mode.

- Time signals 1 to 4 end time

[Monitor & Program setting mode]

[Parameter setting mode: Parameter group No. 47 (P₀₄₇)]

Parameter symbol	Data range	Factory set value
01.E.TM	0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds	0:00 (0 hours 00 minutes)
02.E.TM		
03.E.TM		
04.E.TM		



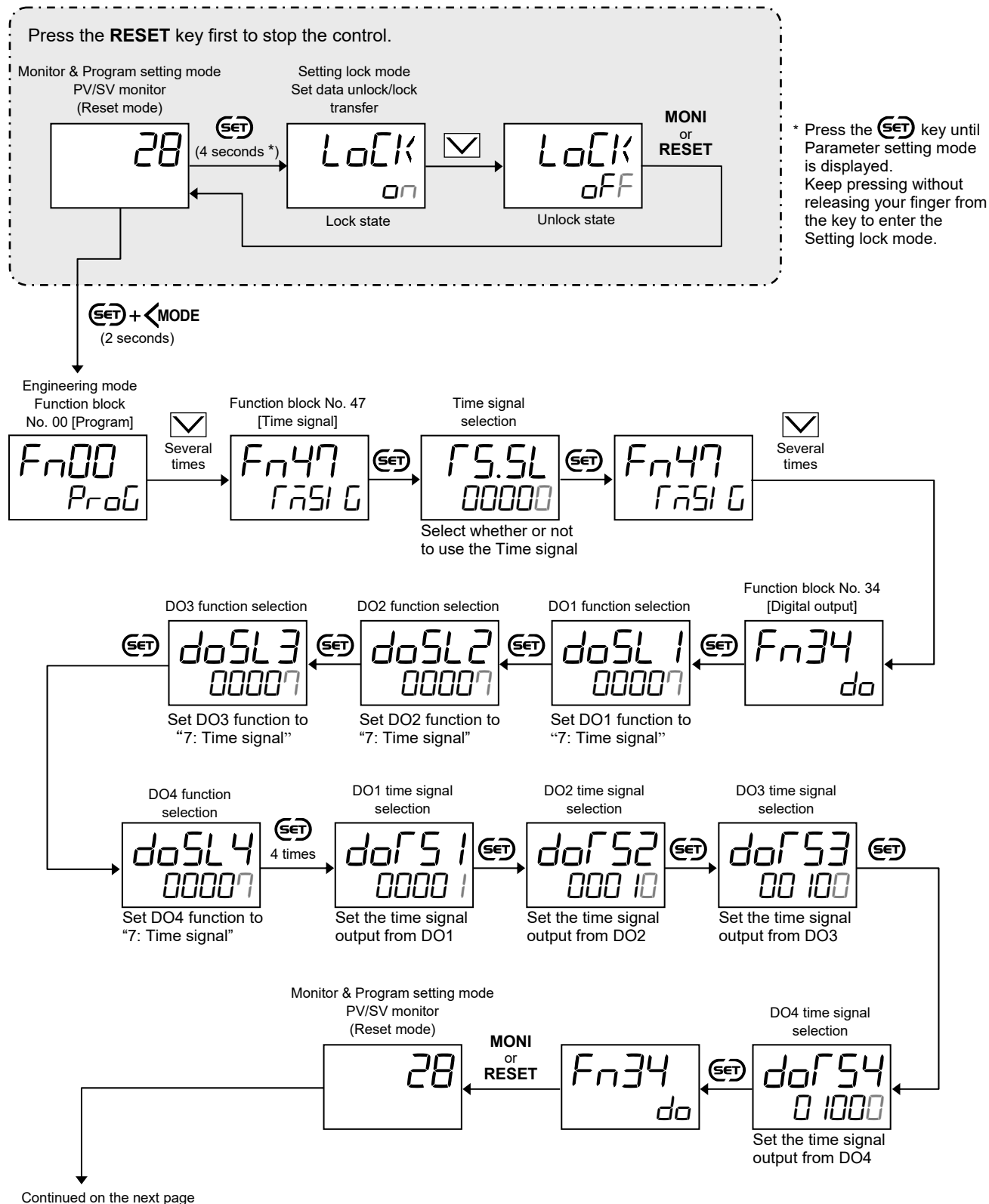
Time unit is set in Engineering mode: Function block No. 00 “Time unit of the setting.”

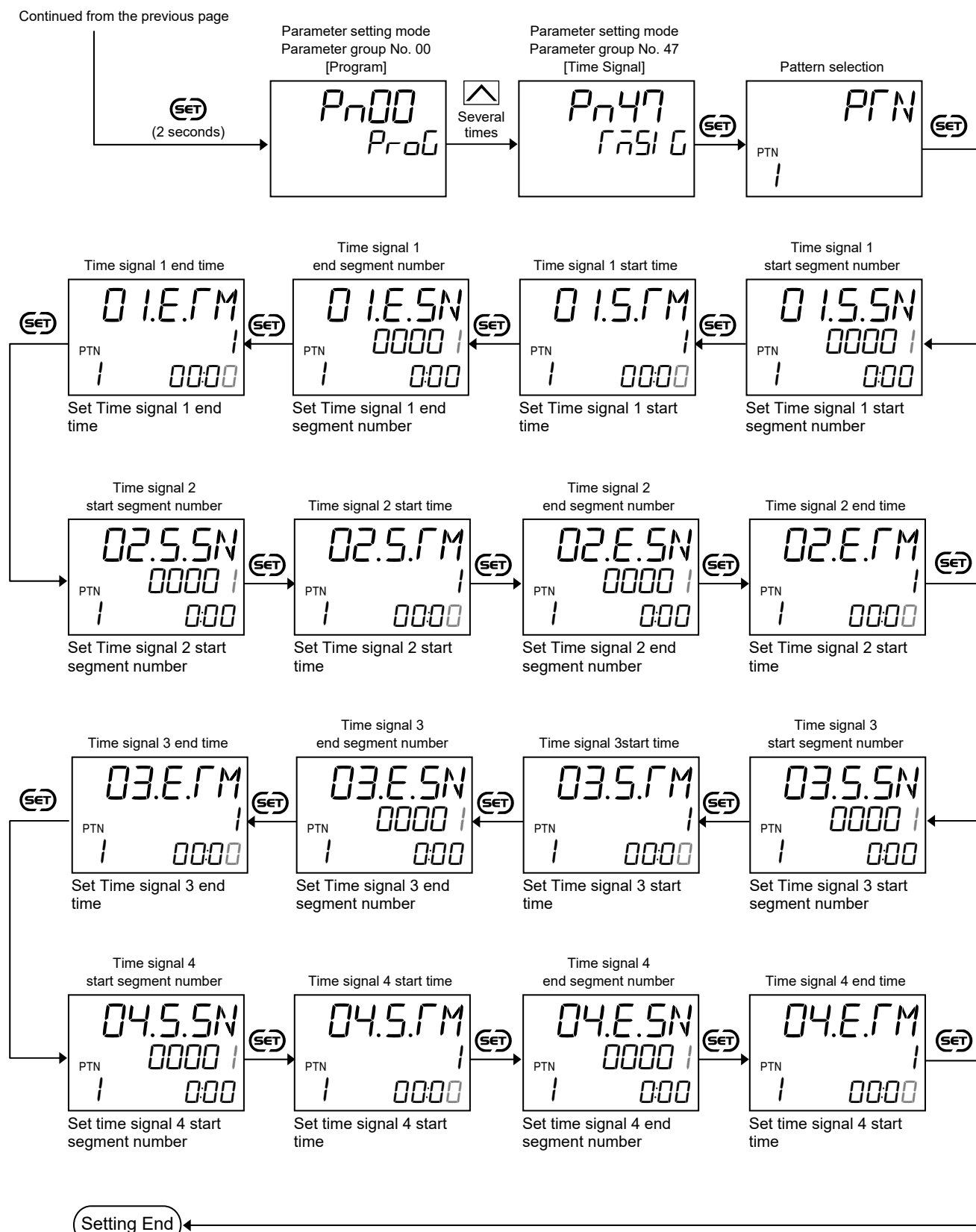


To display “Time signals 1 to 4 end time,” it is necessary to activate the relevant time signal in “Time signal selection” of Function block No. 47 in Engineering mode.

Setting procedure

To enter the Engineering mode





- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



11.10 Changing the Setting Change Action During Program Control

Segment level and Segment time can also be changed in Program control mode (RUN).

There are two setting items for the action upon change.

- Segment setting change type
- Store segment setting change

■ Segment settings change action selection

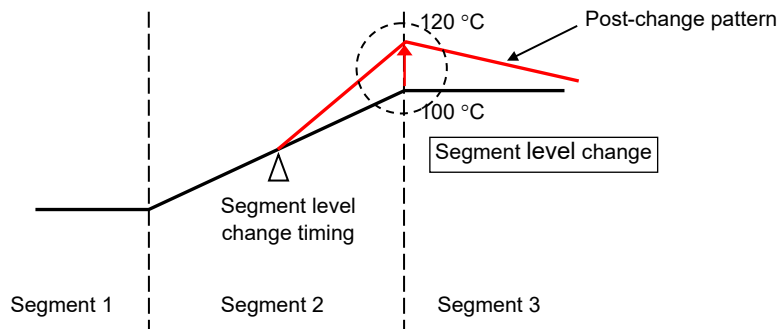
Segment setting change type has “Change type 1” and “Change type 2”

● Change type 1

[Segment level change]

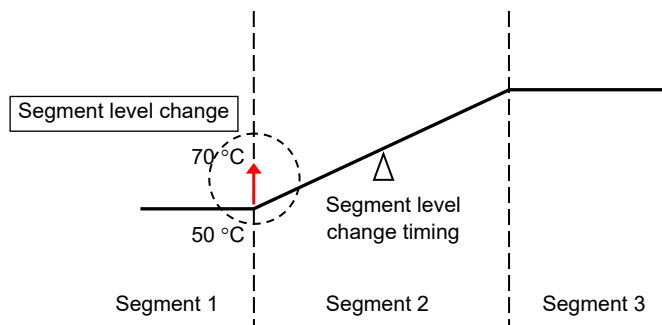
Example: During Segment 2 control, the segment 2 level is changed from 100 °C to 120 °C

The target value changes with a constant slope from the target value at the change to the changed segment level.



Example: During segment 2 control, the segment 1 level is changed from 50 °C to 70 °C

Nothing changes at that point in time since the attempt is to change the condition in the past before the changing timing. If pattern control is to be performed multiple times with Repeat, the change is made in the next control.

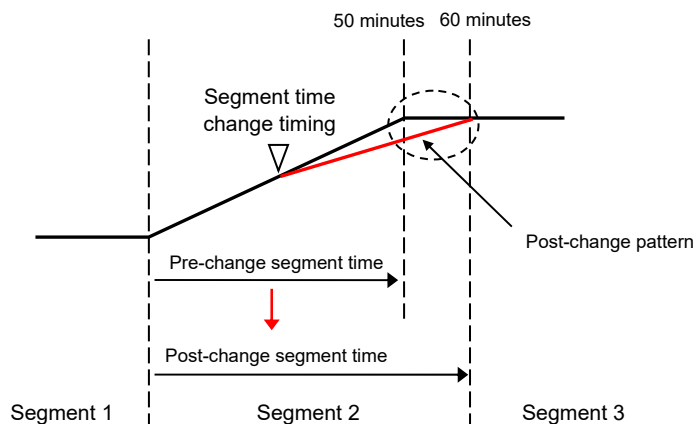


[Segment time change]

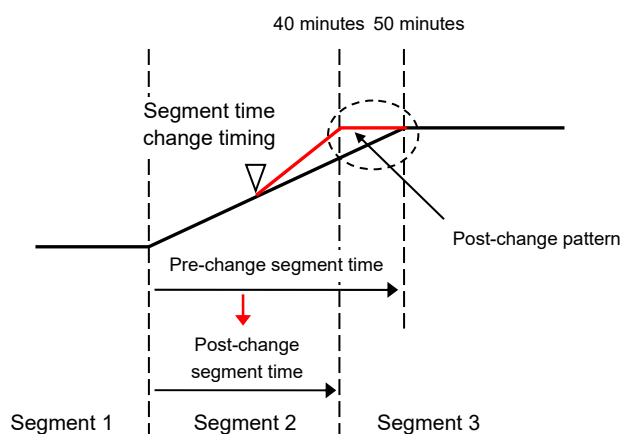
Example: During segment 2 control, the segment 2 time is changed from 50 mins to 60 mins

The changed segment time is used as the time setting for that segment.

The target value changes with a constant slope from the target value at the change to the changed segment level.



Example: During segment 2 control, the segment 2 time is changed from 50 mins to 40 mins

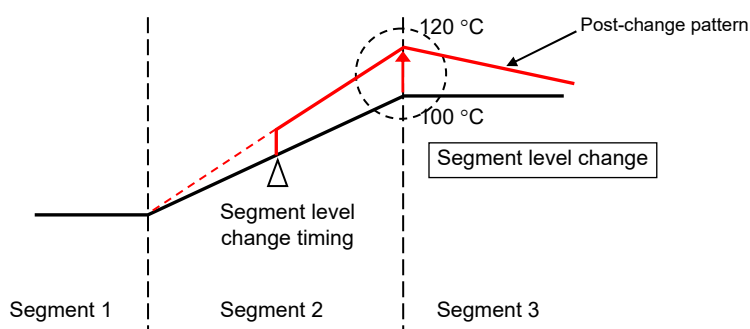


● Change type 2

[Segment level change]

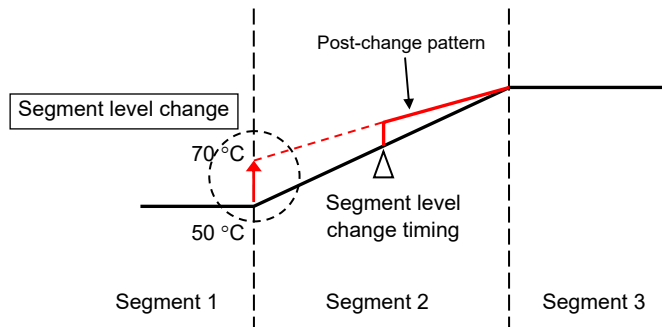
Example: During segment 2 control, the segment 2 level is changed from 100 °C to 120 °C

The target value changes with a constant slope from segment 1 level to the changed segment 2 level.



Example: During segment 2 control, the segment 1 level is changed from 50 °C to 70 °C

The target value changes with a constant slope from changed segment 1 level to the segment 2 level.

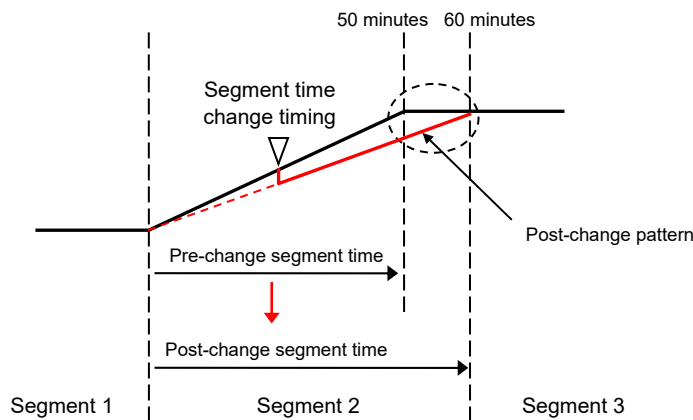


[Segment time change]

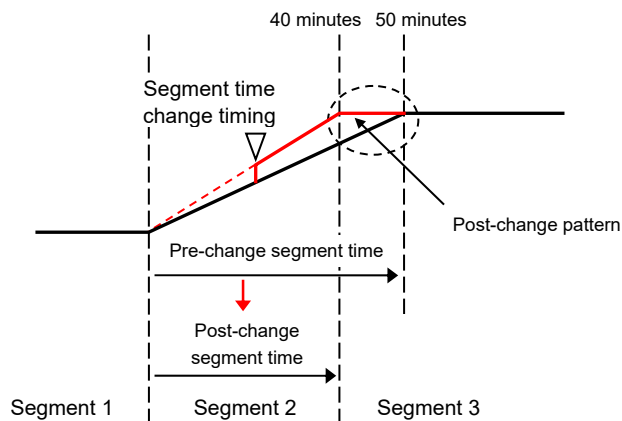
Example: During segment 2 control, the segment 2 time is changed from 50 mins to 60 mins

The changed segment time is used as the time setting for that segment.

The target value changes with a constant slope from segment 1 level to the changed segment 2 level.



Example: During segment 2 control, the segment 2 time is changed from 50 mins to 40 mins



■ Segment setting change keeping selection

When the segment level and the segment time in the Program control mode (RUN) are changed, users can select whether to store the changed value and use it again (0: Store setting), or not to store it and use it just once (1: Do not store setting). “1: Do not store setting” is only applied to the change of the segment level/time in the Monitor & Program setting mode. If those settings are modified through parameter setting mode or communication, modified settings will be stored and maintained.

■ Parameter setting

● Segment setting change type

[Engineering mode: Function block No. 00 (F_n00)]

Parameter symbol	Data range	Factory set value
SG.CNG	0: Change type 1 1: Change type 2	0

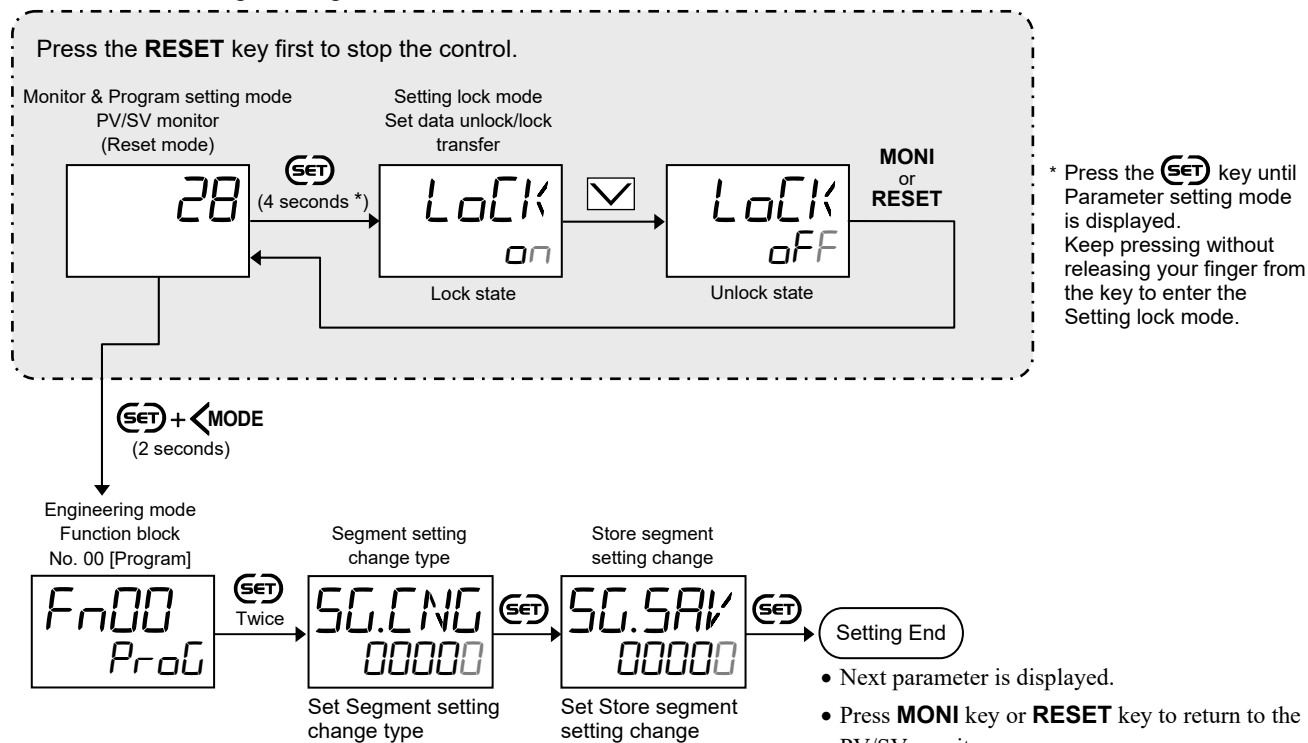
● Store segment setting change

[Engineering mode: Function block No. 00 (F_n00)]

Parameter symbol	Data range	Factory set value
SG.SAV	0: Store setting 1: Do not store setting	0

■ Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.

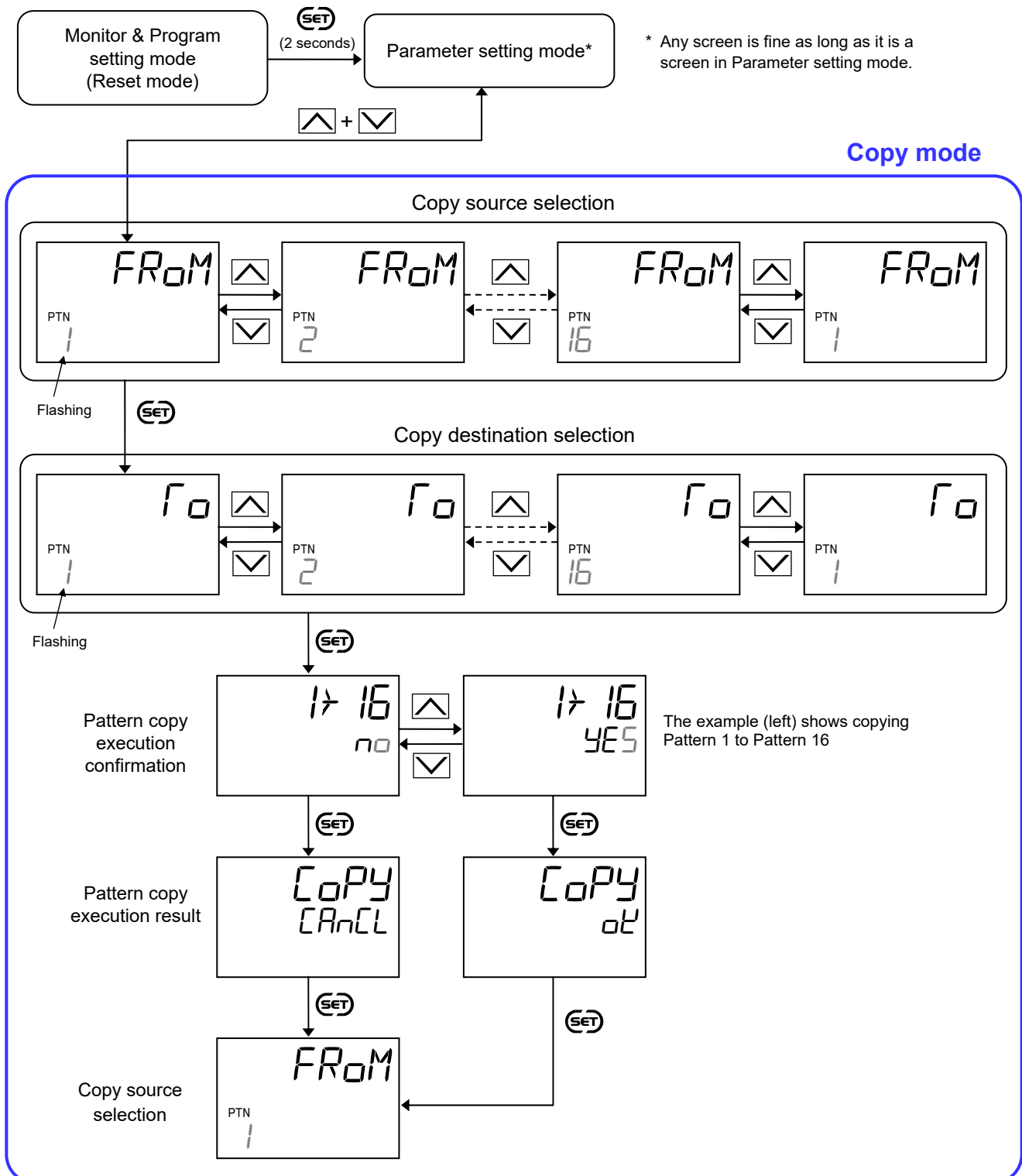
11.11 Copying Program Pattern Data

Up to 16 program patterns can be set, but it consumes time if patterns are set one after another manually. On this instrument, the program pattern can be copied.

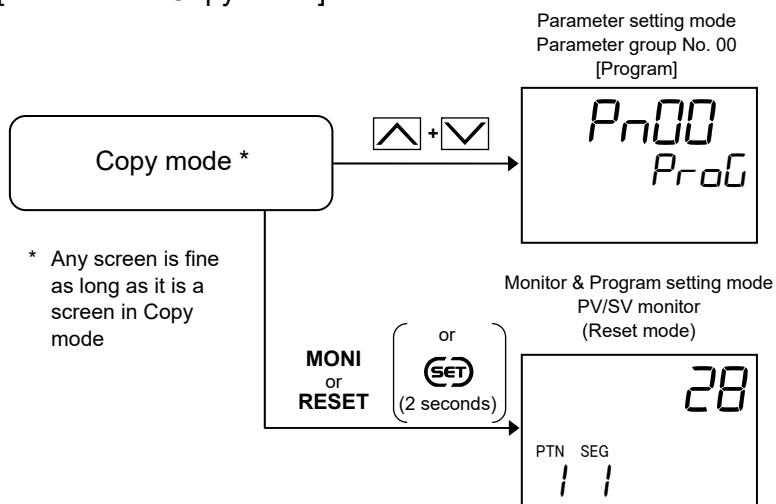


Copy mode can only be displayed in Reset mode (RESET).

■ Copy mode screen transition

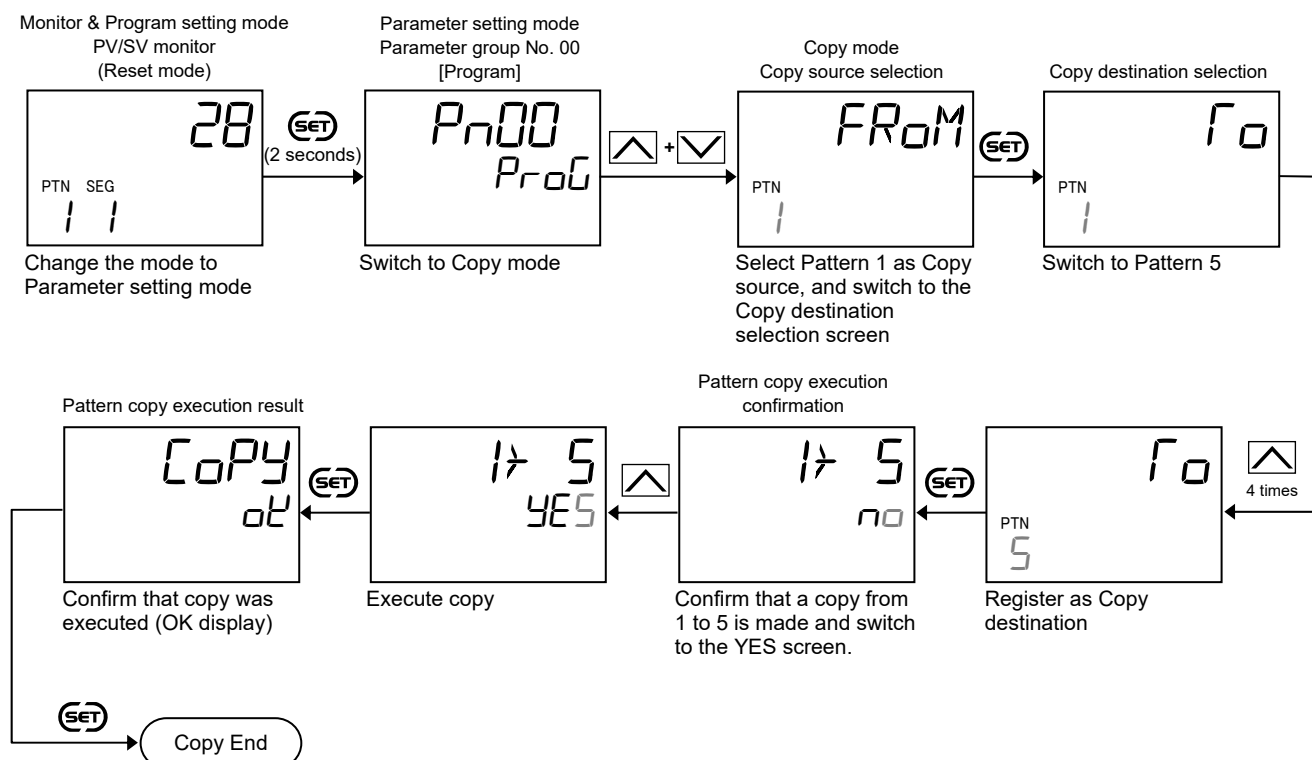


[To exit from Copy mode]



[Pattern copy example]

Copy Pattern 1 data to Pattern 5



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.



Items to be copied by the copy mode:

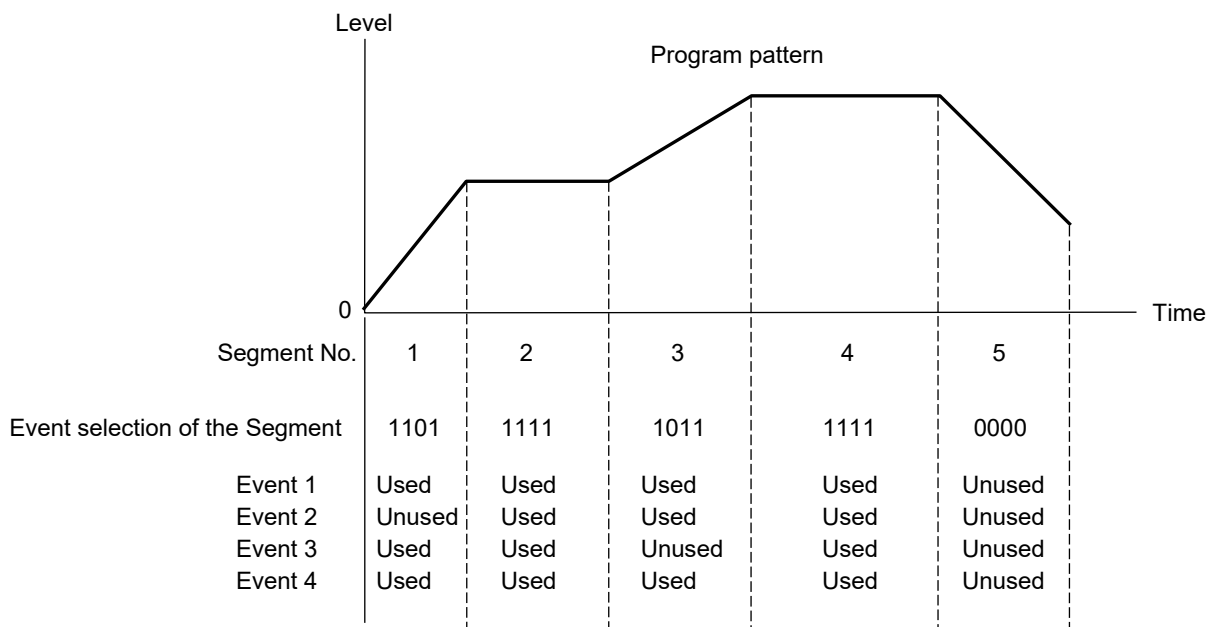
- Segment level
- Segment time
- Time signal start segment number
- Time signal start time
- Time signal end segment number
- Time signal end time
- Pattern end output time
- Event set value
- Number of repeating patterns
- Pattern link number
- Pattern end
- Event selection of the Segment



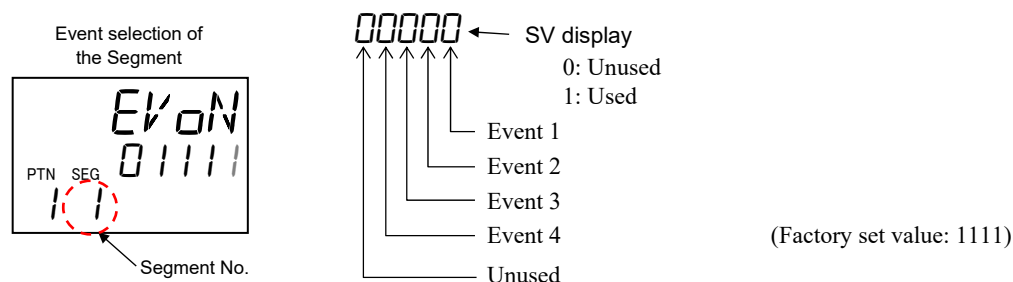
11.12 Setting Event Used/Unused at each segment

This instrument allows enabling/disabling Event function 1 to 4 at each program segment.

[Image of “Event selection of the Segment”]



Set 0 or 1 in each digit on the “Event selection of the Segment” screen.



“Event selection of the Segment” is available only in the Program control mode (RUN).



When event Used/Unused setting was modified when an event occurs, modified setting will be reflected as of its setting modification. When an event was modified from Used to Unused, this event setting becomes event OFF as of its setting modification.
(When “Event selection of the Segment” is available)



When “Event selection of the Segment” is available, event timer is also available.
Interlock status is kept if the event setting is Unused.



“Event selection of the Segment” is available in below states:

- Autotuning (AT)
- Startup tuning (ST)
- Wait
- Hold

“Event selection of the Segment” is not available in below states:

- Overall level autotuning (AT)
- Pattern end *

* Refer to P.11-55 for the events at the pattern end.

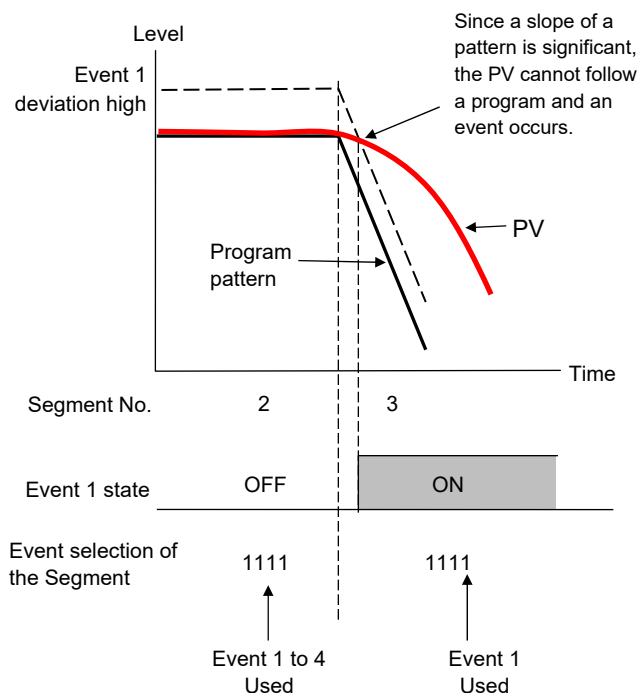
■ Description of function

With this function, users can invalidate an event in each segment if an event occurs due to program setting (program configuration).

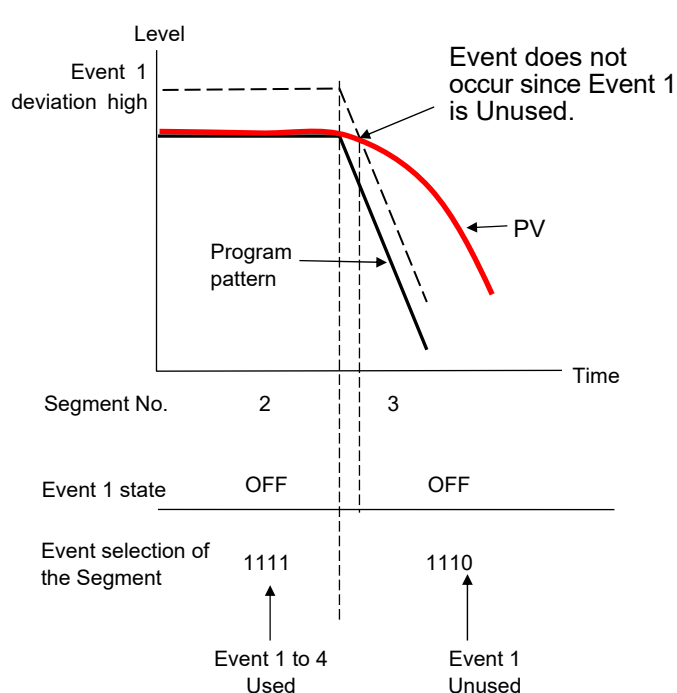
[Example] When the Event type is deviation

When you set a ramp segment with a significant slope to make startup quick, deviation alarm might be on since the Measured value (PV) could not follow a program. In this case, invalidate an event which you do not want to occur in a segment and you can prevent its occurrence.

When Event 1 in Segment 3 is Used



When Event 1 in Segment 3 is Unused

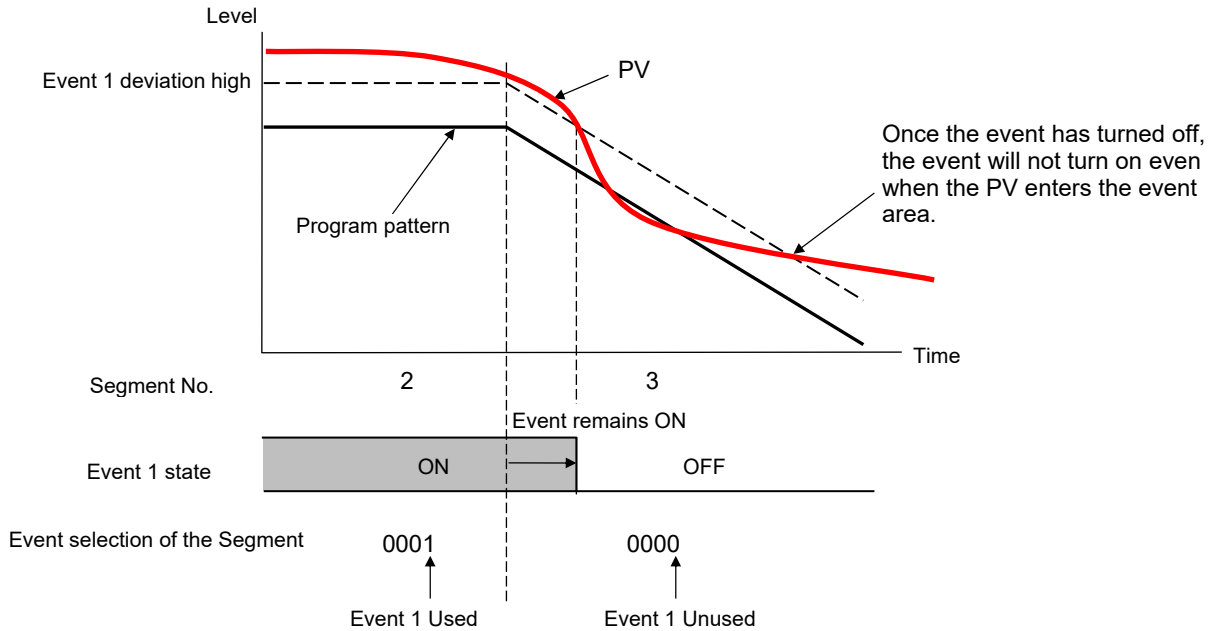




● Action when an event occurred before a segment is switched

When an event was on before a segment is switched to the segment where an event is disabled, the event ON state is kept after the segment is switched. The event at the relevant segment becomes disabled when the event has turned off.

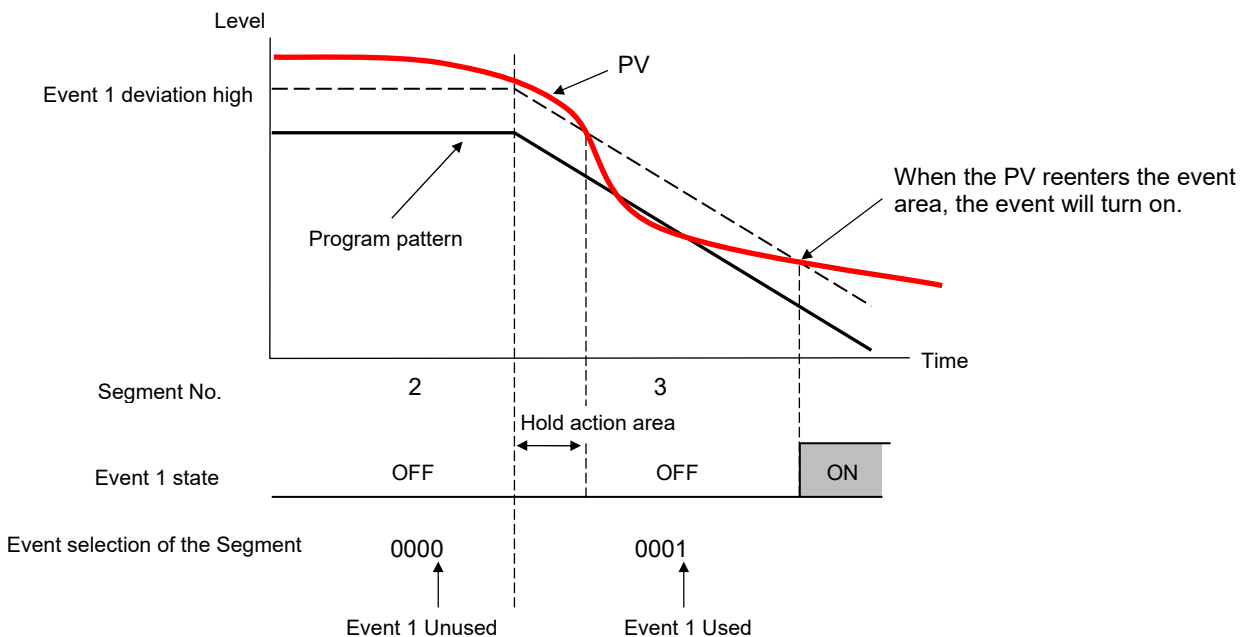
[Example] When the Event 1 is Deviation high



● Action when Event with hold action is enabled

When the segment is switched from a segment where event is disabled to a segment where event is enabled, the hold action will suppress the event from turning on even when the Measured value (PV) is within the event area. When the Measured value (PV) goes out of the event area once and reenters the event area, then the event will turn on.

[Example] When the Event 1 is Deviation high (with hold action)



In the above example, if Event 1 at Segment 2 is enabled, as Segment 2 is in Event ON state, hold action will not function at Segment 3 and event ON state will continue.



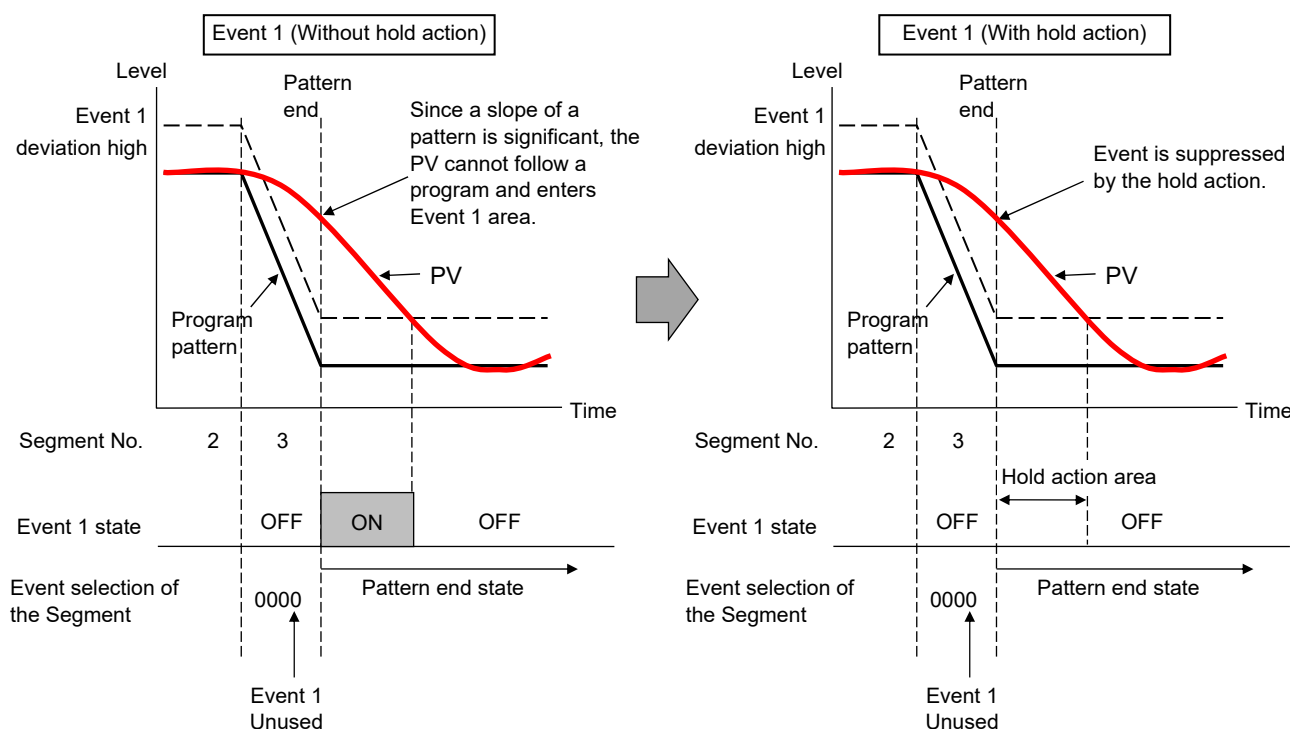
The event action at the Pattern end can be set at “Output action at pattern end.”

[Example 1] The following setting is required to enable Event 1 at the Pattern end.

- Output action at pattern end (Setup setting mode, Setting group No. 00)
「+1: Logic calculation output: Action continues」
- DO1 logic calculation selection (Engineering mode, Function block No. 30)
「+1: Event 1」
- DO1 function selection (Engineering mode, Function block No. 34)
「1: Logic calculation output」

[Example 2] To suppress the Event 1 at the Pattern end, under the conditions above [Example 1], set the Event 1 to have a Hold action.

In this case, the Event is OFF even when the Measured value (PV) is within the Event area at the Pattern end. However, once the Measured value (PV) goes out of the Event area, the Event turns on when the Measured value (PV) reenters the Event area.



Refer to **11.8 Changing the Action When Program Control Ends (Pattern End) (P.11-31)** for action at the pattern end.



Refer to **10.1.2 Adding hold action to the event action (P.10-14)** for an event with hold action.

Parameter setting

Event selection of the Segment 1 to 16

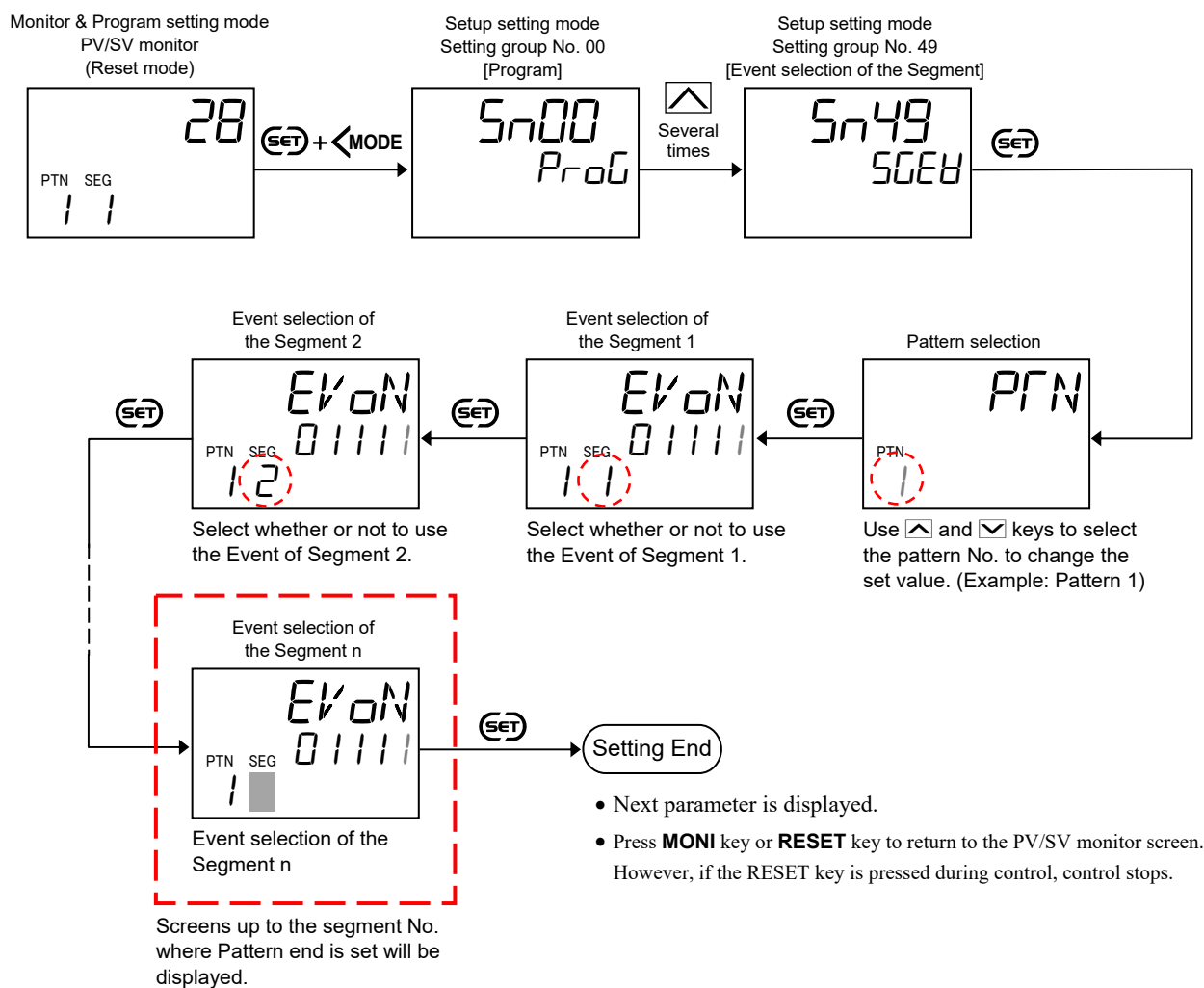
[Setup setting mode: Setting group No. 49 (5n49)]

Parameter symbol	Data range	Factory set value
EVON	Set 0 or 1 for each digit. 	1111



Event selection of the segment No. 2 to 16 which you set the pattern end will be displayed.

Setting procedure





CONTROL FUNCTION

12

This chapter describes control related functions, setting contents and setting procedure based on the key words related to controls.

12.1 Changing Control Action	12-2
12.2 Setting PID Values Automatically (Autotuning)	12-7
12.3 Setting PID Values Automatically (Startup tuning)	12-17
12.4 Setting PID Values Manually.....	12-23
12.5 Controlling with ON/OFF Action	12-30
12.6 Controlling with Fixed Set Point Control.....	12-34
12.7 Controlling with Heat/Cool Control	12-37
12.8 Controlling with Position Proportioning Control	12-46
12.9 Controlling with Manual Control	12-58
12.10 Controlling each temperature level with different PID values (Level PID)	12-61
12.11 Eliminating Offset Inherent to Proportioning Control (Manual Reset).....	12-69
12.12 Suppressing Overshoot.....	12-71
12.13 Changing the Action at Power ON (Hot/Cold Start).....	12-78

12.1 Changing Control Action

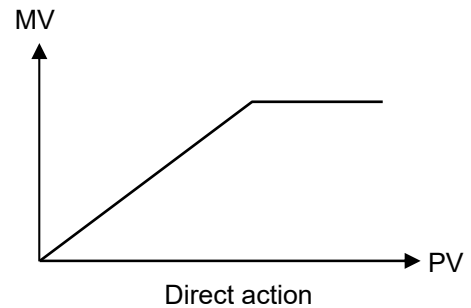
Refer to the following 8 types of control action:

- PID control (direct action)
- PID control (reverse action)
- ON/OFF action
- Heat/Cool PID control (water cooling)
- Heat/Cool PID control (air cooling)
- Heat/Cool PID control (Cooling linear type)
- Position proportioning PID control (direct action)
- Position proportioning PID control (reverse action)

■ PID control (direct action)

The Manipulated output value (MV) increases as the Measured value (PV) increases.

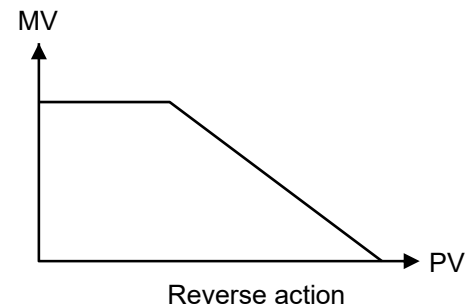
This action is used generally for cooling control.



■ PID control (reverse action)

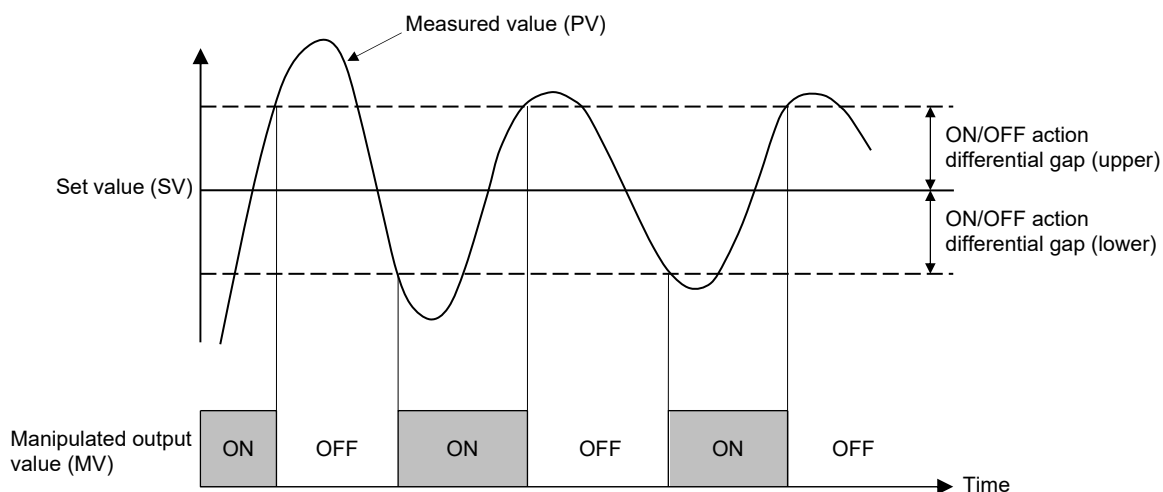
The Manipulated output value (MV) decreases as the Measured value (PV) increases.

This action is used generally for heating control.



■ ON/OFF action

ON/OFF control is possible when the Proportional band [heat-side] is set to 0. In ON/OFF control with Reverse action, when the Measured value (PV) is smaller than the Set value (SV), the Manipulated output (MV) is 100 % or ON. When the PV is higher than the SV, the MV is 0 % or OFF. Differential gap setting prevents control output from repeating ON and OFF too frequently.



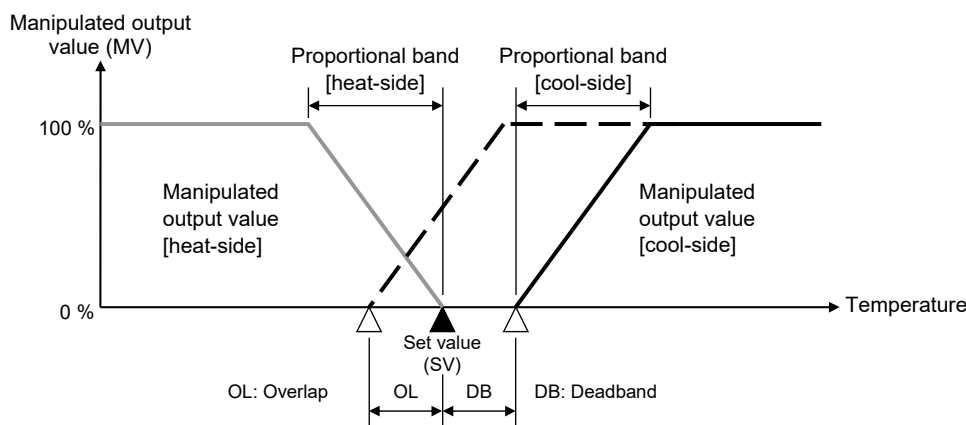
For ON/OFF action, refer to **12.5 Controlling with ON/OFF Action (P. 12-30)**.

■ Heat/Cool PID control

In Heat/Cool control, heating and cooling control can be achieved with a single controller.

Water cooling/Air cooling: The algorithm intended for Heat/Cool control on the plastic extruders is employed. Even in equipment provided with a cooling mechanism having nonlinear characteristics, it responds quickly to attain the characteristic responding to the set value with small overshooting.

Cooling linear type: The algorithm intended for applications without nonlinear cooling capability is employed.

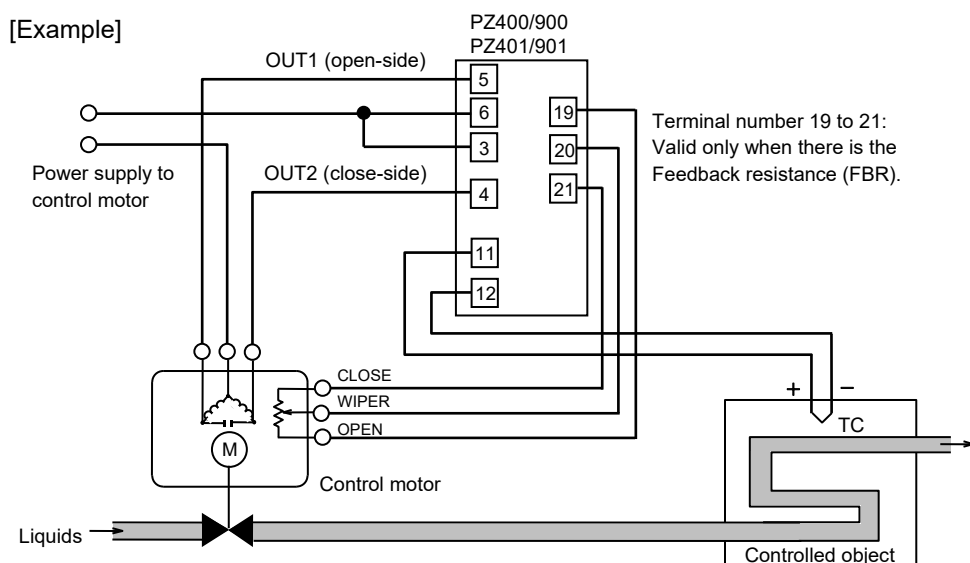


For Heat/Cool PID control, refer to **12.7 Controlling with Heat/Cool Control (P. 12-37)**.

■ Position proportioning PID control

Position proportioning PID control converts the control output value of the controller into the corresponding signal to control a motor driven valve (control motor) and then performs temperature control of a controlled object by regulating fluid flow.

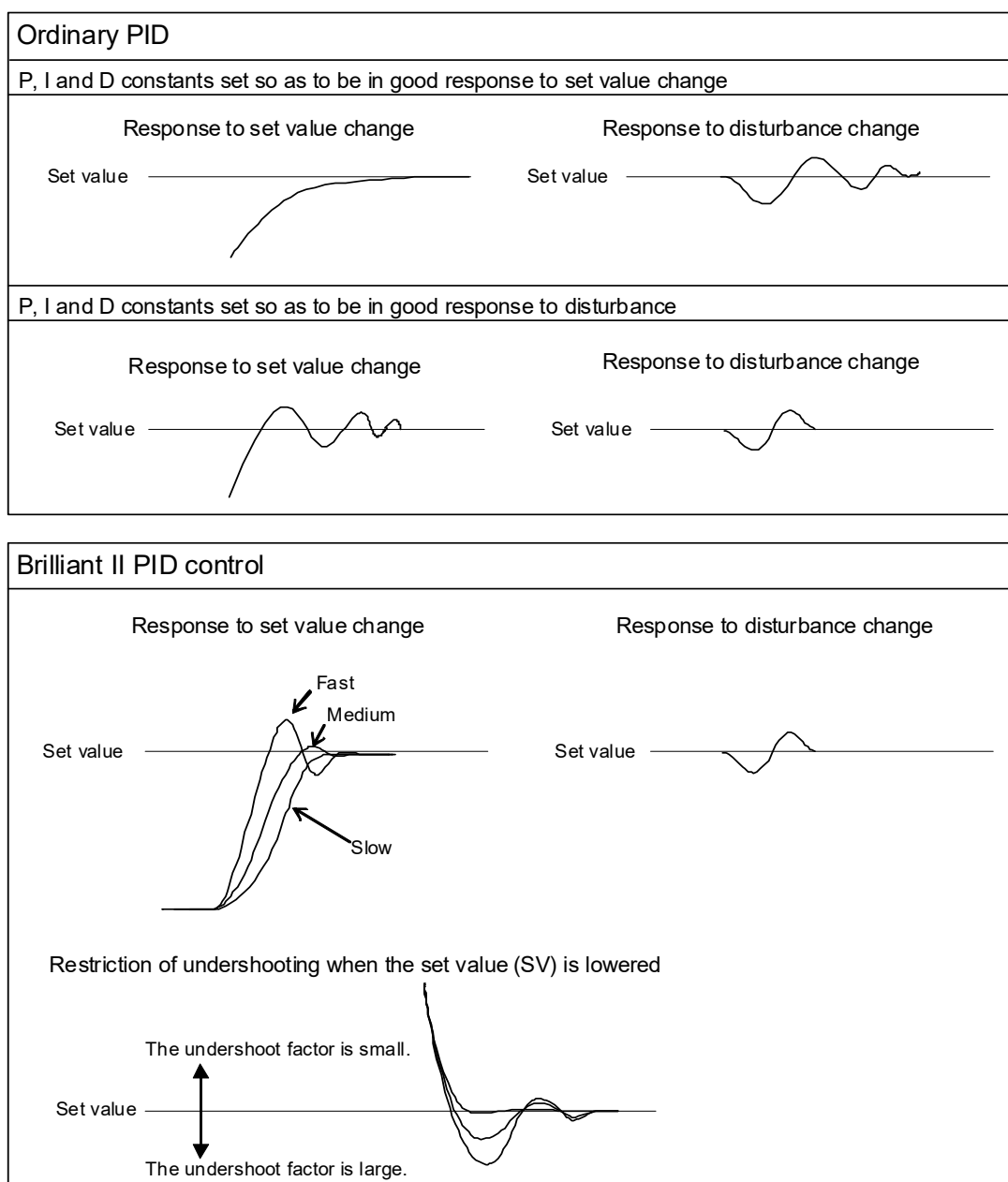
In Position proportioning PID control of this controller, it is possible to select the presence or absence of Feedback resistance (FBR) input which monitors the degree of valve position (Specify when ordering). In addition, the direct action or reverse action can be selected.



For Position proportioning PID control, refer to **12.8 Controlling with Position Proportioning Control (P. 12-46)**.

■ Brilliant II PID control

PID control is a control method of achieving stabilized control result by setting P (Proportional band), I (Integral time) and D (Derivative time) constants, and is widely used. However, with this PID control, if P, I and D values are set to focus on “better response to control set value change,” “response to external disturbance” deteriorates. In contrast, if PID values are set to focus on “better response to external disturbance,” “response to control set value change” deteriorates. In brilliant II PID control a form of “Response to setting” can be selected from among **Fast**, **Medium** and **Slow** with PID constants remaining unchanged so as to be in good “Response to disturbances.” In addition, the controller is provided with the function which restricts the amount of undershooting caused by the cooling nonlinear characteristic possessed by plastic molding machines when the Set value (SV) is lowered in Heat/Cool PID control.





■ Parameter setting

● Control action

[Engineering Mode: Function block No. 51 (F_{n51})]

Parameter symbol	Data range	Factory set value
05	0: Brilliant II PID control (direct action) 1: Brilliant II PID control (reverse action) 2: Brilliant II Heat/Cool PID control [water cooling] 3: Brilliant II Heat/Cool PID control [air cooling] 4: Brilliant II Heat/Cool PID control [Cooling linear type] 5: Brilliant II Position proportioning PID control (reverse action) 6: Brilliant II Position proportioning PID control (direct action)	Control action specified at the time of order.



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized when the Control action is changed.

● Control response parameter

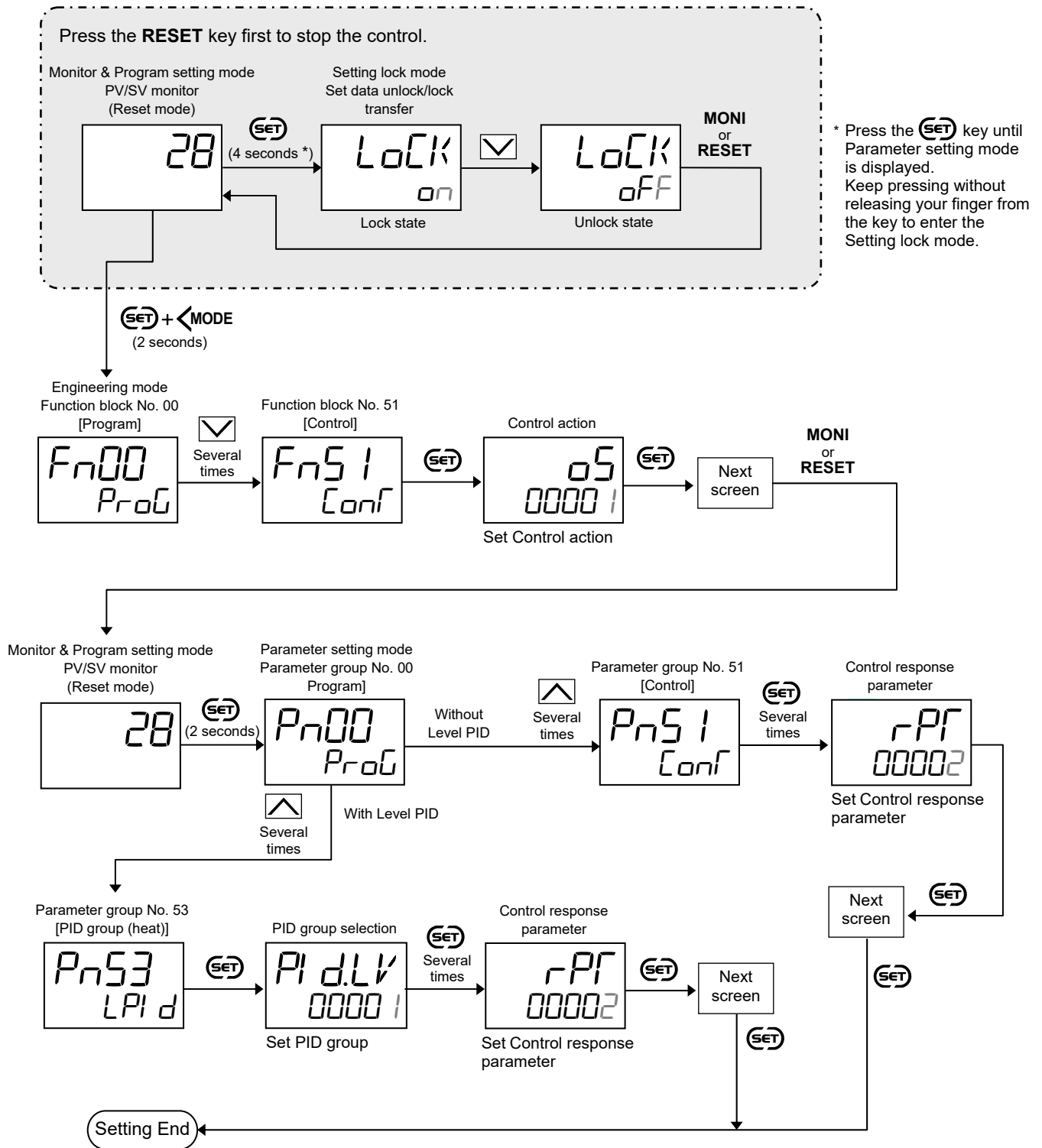
[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
rPr	0: Slow 1: Medium 2: Fast [When the P or PD action is selected, this setting becomes invalid]	2

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

12.2 Setting PID Values Automatically (Autotuning)

The Autotuning (AT) automatically measures, computes and sets the optimum PID values. The Autotuning (AT) can be used for PID control (Direct action/Reverse action) and Heat/Cool PID control.

■ Description of function

● Parameters computed by Autotuning (AT)

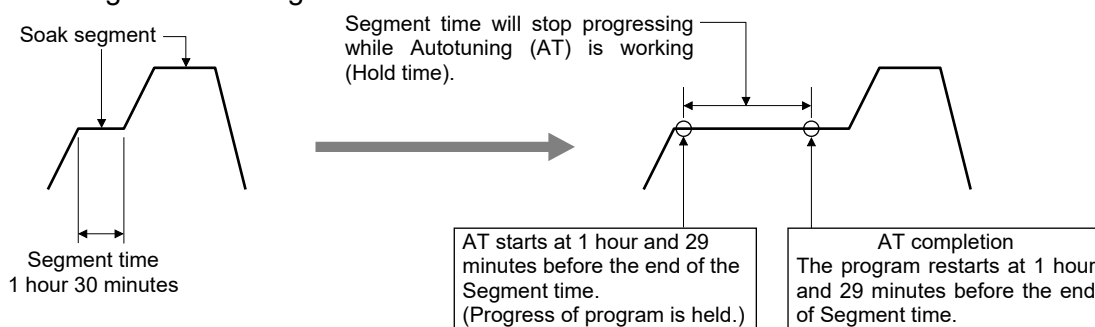
- Proportional band [heat-side]
- Integral time [heat-side]
- Derivative time [heat-side]
- Proportional band [cool-side] (Only for Heat/Cool PID control)
- Integral time [cool-side] (Only for Heat/Cool PID control)
- Derivative time [cool-side] (Only for Heat/Cool PID control)
- Control loop break alarm (LBA) time * (The LBA time is automatically set to twice the value of the Integral time)

* When the Control break alarm (LBA) time is set to 0, the time will not be automatically obtained through the AT.

● Autotuning (AT) in the Program control mode

In the Program control mode (RUN), the progress of the program is automatically held during AT. When AT is finished, the program will restart automatically.

• Autotuning at a soak segment

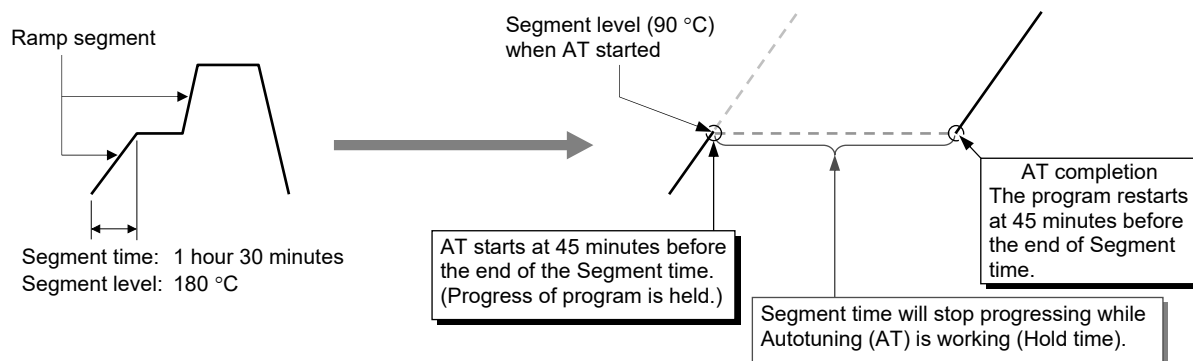


• Autotuning at a ramp segment

AT activates at the Segment level where AT starts when conducting AT at a ramp segment.

During AT, progress of the program is held automatically.

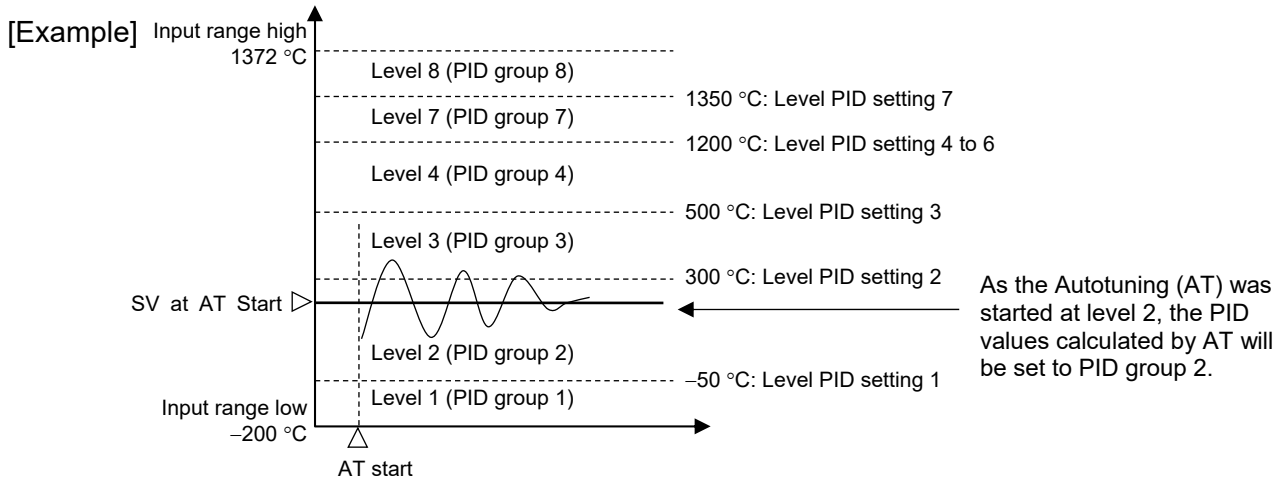
When AT is finished, the program will restart automatically.



● Autotuning (AT) at Level PID

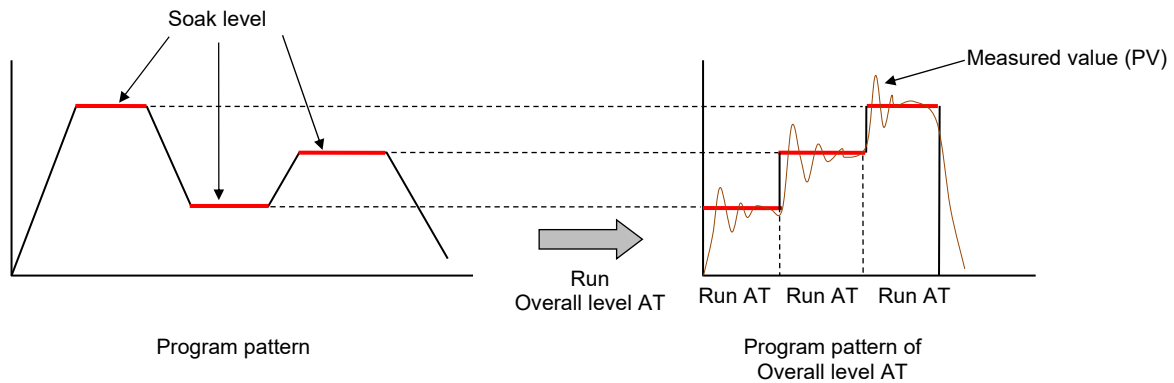
Autotuning (AT) can be started even while Level PID function is used whether or not the Level PID action selection is “Switching by SV” or “Switching by PV”. Autotuning (AT) will be executed at the Set value (SV) when it is initiated.

The calculated PID values are stored in the PID group which has the Set value (SV) at the time of the Autotuning (AT) start.



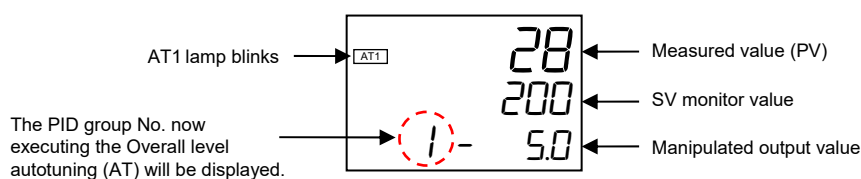
● Overall level autotuning (AT) function

This function automatically searches the Soak segments (fixed value portions of the program) of the selected program pattern, and runs Autotuning (AT). Overall level autotuning (AT) is run with respect to the selected program pattern in the Reset mode (RESET). Moreover, Autotuning (AT) is done for each level in sequence starting from the lowest level Soak segment, and every time PID constant is calculated, it is set in the PID group of that level.



During Overall level autotuning, Event, Heater break alarm (HBA), and Retransmission output are available. However, Control loop break alarm (LBA) is unavailable.

● Display of during the Overall level autotuning (AT)



- PID constant of the level where no Soak segment exists

When there is a level where no Soak segment exists, PID constant is set with respect to the PID group of the level as well.

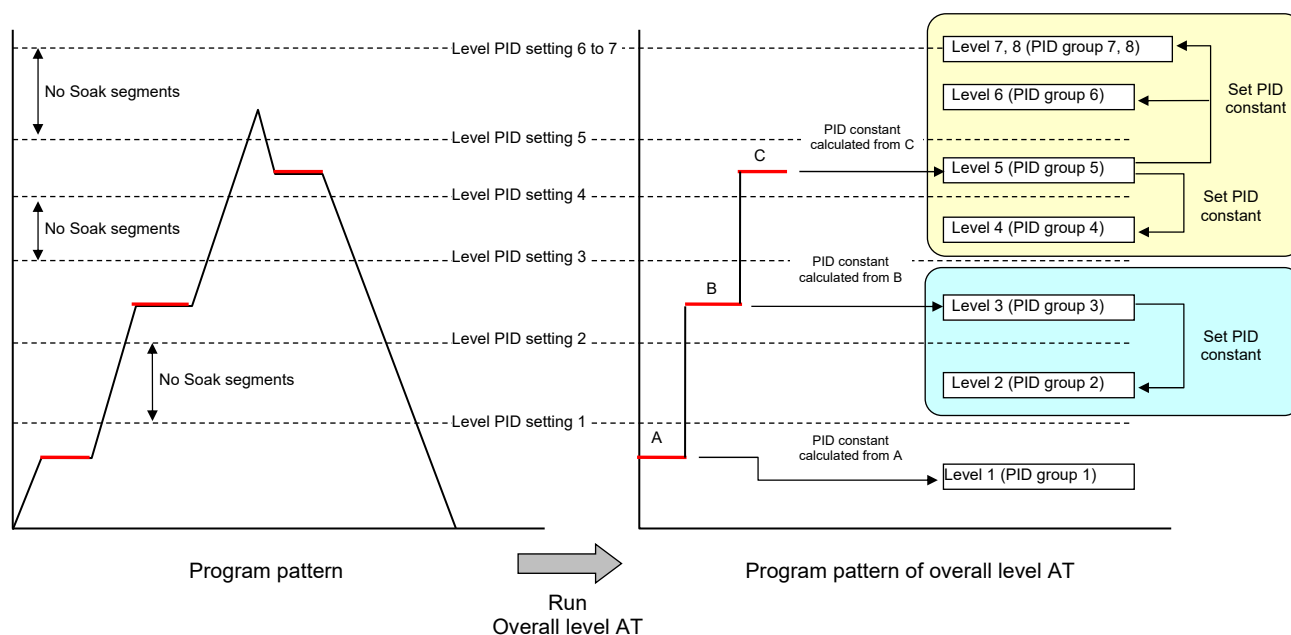
- When there is a level with no Soak segment in the levels lower than that of the Soak segments for which Overall level AT is run

With respect to the PID group whose level doesn't contain any Soak segment, the calculated PID constant is set. (It will not be set again in the PID group of the level where PID constant is already set once.)

- When there is no level with a Soak segment in the levels higher than that of the Soak segments for which Autotuning (AT) is done

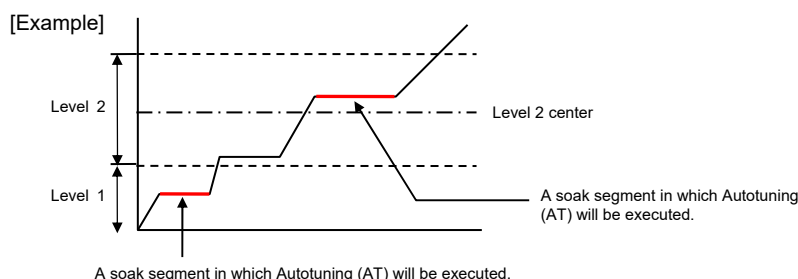
With respect to all PID groups whose levels do not contain any Soak segment, the calculated PID constant are set.

[Example] Overall level AT of the pattern where levels having no Soak segment are mixed



- Overall level autotuning (AT) when there are multiple Soaks within the same level range

Autotuning (AT) will be run for the closest Soak segment from the center of each level range. When there are multiple closest Soak segments from the center of level range, Autotuning (AT) will be run with respect to the lower level Soak segment.



- Location where the results of calculation of Overall level autotuning (AT) function are saved

PID constants calculated with autotuning (AT) are saved in the PID group having the same number as the level.

- Overall level autotuning (AT) when using pattern link

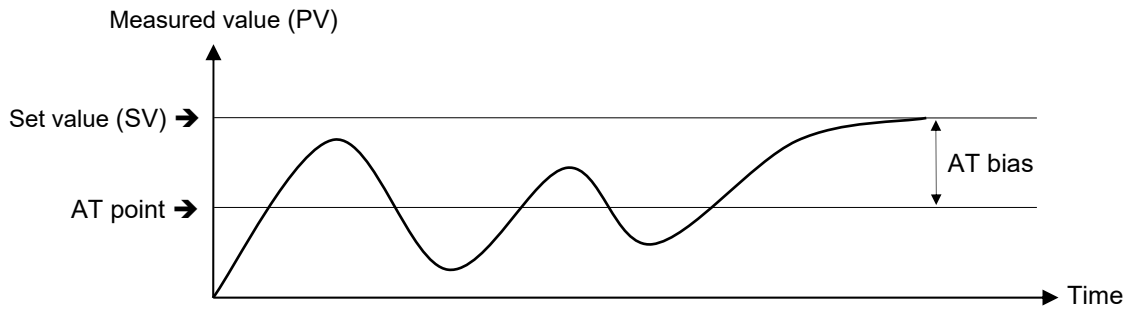
When the Pattern Link function is used, Soak segments containing the linked patterns are automatically searched, and Overall level autotuning (AT) is run.



● AT bias

The AT bias is used to prevent overshoot during the Autotuning in the application which does not allow overshoot even during the Autotuning. RKC Autotuning method uses ON/OFF control at the set value to compute the PID values. However, if overshoot is a concern during the Autotuning, the desired AT bias should be set to lower the set point during Autotuning so that overshoot is prevented.

[Example] When AT bias is set to the minus (–) side.



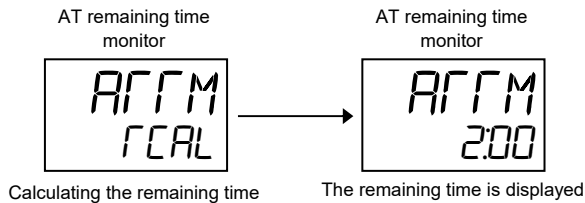
● AT remaining time monitor

Displays the remaining time until the Autotuning (AT) is completed.

(Display range: 0 hours 00 minutes to 48 hours 00 minutes)

The SV display shows “*ATCAL*” from the start of Autotuning (AT) till the display of the remaining time. Once the remaining time is displayed, the time is reduced every minute.

[Example]



The “AT remaining time monitor” is a predictive value and may not be accurate.

● AT/ST status monitor

Displays the execution status of the Autotuning (AT).

- Displays “1” during the Autotuning (AT).
- Displays “0” when the Autotuning (AT) is completed.
- When the Autotuning (AT) is aborted, the display shows –1 up to –4 depending on the reason of the abort.
 - 1: Aborted. Setting changed.
 - When the Set value (SV) is changed. [Fixed set point control mode (FIX)]
 - When the Segment level or the Segment time currently being executed is changed. [For Program control mode (RUN)]
 - When the Segment level just one before the current is changed. [For Program control mode (RUN)]
 - When Step function is executed. [For Program control mode (RUN)]
 - When the AT bias is changed.
 - When the PV bias, PV ratio, or PV digital filter is changed.
 - When the Output limiter high or low is changed.
 - When Operation mode (RESET, RUN, FIX, MAN) is changed.
 - When the Autotuning (AT) is changed to PID control. [Autotuning (AT)]
 - When the Overall level autotuning (AT) setting is turned OFF. [For Overall level autotuning (AT)]
 - When the RESET key is pressed during the Overall level autotuning (AT). [For the Overall level autotuning (AT)]
 - When the Level PID value is changed. [For the Overall level autotuning (AT)]
 - 2: Aborted. Abnormal input.
 - When the Measured value (PV) has entered the Input error range.
[Input error range: Input error determination point high $\geq$ Measured value (PV),
Input error determination point low $\leq$ Measured value (PV)]
 - When the Feedback resistance (FBR) input is broken
 - 3: Aborted. Timeout.
Output state has not been changed (ON to OFF, OFF to ON) for more than two hours.
 - 4: Aborted. Abnormal calculated values. [Not displayed in case of Autotuning (AT)]
Internal calculation Error of the Startup-tuning (ST).

● Caution for using the Autotuning (AT)

- When a temperature change (UP and/or Down) is 1 °C or less per minute during the Autotuning (AT), the Autotuning (AT) may not be finished normally. In that case, adjust the PID values manually. Manual setting of PID values may also be necessary if the set value is around the ambient temperature or is close to the maximum temperature achieved by the load.
- When the Output change rate limiter is used, you may not be able to obtain appropriate PID constants by Autotuning (AT).



For the manual setting of PID values, refer to **12.4 Setting PID Values Manually (P. 12-23)**.



● Requirements for Autotuning (AT) start [including the Overall level autotuning (AT)]

Start the Autotuning (AT) when all following conditions are satisfied:

To start Autotuning (AT), go to Operation transfer mode.

Operation mode state	Operation mode transfer	Program control mode (RUN) or Fixed set point control mode Reset mode (RESET) for the Overall level autotuning (AT)
	Autotuning (AT) setting	PID control (State before starting AT)
Parameter setting	PID control or Position proportioning PID control	Output limiter high [heat-side] > 0 % Output limiter low [heat-side] < 100 %
	Heat/Cool PID control	Output limiter high [heat-side] > 0 % Output limiter low [heat-side] < 100 % Output limiter high [cool-side] > 0 % Output limiter low [cool-side] < 100 %
Input value state	The Measured value (PV) is not inside the Input error range. [Input error range: Input error determination point (high) $\geq$ Measured value (PV), Input error determination point (low) $\leq$ Measured value (PV)]	

● Requirements for Autotuning (AT) cancellation [including the Overall level autotuning (AT)]

The Autotuning (AT) is immediately aborted and PID control starts when an error is detected in “AT/ST status monitor.” The PID values will be the same as before the Autotuning (AT) was activated.

When the Overall level autotuning (AT) is canceled according to [the aborting condition of the AT/ST status monitor](#), the controller immediately aborts the Overall level autotuning (AT) and switches to the PID control. The Segment PID values will remain the same as those before the Overall level autotuning (AT) is started. The PID values calculated before the stop will be saved to the applicable PID group.



For details, refer to “AT/ST status monitor” on the previous page.

The Autotuning (AT) may be aborted in the following cases except for the conditions in “AT/ST status monitor.”

- When the instrument is in FAIL state.
- When the power supply is disconnected.



The AT will not stop even if the Segment level or the Segment time is changed during the Overall level autotuning (AT). The Overall level autotuning (AT) executes AT using the segment level/time when the AT was executed. The changed Segment level/time remains valid, but will not be reflected to the AT now being executed.

■ Parameter setting

● Autotuning (AT)

[Operation Transfer Mode]

Parameter symbol	Data range	Factory set value
ATU	OFF: PID control ON: Start Autotuning When the Autotuning (AT) is finished, the control will automatically return to "OFF."	OFF

● Overall level autotuning (AT)

[Operation Transfer Mode]

Parameter symbol	Data range	Factory set value
LV.ATU	OFF: Overall level autotuning (AT) OFF ON: Overall level autotuning (AT) ON When the Autotuning (AT) is finished, the control will automatically return to "OFF."	OFF



To display the "Overall level autotuning (AT)," set switchover by the Set value (SV) or the Measured value (PV) at "Level PID action selection" in Function block No. 51 in the Engineering mode

● AT bias

[Setup Setting Mode: Setting group No. 53 (5n53)]

Parameter symbol	Data range	Factory set value
ATb	-Input span to +Input span [Varies with the setting of the Decimal point position.]	0

● AT remaining time monitor

[Setup Setting Mode: Setting group No. 53 (5n53)]

Parameter symbol	Data range	Factory set value
ATRM	0 hours 00 minutes to 48 hours 00 minutes	—

● AT/ST status monitor

[Setup Setting Mode: Setting group No. 53 (5n53)]

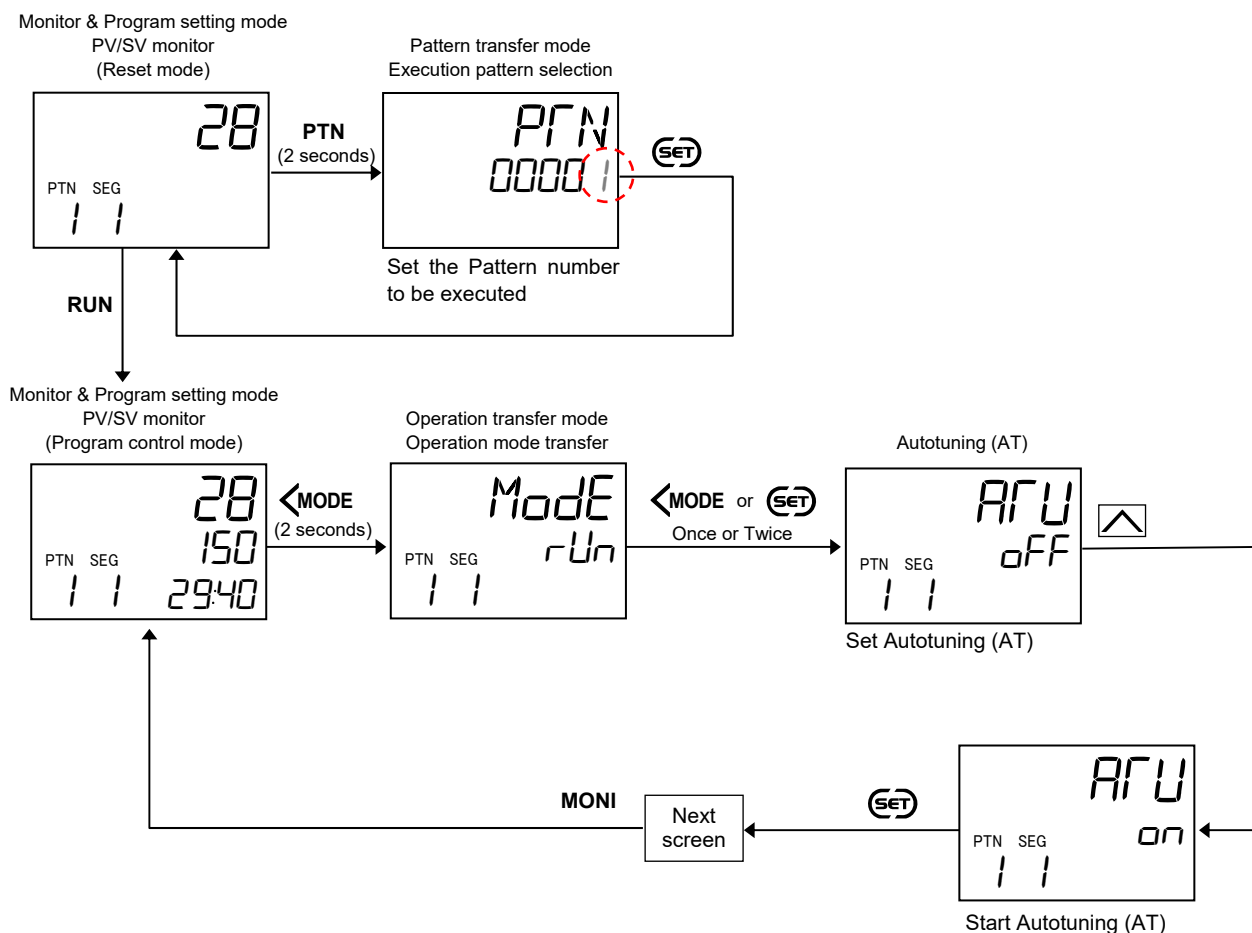
Parameter symbol	Data range	Factory set value
ATNE	0: AT/ST complete 1: AT running now 2: ST running now -1: Aborted. Setting changed. -2: Aborted. Abnormal input. -3: Aborted. Timeout. -4: Aborted. Abnormal calculated values.	—

Setting procedure

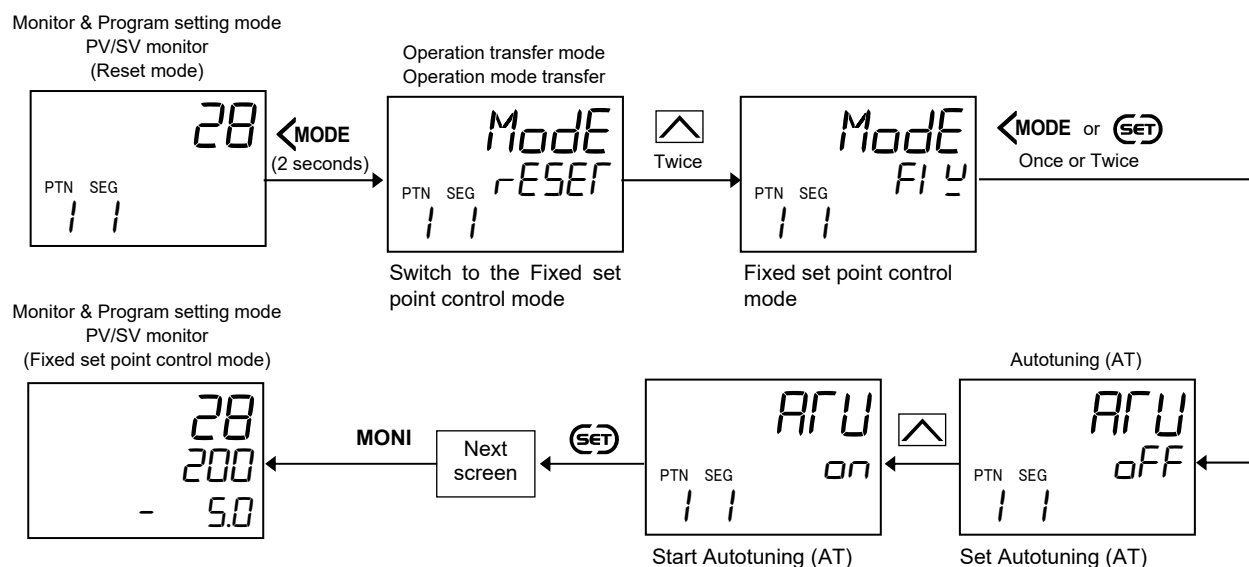
Start the Autotuning (AT)

Before starting the AT, refer to ● Requirements for Autotuning (AT) start (P. 12-12). Make sure that all required conditions to start the AT are satisfied.

[Program control mode (RUN)]

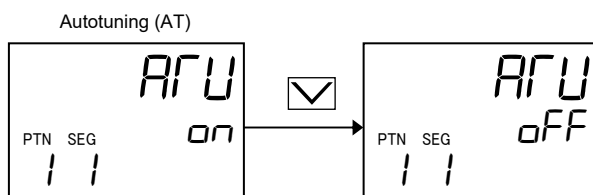


[Fixed set point control mode (FIX)]





Aborting the Autotuning (AT)



During the Autotuning (AT), the AT lamp blinks.



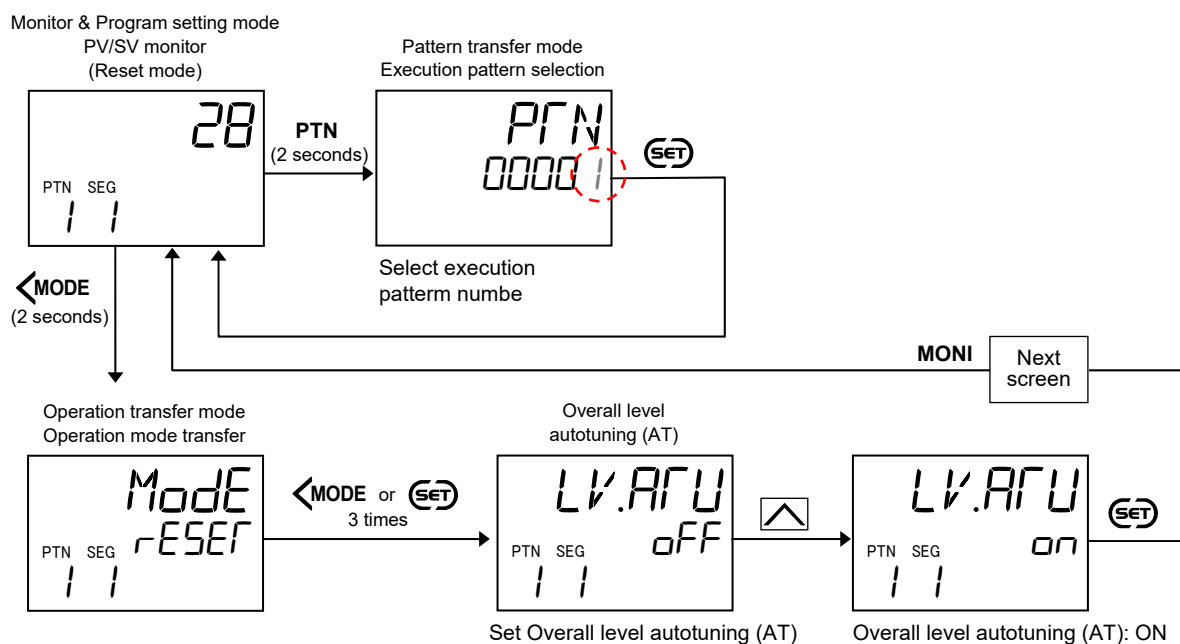
When the Autotuning (AT) is finished, the control will automatically return to “*off*: PID control” and the AT lamp turns off.



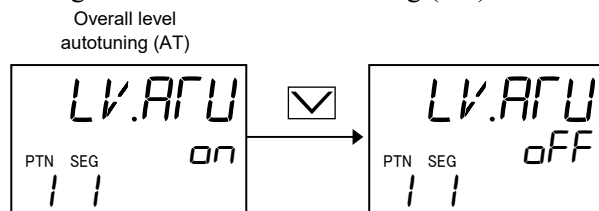
The Autotuning (AT) can be started by Digital input (DI). Refer to **8.2 Switching Functions Using Digital Inputs (DI)** (P. 8-11) for more information on assigning Digital input (DI).

● Executing Overall level autotuning (AT)

Before starting the AT, refer to ● **Requirements for Autotuning (AT) start** (P. 12-12). Make sure that all required conditions to start the AT are satisfied.



Aborting the Overall level autotuning (AT)



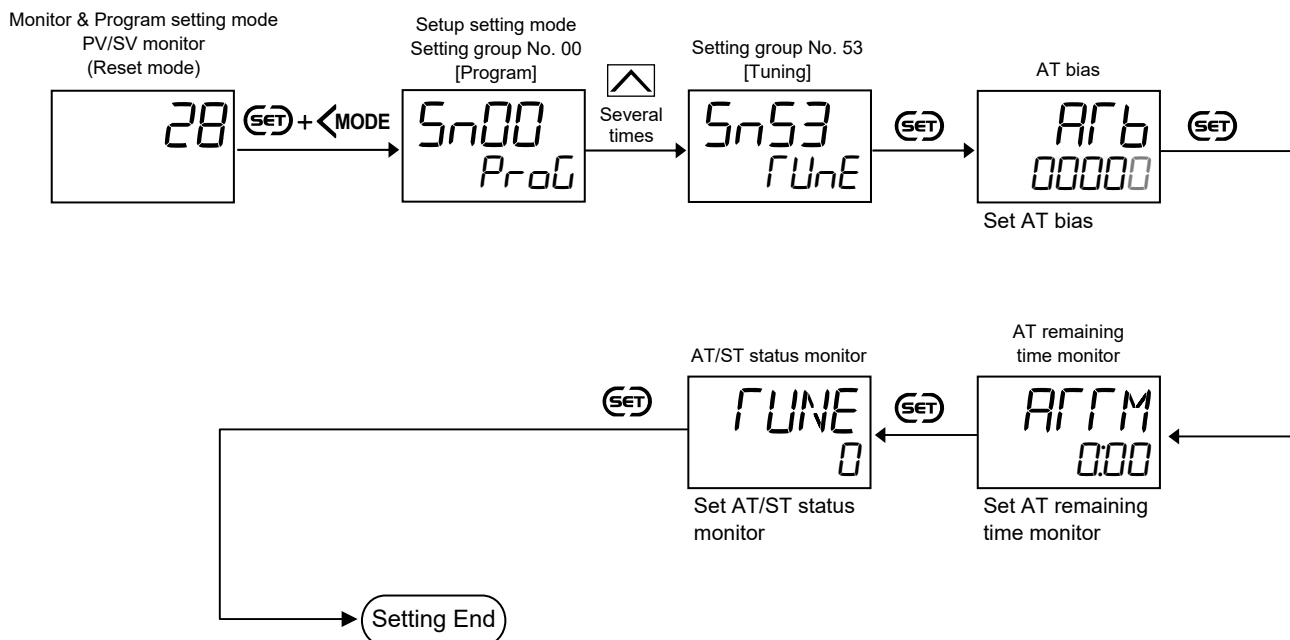
During the Overall level autotuning (AT), the AT lamp blinks.



When the Overall level autotuning (AT) is finished, the screen control will automatically return to “*off*: Overall level autotuning (AT) OFF” and the AT lamp turns off.



● **Setting AT bias. Check the AT remaining time and AT/ST status.**



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.

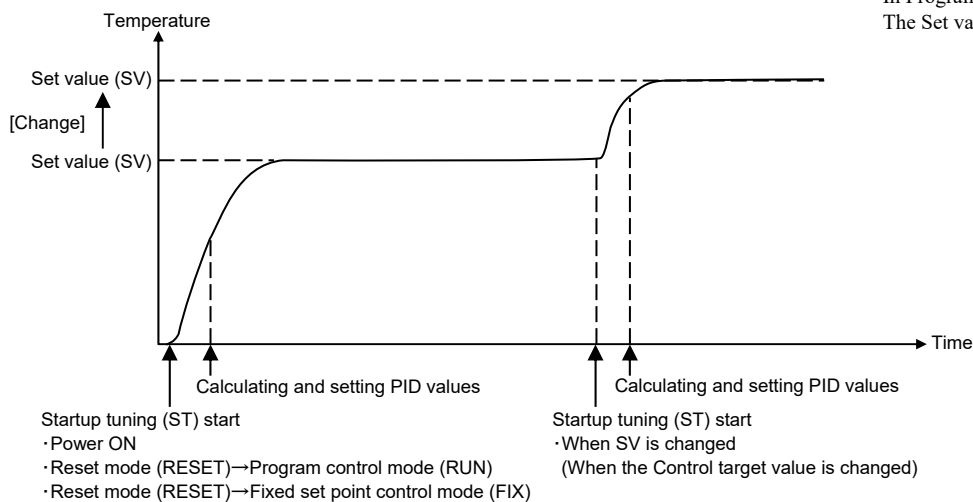
12.3 Setting PID Values Automatically (Startup tuning)

Startup tuning (ST) is a function which automatically computes and sets the PID values (Proportional band: heat-side only) and Control loop break alarm (LBA) time from the response characteristics of the controlled system at power ON, transfer from Reset mode (RESET) to Program control mode (RUN)/Fixed set point control mode (FIX), and Control target value (SV) change.

■ Description of function

- As simple autotuning, the PID values can be obtained in a short time without disturbing controllability for controlled systems with slow response at power ON. At the same time, Control loop break alarm (LBA) time* is calculated (about twice of the Integral time).
- * When the Control loop break alarm (LBA) time is set to 0, the time will not be automatically obtained through the ST.
- For controlled systems which require different PID values for each temperature setting, the PID values can be obtained for each Set value (SV) * change.

* In Program control mode (RUN):
The Set value (SV) is a segment level.



- With a ramp segment in program control, it could happen that PID values are not calculated even Startup tuning (ST) was executed. In this case, PID values might be calculated by setting 0 to the segment time of ramp segment and setting to change the level step-by-step. (However, this is limited to only when the segment time can be set 0.)
- With Level PID, PID values calculated by Startup tuning (ST) will be stored in a PID group in which ST was executed.
- The setting items related to the Startup tuning (ST) are shown below. Set them according to the application used.

Setting item	Details		Setting mode
Start condition	0 (Factory set value)	When the power is turned on, operation is changed from Reset mode (RESET) to Program control mode (RUN)/Fixed set point control mode (FIX), or the Set value (SV) is changed.	Engineering mode
	1	When the power is turned on or operation is changed from Reset mode (RESET) to Program control mode (RUN)/Fixed set point control mode (FIX).	
	2	When the Control target value is changed.	
Execution method	OFF (Factory set value)	ST unused	Operation transfer mode
	ON 1	Execute once	
	ON 2	Execute always	



When the Startup tuning (ST) function is activated in Heat/Cool PID control, only heat-side PID values are calculated and changed. The Startup tuning (ST) is not available when the temperature is downward. (PID values for cooling cannot be calculated)



The Startup tuning (ST) is not available in case of Position proportioning PID control.



If the Startup tuning (ST) is started when the ST start condition is at power on or switching operation mode (RESET→RUN or RESET→FIX), the control will start with Hot start 2 even if the setting is Hot start 1. For Hot/Cold start setting, refer to **12.13 Changing the Action at Power ON (Hot/Cold Start) (P. 12-78)**.

● AT/ST status monitor

Displays the execution status of the Startup tuning (ST).

- Displays “2” during the Startup tuning (ST).
- Displays “0” when the Startup tuning (ST) is completed.
- When the Startup tuning (ST) is aborted, the display shows –1 up to –4 depending on the reason of the abort.
 - 1: Aborted. Setting changed.
 - When the Startup tuning (ST) is disabled (OFF: ST unused).
 - When the PV bias, PV ratio, or PV digital filter is changed.
 - When the Output limiter high or low is changed.
 - When switching the operation mode (RESET, RUN, FIX and MAN)
 - 2: Aborted. Abnormal input.

When the Measured value (PV) has entered the Input error range.
 [Input error range: Input error determination point high $\geq$ Measured value (PV),
 Input error determination point low $\leq$ Measured value (PV)]
 - 3: Aborted. Timeout.

When the Startup tuning (ST) will not end approximately 100 minutes after it has been started.
 - 4: Aborted. Abnormal calculated values.

Internal error of the Startup tuning (ST), etc.

● Caution for using the Startup tuning (ST)

- For Startup tuning (ST) at power ON or transferred operation mode (RESET→RUN or RESET→FIX), always set the heater power to ON simultaneously with the start of tuning or before the start of tuning.
- Start the Startup tuning (ST) in the state in which the temperature differential between the Measured value (PV) and the Set value (SV) at the start of the Startup tuning (ST) is twice the Proportional band, or greater.
- If in the Heat/Cool PID control, start activating the Startup tuning (ST) function under the condition of “Set value (SV) > Measured value (PV).” Only the PID values on the heat-side are automatically calculated but no PID values on the cool-side are changed. The PID values on the cooling side can be obtained by the Autotuning (AT).
- When the Manipulated output value may be limited by the Output limiter setting, the optimum PID values may not be calculated by the Startup tuning (ST).
- When the Output change rate limiter is set, the Startup Tuning (ST) may not be turned on.
- When the Startup tuning (ST) is started at power on, priority is given to the Startup tuning (ST) and the Proactive function will not start.



● Requirements for Startup tuning (ST) start

Start the Startup tuning (ST) when all following conditions are satisfied:

Operation mode state	Program control mode (RUN) or Fixed set point control mode (FIX)
Parameter setting	Startup tuning (ST) is set to ON (Execute once, Execute always)
	Output limiter high $\geq 0.1\%$, Output limiter low $\leq 99.9\%$ [Heat/Cool PID control type: Output limiter high (heat-side) $\geq 0.1\%$]
	The Level PID action selection is done by other than “Switching by the Measured value (PV).”
Input value state	The Measured value (PV) is not underscale or over-scale.
	Input error determination point (high) $\geq$ Input value $\geq$ Input error determination point (low)
	At Startup tuning (ST) at Set value (SV) change, the Measured value (PV) shall be stabilized.
	Set value (SV) $>$ Measured value (PV) [Heat/Cool PID control]
Output value state	At startup, output is changed and saturated at the Output limiter high or the Output limiter low [Heat/Cool PID control type: Output limiter high (heat-side)].

● Requirements for Startup tuning (ST) cancellation

The Startup tuning (ST) will be immediately aborted if any in the cancel condition in the AT/ST status monitor is met. The PID values will be the same as before the Startup tuning (ST) was activated.



For details, refer to “AT/ST status monitor” on the previous page.

The Startup tuning (ST) may be aborted in the following cases except for the conditions in “AT/ST status monitor.”

- Autotuning (AT) has been started.
- When the instrument is in FAIL state.
- When the power supply is disconnected.

■ Parameter setting

● Startup tuning (ST)

[Operation Transfer Mode]

Parameter symbol	Data range	Factory set value
STU	OFF: ST unused ON 1: Execute once * ON 2: Execute always * When the ST is finished, the control will automatically return to “OFF.”	OFF



To display “Startup tuning (ST),” you need to specify the control type other than “Position proportioning PID control” at the time of order, or “Control action” (Function block No. 51 in Engineering mode) must be set to other than “Position proportioning PID control.”



● AT/ST status monitor

[Setup Setting Mode: Setting group No. 53 (5n53)]

Parameter symbol	Data range	Factory set value
5n53	0: AT/ST complete 1: AT running now 2: ST running now -1: Aborted. Setting changed. -2: Aborted. Abnormal input. -3: Aborted. Timeout. -4: Aborted. Abnormal calculated values.	—

● ST start condition

[Engineering Mode: Function block No. 51 (Fn51)]

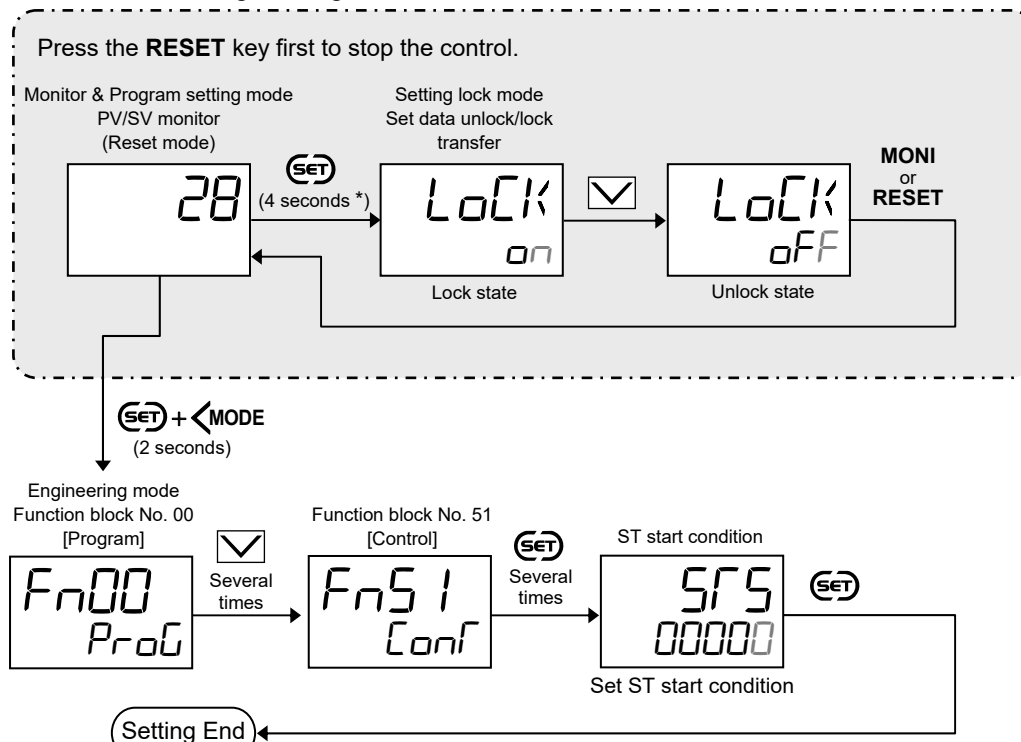
Parameter symbol	Data range	Factory set value
Fn51	0: Activate the Startup tuning (ST) function when the power is turned on; when transferred from Reset mode (RESET) to Program control mode (RUN)/Fixed set point control mode (FIX); or when the Set value (SV)* is changed. 1: Activate the Startup tuning (ST) function when the power is turned on; or when transferred from Reset mode (RESET) to Program control mode (RUN)/Fixed set point control mode (FIX). 2: Activate the Startup tuning (ST) function when the Set value (SV)* is changed.	0

* In Program control mode (RUN): The Set value (SV) is a segment level.

■ Setting procedure

● Set the ST start condition

To enter the Engineering mode

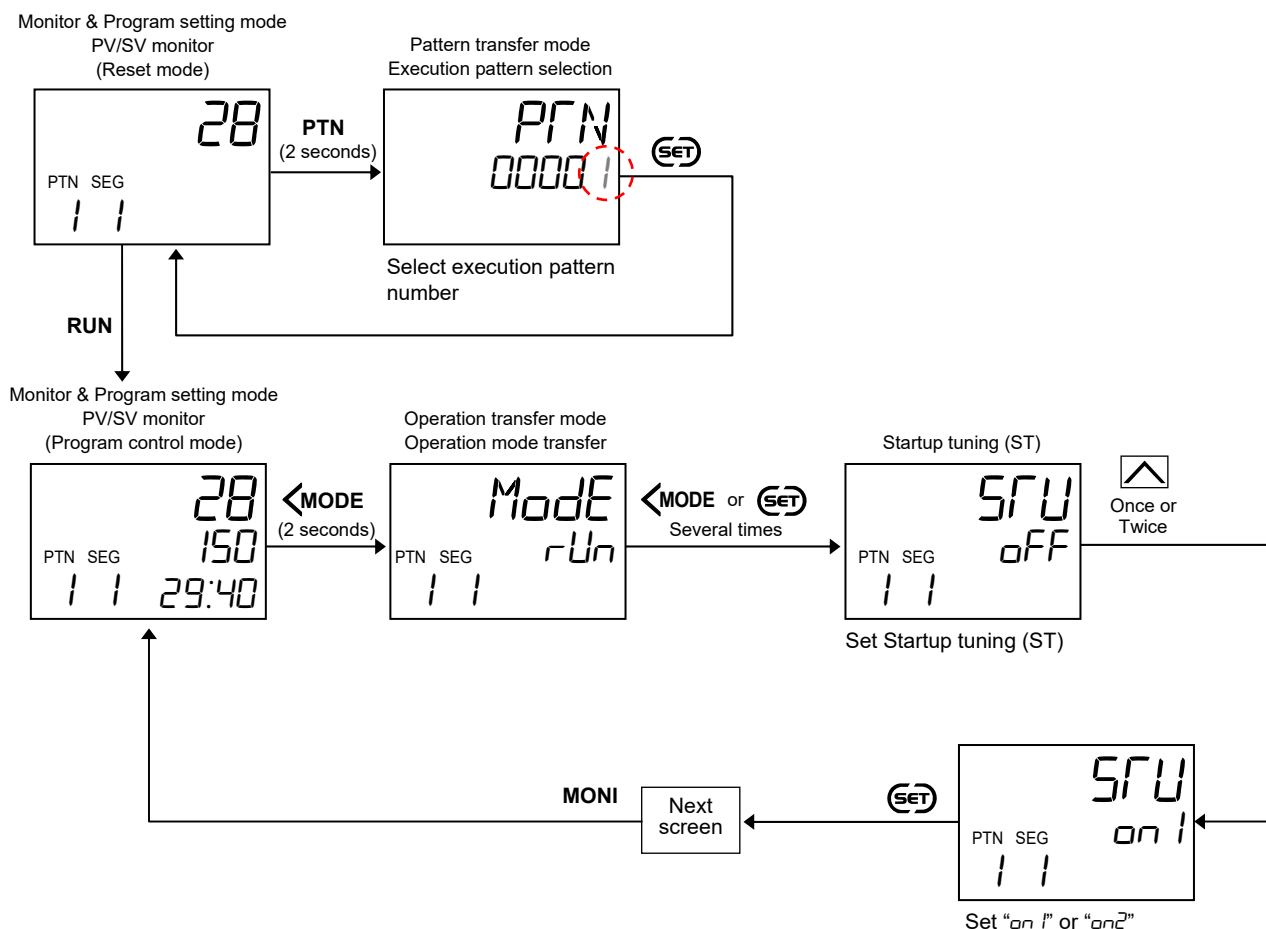


* Press the **SET** key until Parameter setting mode is displayed. Keep pressing without releasing your finger from the key to enter the Setting lock mode.

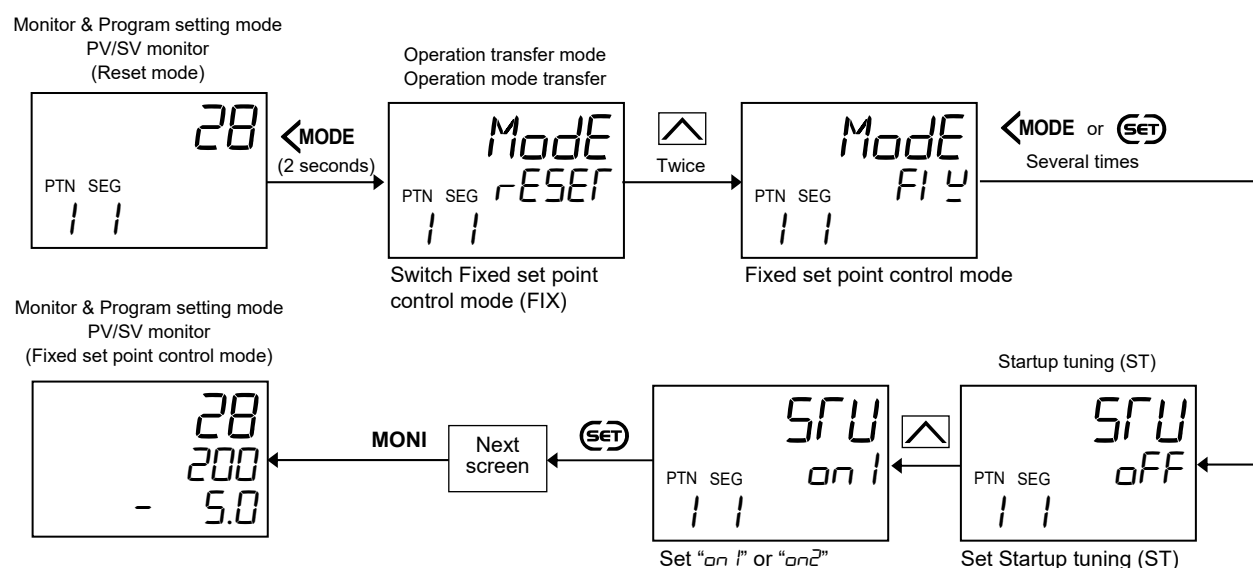
- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.

● Set the Startup tuning (ST)

[Program control mode (RUN)]



[Fixed set point control mode (FIX)]





● Start the Startup tuning (ST)

Before starting the ST, refer to ● **Requirements for Startup tuning (AT) start (P. 12-19)**. Make sure that all required conditions to start the ST are satisfied.

Startup tuning can be started in the following manner. (started in the manner that satisfies the starting condition)

- Power off the controller once and power on again.
- Switch the Operation mode to the Reset mode (RESET) once, and switch the mode back to the Program control mode (RUN) or to the Fixed set point control mode (FIX).
- Change the Set value (SV) *.

* In Program control mode (RUN): The Set value (SV) is a Segment level.



The AT lamp lights during the Startup tuning (ST).



After completion of the Startup tuning (ST), the AT lamp goes off.

When the Startup tuning setting is “ON: Execute once,” the setting will go back to “OFF: ST unused” automatically.

12.4 Setting PID Values Manually

To perform PID control, PID parameters shown below need to be set up. These PID parameters can be automatically set using Autotuning (AT) or Startup tuning (ST). Manual adjustment is also available.

- Proportional band (P)
- Integral time (I)
- Derivative time (D)

 For Autotuning (AT) function, refer to **12.2 Setting PID Values Automatically (Autotuning) (P. 12-7)**. For Startup tuning (ST) function, refer to **12.3 Setting PID Values Automatically (Startup tuning) (P. 12-17)**.

■ Description of function

Critical parameters of PID control such as Proportional action (Proportional band: P), Integral action (Integral time: I), and Derivative action (Derivative time: D) are explained below.

Note that this explanation is based on the reverse action (heating control). With the direct action (cooling control), the output increases as the measured value increases.

● Proportional action

In the ON/OFF control action, the manipulated output is turned on and off repeatedly, resulting in oscillatory control.

To eliminate this oscillation, control is performed by producing Manipulated output value (MV) proportional to the deviation between the Set value (SV) and the Measured value (PV).

Technically a zone called “Proportional band” is established around the Set value (SV) and when the Measured value (PV) enters the proportional band, the Manipulated output value (MV) is gradually reduced.

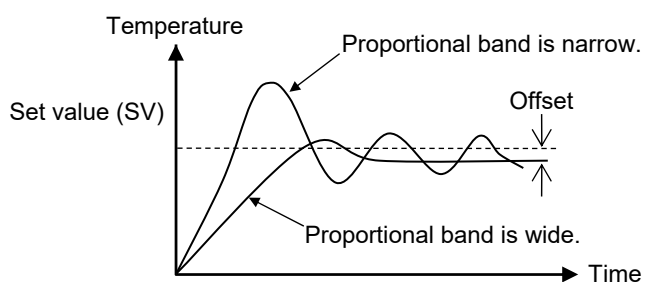
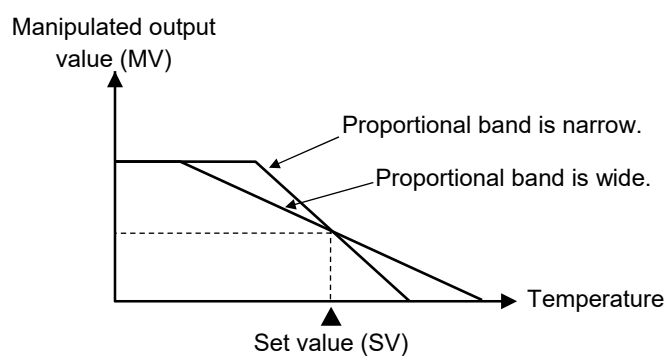
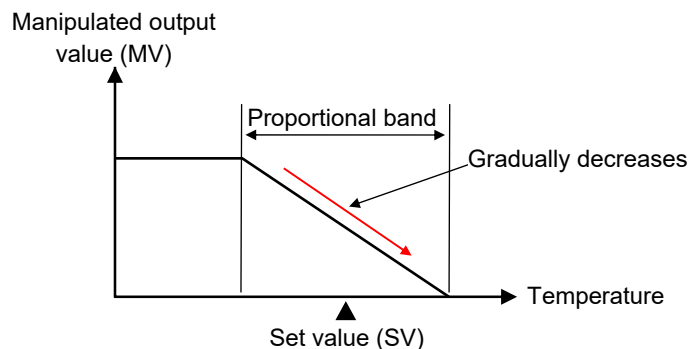
The Measured value (PV) stabilizes within the Proportional band at the equilibrium point, but in many cases the stabilized temperature does not match the Set value (SV).

This deviation between the Set value (SV) and the stabilized temperature is called “Offset.”

With a narrower proportional band the control result becomes closer to that of the ON/OFF control (oscillatory).

With a wider proportional band the output is gradually reduced to stabilize quicker, however, often with a larger offset.

 For ON/OFF action, refer to **12.5 Controlling with ON/OFF Action (P. 12-30)**.



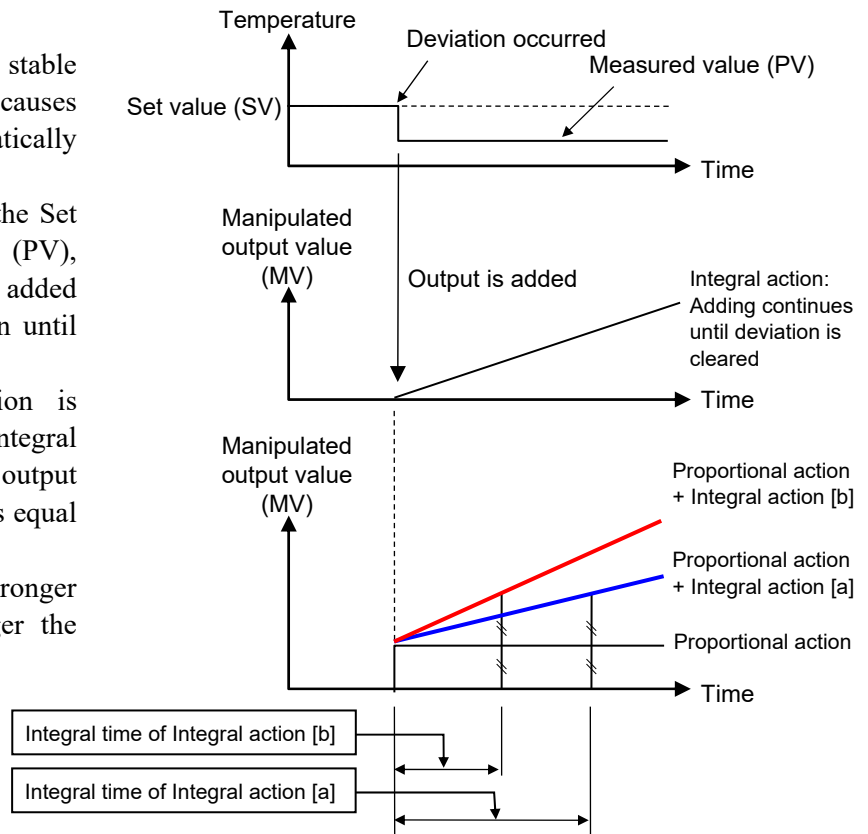
● Integral action

Proportional action provides more stable control than ON/OFF control, but causes offset. This offset can be automatically corrected by Integral action.

As long as deviation exists between the Set value (SV) and the Measured value (PV), the Manipulated output value (MV) is added according to the size of the deviation until no deviation exists.

The strength of the Integral action is expressed by the Integral time. The Integral time is the time till the Manipulated output value (MV) by the Integral action gets equal to that by the Proportional action.

The shorter the Integral time, the stronger the integral effect is, and the longer the weaker.

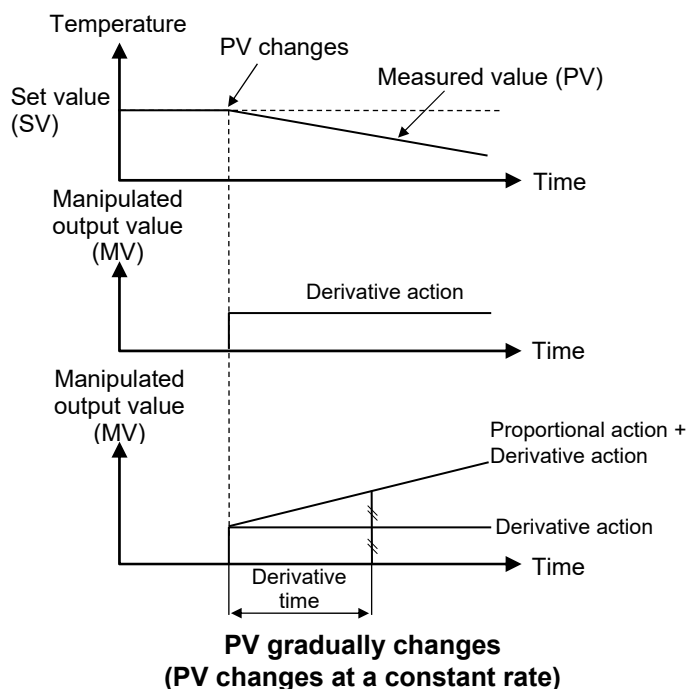
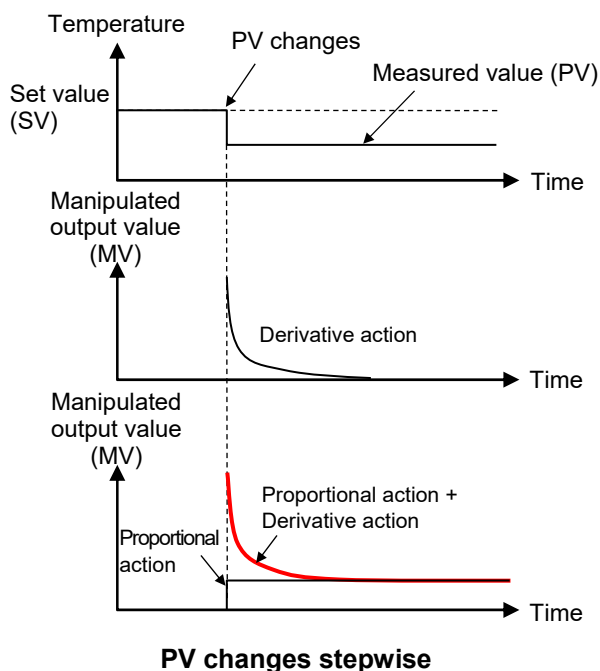


● Derivative action

The Derivative action allows the Manipulated output value (MV) proportional to the changing rate (speed) of the Measured value (PV) to be produced to prevent a fluctuation of the Measured value (PV) before it happens. The strength of the Derivative action is expressed in the Derivative time. The Derivative time is the time until the Manipulated output value (MV) by the Proportional action gets equal to the Manipulated output value (MV) by the Derivative action when the Measured value (PV) changes at a constant rate.

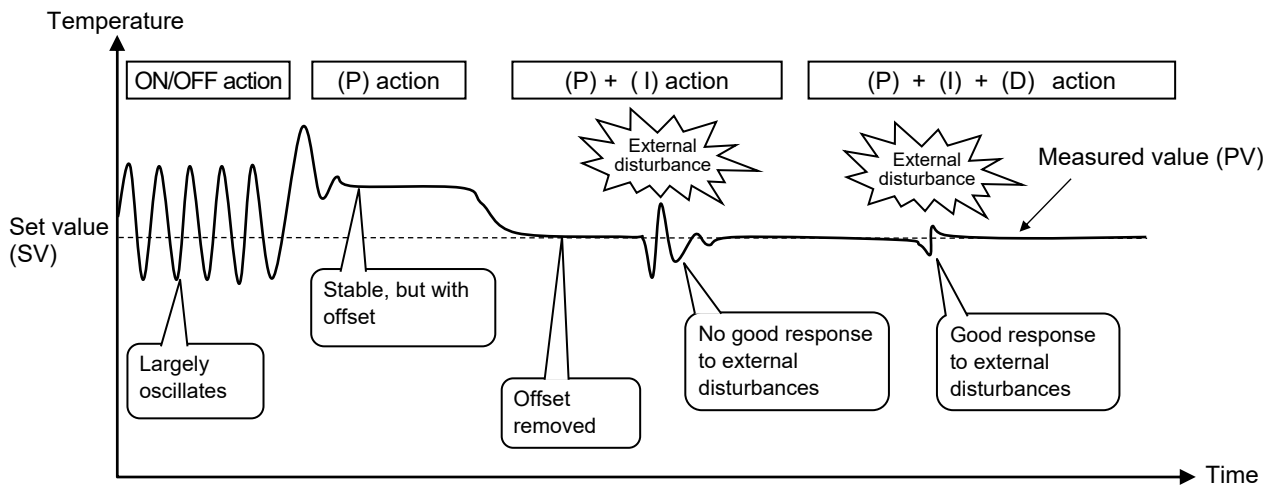
The longer the Derivative time is, the stronger the Derivative effect is, and the shorter the weaker.

The Derivative effect, if set too strong, produces large Manipulated output (MV) against a small change of the Measured value (PV), thus causing hunting and resulting in unstable control.



● Outline of effect of PID

The following figure shows control behaviors under various control actions; ON/OFF control, proportional control (P), Proportional + Integral action (PI action), and Proportional + Integral + Derivative actions (PID control).



● Adjusting PID parameters (Applications controlled with PID control)

In some applications PID values calculated and obtained through Autotuning (AT) and Startup tuning (ST) may not be appropriate. In such a case the PID values need to be adjusted manually.

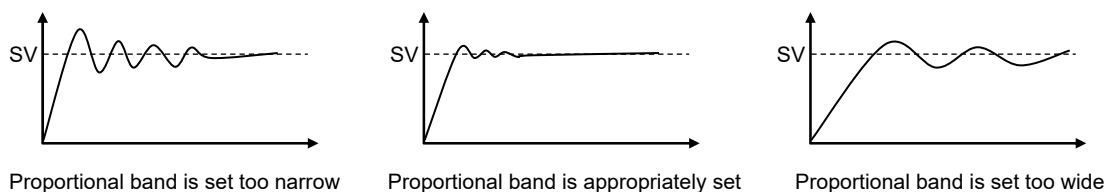
Attempt this adjustment referring to the following.



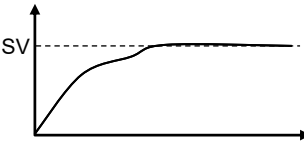
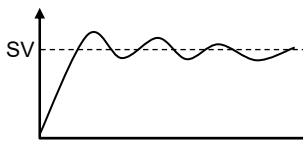
The sample here shows a general tendency. Control results depend on the controlled object and combinations of control constants.

[Adjustment of Proportional band (P)]

Setting the proportional band as small as possible enables the Set value (SV) to be reached faster without overshoot. However, if the proportional band is set too narrow, it will cause hunting and the manipulated output (MV) will become oscillating.



[Adjustment of Integral time (I) and Derivative time (D)]

Made larger (wider, longer)	Made smaller (narrower, shorter)
Overshoot, undershoot and hunting are suppressed. Setting the value too long may need longer time till the Set value (SV) is reached. 	Starts up quickly. Setting the value too short may cause overshoot, undershoot or hunting. 



■ Parameter setting

● Proportional band [heat-side]

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
P	TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 1000.0 % of Input span 0 (0.0, 0.00): ON/OFF action	TC/RTD inputs: 30 V/I inputs: 3.0

● Proportional band [cool-side]

[Parameter Setting Mode: Parameter group No. 56 (P_{n56})]

[Parameter Setting Mode: Parameter group No. 58 (P_{n58})]

Parameter symbol	Data range	Factory set value
P_c	TC/RTD inputs: 1 (0.1, 0.01) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.1 to 1000.0 % of Input span	TC/RTD inputs: 30 V/I inputs: 3.0



To display “Proportional band [cool-side],” you need to specify “Heat/Cool PID control” at the time of order, AND to enter a value other than 0 in the Proportional band [heat-side]*.

* The Proportional band [cool-side] screen in Parameter group No.56 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No. 51.

The Proportional band (cool-side) screen in Parameter group No.58 will be displayed when a value other than 0 is set to the Proportional band (heat-side) in Parameter group No. 53. However, the displayed Proportional band (cool-side) screen will belong to the same PID group as the Proportional band [heat-side] screen.

● Integral time [heat-side]

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
I	PID control or Heat/Cool PID control: 0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PD action Position proportioning PID control: 1 to 3600 seconds, 0.1 to 3600.0 seconds or 0.01 to 360.00 seconds [Varies with the setting of the Integral/Derivative time decimal point position.]	240



To display “Integral time [heat-side],” you need to enter a value other than 0 in the Proportional band [heat-side]*.

* The Integral time [heat-side] in Parameter group No. 51 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No. 51.

The Integral time [heat-side] screen in Parameter group No.53 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No. 53. However, the displayed Integral time [heat-side] screen will belong to the same PID group as the Proportional band [heat-side] screen.

● Integral time [cool-side]

[Parameter Setting Mode: Parameter group No. 56 (P_{n56})]

[Parameter Setting Mode: Parameter group No. 58 (P_{n58})]

Parameter symbol	Data range	Factory set value
$I\ C$	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PD action [Varies with the setting of the Integral/Derivative time decimal point position.]	240



To display “Integral time [cool-side],” you need to specify “Heat/Cool PID control” at the time of order, AND to enter a value other than 0 in the Proportional band [heat-side]*.

* The Integral time [cool-side] in Parameter group No.56 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No.51.

The Integral time [cool-side] screen in Parameter group No.58 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No. 53. However, the displayed Integral time [cool-side] screen will belong to the same PID group as the Proportional band [heat-side] screen.

● Derivative time [heat-side]

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
D	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action [Varies with the setting of the Integral/Derivative time decimal point position.]	60



To display “Derivative time [heat-side],” you need to enter a value other than 0 in the Proportional band [heat-side]*.

* The Derivative time [heat-side] in Parameter group No.51 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No.51.

The Derivative time [heat-side] screen in Parameter group No.53 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No. 53. However, the displayed Derivative time [heat-side] screen will belong to the same PID group as the Proportional band [heat-side] screen.

● Derivative time [cool-side]

[Parameter Setting Mode: Parameter group No. 56 (P_{n56})]

[Parameter Setting Mode: Parameter group No. 58 (P_{n58})]

Parameter symbol	Data range	Factory set value
$D\ C$	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action [Varies with the setting of the Integral/Derivative time decimal point position.]	60



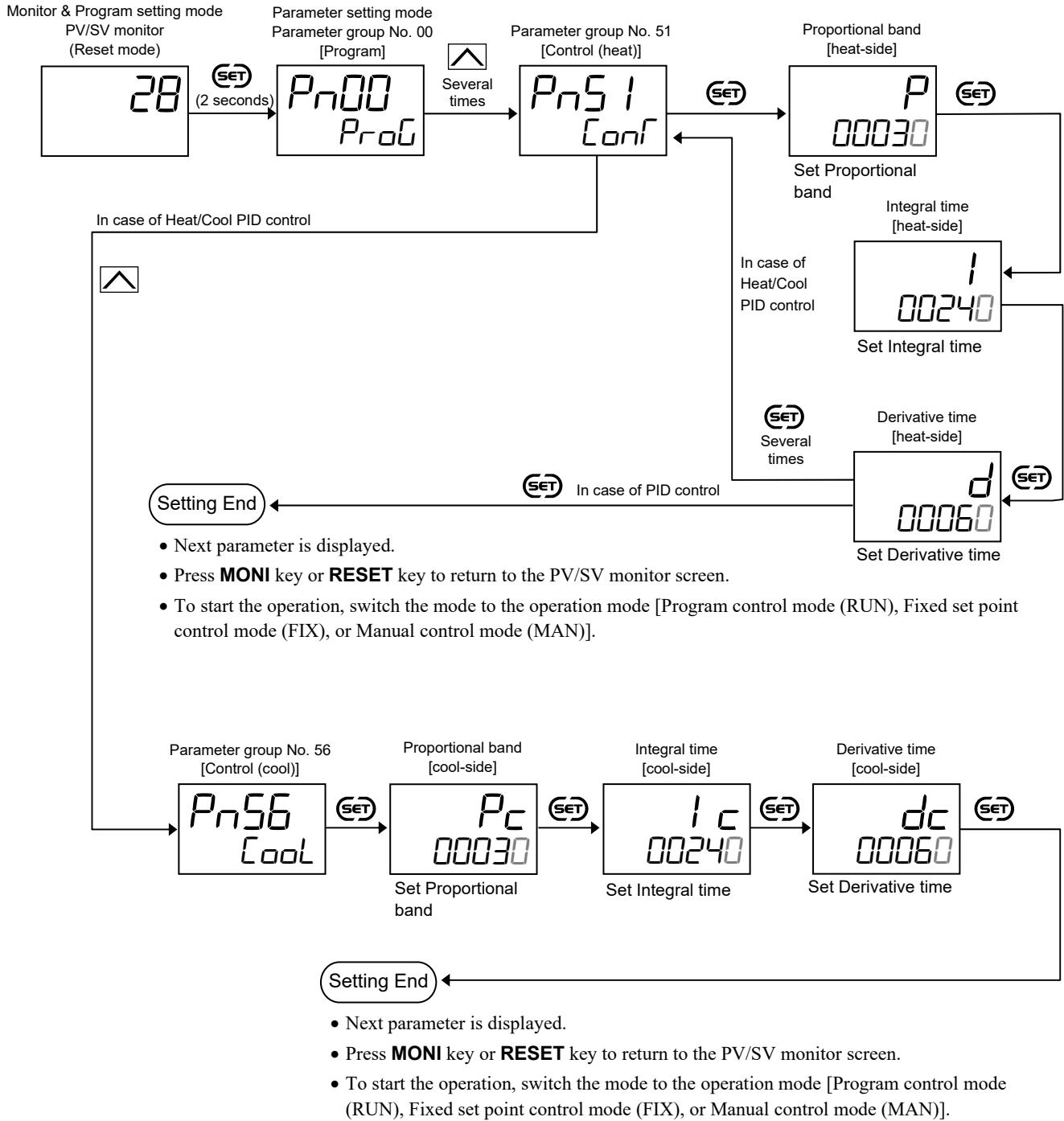
To display “Derivative time [cool-side],” you need to specify “Heat/Cool PID control” at the time of order, AND to enter a value other than 0 in the Proportional band [heat-side]*.

* The Derivative time [cool-side] in Parameter group No.51 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No.51.

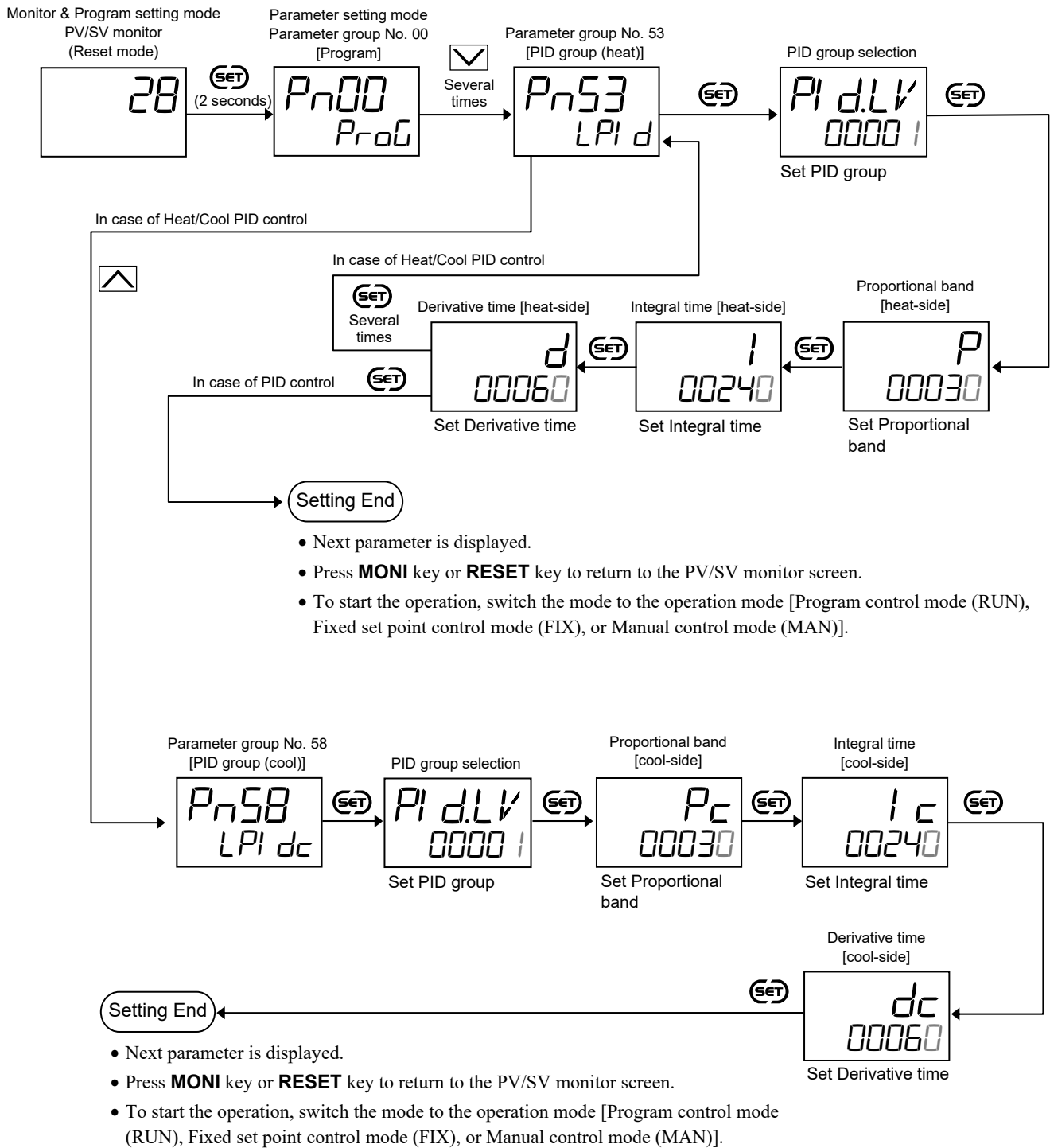
The Derivative time [cool-side] screen in Parameter group No.58 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No. 53. However, the displayed Derivative time [cool-side] screen will belong to the same PID group as the Proportional band [heat-side] screen.

Setting procedure

[Without Level PID]



[With Level PID]



12.5 Controlling with ON/OFF Action

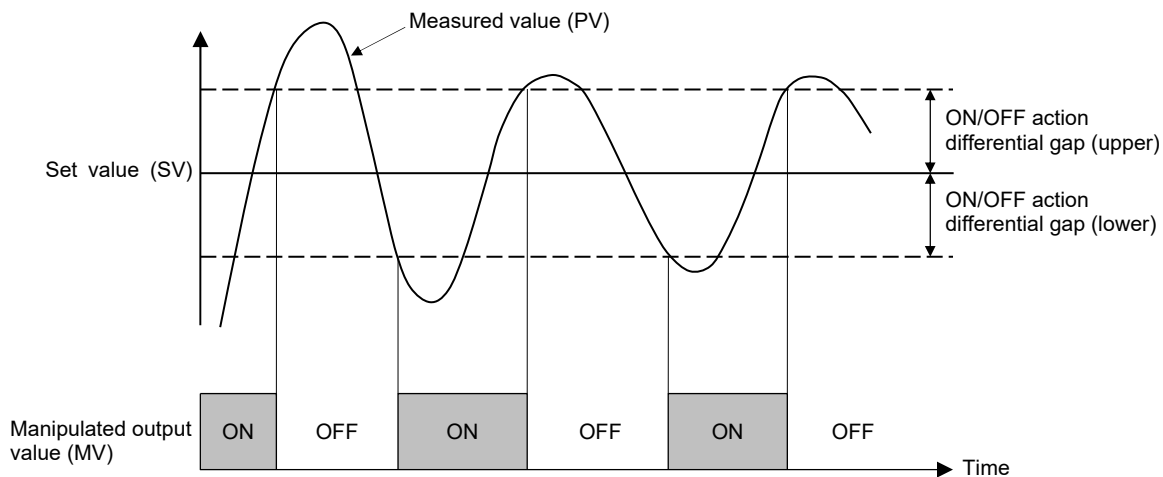
In ON/OFF control, the Manipulated output value (MV) is turned on or off depending on the Measured value (PV) whether it is above or below the Set value (SV)*.

* In Program control mode (RUN): The Set value (SV) is a Segment level.

■ Description of function

When the Measured value (PV) is above the Set value (SV), the Manipulated output value (MV) is turned OFF, and when the Measured value (PV) is below the Set value (SV), the Manipulated output value (MV) is turned ON. **To use the ON/OFF control, set the Proportional band [heat-side] to “0.”**

In the ON/OFF control the output is turned on and off around the Set value (SV) and the output may be turned on and off too frequently for a small change of temperature. This is called “chattering” and may reduce the life of the output relay. To prevent this, ON/OFF differential gap should be properly set.



This explanation applies to “Reverse action” (heating control).



The value of the ON/OFF action differential gap is a deviation from the Set value (SV). This gap can be set individually above and below the Set value (SV). For example, in case of a Reverse action (heating control), assuming that the Set value (SV) is 100 °C with a ON/OFF action differential gap (upper) of 5 °C, the Manipulated output value (MV) turns off at 105 °C.



In case of ON/OFF action, the Output changing rate limiter is deactivated.

● Cooling control with ON/OFF action

The process can be controlled with the ON/OFF action for the Cooling side (direct action) by setting zero to the Proportional band [heat-side] after “0: PID control (direct action)” is set at “Control action” in Function block No. 51 in the Engineering mode.

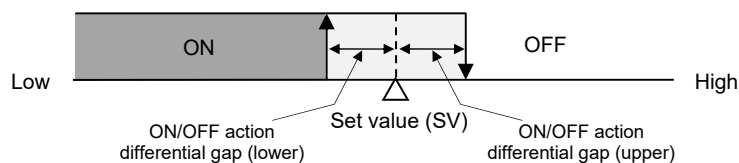
The action is the same as above, but the ON/OFF position of the Manipulated output value (MV) becomes opposite. The ON/OFF action differential gap can be set similarly.

● Heat/Cool control with ON/OFF action

Go to “Control action,” Function block No.51 in the Engineering mode.

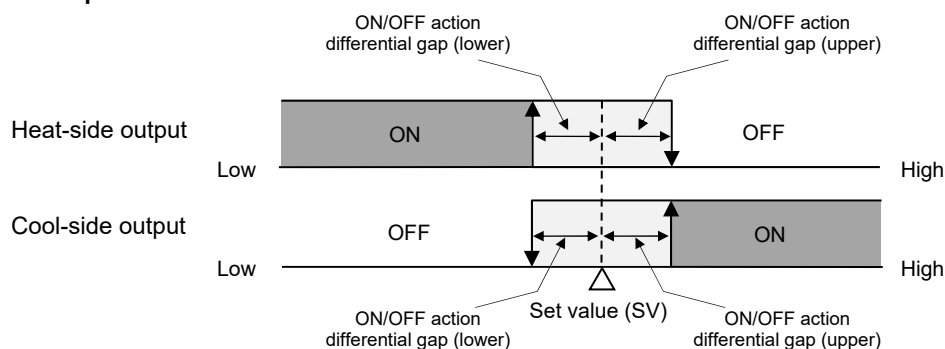
Select any one from “2: Heat/Cool PID control [water cooling],” “3: Heat/Cool PID control [air cooling],” or “4: Heat/Cool PID control [Cooling linear type]” and set “0” at the Proportional band [heat-side]. Then, the controller starts Heat/Cool control with ON/OFF action.

Manipulated output for ON/OFF action [at Heating control]

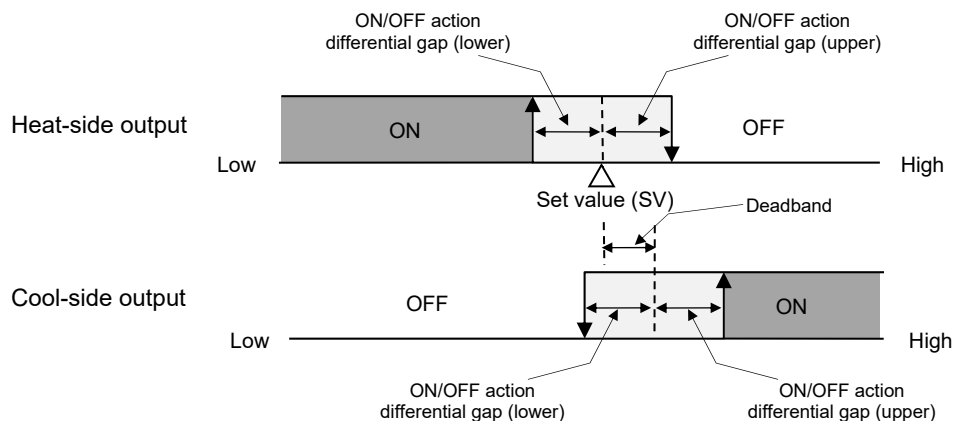


Manipulated output for ON/OFF action [at Heat/Cool control]

● Overlap/Deadband = 0



● Overlap/Deadband > 0





■ Parameter setting

● Proportional band [heat-side]

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
$U \quad IP$	TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 1000.0 % of Input span 0 (0.0, 0.00): ON/OFF action	TC/RTD inputs: 30 V/I inputs: 3.0

● ON/OFF action differential gap (upper)

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
$UoHH$	TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 100.0 % of Input span	TC/RTD inputs: 1 V/I inputs: 0.1



To display “ON/OFF action differential gap (upper),” zero (“0”) must be entered at Proportional band [heat-side]*.

* ON/OFF action differential gap (upper) in parameter group No. 51 will be displayed when 0 is set to the proportional band (heat-side) in parameter group No. 51.

ON/OFF action differential gap (upper) in parameter group No. 53 will be displayed when 0 is set to the proportional band (heat-side) in any one of PID groups in parameter group No. 53.

● ON/OFF action differential gap (lower)

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
$UoHL$	TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 100.0 % of Input span	TC/RTD inputs: 1 V/I inputs: 0.1



To display “ON/OFF action differential gap (lower),” zero (“0”) must be entered at Proportional band [heat-side]*.

* ON/OFF action differential gap (upper) in parameter group No. 51 will be displayed when 0 is set to the proportional band (heat-side) in parameter group No. 51.

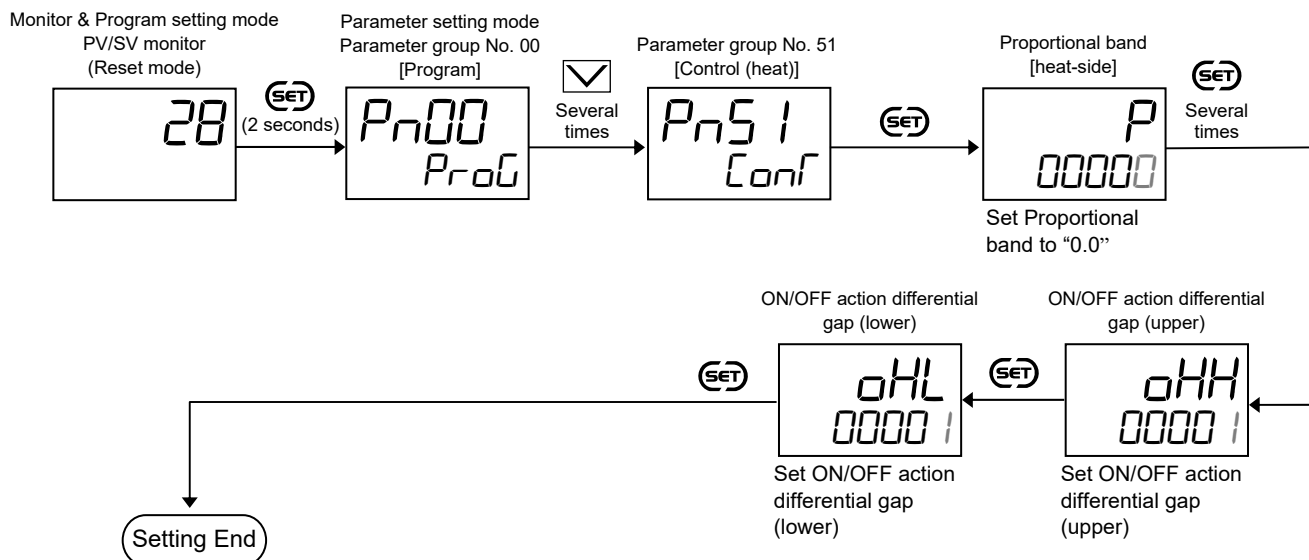
ON/OFF action differential gap (upper) in parameter group No. 53 will be displayed when 0 is set to the proportional band (heat-side) in any one of PID groups in parameter group No. 53.



ON/OFF action differential gap upper/lower in parameter group No.53 will be displayed on each PID group. ON/OFF action differential gap upper/lower in parameter group No.53 is the same for among all PID groups. It is not possible to set each PID group a different value of ON/OFF action differential gap upper/lower in parameter group No.53.

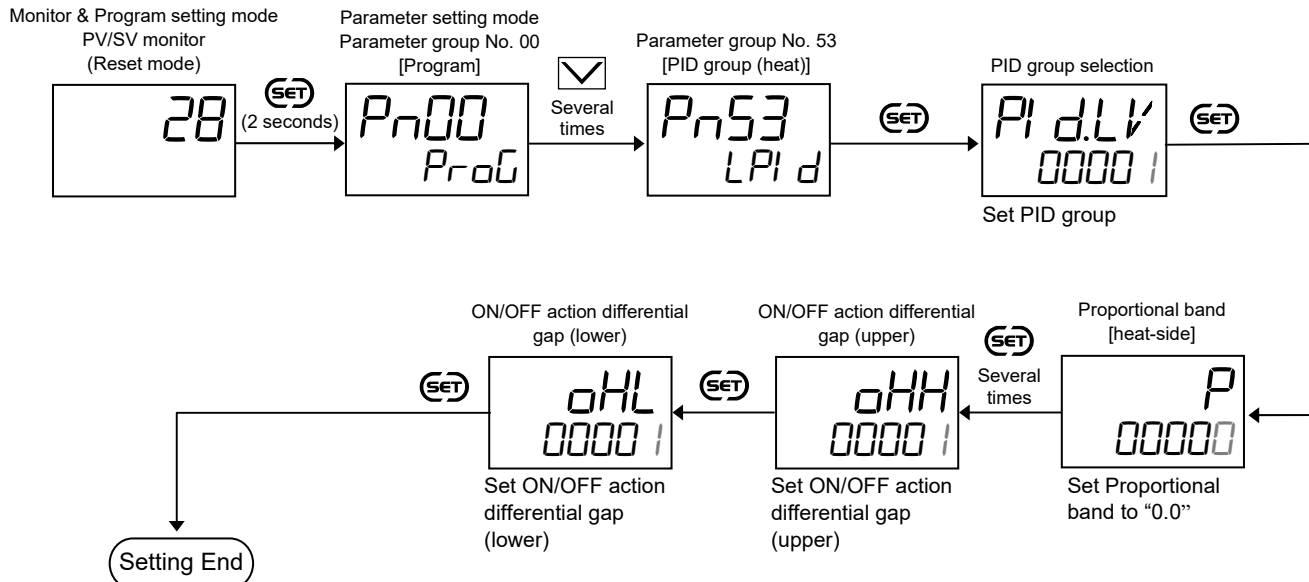
Setting procedure

[Without Level PID]



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

[With Level PID]



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

12.6 Controlling with Fixed Set Point Control

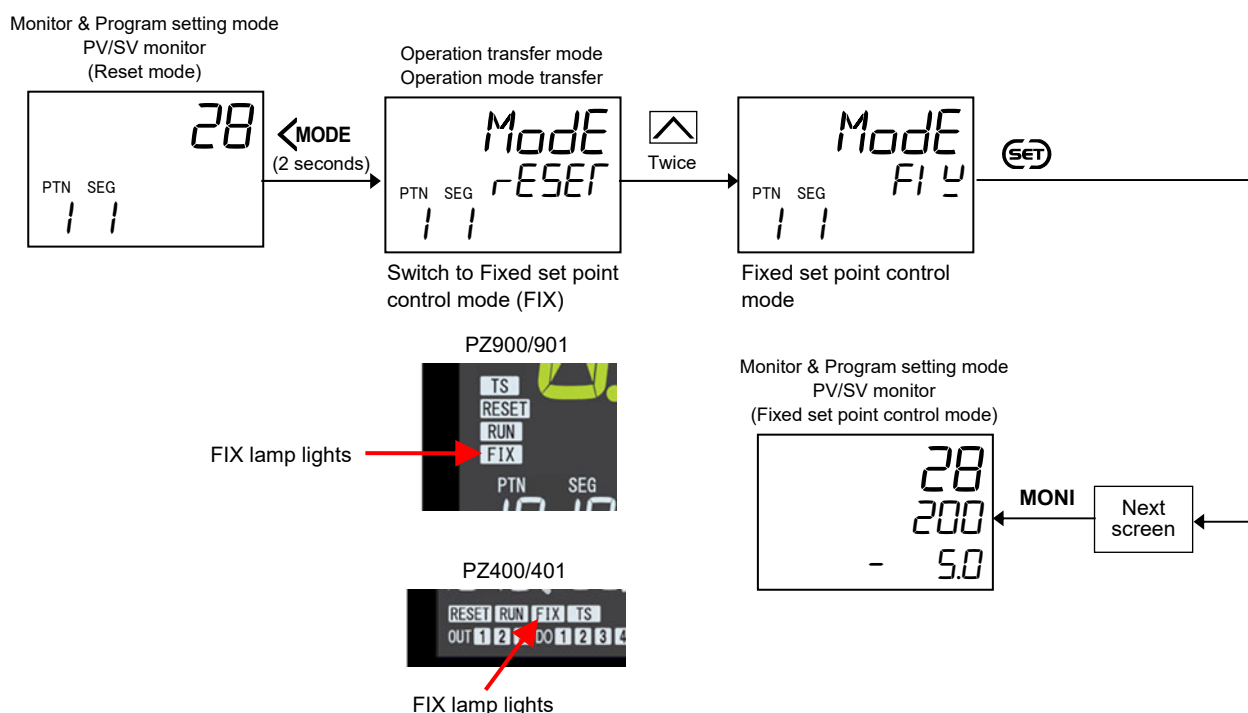
Fixed set point control runs control with the Set value (SV) of the Fixed set point control mode. It can be run in either PID control, ON/OFF action, Heat/Cool PID control, and Position proportioning PID control. Moreover, the level PID function can also be used.

For running Fixed set point control, it is necessary to transfer to the Fixed set point control mode (FIX) through the Operation mode transfer. Mode can be switched with communication (optional) too apart from the method of switch with key operations.

- For the event setting value in Fixed set point control mode (FIX) and Manual control mode (MAN), the event set value for the pattern number selected when in the operation mode (RESET or RUN) prior to switching to the relevant mode will be used.
- For the control action, refer to **12.1 Changing Control Action (P. 12-2)**.
- With regard to setting the PID values, refer to **12.2 Setting PID Values Automatically (Autotuning) (P. 12-7)**, **12.3 Setting PID Values Automatically (Startup tuning) (P. 12-17)** or **12.4 Setting PID Values Manually (P. 12-23)**.
- For the ON/OFF action, refer to **12.5 Controlling with ON/OFF Action (P. 12-30)**.
- For the Heat/Cool Control, refer to **12.7 Controlling with Heat/Cool Control (P. 12-37)**.
- For the Position proportioning control, refer to **12.8 Controlling with Position Proportioning Control (P. 12-46)**.
- For the level PID function, refer to **12.10 Controlling each temperature level with different PID values (Level PID) (P. 12-61)**.
- Refer to the separate manual **PZ400/PZ900/PZ401/PZ901 Host Communication Instruction Manual (IMR02B06-E□)** for switching to the Fixed set point control via communication.

■ Setting procedure

● Start Fixed set point control



● Stopping the Fixed set point control

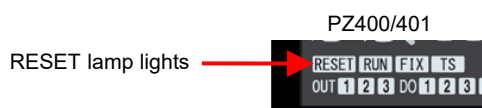
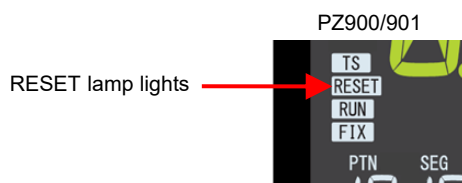
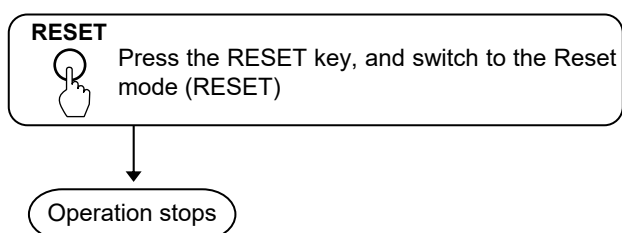
Pressing the RESET key will change the mode to the Reset mode (RESET), and the control will stop. However, Manipulated output value etc. will be output depending on the settings of the following parameters.

- Output action in Reset mode

Set whether to continuously output the logic calculation output, retransmission output, and instrument status output in the Reset mode (RESET).

- Manipulated output value in Reset mode

The Manipulated output value set beforehand will be output when the mode is changed to the Reset mode (RESET).

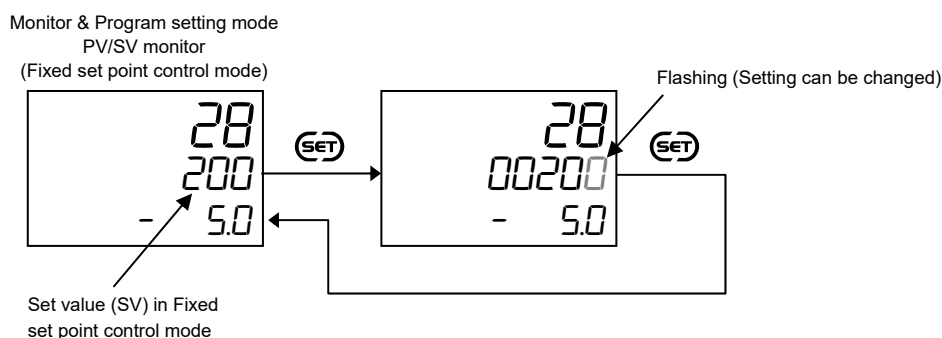


For the “Output action in Reset mode” or “Manipulated output value in Reset mode,” refer to **9.9 Changing the Output Action in Reset Mode (P. 9-36)**.

● Set the Set value (SV) in Fixed set point control mode

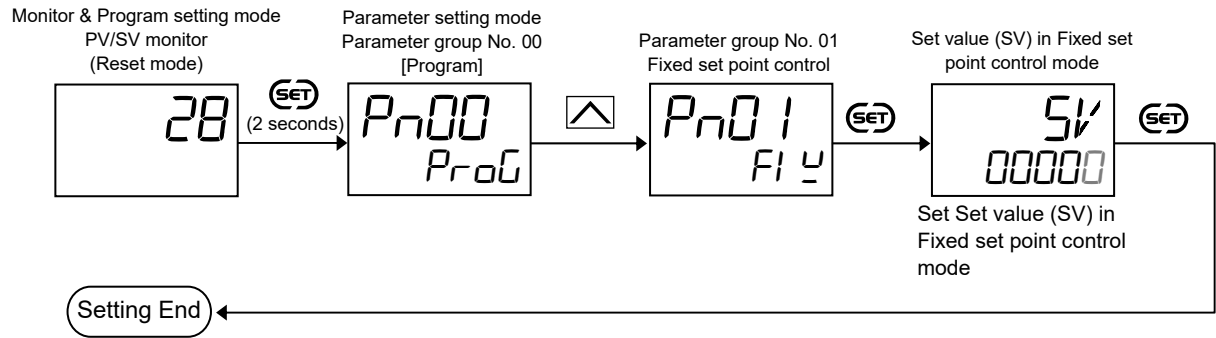
Set the Set value (SV) in Fixed set point control mode in the Monitor & Program setting mode [Fixed set point control mode (FIX)] or in the Parameter setting mode.

[Monitor & Program Setting Mode]





[Parameter setting mode]



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

■ Parameter setting

● Operation mode transfer
[Operation Transfer Mode]

Parameter symbol	Data range	Factory set value
<i>Mode</i>	<i>RESET</i> : Reset mode (RESET) <i>RUN</i> : Program control mode (RUN) <i>Fix</i> : Fixed set point control mode (FIX) <i>MAN</i> : Manual control mode (MAN)	<i>RESET</i>

● Set value (SV) in Fixed set point control mode
[Parameter Setting Mode: Parameter group No. 01 (Pn01)]

Parameter symbol	Data range	Factory set value
<i>SV</i>	Setting limiter low to Setting limiter high [Varies with the setting of the Decimal point position.]	0

12.7 Controlling with Heat/Cool Control

With Heat/Cool PID control method, heat-side and cool-side can be controlled by a controller. For example, this is effective when cooling control is required in extruder cylinder temperature control.

■ Description of function

● Cool control type

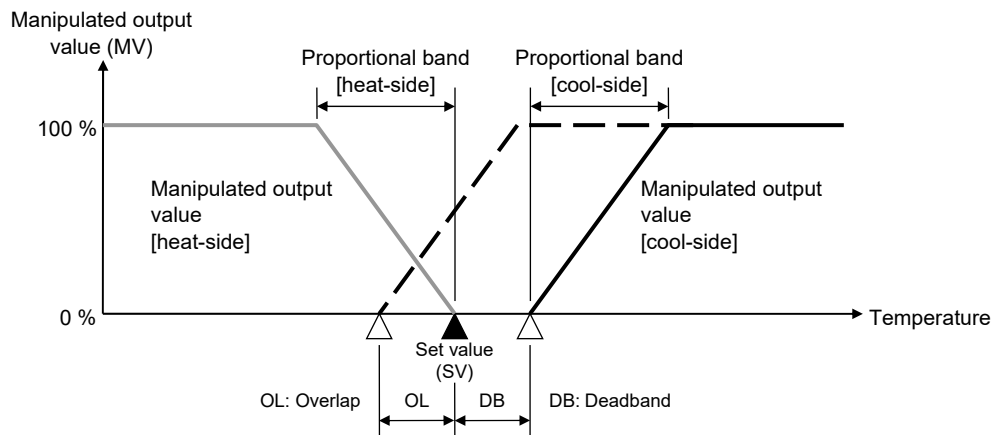
The control on the heat-side is the same as the standard PID control. The control on the cool-side can be selected from a few types according to the controlled object.

- Water cooling/Air cooling: The algorithm assuming plastic molding machine Heat/Cool control is employed. Even in equipment provided with a cooling mechanism having nonlinear characteristics, it responds quickly to attain the characteristic responding to the set value with small overshooting.
- Cooling linear type: The algorithm assuming applications without nonlinear cooling capability is employed.

● Overlap/Deadband

Heat/Cool PID control has a proportional band individually on each side of the heating and the cooling. With the Set value (SV)* as a reference point, setting the Overlap/Deadband below the Set value (SV)* [setting on the negative side] generates an overlap of the heating and the cooling proportional bands. Setting this parameter above the Set value (SV)* [setting on the positive side] generates a deadband.

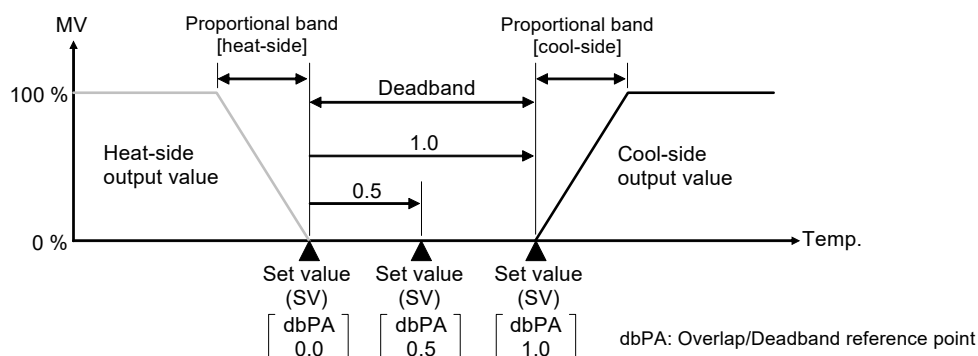
* In Program control mode (RUN): The Set value (SV) is a Segment level.



[Overlap/Deadband reference point]

Each Set value (SV) for the Heat/Cool PID control becomes the Overlap/Deadband reference point.

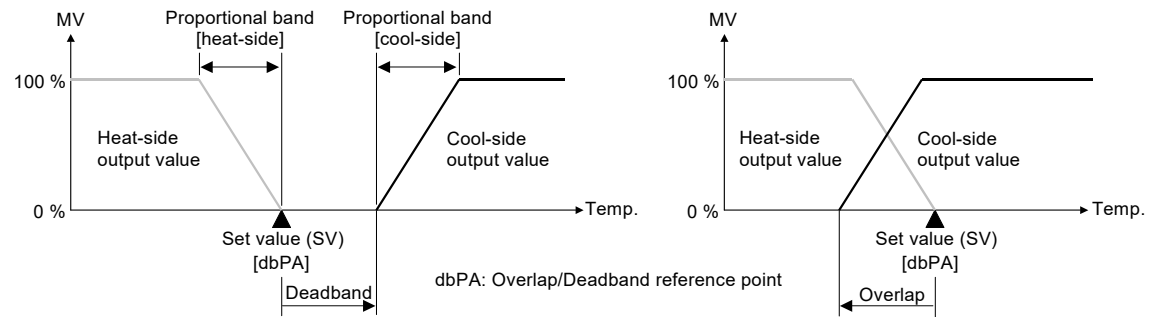
- When setting 0.0, Overlap/Deadband reference point is at 0 % of the output at Proportional band [heat-side].
- When setting 0.5, Overlap/Deadband reference point is at the midpoint of the Overlap/Deadband.
- When setting 1.0, Overlap/Deadband reference point is at 0 % of the output at Proportional band [cool-side].



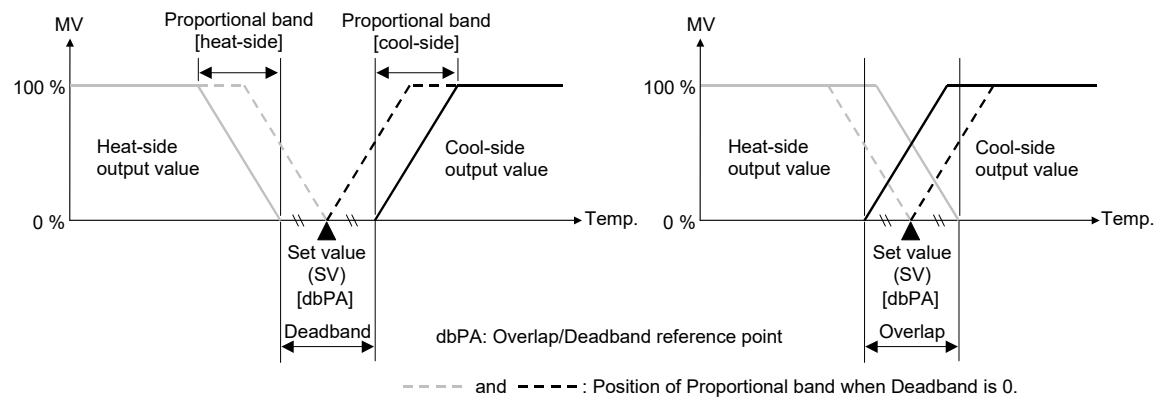


Example: Difference in Overlap/Deadband reference point

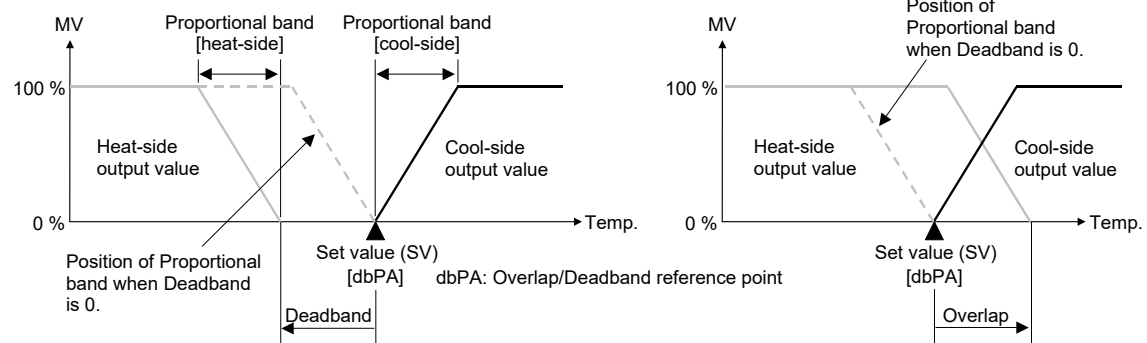
[Overlap/Deadband reference point: 0.0]



[Overlap/Deadband reference point: 0.5]



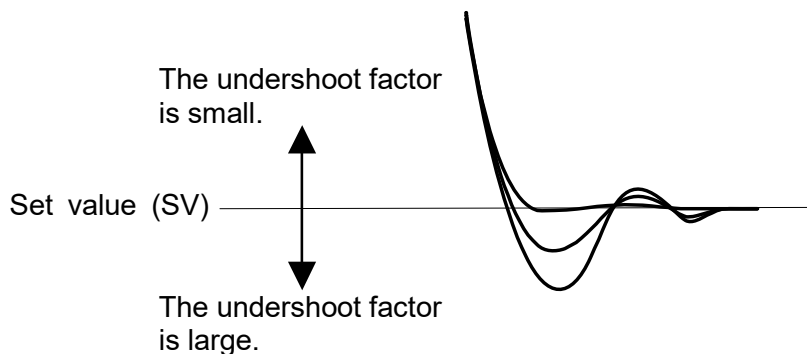
[Overlap/Deadband reference point: 1.0]



To change Deadband when the Overlap/Deadband reference point is 0.5, the Proportional band on heat-side and cool-side shift equidistantly to the midpoint of the Overlap/Deadband.

● Undershoot suppression factor

The Undershoot suppression function suppresses the undershoot that occurs when the Set value (SV) is lowered due to the special cooling characteristic (cooling nonlinear characteristic) of plastic molding machines. The undershoot suppression effect increases as a smaller value is set for the Undershoot suppression factor.



NOTE

If the Undershoot suppression factor is set too small, the undershoot function acts excessively and prevents the Measured value (PV) from reaching the Set value (SV). As a result, the PV stabilizes at an offset or approaches the set value very slowly, preventing normal control. In this event, change the setting for the Undershoot suppression factor to a slightly higher value.

■ Parameter setting

● Proportional band [heat-side]

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
P	TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.0 to 1000.0 % of Input span 0 (0.0, 0.00): ON/OFF action	TC/RTD inputs: 30 V/I inputs: 3.0



● Proportional band [cool-side]

[Parameter Setting Mode: Parameter group No. 56 (P_{n56})] (Without Level PID)

[Parameter Setting Mode: Parameter group No. 58 (P_{n58})] (With Level PID)

Parameter symbol	Data range	Factory set value
P_c	TC/RTD inputs: 1 (0.1, 0.01) to Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: 0.1 to 1000.0 % of Input span	TC/RTD inputs: 30 V/I inputs: 3.0



To display “Proportional band [cool-side],” you need to specify “Heat/Cool PID control” at the time of order, AND to enter a value other than 0 in the Proportional band [heat-side]*.

* The Proportional band [cool-side] screen in Parameter group No.56 will be displayed when a value other than 0 is set to the Proportional band (heat-side) in Parameter group No. 51.

The Proportional band [cool-side] screen in Parameter group No.58 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No. 53. However, the displayed Proportional band [cool-side] screen will belong to the same PID group as the Proportional band [heat-side] screen.

● Integral time [heat-side]

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
I	PID control or Heat/Cool PID control: 0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PD action Position proportioning PID control: 1 to 3600 seconds, 0.1 to 3600.0 seconds or 0.01 to 360.00 seconds [Varies with the setting of the Integral/Derivative time decimal point position.]	240



To display “Integral time [heat-side],” you need to enter a value other than 0 in the Proportional band [heat-side]*.

* The Integral time [heat-side] screen in Parameter group No.51 will be displayed when a value other than 0 is set to the Proportional band (heat-side) in Parameter group No. 51.

The Integral time [heat-side] screen in Parameter group No.53 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No. 53. However, the displayed Integral time [heat-side] screen will belong to the same PID group as the Proportional band [heat-side] screen.

● Integral time [cool-side]

[Parameter Setting Mode: Parameter group No. 56 (P_{n56})]

[Parameter Setting Mode: Parameter group No. 58 (P_{n58})]

Parameter symbol	Data range	Factory set value
I_c	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PD action [Varies with the setting of the Integral/Derivative time decimal point position.]	240



To display “Integral time [cool-side],” you need to specify “Heat/Cool PID control” at the time of order, AND to enter a value other than 0 in the Proportional band [heat-side]*.

* The Integral time [cool-side] screen in Parameter group No.56 will be displayed when a value other than 0 is set to the Proportional band (heat-side) in Parameter group No. 51.

The Integral time [cool-side] screen in Parameter group No.58 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No. 53. However, the displayed Integral time [cool-side] screen will belong to the same PID group as the Proportional band [heat-side] screen.

● Derivative time [heat-side]

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
d	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action [Varies with the setting of the Integral/Derivative time decimal point position.]	60



To display “Derivative time [heat-side],” you need to enter a value other than 0 in the Proportional band [heat-side]*.

* The Derivative time [heat-side] screen in Parameter group No.51 will be displayed when a value other than 0 is set to the Proportional band (heat-side) in Parameter group No. 51.

The Derivative time [heat-side] screen in Parameter group No.53 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No. 53. However, the displayed Derivative time [heat-side] screen will belong to the same PID group as the Proportional band [heat-side] screen.

● Derivative time [cool-side]

[Parameter Setting Mode: Parameter group No. 56 (P_{n56})]

[Parameter Setting Mode: Parameter group No. 58 (P_{n58})]

Parameter symbol	Data range	Factory set value
dc	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action [Varies with the setting of the Integral/Derivative time decimal point position.]	60



To display “Derivative time [cool-side],” you need to specify “Heat/Cool PID control” at the time of order, AND to enter a value other than 0 in the Proportional band [heat-side]*.

* The Derivative time [cool-side] screen in Parameter group No.56 will be displayed when a value other than 0 is set to the Proportional band (heat-side) in Parameter group No. 51.

The Derivative time [cool-side] screen in Parameter group No.58 will be displayed when a value other than 0 is set to the Proportional band [heat-side] in Parameter group No. 53. However, the displayed Derivative time [cool-side] screen will belong to the same PID group as the Proportional band [heat-side] screen.

● Overlap/Deadband

[Parameter Setting Mode: Parameter group No. 56 (P_{n56})]

[Parameter Setting Mode: Parameter group No. 58 (P_{n58})]

Parameter symbol	Data range	Factory set value
db	TC/RTD inputs: –Input span to +Input span (Unit: °C [°F]) [Varies with the setting of the Decimal point position.] Voltage (V)/Current (I) inputs: –100.0 to +100.0 % of Input span Minus (–) setting results in Overlap. However, the overlapping range is within the proportional range.	TC/RTD inputs: 0 V/I inputs: 0.0



To display “Overlap/Deadband,” you need to specify “Heat/Cool PID control” at the time of order, or “Control action” (Function block No. 51 in Engineering mode) must be set to Heat/Cool PID control.



● Control action

[Engineering Mode: Function block No. 51 (Fn5 I)]

Parameter symbol	Data range	Factory set value
05	0: Brilliant II PID control (direct action) 1: Brilliant II PID control (reverse action) 2: Brilliant II Heat/Cool PID control [water cooling] 3: Brilliant II Heat/Cool PID control [air cooling] 4: Brilliant II Heat/Cool PID control [Cooling linear type] 5: Brilliant II Position proportioning PID control (reverse action) 6: Brilliant II Position proportioning PID control (direct action)	Control action specified at the time of order.



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized when the Control action is changed.

● Undershoot suppression factor

[Engineering Mode: Function block No. 56 (Fn56)]

Parameter symbol	Data range	Factory set value
U5	0.000 to 1.000	Water cooling: 0.100 Air cooling: 0.250 Cooling linear: 1.000



To display “Undershoot suppression factor,” you need to specify “Heat/Cool PID control” at the time of order, or “Control action” (Function block No. 51 in Engineering mode) must be set to Heat/Cool PID control.

● Overlap/Deadband reference point

[Engineering Mode: Function block No. 56 (Fn56)]

Parameter symbol	Data range	Factory set value
dbPA	0.0 to 1.0	0.0

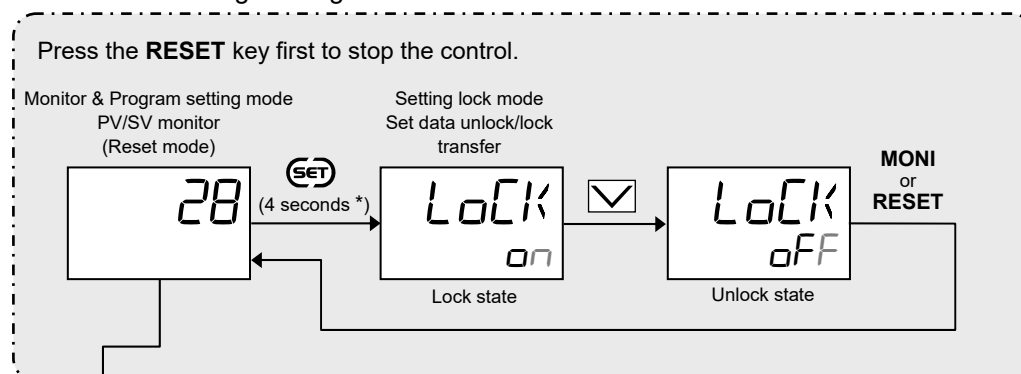


To display “Overlap/Deadband reference point,” you need to specify “Heat/Cool PID control” at the time of order, or “Control action” (Function block No. 51 in Engineering mode) must be set to Heat/Cool PID control.

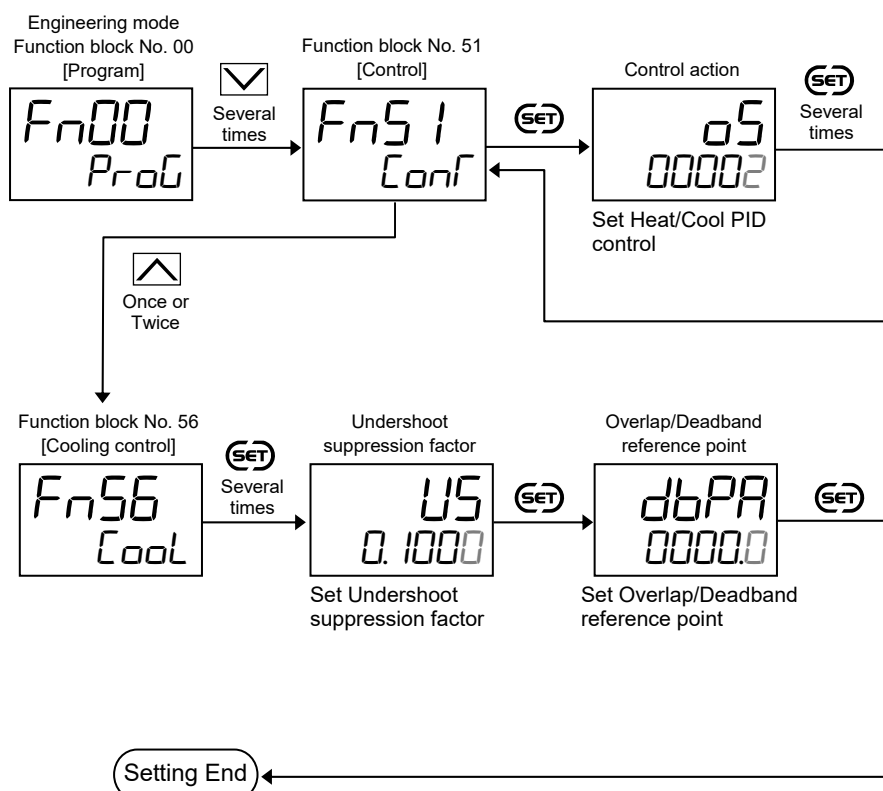
Setting procedure

Selecting Heat/Cool PID control

To enter the Engineering mode



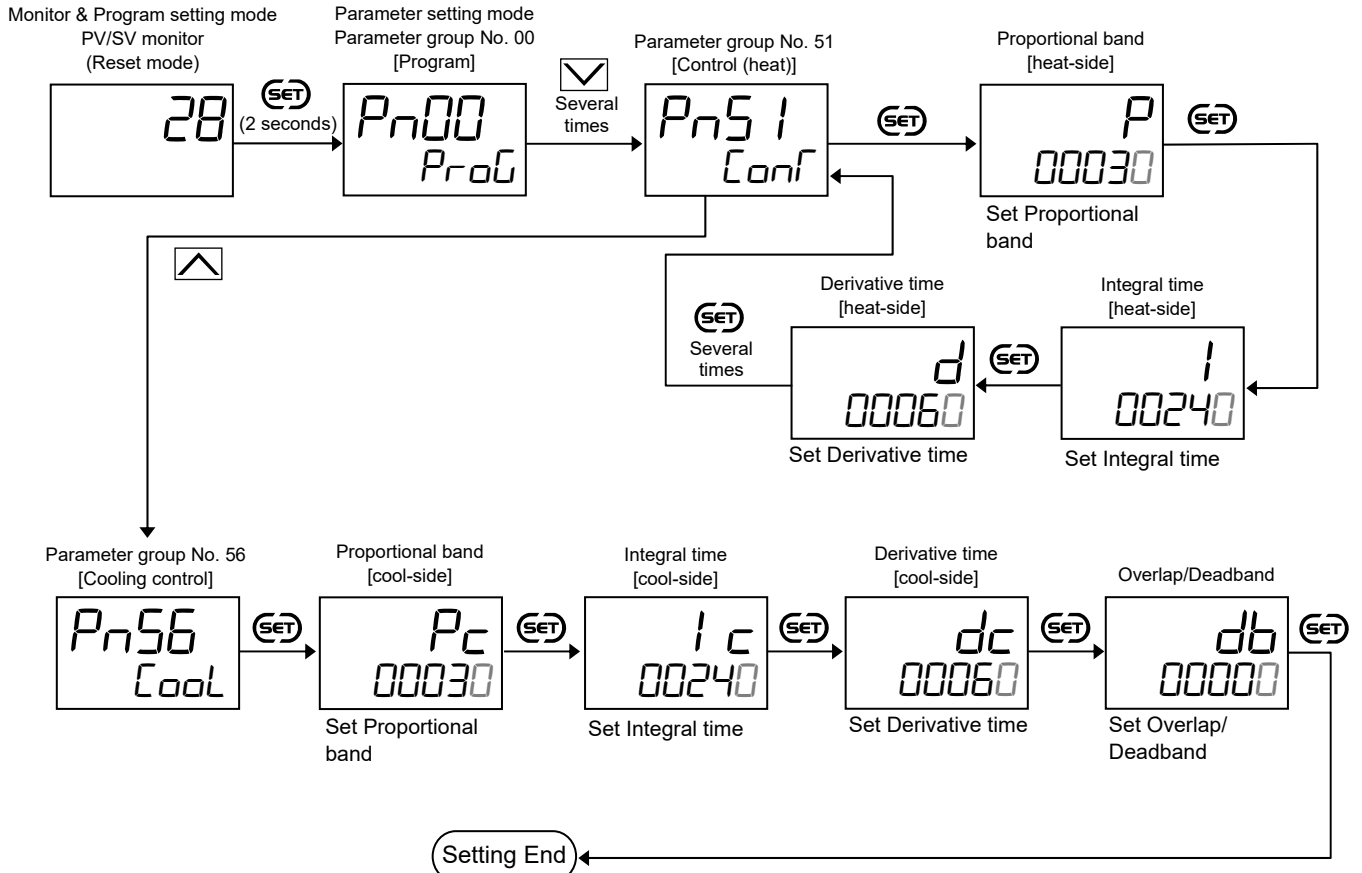
* Press the **SET** key until Parameter setting mode is displayed. Keep pressing without releasing your finger from the key to enter the Setting lock mode.



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

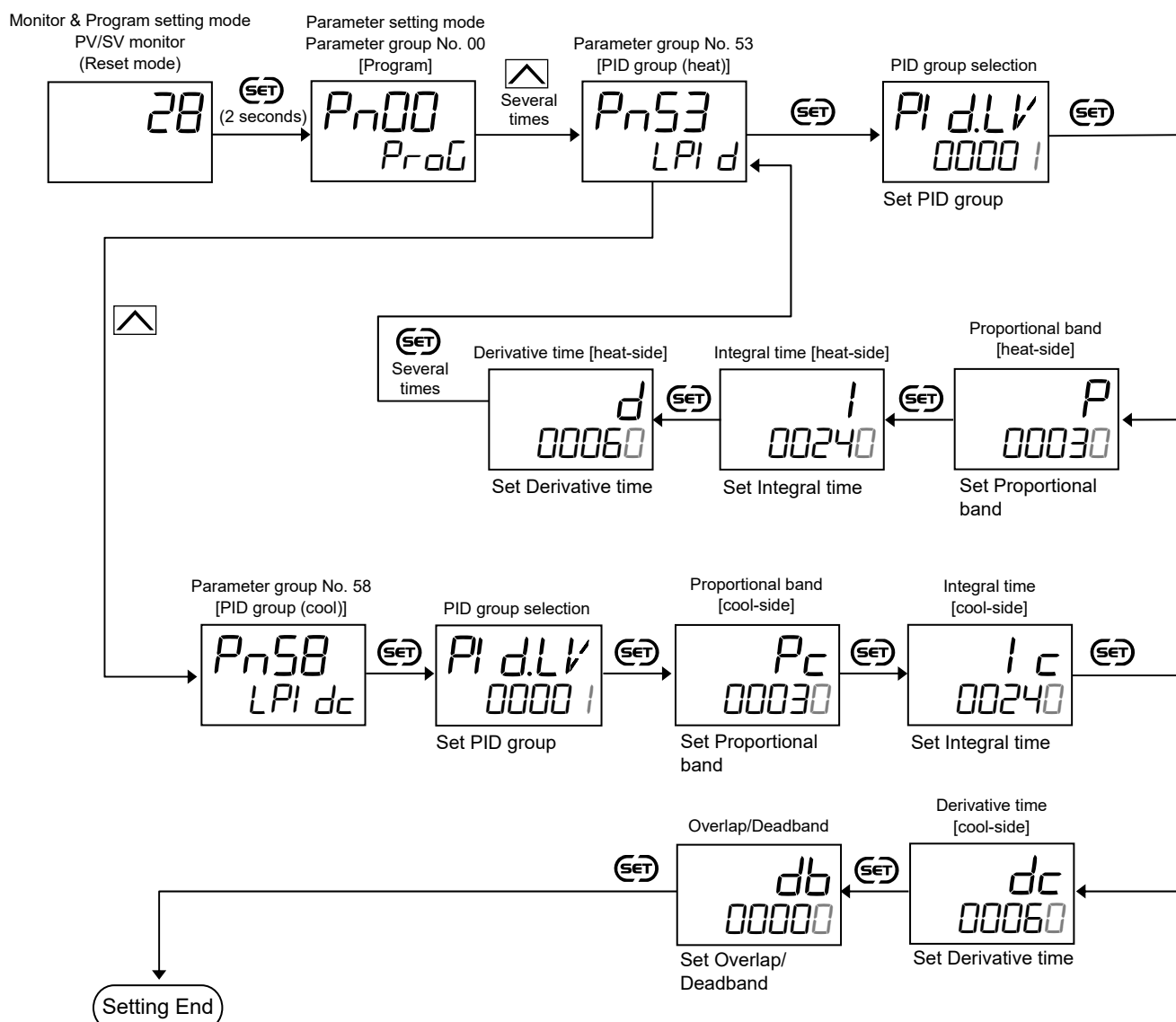
● Setting parameters for Heat/Cool PID control

[Without Level PID]



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

[With Level PID]



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)]



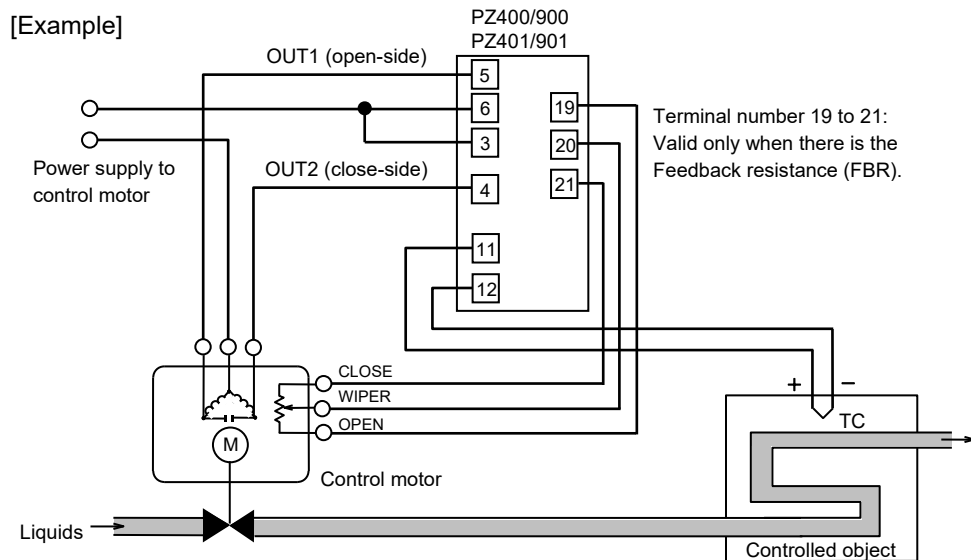
The Parameters in Heat/Cool PID control can be calculated also in Autotuning (AT). (Overlap/Deadband is excluded)
For Autotuning (AT), refer to **12.2 Setting PID Values Automatically (Autotuning)** (P. 12-7).

12.8 Controlling with Position Proportioning Control

Position proportioning PID control converts the control output value of the controller into the corresponding signal to control a motor driven valve (control motor) and then performs temperature control of a controlled object by regulating fluid flow.

■ Description of function

In Position proportioning PID control of this controller, it is possible to select the presence or absence of Feedback resistance (FBR) input which monitors the degree of valve position. In addition, the direct action or reverse action can be selected.



The details of setting differ depending on the presence or absence of Feedback resistance (FBR) input.

● When the Feedback resistance (FBR) is provided:

- High/Low limit of valve position (limit value of FBR input) can be set. [Output limiter high, Output limiter low]
- The valve position can be manually changed. [Manipulated output value (MV) setting in Manual control mode (MAN)]
- The feedback adjustment is necessary. [Feedback adjustment preparation]
- Action taken when Feedback resistance (FBR) input breaks can be selected. [Action at Feedback resistance (FBR) input error]
- The close-side (or open-side) output remains ON when the valve position is fully closed (or opened). [Action at saturated output]

● When the Feedback resistance (FBR) is not provided:

- Control motor operation can be restricted by the Integrated output limiter. [Integrated output limiter]
- The UP/DOWN key is used to output opening or closing signal in Manual mode.
 - UP key (open-side): While the UP key is being pressed, open-side output (OUT1) is output continuously. Releasing the UP key turns off the output on the open-side to hold the opened state at that time.
 - DOWN key (close-side): While the DOWN key is being pressed, close-side output (OUT2) is output continuously. Releasing the DOWN key turns off the output on the closed-side to hold the opened state at that time.



For manual operation of Position proportioning PID control, refer to **12.9 Controlling with Manual Control (P. 12-58)**.

Parameter Valid/Invalid depending on the presence or absence of FBR input (×: Valid, —: Invalid)

Applicable parameters	When the Feedback resistance (FBR) input is provided	When the Feedback resistance (FBR) input is not provided
Manipulated output value in Reset mode [heat-side] (<i>RMV</i>) Engineering mode [Function block No. 51 (<i>Fn51</i>)]	×	—
Output limiter high (<i>oLH</i>) Output limiter low (<i>oLL</i>) Parameter setting mode [Parameter group No. 51 (<i>Pn51</i>)] Parameter setting mode [Parameter group No. 53 (<i>Pn53</i>)]	×	—
Open/Close output neutral zone (<i>Ydb</i>) * Setup setting mode [Setting group No. 55 (<i>Sn55</i>)]	×	×
Open/Close output differential gap (<i>YH5</i>) * Setup setting mode [Setting group No. 55 (<i>Sn55</i>)]	×	×
Action at feedback resistance (FBR) input error (<i>YbR</i>) Engineering mode [Function block No. 55 (<i>Fn55</i>)]	×	—
Feedback adjustment (<i>Pa5</i>) Engineering mode [Function block No. 55 (<i>Fn55</i>)]	×	—
Control motor time (<i>MoT</i>) * Engineering mode [Function block No. 55 (<i>Fn55</i>)]	×	×
Integrated output limiter (<i>oLR</i>) Engineering mode [Function block No. 55 (<i>Fn55</i>)]	—	×
Valve action in Reset mode (<i>VRl</i>) * Engineering mode [Function block No. 55 (<i>Fn55</i>)]	×	×
Action at saturated output (<i>YRSO</i>) Engineering mode [Function block No. 55 (<i>Fn55</i>)]	×	—

* Always set this item regardless of the presence or absence of opening Feedback resistance (FBR) input.



Position proportioning PID control can be performed if two output points are selected when ordering. If Current output or Continuous voltage output is specified, the Position proportioning PID control cannot be selected. [Output value: -5.0 % (fixed)]

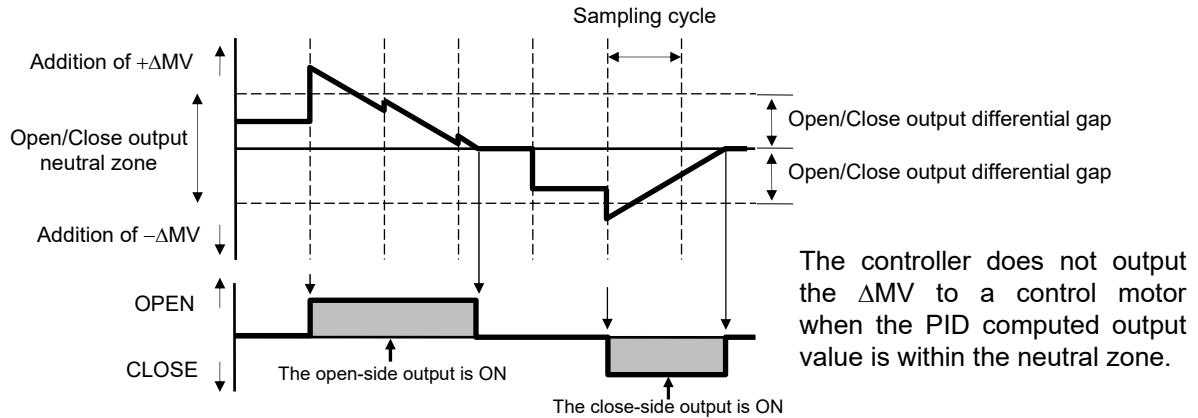


When the control action is the Position proportioning PID control, the Startup tuning (ST) is not available. Proportional cycle time and Output change rate limiter are also invalid.

● Open/Close output neutral zone

The Open/Close output neutral zone is used to prevent a control motor from repeating ON/OFF too frequently. When the PID computed output value is within the Open/Close output neutral zone, the controller will not output the MV to a control motor.

[Example] If the Open/Close output differential gap is set to 1/2 (a half) of the Open/Close output neutral zone (Factory set value)



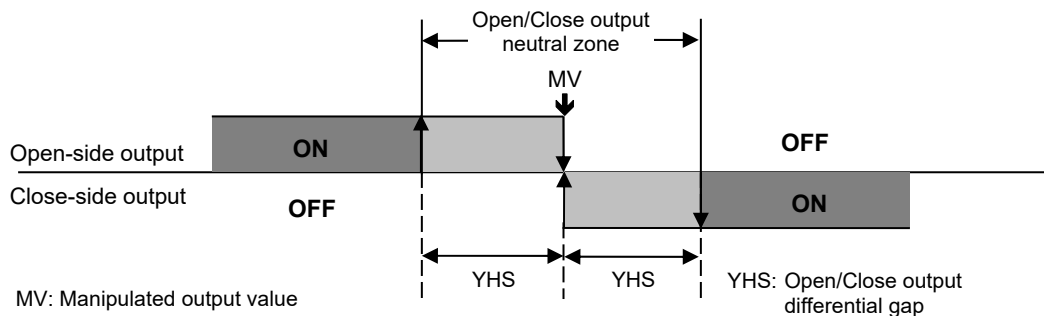
● Open/Close output differential gap

Setting the Open/Close output differential gap is useful in preventing the Manipulated output (MV) for Open/Close side from turning on and off all the time due to the fluctuation of the Feedback resistance input.

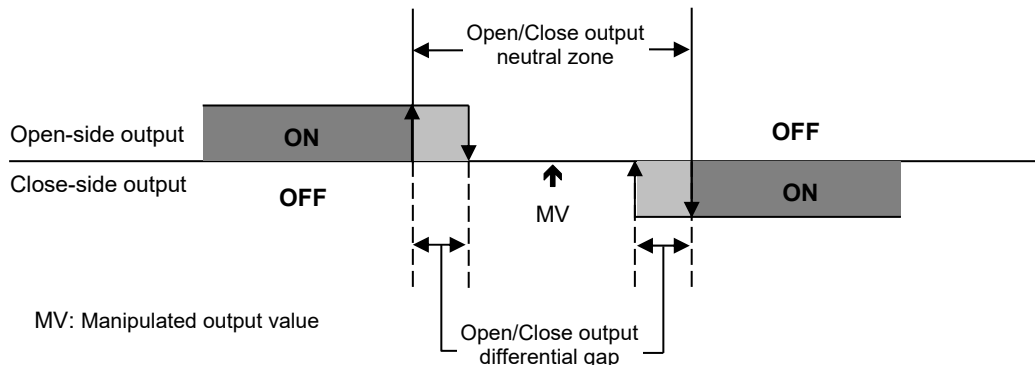


Changing the value of the Open/Close output neutral zone will make the Open/Close output differential gap 1/2 (a half) of the Open/Close output neutral zone.

[Example 1] If the Open/Close output differential gap is set to 1/2 (a half) of the Open/Close output neutral zone (Factory set value)



[Example 2] Narrowing the Open/Close output differential gap



● Feedback adjustment

Feedback adjustment function is to adjust controller's output value to match the Feedback resistance (FBR) of the control motor.

After the adjustment, the Manipulated output value of 0 to 100 % obtained after PID computation matches the valve position signal of the fully closed position to the fully opened position [Feedback resistance (FBR) input] sent from the control motor. The adjustment has to be completed before starting the operation.

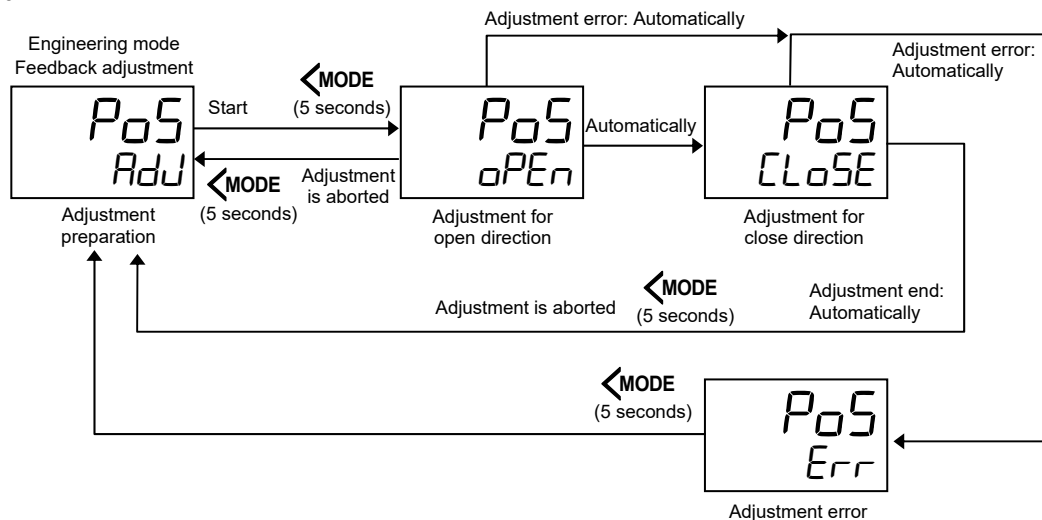
Always make sure that the wiring is correct and the control motor operates normally before the adjustment.



If opening adjustment is performed, the control motor time is automatically computed.

If the calculated value is 5 seconds or shorter, the Control motor time will be set to the low limit value (5 seconds). If the calculated value is 1000 seconds or more, it is handled as an error and the set value will not be updated.

[Adjustment procedure]



● Control motor time

This is the time required until the control motor is fully opened from its fully closed state.

If opening adjustment is performed, the control motor time is automatically computed. If the calculated value is 5 seconds or shorter, the Control motor time will be set to the low limit value (5 seconds). If the calculated value is 1000 seconds or more, it is handled as an error and the set value will not be updated.

● Integrated output limiter

This is a restricted value when the output on the open or closed side is integrated. If the output on the open (or closed) side is output in succession, it is integrated and if the result reaches the Integrated output limiter value, the output on the open (or closed) side is turned off. In addition, if the output on the open (or closed) side is reversed, the integrated value is reset.

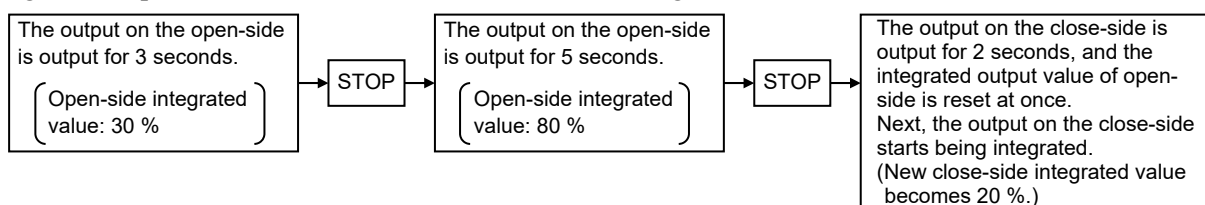


The Integrated output limiter is invalid when the Feedback resistance (FBR) input is used.

This setting is invalid in the Manual control mode (MAN).

[Setting example]

If control is started at the fully closed state when the control motor time is set at 10 seconds and the Integrated output limiter value is set at 100 %, the following results.





● Action at feedback resistance (FBR) input error

Use to select an action at the Feedback resistance (FBR) input break.

Data range 0: Action depending on the Valve action in Reset mode
1: Control action continued

● Valve action in Reset mode

Select the valve action when Feedback resistance (FBR) input is disabled or “0 (Action depending on the Valve action in Reset mode)” is set for the action when a Feedback resistance (FBR) input break occurs.

Data range 0: Close-side output OFF, Open-side output OFF
1: Close-side output ON, Open-side output OFF
2: Close-side output OFF, Open-side output ON

● Action at saturated output

Set to maintain ON state for the close-side (or open-side) output when the valve position is fully closed (or opened).

[When the Action at saturated output is invalid]

The close-side output turns OFF when the valve position is fully closed (FBR input value ≤ 0 %).

The open-side output turns OFF when the valve position is fully opened (FBR input value ≥ 100 %).

[When the Action at saturated output is valid]

The close-side output remains ON when the valve position is fully closed (FBR input value ≤ 0 %).

The open-side output remains ON when the valve position is fully opened (FBR input value ≥ 100 %).



NOTE

To validate the Action at saturated output, make sure to use valve with limit switch.



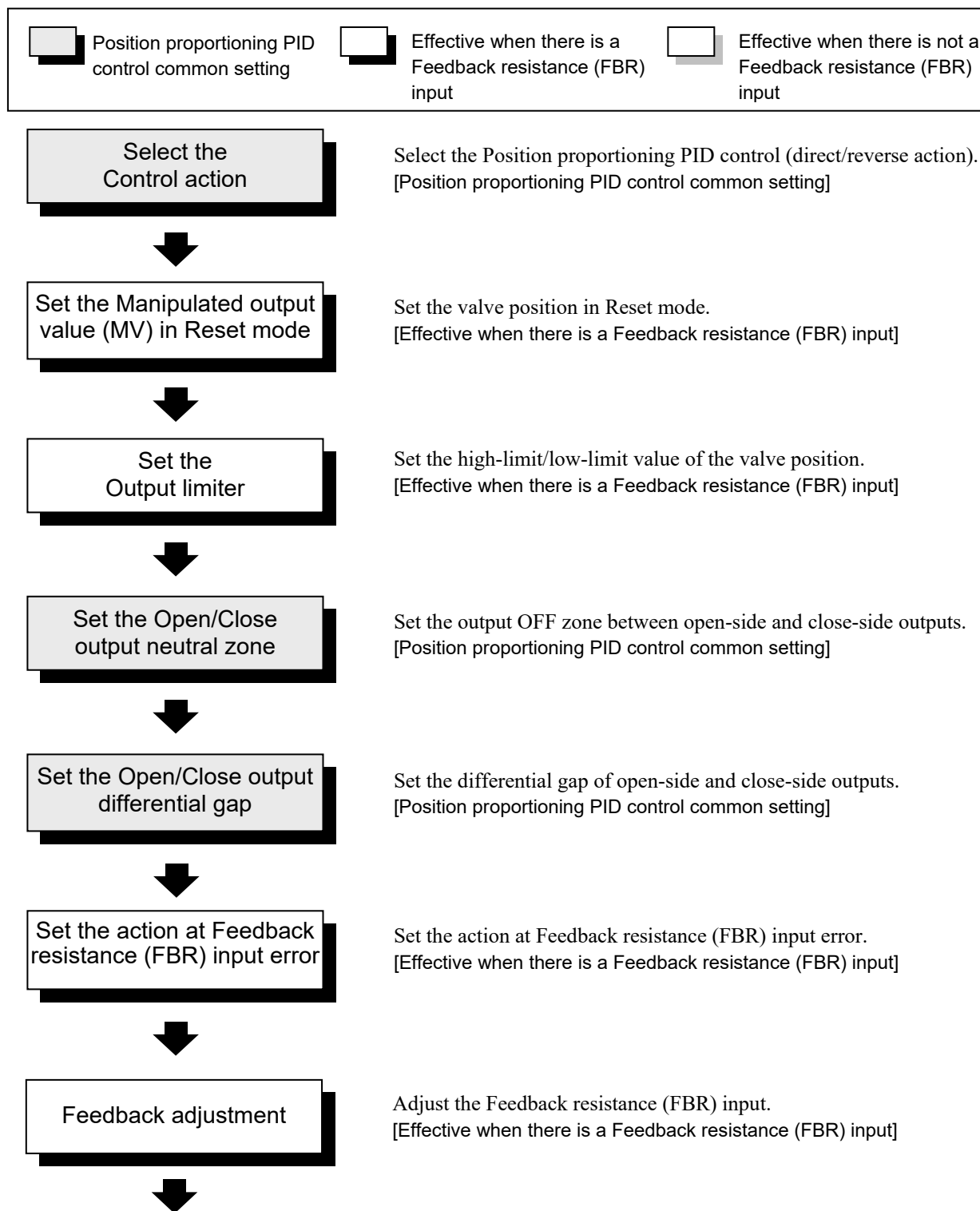
Refer to the Action at Feedback resistance (FBR) input error for the valve action when the FBR input is broken.



The Action at saturated output is invalid when the value of Output limiter high or Output limiter low is between 0.1 % and 99.9 %.

● Setting flowchart

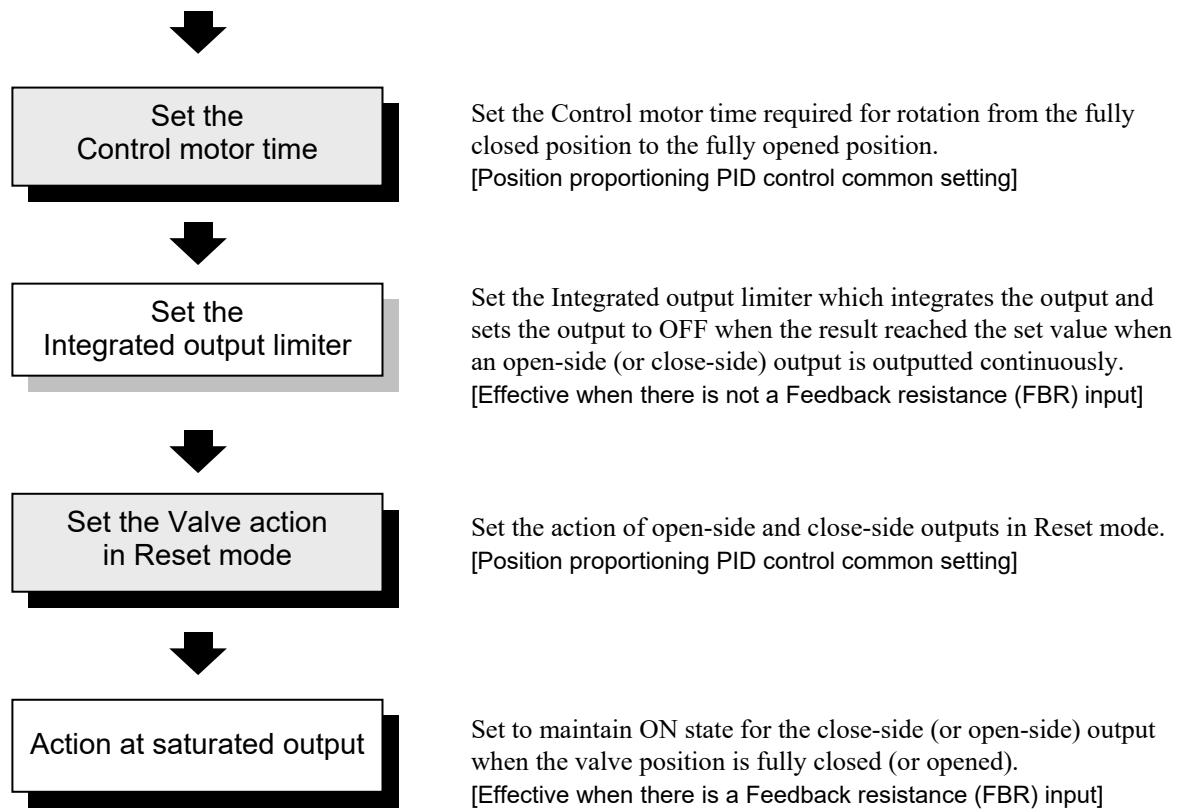
This section describes the Position proportioning PID control dedicated setting items and the setting items which are effective when there is or is not a Feedback resistance (FBR) input. The following setting items are all set in the Engineering mode.



Continued on the next page.



Continued from the previous page.



■ Parameter setting

● Control action

[Engineering Mode: Function block No. 51 (F_{n5} I)]

Parameter symbol	Data range	Factory set value
$o5$	0: Brilliant II PID control (direct action) 1: Brilliant II PID control (reverse action) 2: Brilliant II Heat/Cool PID control [water cooling] 3: Brilliant II Heat/Cool PID control [air cooling] 4: Brilliant II Heat/Cool PID control [Cooling linear type] 5: Brilliant II Position proportioning PID control (reverse action) 6: Brilliant II Position proportioning PID control (direct action)	Control action specified at the time of order.

Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized when the Control action is changed.

● Manipulated output value in Reset mode [heat-side]

[Engineering Mode: Function block No. 51 (F_{n5} I)]

Parameter symbol	Data range	Factory set value
RMV	–5.0 to +105.0 %	–5.0

● Output limiter high [heat-side]

[Parameter Setting Mode: Parameter group No. 51 (P_{n5} I)]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
oLH	Output limiter low [heat-side] to 105.0 %	105.0

Not displayed the Control action is a Position proportioning PID control without Feedback resistance (FBR) input.

Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are automatically converted when the Output limiter high [heat-side] is changed.

● Output limiter low [heat-side]

[Parameter Setting Mode: Parameter group No. 51 (P_{n5} I)]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
oLL	–5.0 % to Output limiter high [heat-side]	–5.0

Not displayed the Control action is a Position proportioning PID control without Feedback resistance (FBR) input.

Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are automatically converted when the Output limiter low [heat-side] is changed.



● Open/Close output neutral zone

[Setup Setting Mode: Setting group No. 55 (5n55)]

Parameter symbol	Data range	Factory set value
Ydb	0.1 to 10.0 % of output	2.0



To display the “Open/Close output neutral zone,” you need to set the parameters for the Position proportioning PID control at “Control action” in Function block No. 51 in the Engineering mode.



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are initialized when the Open/Close output neutral zone is changed.

● Open/Close output differential gap

[Setup Setting Mode: Setting group No. 55 (5n55)]

Parameter symbol	Data range	Factory set value
YH5	0.1 to 5.0 % of output	1.0



To display the “Open/Close output differential gap,” you need to set the parameters for the Position proportioning PID control at “Control action” in Function block No. 51 in the Engineering mode.

● Action at feedback resistance (FBR) input error

[Engineering Mode: Function block No. 55 (Fn55)]

Parameter symbol	Data range	Factory set value
YBR	0: Action depending on the Valve action in Reset mode 1: Control action continued	0



To display “Action at feedback resistance (FBR) input error,” specify “Feedback resistance (FBR) input” at the time of order, AND “Control action” (Function block No. 51 in Engineering mode) must be set to Position proportioning PID control.

● Feedback adjustment

[Engineering Mode: Function block No. 55 (Fn55)]

Parameter symbol	Data range	Factory set value
Pos	When the <MODE key is pressed and held for 5 seconds, Feedback adjustment is automatically started. <i>Adj</i> : Adjustment end <i>OPEN</i> : During adjustment on the open-side <i>CLOSE</i> : During adjustment on the close-side <i>Err</i> : Adjustment error	<i>Adj</i>



To display “Feedback adjustment,” specify “Feedback resistance (FBR) input” at the time of order, AND “Control action” (Function block No. 51 in Engineering mode) must be set to Position proportioning PID control.

● Control motor time

[Engineering Mode: Function block No. 55 (Fn55)]

Parameter symbol	Data range	Factory set value
<i>MOT</i>	5 to 1000 seconds	10



To display the “Control motor time,” you need to set the parameters for the Position proportioning PID control at “Control action” in Function block No. 51 in the Engineering mode.

● Integrated output limiter

[Engineering Mode: Function block No. 55 (Fn55)]

Parameter symbol	Data range	Factory set value
<i>OLA</i>	0.0 to 200.0 % of control motor time 0.0: OFF	150.0



To display the “Integrated output limiter,” you need to set the parameters for the Position proportioning PID control at “Control action” in Function block No. 51 in the Engineering mode.

● Valve action in Reset mode

[Engineering Mode: Function block No. 55 (Fn55)]

Parameter symbol	Data range	Factory set value
<i>VAL</i>	0: Close-side output OFF, Open-side output OFF 1: Close-side output ON, Open-side output OFF 2: Close-side output OFF, Open-side output ON	0



To display the “Valve action in Reset mode,” you need to set the parameters for the Position proportioning PID control at “Control action” in Function block No. 51 in the Engineering mode.

● Action at saturated output

[Engineering Mode: Function block No. 55 (Fn55)]

Parameter symbol	Data range	Factory set value
<i>YASO</i>	0: Invalid (The close-side [or open-side] output turns to OFF when the valve position is fully closed [or opened]). 1: Valid (The close-side [or open-side] output remains ON state when the valve position is fully closed [or opened]).	0



To display “Action at saturated output,” specify “Feedback resistance (FBR) input” at the time of order, AND “Control action” (Function block No. 51 in Engineering mode) must be set to Position proportioning PID control.

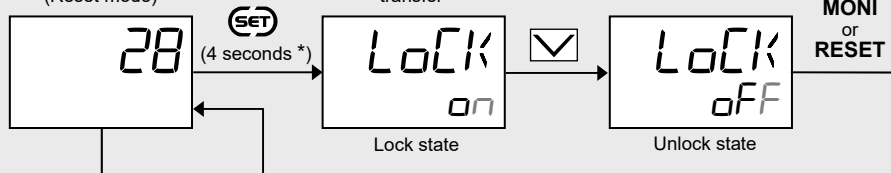
Setting procedure

To enter the Engineering mode

Press the **RESET** key first to stop the control.

Monitor & Program setting mode
PV/SV monitor
(Reset mode)

Setting lock mode
Set data unlock/lock
transfer



* Press the **SET** key until Parameter setting mode is displayed. Keep pressing without releasing your finger from the key to enter the Setting lock mode.

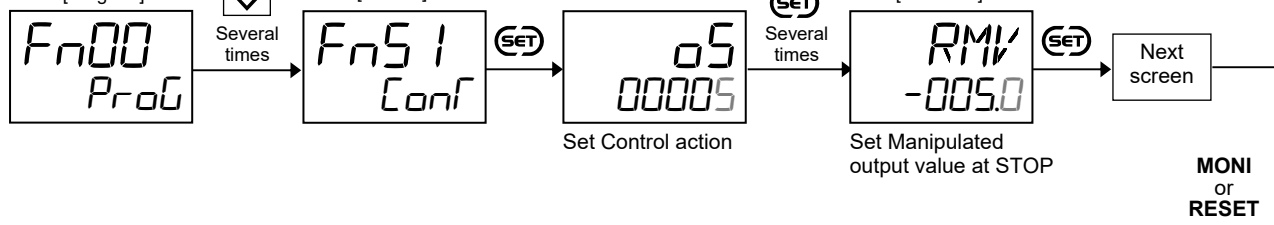
SET + **MODE**
(2 seconds)

Engineering mode
Function block No. 00
[Program]

Function block No. 51
[Control]

Control action

Manipulated output
value in Reset mode
[heat-side]

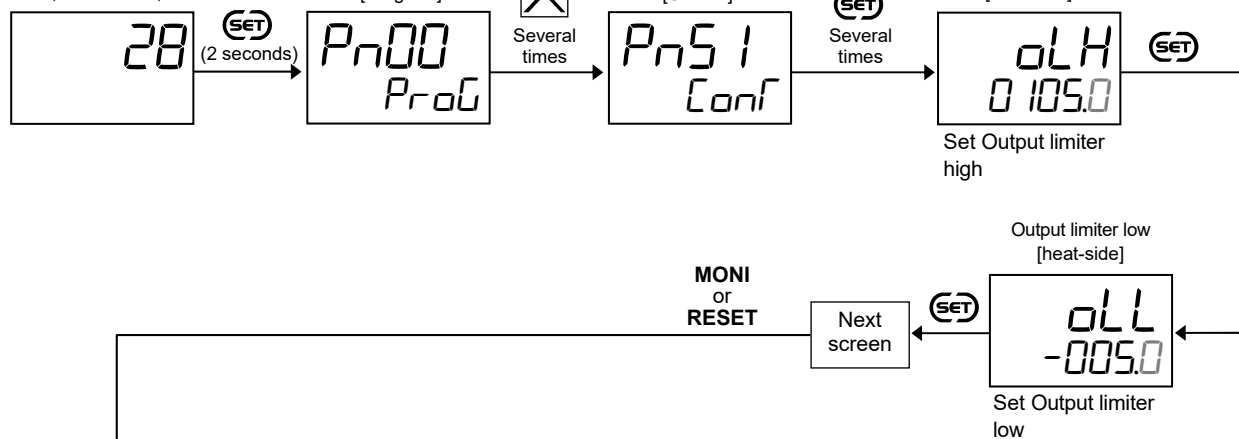


Monitor & Program setting mode
PV/SV monitor
(Reset mode)

Parameter setting mode
Parameter group No. 00
[Program]

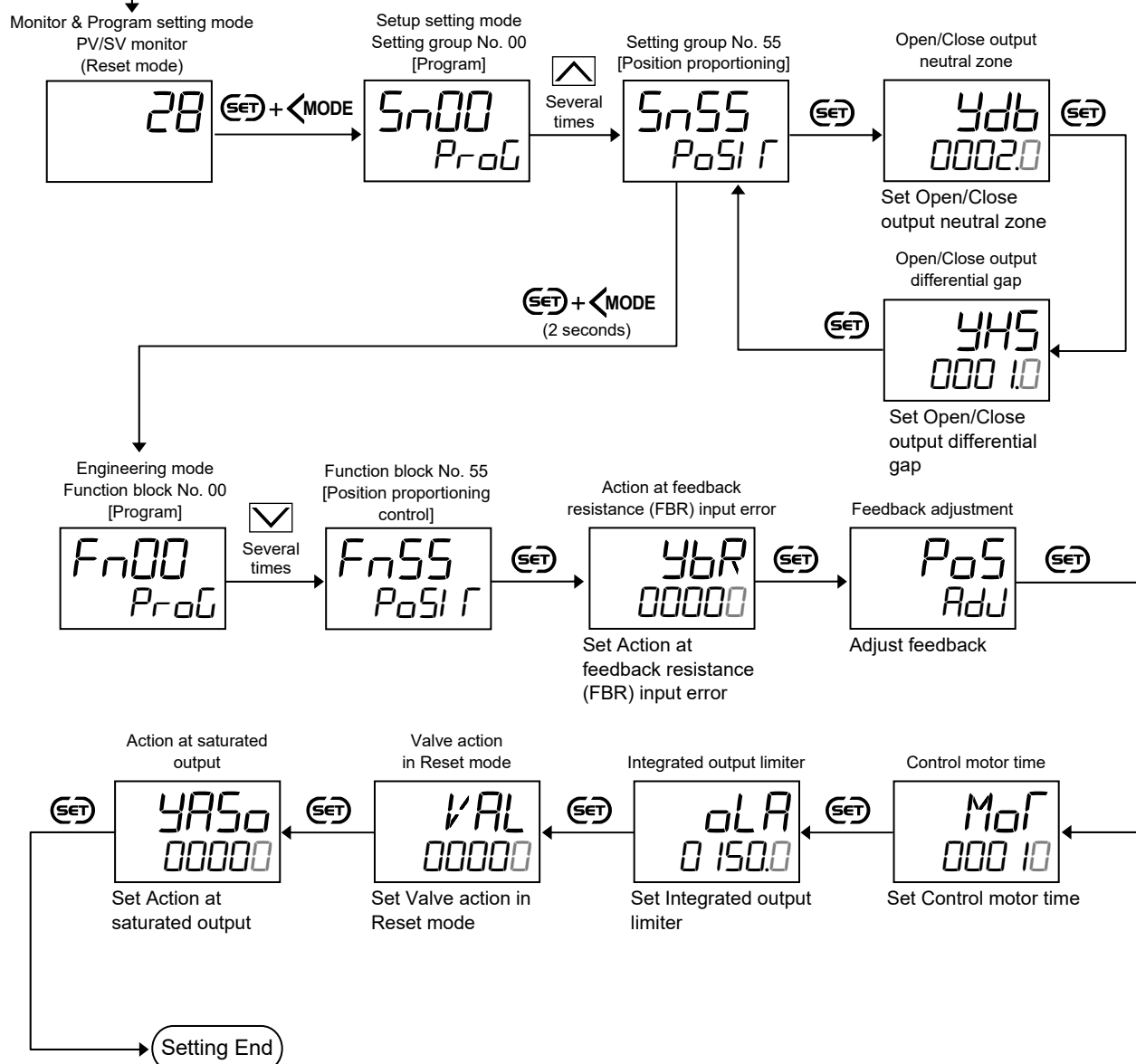
Parameter group No. 51
[Control]

Output limiter high
[heat-side]



Continued on the next page.

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- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

12.9 Controlling with Manual Control

To conduct the Manual control, you need to select the Manual control mode using the Operation mode transfer. The Operation mode transfer can be made by a key operation or communication (optional).



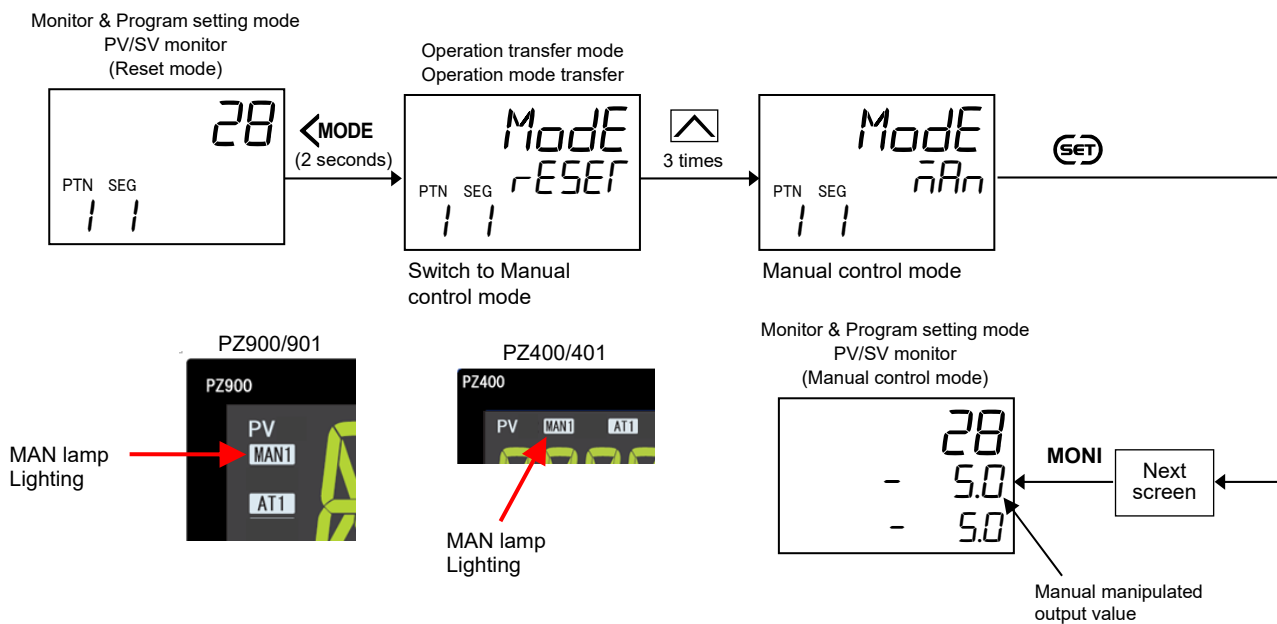
For the event setting value in Fixed set point control mode (FIX) and Manual control mode (MAN), the event set value for the pattern number selected when in the operation mode (RESET or RUN) prior to switching to the relevant mode will be used.



For the detail of the Auto/Manual transfer through communication, refer to **PZ400/PZ900/PZ401 /PZ901 Host communication Instruction Manual (IMR02B06-E□)**.

■ Setting procedure

● Switch to Manual control mode (MAN)



● Switch to Reset mode (RESET)

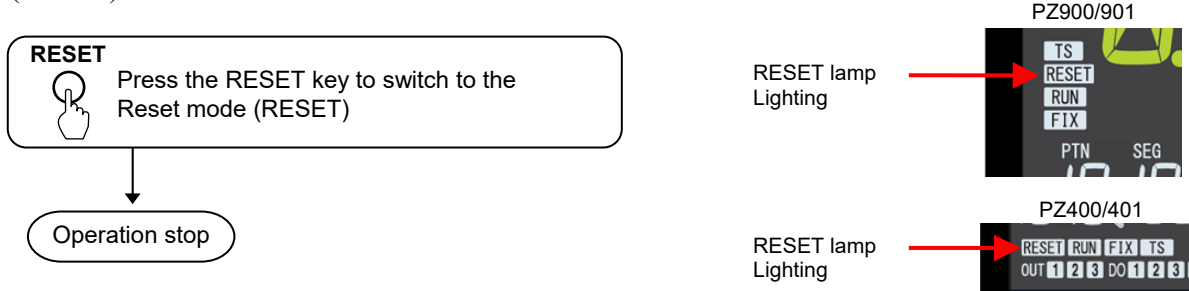
If the RESET key is pressed, the mode is switched to the Reset mode (RESET) and the control will stop. However, some outputs like Manipulated output value may be output depending on the parameter setting shown below.

● Output action in Reset mode

Setting is made here whether the Logic calculation output, Retransmission output, and Instrument status output should continue to stay on during the Reset mode (RESET).

● Manipulated output value in Reset mode

The preset Manipulated output value will be output when the Operation is switched to the Reset mode (RESET).



For the Output actions and the Manipulated output value in Reset mode, refer to **9.9 Changing the Output Action in Reset Mode (P. 9-36)**.

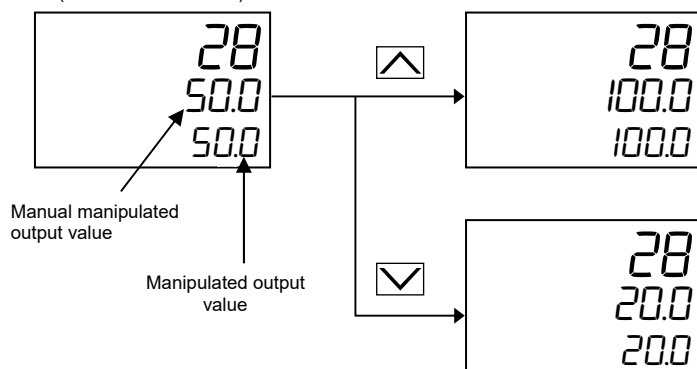
● Setting Manipulated output value in Manual control mode

In the Manual control mode, the Manipulated output value (MV) can be manually set.

Make sure the MAN lamp is on (the instrument is in the manual control mode) before starting the operation.

[Operating procedure]

Monitor & Program setting mode
PV/SV monitor
(Manual control mode)



- key: Increases the Manipulated output value (MV).
- key: Decreases the Manipulated output value (MV).
- Press and hold the key or key makes numeric value change faster.



For Heat/Cool PID control:

When the Manual manipulated output is positive (+), the Heating side manual manipulated output value is output. When the Manual manipulated output is negative (-), the Cooling side manual manipulated output value is output.

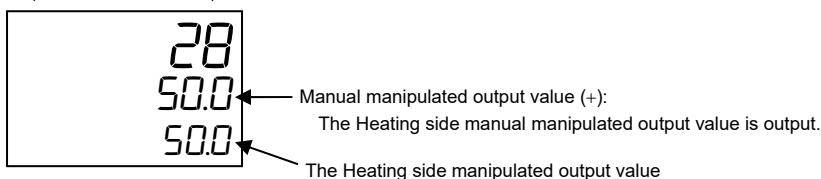
When the Overlap is set on the instrument, the internally calculated value is output in the overlap range.

The Heating side manipulated output value has a priority to be displayed on the TIME display.

When the Manual manipulated output value enters the negative range, the output is transferred to the Cooling side manual manipulated output value.

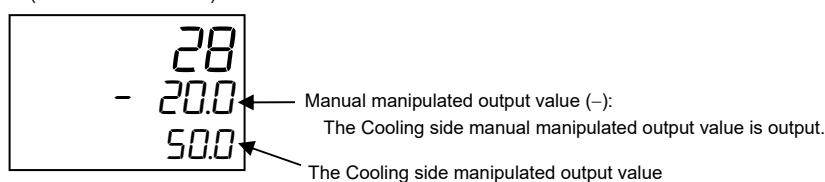
• Display of Manipulated output value [heat-side]

Monitor & Program setting mode
PV/SV monitor
(Manual control mode)



• Display of Manipulated output value [cool-side]

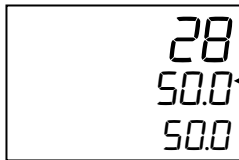
Monitor & Program setting mode
PV/SV monitor
(Manual control mode)



**For Position proportioning PID control:**

- When there is a Feedback resistance (FBR) input, the valve position can be set by or key. When the Feedback resistance (FBR) input is disconnected, the input display of the Feedback resistance (FBR) goes off.

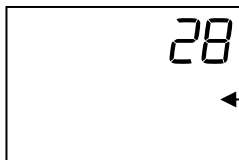
Monitor & Program setting mode
PV/SV monitor
(Manual control mode)



Valve position display (Feedback resistance input value)
(This display goes off at the time of FBR input break)

- When there is no Feedback resistance (FBR) input, the output becomes ON while the key [Open-side output] or key [Close-side output] is pressed and the output becomes OFF when your finger is removed from the key. MV is hidden.

Monitor & Program setting mode
PV/SV monitor
(Manual control mode)



Nothing is displayed here

When the Open-side output is on, the output lamp assigned to the Open-side output will light on.
When the Close-side output is on, the output lamp assigned to the Close-side output will light on.

**For ON/OFF action:**

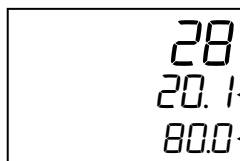
Either Output limiter (high) or Output limiter (low) will be output.

[Condition for output]

- The Output limiter (low) will be output when the Manual manipulated output value $\leq$ the Output limiter low (or 0.0 %).
- The Output limiter (high) will be output when the Manual manipulated output value $>$ the Output limiter (low) (or 0.0%).

Example: When Output limiter (high) 80.0 % and Output limiter (low) 20.0 %

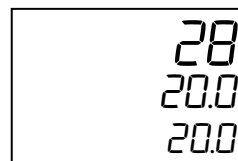
Monitor & Program setting mode
PV/SV monitor
(Manual control mode)



Manual manipulated output value

The Manipulated output value becomes the Output limiter (high) since Manual manipulated output value is larger than the Output limiter (low).

Monitor & Program setting mode
PV/SV monitor
(Manual control mode)



Manual manipulated output value

The Manipulated output value is the Output limiter (low) since the Manual manipulated output value is equal to the Output limiter (low).

Parameter setting

- Operation mode transfer**
[Operation Transfer Mode]

Parameter symbol	Data range	Factory set value
<i>Mode</i>	<i>rESEf</i> : Reset mode (RESET) <i>rUn</i> : Program control mode (RUN) <i>FI U</i> : Fixed set point control mode (FIX) <i>nRn</i> : Manual control mode (MAN)	<i>rESEf</i>

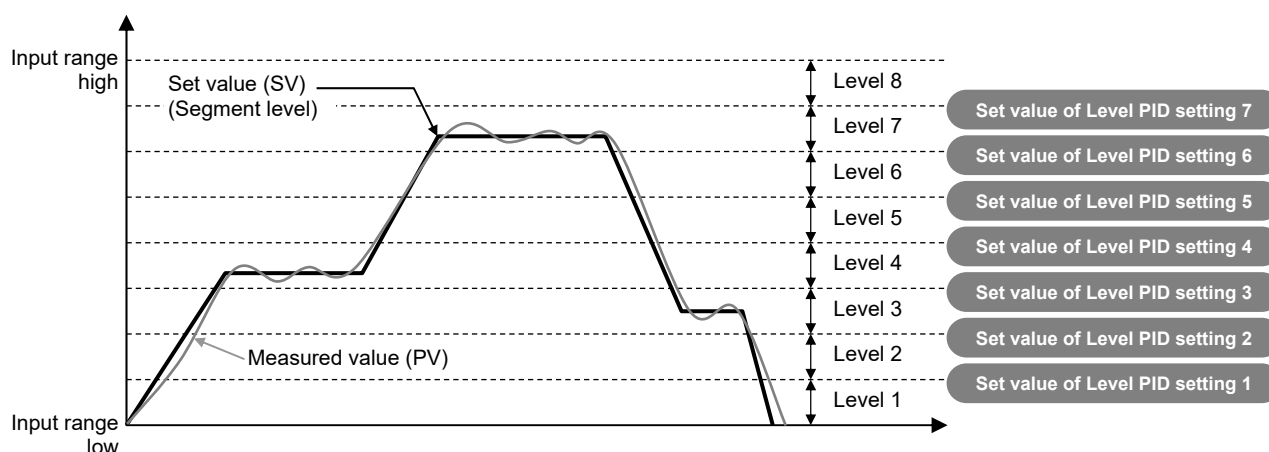
12.10 Controlling each temperature level with different PID values (Level PID)

Level PID function is used to set the following parameters for control to each divided level of the input range (up to 8 levels): PID values, Control response parameters, Output limiter high/low, Control loop break alarm (LBA) time and LBA deadband.

■ Description of function

- Set the values such as PID values of each level to the PID group 1 to 8.
- The input range can be divided based on the setting for the parameters of Level PID setting 1 to Level PID setting 7.
- The value selected in the Level PID action selection [SV* or PV] is checked and determined in which level of the PID it is, and the control is done using the PID values from the PID group appropriate to the level.

* In Program control mode (RUN): The Set value (SV) is a segment level.



● PID group to be used for level

The PID group used at each level will be selected after comparison between the Level PID setting and the value [Set value (SV)* or Measured value (PV)] selected in the Level PID action selection

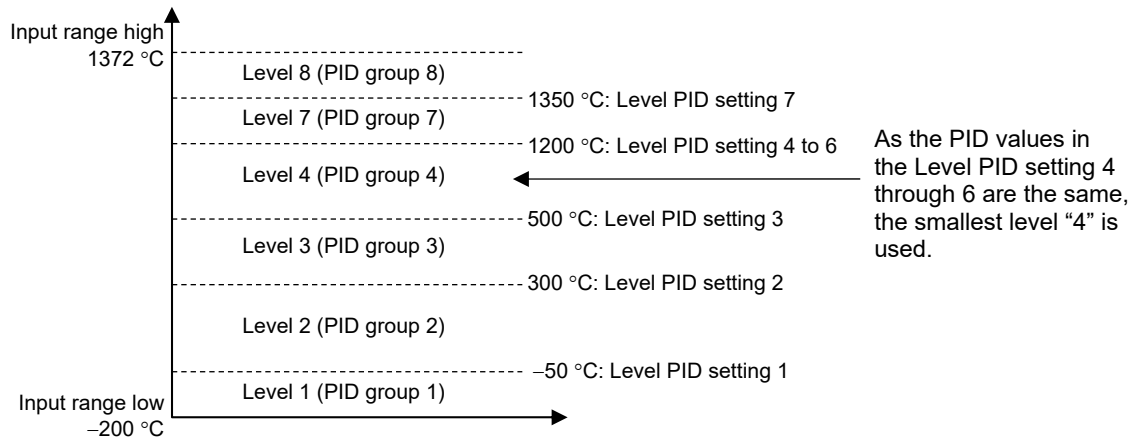
Level	PID group	Description
Level 8	PID group 8	Level PID setting 7 < Set value (SV)* or Measured value (PV) ≤ Input rang high
Level 7	PID group 7	Level PID setting 6 < Set value (SV)* or Measured value (PV) ≤ Level PID setting 7
Level 6	PID group 6	Level PID setting 5 < Set value (SV)* or Measured value (PV) ≤ Level PID setting 6
Level 5	PID group 5	Level PID setting 4 < Set value (SV)* or Measured value (PV) ≤ Level PID setting 5
Level 4	PID group 4	Level PID setting 3 < Set value (SV)* or Measured value (PV) ≤ Level PID setting 4
Level 3	PID group 3	Level PID setting 2 < Set value (SV)* or Measured value (PV) ≤ Level PID setting 3
Level 2	PID group 2	Level PID setting 1 < Set value (SV)* or Measured value (PV) ≤ Level PID setting 2
Level 1	PID group 1	Input range low ≤ Set value (SV)* or Measured value (PV) ≤ Level PID setting 1

* In Program control mode (RUN): The Set value (SV) is a segment level.



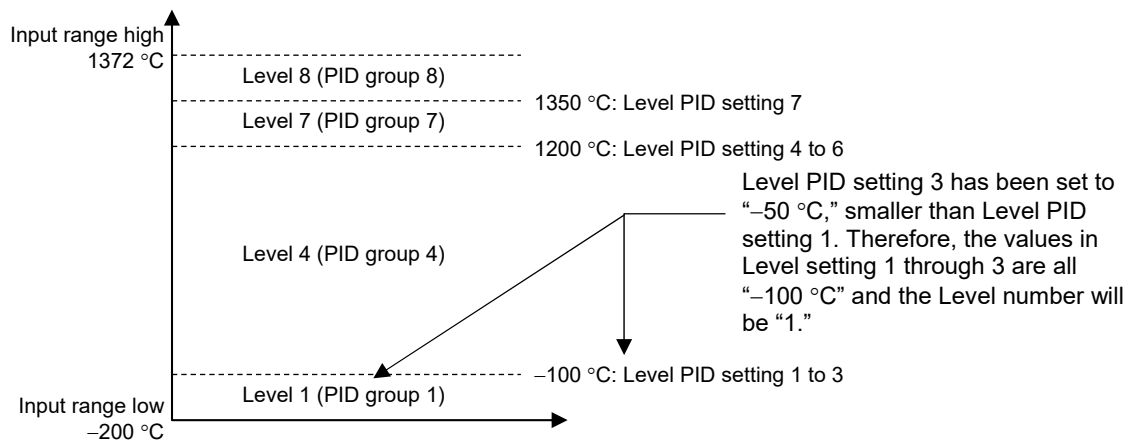
- When two or more levels have the same setting, the values with a smaller level number will be valid and used.

[Example 1] Values in Level PID setting 4 through 6 are the same.



- If the Level PID setting is set ignoring the order of the level Nos., the Level PID values in the set range will be the same and the smallest level number is used. (See Example 2)

[Example 2] Level PID setting 3 in Example 1 has been changed to -100 °C.



● Parameters in Level PID

Parameter group display for the case where “No level PID (Set value: 0)” is selected in Level PID action selection differs from that for the case where “With level PID (Set value: 1 or 2)” is selected.

• In case of No level PID (Level PID action selection: 0)

In case of heating control: Parameter setting mode data of parameter group No. 51 (Pn51) will be used.

In case of cooling control: Parameter Setting mode data of parameter group No. 56 (Pn56) will be used.

• In case of With level PID (Level PID action selection: 1 or 2)

In case of heating control: Parameter setting mode data of parameter group No. 53 (Pn53) will be used.

Furthermore, it is classified into PID groups 1 through 8.

In case of cooling control: Parameter setting mode data of parameter group No. 58 (Pn58) will be used.

Furthermore, it is classified into PID groups 1 through 8.



Either of Parameter group No. 51/No. 56 or Parameter group No. 53/No. 58 will be displayed.



Data of Parameter group No. 51 and data of PID group 1 of Parameter group No. 53 have common contents.

Data of Parameter group No. 56 and data of PID group 1 of Parameter group No. 58 also have common

[Parameter items of Parameter group No. 51]

Proportional band [heat-side]
Integral time [heat-side]
Derivative time [heat-side]
ON/OFF action differential gap (upper)
ON/OFF action differential gap (lower)
Control response parameter
Proactive intensity
Manual reset
FF amount
Output limiter high [heat-side]
Output limiter low [heat-side]
Control loop break alarm (LBA) time
LBA deadband (LBD)

[Parameter items of Parameter group No. 53]

PID group selection

PID group 8
PID group 1
Proportional band [heat-side]
Integral time [heat-side]
Derivative time [heat-side]
ON/OFF action differential gap (upper) *
ON/OFF action differential gap (lower) *
Control response parameter
Proactive intensity
Manual reset
FF amount
Output limiter high [heat-side]
Output limiter low [heat-side]
Control loop break alarm (LBA) time
LBA deadband (LBD)

[Parameter items of Parameter group No. 56]

Proportional band [cool-side]
Integral time [cool-side]
Derivative time [cool-side]
Overlap/Deadband
Output limiter high [cool-side]
Output limiter low [cool-side]

[Parameter items of Parameter group No. 58]

PID group selection

PID group 8
PID group 1
Proportional band [cool-side]
Integral time [cool-side]
Derivative time [cool-side]
Overlap/Deadband
Output limiter high [cool-side]
Output limiter low [cool-side]

* ON/OFF action differential gap upper/lower in parameter group No.53 will be displayed on each PID group. ON/OFF action differential gap upper/lower in parameter group No.53 is the same for among all PID groups. It is not possible to set each PID group a different value of ON/OFF action differential gap upper/lower in parameter group No.53.

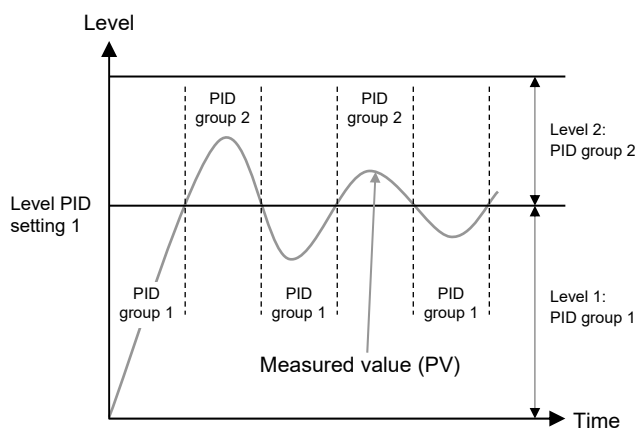
● Level PID differential gap

When setting “Switch by Measured value (PV)” to Level PID action:

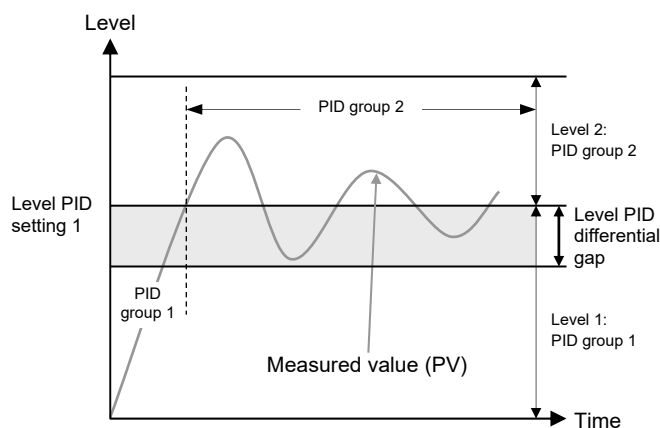
The PID groups storing the parameters for Level PID function may switch frequently by the fluctuation of the input when the Measured value (PV) is close to the Level PID set value.

Setting Level PID differential gap prevents PID groups from switching too frequently.

When Level PID differential gap is not set



When Level PID differential gap is set



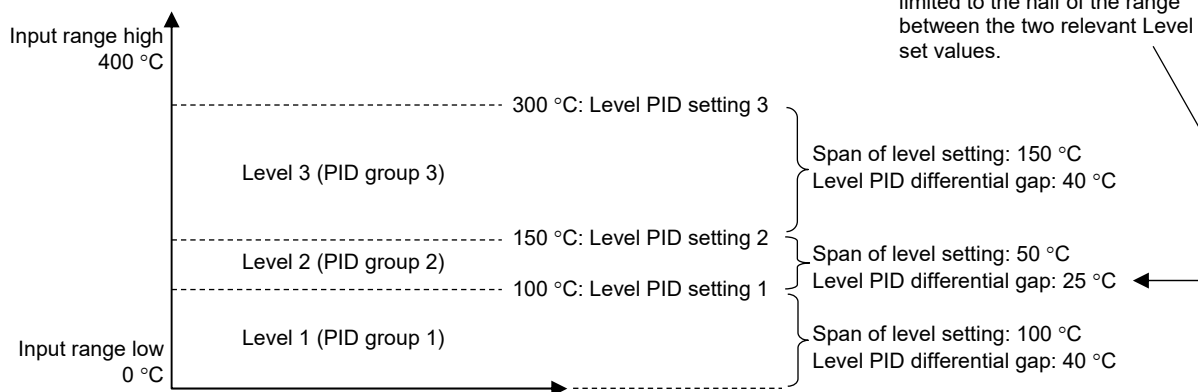
When setting “Switch by Set value (SV)” to Level PID action:

The setting of Level PID differential gap is validated; however, it is recommended to set “0.0” to Level PID differential gap.



When the setting of the Level PID differential gap is set larger than the half of the range between two continuous Level set values, the Level PID differential gap is forcibly limited to the half of the range between the two relevant Level set values.

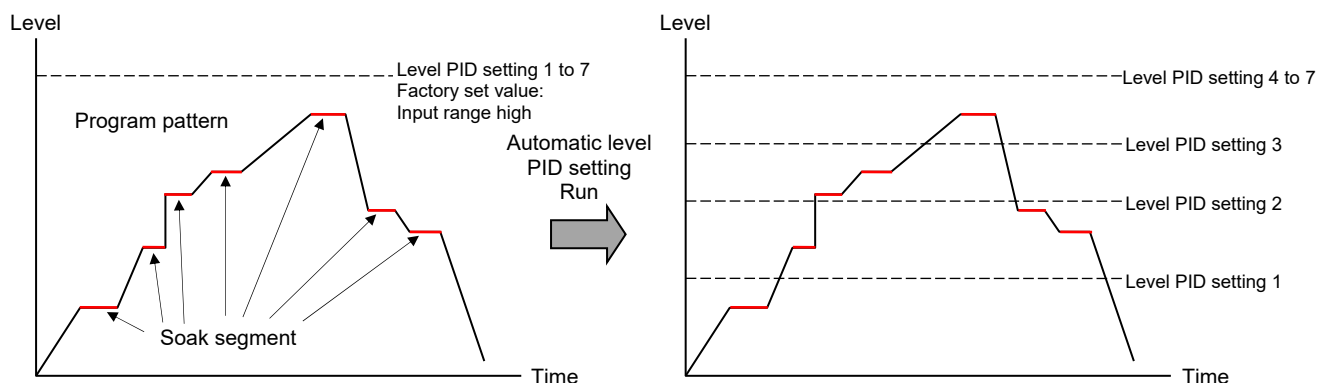
[Example] When Level PID differential gap is “40 °C”



● Automatic setting of Level PID

When you are not sure what should be the appropriate value of Level PID setting that you should set, you can automatically set it. After creating a program pattern, running “Automatic level PID setting” will detect Soak segments and automatically calculate/set the level setting value.

[Setting example]



When Level PID is set automatically, Level PID is not set such that one Soak segment will get into each level. The calculated value of the Level PID setting varies depending on the condition of the program pattern. Therefore, multiple Soak segments may get into one level.

● Start condition of Automatic level PID setting

- The operation mode is the Reset Mode (RESET)
- There are two or more Soak segments in the program pattern

● Restoring the set value to the value given before Automatic level PID setting

Apart from automatic level setting, there is a function for restoring to the level PID setting before running Automatic level PID setting. It is used for restoring to the value before running automatic setting when you run the automatic setting by mistake or other reasons.

[Backup of level PID setting with “Automatic Setting” and “Restore setting before change”]

Level PID setting 1 to 7 (A) ... [Value set beforehand]



“Automatic Setting ON”

Value (A) is backed up

Level PID setting 1 to 7 (B)



“Change the setting Manually”

Value changed manually is not backed up

Level PID setting 1 to 7 (C)



“Restore setting before change”

Restore (A) from the backup and Back up the value of (C)

Level PID setting 1 to 7 (A)

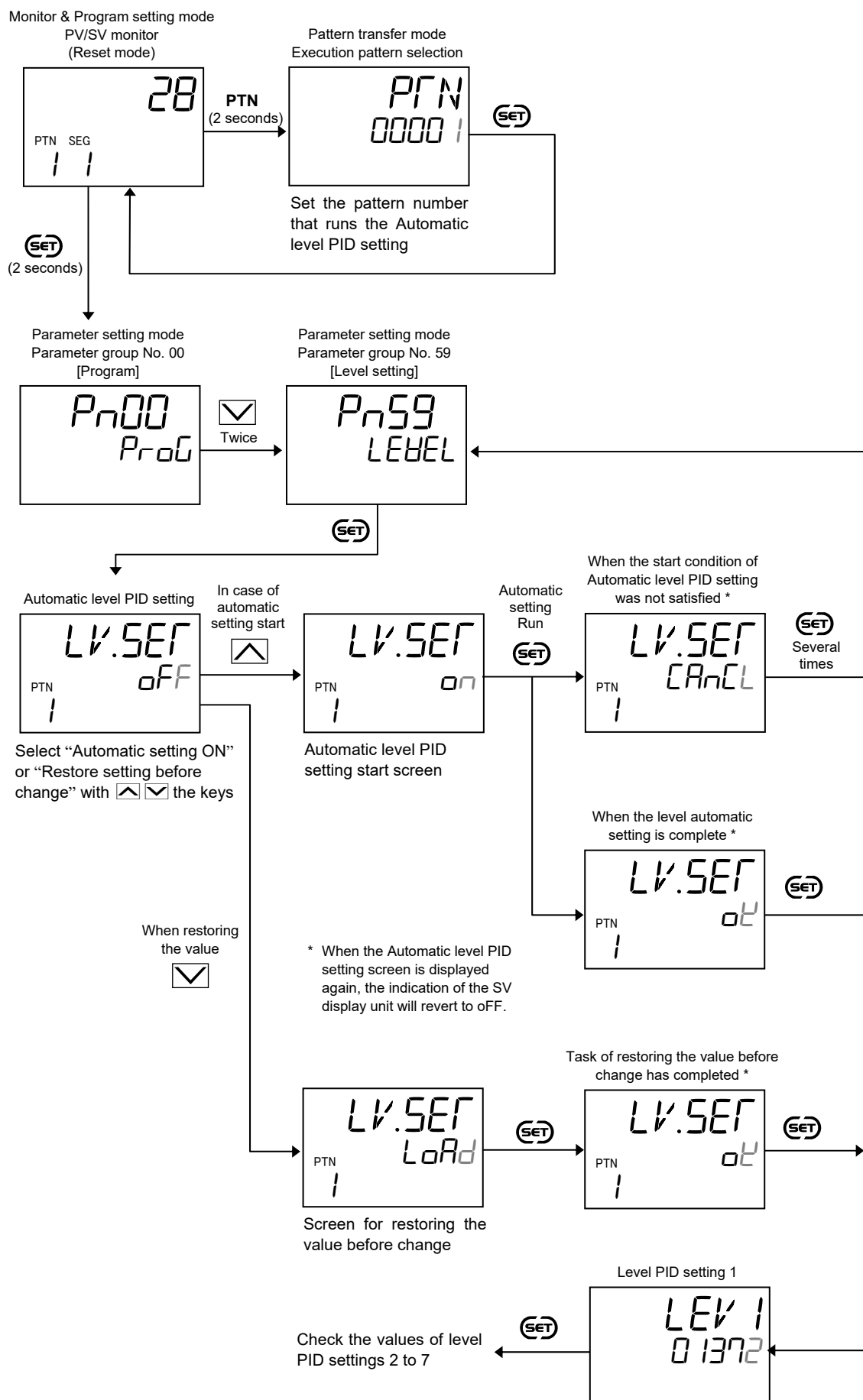


“Restore setting before change”

Restore (C) from the backup and Back up the value of (A)

Level PID setting 1 to 7 (C)

• Running Automatic level PID setting



Parameter setting

Automatic level PID setting

[Parameter Setting Mode: Parameter group No. 59 (P_{n59})]

Parameter symbol	Data range	Factory set value
LEV SET	off: Automatic setting OFF on: Automatic setting ON Load: Restore setting before change After completing the automatic setting, or after the completion of restoring the value before change, the value will automatically revert to off.	off



To display the “Automatic level PID setting,” set switchover by the Set value (SV) or the Measured value (PV) at “Level PID action selection” in Function block No. 51 in the Engineering mode.

Level PID setting 1 to Level PID setting 7

[Parameter Setting Mode: Parameter group No. 59 (P_{n59})]

Parameter symbol	Data range	Factory set value
LEV 1	Input range low to Input range high [Varies with the setting of the Decimal point position.] Level PID settings 1 to 7 always maintain the following relation. (Level PID setting 1) $\leq$ (Level PID setting 2) $\leq$ (Level PID setting 3) $\leq$ (Level PID setting 4) $\leq$ (Level PID setting 5) $\leq$ (Level PID setting 6) $\leq$ (Level PID setting 7)	Input range high
LEV 2		
LEV 3		
LEV 4		
LEV 5		
LEV 6		
LEV 7		



To display the “Level PID setting 1 through 7,” set switchover by the Set value (SV) or the Measured value (PV) at “Level PID action selection” in Function block No. 51 in the Engineering mode.



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are automatically converted when the Level PID setting is changed.

Level PID action selection

[Engineering mode: Function block No. 51 (F_{n51})]

Parameter symbol	Data range	Factory set value
LPI d	0: No level PID 1: Switching by Set value (SV) (Level PID action) 2: Switching by Measured value (PV) (Level PID action)	0

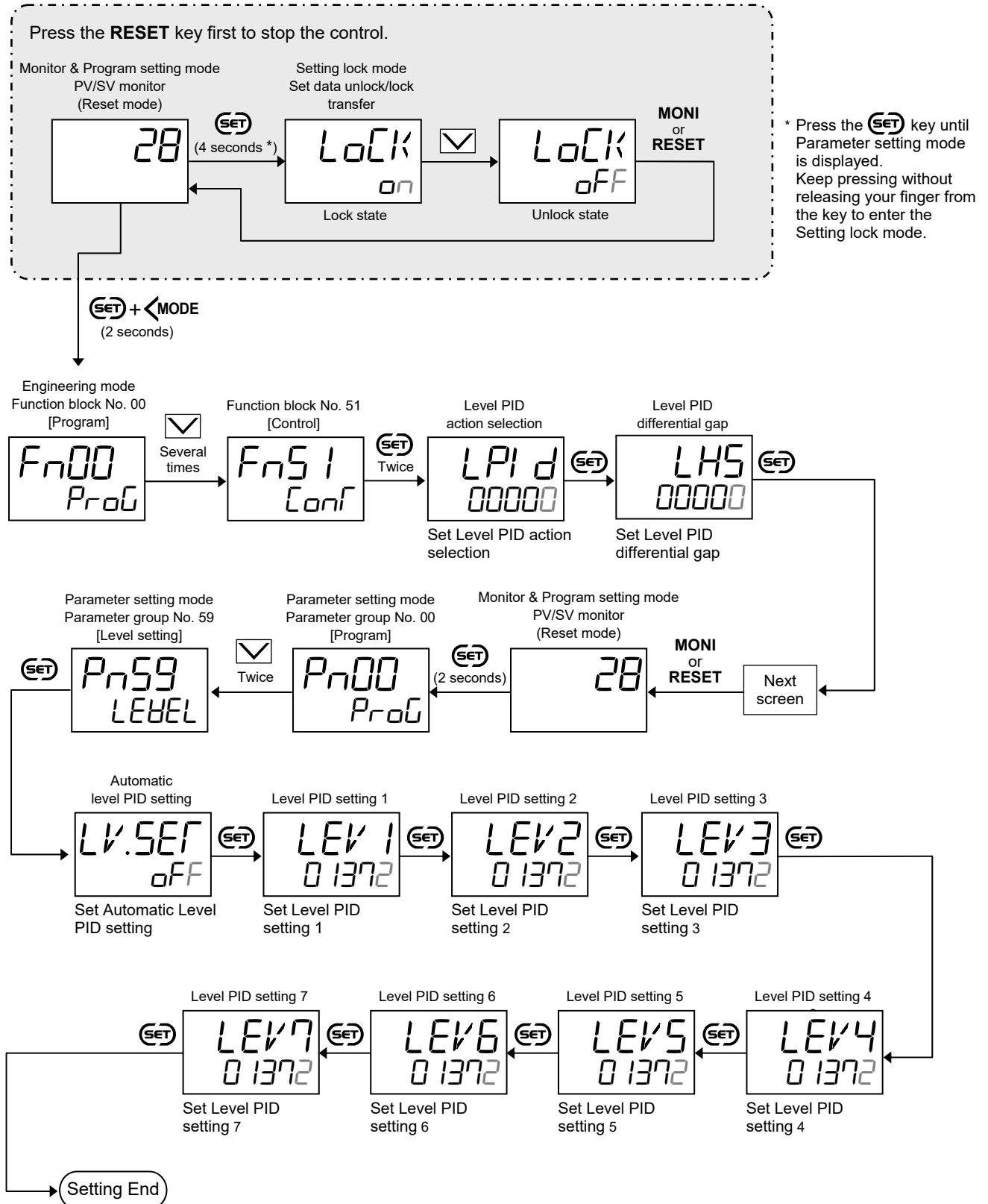
Level PID differential gap

[Engineering mode: Function block No. 51 (F_{n51})]

Parameter symbol	Data range	Factory set value
LHS	0 to Input span [Varies with the setting of the Decimal point position.]	TC/RTD inputs: 2 V/I inputs: 0.2

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

12.11 Eliminating Offset Inherent to Proportioning Control (Manual Reset)

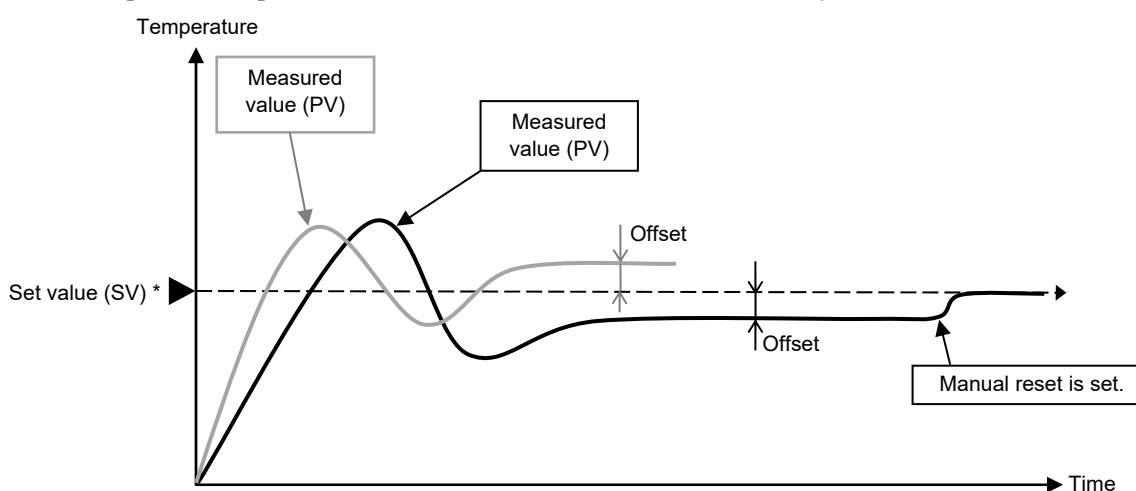
In order to eliminate the offset occurring in Proportional (P) control, the Manipulated output value is manually corrected.

■ Description of function

This is the function used to manually correct the offset when in Proportional (P) control or PD control. If the Manual reset value varies, the Manipulated output value also changes.

Offset means the deviation of the actual when the Manipulated output value becomes stabilized (stable state).

- When the Manual reset is set to the plus (+) side
The Manipulated output value under the stable condition increases by the Manual reset value.
- When the Manual reset is set to the minus (–) side
The Manipulated output value under the stable condition decreases by the Manual reset value.



* In Program control mode (RUN): The Set value (SV) is a Segment level.



Manual reset is available when the Integral time is 0 (0.0, 0.00).

■ Parameter setting

● Manual reset

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
$U \quad MR$	-100.0 to +100.0 %	0.0



In order to display “Manual Reset,” set a value other than 0 to the Proportional band [heat-side] and set 0 to the Integral time [heat-side] or to the Integral time [cool-side]. *

* When Manual Reset in parameter group No.51:

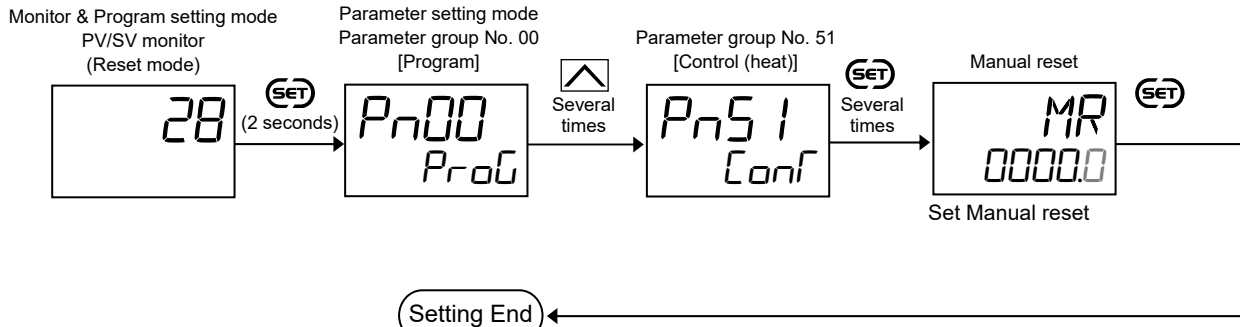
“Manual Reset” will be displayed when a value other than 0 is set to the Proportional band [heat-side] and 0 is set to the Integral time [heat-side] or to the Integral time [cool-side]

When Manual Reset in parameter group No.53:

“Manual Reset” will be displayed when a value other than 0 is set to the Proportional band [heat-side] in the same PID group with Manual Reset and 0 is set to the Integral time [heat-side] or to the Integral time [cool-side]

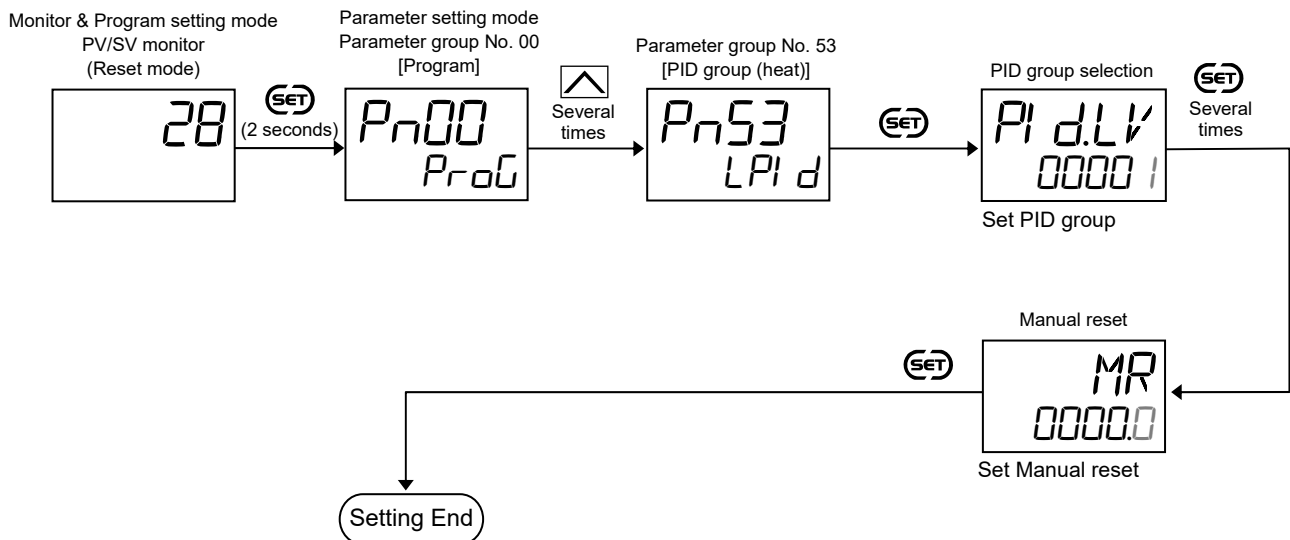
Setting procedure

[Without Level PID]



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

[With Level PID]



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

12.12 Suppressing Overshoot

Overshoot can be suppressed on this instrument at the time of startup (power on, control stop [RESET] to start [RUN or FIX]), Set value (SV)* change, and external disturbances.

Overshoot during the transition from Ramp to Soak can be prevented, when Program control is being executed.

* In Program control mode (RUN): The Set value (SV) is a Segment level.

■ Description of function

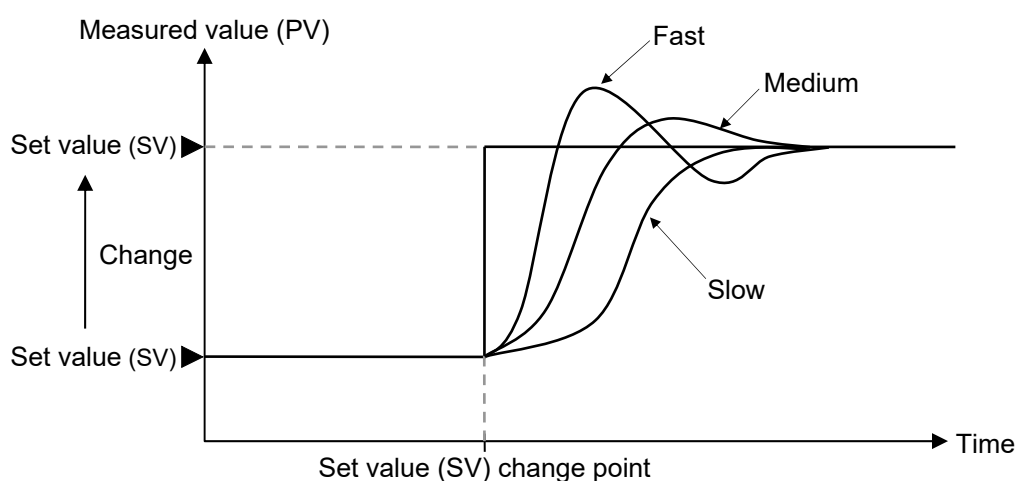
Overshoot suppressing function may include Control response parameter, Proactive intensity, Determination point of external disturbance and Bottom suppression function.

● Control response parameter

A response speed level at changing Set value (SV) at PID control can be selected from three levels (Slow, Medium and Fast) in the Control response parameter.

Select “Fast” to quicken the response of the controlled object to the change in segment level and Set value (SV). When the response speed level is “Fast,” overshoot will occur. To avoid overshoot, select “Slow.”

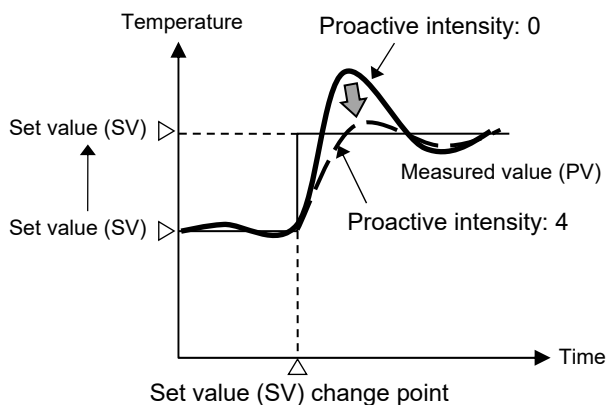
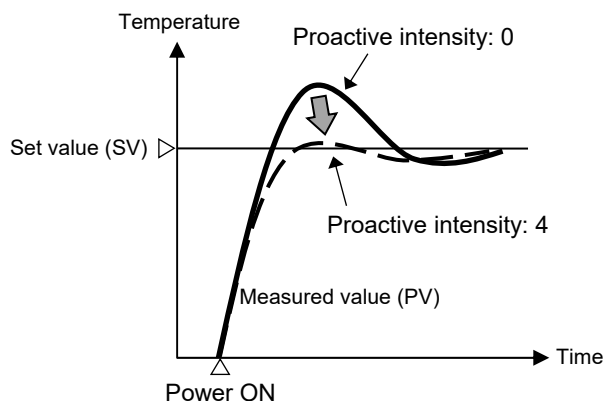
Fast	Selected when rise time needs to be shortened (operation needs to started fast). However in this case, slight overshooting may not be avoided.
Medium	Middle between “Fast” and “Slow.” Overshooting when set to “Medium” becomes less than that when set to “Fast.”
Slow	Selected when no overshooting is allowed. Used when material may be deteriorated if the temperature becomes higher that the set value.



● Proactive intensity, Determination point of external disturbance

Overshoot can be suppressed at startup (power on, control stop [RESET] to start [RUN or FIX]), Set value (SV) change, and external disturbances. Overshoot during the transition from Ramp to Soak can be prevented. The intensity ranges from 0 to 4 (5 scales).

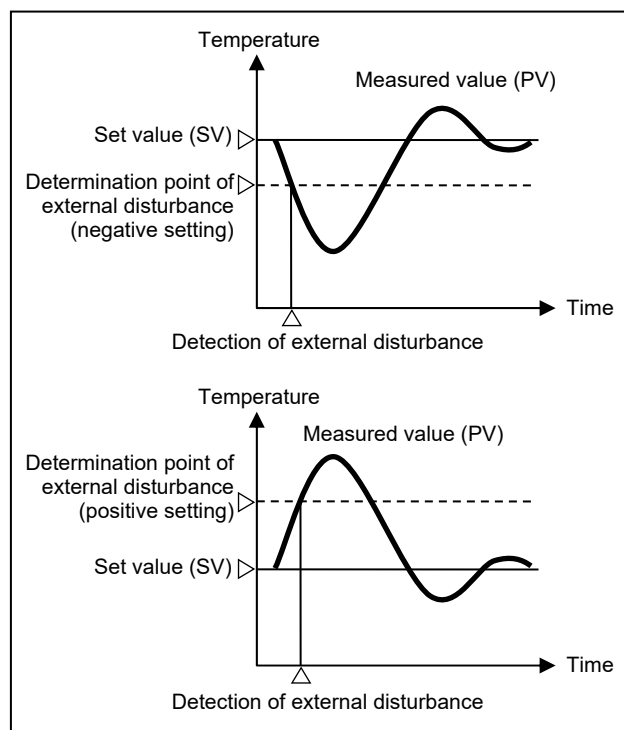
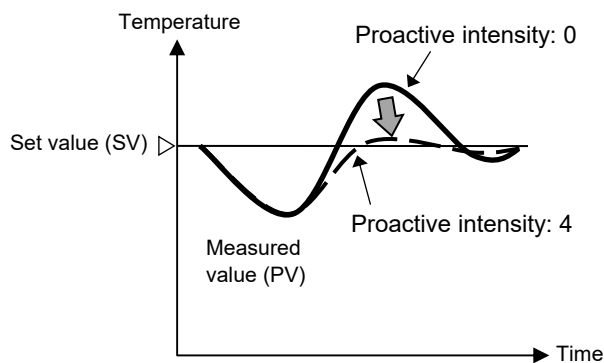
Startup (power on, control stop [RESET] to start [RUN or FIX]), Set value (SV) change



When external disturbance occurs

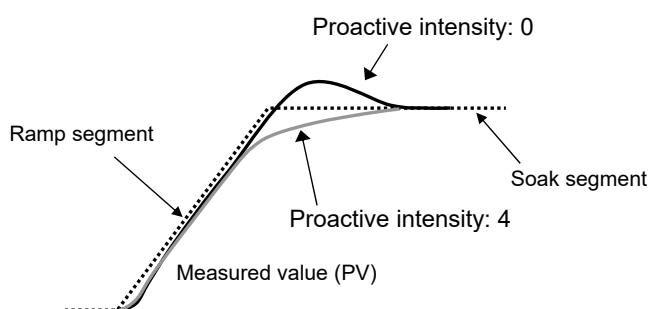
Overshoot can be suppressed when external disturbance occurs.

External disturbances are determined by the fluctuation between the stable state and Measured value (PV) of the external disturbance determination point or more which is then used as a trigger.



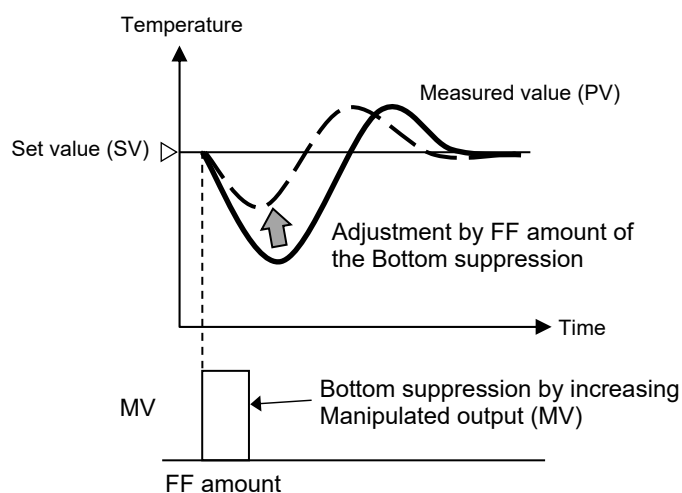
During Ramp control (Program control mode)

Overshoot can be suppressed when the temperature is in transition from the Ramp segment to the Soak segment.



● Bottom suppression function

When the input fluctuation by external disturbance is detected, the amount of FF (Feedforward) is added to the output value to suppress the Bottom.



[Setting items]

- FF amount: This can also be obtained automatically by Amount of FF which is added to detect external disturbance and Learning function
- FF amount learning: FF amount can be calculated from external disturbance when detection of external disturbance is executed after selection of “Learn.” When setting is completed, the value will automatically return to “0: No learning.”
- Bottom suppression function: Used to activate/deactivate the Bottom suppression function as well as a trigger function. There are two types of triggers; when the Determination point of external disturbance (FF amount is added by the level) is exceeded and Forced addition of FF amount. Trigger signal can be input through communication in the case of Forced addition of FF amount.



■ Parameter setting

● Control response parameter

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
RPF	0: Slow 1: Medium 2: Fast [When the P or PD action is selected, this setting becomes invalid]	2

● Proactive intensity

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
$PACI$	0 to 4 0: No function	2



To display “Proactive intensity,” the Proportional band [heat-side]* and the Integral time [heat-side]* must be set to a value other than 0.

* When Proactive intensity in parameter group No.51:

Proactive intensity will be displayed when a value other than 0 is set to both the Proportional band [heat-side] and the Integral time [heat-side].

When Proactive intensity in parameter group No.53:

Proactive intensity will be displayed when a value other than 0 is set to both the Proportional band [heat-side] and the Integral time [heat-side] in the same PID group with Proactive intensity.

● FF amount

[Parameter Setting Mode: Parameter group No. 51 (P_{n51})]

[Parameter Setting Mode: Parameter group No. 53 (P_{n53})]

Parameter symbol	Data range	Factory set value
FF	-100.0 to +100.0 %	0.0



To display “FF amount,” 1 or 2 must be set at “Bottom suppression function” at Function block No. 57 in the Engineering mode, and the Proportional band [heat-side]* and the Integral time [heat-side]* must be set to a value other than 0.

* When FF amount in parameter group No.51:

FF amount will be displayed when a value other than 0 is set to both the Proportional band [heat-side] and the Integral time [heat-side].

When FF amount in parameter group No.53:

FF amount will be displayed when a value other than 0 is set to both the Proportional band [heat-side] and the Integral time [heat-side] in the same PID group with FF amount.



Not displayed when the control action is Position proportioning PID control.



- **FF amount learning**

[Setup Setting Mode: Setting group No. 57 (5n57)]

Parameter symbol	Data range	Factory set value
FF57	0 to 1 0: No learning +1: Learn	0



To display “FF amount learning,” 1 or 2 must be set at “Bottom suppression function” at Function block No. 57 in the Engineering mode

- **Determination point of external disturbance**

[Setup Setting Mode: Setting group No. 57 (5n57)]

Parameter symbol	Data range	Factory set value
Exdu	–Input span to +Input span [Varies with the setting of the Decimal point position.]	–1

- **Bottom suppression function**

[Engineering Mode: Function block No. 57 (Fn57)]

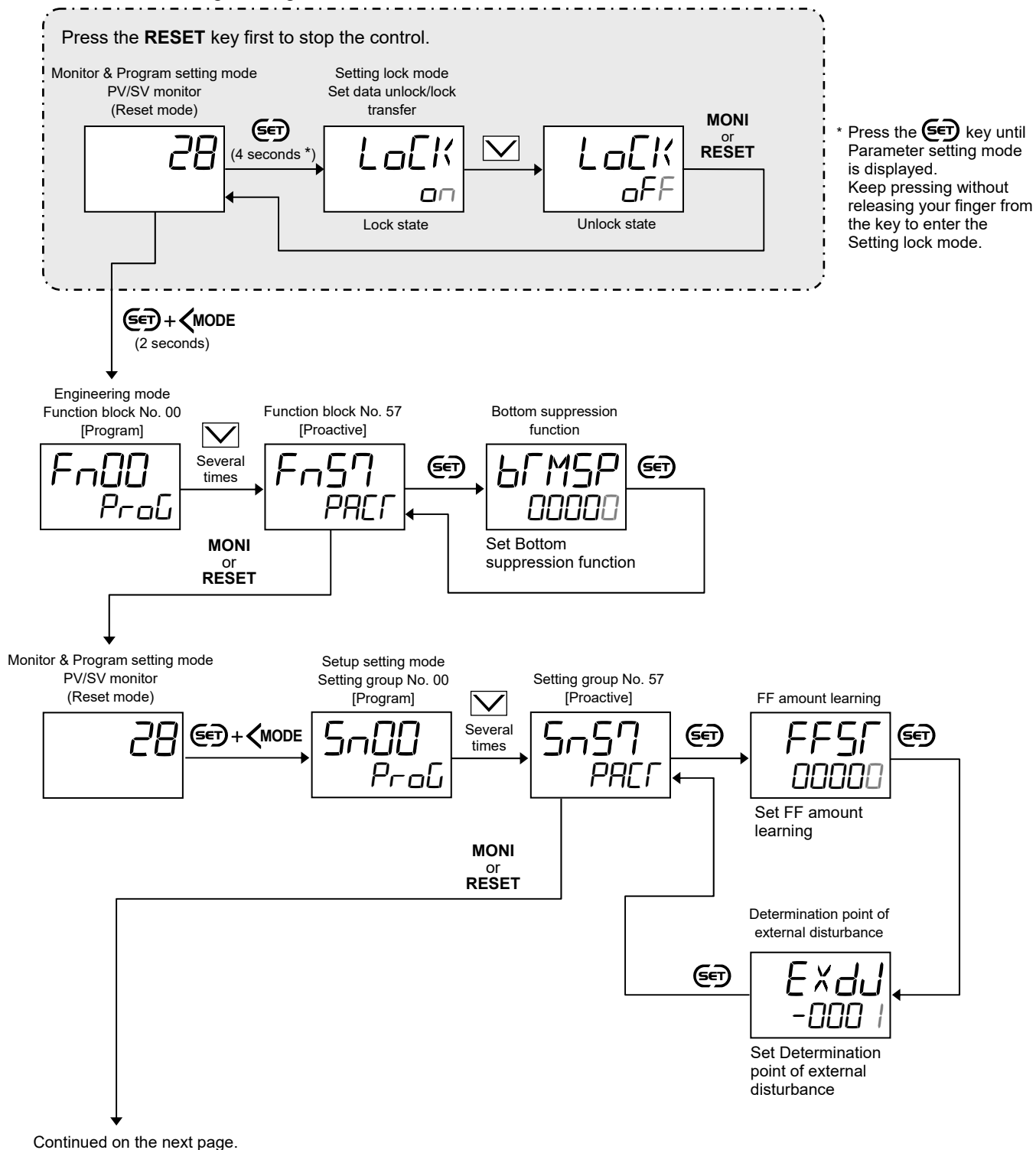
Parameter symbol	Data range	Factory set value
bFMSP	0: No function 1: FF amount is added by level 2: FF amount is forcibly added	0



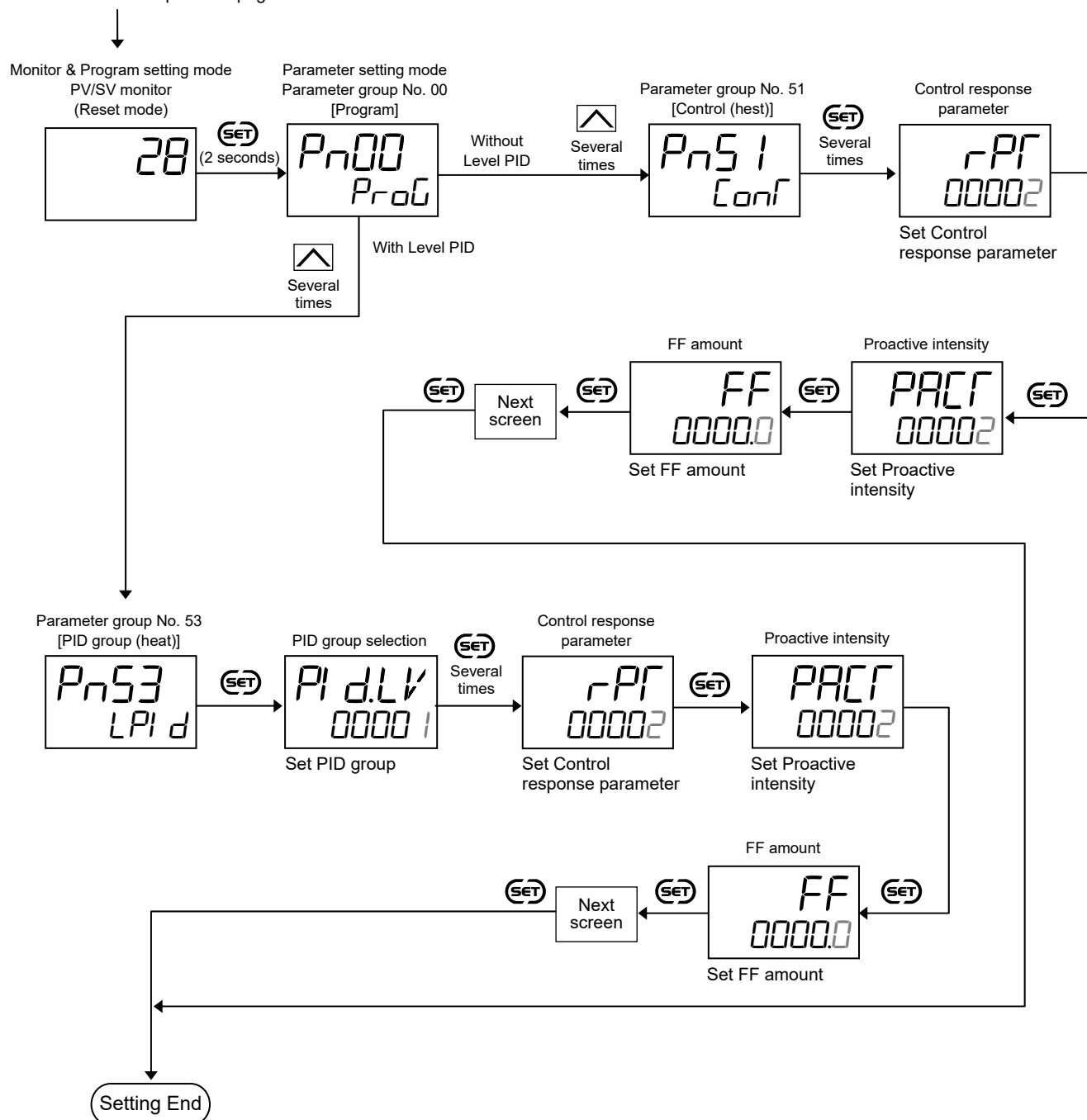
Not displayed when the control action is Position proportioning PID control.

Setting procedure

To enter the Engineering mode



Continued from the previous page.



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



12.13 Changing the Action at Power ON (Hot/Cold Start)

When restarting following a power failure (power OFF from ON), the start action can be selected by the following parameters:

- Hot/Cold start
- Start determination point

■ Description of function

● Hot/Cold start

Recovery action from power failure can be selected from the following.

For PID control or Heat/Cool PID control

Action when power failure recovers	Operation mode when power failure recovers		Output value when power failure recovers	
Hot start 1	Same as that before power failure		Near the output value before power failure occurs	
Hot start 2	Same as that before power failure		Reset mode (RESET)	Manipulated output value in Reset mode (RESET)
			Program control mode (RUN)	Computed control output value *
			Fixed set point control Mode (FIX)	
			Manual control mode (MAN)	Output limiter low
Cold start	Reset mode (RESET)	Reset mode (RESET)	Reset mode (RESET)	Manipulated output value in Reset mode (RESET)
	Program control mode (RUN)	Manual control mode (MAN)	Program control mode (RUN)	Output limiter low
	Fixed set point control mode (FIX)		Fixed set point control mode (FIX)	
	Manual control mode (MAN)		Manual control mode (MAN)	
Reset start	Started in the Reset mode (RESET) regardless of the Operation mode before power failure.		Manipulated output value in Reset mode (RESET)	

Factory set value: Hot start 1

* The result of control computation varies with the control response parameter.



If the Startup tuning (ST) function is executed when the power is turned on as the startup conditions, control starts at Hot start 2 even if set to Hot start 1 (factory set value).
(It is unavailable at Cold start and Reset start.)



At Hot start 1 and Hot start 2, operation mode when power failure recovers in Program control mode (RUN) is the same before power failure. For example, when operation mode before power failure is Hold state, Hold state is kept after power recovery.

**For Position Proportioning PID control**

Action when power failure recovers	Operation mode before power failure	Operation mode and Output value when power failure recovers		
		Without Feedback resistance (FBR) input	With Feedback resistance (FBR) input	
			Feedback resistance (FBR) disconnected	
			Action at FBR disconnected: 1 *	Action at FBR disconnected: 0 *
Hot start 1	RESET	Operation mode: RESET Output: Action depending on the Valve action in Reset mode	Operation mode: RESET Output: Action depending on the Valve action in Reset mode	Operation mode: RESET Output: According to the result of control computation of Manipulated output value in Reset mode
	RUN/FIX	Operation mode: Same as that before power failure Output: Computed control output value	Operation mode: Same as that before power failure Output: Action depending on the Valve action in Reset mode	Operation mode: Same as that before power failure Output: Computed control output value
	MAN	Operation mode: Same as that before power failure Output: No output	Operation mode: Same as that before power failure Output: Action depending on the Valve action in Reset mode	Operation mode: Same as that before power failure Output: According to the result of control computation of Manipulated output value
Hot start 2	RESET	Operation mode: RESET Output: Action depending on the Valve action in Reset mode	Operation mode: RESET Output: Action depending on the Valve action in Reset mode	Operation mode: RESET Output: According to the result of control computation of Manipulated output value in Reset mode
	RUN/FIX	Operation mode: Same as that before power failure Output: Computed control output value	Operation mode: Same as that before power failure Output: Action depending on the Valve action in Reset mode	Operation mode: Same as that before power failure Output: Computed control output value
	MAN	Operation mode: Same as that before power failure Output: No output	Operation mode: Same as that before power failure Output: Action depending on the Valve action in Reset mode	Operation mode: Same as that before power failure Output: According to the result of control computation of Manipulated output value
Cold start	RESET	Operation mode: RESET Output: Action depending on the Valve action in Reset mode	Operation mode: RESET Output: Action depending on the Valve action in Reset mode	Operation mode: RESET Output: According to the result of control computation of Manipulated output value in Reset mode
	RUN/FIX	Operation mode: MAN Output: No output	Operation mode: MAN Output: Action depending on the Valve action in Reset mode	Operation mode: MAN Output: According to the result of control computation of Output limiter low
	MAN			
Reset start	RESET	Operation mode: RESET Output: Action depending on the Valve action in Reset mode	Operation mode: RESET Output: Action depending on the Valve action in Reset mode	Operation mode: RESET Output: According to the result of control computation of Manipulated output value in Reset mode
	RUN/FIX			
	MAN			

* Action at feedback resistance (FBR) input error

0: Action depending on the Valve action in Reset mode

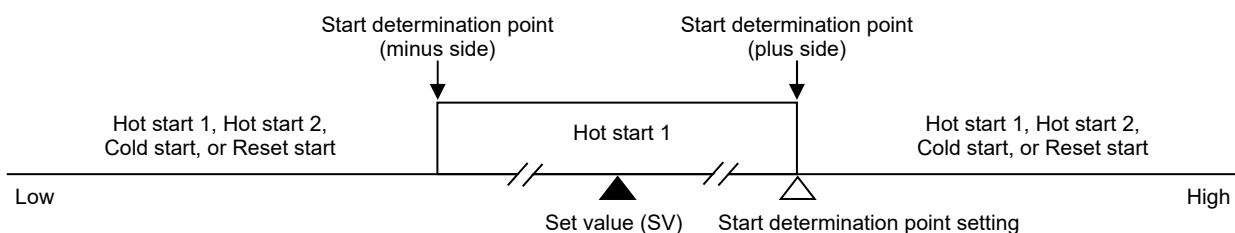
1: Control action continued



● Start determination point

Separately from Hot start and Cold start, users can set the start range (Start determination point) of Hot start 1 after power recovery. Determination point of start is a deviation setting from the Set value (SV).

- The start state is determined according to the Measured value (PV) level [deviation from set value] at power recovery.
- When a Measured value (PV) is between the determination points on the + (plus) and – (minus) sides, always starts from Hot start 1 when recovered.
- When a Measured value (PV) is out of the determination points or the Start determination point is set at “0,” operation starts from any start state selected by Hot/Cold start.
- When the Operation mode is Manual control mode (MAN), the Start determination point setting is invalid.



■ Parameter setting

● Hot/Cold start

[Setup Setting Mode: Setting group No. 00 (S_n00)]

Parameter symbol	Data range	Factory set value
<i>Pd</i>	0: Hot start 1 1: Hot start 2 2: Cold start 3: Reset start	0

● Start determination point

[Engineering Mode: Function block No. 51 (F_n5 I)]

Parameter symbol	Data range	Factory set value
<i>PdA</i>	0 to Input span 0: Operation starts from any start state selected by Hot/Cold start [Varies with the setting of the Decimal point position.]	3 % of Input span

Setting procedure

To enter the Engineering mode

Press the **RESET** key first to stop the control.

Monitor & Program setting mode
PV/SV monitor
(Reset mode)

28

(SET)
(4 seconds *)

Setting lock mode
Set data unlock/lock
transfer

LoCK
oN
Lock state

✓

LoCK
oFF
Unlock state

MONI
or
RESET

* Press the (SET) key until Parameter setting mode is displayed. Keep pressing without releasing your finger from the key to enter the Setting lock mode.

(SET) + <MODE
(2 seconds)

Engineering mode
Function block No. 00
[Program]

Fn00
Prog

✓
Several times

Function block No. 51
[Control]

Fn51
Conf

(SET)
Several times

Start determination
point

PdA
00047

Set Start
determination point

(SET)

Next
screen

MONI
or
RESET

Monitor & Program setting mode
PV/SV monitor
(Reset mode)

28

(SET) + <MODE

Setup setting mode
Setting group No. 00
[Program]

Sn00
Prog

(SET)
Several times

Hot/Cold start

Pd
00000

Set Hot/Cold start

(SET)

Setting End

- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



MEMO



DISPLAY RELATED FUNCTIONS

13

This chapter describes display related functions, setting contents and setting procedure based on the key words related to Display.

13.1 Grouping Necessary Screens (Parameter Select Function)	13-2
13.2 Hiding Unnecessary Screens	13-12
13.3 Changing the ALM Lamp Lighting Condition	13-20
13.4 Checking Input Peak Value/Bottom Value	13-22
13.5 Suppressing the Display Flickering.....	13-24
13.6 Checking the Instrument Information	13-25



13.1 Grouping Necessary Screens (Parameter Select Function)

This instrument has a function that allows a user to specify desired screens to be displayed. This function is called “Parameter select function.” Up to 16 screens can be grouped together.

■ Description of function

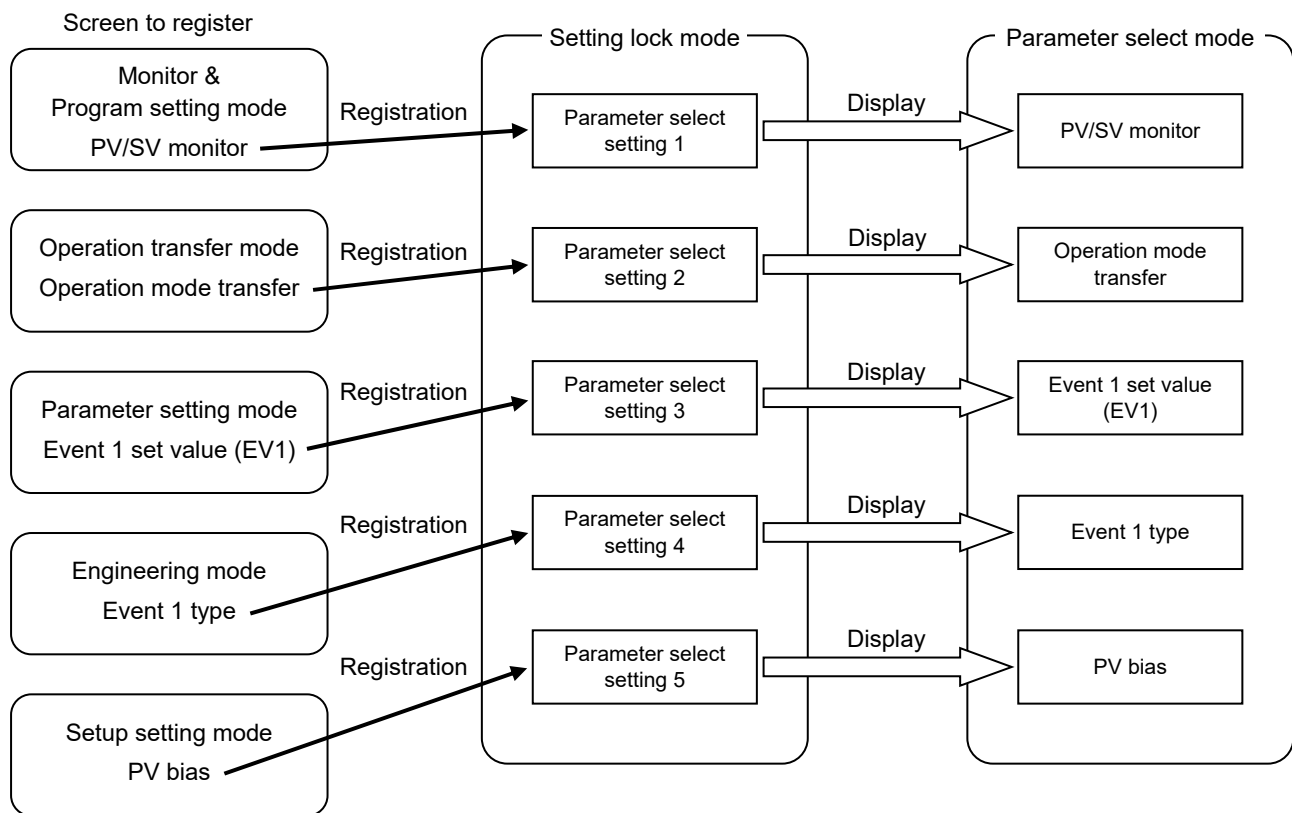
The Parameter select function allows grouping necessary screens into a single mode for display. Screens registered in the Setting lock mode are displayed in the Parameter select mode.

The screens displayed in this mode can be operated in the same manner as they are in the original mode.



With the Parameter select function, the Setting lock mode screen and the Function block No. 91 in the Engineering mode cannot be registered.

[How does Parameter select function work?]



[Example] When “Event 1 set value (EV1)” screen in the Parameter setting mode is registered in the Parameter select setting screen, this screen can be viewed in both the Parameter select mode and the Parameter setting mode.

• Set data lock

This function can be independently activated in each operation mode.

For example, when the parameters in the Parameter setting mode are locked, the same parameters in the Parameter select mode are settable.



For the Set data lock function, refer to **14.2 Restricting Key Operation (Set Data Lock) (P. 14-5)**.



There are two ways to register screens.

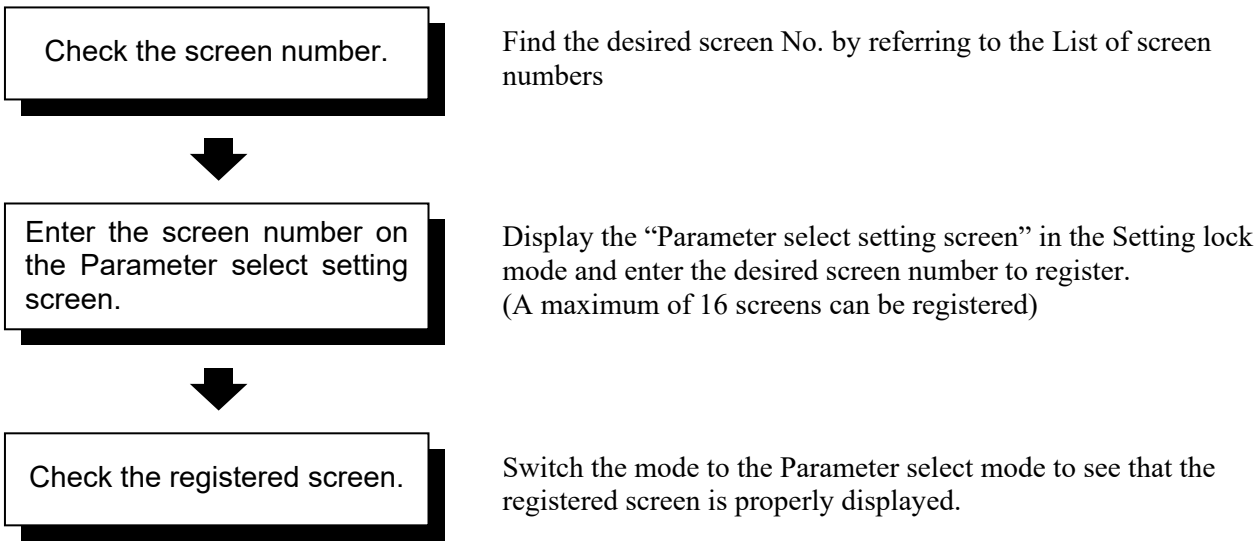
- Screen number entry: Enter the screen No. on the Parameter select setting screen.
- Direct registration: Display the desired screen and register it through key operations.

● **Screen number entry**

Enter the predefined screen number on the Parameter select setting screen in the Setting lock mode. The registered screens in the Parameter select mode will be displayed.

 Refer to the **List of screen numbers (P. 13-9)** for details.

[To register screens]



[Registering screens and display (1)]

There are 16 Parameter select setting screens and these are freely settable. Unregistered screens, if any, will be skipped and screens are displayed in series in the Parameter select mode.

Setting lock mode: Parameter select setting screen (for registration)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	B	C					D	E						F	

 : Registered screens  : Unregistered screens (Set value = 0)

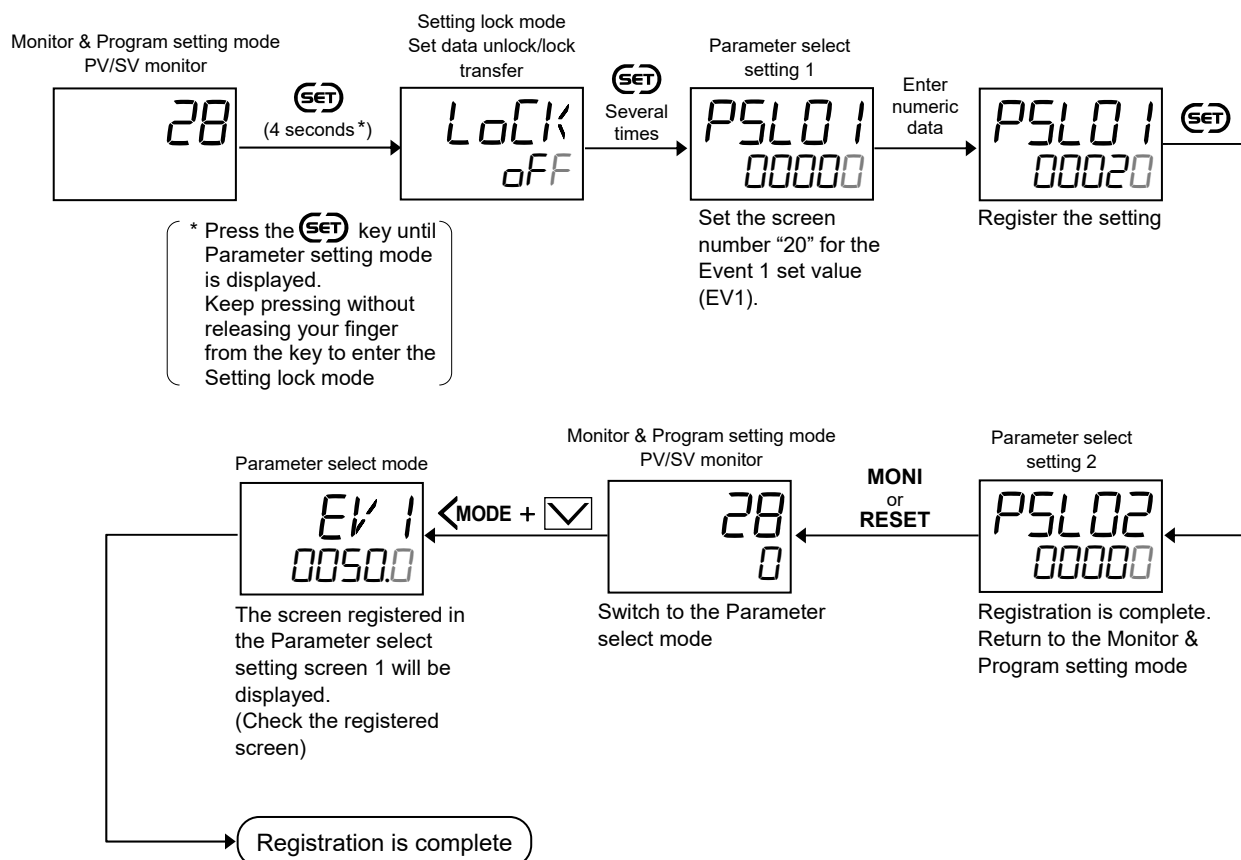
Parameter select mode: Displayed screens

A	B	C	D	E	F

Only registered screens are grouped for display.

**[Entering screen No.]**

In this example we will register “Event 1 set value (EV1)” in the Parameter setting mode.



● Direct registration

Activate the direct registration on the Parameter select direct registration screen in the Setting lock mode. Display the screen to register and press the and keys simultaneously.

The screen will be registered on the Parameter select setting screen.

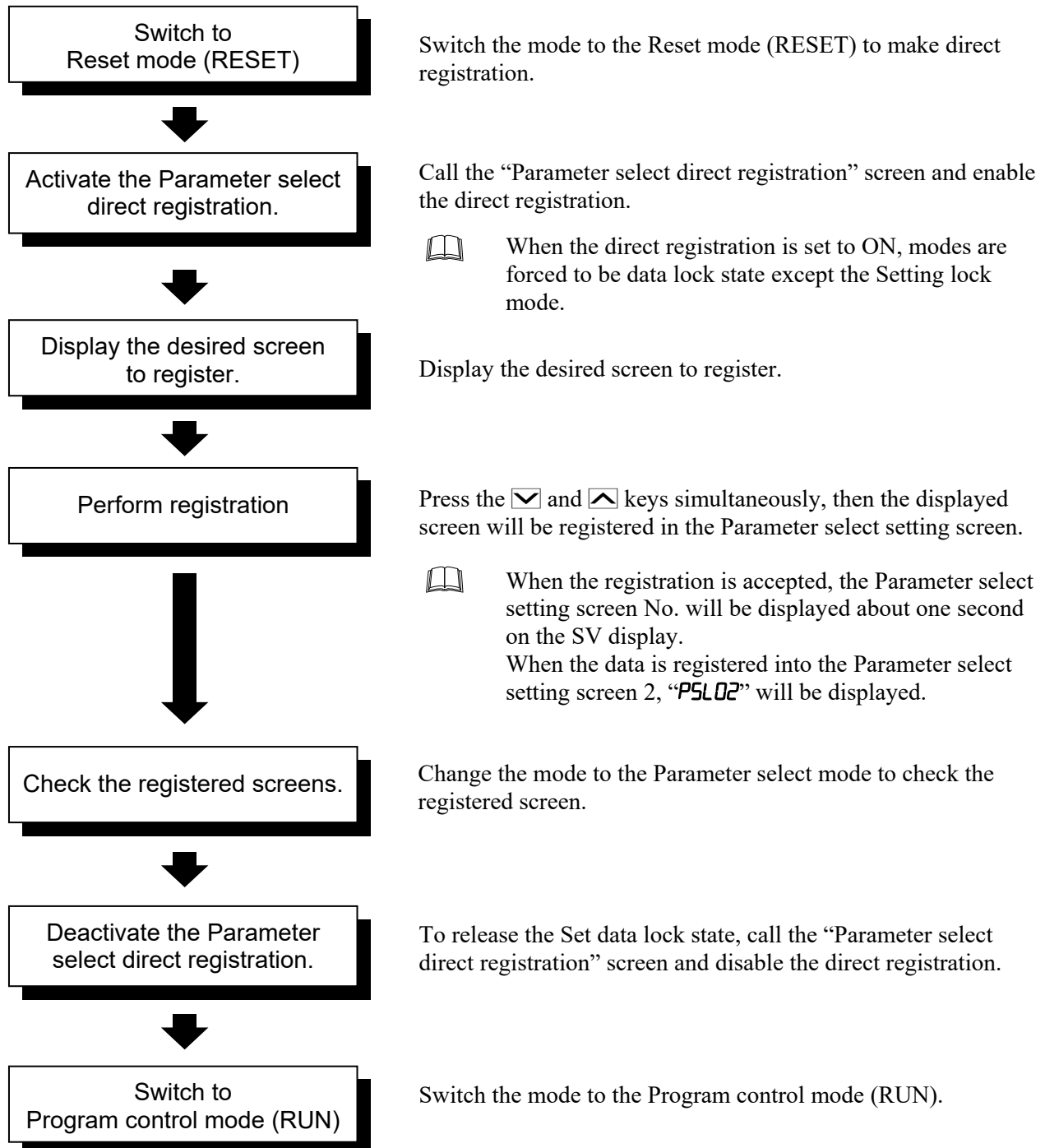


To make direct registration, you need to switch the mode to Reset mode (RESET).



When the direct registration is activated on the Parameter select direct registration screen, all modes except for the Setting lock mode will be locked.

[To register screens]



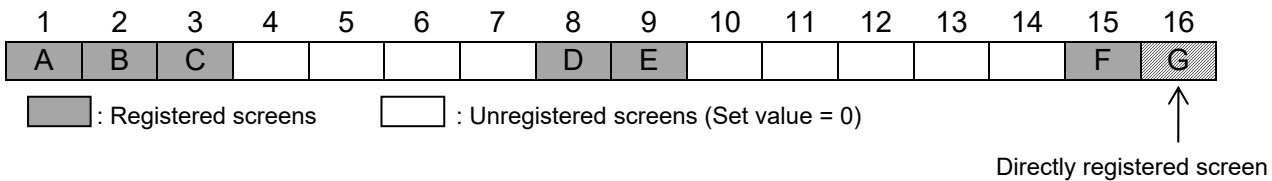
**[Registering screens and display (2)]**

This example shows the case of the direct registration under the state of the “[Registering screens and display (1)]” (P. 13-3).

• When directly registered

When attempting a direct registration, in case there is a registered screen in the Parameter select setting screen, the new screen will be added to after the registered screen. Even if there are unregistered screens, the new screen will be added to after the screen with the largest screen number of the Parameter select setting screen.

Setting lock mode: Parameter select setting screen (for registration)

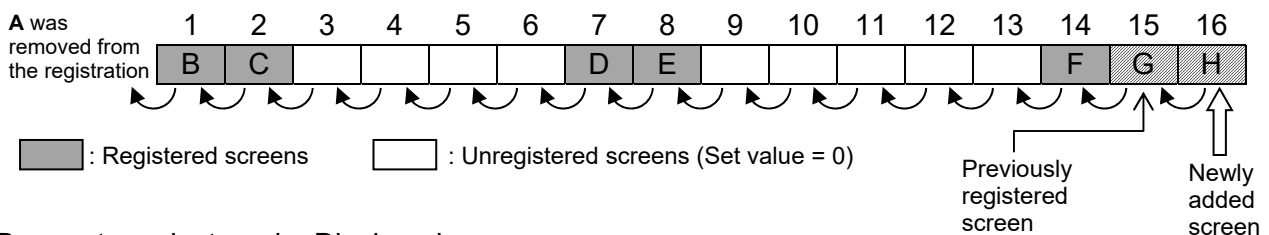


Parameter select mode: Displayed screens

**• Registering further screens**

When the Parameter select setting 16 screens are registered, the latest direct registration is added to the position of No.16, and the data before that will be moved ahead to toward the direction of the smaller numbers. Consequently, the screen registered at the Parameter select setting 1 will be moved out and removed from the registration.

Setting lock mode: Parameter select setting screen (for registration)

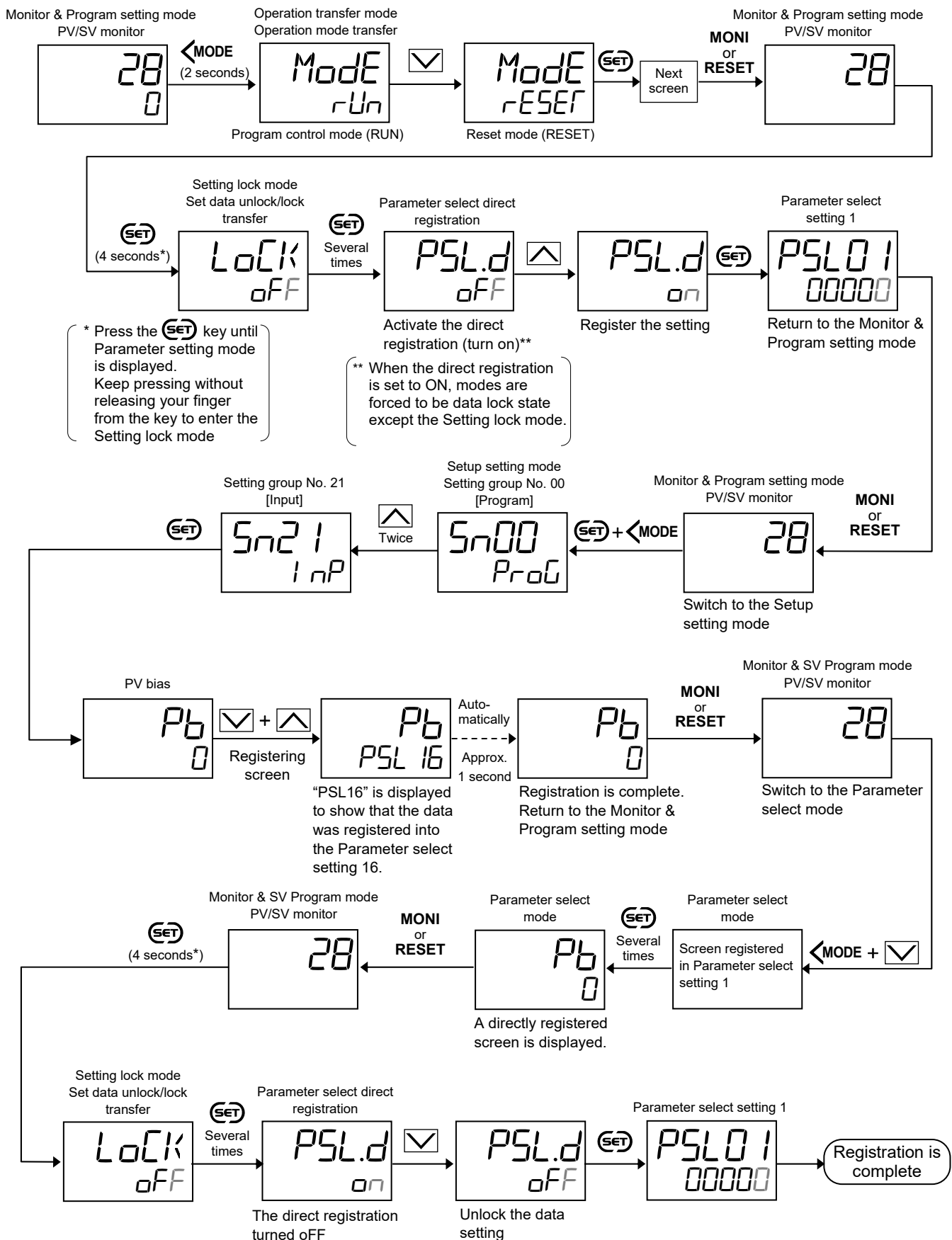


Parameter select mode: Displayed screens



[Example of Direct registration]

This is an example to make a direct registration of “PV bias” in the Setting group 21 in the Setup setting mode under the state of the “[**Registering screens and display (1)**]” (P. 13-3).





■ Parameter setting

● Parameter select direct registration

[Setting Lock Mode]

Parameter symbol	Data range	Factory set value
<i>PSL.d</i>	<i>oFF</i> : Direct registration: OFF <i>oN</i> : Direct registration: ON	<i>oFF</i>



To make “Direct registration of parameter select screen,” the mode must be switched to the Reset mode (RESET)



Set “*oN*: Direct registration ON” to ON. All except Setting lock mode will be forced to data locked. After the registration process is over, return the setting to *oFF*.



This setting returns to *oFF* when the power is turned off.

● Parameter select setting 1 to 16

[Setting Lock Mode]

Parameter symbol	Data range	Factory set value
<i>PSL01</i> <i>PSL16</i>	0: No registration 1 to 254 (Screen No.) For details, refer to List of screen numbers (P. 13-9) .	0



● List of screen numbers

No.	Name	Mode
1	PV/SV monitor	Monitor & Program setting mode Monitor mode
2	Number of repeating patterns monitor	
3	Pattern remaining time monitor	
4	Manipulated output value monitor [heat-side]	
5	Manipulated output value monitor [cool-side]	
6	Current transformer 1 (CT1) input value monitor	
7	Current transformer 2 (CT2) input value monitor	
8	Comprehensive event state	
9	Execution pattern selection	Pattern transfer mode
10	Operation mode transfer	Operation transfer mode
11	Step function	
12	Autotuning (AT)	
13	Overall level autotuning (AT)	
14	Startup tuning (ST)	
15	Interlock release	Parameter setting mode Parameter group No. 00 (Pn00)
16	Segment level	
17	Segment time	
18	Pattern end	
19	Number of repeating patterns (Repeat)	
20	Pattern link number	Parameter setting mode Parameter group No. 01 (Pn01)
21	Set value (SV) in Fixed set point control mode	
22	Event 1 set value (EV1) Event 1 set value (EV1') [high]	Parameter setting mode Parameter group No. 40 (Pn40)
23	Event 1 set value (EV1') [low]	
24	Event 2 set value (EV2) Event 2 set value (EV2') [high]	
25	Event 2 set value (EV2') [low]	
26	Event 3 set value (EV3) Event 3 set value (EV3') [high]	
27	Event 3 set value (EV3') [low]	
28	Event 4 set value (EV4) Event 4 set value (EV4') [high]	
29	Event 4 set value (EV4') [low]	
30	Time signal 1 start segment number	Parameter setting mode Parameter group No. 47 (Pn47)
31	Time signal 1 start time	
32	Time signal 1 end segment number	
33	Time signal 1 end time	
34	Time signal 2 start segment number	
35	Time signal 2 start time	
36	Time signal 2 end segment number	
37	Time signal 2 end time	
38	Time signal 3 start segment number	
39	Time signal 3 start time	
40	Time signal 3 end segment number	
41	Time signal 3 end time	
42	Time signal 4 start segment number	
43	Time signal 4 start time	
44	Time signal 4 end segment number	
45	Time signal 4 end time	
46	Pattern end output time	Parameter setting mode Parameter group No. 48 (Pn48)

No.	Name	Mode
47	Proportional band [heat-side]	Parameter setting mode Parameter group No. 51 (Pn51)
48	Integral time [heat-side]	
49	Derivative time [heat-side]	
50	ON/OFF action differential gap (upper)	
51	ON/OFF action differential gap (lower)	
52	Control response parameter	
53	Proactive intensity	
54	Manual reset	
55	FF amount	
56	Output limiter high [heat-side]	
57	Output limiter low [heat-side]	Parameter setting mode Parameter group No. 53 (Pn53)
58	Control loop break alarm (LBA) time	
59	LBA deadband (LBD)	
60	Proportional band [heat-side]	
61	Integral time [heat-side]	
62	Derivative time [heat-side]	
63	ON/OFF action differential gap (upper)	
64	ON/OFF action differential gap (lower)	
65	Control response parameter	
66	Proactive intensity	
67	Manual reset	
68	FF amount	
69	Output limiter high [heat-side]	
70	Output limiter low [heat-side]	
71	Control loop break alarm (LBA) time	—
72	LBA deadband (LBD)	
73	Do not set this one	Parameter setting mode Parameter group No. 56 (Pn56)
74	Proportional band [cool-side]	
75	Integral time [cool-side]	
76	Derivative time [cool-side]	
77	Overlap/Deadband	
78	Output limiter high [cool-side]	
79	Output limiter low [cool-side]	Parameter setting mode Parameter group No. 58 (Pn58)
80	Proportional band [cool-side]	
81	Integral time [cool-side]	
82	Derivative time [cool-side]	
83	Overlap/Deadband	
84	Output limiter high [cool-side]	Parameter setting mode Parameter group No. 59 (Pn59)
85	Output limiter low [cool-side]	
86	Automatic level PID setting	
87	Level PID setting 1	
88	Level PID setting 2	
89	Level PID setting 3	
90	Level PID setting 4	
91	Level PID setting 5	
92	Level PID setting 6	Parameter setting mode Parameter group No. 80 (Pn80)
93	Level PID setting 7	
94	Wait zone high	Setup setting mode Setting group No. 00 (Sn00)
95	Wait zone low	
96	SV selection at program start	Setup setting mode Setting group No. 00 (Sn00)
97	Hot/Cold start	
98	Control action at pattern end	
99	Output action at pattern end	



13. DISPLAY RELATED FUNCTIONS

No.	Name	Mode
100	Display update cycle	Setup setting mode Setting group No. 10 (5n10)
101	PV bias	Setup setting mode Setting group No. 21 (5n21)
102	PV digital filter	
103	PV ratio	
104	PV low input cut-off	
105	OUT1 proportional cycle time	Setup setting mode Setting group No. 30 (5n30)
106	OUT2 proportional cycle time	
107	OUT3 proportional cycle time	
108	OUT1 minimum ON/OFF time of proportional cycle	
109	OUT2 minimum ON/OFF time of proportional cycle	Setup setting mode Setting group No. 45 (5n45)
110	OUT3 minimum ON/OFF time of proportional cycle	
111	Heater break alarm 1 (HBA1) set value	
112	Number of heater break alarm 1 (HBA1) delay times	Setup setting mode Setting group No. 46 (5n46)
113	Heater break alarm 2 (HBA2) set value	
114	Number of heater break alarm 2 (HBA2) delay times	Setup setting mode Setting group No. 49 (5n49)
115	Event selection of the Segment	Setup setting mode Setting group No. 51 (5n51)
116	Manual manipulated output value	Setup setting mode Setting group No. 53 (5n53)
117	AT bias	
118	AT remaining time monitor	
119	AT/ST status monitor	Setup setting mode Setting group No. 55 (5n55)
120	Open/Close output neutral zone	
121	Open/Close output differential gap	Setup setting mode Setting group No. 57 (5n57)
122	FF amount learning	
123	Determination point of external disturbance	Setup setting mode Setting group No. 91 (5n91)
124	Peak hold monitor	
125	Bottom hold monitor	
126	Peak/Bottom hold reset	Engineering mode Function block No. 00 (Fn00)
127	Time unit of the setting	
128	Segment setting change type	
129	Store segment setting change	Engineering mode Function block No. 10 (Fn10)
130	ALM lamp lighting condition	
131	PV flashing display at input error	
132	Select hide items in Monitor mode	
133	Select hide items in Operation transfer mode	Engineering mode Function block No. 21 (Fn21)
134	Select hide items in Program setting mode	
135	Input type	
136	Display unit	
137	Decimal point position	
138	Input range high	
139	Input range low	
140	Input error determination point (high)	
141	Input error determination point (low)	
142	Temperature compensation calculation	
143	Burnout direction	
144	Square root extraction	

No.	Name	Mode
145	Inverting input	Engineering mode Function block No. 21 (Fn21)
146	Input data type	
147	DI1 function selection	Engineering mode Function block No. 23 (Fn23)
148	DI2 function selection	
149	DI3 function selection	
150	DI4 function selection	
151	DI5 function selection	
152	DI6 function selection	
153	DI logic invert	Engineering mode Function block No. 30 (Fn30)
154	OUT1 function selection	
155	OUT2 function selection	
156	OUT3 function selection	
157	OUT1 logic calculation selection	
158	OUT2 logic calculation selection	
159	OUT3 logic calculation selection	
160	Energized/De-energized selection	
161	Interlock selection	Engineering mode Function block No. 31 (Fn31)
162	Output action in Reset mode	
163	Universal output type selection (OUT3)	
164	Retransmission output 1 type	
165	Retransmission output 1 scale high	Engineering mode Function block No. 32 (Fn32)
166	Retransmission output 1 scale low	
167	Retransmission output 2 type	Engineering mode Function block No. 33 (Fn33)
168	Retransmission output 2 scale high	
169	Retransmission output 2 scale low	Engineering mode Function block No. 34 (Fn34)
170	Retransmission output 3 type	
171	Retransmission output 3 scale high	
172	Retransmission output 3 scale low	
173	DO1 function selection	
174	DO2 function selection	
175	DO3 function selection	
176	DO4 function selection	
177	DO1 logic calculation selection	Engineering mode Function block No. 41 (Fn41)
178	DO2 logic calculation selection	
179	DO3 logic calculation selection	
180	DO4 logic calculation selection	
181	DO1 time signal selection	Engineering mode Function block No. 42 (Fn42)
182	DO2 time signal selection	
183	DO3 time signal selection	
184	DO4 time signal selection	
185	Event 1 type	Engineering mode Function block No. 43 (Fn43)
186	Event 1 hold action	
187	Event 1 differential gap	
188	Event 1 timer	Engineering mode Function block No. 44 (Fn44)
189	Event 2 type	
190	Event 2 hold action	
191	Event 2 differential gap	Engineering mode Function block No. 45 (Fn45)
192	Event 2 timer	
193	Event 3 type	
194	Event 3 hold action	Engineering mode Function block No. 46 (Fn46)
195	Event 3 differential gap	
196	Event 3 timer	



No.	Name	Mode
197	Event 4 type	Engineering mode Function block No. 44 (Fn44)
198	Event 4 hold action	
199	Event 4 differential gap	
200	Event 4 timer	
201	CT1 assignment	Engineering mode Function block No. 45 (Fn45)
202	CT1 type	
203	CT1 ratio	
204	CT1 low input cut-off	Engineering mode Function block No. 46 (Fn46)
205	CT2 assignment	
206	CT2 type	
207	CT2 ratio	
208	CT2 low input cut-off	
209	Time signal selection	Engineering mode Function block No. 47 (Fn47)
210	Pattern end signal selection	Engineering mode Function block No. 48 (Fn48)
211	Control action	Engineering mode Function block No. 51 (Fn51)
212	Level PID action selection	
213	Level PID differential gap	
214	Output change rate limiter (up) [heat-side]	
215	Output change rate limiter (down) [heat-side]	
216	Action (high) input error	
217	Action (low) input error	
218	Manipulated output value at input error	
219	Manipulated output value in Reset mode [heat-side]	
220	Start determination point	
221	Manual manipulated output value selection	
222	Integral/Derivative time decimal point position	
223	ST start condition	
224	Do not set this one	—
225	Action at feedback resistance (FBR) input error	Engineering mode Function block No. 55 (Fn55)
226	Feedback adjustment	
227	Control motor time	
228	Integrated output limiter	
229	Valve action in Reset mode	
230	Action at saturated output	Engineering mode Function block No. 56 (Fn56)
231	Output change rate limiter (up) [cool-side]	
232	Output change rate limiter (down) [cool-side]	
233	Manipulated output value in Reset mode [cool-side]	
234	Undershoot suppression factor	
235	Overlap/Deadband reference point	
236	Bottom suppression function	Engineering mode Function block No. 57 (Fn57)

No.	Name	Mode
237	Communication protocol	Engineering mode Function block No. 60 (Fn60)
238	Device address	
239	Communication speed	
240	Data bit configuration	
241	Interval time	Engineering mode Function block No. 62 (Fn62)
242	Communication response monitor	
243	Register type	
244	Register start number (High-order 4-bit)	
245	Register start number (Low-order 16-bit)	
246	Monitor item register bias	
247	Setting item register bias	
248	Instrument link recognition time	
249	PLC response waiting time	
250	PLC communication start time	
251	Slave register bias	Engineering mode Function block No. 71 (Fn71)
252	Number of recognizable devices	
253	Setting limiter high	
254	Setting limiter low	



13.2 Hiding Unnecessary Screens

On this instrument, a specified range of screens can be hidden.

Below are screens that can be hidden.

- Screens in the Program setting of the “Monitor & Program setting mode”
- Screens in the Monitor mode of the “Monitor & Program setting mode”
- Screens in the Operation transfer mode
- Screens restricted by the Blind function

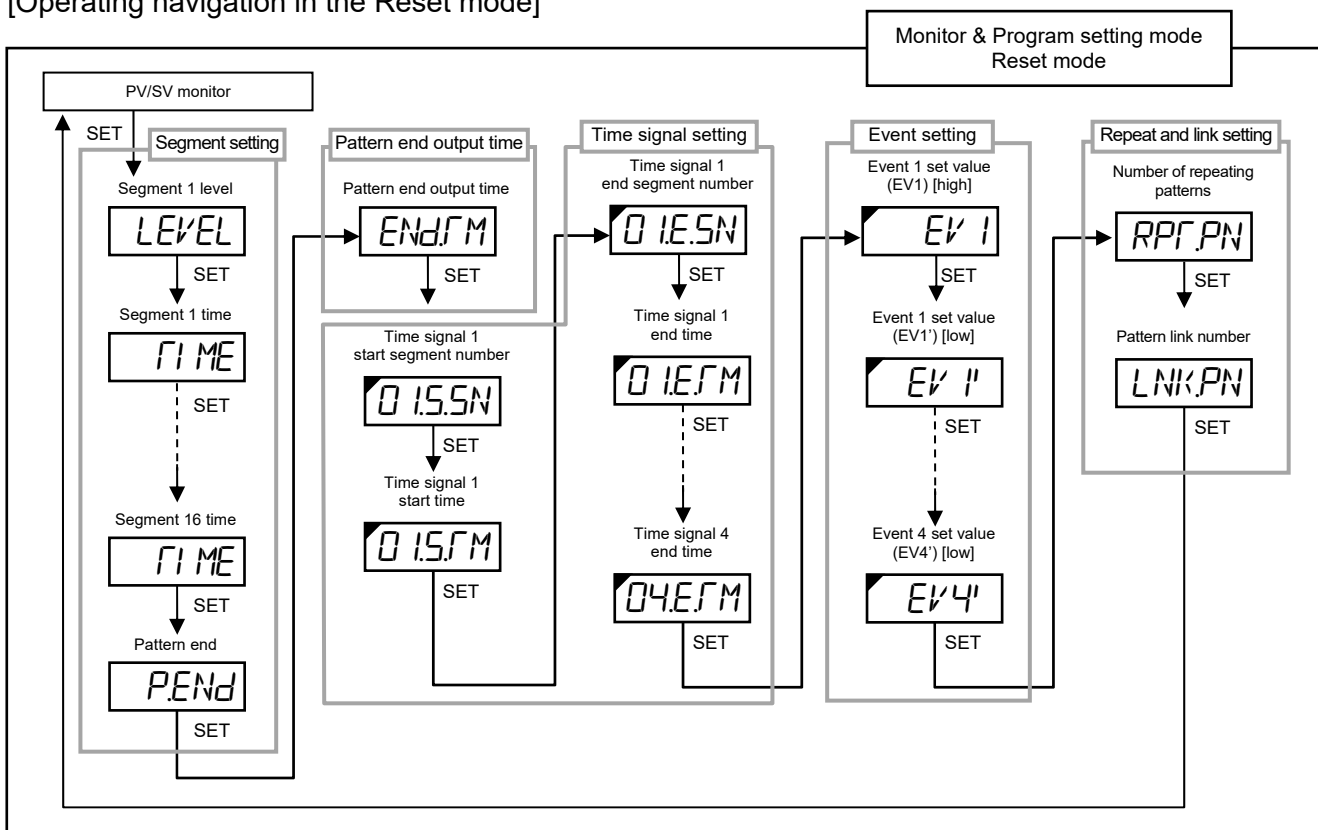
13.2.1 Hide the setting screen in the Monitor & Program setting mode

Show/Hide selection of the program setting screens in the Monitor & Program setting mode is available at “Select hide items in Program setting mode” in Function block No.10 in the Engineering mode.

[Applicable screens]

Set value	Screens to be hidden
0: Show all	None
1: Segment setting	Segment 1 to 16 level, Segment 1 to 16 time, Pattern end
2: Pattern end output time	Pattern end output time
3: Time signal setting	Time signal 1 to 4 start segment number, Time signal 1 to 4 start time, Time signal 1 to 4 end segment number, Time signal 1 to 4 end time
4: Event setting	Event 1to 4 set value (EV1 to EV4) [high], Event 1to 4 set value (EV1' to EV4') [low]
5: Repeat and link setting	Number of repeating patterns, Pattern link number

[Operating navigation in the Reset mode]



■ Parameter setting

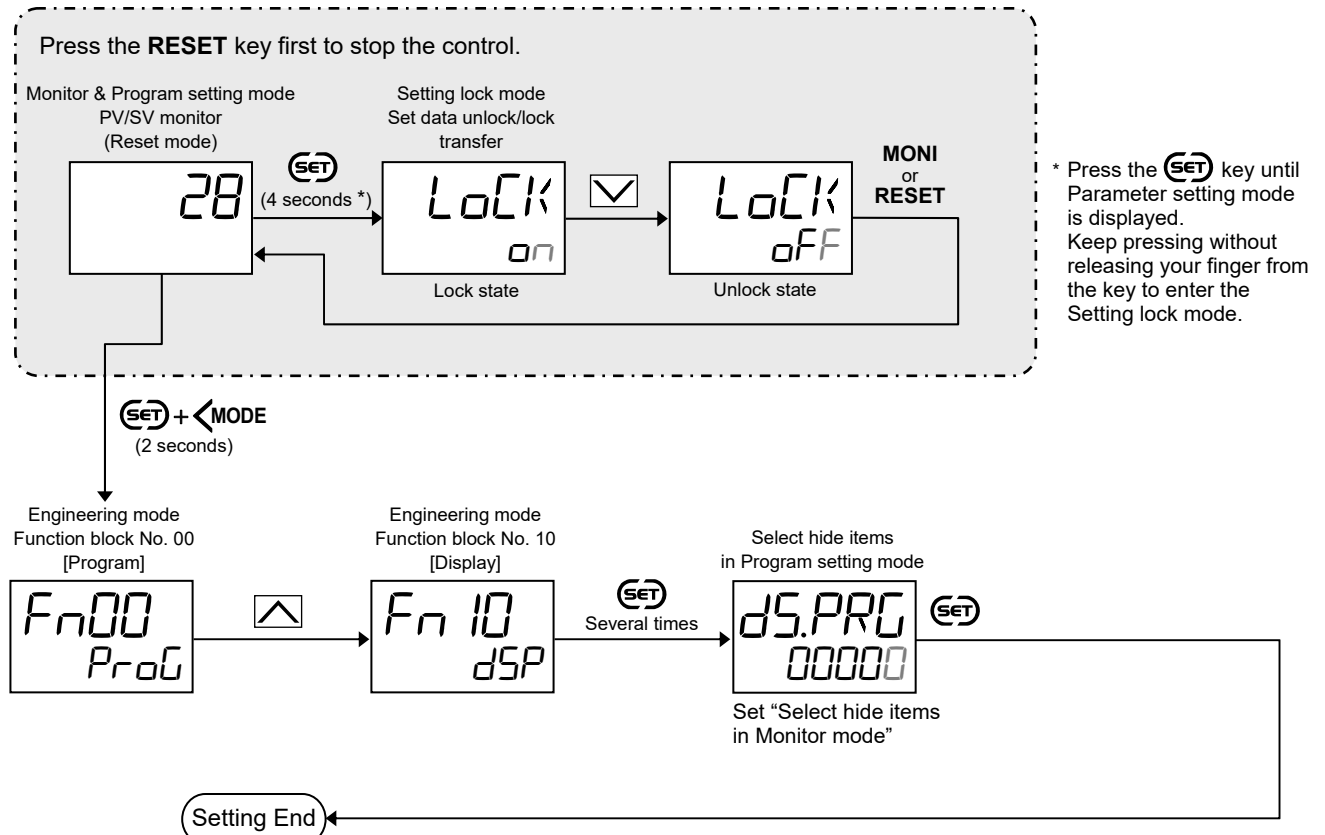
● Select hide items in Program setting mode

[Engineering Mode: Function block No. 10 ($F_n 10$)]

Parameter symbol	Data range	Factory set value
$d5.PRG$	0 to 31 0: Show all +1: Segment setting +2: Pattern end output time +4: Time signal setting +8: Event setting +16: Repeat and link setting To select two or more functions, sum each value.	0

■ Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



13.2.2 Hide the monitor screen in the Monitor & Program setting mode

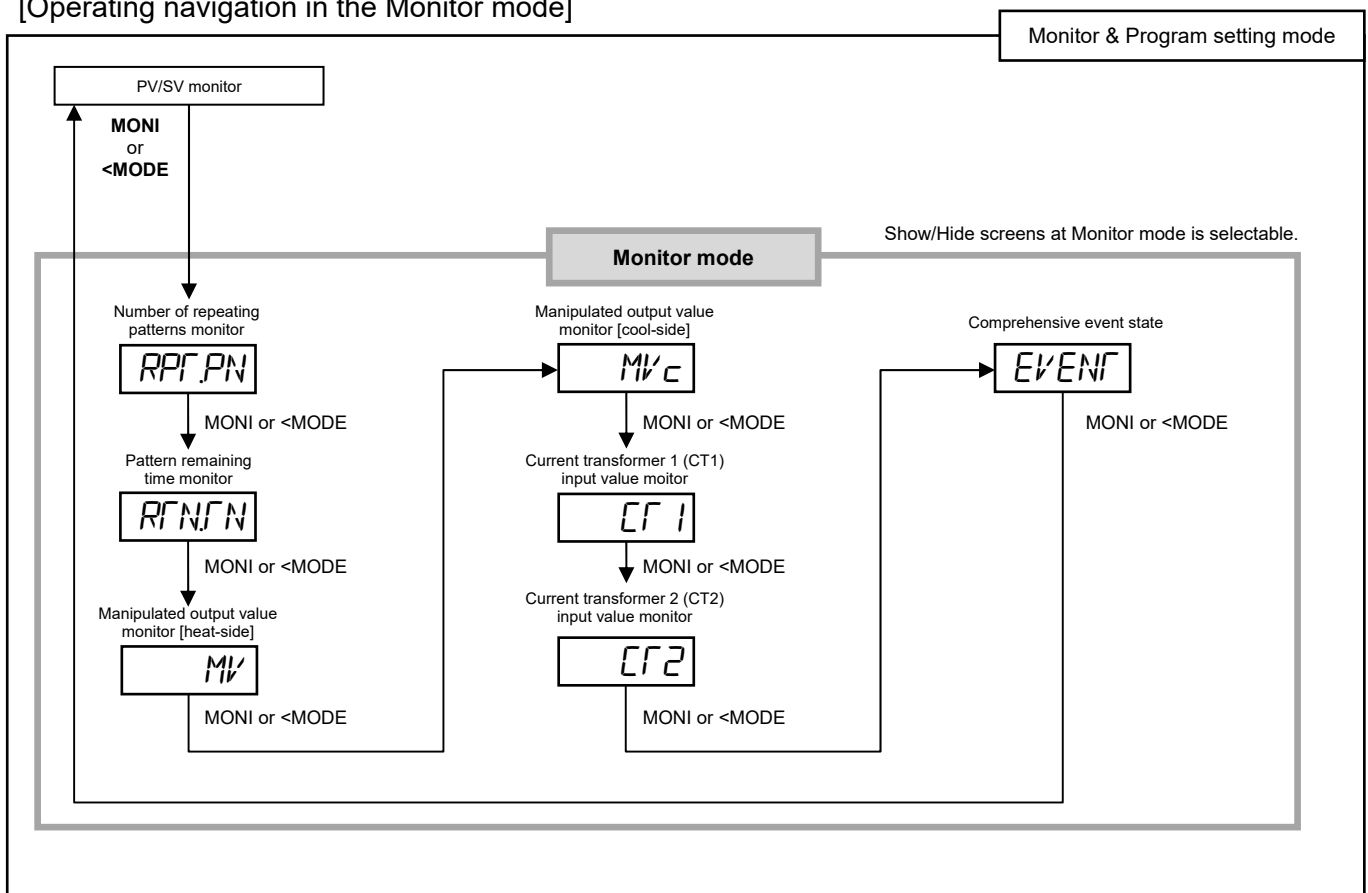
Show/Hide selection of the monitor screens in the Monitor & Program setting mode is available at “Select hide items in Monitor mode” in Function block No.10 in the Engineering mode.

[Applicable screens]

- Number of repeating patterns monitor
- Pattern remaining time monitor
- Manipulated output value (MV) monitor *:
Manipulated output value monitor [heat-side], Manipulated output value monitor [cool-side],
- Current transformer (CT) input value monitor *:
Current transformer 1 (CT1) input value monitor, Current transformer 2 (CT2) input value monitor
- Comprehensive event state

* Setting is done at “Manipulated output value (MV) monitor” and “Current transformer (CT) input value monitor.”

[Operating navigation in the Monitor mode]



■ Parameter setting

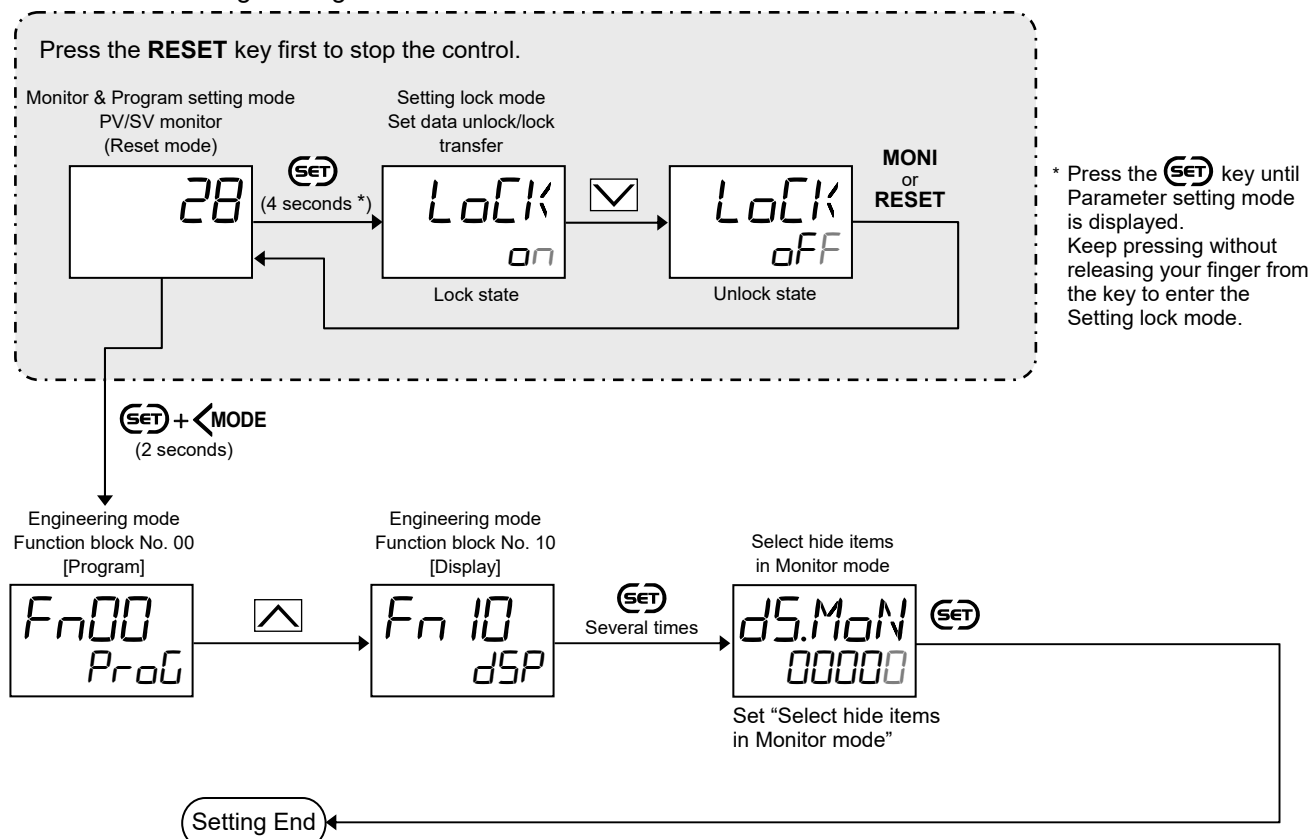
● Select hide items in Monitor mode

[Engineering Mode: Function block No. 10 (Fn 10)]

Parameter symbol	Data range	Factory set value
d5.MoN	0 to 31 0: Show all +1: Number of repeating patterns monitor +2: Pattern remaining time monitor +4: Manipulated output value (MV) monitor +8: Current transformer (CT) input value monitor +16: Comprehensive event state To select two or more functions, sum each value.	0

■ Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



13.2.3 Hiding screens in Operation transfer mode

Show/Hide selection of the screens in the Operation transfer mode is available at “Select hide items in Operation transfer mode” in Function block No. 10 in the Engineering mode.

[Applicable screens]

- Operation mode transfer
- Step function
- Autotuning (AT)
- Overall level autotuning (AT)
- Startup tuning (ST)

■ Parameter setting

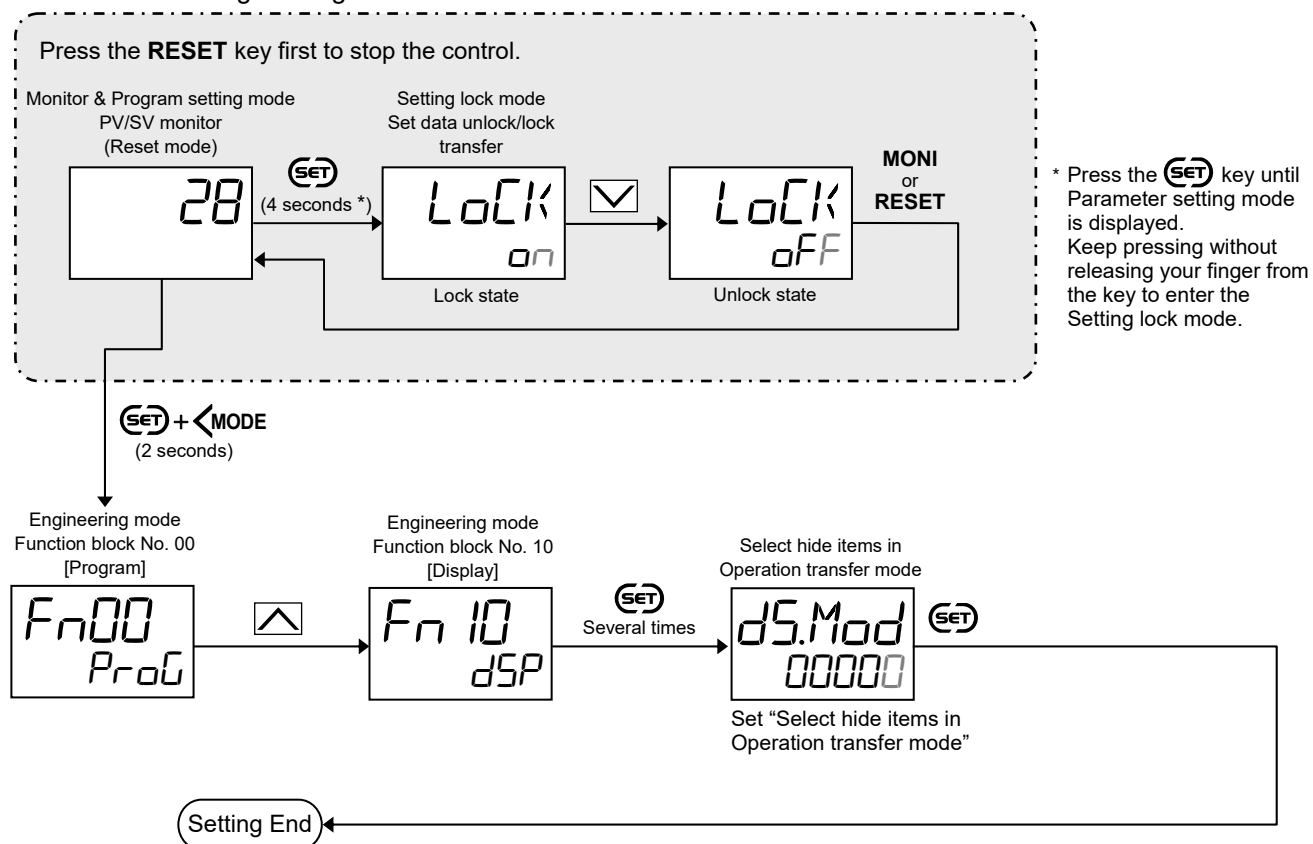
● Select hide items in Operation transfer mode

[Engineering Mode: Function block No. 10 ($F_n 10$)]

Parameter symbol	Data range	Factory set value
<i>d5.Mod</i>	0 to 31 0: Show all +1: Operation mode transfer +2: Step function +4: Autotuning (AT) +8: Overall level autotuning (AT) +16: Startup tuning (ST) To select two or more functions, sum each value.	0

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



13.2.4 Hiding the screen using the Blind function

The Blind function is used to hide all screens except Parameter select mode, Setting lock mode, and PV/SV monitor.

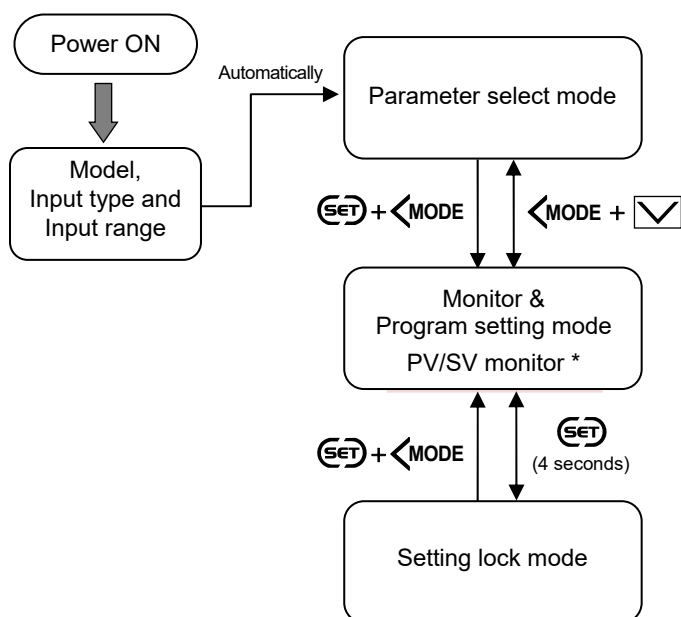
The Blind function can be set in the Setting lock mode.



When the Blind function is activated, the instrument displays the Parameter select mode after displaying the model and the input type/range at the time of power-up.

If all of the necessary screens are placed together in the Parameter select mode, there will be no need of switching screens to other modes.

[Operation flow when the Blind function is activated]



* The PV/SV monitor includes Set value (SV) setting and Manipulated output value (MV) setting.

Modes to be hidden

Operation transfer mode

Pattern transfer mode

Parameter setting mode

Setup setting mode

Engineering mode

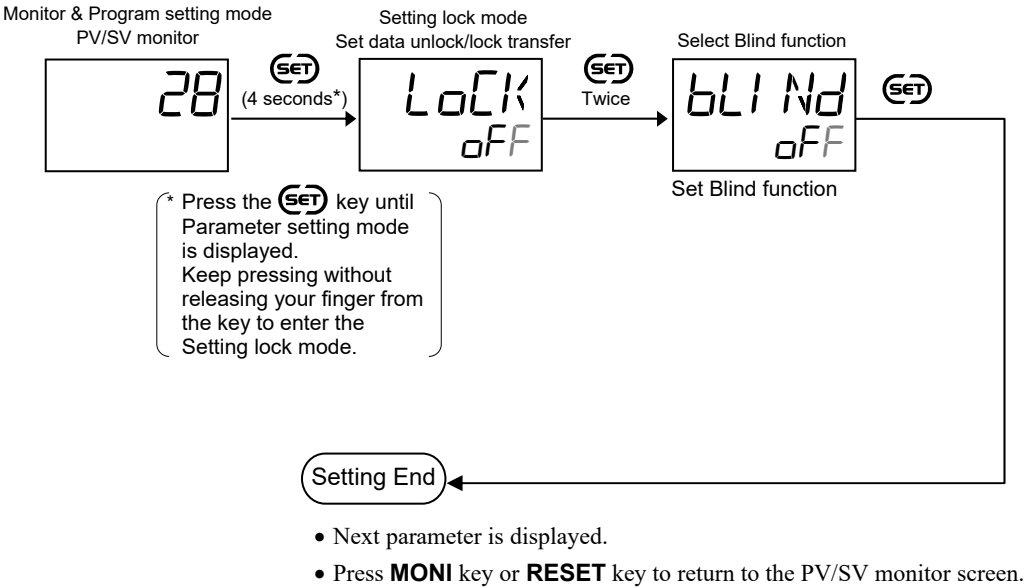


■ Parameter setting

● Select Blind function
[Setting Lock Mode]

Parameter symbol	Data range	Factory set value
<i>bLI Nd</i>	<i>oFF</i> : Blind function: OFF <i>oN</i> : Blind function: ON	<i>oFF</i>

■ Setting procedure





13.3 Changing the ALM Lamp Lighting Condition

The light condition of the ALM lamp on the front panel can be changed.

■ Description of function

ALM lamps can be configured to light on the occurrence of the following events. These are freely combinable. If multiple events occur, *OR*-logic is used for display.

If any one of selected events or alarms occurs, the ALM lamp will lights on.

- Event 1
- Event 2
- Event 3
- Event 4
- Heater break alarm 1 (HBA1)
- Heater break alarm 2 (HBA2)
- Control loop break alarm (LBA)
- Input error high
- Input error low

Item displayed in
factory set value

Display example



ALM lamp

■ Parameter setting

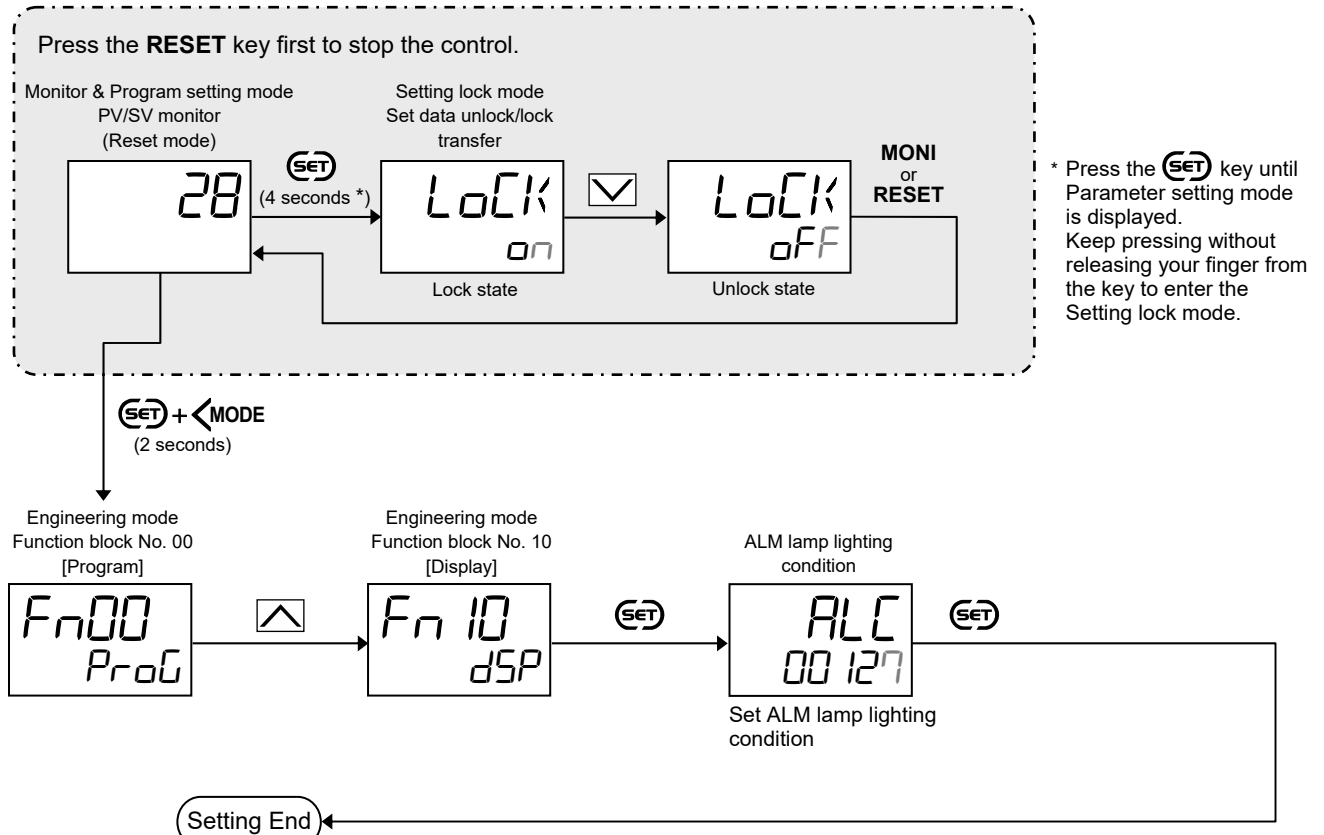
● ALM lamp lighting condition

[Engineering Mode: Function block No. 10 ($F_n 10$)]

Parameter symbol	Data range	Factory set value
ALC	0 to 511 0: OFF +1: Event 1 +2: Event 2 +4: Event 3 +8: Event 4 +16: Heater break alarm 1 (HBA1) +32: Heater break alarm 2 (HBA2) +64: Control loop break alarm (LBA) +128: Input error high +256: Input error low To select two or more functions, sum each value.	127

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

13.4 Checking Input Peak Value/Bottom Value

This instrument incorporates as standard the Peak/Bottom hold function which allows storing the peak (max) and the bottom (min) Measured values (PV).

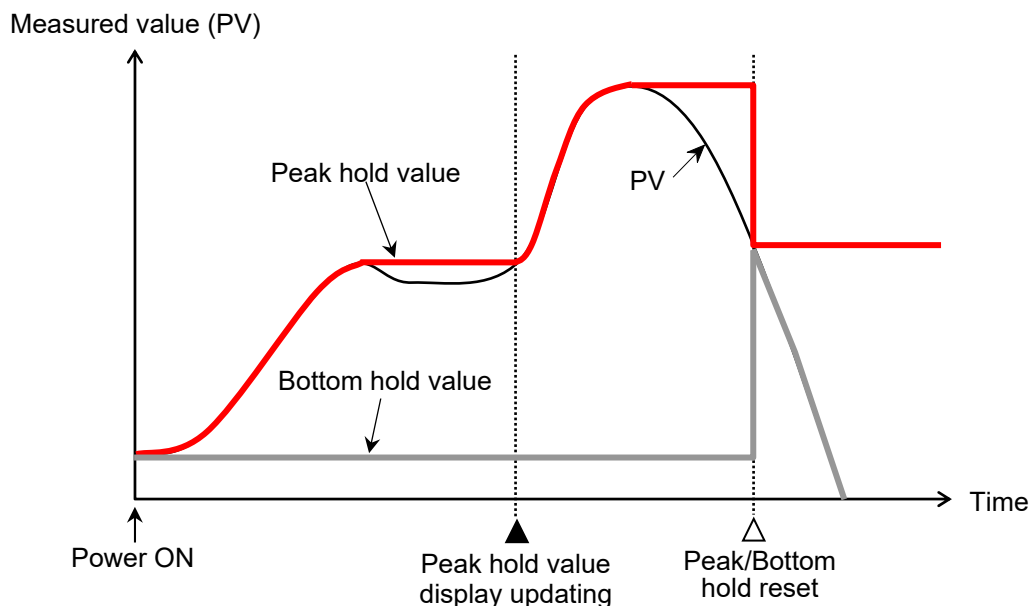
■ Description of function

The peak hold/bottom hold function is used to store (hold) the peak (max) and the bottom (min) Measured values (PV). Each of these values is updated when the measured temperature becomes more (or less) than the value now being held.

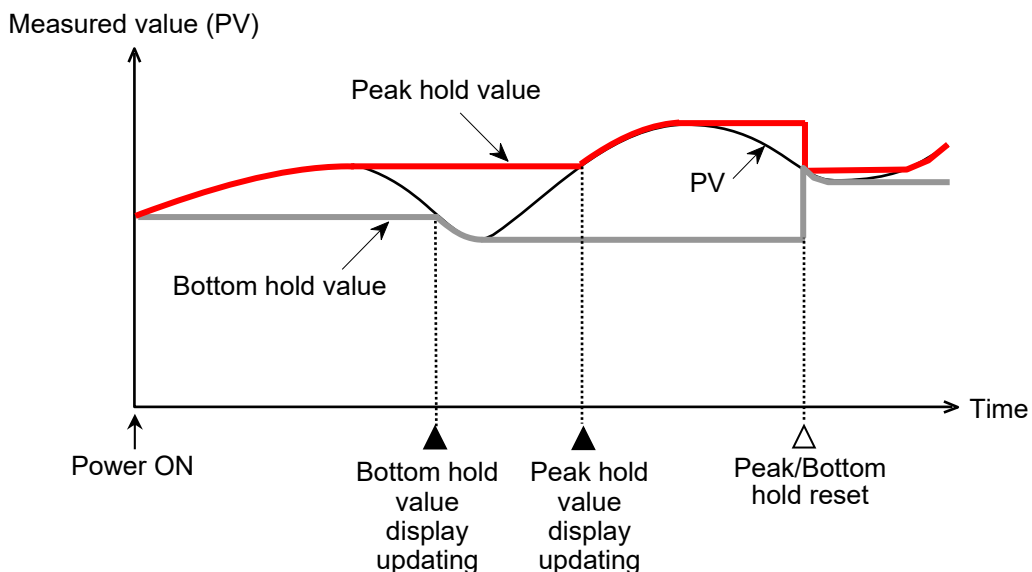


The stored peak (max) and bottom (min) values can be reset on the Peak/Bottom hold reset screen.

- The Description of the the Peak/Bottom hold action
[In the case of Program control mode (RUN)]



- The Description of the the Peak/Bottom hold action
[In the case of Fixed set point control mode (FIX)]



Parameter setting

Peak hold monitor

[Setup Setting Mode: Setting group No. 91 (5n9 l)]

Parameter symbol	Data range	Factory set value
<i>PHLd</i>	Input range low – (5 % of input span) to Input range high + (5 % of input span) Varies with the setting of the Decimal point position.	—

Bottom hold monitor

[Setup Setting Mode: Setting group No. 91 (5n9 l)]

Parameter symbol	Data range	Factory set value
<i>bHLd</i>	Input range low – (5 % of input span) to Input range high + (5 % of input span) Varies with the setting of the Decimal point position.	—

Peak/Bottom hold reset

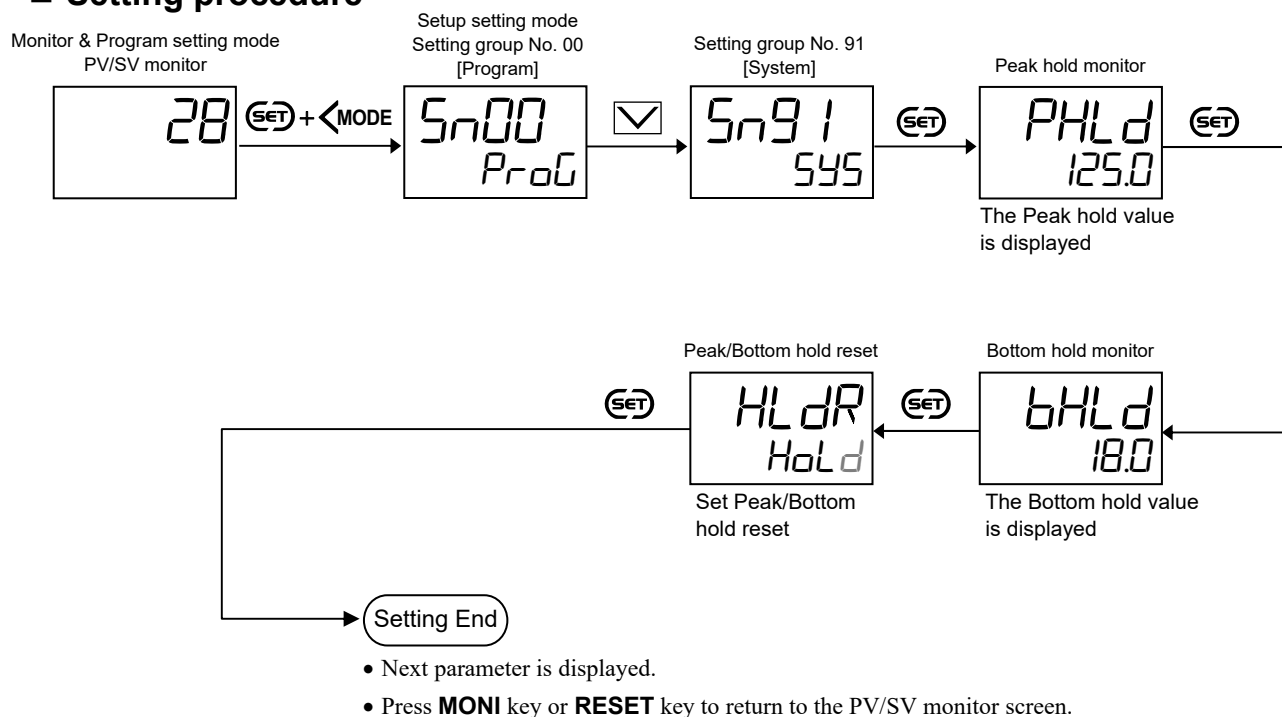
[Setup Setting Mode: Setting group No. 91 (5n9 l)]

Parameter symbol	Data range	Factory set value
<i>HLdR</i>	<i>HoLd</i> : Hold <i>rESEt</i> : Reset Returns to Hold state automatically after reset.	<i>HoLd</i>



Note that the both of the peak and the bottom hold values are reset at a time by the Peak/Bottom hold reset operation.

Setting procedure

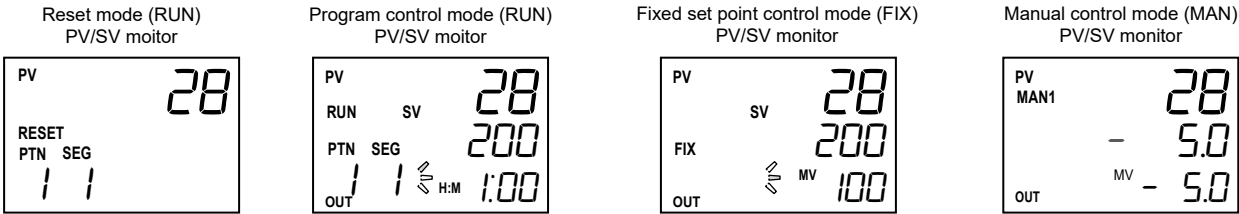




13.5 Suppressing the Display Flickering

The display flickering due to input changes in PV/SV monitor screen can be reduced by extending the display update cycle.

● Applicable PV/SV monitor screens (Monitor & Program setting mode)



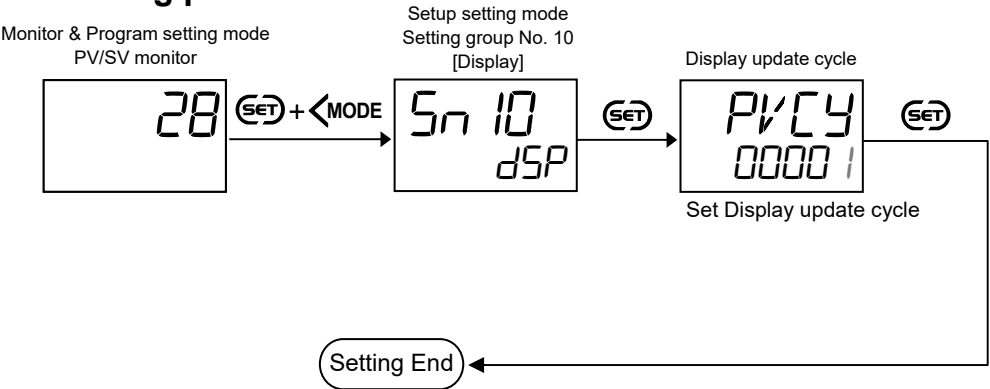
■ Parameter setting

● Display update cycle

[Setup Setting Mode: Setting group No. 10 (5n 10)]

Parameter symbol	Data range		Factory set value
PV CY	1: 50 ms	6: 300 ms	1
	2: 100 ms	7: 350 ms	
	3: 150 ms	8: 400 ms	
	4: 200 ms	9: 450 ms	
	5: 250 ms	10: 500 ms	

■ Setting procedure



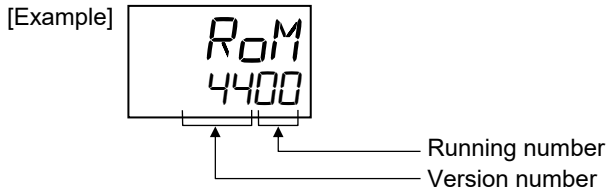
- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.

13.6 Checking the Instrument Information

When error occurs and when you contact us, you are requested to provide us with the information on the instrument model code and specification. You can check the ROM version, model code and serial number of the instrument on the instrument display. The Integrated operating time and the maximum ambient temperature (Peak hold monitor of the ambient temperature).

■ How to check

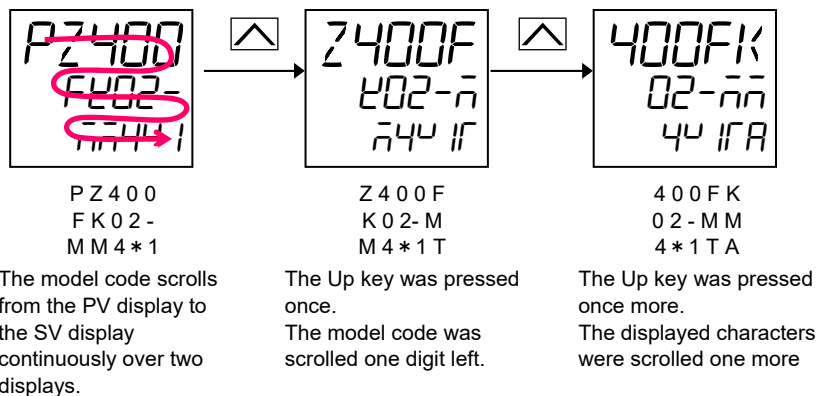
● ROM Version



● Model code monitor

Displays the model code of the instrument. As the Model code is too long to be displayed on a single screen, it can be scrolled left and right with and keys.

Example: Model code is PZ400FK02-MM4*1TAN/1



● Instrument number monitor

Displays the serial number of the instrument.



To read the displayed characters, refer to “Character Symbols” (P. i-3).



Alternatively, you can check the model code (MODEL), serial number (S/N) and suffix code (CODE) on the label on the side of the instrument if you are unable to check the information on the display.

● Integrated operating time

As soon as the instrument is powered, “1” is added. Thereafter, “1” is accumulated for each hour.

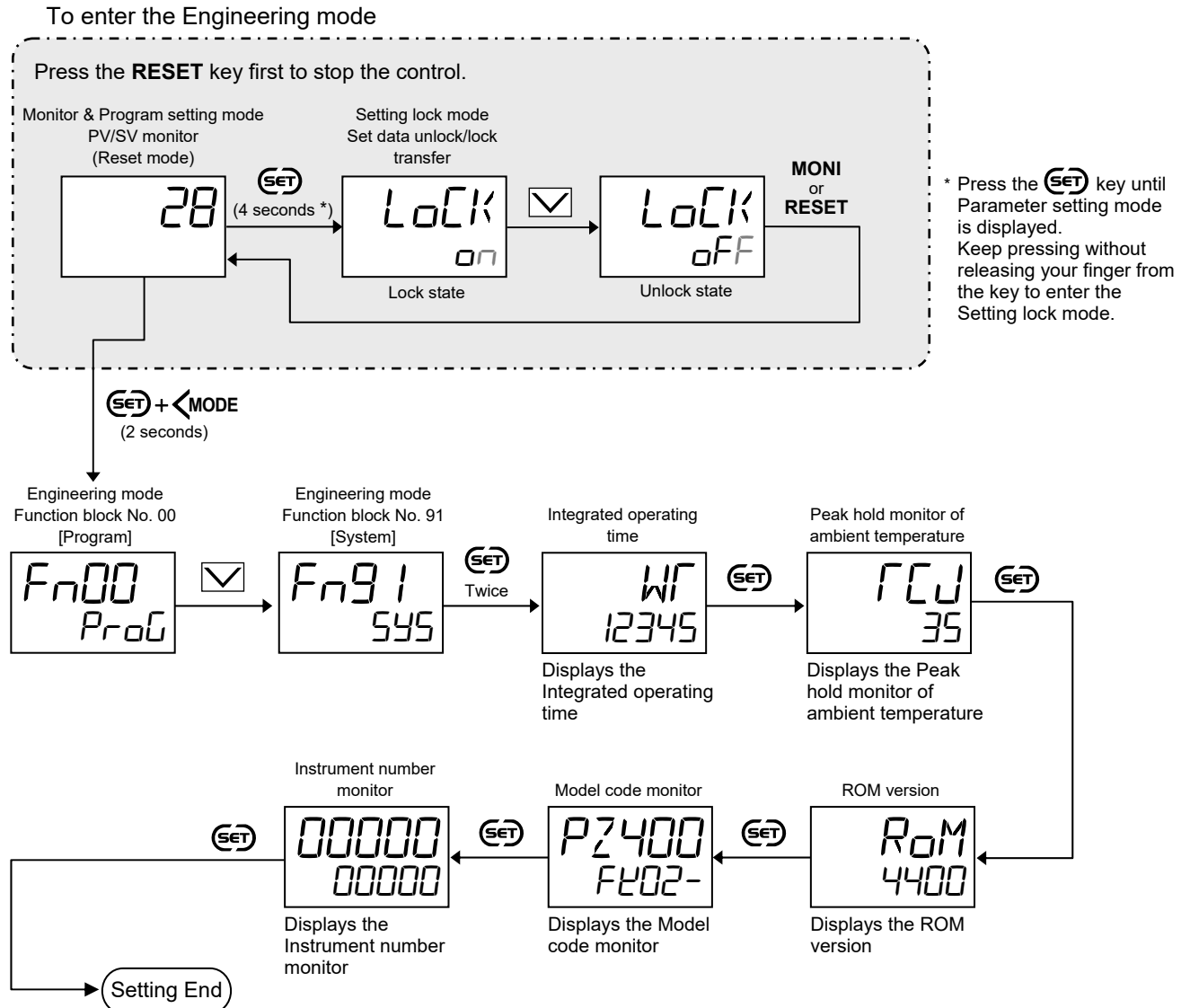
● Peak hold monitor of the ambient temperature

Temperature around the rear terminal is measured and the maximum value is stored.



The Integrated operating time and the maximum ambient temperature (Peak hold monitor of the ambient temperature) cannot be reset.

Operating procedure



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



SETTING AND KEY OPERATION



This chapter describes setting and key operation related functions, setting contents and setting procedure based on the keywords related to setting and key operation.

14.1 Limiting the Setting Range of Set Value (SV).....	14-2
14.2 Restricting Key Operation (Set Data Lock).....	14-5
14.3 Initializing the Set Data.....	14-8

14.1 Limiting the Setting Range of Set Value (SV)

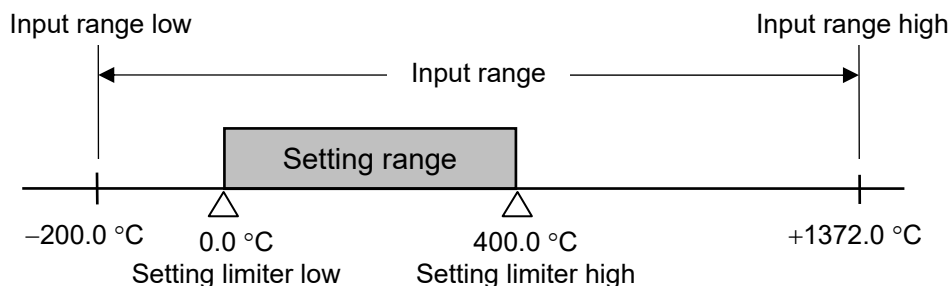
To limit the setting range of the Set value (SV)*, Setting limiter is used.

* In Program control mode (RUN), The Set value (SV) is a segment level.

■ Description of function

Setting limiter is a function to limit the setting range of the Set value (SV) within the input range.

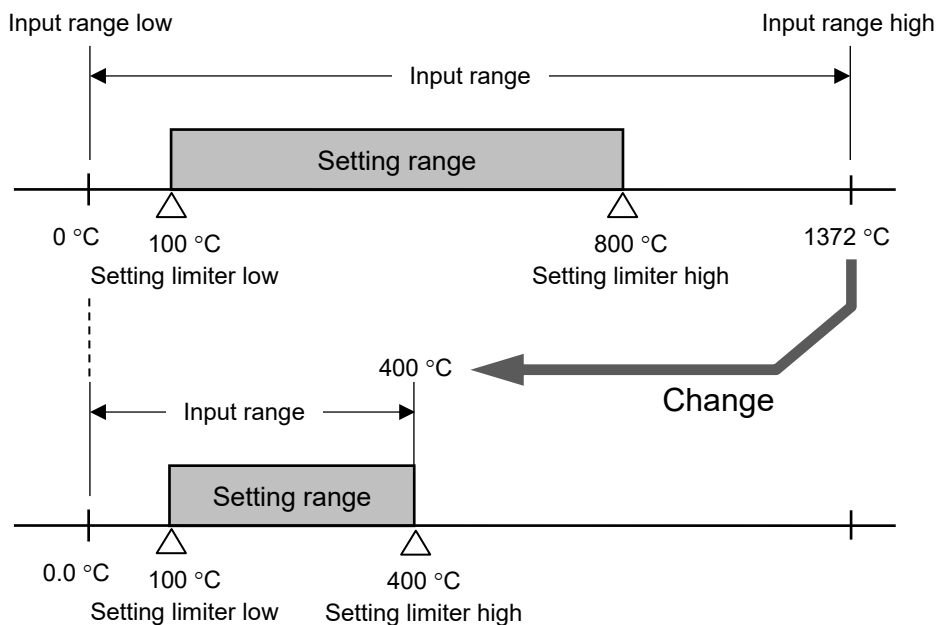
Example: The input range is from -200.0°C to $+1372.0^{\circ}\text{C}$, the Setting limiter high is 400.0°C , and the Setting limiter low is 0.0°C .



When the input range is changed, the setting limiter may be also changed according to the changed setting.

[Example 1]

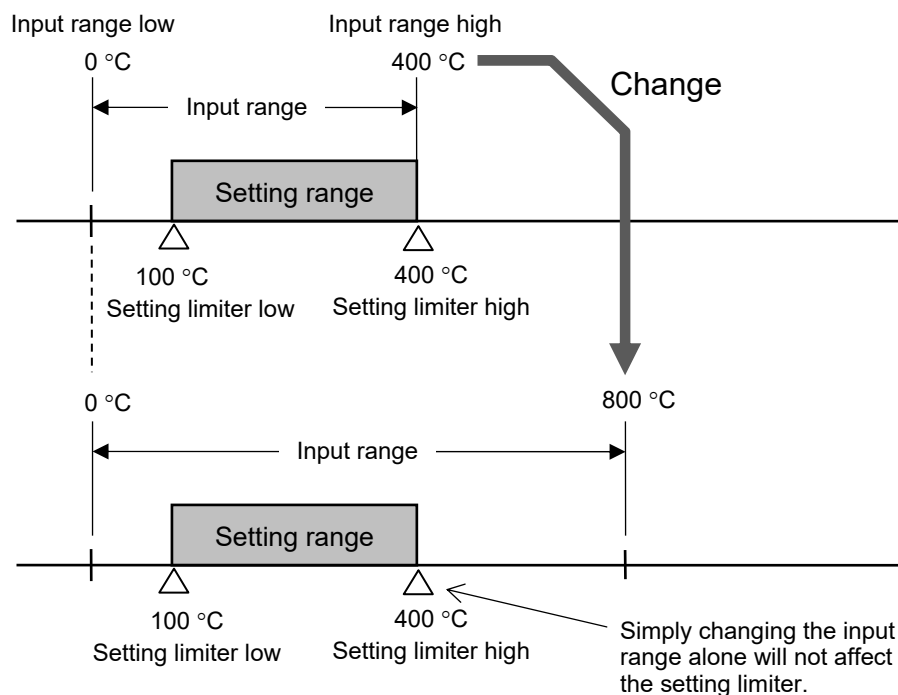
Input range is 0 to 1372°C , Setting limiter high is 800°C . Changing the Input range high to 400°C will change the Setting limiter high to 400°C accordingly.



[Example 2]

When the Input range is 0 to 400 °C and the Setting limiter high is 400 °C, changing the Input range high to 800 °C will not affect the setting limiter value. In this case the Setting limiter high remains 400 °C.

When a wider setting range of the Set value (SV) is required according to the extended input range, change the setting limiter value accordingly.



■ Parameter setting

● Setting limiter high

[Engineering Mode: Function block No. 71 (Fn71)]

Parameter symbol	Data range	Factory set value
SLH	Setting limiter low to Input range high Varies with the setting of the Decimal point position.	Input range high



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are automatically converted when the Setting limiter high is changed.

● Setting limiter low

[Engineering Mode: Function block No. 71 (Fn71)]

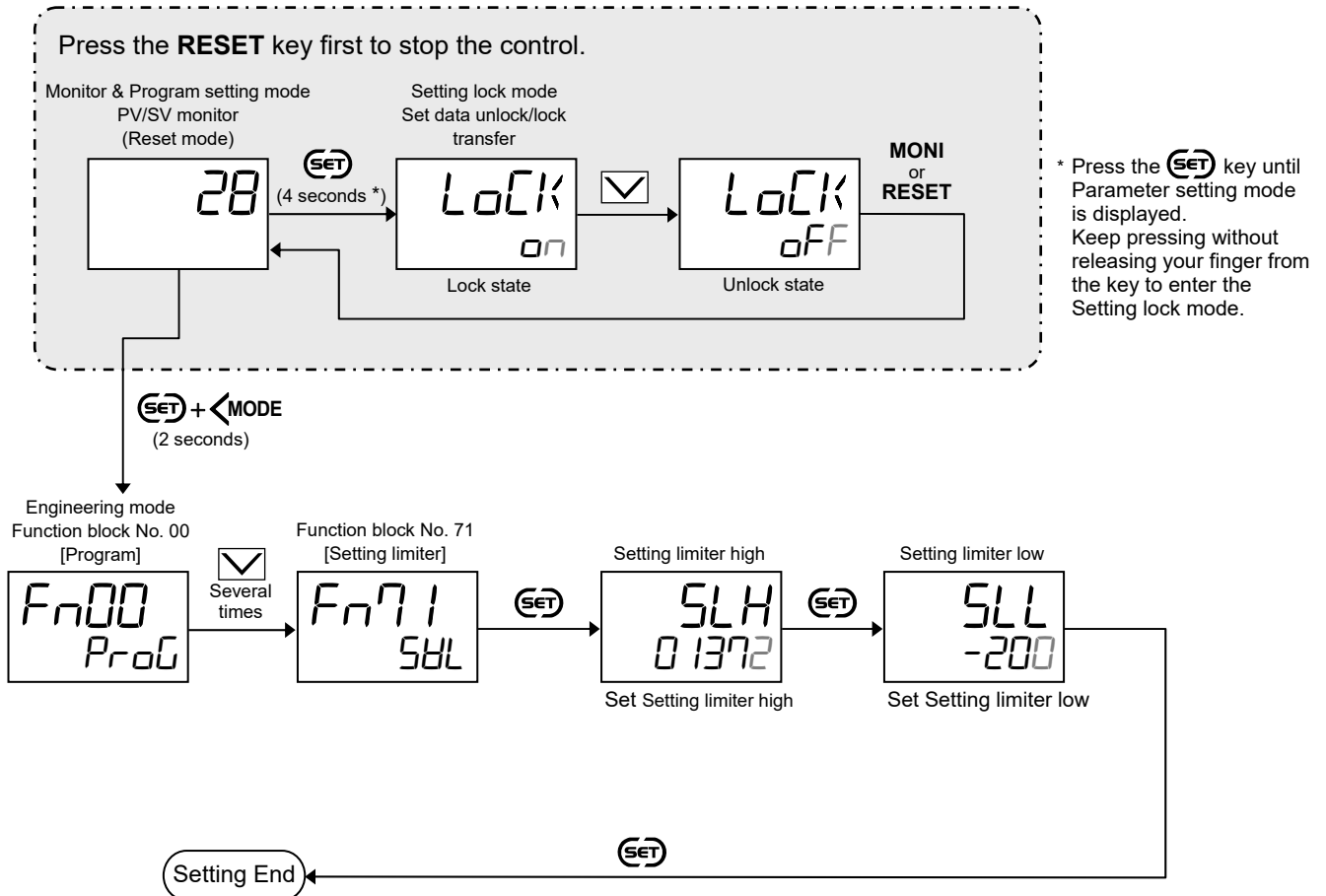
Parameter symbol	Data range	Factory set value
SLL	Input range low to Setting limiter high Varies with the setting of the Decimal point position.	Input range low



Refer to “15. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 15-1)” for the parameters that are automatically converted when the Setting limiter low is changed.

Setting procedure

To enter the Engineering mode



- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

14.2 Restricting Key Operation (Set Data Lock)

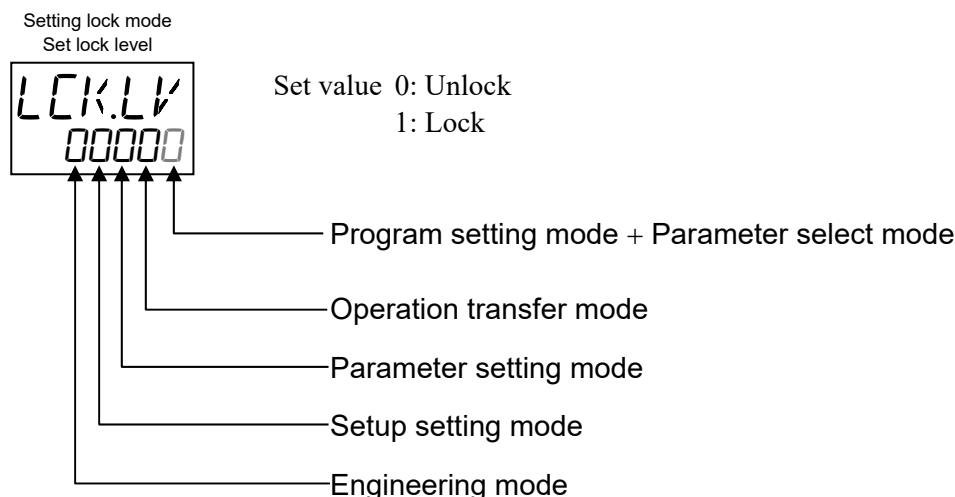
The Set data lock function limits access of unauthorized personnel to the parameters and prevents parameter change by mistake.

■ Description of function

The Set data lock function restricts changing values depending on the parameter mode.

● Set lock level

Select the parameter mode to lock.



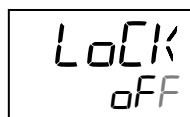
In the below modes and monitor displays, this function cannot be applied.

- Monitor mode of Monitor & Program setting mode
- PV/SV monitor screen of Monitor & Program setting mode
- Pattern transfer mode

● Set data unlock/lock transfer

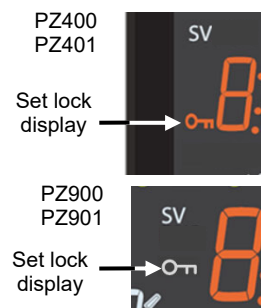
The parameter set with Set lock level can be locked/unlocked.

Setting lock mode
Set data unlock/lock transfer



Set value *oFF*: Unlock state
(Settings can be changed)
oN: Lock state
(Settings cannot be changed)

The Set lock indicator lights on in the lock state.





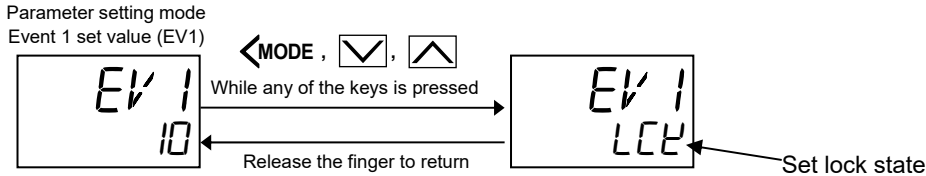
● When the set value was likely to be changed during the Set data lock state

A character will be shown on the Set value (SV) display unit to show the lock mode when any of

◀MODE, ▢ or ▴ key is pressed.

The “LCE” is displayed only while the relevant key is pressed. Releasing the finger from the key will return the display to the original.

Example: “Event 1 set value (EV1)” screen when the Parameter setting mode is locked.



Switching the Set data lock is available any time irrespective the operation mode.



Parameter switching is available during the Set data lock state for checking the data.

When the Program setting mode is locked, the setting screen in the Program setting mode will not be displayed.



Even during the Set data lock state, setting through the communication (optional function) is possible. Make sure to be in the Reset mode (RESET) before conducting parameter setting in the Engineering mode.

■ Parameter setting

● Set data unlock/lock transfer [Setting Lock Mode]

Parameter symbol	Data range	Factory set value
LOCK	0FF: Unlock state 0n: Lock state	0FF

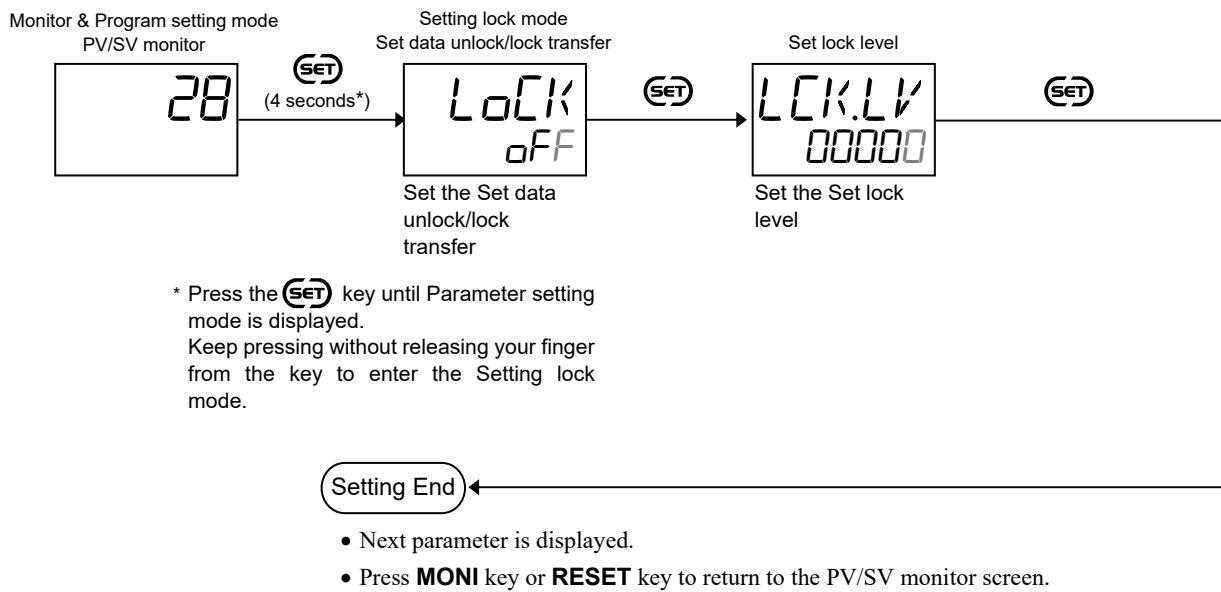
● Set lock level

[Setting Lock Mode]

Parameter symbol	Data range	Factory set value
LCK.LV	Set Lock/Unlock at each digit. 00000 ← SV display 0: Unlock 1: Lock Program setting mode + Parameter select mode Operation transfer mode Parameter setting mode Setup setting mode Engineering mode	00000

■ Setting procedure

Set data lock can be found in the Set data lock mode.





14.3 Initializing the Set Data

The set values can be initialized when all the set values need to be reset.

■ Description of function

When the pass code is entered on the “Initialize” screen in Function block No. 91 in the Engineering mode, all the set values are initialized and reset to the factory set values.



This action initializes and erases all the set values set so far. Record your setting separately if necessary. **7. PARAMETER LIST (P. 7-1)** has a field for user set values which can be used for recording.

■ Parameter setting

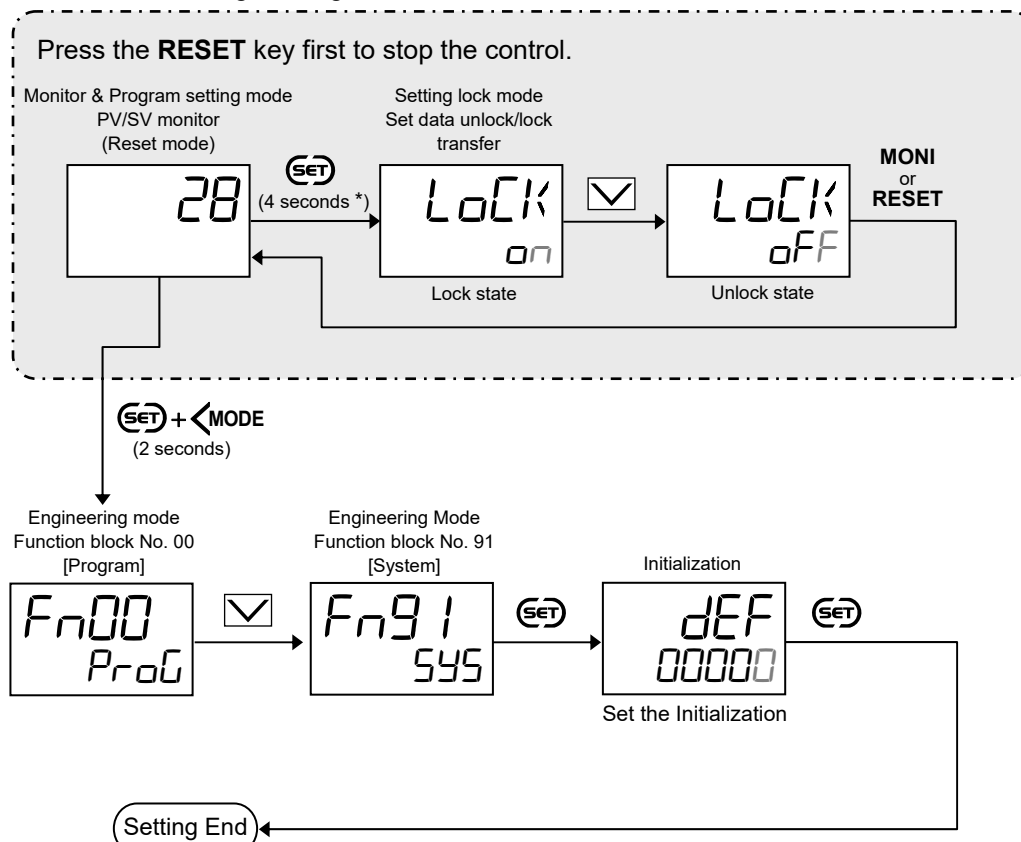
● Initialization

[Engineering Mode: Function block No. 91 (Fn9 I)]

Parameter symbol	Data range	Factory set value
DEF	1225: Start initialization Other values: Set values are maintained After the initialization, this instrument is restarted. This setting will automatically go back to zero.	0

Setting procedure

To enter the Engineering mode



* Press the **SET** key until Parameter setting mode is displayed. Keep pressing without releasing your finger from the key to enter the Setting lock mode.

- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].



MEMO



PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED



This chapter describes the parameters that are initialized/modified when setting is changed.

15.1 Parameters to Be Initialized.....	15-2
15.2 Parameters to Be Automatically Converted.....	15-13



15.1 Parameters to Be Initialized

Changing any of the following parameters will require initialization* of the related settings.

* Settings are reset to the factory preset values. Some parameters may not be set to a factory preset value (such as change of input type).



NOTE

Make sure all settings are recorded before changing the set values.



NOTE

Check all set values after having changed the settings.

			See page
• Time unit of the setting	Engineering Mode	Function block No. 21	15-3
• Input type	Engineering Mode	Function block No. 21	15-4
• Display unit	Engineering Mode	Function block No. 21	15-4
• Control action	Engineering Mode	Function block No. 51	15-6
• Open/Close output neutral zone	Setup Setting Mode	Setting group No. 55	15-6
• OUT1 function selection	Engineering Mode	Function block No. 30	15-7
• OUT2 function selection	Engineering Mode	Function block No. 30	15-7
• OUT3 function selection	Engineering Mode	Function block No. 30	15-7
• Universal output type selection	Engineering Mode	Function block No. 30	15-7
• Retransmission output 1 type	Engineering Mode	Function block No. 31	15-8
• Retransmission output 2 type	Engineering Mode	Function block No. 32	15-8
• Retransmission output 3 type	Engineering Mode	Function block No. 33	15-8
• Event 1 type	Engineering Mode	Function block No. 41	15-9
• Event 2 type	Engineering Mode	Function block No. 42	15-9
• Event 3 type	Engineering Mode	Function block No. 43	15-10
• Event 4 type	Engineering Mode	Function block No. 44	15-10
• CT1 type	Engineering Mode	Function block No. 45	15-11
• CT2 type	Engineering Mode	Function block No. 46	15-11
• Integral/Derivative time decimal point position	Engineering Mode	Function block No. 51	15-11
• Communication protocol	Engineering Mode	Function block No. 60	15-12
• Register type	Engineering Mode	Function block No. 62	15-12
• Initialization	Engineering Mode	Function block No. 91	15-12



15.1.1 When Time unit of the setting (FM.5L) is changed [Engineering Mode: Function block No. 00]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Monitor & Program Setting Mode		Segment time	FI ME	0:00
		Pattern end output time	END.FM	
		Time signal 1 start time	01.SFM	
		Time signal 1 end time	01.EFM	
		Time signal 2 start time	02.SFM	
		Time signal 2 end time	02.EFM	
		Time signal 3 start time	03.SFM	
		Time signal 3 end time	03.EFM	
		Time signal 4 start time	04.SFM	
		Time signal 4 end time	04.EFM	
Parameter Setting Mode	Parameter group No. 00	Segment time	FI ME	
	Parameter group No. 47	Time signal 1 start time	01.SFM	
		Time signal 1 end time	01.EFM	
		Time signal 2 start time	02.SFM	
		Time signal 2 end time	02.EFM	
		Time signal 3 start time	03.SFM	
		Time signal 3 end time	03.EFM	
		Time signal 4 start time	04.SFM	
		Time signal 4 end time	04.EFM	
	Parameter group No. 48	Pattern end output time	END.FM	



15.1.2 When Input type (I NP) and Display unit (UNIT) are changed [Engineering Mode: Function block No. 21]

The following parameters will be initialized.

Some parameters may have prerequisites for initialization. (Refer to the prerequisite and P. 15-6)

Mode		Items	Symbol	Initial value	Condition
Monitor & Program Setting Mode		Segment level	LEVEL	0	—
		Set value (SV) in Fixed set point control mode	SV	0	—
		Event 1 set value (EV1)	EV1	TC/RTD inputs: 10 V/I inputs 5 % of input span	1
		Event 1 set value (EV1) [high]			
		Event 2 set value (EV2)	EV2		1
		Event 2 set value (EV2) [high]			
		Event 3 set value (EV3)	EV3	TC/RTD inputs: 10 V/I inputs 5 % of input span	1
		Event 3 set value (EV3) [high]			
		Event 4 set value (EV4)	EV4		1
		Event 4 set value (EV4) [high]			
		Event 1 set value (EV1') [low]	EV1'	TC/RTD inputs: -10 V/I inputs: -5 % of input span	1
		Event 2 set value (EV2') [low]	EV2'		1
		Event 3 set value (EV3') [low]	EV3'		1
		Event 4 set value (EV4') [low]	EV4'		1
Parameter Setting Mode	Parameter group No. 00	Segment level	LEVEL	0	—
	Parameter group No. 01	Set value (SV) in Fixed set point control mode	SV	0	—
	Parameter group No. 40	Event 1 set value (EV1)	EV1	TC/RTD inputs: 10 V/I inputs 5 % of input span	1
		Event 1 set value (EV1) [high]			
		Event 2 set value (EV2)	EV2		1
		Event 2 set value (EV2) [high]			
		Event 3 set value (EV3)	EV3	TC/RTD inputs: 10 V/I inputs 5 % of input span	1
		Event 3 set value (EV3) [high]			
		Event 4 set value (EV4)	EV4		1
		Event 4 set value (EV4) [high]			
	Parameter group No. 51	Event 1 set value (EV1') [low]	EV1'	TC/RTD inputs: -10 V/I inputs: -5 % of input span	1
		Event 2 set value (EV2') [low]	EV2'		1
		Event 3 set value (EV3') [low]	EV3'		1
		Event 4 set value (EV4') [low]	EV4'		1
	Parameter group No. 53	Proportional band [heat-side]	P	TC/RTD inputs: 30 V/I inputs: 3.0	—
		Integral time [heat-side]	I	240	—
		Derivative time [heat-side]	d	60	—
		ON/OFF action differential gap (upper)	oHH	TC/RTD inputs: 1 V/I inputs: 0.1	—
		ON/OFF action differential gap (lower)	oHL		—
		Control response parameter	rPF	2	—
		Proactive intensity	PACF	2	—
		Manual reset	MR	0.0	—
	Parameter group No. 56	FF amount	FF	0.0	—
		Control loop break alarm (LBA) time	LbA	LBA function is specified: 480 LBA function is not specified: 0	—
		LBA deadband (LBD)	Lbd	0	—
		Proportional band [cool-side]	Pc	TC/RTD inputs: 30 V/I inputs: 3.0	—
	Parameter group No. 58	Integral time [cool-side]	Ic	240	—
		Derivative time [cool-side]	dc	60	—
		Overlap/Deadband	db	TC/RTD inputs: 0 V/I inputs: 0.0	—



Mode		Items	Symbol	Initial value	Condition
Parameter Setting Mode	Parameter group No. 59	Level PID setting 1	LEV1	Input range high	—
		Level PID setting 2	LEV2		—
		Level PID setting 3	LEV3		—
		Level PID setting 4	LEV4		—
		Level PID setting 5	LEV5		—
		Level PID setting 6	LEV6		—
		Level PID setting 7	LEV7		—
	Parameter group No. 80	Wait zone high	ZONEH	0	—
		Wait zone low	ZONEL	0	—
Setup Setting Mode	Setting group No. 21	PV bias	Pb	0	—
		PV digital filter	dF	0.0	—
		PV ratio	PR	1.000	—
		PV low input cut-off	PLC	0.00	—
	Setting group No. 53	AT bias	ATb	0	—
	Setting group No. 57	Determination point of external disturbance	EXdJ	−1	—
	Setting group No. 91	Peak hold monitor	PHLd		—
		Bottom hold monitor	bHLd		—
Engineering Mode	Function block No. 21	Decimal point position *	PGdP	0	—
		Input range high	PGSH	•TC/RTD inputs: Maximum value of input range •V/I inputs: 100	—
		Input range low	PGSL	•TC/RTD inputs: Minimum value of input range •V/I inputs: 0	—
		Input error determination point (high)	POV	Input range high + (5 % of input span)	—
		Input error determination point (low)	PUN	Input range low − (5 % of input span)	—
	Function block No. 31	Retransmission output 1 scale high	AHS1	•No retransmission output, Measured value (PV), Segment level, Set value (SV) in Fixed set point control mode, and SV monitor value: Input range high •Deviation: +Input span	2
		Retransmission output 1 scale low	ALS1	•No retransmission output, Measured value (PV), Segment level, Set value (SV) in Fixed set point control mode, and SV monitor value: Input range low •Deviation: −Input span	2
	Function block No. 32	Retransmission output 2 scale high	AHS2	Same as Retransmission output 1 scale high	2
		Retransmission output 2 scale low	ALS2	Same as Retransmission output 1 scale low	2
	Function block No. 33	Retransmission output 3 scale high	AHS3	Same as Retransmission output 1 scale high	2
		Retransmission output 3 scale low	ALS3	Same as Retransmission output 1 scale low	2
	Function block No. 41	Event 1 differential gap	EH1	TC/RTD inputs: 2 V/I inputs: 0.2 % of input span	1
	Function block No. 42	Event 2 differential gap	EH2		1
	Function block No. 43	Event 3 differential gap	EH3		1
	Function block No. 44	Event 4 differential gap	EH4		1

* When the Input type was changed.



Mode		Items	Symbol	Initial value	Condition
Engineering Mode	Function block No. 51	Level PID differential gap	LHS	TC/RTD inputs: 2 V/I inputs: 0.2	—
		Start determination point	PdR	3 % of input span	—
	Function block No. 71	Setting limiter high	SLH	Input range high	—
		Setting limiter low	SLL	Input range low	—

Condition

- 1: Event type is other than Manipulated output value.
- 2: Retransmission output is “No retransmission output,” “Measured value (PV),” “Segment level,” “Set value (SV) in Fixed set point control mode,” “SV monitor value,” OR “Deviation.”

15.1.3 Control action ($a5$) is changed [Engineering Mode: Function block No. 51]

The following parameters will be initialized.

Some parameters may have prerequisites for initialization. (See following for the prerequisites)

Mode		Items	Symbol	Initial value	Condition
Parameter Setting Mode	Parameter group No. 51	Control response parameter	rPF	2	1
	Parameter group No. 53				
Setup Setting Mode	Setting group No. 00	Control action at pattern end	$ENDP$	0	—
Engineering Mode	Function block No. 56	Undershoot suppression factor	US	Water cooling: 0.100 Air cooling: 0.250 Cooling linear: 1.000	—

Condition

- 1: When Control action is other than switching between Dir/Rev action and Cooling action.

15.1.4 When Open/Close output neutral zone (ydb) is changed [Setup Setting Mode: Setting group No. 55]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Setup Setting Mode	Setting group No. 55	Open/Close output differential gap	yHS	1.0



15.1.5 When OUT1 function selection ($\alpha 5L 1$) is changed [Engineering Mode: Function block No. 30]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Setup Setting Mode	Setting group No. 30	OUT1 proportional cycle time	$r 1$	Relay contact output: 20.0 Voltage pulse output, Transistor output: Note1

Note1: In case OUT1 function selection is “Control output [cool-side]” AND Control action is “Heat/Cool PID control [air cooling] or [water cooling]”: 20.0, Other cases: 2.0

15.1.6 When OUT2 function selection ($\alpha 5L 2$) is changed [Engineering Mode: Function block No. 30]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Setup Setting Mode	Setting group No. 30	OUT2 proportional cycle time	$r 2$	Relay contact output: 20.0 Voltage pulse output, Transistor output: Note2

Note2: In case OUT2 function selection is “Control output [cool-side]” AND Control action is “Heat/Cool PID control [air cooling] or [water cooling]”: 20.0, Other cases: 2.0

15.1.7 When OUT3 function selection ($\alpha 5L 3$) and Universal output type selection ($UNI \alpha$) are changed [Engineering Mode: Function block No. 30]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Setup Setting Mode	Setting group No. 30	OUT3 proportional cycle time	$r 3$	Voltage pulse output: Note3

Note3: In case OUT3 function selection is “Control output [cool-side]” AND Control action is “Heat/Cool PID control [air cooling] or [water cooling]”: 20.0, Other cases: 2.0



15.1.8 When Retransmission output 1 type (R_{01}) is changed [Engineering Mode: Function block No. 31]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Engineering Mode	Function block No. 31	Retransmission output 1 scale high	$RHS1$	• No retransmission output, Measured value (PV), Segment level, Set value (SV) in Fixed set point control mode, and SV monitor value: Input range high • Deviation: +Input span • Manipulated output value, and Current transformer (CT) input value: 100.0
		Retransmission output 1 scale low	$RLS1$	• No retransmission output, Measured value (PV), Segment level, Set value (SV) in Fixed set point control mode, and SV monitor value: Input range low • Deviation: -Input span • Manipulated output value, and Current transformer (CT) input value: 0.0

15.1.9 When Retransmission output 2 type (R_{02}) is changed [Engineering Mode: Function block No. 32]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Engineering Mode	Function block No. 32	Retransmission output 2 scale high	$RHS2$	Same as Retransmission output 1 scale high
		Retransmission output 2 scale low	$RLS2$	Same as Retransmission output 1 scale low

15.1.10 When Retransmission output 3 type (R_{03}) is changed [Engineering Mode: Function block No. 33]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Engineering Mode	Function block No. 33	Retransmission output 3 scale high	$RHS3$	Same as Retransmission output 1 scale high
		Retransmission output 3 scale low	$RLS3$	Same as Retransmission output 1 scale low



15.1.11 When Event 1 type (E51) is changed [Engineering Mode: Function block No. 41]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Monitor & Program Setting Mode		Event 1 set value (EV1) Event 1 set value (EV1) [high]	$EV1$	TC/RTD inputs: 10 V/I inputs: 5 % of input span MV: 50.0
		Event 1 set value (EV1') [low]	$EV1'$	TC/RTD inputs: -10 V/I inputs: -5 % of input span
Parameter Setting Mode	Parameter group No. 40	Event 1 set value (EV1) Event 1 set value (EV1) [high]	$EV1$	TC/RTD inputs: 10 V/I inputs: 5 % of input span MV: 50.0
		Event 1 set value (EV1') [low]	$EV1'$	TC/RTD inputs: -10 V/I inputs: -5 % of input span
Engineering Mode	Function block No. 41	Event 1 hold action	$EH01$	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital function selection of initial setting code: 0
		Event 1 differential gap	$EH1$	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 % of input span MV: 0.2
		Event 1 timer	$EV\Gamma1$	0.0

15.1.12 When Event 2 type (E52) is changed [Engineering Mode: Function block No. 42]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Monitor & Program Setting Mode		Event 2 set value (EV2) Event 2 set value (EV2) [high]	$EV2$	TC/RTD inputs: 10 V/I inputs: 5 % of input span MV: 50.0
		Event 2 set value (EV2') [low]	$EV2'$	TC/RTD inputs: -10 V/I inputs: -5 % of input span
Parameter Setting Mode	Parameter group No. 40	Event 2 set value (EV2) Event 2 set value (EV2) [high]	$EV2$	TC/RTD inputs: 10 V/I inputs: 5 % of input span MV: 50.0
		Event 2 set value (EV2') [low]	$EV2'$	TC/RTD inputs: -10 V/I inputs: -5 % of input span
Engineering Mode	Function block No. 42	Event 2 hold action	$EH02$	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital function selection of initial setting code: 0
		Event 2 differential gap	$EH2$	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 % of input span MV: 0.2
		Event 2 timer	$EV\Gamma2$	0.0



15.1.13 When Event 3 type (E53) is changed [Engineering Mode: Function block No. 43]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Monitor & Program Setting Mode		Event 3 set value (EV3) Event 3 set value (EV3) [high]	E ν 3	TC/RTD inputs: 10 V/I inputs: 5 % of input span MV: 50.0
		Event 3 set value (EV3') [low]	E ν 3'	TC/RTD inputs: -10 V/I inputs: -5 % of input span
Parameter Setting Mode	Parameter group No. 40	Event 3 set value (EV3) Event 3 set value (EV3) [high]	E ν 3	TC/RTD inputs: 10 V/I inputs: 5 % of input span MV: 50.0
		Event 3 set value (EV3') [low]	E ν 3'	TC/RTD inputs: -10 V/I inputs: -5 % of input span
Engineering Mode	Function block No. 43	Event 3 hold action	E $H_{\square}$ 3	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital function selection of initial setting code: 0
		Event 3 differential gap	E H 3	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 % of input span MV: 0.2
		Event 3 timer	E ν Γ 3	0.0

15.1.14 When Event 4 type (E54) is changed [Engineering Mode: Function block No. 44]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Monitor & Program Setting Mode		Event 4 set value (EV4) Event 4 set value (EV4) [high]	E ν 4	TC/RTD inputs: 10 V/I input: 5 % of input span MV: 50.0
		Event 4 set value (EV4') [low]	E ν 4'	TC/RTD inputs: -10 V/I input: -5 % of input span
Parameter Setting Mode	Parameter group No. 40	Event 4 set value (EV4) Event 4 set value (EV4) [high]	E ν 4	TC/RTD inputs: 10 V/I input: 5 % of input span MV: 50.0
		Event 4 set value (EV4') [low]	E ν 4'	TC/RTD inputs: -10 V/I input: -5 % of input span
Engineering Mode	Function block No. 43	Event 4 hold action	E $H_{\square}$ 4	If the Event type is specified by the digital output function selection of initial setting code when ordering, the factory set value of Event hold action differs depending on the Event type. If the Event type is not specified by the digital function selection of initial setting code: 0
		Event 4 differential gap	E H 4	Deviation, Process and SV: TC/RTD inputs: 2 V/I inputs: 0.2 % of input span MV: 0.2
		Event 4 timer	E ν Γ 4	0.0



15.1.15 When CT1 type (CTR1) is changed [Engineering Mode: Function block No. 45]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Engineering Mode	Function block No. 45	CT1 ratio	CTR1	CTL-6-P-N or CTL-6-P-Z: 800 CTL-12-S56-10L-N: 1000

15.1.16 When CT2 type (CTR2) is changed [Engineering Mode: Function block No. 46]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Engineering Mode	Function block No. 46	CT2 ratio	CTR2	CTL-6-P-N or CTL-6-P-Z: 800 CTL-12-S56-10L-N: 1000

15.1.17 When Integral/Derivative time decimal point position ($I d d P$) is changed [Engineering Mode: Function block No. 51]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Parameter Setting Mode	Parameter group No. 51	Integral time [heat-side]	I	240
	Parameter group No. 53	Derivative time [heat-side]	d	60
	Parameter group No. 56	Integral time [cool-side]	$I c$	240
	Parameter group No. 58	Derivative time [cool-side]	$d c$	60



15.1.18 When Communication protocol (*CMPS*) is changed [Engineering Mode: Function block No. 60]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Engineering Mode	Function block No. 60	Device address	<i>Addr</i>	RKC communication, PLC communication: 0 Modbus: 1
		Data bit configuration	<i>bit</i>	0
	Function block No. 62	Register type	<i>MPREG</i>	0

15.1.19 When Register type (*MPREG*) is changed [Engineering Mode: Function block No. 62]

The following parameters will be initialized.

Mode		Items	Symbol	Initial value
Engineering Mode	Function block No. 62	Register start number (High-order 4-bit)	<i>MPSRH</i>	0
		Register start number (Low-order 16-bit)	<i>MP SRL</i>	1000

15.1.20 When Initialization (*DEF*) is changed [Engineering Mode: Function block No. 91]

If Initialization is done by setting “1225” at [Engineering Mode: Function block No. 91], all the settings will be set to the factory set values.



NOTE

Make sure all settings are recorded before Initializing.



15.2 Parameters to Be Automatically Converted

If the data of the following parameter is changed, related set values are also automatically converted.



NOTE

Make sure all settings are recorded before changing the set values.



NOTE

Check all set values after having changed the settings.



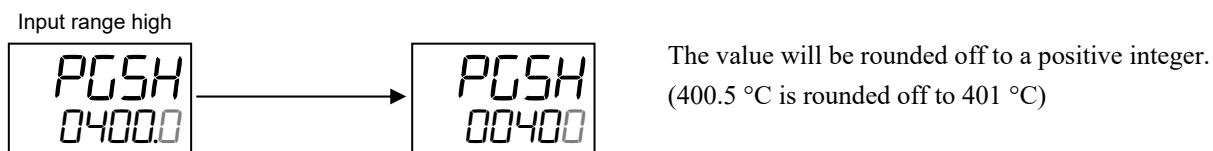
Refer to ■ **Example of automatic conversion (P. 15-14)** for details of automatic conversion.

			See page
• Input data type	Engineering Mode	Function block No. 21	15-15
• Decimal point position	Engineering Mode	Function block No. 21	15-16
• Input range high/low	Engineering Mode	Function block No. 21	15-16
• Control action	Engineering Mode	Function block No. 51	15-18
• Setting limiter high/low	Engineering Mode	Function block No. 71	15-18
• Output limiter high/low [heat-side]	Parameter Setting Mode	Parameter group No. 51	15-18
• Output limiter high/low [cool-side]	Parameter Setting Mode	Parameter group No. 56	15-18
• Level PID setting 1	Parameter Setting Mode	Parameter group No. 59	15-19
• Level PID setting 2	Parameter Setting Mode	Parameter group No. 59	15-19
• Level PID setting 3	Parameter Setting Mode	Parameter group No. 59	15-19
• Level PID setting 4	Parameter Setting Mode	Parameter group No. 59	15-20
• Level PID setting 5	Parameter Setting Mode	Parameter group No. 59	15-20
• Level PID setting 6	Parameter Setting Mode	Parameter group No. 59	15-20
• Level PID setting 7	Parameter Setting Mode	Parameter group No. 59	15-21

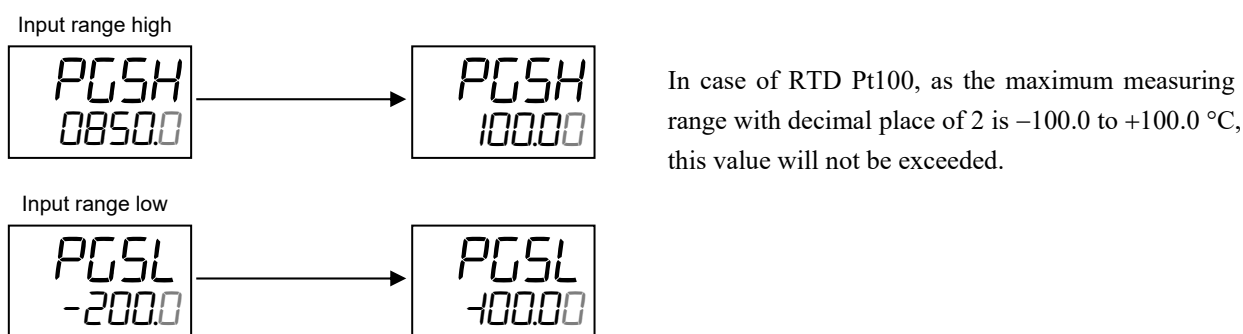
■ Example of automatic conversion

- If the position of a decimal point is changed, the decimal point is shifted according to the setting.

Example 1: When the Input range high is set to 400.0 °C, changing the decimal point position to 0 from 1 will change the Input range high to 400 °C.

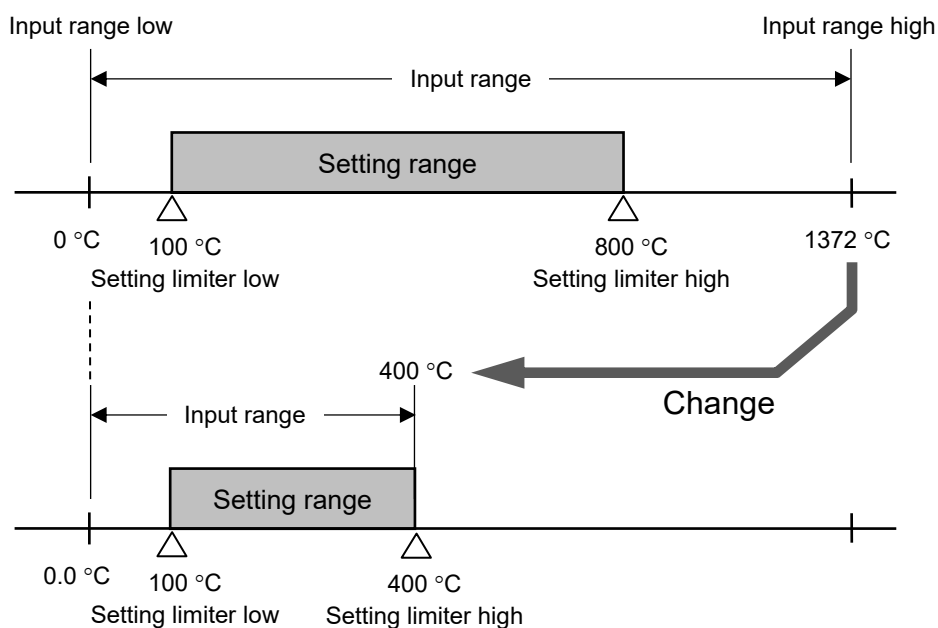


Example 2: When the input range is -200.0 to +850.0 °C (Input type: RTD Pt100), changing the decimal point position to 2 from 1 will change the input range to -100.0 to +100.0 °C.



- When the input range is changed, the setting limiter will be also changed according to the setting.

Example: Input range is 0 to 1372 °C, Setting limiter high is 800 °C. Changing the Input range high to 400 °C will change the Setting limiter high to 400 °C accordingly.





15.2.1 When Input data type (I Ndt) is changed [Engineering Mode: Function block No. 21]

The following parameters will be automatically converted.

Some parameters may have prerequisite for automatic conversion. (Refer to the prerequisite and P. 15-16)

Mode		Items	Symbol	Condition
Monitor & Program Setting Mode		Event 1 set value (EV1)	EV1	4
		Event 1 set value (EV1) [high]	EV1'	4
		Event 1 set value (EV1') [low]	EV1''	4
		Event 2 set value (EV2)	EV2	4
		Event 2 set value (EV2) [high]	EV2'	4
		Event 2 set value (EV2') [low]	EV2''	4
		Event 3 set value (EV3)	EV3	4
		Event 3 set value (EV3) [high]	EV3'	4
		Event 3 set value (EV3') [low]	EV3''	4
		Event 4 set value (EV4)	EV4	4
Parameter Setting Mode	Parameter group No. 40	Event 1 set value (EV1)	EV1	4
		Event 1 set value (EV1) [high]	EV1'	4
		Event 1 set value (EV1') [low]	EV1''	4
		Event 2 set value (EV2)	EV2	4
		Event 2 set value (EV2) [high]	EV2'	4
		Event 2 set value (EV2') [low]	EV2''	4
		Event 3 set value (EV3)	EV3	4
		Event 3 set value (EV3) [high]	EV3'	4
		Event 3 set value (EV3') [low]	EV3''	4
		Event 4 set value (EV4)	EV4	4
		Event 4 set value (EV4) [high]	EV4'	4
		Event 4 set value (EV4') [low]	EV4''	4
	Parameter group No. 51 Parameter group No. 53	Proportional band [heat-side]	P	1
		ON/OFF action differential gap (upper)	oHH	1
		ON/OFF action differential gap (lower)	oHL	1
		LBA deadband (LBD)	Lbd	—
	Parameter group No. 56 Parameter group No. 58	Proportional band [cool-side]	Pc	1
		Overlap/Deadband	db	1
Setup Setting Mode	Setting group No. 21	PV bias	Pb	—
	Setting group No. 53	AT bias	Atb	—
	Setting group No. 57	Determination point of external disturbance	ExdJ	—
	Setting group No. 91	Peak hold monitor	PHLd	—
		Bottom hold monitor	bHLd	—
Engineering Mode	Function block No. 21	Input error determination point (high)	PaV	—
		Input error determination point (low)	PUN	—
	Function block No. 31	Retransmission output 1 scale high	AHS1	2
		Retransmission output 1 scale low	ALS1	2
	Function block No. 32	Retransmission output 2 scale high	AHS2	2
		Retransmission output 2 scale low	ALS2	2
	Function block No. 33	Retransmission output 3 scale high	AHS3	2
		Retransmission output 3 scale low	ALS3	2
	Function block No. 41	Event 1 differential gap	EH1	3
	Function block No. 42	Event 2 differential gap	EH2	3



Mode		Items	Symbol	Condition
Engineering Mode	Function block No. 43	Event 3 differential gap	$EH3$	3
	Function block No. 44	Event 4 differential gap	$EH4$	3
	Function block No. 51	Level PID differential gap	LHS	—
		Start determination point	PdR	—

Condition

- 1: When Input type is Thermocouple/RTD input.
- 2: When Retransmission output is “Deviation.”
- 3: Event type is other than Manipulated output value.
- 4: Event type is a deviation action.

15.2.2 When Decimal point position ($PLdP$), Input range high ($PLSH$) and Input range low ($PLSL$) are changed [Engineering Mode: Function block No. 21]

The following parameters will be automatically converted.

Some parameters may have prerequisite for automatic conversion. (Refer to the prerequisite and P. 15-17)

Mode		Items	Symbol	Condition
Monitor & Program Setting Mode		Segment level	$LEVEL$	—
		Set value (SV) in Fixed set point control mode		—
		Event 1 set value (EV1)	$EV1$	2
		Event 1 set value (EV1) [high]		
		Event 1 set value (EV1') [low]	$EV1'$	2
		Event 2 set value (EV2)	$EV2$	2
		Event 2 set value (EV2) [high]		
		Event 2 set value (EV2') [low]	$EV2'$	2
		Event 3 set value (EV3)	$EV3$	2
		Event 3 set value (EV3) [high]		
		Event 3 set value (EV3') [low]	$EV3'$	2
		Event 4 set value (EV4)	$EV4$	2
		Event 4 set value (EV4) [high]		
		Event 4 set value (EV4') [low]	$EV4'$	2
Parameter Setting Mode	Parameter group No. 00	Segment level	$LEVEL$	—
	Parameter group No. 01	Set value (SV) in Fixed set point control mode	SV	—
	Parameter group No. 40	Event 1 set value (EV1)	$EV1$	2
		Event 1 set value (EV1) [high]		
		Event 1 set value (EV1') [low]	$EV1'$	2
		Event 2 set value (EV2)	$EV2$	2
		Event 2 set value (EV2) [high]		
		Event 2 set value (EV2') [low]	$EV2'$	2
		Event 3 set value (EV3)	$EV3$	2
		Event 3 set value (EV3) [high]		
		Event 3 set value (EV3') [low]	$EV3'$	2
		Event 4 set value (EV4)	$EV4$	2
		Event 4 set value (EV4) [high]		
		Event 4 set value (EV4') [low]	$EV4'$	2
	Parameter group No. 51 Parameter group No. 53	Proportional band [heat-side]	P	1
		ON/OFF action differential gap (upper)	σHH	1
		ON/OFF action differential gap (lower)	σHL	1
		LBA deadband (LBD)	Lbd	—



Mode		Items	Symbol	Condition
Parameter Setting Mode	Parameter group No. 56	Proportional band [cool-side]	P_c	1
	Parameter group No. 58	Overlap/Deadband	db	1
	Parameter group No. 59	Level PID setting 1	$LEV1$	—
		Level PID setting 2	$LEV2$	—
		Level PID setting 3	$LEV3$	—
		Level PID setting 4	$LEV4$	—
		Level PID setting 5	$LEV5$	—
		Level PID setting 6	$LEV6$	—
		Level PID setting 7	$LEV7$	—
	Parameter group No. 80	Wait zone high	$ZONEH$	—
		Wait zone low	$ZONEL$	—
Setup Setting mode	Setting group No. 21	PV bias	P_b	
	Setting group No. 53	AT bias	ATb	—
	Setting group No. 57	Determination point of external disturbance	$ExdJ$	—
	Setting group No. 91	Peak hold monitor	$PHLd$	—
		Bottom hold monitor	$bHLd$	—
Engineering Mode	Function block No. 21	Input range high *	$PGSH$	—
		Input range high *	$PGSL$	—
		Input error determination point (high)	POV	—
		Input error determination point (low)	PUN	—
	Function block No. 31	Retransmission output 1 scale high	$RHS1$	3
		Retransmission output 1 scale low	$RLS1$	3
	Function block No. 32	Retransmission output 2 scale high	$RHS2$	3
		Retransmission output 2 scale low	$RLS2$	3
	Function block No. 33	Retransmission output 3 scale high	$RHS3$	3
		Retransmission output 3 scale low	$RLS3$	3
	Function block No. 41	Event 1 differential gap	$EH1$	2
	Function block No. 42	Event 2 differential gap	$EH2$	2
	Function block No. 43	Event 3 differential gap	$EH3$	2
	Function block No. 44	Event 4 differential gap	$EH4$	2
	Function block No. 51	Start determination point	PdR	—
		Level PID differential gap	LHS	—
	Function block No. 71	Setting limiter high	SLH	—
		Setting limiter low	SLL	—

* Only if the Decimal point position has been changed.

Condition

- 1: When Input type is Thermocouple/RTD input.
- 2: Event type is other than Manipulated output value.
- 3: Retransmission output is “No retransmission output,” “Measured value (PV),” “Segment level,” “Set value (SV) in Fixed set point control mode,” “SV monitor value,” OR “Deviation.”



15.2.3 When Control action ($\alpha 5$) is changed [Engineering Mode: Function block No. 51]

The following parameters will be automatically converted.

There are conditions for the Automatic conversion. (See conditions below the table)

	Mode	Items	Symbol	Condition
Parameter Setting Mode	Parameter group No. 51 Parameter group No. 53	Integral time [heat-side]	I	1
Setup Setting Mode	Setting group No. 51	Manual manipulated output value	MMV	2
Engineering Mode	Function block No. 51	Manipulated output value at input error	PSM	2

Condition

1: When control mode is changed from “Position proportioning PID control” to “PID control or Heat/Cool PID control.”

2: When control mode is changed between “Heat/Cool PID control” and “PID control or Position proportioning PID control.”

15.2.4 When Setting limiter high/low [heat-side] (SLH , SLL) is changed [Engineering Mode: Function block No. 71]

	Mode	Items	Symbol
Monitor & Program Setting Mode		Segment level	$LEVEL$
		Set value (SV) in Fixed set point control mode	
Parameter Setting Mode	Parameter group No. 00	Segment level	$LEVEL$
	Parameter group No. 01	Set value (SV) in Fixed set point control mode	SV

15.2.5 When Output limiter high/low [heat-side] (αLH , αLL) is changed [Parameter Setting Mode: Parameter group No. 51]

The following parameters will be automatically converted.

	Mode	Items	Symbol
Setup Setting Mode	Setting group No. 51	Manual manipulated output value	MMV

15.2.6 When Output limiter high/low [cool-side] (αLH_c , αLL_c) is changed [Parameter Setting Mode: Parameter group No. 56]

The following parameters will be automatically converted.

If the control action is set to “Heat/Cool PID control,” the data of the following parameter will be automatically converted.

	Mode	Items	Symbol
Setup Setting Mode	Setting group No. 51	Manual manipulated output value	MMV



15.2.7 When Level PID setting 1 (LEV 1) is changed [Parameter Setting Mode: Parameter group No. 59]

The following parameters will be automatically converted.

Mode		Items	Symbol
Parameter Setting Mode	Parameter group No. 59	Level PID setting 2	LEV2
		Level PID setting 3	LEV3
		Level PID setting 4	LEV4
		Level PID setting 5	LEV5
		Level PID setting 6	LEV6
		Level PID setting 7	LEV7

15.2.8 When Level PID setting 2 (LEV2) is changed [Parameter Setting Mode: Parameter group No. 59]

The following parameters will be automatically converted.

Mode		Items	Symbol
Parameter Setting Mode	Parameter group No. 59	Level PID setting 1	LEV1
		Level PID setting 3	LEV3
		Level PID setting 4	LEV4
		Level PID setting 5	LEV5
		Level PID setting 6	LEV6
		Level PID setting 7	LEV7

15.2.9 When Level PID setting 3 (LEV3) is changed [Parameter Setting Mode: Parameter group No. 59]

The following parameters will be automatically converted.

Mode		Items	Symbol
Parameter Setting Mode	Parameter group No. 59	Level PID setting 1	LEV1
		Level PID setting 2	LEV2
		Level PID setting 4	LEV4
		Level PID setting 5	LEV5
		Level PID setting 6	LEV6
		Level PID setting 7	LEV7



15.2.10 When Level PID setting 4 (LEV4) is changed [Parameter Setting Mode: Parameter group No. 59]

The following parameters will be automatically converted.

Mode		Items	Symbol
Parameter Setting Mode	Parameter group No. 59	Level PID setting 1	LEV1
		Level PID setting 2	LEV2
		Level PID setting 3	LEV3
		Level PID setting 5	LEV5
		Level PID setting 6	LEV6
		Level PID setting 7	LEV7

15.2.11 When Level PID setting 5 (LEV5) is changed [Parameter Setting Mode: Parameter group No. 59]

The following parameters will be automatically converted.

Mode		Items	Symbol
Parameter Setting Mode	Parameter group No. 59	Level PID setting 1	LEV1
		Level PID setting 2	LEV2
		Level PID setting 3	LEV3
		Level PID setting 4	LEV4
		Level PID setting 6	LEV6
		Level PID setting 7	LEV7

15.2.12 When Level PID setting 6 (LEV6) is changed [Parameter Setting Mode: Parameter group No. 59]

The following parameters will be automatically converted.

Mode		Items	Symbol
Parameter Setting Mode	Parameter group No. 59	Level PID setting 1	LEV1
		Level PID setting 2	LEV2
		Level PID setting 3	LEV3
		Level PID setting 4	LEV4
		Level PID setting 5	LEV5
		Level PID setting 7	LEV7



15.2.13 When Level PID setting 7 (LEV7) is changed [Parameter Setting Mode: Parameter group No. 59]

The following parameters will be automatically converted.

Mode		Items	Symbol
Parameter Setting Mode	Parameter group No. 59	Level PID setting 1	LEV1
		Level PID setting 2	LEV2
		Level PID setting 3	LEV3
		Level PID setting 4	LEV4
		Level PID setting 5	LEV5
		Level PID setting 6	LEV6



MEMO



TROUBLE SHOOTING



This chapter describes error displays and countermeasures for errors.

16.1 Error Displays	16-2
16.2 Solutions for Problems	16-5
16.3 Verifying Instrument Information	16-19

16.1 Error Displays

This Section describes error display when the measured value (PV) exceeds the display range limit and the self-diagnostic error.

■ Input error displays

The table below shows displays, description, actions and solutions when the measured value (PV) exceeds the display range.

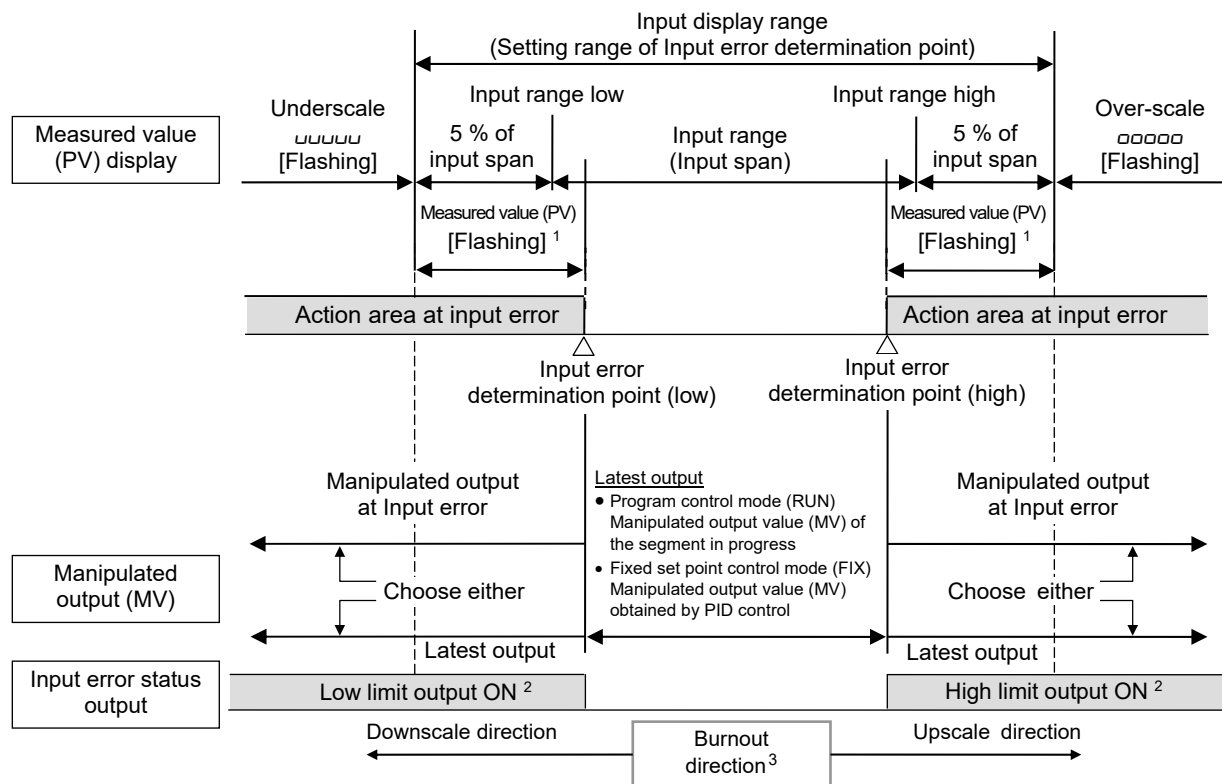


NOTE

Before replacing the sensor, always turn OFF the power of the PZ400/900/401/901 or switch the mode to RESET with Operation mode.

Display	Description	Action (Output)	Solution
Measured value (PV) [Flashing]	Measured value (PV) exceeded the input error determination point or the input range. Display does not flash when “Non-flashing display” is set.	- Action at input error: Output depending on the action at Input error (high/low limit) - Event output: Output depending on the event action at input error	Check input type, input range, sensor connection and sensor break.
000000 [Flashing]	Over-scale Measured value (PV) exceeded the high limit of display range.		
UUUUUU [Flashing]	Underscale Measured value (PV) exceeded the low limit of display range.		

● Input error determination point is set within the input range



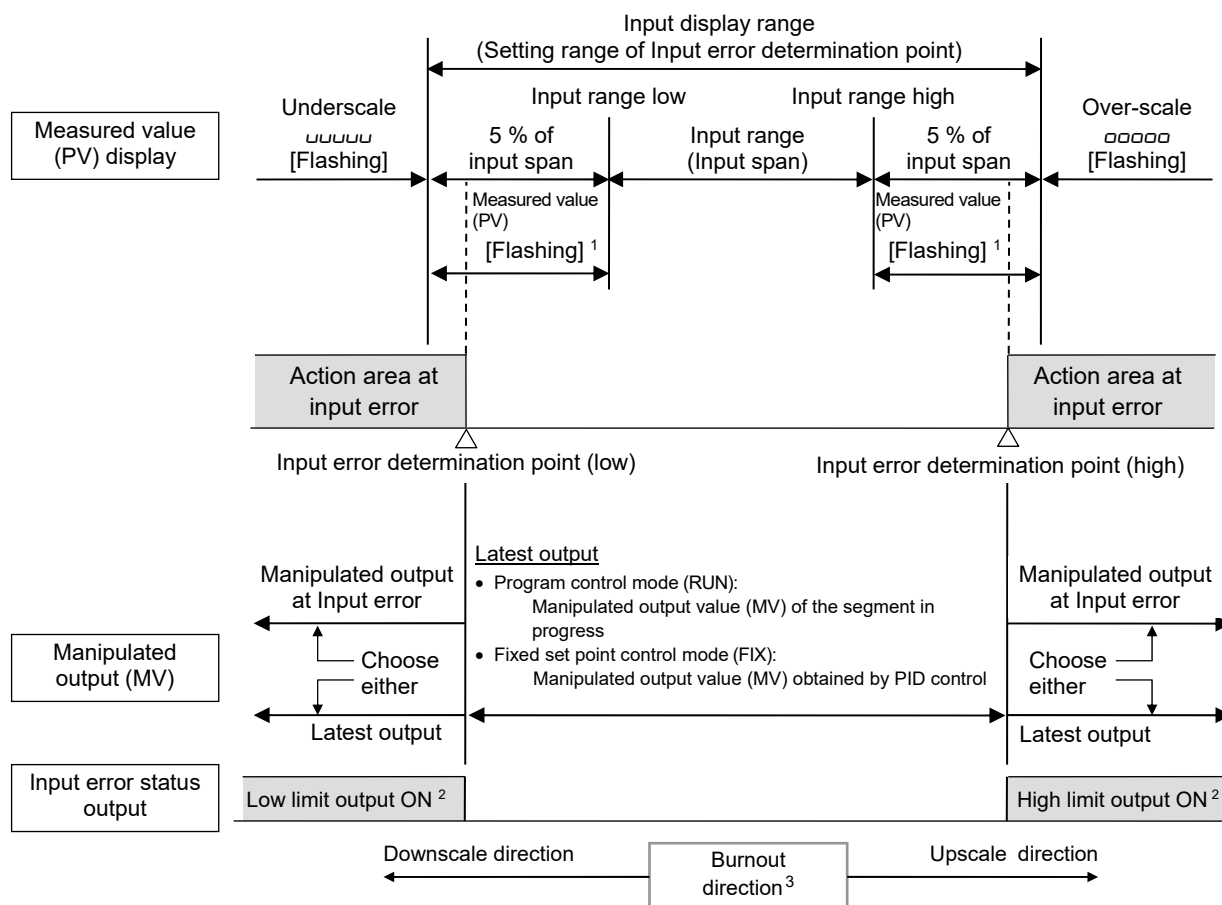
¹ Flashing can be suppressed by setting “PV flashing display at input error” (Function block No. 10 in the Engineering mode).

² For Input error status output, refer to ● **Details of OUT1 to 3 as well as DO1 to 4 logic calculation selection (P. 9-4)**.

³ Setting Burnout direction is valid for thermocouple input and low voltage input (0 to 10 mV DC, 0 to 100 mV DC). Actions of other input types are fixed as follows.

RTD input: Upscale
High voltage/Current inputs: Downscale (Indicates value near 0)

● Input error determination point is set outside the input range



¹ Flashing can be suppressed by setting "PV flashing display at input error" (Function block No. 10 in the Engineering mode).

² For Input error status output, refer to ● **Details of OUT1 to 3 as well as DO1 to 4 logic calculation selection (P. 9-4)**.

³ Setting Burnout direction is valid for thermocouple input and low voltage input (0 to 10 mV DC, 0 to 100 mV DC). Actions of other input types are fixed as follows.

RTD input: Upscale

High voltage/Current inputs: Downscale (Indicates value near 0)



■ Self-diagnostic error

If an error is detected by the Self-diagnostic function, the PV display shows “Err,” and the SV display shows the error code. If two or more errors occur simultaneously, the total summation of these error codes are displayed.

Error code	Description	Action	Solution
1	Adjustment data error • Adjusted data range is abnormal.	Display: Error code display Output: All the outputs are OFF Communication: Relevant error code to be sent	Turn off the power once. If the PZ400/900/401/901 is restored to normal after the power is turned on again, then probable cause may be external noise source affecting the control system. Check for the external noise source.
2	Data back-up error • Back-up action is abnormal. • Data write failure		
4	A/D conversion error • Error in A/D conversion circuit is detected. Temperature compensation error • Out of the temperature measurement range	< Example of error display > 	If an error is repeated after the power is turned on again, the PZ400/900/401/901 may need to be repaired or replaced. Please contact RKC sales office or the agent.

If any of the following errors occur, all actions of the PZ400/900/401/901 are stopped.
In this case the error code is not displayed.

Error code	Description	Action	Solution
No error display	Watchdog timer error • Part of the internal program stops running.	Display: All displays are OFF Output: All outputs are OFF Communication: Stopped	Turn off the power once. If an error is repeated after the power is turned on again, the PZ400/900/401/901 may need to be repaired or replaced. Please contact RKC sales office or the agent.
	Power supply voltage is abnormal (power supply voltage monitoring) • Decrease of power supply voltage	Display: All displays are OFF Output: All outputs are OFF Communication: Stopped	
	Display units error	Display: All displays are OFF Output: All outputs are OFF Communication: Sends error code 64	

16.2 Solutions for Problems

This section explains possible causes and solutions of the errors. For any inquiries or to confirm the specifications of the product, please contact RKC sales office or the agent.

If the instrument needs to be replaced, always strictly observe the warnings below.

WARNING

- To prevent electric shock or instrument failure, always turn off the system power before replacing the instrument.
- To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.
- To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.
- To prevent electric shock or instrument failure, do not touch the inside of the instrument.
- All wiring must be performed by authorized personnel with electrical experience in this type of work.

CAUTION

All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action. The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.



■ Display related errors

Problem	Possible cause	Solution
No display appears	The internal assembly is not inserted into the case correctly.	Insert the internal assembly into the case correctly.
	Power supply terminal connection is not correct.	Connect power supply correctly by referring to 3.3 Wiring of Each Terminal (P. 3-8) .
	Power supply terminal contact failure.	Retighten the terminal screws.
	Supply voltage is not correct.	Apply proper power supply voltage by referring to ■ General specifications (P. 7-21) .
Display is unstable	Noise source is present near the instrument.	Separate the noise source from the instrument. Set the appropriate value at Digital filter according to the input response.
	The terminal block of the instrument (with thermocouple input) is directly exposed to the air flow from an air conditioner.	Do not directly expose the terminal block to the air from the air conditioner.
Measured value (PV) display differs from the actual value	Wrong sensor is used.	Check the instrument specification and use a proper sensor.
	Input type setting is wrong.	Make proper setting by referring to 8.1 Changing Input (P. 8-2) .
	Connection between the sensor (thermocouple) and the instrument is made with a cable other than compensating wire.	Be sure to use a compensating wire.
	For RTD input, leadwire resistance in three wires between the sensor and the instrument is different from one another.	Use a leadwire with the same resistance among three leadwires.
	PV bias is set.	Set PV bias to "0" by referring to 8.3 Correcting Input (P. 8-21) . However, this is limited only to when the PV bias setting can be changed to "0".
	PV ratio is set.	Change the PV ratio setting by referring to 8.3 Correcting Input (P. 8-21) . However, this is limited only to when the PV ratio setting can be changed.



How to check the input

- When the input is configured as Thermocouple input:

Short the input terminals*, and if a temperature around the ambient temperature of the input terminals is displayed, the controller is working properly.

* PZ400/900/401/901: Measured input 1 terminals 11-12

- When the input is configured as RTD input:

Insert a 100 Ω resistor across Input terminals A-B.¹ Short terminals between B-B.²

If temperature around 0 °C is displayed, the instrument is working fine.

¹ PZ400/900/401/901: Measured input 1 terminals 10-11

² PZ400/900/401/901: Measured input 1 terminals 11-12

- When the input is configured as Voltage/Current input:

Input* a certain voltage or current from a voltage/current generator to the controller. If the controller shows the equivalent input value, the input setting and function of the controller is working correctly.

* PZ400/900/401/901: Measured input 1 terminals 11-12

**■ Control related errors**

Problem	Possible cause	Solution
Control is abnormal	Supply voltage is not correct.	Apply proper power supply voltage by referring to ■ General specifications (P. 7-21) .
	Disconnection of sensor or sensor wire.	Turn off the power or switch the operation mode to the Reset mode (RESET) by pressing the RESET key to repair or replace the sensor.
	The sensor is not wired correctly.	Conduct correct wiring of sensor by referring to 3.3 Wiring of Each Terminal (P. 3-8) .
	Wrong sensor is used.	Check the instrument specification and use a proper sensor.
	Input type setting is wrong.	Make proper setting by referring to 8.1 Changing Input (P. 8-2) .
	Sensor insertion depth is insufficient.	Check the sensor insertion. If insertion is loose, firmly insert the sensor.
	Sensor insertion position is wrong.	Insert the sensor at the specified location.
	Input signal wires are not separated from instrument power and/or load wires.	Separate input signal wires from instrument power and load wires
	Noise source is present near the instrument.	Separate the noise source from the instrument.
Startup tuning (ST) cannot be activated	Inappropriate PID constants.	Set appropriate PID constants.
	Startup tuning (ST) mode is "OFF (ST unused)." (Factory set value: OFF)	Refer to 12.3 Setting PID Values Automatically (Startup tuning) (P. 12-17) .
	Requirements for performing the Startup tuning (ST) are not satisfied.	Satisfy the requirements for performing the Startup tuning (ST) by referring to 12.3 Setting PID Values Automatically (Startup tuning) (P. 12-17) .
The Startup tuning (ST) is going to be activated in the Ramp segment of the program control.		Set the Segment time of the Ramp segment to 0.00 and then execute the Startup tuning (ST). However, this is limited to when the Segment time is allowed to set to 0.00.
Autotuning (AT) cannot be activated	Requirements for performing the Autotuning (AT) are not satisfied.	Satisfy the requirements for performing the Autotuning (AT) by referring to 12.2 Setting PID Values Automatically (Autotuning) (P. 12-7) .
Autotuning (AT) aborted	Requirements for aborting the Autotuning (AT) are established.	Identify causes for Autotuning (AT) abort by referring to 12.2 Setting PID Values Automatically (Autotuning) (P. 12-7) and then remove them. Then, execute Autotuning (AT) again.
Optimum PID values cannot be obtained by Autotuning (AT)	Autotuning (AT) does not match the characteristics of the controlled object.	Set PID constants manually by referring to 12.4 Setting PID Values Manually (P. 12-23) .

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Problem	Possible cause	Solution
Autotuning (AT) cannot be finished normally	Temperature change of the process is too slow (1 °C or less per minute for temperature rise and fall).	Set PID constants manually by referring to 12.4 Setting PID Values Manually (P. 12-23) .
	Autotuning (AT) was executed around the ambient temperature or close to the maximum temperature achieved by the load.	
Overall level autotuning (AT) cannot be activated	Requirements for performing the Overall level autotuning (AT) are not satisfied.	Satisfy the requirements for performing the Overall level autotuning (AT) by referring to 12.2 Setting PID Values Automatically (Autotuning) (P. 12-7) .
Overall level autotuning (AT) aborted	Requirements for aborting the Overall level autotuning (AT) are established.	Identify causes for Overall level autotuning (AT) abort by referring to 12.2 Setting PID Values Automatically (Autotuning) (P. 12-7) and then remove them. Then, execute Overall level autotuning (AT) again.
Optimum PID values cannot be obtained by Overall level autotuning (AT)	Overall level autotuning (AT) does not match the characteristics of the controlled object.	Set PID constants manually by referring to 12.4 Setting PID Values Manually (P. 12-23) .
Overall level autotuning (AT) cannot be finished normally	Temperature change of the process is too slow (1 °C or less per minute for temperature rise and fall).	Set PID constants manually by referring to 12.4 Setting PID Values Manually (P. 12-23) .
	Overall level autotuning (AT) was executed around the ambient temperature or close to the maximum temperature achieved by the load.	
Measured value (PV) overshoots or undershoots	Proportional band is narrow. Proportional (P) constant is small.	Increase Proportional (P) value within the acceptable limit of response delay.
	Integral time is short. Integral (I) constant is small.	Increase Integral (I) value within the acceptable limit of response delay.
	Derivative time is short. Derivative (D) constant is small.	Increase Derivative (D) value within the acceptable limit of process stability.
	The instrument is configured for ON/OFF control.	Change the control mode to Proportional control or PID control.
In the Program control mode, when a segment in program pattern changes from ramp to soak, the overshoot/undershoot of the measured value (PV) is too large.	The cause varies from controlled object	Suppress the overshoot or undershoot in a way appropriate for the controlled object by referring to 12.12 Suppressing Overshoot (P. 12-71) .

Continued on the next page.



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Problem	Possible cause	Solution
In the program control, the measured value (PV) does not follow (goes up/down along) the program pattern.	Output change rate limiter is set.	Set the Output change rate limiter to “0.0: OFF” by referring to 9.7 Suppressing Sudden Change in Output (Output Change Rate Limiter) (P. 9-30) . However, this is limited only to when the Output change rate limiter setting can be changed.
No stepwise output change		
Output does not rise over (or goes below) a certain value	Output limiter is set.	Change the Output limiter setting by referring to 9.6 Limiting Output (P. 9-26) . However, this is limited only to when the Output limiter setting can be changed.



■ Operation related errors

Problem	Possible cause	Solution
No setting change can be made by key operation.	Set data is locked.	Release the Set data lock by referring to 14.2 Restricting Key Operation (Set Data Lock) (P. 14-5) .
A set value (SV) above (or below) a certain limit cannot be set.	Setting limiter is set.	Change the Setting limiter setting by referring to 14.1 Limiting the Setting Range of Set Value (SV) (P. 14-2) . However, this is limited only to when the Setting limiter setting can be changed.
For Voltage/Current input types, the displayed value for the input voltage or the input current is inverted.	Invert setting is done.	Set the Inverting input to "0: Unused" by referring to 8.5 Inverting the Input (P. 8-24) .
Operation mode cannot be switched via key operation.	Digital input (DI) terminals for Reset mode (RESET) setting are closed.	Refer to 8.2 Switching Functions Using Digital Inputs (DI) (P. 8-11) , and open Digital input (DI) terminals for Reset mode (RESET) setting.
Program control cannot be started via key operation.		
Hold state cannot be released via key operation.	Digital input (DI) terminals for Hold function are setting closed.	Refer to 8.2 Switching Functions Using Digital Inputs (DI) (P. 8-11) , and open Digital input (DI) terminals for Hold function setting.
	The HOLD key may be being pressed in the Fixed set point control mode (FIX) or the Manual control mode (MAN).	Return to the Program control mode (RUN) once, then press the HOLD key for more than 2 seconds.
Step action cannot be executed even if STEP key is pressed.	Program is in the Hold state.	Release Hold state via Digital input (DI) terminals by referring to 11.3 Pausing a Program (Hold) (P. 11-20) , and then press the STEP key for 2 seconds or more.
Step function cannot be performed via Digital input (DI).	Digital input (DI) terminals for Hold function are setting closed.	Refer to 8.2 Switching Functions Using Digital Inputs (DI) (P. 8-11) , and open Digital input (DI) terminals for Hold function setting.
Program operation cannot be started via Digital input (DI).	Digital input (DI) terminals for Reset mode (RESET) setting are closed.	Refer to 8.2 Switching Functions Using Digital Inputs (DI) (P. 8-11) , and open Digital input (DI) terminals for Reset mode (RESET) setting.

**■ Event related errors**

Problem	Possible cause	Solution
Event function is abnormal	Event function is different from the specification.	Change the Event action type by referring to 10.1 Using Event Function (P. 10-2) after the instrument specification is confirmed.
	Event output relay contact action Energized/De-energized is reversed.	Check the setting details by referring to 9.5 Changing Energizing/De-energizing Output (P. 9-24) .
	Event hold action is ON.	Refer to 10.1 Using Event Function (P. 10-2) , and set a suitable Event hold action.
	Setting of Event differential gap is not appropriate.	Set the appropriate Event differential gap by referring to 10.1 Using Event Function (P. 10-2) .
	Event timer function is set and used.	Refer to 10.1 Using Event Function (P. 10-2) , and set a suitable Event timer.
No output of the Event function is turned on.	Event is not assigned to the output.	Check the contents of Output assignment by referring to 9.1 Changing Output Assignment (P. 9-2) .
	The control mode is the Reset mode (RESET).	Refer to 9.9 Changing the Output Action in Reset Mode (P. 9-36) . Select “Logic calculation output: Action continues.” Then, event output can continue to be output even in the Reset mode.
	The controller is under Pattern end state.	Refer to 11.8 Changing the Action When Program Control Ends (Pattern End) (P. 11-31) . Select “Logic calculation output: Continue action.” Then, Event output can continue to be output even in the Pattern end state.

**■ Heater break alarm (HBA) related errors**

Problem	Possible cause	Solution
No heater break can be detected	Setting of Heater break alarm (HBA) is not appropriate.	Set the appropriate Heater break alarm value by referring to 10.2 Using Heater Break Alarm (HBA) (P. 10-22) .
	CT is not connected.	Connect the CT by referring to 3.3 Wiring of Each Terminal (P. 3-8) .
CT input value is abnormal.	Proper CT is not used.	Check the equipment specifications, and use the CT conforming to the specifications.
	The heater is broken.	Check the heater.
	CT wiring improperly.	Conduct CT wiring correctly by referring to 3.3 Wiring of Each Terminal (P. 3-8) .
	Input terminal contact defect.	Retighten the terminal screws.
No output of the Heater break alarm (HBA) is turned on.	HBA is not assigned to the output.	Check the contents of Output assignment by referring to 9.1 Changing Output Assignment (P. 9-2) .
	The control mode is the Reset mode (RESET).	Refer to 9.9 Changing the Output Action in Reset Mode (P.9-36) . Select “Logic calculation output: Action continues.” Then, HBA output can continue to be output even in the Reset mode.
	The controller is under Pattern end state.	Refer to 11.8 Changing the Action When Program Control Ends (Pattern End) (P.11-31) . Select “Logic calculation output: Continue action.” Then, HBA output can continue to be output even in the Pattern end state.



■ Control loop break alarm (LBA) related errors

Problem	Possible cause	Solution
Control loop break alarm (LBA) is not generated under the alarm condition.	LBA time setting is not appropriate.	Set an appropriate value by referring to 10.3 Using Control Loop Break Alarm (LBA) (P. 10-34) .
	LBA deadband (LBD) setting is not appropriate.	
	Autotuning (AT) is in execution.	Wait for Autotuning (AT) to finish or abort Autotuning (AT).
	The control mode is the Reset mode (RESET).	Refer to 9.9 Changing the Output Action in Reset Mode (P.9-36) . Select “Logic calculation output: Action continues.” Then, LBA output can continue to be output even in the Reset mode.
	The Feedback resistor (FBR) is disconnected on the Position proportioning PID controller (with FBR input).	Turn off the power or switch the mode to the Reset mode (RESET) before attempting the repair or replacement of the disconnected Feedback resistor (FBR).
	The position proportioning PID controller is specified to have “no FBR input” at the time of ordering.	Try another type of alarm.
	LBA is not assigned to the output.	Check the contents of Output assignment by referring to 9.1 Changing Output Assignment (P. 9-2) .
	LBA does not match the characteristics of the process (controlled object).	Try another type of alarm.
	The controller is under Pattern end state.	Refer to 11.8 Changing the Action When Program Control Ends (Pattern End) (P.11-31) . Select “Logic calculation output: Continue action.” Then, LBA output can continue to be output even in the Pattern end state.
Control loop break alarm (LBA) is generated under the no alarm condition.	LBA time setting is not appropriate.	Set an appropriate value by referring to 10.3 Using Control Loop Break Alarm (LBA) (P. 10-34) .
	LBA deadband (LBD) setting is not appropriate.	
	LBA does not match the characteristics of the process (controlled object).	Try another type of alarm.



■ Ramp/Soak control

Problem	Possible cause	Solution
The program does not start from Measured value (PV).	The SV selection at program start is set to "0: zero start (factory set value)."	Change the SV selection at program start by referring to 11.2 Changing the Level When Program Control Starts (P. 11-16) .
When program control is started, one or more segments are skipped.	Segment time set value of the skipped segment(s) is set to "0 (zero)."	Refer to 11.1.3 Creating a Program Pattern (P. 11-4) , and set Segment time.
Segment level does not ramp up/down following the program.	Program is in the Hold state.	Refer to 11.3 Pausing a Program (Hold) (P. 11-20) , and release the Hold state.
	Wait function for Program control mode is ON.	Refer to 11.5 Waiting When a Measured Value Cannot Keep Up with a Program (Wait) (P. 11-23) , and release the Wait state.
		Refer to 11.5 Waiting When a Measured Value Cannot Keep Up with a Program (Wait) (P. 11-23) , and set a suitable Wait zone. However, this is limited only to when the Wait zone setting can be changed.
Ramp/Soak program does not proceed.	Program is in the Hold state.	Refer to 11.3 Pausing a Program (Hold) (P. 11-20) , and release the Hold state.
	Wait function for Program control mode is ON.	Refer to 11.5 Waiting When a Measured Value Cannot Keep Up with a Program (Wait) (P. 11-23) , and release the Wait state.
		Refer to 11.5 Waiting When a Measured Value Cannot Keep Up with a Program (Wait) (P. 11-23) , and set a suitable Wait zone. However, this is limited only to when the Wait zone setting can be changed.
The Segment level does not change as programmed.	The operation mode is in Fixed set point control mode (FIX) or Manual control mode (MAN).	Reset the instrument once (RESET), and switch to the Program control mode (RUN).
Time signals are not output as programmed.	Time signal start time or Time signal end time is not set correctly.	Set Time signal start time or Time signal end time correctly by referring to 11.9 Outputting a Signal According to the Progress of a Program (Time Signal) (P. 11-37) .
Ramp/Soak program does not start.	End state continues after Ramp/Soak program ended.	Go to Reset mode (RESET), and restart the Ramp/Soak program.
	Digital input (DI) terminals for Reset mode (RESET) setting are closed.	Refer to 8.2 Switching Functions Using Digital Inputs (DI) (P. 8-11) , and open Digital input (DI) terminals for Reset mode (RESET) setting.

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Problem	Possible cause	Solution
Program does not proceed as planned.	Some program control related settings may be wrong.	Check the program control related settings are done according to the created program by referring to 11. FUNCTIONS RELATED TO PROGRAM CONTROL (P. 11-1) .
	The selected program pattern is incorrect for the application.	Change the Program pattern number at Execution pattern selection (<i>PFN</i>) by referring to 11.1.5 Program Start and Stop (P. 11-14) .
The Setting change action of the segment level and the segment time during the program control does not work as intended.	Setting of Function block No. 00 “Segment setting change type (<i>SEG.ENG</i>)” in the Engineering mode is not checked.	Change the setting of “Segment setting change type (<i>SEG.ENG</i>)” to the desired setting by referring to 11.10 Changing the Setting Change Action During Program Control (P. 11-46) .
Unable to copy the program pattern.	The instrument is not in the Reset mode (RESET).	Switch the mode to the Copy mode by referring to 11.11 Copying Program Pattern Data (P. 11-50) .



■ Communication related errors

● RKC communication

Problem	Possible cause	Solution
No response	Wrong connection, no connection or disconnection of the communication cable	Check connection and connect cable properly.
	Disconnection, contact failure, or wrong connection of communication cable	Check wiring and connector. Repair or replace, if necessary.
	Communication setting (communication speed, data bit configuration) is different from a host computer	Check setting and make a proper setting.
	Address setting is wrong	
	Data format is wrong	Review communication program
	Transmission line is not set to the receive state after data send (for RS-485)	
	Communication protocol setting is wrong	Set the communication protocol to “0: RKC communication” at Function block No. 60 (“Communication protocol (EMP5)”) in the Engineering mode by referring to the separate PZ400/PZ900/PZ401/PZ901 Host Communication Instruction Manual (IMR03B06-E□) .
EOT return	Invalid communication identifiers	Check if communication identifiers are correct and if there are any unsupported identifiers.
	Data format is wrong	Review communication program
NAK return	Communication error occurred (parity bit error, framing error, etc.)	Identify the error and take necessary actions (e.g. check of transmitted data, retransmission)
	BCC error occurred	
	Data is out of the setting range	Check the setting range and correct the data.
	Invalid communication identifiers	Check if communication identifiers are correct and if there are any unsupported identifiers.



● Modbus

Problem	Possible cause	Solution
No response	Wrong connection, no connection or disconnection of the communication cable	Check connection and connect cable properly.
	Disconnection, contact failure, or wrong connection of communication cable	Check wiring and connector. Repair or replace, if necessary.
	Communication setting (communication speed, data bit configuration) is different from a host computer	Check setting and make a proper setting.
	Address setting is wrong	
	Transmission error detected. (Overrun error, framing error, parity error, or CRC-16 error)	Retransmit after time-out or Review program on master side
	Time interval between the data that composes a message is more than 24-bit time.	
	Communication protocol setting is wrong	Set the communication protocol to “1” or “2” at Function block No. 60 ("Communication protocol (CMP5)") in the Engineering mode by referring to the separate PZ400/PZ900/PZ401/PZ901 Host Communication Instruction Manual (IMR03B06-E□) . 1: Modbus (Order of data transfer: upper word to lower word) 2: Modbus (Order of data transfer: lower word to upper word)
Error code: 1	Function cod error (Specifying nonexistent function code)	Confirm the function code
Error code: 2	When the mismatched address is specified	Confirm the address of holding register
Error code: 3	When the specified number of data items in the query message exceeds the maximum number of data items available	Confirm the setting data
Error code: 4	Self-diagnostic error	Turn off the power to the instrument. If the same error occurs when the power is turned back on, please contact RKC sales office or the agent.

**● PLC communication (MAPMAN)**

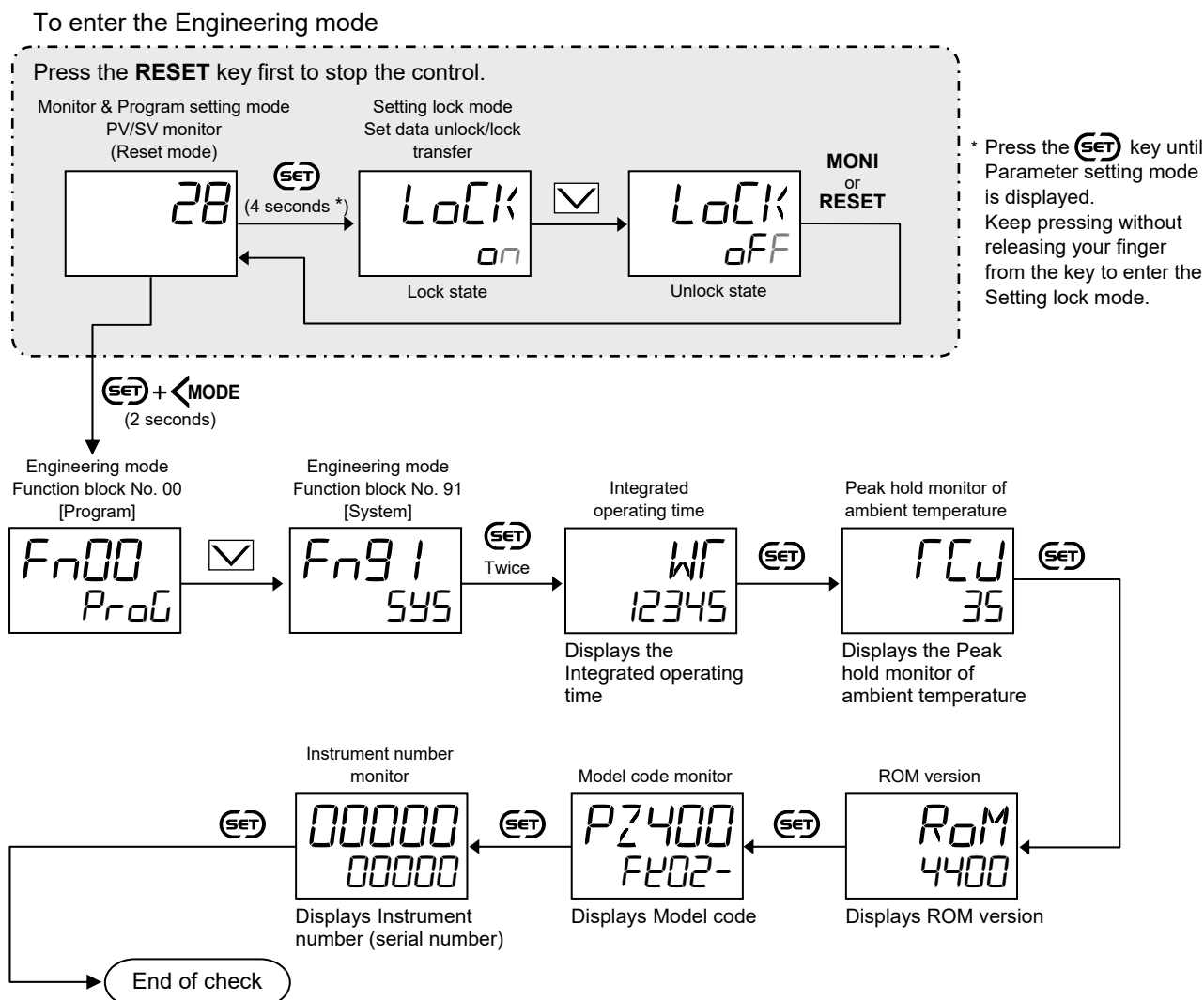
Problem	Possible cause	Solution
• Even if “1” is set to the sitting request bit or monitor request bit in request command, transfer is not finished. Request command does not return to “0” • It looks like communication is done properly, but the monitor values are not sent to the PLC. • No response	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	Mismatch of the setting data of communication speed, data bit configuration and protocol with those of the PLC	Confirm the communication settings of the controller (PZ400/900/401/901) and set them correctly
	Wrong setting of PLC communication data	Confirm the PLC communication settings and set them correctly
		Setting of termination resistor in accordance with PLC or the insertion is done
	Setting of PLC becomes write inhibit	Setting of PLC is turned into write enable (Write enable in RUN, shift to monitor mode, etc.)
If two or more controllers are connected, no units after the second unit are recognized	Instrument link recognition time is short	Confirm the PLC communication environment setting and set them correctly
		Set the Instrument link recognition time * longer. * Set the Instrument link recognition time only for a master controller (address 0).
When the setting request command of request command is set in “1,” setting error is become	Data range error	Confirm the setting range of the set value and set them correctly

16.3 Verifying Instrument Information

When error occurs and when you contact us, you are requested to provide us with the information on the instrument model code and specification. You can check the ROM version, model code and serial number of the instrument on the instrument display. The Integrated operating time and the maximum ambient temperature (Peak hold monitor of the ambient temperature).

■ How to display the information

ROM version, Model code monitor and Serial number monitor can be set at *F_n91* in the Engineering mode.

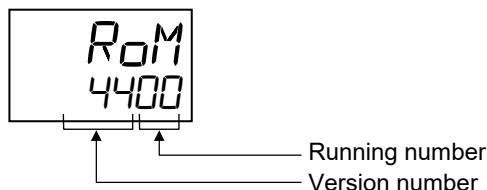


- Next parameter is displayed.
- Press **MONI** key or **RESET** key to return to the PV/SV monitor screen.
- Select lock on the Set data unlock/lock transfer.
- To start the operation, switch the mode to the operation mode [Program control mode (RUN), Fixed set point control mode (FIX), or Manual control mode (MAN)].

■ How to check

● ROM Version

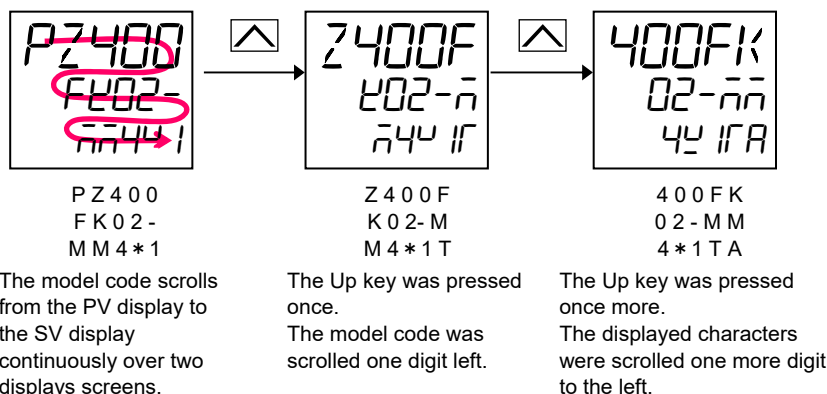
[Example]



● Model code monitor

Displays the model code of the instrument. As the Model code is too long to be displayed on a single screen, it can be scrolled left and right with and keys.

Example: Model code is PZ400FK02-MM4*1TAN/1



● Instrument number monitor

Displays the serial number of the instrument.



To read the displayed characters, refer to “**Character Symbols**” (P. i-3).



Alternatively, you can check the model code (MODEL), serial number (S/N) and suffix code (CODE) on the label on the side of the instrument if you are unable to check the information on the display.

● Integrated operating time

As soon as the instrument is powered, “1” is added. Thereafter, “1” is accumulated for each hour.

● Peak hold monitor of ambient temperature

Temperature around the rear terminal is measured and the maximum value is stored.



The Integrated operating time and the Peak hold monitor of the ambient temperature (maximum ambient temperature) cannot be reset.



SPECIFICATIONS



This chapter describes Specifications.



■ Measured input

Number of input: 1 point

Input type: Thermocouple (TC) input:
 K, J, T, S, R, E, B, N (JIS-C1602-2015)
 PLII (NBS), W5Re/W26Re (ASTM-E988-96 [Reapproved 2002])
 U, L (DIN43710-1985)
 PR40-20 (ASTM-E1751/E1751M-15)
 RTD input: Pt100 (JIS-C1604-2013)
 JPt100 (JIS-C1604-1997, Pt100 of JIS-C1604-1981)
 3-wire system
 Low voltage input: 0 to 10 mV DC, 0 to 100 mV DC
 High voltage input: 0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC,
 -5 to +5 V DC, -10 to +10 V DC
 Current input: 0 to 20 mA DC, 4 to 20 mA DC

Input range:

Thermocouple (TC) input

Input type	Measured range
K	-200.0 to +400.0 °C (-328.0 to +752.0 °F) -200.0 to +1372.0 °C (-328.0 to +2502.0 °F)
J	-200.0 to +400.0 °C (-328.0 to +752.0 °F) -200.0 to +1200.0 °C (-328.0 to +2192.0 °F)
T	-200.0 to +400.0 °C (-328.0 to +752.0 °F)
S	-50.0 to +1768.0 °C (-58.0 to +3214.0 °F) *
R	-50.0 to +1768.0 °C (-58.0 to +3214.0 °F) *
E	-200.0 to +1000.0 °C (-328.0 to +1832.0 °F) *
B	0.0 to 1800.0 °C (0.0 to 3272.0 °F) *
N	0.0 to 1300.0 °C (0.0 to 2372.0 °F) *
PLII	0.0 to 1390.0 °C (0.0 to 2534.0 °F) *
W5Re/W26Re	0 to 2300 °C (0 to 4200 °F)
U	-200.0 to +600.0 °C (-328.0 to +1112.0 °F)
L	0.0 to 900.0 °C (0.0 to 1652.0 °F)
PR40-20	0 to 1800 °C (0 to 3200 °F)

* The least significant digit (LSD) may flicker when the display resolution is set to 0.1°C (0.1°F).

RTD input

Input type	Measured range
Pt100	-200.0 to +850.0 °C (-328.0 to +1562.0 °F) -100.00 to +100.00 °C (-148.00 to +212.00 °F) 0.00 to 50.00 °C (32.00 to 122.00 °F)
JPt100	-200.0 to +640.0 °C (-328.0 to +1184.0 °F) -100.00 to +100.00 °C (-148.00 to +212.00 °F) 0.00 to 50.00 °C (32.00 to 122.00 °F)

Voltage/Current input

Input type	Measured range
Low voltage	0 to 10 mV DC, 0 to 100 mV DC
High voltage	0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, -5 to +5 V DC, -10 to +10 V DC
Current	0 to 20 mA DC, 4 to 20 mA DC

Sampling cycle: 0.05 seconds

Influence of signal source resistance (TC input):

Approx. 0.18 $\mu\text{V}/\Omega$ (Converted depending on TC types)

**Influence of input lead (RTD input):**

Approx. 0.006 %/ Ω of span (100 Ω or less per wire)

If the resistance is 100 Ω or more, the measuring range may be limited.

Input impedance (Voltage/Current input):

Low voltage input: 1 M Ω or more

High voltage input: 1 M Ω or more

Current input: Approx. 50 Ω

Measured current (RTD input): Approx. 1 mA

Action at input break: TC input: Upscale or Downscale (selectable)

RTD input: Upscale

Low voltage input: Upscale or Downscale (selectable)

High voltage input: Downscale (Indicates value near 0)

Current input: Downscale (Indicates value near 0)

Action at input short circuit (RTD input):

Downscale (Measured range: except 0.00 to 50.00 $^{\circ}\text{C}$ [32.00 to 122.00 $^{\circ}\text{F}$] range)

Upscale (Measured range: 0.00 to 50.00 $^{\circ}\text{C}$ [32.00 to 122.00 $^{\circ}\text{F}$])

Action at input error:

- Input error determination point (high), Input error determination point (low)

Input range low – (5 % of input span) to

Input range high + (5 % of input span)

When the input type is Pt100 or JPt100, the low limit value cannot be –5 %.

Low limit of Pt100: –245.5 $^{\circ}\text{C}$ (–409.8 $^{\circ}\text{F}$), corresponding to approximately 2 Ω

Low limit of JPt100: –237.6 $^{\circ}\text{C}$ (–395.7 $^{\circ}\text{F}$), corresponding to approximately 2 Ω

It is also used as Input error determination of the Event action.

- Action (high) input error, Action (low) input error

“Control continues” or “Manipulated output value at input error” (selectable)

- Manipulated output value at input error

PID control: –5.0 to +105.0 %

Heat/Cool PID control: –105.0 to +105.0 %

Position proportioning PID control: –5.0 to +105.0 %

Actual output value is limited by the Output limiter.

When “Control action continued” is selected at “Action at feedback resistance (FBR) input error” on the position proportioning PID control with or without Feedback resistance input, the action will follow “Valve action in Reset mode.”

- PV flashing display at input error

Flashing display or Non-flashing display (selectable)

Measured input correction: PV bias: –Input span to +Input span

PV ratio: 0.500 to 1.500

PV digital filter (First order lag digital filter):
0.0 to 100.0 seconds (0.0: Filter OFF)

Allowable input range: –1.0 to +3.0 V (TC input/RTD input/Low voltage input)

–12 to +12 V (High voltage input)

–20.0 to +30.0 mA (Current input)

Square root extraction function (Voltage/Current input):

Calculation method: Measured value = $\sqrt{(\text{Input value})} \times \text{PV ratio} + \text{PV bias}$

PV low input cut-off: 0.00 to 25.00 % of input span



■ Current transformer (CT) input

Number of input:	2 points
CT type:	CTL-6-P-Z, CTL-6-P-N or CTL-12-S56-10L-N (Sold separately)
Input range:	0.0 to 0.1 Arms
Measurable current range:	CTL-6-P-Z: 0.0 to 10.0 A (high accurate type) CTL-6-P-N: 0.0 to 30.0 A CTL-12-S56-10L-N: 0.0 to 100.0 A
Sampling cycle:	0.5 seconds
Voltage of through current:	300 V or less

■ Feedback resistance (FBR) input

Number of input:	1 point (Non-isolated from PV)
Permissible resistance range:	100 Ω to 10 k Ω (Standard: 135 Ω)
Input range:	0.0 to 100.0 % (for adjustment span of open and close) The value is displayed on the Manipulated output value monitor (FBR input at disconnection: 0.0 %)
Sampling cycle:	0.5 seconds
Action at FBR break:	To be selected from OPEN, CLOSE, OFF, and Continue control.

■ Digital input (DI)

Number of input:	Up to 6 points (DI1 to DI6)
Input method:	Dry contact input OFF (Open state): 50 k Ω or more ON (Close state): 1 k Ω or less Contact current: 3.3 mA DC or less Voltage at open: Approx. 5 V DC
Capture judgment time:	Within 200 ms



■ Output

Assign output:

Number of output:

Output (OUT): 3 points (OUT1 to OUT3)

Event output (DO): 4 points (DO1 to DO4)

Output assignment: Refer to Output assignment list

Output assignment list (PZ400/900/401/901)

Output specification	OUT1, OUT2						OUT3		DO1 to DO4
	Relay contact (1) (Note)	Relay contact (2) (Note)	Voltage pulse (1)	Current	Continuous voltage	Transistor	Voltage pulse (2)	Current	Relay contact (3)
Control output (Heat-side)	✓	✓	✓	✓	✓	✓	✓	✓	
Control output (Cool-side)	✓	✓	✓	✓	✓	✓	✓	✓	
Control output (Position proportioning)	✓	✓	✓			✓	✓		
Retransmission output				✓	✓			✓	
Logic calculation output (Event output)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Logic calculation output (Control loop break alarm (LBA) output)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Logic calculation output (Heater break alarm (HBA) output)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Output of Program control mode (RUN) state	✓	✓	✓	✓	✓	✓	✓	✓	✓
Output of Manual control mode (MAN) state	✓	✓	✓	✓	✓	✓	✓	✓	✓
Autotuning (AT) state output	✓	✓	✓	✓	✓	✓	✓	✓	✓
Output of the communication monitoring result	✓	✓	✓	✓	✓	✓	✓	✓	✓
FAIL output	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time signal									✓
Pattern end signal									✓

(Note) Relay contact (1): OUT1, Relay contact (2): OUT2

Output type:

• Relay contact output (1) [OUT1]

Contact type: c contact

Contact rating (Resistive load):

250 V AC 3 A, 30 V DC 1 A

Electrical life: 300,000 times or more (Rated load)

Mechanical life: 50 million times or more (Switching: 180 times/min)

Proportional cycle time: 0.1 to 100.0 seconds (When configured for control output)

• Relay contact output (2) [OUT2]

Contact type: a contact

Contact rating (Resistive load):

250 V AC 3 A, 30 V DC 1 A

Electrical life: 300,000 times or more (Rated load)

Mechanical life: 50 million times or more (Switching: 180 times/min)

Proportional cycle time: 0.1 to 100.0 seconds (When configured for control output)

• Relay contact output (3) [DO1 to DO4]

Contact type: a contact

Contact rating (Resistive load):

250 V AC 1 A, 30 V DC 0.5 A

Electrical life: 150,000 times or more (Rated load)

Mechanical life: 20 million times or more (Switching: 300 times/min)



- **Voltage pulse output (1) [OUT1 and OUT2]**

Output voltage: 0/12 V DC (Rated)
ON voltage: 10 to 13 V
OFF voltage: 0.5 V or less

Allowable load resistance: 500 Ω or more

Proportional cycle time: 0.1 to 100.0 seconds (When configured for control output)

- **Voltage pulse output (2) [OUT3]**

Output voltage: 0/14 V DC (Rated)
ON voltage: 12 to 17 V
OFF voltage: 0.5 V or less

Allowable load resistance: 600 Ω or more

Proportional cycle time: 0.1 to 100.0 seconds (When configured for control output)

- **Current output [OUT1, OUT2 and OUT3]**

Output current: 4 to 20 mA DC, 0 to 20 mA DC
Output range: 3.2 to 20.8 mA DC, 0 to 21 mA DC
Allowable load resistance: 500 Ω or less

- **Continuous voltage output [OUT1 and OUT2]**

Output voltage: 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
Output range: 0 to 5.25 V DC, 0.8 to 5.2 V DC, 0 to 10.5 V DC
Allowable load resistance: 1 k Ω or more

- **Transistor output [OUT1 and OUT2]**

Allowable load current: 100 mA
Load voltage: 30 V DC or less
Voltage drop at ON: 2 V or less (at allowable load current)
Leakage current at OFF: 0.1 mA or less
Proportional cycle time: 0.1 to 100.0 seconds (When configured for control output)

Related function:

- **Output logic selection**

Energized/De-energized is selectable.
FAIL output functions as “De-energized” even if it is set to “Energized.”

- **Universal output type selection (OUT3)**

Output type is selectable.



■ Performance

Reference performance (Performance under the standard performance condition)

• Measured input (PV):

Accuracy:

Input type	Input range	Accuracy
K, J, T, E, U, L (Accuracy is not guaranteed for less than -100 °C)	Less than -100 °C	±1.0 °C (Approximate value)
	-100 °C or more, Less than +500 °C	±0.5 °C
	500 °C or more	±(0.1 % of Reading)
N, S, R, PLII, W5Re/W26Re (Accuracy is not guaranteed for less than 400 °C for input type S, R and W5Re/W26Re)	Less than 0 °C	±2.0 °C
	0 °C or more, Less than 1000 °C	±1.0 °C
	1000 °C or more	±0.1 % of Reading
B (Accuracy is not guaranteed for less than 400 °C)	Less than 400 °C	±70 °C (Approximate value)
	400 °C or more, Less than 1000 °C	±1.4 °C
	1000 °C or more	±0.1 % of Reading
PR40-20 (Accuracy is not guaranteed for less than 400 °C)	Less than 400 °C	±20 °C (Approximate value)
	400 °C or more, Less than 1000 °C	±10 °C
	1000 °C or more	±0.1 % of Reading
Pt100, JPt100	Less than 200 °C	±0.2 °C
	200 °C or more	±0.1 % of Reading
	0.00 to 50.00 °C	±0.10 °C
Voltage/Current input		±0.1 % of span

Display accuracy:

Is equal to the above accuracy with the value below the minimum resolution rounded up.

Noise elimination ratio: Series mode: 60 dB or more (50/60 Hz)

Common mode: 120 dB or more (50/60 Hz)

Resolution:

Input type		Input Resolution
K, J, T, E, U, L, N, S, R, PLII, W5Re/W26Re		1/200000
PR40-20, B		1/100000
Pt100, JPt100	-200 to +850 °C	1/200000
	-100.00 to +100.00 °C	1/60000
	0.00 to 50.00 °C	
Low voltage input	0 to 10 mV DC	1/120000
	0 to 100 mV DC	1/200000
High voltage input	0 to 1 V DC	1/200000
	0 to 5 V DC	
	1 to 5 V DC	
	0 to 10 V DC	
	-5 to +5 V DC	
	-10 to +10 V DC	
Current input	0 to 20 mA DC	1/200000
	4 to 20 mA DC	

Cold-junction temperature compensation error:

±0.5 °C

(range of the standard performance condition: 23 °C±2 °C)

±1.5 °C (Between -10 to +55 °C)

Close horizontal mounting error:

Close horizontal mounting: Within ±1.5 °C

Close vertical mounting: Within ±3.0 °C



- **Current transformer (CT) input:**

Accuracy: 0.0 to 10.0 A (high accurate type): ± 0.3 A
0.0 to 30.0 A, 0.0 to 100.0 A: $\pm (5 \% \text{ of Reading})$ or ± 2.0 A
(whichever is larger)

Resolution: 100 counts/mA or more

- **Feedback resistance (FBR) input:**

Accuracy: $\pm 0.5 \%$ of span (for adjustment span of open and close)

Resolution: 150 counts/% or more

- **Current output:**

Accuracy: $\pm 0.1 \%$ of span

Resolution: Approx. 1/25000

- **Voltage output:**

Accuracy: $\pm 0.1 \%$ of span

Resolution: Approx. 1/25000

Operating influence (Variation under the operating condition)

- **Influence ambient temperature:**

Input: TC input: $\pm 0.006 \% / ^\circ\text{C}$ of span

RTD input: $\pm 0.006 \% / ^\circ\text{C}$ of span

Voltage/Current input: $\pm 0.006 \% / ^\circ\text{C}$ of span

Output: Voltage/Current output: $\pm 0.015 \% / ^\circ\text{C}$ of span

- **Influence of physical orientation:**

Input: TC input: $\pm 0.3 \%$ of span or $\pm 3 ^\circ\text{C}$ or less

RTD input: $\pm 0.5 ^\circ\text{C}$ or less

Voltage/Current input: Less than $\pm 0.1 \%$ of span

Output: Voltage/Current output: Less than $\pm 0.3 \%$ of span



■ Display

Measured input display (PV):

5-digit 11-segment LCD (PZ400/900: Green, PZ401/901: White)

Display range:

Input range low – (5 % of input span) to Input range high + (5 % of input span)

When the input type is Pt100 or JPt100, the low limit value cannot be –5 %

Low limit of Pt100: –245.5 °C (–409.8 °F),
corresponding to approximately 2 Ω

Low limit of JPt100: –237.6 °C (–395.7 °F),
corresponding to approximately 2 Ω

The display starts flashing when the Input range or the Input error determination point has been exceeded

The display starts flashing “ooooo” when the input exceeds the display range.

The display starts flashing “uuuuu” when the input goes below the display range.

Setting display (SV):

5-digit 7-segment LCD (Orange)

Output value, Time, CT value displays (MV, TIME, CT1, CT2):

4-1/2 digit 7-segment LCD (White)

Pattern display:

1-1/2 digit 7-segment LCD (White)

Segment display:

1-1/2 digit 7-segment LCD (White)

Output display (OUT1 to OUT3):

Action indicator LCD (White) × 3 points

Manual display (MAN):

Action indicator LCD (White)

Autotuning display (AT):

Action indicator LCD (White)

Time signal display (TS):

Action indicator LCD (White)

Reset display (RESET):

Action indicator LCD (White)

Program control display (RUN):

Action indicator LCD (White)

Fixed set point control display (FIX):

Action indicator LCD (White)

Alarm display (ALM):

Action indicator LCD (Red)

Event output display (DO):

Action indicator LCD (White) × 4 points

Set lock display:

Action indicator LCD (PZ400/401: Orange, PZ900/901: White)

Ramp state display:

Action indicator LCD (White) × 3 points

■ Operation keys

Select items/Set parameters:

4 keys (, <MODE , <HOLD , <STEP)

Transfer to Reset mode:

key (RESET)

Transfer to Program control mode:

key (RUN)

Display/Setting mode selector:

key (MONI)

Execution pattern selection (in Reset mode),

Program end setting/release (at Program end setting):

key (PTN/END)



■ Control

● Brilliant II PID control

Overshoot suppression function:	Reset feedback (RFB) method
Proportional band:	• TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C, °F) • Voltage/Current inputs: 0.0 to 1000.0 % of input span 0 (0.0, 0.00): ON/OFF action
Integral time:	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PD action Output is 50 % when the deviation is zero.
Derivative time:	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action
Control response parameter:	Slow, Medium and Fast (3-step selection)
Proportional cycle time:	0.1 to 100.0 seconds
ON/OFF action differential gap:	High/Low individual setting • TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C, °F) • Voltage/Current inputs: 0.0 to 100.0 % of input span
Output limiter high:	Output limiter low to +105.0 % *
Output limiter low:	-5.0 % to Output limiter high *
	* Output limiter low ≤ Output limiter high
Output change rate limiter (up/down):	0.0 to 1000.0 %/seconds of manipulated output 0.0: Output change rate limiter OFF
Manipulated output value in Reset mode:	-5.0 to +105.0 %
Direct action /Reverse action transfer:	Selectable

● Brilliant II Heat/Cool PID control (Water cooling/Air cooling/Cooling linear type)

Overshoot suppression function:	Reset feedback (RFB) method
Proportional band [heat-side]:	• TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C, °F) • Voltage/Current inputs: 0.0 to 1000.0 % of input span 0 (0.0, 0.00): Heat-side and Cool-side are both ON/OFF action
Integral time [heat-side]:	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PD action Output is 0 % when the deviation is zero.
Derivative time [heat-side]:	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action



Proportional band [cool-side]:	• TC/RTD inputs: 1 (0.1, 0.01) to Input span (Unit: °C, °F) • Voltage/Current inputs: 0.1 to 1000.0 % of input span This setting is disabled by setting the Proportional band [heat-side] to zero. ON/OFF action of cool-side only is not possible.
Integral time [cool-side]:	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PD action Output is 0 % when the deviation is zero.
Derivative time [cool-side]:	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action
Overlap/Deadband:	• TC/RTD inputs: –Input span to +Input span (Unit: °C, °F) • Voltage/Current inputs: –100.0 to +100.0 % of input span Minus (–) setting results in overlap. However, the overlapping range is within the proportional range.
Control response parameter:	Slow, Medium and Fast (3-step selection)
Proportional cycle time [heat-side]:	0.1 to 100.0 seconds
Proportional cycle time [cool-side]:	0.1 to 100.0 seconds
ON/OFF action differential gap:	High/Low individual setting • TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C, °F) • Voltage/Current inputs: 0.0 to 100.0 % of input span
Output limiter high [heat-side]:	Output limiter low [heat-side] to +105.0 % *
Output limiter low [heat-side]:	–5.0 % to Output limiter high [heat-side] * * Output limiter low [heat-side] ≤ Output limiter high [heat-side]
Output limiter high [cool-side]:	Output limiter low [cool-side] to +105.0 % **
Output limiter low [cool-side]:	–5.0 % to Output limiter high [cool-side] ** ** Output limiter low [cool-side] ≤ Output limiter high [cool-side]
Output change rate limiter (up/down) [heat-side]:	0.0 to 1000.0 %/seconds of manipulated output 0.0: Output change rate limiter OFF
Output change rate limiter (up/down) [cool-side]:	0.0 to 1000.0 %/seconds of manipulated output 0.0: Output change rate limiter OFF
Manipulated output value in Reset mode [heat-side]:	–5.0 to +105.0 %
Manipulated output value in Reset mode [cool-side]:	–5.0 to +105.0 %
Undershoot suppression factor:	0.000 to 1.000 When the contro action is changed, this parameter is initialized to the following value. Water cooling: 0.100, Air cooling: 0.250, Cooling linear type: 1.000
Overlap/Deadband reference point:	0.0 to 1.0 (0.0: Proportional band on heat-side, 1.0: Proportional band on cool-side, 0.5: Midpoint)



● Position proportioning PID control

Overshoot suppression function:	Reset feedback (RFB) method
Proportional band:	• TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C, °F) • Voltage/Current inputs: 0.0 to 1000.0 % of input span 0 (0.0, 0.00): ON/OFF action
Integral time:	1 to 3600 seconds, 0.1 to 3600.0 seconds or 0.01 to 360.00 seconds
Derivative time:	0 to 3600 seconds, 0.0 to 3600.0 seconds or 0.00 to 360.00 seconds 0 (0.0, 0.00): PI action
Control response parameter:	Slow, Medium and Fast (3-step selection)
Open/Close output neutral zone:	0.1 to 10.0 % of output
Open/Close output differential gap:	0.1 to 5.0 % of output
ON/OFF action differential gap:	High/Low individual setting • TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C, °F) • Voltage/Current inputs: 0.0 to 100.0 % of input span
Output limiter high:	Output limiter low to +105.0 % * When without FBR input: Invalid
Output limiter low:	-5.0 % to Output limiter high * When without FBR input: Invalid * Output limiter low ≤ Output limiter high
Manipulated output value in Reset mode:	-5.0 to +105.0 % When without FBR input: Invalid
Control motor time:	5 to 1000 seconds
Integrated output limiter:	0.0 to 200.0 % of control motor time 0.0: OFF When with FBR input: Invalid
Valve action in Reset mode:	a) Close-side output OFF, Open-side output OFF b) Open-side output OFF, Close-side output ON, c) Open-side output ON, Close-side output OFF Selectable from a) to c)
Action at saturated output:	Invalid/Valid is selectable When the Action at saturated output is valid: • The close-side output remains ON when the valve position is fully closed • The open-side output remains ON when the valve position is fully opened To validate the Action at saturated output, make sure to use valve with limit switch.
Direct action/Reverse action transfer:	Selectable



● Manual control

Setting range of Manual manipulated output value:

- PID control: Output limiter low to Output limiter high
- Heat/Cool PID control: –Output limiter high [cool-side] to
+Output limiter high [heat-side]
- Position proportioning PID control:
 - With FBR input
Output limiter low to Output limiter high
 - Without FBR input
It is possible to turn ON/OFF output by using the UP key or the DOWN key.

Manual manipulated output value selection:

Last manipulated output value or Manual manipulated output value (Selectable)

● Mode switching

Operation mode transfer:

- a) Reset mode (RESET)
- b) Program control mode (RUN)
- c) Fixed set point control mode (FIX)
- d) Manual control mode (MAN)

Switching of a) to d) can be made in any of the following methods.

Switch by front key operation

Switch by host computer via communication

Switch by digital input *

* In case of digital input, it cannot be switched to fixed set point control mode (FIX) or manual control mode (MAN).

● Control action transfer

PID control, Heat/Cool PID control, or Position proportioning PID control (Selectable)

● Autotuning (AT)

Tuning method: Computed by Limit cycle system

AT bias: –Input span to +Input span

AT remaining time monitor: 0 hours 00 minutes to 48 hours 00 minutes

● Overall level autotuning (AT)

Tuning method: Computed by Limit cycle system

Setting range: *oFF*: Overall level autotuning (AT) OFF

oN: Overall level autotuning (AT) ON *

* When the Overall level autotuning (AT) is finished, the control will automatically return to “*oFF*”.



● Startup tuning (ST)

- Startup tuning (ST):** *oFF*: ST unused
on 1: Execute once
on 2: Execute always
- ST start condition:**
- 0: Activate the ST function when the power is turned on; when transferred from Reset mode (RESET) to Program control mode (RUN)/Fixed set point control mode (FIX); or when the Set value (SV) is changed.
 - 1: Activate the ST function when the power is turned on; or when transferred from Reset mode (RESET) to Program control mode (RUN).
 - 2: Activate the ST function when the Set value (SV) is changed.

● Proactive function

- Proactive intensity:** 0 to 4 (0: No function)
- FF amount:** -100.0 to +100.0 %
- FF amount learning:** 0 to 1 (0: No learning, +1: Learn)
- Determination point of external disturbance:**
 -Input span to +Input span
- Bottom suppression function:**
- 0: No function
 - 1: FF amount is added by level
 - 2: FF amount is forcibly added

● Level PID

8 types of PID parameters are selectable according to the position of the Set value (SV) or the Measured value (PV).

- Number of levels:** 8 levels (PID group 1 to 8)
- Level setting range:** Input range low to Input range high
- The values of the Level PID must always have the following relation.
 (Level PID setting 1 ≤ Level PID setting 2 ≤ Level PID setting 3 ≤
 Level PID setting 4 ≤ Level PID setting 5 ≤ Level PID setting 6 ≤
 Level PID setting 7)
- Level:**
- When the setting of PID group 1 is used:
 Input range low limit ≤ Set value (SV) or Measured value (PV) ≤ Level PID setting 1
 - When the setting of PID group 2 is used:
 Level PID setting 1 < Set value (SV) or Measured value (PV) ≤ Level PID setting 2
 - When the setting of PID group 3 is used:
 Level PID setting 2 < Set value (SV) or Measured value (PV) ≤ Level PID setting 3
 - When the setting of PID group 4 is used:
 Level PID setting 3 < Set value (SV) or Measured value (PV) ≤ Level PID setting 4
 - When the setting of PID group 5 is used:
 Level PID setting 4 < Set value (SV) or Measured value (PV) ≤ Level PID setting 5
 - When the setting of PID group 6 is used:
 Level PID setting 5 < Set value (SV) or Measured value (PV) ≤ Level PID setting 6
 - When the setting of PID group 7 is used:
 Level PID setting 6 < Set value (SV) or Measured value (PV) ≤ Level PID setting 7
 - When the setting of PID group 8 is used:
 Level PID setting 7 < Set value (SV) or Measured value (PV) ≤ Input range high limit
- When the same value is set to two or more Levels, the setting in the PID group with the smallest number will be used.

**PID group setting:****Group number:** 1 to 8

Items to be set: Proportional band [heat-side], Integral time [heat-side], Derivative time [heat-side], Control response parameter, Proportional band [cool-side], Integral time [cool-side], Derivative time [cool-side], Overlap/Deadband, Manual reset, Proactive intensity, FF amount, Control loop break alarm (LBA) time, LBA deadband (LBD), Output limiter high [heat-side], Output limiter low [heat-side], Output limiter high [cool-side], Output limiter low [cool-side]

Additional function: Automatic level PID setting function**■ Event function****Number of event:** 4 points (Output selection is possible)

Event type: Deviation high (Using SV monitor value) ¹
 Deviation low (Using SV monitor value) ¹
 Deviation high/low (Using SV monitor value) ¹
 Band (Using SV monitor value) ¹
 Deviation high/low (Using SV monitor value) [High/Low individual setting] ¹
 Band (Using SV monitor value) [High/Low individual setting] ¹
 SV high (Using SV monitor value)
 SV low (Using SV monitor value)
 Process high ²
 Process low ²
 Deviation high (Using segment level) ¹
 Deviation low (Using segment level) ¹
 Deviation high/low (Using segment level) ¹
 Band (Using segment level) ¹
 Deviation high/low (Using segment level) [High/Low individual setting] ¹
 Band (Using segment level) [High/Low individual setting] ¹
 SV high (Using segment level)
 SV low (Using segment level)
 MV high [heat-side] ^{2,3}
 MV low [heat-side] ^{2,3}
 MV high [cool-side] ²
 MV low [cool-side] ²
 Process high/low [High/Low individual setting] ²
 Process band [High/Low individual setting] ²

¹ Event hold and re-hold action is available.
² Event hold action is available.
³ The Manipulated output value (MV) corresponds to the Feedback resistance (FBR) input value when the Control action is a Position proportioning PID controller with Feedback resistance (FBR) input.



Setting range:	a) Deviation	
	Event setting:	–Input span to +Input span
	Differential gap:	0 to Input span
	b) Process and SV	
	Event setting:	Input range low to Input range high
	Differential gap:	0 to Input span
	c) MV	
	Event setting:	–5.0 to +105.0 %
	Differential gap:	0.0 to 110.0 %
Additional function:	Hold action:	
	a) Hold action OFF	
	b) Hold action ON	(When the instrument is powered on; When the mode is switched to the Program control mode (RUN) or to the Fixed set point control mode (FIX) from the Reset mode (RESET).)
	c) Re-hold action ON	(When the instrument is powered on; When the mode is switched to the Program control mode (RUN) or to the Fixed set point control mode (FIX) from the Reset mode (RESET); When the Set value (SV) is changed.)
	Event timer:	0.0 to 600.0 seconds
	Interlock selection:	0 to 511 ^a
	Interlock release:	on (Interlock state), oFF (Interlock release)
	ALM lamp lighting condition:	0 to 511 ^a
	Logic calculation selection (OUT1 to 3, DO1 to 4):	0 to 511 ^a
	Output action in Reset mode:	0 to 7 ^b
	^a OR-selectable from Event 1 to 4, HBA1, HBA2, LBA, Input error high, or Input error low.	
	^b OR-selectable from Logic calculation output (continue control), Retransmission output (continue control), Instrument status output (continue control).	

■ Control loop break alarm (LBA)

Control loop break alarm (LBA) time:

0 to 7200 seconds (0: No function)

LBA deadband (LBD): 0 to Input span

■ Heater break alarm (HBA) [for time-proportional control output]

Number of HBA: 2 points (1 point per CT input)

Setting range: 0.0 to 100.0 A (0.0: HBA function OFF [Current value monitoring is still available])
CT does not detect current value when the control output ON time or control output OFF time is less than 250 ms.

Number of heater break alarm (HBA) times:

0 to 255 times

CT assignment: 0 (None), 1 (OUT1), 2 (OUT2), 3 (OUT3)
(0: HBA function OFF)



■ Time signal

- Time signal selection:** Function to select availability of Time signals 1 to 4
- Ones place: Time signal 1
Tens place: Time signal 2
Hundreds place: Time signal 3
Thousands place: Time signal 4
0: Unused 1: Used
- Time signal:** Function to generate signals at any desired time during the program control
- a) Number of points: 4 points $\times$ 16 patterns
- b) Setting range
- Program pattern selection: 1 to 16
Time signal start segment: 1 to 16
Time signal start time: 0 hours 0 minutes to 199 hours 59 minutes or
0 minutes 0 seconds to 199 minutes 59 seconds
Time signal endsegment: 1 to 16
Time signal end time: 0 hours 0 minutes to 199 hours 59 minutes or
0 minutes 0 seconds to 199 minutes 59 seconds

■ Pattern end signal

- Pattern end signal selection:** Function to select availability of a Pattern end signal
0 (Unused), 1 (Used)
- Pattern end signal:** Function to generate a signal at the completion of the program
- Pattern end output time:** 0 hours 00 minutes to 199 hours 59 minutes or
0 minutes 00 seconds to 199 minutes 59 seconds
(0 setting: Output remains on)

■ Retransmission output

- Output type:** Measured value (PV), Segment level, SV monitor value, Deviation,
Manipulated output value [heat-side] ¹, Manipulated output value [cool-side] ²,
Current transformer (CT) input value
- ¹ Heat/Cool PID control: Output value [heat-side]
² Output value [cool-side] in Heat/Cool PID control
- Output scaling:** High/Low individual setting (High limit > Low limit)
- Measured value (PV): Input range low to Input range high
Segment level: Input range low to Input range high
SV monitor value: Input range low to Input range high
Deviation: -Input span to +Input span
Manipulated output value [heat-side]: -5.0 to +105.0 %
Manipulated output value [cool-side]: -5.0 to +105.0 %
Current transformer (CT) input value: 0.0 to 100.0 %



■ Program control function

Accuracy of time:	±0.01% of reading or input sampling cycle, whichever is larger There is a delay for input sampling cycle at every shift of segment of “segment time = 0.”
Number of stored program:	Number of program patterns: Up to 16 patterns Number of segments: Up to 16 segments per pattern
Segment setting items:	The value changed during the Program control mode (RUN) is immediately reflected. Segment level: Range of setting limiter Segment time: 0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds Event selection of the Segment: Function to select “with or without events” at each segment. Ones place: Event 1 Tens place: Event 2 Hundreds place: Event 3 Thousands place: Event 4 0: Unused, 1: Used
Setting items for each pattern:	Pattern end output time: 0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds (0 setting: Output remains on) Time signal start segment number: 1 to 16 Time signal start time: 0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds Time signal end segment number: 1 to 16 Time signal end time: 0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds Number of repeating patterns: 1 to 1000 times (1000: Continuous operation) Pattern link number: 0 to 16 patterns (0: No link) Event set value [high], Event set value [low]: Deviation: –Input span to +Input span Input value or Set value: Input range low to Input range high Manipulated output value: –5.0 to +105.0 % Pattern end number: 1 to 16
SV selection at program start:	0 [Zero start], 1 [PV start], 2 [PV start (time saving)]
Hold function:	Function to suspend the progress of the program When the program is held by the Digital input (DI), releasing the hold by key operation or communication is not possible. Hold state is not released by switching to the Fixed set point control mode (FIX) or Manual control mode (MAN).
Step function:	Function to advance the program progress by one segment Not available in the hold state.



Wait function:	Function to suspend the time until the condition is met even after the time is up a) Wait zone high: TC/RTD inputs: 0 (0.0, 0.00) to Input span (Varies with the setting of the Decimal point position) Voltage/Current inputs: 0.0 to 100.0 % of Input span 0 (0.0, 0.00): Wait zone high OFF b) Wait zone low: TC/RTD inputs: – Input span to 0 (0.0, 0.00) (Varies with the setting of the Decimal point position) Voltage/Current inputs: –100.0 to 0.0 % of Input span 0 (0.0, 0.00): Wait zone low OFF If the Step function is performed while the program is in the wait state, the wait state will be released and the segment in progress will skip to the next segment.
Action selection function at Pattern end:	Function to select Continue or Stop of the action at the completion of the program a) Control action at pattern end: PID control, Heat/Cool PID control, or Position proportioning PID control (With FBR input): 0 (Control continued), 1 (Control stop) If the control action at Pattern end is selected to “1: Control stop” at FBR break, it follows the setting of Valve action in Reset mode. Position proportioning PID control (No FBR input): 0 (Control continued) 1 (Open-side output OFF, Close-side output OFF) 2 (Open-side output OFF, Close-side output ON) 3 (Open-side output ON, Close-side output OFF) b) Output action at pattern end: 0 to 7 (0: OFF, +1: Logic calculation output: Action continues, +2: Retransmission output: Action continues, +4: Instrument status output: Action continues) The Hold function is executed in the Pattern end state. The output time of the pattern end signal will stop during the hold state.
Copy function:	Pattern copy Function to copy all of the contents of the selected pattern
Remaining time display:	Function to display the remaining time of the segment/pattern a) Segment remaining time: 0 hours 00 minutes to 199 hours 59 minutes or 0 minutes 00 seconds to 199 minutes 59 seconds Remaining time of the segment in execution is displayed. The remaining time of the pattern end output will be displayed when the pattern end signal is valid in the pattern end mode. b) Pattern remaining time: 0 hours 00 minutes to 999 hours 59 minutes or 0 minutes 00 seconds to 999 minutes 59 seconds Remaining time of the pattern in execution is displayed. If the time remaining is larger than the maximum display value, then the maximum display value is displayed.



■ Communication

● Host communication

Interface:	Based on RS-485, EIA standard Based on RS-422A, EIA standard
Protocol:	RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4) Modbus-RTU PLC communication (MAPMAN)

● Loader communication

Protocol:	For RKC communication protocol only (ANSI X3.28-1976 subcategories 2.5 and A4)
Synchronous method:	Start/Stop synchronous type
Communication speed:	38400 bps
Data format:	Start bit: 1 Data bit: 8 Parity bit: None Stop bit: 1 Number of data digit: 7-digit (fixed)
Maximum connections:	1 point
Connection method:	Exclusive cable (not complying with the USB standard)
Interval time:	10 ms
Other:	① The instrument can be powered from the COM-K2 or COM-KG (our USB communication converter) This power supply is designed for setting up the internal set values. Control is stopped (output off, relay open) and host communication is also stopped. The PV/SV monitor shows “LoAd” for the Measured value (PV) display and “-----” for the Set value (SV) display. The LCD backlight is partially turned off. ② While the instrument is powered by COM-K2 or COM-KG, if power is applied to the instrument, the instrument will be reset and starts for normal operation. ③ When the instrument is normally powered, the host communication can be used simultaneously.

■ Self-diagnostic function

Control stop (Error number is displayed):	Adjustment data error (Err 1) Data back-up error (Err 2) A/D conversion error (Err 4) Temperature compensation error (Err 4) Display units error (Err 64)
Action stop (Error number is not displayed):	Power supply voltage is abnormal Watchdog timer error



■ General specifications

Power supply voltage: 100 to 240 V AC type:
 85 to 264 V AC [Including power supply voltage variation], 50/60 Hz
 (Rated: 100 to 240 V AC)
 Frequency variation: 50 Hz (–10 to +5 %), 60 Hz (–10 to +5 %)
 24 V AC type:
 20.4 to 26.4 V AC [Including power supply voltage variation], 50/60 Hz
 (Rated: 24 V AC)
 Frequency variation: 50 Hz (–10 to +5 %), 60 Hz (–10 to +5 %)
 24 V DC type:
 20.4 to 26.4 V DC [Including power supply voltage variation]
 (Rated: 24 V DC)

Power consumption (at maximum load):

PZ400/401: 6.8 VA max. (at 100 V AC)
 10.1 VA max. (at 240 V AC)
 6.9 VA max. (at 24 V AC)
 175 mA max. (at 24 V DC)
 PZ900/901: 7.4 VA max. (at 100 V AC)
 10.9 VA max. (at 240 V AC)
 7.4 VA max. (at 24 V AC)
 190 mA max. (at 24 V DC)

Rush current: 5.6 A or less (at 100 V AC)
 13.3 A or less (at 240 V AC)
 16.3 A or less (at 24 V AC)
 11.5 A or less (at 24 V DC)

Insulation resistance:

	①	②	③	④	⑤	⑥	⑦
① Grounding							
② Power supply terminal	20 MΩ or more at 500 V DC						
③ Measured input terminal/ CT/FBR	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC					
④ Output terminal (Relay)	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC				
⑤ Output terminal (other than Relay)	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC				
⑥ DO terminal (Relay)	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	
⑦ Communication, Digital input terminal	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC

Grounding is done on the control panel.

**Withstand voltage:**

Time: 1 min.	①	②	③	④	⑤	⑥	⑦
① Grounding							
② Power supply terminal	1500 V AC						
③ Measured input terminal/ CT/FBR	1500 V AC	3000 V AC					
④ Output terminal (Relay)	1500 V AC	3000 V AC	3000 V AC				
⑤ Output terminal (other than Relay)	1500 V AC	3000 V AC	1000 V AC				
⑥ DO terminal (Relay)	1500 V AC	3000 V AC	3000 V AC	3000 V AC	3000 V AC	3000 V AC	
⑦ Communication, Digital input terminal	1500 V AC	3000 V AC	1000 V AC	1000 V AC	3000 V AC	1500 V AC	3000 V AC

Power failure handling:**Power failure:**

100 to 240 V AC type/24 V AC type:

A power failure of 20 ms or less will not affect the control action

24 V DC type:

A power failure of 5 ms or less will not affect the control action

Memory backup:

Backed up by non-volatile memory

Number of writing: Approx. One trillion (10^{12}) times (FRAM)

Data storage period: Approx. 10 years (FRAM)

Power failure recovery:

Hot/Cold start:

- a) Hot start 1
- b) Hot start 2
- c) Cold start
- d) Reset start

Selectable from a) to d)

Start determination point:

0 to Input span

(0: Action conforms to the Hot/Cold start)

Unit: same as the reading



■ Environment Condition

● Operating environmental conditions

Ambient temperature:	−10 to +55 °C
Ambient humidity:	5 to 95 %RH (Absolute humidity: MAX.W.C 29 g/m ³ dry air at 101.3 kPa)
Vibration:	Frequency range: 10 to 150 Hz Maximum amplitude: 0.075 mm Maximum acceleration: 9.8 m/s ² Each direction of XYZ axes
Shock:	Free fall from 50 mm in height Each direction of XYZ axes (In non-energization)

● Reference operating conditions

Reference temperature:	23 °C±2 °C Temperature variation: ±5 °C/h
Reference humidity:	50 %RH ± 10 %RH
Magnetic field:	Geomagnetism
Power supply voltage:	Alternating current, Direct current: Reference value ± 1 %

● Transportation and Storage environment conditions

Vibration:

Number of vibration [Hz]	Level		Attenuation slope [dB/oct]
	(m/s ²) ² /Hz	[g ² (1)/Hz]	
3	0.048	(0.0005)	—
3 to 6	—	—	+13.75
6 to 18	1.15	(0.012)	—
18 to 40	—	—	−9.34
40	0.096	(0.001)	—
40 to 200	—	—	−1.29
200	0.048	(0.0005)	—

The effective value of the acceleration is 5.8 m/s² [0.59 g (1)] within the number of vibration.

NOTE: (1) g = 9.806658 m/s²

Shock:	Height 40 cm or less
Temperature:	−40 to +70 °C
Humidity:	5 to 95 %RH (Non condensing) Absolute humidity: MAX.W.C 35 g/m ³ dry air at 101.3 kPa



■ Mounting and Structure

Mounting method:	Panel-mounted Close horizontal mounting or Close vertical mounting (Both are available)
Mounting orientation:	Datum plane $\pm 90^\circ$
Case color:	Black
Case material:	PC (Flame retardancy: UL94 V-0)
Front panel material:	PC (Flame retardancy: UL94 V-0)
Terminal block material:	PPE (Flame retardancy: UL94 V-1)
Filter material:	PC
Panel sealing:	Based on IP65 (IEC 60529) [Front panel (when the front loader connector cover is installed)] * * When the front loader connector cover is not installed: IP00
Weight:	PZ400/401: Approx. 221 g PZ900/901: Approx. 291 g
Dimensions:	PZ400/401: 48 mm $\times$ 96 mm $\times$ 65 mm (W $\times$ H $\times$ Depth behind the panel) PZ900/901: 96 mm $\times$ 96 mm $\times$ 65 mm (W $\times$ H $\times$ Depth behind the panel)

■ Standard

● Safety standards

UL:	UL 61010-1
cUL:	CAN/CSA-C22.2 No.61010-1

● Other approved standards

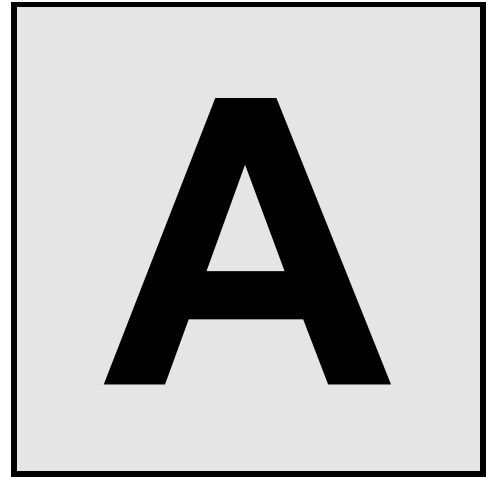
CE marking:	LVD: EN61010-1 EMC: EN61326-1 RoHS: EN IEC 63000
RCM:	EN55011

● Environment Condition

Protection against electric shock:	Class II (Reinforced insulation)
Overvoltage category:	OVERVOLTAGE CATEGORY II
Pollution degree:	POLLUTION DEGREE 2
Altitude:	Altitude up to 2000 m (Indoor use)
Recommended fuse:	Fuse type: Time-lag fuse (Approved fuse according IEC 60127-2 and/or UL 248-14) Fuse rating: Rated voltage 250 V AC Rated current 0.5 A (for 24 V AC/DC type) 1 A (for 100 to 240 V AC type)



APPENDIX



A.1 Replacing the Waterproof/Dustproof Gasket [Optional]	A-2
A.2 Current Transformer (CT) Dimensions [Optional].....	A-5

A.1 Replacing the Waterproof/Dustproof Gasket [Optional]

PZ400/900/401/901 can be equipped with an optional water- and dust-proof structure, which has to be specified at the time of ordering. This waterproof and dustproof construction uses rubber gaskets. If the waterproof and dustproof gasket deteriorates, please contact RKC sales office or the agent.

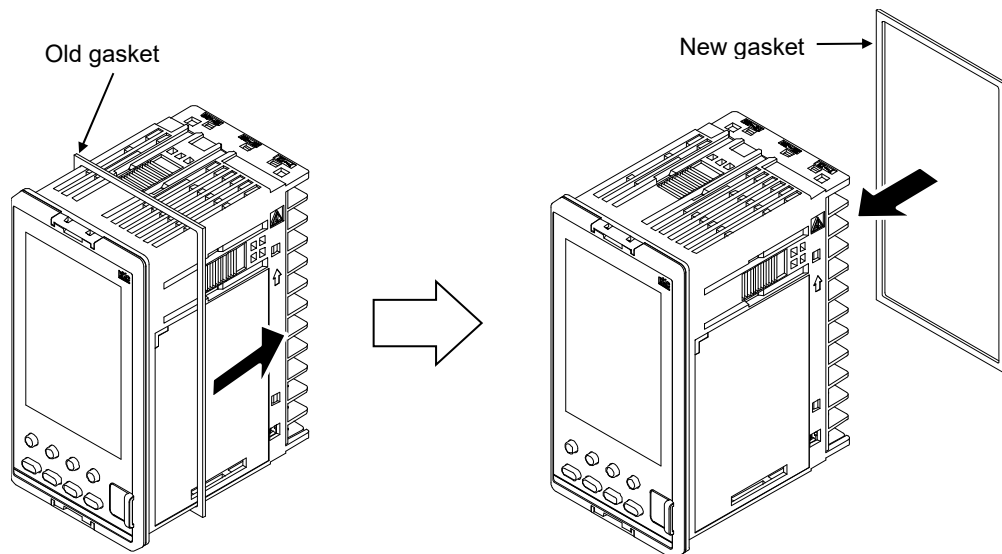
To replace the gasket, take the following steps:

WARNING

- In order to prevent electric shock and instrument failure, always turn off the power supply before replacing the gasket.
- In order to prevent electric shock and instrument failure, always turn off the power supply before pulling out the internal chassis.
- In order to prevent injury or instrument failure, do not touch the internal printed wiring board.

■ Replacement of the gasket for the case

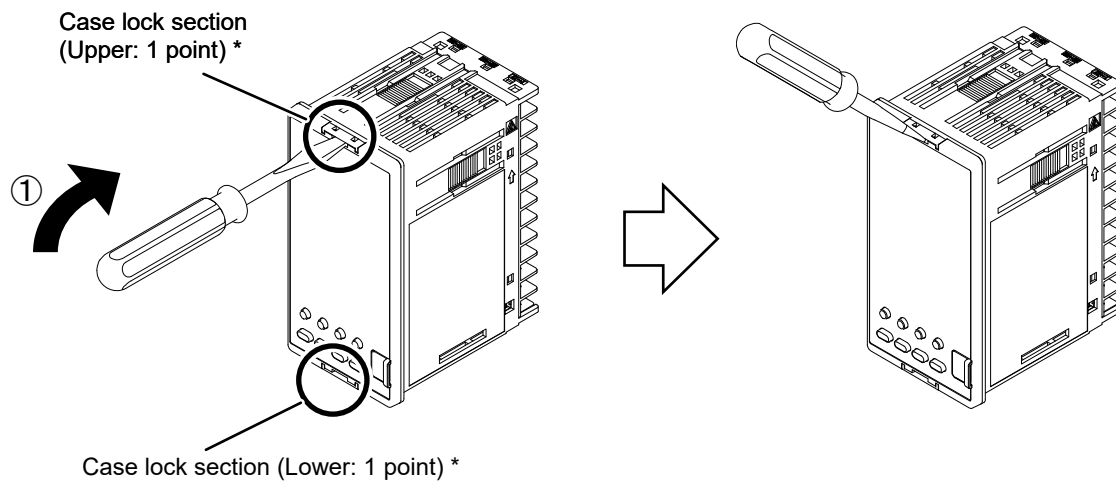
1. Turn the power OFF.
2. Remove the wiring.
3. Remove the mounting bracket, and then remove the instrument from the control panel.
- Refer to **2.3 Procedures of Mounting and Removing (P. 2-4)**.
4. Remove the old gasket, and then replace the old gasket with a new one.



Gasket for the case: PZ400/401: KFB400-36
PZ900/901: KFB900-36

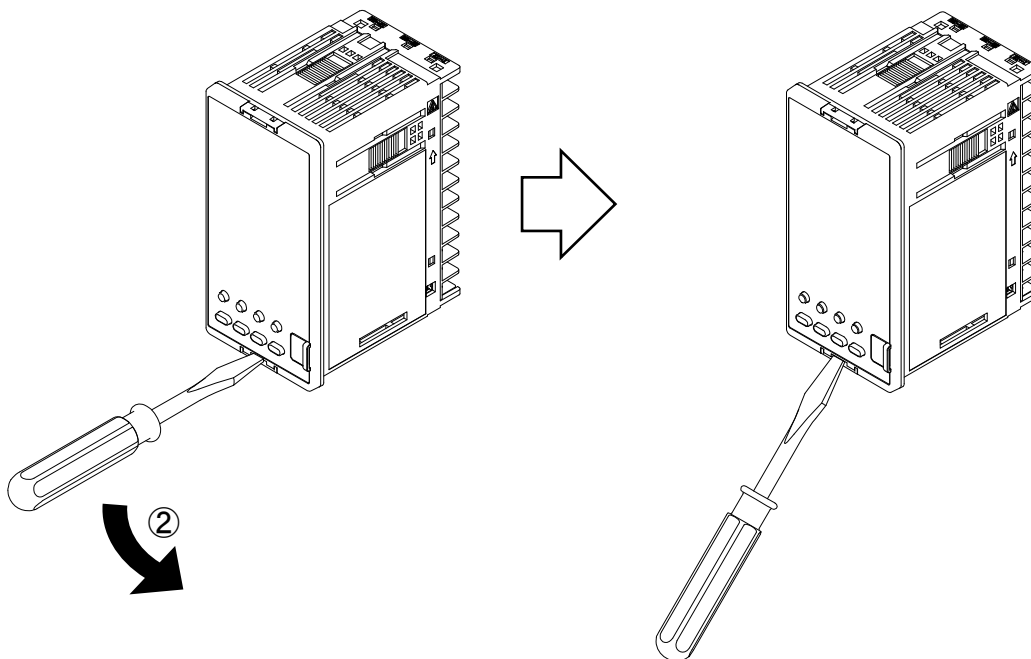
■ Replacing the gasket for the front frame

1. Turn the power OFF.
2. Wedge the slotted screwdriver into the upper case lock section, and lift the grip slowly (①).
The case lock is released.

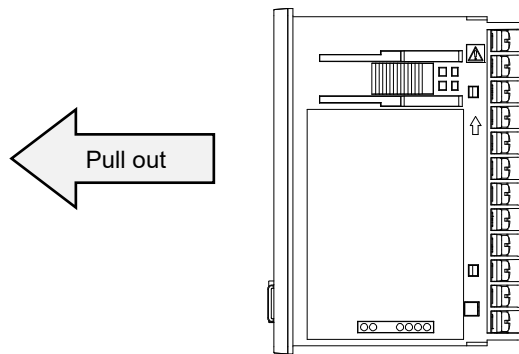


* There are two locks on each side of the case (upper/lower) for the PZ900/901.

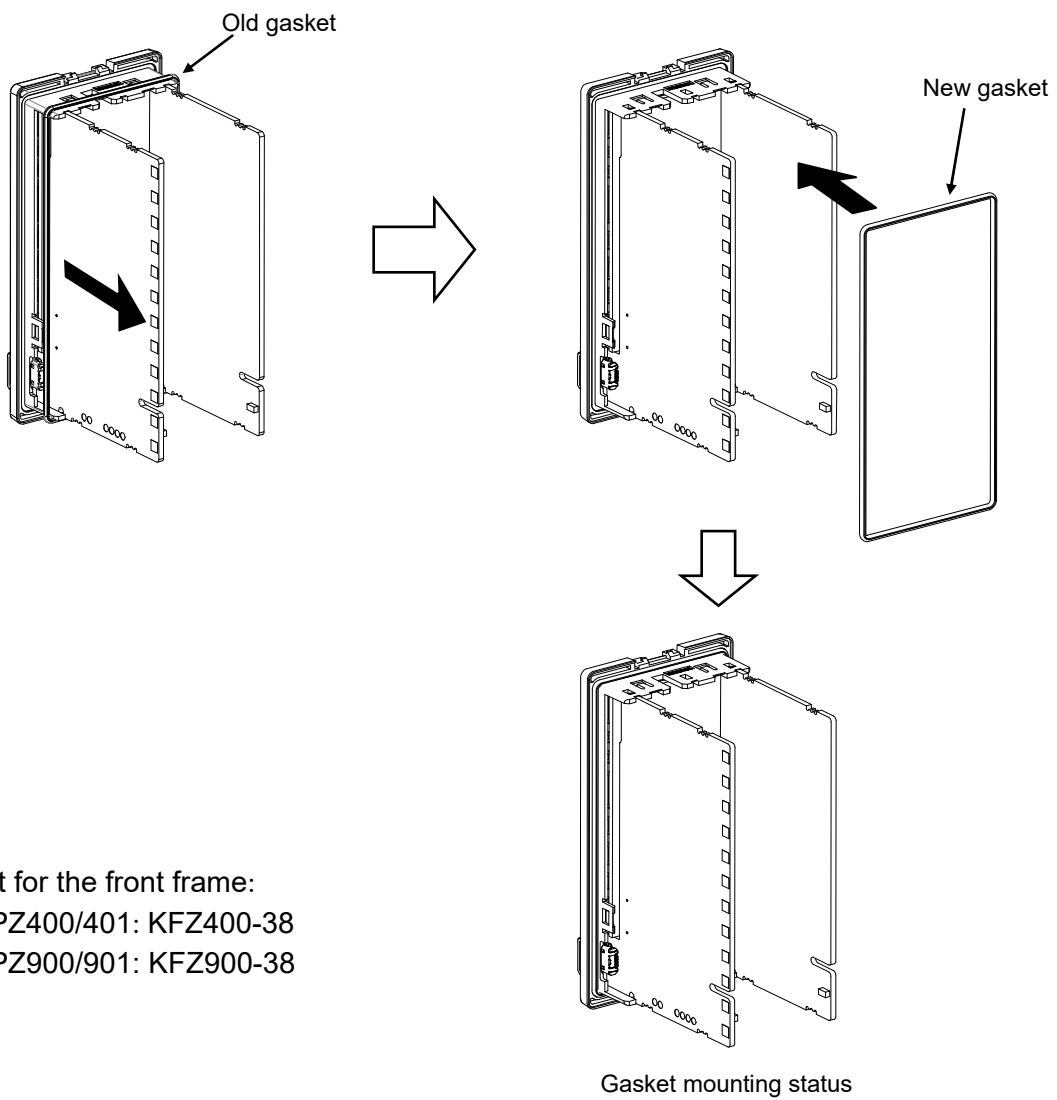
3. Wedge the slotted screwdriver into the lower case lock section, and hold down the grip slowly (②).
The case lock is released.



4. As the internal unit slightly comes out of the case, pull it out toward you.



5. Remove the old gasket, and then replace the old gasket with a new one.

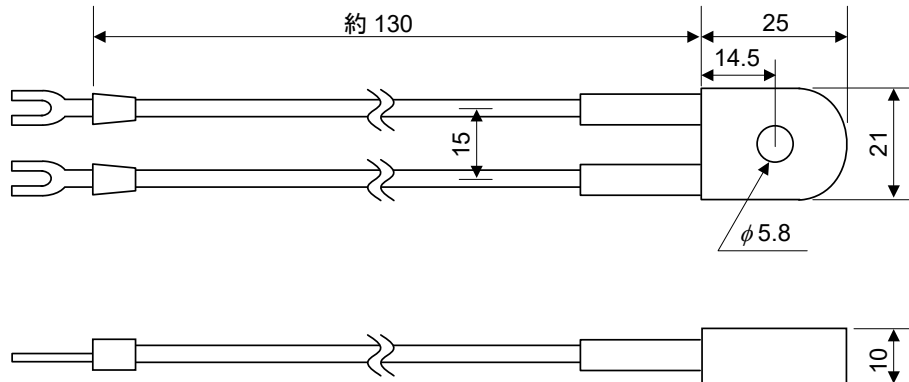


6. Insert the internal assembly in the case.

A.2 Current Transformer (CT) Dimensions [Optional]

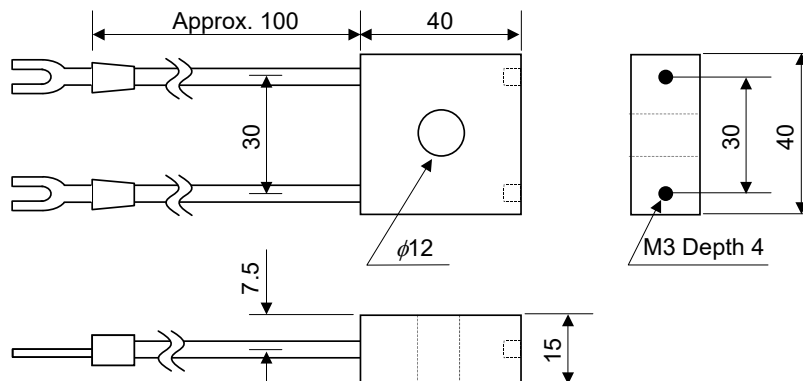
■ CTL-6-P-N (For 0 to 30 A)

(Unit: mm)



■ CTL-12-S56-10L-N (For 0 to 100 A)

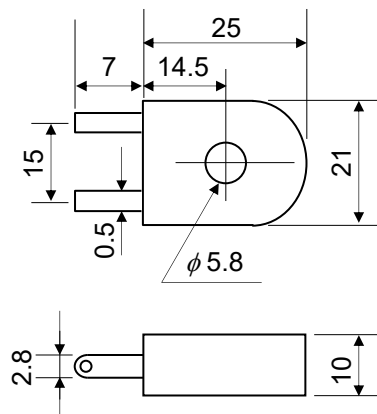
(Unit: mm)



■ CTL-6-P-Z (For 0 to 10 A) *

* A product of U.R.D.Co., LTD.

(Unit: mm)





MEMO



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C: Operation transfer mode

D: Setting lock mode

E: Pattern transfer mode

F: Parameter setting mode

G: Setup setting mode

H: Engineering mode

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<i>EV2'</i>	EV2'	Event 2 set value (EV2') [low]	A — 6-2, 6-10, 7-6, 7-11 F Pn40
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<i>EV3'</i>	EV3'	Event 3 set value (EV3') [low]	A — 6-2, 6-10, 7-6, 7-11 F Pn40
<i>EV4</i>	EV4	Event 4 set value (EV4)	A — 6-2, 6-10, 7-6, 7-11 F Pn40
<i>EV4</i>	EV4	Event 4 set value (EV4) [high]	A — 6-2, 6-10, 7-6, 7-11 F Pn40
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